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Summary of Water Resources Information for Meteorologists/Hydrologists of the National Weather Service Engaged in the Flood and Flash Flood Warning Program

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SUMMARY OF WATER RESOURCES INFORMATION

FOR

METEOROLOGISTS/HYDROLOGISTS

OF THE NATIONAL WEATHER SERVICE

ENGAGED IN THE FLOOD AND FLASH FLOOD WARNING PROGRAM

BY

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CHAPTER 1

INTRODUCTION

Flash floods have historically been viewed by NWS as one of several types of severe weather phenomena. In meeting NWS responsibilities relating to severe weather phenomena, program development and staff efforts have generally focused on the similarities which exist between flash floods, tornadoes, hurricanes and other weather events with disaster potential. This approach has made effective use of the exceptional scientific capabilities of the NWS in meteorology.

This historical emphasis on meteorology is reflected in the make-up of NWS staff. Most staff, especially those assigned responsibilities under the flash flood warning program are meteorologists. This has important implications with respect to conduct of the NWS warning mission related to flash floods because of its effect on the required interaction with water resources agencies at the federal, state, regional and local levels. Contrary to most NWS staff members' view of flash floods as one of several types of severe weather phenomena, water resources planners conceive and deal with flash floods as one of several types of flooding or, along with water supply, irrigation, and hydropower, as one of several functional concerns in the multipurpose planning and development of water resources projects.

Dealing effectively with flash floods and planning community warning systems requires cooperative action between the NWS and the various water resources agencies at all levels of government. Substantial benefits stand to be gained through such cooperative efforts by the NWS, the water resources agencies, and the public. The NWS and each of the water resources agencies has specialized resources and capabilities which, taken together, can accomplish more than might be done individually. Achieving the basic goals of the federal government with respect to reducing losses due to flash floods requires the full coordination of all relevant programs.

* The sort of close and cooperative relationship which is desirable between the NWS flood and flash flood warning program and various water resources programs will not suddenly occur. Its development in the future depends largely on the extent to which Meteorologists/Hydrologists and other personnel at NWS

* Asterisks denote paragraphs of particular importance.

field offices become familiar with the operations of water resources agencies and find those areas in which the coordination of programs is mutually beneficial.

Working closely with the myriad of water resources agencies which exist is not simple. Water resources planning and development, especially that part addressing flood control, takes place within a highly sophisticated set of legal, institutional and financial arrangements. Effective coordination requires that NWS personnel have at least a rudimentary understanding of those arrangements. Without a basic understanding of the mission and programs of the water resources agencies and the arrangements under which they operate, there is little chance of either tapping the resources and skills that they offer or of making valuable contributions to their work. The task of understanding the direction and purpose of the numerous programs relative to flood loss reduction is complicated by the fact that, like NWS, each agency deals as well with other topics and has a history and statutorily established mission which affect how its flood control programs are carried out.

PURPOSE AND ORGANIZATION

This report was prepared to aid the Meteorologist/Hydrologist in quickly gaining a general knowledge of the history of development of water resources agencies, the main parts of the intergovernmental structure which now exists for flood control and the principal programs related in one way or another to flood warning and flood preparedness planning. It contains the following major parts:

1. An overview of the water resources planing and management field which summarizes the large number and diverse types of governmental organizations which are involved;

2. A brief description of the historical development of the nation's water resourses programs with emphasis on the nature of current federal flood loss reduction programs and policies;

3. Summary statements of the history, organization, programs and procedures of the Bureau of Reclamation, Corps of Engineers, Federal Insurance Administration, Geological Survey, Soil Conservation Service and Tennessee Valley Authority;

4. Description of the principal intergovernmental and federal interagency coordinating arrangements important in the water resources field; and

5. A selected bibliography of materials concerning planning of flood and flash flood warning systems.

SCOPE

No effort has been made to make the summary all inclusive with respect to either breadth of coverage or depth of detail. Only those water resources agencies with which NWS staff are most likely to have contact are discussed. Similarly, descriptions of historical aspects are intended only to give the reader something of the flavor of what has been an exceedingly dynamic evolution of agencies and programs. The main precepts of water resources planning are only summarized with respect to their relevance to the mission of the Meteorologist/Hydrologist engaged in the flood and flash flood warning program. No effort is made to deal with the specific legal, financial, economic, environmental and other ramifications of what are, in fact, complex concepts.

OVERVIEW OF WATER RESOURCES FIELD

The development, control, protection and enhancement of water resources is a major national activity. A large and diversified set of organizations representing all levels of government and the private sector has evolved which shares responsibility for planning, design, implementation and operation of water resources projects and programs.

Federal Government

Federal involvement in water resources planning and management began early in the Nation's history in efforts to aid inland transportation and facilitate commerce. As the Nation's needs grew, the range and size of water resources development programs undertaken by the Federal Government increased. The history of water resources development reflects the great social concerns since formation of the Union with periods of canal building, efforts to irrigate and thus open the west for settlement, conservation programs to prevent another dustbowl, wartime expansion of hydroelectric power, and efforts to control and improve water quality. Federal policy with regard to the federal role in water resources development has been extraordinarily dynamic and its making has sometimes been attended by bitter differences as to what and how much should be done, for what group and by whom. leadership of water resources planning and management activities

has been alternately sought and exercised by both the Congress and the Presidents.

The web of policies, customs and laws relating to water resources planning and management is every bit as complex and far ranging as might be expected for controlling use of a vital resource on which so much has been spent and so much depends. Water programs have been used to spur employment, redistribute income, promote regional development, provide competition for railroads' monopoly of transportation and serve dozens of other and less obvious ends.

It is not surprising in view of its importance that most federal departments have found it necessary to deal with some aspect of water management.[1] At least ten federal departments,[2] six independent agencies,[3] five offices and councils in the Executive Office of the President,[4] and eight federal-state commissions are presently involved in one way or another. Within a single federal department, such as the Department of the Interior, water related responsibilities may be found in more than a dozen separate bureaus or offices. Thus, if entities are counted at the sub-departmental level, there are well over fifty federal bureaus, offices, councils, independent agencies, and commissions dealing with water and related land resources.

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[1] The ten departments are Agriculture; Commerce; Defense; Energy; Health Education and Welfare; Housing and Urban Development; Interior; State; Transportation; and Justice.

[2] The independent agencies are the Appalachian Regional Commission, Environmental Protection Agency, Federal Power Commission, Tennessee Valley Authority, National Science Foundation, and the Water Resources Council.

[3] The offices or councils in the Executive Office of the President include the Office of Management and Budget, Office of Science and Technology, Office of Emergency Preparedness, National Council on Marine Resources and Engineering Development, and the Council on Environmental quality.

[4] The federal-state commissions include two established by a federal-interstate compact: the Delaware River Basin Commission and the Susquehanna River Basin Commission; and six established under the Water Resources Planning Act: New England River Basins Commission, Pacific Northwest River Basins Commission, Great Lakes River Basin Commission, Ohio River Basin Commission, Missouri River Basin Commission, and the Upper Mississippi River Basin Commission.

Each of these entities views its water resources activities in the context of its overall responsibilities. For some, like the Department of Energy, water is an ingredient in a larger effort to meet energy requirements through hydroelectric production or cooling of stream power plants. For other agencies, like the Corps of Engineers, water management is the central and largest program.

The agencies administering programs which are related most closely to the Meteorologist/Hydrologist's effort in flood and flash flood warning systems include the Bureau of Reclamation, Corps of Engineers, Federal Insurance Administration, Soil Conservation Service, Tennessee Valley Authority and Geological Survey. These organizations are responsible for the bulk of the federal government's flood control and other water resources planning and management activities.

Each of the agencies has its own special orientation. The Bureau of Reclamation's activities focus on irrigation and contributions to flood control are largely incidental to irrigation projects. SCS stresses conservation of both land and water in agricultural settings with flood control as one of several objectives while the Federal Insurance Administration is responsible for federal insurance programs, one of which is flood insurance. Agencies likewise differ in the approaches which they are authorized to employ in their flood loss reduction programs. Some can build dams, some regulate, some educate and others combine these and other techniques. Meteorologists/Hydrologists dealing with these agencies must appreciate the differences between their interests and programs if constructive and effective relationships are to be developed between their programs and those of the NWS.

In broad terms, the federal government's role in water resources planning and management is well defined and includes:

1. Leadership in international water matters including negotiation and supervision of treaties;

2. Support of research, data collection and other programs having long term returns or of widespread applicabaility;

3. Representation of the long term interest of the public;

4. Planning, management and implementation of needed programs on federally owned public lands;

5. Provision of the financial capability and specialized technical capability to carry out large and complex projects and programs;

6. Responsibility for development and maintenance of water resources projects for certain functions such as navigation and hydropower; and

7. Provision of standardization in programs conducted by non-federal interests.

The foregoing do not encompass all of the federal roles and an extremely long list would be necessary to itemize even the most important water related activities. However, it is perhaps sufficient to note that there are certain characteristic types of activities which fall within the federal sphere and others left to non-federal governments and the private sector. Sections of Chapter 3 describing the programs of selected agencies illustrate those particular federal flood control activities of greatest importance to the Meteorologist/Hydrologist.

State Government

The involvement of state governments in water resources has trended upward and downward over time. States participated extensively in canal building and other types of water development a century ago, some with disasterous financial consequences. Limitations on indebtedness in some present state constitutions can be traced directly to states' costly experiences in water development.

Water resources activities at the state level were at a relatively low ebb in the 1950's excepting in a few states, like California, which had aggressive programs underway for planning and implementation of projects. In an effort to, among other things, stimulate state participation, Congress enacted the Water Resources Planning Act of 1965, Public Law 89-80. The Act provided matching federal funds to states for increases in water resources planning and management budgets. This incentive was generally well received and most states responded quickly with creation of expanded water resources programs. State water programs today run the gamut from collection of basic data and research to complex efforts to optimize resource uses on a large scale.

States presently participate in water resources planning and management in a number of ways. The most important of these are:

1. Provision of financial assistance for water development projects;

2. Conduct of land and water resources planning;

3. Regulation of local activities; and

4. Water rights administration.

State financial assistance for water resource development is provided directly through commitment of the state to providing the non-federal share of federally authorized projects, construction of wholly state supported projects, and diverse types of loans and grants to local governments and private interests. Assistance may be from some revolving fund or specifically authorized by legislatures on an individual basis. Funds may be limited to some single facet of programs such as acquisition of lands or for an extensive array of purposes. What prevails in each state broadly reflects the types of development felt by the legislature to be most important.

Land and water resources planning by states includes a wide spectrum of activities including participation in the framework level planning carried out by river basin commissions and interagency committees, development of statewide comprehensive or specific functional plans and review of federal project proposals. Depending upon the state, planning may be viewed as a supplement to federal planning which supports and adds detail or as a means of guiding federal assistance into desirable patterns.

Regulation and support of local activities to assure safe drinking water supplies has been a well established state function for several decades. More attention has been focused recently on the states' role in water quality planning and management and in flood plain management. All but a few states have enacted legislation enabling local governments to undertake regulation of land use on flood plains. Several states' legislation makes that activity mandatory. States also participate in the National Flood Insurance program, providing coordination of local participation, local-federal liaison, and required management for state owned lands.

One of the most clear-cut state activities is administration of water rights. Even discussion of a federal role in water rights administration brings instant and widespread reaction,

particularly from western states. Excepting for Indian water rights provided for under the Federal Government's reservation doctrine, allocation of available supplies rests with the states. Numerous and complex questions surround the federal-state division of authority regarding water rights. The general topic is a frequent subject of litigation.

The most important activities so far as the NWS is concerned are probably the considerable number of statewide water plans now being developed, the increased role of states in review of federally planned projects and state participation in coordinated or joint planning programs with the federal government. Each of these activities offers the opportunity for introduction of warning as a flood loss reduction technique on a broad basis.

The degree of state involvement in water resources planning and development also varies regionally and with respect to various aspects of water use. In eastern regions of the Nation, state activities tend to emphasize flood control, water quality and urban water supply. A relatively full water supply is usually available so allocation of waters, irrigation and some other concerns important to western regions are given less attention. In broad terms, it appears that resource management in the east focuses more on the related lands than on the water itself.

In western regions, and increasingly in some southern regions, water is often a major limitation on development. Water matters correspondingly take a high priority and states are involved deeply in development of new water supuplies, allocation of available supplies and efforts to improve the efficiency of water use. Flood control is important in the west but no more so than irrigation.

Special Purpose Districts

State legislatures have typically been responsive to the needs of groups of citizens who wished to act together for some particular purpose by enabling creation of a special institution having the powers necessary to accomplish the desired objective. A great proliferation of such organizations has occurred over the years until there are now thousands of special purpose districts across the country. Their purposes vary from operating hospitals and schools to disposing of refuse and sanitary wastes. Some urban areas are overlain with dozens of different districts, some occasionally working at cross purposes with one another.

Special purpose districts of principal interest to the Meteorologist/Hydrologist include: a) Levee, Diking, Watershed, Drainage and Flood Control districts and others with similar names indicating a relation to flood control; and b) Water, Natural Resources and other types of districts having multipurpose authorities. Districts can generally raise revenue by ad valorum taxes or assessment, construct or otherwise carry out construction related to their purpose and contract with the federal government. They often make excellent cooperators for implementing federal programs.

A wide variation exists in the capabilities of special purpose districts. Some operate with an unpaid volunteer board and no staff. Others employ hundreds or thousands of staff and have technical capabilities beyond what is found in many state agencies. Regardless of their size, special purpose districts' role in water resources planning and management is more limited than that of general purpose governments so far as the breadth of each district's responsibilities is concerned. However, in total, they account for a significant share of water resources development expenditures.

City and County Government

City and county governments have a major interest in water resources management, generally characterized by a shorter-term view than that prevailing at the federal or state level. City governments bear the immediate responsibility for adequacy of water supplies, sanitary conditions, and protection from floods. Parent states have delegated to local units of government many authorities such as regulation of land use, eminent domain and others necessary to meet these responsibilities.

City and county governments are more limited, of course, in their geographical area of interest than are the state and federal governments. Few cities or counties take a significant interest in river basin planning or even planning for a whole stream. Likewise, because few cities or counties have any involvement in hydropower or irrigation development, their planning and development activities tend to be single purpose in nature.

* These levels of government are particularly important to the Meteorologist/Hydrologist dealing with warning systems since the final delivery of warnings is at the local level. Local governments also have the greatest incentive to sponsor, operate and otherwise encourage the establishment of warning systems because they are the most directly benefitted level of government.

* Water resource related responsibilities at the local level- are normally distributed between departments of public works, law enforcement agencies, fire departments, planning agencies and civil defense agencies. The exact pattern of allocating responsibilities for flood control, warning, rescue, preparedness planning and other functions is highly variable and needs to be determined on an individual basis.

CHAPTER 2

KEY ASPECTS OF WATER RESOURCES AND FLOOD CONTROL POLICY

Familiarity with the major aspects of water resources and flood control policy is of some value to the Meteorologist/Hydrologist. It provides a basis for viewing flood and flash flood warning systems within the context of the whole range of measures and procedures presently employed for flood loss reduction. This knowledge also enables a better appreciation of the important relationships which either do exist or can be developed between warning arrangements and other programs. Finally, familiarity with the major aspects of flood control policy creates an awareness of its dynamic nature and current trends which is an essential basis for identification of future opportunities for application of warning concepts.

The history and discussion of flood control policy and approaches presented in this Chapter is not intended to be detailed in the provision of historically important dates, although some are noted. Neither is it intended to cite all of the important legislative enactments although some of those are also pointed out and discussed. The principal intent of the Chapter is only to give the reader a sense of the history and a feel for the general direction national policies are proceeding and to describe current major philosophies which govern that policy development.

Flood control and water resources were of little concern to federal and state governments in the first days of the Republic. What cities and developments were on the flood plains were small and streams served in their unaltered form as sources of water supply, as a means of transportation and sometimes as a location for disposal of wastes. Early developments were minor and variously undertaken by governments and individuals to improve the water supply, provide power for mills and facilitate shipping through harbor developments.

Needs for managing the water resource grew as cities increased in size and the Nation's population moved westward. One of the major needs to be recognized was that of navigation. Rivers provided the roads for settlement of the inland areas and for commerce. This sparked a period of public works to improve rivers for navigation and to supplement the natural river paths with canals. Much of the basis for today's federal interest in flood control stems from the desire to create and maintain

navigable waterways and the federal government's constitutionally established control over interstate commerce. Only vestiges of the canal system created in the mid-part of the nineteenth century remain but navigation on major rivers remains a strong part of national water resources management.

The desire to open the arid lands of the west to settlement at the beginning of the twentieth century made it necessary to introduce irrigation on a widespread basis. At about that same time, eastern cities had grown to sufficient size to encounter serious problems of waste disposal and unsanitary drinking water, leading to establishment of medically oriented boards of health. The development of America's industry was also then proceeding at a rapid pace and its needs for power and industrial water supplies caused a large increase in water related construction of diverse types.

Flood control did not become an important subject for federal legislation and action until 1917 when the Corps of Engineers was authorized to undertake flood control measures on the Mississippi and Sacramento Rivers. This initial interest in flood control expanded rapidly in succeeding decades until, in 1936, Congress established a nationwide flood control program.

Numerous water resources management philosophies and practices have evolved in the transition from these first programs to the large governmental involvement summarized in Chapter 1. Several are particularly pertinent to the Meteorologist/Hydrologist. These include the concepts and practices related to multipurpose development, multiple objective planning, river basin planning and use of nonstructural measures.

THE CONCEPT OF MULTIPURPOSE DEVELOPMENT

Early water programs for development or control of water and related lands was planned and carried out largely to serve irrigation, water supply, navigation, flood control or another individual purpose. The prospects and benefits of making one investment serve several purposes had not escaped those concerned with resource development but the concept had not progressed to the point of widespread practice.

The creation of the Tennessee Valley Authority in 1933 provided one of the first experiments in giving multiple authorities to a single entity and assigning it responsibility for the coordinated treatment of several water related purposes. The concept of integrating plans to meet several types of needs and

constructing multiple purpose projects was also a central theme in the work of several presidential commissions, statutorily established coordinating agencies, and interagency committees shortly before and after that time.

Notwithstanding the growing interest in multipurpose development, institutional arrangements within the federal government during this period were inadequate to fully coordinate, let alone integrate, federal water resources planning. The Corps of Engineers, Bureau of Reclamation and the Department of Agriculture's predecessor to the Soil Conservation Service proceeded with essentially unilateral development of plans and projects. Since each agency had a limited interest, the plans which they developed tended to a single purpose. This course of events led in 1950 to a clash between the Bureau of Reclamation and the Corps of Engineers over whether the development works on the Missouri River ought to be pursued by one or the other for purposes of flood control or irrigation. The eventual welding together of their separate plans into the single Pick-Sloan Plan was a major step toward multipurpose development.

In 1962, a document commonly known as Senate Document 97 was developed by a federal interagency committee at the direction of the President. The document established policies, standards and procedures for uniform application by all federal Executive agencies. It specifically directed that:

> Planning for the use and development of water and related land resources shall be on a fully comprehensive basis so as to consider:
>
> > (1) The needs and possibilities for all significant resource uses and purposes of development, including, but not limited to domestic, municipal, agricultural, and industrial uses of water; water quality control; navigation in relation to the Nation's transportation system; hydroelectric power; flood protection, control or prevention; land and beach stabilization; drainage, including salinity control; watershed protection and management; forest and mineral production; grazing and cropland improvement; outdoor recreation, as well as sport and commercial fish and wildlife protection and enhancement; preservation of unique areas of natural beauty, historical and scientific interest; and

(2) All relevant means (including nonstructural as well as structural measures) singly, in combination, or in alternative combinations reflecting different basic choice patterns for providing such uses and purposes.

* This document firmly established concepts of multipurpose planning and development which are followed today by federal agencies in water resources development and management programs. The multipurpose development concept is important to establishment of flash flood warning systems and preparedness plans for several not altogether consistent reasons. First, opportunities for multipurpose development arise most frequently in connection with reservoir construction or in projects having several types of structural components to store, convey and otherwise manipulate the water resource. Such projects are sometimes attractive because costs can be shared among a wider range of beneficiaries or broader political support can be generated. Flood warning systems offer few opportunities for multipurpose development except as necessary gaging, communications and other associated equipment can serve additional purposes.

* This limited compatibility of flash flood warning systems with the concept of multipurpose planning may contribute to a bias on the part of water resources planners to solve problems in other ways where economically and practically possible to do so. However, this is not necessarily so. Cases may arise where projects are undertaken principally for purposes other than flood control and flood or flash flood warning systems may offer a relatively economical and simple way to add flood damage reduction to the overall plan. This case is likely to become increasingly common if present concern over dam safety were to require protection against flooding due to dam failure in areas below all impoundments including those for irrigation, navigation, water supply, hydroelectric power generation and other purposes.

* The second principal way in which the concept of multipurpose development affects the application of flood warning systems is in its discouragement of projects in certain instances. Flash floods arise in many cases from small watersheds in steep or rugged terrain which is largely undeveloped and in which there are few needs or opportunities for multipurpose development. To an extent then, preference for multipurpose developments relegates such cases to lower priority. Warning systems are particularly well suited for use in lieu of other types of protection for such areas.

THE CONCEPT OF RIVER BASIN PLANNING

Early water resources and flood control projects tended to be small as well as for a single purpose. Small requirements for water supply meant only small reservoirs were needed. Since energy couldn't be readily transferred, only small developments for water power at the desired point of use were necessary. Even if larger undertakings had been desirable, the resources of equipment, power and men which could be devoted to these purposes were inadequate to do much more.

This changed also, however, and by the period of the Civil War, the Nation's resources were adequate to construct the larger projects which provided economies of scale and project sizes continued to grow. As planning became more sophisticated and needs more acute, projects began having not just one levee or dam but several such features to more comprehensively attack problems over a whole stream or river basin. By the time TVA was in operation and the Pick-Sloan Plan formulated, water resources development had grown from small, single structure projects to massive construction projects having multiple features and often spanning state boundaries.

This progression toward consideration in water resources planning of larger areas occurred without any specific directive that it be done. It was simply the outgrowth of increased reliance on and use of water resources. However, it became apparent in the mid-part of the twentieth century that planning for individual projects, small tributaries and even significant portions of the country's large rivers did not assure that the most effecient overall pattern of development would be realized.

Senate Document 97 also specifically addressed this problem, saying:

> River basins are usually the most appropriate geographical units for planning the use and development of water and related land resources in a way that will realize fully the advantage of multiple use, reconcile competetive uses through choice of the best combination of uses, coordinate mutual responsibilities of different agencies and levels of government, and other interests concerned with resource use. Planning use of water and related land resources, therefore, shall be undertaken by river basins, groups of closely related river basins, or other regions,

and shall take full cognizance of the relationships of all resources, including the interrelationship between surface and ground water resources. Despite this primary confinement to an area, the fact should be recognized that such planning also requires consideration of pertinent physical, economic, and social factors beyond the area.

To the extent feasible, programs and projects shall be formulated as part of a comprehensive plan for a river basin or other area, and the report proposing development shall indicate the relationship to the comprehensive plan. When a program or project has been formulated independently and not as part of a comprehensive plan, the report shall indicate, to the extent practicable, the relationship of the program or project to the probable later developments needed or to be undertaken in the basin and the reasons for proposing to proceed with the proposed program or project independently.

The direction to approach planning on a river basin basis reversed the planning process which had largely prevailed up to that time. Whereas individual projects had been the building blocks from which regional development schemes were being constructed, now the larger plans were to be developed first and projects measured by how they fitted into the overall program of development. This change was important because it brought systematic order into the planning process. The system developed from it is in use today.

Under the direction of the Water Rersources Council, three principal types of studies have been developed. Level A studies are broad framework studies for major river basins like the Ohio, Missouri and other regions of that size. Framework studies and assessments of major regions are designed to: (a) inventory the extent of water and related land problems, needs, and desires of people for the conservation, development, and utilization of water and land resources throughout the region; (b) indicate the general approaches that appear appropriate for their solution; and (c) identify specific geographic areas with complex problems where more detailed regional, river basin, or implementation planning, investigation and analysis are needed. Framework studies and assessments consider federal, state, and local means of implementation and are multi-objective in nature. They do not normally provide a basis for recommending specific

action for water resource development, except for implementation recommendations which would not require more detailed study.

Level B studies, also called Regional or River Basin Studies are reconnaissance-level evaluations of water and land resources more detailed in scope and more limited in area, than framework studies. They are intended to resolve complex long-range problems identified by framework studies and assessments and vary widely in scope and detail. Level B studies involve federal, state and local interests in the area's water policy coordination and plan formulation and they identify and recommend action plans and programs to be pursued by individual federal, state and local entities. Regional or river basin planning studies are concerned with a broad array of needs. The identification of the more urgent elements of the plan that require early action are used to guide subsequent implementation studies.

Level C or implementation studies are detailed program or project feasibility studies undertaken by a single federal, state or local entity for the purpose of recommending authorization or initiation of plans to solve local resource problems. Most investigations fall into this category. The studies are conducted to implement findings, conclusions, and recommendations of framework studies and assessments and regional or river basin studies. Plan formulation for implementation studies focuses on the preparation of a recommended plan of action to meet near term needs and alleviate problems in a manner consistent with long range plans.

* Familiarity with this system of conducting federal water resources planning studies is of particular use to the Meteorologist/Hydrologist in assuring the need for and use of flood and flash flood warning systems is not overlooked. Initial Level A framework studies have been completed for most parts of the Nation. However, these plans are to be updated every 6 to 10 years. One part of the updating process is to revise as necessary the inventory of flood problems and the identification of approaches for solution of each.

* The principal opportunity to promote the use of flood and flash flood warning systems in Level B studies is during their initial development. Various committees of federal and state staff are usually formed to carry out the planning process and NWS could well be represented on such committees. For both Level A and Level B studies, the proper contact is with the cognizant river basin commission or interagency committee.

Level C studies are somewhat different. They are carried out under leadership of one or another single agency with coordination rather than participation of other agencies. The Meteorologist/Hydrologist's effort in regard to Level C studies should be directed toward the agency in charge of a particular study. Information concerning the principal federal water resources planning and management agencies is provided in Chapter 3 and Appendix A.

THE CONCEPT OF MULTI-OBJECTIVE PLANNING

Federal flood control developments authorized prior to 1936 represented decisions that the various projects should be undertaken for purposes deemed by Congress to be worthwhile. Demonstration of the economic worth of projects had been required but economic analysis of the present day type was not essential. In establishing a national flood control program in 1936, Congress included a requirement for benefit-cost analysis. Section 1 of the Flood Control Act of 1936 stated:

> ...The Federal Government should improve or participate in the improvement of navigable waters or tributaries including watersheds thereof, for flood control purposes if the benefits to whomsoever they may accrue are in excess of the estimated costs...

Although the statutory directive applied specifically only to flood control improvements by the Corps of Engineers and the Department of Agriculture, it was soon adopted by all of the major federal water planning agencies.

The techniques of economic evaluation soon developed into elaborate and complex analyses considering direct, indirect and intangible benefits, often dominating the decision of agencies as to whether or not a project should be recommended to Congress for implementation. However, a concern existed that there were good reasons for federal investment other than economic ones. These also came to the fore in Senate Document 97 which stated three objectives of planning including:

1. National economic development and development of each region within the county to maintain national strength and achieve satisfactory levels of living;

2. Proper stewardship of resources including maintenance and protection of open space, green space, wild areas, and areas of unique national beauty and historical and scientific interest; and

3 Well-being of people.

* Of the three objectives, well-being of all of the people was to be the overriding determinant in considering the best use of water and related land resources.

The directives of Senate Document 97 were superceded in 1973 when the Water Resources Council published the Principles and Standards for Planning Water and Related Land Resources. The Principles and Standards did not make a radical departure from the procedures established pursuant to Senate Document 97. Their most important effect was to clarify and require that environmental concerns be placed on a basis equal to those for economic development. This provided an alternative route to recommending congressional approval of projects. Even a plan with no net economic benefit could be recommended if it had overriding long-term environmental benefits.

The Principles and Standards also changed the method of displaying the benefits of projects. They required the division of benefits into the four categories of national economic development, social well being, environmental quality, and regional development. Instead of a benefit-cost ratio, Congress was to be provided a much fuller accounting of the effects of a project to assist in its decision-making.

* The procedures and effect of multi-objective planning are important to the Meteorologist/Hydrologist. While the Principles and Standards are not specifically binding on the NWS, the method they establish for consideration of flood control projects favors warning systems in two ways. First, they make it possible for agencies to recommend plans with negative economic benefits. This enables consideration of warning alternative which may provide only for evacuation and not for property damage reduction actions from which economic benefits might stem. Second, the Principles and Standards Provide explicit recognition of social well being which includes personal safety. Warning systems fit this benefit account exactly, conferring a measure of safety against catastrophic levels of flooding which cannot be matched by structures for economic reasons.

THE TREND TOWARD NONSTRUCTURAL MEASURES

Early water resources development was largely oriented toward control or development of the water resource and dependent on physical works to accomplish that purpose. Approaches of treating water needs through policy and regulatory tools, financial incentives and other techniques had not emerged or at least were not employed on any widespread basis. It was not until the 1930's that insurance, land use regulation, taxing policies and other possible ways of reducing flood losses were considered in a serious fashion.

In the period of the 1930's to the present, the introduction of these new concepts has proceeded in waves with one after another approach gaining sufficient support to be incorporated into the national flood control program. At the same time, major social concerns other than water resources or flood control arose and each left their imprint on developing policy and programs.

The conservation ethic which prevailed at the beginning of the twentieth century resulted not only in renewed interest in creating national parks and forests but led to concern for good husbandry of soil resources. This concern was amplified by the severe economic and social distress caused by the drought and resulting dustbowl conditions of the 1930's and by the severe flooding of that period. This led to establishment of a federal soil and water conservation program and creation of numerous soil and water districts at the local level.

By the 1950's, interest was strongly developed in the concept that man's activities should be adjusted to make more carefully selected types of uses of flood plain lands rather than increasing the pace of construction of flood control works. By the mid-1960's, states were increasingly engaged in enacting flood plain zoning and other land use regulations in response to that concept.

Movements to introduce new approaches to flood loss reduction were given assistance in the 1950's and 1960's by social concerns which became important. Increasing automation of industry after World War II gave rise to predictions of a new leisure society and stimulated interest in development of public recreation. This merged in turn with the rapidly expanding public interest in water quality and ecological relationships to produce a new ethic built on protection and maintenance of the physical environment. With addition of the recognition of social and economic environments, the current concepts of quality of life came into play. At each stage of its metamorphosis into

today's concern for quality of life, this string of high national interests has tended to support the use of policy, regulatory and other nonstructural techniques for flood loss reduction while simultaneously eroding support for, or resulting in widespread opposition to, dams, levees and other structural approaches.

The other driving force behind acceptance of the new techniques was related to financial concerns. Federal budgets grew rapidly in the period after World War II and deficits increased greatly. Water resources programs felt a part of the resulting pressure to limit expenditures. Appropriations for water resources development stayed more or less constant while inflation increased costs and the introduction of new programs siphoned off funds that might otherwise have gone for construction.

All of this came to a head in the 1965 report of a presidentially appointed task force which observed that previous programs were inadequate and national flood losses were continuing to rise. It recommended the investigation or establishment of new approaches to reducing flood losses including greater emphasis on education and social adjustment to flood hazards, a program of flood insurance and increasing use of warning systems and preparedness plans.

Nonstructural concepts for flood loss reduction developed rapidly in the 1960's and 1970's. Measures which have gotten explicit recognition are generally divided into those which reduce the susceptability to flooding and those which reduce the impact of flooding. Structural measures provide a third category, namely those that control flooding. Measures falling into each category include:

1. Measures for controlling floods;

    A. dams and reservoirs;

    B. dikes, levees and flood walls;

    C. channel alterations;

    D. high flow diversions;

    E. land treatment measures; and

    F. on-site detention measures;

2. Measures to reduce susceptibility to flooding:

   A. state flood plain regulation;

   B. local zoning, subdivision, building code, housing code, sanitary and well code, and other regulations;

   C. design and location of services and utilities;

   D. land rights acquisition and open space use;

   E. redevelopment and renewal;

   F. permanent evacuation;

   G. floodproofing;

   H. flood forecasting and warning systems; and

   I. disaster preparedness and response planning;

3. Measures to reduce the impact of flooding:

   A. provision of information and education;

   B. flood insurance;

   C. tax adjustments;

   D. emergency floodproofing and flood fighting; and

   E. post-flood relief and recovery aid.

While concepts of nonstructural measures for flood loss reduction developed rapidly, application in federal planning lagged far behind. Numerous things have accounted for this lag. One of the important reasons has been that nonstructural measures are not really alternatives to structural measures in the strict sense of achieving the same objectives but in a different way. Generally they provide a different type of protection, involve different groups, have different impacts on

land use and require different types of institutional arrangements for implementation. Some time is required just for water resources planners to become familiar with the concepts and the different ways in which nonstructural tools can be used.

A second reason for delay in incorporating nonstructural measures into flood control programs is that present planning procedures and policies were largely developed to handle structural measures. Whole new procedures for economic analysis must be developed as well as for engineering, environmental, legal and other evaluations. It has also proven difficult to sort out in detail the respective interests of each level of government and the private sector and determine the role which each should play in planning, financing, implementing and operating nonstructural measures.

Congress formalized the growing commitment to nonstructural measures in the Water Resources Development Act of 1974, Public Law 93-251. Section 73 of the Act stated:

> (a) In the survey, planning, or design by any Federal agency of any project involving flood protection, consideration shall be given to nonstructural alternatives to prevent or reduce flood damages including, but not limited to, flood-proofing of structures; flood plain regulation; acquisition of flood plain lands for recreational, fish and wildlife, and other public purposes; and relocation with a view toward formulating the most economically, socially and environmentally acceptable means of reducing or preventing flood damages.
>
> (b) Where a nonstructural alternative is recommended, non-Federal participation shall be comparable to the value of lands, easements, and rights-of-way which would have been required of non-Federal interests under Section 3 of the Act of June 27, 1936 (Public Law Numbered 738, Seventy-fourth Congress), for structural protection measures, but in no event shall exceed 20 percentum of the project costs.

Enactment of Section 73 has created a situation very favorable to the interests of the NWS in establishing flood and flash flood warning systems. First, federal water agencies are now required to consider nonstructural measures but are, in fact, somewhat handicapped in doing so. NWS capabilities in the technical aspects of flood warning and the assistance of NWS staff

in formulating warning alternatives are likely to be seen by water resources planning agencies as being of considerable value. Second, the mandated 80 percent or greater federal cost sharing for nonstructural measures where flood control planning is undertaken may offer an opportunity for overcoming past financial problems connected with establishment of warning systems.

* In 1976, the Water Resources Council published The Unified National Program for Flood Plain Management. That document sets forth a conceptual framework and recommends federal and state actions for a continuing program at all levels of government to reduce flood losses through flood plain management. It also describes general principles to be followed by federal executive agencies in flood plain management. Numerous recommendations deal with increased use of nonstructural measures.

* Executive Order 11988 was subsequently issued in May of 1977, directing implementation of The Unified National Program for Flood Plain Management. It also required federal agencies to recognize that floodplains have unique and significant public values and to:

1. Avoid use or encouragement of use of the 100 year floodplain if possible; and

2. Apply necessary protection to any new construction or rehabilitation located in the floodplain.

* The Executive Order places a considerable constraint on federal construction programs and on state and local programs supported in whole or in part by federal funds. Since many communities are located on floodplains, a powerful incentive exists to locate future structures there and provide flood protection. Warning systems are one of the techniques which can be used to comply with the Executive Order.

CHAPTER 3

PRINCIPAL FEDERAL FLOOD CONTROL PROGRAMS

This chapter describes in summary fashion several federal water resources agencies which administer flood control programs or programs dealing with closely related matters. The agencies treated include the Bureau of Reclamation, Corps of Engineers, Federal Insurance Administration, Soil Conservation Service, Tennessee Valley Authority, and Geological Survey. While numerous other federal agencies have important responsibilities related to flood control and to flood warning systems and flood preparedness planning, these are the agencies likely to be encountered most frequently by Meteorologists/Hydrologists and other NWS staff and the agencies with which cooperative efforts are most likely to be required.

The description of each agency is divided into four parts. The first part briefly describes the history of the agency and its present organization. The second part provides an overview of the programs administered by the agency. The third part describes the agency's flood control programs and/or programs which may be of particular interest or use in developing and implementing flood warning systems. The final portion of each description deals with the general procedures followed by the agency in administration of its programs.

BUREAU OF RECLAMATION

The Bureau of Reclamation is one of several bureaus within the Department of the Interior. It is headed by the Commissioner of Reclamation who is appointed by the President. Headquarters offices are located in the Department of the Interior Building in Washington, DC.

History and Organization

Federal interest in irrigation grew out of the longstanding federal policy of endowing a large part of the public domain of the United States on the people who would live and work on it. Thus, beginning in 1801, Congress accorded settlers a preference right in various preemption acts providing for the sale of public lands. The first Homestead Act in 1862 began

the era in which the Government offered free farmland to settlers who would live on it and cultivate it. However, settlement of the arid West, where agriculture was impossible without irrigation, gave rise to problems not present in more humid regions.

The Desert Land Act of 1877 authorized the sale of 640 acre tracts of arid lands in four states and eight territories to persons who would irrigate them within 3 years. In 1890, Congress limited all entries to 320 acres.

In i879, the first director of the U.S. Geological Survey, Major J.W. Powell, pubished a survey of the sparsely settled dry lands in the West. Mainly as a result of this pioneer planning report, an irrigation division was established in the Geological Survey in 1888. Another probable result of the Powell report was the 1890 statute reserving to the United States a right of way for ditches and canals that it might thereafter construct on all public lands west of the 100th meridian if the ditches and canals would be patented under any of the land laws of the United States. This statute made possible the Reclamation Act of 1902.

The 1894 Carey Act authorized donations of arid land to each public land state for reclamation purposes. Tracts sold by the states were limited to 160 acres and were to be used for irrigation farming. But for reasons varying from lack of adequate hydrologic and soil data to the incapacity of settlers to finance construction, Carey Act projects were not often successful.

The Reclamation Act of 1902 established the Reclamation Fund with money derived from the sale of public lands in 16 western states.[1] It authorized the Secretary of the Interior to use the fund to make examinations and surveys and to locate and construct irrigation works in these states. The Reclamation Service, renamed in 1923 as the Bureau of Reclamation, was organized to carry out the program.

Beginning in 1933, the Bureau of Reclamation was made an integral part of the federal public works program. Not only was the Bureau's planning work coordinated with the drainage basin plans of the national resources planning organization, but construction of reclamation projects was financed by PWA

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[1] Texas was added as the 17th state in 1906.

or by allotments from the Emergency Relief Acts of 1935 and 1937. Later in 1937, emergency public works funds became unavailable to the Bureau and it again became dependent on the Reclamation Fund and on general appropriations.

In 1939, Congress passed the Reclamation Project Act, which authorized the Secretary of the Interior to plan and construct projects for multiple purposes in addition to irrigation. These included navigation, flood control, water power, municipal water supply, and other miscellaneous purposes.

The Bureau's jurisdiction extends to the 17 western states for purposes of its primary activities. Seven regional offices are maintained in the western states and the Chief Engineer's office is located in Denver, Colorado. Figure 3.1 shows the Bureau's general organizational form. Addresses of Bureau of Reclamation regional offices are listed in Appendix A.

In addition to its regional offices, the Bureau has numerous project and field offices with responsibilities for planning, management and operation of various facilities and programs.

Overview of the Programs

The Bureau of Reclamation administers four principal programs for: a) irrigation distribution system loans; b) irrigation systems rehabilitation and betterment; c) federal reclamation projects; and d) small reclamation projects.

The Irrigation Distribution System Loans program provides for fully reimbursable federal loans to organized irrigation districts for construction of irrigation, drainage and associated municipal and industrial water supply systems. Loans are repaid over a period of 40 years or less with interest on that part allocated to municipal and industrial water supply. Almost $90 million has been authorized under the program since 1956 with installed irrigation systems benefitting over 343,000 acres of land.

The Bureau's Irrigation Systems Rehabilitation and Betterment program provides direct loans for rehabilitation of existing irrigation systems on Bureau of Reclamation projects and on projects constructed under the Small Reclamation Projects Act. Funds cannot be used for new construction nor for non-federal irrigation projects. All funds are repaid on a schedule based on the water users ability. Almost $94 million has been authorized for rehabilitation of 94 projects since 1949.

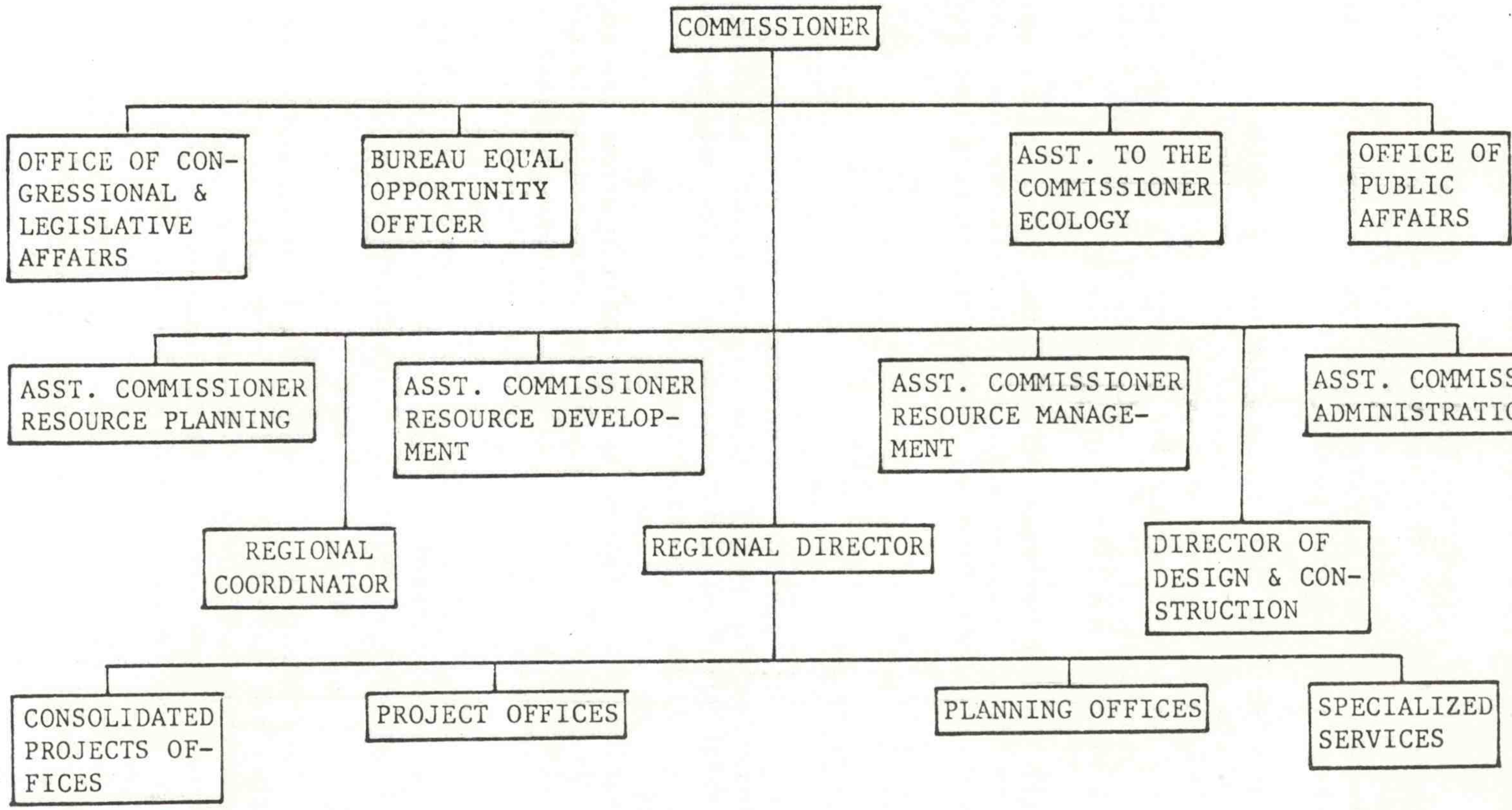

Figure 3.1 ORGANIZATION OF THE BUREAU OF RECLAMATION

The Small Reclamation Projects program provides fully reimbursible loans and grants to non-federal public organizations for rehabilitation and betterment or construction of water resource development projects. Projects can be single-purpose for irrigation or drainage or multipurpose, including municipal and industrial water supply, flood control, fish and wildlife, recreation development and hydroelectric power. Grants can be made for costs allocated to flood control if benefits will accrue to the general public. Loans are repaid on a schedule of up to 40 years. Sixty-five projects have been financed under this program as of 1977 with loans totalling about $200 million.

In terms of federal investment, the Bureau's largest program is the Federal Reclamation Projects program. This program provides for federal development of multipurpose water and related land resource projects including such functions as irrigation, municipal and industrial water supplies, hydroelectric power, flood control and river regulation, water quality control, outdoor recreation and fish and wildlife enhancement. Each reclamation project must be authorized by the Congress on the basis of planning reports. Project costs are shared with non-federal interests or are nonreimbursable according to function. Flood control is generally a nonreimbursable cost. The federal investment in project facilities completed or rehabilitated by the Bureau under this program totalled $7.6 billion as of 1975.

Aspects of Flood Loss Reduction Program

The Bureau of Reclamation administers no programs specifically for flood loss reduction. However, that purpose can be addressed as one of several in multipurpose projects under the Small Reclamation Projects program and the Federal Reclamation Projects program.

* While Section 73 of Public Law 93-251 has not been fully interpreted, it appears that planning activities by the Bureau of Reclamation under the Federal Reclamation Projects program are subject to the requirements of the Act and therefore must include consideration of nonstructural measures if flood loss reduction is a project purpose. Recipients of loans under the Small Reclamation Project program may also be required to undertake such considerations if benefits are claimed for flood loss reduction.

Contact with the Bureau of Reclamation concerning the role of flood warning in particular projects should be made with the head of the field office responsible for planning. General coordination of programs should be undertaken with the appropriate Regional Director.

Procedures (Small Reclamation Projects program)

A feasibility report, similar to that prepared for a major project, must be prepared and submitted to the Secretary of the Interior by the local organization, together with $1,000 to defray the costs for examining the proposal. The report also must be submitted to the states in the drainage basin, unless the project proposal is solely for rehabilitation and betterment of an existing project, in which event only review by the state in which the proposed project is located is required. Plans for projects that have not been authorized by Congress must be prepared in consultation with the Fish and Wildlife Service, National Marine Fisheries Service and the State Fish and Wildlife Management agencies. For projects that have been authorized for construction under the major reclamation program, the Secretary may waive any or all of these requirements.

The local organization must show it holds or can acquire all interests in lands and rights to the use of water necessary to the successful construction, operation and maintenance of the project, and that it is capable of financing its share of the costs of the project.

If the Secretary and the Governor of the state in which the project is located find the project to be financially feasible and if the Secretary finds the project otherwise acceptable, the Secretary may approve the project and transmit his findings and approval to Congress. When the Secretary approves the project, he may enter into a contract. No contract is effective until appropriated funds are available to initiate the specific proposal covered by each contract.

Procedures (Federal Reclamation Projects)

Surveys and investigations are carried out by the appropriate regional office of the Bureau. A survey and investigation leading to a specific reclamation project begins with preparation of a reconnaissance report in which data are compiled to determine whether detailed investigations of the project are

warrented. The second step is preparation of a plan for development of the project, in the form of a feasibility report. Before this undertaking may comence, preparation of the report must be specifically authorized by law. The feasibility report is prepared in draft form by the area office for review by the regional office, and sets forth the proposed project, its features, estimated costs, cost allocations and measures anticipated with respect to charges to be imposed on project beneficiaries. The regional office forwards the feasibility report to the Commissioner of Reclamation, who prepares his report for the Secretary of the Interior. When the Secretary has approved the Commissioner's draft feasibility report, it is transmitted to the affected states and to the Corps of Engineers for review.

When the comments on the feasibility report have been received and incorporated, the Secretary transmits the report to the Office of Management and Budget for its comments on the relationship of the proposed project to the President's budget program. Those comments along with the feasibility report are then submitted to Congress.

CORPS OF ENGINEERS

The Corps of Engineers is a part of the Department of Army. Corps programs are directed by the Secretary of the Army who reports to the President without involving the Secretary of Defense. Work is done under the direction of the Chief of Engineers. Headquarters offices are in the Forrestal Building, Washington, DC.

History and Organization

The Corps of Engineers of the Department of the Army is the oldest of the federal agencies with water resource development programs. In 1802 Congress authorized the President to establish a Corps of Engineers, consisting of one engineer, six assistants, and 10 cadets. In its new role, the Corps became responsible for the large program of national internal improvements which began in the 1820's.

In 1824, Congress passed the General Survey Act empowering the President to employ civil engineers and "officers of the Corps of Engineers" in making survey plans and estimates of such "roads and canals as he may deem of national importance". This legislation initiated a brief period of centralized national planning of internal improvements during which the Corps did the initial planning of such major works as the Chesapeake and Ohio Canal and the completion of the Cumberland Road.

The Corps' planning responsibilities for rivers and harbors improvements, which also began about 1824, were not authorized by the General Survey Act but by separate congressional enactments. The first omnibus Rivers and Harbors Act, authorizing specified improvements and new surveys, was passed in 1826. For many years thereafter, authorizations and appropriations were made for rivers and harbors improvements together with other kinds of measures in the same bill and in other bills passed for individual projects. However, the omnibus Rivers and Harbors Act, giving separate authorization for the planning phases of some projects and the construction phases of others, gradually became the prototype of the enabling legislation of the Corps' navigation improvements program and later of its flood control program.

During the great increase in river and harbor improvements following the Civil War, political factors often caused a demand for improvement of some river and harbor which was found when surveyed to have no commercial potential. To avoid the cost of a full examination and survey and of making estimates in such cases, Congress in 1884 passed general navigation legislation directing that no survey should be made of any harbors or rivers until the district engineer had ascertained at the locality that "said harbor or river is worthy of improvement". But the power of deciding whether a place was worth improving was not used by the Corps to formulate a national policy or general program for the construction of public works. This was regarded as the responsibility of Congress.

Beginning in the middle of the last century, successive acts of Congress also gave the Corps of Engineers responsibility to protect the navigability of waters against various kinds of encroachment. By the end of the century, the Corps was charged with a regulatory responsibility concerning bridges, wharves, piers, channels and harbors, diversions of water, and deposits of refuse and other materials. Following major floods in 1915 and 1916, Congress enacted the Flood Control Act of 1917, giving the Corps responsibility for planning and construction of flood control works on the Mississippi and Sacramento Rivers. These works did not include reservoir projects.

In 1925, Congress directed the Corps and the Federal Power Commission to jointly prepare a list and submit an estimate of the cost of making examinations and surveys of navigable streams and their tributaries on which power development appeared practicable with the exception of the Colorado River. This was to be done with a view to formulating "general plans for the most effective improvement of such streams for the purposes of navigation and the prosecution of such navigation improvements in

combination with development for power, flood control and irrigation." The resulting list of streams was submitted to Congress in 1927 and printed in House Document 308. The 1927 Rivers and Harbors Act authorized the Corps alone to prosecute these surveys, which became known as the "308 reports".

In 1928, following the worst flood on the Mississippi River since the formation of the Union, Congress adopted an ambitious project for control of floods on that river. Although the 1928 Act made immediate provision only for levees and diversion floodways, it called for reports on the effect of flood control of the lower Mississippi of a reservoir system on the tributaries. Studies made pursuant to this section of the Act showed reservoirs were necessary to reduce flood heights and recommended their construction, conditioned on local participation in planning and financing of construction.

In 1935, Congress authorized the Corps to supplement completed 308 surveys by additional studies where these were necessary "to take into account important changes in economic factors as they occur and additional stream-flow records or other factual data." This authorization virtually amounted to continuing authority to undertake nationwide framework river basin planning, with the emphasis on navigation and, later, flood control.

The 1936 Act clarified that flood control was a proper federal activity and assigned jurisdiction over federal flood control investigations and improvements on the waterways to the Corps. The 1936 Act also authorized numerous reservoir projects for navigation, flood control, and "other purposes" as well as preliminary investigations and surveys. A large number of basin-wide flood control plans prepared under the authority of the 1936 Act were authorized for construction in 1938, following another series of catastrophic floods. The river basins included those of the Merrimack, Connecticut, Ohio, Upper Mississippi, Missouri, White, Arkansas, and Willamette Rivers.

The Corps had become the leading construction agency in the water resources field by that time. More than half of the appropriations made for planning and construction in this period were allocated to that agency. Flood control became the agency's most important function and the navigation improvements program was relegated to second place.

The Flood Control Act of 1944 became the Corps' governing policy statement. The Act authorized the Pick-Sloan plan for coordinated development of the Missouri River Basin by the Corps and the Bureau of Reclamation. The 1944 Act also authorized a

great number of projects in numerous river basins "with a view toward providing a reservoir of useful and worthy public works for the post war construction program."

The Flood Control Act of 1960 authorized the Corps to provide information, technical planning assistance, and guidance to non-federal entities in identifying the magnitude and extent of the flood hazard and in planning wise use of the Nation's flood plains. This set in motion the Flood Plain Management Services program through which the authorized information and guidance was furnished in the form of Flood Plain Information Reports to communities requesting such assistance. These types of reports were modified in the 1970's by combining their purpose with the need of the Federal Insurance Administration for information on the flood hazard at various localities as a basis for application of the National Flood Insurance Program.

The Corps' present functions include the investigation, design, construction, operation, and maintenance of works for navigation, flood control, beach erosion control, hydroelectric power generation, municipal and industrial water supply, water quality control, recreation, fish and wildlife conservation, and hurricane protection. In addition, the Corps administers a number of regulatory programs for development and management of water and related land resources that do not involve structural measures. These several functions are carried out through 11 division offices and 37 district offices throughout the United States.

The Office of the Chief of Engineers (OCE) is the headquarters staff required by the Chief of Engineers to assist him in planning, directing, and controlling the activities of the Corps of Engineers. The civil works functions of the Office are supervised by the Director of Civil Works with requisite support from other Directorates and separate offices of OCE. The organization of the Office of the Chief of Engineers is shown in Figure 3.2.

The Director of Civil Works is responsible to the Chief of Engineers for the supervision of matters relating to the planning, design, construction, operation, and maintenance of the Corps civil works. Such works include improvement of rivers, harbors, and waterways for navigation, flood control and other multiple-use purposes and shore protection projects or programs. He is also responsible for the administration of laws to protect and preserve the navigable waters of the United States; for the conduct and direction of emergency operations pursuant to special statutory authorities for flood control and navigation; and

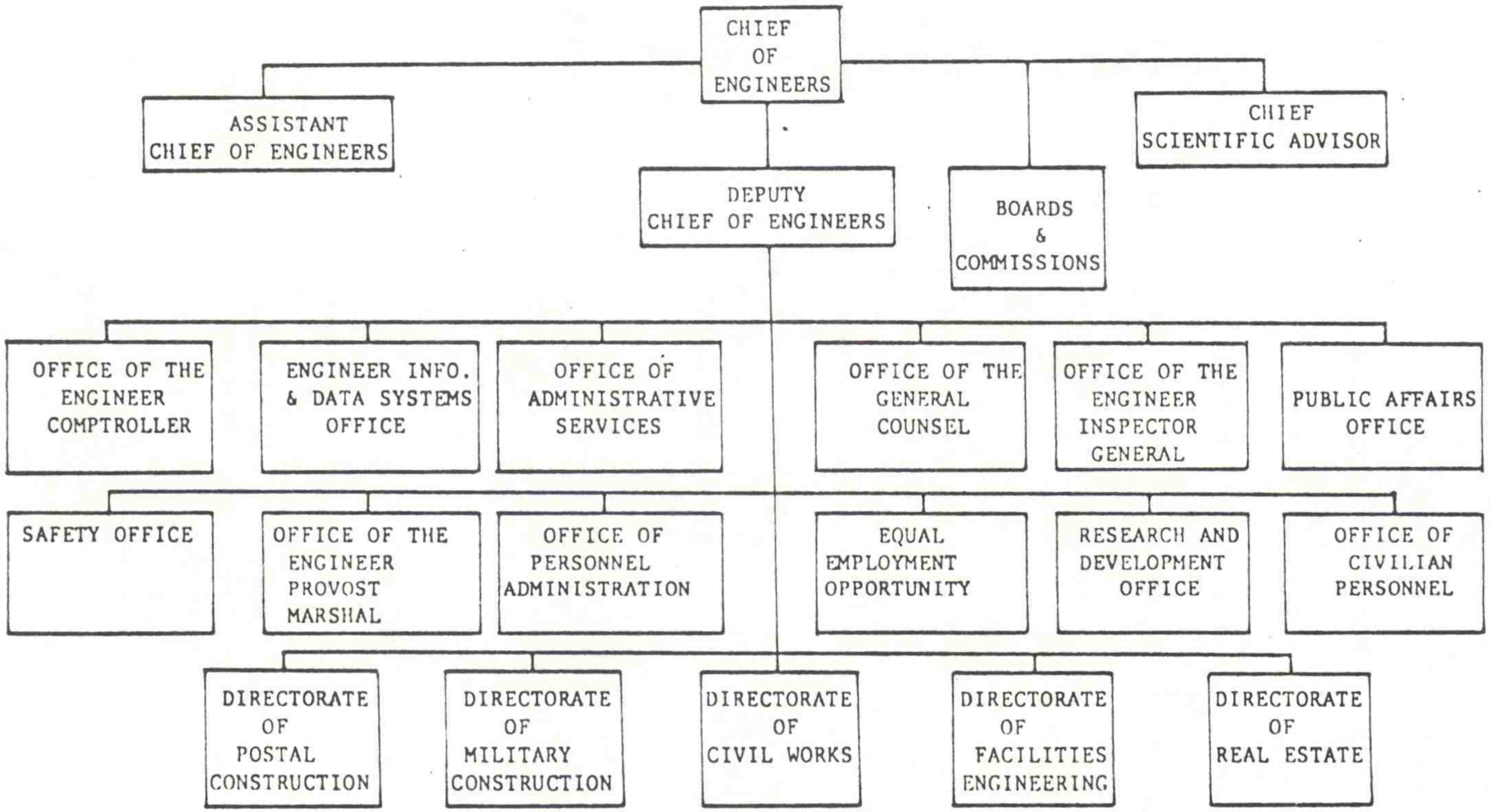

Figure 3.2 ORGANIZATION OF CHIEF OF ENGINEERS OFFICE

for the accomplishment of special projects as assigned. The organization of the Civil Works Directorate in OCE is shown in Figure 3.3.

Offices which advise and support the Chief of Engineers in civil works functions include:

1. Coastal Engineering Board;

2. Board of Engineers for Rivers and Harbors;

3. California Debris Commission;

4. Mississippi River Commission;

5. Shoreline Erosion Advisory Panel; and

6. Chief of Engineers Environmental Advisory Board.

The bulk of work assigned to the Chief of Engineers is accomplished through delegation to field officers and their staffs, under the supervision of OCE. The organization of field offices is shown in Figures 3.4 and 3.5.

U.S. Army Engineer Divisions have jurisdiction over specified geographical areas. Each Division is headed by a Division Engineer. Division Engineers are responsible for:

1. Administering the mission of the Chief of Engineers involving Civil Works planning, engineering, construction, operation and maintenance of facilities, and related real estate matters;

2. Commanding and supervising districts assigned to their control. This supervisory responsibility includes review and approval of the major plans and programs of the districts, implementation of plans and policies of the Chief of Engineers, and review and control of district operations; and

3. Assigning missions to the districts, coordinating execution, developing cooperative interests, and representing the division as a whole.

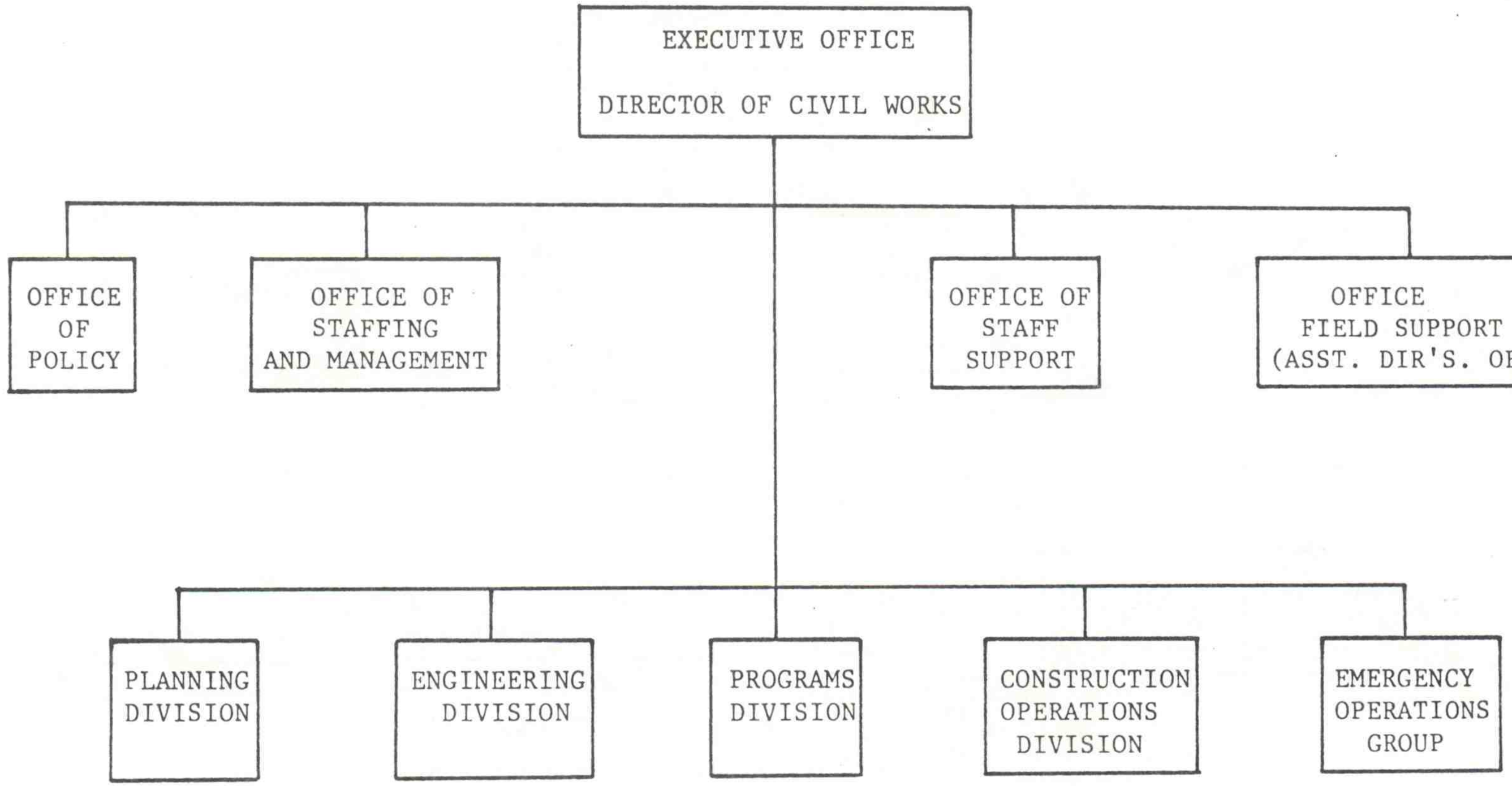

Figure 3.3 ORGANIZATION OF CORPS OF ENGINEERS CIVIL WORKS PROGRAM

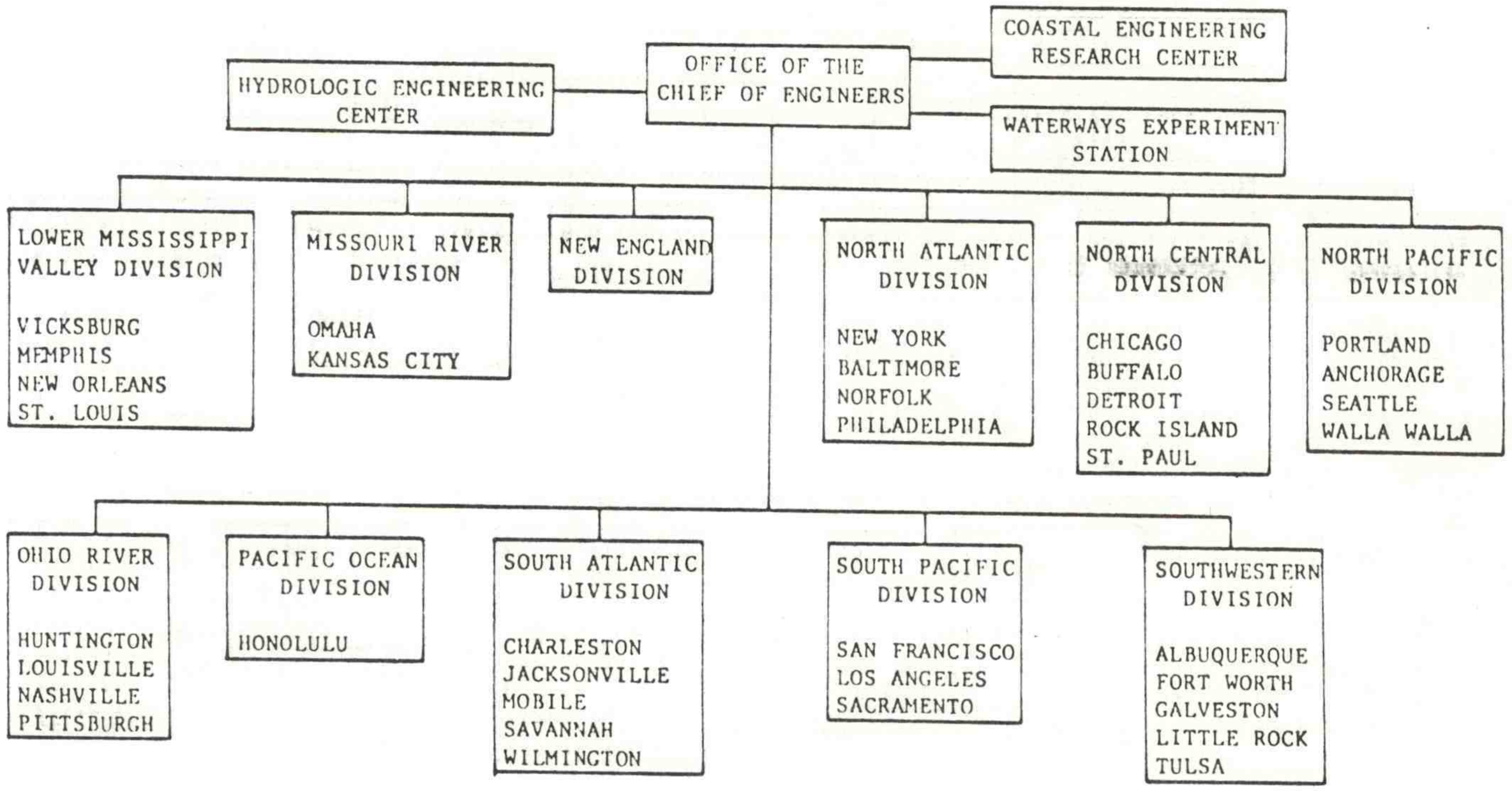

Figure 3.4 ORGANIZATION OF CORPS OF ENGINEERS FIELD OFFICES

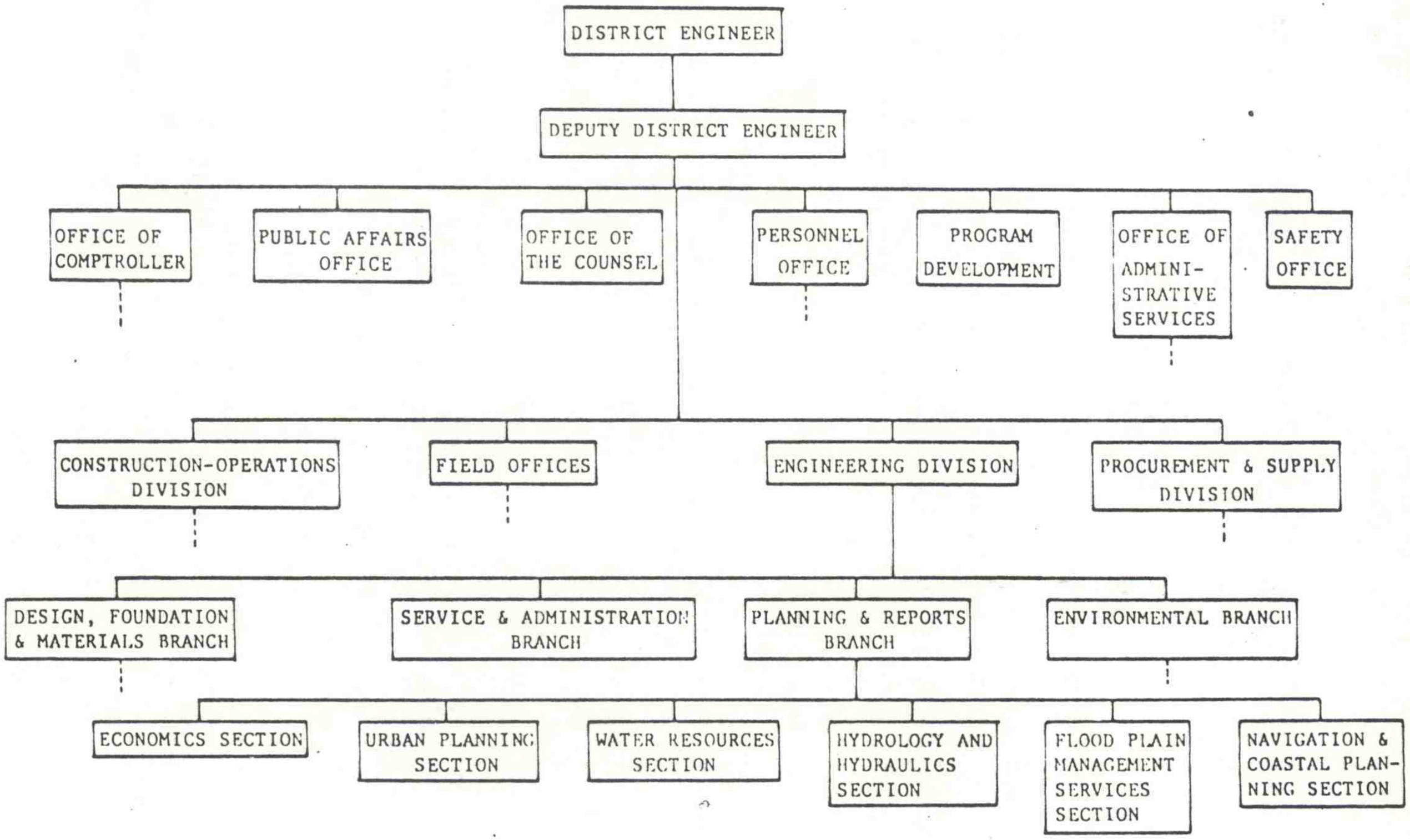

Figure 3.5 ORGANIZATION OF TYPICAL CORPS OF ENGINEERS DISTRICT OFFICE

U.S. Army Engineer Districts are the principal planning and project implementation offices of the Corps. District Engineers are responsible for:

1. Preparing and submiting water resource needs and development studies in response to specific congressional resolutions;

2. Preparing engineering studies and developing the design for facilities;

3. Constructing civil works facilities;

4. Operating and maintaining major water resource projects and river and harbor projects;

5. Administering the laws for the protection and preservation of the navigable waters of the United States; and

6. Acquiring, managing, and disposing of real estate.

Both division and district offices of the Corps are divided into various branches and sections for engineering, economics, planning, flood plain management and other purposes. Addresses of district offices are listed in Appendix A.

Overview of Programs

The Corps administers 11 programs related to water resources planning under continuing authorities including:

1. Aquatic Plant Control;

2. Beach Erosion Control Projects;

3. Flood Control Works and Federally Authorized Coastal Protection Works, Rehabilitation;

4. Flood Fighting and Rescue Operations, and Emergency Protection of Coastal Protective Works Federally Authorized;

5. Flood Plain Management Services;

6. Protection of Essential Highways, Highway Bridge Approaches, and Public Works;

7. Flood Control Projects;

8. Navigation Projects;

9. Snagging and Clearing for Flood Control;

10. Snagging and Clearing for Navigation; and

11. Planning Assistance to States.

The program for Aquatic Plant Control provides assistance to state and local government agencies in controlling obnoxious aquatic plants in rivers, harbors and other waters. The Corps provides federal assistance in the form of specialized services and dissemination of technical information. Non-federal interests must finance 30 percent of the costs of control operations. The program is designed to deal primarily with weed infestations which constitute a problem of economic importance in the area involved. The program currently provides in excess of $2 million (salary and expenses) of assistance annually in the Gulf Coast States.

* The Beach Erosion Control Projects program provides assistance to control beach and shore erosion to public shores through projects specifically authorized by Congress. Projects are limited to $1 million each and the federal share cannot exceed 70 percent of total project cost. Projects average approximately $140,000.

* The Flood Control Works and Federally Authorized Coastal Protection Works, Rehabilitation program provides assistance in the repair and restoration of flood control works damaged by flood or federally authorized hurricane-flood and shore protection works damaged by extraordinary wind, wave or water action. Assistance does not extend to major improvements or betterments of flood control nor to reimbursement of individuals or communities for funds expended in repair and rehabilitation efforts. In fiscal year 1976, 80 repair and rehabilitation projects were authorized at a cost of approximately $50 million.

* The Flood Fighting and Rescue Operations, and Emergency Protection of Coastal Protective Works Federally Authorized program provides emergency assistance as required to supplement local efforts and capabilities in time of flood or coastal storm. No specific restrictions are placed upon such assistance but state and local governments must use their own resources to the maximum extent feasible. No repayment for assistance provided is required. The Corps conducts 50 to 250 flood fights annually under this program authority.

* The Flood Plain Management Services program is intended to promote appropriate recognition of flood hazards in land and water use planning and development through the provision of needed information, technical services and guidance. The program consists primarily of dissemination of technical information, advisory services and counseling. No costs are required of the applicant community. To date over 1,200 flood plain information reports have been completed for more than 3,000 places throughout the Nation.

The Protection of Essential Highways, Highway Bridge Approaches, and Public Works program provides bank protection to highways, highway bridges and essential public works endangered by flood caused erosion. Projects under the program are subject to requirements of economic feasibility and non-federal interests are responsible for a portion of project costs. The average financial assistance provided under this program per project is about $80,000. Projects at 36 locations were under construction in fiscal year 1976.

* The Flood Control Projects program is aimed at reducing flood damages through projects not specifically authorized by Congress. Projects are subject to the test of economic feasibility and non-federal sponsoring agencies are responsible for all lands and damages and project costs in excess of the federal cost limit of $2 million ($3 million if the project is located in an area that has been declared a disaster area). Projects under this program authority provide $120,000 to $2 million financial assistance and projects at 14 locations were under construction in fiscal year 1976.

The Navigation Projects program is intended to provide the most practicable and economic means of fulfilling the needs of general navigation through projects not specifically authorized by Congress. Under this program the Corps of Engineers designs and constructs the project subject to analysis of engineering feasibility and economic justification. A non-federal sponsoring agency must assume responsibility for all costs in excess of $2 million and make other contributions toward the project. Projects at 7 locations were under construction pursuant to this authority in fiscal year 1976.

The Snagging and Clearing for Flood Control program authorizes the Corps to provide specialized services to states, political subdivisions and other local agencies to reduce flood damages through removal of debris, vegetative growth on banks and other impediments to flow. Non-federal sponsors are required to

provide all project costs in excess of $250,000 for a project and certain other commitments. Assistance provided under this program averages about $80,000 per project. Projects at 6 locations were under construction in fiscal year 1976.

The Snagging and Clearing for Navigation program provides specialized services to improve channels for purposes of navigation. Each project selected must be engineeringly feasible and justified. Non-federal interests must provide lands, easements and rights-of-way for construction of the project and bear the cost of necessary annual maintenance. Projects average approximately $50,000 each. One project was completed in fiscal year 1976.

* The Planning Assistance to States program provides the Corps authority to cooperate with any state in the preparation of comprehensive plans for drainage basins located within the boundaries of such state. The state must have a planning program for the development, utilization or conservation of the water and related resources either underway or laid out in sufficient detail so that the Corps' role can be appraised. Approximately $2 million is available annually on a nationwide basis and not more than $200,000 can be expended in 1 year in any one state. Assistance under the program averages about $10,000 per state and planning assistance was given to 29 states in fiscal year 1976.

* Aside from the foregoing programs which are carried out under continuing authorities, the Corps undertakes numerous programs in response to specific authorizations of Congress including the program of General Surveys and Investigations and the Urban Studies program. These latter two programs are important because they include much of the work most closely related to the interests of the National Weather Service in planning and implementation of flood and flash flood warning systems.

* The objective of an Urban Study is to develop, through analysis of alternative solutions to water resources problems, an integrated urban water resources plan which supplements local comprehensive plans and which meets the desires and requirements of local people. Part or all the plan is intended for possible implementation by local governments or to provide local governments with the required planning to support requests for design and construction grants. Urban studies commonly deal with flood control and flood plain management, municipal and industrial water supply, waste water management, bank and channel stabilization, lake, ocean and estuaries restoration and protection, recreation management, and regional harbors and waterways.

Survey, review and interim studies undertaken in response to specific congressional authorization are generally made to determine the need or desirability of specific projects and programs. Investigations of this type are multipurpose and multi-objective in nature. Flood control is usually one principal purpose of such studies. Survey, review and interim studies constitute the bulk of the Corps of Engineers' planning activities.

Aspects of Flood Control Program

Three of the Corps' programs should be of particular interest to Meteorologists/Hydrologists including Flood Plain Management Services, Urban Studies and General Surveys and Investigations.

The Flood Plain Management Services program is one of an ongoing nature and offers an opportunity for long term continuing coordination through which effective working relations can be developed between the NWS and Corps. The program is carried out in each Corps District Office by a branch staff which may vary from one to two dozen people. Each division office has a corresponding function. Activities which may be conducted under the program are very flexible and include provision of assistance in development of flood warning systems and preparedness plans.

The program is important to NWS interests for several reasons. First, the Flood Plain Management Services program staff frequently participate to some degree in other Corps flood control programs such as general surveys and investigations and urban studies. A working relationship with the Flood Plain Management Services program staff can therefore lead to involvement in other programs. Second, the NWS can be of assistance to communities through the Flood Plain Management Services program by assisting the Corps in planning the flood warning component of warning and preparedness plans. The reverse is of course true also. When faced with a request for assistance which exceeds NWS resources, involvement of the Corps' Flood Plain Management Services program staff may provide a way to share the workload and meet community needs more fully. Corps funds may also be available for purchase of hardware associated with warning systems.

Survey reports and investigations should be of particular interest to Meteorologists/Hydrologists because most of these types of studies involve flood control and those which do appear

to fall under the mandate of Section 73 of Public Law 93-251 to consider nonstructural measures. Survey reports are also authorizing documents. That is, they recommend to Congress certain measures for approval, cost sharing between federal and non-federal interests, and other implementation arrangements. Inclusion of flood warning as a recommended measure opens up the possibility of direct funding by Congress of a substantial portion of the costs for implementation including those for hardware and detailed planning.

* The Corps' Urban Studies program should be of particular interest to Meteorologists/Hydrologists for two reasons. First, these studies generally involve flood control and, like survey studies seem to fall clearly under the requirement of Section 73 to consider nonstructural measures. Second, they are specifically devoted to urban areas in which other means of flood control such as levees or channelization are often physically difficult or expensive. Urban studies are intended for local implementation and recommendations for warning systems may offer good opportunities to the NWS for initiating community programs.

Procedures (General Surveys and Investigations)

The common practice for initiation of Corps flood control studies is for the House and Senate Public Works Committees to report an omnibus bill authorizing various surveys. Appropriations for surveys usually are lump sum appropriations. From the lump sum appropriation for surveys, the Chief of Engineers allocates the funds to specific projects. Once a survey has been authorized and funds have been allocated to carry it out, the elaborate and intricate process of report preparation commences. The district engineer first conducts a preliminary examination of the area to determine whether there are any feasible projects that should be explored in a detailed investigation. Although the preliminary examination may be unfavorable for a number of reasons, including economics and lack of local interest in a project, the district engineer's superiors may direct further investigation.

The Corps commonly holds at least three public meetings during the course of survey report preparation. An initial public meeting is held to discuss the problems as perceived by local interests. Following additional field examinations, the second public meeting is held to discuss possible solutions, their respective impacts and environmental effects. Then a plan for the improvements is prepared and its impacts determined. A third meeting is held to present the proposed plan and the views

of federal and state agencies. Preliminary reports and impact statements are prepared and made available for public comment. The district engineer then prepares his report and preliminary draft impact statement. Both are made available to the public.

The division engineer reviews the report, preliminary impact statement, and comments received. His report and the preliminary impact statement with the comments attached are submitted to the Board of Engineers for Rivers and Harbors. The Board, composed of seven engineer officers of the Corps, reviews the project report and the preliminary draft statement. Consideration is given to construction and maintenance costs and the propriety of public expenditure for the proposed work.

The Chief of Engineers then prepares a draft environmental impact statement, which is circulated to the states and federal agencies. After a 90 day comment period, an environmental impact statement, incorporating the comments, if any, is submitted to the Office of Management and Budget with the project report. After OMB review, the Secretary of the Army files a final impact statement with the Council on Environmental Quality. The Secretary submits to Congress the impact statement, the Chief of Engineer's project report, the comments of the states and the Secretary of the Interior, and such comments and recommendations as he deems appropriate.

Once a survey report reaches Congress, the next step is congressional authorization of the project. Favorable survey reports usually recommend authorization of a certain improvement subject to such modifications as in the discretion of the Chief of Engineers may appear advisable. Congressional action usually begins when the project is considered by the House and Senate Committees on Public Works. The project is made part of an omnibus bill and may be the subject of committee hearings open to public testimony.

Congress authorizes projects in a number of ways. First Congress may authorize an individual project at an estimated cost. Second, Congress may authorize a comprehensive plan of improvement as set forth in a project document, but limit authorization of construction to a specific part of the plan at a given estimated cost. Further implementation of such an approved plan of improvement requires that Congress authorize additional projects by name in subsequent legislation before their construction can be undertaken. Third, Congress may make a basic authorization in which a comprehensive plan of improvement set forth in the project document is approved and a specific amount is authorized to be appropriated for initiation and partial accomplishment or for continuation. Under the third type of authorization the Corps may undertake any of the projects included in the approved plan of improvement within the limitations of the monetary authorization.

The appropriate and formal point of initial contact with the Corps of Engineers regarding survey reports and investigations is the district engineer with responsibility for prosecution of the particular study. More informal contacts for day to day coordination should be with the assigned study manager.

Procedures (Urban Studies)

Urban Studies, like general survey investigations, may be authorized by either the Senate or House Public Works Committees. Once commenced, they follow the same general pattern of preliminary and detailed investigation, hearings and forwarding of reports through successively higher levels of authority. Approved reports are provided to local interests for their consideration.

The appropriate and formal point of initial contact with the Corps of Engineers regarding urban studies is the district engineer with responsibility for prosecution of the particular study. More informal contacts for day to day coordination should be with the assigned study manager.

Procedures (Flood Plain Management Services)

Services provided under the Flood Plain Management Services program are highly flexible and procedures vary according to the particular service being provided. In general, there are two aspects of the program of particular interest to the Meteorologist/Hydrologist including: a) general education and information activities; and b) assistance to local governments in flood plain management.

General education and information activities include the development and distribution of written materials and responses to individuals' requests for information. Assistance to local governments in flood plain management can take a variety of forms depending on what is requested and can range from only consultation or provision of readily available information to lengthy assistance in development of a community-wide flood warning system.

There are essentially no procedures specified for services involving requests of individuals or communities for readily available information or provision of educational materials. For

more substantial tasks, a meeting with local interests is held, an informal plan of study developed and coordination meetings held as necessary.

The appropriate and formal point of initial contact with the Corps of Engineers regarding activities under the Flood Plain Management Services program is the district engineer having jurisdiction over the geographical area of concern. More informal contacts for day to day coordination should be with the Chief of the Flood Plain Management Services program.

FEDERAL INSURANCE ADMINISTRATION

The Federal Insurance Administration was created in 1968, in part to administer the National Flood Insurance Program. It is a part of the Department of Housing and Urban Development. Headquarters offices are located in the Housing and Urban Development Building in Washington, DC.

History and Organization

Interest in flood insurance appeared at least as early as the mid-1930's as evidenced by articles appearing in various technical journals. However, early opinion on the practicality of offering such insurance was divided with most believing that the potential for catastrophic losses was too great for private enterprise to underwrite. While interest increased in the succeeding years, no formal proposal was made for instituting flood insurance until 1951.

The first legislative effort to institute a national flood insurance program was made in 1951 when the President requested an appropriation for that purpose, following a series of costly floods in the Midwest. The proposal was defeated. A modified proposal for flood insurance was offered in 1952, and, as in 1951, defeated. Still another proposal was made and enacted in the Flood Insurance Act of 1956, in which 40% of the premiums for insurance were to be subsidized by state and federal governments. However, no funds were ever appropriated, a major factor being the absence of effective flood plain management requirements in the Act. Without flood plain management requirements, many members of Congress felt that subsidized flood insurance would merely stimulate both riverine and coastal flood plain development and would inevitably lead to additional flood losses.

Bills were introduced almost annually during the 1960's to resurrect a national flood insurance program. However, large scale support did not occur until after publication of "A Unified National Program for Managing Flood Losses" (1966), and a HUD report entitled "Insurance and Other Programs for Financial Assistance to Flood Victims" (1966). Both of these publications urged insurance as an alternative to costly structural flood control measures.

The National Flood Insurance Act of 1968 established a voluntary program and provided subsidized flood insurance for existing properties located in identified special flood hazard areas. It also required communities to adopt local flood plain management measures as a condition of eligibility in the flood insurance program. Amendments to the Act in 1969 created the emergency phase of the program, authorizing flood insurance coverage before detailed flood insurance studies had been completed in a community. Further minor amendments were made in 1971 to encourage greater community participation in the program, including extension of the emergency program. By 1973 it was apparent that the principal defect in effecting the Congressional purpose was the voluntary nature of the program.

The voluntary nature of the National Flood Insurance program was changed markedly by enactment of the Flood Disaster Protection Act of 1973. Under the Act, the Secretary of HUD was required to notify known flood-prone communities of their tentative identification as such. Each community was then required to either apply for participation in the flood insurance program or within 6 months submit technical data sufficient to satisfy the Secretary that it was not seriously flood-prone. Communities choosing not to particiate in the program were liable to loss of federal financial assistance of many types. Property owners in participating communities were required to purchase flood insurance in order to receive new or additional federal or federally related financial assistance for acquisition or construction purposes in identified flood-prone areas. They were also required to purchase flood insurance as a condition of eligibility for obtaining federal disaster assistance for construction or reconstruction purposes.

Further amendments to the National Flood Insurance Program were made in 1974, 1975, and 1977. However, the program today is basically the same as that originally instituted in 1968.

The Federal Insurance Administration's Office of Assistant Administrator for Flood Insurance administers the program's operation. Field operations are carried out through staff located

at each of HUD's regional offices. Contact with the Federal Insurance Administration concerning the National Flood Insurance program should be made through regional staff. Regional office addresses and states served by each regional office are listed in Appendix A.

Overview of Programs

The Federal Flood Insurance Administration conducts 4 programs, only one of which bears any direct relationship to flood loss reduction. The several programs include:

1. Flood Insurance;

2. Urban Property Insurance;

3. Crime Insurance; and

4. Land Sales-Parcels of Subdivided Land.

* The objective of the Flood Insurance program is two-fold. First, it is to enable persons to purchase insurance against losses from physical damage to or loss in real or personal property caused by flood, mud-slides or flood caused erosion. Second, it is to promote wise flood plain management practices in the Nation's flood prone and mud-slide prone areas. Flood Insurance is made available in communities which enact or agree to enact flood plain management measures consistent with the program regulations. As of 1977, 15,000 communities had gained eligibility for the program and about 1 million policies were in effect providing $30 billion insurance in force.

The Urban Property Insurance program assures availability of essential insurance coverage for urban property, particularly that located in areas possibly subject to riots or civil disturbance, by providing re-insurance to insurers against catastrophic losses from riot or civil disorders. The federal re-insurance is available only to property insurance companies. Almost 5 million policies are in force under this program, providing some $18.8 billion of coverage.

The objective of the Crime Insurance program is to enable businessmen and residents of homes and apartments to purchase burglary and robbery insurance in states where there is a critical problem of crime insurance availability at affordable rates which is not being resolved by appropriate state action.

The Land Sales-Parcels of Subdivided Land program provides consumer protection through requiring full disclosure of conditions surrounding the purchase of subdivided land covered by the Act. Developers who sell land of 50 or more lots, any one of which is less than 5 acres in size, using any means of interstate commerce or the mails, must register with the Office of Interstate Land Sales Registration and provide property reports describing salient facts about the development and the developer.

Aspects of Flood Loss Reduction Programs

The National Flood Insurance program does not directly result in a reduction of flood losses, at least in terms of reducing damages done by a particular flood. The program's most important feature for property owners is the prospect it offers for spreading costs over time and avoiding financial catastrophy as a result of flooding. Over the long term, the program also is expected to reduce national flood losses through encouraging the wider use of flood plain management measures and damage reduction measures by insurees.

* Premiums in the regular program are to be actuarily determined to reflect risk of property losses. Existance of measures such as flood warning which reduce risk to property loss is to eventually be reflected in premium rate determination. This is of substantial importance to the Meteorologist/Hydrologist because a reduction in flood insurance costs would provide a powerful incentive for property owners and communities to support development of warning systems.

* As yet, no credit in rate determination is allowed for communities which have invested in flood warning systems. However, submission of individual cases for consideration is not ruled out. Regional Flood Insurance Program staff should probably be invited to participate or observe in development of any warning system which a community may want to offer as a basis for reduction of flood insurance rates.

Procedures

Not applicable.

GEOLOGICAL SURVEY

The Geological Survey is one of several subdivisions of the Department of the Interior. It is headed by a Director who is

appointed by the President. Headquarters offices are located at the U.S. Geological Survey National Center in Reston, Virginia.

History and Organization

The federal government made few scientific investigations in its early years and, in fact, its engagement in scientific efforts was considered by many to be unconstitutional. This changed in the early part of the nineteenth century as exploration of the west became a function of the Army and some states established geological surveys to aid in the development of their natural resources. By the 1840's, the need for geographic information had become urgent and the federal government had become more deeply involved in scientific activities.

The railroad surveys of the 1850's required extensive geologic information as did industry, which was beginning to shift from wood to coal as a source of energy. Civilian scientists began after the Civil War to take a major role in exploration of the west. Major efforts included the Geological Exploration of the Fortieth Parallel (1867), the Geological and Geographical Survey of the Territories (1867), Colorado River Exploration (1869), and the Geographical Surveys West of the One Hundredth Meridian (1871). These several investigations were variously administered by the Army and civilian agencies.

Conflict arose as to whether mapping should be under the control of the Army or a civilian agency. Congress referred the question to the National Academy of Sciences in 1873. The Academy favored civilian control of mapping and recommended establishment of an independent organization in the Interior Department to be called the U.S. Geological Survey.

The Geological Survey was established by an Act of Congress in 1879. The new agency was charged with responsibility for "classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain." The Geological Survey's scope of activities became nationwide when, in 1882, the Congress added the duty "to continue preparation of the geologic map of the United States" and authorized the collection of mineral statistics. Topographic mapping was undertaken as a base for the assigned geologic mapping. In 1888, the Survey's work was expanded to include determination of irrigable lands and reservoir sites in the arid regions and, in 1894, to "gauging streams and determining the water supply of the United States." Successive directives from Congress added investigations for mineral resources and survey of forest preserves to the responsibilities of the Geological Survey.

Many of these early activities of the Geological Survey led to formation of new organizations where a management or developmental function evolved. Some of these included the Reclamation Service (1902), Bureau of Mines (1910), Federal Power Commission (1920) and the Grazing Service (1934), the last of which has since been combined with other functions as the Bureau of Land Management.

By 1930, the Geological Survey was conducting mapping investigations in 45 states and nearly 44 percent of the continental United States was mapped. Streamflow was being measured at over 2,000 stations. Creation of the Tennessee Valley Authority in 1933 accelerated the Survey's program to provide maps for the entire Tennessee River valley. Success in using new mapping techniques there led to widespread interest in similar programs for other river basins and the survey conducted extensive mapping for the Bureau of Reclamation.

Water resources investigations were underway in nearly every state by the mid-1960's. Investigations dealt with water use, pollution, geochemistry, and other aspects. The Survey was directed in 1964 by the Bureau of the Budget (OMB) to coordinate and plan all federal activities in collecting water data. By 1970, the Survey had grown to 9,200 employees, had completed topographic maps for 84 percent of the United States, and was collecting streamflow data at more than 11,000 stations and water quality data at more than 4,000 stations. On June 1, 1977, the Survey was also put in charge of the National Petroleum Reserve in Alaska.

The Geological Survey is organized into seven divisions. The Topographic, Geologic, Water Resources, and Conservation Divisions are the primary operating units. They are supported in the execution of their respective functions by the Administrative, Computer Center, and Publications Divisions. In addition, an office of Land Information and Analysis directs and coordinates the multidisciplinary land resource and environmental analysis programs of the Survey. Figure 3.6 is a generalized organizational chart showing those organizational elements of principal interest to Meteorologists/Hydrologists including the Water Resources Division.

The Water Resources Division is composed of the Office of the Chief Hydrologist, the Office of Water Data Coordination, the Office of International Activities, and the Offices of the Assistant Chief Hydrologist for Operations, Scientific Publications & Data Management, and Research & Technical Coordination. Organization of the Water Resources Division is shown in Figure 3.7.

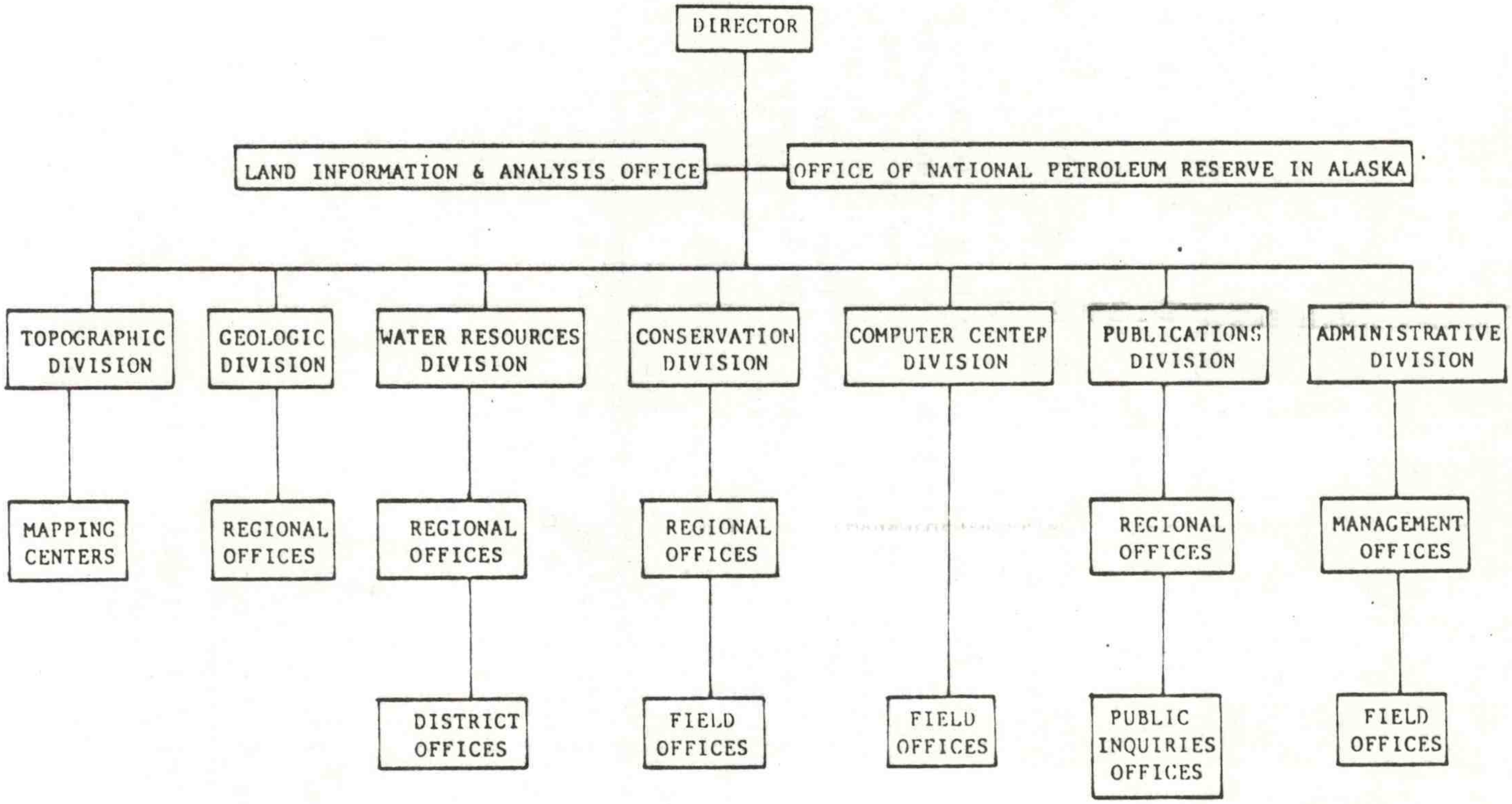

Figure 3.6 ORGANIZATION OF GEOLOGICAL SURVEY

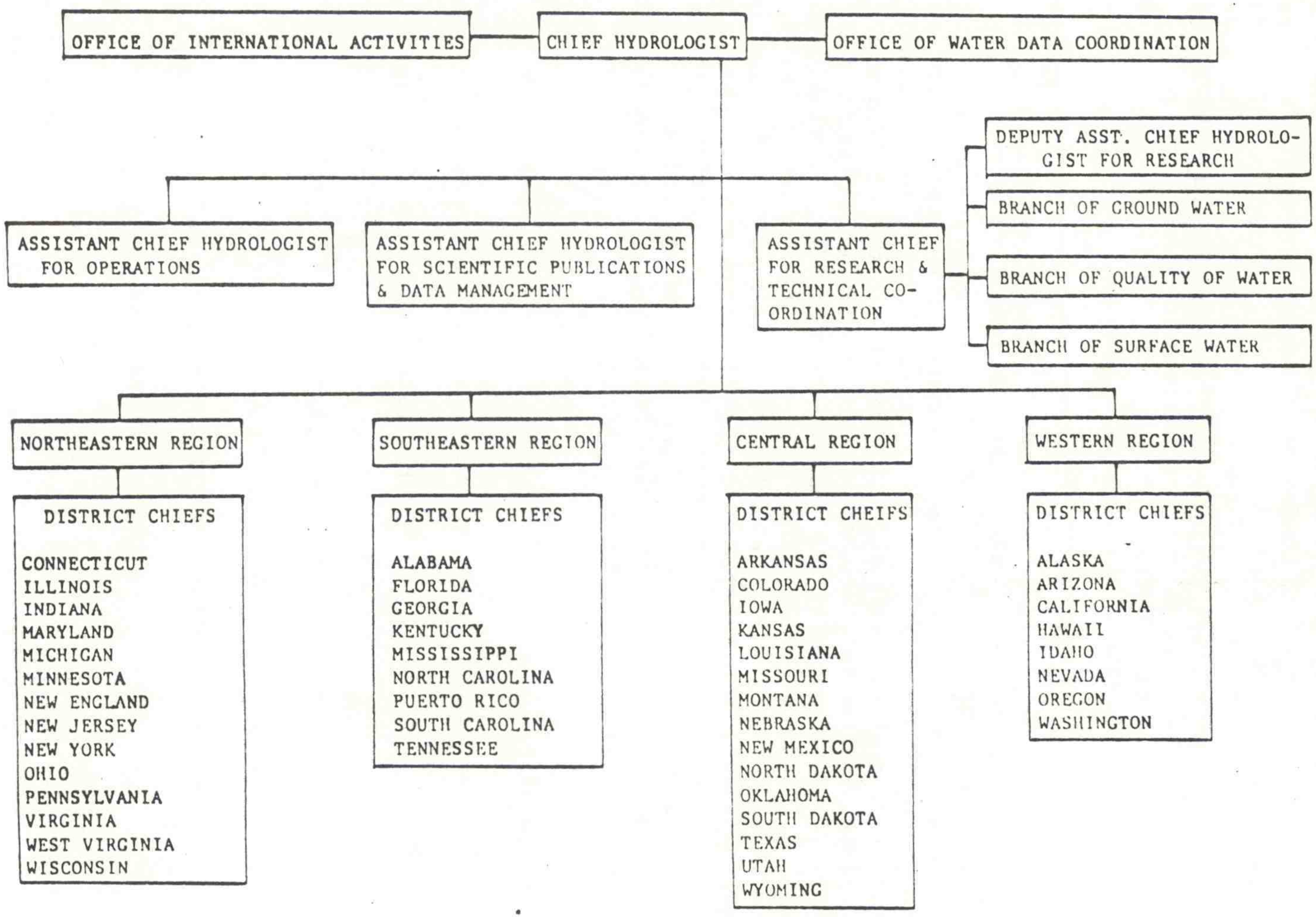

Figure 3.7 ORGANIZATION OF WATER RESOURCES DIVISION OF GEOLOGICAL SURVEY

The field organization of the Water Resources Division consists of four regional offices--Northwestern, Southeastern, Central, and Western--each headed by a Regional Hydrologist. Each region consists of several states and each Regional Hydrologist directs water resources programs in his region and represents the Chief Hydrologist in negotiations and dealings with other organizations and committees on matters of concern to the division, and exercises direction over the District and Research Project offices within his particular region.

District offices, each headed by a District Chief, generally are located in state capitals with jurisdictional boundaries corresponding to state boundaries. There is a district office in each state and Puerto Rico, with the exception of the states of Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont, which comprise the New Englad District with the district office in Boston, Massachusetts, and the states of Delaware and Maryland, which together with the District of Columbia form a district with the district office at Parkville, Maryland (outside Baltimore). Many districts are further subdivided into subdistrict and field unit offices. Each District Chief has responsibility for the planning, programming, and implementation of water resources investigations within his district. Organization of the Water Resources Division at a typical district is shown in Figure 3.8. Addresses of Geological Survey district offices are listed in Appendix A.

Overview of Programs

The Geological Survey administers 5 programs including:

1. Geologic and Mineral Resource Surveys and Mapping;

2. Cartographic Information;

3. Minerals Discovery Loan Program;

4. Topographic Surveys and Mapping; and

5. Water Resources Investigations.

The Geological and Mineral Resource Surveys and Mapping program provides for preparation of geologic maps throughout the United States and the appraisal of mineral and fuel resources. The program also provides for research in the principles and

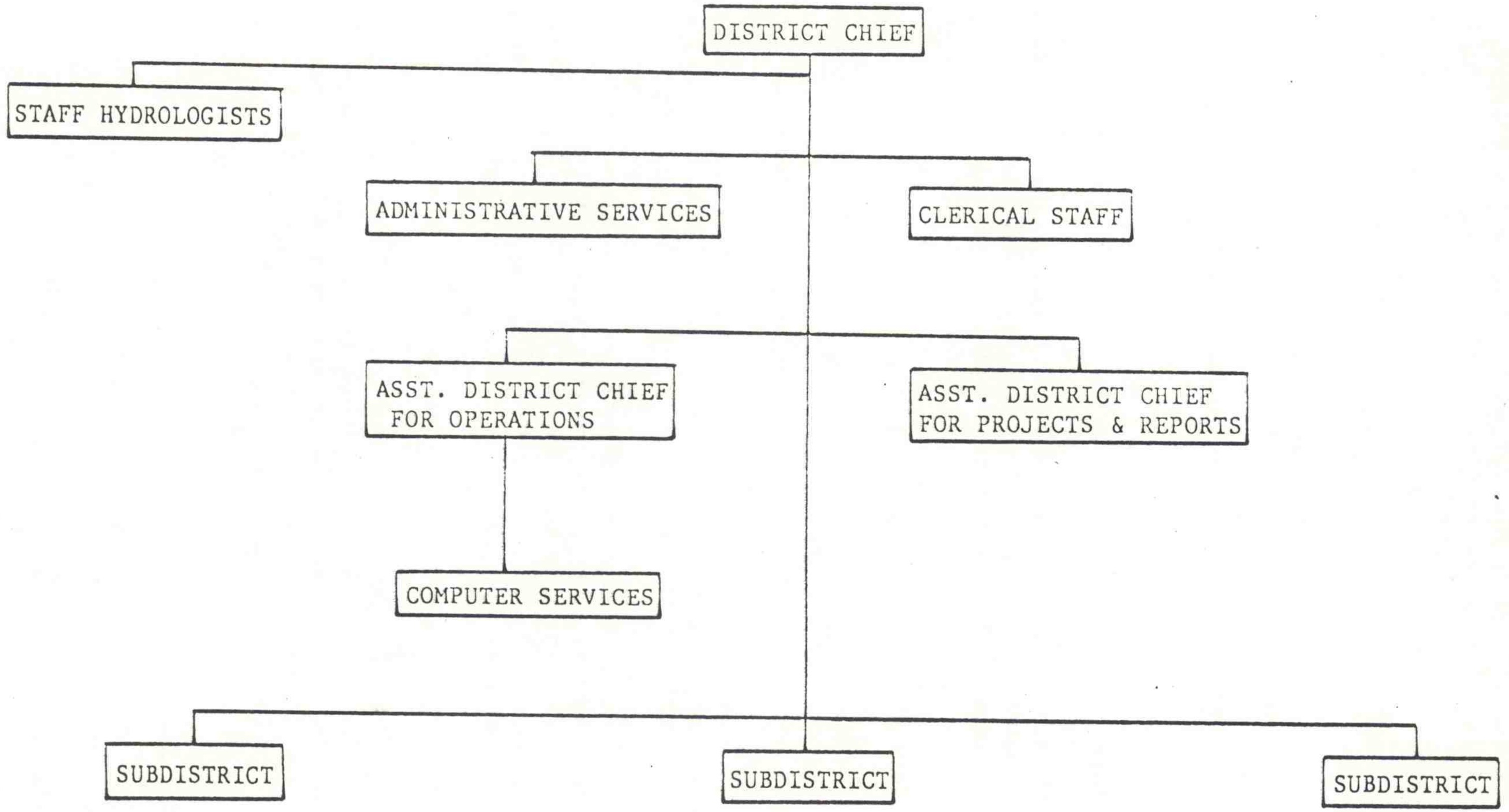

Figure 3.8 TYPICAL ORGANIZATION OF GEOLOGICAL SURVEY WATER RESOURCES DIVISION DISTRICT OFFICE

instrumentation of geology, geophysics, and chemistry. Work under this program is performed in cooperation with states and political subdivisions of states. Technical information developed under the program is made available to the public in the form of geologic quadrangle maps, bulletins and professional papers.

The Cartographic Information program is operated to provide cartographic information to federal and state agencies and to the general public. Users are provided information about maps, charts, geodedic control, aerial and space imagery, and related cartographic data generated by federal and other sources.

The objective of the Minerals Discovery Loan program is to encourage exploration for specified minerals within the United States, its territories and possessions. Direct loans are made to industrial or private firms that qualify for exploration of one or more of the eligible minerals or mineral products. The government will contribute to the allowable costs of exploration up to the maximum of 75 percent for certain mineral commodities. Loans are paid back through royalties on mineral production if a discovery is certified by the government.

The Topographic Surveys and Mapping program encompasses a cooperative effort with states and political subdivisions of states to prepare topographic maps of the Nation and maintain the maps in up-to-date condition. Programs are undertaken on a cost sharing basis between the Geological Survey and the non-federal participant. At present, approximately 96 percent of the country is covered by standard quadrangle mapping.

The Water Resources Investigations program is a federal-state cooperative effort to provide water information for economic development and best use of water resources and to carry on research in hydrology. The Geological Survey provides specialized services for the dissemination of technical information produced under the program. The state sponsor must contribute at least one-half the cost of any cooperative water resource investigation. Presently under this program, the Geological Survey operates 12,700 gaging stations for measurement of stream flow, 5,000 water quality measurement sites and 26,000 observation wells for recording changes in groundwater storage. Data from the stations are released in Water Supply Papers and Water Resources Investigations Reports.

Aspects of Flood Control Programs

* The Geological Survey does not administer any programs directly for flood control purposes. However, the Survey does on

occasion prepare and publish a Hydrologic Atlas describing flood problems in a community which includes stream profiles, maps of inundated areas and other information. Communities and others desiring to do so can use this information as a base for land use regulation and other programs for flood loss reduction. Other water resources investigations carried out cooperatively with states may serve flood loss reduction purposes if designed to do so.

Procedures

In the Federal-State Cooperative program, state and local governmental agencies propose programs to the appropriate district office of the Survey's Water Resources Division. Programs are then reviewed for approval or change at regional and national levels, and presented for further review at bureau (Geological Survey), departmental (Interior) and administration (OMB) levels, prior to transmittal to Congress. Geological Survey programs are handled in Congress by the Interior Subcommittees of the House and Senate Appropriation Committees.

SOIL CONSERVATION SERVICE

The Soil Conservation Service (SCS) is one of several services within the Department of Agriculture. Headquarters of the SCS is in the Department of Agriculture Building, located at 14th Street and Independence Avenue in Washington, DC.

History and Organization

The Soil Conservation Service and Domestic Allotment Act, which was enacted in part in 1935, provided the basis for two programs of soil conservation on private lands with aspects of flood control, siltation control, and water conservation. These were: a) the Soil Conservation Service program of technical assistance to land owners in installing soil and water conservation practices; and b) the Agricultural Conservation program providing payments to landowners for installing similar measures.

The 1936 Flood Control Act also gave the Agriculture Department jurisdiction over federal investigations of flood control and related land management in watersheds and authorized investigations and surveys in specific localities. A 1937 amendment

extended this authorization to cover the watershed of all waterways previously authorized to be surveyed by the Corps of Engineers. The 1944 Flood Control Act authorized installation of improvements in 11 watersheds. But these projects, which then consisted mainly of accelerated land treatment, contained no structures. Within the Department, responsibility for flood control work was divided between the Soil Conservation Service and the Forest Service.

The Department's watershed reports began to include proposals for structural measures after 1948. Agriculture's 1949 Missouri Basin Agricultural Plan, which was intended to coordinate the authorized programs of the Corps of Engineers and the Bureau of Reclamation with departmental soil conservation and farmer service programs, contained proposals for structures estimated to cost $1 billion. In 1950, the Fiscal Year 1951 USDA Appropriation Act contained language that permitted 11 watershed projects to include upstream floodwater detention reservoirs, channel improvements, and other structures. Then in 1951, a subcommittee of the House Committee on Agriculture began hearings on the Missouri Basin Agricultural Plan. At these hearings, members supported their constituents' demands that watershed flood prevention for the purpose of protecting farmers from flood damage in upstream areas be started without waiting for full river basin development.

In 1953, as a result of departmental reorganization, the Soil Conservation Service was given full administrative responsibility for watershed programs.

Pubic Law 566, which inaugurated the small watershed program, was passed in 1954. For watersheds not exceeding 250,000 acres, Public Law 566 authorized the Secretary of Agriculture to help local organizations plan and carry out works of improvement for flood prevention and agricultural aspects of water use and conservation. This assistance was to include conducting investigations and surveys, determining the engineering and economic feasibility of plans, and entering into agreements with local organizations and furnishing them with financial and other assistance. A plan could provide for no single structure with more than 5,000 acre-feet of total capacity and local organizations were to pay an equitable construction cost share determined by the Secretary.

* Public Law 566 was amended in 1956 in response to complaints that the Act gave its local clientele less financial assistance than the programs of the Corps and the Bureau of Reclamation and that local interests who wished to participate were

unable to meet their costs. The key amendments provided that all costs allocated to flood prevention would be borne by the federal government and the Secretary could make loans of up to $5 million to local organizations to finance their share of other costs. The 1956 Act also authorized the inclusion of works for municipal and industrial water supply. However, such works were to be totally paid for by local interests; not even SCS engineering assistance would be available for this purpose. In addition, individual works could now have a total capacity of 25,000 acre-feet, providing that not more than 5,000 acre-feet were devoted to flood protection.

The small watershed program has now evolved to the point that projects, while small, include comprehensive planning for land and water resource management including flood control, municipal and industrial water supply, irrigation, fish and wildlife, recreation and other purposes.

Soil Conservation Service's overall organization is shown in Figure 3.9. Programs of the Soil Conservation Service are administered through state offices, headed by a State Conservationist. Figure 3.10 shows a typical organization for a state office. The SCS also employs District Conservationists, usually responsible for one county and supported by staff of various sizes depending on local workload. State office locations are listed in Appendix A.

Overview of the Programs

The Soil Conservation Services administers 9 programs including:

1. Great Plains Conservation;
2. Resource Conservation and Development;
3. Soil and Water Conservation;
4. Soil Survey;
5. Watershed Protection and Flood Prevention;
6. Plant Materials for Conservation;
7. River Basin Surveys and Investigations;
8. Snow Survey and Water Supply Forecasting; and
9. Land Inventory and Monitoring.

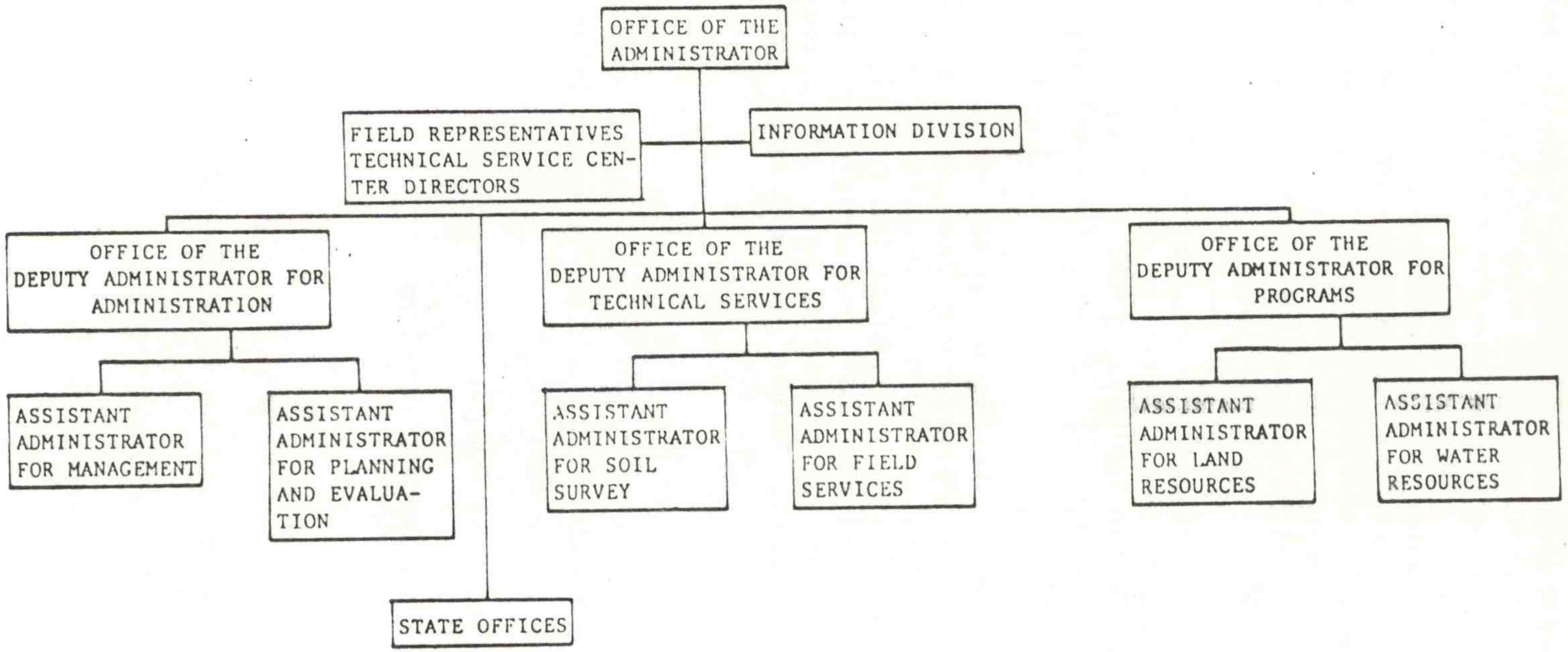

Figure 3.9 ORGANIZATION OF SOIL CONSERVATION SERVICE

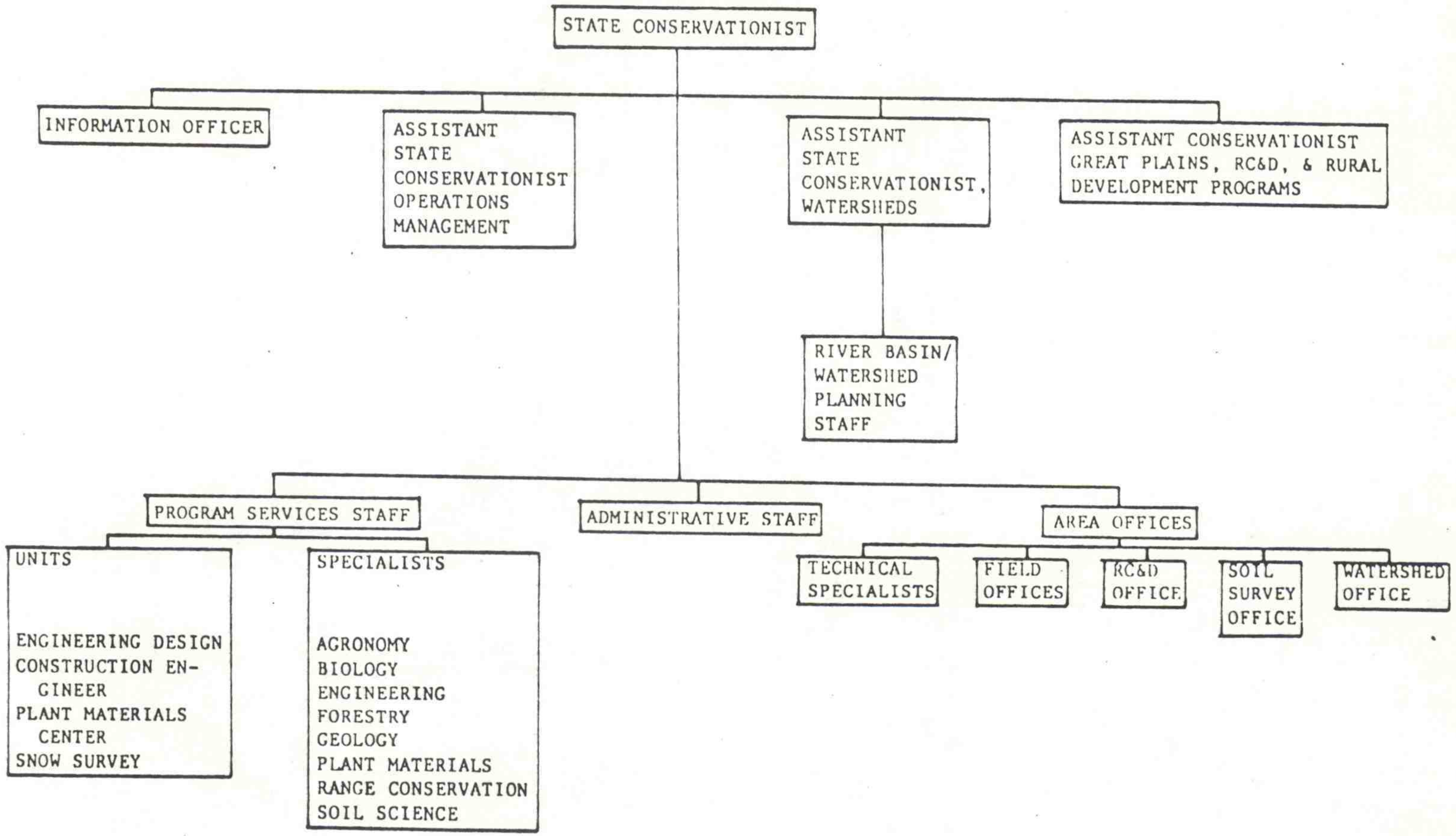

Figure 3.10 ORGANIZATION OF SOIL CONSERVATION SERVICE STATE OFFICE

The Great Plains Conservation program is intended to assist in conserving and developing the soil and water resources of the Great Plains by providing technical and financial assistance to farmers, ranchers and others in planning and implementing conservation practices. SCS provides cost sharing funds for those types of measures with lasting value. Assistance is provided in accord with a long term conservation plan for the operating unit. The program is implemented by means of a contract between the land owners and the federal government running from 3 to 10 years in length. Contracts in 1976 covered over 4 million acres and the program is now operating in 469 counties in 10 states.

The Resource Conservation and Development program assists local interests in initiating and carrying out long range programs of resource conservation and development for rural communities. The objective of the program is to help communities reach satisfactory levels of income and environment and create a favorable investment climate attractive to private capital. Once an area is designated as a resource conservation and development area, the SCS provides technical and financial assistance for planning and installation of approved measures for purposes such as flood prevention, sedimentation and erosion control, water based recreation, fish and wildlife, agricultural water management purposes, water supply, water quality management, and rural fire protection. As of 1976, assistance was given to 168 resource conservation and development areas covering over 702 million acres.

The Soil and Water Conservation program provides assistance to owners and operators of private lands, units of state, county and local government, and others in planning and carrying out soil and water conservation measures. Technical and advisory assistance is provided in making field investigations and recommendations for land use and treatment and other purposes. No financing is available under the program.

The Soil Survey program provides published soil surveys of counties or other comparably sized areas for use by interested agencies, organizations, and individuals. Surveys are undertaken without local participation. To date soil surveys have been completed on 1.3 billion acres and continue at the pace of about 50 million acres annually.

The Watershed Protection and Flood Prevention program provides technical and financial assistance to non-federal interests in planning and carrying out works of improvement to protect, develop and utilize the land and water resources in small

watersheds. Assistance is provided in planning; in sharing costs of flood prevention, irrigation, drainage, sedimentation control, fish and wildlife, recreation, and other measures; and through extension of long term credit to help local interests with their share of the costs. Assistance is provided under this program to any state agency, county, groups of counties, municipality, Soil and Water Conservation District, other special purpose district or any other non-profit agency with authority under state law to carry out watershed works of improvement. In fiscal year 1976, 10 projects were approved for planning and 33 approved for operation. Approximately 425 projects have been completed under the program to date.

The Plant Materials for Conservation program provides assistance in assembling, evaluating, and introducing into commerce new and improved plant materials for soil, water, wildlife, conservation, and environmental improvement. The program operates through field testing with cooperators, followed by large scale production by commercial producers. Over 120 varieties of grasses, legumes and shrubs have been introduced through this program.

* The River Basin Surveys and Investigations program is the vehicle through which SCS provides assistance to other federal agencies and states in the preparation of comprehensive plans for the development of water and related land resources within river basins or regions. This includes providing the USDA's participation in comprehensive framework surveys, regional or river basin studies (Level B) and other investigations. The program also includes SCS's activities to prepare cooperative flood hazard studies with non-federal sponsors.

The Snow Survey and Water Supply Forecasting program consists of making and coordinating snow surveys in the western states and Alaska and preparing forecasts of seasonal water supplies in affected streams for the purpose of relating available water supply to agricultural, industrial, and municipal plans and operations. Data are also used in the regulation of small and large reservoirs for various purposes. Forecasts of water supplies are based on monthly readings taken at 1600 snow courses, 200 aerial markers, 200 soil moisture installations and 300 precipitation gages.

The Land Inventory and Monitoring program provides national assessment of specific types of soil, water and related resources, monitoring of changes in the data and periodic reports on land use. Inventories identify prime and unique farmland that are needed to maintain the Nation's natural resource base.

Aspects of Flood Control Programs

The Resource Conservation and Development program is largely locally operated with respect to both the identification of measures to be undertaken and their execution. The Soil Conservation Service provides only technical and financial assistance and coordination with other federal agencies. Designation of an area as a Resource Conservation and Development District is usually an indication that there is broad concern within the area for water resources related matters. Local boards, committees and government organizations are usually involved in conduct of the program. If flood loss reduction is needed, planning of warning systems can be encompassed as one of the program measures. Identification of Resource Conservation Districts can be made through the state office of the Soil Conservation Service. Programs to develop community flood warning systems could potentially be developed either as a part of the Resource Conservation and Development program or separately, working through the same local organizations.

The Watershed Protection and Flood Prevention program offers an excellent opportunity for implementation of flood warning systems. Flood loss reduction is a major part of most projects carried out under this program and the program appears to be subject to the mandate of Section 73 of Public Law 93-251 to consider nonstructural measures. It may be of value for Meteorologists/Hydrologists to identify projects being planned and offer assistance in consideration of warning alternatives. The extent to which Soil Conservation Service can plan and implement warning systems under this program is not totally clear. Present indications are that tecehnical assistance in planning can be provided but furnishing of necessary hardware is considered a non-project cost which must be borne by non-federal sponsors.

Procedures (Resource Conservation & Development)

Proposals for assistance are initiated at the state or local level, and must be approved at the state level. If planning assistance is approved, technical assistancae is provided in developing a project plan. In addition to SCS assistance, planning assistance also may be provided by the Economic Research Service and the Forest Service. Plannng assistance includes conducting an inventory and evaluation of the physical and human

resources of the area, determination of areawide needs and opportunities, consideration of alternative solutions, and fomulation of conclusions as to a course of action to initiate or install needed measures, including a determination of priorities. After a plan has been prepared it is submitted to the Secretary of Agriculture for approval. The Secretary may authorize operations assistance in carrying out the plan.

Operations assistance includes technical assistance, cost sharing, and loans. Technical assistance is provided in planning and installing land treatment measures, and in designing and installing community type project measures to carry out the objects of the program.

Procedures (Watershed Protection and Flood Prevention)

Before applying for planning assistance under this program, local organizations must submit an application to the state agency having supervisory responsibility over such programs, or to the Governor if no such agency exists. If the application is approved, or not disproved within 45 days, planning assistance may be authorized. In certain circumstances, before the SCS authorizes planning assistance, other agencies must be notified and their views solicited; this must occur before any commitment to local interests is made, and those interests must be informed that any plan is subject to coordination with other agencies.

If planning assistance is authorized, the Secretary of the Interior must be notified so that he "may make surveys and investigations and prepare a report with recommendations concerning the conservation and development of wildlife resources and participate, under arrangements satisfactory to the Secretary of Agriculture, in the preparation of a plan for works of improvement that is acceptable to the local organization and the Secretary of Agriculture."

Assistance in preparing a work plan is authorized upon consideration of the "priority recommendations of the State agency or the Governor." In addition to surveys and investigations, the assistance may include preparing such plans and estimates as required for adequate engineering evaluation. The cooperative efforts produce a watershed work plan outlining the management problems in the watershed, the works of improvement to be installed and their costs and benefits, and cost-sharing and operation and maintenance arrangements.

When the Secretary of Agriculture and the local organization have agreed on a watershed work plan, it is reviewed for 60 days by the state's Governor and concerned federal agencies. A draft environmental impact statement also is prepared and circulated for review. Then the plan is submitted to Congress through the President. If a plan does not require specific approval by a congressional committee, and if the plan has remained before Congress for 45 legislative days, the Secretary of Agriculture is authorized to provide technical and financial assistance for carrying out works of improvement in accordance with the provisions of the watershed work plan.

TENNESSEE VALLEY AUTHORITY

The Tennessee Valley Authority (TVA) is a wholly owned government corporation. A three-member full-time board directs and exercises the powers of the corporation. Members of the board are appointed by the President and confirmed by the Senate for staggered 9 year terms. TVA's main office is located in Knoxville, Tennessee.

History and Organization

TVA was created by the Tennessee Valley Authority Act of 1933. It is unique in that it is the only agency enpowered to exercise all federal functions in the development and management of water and related land resources within a geographical area of the Nation.

The TVA was given general authorization for the planning, construction, and operation of dam and reservoir projects for the primary purposes of navigation and flood control and also for operation of projects for the generation of electricity. Unlike the Corps of Engineers, TVA was required to obtain the approval of only one set of congressional committees, the Appropriation Committees of the House and Senate, before initiating construction of projects. The TVA was also authorized to sell electric power, regulate its rate of resale, build transmission lines to rural areas where needed, and promote the use of electric power for agriculture, domestic use, and regional economic development. The agency was also authorized to operate the Federal Government's World War I nitrates plant for fertilizer experimentation and production in time of peace and for munitions manufacture in time of war. It also was involved in soil conservation and forestry programs, fish and wildlife improvement, recreation development, and elimination of malaria-carrying mosquitos by reservoir management.

Drawing heavily on the Corps of Engineers' 308 survey of the Tennessee River, the TVA prepared a plan for multiple-purpose development of the river and its tributaries in a report published in 1936 and transmitted to the President and Congress. Construction of the TVA's dam and reservoir programs was hastened as a result of World War II. beginning with rearmament in 1939, and on into the war and postwar periods, increasing quantities of electric power were needed for manufacturing aluminum for aircraft and for developing atomic energy. As a result, the TVA had built 20 multiple purpose dams on the main stem and the major tributaries of the Tennessee River by 1953. The Tennessee became the first major river of the United States that could be said to be near total development.

With the major streams in its watershed largely regulated, the TVA found that the heights of major floods in the Tennessee and the lower Ohio and Mississippi River systems were reduced. But many towns in the region still faced damaging floods from smaller streams. For most of these problem areas, no economically feasible plan of structural protection could be designed. In 1953, therefore, the TVA began a cooperative program with the valley states and local governments involving land use management at the local level, to help communities avoid flood damage where they could not prevent floods.

By 1959, 21 communities had initiated flood plain planning studies and nine communities had officially adopted some type of flood plain regulation. In addition, TVA flood reports were used by state highway departments in planning highways and bridges, and by a number of federal agencies in planning and financing public projects and in guaranteeing or insuring home loans. The success of the program prompted the agency to recommend its use nationally in a report to the Senate Committee on Public Works on August 31, 1959. Subsequently, the Flood Control Act of 1960 authorized the Corps of Engineers to undertake a similar program.

TVA's general organization is shown in Figure 3.11. All flood damage reduction programs are administered through the Division of Water Management. Organization of the Division of Water Management is shown in Figure 3.12.

Overview of Programs

The TVA's charter is exceptionally broad. All of its activities are carried out under three general programs including:

1. Fertilizer Development;

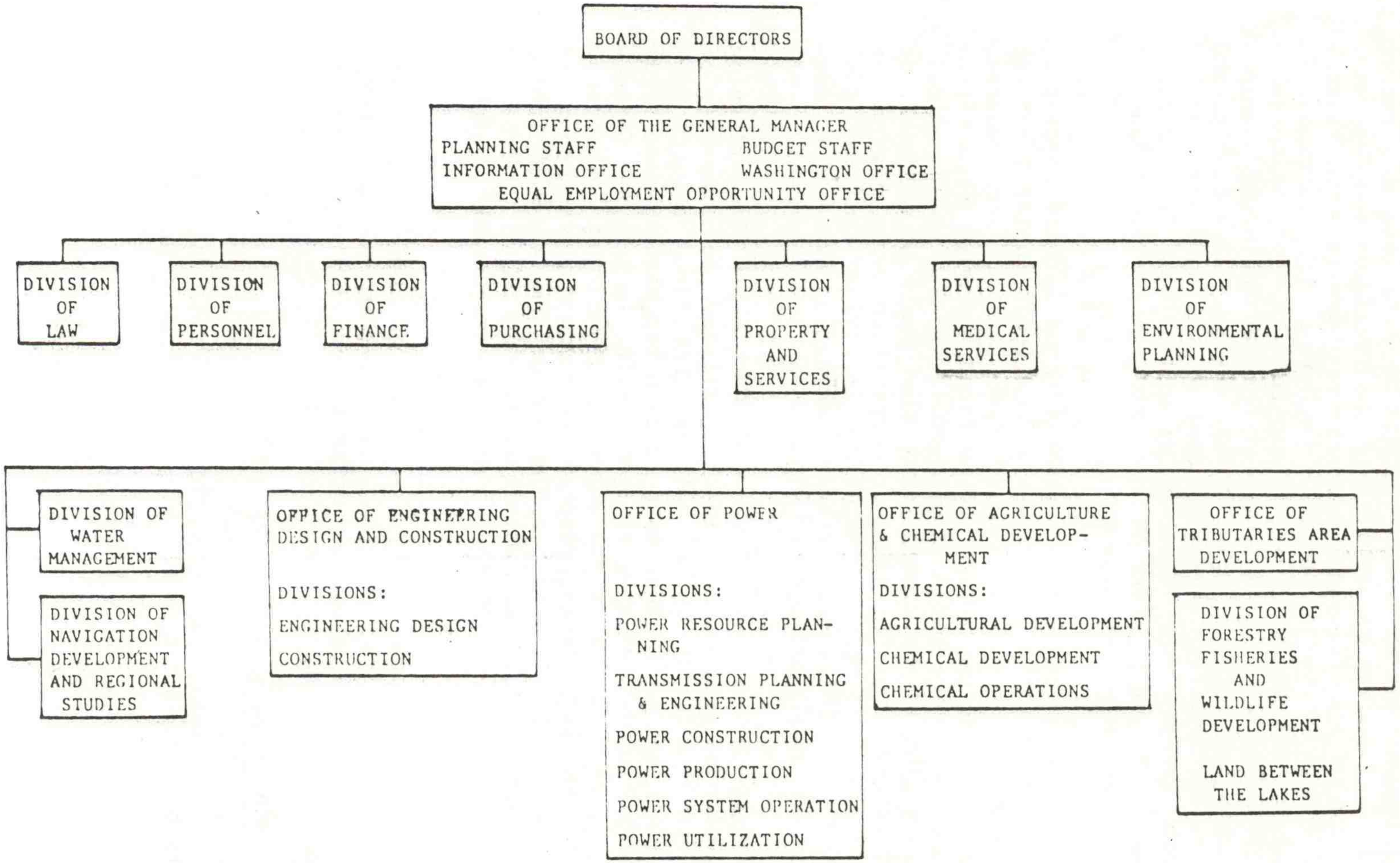

Figure 3.11 ORGANIZATION OF TENNESSEE VALLEY AUTHORITY

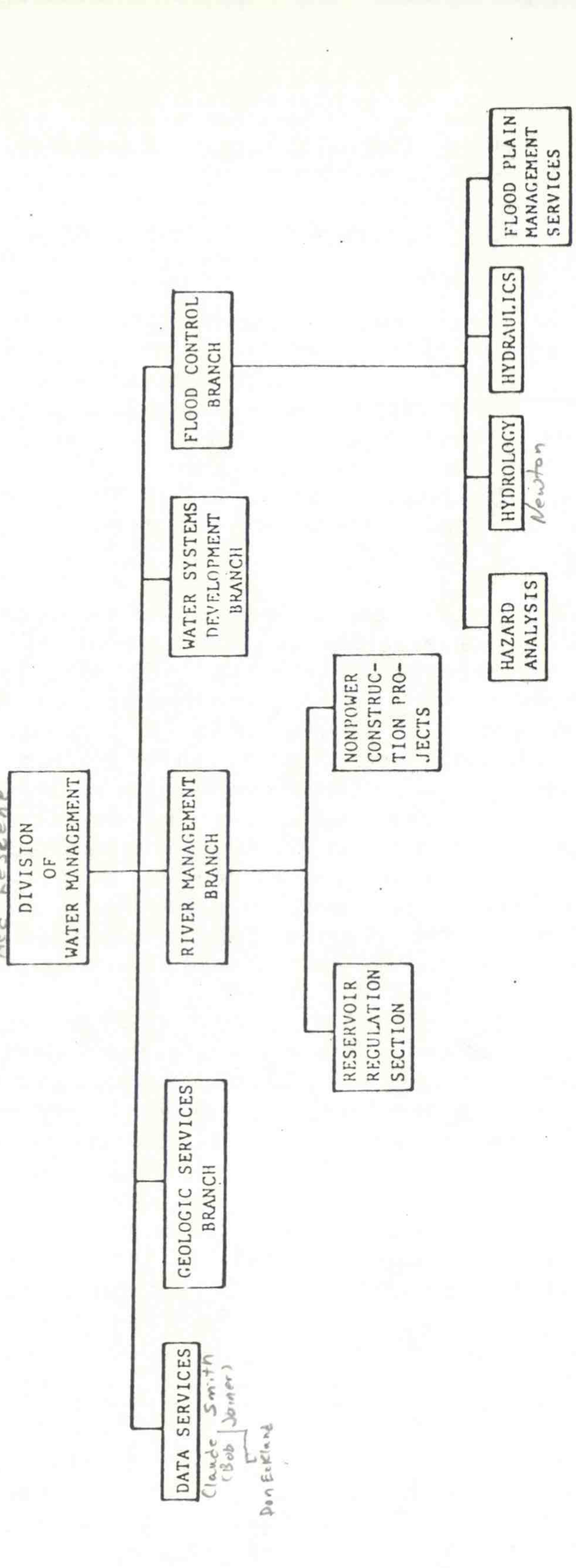

Figure 3.12 ORGANIZATION OF WATER MANAGEMENT DIVISION OF TENNESSEE VALLEY AUTHORITY

2. Tennessee Valley Region-General Resources Development; and

3. Tennessee Valley Region-Water Resources Development.

The objective of the Fertilizer Development program is to develop improved, cheaper fertilizer products and processes, especially in soil and water conservation programs, so as to improve the economic well being of farmers. TVA provides technical assistance and advice; non-exclusive patent licenses; and carries out cooperative programs with land grant colleges to develop new fertilizers. To date, licenses to use TVA patents on fertilizer products have been granted to 361 firms in 39 states.

The Tennessee Valley Region-General Resources Development program promotes the use, conservation and development of the non-water resources of the Tennessee Valley and related adjoining territory. Its ultimate goal is to improve the economic and social well-being of the people in the region and to demonstrate new approaches to national development goals. The program includes development of agricultural, forest, minerals, and environmental resources; tributary development; regional development in planning; and demonstration in human resource development. In some cases, TVA provides financial assistance to help cover administrative costs of local development programs. Technical assistance is provided under the program to all non-federal governments, private organizations and individuals upon request.

The objective of the Tennessee Valley Region-Water Resources Development program is to develop and operate the Tennessee River system for navigation, flood control, and power and for related benefits of industrial developments, water quality management, recreation development, and fish and wildlife development for the social and economic benefit of the region and the national interest. There are no regulations or guidelines for the program. Assistance is provided to officials and agencies of state, county and municipal governments within the Tennessee Valley Region, to private organizations and individuals upon request.

Aspects of Flood Loss Reduction Programs

TVA carries out a broad array of flood loss reduction programs including construction of dams, levees, and other structural works; provision of assistance in flood plain management; distribution of information and others. All programs involving flood control are administered by the Division of Water Management.

Program development within TVA is less constrained than for most other federal water resources agencies and program managers have considerable flexibility in choosing measures for consideration and in formulation of recommendations. As with other federal flood damage reduction planning, TVA's consideration of measures must include nonstructural measures. Some precedents concerning implementation of flood warning systems have already been established by TVA. In the case of one community in which a warning and preparedness alternative was recommended, TVA is paying for 90 percent of the flood warning system hardware costs.

* TVA has traditionally been receptive to the consideration and use of innovative measures. An opportunity exists for Meteorologists/Hydrologists to establish a continuing working relationship with TVA program managers. Obvious prospects exist for combining TVA funds for hardware with warning systems developed by NWS and preparedness planning by local officials.

Procedures

TVA is not very limited by prescription of detailed procedures. Projects are variously initiated upon request of communities or states, results of staff studies of needs, or other bases. Once underway, investigations relating to flood control usually embody a preliminary evaluation of economic and physical feasibility, followed by increasingly detailed studies of engineering, economic, financial, environmental and other aspects.

Flood control projects recommended by TVA were given previous authorization by Congress in the legislation creating TVA. Appropriation of funds is therefore the major step in legislative approval. Funds are normally appropriated on a lump sum basis and available until expended.

CHAPTER 4

COORDINATING ARRANGEMENTS

Coordination of programs was of little concern in early federal water resources development efforts. Activities by the fledgling Corps of Engineers were limited and few other agencies were involved at all. The need for mechanisms to provide coordination did not officially surface until 1907 when the Inland Waterways Commmission recommended creation of a "National Waterways Commission" to coordinate the work of the Corps of Engineers, Bureau of Reclamation, Forest Service and other agencies which had by then been created.

The Waterways Commission was subsequently authorized in 1917 to coordinate the work of all federal agencies with resources responsibilities in order to prepare nationwide multi-purpose plans. However, the members of the Commission were never appointed and the legislation establishing the Commission was repealed in 1920 by the Act creating the Federal Power Commission (FPC) as a cabinet-level committee of the Departments of War, Interior and Agriculture. While the Act did not transfer the Waterways Commission's coordination role to the FPC, the new committee's membership provided an opportunity for coordination through joint investigations and decisions on licensing.

The Employment Stabilization Act of 1931 established a cabinet-level Federal Employment Stabilization Board to advise the President about unemployment situations requiring emergency appropriations for already authorized public works construction. This board was abolished in 1933 and its functions assigned elsewhere. The coordination function of the 1931 Act was very limited and its chief significance for water resources planning was that it required all federal construction agencies to prepare and submit 6-year advance programs to the Director of the Budget. The Director of the Budget was then required to annually report consolidated plans and estimates for the next 6 years to the President. The 6-year advance budgeting program became one of the chief means of coordinating federal planning in succeeding years.

Executive branch efforts to promote interagency coordination of water resources planning began with the 1933-34 report of the President's Committee on Water Flow. This cabinet-level committee--consisting of the Secretaries of Agriculture, War,

Interior, and Labor--worked through six technical subcommittees including representatives from the Departments of War and Interior and the FPC. Coordinating and administrative work was done by the National Planning Board (NPB) which had been created in 1933 to prepare a comprehensive program of public works encompassing the full spectrum of water resources uses. The report of the Committee on Water Flow contained multiple-purpose plans for 10 river basins, largely based on reports by the Corps of Engineers and Bureau of Reclamation.

The National Planning Board continued through various reorganizations as the National Resources Board, National Resources Committee, and National Resources Planning Board, finally being disbanded in 1943 with instructions from Congress that its functions not be transferred elsewhere. During the period of 1933 to 1943, the NPB and its successors developed numerous water resources plans and programs and contributed substantially to development of the 6-year budgeting process of the federal public works program.

In 1943, after the National Resources Planning Board was abolished, the three Departments of Agriculture, Interior and War and the Federal Power Commission entered into a new agreement to coordinate their separate responsibilities in the preparation of river basin surveys. This agreement established the Federal Interagency River Basin Committee (FIARBC), familiarly known as "Firebrick", a voluntary organization without central executive supervision or statutory powers. Enlarged later by the joining of other agencies and departments, "Firebrick" met monthly to discuss the formalized review of each agency's reports by the other agencies.

FIARBC set up regional interagency committees for specific basins: the Missouri in 1945, the Columbia in 1946, the Pacific Southwest in 1948, and the Arkansas-White-Red and the New York-New England Basins in 1950. All of the regional committees included representatives of the affected states although not in all cases as full members. Like the national committee, the regional committees were generally permitted to take action only on the basis of unanimous consent. However, the regional committees were not able to reconcile separate agency plans and policies to the point of providing integrated river basin plans.

President Eisenhower requested in May 1954 that the FIARBC be reconstituted as the Interagency Committee on Water Resources (IACWR) with additional members. The IACWR--or "Icewater", as it soon became known--rechartered FIARBC's regional subcommittes and continued the FIARBC pattern of meetings to facilitate coordination of the activities of its member agencies.

In 1965, Congress passed the Water Resources Planning Act which sought in part to establish the coordination of water resources activities at the national level in a more comprehensive way than had been attempted in the past. The task of coordination, as well as the job of appraising water policies and programs and of planning for the conservation and development of the Nation's water resources, was given to a newly created Water Resources Council, consisting of the Secretaries of Interior, Agriculture, Army, and Health, Education and Welfare and the Chairman of the Federal Power Commission.

With some modifications in its membership and mission, the Water Resources Council remains as the principal vehicle for national coordination in the field of water and land resources. The Council's efforts are supplemented by specialized and variable coordination arrangements for geographical areas, for particular groups of agencies and for intrastate activities. The following sections describe the main coordination arrangements in use today which Meteorologists/Hydrologists are most likely to encounter.

WATER RESOURCES COUNCIL

* In addition to its original members, the Water Resources Council (WRC) now includes the secretaries of Transportation, Commerce, Housing and Urban Development and the Administrator of the Environmental Protection Agency as either full or associate members. The Attorney General, Chairman of the Council on Environmental Quality, Director of the Office of Management and Budget and the Chairmen of the seven river basin commissions participate in the Council as observers.

Duties of the WRC as set forth in the Water Resources Planning Act, Public Law 89-80, are to:

1. Maintain a continuing study and prepare an assessment biennially, or less frequently if appropriate, of the adequacy of supplies of water in the various regions of the United States;

2. Maintain a continuing study of the relation of regional river basin plans and programs to the requirements of larger regions of the Nation;

3. Maintain a continuing study of the adequacy of administrative and statuatory means for the coordination of the water related land resources policies and programs of the several federal agencies;

4. Appraise the adequacy of existing and proposed policies and programs to meet the requirements of larger regions of the Nation;

5. Make recommendations to the President with respect to federal policies and programs;

6. Establish with the approval of the President principles, standards, and procedures: a) for federal participants in the preparation of comprehensive regional or river basin plans; and b) for the formulation and evaluation of federal water and related land resources projects;

7. Participate in the creation, operation, and termination of river basin commissions;

8. Review the plans or revisions thereof from any river basin commission established under the Act and, based on that review, transmit the Council's recommendations, together with the plan and the views, comments and recommendations submitted by any federal agency, governor, interstate commission, or United States section of an international commission, to the President for his review and transmittal to the Congress with his recommendations in regard to authorization of federal projects; and

9. Make financial grants to states over a period of ten years to assist them in developing and participating in the development of comprehensive water and related land resource plans.

* Not all of WRC's assigned duties are directly relevant to the flood and flash flood warning mission of the NWS. Those that are include: the continuing study and assessment of water supplies; recommendations to the President with respect to federal policies and programs; and creation, operation and termination of river basin commissions. The importance of the last is discussed in a separate section.

WRC efforts in maintaining a continuing study and assessment of water supplies has evolved into periodic publication of a national assessment document. The relevance of this program lies in the fact that the original concept has been expanded beyond water supply and now includes both functional and geographical summaries of water related problems. The national assessment document may be used to identify areas where local agencies and other federal agencies perceive flood and flash flood problems to be severe.

The WRC's action on the policy front has had considerable complementarity to NWS interests. The Council has, for example, published guidance for uniform procedures for frequency analysis for use by all federal agencies and guidelines for implementing Executive Order 11988. WRC has also prepared and published The Unified National Program for Flood Plain Management. This document is particularly important in the emphasis and support given to flood warning as a measure for flood loss reduction.

RIVER BASIN COMMISSIONS

Legislation creating the Water Resources Council provided for establishment of River Basin Commissions. Commissions are established by Executive Order of the President upon written request of the Council or a State. Concurrence by the Council and at least one-half of the affected States is an essential condition to commission formation.

A commission is composed of:

1. A presidentially appointed chairman who also serves as chairman and coordinating officer of the federal members;

2. Members from each federal department or independent agency having a substantial interest in the work of the commission;

3. One member from each state in the territorial area covered by the commission;

4. One member from any interstate compact agency whose jurisdiction extends to the waters of the area for which the river basin commission is created; and

5. When deemed appropriate by the President, one member from the United States section of any international commission created by treaty whose jurisdiction extends to the river basin commission area.

The duties of a commission are to:

1. Serve as the principal agency for the coordination of federal, state, interstate, local and non-governmental plans for the development of the water and related land resources in its area;

2. Prepare and keep up-to-date a comprehensive, coordinated, joint plan for federal, state, interstate, local, and non-governmental development of water and related land resources.

3. Recommend long-range schedules of priorities for collection and analysis of basic data and for investigation, planning, and construction of projects; and

4. Foster and undertake studies necessary in the preparation of the plan.

River Basin Commissions have been established for the Pacific Northwest, Great Lakes, New England, Ohio, Missouri, and Upper Mississippi basins. A Commission was formed for the Souris-Red-Rainy basins with a limited life which has since expired. Over thirty states are members of one or more river basin commissions. Areas covered by river basin commissions are shown in Figure 4-1.

INTERAGENCY COMMITTEES

In areas where no river basin commission exists, interagency committees serve as regional entities which act to coordinate water and related land resources planning policies, programs, and activities of the federal agencies and states in their defined areas. Interagency committees presently exist for the Pacific Southwest, the Arkansas-White-Red and the Southeast basins regions. These interagency committees were formerly administered by the Inter-Agency Committee on Water Resources (ICWR). Areas covered by interagency committees are shown in Figure 4-1.

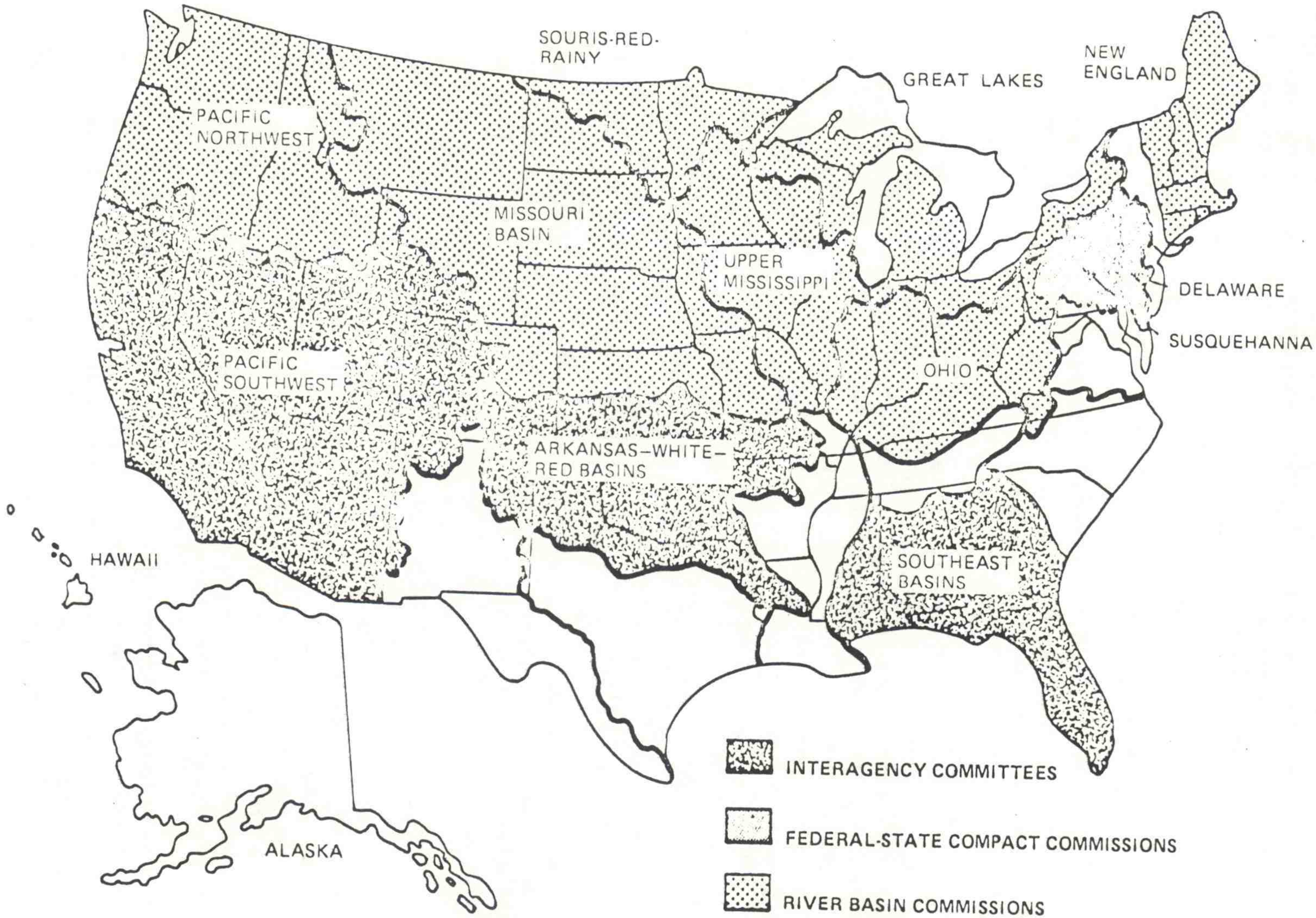

Figure 4-1. AREAS COVERED BY RIVER BASIN COMMISSIONS, INTERAGENCY COMMITTEES AND FEDERAL-STATE COMPACT COMMISSIONS

COMPACTS

Water resources planning and management activities have often been coordinated through compacts either interstate or federal-interstate in nature.

Interstate Water Compacts

Agreements between states are useful devices for dealing with water resources problems involving areas larger than one state and beyond the legal authority of any one state to solve. Such agreements, or "compacts", require the consent of Congress.

The earliest use of interstate compacts in the water resources field occurred under the Articles of Confederation, when such agreements were employed to deal with boundary problems and navigation and fishing rights in interstate waters. They generally were not used for any other water-related purposes until 1922, when the Colorado River Compact was agreed upon to allocate water rights among the Colorado River Basin States. The next half century spawned over 30 compacts dealing with assorted water problems in a variety of ways. In this same period, the Federal Supreme Court encouraged their use in interstate disputes over water rights and pollution. Similarly, Congress indicated that it would look favorably upon compacts dealing with flood control and water quality.

Existing interstate water compacts may be grouped into the three general categories of: a) water allocation compacts; b) pollution control compacts; and c) flood control and planning compacts.

The first interstate compact to allocate the waters of an interstate stream was negotiated in 1922 by the Colorado River Basin states. Subsequently, 18 additional compacts were established to apportion the waters of interstate streams. The general purpose of all water allocation compacts has been to accomplish an equitable apportionment of the water of interstate streams so that development of those rivers might proceed unmarred by continuing controversy among neighboring states over their relative rights in the common stream.

The Federal Supreme Court, Congress and commentators have consistently viewed pollution control on interstate streams as a problem particularly susceptible to solution through the device of the interstate compact. In its 1921 decision in the interstate litigation between New York and New Jersey over pollution

of the Hudson River, the Supreme Court expressed its view that the cooperative attack on pollution through interstate agreement was a more positive approach to such problems than adversary litigation. New York, New Jersey, and Connecticut subsequently entered into the Tri-State Compact in 1935 to deal with water quality problems in New York Harbor. Since that time, there have been at least 10 additional compacts which deal in various ways with interstate water pollution, ranging from simple bilateral agreements, such as that between California and Oregon on the Klamath River, to such multilateral treaties as the Ohio River Valley Water Sanitation Compact among states of the Ohio River Basin.

There are a handful of compacts which deal principally with certain flood control aspects of water resources management--the Red River of the North compact, three compacts on the Connecticut, Merrimack, and Thames Rivers in New England, and the Wheeling Creek compact between Pennsylvania and West Virginia. Most of these compacts emerged from the federal flood control program in the 1930's and were designed to promote cooperative state action in a national flood control program.

Federal-Interstate Compacts

Over the past 50 years there has been a growing recognition of the need to better coordinate water resource planning and programs within the federal establishment and between the federal government and the States. When compacts were proposed for this purpose, it was felt generally by the states that some way had to be found to make the United States a full partner in the compact in order to restrict its authority and its general inclination to "go it alone" in a basin. Thus, in 1953, the Missouri Basin Survey Commission unanimously agreed on the need for a regional coordinating and operating agency for that basin, but there were divergent points of view as to what kind of institutional arrangement would best meet the basin's needs. The Commission majority endorsed a federally created commission appointed by the President with broad powers to plan and implement a basinwide water resources program, while a three-member minority argued for a commission created under a "State-Federal" compact to which the States and the federal government would belong. Nothing came of either recommendation.

A subsequent effort by the New England states at a federal-interstate compact in the late 1950's fared better among the

states but failed to receive congressional consent, largely because of constitutional and other objections from the executive branch. However, concurrent with the unsuccessful efforts for a New England federal-interstate compact, a more sweeping proposal emerged on the Delaware and received congressional consent in September 1961.

The Delaware River Basin Compact grew out of several decades of litigation among the basin states over the apportionment of the waters of that stream system and unsuccessful attempts to resolve the controversy by interstate compact. In the late 1950's after a comprehensive study of various institutional approaches to the region's interstate water problems, the Delaware River Basin states reached agreement that a single, administrative entity was essential for the development plan and for the coordination of federal, state, local and private interests. To implement those objectives, the states speedily reached agreement on and ratified a compact creating the Delaware River Basin Commission (DRBC), comprised of the Governors of the basin states and a federal representative appointed by the President. Congress consented to the compact with certain reservations.

The Delaware Compact reflects a significant departure from traditional compact usage in two respects: 1) the United States is a signatory party with the states; and 2) extremely broad powers are granted to the compact commission. For example, commission powers include:

1. Licensing power for all projects effecting water resources in the basin;

2. Regulatory authority;

3. Authority to construct, operate and maintain projects;

4. Authority to allocate waters among the participating states; and

5. Broad financing authorities.

A similar compact was negotiated for the Susquehanna River and approved in 1970 and proposals are under consideration for the Hudson and Potomac Rivers, as well as the Great Lakes. The proposed compact for the Potomac River Basin has been approved by the states of Maryland and Virginia and needs approval only by the remaining states of Pennsylvania and West Virginia before going to Congress for approval of participation by the District of Columbia and the federal government.

Areas covered by the Delaware and Susquehanna River Basin compacts are shown in Figure 4-1.

COORDINATION BY STATES

The degree of coordination provided by states for water resources related activities of different governmental levels and the private sector is variable and what coordination is provided is accomplished in diverse ways. The principal coordination techniques include review of federal project proposals, state water plan development, and regulatory processes.

Review of federal water project proposals is an effective coordination technique because, as described earlier, procedures for federal planning require solicitation of state comments prior to transmission of many types of plans to Congress. The state review, whether carried out by a single agency or through a mechanism involving multiple state agencies, offers a powerful incentive for early federal coordination since projects have seldom been approved by Congress over the objection of affected states. The state review process can vary from simply ascertaining that water rights required for the project are in order to extensive and sophisticated analysis of economic, engineering, environmental and other technical aspects and impacts on comprehensive development.

* Many states are in the process of developing state water plans. While such plans take many forms, they generally attempt to assess the long term need for and capability of water and related land resources. Some coordination is achieved through use of data and information common to that being used by federal agencies. Other types and extents of coordination are achieved through participation of federal agencies in the state water resources planning program. More direct coordination is occasionally provided by states through inclusion of federal representatives on various advisory committees to resource agencies and planning programs.

Mandatory coordination of planning and development proposals, particularly with regard to private interests, is being increasingly provided through regulatory measures. These measures require various permits and licenses for using or affecting water resources. In some states, permit requirements and requirements for analysis of environmental impacts are being jointed into comprehensive reviews of all new land and water use proposals.

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APPENDIX A

DIRECTORY OF WATER RESOURCES AGENCIES

BUREAU OF RECLAMATION REGIONAL OFFICES

Mid-Pacific
Federal Office Bldg.,
2800 Cottage Way
Sacramento, CA 95825
(916)484-4571

Upper Missouri
P.O. Box 2553
Billings, MT 59103
(406)585-6214

Lower Missouri
Building 20
Denver Federal Center
Denver, CO 80225
(303)234-4441

Lower Colorado
P.O. Box 427
Boulder City, NV 89005
(702)293-8411

Pacific Northwest
P.O. Box 043
550 West Fort Street
Boise, ID 83724
(208)342-2101

Southwest
Herring Plaza
Box H-4377
Amarillo, TX 79101
(806)376-2401

Upper Colorado
P.O. Box 11568
Salt Lake City, UT 84147
(801)524-5592

CORPS OF ENGINEERS DISTRICT OFFICES

Lower Mississippi Valley Division

Vicksburg District
P.O. Box 60
Vicksburg, MS 39180
(601)636-1311, Ext. 401

Memphis District
668 Clifford Davis
Federal Bldg.
Memphis, TN 38103
(901)534-3221

New Orleans District
P.O. Box 60267
New Orleans, LA 70160
(504)865-1121

St. Louis District
210 North 12th St.
St. Louis, MO 63101
(314)268-2821

Missouri River Division

Omaha District
6014 USPO & Courthouse
215 North 17th St.
Omaha, NE 68102
(402)221-3900

Kansas City District
700 Federal Bldg.
Kansas City, MO 64106
(816)374-3201

North Atlantic Division

New York District
26 Federal Plaza
New York, NY 10017
(212)264-0100

Baltimore District
P.O. Box 1715
Baltimore, MD 21203
(301)962-4545

Norfolk District
803 Front Street
Norfolk, VA 23510
(703)625-8201, Ext. 231

Philadelphia District
U.S. Custom House
2nd & Chestnut Streets
Philadelphia, PA 19106
(215)597-4848

North Central Division

Chicago District
219 Deaborn St.
Chicago, IL 60604
(312)353-6400

Buffalo District
1776 Niagara st.
Buffalo, NY 14207
(716)876-5454, Ext. 200

Detroit District
P.O. Box 1027
Detroit, MI 48231
(313)226-6762

Rock Island District
Clock Tower Bldg.
Rock Island, IL 61201
(309)788-6361

St. Paul District
1135 USPO &
Customhouse
St. Paul, MN 55105
(612)725-7501

North Pacific Division

Portland District
P.O. Box 2946
Portland, OR 97209
(503)221-3700

Alaska District
P.O. Box 7002
Anchorage, AK 99510
(907)752-2605 or 279-1132

Seattle District
P.O. Box C-3755
Seattle, WA 98124
(206)764-3690

Walla Walla District
Bldg. 602
City-County Airport
Walla Walla, WA 99362
(509)525-5500, Ext. 100

Ohio River Division

Huntington District
P.O. Box 2127
Huntington, WV 25721
(304)924-9253

Louisville District
P.O. Box 59
Louisville, KY 40201
(502)582-5601

Nashville District
P.O. Box 1070
Nashville, TN 37202
(615)852-5626

Pittsburgh District
Federal Bldg.
1000 Liberty Ave.
Pittsburgh, PA 15222
(412)644-6800

South Atlantic Division

Charleston District
P.O. Box 919
Charleston, SC 29402
(803)577-4171, Ext. 229

Jacksonville District
P.O. Box 4970
Jacksonville, FL 32201
(904)791-2241

Mobile District
P.O. Box 2288
Mobile, AL 36628
(205)690-2511

Savannah District
P.O. Box 889
Savannah, GA 31402
(912)233-8822, Ext. 224

Wilmington, District
P.O. Box 1890
Wilmington, NC 28401
(919)763-9971, Ext. 466

South Pacific Division

San Francisco District
211 Main Street
San Francisco, CA 94102
(415)556-3660

Los Angeles District
P.O. Box 2711
Los Angeles, CA 90053
(213)688-5300

Sacramento District
650 Capitol Mall
Sacramento, CA 95814
(916)448-2232

Southwestern District

Albuquerque District
P.O. Box 1580
Albuquerque, NM 87103
(505)766-2732

Fort Worth District
P.O. Box 17300
Fort Worth, TX 76102
(817)334-2300

Galveston District
P.O. Box 1229
Galveston, TX 77550
(713)527-6301

Little Rock District
P.O. Box 867
Little Rock, AR 72203
(501)378-5531

Tulsa District
P.O. Box 61
Tulsa, OK 74102
(918)581-7311

Divisions Performing District Responsibilities

New England Division
424 Trapelo Rd.
Waltham, MA 02154
(617)894-2400, Ext. 200

Pacific Ocean Division
APO San Francisco, CA
96558
(808)438-1500

FLOOD INSURANCE ADMINISTRATION REGIONAL OFFICES

Region I
15 New Chardon Street
Boston, MA 02114
(617)223-2616
(CT,ME,MA,NH,RI,VT)

Region II
90 Church Street Rm 801-B
New York, NY
(212)264-4756
(NJ,NY,PR,VI)

Region III
Curtis Building
Sixth & Walnut Streets
Philadelphia, PA 19106
(215)597-9581
(DE,DC,MD,PA,VA,WV)

Region IV
1371 Peachtree St. N.E.
Atlanta, GA 30309
(404)881-2391
(AL,FL,GA,KY,MS,NC)

Region V
1 North Dearborn St.
Chicago, IL 60602
(312)353-0757
(IL,IN,MI,MN,OH,WI)

Region VI
Earle Cabell Bldg.
1100 Commerce St.
Dallas, TX 75242
(214)749-7412
(AR,LA,NM,OK,TX)

Region VII
Federal Office Building
911 Walnut Street
Kansas City, MO 64106
(816)374-3161
(IA,KS,MO,NE)

Region VIII
Rm. 311
909 17th Street
Denver, CO
(303)837-5041
(CO,MT,ND,SD,UT,WY)

Region IX
450 Golden Gate Ave.
Post Office Box 36003
San Francisco, CA 94102
(415)556-3543
(AZ,CA,HI,NV)

Region X
540 Logan Bldg.
5th and Union
Seattle, WA 98101
(206)442-1026
(AK,ID,OR,WA)

GEOLOGICAL SURVEY DISTRICT OFFICES

Northeastern Region

Connecticut
P.O. Bldg., Rm. 235
135 High Street
Hartford, CT 06103
(203)244-2528

District of Columbia
(See Maryland)

Delaware
300 S. New Street
Federal Bldg., Rm 1021
Dover, DE 19901
(302)734-2506

Illinois
605 N. Neil Street
Champaign, IL 61820
(217)359-3918

Indiana
1819 North Meridian Street
Indianapolis, IN 46202
(317)269-7101

Maine
26 Ganneston Drive
Augusta, ME 04330
(207)623-4797

Maryland
(Maryland-Delaware-
District of Columbia)
208 Carroll Bldg.
8600 LaSalle Road
Towson, MD 21204
(301)828-1535

Massachusetts
(New England District
Massachusetts, Maine,
New Hampshire, Rhode
Island, & Vermont)
150 Causeway Street
Suite 1001
Boston, MA 02114
(617)223-2822

Michigan
2400 Science Parkway
Red Cedar Research Park
Okemos, MI 48864
(517)372-1910, Ext. 561

Minnesota
Post Office BLdg.
Room 1033
St. Paul, MN 55101
(612)725-7841

New Hampshire
(See also Massachusetts)
Federal Bldg., Rm. 307
55 Pleasant Street
Concord, NY 03301
(603)224-7273

New Jersey
Federal Bldg., Rm. 420
402 East State Street
Trenton, NJ
(609)989-2162

New York
U.S. Post Office & Courthouse
Room 343
Albany, NY
(518)472-3107

Ohio
975 West Third Avenue
Columbus, OH 43212
(614)469-5553

Pennsylvania
Federal Bldg., 4th Floor
228 Walnut Street
Harrisburg, PA
(717)782-4514

Rhode Island
(See also Massachusetts)
Federal Bldg. & U.S.
Post Office, Rm. 224
Providence, RI 02903
(401)528-4389

Vermont
(See Massachusetts)

Virginia
200 West Grace street
Room 304
Richmond, VA 23220
(804)782-2427

West Virginia
Federal Bldg. &
U.S. Courthouse
500 Quarrier St. E.
Charleston, WV 25301
(304)343-6181, Ext. 310

Wisconsin
1815 University Ave.
Room 200
Madison, WI 57306
(608)262-2488

Southeastern Region

Alabama
Oil & Gas Board Boldg.
Room 202
University of Alabama
Tuscaloosa, AL
(205)752-8104

Florida
325 John Knox Road
Suite F-240
Tallahassee, FL 32303
(904)386-1118

Georgia
6481 Peachtree Industrial Blvd.
Suite B
Doraville, GA 30340
(404)526-4858

Kentucky
Federal Bldg., Rm. 572
600 Federal place
Louisville, KY 40202
(502)582-5241

Mississippi
430 Bounds Street
Jackson, MS 39206
(601)969-4600

North Carolina
Century Station
Post Office Bldg.
Room 440
Raleigh, NC
(919)755-4510

Puerto Rico
(Caribbean District, Puerto Rico & U.S. Virgin Islands)
Building 652
Ft. Buchanan [San Juan], PR 00934
(809)783-4660

South Carolina
2001 Assembly Street
Suite 200
Columbia, SC 29201
(803)765-5966

Tennessee
Federal Bldg., & U.S. Courthouse
Room A-413
Nashville, TN 37203
(615)251-5424

Central Region

Arkansas
Federal Office Bldg., Rm. 2301
700 West Capitol Avenue
Little Rock, AR 72201
(501)378-5246

Colorado
Denver Federal Center
Bldg. 53
Lakewood, CO 80225
(303)234-5092

Iowa
Federal Bldg., Rm. 269
400 South Capitol Street
Iowa City, IO
(319)337-4191

Kansas
1950 Avenue "A"
Campus West
University of Kansas
Lawrence, KS 66045
(913)864-4321

Louisiana
6554 Florida Boulevard
Baton Rouge, LA
(504)389-0281

Missouri
1400 Independence Road
Mail Stop 200
Rolla, MO 65401
(314)364-3680, Ext. 185

Montana
Federal Bldg., Rm 421
Helena, MT
(406)449-5263

Nebraska
Federal Bldg. & U.S. Courthouse, Rm 406
100 Centennial Mall N.
Lincoln, NB 68508
(402)471-5082

New Mexico
Western Bank Bldg., Rm. 815
505 Marquette, NW
Albuquerque, NM
(505)766-2246

Oklahoma
201 N.W. 3d St. Rm. 621
Oklahoma City, OK 73102
(405)231-4256

Texas
Federal Bldg., Rm. 649
300 East 8th Street
Austin, TX 78701
(512)397-5766

Wyoming
J.C. O'Mahoney Federal Center
Room 5017
2120 Capitol Avenue
Cheyenne, WY
(307)778-2220, Ext. 2153

North Dakota
New Federal Bldg., Rm 332
3d Street & Rosser Ave.
Bismarck, ND
(701)255-4011, Ext. 227

South Dakota
Federal Bldg., Rm 308
200 4th St. S.W.
Huron, S.D. 57350
(605)352-8651, Ext. 258

Utah
Federal Bldg., Room 8002
125 South State Street
Salt Lake City, UT 84138
(801)524-5663

Western Region

Alaska
218 E. Street
Anchorage, AK 99501
(907)277-5526

California
855 Oak Grove Avenue
Menlo Park, CA 94025
(415)328-8111, Ext. 2326

Hawaii
300 Ala Moana Blvd. Rm. 6110
Honolulu, HI
(808)546-8331

Arizona
Federal Building
301 W. Congress St.
Tuscon, AZ 85701
(602)792-6671

Guam
(see also Hawaii)
P.O. Box Y
U.S. Navy Public Works Center, Bldg. 104
Agana, GU 96910
339-9123 (commercial operator for overseas call)

Idaho
Federal Bldg. Rm 365
550 West Fort Street
Boise, ID 83724
(208)384-1750

Nevada
Federal Bldg. Rm. 227
705 North Plaza St.
Carson City, NV 89701
(702)882-1388

Oregon
830 N.E. Holladay St.
Portland, OR 97232
(503)234-3361, Ext. 4776

Washington
1201 Pacific Avenue, Suite 600
Tacoma, WA 98402
(206)593-6510

SOIL CONSERVATION SERVICE STATE OFFICES

Alabama
Wright Building 138 Gay St.
P.O. Box 311
Auburn, AL 36830
(205)229-4542

Alaska
Professional Bldg. Suite 129
2221 E. Northern Lights Blvd.
Anchorage, AK 99504
(907)276-4246

Arizona
230 North 1st Ave.
3008 Federal Bldg.
Phoenix, AZ 85025
(602)261-6711

Arkansas
Federal Office Bldg.
Rm. 5029
700 W. Capitol St.
P.O. Box 2323
Little Rock, AR 72203
(501)378-5445

California
2828 Chiles Rd.
Davis, CA 95616
(916)758-2200, Ext. 210

Colorado
2490 W. 26th Ave.
Rm. 313
P.O. Box 17107
Denver, CO 80217
(303)837-3947

Connecticut
Mansfield Prof. Park
Route 44A
Storrs, CT 06268
(203)429-9361

Delaware
Treadway Towers
Suite 2-4
9 East Loockerman St.
Dover, DE 19901
(302)678-0750

Florida
Federal Building
P.O. Box 1208
Gainesville, FL 32601
(904)377-8732

Georgia
Federal Bldg.
355 E. Hancock Ave.
P.O. Box 832
Athens, GA 30603
(404)546-2274

Hawaii
440 Alexander Young Bldg.
Honolulu, HI 96813
(808)546-3165

Idaho
Rm. 345, 304 N. 8th St.
Boise, ID 83702
(208)384-1601, Ext. 1601

Illinois
Federal Bldg.
200 W. Church St.
P.O. Box 678
Champaign, IL 61820
(217)356-3785

Indiana
Atkinson Sq. W.
Suite 2200
5610 Crawfordsville Rd.
Indianapolis, IN 46224
(317)269-6515

Iowa
823 Federal Bldg.
210 Walnut St.
Des Moines, IA 50309
(515)862-4260

Kansas
760 S. Broadway
P.O. Box 600
Salina, KS 67401
(913)825-9535

Kentucky
333 Waller Ave.
Lexington, KY 40504
(606)233-2749

Louisiana
3737 Government St.
P.O. Box 1630
Alexandria, LA 71301
(318)448-3421

Maine
USDA Bldg.
University of Maine
Orono, ME 04473
(207)866-2132

Maryland
Rm. 522 Hartwick Bldg.
4321 Hartwick Rd.
College Park, MD 20740
(301)344-4180

Massachusetts
29 Cottage St.
Amherst, MA 01002
(413)549-0650

Michigan
1405 S. Harrison Rd.
East Lansing, MI 48823
(517)372-1910

Minnesota
200 Federal Bldg. & U.S.
Courthouse
316 N. Robert St.
St. Paul, MN 55101
(612)725-7675

Mississippi
Milner Bldg.
7210 S. Lamar St. Rm
590
P.O. Box 610
Jackson, MS 39205
(601)969-4330

Missouri
555 Vandiver Dr.
Columbia, MO 65201
(314)442-2271, Ext. 3155

Montana
Federal Bldg.
P.O. Box 970
Bozeman, MT 59715
(406)587-5271, Ext. 4322

Nebraska
Room 345, Federal Bldg.
100 Centennial Mall North
Lincoln, NE 68508
(402)471-5301

Nevada
U.S. Post Office Bldg.
P.O. Box 4850
Reno, NV 89505
(702)784-5304

New Hampshire
Federal Bldg.
Durham, NH 03824
(603)868-7581

New Jersey
1370 Hamilton St.
P.O. Box 219
Somerset, NY 08873
(202)246-1205, Ext. 20

New Mexico
517 Gold Ave. S.W.
P.O. Box 2007
Albuquerque, NM 87103
(505)766-2173

New York
U.S. Courthouse &
Federal Bldg.
Room 771
100 S. Clinton St.
Syracuse, NY 13202
(305)423-5493

North Carolina
310 New Bern Ave.
Rm. 544 Fed. Office Bldg.
P.O. Box 27307
Raleigh, NC 27611
(919)755-4165

North Dakota
Federal Bldg.
Rosser Ave. & 3d St.
P.O. Box 1458
Bismarck, ND 58501
(701)255-4011, Ext. 421

Ohio
Federal Bldg.
200 N. High St. Rm. 522
Columbus, OH 43215
(614)469-6785

Oklahoma
USDA Agricultural
Ctr. Bldg.
Farm Rd. & Brumley St.
Stillwater, OK 74074
(405)372-7111, Ext. 204

Oregon
Federal Office Bldg.
1220 S.W. Washington St.
Portland, OR 97209
(503)221-2751

Pennsylvania
Federal Bldg. &
Courthouse
P.O. Box 985
Federal Square Station
Harrisburg, PA 17108
(717)782-4403

Puerto Rico
Caribbean Area
G.P.O. Box 4868
Hato, Rey, PR 00936
(809)753-4206

Rhode Island
222 Quaker Lane
West Warwick, RI 02893
(401)828-1300

South Carolina
240 Stoneridge Dr.
Columbia, SC 29210
(803)765-5681

South Dakota
239 Wisconsin Ave. S.W.
P.O. Box 1357
Huron, SD 57350
(605)352-8651

Tennessee
675 U.S. Courthouse
Nashville, TN 37203
(615)749-5471

Texas
P.O. Box 648
101 S. Main St.
Temple, TX 76501
(817)773-1711, Ext. 331

Utah
4012 Federal Bldg.
125 South State St.
Salt Lake City, UT 84138
(801)524-5051

Vermont
1 Burlington Sq.
Suite 205
Burlington, VT 05401
(802)862-6501, Ext. 6261

Virginia
400 N. 8th St.
P.O. Box 10026, Federal Bldg.
Rm. 9201
Richmond, VA 23240
(804)782-2457

Washington
360 U.S. Courthouse
W. 920 Riverside Ave.
Spokane, WA 99201
(509)456-3711

West Virginia
75 High St.
P.O. Box 865
Morgantown, WV 26505
(304)599-7151

Wisconsin
4601 Hammersley Rd.
P.O. Box 4248
Madison, WI 53711
(608)252-5351

Wyoming
Federal Office Bldg.
P.O. Box 2440
Casper, WY 82601
(307)265-5550, Ext. 3217

APPENDIX B

SELECTED BIBLIOGRAPHY

SELECTED BIBLIOGRAPHY

The following publications are suggested for reading by the Meteorologist/Hydrologist. This list does not in any way provide a comprehensive review of the literature related to flood warning. The selection was made only to introduce some of the social, economic, engineering and other aspects with which staff engaged in the flood and flash flood warning program should be familiar. Most of the listed publications contain bibliographies of relevant materials for those who wish to read further.

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Anderson, William A. "Social Structures and the Role of the Military in Natural Disaster." Reprinted from Sociology and Social Research 53. Reprint #20. Disaster Research Center, The Ohio State University. Columbus, Ohio. January 1969.

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Dynes, Russell R., E.L. Quarantelli and Gary A. Kreps. A Perspective on Disaster Planning. Prepared for Defense Civil Preparedness Agency. Washington, DC. Disaster Research Center. The Ohio State University. Columbus, OH. June 1972.

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_____. "Managing Floodplains to Reduce Flood Hazard." Journal of Soil and Water Conservation. Vol. 31. No. 2. March-April 1976.

Owen, H. James. Annotations of Selected Literature on Nonstructural Flood Plain Management Measures. Prepared for the Hydrologic Engineering Center. U.S. Army Corps of Engineers. Davis, CA. March 1977.

Owen, H. James. Guide for Flood and Flash Flood Preparedness Planning. Prepared for the U.S. Department of Commerce. National Weather Service. May 1977.

Quarantelli, E.L. and Russell R. Dynes. Images of Disaster Behavior: Myths and Consequences. Preliminary Paper #5. Disaster Research Center, The Ohio State University. Columbus, OH. February 1973.

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APPENDIX C

SELECTED DOCUMENTS

FOR IMMEDIATE RELEASE MAY 24, 1977

Office of the White House Press Secretary

THE WHITE HOUSE

EXECUTIVE ORDER

- - - - - - -

FLOODPLAIN MANAGEMENT

By virtue of the authority vested in me by the Constitution and statutes of the United States of America, and as President of the Uni d States of America, in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4001 et seq.), and the Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Stat. 975), in order to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative, it is hereby ordered as follows:

Section 1. Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Sec. 2. In carrying out the activities described in Section 1 of this Order, each agency has a responsibility to evaluate the potential effe-s of any actions it may take in a floodplain; to ensure that its planning programs and budget requests reflect consideration of flood hazards and floodplain management; and to prescribe procedures to implement the policies and requirements of this Order, as follows:

(a)(1) Before taking an action, each agency shall determine whether the proposed action will occur in a floodplain -- for major Federal actions significantly affecting the quality of the human environment, the evaluation required below will be included in any statement prepared under Section 102(2)(C) of the National Environmental Policy Act. This determination shall be made according to a Department of Housing and Urban Development (HUD) floodplain map or a more detailed map of an area, if available. If such maps are not available, the agency shall make a determination of the location of the floodplain based on the best available information. The Water Resources Council shall issue guidance on this information not later than October 1, 1977.

(2) If an agency has determined to, or proposes to, conduct, support, or allow an action to be located in a floodplain, the agency shall consider alternatives to avoid adverse effects and incompatible development in the floodplains. If the head of the agency finds that the only practicable alternative consistent with the law and with

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the policy set forth in this Order requires siting in a floodplain, the agency shall, prior to taking action, (i) design or modify its action in order to minimize potential harm to or within the floodplain, consistent with regulations issued in accord with Section 2(d) of this Order, and (ii) prepare and circulate a notice containing an explanation of why the action is proposed to be located in the floodplain.

(3) For programs subject to the Office of Management and Budget Circular A-95, the agency shall send the notice, not to exceed three pages in length including a location map, to the state and areawide A-95 clearinghouses for the geographic areas affected. The notice shall include: (i) the reasons why the action is proposed to be located in a floodplain; (ii) a statement indicating whether the action conforms to applicable state or local floodplain protection standards and (iii) a list of the alternatives considered. Agencies shall endeavor to allow a brief comment period prior to taking any action.

(4) Each agency shall also provide opportunity for early public review of any plans or proposals for actions in floodplains, in accordance with Section 2(b)of Executive Order No. 11514, as amended, including the development of procedures to accomplish this objective for Federal actions whose impact is not significant enough to require the preparation of an environmental impact statement under Section 102(2)(C) of the National Environmental Policy Act of 1969, as amended.

(b) Any requests for new authorizations or appropriations transmitted to the Office of Management and Budget shall indicate, if an action to be proposed will be located in a floodplain, whether the proposed action is in accord with this Order.

(c) Each agency shall take floodplain management into account when formulating or evaluating any water and land use plans and shall require land and water resources use appropriate to the degree of hazard involved. Agencies shall include adequate provision for the evaluation and consideration of flood hazards in the regulations and operating procedures for the licenses, permits, loan or grants-in-aid programs that they administer. Agencies shall also encourage and provide appropriate guidance to applicants to evaluate the effects of their proposals in floodplains prior to submitting applications for Federal licenses, permits, loans or grants.

(d) As allowed by law, each agency shall issue or amend existing regulations and procedures within one year to comply with this Order. These procedures shall incorporate the Unified National Program for Floodplain Management of the Water Resources Council, and shall explain the means that the agency will employ to pursue the nonhazardous use of riverine, coastal and other floodplains in connection with the activities under its authority. To the extent possible, existing processes, such as those of the Council on Environmental Quality and the Water Resources Council, shall be utilized to fulfill the requirements of this Order. Agencies shall prepare their procedures in consultation with the Water Resources Council, the Federal Insurance Administration, and the Council on Environmental Quality, and shall update such procedures as necessary.

Sec. 3. In addition to the requirements of Section 2, agencies with responsibilities for Federal real property and facilities shall take the following measures:

(a) The regulations and procedures established under Section 2(d) of this Order shall, at a minimum, require the construction of Federal structures and

facilities to be in accordance with the standards and criteria and to be consistent with the intent of those promulgated under the National Flood Insurance Program. They shall deviate only to the extent that the standards of the Flood Insurance Program are demonstrably inappropriate for a given type of structure or facility.

(b) If, after compliance with the requirements of this Order, new construction of structures or facilities are to be located in a floodplain, accepted floodproofing and other flood protection measures shall be applied to new construction or rehabilitation. To achieve flood protection, agencies shall, wherever practicable, elevate structures above the base flood level rather than filling in land.

(c) If property used by the general public has suffered flood damage or is located in an identified flood hazard area, the responsible agency shall provide on structures, and other places where appropriate, conspicuous delineation of past and probable flood height in order to enhance public awareness of and knowledge about flood hazards.

(d) When property in floodplains is proposed for lease, easement, right-of-way, or disposal to non-Federal public or private parties, the Federal agency shall (1) reference in the conveyance those uses that are restricted under identified Federal, State or local floodplain regulations; and (2) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successors, except where prohibited by law; or (3) withhold such properties from conveyance.

Sec. 4. In addition to any responsibilities under this Order and Sections 202 and 205 of the Flood Disaster Protection Act of 1973, as amended (42 U.S.C. 4106 and 4128), agencies which guarantee, approve, regulate, or insure any financial transaction which is related to an area located in a floodplain shall, prior to completing action on such transaction, inform any private parties participating in the transaction of the hazards of locating structures in the floodplain.

Sec. 5. The head of each agency shall submit a report to the Council on Environmental Quality and to the Water Resources Council on June 30, 1978, regarding the status of their procedures and the impact of this Order on the agency's operations. Thereafter, the Water Resources Council shall periodically evaluate agency procedures and their effectiveness.

Sec. 6. As used in this Order:

(a) The term "agency" shall have the same meaning as the term "Executive agency" in Section 105 of Title 5 of the United States Code and shall include the military departments; the directives contained in this Order, however, are meant to apply only to those agencies which perform the activities described in Section 1 which are located in or affecting floodplains.

(b) The term "base flood" shall mean that flood which has a one percent or greater chance of occurrence in any given year.

(c) The term "floodplain" shall mean the lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year.

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Sec. 7. Executive Order No. 11296 of August 10, 1966, is hereby revoked. All actions, procedures, and issuances taken under that Order and still in effect shall remain in effect until modified by appropriate authority under the terms of this Order.

Sec. 8. Nothing in this Order shall apply to assistance provided for emergency work essential to save lives and protect property and public health and safety, performed pursuant to Sections 305 and 306 of the Disaster Relief Act of 1974 (88 Stat. 148, 42 U.S.C. 5145 and 5146).

Sec. 9. To the extent the provisions of Section 2(a) of this Order are applicable to projects covered by Section 104(h) of the Housing and Community Development Act of 1974, as amended (88 Stat. 640, 42 U.S.C. 5304(h)), the responsibilities under those provisions may be assumed by the appropriate applicant, if the applicant has also assumed, with respect to such projects, all of the responsibilities for environmental review, decisionmaking, and action pursuant to the National Environmental Policy Act of 1969, as amended.

JIMMY CARTER

THE WHITE HOUSE,
May 24, 1977.

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SECTION 73

OF

THE WATER RESOURCES

DEVELOPMENT ACT OF 1974

(PUBLIC LAW 93-251)

(a) In the survey, planning, or design by any Federal agency of any project involving flood protection, consideration shall be given to nonstructural alternatives to prevent or reduce flood damages including, but not limited to, floodproofing of structures; flood plain regulation; acquisition of flood plain lands for recreational, fish and wildlife, and other public purposes; and relocation with a view toward formulating the most economically, socially, and environmentally acceptable means of reducing or preventing flood damages.

* (b) Where a nonstructural alternative is recommended, non-Federal participation shall be comparable to the value of lands, easements and rights-of-way which would have been required of non-Federal interests under Section 3 of the Act of June 27, 1936 (Public Law Numbered 738, Seventy-fourth Congress), for structural protection measures, but in no event shall exceed 20 per centum of the project costs.