Chapter 1

FLOODPLAIN LAND USE MANAGEMENT AND POLICY EVALUATION

Introduction

For the past 20 years, thousands of local governments across the United States have been working with floodplain land use management to deal with problems brought on by flooding--the largest single cause of property losses from natural disasters (National Science Foundation, 1980). Floodplain land use management can reduce the susceptibility of property to flood damage by affecting *where* and *how* new urban development takes place. By guiding growth to locate outside of identified flood hazard areas, for example, land use management programs seek to eliminate the possibility of flood damage. Since many communities believe floodplains have locational advantages that should not be foregone, floodplain land use management also includes measures that allow building on the least hazardous portions of the floodplain if that development is elevated or constructed in such a way that the potential for flood damage is minimized. Floodplain land use management is not the sole means of coping with flood threats; but, because of shortcomings in the other approaches (principally structural flood control works) that a community might use, every recent piece of federal legislation that deals with flood problems has included provisions to stimulate local governmental use of floodplain land use management.

Over the years since floodplain management began to be widely used, a number of questions about its effectiveness have been raised. What are the impacts of floodplain management programs in terms of the exposure of property to flood losses and other objectives, such as public safety and preservation of open space? Do the benefits of land use management exceed programs costs to the public and private sectors? What causes variation in impacts from one community to another? How can floodplain management programs be designed or modified so that they are most effective in particular local circumstances? Those questions are addressed by the research described in this monograph.

Floodplain Management Alternatives

With substantial federal assistance authorized by the Flood Control Act of 1936 and subsequent legislation, many local governments have attempted to

control flood waters by constructing various engineering works, such as levees, channel improvements, and dams and reservoirs. However, those measures have severe limitations. They are expensive, and federal funds for their construction have diminished sharply since the mid-1970s. They also can fail. A levee can protect property from floods of a certain magnitude, but when a very large flood overtops the levee, waters trapped behind it can aggravate flood damage and recovery efforts. Channel improvements, such as dredging, increase the capacity of a stream to carry flood waters, but the increase in the rate and concentration of streamflow may transfer the flood problem downstream. Reservoirs to hold floodwaters are effective, but most large dam sites that are cost-effective already have been developed.

Each of the engineering approaches to flood damage prevention entails some environmental disruption and damage. And each may set off a chain of private decisions in which people, believing the engineering works provide complete protection, increase their exposure to the risk of flooding, so that in the end, the potential for property damage after the development of the engineering works is greater than before they were put in place (see Krutilla, 1966; White, 1945; White et al., 1958; White, 1975; Burby and French et al., 1985). The various shortcomings of flood control led Congress to require, through provisions of Section 73 of the Water Resources Development Act of 1974, that federal agencies give due consideration to floodplain land use management as an alternative or supplement to engineering works when they consider and evaluate potential solutions to flood problems.

Reliance on relief from federal and state agencies and private voluntary organizations is another traditional way localities have coped with the threat of flooding. The American National Red Cross has been providing help to victims of natural disasters since 1905, and since 1922 Congress periodically has enacted legislation to aid flood victims following large natural disasters. In 1950 Congress took the first step toward systematizing federal relief efforts with legislation to aid disaster-stricken states and localities in restoring public services. It took additional steps to organize federal relief programs with the Disaster Relief Acts of 1966, 1969, 1970, and 1974, which extended federal assistance to a variety of types of disasters, to permanent as well as emergency restoration of public facilities, and to losses incurred by private individuals and nonprofit organizations as well as public agencies.

Relief programs, like flood control, have been criticized because by reducing the costs of locating in hazardous areas, they provide an incentive for individuals and local governments to increase their exposure to flood losses to a degree that may not be warranted by the locational benefits of those areas (see U.S. Congress, Senate Committee on Banking and Currency, 1966; Krutilla, 1966; Lind, 1967; Dacy and Kunreuther, 1969). Because of its concern

with that, Congress added several provisions to the Disaster Relief Act of 1974 to promote prudent floodplain land use management. It encouraged states and local governments to apply for grants which provide up to $250,000 for the development of comprehensive programs for disaster preparedness and prevention. It required that hazard evaluation and mitigation activities be undertaken where federal assistance is used for the repair and replacement of damaged property. The act also required that once property has been repaired and restored with federal funds, its owners must obtain flood insurance as a condition for receiving future federal disaster assistance.

National Flood Insurance Program

While the water resources and disaster relief acts passed in 1974 have undoubtedly led to increased attention to floodplain land use management, neither of those acts accounts as much as the National Flood Insurance Program for the massive increase over the past 20 years in the number of local governments with floodplain land use management programs. Under the National Flood Insurance Program, established by the Flood Insurance Act of 1968 and strengthened substantially by the Flood Disaster Protection Act of 1973, over 17,000 local governments have adopted floodplain management programs. In drafting legislation to make flood insurance available nationwide, Congress was concerned that insurance would reduce individuals' perception of the risk of building in flood-prone areas and lead to a substantial increase in property at risk and overall federal disaster relief costs. To counteract those possibilities, the Flood Insurance Act of 1968 provided that before flood insurance could be sold in a community, it had to adopt and enforce certain floodplain regulations designed to reduce the susceptibility of new construction to flood damages.

The 1973 act put in place a strong inducement for community participation in the program and adoption of the required regulations. The act specified that unless they took part, communities would not be eligible for federal grants-in-aid for construction in flood hazard areas, and individuals would not only be unable to purchase flood insurance, they would no longer be eligible for federal disaster assistance for any flood-related damages, nor would they be eligible for loans, such as home mortgages, from federally supervised, regulated, or insured agencies or institutions for construction in floodplains. Although those sanctions were weakened in amendments to the legislation passed in 1976 and 1977 (the amendments made it possible for federally insured financial institutions to provide conventional mortgages for property in flood hazard areas of nonparticipating communities), more than 85% of the local governments in the nation with designated flood hazard areas have

chosen to participate and to adopt the required floodplain regulations (Petak and Atkisson, 1982, p. 68).

Following the federal lead, state governments have become actively involved in helping localities formulate floodplain land use management programs (see Burby and French et al., 1985; Bloomgren et al., 1980). Almost every state has adopted enabling legislation that allows local governments to regulate floodplains (U.S. Water Resources Council, 1971, p. 112-118), and a majority provide model local ordinances, training and education services, and hydrologic data (Burby and French et al., 1985). In some instances, states require that localities participate in the National Flood Insurance Program and adopt the required floodplain building regulations.

Minimum Standards of the National Flood Insurance Program

In order to minimize the potential for flood damage to new construction, the National Flood Insurance Program has adopted eligibility requirements which rely on site design and building construction components of floodplain land use management; the NFIP has not required communities to employ locational measures to minimize flood damage. When a community enters the emergency phase of the NFIP, it agrees to adopt ordinances which require local government to: 1) review all building permits for new construction and determine the flood zone; 2) using the best available information, require that new construction have the lowest floor elevated to the 100-year flood level (nonresidential structures have the option to floodproof to the same level); 3) apply the same requirements to existing structures if substantial improvement (improvements exceeding 50% of market value) are made; 4) require all mobile homes in the flood zone to be anchored; and 5) review all subdivision proposals and require revisions necessary to minimize flood damage potential. After the Federal Emergency Management Agency completes detailed engineering studies of the flood hazard, a community is eligible to join the regular phase of the NFIP. In the regular phase, a community must continue to ensure that new construction is elevated to or above the 100-year flood elevation, and in addition it must delineate a floodway and prohibit encroachments (fill, new construction, substantial improvements to existing structures) which would result in an increase of one foot or more in flood levels. Also, the placement of mobile homes in the floodplain must be prohibited, except in existing mobile home parks. The NFIP's eligibility standards set forth minimum requirements for floodplain management. Many communities, as we will show later, adopt floodplain land use management programs that include a number of measures not required for participation in the flood insurance program.

Local Floodplain Management Programs

Local floodplain land use management programs may include a variety of measures, in addition to those required for participation in the NFIP, to guide new development to locate in areas not subject to flooding, and to require safe building and construction standards for development that does take place within floodplains. A number of descriptions explain each of the major components of a floodplain land use management program (Conservation Foundation, 1977; Federal Emergency Management Agency, 1981, 1986; Kusler and Lee, 1972; Kusler, 1976; Owen and Wall, 1981; and Sheaffer, 1967). Those components may include the following measures.

Locational Component

Local governments may use one or a combination of the following measures to guide new development to locate outside of designated flood hazard areas: acquisition of floodplain land and relocation of buildings; zoning regulations; incentives and disincentives; and public information.

Land Acquisition and Relocation. Public acquisition of the floodplain is the most direct approach local governments can use to prevent development in flood hazard areas. Acquisition programs have been mounted by hundreds of local governments, often in order to achieve a variety of objectives--open space preservation, water quality protection, ground water recharge, provision of recreational areas--in addition to flood-loss reduction (see Kusler, 1979; Ralph M. Field Associates, Inc., 1982; Burby and Kaiser, 1987). Since fee-simple acquisition is expensive and often requires the provision of funds from higher levels of government (David and Mayer, 1984), a number of supplementary means of acquiring floodplain property are often employed: mandatory dedication provisions in subdivision regulations (provisions that require developers to give to the public or reserve for public acquisition land that meets certain standards, such as the existence of flood hazards); conservation easements (purchase of development rights) to limit development in flood-hazard areas; donations of floodplain property from private landowners; and landowner sales of property to the public at a bargain price in return for classification of the difference between the market and sales price as a charitable deduction for tax purposes.

Relocation, which involves moving structures and occupants from the floodplain, is more expensive and more difficult to accomplish than the acquisition of vacant land. Nevertheless, a number of communities have found that relocation is the most cost-effective solution to their flood problems. After the Rapid City, South Dakota, flood in 1972, for example, the city

acquired 1,400 parcels in the Rapid Creek floodway. Other recent large-scale relocation efforts have included the acquisition and relocation of 246 flood-prone dwellings in Baltimore County, Maryland; relocation of a portion of the Soldier's Grove, Wisconsin, downtown business district out of the floodway of the Kickapoo River; relocation of 350 dwellings from an area of subsidence and tidal flooding in Baytown, Texas; and relocation of 80 families from the Kingery West subdivision in the Salt Creek floodplain in DuPage County, Illinois (Kusler, 1979).

Zoning Regulations. Zoning regulation involves the division of a governmental unit into districts and the regulation within those districts of the height and bulk of structures, the size of lots, and the density of use. As a tool to influence the location of development, zoning can be used to maintain low levels of urban development in flood hazard areas by requiring large lots and by prohibiting some uses, such as multi-family housing and commercial and industrial activities. In some cases, localities use zoning to prohibit virtually all urban uses of flood hazard areas.

Floodplain zoning is generally characterized as "single-district" or "two-district," depending on how it handles the floodway (portion of the floodplain consisting of the stream channel and overbank area needed to convey a selected flood discharge within designated heights) within the floodplain. Single-district approaches are suitable for situations where a flood hazard area can be distinguished, but where data are not adequate to distinguish the floodway from the remainder of the floodplain (usually called the floodway fringe). Where the floodway and floodway fringe can be differentiated, two-district zoning may be used, specifying more restrictive regulations for the floodway (restrictions on fill or added elevation requirements) than the floodway fringe districts.

Incentives and Disincentives. In contrast to land acquisition and zoning, which directly control the extent of development and building in the floodplain, incentives and disincentives are designed to affect floodplain development indirectly by influencing individuals' and firms' calculations of the advantages and disadvantages of building there. The most important incentives at governments' disposal are capital improvements policies, regulatory policies, tax policies, and the decision to participate, or not, in the National Flood Insurance Program.

Capital improvements such as streets and water and sewer lines may be located to affect private development decisions (see Urban Systems Research and Engineering, Inc., 1976; Tabors, Shapiro and Rogers, 1976). When those and other facilities are located in and near flood hazard areas, they tend to encourage urban encroachment on the floodplain. Conversely, locating public facilities that support private development away from hazardous areas (or

restricting access to them when they are located in hazardous areas) should have the opposite effect. Developers and builders may be induced to locate on flood-free sites where public facilities will be provided, particularly if flood hazard areas will not be served with public infrastructure.

Localities usually adopt floodplain building and subdivision regulations to affect the character of development that takes place in the floodplain rather than the location of development within or outside of flood-hazard areas. However, to the extent such regulations increase the cost of construction by requiring hazard-mitigation measures, they render floodplain sites less competitive with building sites located elsewhere; thus, they may act as a disincentive to development. In contrast to those indirect effects, regulatory incentives may also be used directly to influence developers and builders to take certain actions. Density transfer or clustering provisions of zoning ordinances, for example, allow developers to shift development from flood-prone portions of a parcel and build at higher-than-normal densities on that portion of the parcel outside of the hazard zone.

Preferential taxation is widely used to discourage the premature conversion of open, agricultural land to urban uses. Typically, land is assessed for tax purposes at its value in nonurban uses with a proviso that deferred taxes must be paid if the property is developed within a specified period. Although that approach has not been used widely to discourage the development of floodplains, lower tax obligations could be used to create an incentive for landowners to keep flood hazard areas out of development.

Finally, the provisions of the National Flood Insurance Program which require the purchase of insurance for new construction financed with federally insured loans may provide a disincentive for floodplain development, since the floodplain occupant is forced to pay (through insurance) for the costs of potential flood losses. Moreover, to the extent that the NFIP's requirements to floodproof or elevate new construction raise building and development costs, they are disincentives to locating in the floodplain. Thus, when communities decide to participate in the NFIP, that decision brings with it a set of measures that indirectly should have the effect of discouraging floodplain development.

Public Information. Public information can divert development away from flood hazard areas by affecting private development decisions. The provision of information about the flood hazard is one of the oldest techniques for trying to discourage floodplain development. A number of approaches for informing the public have been devised. They include educational programs, publication and dissemination of flood hazard area maps, and posting warning signs. In addition, communities may require that builders, developers, real estate agents, and others involved in the real estate industry disclose the flood hazard before property is sold. Moreover, subdivision regulations often require that the flood

hazard area boundary be delineated on plats (maps of the subdivision), so that prospective lot purchasers know of the hazard and can avoid inadvertently locating damageable property in areas subject to flooding.

Site Design and Building Construction Standards Component

To ensure that new development within the floodplain is built in such a way that the potential for damage in the event of flooding is minimized, communities may employ subdivision, floodproofing and building or site elevation, and public health regulations.

Subdivision Regulations. Subdivision regulations apply to the division of parcels into lots, usually for purposes of sale and subsequent building. The regulations require developers to prepare a map (plat) of the subdivision, which must be approved by local government. Subdivision ordinances contain various standards for lot layouts, street patterns and widths, minimum widths and depths of lots, stormwater drainage, or water and sewer lines. As a floodplain management measure, subdivision regulations may require that lots be free of flooding or that they contain a sufficiently large, buildable portion free of flooding; that adequate drainage facilities be provided; that encroachment of structures into the floodway be prohibited; that roads and utilities be elevated above some minimum flood-protection height; and that flood-prone areas be set aside as public or community open space.

Floodproofing/Elevation Regulations. Flood-proofing involves the requirement of emergency, contingency, or permanent measures to render buildings, contents, and grounds less vulnerable to flood damage. Elevation requirements involve raising structures above the flood level, either by filling low-lying areas with compacted soil or by elevating the foundation through the use of posts, piles, piers, walls, or pedestals. Floodproofing and elevation requirements are often contained in building codes which specify standards that must be met when structures are built or rebuilt. As noted by Kusler and Lee (1972, p. 9), standards may be used to "1) prevent flotation of buildings by requiring proper anchorage, 2) establish minimum construction elevation consistent with flooding potential, 3) restrict use of materials which deteriorate when exposed to water, and 4) require structural design consistent with water pressures and flood velocities."

Public Health Regulations. Sanitary codes and septic tank regulations govern the use of on-site water supply and waste water disposal systems and may control dumping in flood hazard areas. They often prohibit the use of on-site sewage disposal systems in areas subject to flooding.