PROGRAM DEVELOPMENT PLAN

COASTAL HAZARDS PROGRAM

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Survey

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U.S. DEPARTMENT OF COMMERCE
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NATIONAL OCEAN SURVEY

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PROGRAM DEVELOPMENT PLAN

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PART I

1.0 EXECUTIVE SUMMARY

The NOAA Coastal Hazards Program has been developed in response to the threat of hurricanes, severe storms, tornadoes, flooding, erosion, and subsidence along the coastal regions of the United States. This initiative responds to one of the goals of the national coastal protection policy announced in the President's August 2, 1979, Environmental Message to Congress--"to manage coastal development to minimize loss of life and property from floods, erosion, saltwater intrusion and subsidence."

1.1 PURPOSE AND SCOPE

The purpose of the program is to minimize the loss of life, the injury to people, and damage to property by assisting in developing local evacuation procedures, hazards education programs, and floodplain land use policy.

The program is designed to coordinate Federal grants, basic environmental data, technical information, land use management techniques, and local expertise so that local institutions can develop hazards plans to fit their specific problems and requirements.

The program will be carried out by fostering the development of individual hazards plans for 39 geographic coastal regions. A period of 32 months is required to develop and implement each

plan. Five new plans will be started each year, which means the coordination of 15 projects in various stages of development each year during the life of the program.

To accomplish the work required to develop a regional plan, the following will be carried out in support of local disaster planning officials: Storm Surge Modeling, Preparation of Climate Data Packages, Coastal Mapping, Warning Coordination, Public Education, Land Use Control, and Program Management.

1.2 GENERAL

Coastal areas in the United States are affected by a wide range of natural hazards which threaten lives and property. Although many Federal programs are designed to aid coastal residents in coping with these hazard problems, comprehensive coastal hazard planning at the state and local level frequently is missing.

More than 61 million individuals live and work in counties which are within 50 miles of the Gulf of Mexico and the Atlantic Ocean, and the number increases every day. The national shoreline population is increasing three times faster than growth rates for other areas. More than 53 percent of the total industrial base of the U.S. is located within the coastal region. Consequently, more and more people face hurricane and coastal storm threats. Many of these people have never experienced the destructive powers of these storms and live with a false sense of security.

A critical need exists for plans and programs to avoid the use of flood-prone areas, to develop a sense of awareness before a hazardous condition occurs, and to evacuate people when hazards occur. Developing these plans requires the coordination of a multitude of management actions and technical information.

The Administration has placed a high priority on disaster planning and preparedness with the formation of the Federal Emergency Management Agency (FEMA) in June 1978, and the establishment of the Federal Emergency Council (FEC) in July 1979. FEMA has responsibility for coordinating emergency preparedness, mitigation, and response activities in order to strengthen our ability to deal effectively with emergencies. A goal of FEMA is to develop and implement nationwide plans for responding to all types of hazards and disasters, including those in coastal area, primarily by coordination among Federal, State, and local agencies.

The scope of the National disaster problem is so large that FEMA does not have the resources to attack all parts of the problem in detail. Whenever possible FEMA is mandated to delegate responsibilities to other Federal agencies as extensions of the regular missions of those agencies. NOAA, because of its statutory responsibility under the Coastal Zone Management Act of 1972 coupled with its role in supplying oceanic, atmospheric, and coastal environmental data and services, has the resources, experience, and expertise to approach the coastal hazards problem in a comprehensive fashion. FEMA has indicated that NOAA should

play an important role in assisting in developing and implementing plans for coastal areas and has indicated support for NOAA's coastal hazard initiative.

NOAA components collectively provide much of the environmental data, technical leadership, and financial assistance required for developing coastal zone management programs and initial efforts to cope with the problems of coastal hazards. Products and services of these ongoing programs will be increased and modified in direct response to the needs of each individual region. New projects will be initiated to provide products and services not now available.

1.3 MANAGEMENT RESPONSIBILITY

Overall responsibility for the NOAA Coastal Hazards Program is assigned to the Director, National Ocean Survey (NOS). The Coastal Hazards Program Office will be established within NOS to manage the program and to be the central point for coordination of all NOAA coastal hazards-related programs and for coordination with other Federal and state agencies.

1.4 RESOURCES

An initial staff of five from NOS resources will be assigned to the program office to manage and administer the program. A major portion of the program will be carried out by the coordination of Federal grants to state, regional agencies, and academic institutions.

Existing NOAA programs which contribute to this coastal hazards effort are funded at a total of $525K in FY 1980. An increase of $750K in the President's FY 1981 budget request for storm surge modeling and reallocation of $150K by CZ for FY 1981 only will bring the total to $1425K. This plan calls for an increase of $2115K beginning in FY 1983 for a total base of $3300K through FY 1985. The program will begin to decrease thereafter as the regional plans are completed.

PART II

2.0 INTRODUCTION

2.1 BACKGROUND

This document presents a program designed to be of major assistance in minimizing loss of life and property in coastal areas which can result from the occurrences of natural hazards. A major function of the program will be to coordinate the many products and services of the National Weather Service (NWS), the National Ocean Survey (NOS), the National Environmental Satellite Service (NESS), the Environmental Data and Information Service (EDIS), the Office of Sea Grant (SG), the Office of Coastal Zone Management (CZ) and the Environmental Research Laboratories (ERL) to assist states and local areas in developing natural hazard plans.

The Office of Coastal Zone Management is presently undertaking a Presidentially mandated review of all Federal programs in the coastal zone. One of the areas receiving special attention in this review is coastal hazards. The results of this Federal program review will be incorporated into NOAA's program. It is not anticipated that this review will materially alter the thrust of the program described in this document.

A special NOAA Task Group was formed in 1978 to provide the Administrator with a report on NOAA programs related to reducing development in flood-prone coastal areas and preparedness

planning at the local level. The report listed a host of programs which provide environmental data and technical services critical to local hazards planning. The Task Group concluded that while existing NOAA programs provide valuable information and services, they do so at a level far below their potential to meet user needs because common opportunities, program activities, and points of contact outside NOAA are not identified and sufficient lines of communication have not been established.

The Task Group made three recommendations: (1) the unique capabilities of all NOAA programs should be redirected and integrated to achieve the common goals of a Federal hazards program; (2) the level of effort should be increased to meet user requirements; (3) a central office should be established for internal and external coordination.

The total Federal program to mitigate the effects of natural coastal hazards should address the following six areas:

1) Long-range hazard mitigation planning
2) Preparedness planning
3) Disaster event activity
4) Post-disaster relief
5) Reconstruction and development assistance
6) Natural area protection

Although Federal efforts are evident to varying degrees in all of these areas, comprehensive coastal hazard planning at the state and local level to focus the total effort and promote

consistency in all of these areas is frequently missing. Although FEMA has primary responsibility for the hazards problem, it is appropriate for NOAA to assist in filling this gap because of its statutory responsibility under the Coastal Zone Management Act of 1972 and because it is the principal supplier of oceanic, atmospheric, and coastal zone environmental data and services to the nation. The Office of Coastal Zone Management has begun to attack the problem by requiring states to allocate up to 20 percent of their Section 306 development grants for protection of natural systems, management of coastal development, public access to the coast and coordination of government procedures.

2.2 SCOPE OF THE PROGRAM

NOAA, through its NOS, NWS, EDIS, NESS, SG, and ERL programs, has responsibility for detection, warning, research, and preparedness activities related to several of the hazards described below. In its role as administrator of the Federal coastal zone management program, NOAA requires that each state address the coastal hazards within that state's boundaries; in this capacity NOAA has indirect responsibility for all the hazards described below.

Hurricanes and severe storms: More than 6 million people are currently exposed to hurricane storm surge in areas where the population is growing at a rate 3 to 4 times the national average. Although warning systems are improving, the expanding occupation of vulnerable areas and the lack of hurricane experience by new residents results in an enlarging naive

population and high volume of property subject to damage. High winds and tornadoes may extend the impacts to much larger populations.

Floods: Valleys subject to freshwater flooding punctuate the coast in many sectors and in some places have been protected by engineering works. The requirements of the Flood Insurance Act for local land use planning in vulnerable areas have spurred the delineation of flood hazard lands and the enactment of local land use regulations to curb the increasing trend toward expansion of property in lands subject to floods.

Erosion: In about one-quarter of the national shore front, coastal erosion is significant and in as many as 2,700 miles it is a critical problem. In addition to protective works, dune stabilization, and beach nourishment, a wide range of land use controls is available to cope with continued erosion. Currently, there is a shift in emphasis toward land use management as an alternative strategy to erosion control.

Landslide: Although the landslide hazard occurs widely, no explicit national policy exists for dealing with it. Only recently and in a few states has extensive effort been undertaken to combine land management with abatement of the landslide hazard.

Earthquake: Accurate and consistent earthquake prediction has not yet been demonstrated. Other measures which promise major reduction in vulnerability to earthquake damage include the requirement of earthquake resistant construction, land use management, and preparedness planning. The Earthquake Hazard

Reduction Act of 1977 sets forth the nation's commitment to establishing an earthquake hazard reduction program in the U.S. Geological Survey and the National Science Foundation.

Tsunami: The amount of property and number of lives susceptible to these rare but catastrophic events on the Pacific Coast and Hawaii are mounting. Except for an improved warning system and for pioneering efforts in Hawaii, relatively little positive action has been taken to reduce vulnerability to tsunami waves.

Volcano: The lava flows of Hawaii are relatively well defined and susceptible to prediction. Pyroclastic flows and ash flows resulting from violent eruptions are more or less predictable, are less frequent, and constitute a large but rare threat along the Pacific Coast and Alaska.

Avalanche: In a few parts of Alaska, snow avalanches are a significant hazard, and only recently has serious consideration been given to a variety of measures, including land management, to deal with them.

Subsidence: In parts of both the California and Gulf coasts, land subsidence resulting from earthquakes as well as from pumping of water, oil and gas is significant. This sinking of coastal lands increases vulnerability to other hazards such as storm surge.

The primary focus of this plan is on those hazards for which the probability of significant loss of life and property is high, and those for which NOAA has a unique opportunity to mitigate adverse effects. Hurricanes, severe storms, and flooding pose

the greatest risk to the coastal population. Of all coastal hazards, hurricanes and the accompanying flooding have the greatest potential for the loss of lives and destruction of property in a single occurrence. This potential for loss of life can be effectively reduced through discouraging development in hazard prone areas, through land use controls, as well as by use of highly developed warning systems and evacuation procedures so that no lives are lost even with the advent of the most severe storm.

The NWS is responsible for operating the Pacific Tsunami Warning System. The occurrence of destructive tsunamis is a rare event and the warning system appears to work effectively at present. Some additional coordination between state and Federal agencies would help ensure the overall effectiveness of the system, and this issue is addressed by this Plan.

Shoreline erosion and coastal land subsidence are natural hazards that are destructive to property but they are rarely responsible for loss of life. NOAA collects and archives scientific data which can be used to designate high risk erosion and subsidence areas. However, such designation is not presently being done and this lack of action is a problem which is addressed in this Plan.

The scope of the PDP does not include volcanoes and avalanches because these hazards are no more common in coastal areas than in other geographical areas.

PART III

3.0 GOALS AND OBJECTIVES

3.1 PROGRAM GOALS

The goals of the Coastal Hazards Program are to minimize the injury to people, loss of life, damage to personal and public property, and damage to natural resources which can result in the coastal regions from the occurrences of significant natural hazards.

3.2 PROGRAM OBJECTIVES

The objectives of the Coastal Hazards Programs are to:

- Establish 39 regional projects to develop plans and programs to deal with natural hazards in those regions by 1988.
- Provide data and information on weather, climate, ocean behavior, hydrology, and coastal topography to state and local agencies by 1988.
- Provide technical assistance to state and local agencies in dealing with scientific and technical aspects of hazards plan development.
- Provide assistance to state and local agencies to establish land use policies that will minimize damage from coastal hazards.

- Coordinate the activities of NOAA agencies, and integrate them with other Federal, state and local agencies, particularly FEMA[1].

[1]According to the MOU with FEMA.

PART IV

4.0 TECHNICAL APPROACH

4.1 GENERAL

The technical approach followed in the development of this program is based on answers to the following questions:

1. Why do a hazards plan? (i.e. What are the benefits and costs associated with it?)
2. What is needed in a comprehensive hazards plan?
3. What parts are already being done? What else needs to be done? By whom?
4. Who will coordinate the planning process?

On the basis of the answers to these questions, Technical Development Plans (TDP's) will be developed which are tailored to the needs of each region and specific subtasks will be identified. Techniques for priority setting among regions and program schedules are also detailed in the following sections.

4.2 BENEFIT - COST ANALYSIS

The immediate benefit of the NOAA Coastal Hazards Program is increased safety of coastal residents. In areas where hazard plans based on NOAA's environmental data, storm surge models, coastal maps, and forecast and warnings, have been developed and

adopted, local officials will be able to respond quickly and effectively to hazards and prevent casualties which would otherwise occur. Long-term benefits will be wiser use of coastal lands resulting from the land use planning built into each local plan. The total Federal effort to mitigate the effects of coastal hazards is expected to reduce building losses alone by $1 billion by the year 2000 and this program will be able to claim a significant portion of these savings. In addition, the NOAA Coastal Hazards Program, cooperating with CZ, FEMA and other Federal agencies, will be an effective deterent to future damage to our coastal natural resources.

4.2.1 COST OF NATURAL HAZARDS

The primary focus of this program is on hurricane with the accompany storm surge, severe storm, and coastal flooding, with secondary emphasis put on erosion and land subsidence. The following data on the effects of these hazards and possible mitigations are taken directly from "Natural Hazards, A Public Policy Assessment," prepared for NSF by J.H. Wiggins Company; and "Natural Hazard Management in Coastal Areas," prepared for NOAA by the Institute of Behavioral Science the University of Colorado.

Natural Hazards, a Public Policy Assessment is a comprehensive assessment of the effects and possible mitigations for nine natural hazards; earthquake, landslides, expansive soils, riverine flooding, storm surge, tsunami, tornadoes, hurricanes, and severe winds. Annual expected dollar losses with

present mitigating strategies, are derived from historic damage rates for each state and county in the United States, the probability of hazard occurrence within each area, and the level of vulnerability of area buildings, and property to hazard-induced damage. These losses are first derived for 1970 (in 1970 dollars) by treating all of the losses which are expected to occur over a large number of years as though the losses were sustained in equal amounts during each of the several years of exposure. Projections of these values to the year 2000 (in 1970 dollars) were based on the use of regression equations derived from national population and income projections. The expected loss of life is derived from the relationship between damages and the number of lives lost. Projected loss reductions are based on the prudent use of avoidance, building strengthening, site preparation and building removal strategies, the cost associated with the use of these strategies and the implications to natural hazard management programs. Expected losses from hurricanes, storm surge, and coastal riverine flooding are taken from this study.

Natural Hazard Management in Coastal Areas is one of a series of documents prepared for the Office of Coastal Zone Management to provide guidance and information to coastal planners and managers on major coastal issues. It does not analyze the cost of natural hazards or the benefits of mitigation strategies but does contain cost estimates gathered from other studies. Data on erosion and subsidence were taken from this publication.

Hurricanes

Hurricanes cause devastation by wind, flood producing rain, and the most lethal of all, the storm surge. For purposes of this discussion, however, only hurricane wind is considered. Flooding and storm surge are covered in the next two sections.

The most significant portion of the United States coastline at risk is along the Gulf and Atlantic Coasts. Since the beginning of the 20th Century, despite the increasing population density in this area, the number of lives lost due to hurricane has been decreasing. This has occurred as a result of improved prediction and warning systems. However, property losses continue to rise. There is continuing concern that the increasing population, along with ineffective building codes, and inappropriate land use, may lead to a major hurricane disaster along the Gulf or Atlantic Coasts. In a recent address, Richard A. Frank, Administrator of NOAA, said, "A hurricane will kill hundreds, if not thousands of Americans, and cause billions of dollars of property damage sometime soon. I do not know precisely when or where, but it will happen."

Hurricane Frederic, which struck the Alabama Coast on September 12, 1979, is a good example of what Richard Frank was talking about. Frederic, with winds reaching 145 mph, moved over Dauphin Island (near the mouth of Mobile Bay) and inland just west of Mobile, Alabama. Storm tides of 8 to 12 feet above normal were reported from Pascagoula, Mississippi, to Santa Rosa Island, Alabama. Although only 5 deaths have been directly

attributed to Frederic in the U.S., the damage estimate of $2.3 billion makes it the costliest hurricane ever to hit the United States. When a hurricane of this magnitude hits a more highly developed, less prepared coastal area, hundreds, if not thousands, of American lives could well be lost.

The annual expected loss due to hurricane wind by the year 2000 is 153 deaths and $3.2 billion in property damage (Table 4-1).

STORM SURGE

A storm surge is an event in which the coastal water level rises above the level associated with normal tidal action. The most heavily-affected areas of the United States are the Atlantic and Gulf Coasts. Increases in water level along the Gulf and Southern Atlantic coastline generally are caused by hurricanes and other less intense tropical storms. Along the northern Atlantic coastline storm surges are caused mainly by extra tropical winter storms called "Northeasters." When these storms approach land, extremely large waves may be superimposed on the high waters moving toward the coast.

Storm surges generally are associated with two types of damage: (1) still water effects associated with simple inundation of a structure or land area and, (2) wave action effects induced by the pounding of waves against a structure. Inundation (still water) damage is very similar to that caused by

riverine inundation of corresponding depths, except for the increased damage which results from the more corrosive effects of salt water.

Storm surge is expected to produce 103 deaths and $2.3 billion in property damage annually by the year 2000 (Table 4-1).

RIVERINE FLOODING

Since the earth took its present form, the periodic flooding of lands adjacent to streams and rivers have been an ever-present characteristic of the human environment. Caused by stream flows which exceed the capacity of the normal water course, riverine flooding involves the spill-over of above-normal stream flows onto the lands immediately adjacent to the normal water course. Those adjacent lands which are subject to such intermittent flow-determined flooding are referred to as the stream or river's floodplain.

By the year 2000, fresh water flooding is expected to cause 159 deaths and $3.1 billion in property damage. At least 10 percent of these losses will be in the coastal zone (Table 4-1).

COASTAL EROSION

Coastal erosion is the set of processes by which more shore material is removed than deposited. This is accomplished by water, wind, gravity, or biological (including human) action. Waves and tides are the most frequent agents of erosion but ice may contribute to structural damages in the Great Lakes and draught has increased California's erosion losses by reducing the

sediment delivery capacity of coastal streams. Overused and poorly vegetated dunes are subject to migration and wind erosion. About one-quarter of the Nation's shorefront (20,500 miles) is subject to significant coastal erosion.

Average annual losses due to erosion have been conservatively estimated at $300 million in 1975. Most of this stems from damage to private homes, beaches, and shore protection structures. Deaths are extremely rare. As coastal areas continue to attract industries seeking tidewater sites, support facilities, nuclear power plants, and second home owners and retirees, the toll of losses is certain to increase. By the year 2000, these losses could easily amount to $500 million per year (Table 4-1).

SUBSIDENCE

Land subsidence is the relative sinking of the earth's crust in limited areas. The cause includes withdrawal of fluids, underground solution or erosion of rocks, lateral flow of earth materials under loading, drainage of peat lands, mining, tectonic movements, and volcanic activity.

Although most states experience subsidence problems, only Alabama, California, Florida, Illinois, Louisiana, Michigan, New Jersey, New York, Ohio, Pennsylvania, Texas, and Washington have encountered this hazard in their coastal zone.

The most obvious and extensive consequence in coastal zones is the loss of low-lying lands through submergence. Of equal potential importance is the increased amount of land exposed to

flooding from hurricane storm surge or riverine flooding. Expected losses due to storm surge or fresh water flooding in areas where subsidence has occurred is included in the loss estimates for these hazards, but monetary estimates for the loss of real estate through submergence are not available although these losses could easily amount to $100 million per year in the highly developed areas of the coast (Table 4-1).

4.2.2 BENEFITS OF THE NOAA COASTAL HAZARDS PROGRAM

The goals of the NOAA Coastal Hazards Program are to minimize suffering and death, damage to property, and damage to our natural resources. To accomplish these goals, seven specific tasks have been established; storm surge modeling, production of environmental data packages, coastal mapping, land use management (including hazard resistant building codes, post disaster planning, and hazard avoidance), warning coordination, public education, and management. In the following, the benefits of this program are discussed in terms of these goals and tasks. The total cost of the program, as shown in Table 6-2, is the additional funds shown for the FY 1981-FY 1984 period or $17.5 million, which includes the FY 1981 storm surge initiative.

LOSS OF LIFE

In Section 4.21 estimates of the number of deaths resulting from hurricane wind (153) storm surge (103), and coastal riverine flooding (16) total 272 per year by 2000. Since these estimates are based on treating all of the losses which are expected over a

large number of years as though they occurred in equal amount during each year, they actually represent a small number of events over a large number of years, each of which could cost thousands of American lives.

The NOAA Coastal Hazards Program is designed to minimize these deaths by (1) evacuation plans, based on storm surge models historic environmental data, evacuation maps, public education, and warning coordination which will ensure that residences are able to leave the coastal area before a disaster strikes and (2) improved land use management which will limit the number of people who must be evacuated. The NSF study sited above found a high correlation between death and property damage which led to the conclusion that the most effective means for avoiding hazard-induced life loss are those involving: (1) avoidance of high hazard areas; (2) hazard warning and evacuation systems; and (3) rapid extension of high quality emergency medical and survival-promoting services to disaster victims. The NOAA Coastal Hazards Program, which contains all of these elements, is expected to save many of these lives.

DAMAGE TO PROPERTY

The total annual property loss from natural coastal hazards (hurricane wind, storm surge, coastal riverine flooding, erosion, and subsidence) by the year 2000 is expected to be $6.4 billion under present mitigation policies. This estimate does not include (1) damage to community infra-structure (utility lines, pipelines, railroads, streets, highways, and other similar

facilities), (2) damage to personal property not countable as building contents, such as automobiles, boats, and recreational equipment, and (3) damage to crops, livestock, and ornamental vegetation. The annual expected dollar losses in these catagories may well be equal to or greater than the $6.4 billion estimate for buildings an their contents. Community infrastructure would be expected to sustain the greatest dollar losses of the three.

The NSF study sited above assessed the feasibility and estimated the effect of the same currently-available mitigations contained in the land use management task of the NOAA Coastal Hazards Program. These include discouraging development in hazardous areas (hazard avoidance), hazard resistant building codes (building strengthening and site preparation), and post disaster planning (building purchase and removal after a disaster). The study found that the annual expected losses from natural hazard exposure by 2000 could be reduced by more than 40 percent through maximum application of these mitigation procedures without regard to economic and/or political feasibility. Thus, it could be possible, but not feasible, to eliminate $2.5 billion of the $6.4 billion in property losses expected annually by the year 2000.

The second approach taken in this study and the approach proposed for the NOAA Coastal Hazards Program involves the same mitigations applied in the most effective, cost and politically feasible manner. Annual savings in property damage, under these conditions, are expected to be approximately 15 percent or $1

billion. Since the NOAA Coastal Program is designed to coordinate the total Federal Coastal Hazard effort rather than fund and manage it, the exact portion of this $1 billion savings attributable to this program can not be determined. However, these savings can only be realized through a coordinated Federal effort which is neither planned or operating in any other Federal agency.

DAMAGE TO NATURAL RESOURCES

The problems caused by our nation's rush to the shore are not limited to the increased risk of death or injury and the potential for private and public monetary losses but also involve damage or complete destruction of some of our most beautiful and necessary natural resources. When overdevelopment occures, the beach is gradually destroyed as dunes, maritime forests, and marsh habitats disappear and attempts to save the sand by seawalls, groins, etc., ultimately result in no beach at all or a constant sand replenishment problem. Coastal barrier islands are a fragile buffer between the shore and the sea. The 300 or more islands and spits off the Atlantic and Gulf of Mexico Coast are part of a system which helps protect inland areas from severe storms, hurricanes, and the constant battering of waves but development done without regard to the normal function of these islands lessens or destroys their ability to protect inland areas.

President Carter in his 1979 Environmental Message to Congress enunciated a national coastal protection policy. One of the six national goals contained in this message is "to protect significant natural resources such as wetlands, estuaries, beaches, dunes, barrier island, coral reefs, and fish and wildlife." The NOAA Coastal Hazards Program, through its land use management and public education, is designed to carry out this clear Presidential mandate.

Comprehensive coastal hazards plans, developed under this program will not only determine which areas should not be developed, but will contain long-range plans designed to perserve unspoiled coastal resources and to recover and repair where possible overdeveloped areas after a disaster has occurred. This program, in cooperation with the Coastal Zone Management Program and with the improved coordination of all federal programs effecting coastal resources which will be brought about through the Federal Coastal Program Review Process, will be an effective deterent to future damage to our coastal natural resources.

COASTAL HAZARD COSTS

Expected Annual Losses by the Year 2000

(Dollars in Millions)

	Hurricane Wind	Storm Surge	Coastal Riverine Flooding	Erosion	Subsidence
Building Damage	$ 1,742	$ 1,176	$ 159	$ 90*	---------
Building Contents	$ 1,505	$ 1,160	$ 157	$ 10*	---------
Income	$ 276	$ 6	$ 7	------	---------
Number of Deaths	153	103	16	------	---------
Housing Units Lost	52,237	43,757	------	------	---------
Person Years of Homelessness	48,271	10,330	------	------	--------
Person Years of Unemployment	58,224	1,018	------	------	--------
Loss of Real Estate	------	------	------	$400*	$100*

TABLE 4-1

* - Rough estimates

4.3 ELEMENTS OF A COMPREHENSIVE HAZARDS PLAN

Successful hazard planning requires completion of four basic steps:

1. Define the area that has the hazard problem.
2. Determine the probability that the hazard will occur and the intensity with which it will occur in that area.
3. Prepare to react quickly and efficiently when a disaster strikes.
4. Plan the future uses of the area such that fewer people and less development will be affected by a disaster.

In order to complete the first two steps, a great deal of information, much of it in map form, must be collected. The history of hazards in the area must be compiled to determine which areas are subject to the greatest risk. This history is usually in the form of a climate data package. Knowledge of elevation that flood waters have reached during various types of storms is necessary to determine precise boundaries of areas under varying degrees of risk of inundation. This information usually takes the form of storm surge models. Shoreline migration maps show how the configuration and position of the shoreline has changed in the past. Future changes in the

shoreline may be extrapolated from these maps. In areas where the shore is eroding quickly, this type of data is necessary to determine which areas pose the highest risk.

Preparation for quick reaction once a disaster has struck essentially has two parts: warning and evacuation. An adequate warning system must track and monitor storms, prepare forecasts and warnings, support meteorological research to increase warning time and decrease warning areas, and provide public information presentations. The public must be educated about coastal hazards so they will be more receptive to the warnings and react more quickly. Storm surge models will also be useful in the warning and evacuation procedures because they will provide information on what levels flood waters are likely to reach and which areas will be inundated. Information on evacuation routes, elevation data and topographic features of coastal areas--usually compiled in Storm Evacuation Maps--is essential for efficient evacuation during a disaster. Information is also needed on weaknesses in evacuation routes so that determinations can be made regarding how evacuation routes can be improved (by road maintenance or repair, for example).

Planning for the future uses of hazard prone areas should be done in a way that will reduce loss of life and damage to property in the event that another disaster strikes. Since the 1950's the trend of Federal policy has been to discourage development in hazardous areas and to begin making residents of hazard prone areas bear the full costs of their decision to locate in such areas. This change in policy is typically

accomplished through land use controls. Nearly all of the tasks discussed above that deal with delineating hazard areas and making short-term preparations for disasters also need to be done to make intelligent long-term land use decisions in hazard prone areas. Climate packages are used to determine the probable risk of an area, which will determine allowable uses of the area. Storm surge modeling, which demarks boundaries of high water during storms of varying intensities, would also be used to determine allowable uses of land. Storm evacuation maps are the basis for determining how quickly people can be evacuated from areas during disasters, which is an important consideration in land use planning. Similarly, shoreline migration maps can be used to project future positions of the shoreline--also information necessary for planning for use of the shoreline areas. Education of the public about hazards is also essential if they are going to be receptive to land use controls and plans. A survey of areas that may be used for relocation of storm victims whose property has been destroyed should be included in the plan.

4.4 CURRENT NOAA ACTIVITIES AND NEW REQUIREMENTS

4.4.1 RESEARCH

Meteorological research to increase the overall knowledge of severe storms, the resulting surges, and the destructive force of

storms is an ongoing NOAA activity. Weather modification research is also an ongoing activity which may eventually significantly impact this program.

Study of the storm surge phenomenon and the various computer programs used to predict surges will be part of this program. Activities related to the study of surges include computer model verification, surge data gathering, and mapping of the extent of surge flooding.

Behavioral research into the public's reaction to hazard warnings and their actions during an emergency is an ongoing activity and will be included in annual technical plans.

A study of real-time computer modeling of evacuation traffic routing and flow will be made as a part of this program. This activity will be included in annual technical plans.

4.4.2 PRESENT NOAA ACTIVITIES AND NEW REQUIREMENTS

4.4.2.1 GENERAL

NOAA currently provides much of the environmental data and technical leadership that are basic ingredients in programs aimed at reducing the impacts of natural hazards. NOAA is responsible for providing the real-time predictions, long-range forecasts, historical data, special analyses, maps and charts, and data summaries that are crucial to our understanding of the characteristics and actions of the atmosphere and oceans. In addition to technical and scientific assistance, NOAA provides

financial aid and program guidance to states and institutions for dealing with natural hazards. This guidence includes assistance with formulation of land use policy and techniques.

The following sections are a summary of ongoing programs and the additional program efforts required to alleviate the ever-increasing hazards problem. New requirements would be met with the funding increase requested for FY 1983.

4.4.2.2 STORM SURGE MODELING

Present Activities

NWS, in conjunction with SG and ERL research, is now developing models which show the dynamic behavior of water along the coast and within estuaries. While models have been completed for most open coastal areas, only two estuarine models have been completed--Tampa Bay, Florida, and Lake Ponchartrain, Louisiana. Presently, models are being developed for the area around Galveston, Texas, and Ft. Meyers, Florida. Storm surge models are used to predict the elevation of flood water at given locations for various types and intensities of hurricanes and storms.

New Requirements

A total of 20 models is required for estuaries and bays along the Atlantic and Gulf of Mexico coasts. A budget increase of $75 OK in FY 1981 will provide the necessary resources to produce the 20 models. Additional resources are needed to apply historical data to both ocean and estuarine models to predict

water-level data for local hazards planning. Furthermore, additional actual storm surge data must be acquired for model calibration and verification.

4.4.2.3 PREPARING CLIMATE DATA PACKAGES

Present Activities

The EDIS acquires, archives, and disseminates environmental (atmospheric, marine, geophysical) data and information; prepares summarized and descriptive environmental packages tailored to specific regions based on long-term historical records; prepares information on hurricanes, tornadoes, windstorms, thunderstorms, earthquakes, and other geophysical phenomena along with the impact on people and property; and statistically determines probabilities of occurrences of these phenomena.

New Requirements

Only 4 of the 39 packages required for the Atlantic and Gulf of Mexico coasts will have been completed by FY 1983. Funding is required to prepare the additional 35 packages as regional hazards plans are developed.

4.4.2.4 COASTAL MAPPING

Present Activities

Since 1971, NOS has been producing Storm Evacuation Maps, which show evacuation routes, elevation data, and topographic features of various coastal areas. The 190 base maps required for the Atlantic and Gulf of Mexico coasts will be completed in

FY 1982. The program is now being conducted on a cooperative basis with states to accelerate production and tailor the base maps to meet specific local requirements.

NOS is now undertaking a cooperative pilot program with states and other Federal agencies to produce shoreline migration maps and related documents, which will show the movement of the shoreline over the past 150 years.

NOS provides an ongoing aerial photographic service to record hurricane damage. It also provides storm surge data through the National Tide Observation Network.

New Requirements

For adequate regional hazards planning, an estimated 50 new large-scale Storm Evacuation Maps must be produced annually using existing base maps. These are required for cities and high density population areas. Also, the same number of original-issue storm evacuation maps must be updated to show detailed elevations, refuge areas, and other details appropriate to emergency situations. Shoreline migration maps are required by each state for land use planning as part of local hazards plan.

4.4.2.5 LAND USE CONTROLS

Present Activities

The 1976 amendments to the Coastal Zone Management Act required states and territories to develop a planning process to mitigate the effects of shoreline erosion. Puerto Rico serves as an example of a territory that has developed a comprehensive process. A territorywide flood hazard mitigation plan has been

prepared and two regional flood hazard plans have also been completed. The plans delineated the hazard prone areas and suggest possible responses to flood hazards. Delineation is accomplished by determining the likelihood of hazard occurrence, identifying acceptable uses of the area, and mapping. Suggested responses to flood hazards include development and redevelopment policies, floodplain regulations, floodproofing, public awareness, forecasts and warnings, and tax adjustments to encourage appropriate land use.

New Requirements

Regional hazard plans using similar land use control techniques now need to be developed in each of the coastal regions.

4.4.2.6 WARNINGS AND EDUCATION

Present Activities

The National Weather Service has three programs that provide warnings of hazards and related services for all coastal areas. The National Hurricane Center (NHC) tracks and monitors tropical storms, prepares hurricane forecasts and warnings, conducts meteorological research aimed at increasing warning time and decreasing the area of hurricane watch and warning, and provides public information presentations. The Weather and Flood Warnings Coordination Staff performs studies of Weather and Flood Hazards, develops guidelines for the protection of life and property, and prepares and disseminates informational materials designed to help educate the general public and also public officials

regarding hazards and the means of protection. Warnings and Preparedness Meteorologists provide technical assistance to communities in weather hazard preparedness planning. The Coastal Flood Warning Program provides a forecast of the degree of coastal erosion and unusually high water due to tides and waves associated with extratropical storms.

These warnings programs are directly supported by NESS whose field units provide satellite data and analysis. ERL is monitoring experiments in the modification of hurricanes and is conducting studies on the improvement of forecast accuracy as part of its weather research.

The Office of Sea Grant is sponsoring hazard-related research at various universities concerning evacuation. The Sea Grant Marine Advisory Service conducts workshops, seminars, and public meetings to educate local officials and the public about coastal hazards and appropriate mitigation efforts.

New Requirements

Hazard warnings must be integrated into each Regional plan. Workshops, and seminars must be conducted in all regions where hazard plans are to be implemented. These regions will also need assistance in the development of public service messages.

4.4.3 RELATED PROGRAMS

NOAA, USGS, COE, and various states are producing a series of coastal erosion maps. These maps will be used in this program to delineate high-risk areas where future construction should be

avoided. The maps will also be of general benefit to a number of agencies in siting of various commercial coastal activities.

Federal agencies such as the COE and USGS have a need for the information NOAA compiles for the hazard plans. These agencies, in turn, further process the information into a form which is more useful to the planners.

4.4.3.1 U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey (USGS) has the Federal responsibility for geological hazards. In the coastal zone these hazards are primarily earthquakes, subsidence, landslides, volcanoes, avalanches, and erosion. The USGS requires NOAA bathymetric data, geodetic survey data, shoreline maps, aerial photographs, tidal current data, and statistical climatological data to fulfill its mission of providing geological hazard information to the public.

No new mechanism needs to be established to provide mecessary data to USGS since these data are provided under present agreements on a routine basis. Geological hazard data will be required by individual states for developing coastal hazards plans. These data and other geologic information requirements will be coordinated through the NOAA Coastal Hazards Program Manager.

4.4.3.2 U.S. ARMY CORPS OF ENGINEERS

The U.S. Army Corps of Engineers (COE) is responsible for maintaining navigable coastal waterways and beach protection

works. In recent years the COE has sponsored a number of local flood evacuation studies in coastal areas.

The COE has a direct influence upon the safety of the coastal population through its permitting program. Permits issued by the COE (and local government) often allow residential development to occur in areas that are difficult to evacuate. More comprehensive hazard information is needed by the COE so that it can make wiser land use policies and reflect these policies in its permitting program.

An additional technical activity of the COE is the development of flood prediction computer programs or models. These predictive models require calibration data that is derived from measuring the actual water levels during a flood. The COE requires data from NOAA's tide gage network and other postflood survey data gathered by NOAA survey teams. The models are area specific and close coordination will be maintained to eliminate duplication.

4.4.3.3 OTHER FEDERAL AGENCIES

Other Federal agencies such as the Department of Defense, the Nuclear Regulatory Commission, the U.S. Coast Guard, the U.S. Fish and Wildlife Service, and the National Bureau of Standards have direct interest in coastal hazard planning in specific areas. The roles and activities of these individual agencies will be included for specific regions when appropriate.

The following products and services which are required by state and local governments for hazard planning are prepared by the agencies listed.

Product	Agency	Use
Quadrangle Maps	USGS	General Planning, Erosion
Aerial Photography	USGS/NOAA	Population Density Counts, Erosion
Geodedic Data	NOAA	Subsidence Measurement, Erosion
Tidal and Wave Height Data	NOAA/COE USGS	Calibrate Storm Surge Models, Erosion
Hydrographic Data	NOAA	Production of Storm Surge Models
Storm Evacuation Maps	NOAA	Local Evacuation Plan Production of Storm Surge Models Media Presentations
Weather Forecasts	NOAA	Evacuation Planning
Storm Surge Forecasts	NOAA	Evacuation Planning

Climatological Data	NOAA	Risk Assessment and Planning
Descriptive Literature and Manuals	NOAA/FEMA USGS/COE	Risk Assessment and Evacuation Planning
Highway Traffic Models	FHA	Evacuation Planning
Coastal Building Standards	NOAA/FEMA NBS	Coastal Construction Zoning
Teacher Training	NOAA	Tornado Spotters Media Weathermen Flash Flood Observers Cooperative Observers Evacuation Personnel
Hazard Training	NOAA/FEMA	Increase Public Awareness
Evacuation Planning Training	FEMA	Local Evacuation Personnel

Technical Assistance	NOAA/FEMA USGS/COE	Provide Specialized Expertise to Local Government
Public Information	NOAA/FEMA	Raise Public Awareness to Dangers

These products and services will be used by state and local officials to produce hazards plans for their specific areas.

4.5 COORDINATION OF THE PLANNING PROCESS

4.5.1 GENERAL

This section describes the background of development of the NOAA coastal hazards initiative.

The Federal Emergency Management Agency was formed in July 1979 to consolidate the diverse organizations responsible for Federal emergency activities. It has the overall Federal responsibility for managing hazard-related activities. Other Federal agencies either have total responsibility for mitigating specific hazards or share responsibility with non-Federal organizations.

The scope of national disaster problems is so extensive that FEMA will find it difficult to directly provide the Federal service required by the user public. FEMA, therefore, plans to execute a series of agreements with other Federal agencies

specifying the nature and extent of hazard-related products and services to be provided to the public by these agencies. A Memorandum of Understanding (MOU) between NOAA and FEMA is presently being developed (Section 5.4.2).

As a result of increasing hazard-related planning activity by states and an increasing demand for data and information from Federal agencies, NOAA organized a Coastal Hazards Task Group (CHTG) to study the responsiveness of NOAA programs. One of the three major recommendations made by the task group was that a central unit be established with responsibility for hazards program coordination. While existing NOAA programs provide valuable information and services, CHTG concluded, they do so at a level for below their potential in meeting user needs because common opportunities, program activities, and points of contact outside NOAA are not identified and sufficient lines of communication have not been established. The task group further concluded that the focus and unique capabilities and interests of each NOAA program office should be redirected and integrated to achieve the common goal of a national coastal hazards program.

NOAA management, acting upon this CHTG recommendation, established a coastal hazards coordination unit within the National Ocean Survey. One role of this NOS unit will be to coordinate the NOAA effort in gathering the highly technical data and analysis necessary to prepare hazard plans and packaging the information in a form usable by state and local planners. Funds and personnel are now required to complete implementation of an overall hazards effort which includes a formal mechanism to

ensure that each locality fully understands the nature of coastal hazards, the potential impact of these hazards, and the procedures for integrating NWS warnings into a hazard plan.

A total of 39 regional hazards plans is required for the Atlantic and Gulf of Mexico coasts. By FY 1983, only four plans are expected to be developed. Consequently, 35 plans are required by the remaining coastal regions which have not dealt adequately with the natural hazards problem. While much environmental data and information have been generated in the preparation of Environmental Impact Statements and State Coastal Zone Management Programs, serious gaps exist in data and information needed for hazards planning. Even for those coastal areas for which sufficient environmental data now exists, states or regions either do not have resources to acquire and integrate the data and information or may not be aware that this material even exists.

4.6 PROGRAM IMPLEMENATION

The scope of this National effort is too extensive to implement during a short period of time. A strategy for implementing a phased effort on a priority basis has therefore been developed. The Nation's coastline has been divided into a number of manageable sub-units for which individual hazard plans will be prepared.

Before preparation of each new hazard plan is begun, a meeting of representatives from FEMA, from NOAA's Coastal Hazards Program, OCZM, NWS, SG and from the state group which will

prepare the plan will be held to insure that NOAA Objectives will be incorporated into the plan and that the plan does not conflict with, weaken, or duplicate other NOAA programs. In addition, plan preparation must be coordinated with FEMA technical assistance studies associated with moving communities from the emergency phase to the regular phase of National Flood Insurance Program.

The management of the development of individual area hazard plans will be detailed in annual Technical Development Plans (TDPs) for each region which will describe the scope of activity and resources required from each participant. The following section describes the content of individual TDPs.

4.6.1 TECHNICAL DEVELOPMENT PLANS

A regional or local hazard plan will have three objectives:

(1) To establish permissible land use, to avoid new construction, reconstruction, or habitation in hazard-prone areas.

(2) To mandate sound construction practices in hazard-prone areas so as to minimize damage to structures and to ease the evacuation of people.

(3) To have an operational plan for personnel evacuation in the event of a hazard warning.

A typical hazards plan will include storm evacuation route information. Maps showing road elevation and storm surge levels will be included and can be used together to determine how long various routes will remain open during a storm. Strategies to improve evacuation routes through road maintenance will be part of the plan. Warning systems will be described. Land use control methods will be discussed in detail. Primary control will be accomplished through zoning of hazardous areas to discourage inappropriate development, and through designation of areas to be used for relocation of those suffering extensive property damage after disasters. Flood plain regulations, flood proofing incentives, public awareness improvement techniques and tax adjustments used to encourage appropriate land use will also have their place in the TDPs.

4.6.1.1 MAJOR TASKS

To accomplish the work required to develop a regional hazards plan, specific NOAA tasks have been established. These tasks will be undertaken in each region shown in Figure 4-1. The milestones are made up of various phases of the tasks.

These tasks are:

1. Storm surge modeling
2. Production of environmental data packages
3. Coastal mapping
4. Land use management

5. Warning coordination
6. Public education
7. Management

In addition to these NOAA tasks, a number of time-phased tasks must be completed by the local participants or planners. These tasks are:

1. Assemble plan participants and agree to scope of work and insure that NOAA objectives are incorporated into plans.
2. Determine geographic population density and its demography.
3. Determine population's behavioral profile.
4. Delineate evacuation zones.
5. Determine shelter data.
6. Make evacuation route selection.
7. Conduct traffic capacity analysis of evacuation routes.
8. Prepare reports, pamphlets, final plan.

Other, non time-phased tasks include:

1. Preparing post-disaster development plan.
2. Preparing and implementing coastal building codes.
3. Preparing and implementing coastal zoning ordinances.

Each individual regional hazard plan for a specific area will vary in content and task assignment. The NOAA tasks will remain unchanged for all areas, although subtasks will vary. The other tasks will be completed by local units of government, state agencies, universities, or other Federal agencies.

Annual TDPs will detail how NOAA will manage the development of individual regional plans and show the support required by each participant. The actual details of each regional plan will be contained in individual regional plan documents.

4.6.2 SETTING OF PRIORITIES

The primary strategy for implementing the development of state hazard plans is to work through State Coastal Zone Program offices. However, not all states have accepted programs. In those states which do not, NOAA will provide all data and technical assistance necessary to develop state hazard plans, but funding of the plan development will either be by the state or through assistance from FEMA or other Federal agencies.

In developing this plan the coastal area was divided into 39 regions or planning units. These 39 regions correspond approximately with the coastal regional councils which have been formed to coordinate county, city, and local planning. For example, the coastal council in Hawaii includes all coastal counties in the state and is responsible for civil defense, planning, technical program review, coordination, and promotion of the coastal economy. These 39 regional or planning units were

chosen because they lend themselves well to hazards planning due to similar geographical and hazard risk features. Actual regional plans may be produced by state agencies or other organizations.

Priorities must be established according to geographic regions, since the number of personnel and dollars and the sheer size of the U.S. coastal region prohibit simutaneous develompent of hazards plan in all regions. A region's priority is based on three factors: (1) the frequency and severity of hurricanes, tornadoes, storms, and floods; (2) population density and industrial development; and (3) the stage of development of the states' Coastal Zone Management programs.

Geographic Priorities

The program plan has established the following geographic priorities based on the factors set forth above. The list of priorities is expected to change as the program progresses and specific information about each region is gathered.

FY 1980	Alabama - Mobile Bay
FY 1981	Mississippi - coastal areas
	North Carolina - Wilmington to Albemarle Sound
FY 1982	South Carolina - Charleston
FY 1983	South Carolina - Myrtle Beach to Georgetown
	Florida - West Coast

FY 1984	Louisiana - Houma to New Orleans
	Texas - Freeport to Galveston
	Florida - Key West to Jacksonville
	Florida - Pensacola to Panama City
FY 1985	Texas - Brownsville to Matagorda Bay - Port Arthur
	Georgia - Brunswick to Savannah
FY 1986	Virginia-Norfolk, Eastern Shore, Chesapeake Bay
	Delaware - Delaware Bay
FY 1987	New Jersey - Cape May to Perth Amboy, Delaware Bay
	New York - Long Island Sound
	Connecticut - New Rochelle, NY, to New London
FY 1988	Rhode Island - Narragansett Bay
	Massachusetts - New Bedford to Gloucester
	New Hampshire - coastal areas
	Maine - selected coastal areas
FY 1989	California - selected coastal areas
	Oregon - selected coastal areas
	Washington - selected coastal areas
	Alaska - selected coastal areas

This priority listing addresses geologic hazards in the Pacific Basin Coastal areas in 1989. The hazard problems for coastal areas bordering the Pacific Ocean are significantly different from those along the Gulf of Mexico and Atlantic

coasts. The primary natural hazards in these areas are earthquakes, tsunamis, and mudslides. These geologic hazards will be integrated into state coastal zone programs with assistance of the NOAA Coastal Hazards staff, who will assist states in obtaining and interpreting geologic information.

The coastal areas along the Great Lakes are not being considered in this plan because no hurricane risk exists, CZ has already fostered shoreline erosion studies, and states have adequately pursued hazards plans in the past and are doing so today.

4.6.3 SCHEDULES

4.6.3.1 TYPICAL PROJECT SCHEDULE

Figure 4-1 shows the idealized time-phased schedule of areas to be completed each year. The milestones on this chart show the major NOAA management decision points. This plan calls for completion of 15 regional plans annually; however, annual TDPs will list specific regional plans to be completed in that year and may vary from this ideal plan due to the availability of resources.

4.6.3.2 PROGRAM SCHEDULE AND MILESTONES

Figure 4-2 shows the major NOAA tasks that must be completed for each regional plan. This typical schedule, which may vary in fact depending upon when funds become available, must be adhered to by the NOAA participants to complete all individual regional

plans on schedule. The tasks will be initiated for individual programs in the order designated in the geographic priority list in section 4.7.2. The seven major tasks (with milestones) that must be completed by NOAA and the organizations involved are described in the following.

NOAA COASTAL HAZARDS PROJECT
Milestones for Completing Regional Hazards Operational Plans

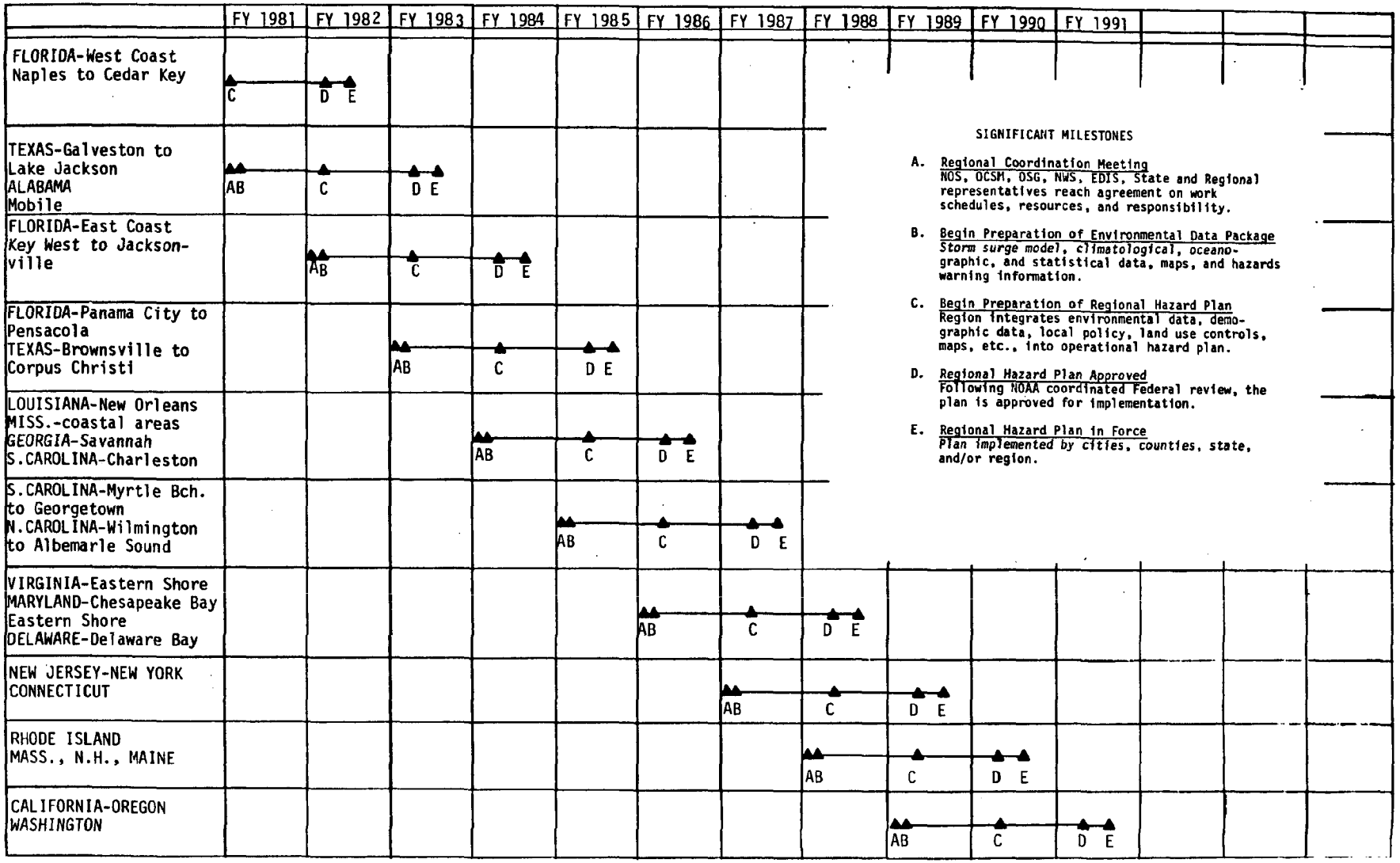
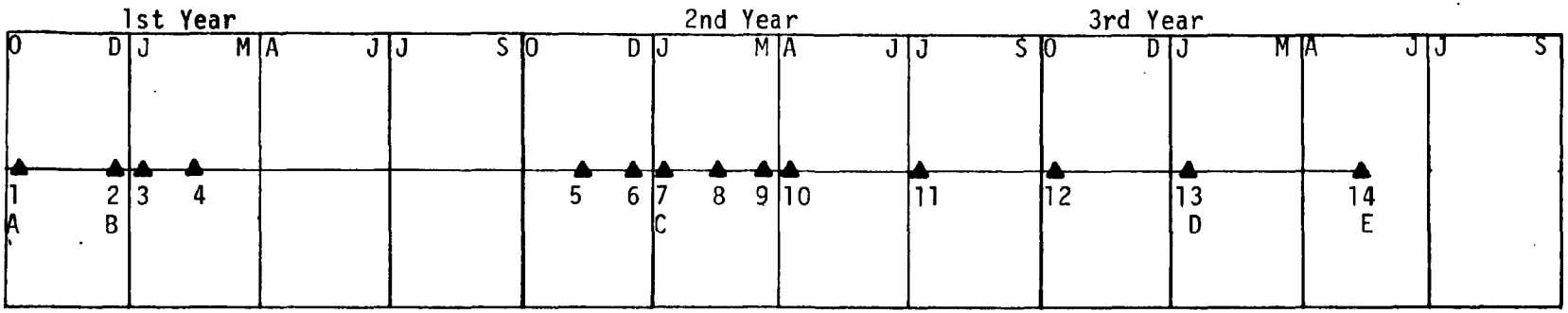


FIGURE 4-1

Each line ▲▲——▲——▲▲ represents 5 TDPs.

SCHEDULE FOR DEVELOPING TYPICAL REGIONAL HAZARDS PLAN



MAJOR MILESTONES

1(A) Planning Session (Oct., First Year)

2(B) Agreement to Develop Plan (Dec., First Year)
Storm Evacuation Maps, Start (Dec., First Year)
Shoreline Erosion Maps, Start (Dec., First Year)

3. Storm Surge Modeling, Start (Jan. First Year)

4. Climate Data Packages, Start (Feb., First Year)
Public Education Materials, Start (Feb., First Year)

5. Public Education Materials, Complete (Nov., Second Year)

6. Storm Evacuation Maps, Complete (Dec., Second Year)
Shoreline Erosion Maps, Complete (Dec., Second Year)

7(C) Begin Development of Regional Plan (Jan., Second Year
Storm Surge Model, Complete (Jan., Second Year)

8. Warnings Procedures, Start (Feb., Second Year)
Climate Data Packages, Complete (Feb., Second Year)

9. Warnings Procedures, Complete (Mar., Second Year)

10. Monitor Plan Development (Apr., Second Year)

11. Monitor Plan Development (July, Second Year)

12. Monitor Plan Development (Oct., Third Year)

13(D) Regional Plan, Complete (Jan., Third Year)

14(E) Regional Plan, Implemented (May, Third Year)

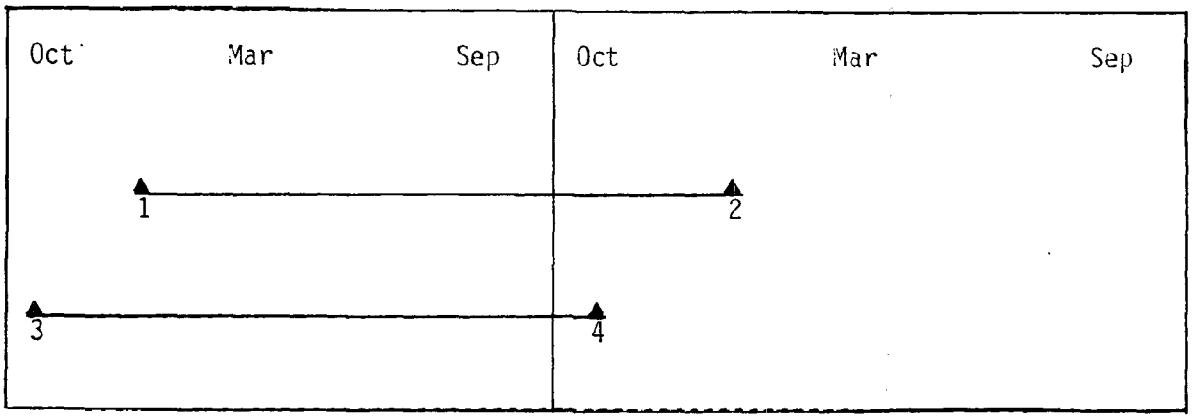
Letters A, B, C, D, and E refer to significant milestones shown in Figure 1.

FIGURE 4.2

Task 1. Storm Surge Modeling

A Hazards Plan must have detailed data on the elevation of flood water which can be expected at strategic locations in an area. A joint effort of NWS and NOS will develop models which show the dynamic behavior of water along the coasts and estuaries. These models will be used to forecast the water surface behavior under various hurricane conditions. NWS is responsible for the development of the model and the collection and analysis of meteorological and storm surge data. NOS will coordinate the modeling task with NWS and assist in the gathering of storm surge data.

Annual Task Schedule



Milestones

1. Modeling. Collect topographic maps form the U.S. Geological Survey, environmental data from EDIS, historical storm surge data form the U.S. Corps of Engineers and oceanographic data form NOS. Compile and format these data. Using these data, adjust the storm surge model to represent the physical and environmental conditions of a specific region. (Jan. - first year.)

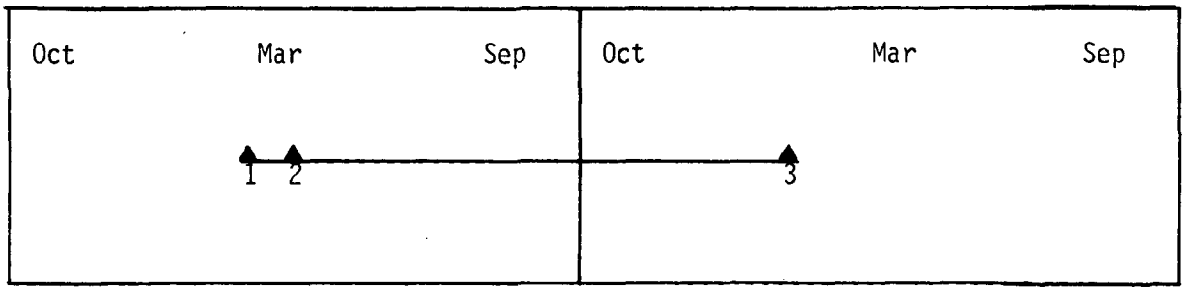
2. Model Completed. Historical and conceptual hurricane data are applied by NWS to the completed storm surge model for the determination of time series water surface elevations at pre-selected locations in the model area. Format and disseminate these data to the planning group for inclusion in the Hazards Plan. (Jan. - second year.)

3. Related Hazards Research. Ongoing projects by NHC and NWS to study the modification of hurricanes and techniques for monitoring hurricane behavior; improve storm surge model development in conjunction with the Environmental Research Laboratorys' Atlantic Oceanographic and Meteorological Laboratory; and the behavioral response of individuals in hazard-prone areas. (Oct. - Oct.)

Task 2 Preparing Climate Data Packages

Detailed information on the history of hazards in the area is required to develop Region Plans. This task, carried out by NOAA's EDIS, provides this information. It involves the compilation of quantitative and descriptive long-term data and information on local and regional rainfall, storms, floods, hurricanes, tornadoes, earthquakes, subsidence, and other atmospheric, marine, and geophysical phenomena. EDIS will also provide hazards impact data and risk analysis.

Annual Task Schedule



Milestones

1. Coordination Session. Meeting of NOAA, state agencies, and planners to agree on the scope of environmental data required and the schedule for delivery of data. (Feb. - first year)

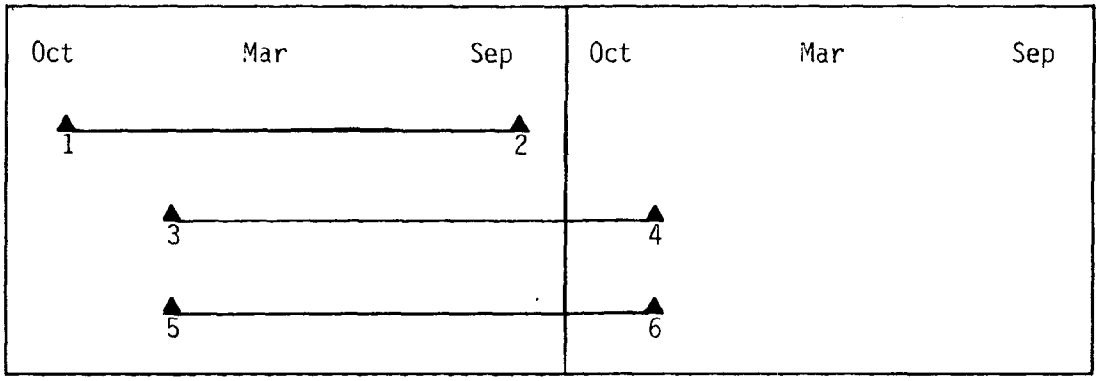
2. Package Develoment. Retrieval, analysis, and formatting of required data carried out by EDIS. (March - first year)

3. Package Complete. Climate Data Packages complete and delivered to planners. (Feb. - second year)

Task 3 Coastal Mapping

Charts and maps are basic tools used in developing Regional Hazards Plans. While nautical charts, certain coastal maps and bathymetric maps are available, detailed storm evacuation maps to meet local requirements and shoreline migration maps are not available. This task, carried out on an NOS-state cooperative basis, will provide these new maps.

Annual Task Schedule



Milestones

1. Shoreline Migration Map Production. Based on regional requirements, maps are prepared which show relocation of shoreline over a period of time with data on wind, waves littoral drift, beach composition, and bottom characteristics. (Oct. - first year)

2. Migration Maps Complete. Maps are produced and delivered to planners. (Sept. - first year)

3. Large-Scale Storm Evacuation Map Production. Detailed storm evacuation maps are prepared for cities and high density population areas. (Dec.- first year)

4. Large-Scale Maps Complete. Maps are produced and delivered to planners. (Dec. - second year)

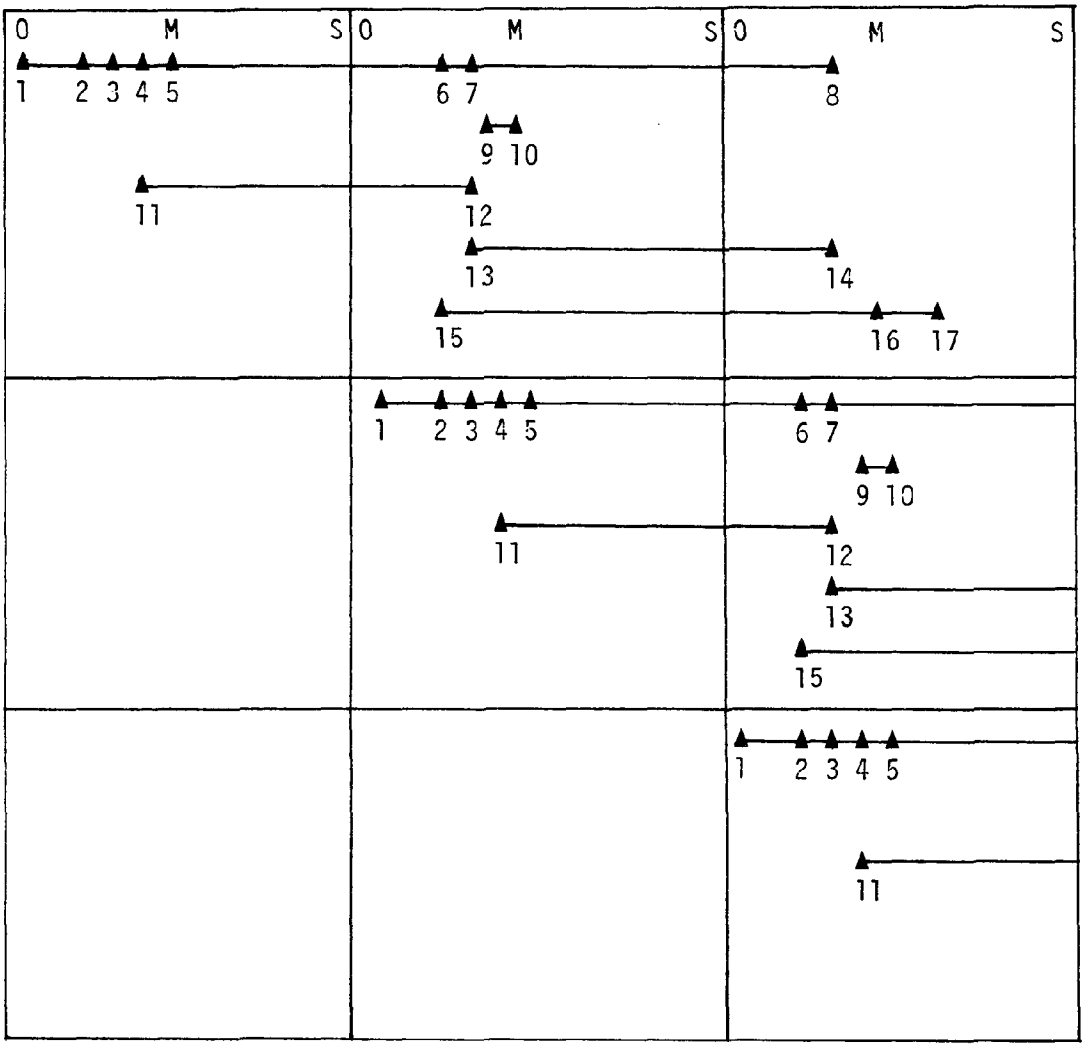
5. Evacuation Planning Map Production. Existing storm evacuation maps are updated and revised to show more elevations, shelters, refuge areas, and other emergency details. (Dec. - first year)

6. Planning Maps Completed. Maps are produced and delivered to planners. (Dec. - second year)

Tasks 4 through 7. Land use management, warning systems, public education, and management

These tasks are the multi-faceted process of coordination between NOS, CZ, NWS, SG, EDIS, FEMA and a state group to organize for and develop a Regional Hazards Plan. A state group will develop data, information, resources, and technical assistance. Thirty-two months are required to develop a Hazards Plan. Five new plans are started each year. This involves the coordination of 15 projects in various stages of completion each year.

Annual Task Schedule



Milestones

1. Plan Initiation--Initial meeting of NOS, SG, NWS, EDIS, FEMA, OCZM, and state representatives to agree upon schedules, scope of work, resources, and required environmental data. (Oct. - first year.)

2. Agreement to Develop Plans--Formal agreement of Hazards Plan development by a state group. (Dec. - first year.)

3. Hazards Plan Initiation--Contract(s) awarded through CZ to a state group for the preparation of a Hazards Plan. (Jan. - first year.)

4. Plan Monitoring--NOS begins monitoring the activities of all program elements which are providing information and services for the development of Hazards Plans. (Feb. - first year to Dec. - second year.)

5. Workshops-- NOS coordinates workshops attended by local and state groups to review the details of putting a hazards plan together which includes scheduling and procedures. (Mar. - first year.)

6. Schedule Confirmation--NOS confirms data and services will be provided on schedule. (Dec. - second year.)

7. Hazards Plan Monitoring--NOS monitors preparation and completion of Hazards Plan. (Jan. - second year.)

8. Hazards Plan Completed--NOS confirms Draft Hazards Plan is completed as scheduled. (Jan. - third year.)

9. Warnings Coordination Session--NOS, NWS, and state groups meet to review and integrate hazards warnings procedures into Hazards Plan. (Feb. - second year.)

10. Warnings Coordination Completed--Review and integration of hazards warnings procedures completed. (Mar. - second year.)

11. Public Education Materials Preparation--Begin preparation of related public education material for inclusion in Hazards Plan. (Feb. - first year.)

12. Public Education Materials Complete--Complete preparation of public education materials and deliver to state groups. (Jan. - second year.)

13. Land Use Coordination Session--NOS, OCZM and state groups meet to review the land use regulations built into the plan. (Feb. - second year.)

14. Land Use Coordination Completed--CZ and NOS approve land use regulations in Hazard Plan. (Jan. - third year.)

15. Hazards Plan Preparation--State group begins preparation of Hazards Plan utilizing supplied environmental demographic data, maps and charts, and related information. (Jan. - second year.)

16. Hazards Plan Adopted--Hazards Plan adopted by state group approved for distribution and implementation. (Mar. - third year.)

17. Hazards Plan Implementation--Approved Plan implemented by city, county, and state governments. (May - third year.)

PART V

5.0 MANAGEMENT PLAN

5.1 SCOPE

The purpose of the Management Plan is to define the relative responsibilities and authorities of the National Ocean Survey (NOS) as the managing organization for the program, and of the other NOAA elements which contribute to the program, and to establish the organizational relationships and mechanisms for effectively carrying them out.

5.2 PROGRAM MANAGEMENT

The responsibility of NOS as the management organization is to design, implement, direct, and coordinate an interdisciplinary program that will assist local communities in the development and implementation of coastal hazards mitigation plans.

An organizational structure will be established which will provide for efficient and effective management with well-defined responsibilities and authorities. Within this structure, mechanisms for direction and control will be established to insure that the program is performed in a timely manner and that the desired results are attained. To achieve such results requires maximum coordination and communication among NOAA

elements and other agencies, in not only the planning phases, but also throughout the duration of individual projects which make up the program, to maximize product quality and utility.

The organizational structure and responsibilities are discussed in the following sections, as well as program and project planning and documentation, schedules, reports, reviews, and mechnaisms for accomplishing the program objectives in a timely manner.

5.2.1 NOAA ORGANIZATION STRUCTURE FOR PARTICIPATING ELEMENTS

Figure 5-1 shows the organizational interrelationships of the principal NOAA participants in this program. A partial NOAA organization structure is shown in Figure 5-1 which highlights those elements that have a direct concern with the Coastal Hazards Program.

5.2.2 COASTAL HAZARDS PROGRAM ORGANIZATION STRUCTURE AND RESPONSIBILITIES

Figure 5-2 shows the program relationships of the NOAA coastal hazard participants and the major products and services they are responsible for. Normal administrative support, including legal, congressional liaison, and financial, is also required but not shown.

5.3 INTERAGENCY PARTICIPATION

5.3.1 GENERAL

A number of Federal, state, and local agencies have varying degrees of interest and responsibilities related to coastal hazards. The Federal agencies most involved are the Federal Emergency Management Agency (FEMA), the United States Geological Survey (USGS), and the Corps of Engineers (COE). Other agencies such as the Nuclear Regulatory Commission, U.S. Coast Guard, and the Fish and Wildlife Service have considerable interest in specific coastal hazards that relate to their individual programs.

5.3.2 LIAISON

Liaison will be maintained with all interest agencies by the program manager. When required, the program manager will request liaison with another agency be conducted at a higher level in the management structure. Appropriate program review documents will be prepared as needed and provided to other interested agencies.

5.3.3 AGREEMENTS

5.3.3.1 GENERAL

When there is a significant interaction between NOAA and another Federal or state agency, a Memorandum of Understanding

(MOU) will be executed to detail the respective responsibilities and authorities of the two agencies.

5.3.3.2 FEMA

A description of FEMA's program is contained in Section 1.2. NOAA and FEMA have executed an umbrella MOU and are presently in the process of developing 9 specific annexes to the general MOU to cover the various agency interactions. These 9 annexes will be completed by October 1980.

5.3.3.3 USGS

A description of USGS's program interactions is contained in Section 4.4.3.1. NOAA and USGS have existing agreements detailing respective responsibilities and authorities. Also, NOAA and USGS hold regularly scheduled coordination meetings to discuss programs and problems.

5.3.3.4 CORPS OF ENGINEERS

A description of COE's program interactions is contained in Section 4.4.3.2. Program elements of NOAA execute specific agreements with COE on a project basis. A general MOU covering coastal hazards will be initiated between NOAA and COE when their role becomes more clearly defined (following FCPR, Section 2.1).

5.4 MANAGEMENT POLICY AND PLANS

5.4.1 GENERAL

The sequence for program planning and implementation of the Coastal Hazards Program involves the essential elements of policy, goals and objectives, long-term plans and priority setting, short-term plans emphasizing technical elements, and related funding and work implementation.

The basis of program planning and implementation strategy is described in this Program Development Plan. Technical Development Plans (TDPs) are prepared for each regional project. In each TDP the tasks are described in detail, including funds required and a schedule of activities and events. A description of TDPs is contained in Section 4.5.1. Figure 5-3 indicates the relative responsibilities for development, review, and approval of the TDPs.

5.4.2 MANAGEMENT POLICY

The Assistant Administrators for Coastal Zone Management, Oceanic and Atmospheric Services, and Research and Development are responsible for providing overall policy guidance for the program. Responsibility for policy on technical design of the program is assigned to NOS. The Coastal Hazards Program Manager is responsible for implementing these policies.

5.4.3 PROGRAM DEVELOPMENT PLAN

The Program Development Plan is the basic document setting forth a multi-year program to reach the goals and objectives of the NOAA Coastal Hazards Program. When approved by the Administrator of NOAA, the plan becomes the working program document.

5.4.4 TECHNICAL DEVELOMENT PLANS

Technical Development Plans (TDPs) are written annually for each of the five regional projects to be initiated the following fiscal year. New TDPs developed each year, when approved by the Assistant Administrators, are the major implementation mechanisms for the PDP. These TDPs follow the technical approach described in Part IV of the PDP and provide a more detailed description of the specific work to be undertaken each fiscal year, a description of how the work in the individual TDP addresses the overall objectives of the program, a planned schedule, and required funding and resources. The TDP will include, but not be limited to, the following:

- The relation of the TDP objectives and milestones to those in the PDP and the relative responsibilities for each TDP's management and logistics.

- General description of each regional area, any unusual problems or features, the subtasks to be undertaken, and the general schedule for duration of each subtask in each area.
- The scope, objectives, and applicability of the subtasks to be undertaken for that area.
- Rationale for selection and level of effort of the subtasks to be undertaken.
- Funding levels required by subtask.
- Schedule at subtask level for the regional project, providing intermediate milestones.
- The logistics support to be provided to the subtask level if known.
- Variations, if any, in program activities from those described in the PDP.
- Products including maps, charts, models, environmental data and educational material, a schedule for delivery of the products and the relationship or interdependence of the products.

5.4.5 OPERATIONAL PLANS

Annual Task Plans are assigned by the Program Manager and developed by the individual task managers. (Components of Annual Task Schedules are described in detail in Section 4.7.3). These plans are forwarded to the program manager to determine consistency with policy, feasibility, and adequacy, and to identify any required coordination for the program as a whole.

The basis for development of the plans are the TDPs. The plan will include when applicable:

- o Detailed schedule of events and proposed operational accomplishments.
- o Integrated support requirements.
- o Identification and resolution of special logistics problems.
- o Scheduled movement and deployment of personnel and equipment.
- o Details, timing, and requirements for logistics support facilities.
- o Indentification of required funding and source.
- o Contingency plans to provide flexibility in meeting operational objectives.

5.4.6 BUDGET AND PROCUREMENT PLAN

An annual budget and procurement plan is developed by the program office to provide guidance to task managers in areas of budget, finance, contracting and procurement.

5.5 MANAGEMENT REPORTS

5.5.1 GENERAL

This section describes the several management reports compiled by the Coastal Hazards Program. The distribution and schedule of these reports are listed in Section 5.7.2.

5.5.2 ANNUAL TECHNICAL SUMMARY REPORT

The program manager will prepare an annual technical summary report for the Director, NOS, to document the significant program achievements and technical process to date. As a minimum, the report will discuss results in relation to program objectives, areas where the program is lacking, and recommendation for improvements.

5.5.3 QUARTERLY REPORTS

The program manager will prepare a quarterly report for submission to the Assistant Administrators. The report will document significant program achievements and technical progress, and report significant problem areas that occurred during the preceding fiscal quarter. The format and content of this report, as specified by the Director, NOS, are in the Management by Objective (MBO) format.

5.5.4 FINANCIAL AND BUDGET REPORT TO THE PROGRAM MANAGER

The task managers will prepare monthly, and on request, a financial and budget report containing costs and obligations to date, financial actions since the last report, actions pending, listing unbudgeted items anticipated for the future, and such other information as may be requested. The report will be broken out by subtask and regional project.

5.6 MANAGEMENT REVIEWS

The program manager will conduct periodic reviews of the overall program. The content, frequency, and recipients are given below.

5.6.1 WEEKLY PROGRAM STATUS REVIEWS

The program manager will conduct weekly meetings with the task managers to ascertain the schedule status of each project, identify problem areas, and ensure coordination.

5.6.2 NOS MONTHLY REVIEWS

The program manager will provide on request a review of the program for the Director, NOS, or other cognizant MPE Directors. This presentation will be in the MBO format and include accomplishments, schedule status, and problem areas.

5.6.3 NOAA QUARTERLY REVIEWS

The program manager will provide on request a review of the program for the Assistant Administrators for Coastal Zone Management, Oceanic and Atmospheric Services, and Research and Development, and other senior NOAA management. This oral presentation will include technical progress, accomplishments, schedule status and problem area, cost status and resource requirements. Task managers provide inputs to these reviews and participate as necessary.

5.7 IMPLEMENTATION SCHEDULES

5.7.1 PROGRAM PLANNING AND IMPLEMENTATION SCHEDULE

Dec. 1	Assistant Administrators provide policy guidance on appoval of priorities among regional projects, tentative budget guidance, and any other pertinent information that will aid in program planning for the following fiscal year.
Dec. 15	Program commences preparation of annual TDPs.
Apr. 15	Program submits draft TDPs to Assistant Administrators.
Jun. 15	Assistant Administrators provide program with comments and recommendations on each TDP.
Jul. 30	Final TDPs are approved.
Oct. 1	Work for new fiscal year commences, contingent on funding allocation or continuing resolution.

5.7.2 PROGRAM REPORT SCHEDULE

Jan. 1	Annual Technical Summary Report submitted to the Director, NOS, for approval and distribution.

Jan. 20	Quarterly Report submitted to the Director, NOS, for approval and forwarding to Assistant Administrators.
Apr. 20	Quarterly Report submitted to the Director, NOS, for approval and forwarding to Assistant Administrators.
Jul. 20	Quarterly Report submitted to the Director, NOS, for approval and forwarding to Assistant Administrators.
Oct. 20	Quarterly Report submitted to the Director, NOS, for approval and forwarding to Assistant Administrators.
15th of each month	Financial and budget reports will be submitted to the program manager.

NOAA ORGANIZATION STRUCTURE FOR PARTICIPATING ELEMENTS

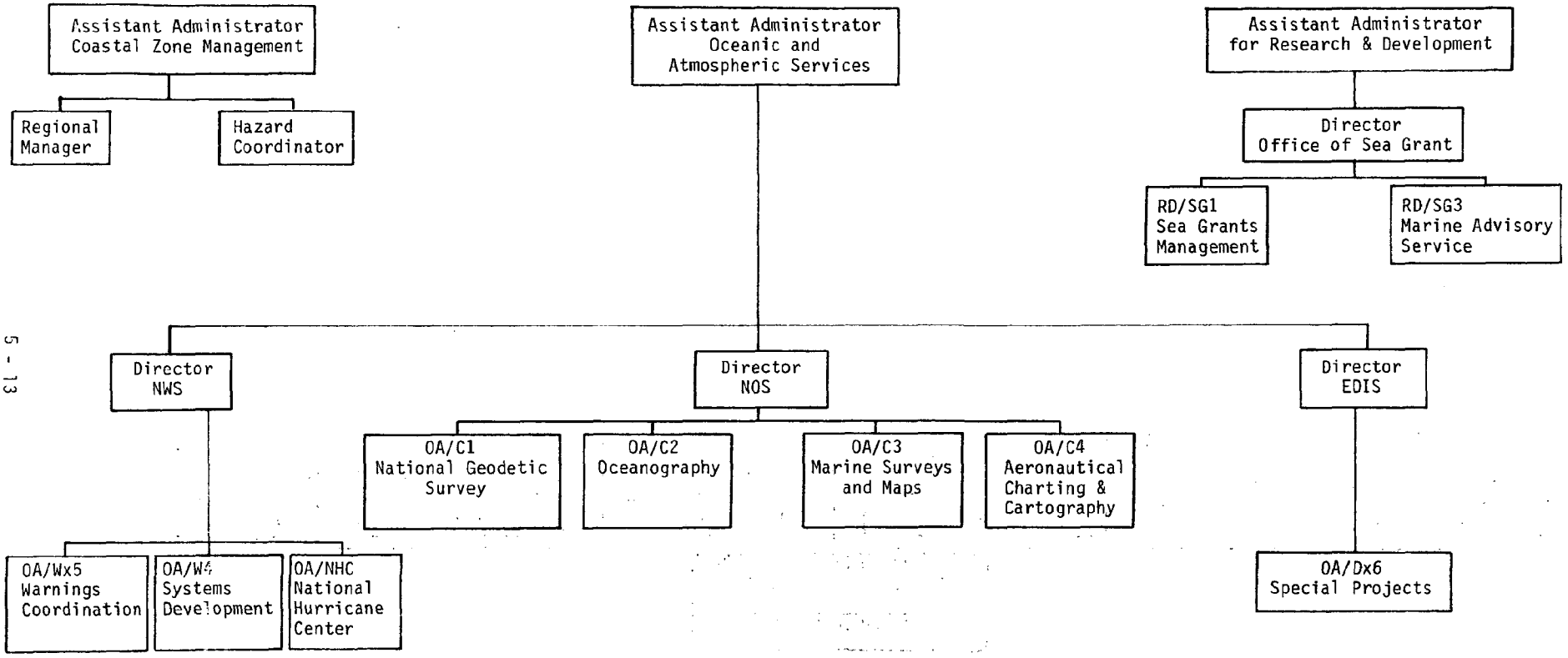


FIGURE 5-1

COASTAL HAZARDS PROGRAM
STRUCTURE AND RESPONSIBILITIES

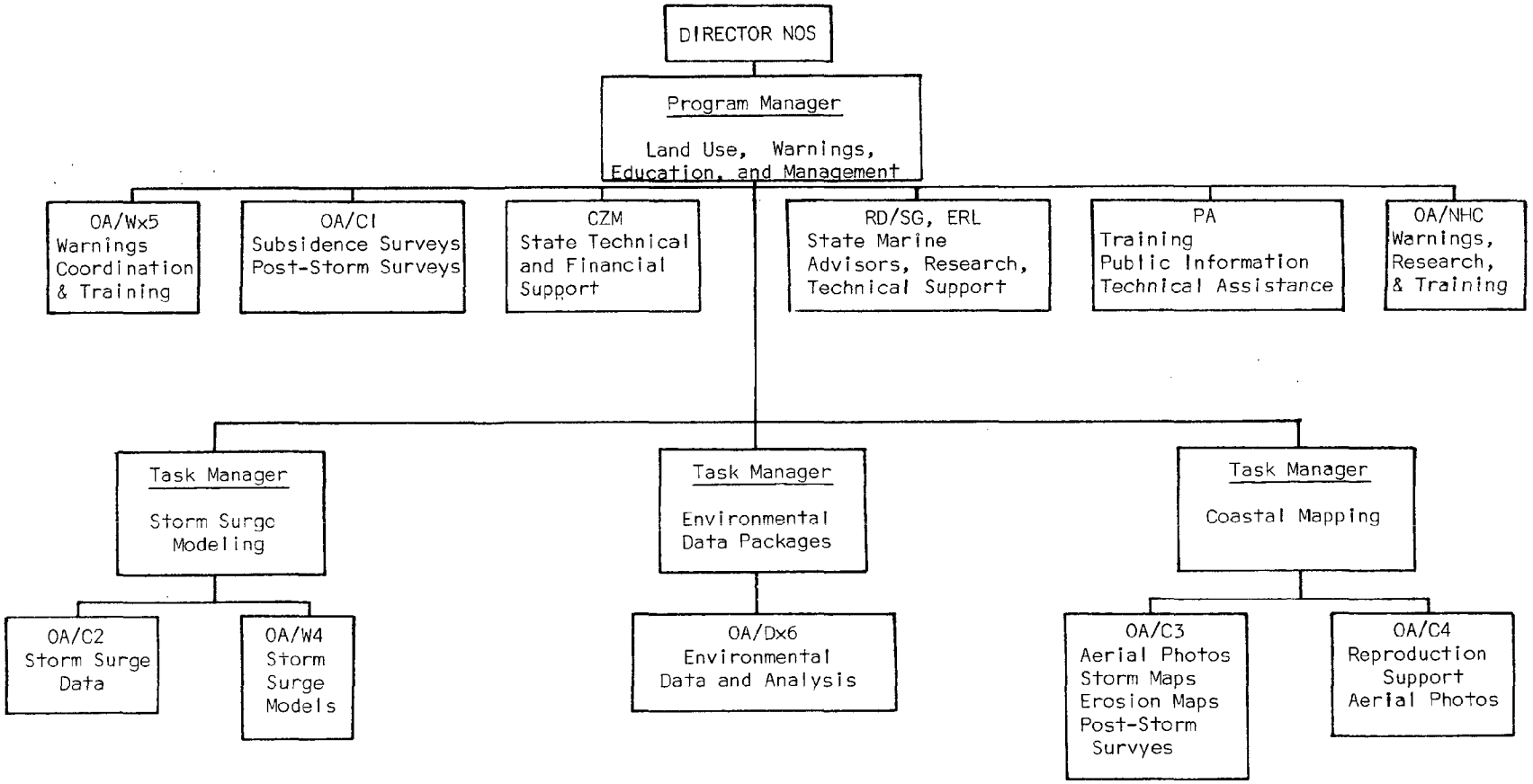


FIGURE 5-2

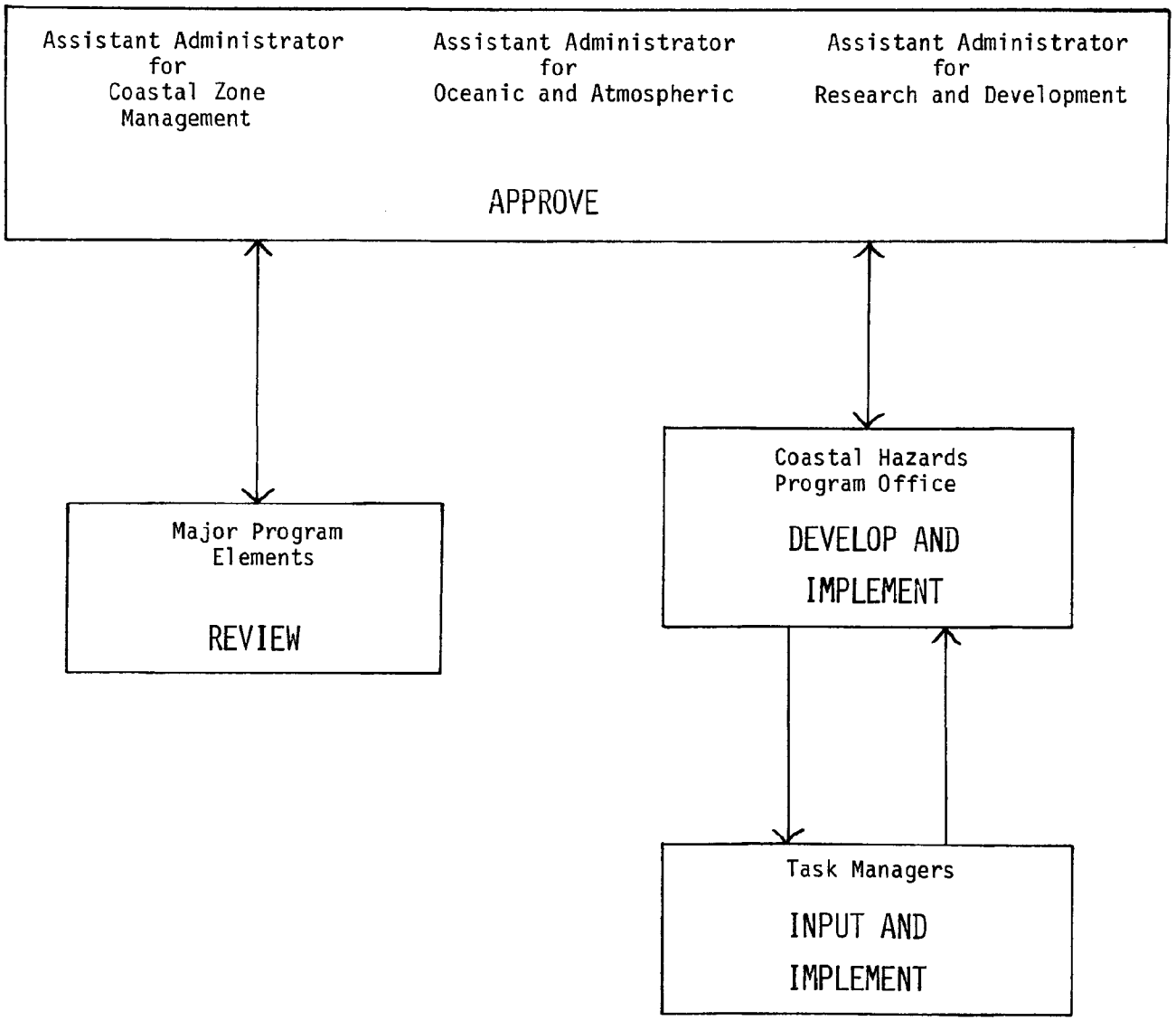

Assistant Administrator for Coastal Zone Management
Assistant Administrator for Oceanic and Atmospheric
Assistant Administrator for Research and Development
APPROVE
Major Program Elements
REVIEW
Coastal Hazards Program Office
DEVELOP AND IMPLEMENT
Task Managers
INPUT AND IMPLEMENT

FIGURE 5.3

PART VI

6.0 RESOURCES

6.1 SCOPE

Resource information is provided in this section based upon existing funds in the base of the present programs being consolidated in this PDP. Also included are the increases needed to meet the requirements of this plan in FY 1983 and beyond. Resources from other Federal, state and local agencies devoted to complementary programs in support of this PDP are not included.

6.2 PERSONNEL

Table 6-1 gives the present (FY 1981) and estimated personnel for the planned life of the program.

Table 6-1

PERSONNEL

FISCAL YEARS	1981	1982	1983-85	1986-88	1989-92
TASK					
Storm Surge Modeling	2	3	3	2	2
Climate Data Package	-	1	3	1	1
Coastal Mapping	1	1	2	2	1
Land Use, Warnings, Eduction, and Management	5	5	5	3	2

6.3 FUNDING

Table 6-2 shows present expenditures for FY 1981-82 and the estimated annual cost for carrying out this program for FY 1983-92. The program staff budget is included under Coordination, Management, and Support and includes labor and other office related cost and travel.

Table 6-3 shows a detailed distribution of base funds and requested increases according to each major task and each NOAA MPE participating in the program. Vertical columns show the funds each MPE or MLC will spend for each task each year. Horizontal totals show the funds spent for each task each year.

COASTAL HAZARDS PROGRAM

Financial Plan Fiscal Year 1981 through FY 1992
(Dollars in Thousands)

Principal Tasks		FY 1981	FY 1982	FY 1983-FY 1985	FY 1986	FY 1987-FY 1989	FY 1990-FY 1992
1. Storm Surge Modeling	Base	160	910	820	970	335	185
	Increase	750	- 90	150	- 635	- 150	---
2. Climate Data Package	Base	---	---	---	120	120	70
	Increase	---	---	120	---	- 50	---
3. Coastal Mapping	Base	100	100	100	300	300	300
	Increase	---	---	200	---	---	- 200
4.-7. Land Use, Warnings, Education, & Management	Base	265	265	265	1,910	1,910	1,300
	Increase	150 *	---	1,645	---	- 610	- 800
	Base	525	1,275	1,185	3,300	2,665	1,855
	Increase	900	- 90	2,115	- 635	- 810	-1,000
TOTAL:		1,425	1,185	3,300	2,665	1,855	855

* - Reallocated for 1 year.

TABLE 6-2

COASTAL HAZARDS PROGRAM RESOURCE DISTRIBUTION
FY 1981-FY 1992

PROGRAM ELEMENT		FY 1981						FY 1982						FY 1983-FY 1985					
		C	D	W	CZ	SG	TOT.	C	D	W	CZ	SG	TOT.	C	D	W	CZ	SG	TOT.
1. Storm Surge	Base			160			160			910			910			820			820
	Inc.			750			750			- 90			- 90	150					150
	Total			910			910			820			820	150		820			970
2. Climate Data	Base																		
	Inc.														120				120
	Total														120				120
3. Coastal Mapping	Base	100					100	100					100	100					100
	Inc.													200					200
	Total	100					100	100					100	300					300
4.-7. Land Use, Warnings, Education,&Management	Base	150		90		25	265	150		90		25	265	150		90		25	265
	Inc.				150*		150							100		750	700	95	1645
	Total	150		90	150	25	415	150		90		25	265	250		840	700	120	1910
TOTAL:	Base	250		250		25	525	250		1000		25	1275	250		910		25	1185
	Inc.			750	150		900			- 90			- 90	450	120	750	700	95	2115
	Total	250		1000	150	25	1425	250		910		25	1185	700	120	1660	700	120	3300

* - Reallocated for 1 year.

TABLE 6-3

COASTAL HAZARDS PROGRAM RESOURCE DISTRIBUTION
FY 1981-FY 1992

PROGRAM ELEMENT		FY 1986 C	D	W	CZ	SG	TOT.	FY 1987-FY1989 C	D	W	CZ	SG	TOT.	FY 1990-FY 1992 C	D	W	CZ	SG	TOT.
1. Storm Surge	Base	150		820			970	150		185			335			185			185
	Inc.			- 635			- 635	-150					- 150						
	Total	150		185			335			185			185			185			185
2. Climate Data	Base		120				120		120				120		70				70
	Inc.								- 50				- 50						
	Total		120				120		70				70		70				70
3. Coastal Mapping	Base	300					300	300					300	300					300
	Inc.													-200					- 200
	Total	300					300	300					300	100					100
4.-7.Land Use, Warnings, Education & Management	Base	250		840	700	120	1910	250		840	700	120	1910	250		530	400	120	1300
	Inc.									-310	-300		- 610	- 50		-400	-300	- 50	- 800
	Total	250		840	700	120	1910	250		530	400	120	1300	200		130	100	70	500
TOTAL:	Base	700	120	1660	700	120	3300	700	120	1025	700	120	2665	550	70	715	400	120	1855
	Inc.			- 635			- 635	-150	- 50	- 310	-300		- 810	-250		-400	-300	- 50	-1000
	Total	700	120	1025	700	120	2665	550	70	715	400	120	1855	300	70	315	100	70	855

TABLE 6-3 (cont'd.)