# IMPLEMENTATION OF NONSTRUCTURAL FLOODPLAIN MANAGEMENT MEASURES BY THE U. S. ARMY CORPS OF ENGINEERS

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## Introduction

The evolution of flood damage prevention measures in the United States portrays a continuing effort to separate flood waters from people and their possessions, all within the framework of an ever-changing set of circumstances. During the early development of this nation, principal concerns were with the most fundamental of human objectives such as dependable food supplies, shelter from the elements, and security from physical danger. The initial development of water resources related directly or indirectly to these needs in the context of an expanding country, and focused mainly on water transportation and water supply. Population centers inevitably clustered along river valleys and in floodplains. Uncontrolled clearing of forested areas for agricultural uses and grading and drainage activities for urban uses changed rainfall-runoff characteristics to compound an already worsening proliferation of unwise uses of floodplain lands.

At this point, flood problems became recognized as a significant concern of the federal government. Early solutions to flood problems were almost always based on the premise that flood waters should be controlled to protect areas of the floodplain for developmental purposes. However, ultimately it became obvious that flood control projects could not protect against all floods, especially if uncontrolled development continued. It was apparent that actions designed to influence land use decisions must become an added dimension to public policy on floodplain management. "Floodplain management," as used herein, is a comprehensive term which covers a full range of actions encompassing both structural and nonstructural measures.

## History of the Corps of Engineers in Water Resources Development

The Corps of Engineers has played a major role in the development of water

resources in this nation. As early as 1824, the Congress established a Board of Internal Improvements to plan a national transportation system of roads, canals, and waterways. Various River and Harbor Acts and, later, Flood Control Acts have provided authorization for the Corps' water resources program. The Corps' mission had to do primarily with navigation improvements until 1879, when the Mississippi River Commission was created with flood control as an added function. Flood control on the Mississippi River, however, remained incidental to navigation until 1917 when the first specific flood control legislation made flood control, by law, as much a part of the Commission's work as navigation.

The first nationwide survey of multiple-use possibilities for development of the nation's rivers was assigned to the Corps by Section 308 of the 1927 River and Harbor Act. In the next decade, the Corps prepared some 200 "308 Reports" outlining possible developments for purposes of navigation, flood control, irrigation, and hydroelectric power. These studies are generally acknowledged to have provided the basis for much of the intensive multiple-purpose water resources planning and development over a period of more than 50 years. Public support for large annual expenditures on conventional flood control projects waned with the recognition that the rate of annual flood damages continued to increase in spite of these expenditures. These concerns were reflected by Section 206 of the River and Harbor and Flood Control Act of 1960, which authorized the Corps to provide information, technical planning assistance, and guidance to other federal and non-federal entities to identify the magnitude and extent of flood hazards, and to assist them in planning for wise use of floodplain lands. This was the genesis of the Corps' Flood Plain Management Services program. The wise use concept added a new dimension to flood plain management and became the forerunner of Section 73 of the Water Resources Development Act of 1974, which requires that nonstructural alternatives for flood damage reduction be considered in the project formulation process.

## Status of Implementation

The Civil Works mission of the Corps of Engineers is very complex and comprehensive. It is funded under Public Works Appropriations and is not a part of the Defense budget. Under the Command of the Chief of Engineers, programs are executed by military and civilian staffs in 11 division offices and the 36 subordinated district offices. Geographical areas of responsibility

are separated by drainage divides and river basin boundaries. Policy guidance comes from the headquarters office in Washington. However, the Corps has a policy of decentralization that provides for authority to be delegated to commanders at division and district levels, in order that differing needs and perspectives of the various regions of the country can be considered. The currently changing emphasis in floodplain management from structural measures to nonstructural measures has not yet resulted in clearly defined procedures for the implementation of plans which include nonstructural measures as a principal component. This does not mean that projects utilizing these components are not being formulated, a high degree of originality is being used by Corps planners to develop locally acceptable solutions to flood problems within established financial and administrative constraints.

## Seminar on the Implementation of Nonstructural Measures

The Civil Works Directorate of the Corps of Engineers hosted a seminar on the Implementation of Nonstructural Measures at Fort Belvoir, Virginia, in November of 1982. The seminar focused on the need for new initiatives in research, information and experience transfer, procedural guidance, and policy issues. Discussions gave strong support for equal consideration of structural and nonstructural flood plain management measures. The seminar was attended by representatives of federal, state and local agencies and the private sector. The Corps was represented by participants from 40 of the 47 district and division offices. The proceedings were published and distributed in July of 1983.

A Corps committee was assembled in July of 1984 to identify key issues and problems discussed at the seminar and develop recommendations for follow-up actions needed to enhance the implementation of nonstructural measures in Corps feasibility studies. Committee members represented Corps headquarters, three division offices and four district offices. Recommendations of the committee are not yet final. However, as a member of that Committee, I will enumerate and discuss some of the primary issues.

## Definition of Nonstructural Flood Plain Management Measures

A universally accepted definition of "nonstructural measures" has not yet been developed. A part of the difficulty in defining the term stems from the fact that floodproofing actions are sometimes not clearly distinguishable from structural measures. A clear separation between the two terms becomes critical when considering an item of construction such as a ring levee. If it protects only one to two houses, it is considered a nonstructural measure and, as such,

has no requirement for freeboard. However, if the ring levee is extended to provide protection to a few more houses, it becomes a structural measure. The difference affects not only the design criteria, but also qualification for (80/20) cost-sharing under Section 73.

Inventory of Nonstructural Measures

A definitive consolidation of information on nonstructural measures completed or recommended in various Corps projects and plans is essential. It is important for Corps planners to know what has been done by others and how their efforts have been received.

Emergency Preparedness Planning

Corps participation in the implementation of flood warning systems or temporary evacuation plans, as elements of an overall floodplain management plan, is generally limited to the provision of technical assistance and planning guidance to appropriate government levels, and to the provision of equipment devoted exclusively to this purpose. Corps assistance in the development of these measures over the last decade has been provided as a technical service under the Flood Plain Management Services program (Section 206, River and Harbor and Flood Control Act of 1960) or the Planning Assistance to States Program (Section 22, Water Resources Development Act of 1974). The effectiveness of emergency preparedness planning as an element of comprehensive floodplain management plans would be maximized if the flood warning and emergency evacuation portions of nonstructural plans could be implemented as early-action items. Under current procedures, none of the plan is funded until the total plan is authorized by Congress and monies are made available. Another significant problem centers on the need for uniform guidance on the evaluation of flood damage reduction benefits specifically applicable to emergency preparedness measures.

Floodplain Regulations

Floodplain regulations may be required as a part of a flood control project. However, adoption and enforcement of regulations for floodplain management are entirely local responsibilities. Local interest may be required to adopt and enforce such regulations as a necessary component to the protection of the federal investment, or to achieve expected project benefits.

Permanent Floodplain Relocation/Evacuation Projects

Policies and regulations for planning and implementation of Corps projects are not easily adapted to meet the special requirements of flood plain reloca-

tion/evacuation measures. The following issues have bearing on such projects.

The reduction of flood damages borne by floodplain activities is not claimed as a benefit of evacuation or relocation because they are already accounted for in the fair market value of floodplain properties. These measures are difficult to justify economically because the costs are high.

Uniform implementation responsibilities and procedures for field management of such projects have not yet been established. These critical items can be undertaken by the local sponsor or by the Corps.

Corps policies and regulations on real estate acquisition and disbursement of project funds are not designed to meet the special needs of relocation/-evacuation projects. Currently, the Corps cannot provide advance financing for the purchase and resale of optional flood-free relocation sites.

A clear distinction between "financial costs" and "economic costs" is a concern in the application of existing guidance to the evaluation of benefits. "Financial costs" require no economic justification because they are assumed to be offset by equal benefits. Remaining "economic costs" must be shown to be justified by calculated benefits.

Voluntary vs. Mandatory Participation

Implementation procedures are not clearly established in regard to whether permanent relocation/evacuation and floodproofing measures are voluntary or mandatory. There appears to be a legal and policy consensus that implementation of an authorized evacuation /relocation project is mandatory (eminent domain can be applied), but floodproofing of individual homes is voluntary.

Level of Protection for Nonstructural Measures

Comprehensive guidance for establishing appropriate levels of protection for nonstructural measures should be formulated. Current guidance establishes no specified minimum level of protection for nonstructural plans. The level of protection for individual floodproofing measures may be selected on the basis of maximizing net benefits. This procedure can result in the selection of less than 100-year level of protection for some measures, which would be inconsistent with the requirements of the National Flood Insurance program, because the protected areas still would be considered flood-prone

## Conclusion

We have reached an awareness that the contribution of nonstructural measures to the objective of flood damage reduction is not only a function of how these measures relate to the physical aspects of a given flood problem, but

also to what extent the benefiting public understands and accepts them. Future success in the implementation of nonstructural projects will depend on the acceptance of an actively involved public. This challenge affects the states and local levels of government, as well as the Corps of Engineers and the rest of the federal establishment. The Association of State Floodplain Managers is a dynamic association of professional floodplain managers representing all levels of government and the private sector which can play an essential role in the achievement of the numerous objectives of this critical period.

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# SOIL CONSERVATION SERVICE ASSISTANCE TO FLOODPLAIN RESIDENTS

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## Introduction

Floodplain management assistance to reduce upstream flood damages is provided through numerous Soil Conservation Service (SCS) programs. Some of the efforts, such as floodplain management studies, river basin studies, and conservation operations provide only technical information. Programs offering both technical and financial assistance are the Watershed Protection and Flood Prevention Act (PL-566) and Resource Conservation and Development (RC&D). Most of the assistance under these programs goes directly to units of government and indirectly to the actual residents living in the floodplain.

Flood Plain Management and River Basin Studies have been conducted on 1) breach routing and inundation mapping below dams, 2) hydraulics and hydrology in areas not covered by flood insurance studies, 3) stormwater management modeling, and 4) project planning. Each study is carried out in accordance with a plan of work developed by the local government and SCS. River Basin Studies have been used for large river systems where other resource problems exist which need to be evaluated.

Flood prevention measures under the PL-566 and RC&D programs are planned, designed, and constructed to reduce flood damages on residential, commercial and industrial properties, railroads, roads, utilities, and agricultural crops in watersheds smaller than 250,000 acres. Historically, structural measures such as dams and channelization have been favored, but nonstructural measures can also be used.

## Flood Warning System

In Connecticut, the Soil Conservation Service has undertaken a special study and pilot project to test the use of a flood warning system and individual assistance to reduce flood damages. SCS and the Connecticut Department of Environmental Protection (DEP) are funding a system of 21 automated precipitation gages for a statewide flood warning network. In addition, five precipita-

tion gages and two river gages will be installed for two local warning systems--one on the Yantic River in Norwich and one on the Quinnipaic River in Southington.

The major components of the automated flood warning system include precipitation gages, river gages, radio transmitters, radio receivers, and a microcomputer. The gages will continuously monitor and instantly transmit data to receivers located at the municipal police station and at a National Weather Service River Forecast Center. There, the data will be processed using a microcomputer system. Along with the hardware, SCS has contracted with the Connecticut Council on Soil and Water Conservation to conduct flood audits on all floodplain properties in the two local areas. The two areas receive almost $500,000 in damages on the average annually. The flood warning system and flood audits are expected to reduce the damages by 10-30%.

## Flood Audits

Individual flood audits focus on providing flood preparedness training to potential flood victims in a local community. The audits are one way to give residents information on the corrective actions that they can take to reduce their flood losses. Without individual flood audit assistance, most people will only know that a flood will occur at a predicted time and it may reach a certain height at the gage. They will not know how a flood of this height at the gage will affect their individual property nor what action to take to reduce flood damage.

The property owners are interviewed to obtain structural and physical information for the building (see Table 1 ). After the interview, the flood heights and their relationship to the individual building are identified and added to the Flood Audit Interview Worksheet. The action items for each flood height are identified and shown on the Sheet on Prescribed Actions (Table 2).

When a person who has had a flood audit is alerted to a predicted river flood stage, he or she can use the information on the worksheets to:

1) Determine whether or not they will be affected by the flood stage predicted.

2) Utilize each additional hour and minute gained through the ALERT system in preparation for the flood.

3) Take damage reduction actions for a given flood stage as specified in the list of recommendations resulting from the individual flood audits.

4) Evacuate in a timely manner using a predetermined route.

TABLE 1
FLOOD AUDIT INTERVIEW WORKSHEET

Address _____ Occupant _____

_____ Contact _____

Telephone _____ Bldg. Owner _____

| Frequency Flood | 10 Yr. | 30 Yr. | 50 Yr. | 100 Yr. |
|---|---|---|---|---|
| Annual Probability | 10% | 3.3% | 2.0% | 1.0% |
| Inches Rain In 24 Hours | 5.0 In. | 5.9 In. | 6.3 In. | 7.1 In. |
| Yantic River Stage | _____ | _____ | _____ | _____ |
| Floodwater Elevation | _____ | _____ | _____ | _____ |
| Floodwater Depth | _____ | _____ | _____ | _____ |

Flood Stage At Which Damage Starts _____

_____

Structure - house - building - ____ stories - _____

____ car garage - shed - _____

FOUNDATIONS - stone w/conc - conc - conc blk - brick - conc slab - _____

WALLS - conc - conc blk - brick - frame - _____

BASEMENT - full - partial - conc/dirt floor - finished - _____

Any evidence of stress? (buckles, cracks)

WATER - public - well (shallow - deep) (submersible pump - reg) -

SEWAGE - public - private (tank-leachfield - _____) -

FURNANCE - elec - oil - gas - wood - hot water - air -

WATER HEATER - elec - oil - gas -

FUEL TANKS - oil - propane - gasoline - diesel -

- in-ground - inside - outside - anchored

DRAINS - foundation - floor - yard - curtain -

DISCHARGE - ground - surface - storm sew - sanit sew

Any flood related problems?

FLOOD PREVENTION MEASURES

- sump pump - sandbag - shield - sealant -

ENTHUSIASM (-) (-/+) (+/-) (+)

TABLE 1 (cont.)

| ITEM | OUTSIDE | BASEMENT | 1ST FLOOR | HIGH | MOBILE | NOTES |
|---|---|---|---|---|---|---|
| 1. Bsmt fl to 1st fl | X | X | X | | X | |
| 2. 6/82 Flood Depth | | | | X | X | |
| 3. 1st Floor Ent | | | | | | |
| 4. Bsmt Ent | | | | | | |
| 5. Bsmt Wind | | | | | | |
| 6. H2O Line/Meter | | | | | | (X's MEAN NOT |
| 7. H2O Pump | | | | | | APPLICABLE) |
| 8. H2O Heat | | | | | | |
| 9. Gas Line/Meter | | | | | | |
| 10. Elec Line/Meter | | | | | | |
| 11. Fuse/Ckr Brk | | | | | | |
| 12. Tele Line | | | | | | |
| 13. Sewage Line | | | | | | |
| 14. Toilet | | | | | | |
| 15. Sink/Tub/Sh | | | | | | |
| 16. Furnace & Burner | | | | | | |
| 17. Fuel Tank/Line | | | | | | |
| 18. Tank Intake/Vent | | | | | | |
| 19. Air Conditioner | | | | | | |
| 20. De/Humidifier | | | | | | |
| 21. Wash/Dry (g)(e) | | | | | | |
| 22. Refrig/Freeze | | | | | | |
| 23. Stove/Oven | | | | | | |
| 24. TV/Stereo | | | | | | |
| 25. Furniture | | | | | | |
| 26. Other | | | | | | |

TABLE 2

PRESCRIBED ACTIONS TO TAKE FOR THE GIVEN FLOOD STAGES

| LOCATION | ITEM | 12 FEET | 14 FEET | 16 FEET |
|---|---|---|---|---|
| Basement | | | Sand Bag Basement | |
| | Furnace | No Action | No Action | Disconnect Burner and bag circulator motor |
| | Hot Water Heater | No Action | No Action | Shut off power |
| | Floor Drain | No Action | Block Floor Drain | No Action |
| | Canning Jars | No Action | No Action | Raise 3 feet |
| | Carpets | No Action | No Action | Raise 3 feet |
| | Misc. Contents | No Action | No Action | Raise 3 feet |
| | Fuse Box | No Action | No Action | Turn off Main Switch |
| | Appliances | No Action | No Action | Disconnect & Enclose in bag |
| | Lavatory | No Action | Block Drain | No Action |

S A M P L E

# THE EVOLUTION OF NONSTRUCTURAL TECHNIQUES IN COMPREHENSIVE FLOODPLAIN MANAGEMENT PROGRAMS

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The nation's first full-scale regional program of floodplain management was launched in 1953 in the Tennessee Valley. Initially it involved floodplain regulations; later other nonstructural measures were added as complements to flood control structures to reduce flood damage potential and urge wise use of floodplains. The success in the Tennessee Valley led to our national program that is growing in effectiveness.

Regional and urban planning was only three decades old in 1953 and many people questioned the appropriateness of such an approach. Just as important was the historical flood-structure-only school of thought, in which floodplains had been subsidized for years. That had cost many billions of dollars but had been unable to reverse the nation's increasing flood damage potential. This was the setting when the new management program was initiated. It was to have people consider the adoption of self-restraints that would control and sometimes restrict use of their lands and related resources, along with the consideration of structural protection heavily subsidized by the federal government.

Major criteria set out for floodplain regulations perhaps had, and continue to have, the greatest effect on comprehensive floodplain management. How a few of those criteria were determined is presented herein. It was decided early that the following must be accomplished for a successful program:

1) States must be an active partner in the local-state-federal team for an effective program.

2) Engineers and town (regional) planners must cooperate closely for the best acceptable solution to local flood problems.

3) Officials and the public must understand the problem and be aware of alternate solutions.

4) An intermediate between "no use" and full use" of the floodplain must be determined. It must permit wise use and also be acceptable.

Below each of these goals is discussed in more detail.

## Local-State-Federal Cooperation

Many of the floodplains are too large for local government or even state government to handle alone. Furthermore, it is neither feasible nor desirable for the federal government to act independently. An increased degree of cooperation between local, state, and federal agencies and individuals was considered a necessary element in proper management.

States have statutory powers and have granted many of those powers to local governments. They should play an active role in shaping and administering state programs in accordance with their respective state constitutions and organization. Local governments must play the major role because they have been granted necessary statutory powers and they can insure that the solution is appropriate to their problem.

Federal technical and financial assistance, encouragement, guidance, and related activities should be channeled through state agencies. This would lead to greater confidence of local officials and public, better administration, and greater continuity of the program. This policy was adopted and followed.

## Engineers-Planners Cooperation

The expertise of planners and the technical expertise of engineers must be coordinated for the best solution to flood problems. Calling on both professions and obtaining input from each in a timely fashion was arranged early in the program. This cooperation resulted in actions acceptable to the public and to the courts.

## Public Understanding of Problem and Possible Solutions

Officials and the public must understand the problem and all alternate solutions in order to select and implement the best solution. This "informed public" is even more important when breaking away from the limited, traditional approach that had been found lacking.

### Nomenclature for Understanding

One of the actions to change and broaden the thinking was to adopt a new and more descriptive term or name for the comprehensive concept. The term "floodplain management" was coined as a part of coordinating efforts of local, state, and federal officials, water resource planning engineers, geographers, planners, economists, lawyers, foresters, recreation specialists, naturalists, and other officials and disciplines concerned with an overall comprehensive approach. It appeared to be the most acceptable (or the least objectionable) to the various groups and interests. It is now widely accepted.

The Legal Question

The skepticism concerning zoning or regulating areas for flood hazards had to be overcome early. Court cases were scarce and generally unknown. Most communities did not have, nor could they afford, full-time attorneys. Since few of the community attorneys were versed in this phase of the law, it was decided to give advice in a general way and be more specific upon request. A brief legal treatise with ample references was prepared in layperson's language. It stated the case and finally declared that "courts have upheld the regulation of land use for the prevention of flood damages." This article was printed in the National Civic Review in 1961. Thousands of reprints were distributed in the Tennessee Valley and nationwide. This article proved very effective.

The Flood Report

Another action was to design a simplified type of report that could be understood by lay as well as technical people. This went counter to tradition in presenting the engineering data. Technical terms were held to a minimum. The best data available were included for general interpretation and use. Maps showing areas inundated by various floods, profiles showing elevation of the floods, photos showing flood heights on prominent structures, and a short history of flooding at the site were among the data presented in the reasonably brief reports. The reports were distributed to respective officials and individuals. They were explained and discussed to insure an understanding of the problem.

Following presentation of the basic flood report, possible alternate solutions to the flood problem were presented and explained. These were described and illustrated in booklet or leaflet form. Planning and engineering assistance and guidance were given to state and local officials to help them choose the appropriate approach for the community. A floodplain regulations solution was generally the first action taken. A comprehensive solution often followed--sometimes with structures--after much more study and time.

Wisely Limiting Use of FloodPlains

Many advocated that the floodplains should not be developed, but be kept clear and open to prevent heavy losses from flooding. Others contended that natural resources of flood plains were too great to sacrifice through no use. Urban planners, engineers, economists, lawyers, geographers, administrators, officials of several states and several communities, and authorities in a few

universities and federal agencies were consulted. These discussions indicated that the "zero" approach could result in the inefficient use of the floodplains. The need for a reasonable, intermediate approach with a judicial balance of development was suggested.

Floodways

The concept which evolved from this process was an intermediate that allowed encroachment onto the floodplain. The decision was to preserve a floodway to accommodate nature's flood waters and require the elevation or floodproofing of structures outside the floodway. The floodway was to be the channel and that portion of adjacent floodplains necessary to carry the specified flood without increasing flood elevations significantly.

The criterion for "significant increase" determined to be a reasonable amount was "no more than one foot." The number "one" did not suggest an accuracy or degree of guidance that a fraction or fractions of a foot might connote. It related realistically to the engineering judgment applied in hydrologic and hydraulic computations. It was to be a minimum criterion intended as a regional standard, recognizing that there were urbanizing areas where elements might indicate a smaller rise might be appropriately considered. The criterion has proven to be reasonable, justifiable, and acceptable.

Selecting Flood Magnitude for Regulations

The devastating effects of failing structures (levees, walls, dams) are quite different from the inundating effects of gradually rising flood waters. That is a major reason why a flood of lesser magnitude can reasonably be considered for regulations.

In selecting a flood criterion it was recognized that an excessively high level would result in wasted resources, but an insufficient level would increase the probability of costly damage in the future. It was believed a "regional flood" based on flood experiences in the immediate region could be reasonably expected to occur at the subject site. Also, local people, officials, and decision makers would be more likely to understand and accept a flood of such magnitude. For those reasons, a regional flood was selected. Developed at a time before the highly theoretical and largely misunderstood frequency designation came into common use, this regional flood was sometimes a little higher than the statistically derived 100-year flood minimum standard selected in 1966 as part of the national program.

### A Larger Flood for Greater Safety

In addition to basing regulations on this regional flood, it was thought that users should be aware that larger floods could be expected. Therefore, it was decided to present data (elevations and areas that would be inundated) for the Tennessee Valley Authority's "maximum probable flood"--the flood related to designing flood control structures by TVA. This was to alert users to the probability of greater floods and provide a guide for those that wished to accept very little, if any, risk.

### Floodproofing

Floodproofing was another element of floodplain management given early attention. In order to better understand the possible role of floodproofing in comprehensive floodplain management, assistance was given the University of Chicago and one of its graduate students (John R. Sheaffer) to make a study. That report, "Flood Proofing," and a later publication prepared by Sheaffer, "Introduction to Flood Proofing," have been used nationwide and extensively. Knowledge gleaned from the study was used in integrating floodproofing into the Tennessee Valley program.

### Corps of Engineers Criteria

The U. S. Army Corps of Engineers (Corps) started its nationwide Flood Plain Management Services program late in 1966. The successful experiences in the Tennessee Valley were reviewed and most were incorporated into the Corps' effort. The concept name of floodplain management was used to denote the broadened approach. The brief, simplified type of report in layperson's language adopted was similar to that of TVA. The floodway concept with the "significant increase" criterion of "no more than one foot" was made a part of the program.

The selected flood chosen by the Corps was termed "Intermediate Regional Flood" to connote a flood that was intermediate between lesser floods and the large damaging floods that could reasonably be expected in the region. The 100-year flood was chosen for this, but it was identified on maps and profiles as an intermediate regional flood. It related reasonably close to, but varied somewhat from, TVA's regional flood. The Corps' standard project flood was used to alert users to the probability of greater floods.

### FEMA (FIA) Criteria

The Federal Insurance Administration (now FEMA) later established some national minimum requirements for federal flood insurance eligibility. Those

included adoption of floodplain regulations meeting certain minimum standards. The terminology of floodplain management, a base flood of 100-year frequency, and the floodway concept using the "no more than one foot" criterion were adopted.

## Review of Criteria

Congressional committees have reviewed the 100-year flood and the "no more than one foot" criterion for floodways two or more times. The criteria have also been reviewed and sometimes challenged by some officials and communities. The reasonableness and acceptability of the criteria have withstood all such reviews. However, some states and some communities in other states have recognized the "minimum" intent of the "one foot" standard and adopted more restrictive standards.

Further information concerning the evolution of floodplain management criteria can be found in TVA's report, "Flood Plain Management--The TVA Experience," December, 1983. Also, a history of the "Corps And Flood Plain Management" may become available in the next several months.