

## FLOOD LOSSES AND FLOOD PLAIN PLANNING

by

James D. Arnold  
Chief of Flood Plain Management Services  
Vicksburg District, Corps of Engineers

### INTRODUCTION

Nationwide, we are continuing to make improper uses of lands subject to flooding. Consequently, we are suffering increased flood losses; now averaging about one billion dollars annually.

We should no longer overlook the risks involved in developing uses of flood plain areas.

The Federal Government has recently expanded a program for furnishing technical information and advice on flood hazard situations. The service is provided, upon request, to Federal agencies, state and local governments, and to other interested groups. The purpose is to contribute information for planning reasonable uses of flood plain areas and to advise on measures to reduce further losses to existing investments.

It is not the purpose of the program to abrogate the programs for the construction of flood control works. Neither is it the purpose of this program to halt any community's economic growth.

The Corps of Engineers and the Tennessee Valley Authority, in its area, conduct the program.

This paper is a synopsis of the background and intent of this expanded program as assigned to the Corps of Engineers and as it pertains to inland areas. Coastal areas present somewhat different problems.

### BACKGROUND AND STATUS

The Tennessee Valley Authority pioneered in these services to communities in the Tennessee River Basin. Their experience formed the basis for the national program.

The Flood Control Act of 1960 authorized the Corps of Engineers to prepare flood plain information reports for communities requesting this service. This Act was amended in 1966 to authorize additional technical services in an expanded program.

In August 1966, the President sent to the Congress a Task Force Report entitled "A Unified National Program for Managing Flood Losses". This report presented recommendations for actions necessary to check the increasing losses from flood damages. The expanded program will implement some of those recommendations.

Following the Task Force Report, the President issued an Executive Order (No. 11296), which directed the Federal agencies to evaluate flood hazards involving certain activities. Now, this must be done (1) when planning new facilities, (2) in connection with facilities involving Federal grants, loans, and mortgage insurance programs, (3) in connection with lands or properties for disposal to non-Federal interest, and (4) in connection with programs entailing land use planning. Requests for flood situation information are directed to the appropriate Corps of Engineers District Office or in the Tennessee River Valley to the Tennessee Valley Authority.

There are over five thousand communities of twenty-five hundred population or more. Most of these have some type of flood problem. Also, there are several thousand smaller communities subject to flood damages.

Studies completed and underway number about five hundred. Of these, about two hundred are in the Tennessee River Basin.

#### PROBLEM SITUATIONS

Most of our communities were settled near rivers and streams. Railroads and highways followed. Urban development has largely consisted of the expansion of existing cities and towns. As flood free areas become occupied, interest in the attractions of flood plains is increased. Marginal flood plain areas usually have gentle slopes and are easily served with extensions of existing transportation and utilities systems. These marginal areas have been the scenes of residential, business, and industrial developments - and sometimes local flood disasters.

The future growth of our population and economy is expected to be mostly urban. Developments will continue to be made in areas near urban communities having favorable terrain, water resources, and transportation facilities. Such areas, although subject to varying amounts of flooding, will be developed, for one purpose or another, to satisfy the needs and desires of the people.

Our flood control projects provide varying degrees of protection for vast areas of our flood plains. Many areas, previously subject to severe flooding now enjoy a high degree of protection. In other areas, flood control improvements only reduce the magnitude of most natural floods. Ordinarily, the degree of protection

provided is dependent upon the type or types of project works that are physically and economically feasible. However, the flood plain areas of most of our communities have no protection from flooding. In all but the most highly protected areas, the sound management of flood plain development is critical.

Our current rate of flood losses proves the folly of irrational investments in unprotected flood plain developments. In addition, we have the casualties of lives, the suffering and inconvenience of people, and the expense of rescue and rehabilitation. The ruins from flooding can be a financial burden on the public as well as on individuals.

#### THE FLOOD PLAIN INFORMATION REPORT

The flood plain information study is made of the flood areas within a community plus adjoining lands that are included in the community's plans for future development. The purpose is to define the local flood situation, particularly with regard to the magnitude and probabilities of future floods.

Since we cannot predict weather events which would produce a given storm at a given time over a given area, we cannot predict the time of a specific flood event. Predictions of future floods are based upon the records of past floods.

For most of our significant stream basins, or adjoining basins, we have on hand hydrologic and hydraulic data from which we can satisfactorily predict the magnitude and frequency of future floods. Additional surveys are needed to verify physical conditions, identify changed conditions, supplement mapping data, or to obtain certain other information necessary to produce a useful report.

Data on hand in other Federal agencies will be used in preparing the report.

The report is a summary presentation of the studies made. It presents the flood situation in terms that can be understood and used by members of a planning commission and managers of flood plains. Detailed technical data and computations are kept on file in offices preparing the report and are available to interested persons. Generally, floods of three magnitudes are studied. These are:

1. The Standard Project Flood.
2. An Intermediate Regional flood, which has a one-percent probability of occurrence, and

3. The largest flood of record, which is of special interest to local people.

There may be special interest in the magnitudes of more frequent floods.

The flood situation is presented in the report by narrative discussion and the following typical illustrations:

1. Tabulation of hydraulic data.
2. Stage hydrographs.
3. Maps delineating the extent of the standard project flood and the intermediate regional flood.
4. Stream profiles showing the flood flowlines, the bank line, the channel bottom, and the locations of structures affecting channel flows.
5. Cross sections of channel at significant locations, indicating elevations of the large floods, and
6. Photographs of structures indicating the relationships between the ground surface and elevations of large floods.

It is important that the report include discussions and illustrations of the effects of existing or planned flood control improvements, and existing or planned structures or land fills within the flood plain.

Other special problems and matters peculiar to a locality may be included.

The report is formally presented to local officials, with a full explanation of the findings of studies made. Copies of published reports are furnished to the state and community and to Federal agencies.

In addition, a condensed pamphlet containing maps, profiles, photographs, and a brief discussion of the report findings is produced for wide distribution to local people and other interests.

#### USE OF INFORMATION AND SERVICES

The report should serve a vital role in a community's plans for future expansion and development.

Cultural adaptations to the defined flood situation should be carefully considered. The economic and social benefits to be derived from the use of flood prone areas must be carefully weighed against the risks to life and property. Adequate consideration of all factors involved can be technically complex.

Three broad considerations to be made in planning developments in or near flood plains are: (1) the risks to life and property, directly and indirectly involved; (2) the effects on flood channel efficiency; and (3) alternative uses of the area.

The risks to lives and property largely depend upon the flood stage-frequency relationship to residences, buildings, roads, water systems, sanitary systems, and electrical facilities.

The efficiency of a flood channel may be adversely affected by structures and land fills within the channel that retard the free flow of the water, raise the flood flowline, or reduce the temporary storage capacity of the channel.

Some uses of flood prone areas that may not involve undue risks are parking lots, parks, outdoor recreational facilities, and agricultural production.

The following alternatives may be considered in efforts to prevent or reduce flood losses:

1. Construct flood control protective works.
2. Remove or modify existing structures or land fills which restrict channel efficiency.
3. Construct buildings on piers or on fills, when practicable.
4. Raise existing structures.
5. Floodproof basements and ground floors.
6. Waterproof or relocate machinery and electrical facilities, or
7. Relocate structures or other facilities outside the flood plain.

Where Federal funds and properties are involved, the considerations outlined above are required of the responsible agencies. Such considerations may be voluntary on the part of private investors. They should be required by state and local government agencies.



Zoning ordinances are the most effective means of maintaining public awareness of the risks involved in the use of flood prone areas. Knowledge can help a man from harming himself. Regulations can help prevent him from harming others. Regulations provide a degree of information on which to base a rational decision, and they will tend to protect some persons from being "victimized". The public as well as individuals are the beneficiaries of well-planned community developments.

The services of the offices preparing flood plain reports are available to other Federal agencies, state and local governments, and other interested groups. Such services are necessarily limited to interpretations of technical data in the report and to providing certain advice and assistance on measures for preventing or reducing flood losses.

In localities where flood plain information studies have not been made, limited technical information will be provided upon request. The information will be in preliminary form only.

Offices of the Corps of Engineers will collect, from all sources, technical data and reports that are important to the solutions of flood problems. At a later date, lists of reports and data that are available will be furnished to State and local governments and to other Federal agencies.

#### PROGRAM EXPECTATIONS

Plans are being made to complete about two hundred and fifty studies annually, for communities of twenty-five hundred population or more. Studies will also be made for smaller communities. For satisfactory coverage, the program now envisioned may require ten to twenty years.

Considering the amounts of property now subject to flood damages, we cannot at first expect dramatic reductions in flood losses resulting from this program. Flood-proofing existing buildings where feasible would show significant results. We hope the program will cause a substantial decrease in the trend of unreasonable uses of flood prone areas. In time, this will achieve the program's purpose.

It is the responsibility of the Corps of Engineers and the Tennessee Valley Authority to develop a public awareness of the program and its purpose. It will be the responsibility of Federal, state, and local government officials, and civic leadership to achieve the success that can be attained.

#### REFERENCES

- Dunham, Allison, "Flood Control via the Police Power," University of Pennsylvania Law Review, Vol. 107, No. 8, (1959) pp. 1098-1132.
- Goddard, James E., "Flood Plain Management Improves Man's Environment," Journal of the Waterways and Harbors Division, ASCE, Vol. 89, No. WW4, Proc. Paper 3702, November, 1963, pp. 67-84.
- House Document No. 465, 89th Congress, 2d Session, "A Unified National Program for Managing Flood Losses," A Report by the Task Force on Federal Flood Control Policy, U.S. Government Printing Office, Washington: 1966.
- Murphy, Francis C., "Regulating Flood Plain Development," Research Paper No. 56, Dept. of Geography, University of Chicago, Chicago, Illinois, 1958.
- Presidential Executive Order 11296, August 10, 1966, Federal Register, Vol. 31, No. 155.
- Public Law 86-645, Section 206, Flood Control Act of 1960, Approved 14 July 1960.
- Public Law 89-789, Section 206, Flood Control Act 1966, Approved November 7, 1966.
- Sheaffer, John R., "Flood Proofing: An Element in a Flood Damage Reduction Program," Research Paper No. 65, Dept. of Geography, University of Chicago, Chicago, Illinois, 1960.
- Sutton, Walter G., "Planning for Optimum Economic Use of Flood Plains," paper presented at Environmental Engineering Conference, ASCE, Atlanta, Georgia, 25-28 February 1963.
- Weathers, John W., "Comprehensive Flood Damage Prevention," Journal of the Hydraulics Division, ASCE, Vol. 91, No. HY1, Proc. Paper 4193, January 1965, pp. 17-27.
- Weber, Eugene W., and Sutton, Walter G., "Environmental Effects of Flood Plain Regulations," Journal of the Hydraulics Division, ASCE, Vol. 91, No. HY4, Proc. Paper 4402, July 1965, pp. 59-70.