

Legal and Policy Impacts of Sea Level Rise to Beaches and Coastal Property¹

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“The oceans are warming. Global mean sea level has been rising.”³

“Coastal property may present such unique concerns for a fragile land system that the State can go further in regulating its development and use than the common law of nuisance might otherwise permit.”⁴

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³ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC), CLIMATE CHANGE 2007 - THE PHYSICAL SCIENCE BASIS (2007).

⁴ Justice Kennedy’s concurrence in *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1035 (1992).

I. Introduction

According to the Intergovernmental Panel on Climate Change (IPCC), there is an international scientific consensus that carbon dioxide emissions are causing and will continue to cause global warming.⁵ Among the international parties, consisting of the National Academy of Science of the United States, the National Scientific Academies of Brazil, Canada, China, France, Germany, India, Italy, Japan, Russia, and the United Kingdom, the consensus has emerged that “there is now strong evidence that significant global warming is occurring . . . It is likely that most of the warming in recent decades can be attributed to human activities. This warming has already led to changes in the Earth’s climate.”⁶

Climate change and variability have already resulted in extensive alterations of both the terrestrial and marine environments. For example, sea level rise is a direct consequence of global climate change. The impacts from sea level rise on beaches, such as erosion, net loss of shorefront, permanent wetland inundation, and storm surge, affect governments, coastal property owners, and the public. In fact, future acceleration of the rate of sea level rise will displace coastal populations, threaten infrastructure, intensify coastal flooding, and ultimately lead to loss of recreation areas and public access as well as private property. Consequently, in the United States, litigation has become and will continue to be more common as regulatory and policy responses are developed to address changing conditions and call into question Constitutional claims, as well as a host of other well-settled legal doctrines.

Under the federal Coastal Zone Management Program,⁷ it is the national policy “to preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation’s coastal zone for this and succeeding generations.”⁸ Under this policy, federally approved state coastal programs are directed to develop management plans for coastal development which “minimize the loss of life and property caused by improper development in flood-prone, storm surge, geological hazard, and erosion-prone areas and in areas likely to be affected by or vulnerable to sea level rise, land subsidence, and saltwater intrusion, and by the destruction of natural protective features such as beaches, dunes, wetlands, and barrier islands.”⁹ To fulfill the mandates of the Coastal Zone Management Act, coastal states and their coastal programs *must* develop effective policies in response to the implications of global warming (*e.g.*, sea level rise).

Many coastal programs currently address natural hazards, which provide a good foundation for additional policies to address sea level rise acceleration, climate change and variability. However, current coastal planning approaches and policy have the tendency to be shortsighted and reactive, without taking a proactive approach to coastal management.¹⁰ Policies which ignore the dynamics of coastal states and systems can be catastrophic when the focus is on human activities rather than the systems which sustain them. To be effective, coastal management policies must be based on sound science. These policies must take into account the limitations of natural systems, while balancing and integrating the demands of the various sectors and stakeholders, including property owners, fisheries, recreational users, industry, tourism, to name a few, which depend on these systems for their livelihoods.

⁵ IPCC, *supra* note 2, at 4; *see also* IPCC, CLIMATE CHANGE 2001: SYNTHESIS REPORT (2001).

⁶ Ken Alex, *A Period of Consequences: Global Warming as Public Nuisance, Symposium: Climate Change Liability and the Allocation of Risk*, 26A STAN. ENVTL. L. J. 77 (2007) (*citing* Academia Brasileira de Ciências, *et al.*, *Joint science academies’ statement: Global Response to Climate Change* (2005), at 1, available at www.royalsoc.ac.uk/displaypagedoc.asp?id=20742).

⁷ *See* National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management, <http://coastalmanagement.noaa.gov/programs/czm.html>. Thirty-four coastal and Great Lakes states, territories and commonwealths have approved coastal management programs, protecting more than 99% of the nation’s 95,331 miles of ocean and Great Lakes coastline.

⁸ 16 U.S.C. § 1452(1).

⁹ *Id.* § 1452(2)(B).

¹⁰ Martin M. Randall, *Coastal Development Run Amuck: A Policy Of Retreat May Be The Only Hope*. 18 J. ENV. L. 145, 177 (2003) (*citing* TIMOTHY BEATLEY ET AL., AN INTRODUCTION TO COASTAL ZONE MANAGEMENT 2, 287 (2d ed. 2002)).

Furthermore, not every coastal state within the United States has adopted or has considered adopting sea level rise polices.¹¹ This delayed response may be due, in part, to the fact that sea level rise usually occurs at a slow pace, and a change in approximately one centimeter per year is imperceptible to most people. Consequently, the threat of sea level rise does not appear imminent to many state officials, and policy decisions regarding development reflect this view.¹² However, to be successful in adapting to the threats of sea level rise, governments must immediately enact policies which constrain development options in light of *anticipated* changes within the coastal zone. There has been a void in national (science-based) policy addressing such threats, as well as a minimal number of court cases over the last decade. To this end, this article will examine existing planned adaptation techniques, such as hard and soft armoring, beach renourishment, setbacks, and retreat.

As with any regulation, a balancing (of interests) test must be employed. State and local governments must evaluate both the economic impact of proposed regulations on property owners and the science which supports the conclusion that regulations are necessary to protect coastal resources and public health, safety, and welfare. The fear of litigation must not paralyze state and local governments.¹³ In fact, some states, as will be discussed, have been victorious in litigation.

With a national focus, but concentrating primarily on Rhode Island, this article will address the causes of sea level rise, impacts to beaches and coastal property, legal implications of existing sea level rise policies, and the current status of sea level rise litigation, and discuss the adaptation responses to the effects of sea level rise on beaches and coastal property.

This paper does not purport to include every solution for long-range coastal planning needs resulting from sea level rise. Rather, it will focus on state and, where appropriate, local policy measures which have proven successful in *litigation*. Sea level rise policies are continuously evolving as state coastal programs strive to achieve the successful balance of protecting human health, coastal resources, and private property. Due to the nascent nature of the policies, many legal claims having to do with loss or interference of property have yet to be litigated and are, therefore, not included in this article.

II. Measuring Sea Level Rise and Coastal Boundaries

A. Relative Sea Level Rise

Sea level rise refers to the change in mean sea level over time in response to global climate and local tectonic changes.¹⁴ Mean sea level is determined by a tide gauge measuring the distance of the water's surface above a reference point (or datum) averaged over a given period, usually at least a month. Sea level is a mean only for a particular time period and will vary over longer time periods, whether monthly, annually, or longer. A tidal datum defines a certain phase of the tide and measures changes when linked to land-fixed horizontal and vertical control points (geodetic datums), known as benchmarks. The horizontal location of where a tidal datum intersects the land at the exact elevation of the tidal datum is usually called a "mark" or "line."¹⁵ This variation in sea level is measured relative to the land (to which the

¹¹ See generally PAMELA RUBINOFF ET AL. SUMMARY OF COASTAL PROGRAM INITIATIVES THAT ADDRESS SEA LEVEL RISE AS A RESULT OF GLOBAL CLIMATE CHANGE (2008), available at http://seagrant.gso.uri.edu/ccd/slr/SLR_policies_summary_Mar6_final.pdf.

¹² *Id.*

¹³ See *supra* note 10, at 176 citing Beatley at 87 (discussing the legal confusion regarding regulatory takings and emphasizing that "[t]he Fifth Amendment does not deny the government proper exercise of its police power. States and municipalities may regulate property and its uses without the owner necessarily being entitled to compensation.").

¹⁴ NATHAN D. VINHATEIRO AND PAMELA RUBINOFF, THE SCIENCE OF SEA LEVEL RISE: OVERVIEW AND POLICY IMPLICATIONS FOR THE STATE OF RHODE ISLAND (2007) (publication forthcoming).

¹⁵ NATIONAL OCEAN SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, TIDAL DATUMS AND THEIR APPLICATIONS, NOAA Special Publication NOS CO-OPS 1 (2001), available at http://tidesandcurrents.noaa.gov/publications/tidal_datums_and_their_applications.pdf

benchmarks are permanently attached) and referred to as “relative sea level.” If the land sinks, it will appear that sea level is rising, and likewise if the land rises, it will look like sea level is falling.¹⁶ The relative sea level rise trends are the trends that affect our coasts and beaches and determine planning mechanisms for coastal communities. Two of the largest components of relative sea level trends are: (1) local vertical land movements and (2) changes in height of the sea surface relative to the geographic center of the earth.

Marine (both on- and offshore) boundaries are also determined by tidal datums. The beach itself may erode or accrete due to such factors as wind, waves, longshore drift, and storm surges. Although this change in shoreline does not affect the tidal datum itself, it does affect the tidal datum line. The tidal datum of mean high water may remain at a constant elevation, but the mean high water line (used as a coastal boundary) may move significant distances horizontally with erosion and sediment depositional processes due to such factors as wind, waves, currents, storm surges, etc. In considering avulsion, the sudden removal of land due to a major storm episode, some state courts have held that boundaries are not subject to change, thus preventing private landowners from losing their beach.¹⁷

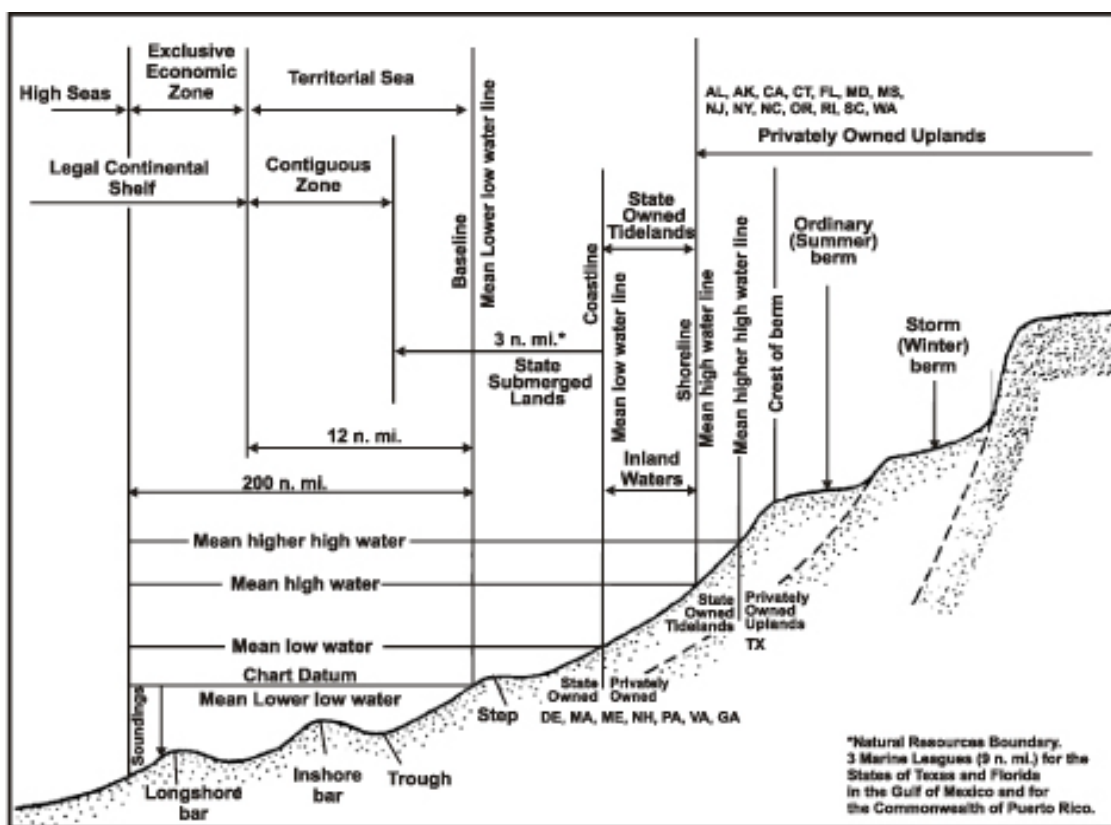


Figure 22. Coastal and marine boundaries from tidal datums.

Graph provided by NOAA's Center for Operational Oceanographic Products and Services (CO-OPS).

Coastal boundaries are formed by the intersection of the ocean surface with the land at the elevation of a particular tidal datum. To designate the boundary, the word “line” is used after the tidal datum name. For example, the boundary between private and state land, in most states, is the mean high water line. The mean high water line or “seaweed line” has historically been used as a proxy for the divide between private property and public trust lands, making the upper portion of the shore – typically the dry sand area in front of beachfront houses or other structures – private property and the wet sand areas public trust

¹⁶ STEACY DOPP HICKS, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, UNDERSTANDING TIDES 55-56 (2006), available at

http://tidesandcurrents.noaa.gov/publications/Understanding_Tides_by_Steacy_finalFINAL11_30.pdf

¹⁷ *Trepanier v. County of Volusia*, 965 S. 2d 276 (Fla. 2007).

lands.¹⁸ The figure below illustrates the many coastal and marine boundaries the United States presently uses.¹⁹ When drafting and adopting sea level rise policies, the legal differences between coastal states must be examined in addition to the geographic and geologic considerations.

B. Predicting Sea Level Rise: Which Estimate Is Accurate?

Various predictions of the global rate of sea level rise have been made (Table 1).

Table 1: Recent sea level rise projections

Report	Year of findings	Projections	Time Period
U.S. Environmental Protection Agency, <i>The Potential Effects of Global Climate Change on the United States: A Report to Congress</i> , EPA 230-05-89-052.	1989	0.5 to 2m	By 2100
U.S. Environmental Protection Agency, <i>Probability of Sea Level Rise</i> , EPA 230-R-95-008.	1995	34 to 65 cm	By 2100
IPCC, <i>Climate Change 2001: The Scientific Basis</i>	2001	10-90 cm	1990-2001
R.B. Alley et al., <i>Ice-sheet and Sea Level Changes</i> , 310 SCIENCE 456 (2005). ²⁰	2005	0.07m/year	
John A. Church and Neil J. White, <i>A 20th Century Acceleration in Global Sea-Level Rise</i> , GEOPHYS. RES. LETTER, 33, L01602, doi: 10.1029/2005GL024826.	2006	195 mm (equivalent to a 20 th century rate of SLR of 1.7± 0.3 mm/yr and a significant acceleration of 0.013± 0.006 mm/yr)	1870-2004
IPCC, <i>Climate Change 2007 – The Physical Science Basis</i>	2007	0.07 inches/year (1.8mm/yr) 0.12 inches/year (3.1mm/yr)	1961-2003 1993-2003
Stefan Rahmstorf, <i>A Semi-Empirical Approach to Projecting Future Sea-Level Rise</i> , 315 SCIENCE 368 (2007).	2007	55-125cm (0.5-1.4m above the 1990 level)	1990-2100
Stefan Rahmstorf et al., <i>Recent Climate Observations Compared to Projections</i> , 316 SCIENCE 709 (2007).	2007	3.3± 0.4 mm/yr (satellite data)	1993-2006

Since the rates of sea level rise have been fairly uniform, short-term projections are probably quite accurate;²¹ however, planning should be done for the longer term. The size and/or amount of shore protection structures and beach nourishment required to mitigate that portion of erosion due to storm surge, waves, coastal feature/underlying substrate (bedrock, unconsolidated gravel, sand, silt), and lack of

¹⁸ Megan Higgins, *Public Access to the Shore: Public Rights and Private Property*, in AMERICA'S CHANGING COASTS: PRIVATE RIGHTS AND PUBLIC TRUST (Diana M. Whitelaw and Gerald R. Visgilio eds, 2005).

¹⁹ *Supra* note 16.

²⁰ Although this steady increase is documented, scientists are concerned that the ice caps in Greenland and Antarctica could melt, causing even greater sea level rise. The collapse of the Larsen B Ice Shelf in 2002 was followed by an acceleration of its major tributary glaciers by two- to eight-fold, contributing about 0.07 mm per year to sea-level rise.

²¹ Short term projections are accurate over a short time period. In Rhode Island, for example, there has been an acceleration in sea level rise over the last twenty years.

sediment source exacerbated by sea level rise depends on the local trend and variability of sea level and local wave climate.²² Private property lines, as well as state and federal coastal and marine boundaries, depend on changes in sea level elevation. Future requirements for drainage pumping and saltwater intrusion prevention are a function of sea level trends. Finally, changes in trends enable physical oceanographers to detect the beginning of the predicted greenhouse-induced sea level rise and allow coastal managers to plan accordingly.²³

There is a disparity among the coastal states regarding which prediction of sea level rise is the most accurate, and for the purposes of this legal examination, which prediction is used for formulating sea level rise policy. The state of Washington, for example, refers to the Intergovernmental Panel on Climate Change while others, like Florida and Texas, refer to the Environmental Protection Agency's estimation of 4m (12 ft) by 2100.²⁴ No research indicates that the EPA requests or compels states to apply its findings.²⁵

C. Case Studies of Historical Trends of Sea Level Rise

The historical sea level data records are obtained from several hundred tide stations around the world, some of which have been operating for up to a century or more. These stations were installed primarily for navigational purposes, not to record global change, as this was certainly not a concern in the mid-1800s or early 1900s; the data were used to make tide predictions. Automated measurements were taken hourly – using a float inside a protective stilling well; now, these measurements are averaged for six-minute intervals. These measurements were related to permanent benchmarks on land and were accurate in comparison to other geophysical data. Comparison observations were made at a tide staff in order to tie the float gauge to the benchmarks, which were leveled directly to the tide staff (that is, the relative elevation of the benchmarks and the zero point on the tide staff was determined by surveying techniques). Since marine boundaries were determined by the mean low water datum (distinction between state and federal jurisdiction) and mean high water datum (boundary between state and private ownership), this process was important not only to the United States, but other governments as well. When offshore oil was discovered, these marine boundaries became even more critical.

The most important requirement for these data is datum continuity; that is, the maintenance of a direct relationship of the measurement to the benchmarks over time. There can be a variety of errors in the water level measurement, but they are generally random and tend to average out monthly or yearly. When trying to determine trends on the order of 1 or 2 mm/yr, however, it is vital that accurate datum continuity be maintained.

The large numbers of tide stations in operation in the United States have been of great benefit to the study of sea level rise. For example, the Newport, RI tide gauge, one of the longest data sets in the United

²² *Supra* note 11.

²³ *Id.*

²⁴ *See supra* note 14. *See also* GREENHOUSE EFFECT AND SEA LEVEL RISE AND CHALLENGE FOR THIS GENERATION (James Titus & Michael Barth eds. 1984), available at <http://www.epa.gov/climatechange/effects/downloads/greenhouse.pdf>.

²⁵ *See* EPA Global Warming Publications, <http://yosemite.epa.gov/OAR/globalwarming.nsf/content/ResourceCenterPublicationsReference.html>. Specific state examples: “This study was funded in part by the United States Environmental Protection Agency in 1998 as part of a nationwide effort to develop a better understanding of the potential economic impacts of sea level rise on the nation's economy.” http://findarticles.com/p/articles/mi_m0EIN/is_2003_Sept_3/ai_107219783;

“Several communities have used EPA funding to develop studies and maps illustrating which areas will be in danger of erosion due to sea level rise.” www.epa.gov/climatechange/effects/downloads/Transportation_Paper.pdf;

“Funding for this project was provided by the Environmental Protection Agency (EPA) through a grant administered by the Southwest Florida Regional Planning Council. This project will use current EPA estimates of a 5-foot rise in sea level over a 200-year period to study the impacts on seven coastal counties in southeast Florida from Key West to Indian River County.” <http://www.sfrpc.com/gis/slr.htm>.

States in the marine environment, has recorded an increase of approximately 0.64 feet between 1930 and 2006.²⁶ The difference between 1970-1988 and 1989-2007 is 0.153 feet.²⁷

III. Impacts of Sea Level Rise

A. Beaches

Coastal ecosystems are changing. As the IPCC's report has made clear with "very high confidence," coasts are experiencing the adverse consequences of hazards related to climate and sea level.²⁸ Increased erosion is caused by longer storm surge and greater wave action from both tropical (especially on the southeast and Gulf Coasts) and extra-tropical storms which results in a constantly changing shoreline. Other impacts to beaches from sea level rise include permanent wetland inundation in low-lying areas, saltwater intrusion, decline in submerged aquatic vegetation, groundwater contamination, septic system failure, and more susceptibility to storm surge.

Sea level rise is a climate-related phenomenon with a major influence on coastlines. Given the evidence of global sea level rise (10-20 cm in the past century) and predictions for the future, regions where subsidence and erosion problems already exist will see the problems exacerbated. The Atlantic and Gulf Coast shorelines are especially vulnerable to long-term sea level rise, as well as any increase in the frequency of storm surges or hurricanes. Most erosion events on these coasts are the result of storms, and the slope of these areas is so gentle that a small rise in sea level produces a large inland shift of the shoreline. Texas, for example, loses approximately five to ten feet of beach per year, shifting the high water line landward approximately five to ten feet per year.

B. Coastal Property

People are moving to coastal areas due to a variety of factors: employment, recreation and tourism, waterborne commerce, and energy and mineral production. According to estimates in 2003, approximately 153 million people (53% of the nation's population) lived in the 673 U.S. coastal counties.²⁹ The coastal population was greatest in the Northeast and Pacific regions, followed by the Great Lakes, Gulf of Mexico, and lastly the Southeast.³⁰ In turn, coastal ecosystems are pressured by population growth, leaving them vulnerable to pollution, habitat degradation and loss, overfishing, invasive species, and increased coastal hazards, such as sea level rise.³¹

With the increase in population, even properties further inland are exposed to greater damage from hurricanes and storm surge as sea level rises. Properties now elevated, out of perceived harm's way, are affected both by higher storm surges and changes in shoreline/property boundaries. Private property lines, as well as state and federal coastal and marine boundaries, are based on sea level elevation.

Erosion impacts to both coastal property and existing infrastructure can also be greatly exacerbated locally by natural inlet dynamics or coastal engineering structures, such as groins or jetties. According to a Heinz Center report published in 2000, over the next sixty years, erosion alone may claim one out of four houses within 500 feet of the U.S. shoreline without coastal engineering projects.³² Flood insurance

²⁶ See <http://www.crmc.ri.gov/regulations/programs/redbook.pdf> (adapted from www.coops.nos.noaa.gov/sltrends).

²⁷ NOAA, Mean Sea Level Trend for Tidal Station 8452660 (Newport, Rhode Island), http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8452660.

²⁸ See generally IPCC, CLIMATE CHANGE 2007 - IMPACTS, ADAPTATION AND VULNERABILITY, available at <http://www.ipcc.ch/ipccreports/ar4-wg2.htm>.

²⁹ NOAA, POPULATION TRENDS ALONG THE COASTAL UNITED STATES: 1980-2008 (2004) available at http://oceanservice.noaa.gov/programs/mb/pdfs/coastal_pop_trends_complete.pdf.

³⁰ *Id.* at 3.

³¹ *Id.* at 1.

³² THE H. JOHN HEINZ III CENTER FOR SCIENCE, ECONOMICS, AND THE ENVIRONMENT, EVALUATION OF EROSION HAZARDS (2000).

maps do not inform current or prospective coastal property owners of erosion risks.³³ A one- to three-foot rise in sea level along four North Carolina coastal counties could mean billions of dollars in private property losses over the next seventy-five years.³⁴

Roads, rail lines, ports, airports, and other important infrastructure located along the coast are also vulnerable to the effects of sea level rise when coupled with storm surge and exacerbated in some locations by land subsidence.³⁵ The vulnerability of transportation infrastructure to climate change, however, will extend well beyond coastal areas. The need for immediacy of addressing this situation cannot be stressed enough, as the majority of the nation's infrastructure is in low-lying areas and the current sea level rise predictions of one to two feet by 2100 can cause the ordinary storm to become a catastrophe.

Experts recommend taking an inventory of all coastal areas, determining elevation and vulnerability to storm surge and starting to plan accordingly. Due to the enormity of the challenge of moving such infrastructure to higher elevations or replacing the infrastructure in order to avoid major catastrophes, experts are stressing that this action be taken within the next five years because the tasks will take decades to complete and will cost "tens of billions of dollars."³⁶

IV. States' Responses to Changes in Sea Level

Research suggests that adaptation to sea level rise should be incorporated into any response strategy.³⁷ Coastal flooding, more frequent severe storms, saltwater intrusion, and coastal erosion are increasing calls for policies to address coastal wetland protection; location and elevation of coastal homes, buildings, and infrastructure; and reflecting sea level rise in flood insurance rates.³⁸

Nearly two-thirds of the coastal states reported to the National Oceanic and Atmospheric Administration (NOAA) that "coastal hazards" were a high priority and that they have begun to develop five-year strategies by examining the social, environmental, and economic impacts of accelerated sea level rise scenarios to address flooding, shoreline erosion, and coastal storms.³⁹ Coastal programs have developed new policies to address public infrastructure siting, site-level project planning, wetland conservation and restoration, shoreline building setbacks, building elevations, and alternatives to shoreline "armoring."⁴⁰ However, only a handful of coastal states have "implementable policy or regulation" that directly addresses sea level rise (many others address shoreline changes, including shoreline setbacks based on local erosion rates – an indirect link to sea level rise).⁴¹

A. Regulatory Responses

While coastal states have been responsive to the *impacts* of sea level rise (i.e., erosion and flooding), most have not addressed the explicit theme of sea level rise, specifically acceleration. Some coastal states, however, have been proactive in anticipating sea level rise while others are just now drafting policies that

³³ *Id.*

³⁴ Appalachian State University. *North Carolina Coastal Economy Vulnerable To Sea Level Rise*. SCIENCE DAILY (2007). <http://www.sciencedaily.com/releases/2007/06/070622184644.htm> (Mar. 14, 2008).

³⁵ Cornelia Dean, *Government Reports Warn Planners on Sea-Rise Threat to U.S. Coasts*. N.Y. TIMES, Mar. 12, 2008.

³⁶ *Id.*

³⁷ Hilary Sigman, *Responses to Global Warming: The Law, Economics, and Science of Climate Change*, 155 U. PA. L. REV. 1953 (2007).

³⁸ *Supra* note 35.

³⁹ COASTAL STATES ORGANIZATION, *THE ROLE OF COASTAL ZONE MANAGEMENT PROGRAMS IN ADAPTATION TO CLIMATE CHANGE* (2007) available at <http://www.coastalstates.org/documents/CSO%20Climate%20Change%20Final%20Report.pdf>.

⁴⁰ *Id.*

⁴¹ *Supra* note 11, citing California, Maine, Massachusetts, New York, Rhode Island, Texas, and Wisconsin.

incorporate predicted changes.⁴² Such regulatory approaches refer to adaptive management strategies, such as erosion rate setbacks, hard and soft coastal armoring, and state building codes improvements.

1. Rolling Easements

Coastal managers are recognizing that large amounts of beaches and coastal wetlands are being lost because natural migration processes are being halted by engineered structures (*e.g.*, bulkheads, revetments, riprap, etc.). For example, Maine, Rhode Island, North and South Carolina, and Texas, in an effort to balance public versus private property rights, have implemented versions of rolling easements which take the natural shoreline processes into account and allow property owners to build near or on the beach, but only on the condition that the structure(s) will be removed if and when it becomes vulnerable to an advancing shoreline.⁴³ A rolling easement is a tool, derived from law (statutory or common) or regulatory authority, that allows publicly owned tidelands to migrate inland as the sea rises, thereby preserving ecosystem structure and function.

In Rhode Island, the Coastal Resources Management Council (CRMC) is responsible for implementing Rhode Island's coastal zone management program, known as the Coastal Resources Management Program. In doing so, CRMC's primary responsibility is "to preserve, protect, develop and where possible restore the coastal resources of the state for this and succeeding generations through comprehensive and coordinated long-range planning and management designed to produce the maximum benefit for society from such coastal resources."⁴⁴ Rhode Island, like Maine, Massachusetts, the Carolinas, and Oregon, has adopted variations of the rolling easement.⁴⁵ The requisite setback requirements for sites along the coast in Rhode Island are based on calculated long-term shoreline change rates. Such a setback is designed to allow the dune to roll back with sea level rise and with storm forces, yet allow a structure to maintain a three-year life expectancy.⁴⁶ Rolling easements and setbacks are not mutually exclusive; a single approach to coastal management will not be appropriate everywhere.⁴⁷

When carrying out its mandate, CRMC must develop regulations for post-coastal hazard events, such as severe storms and erosion. More importantly, CRMC must implement the regulations designed to minimize the *impact* of coastal hazards. Policies regulating where to build on a vulnerable property,⁴⁸ construction of shoreline protection facilities,⁴⁹ and beneficial reuse of dredged materials are a few examples of hazard mitigation measures. The CRMC recently adopted a policy addressing the acceleration of sea level rise, and the resulting erosion and inundation of coastal resources.⁵⁰ The Council recognizes that sea level rise is ongoing and its foremost concern is the accelerated rate of rise and the associated risks to Rhode Island coastal areas today and in the future. Accordingly, for planning and management purposes, it is the Council's policy to accommodate a base rate of expected three to five foot rise in sea level by 2100 in the siting, design, and implementation of public and private coastal activities

⁴² For an overview of coastal states' responses, see *CSO*, *supra* note 40. See also http://epa.gov/climatechange/effects/downloads/maine_b.pdf.

⁴³ James G. Titus, *Rising Seas, Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches Without Hurting Property Owners*, 57 MD. L. REV. 1279 (1998).

⁴⁴ R.I. GEN. LAWS § 46-23-1.

⁴⁵ Meg Caldwell and Craig Holt Segall, *No Day at the Beach: Sea Level Rise, Ecosystem Loss, and Public Access Along the California Coast*, 34 *ECOLOGY* L.Q. 533 (2007).

⁴⁶ See *Puchalski v. Coastal Resources Management Council*, 2001 WL 1006699 (R.I. Super. Aug. 8, 2001).

⁴⁷ *Supra* note 43 at 1391 (explaining that setbacks are useful for protecting tidelands threatened over the next forty to seventy-five years, while rolling easements may be enforced to ensure that bulkheads are not subsequently built at the setback line).

⁴⁸ R.I. Coastal Resources Management Program (CRMP), Section 140: Setbacks, where a setback is defined as "the minimum distance from the inland boundary of a coastal feature at which an approved activity or alteration may take place." <http://www.crmc.ri.gov/regulations/programs/redbook.pdf> (2008).

⁴⁹ CRMP, see generally.

⁵⁰ CRMP, Section 145: Climate Change and Sea Level Rise adopted on January 15, 2008, effective on February 17, 2008.

and to insure proactive stewardship of coastal ecosystems under these changing conditions.⁵¹ Of note is the Council's authorization to collaborate with the State Building Commissioner and adopt freeboard calculations (a factor of added safety above the anticipated flood level), in accordance with R.I. Gen. Laws § 23-27.3-100.1.5.5.

2. Setback Requirements

Much of the Rhode Island shoreline is eroding, calculated by comparing the shoreline location from historic aerial photographs dating back to 1939 to the most recent shoreline position. Shoreline change maps indicate the annual rate of change using the wet/dry beach line.⁵² Sections of the south shore barriers have erosion rates of more than three feet per year. That is an average rate over time. In reality, the shoreline may erode tens of feet in a single storm, followed by some accretion. In critical erosion areas on barriers and headlands, all residential construction with less than six units must be set back thirty times the average annual erosion rate and commercial property sixty times. Erosion setbacks are very effective regulations that protect the homeowner and public resources. The farther the house or commercial structure is set back from the shore, the longer it will last. Because some of these regulations were enacted over thirty years ago, the CRMC recognizes that the time has come for the agency to consider adopting policy for situations when the setback no longer remains and the structure sits on the active beach.

Maine's Department of Environmental Protection's (MDEP) Coastal Sand Dune Rules takes rising sea level (approximately two feet in the next 100 years) into account when issuing permits for activities within sand dune systems.⁵³ Recognizing the dynamic nature of coastal sand dune systems in response to the changing conditions of water levels, waves, and winds, coupled with construction of structures which increase the likelihood of harm – to both the coastal sand dune system and the structures themselves – the Sand Dune Rules bar future bulkhead construction and require removal of new structures in the event of substantial damage or interference with dynamic sand dune systems.⁵⁴

3. Building Code Requirements

In Rhode Island, the CRMP developed and adopted regulations indicative of projected sea level rise and probable increased frequency of intense coastal storms due to climate change. The regulations have, for planning and management purposes, “accommodate[d] a base rate of expected three to five foot rise in sea level by 2100 in the siting, design, and implementation of public and private coastal activities and insure[d] proactive stewardship of coastal ecosystems under these changing conditions.”⁵⁵ The state's Building Code Standards Committee, taking climatic changes and sea level rise into account, adopted new regulations incorporating freeboard calculations promulgated by CRMC within flood velocity zones.⁵⁶

⁵¹ *Id.*

⁵² *Id.*, SHORELINE CHANGE MAPS: WATCH HILL TO NARRAGANSETT PIER AND NARRAGANSETT TO LITTLE COMPTON, <http://www.crmc.ri.gov/regulations/programs/redbook.pdf> ; and JON C. BOOTHROYD AND RACHEL E. HEHRE, SHORELINE CHANGE MAPS FOR NARRAGANSETT BAY, RHODE ISLAND: RHODE ISLAND GEOLOGICAL SURVEY REPORT 2007-1 FOR RI COASTAL RESOURCES MANAGEMENT PROGRAM (2007) available at <http://www.crmc.ri.gov/maps/shoreline.html>

⁵³ 06-096 ME. CODE R. Ch. 355 (2006).

⁵⁴ *Id.*

⁵⁵ R.I. GEN. LAWS. § 46-23 et. seq.; CRMP, § 145(C)(3): Climate Change and Sea Level Rise.

⁵⁶ *Id.* § 23-27.3-100.1.5.5 Hurricane, storm, and flood standards: The state building code standards committee has the authority in consultation with the building code commissioner, to adopt, maintain, amend, and repeal code provisions, which shall be reasonably consistent with recognized and accepted standards and codes, including for existing buildings, for storm and flood resistance. Such code provisions shall, to the extent reasonable and feasible, take into account climatic changes and potential climatic changes and sea level rise. Flood velocity zones may incorporate freeboard calculations adopted by the Coastal Resources Management Council pursuant to its power to formulate standards under the provisions of § 46-23-6.

4. No building areas

As sea level continues to rise, the result will be property on oceanfront dune or on the active beach. South Carolina regulations include a provision that “[a] structure cannot be constructed or reconstructed on a primary oceanfront dune or on the active beach, and in the event that the beach erodes so that in the future the permitted habitable structure is located on the active beach, the property owner agrees to remove the structure at his own expense.”⁵⁷

To prevent such a scenario on dunes, Maine’s regulations state that “no new seawall or similar structure may be constructed.”⁵⁸ Furthermore, “no existing seawall or similar structure may be altered or replaced,” with a few limited exceptions including no unreasonable interference with legal access to or use of the public resources. The MDEP will not permit a project if, “within 100 years, the property may reasonably be expected to be eroded as a result of changes in the shoreline such that the project is likely to be severely damaged after allowing for a two-foot rise in sea level over 100 years.”⁵⁹ Excluded from the requirement are beach nourishment and dune restoration projects.⁶⁰

B. Engineered Responses: Coastal Armoring and Beach Renourishment

1. Coastal Armoring

Shoreline protection structures, including revetments, bulkheads, seawalls, groins, breakwaters, jetties, and other structures, are built to control the erosion of coastal features.⁶¹ Hardened structures on the shoreline destroy the beach in a number of ways. The structures reflect wave energy onto the beach causing sand to be scoured away and erosion around the sides of the structure. Second, the structures disrupt sediment transport, both by sequestering sediment that would normally erode from a bank or dune behind the structure to form new beaches, and by physically blocking the sand movement along the shoreline.⁶² Shoreline armoring destroys the beach in a third way due to “occupation loss,” defined as simply the area of the public beach physically occupied by the seawall.⁶³ “Bulkheading and filling along the inland perimeter of a marsh prevents inland migration of wetland vegetation as sea level rises.”⁶⁴ Sea level rise will reduce the effectiveness of existing coastal engineering structures, such as seawalls and revetments, designed for a historically lower sea level. Other infrastructure (roads, bridges, dams) in the coastal zone will also be at risk.

Without vegetated buffers protecting property from storms, the dynamic boundary between public and private property for littoral owners is causing some property owners to take action. Armoring the shoreline with a bulkhead (including a seawall, riprap, rocks, sand-filled tubes, or other rigid erosion structure installed on or near the seaward perimeter of the property) is an example of hardening the shore to protect private property or forestall the inevitable. Some states, however, including Texas, have concluded that “interfering with shoreline movement by artificial means is not a recognized littoral right.”⁶⁵

⁵⁷ S.C. CODE R. § 30-15(F) (this requirement only applies to the approximately sixty-five houses constructed under a special permit (to build seaward of the baseline), not to all oceanfront houses).

⁵⁸ 06-096 ME. CODE R. Ch. 355.5(E).

⁵⁹ *Id.* at 355.5(C).

⁶⁰ *Id.*

⁶¹ See CRMP, § 300.7: Construction of Shoreline Protection Facilities.

⁶² See <http://www.crmc.ri.gov/coastalhazards/index.html> (2008).

⁶³ Orrin H. Pilkey & Howard L. Wright III, *Seawalls Versus Beaches*, 4 J. COASTAL RES. 41, 43 (1988) (a seawall located on a public beach will naturally prevent use of the beach that it is physically occupying).

⁶⁴ RICRMP § 210.3(B)(4), <http://www.crmc.ri.gov/regulations/programs/redbook.pdf>.

⁶⁵ *Lorino v. Crawford Packing Co.*, 175 S.W.2d 410, 414 (Tex. 1943); *Coastal Indus. Water Auth. v. York*, 532 S.W.2d 949, 952 (Tex. 1976); and *Brainard v. State*, 12 S.W.3d 6, 10, 19-23 (Tex. 2000).

In Rhode Island, hard structures are prohibited along shorelines abutting conservation areas (known as Type 1 waters) which make up more than half of the coast, except where they are used to protect historic structures listed on the National Register of Historic Places. Coastal geologists in Rhode Island recently conducted a study of shoreline change maps of Narragansett Bay, including the islands and Little Compton, finding that 30% of the shoreline (the equivalent to 125 km or 78 miles) is protected with a hard structure.⁶⁶ Boothroyd and Hehre referred to a similar study conducted in 1978 which recorded 25% of the shoreline as hardened, resulting in only a 5% increase in hardened shorelines in 29 years.⁶⁷

South Carolina's Beachfront Management Act (BMA) states that it is the policy of South Carolina to "protect, preserve, restore, and enhance the State's beach/dune system, the highest and best uses of which are declared to provide protection of life and property by acting as a buffer from high tides, storm surge, hurricanes, and normal erosion."⁶⁸ The BMA authorizes the South Carolina Office of Ocean and Coastal Resource Management to permit or deny alterations or development within a critical area, including coastal waters; tidelands; beaches; and the beach/dune system, which is the area from the mean high-water mark to the setback line as determined in Section 48-39-280.⁶⁹

Some states, like Texas, enforce regulations which require property owners to remove encroachments from the public beach easement.⁷⁰ The state owns land submerged under the Gulf of Mexico and navigable waters,⁷¹ which it holds in trust for the use and benefit of the public. The state may require the removal of structures from the active beach to enforce this public easement, which includes the unrestricted right of ingress and egress to an area extending from the line of mean low tide to the line of vegetation bordering on the Gulf of Mexico.⁷²

Even in instances where property owners claim that "[t]he protection of property from erosion is an essential right of property owners," such protection can be denied and will not constitute a Fifth or Fourteenth amendment violation where such takings claims are based on property owners' needs for "a permanent solution to the erosion that threatens its property."⁷³ North Carolina's hardened structure rule, adopted by the North Carolina Coastal Resources Commission, clearly states, in pertinent part "[p]ermanent erosion control structures may cause significant adverse impacts on the value and enjoyment of adjacent properties or public access to and use of the ocean beach, and, therefore, are prohibited. Such structures include, but are not limited to: bulkheads; seawalls; revetments; jetties; groins and breakwaters."⁷⁴ Courts have held that the littoral or riparian rights afforded to property owners do not include "a right to erect hardened structures in statutorily designated areas of environmental concern to protect their property from erosion and migration;" these "natural occurrences" do affect the property boundary, at times divesting landowners of their property – a direct consequence of being a riparian or littoral landowner.⁷⁵

⁶⁶ Boothroyd and Hehre, *supra* note 50.

⁶⁷ JON C. BOOTHROYD AND ABDULLAH AL-SAUD. SURVEY OF THE SUSCEPTIBILITY OF THE NARRAGANSETT BAY SHORELINE TO EROSION. UNPUBLISHED REPORT TO THE UNIVERSITY OF RHODE ISLAND COASTAL RESOURCES CENTER (1978). (The RI Coastal Resources Management Program rules preventing armoring within certain regions of the state went into effect in 1972).

⁶⁸ S.C.CODE ANN. § 48-39-260(1)(a).

⁶⁹ *Id.* § 48-39-10(J).

⁷⁰ TEX. NAT. RES. CODE ANN. § 61.001 defines "public beach" as "any beach area, whether publicly or privately owned, extending inland from the line of mean low tide to the line of vegetation bordering on the Gulf of Mexico to which the public has acquired the rights of use or easement to or over the area by prescription, dedication, presumption, or has retained a right by virtue of continuous right in the public since time immemorial, as recognized in law and custom."

⁷¹ *Id.* § 11.012(d).

⁷² *Id.* §§ 61.011(a) and 61.020.

⁷³ *Shell Island Homeowner's Association v. Tomlinson*, 517 S.E.2d 406 (N.C. App. 1999).

⁷⁴ 15A N.C. ADMIN. CODE 7H.0308(a)(1)(B) and 7H.0301.

⁷⁵ *Supra* note 73 at 414.

The Supreme Court of North Carolina has recognized that when a property boundary, demarcated by a body of water, has been altered by accretion, reliction⁷⁶ or erosion, the changed boundary remains the boundary line of the land, “which is extended or restricted accordingly.”⁷⁷ In other words, the riparian landowner loses title to eroded land that has been washed away or encroached upon by the water.⁷⁸

2. Beach Renourishment

Beach renourishment is the replacing of sand on a beach lost due to natural processes. According to some experts, it is the preferred method for erosion control along coastal United States.⁷⁹ The U.S. Army Corps of Engineers (Corps) is the federal agency designated by Congress to protect the U.S. coasts from flooding and erosion. Pursuant to the Water Resources Development Act of 1999, the Corps has the authority to conduct beach renourishment projects.

Presently the federal government pays 65% of the cost of beach renourishment projects, but the Bush Administration wants to reverse the proportion so that the recipient pays the greater amount.⁸⁰ Requiring that a private homeowner or state bear the cost of a renourishment project (although some may argue that coastal areas should bear most of the cost) will certainly deter owners/managers from doing so, considering costs of such multi-million dollar projects. The NOAA Office of Coastal Resource Management's (OCRM) policy concerning the use of funds available to states under Section 306A of the Coastal Zone Management Act (CZMA) does not generally support the funding of beach nourishment projects, given the limited amount of funds available under Section 306A. However, OCRM does allow states to spend Section 306A funds for planning beach nourishment projects in certain limited instances.⁸¹

Of the eighteen Atlantic and Gulf Coast states with approved coastal zone management programs, sixteen have beach nourishment policies; the other two states, Maine and Maryland, have no formal beach nourishment policies. Nine out of the eighteen states have a continuing funding program for beach nourishment. Six states fund projects on a case-by-case basis, and three have no source of state funding.⁸² The South Carolina Beachfront Management Act (BMA) encourages the use of beach renourishment and erosion control methods with soft technologies where appropriate while “severely restrict[ing] the use of hard erosion control devices to armor the beach/dune system.”⁸³ The BMA has been challenged extensively since the ruling of the state’s most notable case, *Lucas v. South Carolina Coastal Council*.⁸⁴

When promulgating regulations, coastal managers must determine the effectiveness of erosion rate setbacks versus beach renourishment. The Corps oversees federal beach renourishment projects, typically by dredging near shore areas for replacement sand, as federal law prohibits the importing of foreign sand.

⁷⁶ THE AMERICAN HERITAGE, DICTIONARY OF THE ENGLISH LANGUAGE (4th ed.2006) (“Gradual recession of water in a sea, lake, or stream, leaving permanently dry land”).

⁷⁷ *Supra* note 73 at 414.

⁷⁸ *Id.* at 415 (where title was divested by “the sledge-hammering seas the inscrutable tides of God”).

⁷⁹ Orrin H. Pilkey, *Beach Nourishment: Two Sides to Every Story*, Remarks at the Southeastern Section of the Geological Society of America’s 50th Annual Meeting (2001), available at <http://gsa.confex.com/gsa/2001SE/finalprogram/>.

⁸⁰ S. Fretwell, *Federal Funds for Beach Replenishment Appear Safe in the State*, The State-Record Co. (Columbia, S.C.), 2001.

⁸¹ OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, STATE, TERRITORY, AND COMMONWEALTH BEACH NOURISHMENT PROGRAMS, A NATIONAL OVERVIEW, OCRM Program Policy Series Technical Document No. 00-01 (Mar. 2000).

⁸² *Id.*

⁸³ S.C. CODE ANN. § 48-39-260(3).

⁸⁴ 505 U.S. 1003 (1992) (Enforcement of the Beachfront Management Act did not effectuate a taking of a landowner's property where statutorily mandated setback lines prohibited the construction of any permanent structure (including a dwelling) on two vacant oceanfront lots, but the landowner conceded that the Act was properly and validly designed to preserve the valuable resource of the state's beaches by limiting new construction; the deprivation of all economically viable use of property does not amount to a "regulatory taking" when the purpose of regulation is to prevent serious public harm).

The Corps has the discretion to approve or deny beach renourishment projects “due to public interest factors and the availability of less environmentally damaging alternatives.”⁸⁵ For example, the Corps denied applicant Massachusetts Department of Conservation and Recreation’s permit for “a shoreline protection project using one-half million cubic yards of sand and gravel from an offshore site in Massachusetts Bay and placing it on 37 acres of Winthrop Beach, near Boston’s Logan Airport.”⁸⁶ The permit was denied because of the location of the source of the proposed beach fill (100 acres of gravel/cobble), which serves as essential fish habitat for Atlantic cod and other species.⁸⁷

C. Non-regulatory Responses

Non-regulatory approaches, such as state purchases of private property or easements, should be considered in the alternative or as a supplement of regulatory action.

1. Land Trusts and “Presumed Mobility”

While it is recognized that it may not be possible for states, land trusts or other entities to buy all of the coastal property that should be protected from development in the event of rising sea level, a hybrid approach may be employed. A more affordable option or a “presumed mobility” approach, which shifts the risk from the states to private property owners, proposes that the government buys the threatened property, either through eminent domain or a willing seller approach, and then leases it back to the owners for a period of time. The lease expires once the shoreline reaches a certain point (i.e., stable condition).⁸⁸ The rationale would allow current property owners to develop their land on the condition that the structures will not be protected against inundation and must be removed in the event of sea level rise, with the presumption that development will have to make way for migrating ecosystems.⁸⁹

2. Easements

A second non-regulatory approach is suggested by Professor Joseph Sax who recommends the public purchase of a future flooding easement coupled with the requirement that each owner have insurance sufficient to cover the costs of subsequent inundation with the government paying the premiums for the insurance.⁹⁰ The easements would prohibit interference with any flooding caused by sea level rise and would allow the easement holder to remove structures that interfere with natural sea level rise. The flood easements would be sold through negotiated sales or required as a condition on proposed development. The purchase price would be retained by the government and compounded over time, then distributed to owners in the event that a retreat from the shoreline is necessary.⁹¹

⁸⁵ Press Release, U.S. Army Corps of Engineers, *Corps of Engineers Public Interest Review Results in Permit Denial for Winthrop Beach*, Apr. 23, 2008, available at <http://www.nad.usace.army.mil/Winthrop%20Beach%20Permit%20News%20Release2.pdf> (a 60 day period in which to appeal the decision was commenced; as of the final day for appeal (June 23, 2008), no appeals were submitted).

⁸⁶ *Id.*

⁸⁷ Department of the Army Permit Evaluation and Decision Document, NAE-2005-4149 (http://www.nad.usace.army.mil/winthrop_decision.pdf).

⁸⁸ OFFICE OF POLICY, PLANNING, AND EVALUATION, U.S. ENVIRONMENTAL PROTECTION AGENCY, PLANNING FOR SEA LEVEL RISE ALONG THE COST OF MAINE, Ch. 6 - Legal Considerations for Maine’s Policy Response (1995), http://www.epa.gov/climatechange/effects/downloads/maine_6.pdf (referencing James G. Titus, *Greenhouse Effect and Coastal Wetland Policy: How Americans Could Abandon an Area the Size of Massachusetts at Minimum Cost*, 15 ENV’L MGT. 39 (1991)).

⁸⁹ *Id.*

⁹⁰ *Id.* referring to Joseph L. Sax, *The Fate of Wetlands in the Face of Rising Sea Levels: A Strategic Proposal*, 9 J. ENV’L L. 143 (1991) (where the insurance policy would be treated as an annuity payable at fixed sums in the event of rising sea level).

⁹¹ *Id.*

Encouraging removal of homes located on the beach by compensating property owners with conservation easement(s) for a minimal recreational use (e.g., unpaved parking area and small storage) is a third non-regulatory approach to dealing with sea level rise. Owners would have the option of a tax break on the property and would not lose all of the economic use and enjoyment of the particular property.

V. Legal Implications of Existing Sea Level Rise Policies

A. Public Trust Doctrine

Blocking landward migration of the shore by bulkheading or armoring interferes with a portion of the public's rights as enumerated under the public trust doctrine. The public trust doctrine is a body of law which states that public trust lands, waters, and living resources in a state are held by the state in trust for the benefit of all of the people and the principle establishes the right of the public to fully enjoy public trust lands, waters, and living resources for a wide variety of recognized public uses.⁹² Most coastal states have incorporated the public trust doctrine into their constitutions or statutes. The interests protected under the public trust doctrine continue to evolve as states recognize not only traditional uses of the submerged lands, such as navigation, commerce, and fishing, but also more modern uses of state-owned lands for aquaculture, recreation, and the preservation of tidelands in its original state for study, aesthetic value, and as marine mammal and waterfowl habitat.

The origins of the public trust doctrine may be traced back to the Justinian Institutes of Roman civil law where "they [the shores] cannot be said to belong to anyone as private property."⁹³ Furthermore, the Magna Carta specifically condemned interference with public access to navigable bodies of water, and prevented the King from giving favored noblemen exclusive rights to hunt or fish in certain areas.⁹⁴ Though the king was understood to own the land, he had an obligation to protect it for use by the general public.⁹⁵ Each state has the authority and responsibility for applying the public trust doctrine to trust lands and waters "within its borders according to its own views of justice and policy."⁹⁶ The boundary between private property and public trust lands has been defined as the mean high water line: the intersection of the plane of mean high water elevations over an 18.6 year period or Tidal Epoch.⁹⁷ Typically, with the exception of a few coastal states, the mean high tide line "boundary" is the swash or "seaweed" line.⁹⁸

Given the continual rise in sea level, the boundary between public lands and private properties can become problematic. Private property owners abutting the shoreline are afforded an array of rights enjoyed by the owner of the banks of a river or stream, or of a lake or seashore, referred to as riparian and littoral rights, respectively. The rights may include access to the water, the right to wharf out, the right to acquire accretions, the right to fill, the right to continued flow, and the right to preservation of the view of the water. However, these private rights are not without limitations imposed by the public trust doctrine, navigable servitude, and other such legal concepts. One must view these rights as balanced with the public interest.

⁹² For an overview of states incorporating strong public trust and environmental protection provisions into state constitutions, see Alexandra B. Klass, *Modern Public Trust Principles: Recognizing Rights and Integrating Standards*, 82 NOTRE DAME L. REV. 2 (2006). See also Matthew Thor Kirsch, Note, *Upholding the Public Trust in State Constitutions*, 46 DUKE L. J. 1169, 1176 (1997).

⁹³ COASTAL STATES ORGANIZATION, *PUTTING THE PUBLIC TRUST DOCTRINE TO WORK* (2d ed. 1997).

⁹⁴ Matthew Hale, *De Jure Maris et Brachiorum ejusdem*, in F. Hargrave (ed.), *A Collection of Tracts Relative to the Law of England* 1-44 (1787).

⁹⁵ *Supra* note 13.

⁹⁶ *Shively v. Bowlby*, 152 U.S. 1, 26 (1894).

⁹⁷ *Borax Consolidated Ltd. v. City of Los Angeles*, 296 U.S. 10, 22-23 (1935).

⁹⁸ Hawaii, for example, defines the boundary of lands held in trust by the state for the public as the vegetation line. Massachusetts, on the other hand, defines public trust boundaries as the low water line, giving deference to private property owners abutting the shoreline.

Of these, the right of access to the water is the “first and most basic right of the riparian owner,” under which other riparian rights are created and protected. The right of access ensures the riparian owner's “right to be and remain a riparian proprietor,” protects the riparian owner's ability to reach the navigable portions of adjacent waters without unreasonable impediment, supports the riparian's right to wharf out, and includes the right to erect structures in aid of navigation, all of which are now subject to state or local approval. This right also underlies the riparian owner's right to take title to lands that accrete beyond the mean high water mark for if such lands did not join those of the riparian, the riparian's access to navigable waters could be cut off.⁹⁹

Property owners may also lose out when erosion control lines become the new property boundary (if not located directly on the line of mean high water), thereby denying the upland landowners any property gained by accretion. Landowners, however, are still entitled to all of their riparian rights including the right of ingress, egress, view, boating, bathing, and fishing.¹⁰⁰ Under general common law, if the littoral or riparian owner can benefit from the process of accretion, then that same owner can lose the land to erosion.¹⁰¹ Whereas, if erosion or a storm event has caused the mean high tide line to shift, the boundary of public trust lands may change – asserting state ownership of public lands.¹⁰² The erosion analysis refers only to the issue of riparian rights and lost land; it does not establish options in the instance of where a house is seaward of the mean high tide line due to erosion or the encroachment of the sea, interfering with the rights afforded citizens under the public trust doctrine.¹⁰³

As the submerged lands continue to increase in size, and property owners resort to armoring or renourishing in order to control erosion, potential legal options arise for both private and public actions. Shoreline protection structures often impact lateral public access along the shoreline, a right protected under the public trust doctrine. They are a contributing factor in the narrowing and loss of beaches, and they inhibit the public's right to lateral shoreline access. Under the CZMA, approved state management programs include a definition of beach and a planning process for dealing with access to public coastal areas and adverse effects upon the coastal zone of land subsidence and of sea level rise.¹⁰⁴

B. Takings

Regulatory measures, particularly ones anticipating climate change-induced sea level rise and the restricting options of coastal property owners, may be challenged in court. The majority of actions are based on state and federal constitutional provisions prohibiting governmental “taking” of property through burdensome land use and environmental regulations. Claims brought directly under the Fifth Amendment of the United States Constitution or similar state constitutional provisions seek “just compensation” for the alleged prohibition of use, or “taking” of property.¹⁰⁵ Compensation may be inefficient, however, if it weakens the incentives to avoid harm and thus raises social costs of climate

⁹⁹ See *TH Investments, Inc. v. Kirby Inland Marine*, 218 S.W.3d 173 (Tex. App. 2007). (Title of ownership of submerged lands was acquired by the state, only after the once dry land subsided into navigable waters.)

¹⁰⁰ *Save Our Beaches v. Florida Dept. of Env. Protection*, 2006 WL 1112700 at 4 (Fla. App. Apr. 28, 2006).

¹⁰¹ JOSEPH KALO, ET. AL. *COASTAL AND OCEAN LAW: CASES AND MATERIAL* 51 (3d ed. 2007).

¹⁰² *Id.*

¹⁰³ *Id.* at 56.

¹⁰⁴ Coastal Zone Management Act, 16 U.S.C. § 1452. (§ 1452(2)(K) and (3) states, in pertinent part: “(2)(K) the study and development, in any case in which the Secretary considers it to be appropriate, of plans for addressing the adverse effects upon the coastal zone of land subsidence and of sea level rise; and to encourage the preparation of special area management plans which provide for increased specificity in protecting significant natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decisionmaking.”) (emphasis added).

¹⁰⁵ The Fifth Amendment to the United States Constitution states, in pertinent part: “. . . nor shall private property be taken for a public purpose without payment of just compensation.”

change.¹⁰⁶ One estimation of the costs of sea level rise in the United States is approximately 30% lower with private adaptation than without.¹⁰⁷

Regulatory changes should be expected by property owners where their rights are “subordinate” to the government’s ability to protect the rights afforded to the public.¹⁰⁸ In 1987, the State of Maine was successful in a challenge to the 1983 version of its prohibition of new construction or additions in the frontal dune or V-Zone.¹⁰⁹ The Maine Supreme Court found that significant beneficial uses remained for the property owner after the denial of a permit to build a house, when a 27-foot seasonal camper was being used on the property and thus no taking had occurred in violation of Maine’s Constitution.¹¹⁰ The State was successful in a subsequent case where the Court confirmed the vitality of the *Hall* decision and found that a property owner failed to prove that the denial of a permit for a “buildable” lot rendered the property substantially useless and stripped it of all practical value.¹¹¹

The Texas Open Beaches Act (TOBA), enacted in 1959, prohibits the construction of any obstruction, barrier, or restraint that will interfere with the free and unrestricted right of the public to lawfully and legally enter or leave any public beach if the public has acquired a right of use or easement to or over the area by prescription or dedication or has retained a right by virtue of continuous right in the public.¹¹² The boundary determining public (submerged lands) versus private (upland) rights is dynamic, subject to landward and seaward movement over time with erosion and accretion.¹¹³

Texas courts have ruled that the rolling easement enforced under state coastal legislation (i.e., TOBA) is not a compensable taking under the United States or Texas constitutions. A rolling easement applies even where a tropical storm damages property and eventually moves the vegetation line of the beach onto private property.¹¹⁴ The Court in *Arrington* relied on a lineage of cases to rule that a denial of a permit to repair a beachfront home was not a taking, holding that “once a public beach easement is established, it is implied that the easement moves up or back to each new vegetation line, and the State is not required to

¹⁰⁶ Hilary Sigman, *Responses to Global Warming: The Law, Economics, and Science of Climate Change*, 155 U. PA. L. REV. 1953 (2007), referring to R.H. Coase’s notion of the reciprocal nature of externalities where “The belief that it is desirable . . . to compensate those who suffer damage . . . is undoubtedly the result of not comparing the total product obtainable with alternative social arrangements,” see R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 40 (1960). See also Howard C. Kunreuther & Erwann O. Michel-Kerjan, *Climate change, Insurability of Large-Scale Disasters, and the Emerging Liability Challenge*, 155 U. PA. L. REV. 1795, 1840 (2007) (“Today, some insurers feel that the risks from hurricanes and other weather-related events in certain areas are uninsurable by the private sector alone due to the large catastrophic losses of recent years and the impact of global warming on weather patterns.”).

¹⁰⁷ *Id.* referencing Gary W. Yohe & Michael E. Schlesinger, *Sea-Level Change: The Expected Economic Cost of Protection or Abandonment in the United States*, 38 CLIMATIC CHANGE 447, 465-66 tbls. II & III (1998) (estimating transient costs for a 50 cm sea level rise in 2100 to be \$158.30 million with perfect foresight and \$221.81 million without foresight).

¹⁰⁸ *Slavin v. Town of Oak Island*, 160 N.C. App. 57 (2003) (plaintiff oceanfront property owners brought claim against town seeking compensation for limiting littoral right of access to the ocean as a result of a beach renourishment project; plaintiffs appeal was dismissed on constitutional question and denied for discretionary review).

¹⁰⁹ 06-096 ME. CODE R. § 355.2(B)(i)(amended January 4, 1988). See also *Hall v. Board of Environmental Protection*, 528 A.2d 453 (Me. 1987).

¹¹⁰ *Id.* at 456.

¹¹¹ *Wyer v. Board of Environmental Protection*, 747 A.2d 192 (Me. 2000) (“Because of the property’s close proximity to Higgins Beach in Scarborough, the Court properly considered the uses of the property for parking, picnics, barbecues and other recreational uses as beneficial uses available to Wyer despite the restrictive regulation”).

¹¹² TEX. NAT. RES. CODE ANN. §§ 61.001-.026.

¹¹³ *Brainard v. State*, 12 S.W.3d 6, 17-18 (Tex. 2000); *Coastal Indus. Water Auth. v. York*, 532 S.W.2d 949, 952 (Tex. 1976).

¹¹⁴ *Arrington v. Texas General Land Office*, 38 S.W.3d 764 (2001).

repeatedly re-establish that an easement exists up to that new vegetation line (but only that the line has moved).”¹¹⁵

The Texas General Lands Office (GLO) obtained three favorable rulings in 2007 regarding its authority to order the removal of houses on the public beach under the TOBA and state law authorizing removal orders for unauthorized structures on state-owned submerged land.¹¹⁶ Several property owners filed suit claiming that the enforcement of the TOBA violated their constitutional rights. Carol Severance purchased three houses in Galveston that were on the public beach, knowing at that time that the vegetation line could pose a problem.¹¹⁷ Through the Pacific Legal Foundation, a property rights activist group, she filed a federal lawsuit against Land Commissioner Patterson in his official capacity, claiming that the imposition of the rolling beach easement (which put her house on the beach) is a governmental taking of property for public use without just compensation. The Court, in May 2007, granted the GLO’s motion to dismiss Severance’s claims on a number of grounds, namely that the house removal claim was unripe for review.¹¹⁸ Severance appealed the District Court’s dismissal to the U.S. Court of Appeals for the Fifth Circuit.¹¹⁹

Brannan v. State, known as the “Surfside” case because the property rights being disputed are located along the Gulf of Mexico in the Village of Surfside Beach in Brazoria County, Texas has been ongoing since 2001;¹²⁰ it has yet to be decided. At issue is the property owners claim to invalidate the rolling easement, enforceable under the TOBA. The vegetation line is customarily recognized as the landward boundary of the public beach in Surfside. Due to erosion over the years, that “line” has been moved landward, in effect, moving Surfside’s beach landward and plaintiffs’ properties seaward of the line. The plaintiffs claimed that the potential enforcement of the TOBA (where plaintiffs’ properties are in the public beach easement and are subject to removal and penalties) based on the rolling easement is an unconstitutional taking.¹²¹ In September 2007, the Court granted the GLO’s motion for summary judgment, granting an injunction requiring removal by the owners of sixteen houses on the public beach.¹²²

In 2004, the GLO sued three homeowners in the Treasure Island subdivision of Brazoria County (a residential community on the Gulf of Mexico shore at the San Luis Pass end of the Brazoria County, Texas, beachfront), asking the court to order removal of the three structures located on public land.¹²³ In March 2007, State District Judge Margaret Cooper granted the GLO’s motion for summary judgment, ruling that the three Treasure Island houses are located on state-owned submerged land and, therefore, may be subject to removal orders.¹²⁴

¹¹⁵ *Id.* at 766 (citing *Feinman v. State*, 717 S.W.2d 106, 108-11 (Tex. App. 1986) (holding that it is implicit in the Act that a public easement, established by implied dedication, moves with the new vegetation line); and *Matcha v. Mattox*, 711 S.W.2d 95, 98-100 (Tex. Ct. App. 1986) (holding that the public easement established by custom shifts with the natural movements of the beach).

¹¹⁶ *Id.* and TEX. NAT. RES. CODE §§ 11.012(c), 11.041, 11.077, 51.302.

¹¹⁷ *Severance v. Patterson*, 485 F.Supp.2d 793, 797 (D. Tex. 2007). Where Court noted that the “public has established an easement over most of portions of the ‘dry beach,’ which is defined as the sandy land between the mean high tide mark and the vegetation line.” See also TEX. NAT. RES. CODE § 61.001(5) defining line of vegetation as “the extreme seaward boundary of natural vegetation which spreads continuously inland.”

¹¹⁸ *Id.* at 802 (“Federal courts should not adjudicate constitutional limits on state power where the alleged harm is speculative and the judgment would hamper permissible enforcement activity”).

¹¹⁹ *Id.* Oral argument has not yet been scheduled in the appeal.

¹²⁰ *Brannan v. State*, Cause No. 15802 (Brazoria County District Court 2007).

¹²¹ *Id.* State Defendants’ Motion for Summary Judgment on Open Beaches Act Counterclaims, p. 8.

¹²² *Id.* The judge issued a letter ruling reflecting his decision, but a final order has not yet been issued.

¹²³ *State v. Guiberson, et al.*, Cause N. GV400584 (Travis County 201st District Court 2004).

¹²⁴ See TEX. NAT. RES. CODE § 51.302(a), “[n]o person may construct or maintain any structure or facility on land owned by the state, nor may any person who has not acquired a proper easement, lease, permit, or other instrument from the state as required by Chapter 33 of this code and who owns or possesses a facility or structure that is now located on or across state land continue in possession of the land unless he obtains from the [land] commissioner, the

The Supreme Judicial Court of Massachusetts issued a decision against a private landowner holding that the state (Department of Environmental Protection) may deny armoring even in an emergency situation without offending constitutional rights of the private property owner.¹²⁵ In *Wilson*, coastal property owners in Chatham, Massachusetts affected by a winter storm which caused the Nauset Beach to breach, thus exposing their properties to “higher tides and more destructive wave action than before the storm” sought permission from the Commonwealth “to erect protective barriers to prevent further erosion to their properties.”¹²⁶ The homeowners’ were denied permission and while their administrative appeal to build a revetment was pending, their homes were destroyed by the ocean. The Court held that such destruction of property by natural forces during the time of a reasonable administrative proceeding did not amount to a regulatory taking claim.

C. Nuisance

Historically, the legal response to the “environmental externalities” (e.g., public values associated with health, safety, comfort, and convenience) covered by federal environmental statutes has been citizen suits pursuant to the Clean Air Act and Clean Water Act.¹²⁷ However, the list of protected injuries suffered by the general public is not an exhaustive one as covered by the current statutory framework. Remedies for many of the effects of climate change, namely sea level rise, are not currently included in the comprehensive list afforded by federal statutes. Sea level rise causes harm to property produced, in part, as a result of human actions.

To seek recovery for damages suffered (monetary or otherwise), the common law action for public nuisance has begun to have traction, where the law of public nuisance aims to protect public rights/privileges from tortious injuries.¹²⁸ A public nuisance claim for damages for loss of coastal land (from erosion and inundation), buildings, structures, infrastructures, etc., particularly based on present costs of preventing future harms, is the most logical and expedient course of action. Such suits are more prevalently in use by both public officials and private citizens.¹²⁹

Harm caused by human activity, such as global warming, is central to the notion of tort law.¹³⁰ The most common environmental tort is public nuisance, defined by Prosser’s Handbook as “an act or omission which obstructs or causes inconvenience or damage to the public in the exercise of rights common to all.”¹³¹ Simply, public nuisance is “an unreasonable interference with a right common to the general public.”¹³² In determining the unreasonableness of the interference, courts consider: (1) whether the conduct involves significant interference with public health, safety, peace, comfort or convenience; (2) whether a statute or other law makes the conduct unlawful; and (3) whether the conduct is continuous or has a long-lasting effect, and whether the actor knows the conduct to have a significant effect on the public’s rights.¹³³ Although the actor’s state of mind is one factor in the unreasonableness analysis, to

board, or the board of regents an easement, lease, permit, or other instrument required by this chapter or Chapter 33 of this code for the land on which the facility or structure is to be constructed or is located.”

¹²⁵ *Wilson v. Commonwealth*, 413 Mass. 352 (1992).

¹²⁶ *Id.* at 353.

¹²⁷ Randall S. Abate, *Automobile Emissions and Climate Change Impacts: Employing Public Nuisance Doctrine as Part of a “Global Warming Solution” in California*, 40 CON. LAW REV. 591, 599 (2008).

¹²⁸ James R. Drabick, “Private” Public Nuisance and Climate Change: Working Within, and Around, the Special Injury Rule, 16 FORDHAM ENVTL. L. REV. 503, 518-519 (2005).

¹²⁹ *Id.* at 519 (In the 1960s, 57 public nuisance suits were brought nationwide to remedy environmental harms. That number increased to 150 in the 1970’s, 252 in the 1980’s, and 362 in the 1990s).

¹³⁰ See Eduardo M. Penalver, *Act of God or Toxic Torts? Applying Tort Principles to the Problem of Climate Change*, 38 NAT. RESOURCES J. 563, 569 (1998).

¹³¹ WILLIAM L. PROSSER, HANDBOOK OF THE LAW OF TORTS § 72, at 570 (1st ed. 1941).

¹³² Restatement (Second) of Torts § 821B(2) (1979).

¹³³ *Id.* See also Randall S. Abate, *Climate Change, the United States, and the Impacts of Arctic Melting: A Case Study in the Need for Enforceable International Environmental Human Rights*. 1 SELJ 26A (2007) (referencing *New York v. Waterloo Stock Care Raceway, Inc.*, 409 N.Y.S.2d 40, 44-45 (N.Y. Sup. Ct. 1978) (finding

prove a public nuisance, there is no need to show the actor was negligent or intended to cause the harm; only proof of unreasonable interference with public rights is required.¹³⁴ After all, nuisance principles form the basis of modern environmental statutes.¹³⁵

Given Prosser's definition of a public nuisance, the impacts of sea level rise (a chronic hazard) can pose a nuisance. Climate change, as a whole, meets the elements of a public nuisance for its effects are "an unreasonable interference with a right common to the general public."¹³⁶

Since global sea level rise is accelerating (some regions more inundated than others), coastal infrastructure will become increasingly susceptible as a result – residential and commercial structures, roads, and bridges will be more prone to flooding and the effectiveness and integrity of existing seawalls and revetments will be reduced because they were originally designed for historically lower water levels.¹³⁷ In response, coastal states must develop and adopt policies to manage coastal resources and protect life and property from hazards resulting from projected sea level rise and probable increased frequency and intensity of coastal storms due to climate change *even if* such policies infringe on property rights.¹³⁸

As Justice Kennedy stated in his concurrence in *Lucas v. South Carolina Coastal Council*, with regard to both the common law of nuisance and the takings clause, states "should not be prevented from enacting new regulatory initiatives in response to changing conditions . . . The Takings Clause does not require a static body of state property law."¹³⁹ Although the burden to prove a regulatory taking is on the aggrieved property owner, once this is demonstrated, the burden then shifts to the government to prove a background nuisance. Thus, where compensation to property owners is due, governments in some instances may have difficulty rationalizing regulations under the auspices of background principles of nuisance or the public trust doctrine.¹⁴⁰

In South Carolina, post-*Lucas*, there have been instances where landowners are allowed to repair existing erosion control devices as well as construct new ones, in an active beach area.¹⁴¹ On the other hand, there are instances where the landowner's application for permits to bulkhead and backfill two noncontiguous lots located in predominantly critical area wetlands was denied.¹⁴² Here, the South Carolina Supreme Court in *McQueen* reversed the Court of Appeals decision by finding no compensatory taking of lots had

unreasonable interference existed where the actor's conduct lasted for decades and recurred on a weekly basis, and dismissing the conduct's compliance with zoning ordinances as immaterial); *Flo-Sun, Inc. v. Kirk*, 783 So.2d 1029, 1036 (Fla. 2001) (stating that public nuisances may exist even if the actor complies with pollution laws)).

¹³⁴ *Id.* (referencing *Copart Indus. Inc. v. Consol. Edison Co. of N.Y.*, 362 N.E.2d 968, 971 (N.Y. 1977) (explaining that "nuisance, as a general term, describes the consequences of conduct, the inconvenience to others, rather than the type of conduct involved"))).

¹³⁵ *Cox v. Dallas*, 256 F.3d 281, 289 (5th Cir. 2001) ("The nuisance action originated in the twelfth century.")

¹³⁶ David A. Grossman, *Warming up to a Not-So-Radical Idea: Tort-Based Climate Change Litigation*. 28 COLUM. J. ENVTL. L. 1, 53. (2003). (referencing Restatement (Second) of Torts §§ 821B(1), 834 (1979), "One is subject to liability for a nuisance caused by an activity, not only when he carries on the activity but also when he participates to a substantial extent in carrying it on.").

¹³⁷ CRMP, Section 145 (2007).

¹³⁸ *See id.*

¹³⁹ *Lucas v. South Carolina Coastal Council*, 505 US 1003, 1034-1035 (1992).

¹⁴⁰ *Id.* *See also Hirtz v. Texas*, 773 f. Supp. 6 (S.D. Tex. 1991) (state may not prohibit owners from repairing and reinforcing existing structures which, due to erosion, are left seaward of vegetation line); Compare *Mikeska v. City of Galveston*, 328 F. Supp 2d 671 (S.D. Tex. 2004) (city did not have to reconnect utilities and sewers to houses left on dry sand beach); Compare *Slavin v. Town of Oak Island*, 160 N.C. App. 57 (2003) (the legislature in the exercise of its powers may prescribe for the protection of the public rights that appurtenant littoral rights are subordinate to public trust protections); *Gove v. Zoning Board of Appeals of Chatham*, 831 N.E.2d 865 (2005) (where the owner has a legitimate property interest compensation may be required when the taking is tantamount to a direct appropriation or ouster).

¹⁴¹ *See South Carolina Coastal Conservation League v. South Carolina Department of Health and Environmental Control*, 582 S.E.2d 410 (S.C. 2003).

¹⁴² *McQueen v. South Carolina Coastal Council*, 580 S.E.2d 116 (S.C. 2003).

occurred, as lots had reverted to tidelands and tidelands were public trust property subject to the control of the State.¹⁴³ The Court elaborated by stating “[a]ny taking McQueen suffered is not a taking effected by State regulation, but by the forces of nature and McQueen’s own lack of vigilance in protecting his property.”¹⁴⁴

California courts have ruled that coastal armoring encroaching upon the public’s land constitutes a nuisance *per se* and forcible removal is not recoverable as inverse condemnation. In *Scott v. City of Del Mar*, because “the legislature has the power to declare certain uses of property a nuisance and such use thereupon becomes a nuisance *per se*,” governments can also simply define armoring in vulnerable locations as a nuisance.¹⁴⁵ In fact, the court upheld such a legislative definition where the city of Del Mar, using its police power, removed coastal armoring because the city found that a seawall constituted a public nuisance. The court, however, did not reach the question of whether erosion caused by the structures at issue was a nuisance, instead deciding the case on public access grounds.

In Massachusetts, a new standard of liability among littoral owners was created as a result of neighbors feuding over a groin and displaced sand.¹⁴⁶ *Lummis v. Lilly* examined the proximate cause of the conditions of which the plaintiff complains and the appropriate remedy by inquiring as to whether the defendants had made reasonable use of their property as such use affected the plaintiff’s property with the following factors to be considered: “(a) the licenses issued by the Department of Public Works and the [Corps] to construct the groin below mean high water mark and whether the conditions have been met; (b) the purpose for which the groin was constructed; (c) the suitability of the use to the watercourse; (d) the economic value of the use; (e) the social value of the use; (f) the extent and the amount of harm which the use causes; (g) the practicality of avoiding the harm by adjusting the use or method of use of one owner or the other; (h) the practicality adjusting the quantity of water used by each owner; (i) the protection of existing values of water uses, land, investments and enterprise; and (j) the justice of requiring the user who is causing harm to bear the loss.”¹⁴⁷

In Florida, coastal construction lines are established by the Department of Environmental Protection and governed by the Beach and Shore Preservation Act (BSPA) where construction within 50 feet of the mean high water line is prohibited by BSPA and any coastal construction and other activities seaward of the established control line violates the statutory provisions and is considered a public nuisance.¹⁴⁸ Structures that existed or are under construction before the establishment of the control line are exempt from these requirements.¹⁴⁹ However, when a property in existence prior to the establishment of (and located seaward of) the control line is considered to be a public nuisance, the state may use its police powers to deny a permit to build on that property if that use “will injure adjacent property owners and the community at large.”¹⁵⁰ The State of Florida has recognized that “coastal areas form the first line of defense for the mainland against both winter storms and hurricanes, that the dunes of coastal areas perform valuable protective functions for public and private property and that placement of permanent structure in these protective areas may lead to increased risks to life and property and increased cost to the public . . .”¹⁵¹ A Florida district court held that the danger the proposed construction posed to others by destroying the dune justified a denial of a building permit, even though it denied the property owner all economically viable use of the beachfront lots.¹⁵²

¹⁴³ *Id.* at 120 (Court found that an artificial waterway designation is irrelevant because it is considered the “functional equivalent of a natural waterway” citing *Hughes v. Nelson*, 303 N.C. 102, 399 (1990)).

¹⁴⁴ *Id.*

¹⁴⁵ *Scott v. City of Del Mar*, 58 Cal.App.4th 1296, 1305-6 (Ct. App. 1997).

¹⁴⁶ *Lummis v. Lilly*, 385 Mass. 41 (1981).

¹⁴⁷ *Backman v. Lilly*, 1992 WL 12151916, *1 (Mass. Land Ct. May 29, 1992).

¹⁴⁸ See FLA. STAT. § 161.052.

¹⁴⁹ *Id.* § 161.053.

¹⁵⁰ *McNulty v. Town of Indialantic*, 727 F.Supp. 604, 610 (M.D.Fla., 1989).

¹⁵¹ *Id.*

¹⁵² *Id.*

VI. Conclusion

Given the predictions of the accelerated rate of sea level rise, state governments along the coast should be developing policies anticipating the results of climate change. In particular, those states in the most at risk areas, such as Alabama, Louisiana, Mississippi, and Georgia, should consider proactive versus reactive measures in coastal management planning.

The gap in science and national leadership on sea level rise adaptation for over a decade is apparent and needs to be rectified via long-term coastal management planning. There are a number of potential solutions for addressing sea level rise: setbacks, rolling easements, armoring prohibitions, financial incentives, and elevation and new construction techniques in vulnerable areas. Such adaptive management techniques have been, and will continue to be, upheld in court decisions. Therefore, coastal management agencies should not be hesitant to enforce stringent regulations for sustainable long-term planning. The effects of climate change will continue to impact those areas most susceptible to storms, flooding, and other natural hazards. In addition, if the scientific predictions are correct, surrounding areas are also at risk.

When property boundaries along the coast are determined by the ocean, something far beyond the control of the respective state's courts, an increase in sea level rise litigation is inevitable. Particularly, as property owners react to regulations enacted to reduce the hazards of sea level rise. By enforcing setback and building code requirements, purchasing rolling easements in critical areas and upholding the prohibition of shoreline protection structures in vulnerable areas, local and state governments have the tools to plan for long-term coastal management while avoiding harm to property owners.