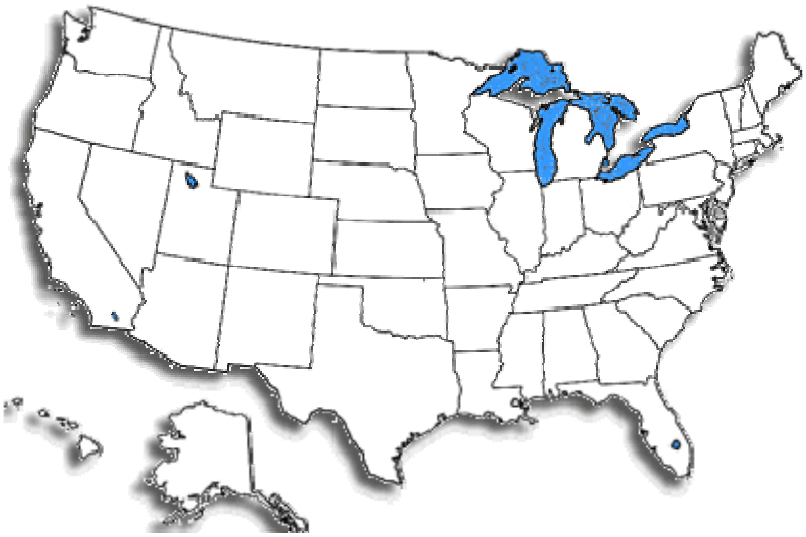
Effective State Floodplain Management Programs 2003



The Association of State Floodplain Managers

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Executive Summary

Effective state floodplain management programs are those that acknowledge that wise use of the state's flood-prone areas is fundamentally the responsibility of state and local governments. Although the federal government's involvement in flood hazard management reaches back decades and the federal interest is undeniable, it is illogical to rely on federal standards to address locally unique circumstances. Nor is it enough to rely on federal funding for implementation to meet state needs and local demand, or to reduce state, regional, and local costs and damage associated with flooding.

By taking charge of managing floodplains within their jurisdictions, states vastly improve the opportunity to avoid flood disasters and reduce flood losses and disaster costs. They are able to tailor solutions to their own specific situations, which nationwide standards and norms simply cannot do. These states protect the health and safety of their citizens, improve quality of life, enhance environmental quality, and save state and local economies money in the bargain.

This document was produced as a guide for national and state legislators and their staffs, for agency managers, others who make policy decisions about state programs and priorities, and for state and local floodplain managers who are interested in improving their programs. It is not a "how-to" manual for managing floodplains, but instead provides an overall blueprint for an effective state program designed to reduce losses and damage from floods, and to protect natural floodplain resources. Its 10 principles describe the main concepts underlying state-level floodplain management programs, and the separate sections of the document outline what the basic components of a state program should be, if it is to be effective. The various subsections and brief descriptions of tools and techniques can be used as checklists by those who wish to profile their programs' strengths and identify opportunities for enhancement and growth (see Appendix A).

There is no single "perfect" model for a state floodplain management program, because every state has a unique combination of factors that shape its approach to managing its flood risk and floodplain resources. Flood hazards vary significantly by geographic region. The constitutionally established relationships between states and local jurisdictions differs considerably from state to state. Further, the political cultures often are such that a program component that works well in one state may not be accepted in another.

However, all effective state floodplain management programs contain components that are consistent with 10 guiding principles. Those guiding principles and the kinds of programs, projects, and activities that further them effectively at the state level are described below.

1. State floodplain management programs need strong, clear authority.

Effective state programs are stable and long-lasting—they are founded with clear legal authority, work cooperatively with local governments and other state and federal agencies, and are supported by adequate resources. Although they are institutionalized via state law, good state-level floodplain management programs are administered to allow evolution and improvement in response to changes such as major floods, new research and management techniques, and new federal programs and initiatives.

Whatever form the state/local relationship takes, an effective state floodplain management program provides for strong elements at both state and local levels. Effective state floodplain management programs extend into many facets of state government, and certainly extend far beyond simply performing the duties and responsibilities outlined in the National Flood Insurance Program (NFIP) regulations for "state coordinating agencies." An effective state program with strong leadership identifies all floodplain-related state and local activities and coordinates with all state agencies and the state legislature to effect programmatic changes.

2 State floodplain management programs should be comprehensive and integrated with other state functions.

Effective state floodplain management programs set a performance standard by ensuring not only that flood hazards are identified, avoided, minimized, and mitigated but also that floodplain functions and resources are protected whenever state construction projects or state-funded projects are undertaken. In addition, state floodplain management programs should be comprehensive and be integrated with elements from many state agencies and programs. Because the actions and policies of many state agencies can influence new development, mitigation of existing flood risks, and resource management, effective state floodplain management programs are not confined to a single office or agency.

3 Flood hazards within the state must be identified and the flood risks assessed.

Flood hazard areas need to be identified and delineated in order to

- Avoid future flood damage and disaster costs,
- Apply regulatory criteria,
- Inform property owners and the public, and
- Craft mitigation measures for existing at-risk development.

Flood hazard areas change over time, through deliberate modification or as a result of changes in the watershed or the body of water itself. An effective state floodplain management program ensures that the flood risks are known and that changing conditions are accounted for.

4 Natural floodplain functions and resources throughout the state need to be respected.

Effective state floodplain management programs recognize the additional effort needed to manage the floodplain resources and functions, and allow for the fact that not all flood loss reduction techniques automatically account for natural functions and resources. Effective state programs take a holistic approach to floodplain management—one that moves beyond simply protecting people and property to recognizing the value of allowing floodplains to function as floodplains, and enjoying the benefits that accrue when they do. Effective states coordinate and integrate their goals and activities with the many other state (and federal, and local, and private) programs, agencies, and departments whose activities affect floodplain functions, such as

- Control of sediment and erosion;

- Protection of water quality, wetlands, aquifer recharge, and open space;
- Management of coastal areas, shorelines, overall growth, and stormwater;
- Preservation of wild and scenic rivers, rare and endangered species, cultural resources, and agricultural lands; and
- Public recreation.

5 Development within the state must be guided away from flood-prone areas; adverse impacts of development both inside and outside the floodplain must be minimized.

Adverse floodplain impacts can be avoided or minimized if communities within the state have the authority, tools, and political will to guide development to less hazard-prone areas, or to examine the full extent of impacts—both on-site and off-site—when floodplain development *is* proposed. By guiding development away from flood-prone areas, the state protects its citizens.

- First, it protects landowners by requiring that their development activities meet certain standards to avoid flood damage to their property.
- Second, it protects the entire community by requiring that those activities do not adversely affect others.

Effective state programs apply land use management techniques directly through state regulation, or authorize and foster application of those techniques at the local level, including planning, zoning, risk assessment, growth management, impact analyses, subdivision regulations, and permitting programs. Besides requiring that floodplain development be built so that it withstands flood damage, effective programs acknowledge that watersheds and floodplains are complex natural systems, and that their interrelationship with human-caused actions and the impacts of each development on other property owners must be taken into consideration.

6 Flood mitigation and recovery strategies should be in place throughout the state.

Effective state floodplain management programs use post-flood mitigation and recovery strategies to break the cycle of flood damage, recovery, then repeated flood damage. Immediately after a flood, citizens and governments are most aware of the risks and far-reaching consequences of major losses, and additional funds may be leveraged for flood-reduction projects because governments feel compelled to assist right after a disaster.

Rather than rely on federal post-disaster mitigation resources, effective state programs have clear authority and adequate resources to work on their own and cooperatively with local governments on planning and projects that will reduce the costs of flooding over the long term. The majority of floods in any state do not become federally declared disasters, but ones the state and local governments must deal with. In effective state programs, interagency coordination for the purpose of mitigation is not dependent upon, or limited to, declaration of a federal disaster. Effective state programs

- Authorize or encourage temporary post-disaster moratoria on reconstruction and repair to create the time needed to assess damage,

- Set priorities for mitigation,
- Consider alternative ways to recover while reducing future risk,

- Have the ability to provide needed help to localities, through pre-disaster training, mobilization of damage assessment teams, direct support, or agreements with other governments and organizations for staff and expertise.

Effective state mitigation programs should be in place and active regardless of the presence or absence of flood conditions, because better, more financially sound decisions can be made in the absence of the post flood rush to correct the problem.

7 The state's people need to be informed about flood hazards and mitigation options.

An effective state provides the appropriate authority and encourages use of informational tools for flood hazards. Better informed citizens, property owners, private sector entities, public officials, and government agencies are more likely to make sound decisions about whether and how to develop and redevelop property, and how to make sound land and home purchases.

Although many tools to inform the public are best applied at the local level, states have a number of roles, especially to actively support local public information efforts, whether they be training workshops, printed materials, newsletters, media coverage, or websites. Some tools for informing the public are most effective if required by state statute or regulation, such as disclosure during property transactions, recording flood history on property deeds, and continuing education for professionals.

8 Training and technical assistance in floodplain management need to be available to the state's communities.

Effective state programs assess community needs and provide ongoing training opportunities and access to technical assistance. In most communities, floodplain management is just one of many responsibilities that must be handled by small staffs, but the administration of the floodplain provisions can be quite complex, and the consequences of inadequate attention to the flood hazards can be disastrous and expensive. Effective states

- Produce a reference manual to inform local officials about floodplain management;
- Monitor how communities are administering their regulations, including enforcement actions for any violations;
    - Support community efforts to participate in the Community Rating System;
    - Hold workshops and training on a variety of issues;
    - Encourage local staff to become Certified Floodplain Managers;
    - Support state-level professional associations;
    - Produce newsletters and web pages; and
    - Are accessible to local staffs.

9 The levels of funding and staffing for floodplain management should meet the demand within each state.

Effective state floodplain management programs know that it is not enough to rely on federal funding to meet state needs or to effectively reduce state, regional, and local flood costs and damage. Behind an effective state floodplain management program are state executive and legislative branches that have committed adequate staff resources and funding to the necessary program elements and agencies.

Effective states have assessed the needed level of funding and staffing, based on factors appropriate to their states, such as frequency and severity of flooding, extent and capability of local administration, and the anticipated functions of staff members. With this information, a budget is developed that includes salaries, operations, mapping, mitigation grants, and other activities. Creative ways of obtaining funds and generating revenue are not overlooked.

10 Evaluation of the effectiveness of states' floodplain management programs is essential and successes should be documented.

Achieving and maintaining an effective state floodplain management program is an ongoing effort. When program effectiveness is measured through regular evaluations, it is easier to identify opportunities to make adjustments or to add new program elements.

An effective state program finds ways to tally and keep records on different aspects of the status of floodplain management within its jurisdiction, such as inventorying flood-prone property, taking advantage of the post-disaster period to document damage avoided and the success of mitigation projects, taking an accounting of acreage of floodplain lands preserved in a natural state or otherwise protected, monitoring community program administration, and tracking the progress of mitigation projects. Such data are essential to evaluating how effective programs are, and how to adjust the program to be even more effective

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Introduction

Every state and territory in the United States has experienced flooding, whether from fast-moving mountain streams, storm surge from hurricanes, or slow-rising river water. And every state will continue to face those flood risks in the future. Occupying flood hazard areas (and enduring the inevitable floods) has numerous costs, both direct and indirect. But states that have tackled their flood problems through statewide programs that also interact with local programs and federal initiatives have made progress toward minimizing their flood risks, reducing their losses from floods, protecting public health and safety, and improving the quality of life for their residents. There is ample evidence that a strong program for floodplain management is worth a state's investment.

Protecting Health and Safety

Protecting the health and safety of its citizens and visitors is a primary concern and responsibility of state and local governments. Floods and their aftermath are dangerous. People's lives are threatened, as are those of emergency personnel. Contaminated floodwaters can cause illness even after the immediate threat has subsided. Recovery and cleanup are fraught with risks from damaged buildings, displaced animals, broken utility lines, and the use by citizens of unfamiliar equipment. Some flood victims experience long-term psychological problems.

Keeping these dangers at bay is an important state responsibility. State floodplain management programs further this cause by working to keep people and their property out of harm's way, making sure they understand how to handle such situations properly if they do arise, and doing what is possible to make sure special flood problems are resolved according to health standards. Further, properly managed floodplains within the state contribute to improved health on the part of citizens by providing recreational opportunities, preserving vegetation that filters air and water, and buffering noise.

Preserving Quality of Life

When they do occur, floods land a devastating blow on quality of life—that is, disruption. People value the routine of their daily lives, their familiar surroundings, and the connections they have with their neighborhoods. But a flood forces people away from their homes and businesses. Public services can be suspended as a result of damage to buildings, facilities, and infrastructure. State and local government staff are diverted from normal functions to handle response and recovery. Public projects are postponed. A full recovery to the previous level of well-being can be a long time in coming for citizens, businesses, and governments. State floodplain management programs reduce the damage and disruption caused by floods.

States that effectively manage their floodplains also are improving the quality of life of their citizens. Floodplains and coastlines that are kept in as natural a state as possible provide immeasurable aesthetic and recreational benefits to the state's residents and visitors. The significance of these amenities to people is illustrated by the higher prices they are willing to pay for property near such areas.

Natural floodplains, whether along the coast or in riverine or lake areas, also improve quality of life by virtue of their role in maintaining overall environmental health. These areas are complex ecosystems that are in turn part of larger systems. They filter air and water; provide habitat for wildlife; store flood waters; recharge aquifers; and buffer noise, wind, waves, and storms. States that preserve these functions are improving quality of life.

Minimizing Economic Costs

The full impact of flooding on state economies is difficult to measure. In 2001, average annual flood losses in all of the United States were estimated at $6 billion. This is almost certainly an underestimate because of the tremendous difficulty of including and quantifying all the direct and indirect costs and impacts of floods, including losses from very isolated events; damage to habitat and other natural resources; psychological and health consequences suffered by victims; and business income, taxes, and wages that are lost from the local and state economies.

Between 1988 and 1998, state and local costs to match federal disaster assistance (usually just 25%) exceeded $2.5 billion for 455 major disaster declarations, most of them floods. But this underestimates the total burden on state and local budgets and economies in part because federal assistance does not cover all the costs that result from disasters. In addition, small floods usually do not trigger a rigorous assessment of damage and accounting of expenditures.

In practice, states are more likely to keep records of direct impacts such as the dollar value of work required to repair damaged state buildings or replace washed out state roads and bridges. But a full accounting of the state costs of floods should consider many hidden elements, especially indirect ones, that are more difficult to measure.

Hidden State Costs for Floods

- Capital projects that are postponed when state funds are diverted for disaster assistance become more expensive when pushed into future years when labor rates and expenses are likely to be higher;
- Long-term environmental damage can occur;
- State employees may not be available to perform their normal functions when deployed for flood disaster support, which can adversely affect the recipients of those services (such as processing state permits, administering state programs, issuing state contracts, etc.);
- State tax revenues are reduced when business are closed, and state expenditures rise when people are laid off;
- Local tax revenues are reduced when property values diminish; and
- The demand for certain government services may increase, especially when low income and minority populations are affected.

The Need for State Floodplain Management

Reliance by the states on federal flood programs has not reduced the impacts of floods and, what is worse, it has reinforced the misperception that flooding is primarily a federal problem. By taking charge of managing the floodplains within their jurisdictions, states vastly improve the chances for avoiding unwise flood-prone development and reducing flood losses. They are able to tailor solutions to their own specific situations, which nationwide standards and norms simply cannot do. They protect the health and safety of their citizens, improve quality of life, enhance the environment, and reduce the financial burdens on state and local economies in the bargain.

Achieving these goals requires the establishment and maintenance of effective state floodplain management programs. Such programs build on federal minimum standards and leverage federal programs in order to positively influence local development and redevelopment cycles and to effect long-term changes. This report identifies and describes components of a strong state floodplain management program and lists options from which states can choose to created a balanced, effective program that takes into account the full range of benefits and costs.

A Brief Overview of Floodplain Management

The concept of floodplain management is broad, and no simple definition captures all its components. A number of historical documents characterize it, including *House Document 465*, issued in 1966 by the Task Force on Federal Flood Control Policy. In 1976, the United States Water Resources Council issued *A Unified National Program for Flood Plain Management* (updated in 1986 and 1994). Still regarded as a seminal document, the report set forth a conceptual framework and recommendations for actions at all levels of government to reduce flood losses through floodplain management.

Floodplain management can be regarded as a continuous decision-making process that aims to achieve the wise use of the nation's floodplains. The process includes issuance of permits for development and other more comprehensive tools, such as land use planning and growth management, protection of the floodplain's natural functions, and traditional structural flood control works.

The National Flood Insurance Program (NFIP) regulations, written in 1976, more narrowly define floodplain management as "the operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and flood plain management regulations." Historically, the NFIP has focused on identification of flood hazard areas, regulations to recognize those flood hazards in the development process, and administration of flood insurance.

Beginning in the mid 1970s, each governor designated a "state coordinating agency" for the NFIP, with minimum duties and responsibilities under that program. Since then, the scope and variety of state floodplain management authorities, responsibilities and initiatives have multiplied.

A Brief Overview of Hazard Mitigation

Hazard mitigation is an integral part of floodplain management. Although it has long been advocated by floodplain managers, the idea of hazard mitigation gained currency nationwide with the passage of the Robert T. Stafford Disaster Relief and Emergency Assistance Act in 1988. The Stafford Act authorized a program to foster recognition of natural hazards and the many adverse impacts they have on states and communities. The Act established a cost-shared grant program to fund projects determined to be cost effective and technically feasible to reduce future losses from hazards, including flooding. The Act also required mitigation planning at the state level in order to be eligible for federal mitigation funds, which are cost shared 75/25 federal/non-federal. In 2000, the planning requirement was extended to communities interested in seeking federal grant funds to implement certain mitigation projects and certain forms of disaster assistance.

Hazard mitigation is broadly defined to include any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. With regard to property, the intent is to reduce or eliminate damage, which in turn reduces economic losses. Hazard mitigation has become a more distinct element in emergency management, sharing the stage with emergency operations, planning, and response and recovery. It is widely recognized that mitigation may occur throughout the "cycle" of disasters, whether immediately after an event or well in advance of the next one.

Principles for Effective State Floodplain Management

There is no single "perfect" model for a state floodplain management program, because every state has its own unique combination of factors that shape its approach to managing its flood risk and its floodplain resources. Flood hazards vary significantly by geographic region. The constitutionally established relationships between states and local jurisdictions differ considerably from state to state. Further, the political cultures often are such that a program component that works well in one state may not be acceptable in another.

However, all effective state floodplain management programs contain components that are consistent with 10 guiding principles.

This document describes a series of ideal, effective program elements. It is not intended to promote a single vision of a model program, other than the concept that effective programs contain elements that are consistent with certain guiding principles. Those guiding principles are:

1. State floodplain management programs need strong, clear authority.
2. State floodplain management programs should be comprehensive and integrated with other state functions.
3. Flood hazards within the state must be identified and the flood risks assessed.
4. Natural floodplain functions and resources throughout the state need to be respected.

5. Development within the state must be guided away from flood-prone areas; adverse impacts of development both inside and outside the floodplain must be minimized.
6. Flood mitigation and recovery strategies should be in place throughout the state.
7. The state's people need to be informed about flood hazards and mitigation options.
8. Training and technical assistance in floodplain management need to be available to the state's communities..
9. The levels of funding and staffing for floodplain management should meet the demand within each state.
10. Evaluation of the effectiveness of states' floodplain management programs is essential and successes should be documented.

The implications of the guiding principles, their importance to states, and the kinds of programs, projects, and activities that further them effectively at the state level are described in the rest of this document.

How to Use this Guide

This is a guide for national and state legislators and their staffs, for others who make policy decisions about state programs and priorities, and for state and local floodplain managers who are interested in improving their programs. It is a vision of managing floodplains, not a "how-to" manual. It provides an overall blueprint for a state program that aims to reduce losses and damage from floods, and protect natural floodplain resources. The various subsections and brief descriptions of tools and techniques are not meant to be comprehensive instructions, but rather suggestions that can be used as checklists by those who wish to assess their programs' strengths and identify opportunities for effective enhancement and growth. It is intended to help answer such questions as

- Are we, as a state, doing everything we can and should be doing?
- Has anyone else had success with a particular technique or program?
- How can we revitalize our state approach and foster more effective local programs?
- What other state expertise and assets can be brought to bear on this particular problem?

It is recommended that, once a state has decided what it wants to achieve (from solving a particular problem to a revamp of the whole program), it prepare a profile of its existing program. That profile can then be compared with the principles, components, and elements described in this guide (see the summary checklist in Appendix A). This will make is possible to identify opportunities for change, estimate demand for different elements, and establish the service levels that will be required.

The rest of this guide is organized into 10 parts, one for each of the principles listed above, so that each part addresses one main component of a state floodplain management program. Within each part, that component is presented and its importance to the state and its people explained. The subsections outline the elements of a state program that support that component and its underlying principle, with brief descriptions of the tools and techniques that in turn can be

effective in supporting that element. Frequent reference is made to *Floodplain Management 2003: State and Local Programs*, a publication of the Association of State Floodplain Managers that assesses the status of floodplain management in the United States from 1995 to 2002. Details about the use of many specific program elements and techniques can be found in that document.

Part 1 Authority for State and Local Floodplain Management

Principle**: **State floodplain management programs need strong, clear authority.

Overview

Program Leadership
- State Coordination of the NFIP
- Interagency Coordination

Statutory Authority
- Full Authority Granted to Communities
- Partial Authority Granted to Communities
- Shared State and Community Authority
- Authority for Land Use Planning and Zoning

Regulatory Program Elements
- Permit Mechanisms
- Program Performance
- Enforcement Mechanisms
- Program Variables

Effective state floodplain management programs are stable and long-lasting—they are established with clear legal authority, work cooperatively with local governments and other state and federal agencies, and are supported by adequate resources. Although they are institutionalized via state law, good state-level floodplain management programs are administered in ways that allow evolution and improvement in response to changes such as major floods, new research and management techniques, and new federal programs and initiatives.

States have different forms of government, and that affects the way they manage their floodplains. Some states strictly limit the authority of local jurisdictions to only those authorities explicitly granted by the state legislature (referred to as "Dillon rule"). Others allow local jurisdictions broad authority to adopt rules and regulations that each jurisdiction finds appropriate to its circumstances (commonly known as "home rule"). Regardless of the form of state government, an effective state floodplain management program incorporates strong elements at both state and local levels. Details on state and local floodplain management authority, drawn from 1995–2002 data, can be found on pages 5–6 in *Floodplain Management 2003*.

An effective state program goes beyond the minimum level of commitment required by federal programs, such as the National Flood Insurance Program (NFIP), to incorporate other techniques and actions that will enable it to best protect the citizens, property, and resources within its

jurisdiction from floods. It also ensures not only that its localities are authorized (by appropriate legislation) to take action to exceed minimums, but also that they are required, or at least encouraged, to do so. It stays abreast of the relevant state and federal case law on liability as it pertains to floodplain management, and on court decisions about the constitutionality of land use and other regulations.

1.1 Program Leadership

Floodplain management program leadership flows from an established program that has a clear mission, clear statutory authority, high-level support within the state, adequate financial resources, and demonstrated effectiveness. Leadership is necessary to effect programmatic adjustments in other state agencies and programs that will support floodplain management while also each agency's statutory purpose is also fulfilled. State leadership influences and builds upon relationships with the various federal agencies whose activities support state and local floodplain management programs and projects.

1.1.1 State Coordination of the National Flood Insurance Program

Although by itself it is not enough to effectively manage a state's flood risks, coordination within the state of various aspects of the NFIP is a core component of a state's floodplain management program. The NFIP encourages each state to designate an agency as the NFIP State Coordinating Agency, and that agency, in turn, assigns one or more individuals to be responsible for the function. Commonly called the NFIP State Coordinator, the responsible person may be located in whatever state agency is appropriate, although most are found in natural resources, water resources, or emergency management agencies. This is an important function because an active, productive partnership with FEMA helps ensure that the NFIP satisfies the needs of the state and its citizens, and in many cases helps establish a foundation for broader state effort.

> ***National Flood Insurance Program***
>
> So that citizens can purchase flood insurance and receive certain forms of disaster assistance, the NFIP requires participating communities to adopt and enforce ordinances that require development to meet certain minimum standards—and requires states to authorize communities to take such action and to assist them in that and other flood loss reduction activities. Under the NFIP, a state also is considered a community.

Effective state programs establish active partnerships with FEMA and communities, serving as a link between the two for purposes of the NFIP. According to federal regulations (44 *CFR* 60.25), the state shall

- Enact, if necessary, legislation to enable the state and local governments, and tribes (collectively called communities) to regulate development in flood hazards areas;

- Encourage, guide, and assist communities to qualify for the NFIP, to develop, implement, and maintain local floodplain management regulations, and resolve problems and notify FEMA of irreconcilable matters;
- Provide information on the coordination of local activities with federal and state requirements to communities and the public, including dissemination of information on the minimum elevation requirements;
- Assist with the delineation of riverine and coastal flood-prone areas;
- Recommend priorities for federal floodplain management activities based on community needs;
- Establish minimum state standards for floodplain management consistent with the NFIP regulations and in conformance with federal and state environmental and water pollution standards for prevention of pollution during floods;
- Assure coordination and consistency of activities with other planning and enforcement agencies;
- Assist with the identification and implementation of flood mitigation measures; and
- Participate in and provide opportunities for training.

Over the years the state role in coordinating programmatic matters has expanded significantly beyond the minimum responsibilities. State Coordinating Agencies are expected to participate in and perform additional functions, including

- Administering various mitigation grant programs or coordinate with the agency designated to administer those programs;
- Providing technical assistance to communities seeking to qualify for the NFIP's Community Rating System;
- Participating in pre- and post-disaster planning initiatives and mitigation projects; and
- Fostering and supporting state and local contributions to flood hazard mapping.

Details on state activities in support of the NFIP, drawn from 1995–2002 data, can be found on pages 21–27 and Table 3 in *Floodplain Management 2003*.

1.1.2 Interagency Coordination

Effective state floodplain management programs extend into many facets of state government, and certainly far beyond the duties and responsibilities outlined in the NFIP's regulations for "state coordinating agencies." Many state agencies may undertake or support programs and activities that inadvertently increase exposure to flood hazards. An effective program with strong leadership identifies those activities and coordinates with all state agencies and their state legislature to effect programmatic changes. Importantly, state programs that support mitigation of flood risks and protection of floodplain resources are coordinated to maximize efficiencies and achieve multiple objectives.

An effective mechanism to achieve these objectives is the organization of an interagency task force that can both identify opportunities in various state programs, and monitor implementation.

Many states build on interagency mitigation teams or councils that are established to further state and local resilience in the face of all natural hazards. Some effective measures to reduce flood losses and adverse impacts are

- State roads built over waterways are designed to adequately pass flood discharges.
- State roads that parallel waterways do not encroach into flood hazard areas so that large volumes of fill do not displace flood conveyance or storage that can increase flood levels.
- Local roads and bridges supported with state funding are designed by taking flood hazards into full account, so that communities do not suffer from washed out bridges, flooded roads, or increased flood damage.
- State funding for schools is conditioned on identifying and avoiding flood hazard areas and wetlands in site-selection procedures, and funds for reconstruction and renovation that incorporate mitigation measures are available.
- Housing authorities support funding programs to replace flood-prone public housing units and funds are made available to mitigate flood risks in low-income neighborhoods.
- Community development programs provide funding to support mitigation measures to reduce the likelihood of future flood damage to community buildings and infrastructure.
- Water quality funds are applied to relocate, retrofit, or floodproof existing wastewater treatment plants that are in flood hazard areas to protect both the physical plant and the environment.
- State coastal zone programs recognize flood hazards and short- and long-term erosion risks.

Details on coordination of floodplain management activities among state agencies, drawn from 1995–2002 data, can be found on pages 8–9 in *Floodplain Management 2003*.

1.2 Statutory Authority

Effective floodplain management programs are established with clear statutory authority. Communities must not only have the authorities they need to comply with NFIP minimum requirements, but also the enabling authorities they need to take all of the other actions necessary to implement effective programs, including the authority to adopt a building code. State floodplain management programs also need to have clear statutory authorities. The authority must define the geographic area subject to regulation, the respective responsibilities of the state and its communities, the activities that are subject to regulation, the limitations on impacts, the consequences for violations, and the entity authorized to issue permits and to take enforcement action.

The degree to which states establish the authority to regulate flood hazard areas at the local level varies, and the legislative history behind each state's program is similarly varied. Three basic approaches, described below, are used to delegate authority and achieve regulation of flood hazard areas.

- The state explicitly or implicitly grants full regulatory authority to communities and retains no clearly defined regulatory role at the state level;

- The state splits authority with communities by granting the authority to regulate some areas of the floodplain or some activities, while retaining sole regulatory jurisdiction over certain areas of the floodplain or certain activities; and
- The state and communities have overlapping or shared regulatory authority over the same area and the same activities.

In many states, local jurisdictions are an extension of state authority that is established by the constitution and vested at the state level; thus, communities exercise only the authority that is specifically conveyed or delegated. In other states, communities are given broad and unrestricted authority. Regardless of the degree or manner by which authority is conveyed, if exemptions or exceptions for certain activities or other gaps in local regulations are created, the state has a duty to ensure that such activities are then captured by state regulatory authority.

To be enforceable, whether at the state or local level, the authority to develop and administer regulations must

- Be clearly written and understandable by those who are charged with administering and enforcing the rules, and by those who are subject to the regulations;
- Be plausible and not contradictory with other federal, state, and local statutes and regulations;
- Include procedures and provisions for penalties for infractions; and
- Be constitutionally valid.

Not surprisingly, a state's role in floodplain management is often influenced by historically significant floods. Many states can trace the origins of their state regulatory programs to major disasters and, in general, these states strongly support local regulations. But in other states, especially where historically there has been little government influence on development, the state's authority with regard to floodplain management may be ill-defined, incomplete, or nonexistent. In these states, the authority to regulate flood hazard areas is at the local level and usually is based on the desire of communities to participate in the NFIP and reduce local costs associated with flooding and unwise development. The NFIP requires participating communities to have permitting authority to regulate development in flood hazard areas.

As described in Section 1.2.4, states support comprehensive floodplain management by granting to communities the authority to prepare and adopt comprehensive plans, zoning ordinances, land use regulations, and building codes. Effective programs also authorize communities to adopt higher standards in order to recognize locally significant conditions and to respond to local flooding conditions and local desires for heightened levels of protection, preservation of resources, and the like.

1.2.1 Full Authority Granted to Communities

Some states implicitly grant to communities the full, broad, and unrestricted authority to regulate land use and development, while other states explicitly grant and fully define the authority that they convey to communities. When full authority is granted to the local level, usually the state does not retain a regulatory function.

- **Wisconsin** explicitly delegates regulatory authority to local jurisdictions but retains an oversight and enforcement role to assure adequate performance.

Communities must have adequate authority to meet the minimum NFIP requirements and to take all other appropriate actions to effectively manage their floodplains. To be effective, the authority must allow communities to regulate all activities proposed within all flood hazard areas, including those areas that are defined at the local level that may extend outside areas mapped for the NFIP.

1.2.2 State Authority Split with Communities

Some states grant partial authority to communities to regulate flood hazard areas, while retaining sole authority over certain activities or over certain portions of the floodplain. The most common examples of activities excluded from local regulation are those undertaken by state agencies. Some states exclude certain other activities—such as construction of agricultural buildings or schools—from any local regulation. For effective floodplain management as recognized by the NFIP, a state must explicitly regulate any activities excluded from local authority with respect to location and construction in flood hazard areas.

An effective state program ensures that the state's regulatory authority meets or exceeds the minimum requirements of the NFIP. Examples of state programs that retain partial authority over activities (besides state projects) are noted below.

- **Ohio** directly regulates and issues permits for construction of all building occupancies except 1-, 2- and 3-family dwellings, unless a community has a certified building department, in which case the state delegates the authority to regulate and issue permits.
- **Illinois** excludes from local regulation the functions of a public agency, including school districts. For the most part the state school funding program ensures consistency with the state executive order on floodplain management.

1.2.3 Overlapping State and Community Authority

A number of states share regulatory authority with communities over all or part of their flood hazard areas.

- **Delaware** regulates a coastal zone that generally extends farther inland than the V Zone defined by the NFIP, up to 1,000 feet landward of the mean high water line; communities issue building permits only after the state's permit is issued because state regulations may affect siting.
- **Indiana** has primacy over activities proposed within designated floodways; applicants must obtain the state's permit before local permits can be issued.
- **Connecticut** requires state agencies that provide funding for projects in floodplains to submit a certification of consistency with state floodplain requirements; the NFIP State Coordinating Office reviews and issues approvals of consistency. State-funded projects must still obtain all other required federal, state, and local permits and approvals.
- **Maryland** regulates all activities (including temporary disturbances) that occur within the 100-year floodplain of nontidal waterways extending up to drainage areas of 100 acres (natural trout waters) or 400 acres (other waters). Local jurisdictions share authority

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>
> People no longer believe, as they did in the 19th century, that land is merely a commodity to be bought and sold. We now also regard land as a resource. Where we once encouraged the filling in and development of swamps, we now regard those same wetlands to be a vital part of nature's system of flood control, and important for wildlife and their habitats.
>
> —http://www.planning.org

and issue local permits for activities in nontidal floodplains, while having sole jurisdiction over coastal floodplains.

1.2.4 Authority for Land Use Planning and Zoning

Management of flood hazards extends beyond simply issuing permits for development in floodplains. To be effective, local jurisdictions need a variety of tools, some of which may require explicit authority at the state level. Rather than simply issuing permits for all types of development that may be proposed, effective programs guide the nature of development in full recognition of how development affects future flood hazards.

Effective state programs require local land use planning and zoning, or grant communities the authority to use such tools, including

- Comprehensive planning to guide the rate, density, form, and quality of development in communities;
- Zoning to guide the types of land uses anticipated;
- Building and floodplain permits to specify controls;
- Subdivision ordinances to provide for configuration of parcels, standards for developer-built infrastructure, and requirements for open space that may include environmentally sensitive areas and flood hazard areas; and
- Interjurisdictional or watershed-based planning and stormwater management.

1.3 Regulatory Program Elements

Effective state floodplain management programs have several common regulatory characteristics, whether applied at the state or community level, that are considered crucial. Programs must have permit mechanisms by which to issue approvals, methods to monitor performance and provide technical assistance, comprehensive enforcement mechanisms, and the flexibility to incorporate variables to address specific needs and goals.

1.3.1 Permit Mechanisms

Development proposed to take place in flood hazard areas is regulated partly to protect other upstream and downstream property owners and the floodplain from adverse impacts, and in part to protect the proposed development itself. Whether at the state or community level, an effective regulatory program requires that applications are submitted and reviewed, criteria are applied, and permits are issued or denied. Effective regulatory programs have these common elements:

- Sound basis founded on legal principles and clear enabling authority;
- Regulations that are clear to the average applicant with a plain reading;
- Regulations that appropriately apply to each type of development activity;
- Explanatory materials that are readily available to applicants;
- Permit application forms that are complete, easy to use, and easy to access;
- Staff who are well-versed in the regulations and their practical application;
- Sufficient staff to process the permit load and help applicants;
- Permit documents that clearly outline limitations, restrictions, and consequences for failure to comply; and
- Inspection and enforcement authority and resources.

1.3.2 Program Performance

Even in states with direct regulatory authority over activities in floodplains, communities do not relinquish their roles and responsibilities. (The NFIP requires that, at a minimum, all communities adopt, administer, and enforce locally applicable regulations.) Effective state programs oversee local program performance, provide technical assistance to resolve performance irregularities, and apply state-level sanctions for failure to resolve chronic program weaknesses.

Performance evaluation and assistance visits are an effective way for state programs to monitor local performance, which includes maintaining current regulations and using current flood maps; properly reviewing applications and applying the regulations; appropriately processing requests for variances and waivers; regularly inspecting permitted development to ensure compliance; regularly inspecting flood hazard areas to identify unauthorized activities; and prosecuting violators. On-site visits are effective largely because of the opportunity to provide one-on-one assistance with community staff and to discuss community-specific issues in depth. Such visits also allow state and community staff to develop professional relationships and provide training

specifically targeted to a community's needs. Increased communication increases the likelihood that assistance will be requested when communities are faced with complicated development proposals and violations.

1.3.3 Enforcement Mechanisms

At the state level, in addition to technical assistance, an effective program has an enforcement mechanism related to community performance. This mechanism is separate from enforcement of

state regulations and permit conditions. It is available to sanction communities that fail to resolve technical and administrative deficiencies.

Depending on the structure and authority of a state program, enforcement mechanisms fall into three broad categories: (1) mechanisms applied to property owners and developers who fail to obtain permits; (2) mechanisms applied to those who fail to comply with permit conditions; and (3) mechanisms applied to communities that fail to adequately administer their program as required. For the first two categories, effective state programs provide advice and technical assistance to help resolve problems within the constraints of the regulatory and legal process. When communities determine that enforcement action is required, the state program should

State Staff Levels

Many states report improved performance by communities and higher levels of compliance by permittees when communities are visited by the state every 2 or 3 years or whenever turnover of key local staff occurs. This level of service requires adequate numbers of qualified state staff.

continue to offer support and advice. State programs are even more effective if the state has the ability to go directly into court to seek a remedy for violations. Some state enforcement authority is described below. Details on state enforcement authority and techniques, drawn from 1995–2002 data, can be found on pages 26–27 in *Floodplain Management 2003*.

- **Oregon** can impose penalties on communities that fail to address natural hazards, such as flooding, in their comprehensive land-use plans, which are required by state law.
- **Wisconsin** can, through the courts, force a community to adopt or amend its floodplain management ordinance. In addition, the state has the authority to directly cite violations of local ordinances and prosecute them through the attorney general's office.
- **Michigan** has authority to allow communities to assume regulatory authority for certain programs, while the state retains oversight responsibility. If a community fails to enforce its ordinance, the state can rescind that local authority and re-assume state jurisdiction.

At a minimum, effective state programs stand ready to initiate the documentation required for the NFIP sanctions that are available for persistent local program deficiencies. The NFIP exercises two levels of sanctions:

- **Probation** is applied to communities that are found to have a pattern and practice of poor administrative procedures resulting in non-compliant development, or communities that neglect to enforce the floodplain management regulations. Before being placed on probation, a community receives a written notification of specific deficiencies and violations and is given a specified period during which it is expected to take action. If the community does not take remedial action, FEMA notifies policyholders of the impending probation and a $50 annual surcharge per policy is assessed during the probationary period (or a minimum of one year).

- **Suspension** action is taken if the community fails to remedy its program deficiencies during probation. When suspended, the community is no longer in the NFIP, citizens cannot purchase or renew flood insurance, the availability of federally insured mortgages is curtailed, federal grants for activities in mapped flood hazard areas are not provided, and federal disaster assistance is limited. Automatic suspension occurs if a community fails to adopt required revisions to its floodplain ordinance or to adopt new NFIP maps.

1.3.4 Program Variables

Effective state programs have sufficient capacity to incorporate variables to address state-specific goals, flood-related factors, and differences between specific regions or communities. An effective regulatory program is not constrained by minimum performance and regulatory standards that are broadly applicable, but allows for such variables as

- **Higher standards**, established or authorized to recognize that nationally applicable minimum regulatory standards cannot address every situation (see Section 5.5.3).
- **Safety-based decision factors**, developed for application in areas where flood velocity, depth, or duration not only threatens property but also poses risks to occupants and emergency workers (see Section 5.5.4).
- **Flood hazard areas in addition to those mapped by FEMA**, recognized as important components of the natural drainage system and subject to regulatory provisions (see Section 5.5.5).
- **Special flood-related hazards**, identified so that development in areas subject to these hazards is conducted in ways that fully recognize the risks (see Section 5.5.6).

Details about specific state floodplain management regulations, drawn from 1995–2002 data, can be found on pages 19–21 in *Floodplain Management 2003*.

Part 2 Comprehensive, Integrated State Floodplain Management

Principle: State floodplain management programs need to be comprehensive and integrated with other state functions.

Overview

State Projects, State Funding, and State Buildings
- State Construction Projects
- State-funded Activities
- Inventory of State Buildings in Flood Hazard Areas

Related State Programs and Functions
- State Planning Agency
- Environmental or Water Resources Agency
- State Building Code
- Insurance Agency and Flood Insurance
- Emergency Management
- State Transportation and Road Construction
- State Health Department
- State Dam Safety
- Housing, Community, and Economic Development
- Agriculture & Food Safety
- Parks and Recreation
- Forestry
- State Geographic Information System Coordination
- Public Service Commission
- Mining of Aggregates

Effective state floodplain management programs are not confined to a single office, but instead are comprehensive, and encompass elements from many state agencies and programs. This is essential because the actions and policies of many state agencies can influence new development, mitigation of existing risks, and the functions and resources of floodplains. In addition, effective state floodplain management programs ensure that flood hazards are identified, avoided, minimized, and mitigated as part of state construction projects and projects undertaken with state funding. Details about the extent to which state projects, property, and facilities are protected from flood risks, drawn from 1995–2002 data, can be found on pages 6–7 in *Floodplain Management 2003*.

2.1 State Projects, State Funding, and State Buildings

An effective state floodplain management program sets an example by ensuring that it avoids, minimizes, and/or mitigates the effects of flood hazards when it is carrying out its own activities and programs. State governments own and acquire land and they own, acquire, and construct buildings. In addition, they provide funding to others, notably communities, for capital projects, infrastructure, and community improvements. These state investments and state property are vulnerable to flood hazards, just as those of a local jurisdiction or a private party are.

2.1.1 State Construction Projects

Effective state programs ensure that construction projects are planned, designed, and constructed to minimize floodplain impacts and future damage. State construction activities usually are not subject to local regulation, but often must meet the substantive requirements of the local ordinance. In most states, the most common state activity that affects flood hazard areas is the construction and reconstruction of state highways, bridges, and culverts.

Under the NFIP, states are included in the definition of community and thus FEMA expects that state construction projects in mapped flood hazard areas are undertaken in compliance with the minimum floodplain management criteria set forth in 44 *CFR* §60.3. As with communities, federal flood insurance cannot be obtained on state buildings if the state is not properly fulfilling its responsibilities as a participating community. States can take any of the following approaches to meet or exceed the minimum requirements of the NFIP for state construction projects.

- Requiring that state projects comply with local floodplain management ordinances;
- Adopting floodplain management regulations and permit requirements that apply to all state agencies and their construction activities;
- Issuing a governor's executive order (may be less effective than regulations because it can be rescinded, may not survive a change in administration, and may have less rigorous monitoring and enforcement mechanisms); and
- Incorporating appropriate standards into individual agency procedures and requiring review by the state's floodplain management program.

Effective state procedures require that all state agencies follow an established planning and design process, and that agencies obtain permits from a state and/or local permit authority. The important steps to cover are listed below.

- Agencies proposing floodplain development are required to undertake alternatives analyses to demonstrate that flood hazard areas have been avoided to the extent practicable, and if unavoidable, that the proposed impacts are the minimum necessary.
- Unavoidable impacts are mitigated (for example, many states require the purchase of easements if flood depths or the extent of the floodplains will be increased by proposed activities).
- Buildings proposed to be located in flood hazard areas are designed to account for flood loads (depth, velocity, duration, erosion, and debris impacts).
- Critical facilities are required to be sited outside of flood-prone areas (usually defined to include the 0.2% annual chance flood hazard area, commonly called the 500-year

floodplain) or meet higher standards in order to protect their ability to function during and after floods.

- Inspection by the permit authority and enforcement provisions is included to ensure accountability.

2.1.2 State-funded Activities

States generally have a variety of funding mechanisms to support local governments with construction projects for public infrastructure, public buildings and facilities, public schools, economic development, and housing and community development. To protect those investments of state funds, and to protect public health, safety, and welfare, an effective state establishes regulations, an executive order, or guidelines for the use of funds. Administrative rules are more effective because executive orders and guidelines can be rescinded, may not survive a change in administration, and may have less rigorous monitoring and enforcement mechanisms.

State-funded Public Infrastructure. To ensure that state-funded infrastructure that is constructed by communities resists flood damage, the regulations, executive order, or guidelines address linear infrastructure such as roads, water supply networks, and sewer collection lines that often follow stream channels or cross over or under waterways and floodplains. For implementation, the funding agencies establish criteria to evaluate proposed projects and to monitor project effectiveness. Planning can help locate such infrastructure in less hazard-prone areas. However, when this is not possible, protection against flood damage can be achieved during siting and design, and may include such measures as

- Buried utility lines set back from the banks of waterways to minimize exposure due to erosion;
- Utility lines under waterways placed at a required minimum depth and encased to minimize damage associated with scour;
- Manholes elevated above the base flood elevation or floodproofed to eliminate infiltration of floodwaters and discharge of sewage into floodwaters;
- Wellhead protection measures to protect public water supplies from contamination by floodwaters;
- Septic tanks protected to the base flood elevation to prevent discharge or sewage into flood waters;
- Bridges and culverts sized to pass the base flood discharge without causing backwater flooding on adjacent properties;
- Bridges and culverts designed to withstand the passage of floodwaters without significant damage so that traffic disruption and future repair costs are minimized; and
- Over wide floodplains, built-up road approaches designed for weir flow to relieve backwater flooding and bridge damage, or culverts that allow flood flows to pass without inundating the road.

State-funded Public Buildings and Facilities. Effective state programs ensure that local government buildings and facilities constructed with state funds are not located in flood hazard areas if alternative sites are available. However, if development in flood hazard areas is

unavoidable, then the state's investment is protected by minimizing the risks and impacts through appropriate construction standards. The continued functioning of emergency services centers, fire and police stations, public schools, community health centers, town halls, water supply sources and treatment facilities, and wastewater treatment plants is vital to public health and safety, so they must be protected from direct physical damage by flood waters, loss of service, environmental impacts, and limited access.

To ensure this protection, state regulations or the governor's executive order addresses these categories of work. The funding agencies establish criteria to evaluate proposed projects and monitor project effectiveness.

- **North Carolina's** coastal area regulations prohibit the construction or placement of publicly funded facilities (such as sewers, waterlines, roads, etc.) in high hazard areas unless: there is an overriding public benefit; the facility will not promote development in Areas of Environmental Concern; it will not damage natural mitigating features or worsen hazard risk; and it is designed to withstand erosion and flood damage.
- **Oregon** prohibits new essential facilities and special occupancy buildings from being constructed in the tsunami hazard inundation zone.
- **New Mexico** requires NFIP compliance for all public buildings that receive state funds for construction or substantial improvement.
- **Pennsylvania** requires communities that have been identified by the NFIP as having flood hazards to participate in the NFIP or public school funding is withheld.

Other State-funded Programs. State agencies that administer other programs that deliver state funding establish criteria to ensure that avoiding and minimizing future risk is a factor in their evaluation procedures, and that if flood hazard areas cannot be avoided, impacts are minimized. State programs that deliver funding for local programs and projects administered by communities include programs for local economic development, community development, and housing. These programs are subject to regulations or are included under the governor's executive order so that investment of those funds in flood hazard areas may be limited or subject to additional requirements.

2.1.3 Inventory of State Buildings in Flood Hazard Areas

An effective state floodplain management program maintains an inventory of state buildings located in flood hazard areas. Such an inventory is useful in several ways: to characterize the nature and extent of the state's exposure to potential losses; to ensure that adequate flood insurance coverage is in place; to determine whether occupants are at risk; and to help identify whether mitigation measures and emergency plans are appropriate.

Potential Losses. An analysis of potential flood losses, also called loss estimation, involves a number of steps. The first is to define the hazards, which typically has been done through engineering analyses to model rainfall-runoff or coastal storms to delineate flood hazard areas and assign frequencies to events of different magnitudes. The second step is to determine what is exposed to the flood hazard, including determination of frequency, depth, velocity, duration, and flood-related hazards such as erosion. The last step is to assign a cost to the damage that is likely

to occur under floods of varying frequencies. In a comprehensive loss estimation analysis, damage includes both direct (physical) damage and indirect costs. Indirect costs are costs other than those required to repair the physical damage, such as renting alternative space during repairs, or reconstructing lost paper records from other sources.

Insurance Coverage. Only with a complete inventory of state buildings in flood hazard areas can a state's risk management agency determine whether insurance coverage is adequate. This is true whether a state is considered "self-insured" (that is, intends to absorb some or all of the cost of damage), whether it purchases federal flood insurance, or whether it purchases commercial insurance that includes flood coverage. Federal flood disaster assistance is limited under certain conditions, notably if a public building is in a mapped floodplain and does not have appropriate flood insurance coverage. As of 2003, this essentially represents a "deductible" of $1 million because the maximum amount of federal flood insurance available for public buildings is $500,000 for the structure and $500,000 for contents.

At-Risk Occupants, Contents, and Users. The inventory of state buildings and facilities is prepared with an indication of the nature of the hazards for those buildings located in flood hazard areas. With this specific information, informed decisions can be made regarding risks to the occupants and contents of those buildings, and to customers or users of state facilities such as park campgrounds. Other mitigation measures can be put in place, such as altering how flood-prone space is used, implementing a flood warning mechanism, drawing up a plan for post-disaster continuity of government functions, and establishing parameters for evacuations.

Mitigation Measures. Many state buildings undergo some degree of capital improvement at one time or another. Retrofit floodproofing and other mitigation measures are effective, whether undertaken as part of scheduled improvements or as separate capital projects specifically designed to address flood risks. A notable benefit of a statewide inventory of at-risk buildings is that projects to reduce future flood risk can be identified and planned for as part of improvements, or be "on the shelf" ready to be incorporated in post-disaster reconstruction work or to qualify for mitigation funds from FEMA or other sources.

2.2 Related State Programs and Functions

An array of state agencies is essential to a comprehensive and effective state floodplain management program. This is not to say that the primary functions of other agencies or the focus of their programs should be redefined. Rather, it is important that the different ways in which state agencies influence state and local floodplain management be recognized and that the agency interrelationships be nurtured and leveraged to reduce the harmful impacts of floods. A state's success at managing its floodplains is influenced by virtually any state agency or program that undertakes, finances, or helps construction and repairs; acquires, manages, or disposes of state lands or facilities; or conducts work that affects land use, such as planning or regulation.

2.2.1 State Planning Agency

State planning agencies are important elements in an effective state floodplain management program because growth needs to be managed in such a way that future exposure to flood hazards is minimized. State planning agencies may

- Advise state agencies, local jurisdictions, and regional authorities on planning matters;
- Set standards for local plans, perform reviews, determine consistency, and monitor implementation;
- Develop model plans and ordinances;
- Conduct training and workshops;
- Provide incentives for local planning;
- Establish and support regional planning authorities; and
- Develop and coordinate a variety of state plans.

There is no single vision of a state planning agency's roles and responsibilities, and the origin of any given state's planning agency most likely differs from that of other states. Some state agencies focus on growth management, while others address a full range of local, regional, and state-level planning responsibilities (e.g., comprehensive land use and zoning, agricultural preservation, open space, housing, transportation, watershed management and water quality, capital improvements, recreation, economic development).

2.2.2 Environmental or Water Resources Agency

State programs for environmental protection typically cover a wide span of issues. Effective state program components that relate to floodplain management include

- Limitations on locating new hazardous materials handlers or waste sites in flood hazard areas, or requirements for protection measures to the 0.2% (500-year) flood level;
- Requirements that hazardous materials handlers identify whether facilities are subject to flooding and include that information in reports to communities;
- Coastal programs that offer technical assistance for local growth and land management programs;
- Shoreline programs that map erosion and establish development standards (such as setbacks) to minimize future losses of buildings due to long-term and episodic erosion;
- Regulatory controls for shoreline stabilization and protection (bulkheads, riprap);
- Technical and financial assistance for non-structural shoreline stabilization measures;
- Wetlands regulatory programs, coordinated with federal controls, to prevent some impacts and minimize those that are unavoidable.
- Groundwater protection standards, including wellhead protection and private well standards to minimize contamination from floodwaters;
- Underground storage tank standards that not only provide for stability when soils are saturated, but also require that vents and openings be elevated or otherwise protected against flooding;
- Above-ground storage tank standards requiring protective diking above flood levels or anchorage to prevent flotation and requiring vents and openings to be elevated or otherwise protected against flooding;

- Regulatory provisions that control activities within waterways, including dredging, mining, and channel re-alignments;
- Standards and guidelines for bio-engineered projects, such as fish habitat enhancement and stream restoration;
- Regulatory provisions for the construction of new dams and operation and maintenance of existing dams;
- Conservation easement programs to encourage property owners to preserve wetlands, critical habitats, groundwater recharge, and other sensitive areas; and
- Direct acquisition and management of public lands.

2.2.3 State Building Code

Effective and comprehensive state floodplain management includes adoption and implementation of a state building code that establishes design and construction criteria for buildings and other structures. Public safety and the protection of building occupants is the primary objective of building codes, but a related objective is the reduction of damage associated with identified and reasonably expected hazards. The location of buildings—a key factor in minimizing flood hazards—typically is addressed by other mechanisms, such as zoning and land use ordinances. Effective state floodplain programs ensure that local agencies responsible for codes and land use planning coordinate their work to achieve an integrated approach.

Building codes include specific provisions to address climatic and geographic variations, including wind loads, snow loads, seismic design criteria, frost depth, fire suppression, and flood hazards. As of 2003, the model codes developed by the International Code Council (http://www.iccsafe.org), and the codes developed by the National Fire Protection Association (http://www.nfpa.org), include design and construction provisions that are consistent with the minimum provisions of the NFIP.

Michigan trains Building Code Officials in Floodplain Management

Michigan's NFIP State Coordinating Office offers training on floodplain management for building code officials. The State Construction Code Commission approved that course for the continuing education units required for code officials to maintain their professional certification.

States handle building codes in a number of ways. Some states adopt the code at the state level and delegate implementation and enforcement to the communities; some states specify which code must be adopted by communities; some states are silent on which code to adopt; and still others explicitly authorize some communities but not others to adopt a code. In addition to those variations, some states do not allow any local amendments to the building code, while others allow communities to adopt only provisions that result in a higher level of protection. Other states allow modifications that are specifically justified and approved by a state authority.

Whatever procedure the state uses, there needs to be a clear understanding between the community and state building code agency of who is responsible for what in the floodplain development process to assure that the buildings do in fact comply with all applicable requirements.

Effective state floodplain management programs specifically authorize communities to adopt higher standards to address local needs. Details on how states use building codes in floodplain management, drawn from 1995–2002 data, can be found on pages 17–19 in *Floodplain Management 2003*.

When adopting a building code, some states identify certain specific activities that are not subject to the code, in effect expanding the activities that are exempt from obtaining a building permit. To have a complete program of floodplain management, a state ensures that activities exempt from a building permit are appropriately captured by local permit processes. In addition to state-specific exemptions, the following activities and structures must be addressed by a local ordinance to meet the minimum requirements of the NFIP:

- Agricultural buildings and structures;
- Subdivision of land;
- New and replacement manufactured housing units, including permanent foundations;
- Placement of temporary buildings, including recreational vehicles;
- Installation of water and waste collection systems, including septic systems;
- Filling and grading, including storm drainage, stormwater management facilities, and mound septic systems;
- Mining and gravel operations;
- Structures such as towers, oil derricks, signs, and fences;
- In-ground and above-ground pools;
- Retaining walls; and
- Above-ground and underground tanks.

Building code organizations, and some states, have programs to certify code officials, including plans examiners and inspectors. Maintaining certification requires that code officials participate in continuing education and training. Qualified courses can be specific, for example to address the certain provisions related to flood resistant construction.

2.2.4 Insurance Agency and Flood Insurance

Effective state floodplain management programs recognize that insurance professionals can influence property owner decisions about purchasing flood insurance and, accordingly, coordinate with the state insurance agency. State insurance agencies serve citizens through consumer protection and regulation of the insurance industry, investigating and resolving consumer complaints, and educating the public in loss prevention and safety awareness. State insurance departments can coordinate consumer education initiatives to increase awareness and understanding of the financial protection offered by flood insurance. Even though federal flood insurance is not regulated at the state level, state insurance departments can establish licensing criteria and continuing education requirements for insurance professionals.

- The **Kansas** Insurance Department collaborated with the NFIP on an education campaign directed at insurance agents and consumers.
- **North Carolina's** Department of Insurance notifies insurance agents that they can take a flood insurance course as part of their annual continuing education requirements, and it waives the fees when agents attend NFIP courses.

2.2.5 Emergency Management

The state emergency management agency's mission is to protect the lives and property of citizens from natural and human-made emergencies and disasters, by coordinating the state's emergency preparedness, mitigation, response, and recovery efforts. The specific elements of emergency management that are related to floodplain management include

- Preparation and implementation of a state hazard mitigation plan;
- Technical and financial assistance to communities for preparing risk assessments and mitigation plans;
- Coordination of emergency response plans for floods and dam failures;
- Development of hurricane evacuation plans;
- Facilitating community involvement in pre-disaster mitigation through public outreach;
- Coordinating recovery from events declared as state disasters;
- Coordinating and administering disaster recovery and assistance programs, in conjunction with federal agencies and other relief entities;
- Identification of mitigation opportunities when inspecting damaged public facilities and infrastructure;
- Administration of mitigation grant programs to support state and community projects to reduce future damage and loss; and
- Establishment of a state fund to support mitigation projects.

2.2.6 State Transportation and Road Construction

State transportation agencies plan and construct new roads, upgrade existing roads and bridges, maintain and inspect roads and drainage facilities, establish drainage standards, and conduct research. Effective state roads programs can avoid adverse impacts to floodplains by requiring that flood hazard areas be identified and that potential impacts be analyzed during the planning phase of both new roads and upgrades. Establishing minimum design specifications can limit channel modifications and floodplain encroachments that increase the base flood elevation. Road and bridge designs that avoid the floodway and minimize backwater flooding minimize wetlands and other environmental impacts, as well. This multiple benefit not only protects ecological functions, but also can significantly reduce the length of time required to obtain permits.

Federal funding supports many state road construction projects (and some local road work). The Federal Highway Administration's design guidance addresses flood-related issues as a direct consequence of the President's Executive Order 11988, Floodplain Management.

In many parts of the country backwater flooding is common because of undersized bridges and culverts and raised approach roads that effectively block the passage of flood discharges. Effective state floodplain management programs try to limit adverse floodplain impacts associated with new road construction and encourage opportunities to reduce existing flooding when waterway crossings are replaced or upgraded.

2.2.7 State Health Department

Because floodwaters are easily contaminated by sewage, animal waste, chemicals, and oil products, effective state floodplain management programs take steps to minimize such risks to health. Some states address these elements in their water quality agency and others in their health department. Flood response and recovery efforts typically include campaigns to alert people to the hazards, encouraging them to boil water for consumption, and following decontamination procedures during cleanup. Examples of health related program elements include:

- Limitations on installation of on-site septic fields or mound systems in areas subject to frequent flooding;
- Minimum statewide standards for on-site sewage disposal, typically administered by local health departments, including holding tank stability when soils are saturated and requiring sewerage vents and openings to be elevated or protected against flooding;
- Design and construction standards for municipal wastewater treatment plants to ensure that ways to avoid or reduce flood hazards are incorporated into the entire site design;
- Guidelines for location and protection of public and private water supply wells;
- Funding programs for retrofit and upgrade of existing wastewater treatment plants, to assess exposure to flood hazards, and construct feasible protection measures;
- Limitations on placement of new landfills in areas subject to flooding, requiring that old landfills in floodplains be examined to determine their stability under flood conditions, and funding the construction of feasible protection measures;
- Limitations on placement of vehicle recycling facilities in flood hazard areas, and requirements that existing facilities treat runoff to minimize contamination; and
- Limitations on locating certain intensive livestock uses in the floodplain (such as feed lots and waste collection ponds).

2.2.8 State Dam Safety

Effective state dam safety programs have the authority and adequate staff resources to require permits; review construction proposals and process permits; perform inspections and require owners to perform inspections; provide training and exercises for emergency action plans; and issue notices to require dam owners to take appropriate action (such as maintenance, remedial work, and revising operating procedures). Due to the extraordinary public safety risks posed by unsafe dams, effective state programs have the authority and funds to take appropriate action to protect life and property if the dam owner fails to do so (including dam removal). For added public protection, effective state programs regulate or require local regulatory programs to recognize the area that could be inundated in the event of failure or breach of dams.

State dam safety programs also regulate the construction (including modifications and removals), inspection, maintenance, operation, and emergency planning of non-federal dams, and coordinate emergency planning with the owner agencies of federal dams. State programs coordinate with the U.S. Army Corps of Engineers, the Federal Energy Regulatory Commission, and FEMA for a variety of programmatic matters, including maintaining the National Dam Inventory.

State Dam Safety Regulations

In July 2004 Delaware became the 49th state to pass legislation requiring standards for maintenance, operation, and inspection of publicly owned dams. Alabama, the only state that lacks such a program, is expected to consider a dam safety bill in the coming year.

Dams affect flooding in a number of significant ways:

- Dams designed specifically for flood control offer a false sense of security to downstream development that is undertaken on the assumption that the degree of flood control is constant.
- Dams designed for water supply or recreation may be falsely perceived as providing flood control, leading to increased downstream development within areas that could be inundated under extreme flood conditions.
- Dams that are not inspected and maintained can become unsafe and thus more likely to fail under extreme conditions. Dam failure results in release of huge quantities of water that rise significantly higher and more rapidly than experienced with no dam or under the conditions of the base flood shown on Flood Insurance Rate Maps. Dam failures in the United States have caused extraordinary property damage, loss of infrastructure, and hundreds of deaths.
- Flood control dams are designed to manage specific inflow flood discharges. Water levels and release operations are managed based on those inflows and a schedule of releases. Upstream development can significantly alter the volume of runoff and the rapidity with which runoff drains to the waterway. Dam operations must be examined and adjusted periodically to account for changes in flood flows in order to protect both the dam and the downstream areas.
- Under flood conditions, dams capture large volumes of water and can cause lake levels to rise dramatically. Unless the land upstream of the dam is regulated to the maximum lake levels, flood damage can result.

Details about state dam safety programs, drawn from 1995–2002 data, can be found on pages 37–38 and Table 5 in *Floodplain Management 2003*.

2.2.9 Housing, Community, and Economic Development

Effective state floodplain management programs support physical improvement of communities, housing opportunities, and economic growth by working to minimize flood impacts and maximize the benefits of natural floodplain functions and resources. Major floods can significantly depress local and regional economies, both by affecting existing businesses and industries and by discouraging new ventures and adaptive re-use of older buildings.. Low-income areas are particularly susceptible to disasters because residents generally have fewer resources to support full recovery. In addition, some programs are structured so that strict reliance on a benefit/cost analysis may make it difficult for projects in low-income areas to qualify. Among the measures that state programs can take are

- Outreach to citizens who access agency services, to provide information about local flood hazards and low-cost ways to reduce damage;
- Technical assistance for communities to encourage planning to avoid and minimize flooding impacts, and to develop evacuation plans and disaster recovery plans;
- Incorporation of hazards and mitigation objectives in economic development plans to support growth and sound redevelopment;
- Limitations on use of community development funds unless flood hazard areas are avoided or, if unavoidable, that damage reduction measures are incorporated;
- Specifications in appropriate plans that Community Development Block Grant and other funds may be used to support and provide incentives for mitigation;
- Establishment of a funding source specifically for augmenting mitigation projects in low- and moderate-income areas;
- Coordination of access to state geographic information systems to facilitate use of hazard identification information by business interests seeking site development information;
- Technical assistance for at-risk businesses and industries to learn about damage reduction measures;
- Requirements that manufactured housing installers become familiar with flood hazards and the additional provisions required for installation in floodplains; and
- Requirements that installers of home fuel tanks (heating oil, liquid petroleum gas) become familiar with flood hazards and the additional provisions required for installation in floodplains.

2.2.10 Agriculture and Food Safety

Effective statewide floodplain management programs recognize that, because of their fertile soil and generally flat topography, some of the state's most fertile and productive agricultural lands are floodplains. Coordination with state programs that are responsible for agriculture and food safety concerns is an effective means of minimizing flood damage and losses to state agriculture. Agricultural losses due to flooding can be locally, regionally, and nationally significant. In the 1993 Midwest floods, agriculture damage constituted 50% of all disaster costs paid by taxpayers.

Floodplain management can be integrated with agricultural and food safety programs through

- Information tailored to the farming community to encourage measures to reduce flood damage;
- Technical assistance to help farmers evaluate alternative crops that are less susceptible to flood damage;
- Technical assistance to local soil and water conservation districts which, in turn, provide assistance to communities and landowners;
- Outreach efforts to encourage farmers to evaluate the merits of crop insurance;
- Technical assistance for food processors to determine if their facilities are subject to flooding and to identify cost-effective measures to minimize flood losses;
- Coordination with flood forecasting agencies and regional planning for evacuation of livestock before a flood;
- Technical assistance to help farmers comply with state and local floodplain permit requirements;
- No or limited support for levees that provide protection to arable land from frequent flooding, but that divert floodwaters or increase the depth of flooding and increase losses on other properties;
- Technical support for programs to encourage soil conservation (which helps reduce the volume of sediment that can worsen downstream flooding and also have adverse impacts on floodplain habitats);
- Financial and other support for conservation measures, including stream buffers for water quality and habitat improvement and wetlands set-asides for upland flood storage; and
- Agricultural preservation programs to help create buffers and manage growth, especially in the upper reaches of waterways that already experience flood damage.

2.2.11 Parks and Recreation

Effective state floodplain management programs take advantage of the fact that public parks are frequently located near prominent water features (shores, beaches, lakes, rivers, and streams) and that water-based recreational features are increasingly popular. Working in tandem with the state and local park agencies makes floodplain management more successful. States can

- Incorporate in long-range state and local plans the identification of flood-prone areas that can be preserved from development by being included in public parks.
- Identify funding sources to achieve the multiple objectives of adding to public park and recreation lands by removing buildings from flood hazard areas in order to restore natural floodplain functions.
- Restricting flood-prone lands that are in public ownership to passive uses and uses that are compatible with the flood hazard.
- Develop parks in ways that are compatible with potential flood hazards and natural floodplain functions and resources. User-intensive development, such as park buildings, picnic pavilions, campsites, showers, restrooms, and ball fields can be located in less hazard-prone areas with appropriate flood protection.

- Concentrate less-intensive park uses in areas subject to frequent flooding or where flood depths are expected to be significant and velocities high. Low-impact uses include passive recreation (hiking/biking paths, birding) and other compatible uses, including habitat protection, wetlands conservation, and reforestation.
- Ensure that parks and passive recreational areas provide opportunities for public education about the natural resources and functions of floodplains.

2.2.12 Forestry

Effective floodplain management includes the recognition that the state's forests play a central role in the overall health of many watersheds. Floodplain concerns need to be integrated with state forestry programs, which focus on preservation, conservation, and utilization of large tracts of forested lands. Conditions that adversely affect forests, including extensive wildfire burns and insect infestations, also are detrimental to watershed health and especially to the rainfall-runoff relationship. Rapid rehabilitation of damaged forested areas can help minimize soil erosion, sediment loading, channel choking, and downstream flooding.

2.2.13 State Geographic Information System Coordination

A geographic information system is a computer system (and the personnel required to operate it) that is capable of assembling, storing, manipulating, and displaying geographically referenced information, i.e., data identified according to location. The power of geographic information system (GIS) technology is its ability to combine layers of information about a place to improve understanding of that place. A GIS allows decision makers to quickly query, analyze, and map data for display.

During the early 1990s, explosive growth occurred in the development and use of GIS technologies. Because of the widespread use of GIS throughout virtually all government agencies, most states have established a coordinating body charged with, among other functions, stewarding data, establishing consistency standards, and leveraging funds and sharing data among state, regional, and local agencies and the private sector.

Effective state floodplain management programs capitalize on the GIS coordinating bodies to maximize use of GIS to support such action as:

- State and local comprehensive planning and zoning, environmental and habitat protection, and mitigation planning;
- Selection of desirable lands for development;
- Post-disaster damage assessments and recovery and redevelopment planning;
- Networking partners and data for the preparation of flood maps (see Section 3.3); and
- Risk assessments (see Section 3.4).
- Building databases for structures that are at risk of flooding in floodways and flood fringe areas, as well as for other data needed for mitigation projects.

2.2.14 Public Service Commission

Effective state floodplain management programs ensure that an appropriate entity has jurisdiction to apply suitable construction standards for utility system elements that are located in flood hazard areas and to ensure compliance with the state floodplain management regulations or governor's executive order. Often utility companies do not consider themselves subject to regulation by communities because they are under the jurisdiction of the state's public service commission. However, most commissions' regulations do not establish explicit standards for construction of plants, power lines, phone lines, water supply lines, sewer collection systems and the like. This leads to a gap in regulation that may increase exposure to flood damage and service disruptions, which proper state oversight can avoid.

2.2.15 Mining of Aggregates

Effective state floodplain management includes accounting for the potential adverse impacts that can result from the mining of aggregates from floodplains within the state. Sand and gravel, washed into floodplains along waterways over millennia, are used in the construction industry. Provisions that can be incorporated into a state's aggregate mining programs include

- Site management and sediment trapping measures to minimize loss of materials into waterways (sediment deposits can limit the ability of the channel to convey flood discharges and adversely affect water quality);
- Requirements that applicants for mining permits delineate floodplain boundaries, including floodway limits, where such mapping has not already been done;
- Regulation of in-stream mining that may jeopardize the stability of streambanks;
- Limitations on the stockpiling of materials or the construction of temporary dikes in designated floodways to avoid increasing off-site flood impacts;
- Construction requirements for wash-pond impoundments and periodic inspections to minimize risks associated with washout; and
- Requirements that operators or owners submit data necessary to revise flood hazard mapping when the mining is finished and site reclamation is underway.

Part 3 Flood Hazard Identification and Risk Assessment

Principle: Flood hazards within the state must be identified and the flood risks assessed.

Overview

Flood Hazard Map Coordination
- NFIP Map Study Process and Priorities
- Inventory or Periodic Review of Map Needs
- Technical Assistance to Communities
- Cooperating Technical Partners

State Hazard Identification Program
- Establish Mapping Standards
- Perform Studies
- Review and Approve Studies by Others
- Special Flood-Related Hazards
- Funding

Map Tools
- Geographic Information Systems
- Base Mapping

Risk Assessment
- Hazards U.S.

It is fundamental to state floodplain management that flood hazard areas within the state be identified and delineated in order to avoid future flood damage, to apply regulatory criteria, to inform property owners and the public, and to craft mitigation measures for existing at-risk development. It is just as basic that flood hazard areas often change over time, whether through deliberate modification or due to changes in the watershed (upland development or wildfire) or in the body of water itself (coastal erosion or river migration). Whether flood hazards are identified using detailed engineering or approximate methods, an effective state floodplain management program ensures that the flood risks are known and that changing conditions are accounted for.

States have long been involved in mapping flood hazards, and a small number of state mapping programs pre-date the NFIP by decades. In the early years, flood hazard areas often were defined by historic events. More recently, a number of states have created new initiatives or reinvigorated existing programs. This recent activity has been prompted in part by the growing awareness of the importance of defensible, up-to-date maps and the advent of new technology and tools (see Section 3.3 and Section 3.4). It is also due to the long-term trend of ever-increasing flood losses.

The most common maps are those produced by FEMA's flood hazard mapping program. The program has specific mandates within the Housing and Urban Development Act of 1968 (also known at the National Flood Insurance Act of 1968), as amended; the Housing and Urban Development Act of 1969; the Flood Disaster Protection Act of 1973, as amended; and the National Flood Insurance Reform Act of 1994. FEMA is authorized to identify, publish, and update information with respect to all flood-prone areas in the nation. Under this federal program alone, over 100,000 flood map panels have been published for more than 19,000 communities.

3.1 Flood Hazard Map Coordination

Effective state floodplain management programs coordinate a variety of functions related to flood hazard mapping. Whether flood studies and maps are produced by a state agency, by consultants under contract to a state agency, or by other governmental entities, the state program has a coordination role. A significant state function is the establishment of statewide priorities for new studies and revisions to existing maps. Priorities must be revised periodically so that the most significant needs in the state are addressed. Details on the state coordination of various mapping activities, drawn from 1995–2002 data, can be found on pages 47 and 51–54 in *Floodplain Management 2003*.

State floodplain management programs enhance the mapping process by

- Establishing criteria that meet the specific needs of the state and its communities, through, for example, higher standards or recognition and regulation of flood-related hazards and flooding conditions in that state, such as debris flows, ice jams, sediment flows, and coastal erosion;
- Coordinating the community's review of new studies and maps;
- Performing quality control on studies prepared by others to ensure that the state's criteria are satisfied and community needs are met; and
- Coordinating with communities to ensure that local floodplain management ordinances adequately reflect new hazard information contained in new flood studies.

In a state with an effective program, many state, local, and private-sector decisions are based on the information contained in floodplain studies and shown on flood hazard maps.

- Developers use flood maps to decide whether to buy land, whether to avoid certain flood-prone areas, what to build that is compatible with the risks, and how to build to minimize future damage and liability.
- Mortgage lenders, Realtors®, and insurance agents refer to the flood maps to determine the flood hazard on a given piece of property, ascertain whether flood insurance is required, and advise prospective buyers of these facts.
- Local governments use flood maps as part of their comprehensive planning, to determine land use zones, to process building permits and floodplain development approvals, to develop mitigation projects, and to formulate response and recovery strategies.
- Transportation agencies use flood maps when planning roads.

- Facility planners use flood maps to site public works and essential facilities such as emergency operations centers, fire stations, schools, and shelters.
- Emergency management agencies use flood maps to identify vulnerable areas and evacuation needs and to respond to flood emergencies.
- Water quality agencies factor the presence of flood-prone areas into decisions about on-site sewage systems, water supply wells, hazardous waste sites, and protection of source water supplies.
- Environmental agencies and organizations use flood maps to prioritize undeveloped lands for regulatory protection and other protection measures.

3.1.1 Map Study Process and Priorities for the National Flood Insurance Program

The governors of all states and U.S. territories designate an office to fulfill the responsibilities of the State Coordinating Agency for the National Flood Insurance Program. To foster the identification of flood hazards, these state agencies (commonly referred to as NFIP State Coordinators) perform a number of specific functions, including but not limited to assisting with

- Dissemination of flood hazard information;
- Delineation of flood-prone areas;
- Review, approval, and adoption of flood hazard maps;
- Revision and adoption of local floodplain management ordinances;
- Maintenance of service centers where maps can be accessed and obtained and historic maps consulted; and
- Recommending priorities for flood studies and revisions to current flood maps.

3.1.2 Inventory or Periodic Review of Map Needs

To be effective, a state floodplain management program should maintain an inventory of map needs so that resources can be focused where they are needed. An effective state program also periodically surveys communities to identify new map needs and determine changing priorities.

In 1997, FEMA initiated a multi-year plan to modernize the flood hazard maps that had been prepared for over 19,000 local jurisdictions, many of which are more than 15 years old or have become otherwise out of date due to changes in community boundaries, land use changes, projects that have altered the floodplain, or the availability of more detailed base mapping. States assisted in an early step of FEMA's map modernization, which involved collecting information about map needs from all NFIP communities. Beginning in fiscal year 2003, additional funding for implementation of map modernization was provided by Congress.

3.1.3 Technical Assistance to Communities

Effective state programs are capable of providing technical assistance to localities in the revising and updating maps. This is needed because many communities do not have in-house engineering

staff qualified in hydrologic and hydraulic modeling methods, making it difficult for them to adequately assess the technical material that supports new and revised flood hazard maps.

3.1.4 Cooperating Technical Partners

Effective state programs foster initiatives to produce and revise flood hazard maps so that all users have current data on which to base decisions (see Section 3.2). With a map inventory for nearly 19,000 communities, it is a significant challenge to keep flood maps current. The Cooperating Technical Partners (CTP) program creates partnerships between FEMA and participating NFIP communities, regional agencies, and state agencies that have the interest and capability to become more active participants in the FEMA Flood Hazard Mapping Program. Participating state agencies may include those that produce base mapping (such as a transportation or natural resources agency), those that perform floodplain studies, or those that coordinate GIS data and use.

Effective state programs have the technical ability and resources to participate as CTPs to strengthen their capacity for future mapping work. As CTPs, states contribute data and units of work to maximize the extent, accuracy, and usability of flood hazard studies to best meet a range of needs, while minimizing costs for all parties. Some partnerships involve cost-sharing, others recognize contributions of data or services, and some are simply recognition of ongoing functions that contribute to mapping goals.

CTPs recognize the benefits of establishing ongoing partnerships to accomplish common goals. Communities and states become CTPs for many reasons, among them

- Consistency between locally-produced base maps and flood hazard maps facilitates administration of floodplain requirements;
- Improved administration flows from having flood maps that are consistent with community-specific criteria, especially tailored to local flooding conditions and exceeding national minimum standards;
- Faster decisions can be made when developers submit revised or updated studies; and
- Citizens more readily accept maps that are made with local topography and thus have fewer errors and they avoid having to hire land surveyors to prove that certain parcels are high above the floodplain.

CTPs may collaborate in a variety of ways, including

- Refining Approximate A Zone boundaries;
- Conducting hydrologic and hydraulic analyses and floodplain mapping;
- Performing coastal flood hazard analyses and floodplain mapping;
- Preparing Digital Flood Insurance Rate Maps;
- Re-delineating floodplain boundaries using updated topography;
- Developing digital topographic data;
- Producing limited detailed studies to enable the elimination of Approximate A Zones;

- Digital base map inventory and data sharing; and
- Reviewing hydrology and hydraulic studies.

> ***Virginia's Digital Mapping***
>
> Under the Cooperating Technical Partners program, and using both state and federal funds, Virginia has completed digitizing the topography for the entire state, facilitating its use for flood hazard mapping and management.

3.2 State Hazard Identification Program

Effective state hazard identification programs include both those that establish state standards and have the capability to perform detailed and complex analyses, as well as those that provide technical assistance to communities during review of studies performed by others. Key components of an effective program include the collection, permanent archiving, and dissemination of flood hazard area data and studies, and ongoing coordination and priority setting with federal partners and communities. Details on state hazard identification and mapping programs, drawn from 1995–2002 data, can be found on pages 47–49 in *Floodplain Management 2003*.

3.2.1 Establish Mapping Standards

An effective state program is capable of establishing standards that are specifically applicable to some or all of the communities within that state. Those standards may exceed the minimum and nationally applicable standards of the NFIP or may address flood-related hazards that are not identified by the NFIP. The NFIP will recognize higher state mapping standards and use them to produce the state's Flood Insurance Rate Maps, notably more restrictive floodways and future-conditions hydrology. Some standards established by states and regional authorities include

- **Wisconsin** requires delineation of floodplains based on the assumption that dams may fail or be removed.
- Denver's **Urban Drainage and Flood Control District** prepares floodplain studies assuming full build-out to future land use conditions, and requires developers to use the same standard when considering floodplain impacts.
- The **District of Columbia**'s Flood Hazard Rules prohibit any encroachment, alteration, or improvement to any watercourse that would reduce its flood-carrying capacity.

3.2.2 Perform Studies

Effective state programs perform watershed and floodplain studies (or contract for those studies) to address state and local needs and changes that are not reflected in national priorities. When backed by funding, this ability also may position a state to leverage funding and resources under the FEMA Cooperating Technical Partners initiative (see Section 3.1.4). States that perform studies that lead to better, more up-to-date floodplain mapping for regulatory purposes include

- **Nebraska** does floodplain mapping studies and archives the data, both in hard copy and in GIS format. This information is shared with FEMA and the Corps of Engineers.
- Part of **New York**'s $2.5-million mapping program includes identifying and improving floodplain maps. Hard copies and GIS-format maps are maintained with coordination among the state, FEMA, and the Corps of Engineers.

3.2.3 Review and Approve Studies by Others

When appropriate, an effective state program reviews and approves flood hazard studies performed by others. Activities that result in changes to mapped flood hazard areas take place regularly, and the work to reflect those changes often includes engineering analyses and studies to evaluate the impact on waterways and floodplains. States review those studies when

- Communities do not have staff qualified to evaluate hydrologic and hydraulic analyses;
- State law requires state review to assure consistency with state standards;
- State permits are required for certain activities, especially those that are most likely to cause adverse impacts on other properties; or
- The state is a FEMA-approved Cooperating Technical Partner authorized to function as a technical reviewer according to FEMA mapping standards.

3.2.4 Special Flood-Related Hazards

Effective state floodplain management programs allow the regulatory authority (whether at the state or local level) to recognize special or unique flood-related hazards that are not reflected on the typical basic flood hazard map produced by the NFIP. The basic map depicts only the most common types of flooding—"clear water" riverine and coastal/lake flooding—because of the need for some uniformity in mapping standards and risk-based insurance rates, and also because of the cost of using multiple methods to develop maps that reflect the unique hazards in 20,000 communities. But effective floodplain management dictates that these hazards be depicted on flood hazard maps and adopted in land use criteria, construction setbacks and other measures to minimize risk, including post-storm redevelopment policies. Good, locally tailored maps that reflect special or unique hazards benefit the community and the property owners, reduce local and state disaster costs, and benefit federal and state taxpayers in general.

Many flood-related hazards have been identified and are described in Appendix B, including

- Flash floods
- Erosion-prone coastal areas
- Moveable bed streams and riverine erosion
- Dam inundation zones
- Levee- and floodwall-protected areas
- Flood hazard areas affected by subsidence
- Ice jam areas
- Closed basin lakes
- Alluvial fan hazards
- Debris flows (mud flood, mudslide, mudflow)
- Tsunami hazards
- Wildfire areas
- Volcanic hazards

Details on state regulation and mapping of special hazards, drawn from 1995–2002 data, can be found on pages 21, 49, and Table 7 of *Floodplain Management 2003*.

3.2.5 Funding

Effective state programs for identifying flood hazards are funded sufficiently to address the needs as determined by ongoing evaluation of priorities. The benefits of good flood hazard maps accrue in many ways as sound land use decisions are made, as landowners decide to build outside of the flood-prone area, as multi-objective projects are implemented, and as the trend of increasing flood damage is altered.

- **California** has a program for identifying and mapping flood hazards not mapped for the NFIP. This program receives $0.5 million annually from various sources.
- **Minnesota** has earmarked funding for hazard identification amounting to $200,000 from the state for flood maps and $200,000 from other sources for other hazard maps.
- **North Carolina** committed $32 million after Hurricane Floyd for a statewide flood hazard mapping program, which is being carried out under (and with additional funding from) the Cooperative Technical Partners program. The state sets priorities for mapping, conducts engineering and/or floodplain delineation reviews, and helps acquire base maps and terrain data.

3.3 Map Tools

An effective state floodplain management program uses efficient tools to support flood hazard mapping, regardless of who conducts the studies or proposes revisions to maps. The availability of digital technologies and tools has dramatically changed the way that maps are prepared. Details about state use of new mapping techniques, drawn from 1995–2002 data, can be found on pages 49–52 in *Floodplain Management 2003*.

3.3.1 Geographic Information Systems

An effective state program fosters use by communities of geographic information systems (GIS) to take advantage of the flexibilities offered by this computer-based mapping. Every state has an agency or coordination council designated to lead efforts for consistency of standards, development of statewide data, and coordination of GIS use by state and local governments. Combined with other new technologies to acquire data, such as satellite imagery, remotely sensed ground data, and global positioning system equipment, GIS has revolutionized how flood maps are prepared, distributed, and used. States support floodplain management through their GIS initiatives in different ways.

- The **Texas** Natural Resources Information System is part of the Texas Water Development Board and supports topographic and geologic mapping. The staff provides data management, clearinghouse, and dissemination services to state and other agencies.
- Funded by a fee generated from land recordations, the **Wisconsin** Land Information Program provides grants to counties to develop and maintain county-wide GISs, including aerial photography, establishment of elevation controls, property surveys, hardware, software, training, and staff.

- **West Virginia** University's Geographic Information System Technical Center has developed orthophoto quadrangles for the entire state, in support of state and local management of natural resources, economic development, and flood loss reduction.
- **Mississippi** has an extensive GIS mapping program, having developed maps for orthophoto, hydrographic, roads, geodetic control, digital terrain models, structures, and land cover. All of these maps help in managing the state's floodplains.

3.3.2 Base Mapping

Effective state programs support preparation of base maps that serve multiple purposes, including flood hazard mapping. States and local jurisdictions use base maps for every function that involves display and analysis of geographic distribution, whether population, land use, soil types, transportation networks, drainage patterns, environmentally sensitive areas, coastal erosion, or other attributes. For preparing flood hazard maps, the base map must include topography, because it influences every aspect of flooding, from the direction the water will flow, to the rapidity with which rainfall runs off the land, to how high water rises in stream valleys, to how far inland a coastal storm surge will reach.

- **Alaska** capitalizes on partnerships with small communities to produce orthophoto base maps with one- to two-foot contour interval topography.
- **Virginia** has a Geographic Information Network, funded at $12 million, that produces base maps for orthophoto, hydrographic, roads, geodetic control, digital terrain models, and structures. All are in GIS format.

3.4 Risk Assessment

Effective state floodplain management programs support the collection of data used in flood risk assessments, and provide a range of technical assistance to communities to undertake risk assessments. Assistance may take the form of training so that communities and regional organizations can perform assessments, or a state program may conduct risk assessments with information provided by communities. Although all areas identified as subject to flooding of the same frequency (e.g., the 1%-annual chance flood) have the same probability of occurrence, it is natural to focus on areas that have experienced recent damaging floods. Consistent application of risk assessment tools is useful to identify high-risk areas that do not have that recent history.

The term "risk assessment" refers to a systematic process to evaluate the likelihood of a hazard event, the severity of the event, and the probable degree of damage that would result if an event occurs. Sound decisions about a range of statel and local actions can be based on an assessment of risks, such as prioritizing map needs, preparing local land use and mitigation plans (see Section 5.1), and identifying and ranking possible mitigation measures.

Comprehensive risk assessments take into account primary damage (to structures and contents), secondary damage (such as the water well contamination), and indirect losses (such as loss of function, see Section 10.1.2). Typical indicators include the number of people living or working in a hazard-prone area; the number and values of properties subject to varying degrees of risk; the number and types of public buildings and infrastructure (roads, streets, bridges, water lines, sewers, power lines, etc) facilities affected; and other economically important land uses and

natural features that are exposed. Environmental damage and health risks are considered in a comprehensive risk assessment, as are economic disruption and losses.

Basic assessments that are prepared using flood hazard maps, ground elevation, and estimates of the types and number of buildings can yield meaningful results. Applying information about how those building types generally perform when flooded yields estimates of damage for various depths of floodwater. Standardized depth-damage curves for various building types have been prepared by the NFIP and by the Corps of Engineers. Methods such as FEMA's Hazards U.S. Multi-Hazard Loss Estimation Software Program (HAZUS-MH) use GIS data and allow assessment of a wide range of scenario impacts, for both existing and proposed development.

3.4.1 Hazards U.S.

Effective state floodplain management programs provide a range of technical assistance to support communities and regional organizations that use loss estimates from the HAZUS Flood Loss Estimation model to prepare mitigation plans, evaluate changes in development and regulatory policies, and identify pre-disaster mitigation opportunities (see Part 5).

HAZUS-MH Loss Estimation Supports Planning

HAZUS-MH, a GIS-based multi-hazard loss estimation method developed by the Federal Emergency Management Agency, includes a flood module that will allow communities to evaluate the effects of different land use and development policies in order to better determine the long-term benefits and adverse impacts of each (see Section 3.4).

HAZUS is a GIS-based program that produces loss estimates that help state, regional and local governments plan for damage, to prepare emergency response and recovery plans, and to help examine options to reduce future damage. The method covers nearly all aspects of the built-environment and a wide range of losses. Originally developed by FEMA to assess risks from earthquakes, the model has been expanded to address both floods and winds (wind is only for the Atlantic and Gulf Coast regions).

The HAZUS model allows users to determine flood depths and to estimate damage and losses for floods of varying magnitudes. Loss categories include buildings, essential facilities, transportation and utility lifelines, and agricultural losses. Estimates of debris associated with flooding and shelter requirements can be made, along with estimates of economic losses. Three levels of analysis are available, depending on the level of detail, types of data at hand, and the capability of the user.

Part 4 Respect for Floodplain Functions and Resources

Principle: Natural floodplain functions and resources throughout the state need to be respected.

Overview

Floodplain Functions and Resources
- Identifying Functions and Resources

State and Local Management of Functions and Resources
- Program Elements and their Coordination
- Technical Assistance
- Public Awareness and Education

Floodplains are ecologically sensitive areas that provide a range of natural and beneficial functions. The best-known natural function of a floodplain is to allow for the storage and conveyance of flood waters, but the hydrological processes in the drainage area also are continuously shaping the channel and stream banks, operating on the instream and riparian vegetation, affecting the soil, and creating habitats both within the waterway and around it. Floodplains host unique plant and animal habitats and riverine drainage networks serve as wildlife corridors. Many high-value wetlands lie within floodplains, especially along the coast. Many of the nation's important cultural, historical, and archeological resources are found along waterways and lake and ocean shores, because early development depended on proximity to water (Task Force on Natural and Beneficial Functions of the Floodplain (2002).

Report to Congress

"Protecting and restoring the natural and beneficial functions of floodplains will not only reduce flood damage, but also will contribute to a community's social and economic well-being."

Task Force on the Natural and Beneficial Functions of the Floodplain (2000)

Although much of floodplain management to date has focused on keeping development protected from flood flows and allowing some conveyance area for them, in fact truly effective management of the floodplain is more complex. The *Unified National Program for Floodplain Management* puts the preservation and restoration of the natural functions and resources of floodplains on a par with reducing flood losses, making them co-equal national goals (Federal Interagency Floodplain Management Task Force, 1994). A focus on simply reducing damage does not automatically address the protection of the floodplain functions and resources that are of value in themselves and also act over the long term to ameliorate flood damage as well.

Effective state floodplain management programs acknowledge that

- Floodplains and the watersheds around them are complex natural systems and that every human-caused action may have both positive and negative impacts on them. The interrelationships among human activities and natural systems must be considered.
- Management standards for reducing flood losses (such as the 100-year floodplain) do not necessarily coincide with the realities of hydrologic, geomorphologic, and ecologic processes taking place on floodplains. In fact, for example, the more-frequent floods have a bigger effect on channel morphology and on the riparian habitats.
- The preservation and restoration of floodplain functions and resources are becoming both more critical and more difficult, as development, pollution, invasive species, and other environmental alterations affect floodplain areas.

4.1 Identifying and Mapping Floodplain Functions and Resources

As with flood risks, the functions and resources of the floodplains within a state need to be identified and delineated in order to avoid causing harm to them, to apply appropriate regulatory criteria and other management techniques, to keep the people informed about their value, to craft mitigation techniques, and plan for restoration as needed.

Floodplain Functions

- Store and convey floodwaters
- Reduce flow velocities and flood peaks
- Absorb coastal wave energies
- Reduce sedimentation
- Filter nutrients and impurities
- Enhance agricultural lands
- Process organic wastes
- Moderate fluctuations in the stream's water temperature
- Promote infiltration and aquifer recharge
- Reduce the frequency and duration of low-flow periods
- Support plant growth
- Maintain the biodiversity and integrity of the ecosystem

Floodplain Resources

- Breeding and feeding grounds for wildlife
- Fertile soils
- Habitat for waterfowl
- Habitats for rare, threatened, or endangered species
- Corridors for wildlife movement
- Sites for aquaculture
- Forested bottomlands, riparian vegetation
- Places for passive and active recreation
- Open space
- Beauty.

(Note that the functions and resources tend to overlap.)

Effective states have an inventory of the floodplain functions and resources, such as those listed above, within their boundaries. Having these attributes mapped is helpful to decisionmakers, planners, environmental groups, and others, and it is even more useful to have them on overlays or a GIS that allows them to be correlated spatially with other attributes, such as regulatory areas, soil type, land cover, species habitat, aquifer recharge zones, ownership, and protected areas.

4.2 Management of Floodplain Functions and Resources

Floodplain functions and resources can be managed in a variety of ways, both within the state' floodplain management program and within other programs. Effective states use all available approaches, including

- **State regulatory programs** administer some form of direct state permit or approval process for actions that directly or indirectly affect natural floodplain resources and functions;
- **State laws** to protect certain resources, such a dune protection ordinance;
- **State advisory or oversight programs** set guidelines or criteria for local programs for natural floodplain resource protection and restoration, whether those local programs are voluntary or mandatory, and monitor local administration and enforcement.
- **Governors' executive orders** can set policies and standards for state treatment of special resources, such as wetlands.

4.2.1 Floodplain Management Program Elements

Within the context of the state's floodplain management program, special care can be taken to adopt policies or approaches that serve to protect floodplain resources and resources while also minimizing flood damage and losses. Effective states should consider the following.

- Adopt or encourage adoption of a zero-rise floodway (or close to it). Where 1-foot rise floodways are allowed, encroachment can take place in the area now called "flood fringe" (which is actually nature's floodway), making it much more difficult to manage the floodplain area to protect natural resources.
- Focus not just on 100-year flood when deciding whether to approve channelization or other hydrological modifications, but also on the more frequent floods that play a more significant role in the maintenance of natural floodplain functions and resources. To protect the natural channel, it is necessary to look at the more frequent channel-forming events, fully considering the hydrological, geomorphological, and critical environmental effects of proposed changes on water ecology and geomorphologic function.
- Use a watershed-based approach as much as possible, and thereby tie floodplain management, including the NFIP, more closely to the stormwater management, water quality, and other programs that tend to use the watershed (rather than the community) as an organizing principle.
- In proposals for development, require an analysis of impacts on the floodplain resources and functions along with the impacts on flood flows and stormwater runoff, etc.

- Encourage communities to link mitigation programs with their comprehensive planning for open space protection in the form of future expansion of parklands, recreational corridors, or natural spaces. Communities can make acquisition and clearing of floodprone lands for open space a mitigation priority.
- Require, or authorize localities to require, analyses of environmental impacts to natural floodplains that would result from proposed development or other human activity. As discussed in Section 5.7.2, this analysis makes it possible to determine what steps could be take to avoid or minimize such impacts. Some aspects of the floodplain environment are regulated by federal programs (such as the Section 404 Clean Water Act and the Endangered Species Act) or resource-specific state programs, but those programs are not a substitute for state- or local-level investigation of the potential environmental effects on the floodplain of proposed development.

Using Buffers and Setbacks

- Maine enforces a mandatory shoreline zoning requirement for a 250-foot zone around every body of water.
- New Jersey's new stormwater rules require a 300-foot buffer around all of the state's high-quality water bodies (over 6,093 stream miles). See http://www.state.nj.us/dep/newsrel/ releases/04_0105.gov.htm.
- South Carolina has designed a model riparian buffer ordinance and a brochure about "backyard buffers" to encourage local governments and the public to adopt such measures. See http://www.scdhec.net/ocrm/pubs/buffers.pdf and http://www.scdhec.net/ocrm/pubs/model/pdf and http://www.scdhec.net/ocrm/pubs/backyard.pdf.

- Require, or encourage localities to require, floodplain restoration or enhancement as a condition of development when appropriate.
- Require, or encourage localities to require, setbacks from the edge of waterways, lakes, and/or the ocean.
- Include adverse impacts to natural functions and resources among those occurrences that must be avoided or mitigated, along with more familiar impacts on conveyance, velocities, etc. Ft Collins, Colorado, for example, specifically requires that scenic views of and vegetation within substantial natural habitats (such as floodplains) not be negatively affected by proposed development (disturbance and subsequent restoration is allowable).
- Promote multi-objective management, including planning and projects for river corridors, watersheds, and shoreline areas.
- Coordinate with programs that already offer tax breaks and other support for preservation of agricultural lands, forests, wildlife habitat, and other lands that may include floodplain

areas. For example, the Natural Resources Conservation Service has a number of such programs that can provide for stream buffers, protect wetlands, etc.

- Require that floodplain resources and functions be specifically addressed in local planning.

> ***Planning in Oregon***
>
> Oregon requires communities to address natural hazards in their comprehensive land-use plans and to adopt programs to protect riparian corridors, wetlands, groundwater resources, and state scenic waterways.

- Authorize and encourage communities to institutionalize sustainability initiatives. Sustainable communities make efficient use of flood-prone and environmentally sensitive lands while still maintaining economic opportunity and community well-being. Preservation of floodplains is emphasized, along with low-impact recreational uses such as greenways, hiking-biking paths, parks and wetlands, or forestry conservation.
- Require or encourage the practice of "green lining," in which environmentally sensitive areas (floodplains, wetlands, habitats, tree stands, eroding shorelines, dunes) are delineated, either as an early step in subdivision design (see Section 5.6.2) or as part of a continual management or restoration strategy. Some communities (in southeast Wisconsin, for example) set aside the entire floodplain as an open space greenway within their comprehensive land use plans. This achieves the multiple objectives of risk reduction, resource protection, open space and parks, and habitat enhancement.

> ***Green Space in Georgia***
>
> Georgia's Greenspace Program, established in 2000, creates a framework within which both developed and developing communities can preserve green space, which includes connected and open lands for natural resource protection (including floodplains) and informal recreation.

4.2.2 Coordination of other Program Elements

Many state and local activities not directly tied to floodplain management nevertheless protect and manage floodplain functions and resources. An effective state floodplain management program is aware of the various agencies and programs that operate within the state and coordinates with them in order to better protect floodplain resources. When the goals of these programs are linked with floodplain management concepts, they become even more effective because they work synergistically to guide development in ways that minimize environmental (and flood risk) impacts. In addition, those states have mechanisms for ensuring that the rules, regulations, policies, and other management techniques for these program elements are implemented and enforced.

- **Sediment and Erosion Control.** Urbanizing watersheds can prompt dramatic changes in stream regime. In addition to increasing the volume and rapidity of rainfall runoff,

construction activities generate large quantities of sediment. Heavy sedimentation can kill subaquatic vegetation, smother bottom-dwelling insects and fish eggs, and increase water treatment costs. Sediment loads that exceed natural levels can fill in channels, sometimes increasing the frequency that streams rise out of bank and flood adjacent lands. Programs that require sediment and erosion control for land-disturbing activities help limit such impacts on floodplain resources.

- **Water Quality.** Best management practices that are designed to minimize water pollution associated with land development also benefit floodplain functions that depend on quality environments for plants and animals.
- **Stormwater Management**. Most stormwater management programs require post-construction runoff to match pre-development quantities, often with additional water quality management of the "first flush" that carries higher concentrations of pollutants. By attenuating peak flows, stormwater management can help avoid instabilities in stream channels and banks.
- **Source Water and Aquifer Recharge Protection.** The Environmental Protection Agency's Source Water Program identifies sources of water supply, then develops plans to protect them through watershed approaches. Many states prohibit wells in the entire floodplain, or have other measures to protect water supplies from flood waters. Aquifer protection programs are aimed at ensuring adequate groundwater supplies for human uses, including domestic, industrial or agricultural consumption. Floodplains, and especially the wetlands within them, may contribute to aquifer recharge while also storing water that subsequently becomes base flow.
- **Wetlands Protection.** Wetlands are widely regarded as crucial for their ability to store floodwaters, their water quality and filtration capabilities, their biodiversity, and the extent and richness of habitats and feeding areas for fish and wildlife. Many nontidal and tidal wetlands are found in floodplains. Therefore, significant and multiple benefits accrue when wetland regulatory programs guide development to high ground. Similarly, effective floodplain management programs reduce development pressures to encroach into wetlands.
- **Wild and Scenic Rivers Programs.** Wild and scenic rivers programs usually influence the type and density of development, including roads and bridges, that is allowed within defined corridors along designated rivers. The environmental and aesthetic qualities of these rivers and their floodplains are protected.
- **Rare, Threatened, and Endangered Species.** Designated rare, threatened, or endangered species and their habitats are found throughout landscapes and water-dependent environments. State floodplain management programs take advantage of the need (and requirements) to protect habitat for these species to also preserve other floodplain and riparian resources.
- **Cultural Resources.** State historic preservation programs focus on individual structures, sites, and groups of buildings and districts that have cultural, historical, and archeological significance. When located in floodplains, those valued resources can be identified and feasible measures to minimize the effects of flooding can be brought to bear while still protecting historic values.

- **Open Space Protection.** States administer a variety of programs that use mechanisms, including acquisition and easements, to preserve and protect open space. Some programs focus on habitats and wildlife corridors, high value forest stands, parks and passive recreational areas, unique archeological and geological areas, and other characteristics that are deemed of public value, including many that are identified as natural and beneficial floodplain functions and characteristics of floodplains.
- **Coastal/Shoreline Management.** State coastal zone management programs generally derive from the federal level and incorporate broad goals. Some programs focus on growth management while others deal with such matters as coastal erosion, coastal wetlands, regulation of shoreline structures and protection of dunes, and how and where buildings can be constructed. Programs that impose a setback or buffer to guide development back from the water's edge not only limit the interference of shoreline processes, but also reduce exposure of development to coastal storms and flooding.
- **Growth Management.** Growth management programs typically include broad objectives to protect natural resources, which in turn may be broadly defined to directly or indirectly include many of the natural and beneficial floodplain functions. Some programs explicitly require that land development proposals delineate or "green line" natural resource areas as a first step so that sensitive areas can be more readily avoided.
- **Agricultural Preservation.** Floodwaters carry nutrient-rich sediment and trigger chemical processes in the soil that contribute to the fertility of river bottomlands, where agricultural production can be very high. While flood-related agricultural losses can be significant, the societal impacts of such flooding are generally smaller than if buildings and infrastructure are flooded. Programs that preserve agricultural lands for farming help guide encroaching development to other areas. At the same time, it is important to recognize that high intensity agricultural use, like row crops, can contribute heavy amounts of sediment, chemical fertilizers and pesticides and herbicides to the floodwater and our natural streams. The Natural Resources Conservation Service of the U.S. Department of Agriculture has many programs that pay farmers to set aside those lands or to put them into lower intensity uses that cause far fewer adverse impacts to the stream ecosystem.
- **Public Recreation.** State and local programs that plan for and fund public parks and recreational facilities should specifically identify and actively incorporate water features and flood hazard areas into passive recreational uses. While retaining these lands as public open space prevents encroachment by private development, it also preserves their natural and beneficial environmental functions and values.
- **Forestry.** Because forests play a central role in the overall health of many watersheds—and to the rainfall/runoff relationship—floodplain concerns need to be integrated with state forestry programs. The preservation and conservation of forested lands, management of wildfire burns and insect infestations, and rehabilitation of damaged forests can minimize soil erosion, sediment loading, channel choking, and downstream flooding.
- **Septic System, Waste Water Protection.** Many state have programs with requirements on placement of septic tanks and other waste water programs that prohibit their use in floodplains, or at the least, the floodways.

- **Solid and Hazardous Waste Sites.** Solid waste sites are often prohibited from the 1% chance floodplain, and hazardous waste sites from the 0.2% floodplain. These programs again, can be integrated with flood risk programs to protect natural floodplain functions.

Details on state programs to protect and preserve and floodplain functions and resources, drawn from 1995–2002 data, can be found on pages 28–33 and Table 4 in *Floodplain Management 2003*.

4.3 Technical Assistance

Just as they provide help to communities with their work to reduce flood damage, so effective state floodplain management programs are capable of providing technical assistance to localities in the protection and management of floodplain resources and functions. A large part of this assistance may consist in having and sharing contacts with the federal, state, or private agencies and organizations that specialize in the particular resource, or have specific programs to enhance local efforts (such as the typical state programs listed in section 4.2). States also pass along to local staff and officials their understanding of the connections between the many other flood loss reduction activities and programs and that, often implicitly, can help protect the underlying natural functions and resources of floodplains.

- State staff need knowledge of innovative zoning and/or subdivision techniques (such as those described in sections 5.2.2 and 5.6) that can be integrated with local floodplain management codes to protect natural functions of floodplains. State programs can help review the codes or suggest how they could be strengthened.
- There are many federal and private programs that provide financial and technical support for protection of resources. Many of these can easily be linked to floodplain management or flood loss reduction activities. For example, FEMA's Hazard Mitigation Grant Program funds are often used to help acquire floodplain structures so that the floodplain can be converted to open space. The Natural Resources Conservation Service has an array of programs that help and provide incentives for landowners (especially of agricultural lands) to keep riparian areas and wetlands in a natural state, reduce flooding, and improve watershed stewardship. Community Development Block Grants from the U.S. Department of Housing and Urban Development can be applied to the preservation and protection of at-risk historic and cultural structures.
- The Community Rating System provides credit to localities for preserving open space, keeping floodplain lands vacant, using deed restrictions, and other local measures that both reduce flood losses and protect resources.
- Habitat that is needed by threatened or endangered species often coincides with a riparian or floodplain area. Numerous federal and state agencies may provide cost sharing programs (e.g., NRCS) to protect floodplain resource areas for the future and to strengthen watershed management.
- For coastal communities, the Coastal Barrier Resources Act restricts federal funds (including flood insurance) for development in certain barrier areas, but it also acts to protect resources and particularly when states fashion their management measures to complement it. For example, Alabama has delineated its coastal construction control line

to match the boundary of the CBRA area. This gives “double” protection to the fragile coastal ecosystem.

4.4 Public Awareness and Education

Effective state floodplain management programs incorporate information about floodplain functions and resources into their existing initiatives for flood hazard awareness. The two aspects go hand-in-hand, and people tend to understand the natural processes better when they are presented as a whole. Programs for school children, neighborhood stream teams, posters, public service announcements, newsletters, and other flood awareness techniques can easily be expanded to point out the resources and functions that floodplains provide.

Ohio Kids Learn about Floodplains

The Ohio Department of Natural Resources sponsors "School Days" at its state parks. This event allows local schoolchildren from kindergarten through 6th grade to enjoy the park and learn about different environmental issues. One station, staffed by the state floodplain management program, teaches about floods and flooding, highlighting the natural functions of streams, floodplains, and wetlands.

Part 5 Guiding Development and Managing its Impacts

Principle: Development within the state must be guided away from flood-prone areas; adverse impacts of development both inside and outside of the floodplain must be minimized.

Overview

Planning
- Comprehensive Plans
- Land Use
- Interjurisdictional Watershed Plans
- Mitigation Plans

Zoning
- Development Density
- Conservation Zoning
- Bonus or Incentive Zoning

Growth Management/Sustainable Development

Other Land Management Tools

Building and Floodplain Permits
- Variance Requests
- Inspection and Enforcement
- Higher Standards
- Safety-based Decision Factors
- Flood Hazard Areas Not Mapped by FEMA
- Special Flood-Related Hazards

Subdivision Regulations
- Lot Layout
- Open Space and "Green-Lining"
- Additional Requirements for Subdivision Development

Impact Analyses Required
- Hydrologic and Hydraulic Impacts
- Environmental Impacts
- Emergency Services Impacts
- Socio-economic Impacts
- Coastal Impacts

In large measure, adverse floodplain impacts can be avoided entirely, or certainly minimized, if communities have the authority, tools, and political will to guide development to less hazard-prone areas and to examine the full extent of impacts when floodplain development *is* proposed.

To accomplish this, effective state programs apply land use management tools directly through state regulation, or authorize and foster application of those tools at the local level.

Effective programs acknowledge that watersheds and floodplains are complex natural systems and that every human activity may have both positive and negative impacts, so those interrelationships must be taken into consideration. This is a more effective approach than simply requiring that each individual development activity proposed in flood hazard areas be built so that it withstands flood damage. The legal basis for floodplain management is the protection of citizens: not only the protection of landowners (by requiring that their activities meet certain standards to avoid flood damage to their property), but also the protection of the entire community (by requiring that those activities do not adversely affect others). Thus, effective state programs require that both on-site and off-site impacts be considered.

A useful overall framework for implementing this principle is the "No Adverse Impact" approach to floodplain management. This concept means that any proposed development within a watershed should be analyzed in advance to determine if it will have any negative impacts on other residents or property owners. If it will, then those impacts must be mitigated in some way, preferably as provided for in the community's or watershed's overall plan (see http://www.floods.org).

The following sections outline tools that can be used to guide development toward less hazard-prone areas and, where floodplain development is proposed, to consider the full range of impacts that it would have and minimize the negative ones. Although most of these tools are applied at the local level, states with direct regulatory authority coordinate with communities so that local land use and comprehensive plans, local zoning, and locality-specific mechanisms are not overridden.

5.1 Planning

Effective state programs require that flood hazards be specifically addressed in local planning. Plans typically are a collection of policies and guidance on how a community expects to grow, change, and look in the future. With respect to flood hazards, effective local planning will recognize existing and future risks and establish a goal of reducing future exposure through various mechanisms. In part, establishing mechanisms to guide development to achieve those goals allows a community to strike important balances. The right of citizens to live and work where they please—and to reasonably use their lands—must be balanced with public costs and the need to protect those same citizens and the whole community as well, including its natural resources, cultural amenities, and economic vitality. Details about state and local planning for floodplain management and flood mitigation, drawn from 1995–2002 data, can be found on pages 16–17, 29, and 34–35 in *Floodplain Management 2003*.

5.1.1 Comprehensive Plans

Comprehensive plans establish the long-term "vision" of how communities will grow—they set broad goals and establish objectives for achieving them. Plans identify how a community should be developed and where development should not occur, govern the rate, intensity, form, and quality of physical development; and also address economic development, environmental, social,

and hazard mitigation concerns. To reduce the impacts of disasters, comprehensive plans help guide other local measures, such as capital improvement programs for infrastructure, zoning ordinances, park and recreation (and open space) plans, and subdivision ordinances.

Comprehensive Plans and Flood Hazards

Few states require local comprehensive plans or require that the plans explicitly include floodplain management or hazard mitigation elements. Yet research shows that such state mandates result in stronger growth management at the local level (Burby et al. 1993).

Effective state floodplain management programs ensure that flood hazard mitigation objectives are integrated into local comprehensive planning. This improves the effectiveness of flood hazard reduction in at least three ways:

- It fosters plans that identify flood risks and guide development to less hazard-prone areas;
- It institutionalizes the process of addressing hazards, increasing opportunities to support other community objectives; and
- It can create a constituency for mitigation because of the extensive public involvement usually undertaken during the comprehensive planning process.

Among other tasks, comprehensive planning requires the collection and analysis of information about the suitability of land for development. What is known about flood hazards (flood maps, soils maps, areas affected by historic floods) is then incorporated so that mechanisms to reduce future risk can be applied (land conservation, environmental protection, appropriate land uses, standards for building, redevelopment, etc.). This process helps policy makers and citizens understand the limitations to development in hazard-prone areas. In turn, land uses can be tailored to the hazard risk, typically by reserving dangerous areas for less intensive, hazard-compatible uses such as natural areas, wildlife refuges, passive parks, hiking/biking trails, and some types of recreational areas.

Other elements of a comprehensive plan should directly address flood risk:

- The capital improvements element should ensure that hazards are considered in the planning and design of new and replacement public infrastructure (road and bridges and water, sewer, electric, and telephone lines). Damage to these systems accounts for significant post-disaster recovery costs incurred by all levels of government.
- The transportation element should acknowledge the importance of the safety of and access for the traveling public and the high cost of repairing and replacing roads and bridges that are not designed to adequately pass the discharge of the base flood.

5.1.2 Land Use Plans

Effective state floodplain management programs require (or at least encourage) communities to include recognition of flood hazard areas in land use plans in order to help guide development to

less hazard-prone areas and to ensure that floodplain development that does take place incorporates measures to minimize the impacts and exposure to future damage.

> ***Oregon's Statewide Planning Reduces Damage***
>
> It is estimated that $10 million in flood losses are avoided each year due to Oregon's statewide planning goals, which require communities to address natural hazards and floodplain resources in mandated comprehensive land use plans.
>
> *(Federal Emergency Management Agency, 2000)*

Land use planning is the process of deciding whether and how to develop and redevelop the land. It is the framework within which a community, and individual property owners, take into account various factors that may limit or influence development. Those factors may vary from community to community but generally include the adequacy of the transportation network, water supply, wastewater treatment capacity, school capacity, park and recreational opportunities, and adequacy of emergency services. Many land use plans incorporate measures to identify and preserve historical and cultural features and sensitive areas and environmental resources. Effective local land use plans have financial benefits because development and the associated infrastructure investments are planned in ways that create efficiencies.

5.1.3 Interjurisdictional Watershed Plans

Like many natural features, riverine flooding does not respect community boundaries. The actions of every community and every property owner upstream of a location can affect flooding at that location as well as downstream. Effective state floodplain management programs require or foster watershed-based planning to account for the complexity of the watershed drainage and ecosystem. Only through such efforts can the effects of upstream activities on downstream communities be understood. Watershed planning supports multiple goals, including flood hazard management, water quality, stormwater management, habitat protection and enhancement, and other environmental objectives.

Although upland growth and development within a watershed have many impacts, with respect to flood hazards the most significant is the effect on runoff. As described in Section 5.7.1, expanding the amount of impervious area increases the amount of rainfall that runs off the land, changes the path of runoff (e.g., curbs, storm drains), and decreases the time it takes for runoff to

> ***Are We Planning Safer Communities?***
>
> In a 2002 publication by this name, the Institute for Business and Home Safety reported that "with land use planning that takes into account an area's potential disaster risks, many losses could be avoided or reduced. Unfortunately, few communities have fully embraced this approach."
>
> http://www.ibhs.org/research_library/

collect in waterways. Both effects tend to increase the volume of flood discharges, increase the rapidity with which flooding starts, and increase the depth of flooding in downstream reaches.

It is important to consider how proposed future development patterns will alter flooding, especially when downstream communities have existing development located in flood hazard areas. The results of future development scenarios that cause significant increases in downstream flooding (such as expanding the amount of impervious area) may prompt changes in zoning and allowable densities or the adoption of higher standards for stormwater management.

Another activity for which a watershed management plan is particularly important is evaluation of off-site impacts associated with certain structural flood control measures. Levees and floodwalls may protect one area but transfer flooding problems downstream due to increased flood velocities and depths.

5.1.4 Mitigation Plans

Effective state floodplain management programs foster development of state, regional, and local multi-hazard mitigation plans. Hazard mitigation planning at both the state and local levels is the process of determining how to avoid or minimize the loss of life and property damage caused by natural and human-caused hazards. Access to state and federal mitigation funds is conditioned on the development and adoption of a mitigation plan. Because mitigation plans, especially those developed in the aftermath of a flood, may be overlooked or quickly discarded in the press of recovery, it can be more effective to integrate mitigation into other community plans.

Mitigation plans define very specific actions covering many aspects of the community, including undeveloped lands; existing buildings that are exposed; public safety and education; infrastructure construction standards and retrofits; emergency response and recovery; and preservation of natural functions that help reduce future damage (specific to flood hazard areas).

State and local mitigation plans are most effective when they are developed to address the full range of likely natural hazards, including flooding, erosion, earthquakes, tornados, hurricanes, wildfire, landslide, severe winter storms, and human-caused hazards. Proper mitigation planning is a deliberative process that involves several steps, including

- Organizing a committee;
- Involving citizens representatives and businesses;
- Identifying hazards and the likely frequency and severity of occurrence;
- Assessing potential risks to determine people, property and infrastructure that could be damaged;
- Developing a mitigation goal statement;
- Evaluating existing capabilities and limitations;
- Prioritizing actions that will move the state/community toward its mitigation goal;
- Preparing and adopting the mitigation plan; and
- Implementing the actions and documenting progress.

Federal Mitigation Planning Requirements

Access to federal mitigation grant funds is conditioned on the adoption of mitigation plans that satisfy specific regulatory requirements:

- Section 322 of the Disaster Mitigation Act of 2000 requires state and local plans to be eligible for pre-disaster and post-disaster funds (44 *CFR* Parts 201 and 206); and
- The National Flood Insurance Reform Act of 1994 requires a plan to be eligible for Flood Mitigation Assistance Program funds (44 *CFR* Part 78.5).

5.2 Zoning

Effective state floodplain management programs require, authorize, or encourage communities to control the type of uses and density of development in flood hazard areas as a specific element in their local zoning ordinances. Zoning ordinances articulate a pattern of safe and flood-resilient growth in the community by designating zones where certain types of uses (residential, commercial, institutional, agricultural, industrial, recreational, and conservation)and densities will be allowed.

5.2.1 Density Zoning

Because controlling the density of development in flood hazard areas can minimize intense uses that place more people and property at-risk, effective state floodplain management programs establish minimum zoning requirements and authorize or allow communities to exercise flexibility in developing and applying various zoning mechanisms such as the following.

- Zoning ordinances establish density (the number of units per acre) as a function of land use. Whether flood hazard areas are handled as an overlay zone or a separately designated zone, future losses can be limited by setting minimum densities or large lot sizes.
- Planned unit development regulations establish area-wide objectives rather than specifications for individual lots and usually allow negotiations between the developer and the community on a project-by-project basis.
- Cluster development allows developers to preserve the expected total number of units based on the underlying zone by closely grouping houses together while preserving other areas—such as floodplains or other environmentally sensitive areas—as open space.

5.2.2 Conservation Zoning

Effective state floodplain management programs establish minimum criteria and encourage application of conservation zoning to certain flood hazard areas, especially those in which

development would adversely affect the natural functions of the floodplain. Although it may be referred to by a different term, conservation zoning generally refers to designation of a land use zone drawn specifically to encompass areas the community desires to protect or preserve, such as flood hazard areas, erosion zones, wetlands, natural forest stands, threatened and endangered species habitats, and aquifer recharge areas. Some communities (in southeast Wisconsin, for example) set aside the entire floodplain as an open space greenway. This achieves the multiple objectives of risk reduction, resource protection, open space and parks, and habitat enhancement.

5.2.3 Bonus or Incentive Zoning

Effective state programs allow communities to apply zoning mechanisms in creative ways that help achieve floodplain management goals while fostering sound development in flood-free areas. Bonus or incentive zoning allows developers to exceed limitations imposed by current regulations, such as subdivision density (units per acre) or building size (footprint or total square footage), in return for specific concessions. This makes it easier to set aside flood hazard areas as open space while allowing increased density outside the floodplain. Developers are receptive because it preserves the initial expectation of the number of units and may even reduce development costs. This approach can also increase profits because nearby open space improves the value and attractiveness of homes, making it possible to sell them at a higher price.

5.3 Growth Management and Sustainable Development

Effective state floodplain management programs recognize that the goal of reducing future flood damage is compatible with the goals of growth management and sustainable development and redevelopment—strategies to encourage planned growth in ways that minimize costs and adverse impacts. Sustainable development maintains or enhances economic opportunity and community well-being while respecting, protecting, and restoring the natural environment upon which people and economies depend.

Sustainable communities make efficient use of flood-prone and environmentally sensitive lands. Preservation of these areas is emphasized, along with low-impact recreational uses such as greenways, hiking-biking paths, parks and wetlands, or forestry conservation. Effective state programs authorize and encourage communities to exercise a range of planning and regulatory tools (such as those described in Part 4) to make management and sustainability initiatives successful and institutionalized. Details about state use of growth management, sustainability, and No Adverse Impact floodplain management, drawn from 1995–2002 data, can be found on pages 16–17 in *Floodplain Management 2003*.

5.4 Other Land Management Tools

Effective state programs authorize, require, or encourage the use at the state and/or local level of a wide variety of tools to foster floodplain management. These tools support the basic local permit mechanisms in ways that allow communities to accomplish multiple goals. In some states, these tools may require enabling legislation in order to be used by communities. Brief descriptions of the following land management tools are found in Appendix C.

- Alternative site analyses;
- Tax incentives;
- Land trusts;
- Purchase or transfer of development rights;
- Land swaps;
- Setbacks and buffers;
- Deed restrictions;
- Open space dedication; and
- Conservation easements.

North Carolina's Principles of Sustainability

To guide the redevelopment of eastern North Carolina after Hurricane Floyd caused widespread damage in 1999, the state endorsed the following principles:

- **Community Sustainability.** Encourage people to work together to create healthy communities where people have opportunities to improve their lives and those of future generations through preserved resources, available jobs, limited sprawl, secure neighborhoods, lifelong education, and accessible transportation and health care;
- **Housing**. Ensure that all persons have equal access to safe, affordable, and adequate housing;
- **Infrastructure.** Ensure that efficient public infrastructure is provided and maintained in a way that avoids sprawl, yet achieves safe, responsible, and desirable patterns of community development;
- **Agriculture**. Stimulate productivity for the agriculture industry through economic benefits and advantages for large and small farming operations;
- **Vulnerability to Natural Hazards.** Protect life, property, and the economy by minimizing present and future vulnerability to all natural hazards;
- **Conservation of Nature and a Healthy Environment.** Protect, conserve, use, and restore natural resources to ensure long-term social, economic, and environmental benefits for present and future generations;
- **Economic Prosperity.** Sustain a growing healthy economy that creates meaningful jobs, reduces poverty, nurtures agriculture and small business, thus providing a high quality of life;
- **Justice and Opportunity.** Provide equal access to education and life-long learning to give all people the means to achieve social, economic, and environmental well-being, preparing them for meaningful work, and allowing them to participate in the decision-making processes that affect them;
- **Aesthetics.** Maintain the unique and attractive aesthetic features of the physical environment that cultivate a community's sense of place and beauty; and
- **Stewardship.** Maintain an ethic that strongly encourages individuals, institutions, and corporations to take full responsibility for the social, economic, and environmental costs of their actions.

5.5 Building and Floodplain Permits

As described in Section 1.3, effective state floodplain management programs can be designed to issue floodplain permits in conjunction with permits issued at the local level, or a state program can take sole jurisdiction over certain areas (such as the floodway or coastal high hazard area). It can also be effective for a state program to authorize communities to be the sole permit authority, in which case the state's role is supportive.

A floodplain permit (which may be one part of a comprehensive development permit) addresses non-building provisions such as location of the building on the site, site grading and fill, water and septic, and building provisions specified in the floodplain regulations (such as elevation, flood-resistant materials, foundation openings, etc.).

Effective state and local floodplain management programs administer a complete process that involves the following elements:

- Submission of applications and review to determine compliance with established regulations;
- Issuance of a permit;
- Periodic inspections of the authorized activity;
- Enforcement of the terms of the permit;
- Penalties for failure to secure a permit;
- Recognition of special conditions, flood-related hazards, and higher standards applicable to individual communities; and
- Consideration of requests for variances.

5.5.1 Variance Requests

Effective state floodplain management programs recognize that few communities have experience handling requests for variances (a grant of relief from the strict application of the regulation or ordinance) to floodplain management standards. Accordingly, they offer technical assistance or require the community to consider state comments. This is important because variances to the floodplain management requirements result in buildings being built at risk of future flooding, thus exposing people and property to loss and damage.

Although a variance may waive certain construction provisions, it does not relieve the property owner from higher flood insurance rates that result from the structure's being more prone to flood risk than if the regulations had been followed. The owner—and all future owners—may have to pay very high rates in order to obtain flood insurance. The annual premium for $100,000 in coverage (plus $40,000 in contents coverage) for a slab-on-grade or crawlspace building that has its lowest floor constructed only one foot below the base flood elevation is nearly triple that for the same building at base flood elevation ($759 compared to $2,351 using 2003 rates).

Communities may also suffer adverse consequences from improperly issued variances, including liability for increased damage that results. Communities are exposed to sanctions by the federal

government if a pattern and practice of waiving the basic floodplain management requirements of the NFIP is identified. Federal sanctions include probation by the NFIP (which imposes a penalty fee on every flood insurance policy in the community—every year) or suspension from the NFIP (so neither federal flood insurance nor individual disaster assistance will be available). Some states impose additional consequences for poor performance.

- **Wisconsin** communities are required to provide notice to the state of variances they are considering. The state has 30 days to review the situation, and its comments become part of the record for potential future legal action by the state or other parties.
- **Maryland's** model local ordinance includes language requiring communities to obtain written comments from the state floodplain management office; the comments become part of the permanent file and must be considered in the deliberations.

5.5.2 Inspection and Enforcement

Reviewing applications and issuing permits is only part of an effective program to regulate floodplain development. Whether at the state or local level, fully effective programs have adequate authority and sufficient staff to conduct a series of inspections of permitted activities and to identify unpermitted ones. The authority and resources must extend to enforcing the requirements, including issuing citations and imposing fines and other penalties.

Effective state programs provide a full range of inspection and enforcement support for communities, including

- Training for local inspectors;
- Technical assistance in reviewing complex or difficult enforcement situations and advising on resolutions;
- Coordinating with the NFIP on interpretations of regulatory provisions;
- Providing information for local elected officials so they understand the importance that inspection and enforcement has in maintaining good standing in the NFIP;
- Participating in the process under the NFIP known as Section 1316, which denies flood insurance on any building on a property for which the community has pursued compliance, but remains an unresolved violation of the minimum floodplain management requirements; and
- Direct legal action against either the violating property owner or the community, in those states where such authority exists.

Details about state monitoring and enforcement, drawn from 1995–2002 data, can be found on pages 25–27 in *Floodplain Management 2003*.

5.5.3 Higher Standards

The term "higher standards" generally refers to regulatory standards that exceed the minimum provisions of the NFIP. Because the minimum provisions were specifically designed to lessen damage to individual buildings, they do not fully recognize all of the adverse impacts that may be caused by development of even a single lot. Accordingly, effective state programs authorize

and encourage communities to exceed minimum requirements in order to account for local conditions and to support local hazard reduction, especially where past flood experience or other factors suggests that higher standards will contribute to reduced losses.

Higher standards are not the same as mechanisms that guide development away from flood hazard areas. Higher standards apply to development that will take place in or outside the floodplains, and the objective is to allow that development to occur while ensuring a higher degree of protection than that provided by the minimum NFIP standards. Materials prepared for the NFIP's Community Rating System (CRS) describe a wide variety of higher standards. The CRS was developed, in part, to recognize and encourage communities to understand that higher standards can lead to direct and measurable reduction of future flood damage. Flood insurance premiums are discounted in communities that participate in the CRS.

Some of the more common higher standards are listed below. Brief descriptions and additional examples are provided in Appendix D. Details on specific state regulations for higher standards, drawn from 1995–2002 data, can be found on pages 19–21 in *Floodplain Management 2003*.

- Freeboard
- Lower substantial improvement/damage threshold
- Foundation protection
- Mapping all waterways
- Coastal A Zones.

5.5.4 Safety-based Decision Factors

An effective state program should incorporate safety-based factors into its rationale for making development decisions. The underlying basis for government involvement in floodplain management is the protection of public health, safety, and welfare, but explicit safety-based factors are often ignored, even though floodplain management regulations are consistently upheld in the courts largely because they are enacted to protect public health, safety, and welfare.

> ***Floodway Safety in Illinois***
>
> The state's prohibition on buildings in floodways in northeastern Illinois was upheld by a state supreme court ruling because the prohibition used public safety as the key factor.

Each year, many deaths are associated with flooding. Most deaths occur when people attempt to drive through floodwaters and cars are washed downstream. Perhaps as great a risk is electrocution caused by entering a flooded space (basement) where electrical power has not been turned off. People also get trapped in their flooded homes, and the emergency response workers who rescue them are at risk too. Long-duration flooding that saturates building materials has been shown to significantly contribute to the presence of molds that are associated with certain health problems.

5.5.5 Flood Hazard Areas Not Mapped by the Federal Emergency Management Agency

Effective state and local programs implement mechanisms to define and regulate unmapped flood hazard areas within their jurisdictions. Although every waterway, creek, lake, stream, swale, ocean coast, and rill in the nation has a floodplain, as a practical matter federal and state programs that study and map floodplains must limit the scope of their efforts. For example, most FEMA studies do not map the flood hazards of drainage areas smaller than one square mile. In addition, many waterways are entirely unmapped, especially in rural areas where little development is anticipated. Therefore, flood-prone areas along many miles of waterways are not subject to management under the minimum regulations of the NFIP, which apply only within mapped flood hazard areas in participating communities.

> ***Flood Elevations on Unmapped Waterways***
>
> In Wisconsin, developers must calculate flood elevations on unmapped waterways. The state performs the calculations for individual single family home proposals if the landowner provides surveyed ground elevations.

States can minimize the flood risk on these unmapped areas in other ways.

- Flood protection setbacks (sometimes combined with a "set up") from stream channels can be specified and the land area within the setback is then either protected from development or subject to floodplain management regulations.
- Applicants for subdivisions or single-lot proposals can be required to specifically calculate or at least approximate the floodplain along waterways above the limit of FEMA's floodplain boundary and a specific point higher up the watershed.

5.5.6 Special Flood-related Hazards

Special flood-related hazards are described in Section 3.2.4. For each, a variety of management options may be effective, although effectiveness will likely depend upon site-specific characteristics. For many, especially those that pose significant threats to public safety, the safest option may be to identify the hazard area and guide development to less dangerous land. Publications issued by the NFIP Community Rating System outline management options for some flood-related hazards (see the Bibliography and Resources section at the end of this guide).

5.6 Subdivision Regulations

Effective state programs require or authorize local adoption of subdivision regulations that go beyond simply delineating the flood hazard areas and determining the flood elevations. In addition to controlling the configuration of parcels, subdivision regulations typically set standards for developer-built infrastructure that may subsequently be conveyed to public

ownership (such as roads, drainage and stormwater management, sidewalks and bike paths, water and sewer service, and open space and recreational areas). State floodplain management programs can take advantage of these existing mechanisms to make sure that flood hazards and floodplain resources are considered in lot layout, open space designation, and other aspects of subdivision development, as explained below. Provisions related to guiding development to less hazard-prone areas are outlined throughout Part 5.

5.6.1 Lot Layout

The layout of lots during subdivision design influences the amount of impervious surfaces, how natural features are incorporated, the cost of infrastructure, and access to amenities and surrounding areas. Subdivision regulations generally specify lot frontage and driveway placements, placement of on-site sewage systems (if applicable), and local drainage patterns. If not governed by zoning, the regulations also identify lot sizes and limitations.

> ***Validity of Regulations***
>
> Courts at all levels, including the U.S. Supreme Court, have broadly and repeatedly upheld the general validity of floodplain regulations over the last 15 years.
>
> (Kusler, 2003)

Effective state floodplain management programs authorize additional requirements for lot layout that reduce exposure to flood hazards, such as those described below.

- Waterfront lots along erosion-prone shorelines are laid out far enough back from the high water line to facilitate relocating buildings if erosion threatens.
- In hurricane-prone areas, total subdivision size or density may be limited if existing emergency evacuation routes are constrained to the point of jeopardizing public safety.
- Sensitive natural area such as wetlands are delineated and dedicated to open space.
- All or part (e.g., the floodway) of the flood hazard area is avoided by dedication to open space.
- Building footprints are required to be a minimum distance from the floodplain boundary or located on the highest portion of the lot to minimize floodplain impacts.
- "Flood protection setbacks" are delineated along waterways with unmapped flood hazard areas.

5.6.2 Open Space and "Green Lining"

Effective state and local floodplain management programs require or encourage the practice of "green lining," in which environmentally sensitive areas (floodplains, wetlands, habitats, tree stands, eroding shorelines, dunes) are delineated as an early step in subdivision design. These areas are then avoided during lot layout, although the number and size of lots may be adjusted to maintain the number of units per acre allowed by zoning. The undeveloped areas are held in

common ownership by the owners' association or conveyed to the local government, and used for recreation or conservation

5.6.2 Additional Requirements for Subdivision Development

Effective state programs authorize or encourage additional requirements on subdivisions that help ensure wise floodplain management and flood safety.

- Primary access roads that cross floodplain areas must be above the predicted flood level to protect the traveling public and to provide safe entry for emergency vehicles.
- Recreational facilities in flood hazard areas, including playing fields and paths, must be designed to withstand flooding.
- Water and sewer lines that cross under waterways must be sufficiently below the stream invert or otherwise protected to minimize the potential for washout during floods or from long-term degradation of the channel.
- Water and sewer lines that parallel waterways must be installed back from the channel to minimize exposure due to channel migration and erosion.

5.7 Impact Analyses Required

Because of the variety of factors that influence flooding—including the geographic diversity and wide variety of growth patterns that characterize most states—effective state programs allow communities to adopt locally applicable land use and growth management techniques and standards. Requiring an impact analysis is one of the best ways to determine what techniques are needed and would be most effective.

Every proposed development has a variety of impacts. Impact analyses provide the basis on which each development proposal can be measured so that unanticipated adverse impacts can be avoided or, if unavoidable, minimized. Not all impacts are adverse, although what constitutes "adverse" may vary considerably depending on many factors. This concept is widely recognized when it comes to site-specific development proposals that affect wetlands or that increase stormwater runoff, and is becoming more common in floodplain management, with adoption of the Association of State Floodplain Managers' No Adverse Impact approach to floodplain management (http://www.floods.org).

Effective state programs recognize at least five types of potential impacts that may need to be mitigated: altering flood characteristics (hydrology and hydraulics); site-specific and cumulative environmental impacts; changes affecting the safety of citizens and emergency responders; long-term impacts on community integrity and economics; and (in some states) coastal impacts.

5.7.1 Hydrologic and Hydraulic Impacts

Riverine floodplains are part of the natural drainage process by which the land surface of a watershed drains to waterways that, in turn, drain under the force of gravity towards sea level. When water collects in waterways and exceeds the capacity of the channel, it rises out of the channel and spreads out along the adjacent low-lying lands. Riverine flooding is directly related to how much rain or snow falls over a period of time, and how that rainfall or snowmelt soaks in

or runs off the land. This is called the "hydrology." The term "hydraulics" refers to how the runoff water collects in the waterways and the various factors that determine how high it will rise above normal water levels, and how fast the water will flow. There are two categories of possible alterations to the hydrology and hydraulics of flooding:

(1) Actions that change the amount of runoff or the time it takes the runoff to drain off the watershed. Both alterations can increase can adversely impact other properties and communities because they determine how high the water rises out of the channel and how much adjacent land is covered by floodwaters. One example occurs in developments that pave portions of the land surface and thus reduce the amount of rainfall that soaks in or is trapped by vegetation, meaning that more runoff reaches the waterway.

(2) Actions that change the floodplain itself. The floodplain has two main hydrologic functions: to convey (or pass) the floodwaters downstream, and to store floodwaters by allowing them to spread out over a larger area. Development activities in the floodplain can obstruct both functions, causing flood levels to increase.

To assess the hydrologic and hydraulic impacts of individual development proposals, effective state programs require use of the same tools used to delineate the floodplain. Analyses can take several forms, to answer a number of questions:

- **How does all planned development affect downstream flooding?** The most effective, long-term approach to reducing flood damage associated with increasing development is to prepare watershed or basin-wide analyses. The watershed model reflects "today's" floodplain and serves as the baseline. By assuming total build-out based on existing zoning and land use plans, "tomorrow's" floodplain can be delineated. If increases in flood levels are predicted, then mitigation measures can be instituted.
- **How will the proposed development affect downstream flooding?** Effective state programs recognize that flooding in some watersheds may be more sensitive to changes in land use than others. In those places, watershed-based hydrologic models are used to evaluate individual development proposals whether they are located in the delineated floodplain or not. Often downstream flooding is addressed as part of stormwater management programs.
- **How does all planned development affect flooding in the immediate vicinity?** In areas where floodplain development will be allowed, the full hydraulic effects of that development (diverted flows, increased velocities, water surface elevations, and erosion) should be assessed. Changes in zoning or other mechanisms can then be brought to bear as needed. The cumulative impact of allowing all other properties to develop in the same manner must also be considered. To avoid discrimination, communities must consider all such properties on both sides of the stream for its entire hydraulic reach.
- **How will a specific proposed development affect flooding in the immediate vicinity?** A site-specific assessment based on a hydraulic model is needed to see how a specific proposal may change flood depths and flow velocities. For example, if a property owner proposes to build a levee to keep water from a specific area, any hydraulic impacts to upstream, downstream, or across-stream properties must be must eliminated or mitigated.
- **What will be the impacts on the floodway?** Effective state programs recognize that future risks are underestimated when using the floodway boundary and base flood

elevations shown on the FIRM, which are based on "existing conditions" and do not reflect the increases projected by floodway analyses. Many states and communities allow "no rise" in flood elevations (as opposed to the one foot allowed under the NFIP) to provide a wider margin of error, greater protection, and equal treatment of all property.

5.7.2 Environmental Impacts

Effective state programs require, or authorize localities to require, analyses of environmental impacts to natural floodplains, which are widely recognized as sensitive areas that provide a range of natural and beneficial functions, as documented in report prepared for the U.S. Congress by the Task Force on Natural and Beneficial Functions of the Floodplain (2002). Floodplains host many unique plant and animal habitats and riverine drainage networks serve as wildlife corridors. Many high-value wetlands lie within floodplains, especially along the coast.

In states with effective floodplain management programs, impact analyses address specific environmental impacts that may affect and increase flood risks or degrade floodplain ecosystems, in order to identify during the development proposal process what steps could be taken to avoid or minimize such impacts. Some aspects of the floodplain environment are regulated by federal programs (such as the Section 404 Clean Water Act and the Endangered Species Act), but those programs are not a substitute for state- or local-level investigation of the potential environmental effects on the floodplain of proposed development. Effective states coordinate their impact analyses processes with the various resource protection programs at all levels of government and the private sector.

5.7.3 Emergency Services Impacts

Effective state programs recognize that floodplain occupancy of almost any sort places a burden on state and local officials and emergency responders who are responsible for issuing warnings, planning and directing evacuations, making rescues, or attempting to provide normal fire, police, and emergency medical response through flooded roads. Accordingly, they require (or authorize local governments to require) that those burdens be assessed before development is allowed in flood-prone areas. If evacuation routes cannot carry the existing traffic, for example, it may be inappropriate to allow new subdivisions that will further overload the system. Perhaps growth should not be permitted where existing roads used by emergency vehicles are subject to flooding.

5.7.4 Socio-economic Impacts

Effective state programs require, or authorize local governments to require, impact analyses in certain situations to assess the fuller benefits and increased costs associated with floodplain development. This is important because floodplain development can have socio-economic impacts that are different from those resulting from development in other areas.

- Even if buildings are elevated, property values often fall after a flood. This not only represents a loss of value to individual property owners, but also can result in changes in assessed property values and taxes.
- Infrastructure costs increase when capital improvements and repairs are factored in to cover flood-damaged roads and water and sewer lines.

- Public costs for debris removal and clean-up, whether at the federal, state, or local level, increase when developed floodplains are flooded.
- Interruption in business operations can have far-reaching and long-term effects on the local economy and sense of community.

5.7.5 Coastal Impacts

Effective state programs require, or authorize local governments to require, specific impact analyses in coastal areas. Coastal flooding is generally characterized by wind-driven waves, both at the ocean's edge and along the Great Lakes shorelines. These waves interact with human-made changes, such as bulkheads and revetments, and can redirect floodwaters and waves to cause increased wave impacts, debris impacts, and erosion risks on adjacent properties. In addition, erosion of the shoreline contributes to coastal flooding in many areas, including along the Great Lakes, so proposed development in these areas should be evaluated for its potential impact on erosion as well as flooding.

Part 6 Flood Mitigation and Recovery Strategies

Principle: Flood mitigation and recovery strategies should be in place throughout the state.

Overview

Authority
State Staff and Funding
Coordination Mechanisms
Mitigation Grant Programs
Mitigation of Damage to Public Facilities and Infrastructure
Authority for Post-Disaster Moratoria
Post-Flood Mobilization
- Substantial Damage Determinations
- Increased Cost of Compliance
- Permit Reviews and Variances
- Public Awareness and Information
- Cooperative Agreements with Others
- Flood Audits and Floodproofing

Millions of buildings and public infrastructure installations were constructed in the United States before the frequency and impacts of flooding were fully recognized, and every time there is a flood, they are susceptible to damage. Unfortunately, the natural tendency is to quickly repair the damage and get the building or facility back to "normal," which means it is will be similarly damaged when the next flood occurs. Obviously, the "damage, recover, damage again" cycle will continue unless it is broken by changing what is at-risk.

Effective state floodplain management programs use post-flood mitigation and recovery strategies to break this cycle. Immediately after a flood, citizens and governments are most aware of the risks and far-reaching consequences of flood losses. In addition to prompting a higher degree of cooperation, this scenario may make it possible to leverage additional funds to implement specific flood-reduction projects because governments feel compelled to help right after a disaster.

6.1 Authority

Effective post-flood programs at the state level are stable and long-lasting, not activated simply in response to a single event. Rather than rely on federal post-disaster and mitigation resources, effective state programs have clear authority and adequate resources to work on their own and cooperatively with local governments. Although they are established in state law, effective programs are administered in ways that allow evolution and improvement in response to changes

such as major floods; new research, technology, and management techniques; and new federal programs and initiatives. Periodic reporting to administrative and legislative bodies allows broad-based decisionmaking on program evolution.

6.2 State Staff and Funding

Effective state mitigation and recovery programs have continuity through periods of fewer floods and include personnel with the pertinent knowledge, skills, and abilities. As with other state floodplain management program elements, flood mitigation and recovery functions may be located in various state agencies, but they should be considered as a whole when determining how many persons are needed to meet the demand. The number of staff and mix of disciplines depends on the number of flood-prone communities in the state, extent of flood hazard areas, flood history, development pressures, and the nature of each state's program. Consideration should be given to

- The level of technical assistance needed to foster local mitigation plans and citizen awareness and responsibility for individual mitigation measures;
- The degree of participation needed in community efforts to identify specific projects and apply for funding;
- The nature of post-flood inspections of damaged public buildings, facilities, and infrastructure that will be needed to find ways to incorporate mitigation in recovery;
- The number of staff positions needed to provide effective post-flood support to communities dealing with numerous private and public reconstruction demands; and
- The level of state participation desirable in reviewing mitigation project proposals for federal funds, including benefit/cost analyses, engineering feasibility, and environmental impacts. An effective state program help locals by providing an added state cost share.

State Commitments to Flood Mitigation

Washington has an established state-level coordinating committee for review of mitigation projects. It receives funding from the Flood Control Assistance Account Program and maintains ongoing coordination with all interested agencies.

Oklahoma's state hazard mitigation team was established by state law. Although it receives no direct funding support, it can tap the Emergency Fund for Public Infrastructure.

To maintain long-term effectiveness, the best state programs are supported by a strong commitment to adequate and consistent funding that is not dependent on the occurrence of a major flood that prompts a disaster declaration. Different funding sources are used, separately and in combination, to support elements of mitigation programs, including federal grant funds, appropriations of state funds, and fees and surcharges. FEMA provides some funding to support

certain mitigation planning activities and administration of mitigation grant programs. However, that funding is not intended to support all elements of an effective state mitigation program. As with staffing, the appropriate funding levels are a function of the specific details of the mitigation program's elements. The most obvious elements that require funding continuity are

- Personnel and operating budgets; and
- Support for planning and mitigation projects, whether to satisfy the non-federal match requirement or to conduct programs without federal funds.

6.3 Coordination of Mitigation and Recovery

The concept of a state interagency hazard mitigation team was first implemented in the early 1980s and has proven to be an effective coordination mechanism. Often called a mitigation team or a mitigation and recovery council, the team approach is now considered a distinguishing characteristic of an effective state hazard mitigation program. Many states experience hazard events with such frequency that the team or council is a standing body, typically established by a governor's executive order. In other states, the interagency coordination mechanism is mobilized when certain conditions occur, notably a significant flood or other disaster. In effective state programs, interagency coordination for the purpose of mitigation is not dependent upon, or limited to, declaration of a federal disaster. Details on state coordination of mitigation activities, drawn from 1995–2002 data, can be found on pages 35–36 in *Floodplain Management 2003*.

In general, the mitigation/recovery team's responsibility is to

- Participate in the development, implementation, and review of the state hazard mitigation plan, which identifies the state's key hazards and establishes priorities for mitigation approaches;
- Create interagency partnerships and packaging of programs;
- For specific events, evaluate the cause of the disaster and subsequent damage;
- For specific events, examine the nature of the direct damage and consider the full impacts of indirect damage;
- Identify potential projects to address specific circumstances;
- Identify programmatic and policy changes that inadvertently contribute to exposure to flood hazards;
- Establish priorities for award of mitigation funds; and
- Evaluate proposals for mitigation projects to select measures that are technically feasible and cost-effective and that further state and community mitigation goals.

6.4 Mitigation Grant Programs

Effective state floodplain management includes a program to provide technical assistance and financial support for local mitigation planning and projects to reduce the costs of flooding over the long term. State funds can be derived from annual or special appropriations or set-asides out of income (for example from state fees on property transactions). Effective state programs also

make funds available as part of the non-federal match for federal grant programs and to support local mitigation projects in the absence of federal funds. Details about state mitigation grant programs, drawn from 1995–2002 data, can be found on pages 34–35 in *Floodplain Management 2003*.

- **Minnesota** uses state general fund monies and bond funding to supplement or support mitigation projects. The funds are disbursed to local community project sponsors for 50% of the project cost; the community pays the other 50%.
- **Washington**'s Flood Control Assistance Account Program is funded by the state's general fund at $4 million every two years and is directed toward flood hazard reduction plans and projects.
- **California** uses state funds for mitigation projects through a program administered by the California Office of Emergency Services.

Since 1988, FEMA's mitigation grant programs have dominated the federal arena in terms of direct support for state and local mitigation projects. The programs authorize cost-shared funding support for specifically identified types of projects. Eligible projects must solve a hazard/risk problem, be cost effective, conform with environmental regulations, meet all applicable codes and standards, and be supported by state and local mitigation plans. To address flood-related hazards, mitigation funds have been used for acquisition, relocation or elevation-in-place of flood-prone houses, floodproofing of public infrastructure, floodproofing of non-residential buildings; and certain types of drainage improvements.

6.5 Mitigation of Damage to Public Facilities and Infrastructure

Effective state floodplain management includes a program to apply mitigation measures to public facilities and infrastructure in a pro-active manner. In those states, mitigation initiatives (which also incorporate technical assistance and financial support) are designed to encourage owners and operators to identify risks and implement technically feasible and cost effective protection measures. This is important because, between 1988 and 1999, nearly half of all federal expenditures for disasters (most of them floods) went to public buildings, public utilities, and water control facilities. The 25% non-federal share for those three categories of disaster assistance was estimated at $2.14 billion—a huge drain on state and local budgets. An additional $1.89 billion was expended by the federal government during the same period to pay for damaged roads and bridges. Further, it is estimated that during that same period only about 10% of significant natural hazard events met the criteria for federal disaster assistance, meaning states and locals paid the recovery costs for the other 90%. (Note that non-federal disasters, though more frequent, tend to be smaller and result in lower costs.)

Whether done before a disaster or during recovery (when additional Section 406 funds may be made available by FEMA for mitigation), mitigation of public facilities and infrastructure not only lowers future costs but also minimizes disruption, as noted below.

- Water supply plants that are out of operation contribute to increased health hazards due to lack of potable water;
- Flooded wastewater treatment plants can discharge untreated sewage into waterways;

- Service is interrupted when water distribution and sewer collection lines, including pump stations, are damaged by erosion and flooding; and
- Service disruptions occur when municipal electrical systems and those of rural electric cooperatives are unable to provide power to citizens and businesses.

The range of public buildings and those of qualifying not-for-profit entities that provide public services includes everything from hospitals, small town libraries, health clinics, schools, and fire stations to major buildings on university campuses and state office complexes. If risks are identified and mitigation measures are implemented before a disaster, these sorts of services are more likely to continue uninterrupted, thus reducing costs and risks to life, health, and property.

6.6 Authority for Post-Disaster Moratoria

A moratorium on development is a short-term suspension of the right to develop or redevelop a property and is usually accomplished by not issuing permits. Imposing a moratorium after a disaster is a serious undertaking, but effective state programs authorize or encourage post-disaster moratoria because they can be effective tools for disaster-resistant recovery. Especially in communities where damage is extensive, a temporary moratorium on reconstruction and repair creates the time needed to assess the damage, to set priorities for mitigation, and to consider alternative ways to recover while reducing future risk. For example, it is not productive to spend private and public funds to reconstruct buildings and facilities in a heavily damaged area, where the community will ultimately decide the best solution is acquisition and relocation. Temporary moratoria, even of a year's duration, have been found by the courts to be a reasonable imposition of a community's powers.

Most flood mitigation projects—whether acquisition and elevation of flood-prone houses or retrofit of commercial buildings—are prompted by actual damage. This "window of opportunity" after the flood damage occurs is a good time to identify mitigation measures because everyone is aware of the personal and public risks and true costs of floods. However, rapid recovery can thwart sound planning because, after repairs, property owners tend to discount the likelihood of recurring events and are less interested in mitigation. A temporary moratorium, paired with an immediate creative process to examine alternatives, can lead to enhanced resilience to future events, which also enhances a community's attractiveness to growth.

- **Nags Head, North Carolina**'s Mitigation and Reconstruction Plan calls for building moratoria of various lengths after a disaster, starting with an initial 48-hour period. Replacement of destroyed structures is halted for 30 days, during which time planners and the Board of Commissioners may adjust the zoning code to reflect new inlets or eroded areas or to incorporate mitigation tools. All replacement construction must comply with any new requirements established during this time. Building permits issued before the storm are suspended for at least 30 days.
- **Sanibel Island, Florida,** can apply a post-disaster moratorium based on the severity of damage. The hardest hit areas, defined as the "redevelopment" district, are subject to a complete moratorium. Properties in the "restoration" district can be repaired during the moratorium period only with a permit. Homes and businesses located in the "impacted"

district, where only minor damage has been experienced, can be repaired without a permit.

- The **Texas** General Land Office places a two-year moratorium on beaches after disasters. This allows the beaches to restore themselves. If, after two years, the vegetation line is still behind the structure, then the state will take action and the structure is removed.

6.7 Post-Flood Mobilization

Few communities have sufficient staff to handle the surge in demand for inspections and permits after a flood that affects many properties. Effective state programs have the ability to provide needed help, through pre-disaster training, mobilization of damage assessment teams, direct support, or agreements with other governments and organizations to provide staff and expertise.

6.7.1 Substantial Damage Determinations

A building in a flood hazard area sustains "substantial damage" when the cost of repair to pre-damage conditions exceeds a threshold value, regardless of the actual repair work undertaken (usually 50% of the building's pre-damage market value). When the damage reaches that level, the floodplain management regulations and codes require the entire building to meet the same flood-resistant standards established for new construction (most often this means the building must be modified or elevated to meet the minimum elevation criterion).

Making substantial damage determinations is widely considered to be one of the more difficult tasks faced by local floodplain managers and building code officials. Not only are the determinations themselves complex (requiring estimates of damage, repair costs, and the value of the property in an undamaged condition) but also the owners of substantially damaged property are being faced with repairs and clean-up from the flood along with the additional cost and effort of complying with flood-resistant standards.

Accordingly, effective state programs mobilize qualified personnel to support communities in their examinations of flood damage and the determinations of whether substantial damage has occurred. Personnel from different state agencies or communities from other parts of the state may be appropriate. Training must be provided and personnel should be familiar with construction, estimating repair costs, estimating damage levels, identifying mitigation opportunities, and using software developed by FEMA to facilitate residential substantial damage determinations. When credible determinations are made, and especially if paired with suggestions for mitigation, the community is better able to properly administer its floodplain management program to effect long-term reduction in damage.

It is important to bring substantially damaged properties up to the state or local flood-resistant standards. This is the single best window of opportunity for the community to help the property owner prevent future damage for little added cost. It is also the time when more and more federal and state programs offer assistance to make that happen. Anything the state can do to assist the community reduces long-term flooding costs for everyone. Details about state use of the substantial damage technique, drawn from 1995–2002 data, can be found on page20 in *Floodplain Management 2003*.

6.7.2 Increased Cost of Compliance Coverage

Effective state floodplain management programs provide training, resource materials, and technical assistance to communities and property owners on Increased Cost of Compliance (ICC) insurance coverage. This mitigation insurance is triggered when a building insured under the NFIP is substantially damaged (more than 50% of the building's pre-damage market value or other, higher standard set by the community) and is intended to help pay for the cost of repairing the building to meet state and local floodplain management requirements. Because ICC is triggered by flood damage and access to ICC is time-limited, that assistance must be made available immediately after the flood. Communities must make a formal substantial damage determination, property owners must work with communities to determine acceptable work that will result in compliance, and insurance adjusters must coordinate throughout the process.

ICC claim payments can be used to support local floodplain acquisition projects and be a source of non-federal funds but again, the degree of coordination required can be considerable and communities may need help in rapid mobilization of technical assistance and resources.

The ICC Benefit

As of May 1, 2003, ICC pays eligible claimants up to $30,000 to help with the cost of complying with the floodplain management ordinance, including

- Elevation in place,
- Relocation to higher ground,
- Demolition of the building, and
- Floodproofing (non-residential buildings only).

6.7.3 Permit Reviews and Variances

In effective state programs, state support and oversight are available to augment local staff resources (although not replace local permit authority). Because variances are subject to state statutes and state case law, there can be state-specific procedural and other requirements that are not covered in the variance guidelines provided under the NFIP (which are what most local officials will check first). Communities may also benefit from having the state review variance requests after a flood to strengthen administration of the requirement that variances be the minimum necessary. Local officials may welcome state support to review complex permit applications for repair and reconstruction, especially after flooding when owners of damaged homes and businesses are eager to recover as quickly as possible. Because of the serious consequences for both the community as a whole and for individual property owners, variances must be handled according the established procedures.

For state programs that include state permits, mobilizing personnel to review and process permits on-site is an effective way to minimize the burden on flooded property owners while supporting community recovery. It also facilitates coordination between state and local permits to minimize confusion during times when the public expects a higher level of service.

6.7.4 Public Awareness and Information

Interest often runs high after a flood and property owners and others may be more receptive to information about reducing exposure to future damage. Effective state programs

- Prepare materials for use during the post-flood period, including handouts and public service announcements;
- Develop sample letters for community officials to use with owners of substantially damaged buildings; and
- Plan materials and staffing for recovery information centers to meet personally with owners of flood-damaged property to identify mitigation measures.

6.7.5 Cooperative Agreements with Others

Mobilizing state staff to support local post-flood recovery needs may be difficult, especially if many communities have been flooded. Effective states have cooperative agreements with others to help address the demand for support. Agreements should address proper training, supplies, liability, and funding. Organizations that have members in all regions of the state will be the most useful, including

- State floodplain management associations;
- State emergency management associations;
- State organizations of building code officials and inspectors; and
- Professional associations of planners, engineers, and architects.

6.7.6 Flood Audits and Floodproofing

Effective state programs provide the resources and technical assistance to help communities do floodproofing audits, either before or after a flood. Property owners often are more receptive to examining their buildings and developing floodproofing options to minimize damage only after flood damage has occurred—precisely when local government personnel are least available to provide one-on-one advice.

State personnel can help perform flood audits, or provide training for local officials and others who can perform them. Flood audits can offer a wide range of advice to help individual property owners reduce damage and facilitate recovery, including

- Elevation in place;
- Dry floodproofing of non-residential buildings, after a detailed structural engineering analysis confirms its effectiveness;
- Wet floodproofing for some older buildings, depending on their use and occupancies;
- Elevating utilities (furnaces, hot water heaters, heat pumps,) and anchoring water and fuel tanks; and
- Backflow valves in sewer lines to prevent floodwaters from backing up into buildings.

Part 7 Public Awareness

Principle: The state's people need to be informed about the flood hazards and flood mitigation options.

Overview

An effective state provides the appropriate authority and encourages use of informational tools for keeping people informed about flood hazards. Citizens, property owners, the private sector, public officials, and various government agencies should have ready access to available information about the location of hazards within a state, the associated risks, and how to incorporate that information into decisions. The better informed everyone is about risks, the more likely it is that they will make sound decisions based on that knowledge—including whether and how to develop property, how to manage post-disaster reconstruction, and how to make sound land and home purchases.

Although many informational tools are applied most effectively at the local level, states have a number of roles, especially to actively support local public information efforts. Some tools for informing the public are most effective if required by state statute or regulation, such as disclosure during property transactions, recording flood history on property deeds, and continuing education for professionals.

7.1 Initiatives for Outreach and Education

Effective state programs undertake informational initiatives and develop and provide materials and tools to communities and others for use in tailored and focused campaigns. Initiatives to

inform the public about matters related to flood hazards range from the passive, which are designed for those who seek out the information on their own, to those that target and reach out to specific populations or groups because of their special circumstances. Details on the outreach initiatives used by states, drawn from 1995–2002 data, can be found on pages 43–44 in *Floodplain Management 2003*.

7.1.1 Using Internet Web Pages

Effective state programs maintain web pages on the internet that relate to floodplain management, hazard mitigation, and disaster recovery. Basic information is provided, often through links to other sites, about family preparedness plans, permit requirements, the NFIP, the natural resources of floodplains, business recovery, past disasters, and similar topics. The more effective sites display state-specific elements.

Although the internet has become a dominant tool to communicate, it falls within the passive category of initiatives because most web pages are destinations for those already seeking information. Active outreach through the internet can be accomplished by using lists of e-mail addresses, which usually are compiled by allowing those who visit a web page to sign up to receive further electronic notices. Even most small and rural town and county governments have access to the internet, as do many public libraries. However, rural and low-income families are less likely to have easy access. Therefore, although web pages and e-mail have the potential to be high-impact tools to inform the public, they cannot be the sole approach.

7.1.2 Using Printed Matter

Effective state programs develop and distribute printed materials, such as handbooks and reference manuals, designed specifically for community officials responsible for administering floodplain regulations. They also distribute materials to improve general understanding of floods and encourage mitigation of flood damage. The most common materials are brochures that address one or more topics, such as

- The need to obtain local (and state) permits before developing in the floodplain;
- The importance of flood insurance for the financial security of families and businesses;
- Safety, especially cautions about driving on flooded roads;
- Post-flood recovery and simple measures to reduce future damage; and
- How other resource materials can be obtained.

7.1.3 Using the Media

Effective state programs include special media campaigns designed to highlight flood-related risks, such as through a governor-designated "flood awareness week." In addition, effective state programs prepare ahead of time to encourage and help the media (newspapers, magazines, television, radio, and internet news services) show the "good news," rather than the more apparent and predictable consequences that tend to be focused on—washed out bridges; families in shelters when homes are flooded; and homes destroyed and businesses closed. State programs facilitate the media's information as part of news stories. This can be done by drawing from the documentation and measures of success described in Part 10, including specific examples that

- Show how preserving open space recognizes flooding as a natural event and avoids costly damage;
- Show areas where elevated buildings were not damaged;
- Demonstrate that applying higher standards to floodplain development reduces damage;
- Characterize how homeowners who have flood insurance are able to rebuild more readily than those who are uninsured, and usually without going into debt;
- Report on businesses with insurance and recovery plans that got up and running more quickly than those without plans; and
- Highlight mitigation projects that target high-risk areas to prevent recurring disaster damage, through measures such as elevation and acquisition.

7.1.4 Using Flood Warning Systems

Effective state programs are designed to support or implement flood warning systems, because the first step in reacting to potential disaster is knowing that one may be coming. The term "flood warning" refers to a suite of capabilities, including monitoring local conditions and weather forecasts, distributing alerts, holding periodic exercises so public agencies know how to respond, and educating the public so people know what to do. The National Weather Service issues area-wide warnings for the entire United States, which are broadcast on NOAA weather radios and public media. State support of flood warnings may take the form of technical assistance to design and operate locally based systems, or financial support to encourage communities and regions to install systems. Warning systems that cover large areas may be effectively operated by the state,

> ***Flood Warnings in Connecticut***
>
> Connecticut maintains a statewide flood warning system. It is divided into 10 watersheds and the state is responsible for its operation and maintenance.

in conjunction with the communities responsible for distribution of alerts, whether by sirens, public media, telephone trees, or other means. Details on state and local warning systems, drawn from 1995–2002 data, can be found on page 42–43 in *Floodplain Management 2003*.

7.1.5 Reaching out to Local Elected Officials

Effective state programs recognize that elected officials constitute a special subset of citizens who warrant a different level of information tailored to their public roles and responsibilities. Basic information must be conveyed to elected officials, and a continuous effort is required. Especially at the local level, these officials influence local regulations, development decisions, and how development and redevelopment is handled.

Local officials need to be aware that there are consequences associated with failure to properly recognize flood hazards, including legal liability for damage if an improper decision has put people and property at-risk and subsequently results in damage. Elected officials should be aware

that allowing variances to build below the required flood elevation will significantly increase the cost of flood insurance for both the applicant and all future property owners. Granting illegal variances, not enforcing against violations, and other such actions indicate a community is not in compliance with the NFIP, and FEMA may impose sanctions such as probation and suspension from the program (see Section 1.3.3).

Elected officials also are prominent in the post-flood period when affected residents turn to government for support. Therefore, it is valuable for them to have a basic understanding of floods, requirements pertaining the repair and reconstruction of damaged property, and options to help citizens mitigate future damage. Knowledgeable local officials are in a position to impose a moratorium on rebuilding for some period after a very large flood, thus giving the community time to plan and appropriately direct re-development, including relocation of flood-damaged and flood-prone properties, and other mitigation.

7.1.6 Reaching out to Government Employees

Effective state programs recognize that government employees constitute a special subset of citizens and warrant a different level of information tailored to their roles and responsibilities. All government workers, especially those in public safety and emergency management agencies, are critical to effective flood response and recovery. Education and training for employees can generate awareness of flood hazards, knowledge and interest in appropriate mitigation measures and insurance, and preparation of family disaster plans. Employees whose families could be affected by floods will be better able to fulfill their job responsibilities if they are informed and take action based on that information.

7.1.7 Involving the Private Sector and Organizations

State and local government programs to inform the public can be strengthened and made more effective through partnerships with the private sector and organizations that represent certain groups and professions. Delivery of information can be greatly expanded by building on both pre-identified audiences and existing dissemination tools such as newsletters, web pages, meeting presentations, conferences, training courses, and workshops. Material on local flood hazards, flood insurance, the natural resources of floodplains, flood safety, and mitigation can be tailored to local conditions. Effective state programs explore a range of possible partners for public information campaigns, including

> ***McDonalds and Oklahoma***
>
> The State of Oklahoma, the Oklahoma Floodplain Managers Association, the Red Cross, the National Weather Service, and MdDonalds restaurants teamed up to produce the “Familly McReady–OK” public awareness program. It featured information about family preparedness for severe storms, including floods, printed on tray liners and bags and offered in brochures and maps in display racks.

- State floodplain management associations;
- Builders and developers organizations;
- Organizations that represent engineers, architects and land surveyors;
- Associations for real estate professionals;
- Associations for insurance agents and adjusters;
- Bankers and lenders;
- The American Red Cross and other emergency services organizations;
- Environmental and watershed watch groups;
-
- Chambers of commerce;
- Neighborhood associations;
- Conference and visitors bureaus;
- Organizations of outdoors enthusiasts;
- Religious groups.

Flood Information for Louisiana

The Louisiana State University Cooperative Extension Service maintains and makes available through various media a library of all flood-related issues, a virtual floodproofing mall on its website, and training programs about addressing flooding and floodproofing.

7.1.8 Using Other Initiatives

Effective floodplain management programs use other initiatives to inform citizens, both at the state and local levels:

- Markers placed at the site of historical disasters, including past flood levels.
- "Road Flooded" signs to show the public where frequent flooding occurs.
- Showcases of new and retrofitted buildings with cutaway walls to show owners how to make their buildings more resilient to flood (and other) hazards.
- Videos and slide shows that can be used by communities, chambers of commerce, business organizations, neighborhood groups, and public service organizations and as public service announcements for the media.
- Booths for state and local fairs and festivals.

7.2 Requirements for Public Notice of Flood Risk

Effective state programs require or authorize the requirement of measures to inform the public about the presence of flood hazards, because protecting public health, safety, and welfare is a fundamental purpose of government. Some examples follow, and more specific information, drawn from 1995–2002 data, can be found on page 44 in *Floodplain Management 2003*.

7.2.1 Real Estate Disclosure

Consumers who know about flood risks are more likely to make better decisions when building new homes and purchasing existing ones. They may avoid buying property in hazardous areas or may demand a lower price to offset future damage or investment in needed mitigation.

Federally regulated lending institutions must advise applicants for a mortgage or other loan if the building is in a floodplain as shown on the Flood Insurance Rate Map. Since this requirement must be met only 10 days before closing, the purchaser typically is already committed to the property and rarely changes that decision even after finding out about flood hazards.

States with effective programs have some form of real estate disclosure law that requires the seller to notify the buyer if the property lies in an identified flood-prone area during the marketing (multiple listing) of property, when consumers are still "shopping" and have not yet made a decision. The notification must be strong and clear; it is not sufficient merely to require that the seller say whether a property has sustained flood damage (including drainage problems such as wet basements).

Disclosure requirements imposed at the community level are considered more likely to be effective, especially if paired with readily available flood maps and information about restrictions on development and redevelopment. Some communities require landlords to advise tenants about flood risks and the availability of flood insurance for rental properties.

7.2.2 Flood Hazard Area Delineation on Plat

Flood hazard areas are delineated on subdivision proposals so the community can determine whether flood hazards are appropriately addressed. The delineation typically is carried through to the final recorded subdivision plat. To improve effectiveness and to inform future buyers, the flood hazard information is recorded on individual plats.

7.2.3 Deed-recorded Restrictions

Deeds are recorded in the land records of local governments. Easements and restrictions on specific parcel of land are conveyed from owner to owner through the deed of ownership. Often, the deed is the only mechanism to notify buyers of such restrictions.

To improve citizen awareness, inform buyers and owners, and limit potential local government liability, the property deed can identify the flood hazard area and specify that permits are required for activities within the identified area. The deed to a building in the flood hazard area notifies the buyer that the area surrounding it will experience flooding. The deed can convey applicable restrictions such as non-conversion of enclosed areas below the elevated building.

7.2.4 Licensing for Allied Professions

Effective state programs mandate that floodplain management elements be incorporated in the requirements for state licensing or certification of practitioners that can help inform people about flood hazards. Many states and professional organizations have certification, training, and examinations for professions allied with floodplain management, including

- Engineers, planners, and architects, who work with developers and property owners to design projects that meet state and local requirements, and can both influence avoidance of flood hazard areas and design projects that resist flood forces;
- Land surveyors, who draw up property plats and subdivision plans, delineate the floodplain boundary on plats and lots, stake out construction sites, and prepare required elevation certificates for buildings in flood hazard areas;
- Building code officials and plans examiners, who are responsible for ensuring that proposed development and construction plans meet code and regulatory requirements;
- Building inspectors, who are responsible for checking development and construction in the field, including unauthorized activities that violate codes and regulations;
- Real estate agents, who are familiar with communities and work with buyers to find properties that meet certain needs, and thus are particularly well-positioned to help citizens learn about flood hazards;
- Home inspectors, usually hired by prospective buyers, who focus on the physical condition of buildings and detect evidence of past flood damage;
- Insurance agents, who help building owners and tenants obtain insurance as financial protection from certain types of damage due to fire, wind, and flood;
- Manufactured home installers, who need to understand the additional installation requirements that help protect vulnerable manufactured homes in flood hazard areas; and
- Attorneys, especially those who work with municipalities that administer ordinances for flood loss reduction and land use, who need to understand the underlying legal principles and the procedures for enforcing floodplain management and documenting violations in preparation for legal action.

More details on state licensing programs, drawn from 1995–2002 data, can be found on page 46 in *Floodplain Management 2003*.

Part 8 Training and Technical Assistance

Principle: Training and technical assistance in floodplain management need to be provided to the state's communities.

Overview

Manual for Administering Local Programs
Workshops and Training
Certification for Floodplain Managers
Technical Assistance
Community Rating System
State Associations
Newsletters and Web Pages

Effective state programs recognize the importance of finding out what communities need and providing ongoing, appropriate training opportunities and access to technical assistance. In most communities, floodplain management is just one of many responsibilities that must be handled by small staffs. Only larger communities and those with significant floodplain development are likely to have one or more persons assigned to deal exclusively with floodplain management. At the same time, however, the administration of the floodplain provisions may be quite complex, as localities have responsibility for reviewing all forms of development activities, issuing permits in accord with local and NFIP provisions, applying additional state-imposed requirements, and considering their own locally adopted standards that may vary according to the physical characteristics that affect the flood loads (velocity, depth, presence of waves, etc).

8.1 Manual for Administering Local Programs

Effective state floodplain management programs produce a reference manual to inform local officials about the fundamentals of floodplain management, additional standards and procedures required by the state, community-specific higher standards adopted by the community, and to help them develop efficient procedures that are compatible with their other permitting and regulatory processes. Although many materials are already available to help local officials, a state-produced manual can incorporate more specific information that is more useful to a local floodplain administrator than general descriptions or information based on other jurisdictions.

A thorough and well-written manual is a ready resource for the most common applications of the regulations and can offer guidance for unusual situations. It helps ease the transition when new local staff come onto the scene, thereby ensuring some continuity in local management of flood risks. It can supply a common perspective among the local floodplain management personnel of the state, whose backgrounds probably differ widely and whose "home" departments within the community may range from an agency responsible for planning and zoning, to one for building

State Floodplain Management Manuals

Most states have prepared technical reference manuals for local officials that cover state-specific requirements and program elements as well as the basics of the National Flood Insurance Program.

Illinois, for example, has both a full technical manual for local administrators and a "quick guide" (adapted from a similar publication by the State of Missouri) that gives the basics with lots of illustrations. See http://dnr.state.il.us/owr/resman/index.htm.

codes and permits, stormwater, public works, housing and community development, emergency management, or a combination of these.

The manual should cover

- History of floodplain management and floods within the state;
- Relationships between communities, the state, and federal programs, including materials about the NFIP, its minimum standards, and administrative procedures;
- Fundamentals of flooding and floodplains, including hydrology, hydraulics, coastal processes, and the natural functions and resources of flood-prone areas;
- Flood hazard maps, including how they are made and how they are used;
- Standards for all regulated development;
- Administrative processes such as application review, permit issuance, and record keeping;
- How to handle variances, including guidance for boards of appeals;
- Overview of legal aspects of floodplain management in the state, including the constitutionality of state and local regulations; rulings on property rights and "takings;" potential liability of state and local agencies and staff; and how to initiate legal action for violations and document the process;
- Inspection and enforcement, including documentation of compliance;
- The relationship between floodplain management and local or state building codes;
- Repetitive losses and substantial damage and how mitigation programs could help address those problems;
- Suggestions for improving floodplain management, including higher standards;
- Advice on handling post-flood permit requirements, including damage assessments, substantial damage determinations, and coordinating with property owners and insurance adjusters for mitigation measures;
- Related state and federal programs and contact information for their staff; and
- Additional sources of information.

8.2 Workshops and Training

Although a technical reference manual as described above is a valuable tool, it is not a substitute for workshops, one-on-one training, or individualized technical assistance. Effective state floodplain management programs provide opportunities for local officials and private sector professionals to learn about floodplain management at workshops and training sessions. Attendees will include both newcomers to the field and seasoned professionals, so sessions designed to meet the needs of all are essential.

> ***Floodplain Management Training Required***
>
> Under Arkansas law, the state is required to provide training to local floodplain managers and/or those assigned to administer the National Flood Insurance Program.

The appropriate number and frequency of workshops and training sessions within a state are functions of the need, which in turn is a function of several factors:

- The number of communities and rate of staff turnover;
- The extent to which growth patterns result in pressure to build in flood hazard areas;
- The variety of flood hazard areas and related factors that are considered when reviewing development proposals;
- The nature and breadth of the state's regulatory authority and the number of related programs, include environmental regulations and the state's building code;
- The number, frequency, and severity of floods; and
- Requirements for continuing education credits for Certified Floodplain Managers and allied professionals.

Details about state training programs, based on 1995–2002 data, can be found on pages 45–46 in *Floodplain Management 2003*.

8.3 Newsletters and Web Pages

Effective state programs use newsletters (printed or electronic) to advantage, in large part to maintain regular contact with local officials. Especially in communities with low growth or few floodplain development proposals, it is vital for the state to have a presence so that if and when assistance is needed the local officials know where to seek help. Although they do not replace training and technical assistance, newsletters are simple tools to inform a specific audience.

Web pages can inform the public and also can include specific content for local officials charged with administering floodplain management programs. Some states have all community flood maps on the web, and often include other community attributes such as property plats and history of permits.

Effective state programs use both newsletters and web pages, often in the "frequently asked question" format, to describe interesting and unusual situations and solutions particular to that state. Details about state newsletters and web pages, drawn from 1995–2002 data, can be found on pages 43–44 in *Floodplain Management 2003*.

8.4 Certification for Floodplain Managers

Because there is no specific course of academic study that prepares someone to practice as a floodplain manager, effective state programs endorse the Certified Floodplain Manager program, encourage state and local staff to participate, and disseminate information about the availability of this certification for floodplain managers.

The Certified Floodplain Manager (CFM®) program, developed and administered by the Association of State Floodplain Managers, establishes credentials for professionals from varied backgrounds and disciplines who are trained to meet floodplain management's multi-disciplinary challenges. The CFM® program

- Promotes an understanding of floodplain management that is consistent nationwide;
- Conveys new concepts and practices as they develop;
- Builds partnerships among different professions involved in floodplain management.
- Recognizes and provides incentives for individuals to improve their knowledge of floodplain management concepts; and
- Enhances individual professional development goals.

Effective state programs also may develop an ASFPM-approved certification exam tailored to the state's specific programs and activities. This leads to improved basic knowledge and, through continuing education requirements, increased awareness of how floodplain management relates to other state and local goals and programs. Details about state certification programs, drawn from 1995–2002 data, can be found on page 46 in *Floodplain Management 2003*.

New Mexico Requires Certification

By state law passed in 2002, local officials who are responsible for administering floodplain management ordinances are required to become Certified Floodplain Managers.

8.5 Technical Assistance

One-on-one technical assistance cannot be replaced entirely by manuals, training, or workshops. Therefore, effective state programs have sufficient staff resources to support local officials when complex situations arise, including the identification of projects to reduce future flood damage (see Part 5), preparing mitigation plans (Part 6), and building on other state programs to achieve the same objective. With regard to floodplain regulatory responsibilities, technical assistance provided by the state may include

Support for Effective State Programs

State floodplain management associations can be valuable resources to support legislative initiatives to enhance state programs and to advise governors about the importance of adequate funding because of the long-term benefits and cost savings provided by effective state floodplain management.

- A current model ordinance for localities that includes provisions and standards required by both the state and the NFIP;
- Comments on ordinances and revisions to ordinances;
- Participating in meetings about or commenting on complex permit applications to ensure consistent statewide interpretation of floodplain management regulations;
- Engineering review of floodplain studies, map revisions, and floodway encroachments;
- Conducting community assistance visits to monitor administration of local ordinances;
- Coordinating with other state agency programs on floodplain management matters;
- Coordinating with federal agencies on policy, engineering, or legal interpretations;
- Sharing information about legal matters and regulatory interpretations;
- Providing written comments on variances for legal compliance and to reinforce the importance of due consideration of certain criteria by local boards of appeals;
- Advising on resolution of violations, including whether and how to seek sanctions against individual property owners who refuse to bring properties into compliance; and
- Taking state enforcement action when necessary.

Effective state programs recognize that uncertainty about potential legal liability, court challenges to regulations, and claims of unconstitutional takings of private property can inhibit action by state and local agencies to manage flood-prone areas. Accordingly, state programs bolster their technical assistance by coordinating with the state attorney general's office to stay abreast of relevant case law, and to obtain official opinions as needed about how to draft and administer regulations so that legal challenges are avoided.

8.6 State Associations

Effective state programs recognize the value of professional floodplain management associations and foster their development and growth. The first association of professionals involved in floodplain management and reducing the impacts of floods was organized in 1977. The Association of State Floodplain Managers, Inc., now is a nationwide organization that consists of individual members, agency and corporate members, and state chapters. The national association encourages and supports state floodplain management associations. As of mid-2003, floodplain management and mitigation associations served 35 states. Those states have up to 500 members—mostly local floodplain managers—who can meet with their peers to learn, exchange

information, and become more effective in the profession. Details about state associations, drawn from 1995–2002 data, can be found on page 45 in *Floodplain Management 2003*.

Partnerships between state floodplain management programs and professional associations are effective at improving broad understanding of floodplain management, encouraging a range of mitigation actions, and enhancing professionalism. Cooperative efforts result in sharing of certain responsibilities and many functions, including:

- Disseminating information through newsletters, web pages, email listservers, training, workshops, and conferences;
- Collecting information on local programs to endorse program enhancement;
- Identifying community needs to focus state resources;
- Formulating positions and comments on program needs and proposed changes; and
- Conducting workshops and training.

8.7 Community Rating System Support

Many state and community floodplain management programs apply a wide variety of planning and regulatory tools that exceed the minimum requirements of the NFIP. To recognize the added value of those initiatives in minimizing flood losses, the NFIP created the Community Rating System (CRS) to provide flood insurance premium adjustments (discounts) to policyholders. Initiatives rewarded under the CRS are those that reduce flood losses, facilitate accurate insurance rating, and promote the awareness of flood insurance.

Effective state floodplain management programs encourage communities to participate in the CRS, and provide recognition for them when they do so. Training, workshops, and technical assistance are offered to help communities identify eligible activities, prepare applications, maintain eligibility, and adopt new activities to further state and local goals of reducing flood damage and strengthening communities. State programs also seek recognition of state-level activities that qualify for CRS credit, such as state dam safety programs, minimum stormwater management requirements, and real estate disclosure laws.

Part 9 Funding and Staffing

Principle: The levels of funding and staffing for floodplain management should meet the demand within the state.

Overview

Staff Levels and Capabilities
Funding Levels

Regardless of how well designed a state program is in terms of its statutes and regulations, or how many state agencies are involved, it cannot perform as envisioned if it lacks the resources to do so. Only when a state's executive and legislative branches commit adequate staff resources and funding to the various program elements and agencies will a floodplain management program operate efficiently and effectively to protect and serve the state's citizens and communities. Making wise use of the state's flood-prone areas is fundamentally the responsibility of state and local governments. It is illogical to rely on federal standards to address locally unique circumstances, federal funding to meet state needs and local demand, or federal action to reduce state and local costs and damage associated with flooding.

The most definitive way to establish the optimum number and type of staff positions and funding levels is to conduct a detailed needs assessment that examines all aspects of the state's floodplain management program. It must include not only what is readily measurable but also those factors that can only be assessed indirectly. For example, the amount and types of technical assistance that are really needed throughout the state are not necessarily reflected by past records of the number of inquiries received and assistance provided. Often community officials and others are simply unaware of the availability of technical assistance and thus do not ask for it. A way must be found to assess these hidden needs, and others, in order to allocate funds and staff.

9.1 Staff Levels and Capabilities

Effective state programs are adequately staffed with personnel who have the requisite knowledge, skills, and abilities in floodplain management. The number of flood-prone local jurisdictions and the frequency and severity of flooding are factors that influence state staffing levels. However, in determining the appropriate number of staff and variety of disciplines, each element of the program described in this document should be examined. For example,

- The degree of state regulatory authority affects staffing. Administering a program that issues state permits demands different staffing than one that monitors the performance of local jurisdictions.

- A state mapping program that performs studies in-house or reviews and approves materials submitted to communities requires different staffing than a program that reviews and coordinates the work of others.
- The number and frequency of community visits to monitor local program performance and provide technical assistance determines the number of staff required to provide the service needed for effective local programs.

It is notable that the state floodplain management program elements described in this document may be located in various state agencies. These descriptions of staff levels and capabilities are not intended to imply that all positions should be located in a single agency. However, how those program elements network to achieve the state's desired goals should be considered as a whole when determining the appropriate numbers and types of personnel needed.

Although the level of staffing that is adequate varies from state to state, it is possible to get a rough idea of the number of personnel that would be needed for effectiveness. A rule of thumb based on some of the state programs that are or have been effective is to figure on one state floodplain management staff person for each 25 to 35 flood-prone communities in the state. That starting point could be adjusted up or down somewhat depending on factors such as level of state vs. local authority, intensity of development, or number of at-risk structures. The staff should have the mix of disciplines explained below, and the more staff the state can place in field offices (closer to the communities) the more communities will get to know them, trust them, and call on them for guidance. The state personnel may well be distributed among several state agencies.

The appropriate mix of professional disciplines required to staff an effective state floodplain management program (spread among multiple agencies) can be selected from among the following.

- Certified Floodplain Managers are needed to ensure overall consistency and knowledge about program implementation.
- Professional planners contribute interdisciplinary skills that are critical to many elements of floodplain management, such as integrating flood hazards into local planning and zoning processes, identifying opportunities to improve local processes to achieve multiple objectives, and others.
- Civil engineers, water resources engineers, and other engineers are required for state mapping programs and as technical support for reviewing certain types of proposed developments, notably those that may have hydrologic or hydraulic impacts.
- Structural engineers may be required to support building code reviews or to evaluate proposals to floodproof individual buildings.
- Geographic information system (GIS) specialists are required to support a variety of functions ranging from mapping to public outreach to post-disaster impact analyses.
- Specialists in geology, geography, ecology, coastal geomorphology, fluvial geomorphology, hydrology, meteorology, and emergency management may be essential, depending on the nature of a state's floodplains and flood-related hazards.

- Public information specialists and trainers are needed to craft effective outreach initiatives and to deploy technical workshops and training sessions.
- Administrative support staff, including technicians, are vital to efficient service delivery.

Details on the characteristics and numbers of state staff, drawn from 1995–2002 data, can be found on pages 9–10 and 57 and Tables 8 and 9 in *Floodplain Management 2003*.

9.2 Funding Levels

To maintain their effectiveness, state programs must be supported by adequate and consistent funding. Different funding sources can be used, separately and in combination, to support elements of floodplain management programs, including appropriations of state funds for operating budgets and special purpose funds, fees and surcharges, federal grants, and others. FEMA provides some funding for specific functions related to the NFIP and additional funds to support certain mitigation activities. However, that funding cannot—nor is it intended to—support all elements of an effective state program.

As with staffing, the appropriate funding levels are a function of the specific program's components and how they are distributed among various state agencies. The most obvious elements of funding are

- **Staff budget.** Regardless of whether staff and program elements are located in one or multiple agencies, the executive branch and legislative branch should consider the elements as a whole when establishing funding levels.
- **Operating budget.** The operating budget must be sufficient to accomplish the work, make progress towards program goals, and meet the needs of local jurisdictions,.
- **Mapping program budget**. The appropriate funding level is a function of the identification of priority needs, as well as recognition that maps must be maintained and revised periodically to reflect changes and preserve the value of the initial investment.
- **Mitigation project grant budget**. An effective state program supports local mitigation projects with funding, whether for ongoing mitigation projects outside of federal grant programs, or for a portion of the non-federal cost share required by federal grants. As more communities prepare mitigation plans, the demand for funding support outside of federal programs likely will grow.

A significant threat to effective state programs is the perception that floods do not occur regularly. Although in most states, the occurrence of floods does vary over time, the probability of future flooding does not change. All too often, state legislatures look at the short term when establishing agency budgets, and legislative support for programs can weaken when weather patterns do not produce floods. The long-term effectiveness of state floodplain management programs should be ensured by a long-term commitment to state funding.

There are times and situations that call for examination of alternative funding sources. States occasionally look to generate revenue and fees for services (such as permits) although the added cost and administrative burden of managing such systems must also be calculated. At the local level, permit application fees are a standard revenue generator, although rarely are fees

Connecticut Considers Additional Fees

After deciding that surcharging flood insurance premiums would be like "penalizing the victims," a state representative is pursuing an increase in existing state fees that are assessed for local development permits. In this case, "those who are contributing to the [flooding] problem" will then contribute to managing the solutions to it.

established high enough to pay the full costs of a regulatory program. Some ways to generate additional revenue to support state programs are

- Charging a fee for state permits;
- Assessing a surcharge on local permit fees;
- Assessing a surcharge or tax on flood insurance policies and dedicating the income to floodplain management; and
- Assessing a fee on property sales, and dedicating a portion to floodplain management.

Details on state floodplain management budgets, drawn from 1995–2002 data, can be found on pages 9–11and 64 and Tables 1, 2, 8 and 9 in *Floodplain Management 2003*.

Part 10 Evaluation and Documentation

Principle: Evaluation of states' floodplain management programs is essential and successes should be documented.

Overview

Measuring successful floodplain management is not straightforward, in part because success is measured by floods and damage that does *not* occur and by floodplain benefits that are hard to measure. In floodplain management the more significant measures of effectiveness are not recorded—such as the number of individual decisions to build *outside* a flood hazard area rather than within it, or the number of times a building was *not* damaged by floodwaters because it was constructed properly, or the amount of recreational use, habitat, or natural flood protection a floodplain provides.

Nevertheless, a truly dedicated state program can find ways to tally different aspects of the status of floodplain management within its jurisdiction. That status can be thought of as falling into two broad categories: (1) overall impacts (or outcomes) and (2) program operations.

10.1 Measuring Outcomes of Floodplain Management

The two overarching purposes of floodplain management at all levels are (1) to avoid or at least minimize the damage and disruption caused by floods, and (2) to protect natural floodplain resources and functions as much as possible. The extents to which a state floodplain management program makes progress towards those goals can be thought of as the "outcomes" of the program. Some positive outcomes would be lower actual flood losses, both direct and indirect; lower potential for future losses, both direct and indirect; or improved floodplain functions and resources. Some undesirable outcomes would be increases in flood damage and losses; additional people and property at risk from future floods; or reductions in the natural functions and resources of floodplain lands. Under these general categories, each state must determine its own

specific desired "outcomes," and develop ways to measure progress toward them. And, finally, causal connections need to be established between the various aspects of the state program and how well they are performed (see Section 10.2), and the results the state is getting.

10.1.2 Identifying Losses and Costs

Floods are inevitable, and so are some flood losses. Effective state programs establish ways to measure the losses, decide what level is acceptable, track changes over time, and make adjustments to their program, policies, and approaches as needed. This is particularly important at the state level because, despite the magnitude of flood-related losses in the United States (estimated at over $6 billion per year), accurate measures of flood losses are neither used widely nor uniformly applied. Losses are generally described as being "direct" or "indirect."

Direct losses that need to be measured include, but are not limited to

- The physical damage sustained by buildings, measured by the cost of repairs;
- The loss of personal belongings when homes are flooded and business inventory when non-residential buildings are flooded;
- The physical damage associated with flooded government buildings that provide critical services, such as wastewater treatment plants;
- The catastrophic losses associated with failure of flood control levees and floodwalls, or dam failures; and
- Costs of repairs to infrastructure, including provision of temporary services.

Indirect losses include, but are not limited to

- Increased costs associated with emergency response to floods, including evacuation, search and rescue operations, and police and fire patrols during and after disasters;
- Certain costs associated with recovery from floods, especially capital projects that are postponed and loss of certain services if government agency staffs are diverted from their normal jobs to participate in flood recovery;
- The costs associated with loss of use of buildings and loss of access to the buildings due to flooding, including lost business income, lost tax revenue, and lost wages;
- Reduced property values and diminished home values for areas that have been flooded or are at risk from future flooding, which may result in lowering property taxes;
- The increased health risks, costs of treating or importing potable water, and environmental costs associated with cleanup after floods;
- Health problems associated with persistent mold due to frequent or prolonged inundation.

10.1.3 Identifying Benefits and Successes

If state floodplain management is being effective, one of the outcomes will be an increase (or at least not a reduction) in the benefits derived. Too little attention has been focused on measuring the benefits of effective floodplain management. Like losses, benefits are generally described as being "direct" or "indirect," but many fall in the indirect category and are hard to quantify. In

addition, benefits usually accrue over long periods of time, making it more difficult to compare them to costs, which usually can be readily expressed in numbers or rates. Effective state programs establish measurements of benefits in order to track changes and make appropriate adjustments to their programs and policies.

Examples of direct and indirect benefits associated with effective state and local floodplain management programs include the following.

- Fewer at-risk buildings in floodplains.
- Homeowners and business owners having more money more quickly after a flood, to help repair damage and incorporate mitigation measures.
- Increased attractiveness of, and higher property values in, neighborhoods with floodplain-based open space and recreation.
- Fewer critical facilities in floodplains.
- Reduced losses and costs from floods, or at least losses and costs that are less than would be expected given the state's population growth and development pressure.
- Enhanced fisheries, and reduction of sediment loading.
- Savings to the U.S. Treasury and taxpayers when fewer income tax returns claim a casualty loss deduction.
- Improved water quality, natural storage and filtration of floodwaters, and groundwater recharge.
- Preserved natural habitats, forests, and wetlands.

Information about state efforts to assess their progress in floodplain management, drawn from 1995–2002 data, can be found on pages 13–15 in *Floodplain Management 2003*.

10.2 Evaluating Program Operations

Achieving and maintaining an effective state floodplain management program is an ongoing effort. Although program needs may be identified at any time, an effective state schedules regular evaluations of its program to identify opportunities to make adjustments or to add new program elements. To really keep track of how well the program is operating and also figure out what it needs to keep doing and what it needs to change, the regular evaluation should have at least two main components: (1) a review of the program's specific activities, staffing levels, budget, and other operational matters; and (2) a review of how the program's work is affecting the floodplain management outcomes being realized throughout the state (see Section 10.1). These relationships can be difficult to identify with certainty. Some examples follow.

- Reduced damage when floods exceed the design levels can be a direct result of the state's requiring or encouraging regulations based on higher standards.
- The increased attractiveness of some neighborhoods could be because the state requires or encourages the dedication of flood-prone areas to open space and recreation.

- When homeowners and business owners have more money for repairs and mitigation, more quickly after a flood, it could be a result of state and local initiatives to encourage the purchase of flood insurance.
- Increases in property values can be partly a result of dedicating flood-prone areas to open space and compatible recreational uses.
- More natural habitats, healthier wetlands, better water quality, increased groundwater recharge, enhanced fisheries, and reduced sediment loading all can be attributed in part to state efforts to retain flood hazard areas in their natural state.
- Fewer new buildings at risk could be a result of reduced numbers of variances being granted, which in turn could be a product of state-sponsored training and technical assistance in variance guidelines.

A discussion of state efforts to evaluate state and local programs, drawn from 1995–2002 data, can be found on page 15 in *Floodplain Management 2003*.

10.2.1 Monitoring Community Program Administration

Successful floodplain management depends heavily on local administration and enforcement of land use planning mechanisms, regulations, and building codes. Effective state programs have a way of setting priorities for visiting communities, and a schedule for doing so. Effective states monitor

- Number of permits issued and the types of activities authorized for flood-prone areas (buildings, additions, substantial improvement, fill, storage tanks, etc.);
- Number and nature of variances considered and the number approved;
- Number of violations cited and how resolution was achieved; and
- Number of buildings, including new construction, substantially-improved buildings, and buildings protected or removed from flood hazard areas through mitigation measures.

10.3 Documentation

Whether assessing the overall status of the floodplains within their boundaries, or evaluating their performance at the last training session, effective state programs keep track of activities, events, and changes related to floodplain management. This means they establish baselines for assessing progress, keep records of floods, find ways to measure the various floodplain-related benefits and losses, and keep records of successes that are not quantifiable.

10.3.1 Inventory of Flood-prone Areas

Effective state programs have concrete information about the status of their flood-prone lands to use as a starting point for evaluating progress towards floodplain management goals. The inventory should form a state-wide picture of the amount and types of lands that are flood-prone; the amount and types of development that are already located in mapped flood hazard areas and thus exposed to future flooding; the flood-prone lands that are protected from encroachment or otherwise have their natural resources and functions preserved; and the growth potential (i.e.,

undeveloped parcels represent potential new permit actions). An inventory of flood-prone lands is most useful when undertaken at the community level because it helps local officials to understand the breadth of their flood hazard and floodplain resources. Effective state programs encourage or require that such inventories be prepared.

Each state's inventory will be tailored to its own situation and goals but, at a minimum, a digital map of the flood-prone areas and some type of data characterizing the pattern of development are required. To be most useful, a state's floodplain inventory should have sufficient detail to distinguish between, and track changes in, several categories, including number of buildings, land ownership, and resource protection. For buildings, it is important to distinguish the number of "at-risk" structures (some structures may be above the flood level, even if they are in the identified floodplain). In addition, an inventory should identify buildings that are pre-FIRM (most are assumed not to conform to flood-resistant regulatory provisions), pre-FIRM but brought into conformance (i.e., substantially improved or otherwise mitigated by grants); post-FIRM (fully compliant with permit requirements); and post-FIRM but not fully protected because the building was granted a variance or flood levels have increased over time. An inventory needs these categories:

- Residential buildings (single family, multi-family);
- Commercial and industrial buildings;
- Public and institutional buildings;
- Vacant parcels (by land use or zoning) as a measure of potential floodplain development;
- Lands in public ownership (federal, state, local);
- Roads and waterway crossings (bridges and culverts); and
- Area protected from development due to non-profit ownership or by setbacks, buffers, easements and covenants, wetlands initiatives, and reforestation projects.

10.3.2 Gathering Information after Floods

Effective state programs provide technical assistance to communities in gathering and cataloging information about the impacts of flooding, and use the results to track losses and successes, identify trends, and document the state's progress in floodplain management. Information should be tracked by community, year, and event frequency. For each flood, the data recorded should include: location and water body; land area affected (including undeveloped areas); number and occupancy of buildings affected (including those that were not damaged because they meet local standards); frequency and elevation of flood (along with a comparison to projected flood levels); number and nature of infrastructure and public services affected; dollar estimates of actual damage and expenses; and number of insured and uninsured buildings.

Information can be assembled through traditional post-event tours of flooded neighborhoods to estimate damage, or with more sophisticated methods as the use of geographic information systems (GIS) and other computerized tools expands. Success in preserving and protecting natural floodplain functions can also be documented with little additional work if damage inspectors in the field after a flood are on the lookout for "successes" and the state program documents them with photographs and background information.

10.3.3 Tracking Mitigation Plans and Projects

Effective state programs recognize that documentation of successful flood loss mitigation requires information on the full range of benefits, also described as "future damage avoided." Every mitigation action within the state should be tracked to capture evidence. Although damage avoided can be expressed through statistical analyses, it is not nearly as meaningful to general audiences as direct evidence like

- Before and after photographs, where the "after" shots show flooding where homes have been bought out, removed, and replaced by open space or parks;
- Photographs showing elevated buildings safe above the water level;
- The number of (and stories about) homeowners who benefited from flood insurance compared to the number who were uninsured;
- The number of (and stories about) property owners who implemented mitigation measures on their own and therefore suffered less damage; and
- Estimates of how much damage and disruption would have occurred if public facilities and infrastructure had not been protected.

10.3.4 Measurements

For each outcome of floodplain management, an effective state program can develop some form of measurement and track it over time to document losses and successes. Some measures are

- Records of actual floods and losses, regardless of size. Information should be tracked by community, year, and event frequency.
- Acreage of flood hazard areas that are constrained to protect or restore natural floodplain functions, including acres under easement or subject to setbacks, those set-aside in public open space, those being used for passive or active recreation; and those protected by other regulatory constraints (wetlands, riparian or water quality buffers, reforestation);
- Number of state activities, including state funded projects, that were reviewed for consistency with floodplain management standards and the number of such activities that were found to be appropriate for location within a flood hazard area.
- Number of buildings in flood hazard areas and the degree to which they are at risk, including state-owned, community-owned, residential, industrial, commercial, and institutional (see Section 10.3.1).
- Changes in public awareness of flood hazards and understanding of floodplain resources, as measured by surveys;
- Extent of successful application of planning and land use tools to guide development, as determined through surveys of local planning officials; and
- Federal, state, and local dollars expended over time in communities selected to demonstrate long-term benefits;

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Appendix A Checklist for Effective State Floodplain Management

This appendix summarizes the components, program elements, and main tools and techniques that contribute to effective state floodplain management. It can be used as a checklist by states wishing to examine their programs and find opportunities for improvement.

Checklist for
Effective State Floodplain Management

Authority for State & Local Floodplain Management

Program Leadership

- ☐ State Coordination of the NFIP
- ☐ Interagency Coordination

Statutory Authority

- ☐ Full Authority Granted to Communities
- ☐ Partial Authority Granted to Communities
- ☐ Shared State and Community Authority
- ☐ Authority for Land Use Planning and Zoning

Regulatory Program Elements

- ☐ Permit Mechanisms
- ☐ Program Performance
- ☐ Enforcement Mechanisms
- ☐ Program Variables

Comprehensive, Integrated State Floodplain Management

State Projects, State Funding, and State Buildings

- ☐ State Construction Projects
- ☐ State-funded Activities
- ☐ Inventory of State Buildings in Flood Hazard Areas

Related State Programs and Functions

- ☐ State Planning Agency
- ☐ Environmental or Water Resources Agency
- ☐ State Building Code
- ☐ Insurance Agency and Flood Insurance
- ☐ Emergency Management
- ☐ State Transportation and Road Construction
- ☐ State Health Department
- ☐ State Dam Safety
- ☐ Housing, Community, and Economic Development
- ☐ Agriculture & Food Safety
- ☐ Parks and Recreation
- ☐ Forestry
- ☐ State Geographic Information System Coordination
- ☐ Public Service Commission
- ☐ Mining of Aggregates

Flood Hazard Identification & Risk Assessment

Flood Hazard Map Coordination

- ☐ NFIP Map Study Process and Priorities
- ☐ Inventory or Periodic Review of Map Needs
- ☐ Technical Assistance to Communities
- ☐ Cooperating Technical Partners

State Hazard Identification Program

- ☐ Establish Mapping Standards
- ☐ Perform Studies
- ☐ Review and Approve Studies by Others
- ☐ Special Flood-Related Hazards
- ☐ Funding

Map Tools

- ☐ Geographic Information Systems
- ☐ Base Mapping

Risk Assessment

- ☐ Hazards U.S.

Respect for Floodplain Functions & Resources

- ☐ Identifying and Mapping Floodplain Functions and Resources

Floodplain Management Program Elements

- ☐ Zero-rise Floodway
- ☐ Watershed-based Approach
- ☐ Assessment of Impacts on Natural Resources & Functions
- ☐ Tax Breaks
- ☐ Sustainability Initiatives
- ☐ Multi-objective Management
- ☐ Greenlining
- ☐ Buffers and Setbacks

Coordinating other Program Elements

- ☐ Sediment and Erosion Control
- ☐ Water Quality
- ☐ Stormwater Management
- ☐ Wetlands Protection
- ☐ Open Space Protection
- ☐ Coastal/Shoreline Management
- ☐ Growth Management
- ☐ Aquifer Recharge Protection
- ☐ Wild and Scenic Rivers Programs

- ☐ Rare, Threatened, and Endangered Species
- ☐ Forestry
- ☐ Cultural Resources
- ☐ Agricultural Preservation
- ☐ Public Recreational Uses

Technical Assistance

Public Awareness and Education

Guiding Development & Managing its Impacts

Planning

- ☐ Comprehensive Plans
- ☐ Land Use
- ☐ Interjurisdictional Watershed Plans
- ☐ Mitigation Plans

Zoning

- ☐ Development Density
- ☐ Conservation Zoning
- ☐ Bonus or Incentive Zoning

Growth Management/Sustainable Development

Other Land Management Tools

- ☐ Alternative Site Analyses
- ☐ Tax Incentives
- ☐ Land Trusts
- ☐ Land Swap
- ☐ Purchase or Transfer of Development Rights
- ☐ Setbacks and Buffers
- ☐ Deed Restrictions
- ☐ Open Space Dedication
- ☐ Conservation Easements

Building and Floodplain Permits

- ☐ Variance Requests
- ☐ Inspection and Enforcement

Higher Standards

- ☐ Freeboard
- ☐ Foundation Protection
- ☐ Lower Substantial Improvement/Damage Threshold
- ☐ Mapping All Waterways
- ☐ Coastal A Zones
- ☐ No Rise Floodway

- ☐ Protection of Floodplain Storage Capacity and/or Compensatory Storage
- ☐ Dry Land Access
- ☐ Floodway Development Prohibition
- ☐ Enclosure Limitations
- ☐ Restrictions of Land Uses and/or Density Based on Zone
- ☐ Protection of Critical Facilities
- ☐ Underground Utilities
- ☐ Setbacks and Set-Ups
- ☐ Manufactured Housing Requirements
- ☐ Cumulative Substantial Improvement
- ☐ Electric Service to Buildings
- ☐ Minimum Height above Grade

☐ Safety-based Decision Factors

☐ Flood Hazard Areas Not Mapped by FEMA

Special Flood-Related Hazards

- ☐ Flash Flood Areas
- ☐ Erosion-Prone Coastal Areas
- ☐ Moveable Bed Streams and Riverine Erosion
- ☐ Dam Inundation Zones
- ☐ Levee- and Floodwall-Protected Areas
- ☐ Flood Hazard Areas Affected by Subsidence
- ☐ Ice Jam Areas
- ☐ Closed Basin Lakes
- ☐ Alluvial Fan Hazards
- ☐ Debris Flows (Mud Flood, Mudslide, Mudflow)
- ☐ Tsunami Hazards
- ☐ Wildfire Affected Areas
- ☐ Volcanic Hazards

Subdivision Regulations

- ☐ Lot Layout
- ☐ Open Space and “Green-Lining”
- ☐ Additional Requirements for Subdivision Development

Impact Analyses Required

- ☐ Hydrologic and Hydraulic Impacts
- ☐ Environmental Impacts
- ☐ Emergency Services Impacts
- ☐ Socio-economic Impacts
- ☐ Coastal Impacts

Flood Mitigation & Recovery

- ☐ Authority
- ☐ State Staff and Funding
- ☐ Coordination Mechanisms
- ☐ Mitigation Grant Programs
- ☐ Mitigation of Damage to Public Facilities and Infrastructure
- ☐ Authority for Post-Disaster Moratoria
- ☐ Post-Flood Mobilization
    - ☐ Substantial Damage Determinations
    - ☐ Increased Cost of Compliance
    - ☐ Permit Reviews and Variances
    - ☐ Public Awareness and Information
    - ☐ Cooperative Agreements with Others
    - ☐ Flood Audits and Floodproofing

Public Awareness

Initiatives for Outreach and Education

- ☐ Using Internet Web Pages
- ☐ Using Printed Matter
- ☐ Using the Media
- ☐ Using Flood Warning Systems
- ☐ Reaching out to Local Elected Officials
- ☐ Reaching out to Government Employees
- ☐ Involving the Private Sector and Organizations
- ☐ Using Other Initiatives

Requirements for Public Notice of Flood Risk

- ☐ Real Estate Disclosure
- ☐ Flood Hazard Area Delineation on Plat
- ☐ Deed-Recorded Restrictions
- ☐ Licensing for Allied Professions

Training & Technical Assistance

- ☐ Manual for Administering Local Programs
- ☐ Workshops and Training
- ☐ Certification of Floodplain Managers
- ☐ Technical Assistance
- ☐ Community Rating System
- ☐ State Associations
- ☐ Newsletters and Web Pages

Funding & Staffing

- ☐ Staff Levels and Capabilities
- ☐ Funding Levels

Evaluation & Documentation

Measuring Outcomes of Floodplain Management

- ☐ Identifying Losses and Costs
- ☐ Identifying Benefits and Successes

Evaluating Program Operations

- ☐ Monitoring Local Program Administration

Documentation

- ☐ Inventory of Flood-prone Areas
- ☐ Gathering Information After Floods
- ☐ Tracking Mitigation Plans and Projects
- ☐ Measurement

Appendix B Special Flood-Related Hazards

This appendix contains brief descriptions of the following special flood-related hazards that states need to identify and manage if they are to cope effectively with the full range of their flood risks.

B.1 Flash Flood Areas

Although a technical definition has not been developed, flash floods generally are understood to be characterized by rapid onset and rapid rise of waters out of channels. Some areas subject to flash floods are in small watersheds where the land is steeply sloped. In some areas of the West, storms over distant mountain ranges can produce sudden flood flows in channels that typically are dry. On National Flood Insurance Program maps, areas subject to flash flooding may be above the standard upstream limit and thus not shown, or they are shown but the rapidity of onset is not differentiated from other flood hazard areas.

B.2 Erosion-Prone Coastal Areas

About 24% of the Atlantic, Pacific, Gulf of Mexico, and Great Lakes coasts face significant erosion that threatens existing and new development in coastal floodplains and on shoreline bluffs. Areas subject to coastal erosion are not shown on the flood maps prepared by the NFIP. Most state coastal zone management agencies have identified shoreline reaches and erosion rates.

B.3 Moveable Bed Streams and Riverine Erosion

Some rivers, especially in the arid West, experience channel instability characterized by lateral erosion and channel movement. Moveable bed streams include those where erosion (degradation

of the streambed), sedimentation (aggradation of the streambed), or channel migration are major processes during a flood, and can have a major impact on the extent of flooding and flood damage. Those processes can change the topography of a stream enough to increase the flood elevation or the increase the width of the floodplain or floodway. In some cases, these processes may occur simultaneously, or one may occur in one flood and another in a subsequent event.

B.4 Dam Inundation Zones

Waterways downstream of dams may be subject to two types of inundation that are not necessarily associated with the passage and discharge of inflowing floodwaters:

- Dam-break inundation results from the failure (breach, break or collapse) of a dam. Dams are rated as "high hazard dams" if failure would probably cause loss of life or substantial property damage.
- Unusually large spillway releases may inundate lands and development even when conditions in the immediate vicinity do not appear to suggest likely flooding, for example if intense or prolonged rainfall has not occurred locally.

B.5 Levee- and Floodwall-Protected Areas

By their very nature, flood control levees and floodwalls are designed to provide protection for a certain frequency or magnitude of flood. Therefore, larger and less frequent floods will overtop or cause a failure of the structure. The resulting inundation can be catastrophic, not only for its sudden nature, but because development in the protected area typically is conducted without regard for the possibility of overtopping or failure. Many levees and floodwalls have been constructed to provide protection against only low level and frequent flooding, yet occupants in the protected area may not fully understand the likelihood of overtopping and inundation. This is particularly true where small levees that were built many years ago to reduce the frequency of damage to agricultural areas are inaccurately perceived to protect encroaching development, leading to a false sense of security.

B.6 Flood Hazard Areas Affected by Subsidence

Subsidence of the land surface, primarily associated with the withdrawal of water, oil, or minerals, can affect flooding and flood damage. As the land surface is lowered, the net effect can be increases in the depth of flooding, especially in coastal areas where area-wide subsidence increases flooding throughout entire communities. Subsidence has been identified in at least 38 states and is recognized as a factor contributing to increased flood risk in many areas.

B.7 Ice Jam Areas

Ice jams form in a variety of ways and at different times during the winter in as many as 35 states. Damage from ice jam flooding often exceeds that of clear water flooding because of higher surface elevations, rapid increases in flood elevations, and physical damage caused by moving ice chunks. Certain natural and human-built features and constrictions increase the probability of ice jam formation at specific locations.

B.8 Closed Basin Lakes

Two types of lakes pose special hazards to adjacent development because flood flows that drain to them do not drain away quickly. Lakes with no outlets and lakes with inadequate, regulated, or elevated outlets are called "closed basin lakes." They may be subject to very large fluctuations in water surface elevation that persists for weeks, months, or years. Closed basin lakes occur throughout the U.S. In the northern tier of states and Alaska, glaciers scoured areas that filled with water and have no outlet. In the West, tectonic action formed playa lakes without outlets, including the Great Salt Lake in Utah, Malheur and Harney Lakes in Oregon, and Devil's Lake in North Dakota. Sinkhole lakes result where large limestone deposits at or near the surface are dissolved by surface water and rainfall.

B.9 Alluvial Fan Hazards

Flood hazards related to alluvial fans and moveable bed streams are collectively referred to as "uncertain flow path hazards." Alluvial fans occur where there are steep gradients from the sources of sediment to the depositional areas, where the source areas are rich in sediments, and where precipitation is not sufficient to carry the sediments downstream as rapidly as they accumulate. These conditions exist primarily in the arid and semi-arid regions west of the Great Plains. Alluvial fan flood hazards result from moving water, sediment, debris, and channel migration that can occur across the entire geologic feature.

B.10 Debris Flows (Mud Flood, Mudslide, Mudflow)

These flood-related hazards may occur where runoff associated with heavy rainfall events flows over sloping land that is characterized by unconsolidated materials, including hillsides denuded by wildfire. Mud floods carry hyperconcentrated sediment loads which increase the potential for damage over "clear water" flooding. Debris flows often carry large rocks and vegetative debris.

B.11 Tsunami Hazards

A tsunami is a wave or series of waves generated at sea or near shore by an earthquake, volcano, or landslide. Tsunamis, usually originating in the Pacific Ocean, can move as fast as 1,000 kilometers per hour. The wave height can build up dramatically as the wave reaches shallow water, often appearing more like a rise in sea level than a breaking wave. Where the shoreline is configured in narrow bays and river mouths, water levels from tsunamis can be as much as 100 feet or more above normal tides. Because most tsunamis are seismic in origin, their occurrence is most likely in the Pacific and Caribbean coastal areas.

B.12 Wildfire Affected Areas

Especially in the mountainous West, areas that are burned over by wildfire lose tree and brush cover, leaving the land without vegetative cover to help absorb and detain rainfall. Large sediment loads wash off slopes, often as mud flows and mud floods. Depending on soil types, fires can "glaze" the soil surface, a long-lasting effect that significantly increases runoff. As a result, watersheds respond more rapidly and runoff generally accumulates faster, causing increased flood levels. Due to altered soil conditions, short growing seasons, and the nature of

vegetation in these areas, restoration of vegetative cover may take decades. During that time, flood hazards can be significantly greater than what may be shown on flood maps that pre-date the wildfire.

B.13 Volcanic Hazards.

Flood-related hazards are associated with volcanic activity, as evidenced by the 1980 eruption of Mount St. Helens in Washington State. Mountain snowpack and glaciers can melt rapidly, mountainside lakes can overflow, and large quantities of debris can dam waterways. Regional vegetation and hydrology can be altered for long periods of time, leading to greater runoff volumes and increased downstream flooding.

Appendix C Other Land Management Tools

This appendix describes each of several land management tools (listed below) that states can authorize, require, or encourage at the state and/or local level to foster wise floodplain management. These tools support the basic local permit mechanisms in ways that allow communities to accomplish multiple goals. In some states, these tools may require enabling legislation in order to be used by communities.

C.1 Alternative Site Analyses

All too often, floodplain permit programs tend to focus on rules that govern *how* development will take place, which is different than applying rules to guide development to less-hazard-prone locations and reducing the impacts on others. Effective planning and permit programs at state and local levels use different mechanisms to encourage developers and property owners to avoid flood hazard areas, or at least to avoid those parts of the floodplain that are deemed most appropriate to avoid. Factors that may be used to determine areas appropriate to avoid include physical characteristics of the flood hazard itself (designation as floodway, depth, duration, velocity), as well as factors designed to protect the natural and beneficial functions of the floodplain.

Effective state programs authorize communities to require alternative site analyses. Such analyses generally require applicants to demonstrate that proposed development cannot reasonably be located elsewhere. Sometimes, applicants are required to evaluate alternative sites at other locations, which may result in entirely avoiding the floodplain. This approach is especially effective when the community has experienced significant flood damage and can document the burdens that floodplain development imposes in terms of emergency services and public costs for infrastructure repairs and clean-up.

Minimization of unavoidable impacts also can be incorporated in alternative site analyses requirements. Examples include:

- **Location on the site**. A property owner may assert that the only feasible location for the proposed project is on a lot that is in the mapped flood hazard area. Through the alternatives analysis, the owner may determine that the building footprint can be sited on

the highest ground even though it may not be the optimal location for visual appeal or other objectives unrelated to public safety and damage reduction.

- **Other site requirements.** Sometimes the optimal location that reduces exposure to flood-related risk is not consistent with other regulations, notably lot line setbacks or height restrictions. An alternatives analysis identifies appropriate waivers to those rules while maximizing public safety and damage reduction.
- **Elevation alternatives.** Except in coastal high hazard areas (V Zones), applicants typically are free to determine how to accomplish the required elevation of the lowest floor. Often, the method is chosen by default, using whatever technique is most common in the area. An alternatives analysis requires examination of the benefits of different elevation methods.
- **Location/elevation alternatives.** A simple combination of the preceding examples would be determining that locating the building on the highest ground will require less fill (which preserves floodplain storage functions) or shorter foundation height, which improves access.

APA's Additional Resources

The American Planning Association is a good resource to learn more about specific land management tools. For example, Chapter 9 in APA's Growing Smart Legislative Guidebook addresses special and environmental land development regulations and land-use incentives. It contains model statutes, including environmental issues:

§9-101 addresses protection of, and regulation of development in, critical and sensitive areas and natural hazard areas.

§9-401 and 9-402 cover transfer of development rights and the purchase of development rights, including conservation easements.

§9-501 addresses land development regulations that provide density and intensity incentives.

C.2 Tax Incentives

Communities should have the authority to offer selective tax incentives for property owners who recognize their direct role in reducing future flood damage. The extent to which such incentives may reduce tax income is an evaluation that is best made at the local level. Examples include:

- The tax rate on flood-prone lands can be reduced when those areas are avoided by single lot owners who also agree to deed restrict such areas so that future owners do not encroach into the floodplain.
- Community programs can be designed to accept fee simple or easement donations of flood-prone land in return for a schedule of tax credits over a number of years.

- Property tax rebates can be offered to owners of existing buildings who undertake approved modifications that reduce flooding, such as elevating utilities, abandoning and filling in basements, floodproofing non-residential buildings, or elevating buildings in-place.

Some flood reduction activities have long-term benefits for both the property owner and the community, thus tax incentive programs can result in positive impacts on the tax base. Donations may help complete a neighborhood park or greenway system with hiking/biking paths, public amenities that are known to increase values of nearby properties. Older homes that have been elevated have been shown to be more marketable and of higher value than surrounding flood-prone homes, especially in the years immediately after a flood event.

C.3 Land Trusts

Organizations that seek to preserve certain lands or certain characteristics of lands are becoming increasingly common. If allowed by state law, non-profit agricultural land trusts, heritage land trusts, forested land trusts, and environmental land trusts accept donations of land or financial donations to support acquisition of land or acquisition of easements over privately-owned land. Land trusts may be established by state or local governments, by consortia of public and private interests, or they may be entirely private enterprises. Regardless of the original intent and objectives of a land trust, most can accommodate inclusion of flood hazard areas in order to support multiple benefits.

C.4 Land Swap

Most communities own land and lots that have been acquired because the owner abandoned them or failed to pay taxes. Often these parcels have little public value because they cannot be used for public purposes. Programs to facilitate land swaps may be especially effective where existing homes located in flood hazard areas are identified for acquisition in order to permanently eliminate the risk of future flood damage. As part of the buyout offer, an owner may agree to "swap" the at-risk home for a home that is publicly owned, especially if it is in an area already served by public utilities. Land swaps can also work when flood-prone homes are sufficiently sound that relocation out of the flood hazard area is desirable. Placing them on existing vacant lots eliminates the need for site development and utility costs.

Swapping undeveloped flood-prone land for in-fill lots that are out of the flood hazard area (perhaps combined with other incentives to make in-fill development more attractive) may be an effective way to guide development and reduce the need to extend public utilities.

C.5 Purchase or Transfer of Development Rights

Land is a valuable commodity, especially in areas that experience growth pressure. Despite the land management and planning tools available to states and communities, the pressure to grow into certain areas can be difficult to control. Effective state programs foster local initiatives to guide development to areas that are more compatible with overall goals, including initiatives that use the purchase or transfer of development rights.

The right to develop can be treated as a commodity that is separable from the land itself and therefore does not preclude all uses of the land by the original owner or future owners. The concept of purchase or transfer of development rights is fairly simple. The community identifies areas that are desirable to protect from new development or changes in use (called the "sending" area). The characteristics that are to be protected may include flood hazard areas, wetlands, forest stands, sensitive habitats, etc. In addition, the community identifies areas that are desirable for new growth (called the "receiving" area), ideally where existing infrastructure will support increased densities.

Landowners in the sending area are awarded a set of development rights, typically based on the value and acreage of land. Landowners in the sending area sell their development rights and must record deed restrictions that prohibit future development. They continue to own the land and are allowed continued use in according with the restrictions. The development rights are sold to developers or landowners in the receiving area, who then are permitted to build to higher densities or more intense land uses than would otherwise be permissible.

The community (or designated non-profit entity) monitors the sale and purchase, and monitors the conditions of the restrictions placed on land in the sending areas because unenforced rights may eventually be forfeited. In some cases, the community manages development rights much like a land bank, buying development rights to help achieve its public objectives, and selling them when pressures to grow warrant control.

The purchase of development rights is an alternative when communities do not want to acquire title to land, but simply want to limit development while recognizing that value of development rights. An added public cost of purchasing development rights is the long-term impact on property taxes. Landowners in the sending area generally qualify for a lower tax rate that reflects the diminution of value. On the other hand, the new development in the receiving area is likely to be taxed at a higher rate.

C.6 Setbacks and Buffers

Although precise distinctions between setbacks and buffers may be difficult to define, the two terms tend to be used in different contexts. For example, a setback from some reference point may be a factor used in locating a proposed building on a site, such as a front yard setback. A buffer tends to describe an area or zone around a feature that is the focus of some degree of protection. For example, a buffer may be required along waterways to preserve the riparian zone by limiting disturbances and alteration of the natural vegetation in order to maximize water quality and habitat and minimize erosion.

Regardless of whether a buffer or setback is specified, when applied along a body of water there likely will be natural and beneficial floodplain functional benefits:

- Riverine or streamside buffers, although generally narrow with respect to the width of the floodplain, effectively limit disturbances that alter the flow of water over and through those areas.
- Development setbacks are imposed to limit visual and environmental impacts on wild and scenic rivers.

- Reforestation buffers are delineated to encourage protection of existing trees and planting of new trees to restore streamside habitat and water quality filtering capacity and stabilize streambanks.
- Flood protection setbacks are designated to recognize that flooding occurs on all streams, not just those for which flood hazard maps have been prepared.

C.7 Deed Restrictions

A mechanism used to inform future purchasers and owners is to record specific restrictions that are imposed as a condition of development on property deeds. Although the owner is informed and has a duty to comply with the restrictions, it usually falls to a regulatory authority to enforce the deed restrictions. In some instances, the purpose of a deed restriction is to clearly place responsibility on the landowner rather than on the community. Examples of deed restrictions include

- Buildings constructed with enclosures below the elevated lowest floor may be deed restricted to advise owners of the limitations on allowable use and stating that conversion to habitable use is not allowed. Future owners who perform work that is contrary to the deed restriction do so in the face of a clear restrictive statement, and thus they assume full liability for their actions, which may include adjustments to insurance claims.
- Setbacks from streams or flood hazard areas may be drawn on plats and described in deeds to specifically inform owners that land disturbance and structures are not allowed within the setback area.
- When a dam is constructed and a lake created, the dam owner may create parcels that result in privately-owned lands extending below the flood pool. State dam safety programs may require use of deed restrictions to designate areas over which the dam owner reserves the right to flood and to convey construction limitations that may exceed community floodplain regulations. This is especially likely if the owner anticipates that high lake levels may occur with greater frequency than reflected on the community's flood hazard maps.
- Downstream of dams that release high discharges on a regular basis, deed restrictions and easements may be used to limit at-risk development.

C.8 Open Space Dedication

Increasingly, communities are requiring that developments retain land in open space in order to satisfying a variety of public purposes. And as more residents come to value open space as a community amenity, the development industry is realizing that preserving floodplains, wetlands, tree stands and other sensitive areas is mutually beneficial. Where flood-prone lands are dedicated to open space, multiple objectives can be achieved, including permanent avoidance of future development, water quality buffers, habitat improvement, and creation of linear parkland or greenways. Effective state programs authorize and encourage communities to incorporate open space requirements in zoning and land use ordinances.

- **Massachusetts'** Rivers Bill (1997) established a 200-foot protective zone around every river in the state. Areas within those boundaries are under the supervision of local conservation commissions, who also have jurisdiction over the state's wetlands.
- **Georgia**'s River Care 2000 Program enhances management of the state's river corridors The program focuses on appropriate land use in floodplains, land acquisition, public education, and financial incentives. Georgia also maintains a Greenspace Program that facilitates proper floodplain use.

C.9 Conservation Easements

An effective state floodplain management program authorizes and encourages the use of conservation easement to achieve multiple benefits. Easements either grant an affirmative right to use property (such as a right of access) or restrict the landowner's right to use the property in a particular way. Easements are flexible in that they can be written to apply to only some portions of a property, such as the floodway or the floodplain. They must clearly state the restrictions placed on the property and should also allow inspection by the entity that owns the easement to ensure compliance with the specific provisions. Easements may be donated or purchased:

- The best incentive for encouraging landowners to donate conservation easements is to make the donor eligible for tax credits. Eligible recipients of such donations include local governments, land trusts, environmental organizations, drainage districts, and others.
- Lowering the tax rate for floodplain lands that are placed in easement is an alternative, provided that the easement is recorded on deeds and plats, and the restrictions are known to the permit authorities.
- Government agencies and non-profit organizations can prevent development by purchasing easements to avoid certain land uses, in which case the "right to develop" the property is "owned" by the owner of the easement, not the owner of the property. The owner of an easement has one or more of the rights in a property, leaving the rest of the "bundle" of land rights in the hands of the landowner. This is an effective approach to foster compatible agricultural uses of areas that flood frequently.

Appendix D Higher Regulatory Standards

This appendix describes briefly of the higher standards or regulated development activities that are applied by communities and states to development inside or outside the floodplains, in order to ensure a higher degree of protection than that provided by the minimum NFIP standards. (See the full discussion, and a list of the most common higher regulatory standards, in Section 5.5.3.)

D.1 Freeboard. Freeboard is the most common higher standard. It is a specific height (usually 1, 2 or 3 feet) that is added to the base flood elevation. Freeboard usually is adopted to compensate for uncertainties inherent in determining flood frequencies and flood elevations or to recognize historic flood elevations that have exceeded the BFE. Buildings that are constructed with their lowest floor elevations at least 1 foot above the BFE enjoy significantly lower flood insurance costs, reflecting the anticipated reduction in damage.

D.2 Foundation Protection. Historically, most attention has been paid to how high buildings are elevated, not whether they are designed and constructed to resist flood loads at specific sites. Buildings in A Zones are not required to have engineered foundations, despite the fact that many floodplains have high velocity water or other factors that may impose considerable loads. Recognition of the full range of flood-related loads is achieved by requiring that foundations be designed and engineered for site-specific conditions.

D.3 Lower Substantial Improvement/Damage Threshold. Existing buildings are subject to certain requirements if they are improved (including additions) or repaired. At a minimum,

existing buildings are to be brought into compliance with the floodplain management requirements if the cost of improvements or repair of damage equal or exceed 50% of the market value of the building before the improvement or damage. Lower thresholds, for example 40% or 30%, have the effect of requiring more buildings to come into compliance, leading to reduced exposure to flood damage.

D.4 Mapping All Waterways. The maps prepared by the Federal Emergency Management Agency (FEMA) often have limitations and do not show flood hazard areas on all waterways. Of course, all bodies of water have adjacent land areas that are subject to flooding even if those areas are not shown on the Flood Insurance Rate Map. For example, the mapped flood hazard area usually does not extend up streams with drainage areas of less than one square mile. And in many rural areas entire streams have not had flood hazard areas delineated because a determination may have been made 20 or 30 years ago that development pressures were unlikely in those areas.

D.5 Coastal A Zones. Certain coastal flood hazard areas are designated as A Zone, and yet waves are present and contribute to damage. The waves experienced in these areas, called "Coastal A Zones," are not as large as those in V Zones (also called coastal high hazard areas or areas subject to high velocity wave action). In general, Coastal A Zones are where flooding is due to astronomical tides, storm surges, seiches, or tsunamis, not riverine flooding, and the potential for breaking wave heights greater than or equal to 1.5 feet exists during the base flood conditions. A greater degree of protection, and thus damage avoidance, is achieved when V Zone standards are applied within Coastal A Zones.\

D.6 No Rise Floodway. FEMA's standard method for determining the floodway is to model potential encroachments into the flood fringe until a "surcharge" or increase in water surface elevation of no more than 1 foot is predicted. The effect of this is that, as the flood fringe is developed over time, the base flood elevation will increase. If a higher standard requires a zero surcharge (or a smaller allowable surcharge) when flood hazard maps and map revisions are prepared, then such increases are prevented, and wider floodways result.

D.7 Protection of Floodplain Storage Capacity and/or Compensatory Storage. Many flood hazard areas are very sensitive to reduction in storage—the placement of fill and buildings may cause increases in the depth of flooding. Storage capacity can be protected in two ways that may be applied separately or together. A prohibition on the use of fill is the most straightforward and surest way to protect floodplain storage. Compensatory storage is more complex. The premise is that if fill is placed in the floodplain it must be accompanied by removal of an equivalent volume of earth elsewhere within the floodplain in order to compensate for any increases in flood level. In order to ensure that the compensatory storage is hydraulically equivalent, engineering evaluations of the effects are required

C.8 Dry Land Access. One effect of allowing elevated buildings in flood hazard areas is that some access—including access by emergency vehicles—may be restricted due to flooded roads. To address this public safety concern, a higher standard may require that buildings have dry-land access. In large measure, such a requirement results in buildings being located only on the very fringe or entirely outside of the floodplain.

D.9 Floodway Development Prohibition. Not only is the floodway generally where floodwaters are expected to be deepest and have the highest velocity, it is the area that is to be preserved to convey floodwaters without increasing flood depths more than a specified amount (generally no more than 1 foot). Prohibiting all floodway development protects public safety while also preserving the area as open space so that it can perform the natural and beneficial floodplain functions.

D.10 Enclosure Limitations. When floodplain buildings are elevated, especially if more than 6-feet above grade, the area underneath may be enclosed. This is permitted, provided certain restrictions are met, including limiting the use of the space to parking, storage, building access, or a crawlspace. Experience has demonstrated that even small enclosures are likely to be modified by owners so that they are no longer compliant with one or more of the restrictions. To overcome this, communities adopt higher standards to prohibit enclosures or to limit their size.

D.11 Restrict Land Uses and/or Density Based on Zone. Zoning is used to designate allowable uses. Combined with flood hazard area delineation, zoning can be used to guide damage-prone development to less hazard-prone areas. For example, the floodway can be designated a conservation zone where certain passive uses are allowed, such as open space, pervious parking, recreation, and water quality buffer or wetland and tree preservation areas. The entire floodplain may be zoned for such uses, or a minimum density may be imposed in order to limit the number and types of floodplain development.

D.12 Protection of Critical Facilities. Certain types of buildings serve critical needs on a daily basis or during the post-disaster period. Although there is no definition of which types are critical facilities, the term is generally understood to include emergency operations centers, disaster shelters, schools, fire and emergency medical stations, hospitals, water and wastewater treatment plants, power facilities, and community buildings that are occupied by important public services. Protection of new and substantially improved critical facilities to a higher standard involves limitations on siting within the 500-year floodplain or requiring protection against damage, loss of use, and loss of access to at least the 500-year flood elevation.

D.13 Underground Utilities. The minimum requirements for underground utilities address water supply and sanitary sewer systems and require designs to minimize or eliminate infiltration of floodwater into such systems and discharges from such systems into floodwaters. The requirements do not address where underground utilities are located, for example, with respect to eroding streambanks or underneath unstable stream channels. Higher standards address setbacks from banks or shorelines, depths below stream inverts, and various measures intended to protect against flood-related damage due to undermining, rupture, and collapse.

D.14 Setbacks and Set-Ups. Delineation of a setback is one way to achieve greater protection while acknowledging uncertainties in the flood hazard area determination and/or the topography used to delineate the floodplain boundary. A setback is usually a fixed distance measured from a reference point, for example the floodplain boundary. The effect is to expand the footprint or area of the regulated floodplain. Applying a "set-up," or specific height above the base flood elevation, is similar to freeboard, but also has the effect of expanding the area of the floodplain. For example, applying a 2-foot set-up means the land area under the elevation defined as the BFE plus 2-feet becomes the area subject to floodplain management regulations.

D.15 Manufactured Housing Requirements. Manufactured housing meets a significant part of the nation's demand for low- and moderately priced housing. However, it is known to be the most vulnerable type of structure in terms of the potential for flood damage. The minimum NFIP requirements allow replacement of units in existing manufactured parks to be done without full elevation (unless the unit is replacing one that was substantially damaged).

D.16 Cumulative Substantial Improvement. Over the years, a community may issue a number of permits for different repairs or improvements to a single building. If none of the work proposed in each individual permit application triggers the substantial improvement requirement to bring the building into compliance with the floodplain regulations, then the building will remain at risk. Under the higher standard known as cumulative substantial improvement, the value of all improvements and repairs that are permitted is tracked over a specific period of time and, when the cumulative value meets a pre-determined percentage of market value, the building must be brought into compliance.

D.17 Electric Service to Buildings. Electric companies are subject to the control of state public service commissions and generally are exempt from local regulations. In flood hazard areas where flood depths exceed the typical height of the electric meter, this generally means meters are not installed above the BFE. While routine meter reading and service is facilitated, it may mean longer recovery periods if meters must be replaced and electric service is delayed. Requiring or encouraging companies to install meters above the BFE facilitates recovery.

D.18 Minimum Height above Grade. Some areas of the country regularly experience intense and prolonged rainfall. Where the topography is too flat to allow adequate drainage, the result can be standing water even in areas generally are not mapped as flood hazard areas. Requiring buildings to be a minimum height above grade is a reasonable management standard that reduces future damage.