

WASHINGTON STATE  
DEPARTMENT OF  
E C O L O G Y

# Sea Level Rise Policy Alternatives Study: Volume 1

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## ALTERNATIVE POLICY RESPONSES FOR ACCELERATED SEA LEVEL RISE AND THEIR IMPLICATIONS

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Washington Department of Ecology  
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## PREFACE

A sea level rise response project was initiated by the Shorelands and Coastal Zone Management Program, Washington Department of Ecology in 1988. This Sea Level Rise Policy Alternatives Study is one of a number of technical and policy studies undertaken to investigate the implications of existing and accelerated sea level rise for Washington state. Volume 1 provides a critical evaluation of response alternatives and some of their implications. Volume 2 provides supporting information on existing, relevant Washington state and federal laws and regulations; the primary legal principals governing coastal zone management; and the policy responses of other states and nations to the prospect of accelerated sea level rise.

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## EXECUTIVE SUMMARY

The potential effects of accelerated sea level rise could impact a wide range of environmental, social, and economic systems within Washington State's coastal areas. A change in relative sea levels may be the result of anthropogenic climate change or global warming, local geotectonic subsidence or uplift, and human related activities such as groundwater extraction, reduced sediment load, and soil compaction. Any combination of these phenomena must be considered when developing scenarios for the potential future sea level of a specific area.

The focus of policy and management attention is on existing long term objectives and goals that may be exacerbated by accelerated sea level rise. Shoreline and bluff erosion may increase dramatically, wetlands may be lost, dunes may migrate, and storms may increase in frequency and intensity. As a consequence, coastal buildings, structures and facilities may be jeopardized, and fish and wildlife habitats may be reduced or degraded. Salt water intrusion may affect the supply of potable groundwater. From a management standpoint, the risks posed by accelerated sea level rise deserve attention because of the severity and extent of their potential impacts.

This report incorporates three separate studies that were prepared in conjunction with an analysis of alternative policy responses for accelerated sea level rise for the State of Washington: A Survey and Analysis of Washington State and Federal Laws and Regulations Relevant to the Management of Sea Level Rise; The Primary Legal Principles and Considerations Governing Coastal Development; and A Survey of National and International Policy Responses to Sea Level Rise. These component studies provide the foundation for assessing the range of management concerns that are implicated by sea level rise and for analyzing the various types of policies that may be applied in response.

A study of alternative policy responses necessitates an overview of the existing institutional structures and current management practices for Washington's coastal land and water resources. This system of governance involves the cooperation and coordination of many local, state, tribal, and federal agencies and programs. These participants range from agencies under the jurisdiction of the state such as the Department of Ecology and Department of Natural Resources, cities, counties, and port districts at the local level, to tribal governments and the Environmental Protection Agency and Army Corps of Engineers at the federal level. Most of the agencies and programs involved in managing the state's coastal environmental, economic, and social resources have mandates that extend beyond the coastal zone. A number of ongoing programs exist to ensure a cooperative interagency and intergovernmental focus on issues and problems, and to require a uniformity of purpose, planning, and regulation in coastal areas.

The overview of the state and federal regulatory structure surveys the major statutes and regulations that control activities and development in Washington's coastal and marine environments. It focuses on the characterization of the coastal environment, the types of uses and activities that are permitted there, and the institutional framework and jurisdictional relationships that exist. The laws and regulations governing jurisdictions, including the state, counties, and municipalities, that are subject to tidal influences and may be affected by changes in sea level are described. This section includes a brief analysis of the implications of sea level rise for each regulation or law being reviewed. The analysis discusses how sea level rise might affect the application of the law and potential interactions between various laws and regulations.

Section two examines the primary legal principles and considerations governing coastal development and discusses potential areas of concern and conflict that may result from accelerated sea level rise. Various legal principles guide public policy and private activities related to coastal and marine resource development. This section discusses three principles which may affect public policy designed to address accelerated sea level rise. The first of these principles, the public trust doctrine, governs states' dominion over their tidelands and creates special rights and responsibilities for the states in relation to those lands. The prohibition of the taking of private property without just compensation, as established by the fifth amendment to the U.S. Constitution, may be triggered as a result of the state pressing its public trust responsibilities or by other regulatory actions related to land use or ownership. A related issue is the government's potential liability resulting from the exercise of its authority to regulate land use in hazardous coastal areas. The third area of law, the question of land ownership under shoreline accretion and erosion, may also have an important impact on public policy related to sea level rise.

The final section surveys the policy responses among state and regional, federal, and international coastal authorities have made to sea level rise or analogous conditions. Several jurisdictions consider sea level rise a factor that may complicate current policy objectives and have made changes in their regulatory and management programs in response to the risks posed by sea level rise. Other jurisdictions, while not addressing sea level rise directly, are responding to problems that are analogous to sea level rise such as chronic erosion, subsidence, and the loss of vital ecosystems such as wetlands. Examination of the way these jurisdictions have responded to relative sea level rise and analogous problems provides an overview of the policies that are currently being implemented or considered in response to accelerated sea level rise.

Typically, policies addressing sea level rise are linked to existing coastal regulatory program objectives such as erosion control, coastal ecosystems preservation, and flood hazard protection. The jurisdictions that have already incorporated concerns about sea level rise into their policies have done so on the basis of these pre-existing policies and established program goals. Policies or activities that are based on pre-existing authority have

generally been found to be politically acceptable and easier to implement than attempts to establish new authorities. The uncertainty associated with sea level rise is less a deterrent to action when it is linked to significant existing issues.



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## **SECTION 1.0**

# **A SURVEY AND ANALYSIS OF WASHINGTON STATE AND FEDERAL LAWS AND REGULATIONS RELEVANT TO THE MANAGEMENT OF ACCELERATED SEA LEVEL RISE**

### **1.1 INTRODUCTION**

The management of Washington's coastal land and water resources requires the cooperation and coordination of many local, state, and federal agencies and programs. These participants range from agencies under the jurisdiction of the state such as the Department of Ecology (Ecology) and Department of Natural Resources (DNR), to cities, counties, and port districts at the local level, and the Environmental Protection Agency (EPA) and Army Corps of Engineers (ACE) at the federal level. Most of the agencies and programs involved in managing the state's coastal environmental, economic, and social resources have mandates that extend beyond the coastal zone. A number of ongoing programs exist to ensure a cooperative interagency and intergovernmental focus on issues and problems, and to require a uniformity of purpose, planning, and regulation in coastal areas.

This overview of the state and federal regulatory structure surveys the major statutes and regulations that control activities and development in Washington's coastal and marine environments. It focuses on the characterization of the coastal environment, the types of uses and activities that are permitted there, and the institutional framework and jurisdictional relationships that exist. This section describes the laws and regulations governing jurisdictions, including the state, counties and municipalities, that are subject to tidal influences and may be affected by changes in sea level.

Included in each section is a brief analysis of the implications that sea level rise may have for the statute or regulation discussed in that section. It is a premise of this study that the law makers and framers of these coastal and marine statutes and regulations did not consider the possibility of significant unexpected modifications of the physical environment when they were creating the language of these laws. Rather, the coastal zone is viewed in relatively static terms, subject only to normal cyclical oceanic and atmospheric conditions. The job of the law maker is to provide reasonable guidance for human activity in this context. Accelerated sea level rise, however, involves a major departure from the norm – a quantum jump, from one environmental state to another very different one, that could be relatively rapid and persist until a new state is achieved. Given this perspective, the implications sections of this report will examine the following kinds of questions:

- How does the law, statute or regulation relate to sea level rise?
- To what extent does the law, statute or regulation address any of the direct or indirect consequences of sea level rise?
- How might sea level rise affect the application of the law, statute or regulation?

- How might the law, statute or regulation affect responses to sea level rise?
- How might different laws, statutes or regulations interact or relate to one another in the context of sea level rise?

A change in relative sea levels may be the result of anthropogenic climate change or global warming, local geotectonic subsidence or uplift, and/or human related activities such as groundwater extraction, reduced sediment load, and soil compaction. Any combination of these phenomena must be considered when developing scenarios for the potential future sea level of a specific area.

## **1.2 SHORELINE MANAGEMENT ACT OF 1971**

### **1.2.1 Background and Objectives**

The Shoreline Management Act of 1971 (SMA) establishes a cooperative state and local program to maintain and improve shoreline quality while allowing for reasonable and appropriate uses (RCW 90.58). The act establishes Ecology as the lead agency for implementation of the coastal zone management program and requires the development of shoreline master programs and the administration of a permit system at the local level. The SMA is supported, in terms of requiring a uniformity of purpose, planning, and regulation, by the State Environmental Policy Act of 1971, the Environmental Coordination Procedures Act of 1973, and numerous other laws and regulations which are discussed below.

In 1976, Washington's Shoreline Management Program became the first coastal zone management program approved by the Secretary of Commerce under the Federal Coastal Zone Management Act of 1972 (CZMA) (16 U.S.C. 1451-1464). The CZMA was enacted by the U.S. Congress to promote active state involvement in preserving, protecting, and developing U.S. coastal areas. The CZMA encourages states to exercise their full authority over lands and water in the coastal zone and establishes ecological, cultural, historic, and aesthetic values as well as economic development as the primary program objectives. CZMA Section 306 (e) (1), along with the Federal Water Pollution Control Act and the Federal Clean Air Act, provides for state control of land and water uses in the coastal zone. Under the CZMA program, state and local components of the state's coastal zone management system receive annual grants from the federal government to assist in program administration and to help fund specific shoreline improvement projects and educational efforts.

The SMA establishes policies for managing state shorelines to ensure appropriate development and uses that promote the public interest by protecting against adverse effects to the public health, vegetation and wildlife, water resources, and public rights of navigation and access (RCW 90.58.020). Uses that are consistent with the control of pollution and prevention of damage to the natural environment or are shoreline dependent are preferred. These uses are listed in the following order of preference:

- Recognize and protect state-wide interest over local interests
- Preserve the natural character of the shoreline
- Result in long-term over short-term benefit
- Protect the resources and ecology of the shoreline
- Increase public access to publicly owned shorelines
- Increase recreational opportunities for the public
- Provide for any element under RCW 90.58.100 deemed necessary or appropriate.

### **Implications of Sea Level Rise for the Shoreline Management Act**

The CZMA requires the approved Shoreline Management Program to be consistent with the federal program. If the Coastal Zone Management Act is amended to require participating state programs to address sea level rise as a component of a current objective, the state program must comply. The federal program may also create voluntary incentives such as grants that encourage state coastal zone management programs to address sea level rise. State programs would be eligible for the incentives through improvements to current programs such as flood and hazard mitigation, shoreline preservation, and erosion control by including considerations for sea level rise.

#### **1.2.2 Administrative Structure and Implementation**

Local governments have the primary responsibility for initiating and administering the regulatory program of the SMA (RCW 90.58.050). Local master programs must incorporate policies which are consistent with the guidelines established by Ecology into their Shoreline Master Programs (SMPs) (RCW 90.58.080). The SMPs are combined planning and regulatory documents that guide the use and development of the shoreline (RCW 90.58.100). Those jurisdictions developing local master programs are required to utilize an interdisciplinary approach and to consult and consider all available information, technical data, research, and analytical techniques. Master programs are required to address the following topics:

- An economic development element for the location and design of water dependent uses and activities
- Public access and recreational considerations
- Transportation, utility, and facilities siting
- General use siting, conservation and preservation of natural resources, aesthetic values, and fish and wildlife habitat
- Historic and cultural preservation and restoration
- Any other element deemed appropriate to effectuate the policy of the SMA.

The planning program consists of a shoreline inventory and the implementation of a master program for shoreline uses which is a comprehensive land use plan based on the shoreline's environmental categorization.

The standards for implementing the SMA and criteria for establishing master programs are set forth in WAC 173.16. These guidelines establish a system for categorizing shoreline areas throughout the state on a uniform basis. The WAC requires that master plans be comprehensive long-range programs to govern land and water use in the coastal zone for at least 20 to 30 years, look beyond current issues, and follow creative objectives rather than simple projections of current trends and conditions.

Four basic environmental types of shoreline (natural, conservancy, rural, and urban) are recommended as standard categories. The categorization of a shoreline area is based upon existing development patterns, the biophysical capabilities, and the goals and aspirations of the local citizenry. The categorization system encourages activities and uses that minimize the detrimental effects upon each type of environment in accordance with locally derived goals and objectives. These management objectives are superimposed over local zoning and planning within the shoreline areas.

#### **The Implications of Sea Level Rise for Program Administration**

Most local master plans operate on a 20- to 30-year time horizon. Current research and modeling methods are not capable of accurately predicting the regional impacts of climate change and geotectonic vertical land movement on relative sea levels due to the uncertain timing and severity of the event. As a result, local decision makers fail to plan for these potential future impacts and ordinarily would not begin to respond to sea level rise until the impacts are already evident. The master plans' objectives of siting facilities, mitigating flood and hazard damage, providing public access and recreation, and preserving natural resources and habitats are, therefore, put at risk because of the current lack of reliable information.

#### **1.2.3 Jurisdiction and Environmental Designations**

The SMA defines "shorelines of the state" as all "shorelines" and "shorelines of state-wide significance" (RCW 90.58.030 (c)).

"Shorelines" is defined as:

- All waters of the state, their associated wetlands and lands underlying them including marine waters, lakes over twenty (20) acres, and streams and rivers exceeding a mean annual flow of twenty (20) cubic feet per second. All marshes, bogs, swamps and deltas associated with marine waters, lakes, and streams are to be considered shorelines. Shorelines include a two hundred (200) foot wide area landward of the ordinary high water mark for these waters (RCW 90.58.030 (d)).

"Shorelines of state-wide significance" is defined by RCW 90.58.030(e) as:

- The areas between the ordinary high water mark and the state's western boundary from Cape Disappointment to Cape Flattery including all harbors, bays, estuaries, and inlets
- Puget Sound and the Strait of Juan De Fuca between ordinary high water and extreme low tide including Nisqually Delta, Birch Bay, Hood Canal, Skagit Bay, and Padilla Bay
- Those areas of Puget Sound and the Strait of Juan De Fuca and adjacent waters north to the Canadian border
- Lakes in excess of 1000 acres and some coastal rivers
- Wetlands associated with each of these bodies of water.

Wetland areas associated with the "shorelines" of the state are defined as:

- Those lands extending landward for two hundred feet in all directions from the ordinary high water mark
- Floodways and contiguous floodplain areas landward two hundred feet from such floodways
- All marshes, bogs, swamps, and river deltas associated with the stream, lakes and tidal waters subject to this chapter of the SMA
- Portions of the one-hundred-year flood plain included by any city or county in its master program, minimally including the floodway and the adjacent area extending two hundred (200) feet landward (RCW 90.58.030 (f)).

The criteria for designating tidal waters as wetland areas associated with state shorelines subject to SMA jurisdiction are: areas 200 feet landward of the ordinary high water mark including all marshes, bogs, and swamps that influence or are influenced by tidal water through periodic inundation, geohydraulic processes, or a culvert surface connection (WAC 173.22.040.1 (a) (b)). Wetland designations are reviewed at five-year intervals (WAC 173.22.050). Alterations of shorelines affecting the boundaries of wetlands, either through development or natural causes, warrant a review of the designation of those shorelines and associated wetlands (WAC 173.22.052). In cases where there are conflicts concerning the designation of wetlands, the criteria for defining a wetland stated in WAC 173.22.040 take precedence over designations indicated by the shoreline designation maps (WAC 173.22.055).

## **Implications of Sea Level Rise for Jurisdiction and Boundaries**

The designation of boundaries is based upon the high water mark and applies to open beaches, bluffs, and wetlands. As this mark changes, so too should the area that falls within the 200-foot boundary under the jurisdiction of the SMA. On shorelines that have gradual slopes, the high water line would move upland at a rate proportionate to the incline of the shoreline profile. Some sandy beaches with a flat profile could experience a much more dramatic recession as the beach sediment is redistributed to maintain an equilibrium between the offshore water depth and onshore beach slope. For example, it is possible for a beach with a very flat profile that extends offshore to experience a 100-foot recession of the high water mark for every foot of sea level rise. Generally speaking, beaches with mild slopes will retreat more rapidly than steep beaches for each unit of sea level rise.

Under normal conditions, wetlands naturally adapt to variations in the temperature, salinity and oxygen levels of fluctuating tides. A wetlands long-term survival is dependent on its ability to maintain the surface elevations necessary for plant growth. If a wetland is inundated by sea level rise and the soil is saturated, the environment will become anaerobic, threatening the plantlife and all other species that depend on it. Wetlands require gently sloping, expansive uplands to successfully expand and migrate. A wetland adjacent to a mildly sloping upland could gradually migrate with the rising water level, while one bordered by steep slopes or obstructions, such as bulkheads and levees, would become inundated and reduced in size. Wetland designations are reviewed at five-year intervals using the regulatory criteria for defining wetlands. As the water level rises and wetlands migrate, the jurisdictional boundary should be adjusted accordingly.

In some areas, the 200-foot shoreline band under the jurisdiction of the SMA may not be adequate for addressing problems associated with sea level rise. The boundary is artificial and does not reflect the coastal area's environmental processes. It therefore does not lend itself to comprehensive planning for a whole environmental system. Activities that occur outside the current shoreline area may have a significant influence on the area's environmental quality as the sea level rises and the shoreline recedes.

### **1.2.4 Environmental Categories**

The Ecology guidelines characterize the four basic shoreline environmental categories in terms of management objectives and features (WAC 173.16.040(4)(b)(i-iv)). The four basic categories can be briefly summarized as:

### *Natural Environment*

This category includes areas of unique natural or cultural features considered valuable in their original condition and intolerant of intensive human uses. Local policies should seek to preserve and restore these systems by regulating development that would degrade or change their natural characteristics. Local citizen opinion, as well as the needs and desires of other people in the state, determine the relative value of these resources.

### *Conservancy Environment*

This category includes undeveloped areas that are intended to remain in their current state. Policies should seek to protect, conserve, and manage these areas to ensure continued recreational benefits to the public and sustained resource utilization. Nonconsumptive uses that are non permanent in nature, such as outdoor recreation, sustainable timber harvesting and passive agriculture (such as pasture and range), are appropriate for these areas. This category includes areas that are biophysically unsuitable for rural or urban development such as steep slopes or flood zones.

### *Rural Environment*

This category includes areas presently supporting intensive agricultural and recreational uses or capable of supporting such uses in the future. Policies are to be designed to preserve the rural character through limiting density, providing open space, and maintaining adequate setbacks from the shoreline thus preventing coastal resources from being destroyed for other types of rural uses. Shoreline access and recreational opportunities that are compatible with agricultural uses are to be maximized. Agricultural practices that do not cause erosion or siltation of water bodies are encouraged.

### *Urban Environment*

This category includes areas of high intensity land use including residential, commercial, and industrial. Policies for this category should provide optimum utilization of the shorelines for a multiplicity of urban uses allowing for public access and emphasizing a preference for water-dependent industrial and commercial development that requires frontage on navigable waters.

Many jurisdictions have found it necessary to expand on the four basic environments in order to adequately characterize their specific environmental conditions and management objectives. The following new categories and subcategories have been created (Fox and Heikala, 1983):

- Aquatic environment
- Intermediate environments between the urban and rural, such as urban residential, suburban, semi-rural, and rural residential

- Subcategories within the urban environment, particularly in highly developed and complex shoreline areas.

The code also describes various natural systems to which the SMA applies. The systems provide the basis for the code's use and activities guidelines (WAC 173.16.050). The definitions are in a descriptive form, focusing on the geophysical and biological processes that are prevalent along the state's shorelines. The descriptions include the identification of potential impacts on certain systems that may result from human activities, e.g., removing sand from dunes may subject upland areas to flooding from heavy wave action during severe storms, and building of dikes and levees may increase the potential for flooding by causing channelization and the destruction of shoreline habitat.

### **The Implications of Sea Level Rise for Environmental Categories**

Sea level rise may accentuate the impacts that human activities have on natural systems. Beach and shoreline erosion resulting from sand removal and increased flooding resulting from the filling of wetlands are examples of adverse impacts from inappropriate activities in those environments. The impact of these activities and others affecting the shoreline ecosystems may increase in severity if the sea level rises.

#### **1.2.5 Guidelines for Shoreline Uses**

The implementing regulations found in WAC 173.16.060 list the appropriate shoreline activities and uses that localities are to use as guidelines for developing shoreline management programs. Presently, most SMPs in Washington organize regulations around use activities rather than environmental designation (Fox and Heikala, 1983). The general guidelines for categories of uses, and some of the RCW and WAC sections that authorize and implement them, are listed below:

##### *Agricultural Practices*

Protect water quality by using practices that do not cause erosion or permit agricultural chemicals and wastes to enter water bodies.

##### *Forest Management Practices*

Guard against siltation, increased water temperatures of fish spawning habitats, pollution from the use of chemicals, and destruction of scenic quality. The SMA permits timber cutting within shorelines of statewide significance on a selective basis (RCW 90.58.150).

### *Aquaculture Practices*

Aquaculture is a water dependent preferred use that should be constructed with consideration for navigational rights and visual quality.

### *Mining*

Removal of sand and gravel from marine beaches should normally not be permitted, but if permitted should take into consideration the siltation and erosion of sensitive biophysical environments.

### *Shoreline Protection*

Flood protection devices such as dikes should be located on the landward side of wetlands. Stabilization measures should protect the natural streamway and avoid channelization.

### *Breakwaters*

Breakwaters should be constructed in a manner which reduces the detrimental effects on sand movement, water circulation, and the public use of surface waters. Standards for breakwater construction are based on the protection of fish habitats and spawning areas (WAC 220.110.330).

### *Bulkheads*

For ocean exposed locations, bulkheads are not to be considered a long-term solution to protecting uplands. They may be constructed to protect upland property from imminent erosion but should not cause adverse impacts on beaches, fish, and wildlife habitats or detract from the aesthetic quality of the shoreline.

### *Dredging*

Dredge and fill projects must minimize damage to existing ecological values and natural resources and include consideration for disposal of fill on land. Standards for dredging are based on avoiding damage to shellfish and fish habitats (WAC 220.110.320).

### *Jetties and Groins*

Effects of proposed structures on sand movement must be evaluated and investigated when necessary.

### *Piers*

Community piers and offshore boat moorage are preferred over open-pile piers except where there is significant littoral drift.

### *Landfill*

Landfill may cause significant destruction to the natural character of land, cause erosion, and diminish surface water. Landfills must be designed to avoid damage to natural resources and water currents, with priority given to development for water dependent uses. The project and the fill material must be evaluated for their effects upon water quality and habitat.

### *Commercial Development*

Commercial development should be located in urban areas. There is a preference for shoreline dependent commercial activities which serve large numbers of people.

### *Marinas*

Marinas must be located and constructed to reduce damage to fisheries. There is a preference for floating rather than solid-type construction following the guidelines established by the Department of Fisheries. The standards for marina construction are based on providing protection for fish and shellfish habitat (WAC 220.110.330).

### *Recreational Development*

Priority is given to water oriented recreational uses that facilitate public access to the shoreline and that are compatible with the environment. Standards should be developed for the preservation and enhancement of scenic views. Pacific Ocean beaches are declared public highways and public recreation areas (RCW 79.16.160 and RCW 79.16.172).

### *Residential Development*

Residential development should protect the aesthetic quality and natural character of the shoreline by preserving vegetation, designing for density compatible with the physical capabilities of the shoreline, using planned unit development, and promoting access to shorelines. Over-water structures should not be permitted.

### *Ports and Water Related Industry*

Priority is given to water dependent industries including ports. Sewage treatment, water reclamation, desalinization, and power plants should be located so as not to interfere with

recreation, residential, and other public uses of shorelands. Where feasible, transport corridors and utilities should be located upland.

#### *Road and Railroad Development*

Road and railroad development should be located away from the shoreline whenever possible. State codes require roads to fit the topography, minimize road construction in wetlands, and be located away from slopes. Design and construction should prevent erosion and water pollution by permitting natural groundwater movement in wetland areas (WAC 222.24.020).

#### *Solid Waste Disposal*

Shorelines and flood plain areas should not be used for dumps or landfill.

#### *Utilities*

Utilities should minimize the disturbance to the shoreline by restoring sites to their original condition and by placing facilities underground when possible.

#### *Outdoor Advertising*

Outdoor advertising is limited to high use areas and should not degrade the view or aesthetic quality.

#### *Archaeological Areas and Historic Sites*

The state Parks and Recreation Commission is responsible for the protection, restoration, and reconstruction of historic sites, buildings, and structures (RCW 43.51).

### **The Implication of Sea Level Rise for Shoreline Use Guidelines**

Shoreline use guidelines establish a pattern of development based upon current environmental conditions. The most important guidelines are those that determine the siting of development projects and flood protection devices such as dikes, bulkheads, breakwaters, and landfill. Currently, shoreline protection devices are required to be on the landward side of the wetland or water body and there is no provision for accommodating long-term changes in the configuration of the shoreline.

Current guidelines do not provide a sufficient buffer zone between the shoreline and structural development to accommodate sea level rise. There will be no place for wetlands to migrate if the sea level rises, causing wetlands to be inundated or significantly reduced. Structures that are built at the bluff's edge would be jeopardized as the beach buffer is inundated and the scouring effect of the waves on the bluff causes an increase in the

slumping and collapse of coastal cliffs. Sandy beaches will be subject to increased erosion and storm surge, threatening structures that are built in hazardous flood areas.

The current guidelines for agricultural and forest management practices permit certain activities within the shoreline area. Some of these activities degrade or develop areas directly adjacent to wetlands. If allowed to continue, these activities could contribute to the reduction or loss of these wetlands if the wetlands are unable to migrate as the sea level rises.

Projects such as drainage systems, marinas, roads, and other infrastructure that have a useful life expectancy exceeding the normal 20- to 30-year shoreline planning framework may be subject to adverse and unanticipated impacts resulting from sea level rise. Current guidelines for design and construction standards may be adequate to prevent flooding, erosion, and water pollution under present shoreline conditions. They may, however, be inadequate if significant changes in the shoreline and water table cause damage to or impair the operation of these projects. For example, the outfall for a flood drainage system built today may end up below the future water level due to sea level rise, thus reducing the system's ability to drain off excess surface water.

The guidelines also call for the protection and restoration of historic and archaeological sites. This task may be made more difficult by rising sea levels as structures and sites become more vulnerable to erosion and wave action, requiring some form of protection.

#### **1.2.6 Shoreline Substantial Development Permit**

The primary purpose of shoreline master plans under the SMA is to establish a regulatory permit system administered by the local government. Local governments are required to establish a master program consistent with the rules set forth by Ecology for the administration and enforcement of shoreline substantial development permits for building or activities in the shoreline (WAC 173.14.020). Substantial developments are those that exceed a fair market value of \$1,000 or that materially interfere with normal public use of the shorelines of the state. The environmental designations and use regulations in the SMA are used in local master programs to determine whether a proposed activity requires a shoreline substantial development permit and if it should be granted.

The Washington Ecology and the state Attorney General review permit decisions to ensure consistency with the local shoreline master plan and the SMA policies and guidelines. The SMA Enforcement Regulations establish enforcement procedures and penalties for violations of permit policies (WAC 173.17). The enforcement action depends upon the nature of the violation, the damage or risk to the public or public resources, and the degree of bad faith. Permit decisions and actions that are found to be inconsistent with the SMA guidelines may be appealed through the Shorelines Hearings Board, a quasi-judicial body representing citizen interests (RCW 90.58.140). Decisions pertaining to the

granting, denying, rescinding, rulemaking or procedures, are reviewed by the Superior Courts of the State of Washington (RCW 90.58.180). Any party affected by a proposed action has the right to appeal a permit decision to the Shorelines Hearings Board.

Most shoreline activities or developments that significantly affect an adjacent water body will be subject to approval under the state Hydraulic Project Approval Law and the permit requirements of Section 10 of the federal Rivers and Harbors Act and Section 404 of the federal Clean Water Act. These regulations are discussed in more detail below.

### **1.2.7 Exemptions and Variances for Shoreline Development**

Developments that are exempt from the substantial development permit requirements of the SMA are listed in WAC 173.14.040:

- Normal protective bulkheads for single family residences and developments that do not exceed \$2,500 in cost or total value
- Repair of existing structures and development from damage caused by natural elements except when it causes adverse effects to the shoreline resources or environment
- Emergency construction for protecting property from damage by natural forces and threats to public health, safety, or the environment
- Construction of dykes, levees, roads, and other structures and practices associated with agricultural activities
- Construction of single family residences for use by the property owner's family, not exceeding 35 feet in height and meeting all requirements of other state and local agencies.

Single family residence bulkheads must comply with local shoreline master plan standards and policies and may require a certificate or letter of exemption and a building permit (RCW 90.58.140). Some shoreline master programs require a variance or conditional use waiver under certain conditions. Incidental backfilling for bulkhead construction of less than one cubic yard per running foot of shore protection does not require a shoreline substantial development permit provided that it does not extend more than five feet beyond the natural bank, does not interfere with the normal littoral drift, and does not adversely affect fish spawning, rearing, or migration habitat identified by the Department of Fisheries.

The criteria for conditional use permits require that such uses are consistent with SMA policies, are compatible with other permitted uses, do not interfere with normal public use of the shoreline, and have no detrimental effects on the public interest (WAC 173.14.140).

Variances are permitted where extraordinary or unique circumstances relating to property would cause the local master plan to impose an unnecessary hardship on an applicant (WAC 173.14.150).

The permit requirement is also waived for development that is certified as conforming with the Energy Facilities Site Locations Act (RCW 80.50.110) and for limited road construction under the Forest Practices Act (RCW 76.09.240), which will be discussed below.

The SMA explicitly withholds the authority to order removal of structures, improvements, docks, fills, or developments placed in the navigable waters prior to December 4, 1969, and that are not in violation of state statutes (RCW 90.58.270).

The SMA creates a prohibition on surface drilling for oil or gas in the waters of Puget Sound and the Strait of Juan De Fuca and all lands one thousand feet landward of the ordinary high water mark (RCW 90.58.160).

### **The Implications of Sea Level Rise for Local Shoreline Master Program Implementation, Substantial Development Permits, and Exemptions**

Many of the adverse impacts resulting from potential sea level rise could be mitigated by the effective long-term management of coastal resources. Such long-term management is not occurring, however, because current use regulations and environmental designations focus on incremental development actions based on current conditions and give little or no consideration for the long-term implications of these actions. There are a number of constraints that keep local shoreline management programs from implementing comprehensive long-term planning that considers those longer-term implications. These constraints are associated with four aspects of current shoreline master program implementation: regulations and standards, administration, exemptions and waivers, and intergovernmental program coordination.

#### *Regulations and Standards*

The potential impacts of sea level rise may be most effectively addressed by comprehensive long-term planning. As currently constituted, the SMA use regulations and environmental designations do not foster such planning, however. They require evaluating the impact of an individual project within only a limited geographical space and do not take into account the aggregate long-term impacts of all shoreline developments. For example, a breakwater may meet use regulations and still cause erosion by reducing shoreline accretion. At present, it is up to individual jurisdictions to develop and implement comprehensive long-term management plans addressing county- or city-wide areas and problems.

Some SMPs contain highly detailed standards for the size, density, and type of development permitted, while others contain general policy statements that provide broad guidelines for development. Detailed regulations and standards provide a more streamlined permit review process because they are more explicit about what uses are permissible and what factors must be addressed in a project proposal. Having more uniform, detailed, and

comprehensive regulations would be particularly useful for areas where there is a high level of public concern and increasing pressure to develop. Wetlands, bluffs, and sandy beaches are examples of areas subject to impact by sea level rise where detailed and well defined regulations could be beneficial for siting development.

#### *Administration*

Typically, local governments are ill prepared to incorporate sea level rise concerns into their comprehensive land use and shoreline master plans. A shoreline master plan's effectiveness is dependent on the availability of data, the level of staff expertise and experience, the program's acceptance in the community, and the political climate. Programs that lack any of these will have difficulty in addressing issues as complex and distant as sea level rise.

The effective implementation of substantial development permits and other shoreline development regulations requires consideration of a broad range of geophysical and biological processes. Incorporating the potential impacts from sea level rise into the permit evaluation process would increase the complexity of the technical aspects that need to be considered for a proposed project. Many local shoreline management programs lack the technical information and data gathering capability required to fully consider the long-term cumulative impacts of development on the entire shoreline area. Current siting and building standards, intended to meet environmental and hazard mitigation objectives, may not be adequate under future conditions if the sea level rises.

Often, local planning horizons are too short to consider impacts from sea level rise that may occur in the distant future. Communities and private investors usually seek to maximize the economic return on their resources, and the short-term benefits from shoreline development are weighted more heavily than the potentially adverse future impacts associated with sea level rise.

#### *Exemptions and Waivers*

Activities that are exempted or waived from substantial development permit requirements include bulkheading for single family residences, incidental filling, dikes, and levees for agricultural purposes, certain forest practices, energy facility siting, and the rebuilding of damaged structures. Continuation of these development activities could lead to a more structurally armored shoreline, degraded water quality, and increased shoreline erosion. Sea level rise would contribute to the long-term cumulative impacts of these activities.

#### *Program Coordination and Intergovernmental Relations*

The integration of shoreline management and use regulations into local zoning and comprehensive planning ordinances affects how well they can be implemented. Without

well defined state policies and technical assistance, local governments may lack the authority and institutional support for addressing complex problems such as those posed by sea level rise.

Overlapping jurisdictions of local, state, and federal regulatory programs may lead to actions that are not consistent with local policies. For example, the local SMP may restrict development adjacent to wetlands while the Department of Natural Resources is permitting forest practices in its shorelands. It is also possible that federal agencies such as EPA may assume a more aggressive stance on responding to sea level rise and put pressure on state and local governments to be consistent in their response.

Local governments, the Shorelines Hearings Board, and state superior and appellate courts have not been consistent in their implementation of the SMA objectives. A statistical comparison evaluating permit decisions rendered by local governments, superior courts, and the Shorelines Hearings Board from 1974 to 1983, shows that the Shorelines Hearings Board has been more consistent in implementing the objectives of the SMA concerning non-shoreline dependent development, the development of natural shorelines, and environmentally harmful development than have local governments and the superior courts.<sup>1</sup> This reflects a difference in perspective in terms of program objectives and implementation. Sea level rise, with its long-term uncertainties and potentially adverse impacts, could further exacerbate the difference between local and state level implementation of SMA objectives.

### **1.3 FLOOD PLAIN MANAGEMENT**

#### **1.3.1 Relation to Federal Program**

Flood control relies on the participation of state and local governments in the National Flood Insurance Program (NFIP) administered through the Federal Insurance Administration. Local governments that participate in the program are required to use the base flood elevations and delineation of flood hazard and coastal high hazard areas as developed by the Federal Emergency Management Agency (FEMA). To be eligible for the program, the local governments must adopt, administer, and enforce land use control measures in their building ordinances, subdivision regulations, health regulations, and construction specifications.

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<sup>1</sup> William Chapman's *Substantive Decision Making Under the Washington Shoreline Management Act* is a statistical analysis of the permit decisions made by local governments, the Shorelines Hearing Board, and state courts regarding the implementation of the Shoreline Management Act. It tracks how the objectives established in the SMA have been acted upon in permitting actions by these decision makers and provides a method for evaluating the implementation of the law.

### **1.3.2 State Flood Plain Management Program**

The Flood Plain Management Act of 1987 establishes Washington's flood plain management policy. The act makes Ecology responsible for coordinating the flood plain management regulation aspects of the national flood insurance program (RCW 86.16). DOE's Flood Plain Management section assists communities to develop comprehensive plans that incorporate building, shoreline, and floodplain management objectives into their permit systems (RCW 86.16.031). Ecology provides assistance in maintaining flood control systems through the Flood Control Assistance Account Program (RCW 86.26) and (WAC 173.145).

Flood plain management implementation guidelines and standards are provided in WAC 173.142. Ecology also establishes standards and rules pertaining to new development in high hazard coastal areas, known as V-zones, which are susceptible to storm surge (WAC 173.158). At present, structures are still permitted to be constructed within the V-zone if they meet the building standards and codes set by the local government.

#### **The Implications of Sea Level Rise for Flood Plain Management**

The subsidized insurance available through the National Flood Insurance Program provides a significant economic benefit to the citizens and property owners of participating communities. The availability of subsidized flood insurance has reduced much of the risk of owning shoreline property and provided an incentive for developing in hazardous coastal areas. The tendency of the flood insurance program to encourage development in flood prone areas runs contrary to the objectives of the federal Coastal Zone Management Act, the state Shoreline Management Act, and local shoreline master programs.

Sea level rise would exacerbate the problem of mitigating coastal hazards by increasing the probability and severity of flooding, erosion, and permanent inundation. Under the current program, if flood prone areas continue to be developed and redeveloped, communities will be faced with a choice of either constructing protective flood barriers or eventually abandoning the area as it becomes permanently inundated. Voluntary NFIP programs, designed to encourage property owners to relocate or remove structures that are in imminent danger of collapse from flooding and erosion, have not proved successful in reducing the amount of development in hazardous areas.

## **1.4 THE MANAGEMENT OF STATE AQUATIC LANDS**

### **1.4.1 Jurisdiction, Definitions, and Title of Aquatic Lands**

Aquatic lands are defined as all state-owned tidelands, shorelands, harbors areas, and beds of navigable waters (RCW 79.90.010 and WAC 332.30.106(5)). The Department of

Natural Resources (DNR) has title and jurisdiction over these lands (RCW 79.90.010). All the public lands under DNR proprietorship, including tideland and shoreland properties, are managed as a public trust. Prior to the prohibition on selling state tidelands passed into law in 1971, the state had sold 60 percent of the public tidelands to private individuals. DNR manages most of the 1,160 miles of marine beach remaining in public ownership, with approximately 400 miles being managed by the state's Parks and Recreation Commission, Departments of Fisheries, or Department of Wildlife.

- First class tidelands are defined as the shores of navigable tidal waters belonging to the state lying within or in front of the corporate limits of a city, or within one mile on either side and between the line of ordinary high tide and the inner harbor line; and within two miles of the corporate limits on either side and between the line of ordinary high tide and the line of extreme low tide (WAC 332.30.106). Port districts are located in first class tidelands.
- Second class tidelands are the shores of navigable waters lying more than two miles outside the corporate limits. In general, the line of ordinary high tide is the landward boundary and extreme low tide is the waterward boundary (332.30.106). Second class tidelands should be free of bulkheads, seawalls, and landfills except when in the public interest (WAC 332.30.118).
- Shorelands that are subject to "avulsion," or the sudden and perceptible change in the shoreline of a body of water, are not subject to a change in boundary line.
- Erosion is defined as the gradual cutting away of the shore by natural forces, while accretion is the natural buildup of the shore by alluvial deposits. Title is gained to lands that are formed by accretion and title is lost to land that are reduced by erosion. Boundary lines change to reflect the formation or reduction of lands (WAC 332.30.106).

#### **The Implications of Sea Level Rise for the Jurisdiction, Definition, and Title of Aquatic Lands**

Sea level rise would occur over a long period of time extending through the next century and would result in the gradual erosion and inundation of coastal shorelands. Based upon the definition of state owned tidelands, as those shorelands erode and land becomes permanently inundated, title to the newly formed tidelands would pass to the state. This is similar to the process that has been experienced in many Gulf and Atlantic coastal areas for several decades where local erosion and subsidence patterns have resulted in extensive inundation of upland properties. Generally speaking, state and federal courts have supported the proprietary interests of states in the newly created waters.

#### **1.4.2 Aquatic Lands Management**

The Washington legislature has stated that state-owned aquatic lands are "finite natural resource of great value and an irreplaceable public heritage" which are to be managed "to provide a balance of public benefits for all citizens of the state" (RCW 79.90.450 and 79.90.455). The public benefits provided by aquatic lands are listed as:

- Encouraging direct public use and access
- Fostering water dependent uses
- Ensuring environmental protection
- Utilizing renewable resources
- A public benefit is derived from generating income consistent with these uses.

The management of state-owned tidelands and shorelands is implemented through WAC 332.30. Mineral and material production and the promotion of production of renewable resources are additional management goals listed in WAC 332.30.100 (1). Management methods are required to promote uses that protect resources of statewide value (WAC 332.30.100 (2)). The management criteria for aquatic land planning are based on the uses listed in the SMA (WAC 332.30.107), including:

- Coordination of planning with local SMPs
- Supplemental planning to meet statutory responsibilities for activities requiring intensive management, special protection or conflict resolution when these needs are not met by the SMP
- Mitigation of unacceptable adverse impacts on resources of statewide value by the following methods, in order of preference
  - a. Seek alternatives that avoid adverse impacts
  - b. When avoidance is not practical, seek alternatives that cause insignificant adverse impacts
  - c. Replace, preferably onsite, impacted resources and uses of statewide value. It must be demonstrated that these are capable of being replaced
  - d. In lieu of replacement, payment may be accepted from the responsible aquatic land user for the lost economic value of off-site resources.

Uses and activities in aquatic lands are regulated for the public benefit (WAC 332.30.118). This requires using the state-owned aquatic lands to obtain revenue by emphasizing water dependent and renewable resource uses. Public recreational use and access to state-owned aquatic lands is protected (WAC 332.30.131).

### **1.4.3 Environmental Protection**

Environmental protection of aquatic lands is implemented under WAC 332.30.134. The statute requires:

- A coordinated interagency state and federal planning effort
- The participation of other state and federal agencies and programs such as the SMA, SEPA, NEPA, Hydraulics Project Approval, Federal Clean Water Act, Fish and Wildlife Coordination Act, and Section 10 of the Rivers and Harbors Act, when their appropriate jurisdictional interests and technical expertise are relevant to individual projects
- Methods for determining if leases and other aquatic land conveyances should include environmental protection requirements when:

- a. the regulatory agencies' approval is not required
- b. unique circumstances require long-term monitoring or project performance, or
- c. there is substantial evidence that the project warrants special protection.

The state has the authority to establish land reserves for environmental, educational and scientific uses (RCW 79.68.060). Aquatic lands of special educational, scientific or environmental importance that are threatened with degradation may be nominated for reserve status with the approval of the commissioner of public lands (WAC 332.30.151). These lands may be protected from conflicting land uses by lease actions or through assignment to another agency.

#### **The Implications of Sea Level Rise for Aquatic Lands Management and Environmental Protection**

Sea level rise may effect aquatic land management in several areas. First, the management criteria for aquatic lands planning requires the mitigation of unacceptable adverse impacts on resources of statewide value. If there is no prior policy addressing potential sea level rise, the state's aquatic resources may suffer adverse impacts, requiring the Department of Natural Resources to respond in a reactive manner. Secondly, the requirement for a coordinated interagency and intergovernmental planning effort may be more difficult to achieve if the various agencies do not share a common perspective of the risk posed by sea level rise. Finally, the authority to create land reserves for environmental, educational and scientific uses, and for aquatic lands that are threatened with degradation, may offer an opportunity for the state to set aside critical coastal and wetland habitats so that they may gradually evolve as the environment changes.

#### **1.4.4 Public Port Districts**

DNR authorizes the use and management of state-owned aquatic lands by port districts according to the criteria established in WAC 332.30.114. Specific harbor use classes accentuate water dependent and oriented commerce and public access, while restricting residential development (WAC 332-30-115). There are currently over 40 public port districts within the coastal zone of Washington State. Port districts provide a system of harbor improvements, belt line railways, water and land transfer and terminal facilities, airports, bridges and tunnels, and other economic developments. The port districts must adhere to the policies specified in RCW 79.90 through 79.96. All port and harbor developments are regulated under the federal Rivers and Harbors Act and the Clean Water Act, (which are discussed below), as well as Ecology, DNR, the Department of Social and Health Services and the local city and county SMPs. Port districts generally abide by the county and city zoning ordinances and building codes.

## **The Implications of Sea Level Rise for Port and Harbor Management**

Ports are constantly planning and developing shoreline projects with useful lifetimes exceeding twenty to thirty years that may be susceptible to the potential impacts from sea level rise. In areas experiencing subsidence or submergence resulting from vertical land movement, groundwater extraction, and compaction there may be cause for concern regardless of sea level rise.

A rise in sea level will increase the tidal prism of a harbor, alter the sedimentation pattern and exert increased wave energy on harbor structures. Harbors that depend on structural protection may be threatened by waves overtopping the jetties and breakwaters.

Ports and harbors are required to mitigate the environmental impacts of that development. Some of the methods used to mitigate waterfront development are creating or enhancing natural habitats, applying engineering measures and providing public access. The engineering standards used for new fill for bulkheads, site cleanup, the mitigation of wetlands loss, and other port activities may be adequate for current conditions but not for future conditions if the sea level rises. While engineered structures may be adapted to new conditions, natural systems like wetlands may not be as adaptable, and may be reduced in value and size as a result of sea level rise.

### **1.4.5 Forest Management Practices**

Forest Management is the responsibility of the Department of Natural Resources. The DNR is the proprietor of nearly 880,000 acres classified as productive timber land located in the coastal zone. The Forest Practices Act establishes a permit process for governing forest practices on both state and private forest lands (RCW 76.09). The act requires compliance with the SMA and the state hydraulics code, with the exception of limited road construction (RCW 76.09.240). Also, the Forest Practices Act provides that any powers granted by the SMA pertaining to forest management are limited to those lands located within the shoreline area defined by RCW 90.58.030.

#### **The Implications of Sea Level Rise for Forest Management Practices**

As previously discussed, the degradation of wetlands and the erosion of shorelines resulting from permissible forest practices such as road construction may be accentuated by sea level rise. Forest harvesting activities that are conducted outside the 200-foot shoreline barrier may have a significant impact on that area. If the shoreline experiences increased erosion as a result of sea level rise, the area serving as a buffer between the shoreline and the land being harvested will be reduced.

## **1.5 STATE ENVIRONMENTAL POLICY ACT OF 1971 (SEPA)**

The State Environmental Policy Act of 1971 (SEPA) is the state's most comprehensive statement on environmental policy, requiring environmentally sound planning and the disclosure of issues concerned with the governmental decision making process pertaining to proposed activities and development (RCW Chapter 43.21C).

SEPA requires that an Environmental Impact Statement (EIS) be prepared prior to the authorization of projects "significantly affecting the quality of the environment," including natural geologic conditions and hazards that may affect the project. After an action is proposed by a public agency or private party, a lead agency is chosen and it determines whether the project requires that an environmental impact statement be prepared. Projects that require Substantial Development Permits or Hydraulic Project Approvals must go through an EIS. The draft EIS is circulated for review by public agencies and the public. The public's comments are included in the final EIS used by decision makers as the basis for their decisions regarding the project (RCW 43.21C.030). The guidelines for interpreting and implementing SEPA are set forth in WAC 197.010 through 197.11.990.

The elements of the environment to be considered in the EIS include all geologic and biologic elements of the environment, air and water quality, natural hazards, natural and renewable resources, and aesthetic resources. The EIS must also consider built environments, including land and shoreline use considerations concerning land use plans, aesthetics, and public services such as utility facilities, transportation, recreation, storm water, and solid waste management (WAC 197.11.444).

### **The Implications of Sea Level Rise for Drafting Environmental Impact Statements**

The State Environmental Policy Act requires that an EIS be prepared prior to the authorization of projects "significantly effecting the environment." The elements of the environment to be considered in an EIS include natural hazards, water quality, biological habitats, recreational resources, waste management, etc. As previously discussed, all of these elements may be effected by potential sea level rise. Interested members of the public and government agencies could question whether an EIS has adequately addressed the potential risk that sea level rise poses for a project. They may also question whether a project could have significant detrimental environmental impacts under unanticipated conditions like sea level rise.

## **1.6 HYDRAULIC PROJECTS APPROVAL LAW**

The Hydraulic Project Approval Law states that any project that would use, divert, obstruct or change the natural flow or bed of salt or fresh waters must get approval from the Department of Fisheries or Department of Wildlife in order to ensure the protection of fish

habitat and spawning areas (WAC 75.20.100). The standards for construction projects which are affected by the law are listed for bulkheads (WAC 20.110.280), dredging (WAC 220.110320), and for marinas and breakwaters (WAC 220.10.330). The primary objective of the Hydraulic Project Approval Law is to avoid the degradation of fish habitats and shellfish beds.

### **The Implications of Sea Level Rise for Hydraulic Project Approval**

Sea level rise may result in an increase in eroded shorelines, reduced and inundated wetlands, and degraded water quality, all of which would damage fish and shellfish habitats. If the risk to these habitats is considered significant, the Departments of Fisheries and Wildlife may have the authority to require adequate buffers around wetlands to allow for their upland migration. They could also review construction projects to ensure that their design and construction are able to accommodate higher water levels without having any negative impacts on the environment.

## **1.7 THE SEASHORE CONSERVATION ACT (SCA)**

The Seashore Conservation Act created a conservation area consisting of all state-owned lands along the Pacific Coast from Cape Disappointment to Leadbetter Point, Toke Point to South Jetty on Point Chehalis, and Damon Point to Makah Indian Reservation. It includes the areas between the seashore conservation line (the line of ordinary high tide) and extreme low tide (RCW 43.51.655).

The SCA notes that these beaches provide an opportunity for "the observation of nature as it existed for hundreds of years before the arrival of white men" and uses should be limited so that the "seashore may be saved for our children in much the same form as we know it today." The act places these lands under the jurisdiction and administration of the Parks and Recreation Commission (RCW 43.51.660). However, no regulations for implementing the policies created by the SCA have been promulgated.

The sale or lease of these lands is permitted for the exploration and production of oil and gas, provided that no drilling rigs and equipment is placed on it (RCW 43.51.685). Sand that is accreted may be sold and leases and permits for sand removal is permitted if it is not harmful to the character of the land.

These lands are intended for recreational uses, and local governments may adopt recreation management plans pursuant to the requirements of the act (RCW 43.51.705). Preservation of native beach vegetation and protection of dune topography are listed under pedestrian use and access (RCW 43.51.710).

## **The Implications of Sea Level Rise for The Seashore Conservation Area**

The Seashore Conservation Area includes the beach between the line of ordinary high tide and extreme low tide. The act calls for these shorelands to be preserved in their natural state. As the sea level rises, tidelines will rise also and the strip of beach that falls within the conservation area will migrate, moving upland. Preserving the beach in a natural state will depend on preserving the upland areas in a natural condition to accommodate for the gradual migration of the beach.

### **1.8 THE ENVIRONMENTAL COORDINATION PROCEDURES ACT OF 1973 (ECPA)**

The Environmental Coordination Procedures Act of 1973 (ECPA) was implemented to provide the public with:

- A coordinated administrative decision making process to assist those who seek an optional procedure to obtain environmental permits from state agencies
- An opportunity for the public to express their views on proposed uses of natural resources and related environmental matters
- A higher degree of certainty in terms of permit requirements
- Better coordination between state and local agencies
- An opportunity to obtain information on the requirements of state and federal law (RCW 90.62).

ECPA provides an optional method for obtaining permits by filing a master application with Ecology. Ecology coordinates the issuance of all permits prior to any action on a proposed project. It sets out a process for the review of a proposed project by state agencies, public notification, and hearings. Final decisions and comments are combined into a single document. All applications must be certified by the pertinent local government for compliance with local zoning and comprehensive plans (RCW 90.62.040). Such certification does not indicate compliance with specific action permits or requirements, such as building codes or set backs (RCW 90.62.100).

The certification of a project by the local government under this process must indicate whether it comes under the jurisdiction of the SMA, and the approval of an application for certification does not eliminate any of the requirements of the SMA or any other statutes administered by the local government. The permits and environmental authorization programs covered by the ECPA include the Department of Ecology, Department of Natural Resources, State Parks and Recreation Commission, Department of Fisheries, Department of Health Services, Regional Air Pollution Control Authorities, and Incorporated Cities and Counties (WAC 173-08-030(4)).

## **1.9 OTHER STATE AGENCIES WITH REGULATORY INTERESTS IN COASTAL AREAS**

### **1.9.1 The Department of Fisheries and Department of Wildlife**

As previously discussed both of these agencies participate in the approval of shorelands and aquatic lands development pursuant to RCW 75.20.100 which requires their approval on all hydraulic projects. The Department of Wildlife also owns and operates wildlife habitats in the coastal zone.

#### **The Implications of Sea Level Rise for Fisheries and Wildlife Management**

The role of the Fisheries and Wildlife Departments has already been discussed under the section concerning the Hydraulics Project Approval Law. Climate change and sea level rise may have an impact on regional fisheries to some unknown degree, but the changes may occur over a period of time, allowing management practices to adapt. Property and facilities owned and managed by the departments may be affected by sea level rise.

### **1.9.2 Parks and Recreation Commission (PRC)**

The Parks and Recreation Commission (PRC) acquires, develops, operates, and maintains recreation areas, facilities, and state parks throughout the state, some of which are on the shoreline. The PRC works along with the Interagency Committee for Outdoor Recreation which allocates state and federal funds for the acquisition of parks and recreation properties and prepares a comprehensive plan for the development of statewide recreational resources (RCW 43.99). Accreted non-trust lands in which the state has an interest and lands which make up the Seashore Conservation Area are transferred from DNR to the PRC (RCW 43.51.685).

#### **The Implications of Sea Level Rise for Parks and Recreation**

The use of state-owned recreational facilities, such as boat ramps and other shore-side structures, may be affected by sea level rise. In South Puget Sound, the natural process of submergence, reduced sediment load, and groundwater extraction may cause local shorelines to subside producing a relative rise in sea level. As previously discussed, the Parks and Recreation Commission is the proprietor of state-owned coastal beach lands placed in the Seashore Conservation Area and would have to concern itself with the potential migration of the shoreline resulting from sea level rise.

### **1.9.3 Energy Facility Site Evaluation Council (EFSEC)**

The Energy Facility Site Evaluation Council evaluates applications for siting energy plants and associated facilities. Its primary goals are to ensure operational safety, preserve and protect the quality of the environment, promote clean air, pursue beneficial changes in the environment, and provide abundant low-cost energy.

#### **The Implications of Sea Level Rise for Energy Facility Siting**

The council evaluates applications for siting energy plants and associated facilities to ensure operational safety and preserve and protect the quality of the environment, among other factors. These types of facilities and projects generally have useful lives that would extend well into the next century. Potential changes in the relative sea level may result in environmental conditions that need to be considered in the planning and design stage.

### **1.9.4 The Department of Social and Health Services (DSHS)**

The Health Services Division of DSHS is responsible for management activities relating to public water supplies, solid and liquid waste disposal and preventing public health hazards to recreational facilities, among other duties. The DSHS authority to manage water supply is provided by RCW43.20, and is shared jointly with Ecology Water Resources Division.

#### **The Implications of Sea Level Rise for Public Health**

Salt water intrusion from sea level rise could cause the degradation of water quality in coastal aquifers and reduce the availability of potable water. Long-term water resource planning may be required to prevent a decline in groundwater recharge and a reduction in groundwater flow. Other climate change impacts such as reduced snow melt and periods of drought may also exacerbate water resource planning.

There are numerous abandoned solid waste facilities in wetlands that could be affected by a rising water table and inundation. Pollution from these sites may enter the groundwater or surface water. Pollution, along with increased salinity, could degrade wetlands and have a detrimental impact on wildlife and fish habitats.

## **1.10 REGIONAL, LOCAL, AND TRIBAL GOVERNMENT**

### **1.10.1 Regional Councils of Government**

Regional councils of government provide planning coordination among local units of government, to develop regional plans, to provide specific planning assistance to member

governments and to meet the objectives of various federal laws and regulations relating to interlocal planning and coordination. Fourteen of the fifteen counties in the coastal zone are members of regional councils.<sup>2</sup>

### **1.10.2 County and Municipal Governments**

Cities and counties have considerable authority over their coastal areas, not only through the implementation of their shoreline masters programs but also through their other land use planning and regulation, building codes and health regulations (RCW 35.63). The State Building Code Act authorizes local governments to establish local codes based on minimum standards set by the state (RCW 70.92). Local land use and zoning requirements, building setbacks, site development, side and rear yard requirements, and subdivision requirements are all within the local governments' authority. Health services provided by local governments include water and sewage approvals, control of water districts, solid waste management, and various other functions. The list of local shoreline masters programs is provided in WAC 173.19.

### **1.10.3 Tribal Lands**

Tribal lands fall into three categories of ownership; trust lands, allotted lands, and alienated lands. The federal government has trust responsibility over the trust and allotted lands and title is held by the Secretary of Commerce. The status of the alienated lands is unclear. Each tribe has full internal governmental powers over its members except where those powers are specifically abrogated or limited by Congress. Tribes have regularly engaged in the direct regulation of their coastal areas and have managed a number of resource conservation projects on reservation lands. Tribes also participate in intergovernmental agreements such as the Timber, Fish and Wildlife Agreement, with the local, state and federal governments, that seek to regulate natural resources uses and development. The federal Department of the Interior's Bureau of Indian Affairs encourages tribes to use good conservation methods within their coastal zone.

### **The Implications of Sea Level Rise for Local Governments**

County, municipal, and tribal governments have considerable authority over the coastal areas within their jurisdiction through the implementation of shoreline masters programs and through other comprehensive land use planning regulations, zoning ordinances, building codes, and public health regulations. The implications of sea level rise for the implementation of local shoreline masters programs has already been discussed under the section addressing substantial development permits. As previously noted, there could be

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<sup>2</sup>San Juan County is the only county in the coastal zone that is not a member of a regional council.

significant impacts resulting from accelerated sea level rise on the coastal areas under the jurisdiction of local and tribal governments.

Communities that are exposed to an increased risk from extensive flooding and environmental degradation would need to develop strategies for mitigating the potential impacts. Technical information and expertise are required to build the data base necessary for developing appropriate strategies. One of the primary components of that data base is the ability to identify, inventory and map coastal resources and environments that are susceptible to inundation, flooding, salt water intrusion, and other environmental impacts, with particular attention to wetlands, flood hazard areas, unstable bluffs, and shoreline infrastructure. Most local governments don't have the technical resources and information necessary to perform these tasks.

## **1.11 FEDERAL REGULATORY ACTIVITIES**

### **1.11.1 Coastal Zone Management Act**

The role of the federal Coastal Zone Management Program, as previously discussed in the section on the state Shoreline Management Act, is one of supporting and guiding state programs who participate in the federal program. The CZMA is reauthorized periodically, and the objectives and guidelines that state programs must comply with may be amended as part of the reauthorization. The Office of Ocean and Coastal Resource Management (OCRM), through which the CZMA is administered, is currently considering amending the CZMA to address potential sea level rise.

#### **The Implications of Sea Level Rise for the Federal Coastal Zone Management Program**

During the program's current reauthorization, OCRM is considering amending the CZMP to incorporate consideration for potential sea level rise into the federal and state program objectives and activities addressing coastal hazards, the preservation of natural ecosystems, and erosion control. In order to remain consistent with the federal law, the state Shoreline Management Program and local shoreline master plans would be required to incorporate sea level rise considerations into their program objectives and activities.

OCRM is also considering an initiative that would create a new voluntary CZMA section 306"B" grant program to provide additional grants to states for program improvements relating to erosion control and flood management. Under the proposed program, state approved CZMPs would be eligible for federal coastal erosion and flood prevention grants if the state adopts a 30-year erosion setback requirement for new construction and the Secretary of Commerce approves of the state coastal erosion and flood control program. A program

would be approved if it places first priority on nonstructural erosion and flood control projects such as elevating or relocating structures, planting vegetation and floodproofing. The second program priority would be the acquisition of erosion and flood prone land to be retained as open space and to be used for activities that are consistent with the threat the area faces from coastal hazards.

#### **1.11.2 U.S. Army Corps of Engineers**

All activities taking place in coastal waters, including port and harbor development, are strictly regulated under federal law in Section 10 of the River and Harbor Act of 1899 (RHA) (33 USC § 403), which prohibits the obstruction or alteration of any navigable water of the United States unless authorized by the U.S. Army Corps of Engineers (ACE), and Section 404 of the Federal Clean Water Act of 1972 (CWA) (PL92-500), which authorizes ACE to issue permits for the discharge and fill material into navigable waters. Under Section 404 of the CWA, the definition of navigable waters is expanded to include all waters under tidal influence. Applicants must meet all the state requirements prior to obtaining certification under the Section 10 and Section 404 permits.

#### **The Implications of Sea Level Rise for the Army Corps of Engineers**

The Corps of Engineers evaluates projects, including navigation, storm damage mitigation, and flood control, based upon the historic sea levels. The Corps is required to investigate and certify that a proposed project for construction, dredging, or landfilling in waterways, wetlands, or along the coast would not seriously degrade or harm the environment. Each of the Corps district offices conducts studies of the hydraulic process and environmental systems within their jurisdiction and use that information to make their evaluations of proposed projects. The district office could, at some point, determine that the risk from relative sea level rise is significant enough to be considered in the evaluation of future projects, as it has already done in Louisiana and Texas.

#### **1.11.3 Environmental Protection Agency and the Clean Water Act**

The Environmental Protection Agency (EPA) has a broad mandate under the National Environmental Protection Act to preserve and protect the physical environment through the imposition of standards, criteria, procedures, incentives and research. The standards used under Section 404 of the CWA are set by the EPA. The National Estuary Program (NEP), established under the Water Quality Act of 1987, has identified Puget Sound as a nationally significant estuary threatened by pollution, development and overuse. The NEP seeks to address pollution problems associated with the entire basin and to develop an integrated regulatory approach for managing such problems.

### **The Implications of Sea Level Rise for the Environmental Protection Agency**

The national office of the EPA has been very aggressive in its policy concerning wetlands and is actively promoting the no net loss policy of preserving wetlands. The EPA has identified sea level rise as a significant threat to the long-term preservation of wetlands and as a potential cause for increased water pollution. Under the authority given them by the Clean Water Act, the EPA may require projects impacting water quality and wetland habitats to address this sea level rise. Regionally, the EPA could incorporate considerations for global warming and sea level rise within the National Estuary Program for Puget Sound.

#### **1.11.4 FEMA and the National Flood Insurance Program**

The Flood Disaster Protection Act of 1973 (P.L. 93-234) amended the NFIA providing stronger incentives for local communities to participate in the flood insurance program. FEMA, as previously discussed, is responsible for coordinating federal hazard mitigation efforts including the the Federal Insurance Administration. The Flood Disaster Relief Act of 1974 (FDRA) required applicants to take actions to mitigate hazards as a condition for receiving disaster assistance and that rebuilding be done in conformance with applicable codes, specifications and standards (P.L. 93-288). Under Section 406 of FDRA the receipt of federal grants or loans for disaster assistance is tied to the state's effort to evaluate natural hazards and identify appropriate actions, including safe land use and construction practices, to mitigate such hazards.

#### **The Implications of Sea Level Rise for the Flood Insurance Program**

The risk posed by sea level rise may prompt FEMA to revise its policies concerning the availability of insurance in areas that are considered highly hazardous and for structures that have previously been destroyed by floods. Future FEMA flood hazard mapping projects and flood hazard zone designations may incorporate the potential for accelerated sea level rise by assigning a higher risk to areas that would be subject to future storm surge and flooding.

Programs, such as the Upton-Jones Act, that provide incentives for relocating and removing structures from hazardous areas could be implemented, either on a voluntary or mandatory basis. FEMA may choose to restrict the availability of flood hazard insurance and relief assistance in certain undeveloped high risk areas, much as it has done in the coastal barrier systems placed under the Coastal Barriers Resources Act. The Pacific coastal beaches of the northwest are presently being considered for mapping and evaluation to determine what areas might qualify for placement in the federal Coastal Barrier Resource System.

FEMA could also require participating state and local governments to revise their flood hazard mitigation plans so that they also address sea level rise in their planning and implementation. One method of doing this would be to require all programs to implement erosion setback requirements based on the annual erosion rate for that area. FEMA could also provide funds for state and local governments to acquire properties that are at risk from inundation and to retain them as open space for public use.

#### **1.11.5 The Coastal Barriers Resources Act of 1982 (CBRA)**

The CBRA (P.L. 97-348) places undeveloped coastal barrier islands and systems into the "Coastal Barriers Resource System." Areas within this system are prohibited from receiving federal funds for flood insurance and construction projects such as water supply systems, bridges, bulkheads or jetties. The intention of the CBRA is to transfer the financial risks of coastal barrier development to the private sector, protect valuable coastal resources, and to minimize the loss of human lives from storms and flooding. Upon recommendation by the Department of the Interior, areas may be added or deleted from the system every three years through an act of Congress. No areas within Washington are part of the coastal barriers system at present, though some areas may be eligible according to the definition of a coastal barrier. According to the CBRA, an area is eligible for inclusion in the coastal barrier system if it:

- Consists of unconsolidated sedimentary materials
- Is subject to wave, tidal and wind energies
- Protects landward aquatic habitats including the adjacent wetlands, marshes, estuaries, inlets and nearshore areas
- Is undeveloped land with one, or less than one, walled and roofed structure per five acres of land.

Under the CBRA, the Veteran's Administration and Federal Housing Administration will not extend loans and the Army Corps of Engineers will not fund new or expanded navigation projects or assist in beach erosion control, hurricane protection and flood control works. Maintenance of existing channel improvements, transportation and energy resources are permitted.

#### **The Implications of Sea Level Rise for the Coastal Barrier Resources System**

Areas within the system will undergo considerable physical change if the sea level rises, as the CBRA's "hands off" policy would allow them to evolve and migrate naturally. Because of the physical nature of the barrier system, it can be expected that some areas may "roll over" as increased sea levels and storm surge push them back. Dune systems and sheltered wetlands will be able to adjust to the environment unimpeded by structures and developments. The resource system may act as a preserve for undeveloped coastal areas. As

previously mentioned, there are presently no areas in Washington that are part of the Coastal Barriers Resources System.

#### **1.11.6 The Fish and Wildlife Service**

The Fish and Wildlife Service (FWS) is responsible for guiding the conservation, development and management of the nation's fish and wildlife resources. They have consulting and approval authority over developments that may impact habitats and participate in the ACE permitting process for all dredge and fill projects.

##### **Implications of Sea Level Rise for the Fish and Wildlife Service**

Sea level rise may lead to the degradation and loss of wetlands, dunes and other coastal fish and wildlife habitats. FWS may incorporate the risk posed by sea level rise in their evaluation of projects impacting coastal habitats. Even habitats that are not subject to development would be detrimentally impacted by sea level rise, as they become inundated and reduced in size.

#### **1.11.7 Marine Protection, Research and Sanctuaries Act of 1972 (16U.S.C. § 1431 et seq.)**

This bill authorizes the Secretary of Commerce through the National Oceanic and Atmospheric Administration (NOAA) to designate specific coastal areas as national marine sanctuaries. The coastal area of the Olympic National Park is one of the areas currently being considered for designation. The act is intended to protect valuable ocean and coastal resources through a coordinated management program.

##### **The Implications of Sea Level Rise for National Parks and Marine Sanctuaries**

The coastal area from Copalis to Cape Flattery will be designated as a national marine sanctuary in 1990, although specific boundaries have not been established, and the National Park Service owns a large portion of the Olympic Peninsula. Future sea level rise in these areas should not present a significant problem since they will not have substantial amounts of facilities or development.

## SECTION 2.0

### THE PRIMARY LEGAL PRINCIPLES AND CONSIDERATIONS GOVERNING COASTAL DEVELOPMENT

#### 2.1 THE PUBLIC TRUST DOCTRINE

Various legal principles guide public policy and private activities related to coastal and marine resource development. This section discusses three of these principles which may affect public policy designed to address accelerated sea level rise. The first of these principles, the public trust doctrine, governs states' dominion over their tidelands and creates special rights and responsibilities for the states in relation to those lands. The prohibition of the taking of private property without just compensation, as established by the fifth amendment to the U.S. Constitution, may be triggered as a result of the state pressing its public trust responsibilities or by other regulatory actions related to land use or ownership. A related issue is the government's potential liability resulting from the exercise of its authority to regulate land use in hazardous coastal areas. The third area of law, the question of land ownership under shoreline accretion and erosion, may also have an important impact on public policy related to sea level rise. Each of these three legal principles is discussed briefly below.

##### 2.1.1 Statement of the Doctrine

The public trust doctrine generally asserts that the beds of tidal and navigable waters and their related shorelands are held by state governments in trust for the benefit of the public. The doctrine holds that these governments do not have unlimited discretion to determine how these lands are used. Instead, governmental decisions to manage, sell, lease, or use such lands must be consistent with trust purposes. While state governments can grant title to these lands to private parties, such ownership or other interest in the tidelands and shorelands is always subject to the paramount right of the public for certain uses. Thus, state governments always retain the right to use, regulate, and control the waters in such a way as to preserve the waters for the public use.

The public trust may be viewed as providing state governments with the authority to claim a public interest in protecting a resource or as a way of compelling those same governments toward a particular course of action. In a famous case illustrating this latter use, the U.S. Supreme Court relied on the public trust doctrine to invalidate an attempt by the state of Illinois to alienate a natural resource of critical value. Illinois Central Railroad v. Illinois, 146 U.S. 387 (1892). In this case the Court declared that the state legislature could not grant title for a portion of Chicago's harbor to the railroad because the public trust doctrine made the state powerless to convey away such a large portion of the harbor. In a more recent case, the U.S. Department of Interior was ordered by the federal

district court to take specific actions to protect the Redwood National Park from erosion caused by neighboring timber companies. Sierra Club v. Department of Interior, 424 F. Supp. 172 (N.D. Ca. 1976). If this concept were extended to the protection of coastal resources systems such as wetlands, the government could potentially be compelled by its trust responsibilities to prevent actions that may be harmful to those resources.

Commentators hold that the tidelands public trust doctrine is rooted in the common law and became binding on the states as they acquired ownership of all tidal lands upon gaining statehood. In Caminiti v. Boyle, 107 Wn.2d 662, 732 P.2d 989 (1987), the Washington Supreme Court stated that the public trust doctrine has "always existed" in Washington and that state ownership has two aspects: the private property interest which is embodied in title to the tidelands and the public interest which reflects the state's dominion and sovereignty. Although title to tidelands can be conveyed to private owners, the court declared that the state still has a trust interest in them based on the public right of access to navigable waters and fishery.

While during the nineteenth century this doctrine served more as a rationale for state development of tidal lands than a limitation on state power, the public trust has increasingly come to provide a rationale for state protection of public access to navigable waters and the protection of environmental quality. There is no single, consistent application of the public trust, and different resources may be subject to different forms of trust by different levels of government. Both the state and federal governments have public trust responsibilities in marine and coastal resources and each state has its own treatment of this legal doctrine. In Washington, the state's title to the tidelands is held in trust for public purposes by the Department of Natural Resources pursuant to state law.

### **2.1.2 Physical Boundaries of Public Trust Lands**

The physical boundaries of the resources subject to the public trust encompass considerable areas of land. Initially, the doctrine applied to lands along the margins of the sea--tidelands and submerged lands in particular. This coverage was supported and extended to all navigable waters by the U.S. Supreme Court in Shively v. Bowlby, 152 U.S. 1 (1894). In 1935, the Court refined the determination of California's ownership when it decided that the state's tidelands extended up to the line of mean high tide averaged over a period of 18.6 years. Borax Consolidated Ltd. v. Los Angeles, 296 U.S. 10 (1935).

Cinque Bambini Partnership v. Mississippi, 491 So.2d 508, 519-20 (Miss 1986), is a case that is more directly analogous to the relation of the public trust to the issue of sea level rise. In that case, the Mississippi Supreme Court declared that the state public trust lands include those that are inundated by long-term tidal influences and therefore become new tidelands. The state court's decision was appealed and the U.S. Supreme Court recently affirmed that Mississippi still holds title to non-navigable coastal wetlands that had been

leased to the oil company and that the property is subject to state management. Phillips Petroleum Co. v. Mississippi, 108 S. Ct. 791 (1988).

Over time, various state courts have also refined their own interpretations of just how broadly the public trust should extend. Under the law of the various states, public trust lands generally extend from the mean high tide line seaward three miles, including the tidelands and areas such as wetlands which are tidally influenced. In Washington, the public trust extends to the beds of all navigable waters, "whether lakes or rivers, or fresh or salt." New Whatcomb v. Fairhaven Land Co., 24 Wn. 493, 64 P. 735 (1901). Tidelands that may have been altered under private ownership may still retain their public trust status. In City of Berkeley v. Superior Court, 162 Cal. Rptr. 327, 606 P.2d 362 (1980), the court found that the state retained a public trust interest in tidelands that were physically adaptable to trust uses even though they had been conveyed to private ownership under an 1870 act.

The public trust doctrine can also apply to non-navigable waters in certain circumstances. In a California case, the court held that flows in creeks that had not been established to be navigable are subject to the public trust doctrine because of their impact on Mono Lake, a navigable body of water. National Audubon Society v. Superior Court of Alpine County, 33 Cal.3d 419, 658 P.2d 709 (1983), cert. denied 104 S. Ct. 413 (1983). In a decision somewhat limiting the coverage of the public trust, a Maine court decided that the legislature could not extend the doctrine's coverage to intertidal lands held in fee by a private owner without compensation to the owners. Bell v. Town of Wells, 57 U.S.L.W. 2590 (Maine Sup. Jud. Ct. No. 5029 3/30/89).

### **2.1.3 Public Interests That Must Be Preserved**

Traditionally, courts have identified three public uses of navigable waters that are protected by the public trust: navigation, commerce, and fishing. On the federal level, the primary trust relating to federal responsibilities over marine resources is derived from the navigational powers and navigational servitude as derived from the commerce clause of the U.S. Constitution. To ensure free navigation, commerce, and fishing, the federal government can improve both inland and coastal waters by building structures or creating diversions in a water body. Private property owners who lose the benefits of access to water due to federal improvements made under the navigational servitude have no legal recourse and do not have to be compensated.

The commerce clause defines both the scope of navigational servitude and of the regulatory authority of Congress over navigable waters. Congressional authority is broader than that of navigational servitude in that it also provides for the regulation of interstate commerce and non-navigable waters. The regulatory authority exercised by Congress may sometimes require compensation for a property owner under the fifth amendment which protects property rights. In Kaiser Aetna v. United States, 444 U.S. 164 (1979), the Supreme

state governments' ability to infringe on (or to "take") private property rights for public purposes without providing just compensation and due process of law to the property owner. A government action that results in a taking without compensation can be one that physically invades private property, confers a benefit on the public rather than avoiding a harm, or which removes virtually all reasonable economic uses of the property.

Addressing this issue in Pennsylvania Coal Co. v. Mahon, 260 U.S. 393 (1922), the U.S. Supreme Court stated that "while property may be regulated to a certain extent, if a regulation goes too far, it will be recognized as a taking." 260 U.S. at 413. As this somewhat cryptic declaration indicates, there is no precise formula that can be used in all circumstances to determine whether a regulatory action results in a taking. Instead, the particular state action and objectives as well as the impact on private property rights must be examined in each case to determine whether a taking has occurred.

### **2.2.2 The Scope of Legitimate Regulatory Action**

Determining what constitutes a legitimate state interest and whether the challenged state action achieves that interest are central to finding whether a particular regulatory action controlling private property use will withstand legal challenge. In its ruling in Nollan v. California Coastal Commission, 483 U.S. 825 (1987), the Supreme Court held that the California Coastal Commission failed to prove that there was a legitimate state interest being advanced by its conditioning of a permit to build a beach bungalow and that the conditioning of the permit constituted an uncompensated taking. Nollan did not renounce the validity of environmental protection or the right of the commission to deny the permit. The Court noted that the property owner did not have an unfettered right to build on the property and that the commission could deny a permit if doing so provided some public benefit relating to public health, safety, or welfare. A permitting authority can condition a permit to restrict developments such as bulkheading and seawalls if it is able to show at least a rational if not a substantial relationship between the permit conditions and the public welfare and environmental protection goals it is charged with pursuing.

What will be considered a valid state purpose that would legitimate a state land use regulation? Some state courts have found that the protection of wetlands to enhance water quality is, in and of itself, a valid state purpose. Iust v. Marinette Co., 201 N.W.2d 761 (Wis. 1972). Most courts, however, require that the state purpose be explicitly tied to achieving the human concerns of health, safety, and welfare. Furthermore, in order for the state action to be supportable in court, the state regulatory authority should be based upon an explicit legislative or administrative finding that the action furthers these state interests.

In United States v. Riverside Bayview Homes, 474 U.S. 121 (1985), the Supreme Court commented that a state regulatory action designed to protect wetlands would not necessarily

constitute a taking of property. Likewise, in Agins v. City of Tiburon, 447 U.S. 255 (1979), the Court upheld a zoning ordinance limiting the number of buildings that could be constructed on a piece of property, thereby preserving open space, preventing pollution, and avoiding premature development.

### **2.2.3 The Economic Impact and Alternative Uses Question**

The degree of economic impact to the private property may also determine whether a particular regulatory action will be held to be a taking. If a regulatory action that prohibits coastal development leaves property owners with some reasonable economic use of their property, it will be less likely to be considered a taking than if more complete economic loss occurs. Pennsylvania Central Transportation Co. v. New York City, 438 U.S. 104 (1978). Also, if there are reasonable alternative economic uses for the property, such as camping or recreation, a regulatory action that partially decreases the value of property may not be found to have caused a taking. Claridge v. State Wetlands Board, 485 A.2d. 287 (N.H. 1984) and Orian Corp. v. Washington, 109 Wn.2d 621, 747 P.2d 1062 (1987).

### **2.2.4 Physical Invasion of Property**

Even where a government action results in very little economic loss to the private property holder, the action will be likely to be considered a taking if it results in a physical invasion of the property. In Kaiser Aetna v. United States, 444 U.S. 164 (1979) the Court required that the owner of a lagoon be compensated when the Army Corps of Engineers prevented him from excluding the public from the lagoon. Likewise, in Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 417 (1982), the Court found a taking when the state of New York required apartment owners to allow cable companies to install facilities on their premises.

### **2.2.5 Liability**

The administrative management of potentially hazardous coastal areas may leave local governments liable for property damage and personal injuries resulting from natural hazards. Development in the coastal zone is regulated and guided by local zoning ordinances and building codes. Often, private developers prefer local standards that do not restrict their ability to use their property to the greatest economic advantage. Local government land use policies that lead to development in naturally hazardous areas such as atop bluffs or in flood zones, may put people and property at risk to injury. Property owners often assume that the local government is responsible for providing protection for areas where it has permitted development.

These circumstances lead to the question of the liability of local governments for damages to property in known hazardous areas of the coast. The policies and guidelines

provided by coastal zone authorities, coupled with the tort liability provisions of the state, could be construed in a manner that places a high level of duty on the local government to exercise the degree of care mandated by the state environmental and public safety regulations. This level of duty could be extended so broadly by the courts that a local government will have to avoid the traditional injury to private property rights as well as injury to public rights in natural resources, including water quality, beach access, and aesthetic qualities.

## 2.3 SHORELINE ACCRETION AND EROSION

The legal status of land ownership under conditions of shoreline accretion and erosion may also have an important impact on public policy related to sea level rise. Erosion and sediment deposit occur constantly in nature. These processes may be altered by man-made changes to the shore, structures, dredge and fill activities, and the construction of erosion control barriers.

### 2.3.1 Accretion

Accretion occurs when natural forces gradually add sand or soil to riparian land. Under the common law, the riparian landowner gains ownership to the newly added land. Various reasons are given for this legal treatment. Among these are fairness in giving the landowner who bears the risks of land ownership whatever benefits accretion may bring and the necessity of preserving the riparian right of access to the water. Board of Trustees of the International Improvement Fund v. Medeira Beach Nominee, Inc., 272 So.2d 209 (Fla. App. 1973).

The riparian has historically been entitled to new land created by artificial as well as natural causes. This general rule may be changing, however. The refusal to distinguish between natural and artificial accretions is a product of the tendency to equate the public interest with private navigation-promotion improvements during the nineteenth century. In the twentieth century, states' interest in tideland ownership and use has grown. States have begun to argue that the public should capture the benefits of accretions due to public improvements. California, in particular, has chosen not to apply the general rule that artificial as well as natural accretions belong to the upland owner. In that state, it is argued that artificial accretions caused by public improvements should belong to the state. This policy has not yet been widely followed, however, and it is not clear to what extent this distinction between public and private improvements will be made in other states and instances.

Washington is a notable exception to the common rule that the riparian landowner gains ownership to accreted land. Under RCW 79.94.310, any accretions that may be added to any tract of tide or shore lands that have been or may in the future be sold by the state shall

belong to the state. This Washington code section also provides for the sale of the accreted land by the state after the Department of Natural Resources first surveys the accreted land. The owner of the adjacent tide or shore lands is to be given the preference right to purchase these lands produced by accretion.

### 2.3.2 Erosion

The common law states that if erosion is gradual, the riparian loses title to the eroded land. United States v. Keenan, 753 F.2d 681 (5th Cir. 1985).

### 2.3.3 Avulsion

Avulsion is the severing of land from a land holding when a stream suddenly and perceptibly abandons its old channel. Baldwin v. Anderson, 40 Wis.2d 33 (1968). Title does not shift as the result of avulsion. The former boundary remains in place even though the riparian owner may be cut off from access to the water. City of St. Louis v. Rutz, 138 U.S. 226 (1891). This rule applies whether the change comes from natural or artificial causes.



## SECTION 3.0

### A SURVEY OF NATIONAL AND INTERNATIONAL POLICY RESPONSES TO SEA LEVEL RISE

#### 3.1 INTRODUCTION

Sea level rise resulting from climate change poses a challenge for policy makers, planners, and the public for the simple reason that it is a problem that is fraught with uncertainty. Many state and regional coastal authorities consider sea level rise a factor that may complicate current policy objectives. Several jurisdictions have made changes in their regulatory and management programs in response to the risks posed by sea level rise. Other jurisdictions, while not addressing sea level rise directly, are responding to problems that are analogous to sea level rise such as chronic erosion, subsidence, and the loss of vital ecosystems such as wetlands. Examination of the way these jurisdictions have responded to relative sea level rise and analogous problems provides an overview of the policies that are currently being implemented or considered in response to accelerated sea level rise.

##### 3.1.1 Overview

Typically, policies addressing sea level rise are linked to existing coastal regulatory program objectives such as erosion control, coastal ecosystems preservation, and flood hazard protection. The focus of attention is on existing long-term objectives and goals that may be exacerbated by accelerated sea level rise. Shoreline and bluff erosion may increase dramatically, wetlands may be lost, dunes may migrate, and storms may increase in frequency and intensity. As a consequence, coastal buildings, structures, and facilities may be jeopardized and fish and wildlife habitats may be reduced or degraded. Salt water intrusion may affect the supply of potable groundwater. From a management standpoint, the risks posed by accelerated sea level rise deserve attention because of the severity and extent of their potential impacts.

The jurisdictions that have already incorporated concerns about sea level rise into their policies have done so on the basis of pre-existing policies and established program goals. Policies or activities that are based on pre-existing authority have generally been found more politically acceptable and easier to implement than attempts to establish new authorities. The uncertainty associated with sea level rise is less a deterrent to action when it is linked to significant existing issues.

### **3.1.2 Organization of the Section**

This section begins with a survey of the existing federal laws, programs, and agencies that have significant authority over coastal resource and land use policies. The role of these various authorities and the manner in which sea level rise would affect or be affected by their implementation is briefly discussed. Initiatives that have recently been instituted or are being considered are also reviewed.

Section 3 presents the results of a survey of 24 marine coastal states examining their activities and responses related to sea level rise. The results of that survey are summarized in a table showing the level of response, existing or adaptive policies, and new policies for addressing sea level rise. The types of policy responses found in these jurisdictions are categorized and described and a table is provided summarizing these findings. Section 4 presents case studies of three jurisdictions that have adopted new or adaptive policies that respond to sea level rise or analogous problems.

The final section is an overview of the policy responses and activities in other nations. The principal objective of this section is to summarize the level of international awareness concerning sea level rise and how other types of administrative organizations are approaching the problem.

## **3.2 UNITED STATES: FEDERAL GOVERNMENT POLICY RESPONSES TO ACCELERATED SEA LEVEL RISE**

This section provides an overview of the activities and policies of the federal government that apply to issues and problems related to accelerated sea level rise. The federal government does not have a coherent or consistent policy toward accelerated sea level rise. Though scientific and technical studies have been sponsored by a number of regulatory agencies and authorities, there is no uniform perception of the risk posed by accelerated sea level rise. The following discussion summarizes the policies and actions of the federal agencies and congressional programs most pertinent to coastal resources and land use management.

### **3.2.1 Federal Agencies**

#### **The Environmental Protection Agency**

The Environmental Protection Agency (EPA) has been involved in the study of sea level rise and its impacts since 1984 and has funded a series of studies and research projects examining the impacts of sea level rise on various communities on the Atlantic and Gulf coasts. Many of these studies have contributed to the efforts of states such as South

Carolina to develop strategies for addressing sea level rise as it relates to concerns about coastal hazards, chronic erosion, and environmental quality.

The EPA has taken considerable interest in the effect of sea level rise on wetlands and has actively promoted stricter regulatory action on the part of both federal and state permitting agencies that control development adjacent to wetlands. A national goal of "no net loss of wetlands policy" has been adopted by the EPA, using its authority over the discharge of dredge and fill material under Section 404 of the Clean Water Act.

EPA's efforts to protect coastal wetlands are also evident in the joint federal, state, and local agreements that are designed to manage specific watersheds. These initiatives, such as the Chesapeake Bay Agreement between the EPA, Maryland, Virginia, and Pennsylvania, and the Delaware Estuary Program involving Delaware, Pennsylvania, and New Jersey, have been developed under EPA's National Estuary Program.

#### **U.S. Army Corps of Engineers**

Though the U.S. Army Corps of Engineers (ACE) has as direct and powerful an influence on coastal development as any federal agency, it is taking a "wait and see" attitude toward sea level rise. Through its Coastal Engineering Research Center, it is carrying out technical studies on the potential impacts of sea level rise on barrier island processes.

ACE recommends that feasibility studies be conducted to develop strategies appropriate for the entire range of uncertainty rather than a specific rate of sea level rise. While awaiting more definitive scientific information, ACE has directed its district branches to consider relative historic sea level rise and not an accelerated rate scenario in evaluating project designs.

This directive encourages the development of project designs that incorporate features that facilitate future environmental changes. However, the ACE contends that there is no justification for considering any sea level change rate other than the historical rate, given the current uncertainties.

ACE has introduced the use of risk analysis as a method for selecting appropriate designs to mitigate natural hazards under conditions of uncertainty. The application of risk analysis in the economic evaluation of alternative plans is designed to identify the type and scale of project that maximizes economic development benefits. Sea level rise is addressed by integrating variables such as the rate of sea level rise, the frequency of storms, and unknown future socioeconomic conditions and adaptive mechanisms into the formula.

### 3.2.2 Congressional Programs

#### **Coastal Zone Management Act**

In 1972, Congress enacted the Coastal Zone Management Act (CZMA) that created an integrated state and federal program in which the federal government provides funding and technical assistance to states with federally approved and authorized coastal management programs. The primary objective of the CZMA is to encourage state and local governments to incorporate hazard protection, natural resource protection and development, public access, urban waterfront redevelopment, and intergovernmental cooperation considerations into comprehensive programs for coastal land use and resource development. The program is administered by the Office of Ocean and Coastal Resource Management in the National Oceanographic and Atmospheric Administration of the Department of Commerce.

Several amendments to the CZMA that would address sea level rise are now being considered. The first, filed as a Section 306B program<sup>3</sup>, would provide coastal erosion and flood prevention or protection grants to states with approved programs if the state imposes a 30-year erosion setback for new construction and the Secretary of Commerce approves the state coastal erosion and flood control program. Another proposed amendment to the CZMA would bring sea level rise into the state programs by either requiring the state programs to include considerations for sea level rise in their environmental objectives or by providing incentives for state programs to respond voluntarily. The proposed incentive provides additional funding for states that incorporate sea level rise into their management program, though exactly what the states have to do to satisfy this requirement has not yet been determined.

#### **The National Flood Insurance Program**

The National Flood Insurance Program (NFIP) was created by the National Flood Insurance Act of 1968. The Federal Insurance Administration of the Federal Emergency Management Agency (FEMA) has responsibility for managing the NFIP. The NFIP was created to provide federally backed flood insurance coverage to property owners through a partnership with state and local governments. Communities may participate by incorporating land use regulations to reduce future flood damage, with adequate enforcement provisions, into local flood plain management ordinances.

The NFIP has been criticized by state and local flood plain and coastal management programs for encouraging the development of areas at risk to flood hazards. A Congressional

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<sup>3</sup>Section 306b of the CZMA provides approved state programs with resource management improvement grants for the preservation of specific areas that: are of recreational, ecological, or aesthetic value; contain resources of national significance; provide public access; or are deteriorating urban waterfronts.

Research Service Report, *Managing Coastal Development Through Coastal Zone Management and Flood Insurance Programs: Experience to Date and the Views from Selected States*, has recommended that Congress consider prohibiting federal or private flood insurance and disaster assistance for new construction in high hazard areas or that an actuarially sound premium surcharge be phased in for these properties. The same report recommended that Section 303 of the CZMA encourage more state programs to adopt setback lines based on flood elevation and erosion history.

The NFIP has two programs that promote coastal hazard mitigation. The Federal Damaged Property Purchase Program under Section 1362 of the NFIP uses federal funds to relocate or demolish structures endangered by hazards and to purchase the property on which the structure stood. To qualify, the structure must incur damage exceeding 50 percent of its market value or have been damaged three times in the past five years. Also, the local community must adopt a non-residential and non-commercial land use policy for the property.

The Upton-Jones amendment to the National Flood Insurance Act allows FEMA to prepay an insurance claim under the NFIP to relocate or demolish an insured structure certified to be in "imminent danger of collapse" from wave action or erosion within the next three years. Under the program, up to 110 percent of a structure's fair market value could be paid to demolish the structure, and 40 percent could be paid to relocate smaller structures landward of the 30-year erosion setback and all other structures landward of the 60-year setback. The amendment also prohibits any flood insurance coverage and most disaster assistance for any structure relocated or constructed on a site that is seaward of the erosion setback. The formula for determining the active erosion zone is defined as "5 X + 10 ft." where X equals the annual erosion regression rate. The reference point for determining the seaward edge of the active erosion zone depends on the local shoreline geomorphology and would be a bluff edge, dune or escarpment edge, normal high tide line, or vegetation line.

A NFIP proposed rule change would define the "coastal high hazard area," or V-zone, to include the inland limit of the primary frontal dune. Flood plain management regulations for V-zones prohibit the use of fill for the structural support of buildings and any man-made alteration of sand dunes that would increase flood damages. The National Academy of Sciences is presently concluding a study to assist FEMA in developing an erosion management strategy and methodologies to develop and implement these regulations.

### **Coastal Barriers Resources Act**

The Coastal Barriers Resources Act (CBRA) allows undeveloped coastal barrier areas to be placed into the Federal Coastal Barrier Resources System by a vote of Congress. Areas within the system are intended to be left undeveloped and in their natural state. This act prohibits federal subsidies for infrastructure and eliminates insurance coverage by the NFIP

and most disaster assistance in the designated areas for structures constructed or improved after October 1, 1983. These barrier island systems will be allowed to migrate and recede in a natural manner as the sea level rises.

### **3.3 STATE AND LOCAL POLICY RESPONSES TO SEA LEVEL RISE**

This section summarizes the results of a survey of state or local governments' response to accelerated sea level rise or analogous conditions such as chronic erosion and increased exposure to coastal hazards. The data was collected in 1989 from coastal management programs, environmental, and natural resource agencies in 23 continental coastal marine states. The survey focused on policy responses and actions related to sea level rise, chronic coastal erosion, and mitigation of coastal hazards. That information consists of documentation such as laws, regulations, rule changes, ordinances, departmental reports, official memos, executive proclamations, legislative finding, or other official statements concerning the management of coastal hazard and chronic erosion problems, and more specifically, where sea level rise is recognized as a contributing factor.

The survey of 23 coastal marine states revealed that accelerated sea level rise has become an issue of importance for state and local authorities. In fifteen of the states accelerated sea level rise has already been recognized as an issue of salience. Eleven of these states have initiatives underway to study the matter more closely and to involve a broader range of state and local policy makers and private interests.

The survey also revealed that a number of states have existing coastal land use policies that are designed to be adaptive to certain geomorphic changes in the shoreline, such as setbacks for development, based upon annual erosion rates. Some states have policies designed to protect or preserve designated environmental systems or areas such as wetlands, sand dunes, or estuaries. Such policies would only be partially responsive to the impacts of sea level rise because they provide the space necessary for designated environmental systems to migrate by creating setbacks or buffers around them.

In South Carolina, Maine, and California (San Francisco Bay), concerns about accelerated sea level rise have contributed to new regulations regarding coastal land use and development. In Louisiana, where 60-square miles of wetlands are being inundated and lost each year, a program has been created to fund special engineering projects designed to retard erosion and rebuild natural coastal barrier systems.

The new policies adopted by these states, like the existing adaptive policies mentioned above, are only partially responsive to the impacts from accelerated sea level rise. The policies only address some of the impacts from sea level rise and do not apply to all the areas that may be affected. A summary of this information is presented in Table 1. In the table, states with previously existing or new policies that are partially responsive to sea level rise impacts, are listed as YES in columns 2 and 3.

Table 1. Sea Level Rise: Issue Recognition, Existing and New Adaptive Policies

State	Issue Recognition of Sea Level Rise	Existing Adaptive Policies	New Adaptive Policies
Alabama	NO	YES	NO
Alaska	NO	NO	NO
California	YES	NO	NO
San Francisco Bay	YES	YES	YES
Connecticut	NO	NO	NO
Delaware	YES	YES	NO
Florida	YES	YES	NO
Georgia	NO	NO	NO
Hawaii	YES	NO	NO
Louisiana	YES	YES	YES
Maine	YES	YES	YES
Maryland	YES	YES	NO
Massachusetts	YES	YES	NO
Mississippi	NO	NO	NO
New Hampshire	YES	NO	NO
New Jersey	YES	YES	NO
North Carolina	YES	YES	NO
Oregon	YES	NO	NO
Pennsylvania	NO	YES	NO
Rhode Island	YES	YES	NO
South Carolina	YES	YES	YES
Texas	NO	YES	NO
Virginia	NO	NO	NO

The state and local government policy responses fall into seven categories:

- Zoning, land use and building codes
- Prohibitions or restrictions on development
- Requirements for project design and planning
- Economic incentives and disincentives
- Environmental engineering requirements and controls
- Structural engineering requirements and controls
- Protection and preservation of groundwater resources.

In order to fulfill their statutory mandates, state and local jurisdictions develop strategies that are responsive to changing environmental conditions. Accelerated sea level rise is generally perceived as compounding problems associated with mitigating coastal hazards, preserving valuable coastal ecosystems, and maintaining public access and recreational opportunities. Generally speaking, as authorities attempt to develop and implement policies to deal with these issues, they have to weigh the advantages and disadvantages of either armoring or protecting coastal property, or gradually retreating as the sea encroaches. Private property rights and public expenditures are the primary concerns that policy makers address in either case.

In recognition of the extended time period and lack of scientific certainty concerning global warming and sea level rise, adaptive strategies are being designed that are prudent and appropriate for addressing current policy objectives. These strategies have several advantages. First, they are designed to fulfill current objectives in a comprehensive and balanced manner for a broad range of scenarios. Second, they will internalize changes in the environment as sea levels rise and storm surge increases. Finally, they are conditioned on the impact from future sea level rise and thus do not overly restrict present day activities. Because the potential impacts to people and property are distant and uncertain, there is a preference for policies that will not impinge on private property interests until the significant impacts of sea level rise are imminent.

Strategic retreat policies are emerging as the preferred response to problems associated with chronic erosion, storm and flood protection, and the preservation of valuable ecological resources, all of which would be exacerbated by accelerated sea level rise. Strategic retreat may be defined as a policy of gradual measured response to the actual or potential impacts of changes in the environment. Responding proactively to sea level rise, rather than reacting to its adverse impacts, reflects a risk management policy that considers the potential costs of those impacts.

The most common components of strategic retreat policies include laws or regulations that allow the conditional use of property located in areas susceptible to erosion and flooding, restrictions on hard structural protection, protection of critical environmental areas and post-

storm redevelopment restrictions. Strategic retreat policies are designed with the understanding that highly valued and densely developed areas will require some form of structural protection while the dynamic geologic processes should not be impeded in less developed and undeveloped coastal areas.

Typically, strategic retreat encompasses a range of regulatory activities and programs in the form of a comprehensive management and planning program. The regulatory components of strategic retreat policies provide the full range of alternative responses to conditions analogous to accelerated sea level rise including chronic erosion, inundation, hazard mitigation, and environmental denigration. These regulatory actions are discussed below and summarized in an abbreviated form in Table 2.

### **Zoning, Land Use, and Building Codes**

Zoning and land use policies use setbacks based on annual erosion rates that are periodically recalculated to provide an accurate measure of the shoreline. South Carolina's Beach Management Act and Florida's Beach Management Act are examples of states where a setback policy of this type has been implemented. These setbacks are usually based on a multiple of the annual erosion rate that is loosely based on the expected usable lifetime of the structure. In most states, a 30- or 40-year multiple of the erosion rate is used. The setback requirements for larger buildings are often increased. Mapping and monitoring programs are required to establish a tidal baseline and to track the geomorphic changes in the coastline. Several states require monitoring programs on a periodic basis in order to reset the reference points or markers for measuring the setbacks. The zoning markers are physical monuments that can be moved periodically to reflect any changes in the shoreline. South Carolina requires the baseline for shoreline setbacks be reset every five to ten years, or when events dictate the need. The annual erosion rate can be recalculated from the changes in the shoreline relative to the markers.

Some states designate special critical or sensitive environmental resource areas that are protected by buffer zones and building restrictions. Activities within and adjacent to these areas are regulated in order to preserve their natural resources and environmental quality. Maryland's Chesapeake Bay Critical Areas Act protects wetland areas of the Chesapeake Bay with a 200-foot buffer zone and there are additional restrictions on the density and location of adjacent development. The Rhode Island Coastal Resources Management Program designates Critical Erosion Areas where it establishes setbacks of 30-to-60 times the annual erosion rate for areas where erosion rates range from two-to-six feet per year. Rhode Island also regulates development adjacent to the salt ponds wetlands that line its coastal area by creating buffer zones within which there are setbacks and controls on structural density.

**Table 2. Alternative Policy Responses to Sea Level Rise**

RANGE OF POLICY RESPONSES	EXAMPLES OF FEDERAL OR STATE POLICIES
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**Zoning and Land Use**

Erosion Rate Based Setbacks	<p>South Carolina Beach Management Act (BMA) establishes setbacks of 40 X annual shoreline erosion rate and requires remapping the baseline every 5 to 10 years.</p> <p>North Carolina Coastal Areas Management Act (CAMA) establishes setbacks of 30X annual erosion rate for single residence and 60X annual erosion rate for multiple residence structures.</p>
Building Codes / Size Restrictions	<p>Maine Sand Dune Law restricts structures to 2500 sq. ft. and 35 ft. in height with 1 ft. elevation above 100 year base flood elevation in low hazard areas.</p> <p>North Carolina CAMA restricts structure size to 5000 sq. ft. within shoreline setback areas.</p>
Coastal Hazard Areas Restrictions.	<p>Maine Sand Dune Law restricts development to low hazard areas. Density not to exceed 40% of undeveloped dune areas, with 20% being buildings.</p> <p>Florida Construction Control Lines establish area where new development must be permitted. Creates a 30 year erosion zone prohibits new construction.</p>
Downzone to Restrict Development	Transferable Development Rights: a local land use planning method used to retain an area in a lesser or undeveloped state and shift new development to preferred locations.

**Economic Incentives/Disincentives**

Restrict New Infrastructure	Coastal Barriers Resource Act prohibits federally subsidization of infrastructure within coastal barrier system.
Restrict Flood Insurance	Coastal Barriers Resource Act prohibits federally subsidized flood insurance for structures within coastal barrier system.
Incentives to Remove and Relocate Development	National Flood Insurance Program/Upton-Jones Act program reimburses property owners 110% of structures value to remove and 40% to relocate buildings that are in danger of collapse from erosion and flooding.
Proposed Tax Incentives	Delaware Beaches 2000 Plan proposed favorable tax assessments for land uses compatible with preservation of shoreline areas.

**Table 2 Continued**

RANGE OF POLICY RESPONSES	EXAMPLES OF FEDERAL OR STATE POLICIES
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**Project Design and Planning**

Engineering Standards	San Francisco Bay Conservation and Development Commission Bay Plan: mandatory project review requires proposed development engineering and design plans to incorporate consideration of sea level rise.
Remodel or Redesign Infrastructure	Charleston, South Carolina designed a new flood control and drainage system to accommodate local sea level rise over the next 100 years.

**Prohibit Development and Preserve Natural Shoreline**

Restrictions on Post-Storm Reconstruction	<p>South Carolina BMA prohibits new or rebuilt structures seaward of setback lines and mandates replacement of all vertical erosion protection devices within 30 years.</p> <p>Texas Open Beaches Act prohibits reconstruction of damaged structures on property seaward of the vegetation line which is open to public access.</p>
Land Acquisition and Conservancies	<p>California Coastal Conservancy allocates state bond monies to local governments and private organizations to acquire and manage ecologically sensitive coastal land.</p> <p>Florida buys shoreline property to preserve public access, beaches and recreation areas.</p> <p>Local governments acquire easements, establish greenbelts and buy development rights to create open space.</p>
Preserve Critical Wetland Habitats	<p>Maryland Cheseapeake Bay Critical Areas Act establishes buffers around wetlands and reduces density of adjacent development.</p> <p>Snohomish County, Washington: County implements ordinances to reserve wetlands and aquatic lands for agricultural, recreational or other non-structural development uses.</p>
Proposed Abandonment Policy	Long Island Regional Planning Board (NY) proposes ending long-term leases of selected state coastal lands and buying erosion prone barrier island properties.

Table 2 Continued

RANGE OF POLICY RESPONSES	EXAMPLES OF FEDERAL OR STATE POLICIES
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**Environmental Engineering**

Resedimentation of River Deltas	Louisiana Coastal Environment Protection Trust Fund and Federal/State Task Force sponsor local resedimentation projects.
Wetlands Mitigation Projects	State and federal laws require the mitigation of wetlands loss from development through enhancement and construction projects using reclamation, sedimentation and vegetation methods.
Beach Renourishment, Dune Vegetation and Stabilization	<p>Florida: Beach Management Fund authorizes up to \$35 million annually toward beach erosion, preservation and restoration projects.</p> <p>Maryland: \$60 million multi-year federal, state and local program to renourish Ocean Beach shorelines.</p> <p>South Carolina: BMA requires property owners to replenish beach sand at a rate of 150% annual erosion volume to replace damaged erosion structures.</p>

**Structural Engineering**

Large Scale Hydologic Projects	<p>Netherlands has a system of dikes and seagates enclosing the reclaimed land along their coast.</p> <p>Venice Italy is constructing "Moses" seagate system to encircle the city's coastal lagoon and islands.</p>
Structural Protection for Coastal Development and Infrastructure	Continued use of seawalls, bulkheads, dikes and other vertical structural devices to protect developed areas.

**GroundWater Resource Protection**

Manage Coastal Aquifers to Control Sea Water Intrusion	Maine: Requires all permit applications for new wells be reviewed by the local water district to determine the impact on ground water recharge and sedimentation.
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Maine's Sand Dune Rules and Florida's Coastal Construction Control Line Law require stricter building codes for coastal properties subject to increased risk from storm and flood hazards. Florida's codes require buildings within the construction control line area to be able to withstand levels of flooding and storm surge in excess of a one hundred year storm, as well as increased winds. In Maine, structures built in the low hazard zones must be elevated from one-to-four feet above the base flood elevation for a one hundred year flood.

South Carolina's Beach Management Act and Maine's Sand Dune Rules place restrictions on the size and density of coastal development. Maine's restriction on building size of 35 feet in height and 2500 square feet in area, is intended to ensure that structures are small enough that they can easily be moved back from the encroaching shoreline.

### **Prohibitions or Restrictions on Development**

Many states place restrictions on the use of structural protective devices such as bulkheads and seawalls, especially in areas considered to be critical ecological resources like sandy beaches, dunes and wetlands. States with restrictions on the use of structural erosion protection, either for specific ecosystems or designated areas include Maine, Massachusetts, Rhode Island, New York, Delaware, Florida, Maryland, North Carolina and South Carolina.

Post-storm redevelopment policies that prohibit and restrict post-storm reconstruction of damaged structures have been implemented in almost all the Atlantic and Gulf coast states. The National Flood Insurance Program prohibits construction or rebuilding of structures within the high hazard zones. Several states, for example Maine and North Carolina, require structures to be moved or abandoned if they receive substantial flood damage and are susceptible to continued flooding.

Many states have passed legislation to fund or support conservancy programs that preserve critical habitats and environments. These conservancy programs may be funded through agency budgets, the state legislature, public bonds, or private donations. California's Coastal Conservancy, for example, is authorized to distribute bond funds from statewide initiatives to local governments and non-profit organizations for the acquisition, restoration, and preservation of ecologically sensitive coastal lands. The Nature Conservancy, a non profit environmental organization, buys and accepts land to place into private natural reserves where all development is prohibited.

### **Requirements for Project Design and Planning**

Several jurisdictions require that coastal developments and infrastructure be planned and designed to accommodate potential change in water levels and increased storm surge. Charleston, South Carolina's new storm drain system, for example, incorporates projected sea

level rise over the next 50 years into its design and construction. Public works projects in Louisiana's coastal parishes are required to incorporate relative sea level rise into their design. The San Francisco Bay Conservation and Development Commission recently amended the Bay Plan to require consideration of sea level rise in the review of designs and plans for coastal structures. Local geomorphic conditions as well as potential eustatic sea level rise must be factored into the project design to assure that the structure will be safe for its expected useful lifetime.

As previously mentioned, the Army Corps of Engineers recommends that its district offices consider the historic relative rise in sea level in their evaluation of projects. Areas with higher rates of subsidence, such as the Louisiana coastal plain and Mississippi Delta are undergoing a process analogous to sea level rise and the Corps, along with EPA, state, and local authorities are in the process of developing long-term strategies that include requiring future hydraulic projects to incorporate sea level rise into their design.

#### **Economic Incentives and Disincentives**

The federal Coastal Barriers Resources Act restricts government subsidization of coastal development by prohibiting funding for infrastructure and restricting the availability of federal flood insurance and disaster assistance in those areas placed in the Coastal Barrier System. This law is intended to transfer the burden of development and property ownership to private sector investors in particularly hazardous and erosion prone areas.

States are also considering ways of creative economic incentives or disincentives for development. Several states have proposed legislation requiring property owners in hazardous areas to pay an increased share for improvements and repairs to the public infrastructure that serves them. The Delaware Beaches 2000 Report includes recommendations of this type as a method for making private investors pay the real cost of coastal property.

The use of tax incentives and disincentives to promote the preservation of undeveloped property is a vehicle for controlling land use that is being considered by a number of states. Another strategy is to create incentives to locate or relocate structures in preferred areas and disincentives for placing them in hazardous areas.<sup>4</sup>

#### **Environmental Engineering Requirements and Controls**

Environmental engineering, or the use of non-intrusive protective measures such as beach renourishment, revegetation of dune grasses, or construction of artificial dune barriers, is gaining popularity as an alternative to structural devices such as seawalls, bulkheads, and

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<sup>4</sup>As previously mentioned, the Upton-Jones amendment to FEMA's National Flood Insurance Program establishes a voluntary program that provides an economic incentive for removing or relocating structures that are in imminent danger of being destroyed by erosion or flooding.

revetments. These methods are designed to reduce erosion, provide protection for upland property, and restore the natural character of the environment. In South Carolina, for example, a property owner who wishes to rebuild a structure that has been destroyed or damaged by flooding is required to renourish the beach in front of the structure at a rate of 150 percent of the annual erosion loss rate.

Florida's Beach Management Fund authorizes up to \$335 million annually for the restoration, renourishment, and preservation of beaches. During the 1970s, \$65 million was spent to create a 300-foot wide beach over a 10 mile stretch of Miami Beach, which is still being maintained by a renourishing program. Maryland, along with the federal and local governments, is spending \$60 million to renourish the beaches of the Ocean City area.

The Louisiana Coastal Environmental Protection Trust Fund was established to sponsor a series of environmental engineering projects to restore and stabilize the wetlands and barrier islands of the Mississippi Delta. The state Coastal Protection Master Plan and the Joint State and Federal Coastal Protection Task Force plan and manage the projects. In 1989, a constitutional amendment was passed by the citizens of Louisiana creating a Restoration Fund. The fund's annual allocations will range between \$10-40 million based upon the state's total revenues from offshore oil.

#### **Structural Engineering Requirements and Controls**

Building structural devices such as seawalls, dikes, revetments, groins, and jetties to prevent flooding and inundation continues to be the preferred method of protecting coastal development and facilities. Many developed areas depend on these devices and can be expected to redesign and improve them to meet new conditions.<sup>5</sup>

#### **Protection and Preservation Groundwater Resources**

Protecting coastal aquifers from saline intrusion is a rising concern to many states. The threat to coastal aquifers is expected to increase as the sea level rises, especially in areas where development is limiting freshwater flows and recharge. Maine requires that all permit applications be reviewed by the local water district to determine if a proposed development will have a detrimental impact on the quality of the groundwater due to a decrease in the flow and recharge. Methods of protecting groundwater being considered in other states include artificial recharge of aquifers and construction of underground barriers that block salt water intrusion.

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<sup>5</sup> As discussed in Section 5, a number of countries; Great Britain, the Netherlands and Italy, for example, are undertaking major public works projects designed to preserve and protect coastal areas from inundation.

### **3.4 SUMMARY OF COASTAL STATE POLICY RESPONSES: CASE STUDIES**

This section summarizes the response of four coastal states to the potential of accelerated sea level rise and its associated impacts. These case studies are based on information obtained as part of a survey of policy response and actions in 23 coastal marine states in the United States. A summary of the types of policy responses found in this survey was presented in Section 3.3. The purpose of this section is to provide a description of how individual states have structured their policy response initiatives.

Case Studies of Maine, California's San Francisco Bay Conservation and Development Commission, and South Carolina are presented as examples of development and land use practices in response to the potential impacts from accelerated sea level rise. Florida has existing policies addressing chronic erosion and coastal storm hazards, but does not specifically address accelerated sea level rise.

#### **3.4.1 Maine**

##### **Background**

Since 1979, Maine's Coastal Wetlands and Sand Dune Law has authorized the state's Department of Environmental Protection (DEP) to regulate construction in the coastal sand dunes through a review and permit process. The DEP, which has oversight responsibility for the Mandatory Shoreland Zoning Act (MSZA), provides local governments with technical assistance in developing local ordinances that meet the intent of the MSZA. In 1988, the Sand Dunes Rules were changed to encourage a landward retreat from the encroaching sea, reflecting a concern that sea level rise might compound the existing erosion and storm hazard problems. In addition, the Coastal Wetlands and Sand Dunes Act was consolidated with other state laws into the Natural Resources Protection Act in order to create a comprehensive planning framework and guidelines for incorporation into local planning and zoning ordinances. The role of the state in shoreland zoning is to provide technical assistance to local governments, while the role of the local governments is to administer and enforce shoreland zoning ordinances.

In Maine, local governments generally have jurisdiction over areas where a local shoreland zoning permit is required and are 250 feet from normal high water, as well as over any structure built on, over or abutting a dock, wharf, pier or other structure extending beyond the high water mark. The DEP, which has oversight responsibility for the Mandatory Shoreland Zoning Act (MSZA), provides local governments with technical assistance in developing local ordinances that meet the intent of the MSZA. The new rules are based partially on information provided by the Sand Dune Mapping Project that is discussed below. Simply stated, the law requires that a project will not:

- Create an unreasonable flood hazard to structures built in, on, or over any coastal sand dune or neighboring property
- Unreasonably interfere with the natural supply or movement of sand within or to the sand dune system
- Unreasonably increase the erosion hazard to the sand dune system
- Cause unreasonable interference with existing recreational uses or fish and wildlife habitats.

The Sand Dune Rules provide more detailed guidelines for determining whether a project is unreasonable. To satisfy the rules, the geologic environment of the dune system must be determined as part of the review process. The rules prohibit any construction in the frontal dune systems and place restrictions on back dune development depending on the geologic conditions. The vulnerability of the proposed structure to permanent damage is one of the criteria for determining the extent of acceptable development. Such damage would result primarily from temporary increases in sea level and the erosion of protective frontal dunes due to storm activity.

The intent of the Sand Dune Law is to prevent development in areas where the development might be susceptible to damage or destruction from the natural processes within the next 100 years. The potential that accelerated sea level rise would subject the area to increased flooding and storm damage contributed to the impetus to revise the Sand Dune Rules.

### **Technical Mapping Project**

In 1986, the DEP initiated a coastal hazards mapping project to provide information the department needed to review sand dune permit applications. The project was conducted by the the Marine Geology Division of the state Geological Survey. This project was supported by the Citizen Appeals Board, which advises DEP. The project was partially funded by a federal Coastal Zone Management Section 306 assistance grant from NOAA's Office of Coastal Resource Management . The project produced geologic scale maps (1:4800) of Maine's large southern beaches and barrier islands, an approximately 30 mile stretch of coastline where erosion and storm events are long-term problems. The maps were incorporated into the Department of Conservation's computerized Geographic Information System (GIS) together with coastal FEMA flood zones, elevation contours, and cultural features. The resulting computer-generated map of the geologic environments and flood zones displayed areas susceptible to damage in major coastal storms.

### **Coastal Sand Dune Rule Changes**

In 1988, DEP revised the Sand Dune Rules. The intention of these rule changes was to scale down the size, location, and density of coastal development in order to prevent future

flood hazards and interference with sand supply and movement that might result from sea level rise and shoreline retreat. The key aspects of the Sand Dune Rules revisions are as follows:

#### *Flood Hazard*

The coastal area is divided into zones depending upon the extent of flood hazard. Specific construction restrictions and requirements apply to each zone. The rules applying to the V-zone, which is the very high hazard shoreline area subject to a one percent or greater chance of flooding in any year and to high velocity wave action, were revised to prohibit all construction. Construction is also prohibited in the A-zone of the frontal dunes, a high hazard area subject to a one percent chance of flooding on any given year.

Construction is permitted in the A-and B-zones in the secondary dunes, which are considered low hazard areas, but single and duplex homes, including basements, must have one foot elevations above the 100-year base flood elevation (BFE) and multiple unit buildings must have a four-foot elevation above BFE. These elevation standards includes sheds and garages. B-zones are defined by the limits of a 500-year flood and 100-year floods where water depths are less than 1 foot.

Requirements for elevation and stability are also specified for the C-zones of the frontal dunes. These are areas on the landward side of the dunes escarpment that are designated as intermediate hazard areas. Structures exceeding 35 feet in height and 2500 sq. feet in size must be stable given a three-foot rise in sea level over the next 100 years and multi-unit buildings must have a four-foot elevation above BFE. The C-zone of the back dunes is designated as a very low hazard area. New development is permitted in the low or very low hazard areas but cannot exceed 40 percent of undeveloped dune areas. The low hazard C-zone areas include back dunes and eolian flats, areas with artificial fill over back dune sand, and adjacent wetlands.

#### *Geology*

The definition of frontal dunes was expanded to include the most seaward ridge of sand and not just one ridge of sand and former frontal dunes modified by development. This was done to account for the dynamic character of dune systems. No new construction is permitted in the high and very high hazard areas on or seaward of the frontal dune.

In previously developed back dunes, development is restricted to the existing level or to forty percent of the area. In the remaining undeveloped natural dunes, buildings may not exceed 20 percent of the area, another 20 percent may have other types of development such as driveways and landscaping, and the remaining 60 percent must be undisturbed.

#### *Erosion*

Existing structures damaged by erosion must be rebuilt to 1988 standards. Structures that are encroached on for more than six months by a wetland due to erosion or sea level rise must be removed.

As before, new structures are prohibited if they were to be located in an area where erosion would cause them to suffer damage during the next 100 years based on existing rates of erosion. The construction of seawalls is prohibited and existing seawalls may not be enlarged.

### *Recreation*

As before, projects shall not interfere with legal access or use of public resources, and bird nesting or breeding areas should not be disturbed and must be provided with adequate buffers. The line-of-sight from the seaward points of existing buildings must be preserved.

### *Groundwater Protection Standards*

A new clause has been added to the rules addressing the potential impacts of salt water intrusion due to sea level rise. It requires all development permit applications be reviewed for "unreasonable" interference with the natural flow or quality of subsurface water by the local water district.

As a result of these rule changes, new construction is limited to 35 feet in height and 2,500 square feet in area, which is small enough to be moved if needed. The landward edge of the coastal wetland establishes a buffer zone for development, and as it moves, so must that development. This results in the relocation or abandonment of structures by forcing their removal should the wetland encroach on them for a period longer than six months or if the structure incurs more than 50 percent damage by flooding. In conjunction with an existing prohibition on hard protection structures such as seawalls, these rule changes constitute a policy of gradual forced or strategic retreat.

### **Advantages of the Sand Dune Law**

The Sand Dune Law is an effective regulatory tool for managing shoreline development in hazardous coastal areas with distinct advantages over outright prohibition or limited control on development. First, it allows shoreline property owners to make use of their property until such time that the sea level actually rises and becomes an immediate danger to the structures. State officials felt that because the law was an adaptive policy only activated by an actual change in the physical environment, it was perceived to be less harsh or restrictive than other alternatives. State officials reported that property owners and others who felt the level of uncertainty was very high and didn't believe that sea levels will rise significantly, were not as threatened by a regulation that was triggered only should such an event occur. Because it may be many years, if ever, before it is necessary to move or abandon structures that are currently standing, the present property owners are unlikely to be affected. Future property owners who will inherit whatever regulatory system is in place are likely to take the restrictions as a given. Except for properties in highly hazardous flood zones, most properties will not be immediately affected, and therefore neither will their values.

The regulations also enable the state and local governments to achieve their primary objectives of hazard protection, erosion control, resource management, and public recreation and access in a more comprehensive and planned manner. The detrimental impact that structural development can have on the ability of dune and beach systems to migrate and remain intact is addressed through the rule changes. This is important because the dune

system provides a protective barrier against storms and flooding, as well as a place for recreational activities and a wildlife habitat.

### **Constraints and Problems**

The primary drawback of the Sand Dune Law as a response to sea level rise is that it applies to only those areas of the state that have sand dune systems. The same restrictions do not apply to development in other ecosystems such as wetlands and bluffs.

Another area of concern is that local municipalities are delegated the right to issue permits but are not provided the technical assistance they require to do so adequately. For instance, the groundwater protection clause relies on the local water district to evaluate the impacts of the development on the long-term viability of the groundwater system, but the water districts generally have neither the staff expertise nor the budget to conduct such assessments adequately.

Implementation of the rules is dependent upon up-to-date and accurate maps of the coastal areas and relevant geological data. The state has mapped only a 30 mile section of barrier beaches and sand dune environments along the highly populated and developed southern seaboard. The unorganized lands, which represent a large portion of the coast, are not mapped. Where maps are not available, the law reverts to the definition of a sand dune system to determine the laws applicability and requires on-site evaluation.

Finally, more careful definition of terms is needed. It is not clear what constitutes damage from flooding. The present definition states that a permit is required for reconstructing buildings that are damaged in excess of 50 percent of their appraised value. The same holds true for the stipulation that a structure be removed if it is encroached upon by a wetland for six months or more. The definitions of a both wetlands and encroachment are imprecise enough to be subject to legal challenge.

One official at the Office of Coastal Resource Management felt that Maine was not forcefully implementing its Sand Dune Rules for fear of legal challenges and lack of support from local governments.

### **3.4.2 California: San Francisco Bay Conservation and Development Commission**

#### **Background**

The San Francisco Bay Conservation and Development Commission (BCDC) is a state agency, created by the McAteer-Petris Act, with planning and regulatory authority over San Francisco Bay, including its tidal marshes, managed wetlands, salt ponds, and a 100-foot wide strip of contiguous shoreline. BCDC has permitting authority for implementing the

San Francisco Bay Plan as adopted by the state legislature. The commission also has the responsibility for implementing the state coastal zone management program in that region.

The commission is made up of 27 commissioners of which (five) are chosen by the governor, (one) by the State Senate, (one) by the Speaker of the House, (four) represent the Association of Bay Area Governments (ABAG), (nine) come from local county governments, (five) from state natural and water resource agencies, and (one) each comes from the EPA and Army Corps of Engineers. The commission is enabled to amend the Bay Plan through the authority vested in it by the legislature, to regulate the bay for fills caused by development, and to ensure safety from hazards.

BCDC has sponsored two studies focusing on the implications of sea level rise for the bay area. The first, completed in 1986, described the climatic and man-made processes that contribute to relative sea level rise, impacts on the bay's natural resources, policy implications, and research needs. In 1987, a second study, partially funded by a CZMA Section 306 grant for program improvement, included detailed assessments of the potential impacts of sea level rise on the bay's wetlands, projected future tidal levels, and examined the role of vertical land movement and subsidence in the bay area's evolving geomorphic state. This study recommended that sea level rise be considered during the permitting review process when assessing the impacts of a development project on bay resources.

### **Bay Plan Objectives**

The regulatory scope of the Bay Plan and the authority of the commission to amend the plan are derived from California Government Code Sections 66632(a) and 66605(e). These sections authorize the commission to issue permits for all projects within their jurisdiction if those projects:

"make any substantial change in the use of any water, land, or structure in accordance with sound safety standards that afford reasonable protection to persons and property against the hazards of flood or storm waters."

The commission has advisory authority for the area upland of the shoreline band, though historically they have also provided the technical expertise and developed the standards utilized by local governments, for shoreline planning and development.

BCDC staff members feel that federal agencies such as the EPA, Army Corps of Engineers, U.S. Geological Survey, and the state's Water Resources Control Board are better equipped and more appropriate agencies to conduct such research than the commission. However, because the federal and state agencies had declined to consider sea level rise as a factor in their planning for bay area projects, the commission felt that its statutory duty compelled it to provide enforceable policies concerning sea level rise. Commission staff cited FEMA as an example of the federal agencies' lack of foresight concerning response to relative sea level rise in the bay area. FEMA establishes its Base Flood Elevations (BFE)

and Special Flood Hazard Areas based upon the existing topographic and hydrological information. It does not include anticipated relative sea level rise on the grounds that the level of uncertainty is too high. BCDC staff also objected to FEMA's policies because they felt that local geophysical conditions such as tectonic subsidence, soil compaction, groundwater extraction, and reduced sedimentation should have been reflected in FEMA's projections of future water levels, but were not.

#### **Amendment of the Bay Plan**

The commission staff determined that it should develop "practical and specific" engineering flood control criteria for the construction of shoreline erosion control structures and buildings. This was accomplished by establishing new standards for structural site and ground floor elevations based upon future projections of relative sea level rise. In January, 1989, the new findings and standards were adopted as Bay Plan Amendment No. 3-88 by a unanimous vote of the commission.

The amendment made significant changes in the findings and the policies sections of the Bay Plan. In the findings section, sea level rise is identified as a factor related to the recognition and investigation of potential hazards. The findings section was amended to state:

The height of the water level above the high water mark should be an additional consideration for future construction projects. Adequate design measures should be taken to minimize the hazards from sea level rise, storms and extreme high water levels.

Water levels will increase in the future because of a relative sea level rise resulting from a rise in global sea levels and subsidence in the bay area. Global sea levels may increase between 1.5 feet and 5 feet by the year 2100 due to anthropogenic global warming. Changes in land elevation from tectonic activity, soil compaction and extraction of groundwater are also noted as contributing to the variable rate of relative sea level rise in the bay area.

The policies section that established the function of the Engineering Criteria Review Board, the body that reviews and approves all development projects within the Bay Plan's jurisdiction, was also amended. The amendments specified the qualifications of board members and the location of structures as follows:

The Board will include geologists and civil engineers specializing in geotechnical and coastal engineering, structural engineers, and architects to evaluate design plans for adequate flood protection including consideration of future relative sea level.

Structures should be above the wave run-up level and set back from the shoreline so that they are not subject to dynamic wave energy, with the bottom floor levels above the highest estimated tide elevation for the expected lifetime of the project.

The policy section establishing BCDC's advisory relationship with the Association of Bay Area Governments was amended to state:

Local governments and special districts should adopt similar requirements for the shoreline developments for which they issue permits, and the commission should not

allow projects that are not designed accordingly to go forward until the local government has taken adequate precautions.

### **The Advantages of the Bay Plan**

BCDC's Bay Plan consciously avoided making specific predictions about future sea levels. This served two beneficial functions. First, it accommodated both the scientific uncertainty about the timing and intensity of future sea level rise, and the diversity of local geologic conditions around the bay. The shoreline bordering San Francisco Bay is experiencing very uneven patterns of subsidence and uplift that are affecting the relative sea level quite significantly. Second, it avoided liability problems that might have resulted from the establishment and enforcement of standards that later proved to either under or over estimate sea level.

Evaluating projects on a case by case basis allows BCDC to make the best use of their technical expertise and also to account for the discrepancies in local geologic conditions. The addition of coastal and geotechnical engineers to the Engineering Review Board also contributes to the board's ability to evaluate design plans, establish safety criteria and develop performance data for specific projects.

### **Constraints and Problems**

A primary limitation of the Bay Plan is that it applies only to a relatively narrow band around the bay. Outside this area, BCDC must rely on local governments and special districts to comply with its recommendations. In many areas around the bay, local governments have permitted developments in areas that are flood prone under current conditions, any future increases in relative sea level rise would place these developments at significant risk. Furthermore, the Bay Plan gives BCDC no authority over activities that may significantly impact future bay water levels such as the reduction in sediment load from the Sacramento River system and depletion of groundwater aquifers by local water districts, thus reducing the Commission's ability to mitigate shoreline problems.

In 1989, BCDC convened a workshop of the Association of Bay Area Governments (ABAG) planners, officials, and technical experts to facilitate and encourage the compliance of local governments with the new design standards. The response by local government representatives and planners was varied. Some expressed concern about the continuing uncertainty of sea level rise, others were uncomfortable with BCDC's efforts to influence planning beyond its jurisdiction.

Because federal agencies such as FEMA and the Army Corps of Engineers are not fully supportive of the BCDC amendments to the Bay Plan, their technical resources and authority, which would be helpful in getting local communities to incorporate the Bay

Plan's new standards into local land use planning and permitting practices, are not likely to be freely applied to this effort.

### 3.4.3 South Carolina

#### Background

South Carolina's coastal zone program is administered by the South Carolina Coastal Council (SCCC) under the Coastal Tidelands and Wetlands Act of 1976. In 1988, the act was amended by the adoption of the Beach Management Act (BMA) which provides the SCCC with increased jurisdiction and authority to protect the integrity of the state's beach and dune systems. The adoption of the BMA resulted from problems associated with severe chronic erosion, storm and flood hazards that have been exacerbated by increased development. The threat posed by potential sea level rise further heightened concerns about coastal development and land use practices.

Flood and storm hazards, erosion, and sea level rise were the focal points for the North Carolina Blue Ribbon Committee on Beachfront Management that was formed in October of 1986. The efforts of the committee eventually led to the amending of the state coastal management program. The committee consisted entirely of representatives from coastal county and municipal governments. One of the committee's findings was that the SCCC was unable to effectively implement existing legislation because it was not given sufficient authority over development in the beach and dune areas.

In the past, property owners were allowed to build structures and harden protection devices in erosion prone beach areas susceptible to storms and flooding, even though these developments contributed to the existing erosion problems. Property owners were also allowed to rebuild damaged and destroyed structures on the same site, further compounding the problem. The state guidelines for managing coastal development were not adequate for addressing these problems and the SCCC did not have adequate authority to enforce those that existed. The committee found that the state's coastline was in crisis due to erosion and that sea level rise was a causal factor. It called for the legislature to amend the state coastal zone management program's enabling legislation so that the SCCC would have the authority needed to provide effective stewardship of the coastal resources.

The committee recommended a policy of gradual retreat in response to the erosion and flooding problems. It proposed restricting new development and the construction of protective devices. The bill was opposed by property owners, developers, and lending institutions who felt that property values and economic development would be adversely affected

## **The Beach Management Act of 1988**

The Beach Management Act of 1988 (BMA) is specifically designed to address the problem of development in a highly hazardous and migratory beach environment. It does so by redefining the importance of the environment to the state as a whole and by implementing new policies that restrict reconstruction and development on properties that are in flood and erosion prone areas. The BMA redefined the value of the coastal environment as a natural and economic resource and significantly increased the role of the state in managing it. The findings section of the BMA states:

The beach and dune system is an asset to the state that provides protection from storms and flooding, a valuable tourist and recreational attraction, and a valuable wildlife habitat.

Protective devices contribute to erosion and provide a "false sense of security" for shoreline property owners. Erosion is a natural process that becomes a significant problem when structures constrain the ability of the beach and dune systems to accrete and erode naturally.

Long-range, comprehensive beach management is needed to protect the coastline, prevent unwise development, and minimize man's adverse impacts on the environment.

The same objectives are repeated in the policy section, which basically stated that South Carolina would establish guidelines, procedures and programs by which these objectives will be implemented. The section on Beach Protection contained the new regulations and mechanisms for controlling coastal development. A 40-year retreat policy was implemented through the creation of erosion zones, a system of setbacks, restrictions on the location and size of structures, renourishment requirements, limitations on erosion control devices, and revised reconstruction practices. The primary revisions in this section are:

The creation of setbacks requirements based on 40 times the annual erosion rate. The annual erosion rate is determined by taking an average of the erosion rate for the previous 40 years. The setback is a minimum of 20 feet even where the shoreline has been stable.

The baseline for the erosion rate was to be determined utilizing current monitoring and scientific analysis by coastal geologists and engineers. It would be reset within 10 years and between every 5 to 10 years thereafter. Survey point monuments will be established to locate the baseline.

All vertical seawalls would have to be replaced with an approved protection device within the next thirty year period and those that had been more than 50 percent damaged must be removed.

Damaged and destroyed structures are restricted to their original size and must be placed behind the setback whenever possible, or as far landward as possible.

Property owners are required to renourish beach sand in front of their property at a rate of one and half times the yearly volume of sand lost to erosion whenever a damaged structure or erosion device is being replaced.

An area known as the "dead zone" is created by the minimum setback line measured 20-feet landward of the baseline. The baseline itself is determined by the "ideal" location of

the primary dune system. According to the BMA, the ideal location for the primary dune system is where the dune would be located if there was no shoreline development. It is determined by a formula that factors in the beach's natural sand volume and adjacent shoreline topography. In some cases, the baseline is located on the first block of development. Erosion setbacks for new development are measured landward from the baseline. All new construction and the reconstruction of destroyed structures is prohibited seaward of the minimum setback line. Hurricane Hugo resulted in 130 structures being destroyed within the dead zone. The BMA is being challenged by many of the owners of the destroyed structures who have been prohibited from rebuilding.

The state legislature is presently considering an amendment that would permit the SCCC to issue variances for owners whose property is entirely seaward of the minimum setback line. The amendment would allow those property owners to build a single family residence, no larger than 1500-square feet, as far landward as possible on their lot. The property owners would not be allowed to build any erosion or protection devices and must meet all building codes and standards for hurricane and flood damage mitigation. If the structure is destroyed it must be removed and not rebuilt.

The section of the BMA restricting the use and reconstruction of erosion control devices has not been legally challenged. Currently, the state legislature is considering an amendment to the BMA that would require all structural erosion devices, and not only the damaged devices, to be removed within 30 years.

The BMA directs the SCCC to create a long-range, comprehensive beach management plan for the Atlantic shoreline of the state to be completed in 1990. The comprehensive plan is required to include a scientific data base inventory of the state's coastal environmental systems, and guidelines for local governments and state agencies to follow in developing plans that provide public access, maintenance, protection, and restoration programs.

The bill also requires local governments to implement their own comprehensive beachfront management plans, following the guidelines established by the SCCC, within two years of the completion of the SCCC state-wide, long-range, comprehensive beach management plan. The SCCC is authorized to implement the BMA in communities where the local government fails to establish a beach management plan. If a local government fails to enforce the beach management plan it loses eligibility to receive state generated or shared revenues for beach/dune protection, preservation, restoration or enhancement projects. (Some local government ordinances are actually more restrictive than the BMA. Myrtle Beach implemented setbacks based on 50-year erosion rates, three years before the BMA was passed by the state legislature.)

These actions are having results. In 1989, review of a permit application for an extensive storm drain system for the Charleston Peninsula area by the SCC resulted in a

requirement that new drainage systems be designed to accommodate a rise in sea level over a 50-year period. The city is plagued by storm and tidal flooding and is subsiding in many areas.

#### **Strengths and Advantages of South Carolina's BMA**

The BMA directly addresses the state's primary objectives in managing coastal development, namely; the mitigation of hazards, erosion control, public access, recreation, and environmental protection. Sea level rise is viewed as a factor contributing to these problems and is addressed as a risk that must be managed over the long term. The BMA is a comprehensive law that provides the SCCC with significant authority over the entire coastal region. The act provides clear guidelines and regulations for the issuance of permits in risk prone areas. Local governments are being provided with the technical data and resources they require to implement the new regulations, and there is an enforcement component that encourages compliance with the new standards. The BMA incorporates up-to-date information and a periodic shoreline monitoring program into the establishment of the baselines for measuring setbacks. The setbacks are not static and will be adjusted to reflect the changes in the shoreline as they occur.

#### **Problems and Constraints**

There is significant opposition to the BMA among local beachfront property owners and the state has been sued at many times for the "taking of property without just compensation." The post-storm reconstruction regulations that prohibit rebuilding structures that are more than two thirds destroyed in the area seaward of the setback line has been successfully challenged in a state lower court on the grounds that methods for measuring the percentage of destruction are not well defined. The SCCC feels confident that the BMA will withstand court challenges when they are appealed to the state supreme court or federal court. A recent federal district court decision, concerning the right of a property owner to build within the dead zone, upheld the BMA's prohibition on development.

As previously mentioned, the SCCC is supporting an amendment that would give them the authority to issue variances for property owners whose property is entirely within the dead zone. The SCCC would like to provide these property owners with some economic use of their property. The SCCC believes it will avoid many of the court challenges by having the ability to issue conditional variances that prohibit the construction of erosion and shoreline protective devices and make the property owner assume the full burden of risk for building in the dead zone.

The BMA does not provide adequate protection for wetlands, where the 1976 law still applies. First, the SCCC only has jurisdiction over the shoreline reaching one half mile up the coastal estuaries. Within this area, there are no setbacks for construction adjacent to

coastal wetlands located on the bayside of the barrier islands and along the interior coastline. Local governments usually don't have any restrictions on development adjacent to wetlands and development is permitted right up to the line delimiting saltwater plants from upland vegetation. This practice has led to considerable flooding and pollution problems.

### 3.5 INTERNATIONAL RESPONSES TO SEA LEVEL RISE

This section provides a brief survey of the response to global climate change induced sea level rise outside the United States. Broadly speaking, the more technically advanced developed nations are looking towards engineering solutions while the less developed nations are only beginning to examine the potential impacts of accelerated sea level rise on their coastal communities. There is little evidence that the adaptive policy approaches, increasingly prominent in US shoreline management efforts, is being applied in other countries. Information gathered from the United Nations Environmental Programme and from recent conferences in Cairo and Miami provide some insight into how the issue is being addressed internationally.

Most nations do not have comprehensive coastal management systems that address land use policies and environmental considerations at the national, regional/state, and local level as the United States, Netherlands, and several other European countries do. Often, government agencies that are concerned with hydraulics, water resource management, and coastal engineering are the responsible authorities for managing the coastal resources and infrastructure. The implementation of a comprehensive response to sea level rise in Europe is complicated by the unique relationship these nations have within the European economic community.

This lack of comprehensive planning and technical expertise is reflected in a review of the papers presented at the International Workshop on Sea Level Rise held in Miami in late 1989. Many of the participants from less developed nations stated that the institutions in their nations were not well suited or prepared to deal with the issue of accelerated sea level rise and that problems resulting from sea level rise would have to be managed by the local jurisdiction. This was viewed as a problem, particularly in developing nations that have experienced rapid urbanization in low-lying coastal cities and where the development has sprawled onto the adjacent coastal plain such as Dakar, Senegal and Buenos Aires, Argentina.

Many European nations have coastlines that are heavily developed and have fixed protection devices and structures. In these areas, the tendency has been to look towards defensive engineering solutions. European nations have been addressing problems that are analogous to sea level rise for more than a century as coastal development, overdrafting of groundwater, and reduced sediment from damming and subsidence have produced relative sea

level changes exceeding 10 to 15 cm. per century. Many coastal wetlands that have been reclaimed during the past several hundred years are protected by diking systems.

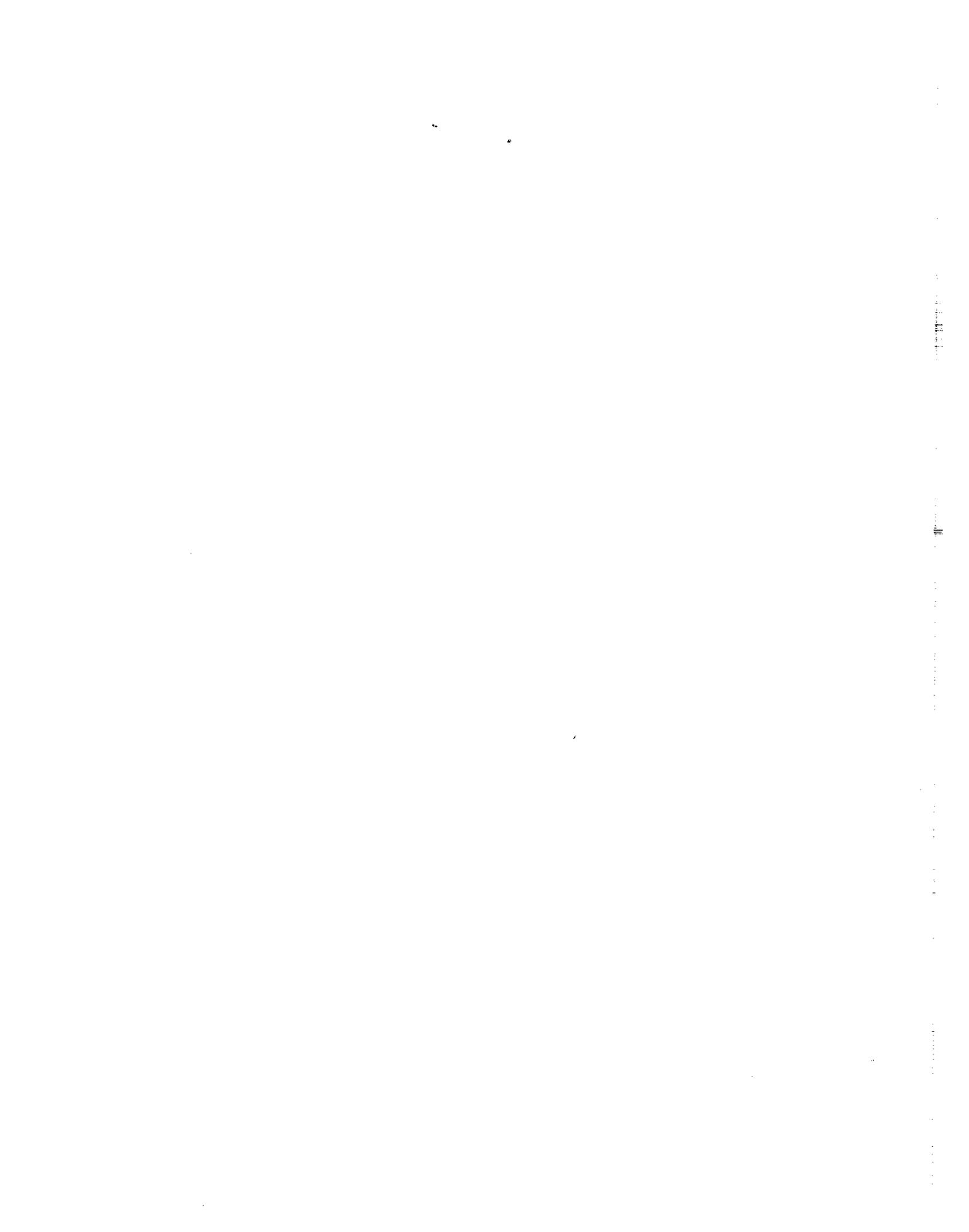
A report from the Geological Survey of the Netherlands attributes increased shoreline erosion, inundation and storm surge, subsidence, and salt water intrusion to human related factors. The activities that are identified as causing these problems are:

- Reclamation of coastal lowlands for agricultural, industrial, recreational and residential development
- Sand extraction from beaches for the construction industry
- Destruction of natural barriers such as sand dunes to provide for development
- Interruption of longshore sediment transport by groins, jetties and harbors
- Reduction of sediment load of rivers by water management systems
- Canalization of rivers for navigational purposes
- Utilization of groundwater leading to subsidence and salt water intrusion.

The report goes on to detail the type of technical data required to map and apply objective criteria for land use planning in the coastal lowlands. It concludes that Europe has the types of infrastructure that would enable it to respond effectively to sea level rise but that the socioeconomic impacts in the less developed nations would be significant.

In England, flood tides and storm surge that have inundated interior lowlands along the Thames River have resulted in the construction of the Thames Barrier which will act to protect the upriver areas from tidal surges and control water levels in the estuary. Similarly, Italy is planning to build the Venice Safeguard, an elaborate six billion dollar system that will enclose the lagoon in which Venice is located. Venice which has been experiencing a relative sea level rise of 20 cm. per century during the past several hundred years, is anticipating an even greater increase in relative sea level in the future.

A report authored by a professor at Odessa State University highlights the lack of institutional mechanisms for dealing with the issue of sea level rise in the Soviet Union. The report states that the Ukrainian Republic's Coast Protection Concerns, Communal Building Institute, and Coast Protecting Constructions Institute, are the only institutions presently addressing issues concerning coastal development. The type of response these institutions would provide could be expected to reflect their primary concern with the planning and construction of large-scale public works projects.



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New York

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Pennsylvania

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Rhode Island

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#### South Carolina

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