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Introduction to *Legal Solutions to Coastal Climate Change Adaptation in Connecticut* Symposium Special Issue

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Abstract: The Legal Solutions to Coastal Climate Change Adaptation in Connecticut *conference was held at the University of Connecticut School of Law on February 10, 2012. The conference presentations and discussions aim to enhance understanding and promote discussion of cutting-edge policy and legal approaches to climate change adaptation in coastal areas, with potential application to Connecticut. The conference was funded through the generous support of the National Sea Grant Law Center, Connecticut Sea Grant, the Connecticut Chapter of The Nature Conservancy, and the University of Connecticut School of Law Center for Energy and Environmental Law.*

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I. Introduction

The papers compiled in this Special Issue of the *Sea Grant Law and Policy Journal* were generated and presented at a conference convened by Connecticut Sea Grant (CTSG) in partnership with the University of Connecticut School of Law and The Nature Conservancy. This initiative, focusing on climate change adaptation, recognizes that the climate is already changing significantly in Connecticut and these changes and associated ramifications will increasingly demand the attention of Connecticut's coastal communities and stakeholders.

A. Climate Change Impacts and Responses in Connecticut

Since its formation in 1988 by the World Meteorological Organization and the United Nations Environment Program, the Intergovernmental Panel on Climate Change (IPCC) has issued and routinely updated a series of reports on the status and potential trajectories of climate change. The last assessment completed in 2007 states that evidence of climate change is now unequivocal.[6] Connecticut's climate is changing as well. Average air and water temperatures are increasing and sea levels along the coast of Long Island Sound are rising and all are projected to continue trending in the same direction, although the rate and trajectories of these changes are not yet entirely clear. Models have forecast increases in New England's air temperature ranging from 4°F to 9°F by 2100[7] and corresponding increases in sea surface and bottom water temperatures ranging from 4°F to 8°F.[8] Rising emissions of carbon dioxide have also been implicated in the acidification of marine waters.

Precipitation, especially in coastal areas of the Northeast, has been shown to already be increasing, at about 1.9 cm per decade, and is forecast to continue to increase.[9] More problematically, the frequency of extreme precipitation events is also increasing, especially in the spring and fall and expected to continue to do so.[10] There is also projected to be an increase in intense tropical hurricane activity in the North Atlantic, including Connecticut. Researchers have projected that by 2100 the frequency of the 100-year storm surge event in the New London/Groton area will increase, as compared to 2005, recurring every 3 to 50 years depending upon the emission scenario used in the model.[11]

Associated with these predictions of air temperature changes are increases in sea level; however, currently no consensus on rates of increase exists among the scientific community, sea level rise forecasts in Connecticut are complicated by subsidence associated with its recent geological history as well as the phenomenon of isostatic rebound. Currently sea level in Connecticut is increasing on the order of 2 to 3 mm per year, but this rate has increased over the last decade trending toward 4 mm per

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[6] IPCC, CLIMATE CHANGE 2007: SYNTHESIS REPORT 30 (2007), *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm.

[7] ENVTL. DEFENSE, BRACING FOR CLIMATE CHANGE IN THE CONSTITUTION STATE: WHAT CONNECTICUT COULD FACE 9 (2004), *available at* http://pubs.giss.nasa.gov/docs/2004/2004_Gornitz_etal.pdf.

[8] NORTHEAST CLIMATE IMPACTS ASSESSMENT SYNTHESIS TEAM, CONFRONTING CLIMATE CHANGE IN THE US NORTHEAST: SCIENCE, IMPACTS AND SOLUTIONS 36 (2007), *available at* http://www.climatechoices.org/assets/documents/climatechoices/confronting-climate-change-in-the-u-s-northeast.pdf [hereinafter NORTHEAST CLIMATE IMPACTS ASSESSMENT].

[9] *See generally*, SUSAN G. SPIERRE & CAMERON WAKE, TRENDS IN EXTREME PRECIPITATION FOR THE NORTHEAST UNITED STATES 1948-2007 (2010), *available at* http://carbonsolutionsne.org/resources/ne_climate_reports/pdf/2010_NortheastExtremePrecip.pdf.

[10] *Id. See also* NORTHEAST CLIMATE IMPACTS ASSESSMENT, *supra* note 8.

[11] *See* Paul Kirshen et al., *Coastal Flooding in the Northeastern United States due to Climate Change*, 13 MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE 437–51 (2008).

year.[12] Rising sea levels coupled with more frequent and intense storm events will put more people and structures in high risk flood areas.

The IPCC has published a series of estimates of the rates and extents of sea level rise based on different emission scenarios.[13] Often considered conservative, these estimates reflect only the thermal expansion of water into account and do not consider the melting of continental ice sheets (e.g., Antarctica and Greenland). Great uncertainties over the rate of melting of the Antarctic and Greenland ice sheets, in addition to other variables, limit the accuracy of these estimates. The IPCC projects a sea level rise ranging from 18 to 59 cm by the end of the 21st century under their modeled scenarios, and notes that that these estimates do not indicate the maximum extent as they exclude potential future rapid changes in ice flows. Local projections of sea level rise in Connecticut have forecast increases on the high end of IPCC projections, in the order of 28 to 89 cm by 2080.[14] Other studies have attempted to take the melting of ice sheets into account and have accordingly forecast even higher rates of sea level rise, up to 1 to 2 meters in the next century.[15]

These climatic changes are likely to create a suite of impacts for Connecticut's coastal communities, including the inundation of coastal areas, eroding shorelines, loss of wetlands, more severe damage associated with the increasing magnitude of storm surge causing destruction of coastal property and infrastructure and corresponding impacts to local economies and human health and well-being. In addition, there are probable impacts to coastal and marine species, both aquatic and terrestrial, caused by greater volumes of stormwater runoff, acidification of coastal waters, more frequent and severe hypoxic events, harmful algal blooms, invasive species, and new or more problematic pests and pathogens.

The economic consequences of climate change in Connecticut are substantial, especially those associated with sea level rise and increased storm intensity. Estimates of property damage and business interruptions associated with storm events reach the billions of dollars. The cost of damages generated by a 100-year flood scenario, using a FEMA HAZUS (risk assessment methodology) analysis, are estimated to be on the order of $18,683,770,000.[16]

Clearly, Connecticut and its coastal communities need to understand these impacts and develop strategies to decrease their vulnerabilities. State and municipal governments can facilitate this process by creating laws and policies that provide legal and economic incentives for individuals and communities to either mitigate or adapt to climate change. The mitigation route involves the reduction of greenhouse gases emissions, while the adaptation aims to enhance resilience to climate change impacts.

Indeed, responding to escalating concerns regarding these projections and future trends, the state of Connecticut developed a Climate Change Action Plan that laid out steps which the state should take to reduce greenhouse gas emissions and thereby mitigate potential climate change impacts.[17] The

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[12] Interview with Dr. Frank Bohlen, University of Connecticut Department of Marine Science (Feb. 2011).

[13] IPCC 2007, *supra* note 6.

[14] ENVTL. DEFENSE, *supra* note 7, at 24.

[15] *See* Stefan Rahmstorf, *A Semi-Empirical Approach to Projecting Future Sea-Level Rise*, 315 SCI. 368–370 (2007). Another reference along these lines is IAN ALLISON ET AL., THE UNIVERSITY OF NEW SOUTH WALES CLIMATE CHANGE RESEARCH CENTER, THE COPENHAGEN DIAGNOSIS: 2009: UPDATING THE WORLD ON THE LATEST CLIMATE SCIENCE (2009).

[16] ADAPTATION SUBCOMMITTEE TO GOVERNOR'S STEERING COMMITTEE ON CLIMATE CHANGE, THE IMPACTS OF CLIMATE CHANGE ON CONNECTICUT AGRICULTURE, INFRASTRUCTURE, NATURAL RESOURCES, AND PUBLIC HEALTH 18 (2010), *available at* http://ctclimatechange.com/index.php/the-impacts-of-climate-change-on-connecticut-agriculture-infrastructure-natural-resources-and-public-health-2010/ [hereinafter ADAPTATION SUBCOMMITTEE REPORT].

[17] GOVERNOR'S STEERING COMMITTEE ON CLIMATE CHANGE, CONNECTICUT CLIMATE CHANGE ACTION PLAN 2005 (2005), *available at* http://ctclimatechange.com/StateActionPlan.html.

same year, seven New England and Mid-Atlantic states, including Connecticut, signed an agreement to create the Regional Greenhouse Gas Initiative, a market-based emissions trading program aimed at reducing CO_2 emissions from power plants. The program, currently in operation, now includes ten states and aims to cut CO_2 emissions by 10% by 2018. The funds generated by this program are earmarked for energy conservation efforts and in the case of Connecticut for adaptation efforts.

This was followed in 2008 by Connecticut Public Act No. 08-98 (An Act Concerning Global Warming Solutions) which laid out specific greenhouse gas reduction goals along with a timeframe for achieving them and directed the Governor's Steering Committee on Climate Change to establish an Adaptation Subcommittee. The Adaptation Subcommittee set up four working groups focused on infrastructure, agriculture, natural resources, and public health to develop adaptation plans. These working groups completed assessment reports on the likely impacts of climate change and in 2011 completed a preliminary report identifying specific adaptation strategies which is currently open for public comments.[18]

At the same time, in an attempt to fill the lack of top-down policy direction, municipalities have begun to address climate change on their own. Some have established committees focused on energy and climate change and are launching mitigation and adaptation planning efforts along with developing informational baselines through energy audits and carbon footprint models. Several Connecticut municipalities are members of ICLEI (an international association of local governments committed to sustainable development).

These nascent efforts were brought into sharp relief when, in the summer of 2011, Tropical Storm Irene approached the coast of Connecticut. Although downgraded from a hurricane, with much of her force eroded by the time she hit Connecticut, Irene was still able to generate a great deal of damage. According to Munich Re, the storm caused economic losses in the Caribbean and U.S. totaling $15 billion, of which $7 billion was insured.[19] In Connecticut, the insurance companies paid out more than $230 million to property owners for insurable losses due to Irene, according to the Connecticut Insurance Department.[20] The federal government through the Federal Emergency Management Agency (FEMA) provided nearly $9 million to assist individuals who had expenses and losses not covered by insurance.[21] Connecticut's Congressional delegation sent a letter to the President stating,

> As with other neighboring states, Hurricane Irene devastated parts of Connecticut and left many of our residents displaced, under water and without power. The Connecticut, Housatonic, Farmington, Pomperaug and Pequabuck Rivers have experienced major flooding. Additionally, Hurricane Irene's forceful winds pushed water into the western Long Island Sound resulting in coastal flooding, wave damage and erosion which damaged or destroyed numerous homes, public beaches and other public and private facilities. At one time over 900,000 customers were without electricity, a new historic outage level. Downed trees closed over 1,000 local roads and 65 state roads. During the disaster, shelters housed over 2,000 residents. Preliminary surveys

[18] *See* ADAPTATION SUBCOMMITTEE REPORT, *supra* note 16.

[19] Press Release, Munich Re, Review of Natural Catastrophes in 2011: Earthquakes Result in Record Loss Year (Jan. 4, 2012), http://www.munichre.com/en/media_relations/press_releases/2012/2012_01_04_press_release.aspx (last visited June 28, 2012).

[20] Gerard O'Sullivan & George Bradner, Connecticut Insurance Department, Storm Irene: Response and Recovery, Remarks at the Meeting of the Connecticut Shoreline Preservation Task Force (May 23, 2012), *available at* http://www.housedems.ct.gov/Shore/pubs/MAY23CIDpresentation3.pdf.

[21] *Id.*

by local officials in those areas that are reachable have discovered over 7,300 homes with some degree of damage.[22]

This was followed at the end of October by a record-setting snowstorm which again paralyzed the state for weeks, left approximately three million residents across the Northeast without electricity, of which almost one-third (~875,000) were from Connecticut. Insurance companies paid about $247 million in claims for that storm, state insurance regulators said.[23]

The State Legislature responded to Irene with notable alacrity by passing Connecticut Public Act 12-101 (An Act Concerning the Coastal Management Act and Shoreline Flood and Erosion Control Structures), which amended Connecticut's Coastal Management Act.[24] It is the first legislation to specifically define and identify sea level rise as a consideration for planning decisions and requires that any future revisions to the State's Plan of Conservation and Development take into consideration risks associated with a rise in sea level. It also seeks to minimize the use of shoreline armoring to protect coastal properties and encourages the use of "feasible, less environmentally damaging alternative[s]," which include realignment ("the relocation of an inhabited structure to a landward location"), elevating structures, restoring or creating dunes, salt marshes and vegetated coastal buffers, among other options.[25] In addition a Shoreline Preservation Task Force has been created by the Legislature and is holding hearings as this journal issue goes to press.[26] It appears that in Connecticut climate change is now recognized as part of the policy agenda and has begun to move through the various phases of the policy process.

B. Legal Solutions Conference and Papers

At this policy juncture, it makes sense for the state and its coastal communities to have a better understanding of the feasible options available to address a climate that may already be changing and to begin to develop strategies to decrease their vulnerabilities. Government can facilitate this process of adaptation by making or modifying laws, regulations, and policies that either require or create incentives to adapt to climate change. However, no analysis of Connecticut's existing legal framework or assessment of innovative policy options available for climate change adaptation has been completed. The conference *Legal Solutions to Coastal Climate Change Adaptation in Connecticut* was conceived of as a means to begin to fill that gap.

In many respects, Connecticut represents the perfect policy model in which to discuss local climate change adaptation. A "home rule" state, Connecticut's state constitution places matters such as land

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[22] Letter from Joseph Lieberman, U.S. Senate, to President Barack Obama (Sept. 1, 2011), *available at* http://lieberman.senate.gov/index.cfm/news-events/news/2011/9/delegation-asks-president-to-view-ct-irene-damage.

[23] O'Sullivan & Bradner, *supra* note 20.

[24] CONN. GEN. STAT. §§ 22a-90 – 22a-111.

[25] The bill was signed by the Governor on June 8, 2012. Most of the provisions take effect on October 1, 2012. *See* An Act Concerning the Coastal Management and Shoreline Flood and Erosion Control Structures, 2012 Conn. Legis. Serv. P.A. 12-101 (June 8, 2012).

[26] House Democrats of Connecticut, Preserve the CT Shore, http://www.housedems.ct.gov/Shore/index.asp (last visited June 28, 2012). *See also* Jan Ellen Spiegel, *New Shoreline Task Force to Explore Post-Irene Issues,* THE CT MIRROR, Feb. 2, 2012, http://www.ctmirror.org/node/15328 (last visited July 10, 2012).

use in the hands of the 169 municipalities.[27] This localized approach has been reinforced by the elimination of the county government system. As a result, the statewide effects of climate change must be addressed, at least in part, by each municipality. The solutions presented at the conference addressed not only policies to be potentially enacted, but the municipal-state strategies to enact and implement them as well.

A call for papers was drafted and disseminated that identified policy-relevant topics for climate adaptation in Connecticut. These included examinations of (1) the opportunities and roadblocks to adaptation in existing laws and policies, (2) the interplay between public resource protection and private property rights, (3) use of the Coastal Management Act for climate change adaptation, (4) rolling easements, (5) ecosystem-based adaptation incentives, (g) land use planning and growth strategies for adaptation at the municipal and state levels, (7) climate justice: who bears the burden? who reaps the benefits?, (8) legal approaches to emergency planning and changing hazards, (9) adaptation economics: the costs of adapting or not, who pays and when?, (10) reactive versus proactive approaches to adaptation, and (11) strategies for financing adaptation.

From the abstracts received, seven manuscripts were produced and presented at the conference, in addition to two keynote addresses from invited speakers. Conference organizers made efforts to provide ample opportunities for the audience, comprised of state and municipal elected officials and agency staff, scientists, planners, lawyers, practitioners, students and others involved in or merely intrigued by the topic of climate change adaptation in Connecticut, to share their legal and policy adaptation strategies and priorities. These are presented in the next two sections of this paper, and are followed by a discussion of the legal solutions recommended by the authors. The conference was videotaped and the conference website (http://seagrant.uconn.edu/climatelaw/) provides a link to this video as well as presentation slides and other supporting information.

II. Climate Change Adaptation Approaches

The articles in this Special Issue all seek in one way or other to develop or translate legal and policy approaches to climate change adaptation for application in Connecticut or to identify and assess existing approaches. The articles fall into one of three thematic clusters. One theme, building on the state-town sharing of governance authority, focuses on assessing and elaborating on existing municipal governance structures in Connecticut and includes Mark Boyer's examination of the scope of existing municipal adaptation planning and action and Carl Zimmerman and Katherine Owen's proposed creation of municipal Climate Adaptation Boards based on the existing Inland Wetlands Agency model. A second cluster comprised of three articles examines adaptation approaches used in other states and regions of the United States and translates these approaches to Connecticut. These articles include Jessica Grannis, Julia Wyman, Meagan Singer, Jena Shoaf, and Colin Lynch's examination of local adaptation approaches developed in Maryland and state-level approaches adopted in Rhode Island. Nicole Rinke and Sarah Fort base their legal analysis of adaptation strategies on work conducted in South Boston, while David Lewis examines the acquisition of flood-prone coastal areas used by Louisiana and Mississippi as a means of adapting to climate change impacts. The third group, comprised of two papers, analyzes the legal implications associated with various coastal retreat

[27] *See* Conn. Const. Art. X. Specifically, "After July 1, 1969, the general assembly shall enact no special legislation relative to the powers, organization, terms of elective offices or form of government of any single town, city or borough, except as to (a) borrowing power, (b) validating acts, and (c) formation, consolidation or dissolution of any town, city or borough, unless in the delegation of legislative authority by general law the general assembly shall have failed to prescribe the powers necessary to effect the purpose of such special legislation." *Id.* Art. X, § 1.

strategies and the constitutional ramifications of the Fifth and Tenth Amendments of the U.S. Constitution in adopting these approaches.

Although not included as an article in this Special Issue, the conference was kicked off by a morning presentation by Tony MacDonald, Director of the Urban Coast Institute at Monmouth University, who has been a participant in the current National Climate Assessment effort. MacDonald's presentation was critical in setting a foundation for the following presentations of legal and policy approaches. MacDonald highlighted the problematic nature of adaptation planning, noting it is difficult because it is contingency planning for high impact, low probability outcomes, which are often compounded by other anthropogenic impacts such as invasive species, habitat fragmentation, pollution, and overfishing, as well as natural hazards. In addition, locating funding mechanisms for this scale of policy effort is often difficult. Adaptation outputs need to carefully match the scale of the problem to the solution, have a larger landscape focus, be adaptable in and of themselves, and explicitly focus on ecosystems which include humans as a component of the environment. From an organizational point of view, adaptation has to be somebody's job, not just another task on a to-do list. It is important to engage the appropriate actors within the private sector, which include the insurance and real estate industries, and focus on creating the right incentives for adaptation to occur. Several states already have developed adaptation plans such as California's 2009 Climate Adaptation Strategy which used a hybrid public-private committee to set adaptation priorities; Maine, where the state has embedded the concept of No Regrets Actions into adaptation planning; and Southeast Florida.

Mark Boyer, a political scientist from the University of Connecticut, who has focused much of his research on issues related to international relations, has recently moved his gaze down several levels of organization to Connecticut's municipalities which have begun efforts to adapt to climate change. He has surveyed all 169 municipalities in the state to track their responses and the results are being used by Connecticut's Department of Energy and Environmental Protection to populate an online map of adaptation efforts within the state. His analysis of his research included in his article, *Adapting to Climate Change: Mapping Connecticut's Coastal Responses to a Global Problem*, focuses only on the efforts of 24 coastal towns and cities and the impetus behind these efforts. His research finds that these municipalities are already highly engaged in the process of adaptation, having integrated climate change into their Plans of Conservation and Development[28] and that policy entrepreneurs are clearly a critical factor driving this high response rate.

Carl Zimmerman of the University of Connecticut and Katherine Owens of the University of Hartford outline a novel approach to climate change planning in their article, *A Local Solution for Climate Change: The Climate Adaptation Board*. Using municipal Inland Wetlands Agencies as a model for a Climate Adaptation Board, they outline a municipal governance structure for adaptation decision-making. They believe that local level adaptation has the nuanced ability to reflect local values and knowledge as well as the local scale of development needs and is the best fit for a "home-rule" state like Connecticut.

Nicole Rinke, and Sarah Fort from the Harvard Emmett Environmental Law and Policy Clinic translate their experience assisting the municipality of South Boston with the development of a suite of legal options for adaptation to the state of Connecticut. Building on the legal research and analyses conducted by Wendy B. Jacobs, Leah R. Cohen, and Jennifer McGrory, Rinke and Fort's paper, *Legal Options for Municipal Climate Adaptation in South Boston: An Example for Connecticut Coastal Jurisdictions*, examines the efficacy of using five policy tools for adaptation. Regulating land use

[28] *See* CONN. GEN. STAT. § 8-3(a)(1). ("At least once every ten years, the commission shall prepare or amend and shall adopt a plan of conservation and development for the municipality… The commission may adopt such geographical, functional or other amendments to the plan or parts of the plan, in accordance with the provisions of this section, as it deems necessary…")

through zoning relies on the broad powers that municipalities possess over local land use decision-making. However, although Connecticut municipalities have broad powers, there exists little legal structure which coordinates or encourages cooperative solutions for common problems, such as climate change threats. Addressing this concern, specific policy approaches advanced in the paper include the use of overlay zones to protect particular resources or to promote various adaptation outcomes. The use of freeboard regulations to increase building elevations is a tool available to state managers, but problematic for Massachusetts municipalities since it is regulated under the state building code rather than through local ordinance. Mandating a process of development site review and/or design review is another tool available to ensure that potentially adverse impacts are mitigated through design techniques and that adaptation considerations are incorporated into new developments. Procurement strategies can be modified by communities to integrate adaptation goals such as climate resilient building criteria and a consideration of life cycle costs into municipal projects and activities. Wetland regulations can be modified to extend the designated coastal wetland zone and thereby increase protections on wetlands which are important in buffering adjacent developed uplands. Finally, they suggest that the state's environmental review process for projects funded or authorized by the state can be amended to consider project impacts at the design stage and incorporate features that provide resilience to climate change impacts.

Adapting to climatic impacts along Connecticut's coast will require a balance of competing demands of economic development and environmental conservation assert Jessica Grannis of Georgetown Law and Julia Wyman of the Rhode Island Sea Grant Law Program, along with students Meagan Singer, Jena Shoaf, and Colin Lynch, in their article, *Coastal Management in the Face of Rising Seas: Legal Strategies for Connecticut*. The authors suggest that the governance challenges and tradeoffs of this balance hinge on three primary strategies to adapt to sea level rise: protection, accommodation, and retreat. The authors evaluate the legal approaches for each strategy against current land use law resulting in an assessment of legal feasibility, opportunities for implementation under existing authorities, the identification of any legal and policy changes needed at municipal and state levels, and most appropriate governance level to implement these strategies in Connecticut. Specific legal approaches discussed include a model sea level rise ordinance for Connecticut municipalities that augments existing land use regulations and provides flexibility to tailor adaptation measures by dividing coastal areas into three districts for each of the primary strategies (protection, accommodation, conservation districts). At the state level, the authors explore the application of a "rolling" coastal management statute designed to regulate coastal activities including development through reference to a "dynamic" and moving coastal feature. Ultimately, the authors provide regulatory recommendations Connecticut that are actionable either today or that require additional legal authority and a longer time horizon. These legal tools and changes reduce climate risk through retreat.

In his article, *Adapting to Climate Change through the Acquisition of Flood-Prone Coastal Properties: Lessons from the Gulf Coast and Application in Connecticut*, David Lewis suggests that Connecticut policy-makers and property owners "break the cycle" that subsidizes and protects development in flood-prone areas through proactive relocation strategies such as acquisition and redevelopment elsewhere. In this well-constructed argument, the reader is guided through a construct beginning with "benefits and barriers" to acquisition programs along with a policy framework. This is followed by an examination of two distinctly different approaches following Hurricanes Katrina and Rita: Louisiana's Road Home Program and Mississippi's Coastal Improvement Plan. Benefits identified by Lewis include proven success in numerous federal, state and local contexts; cost effectiveness over the long-term versus continued fortification (i.e., seawalls and levees) and elevation of structures; improved environmental conditions; and economic benefit when combined with redevelopment outside of flood-prone areas. Barriers to implementing an acquisition program are centered primarily on political and

cultural barriers that are driven by proclivity to build and protect private property rights, emotional connections to "coastal living," value of real estate, and the corresponding dependence on this tax base. Other barriers discussed here involve the current uncertainty of the magnitude of future hazards and the engineering challenges presented by relocation in highly urbanized coastlines. A few of the key recommendations as presented by Lewis involve establishing a comprehensive acquisition plan prior to a catastrophic event, engagement with the public and the federal/state agencies in high-hazard locations, reducing subsidies and other incentives that favor rebuilding versus relocation after events, and coupling redevelopment in low-hazard areas with relocation efforts. To enable the development of a broad acquisition plan in Connecticut, Lewis suggests a spatial inventory of hazards and vulnerable development and the phased establishment of "high-priority acquisition areas" and redevelopment sites in low-risk areas. Lewis provides recommendations based on the successes and failures of these case studies for a potential acquisition strategy in Connecticut and other northeastern states and ultimately finds that acquisition represents an often overlooked opportunity to comprehensively reduce risk posed to coastal development from hazards.

Chad McGuire and Jason Hill of the University of Massachusetts, Dartmouth examine the role of the U.S. constitutional protections against taking private property for public purpose[29] in coastal adaptation, conducting a takings analysis of certain strategies in their article, *Climate Adaptation and the Fifth Amendment of the United States Constitution: A Regulatory Takings Analysis of Adaptation Strategies in Coastal Development with Application to Connecticut's Coastal Management Regime*. Two primary responses to sea level rise exist in coastal areas: stay and armor or retreat and allow sea level rise to occur. Rolling easements provide a means of staying, at least temporarily, and allowing sea level rise. They urge a shifting of risks from government to landowners.

Hyo (Charlene) Kim and Caroline Karp of Brown University also examine the legal foundation of coastal adaptation focusing their analysis on the Fifth Amendment to the U.S. Constitution, as well as the Public Trust Doctrine. The critical question they ask in their article, *When Retreat is the Better Part of Valor: A Takings Analysis of Strategies to Incentivize Retreat from the Shore*, is whether state and local governments can regulate or prohibit development of property in high risk areas (e.g., FIRM A, V, high erosion zones) if that regulation results in loss of all economic beneficial uses. They note that mitigation will be cheaper and easier to accomplish than adaptation. They list a series of coastal adaptation strategies coupled with an analysis of the legal and policy implications of their implementation. These strategies include enhancing real estate disclosure forms, assessing risk-based special assessments to reflect the actual costs to municipalities in responding to climate change-related coastal hazards (e.g., flooding), requiring special insurance for high risk property owners, conditioning ownership on performance bonds to be used if/when there is catastrophic loss, state laws to prohibit rebuilding after catastrophic losses, requiring/acquiring setbacks and buffers for coastal features, prohibiting development in high risk areas, requiring the disclosure of flood, storm damage and FIRM designation at the sale of coastal properties, establishing rolling easements and erosion control easements and developing coastal growth boundaries.

III. Summary of Discussion and Audience Ideas

A novel aspect of this conference was the invitation extended to the audience to become active players in the conference's policy recommendations. Pads of paper and links to the conference email address were given to all attendees along with the request that they share their top three adaptation ideas. Over 60 ideas were generated, collected and entered into a database. Some ideas were process-

[29] The Fifth Amendment to the U.S. Constitution provides, in part, that "…nor shall private property be taken for public use, without just compensation."

oriented, other involved structural approaches like engineering, and others involved legal and policy changes. Ample time was also allowed for audience questions and panel discussions. Audience feedback and points of discussion are categorized and summarized below in several general themes. A majority of the discussions and feedback focused on regulatory approaches to increase coastal resiliency.

Home Rule and the Scale of Governance

Climate change is a wicked, messy policy problem[30] for a number of reasons, notably including the cross-scale challenges generated by the institutional mismatches among the scale of the problem's causes and effective and feasible policy responses. Reflecting this, there was uncertainty on whether local regulations should precede state regulations, and how the respective roles of local and state governments would be defined. As noted above, Connecticut is a "home rule" state, with the decision-making process regarding land use weighted heavily toward the municipal government level. There is a need to use local governance structures to implement adaptation, but significant differences in size, affluence and opinions exist between the 169 municipalities within the state. Some suggestions highlight the need for a menu of adaptation options which may be selected by coastal communities based on their appropriateness or political viability. However, adaptation will require broader regional and statewide approaches as well. Thus it was recognized that guidance and leadership from the state will be useful to guide and facilitate local actions. Some audience members suggested building upon the existing Coastal Management Act, which has a tiered, geographic and regulatory approach already in place.

Regulatory Changes

According to one conference participant, government needs to "provide tools and remove obstructions" while recognizing the importance of protecting the public trust, by encouraging "less damaging alternatives" to development. Those in government need to have the enabling statutes amended to implement such advice. Thinking "outside the box", this audience member suggested that Sections 8-2 and 8-2b of the Connecticut General Statutes could be amended to include:

- "Such regulations may also encourage climate adaptation patterns of development to minimize uncertain costs of reconstruction, emergency response, and clean-up after severe weather events of high impact and low probability."

- "Such regulations may also provide incentives for developers who include accommodations for sea level rise and uncertain, anticipated relocations of high tide lines including transferable development rights, designated shoreline and inland wetland conservation

[30] For a discussion of wicked, messy policy problems, *see* Robert T. Lackey, *Axioms of Ecological Policy*, 31 FISHERIES 286-90 (2006). "Wicked, messy ecological policy problems share several qualities: (1) complexity — innumerable options and trade-offs; (2) polarization — clashes between competing values; (3) winners and losers — for each policy choice, some will clearly benefit, some will be harmed, and the consequences for others is uncertain; (4) delayed consequences — no immediate "fix" and the benefits, if any, of painful concessions will often not be evident for decades; (5) decision distortion — advocates often appeal to strongly held values and distort or hide the real policy choices and their consequences; (6) national vs. regional conflict — national (or international) priorities often differ substantially from those at the local or regional level; and (7) ambiguous role for science — science is often not pivotal in evaluating policy options, but science often ends up serving inappropriately as a surrogate for debates over values and preferences." *Id.* at 286.

> areas which reduce local tax assessments, designed-in portability and modular construction which allows for future relocation and/or raising of structures as less damaging design alternatives to protect expanding public trust areas, and voluntary abandonment of the right to maintain the use of structures in vulnerable areas based on a schedule for such abandonment to be filed on the land records of such municipality."

Several participants proposed that innovations, improvements or mandated changes in building codes, and the design of shoreline structures would enhance coastal resilience. Some were concerned that these changes would increase building costs.

Amending Connecticut's Coastal Management Act (CMA) to increase its focus and support for adaptation was a common discussion topic and suggestion, however divergent preferences existed among participants regarding shore armoring or living shorelines approaches.[31] Some suggested the need to add flexibility to the CMA to accommodate the need for engineered adaptation solutions, given that under the current regulatory scheme those efforts are often either non-starters or too complex to implement. Others suggested that hard armoring is not the solution and proposed that flood-proofing by raising elevations would be more effective. It was agreed that land use policies are a critical component, and will require significant public education and outreach efforts. Some participants further proposed that the Connecticut Tidal Wetlands Act could be amended to include a mandatory setback, which towns could implement under the Inland Wetlands and Watercourses Act.

There were discussions on the Army Corps of Engineers' current efforts that would allow the filling of wetlands for a fee to be used for mitigation and or wetland creation elsewhere. Some suggested the elimination or restructuring of the federal flood insurance program, its implicit subsidies, and facilitation of new construction and significant reconstruction in flood-prone areas.

Enforcement

Some participants noted that these changes in building codes or other public policies would not be effective without compliance, suggesting the need for sustained and strong monitoring and enforcement programs.

Novel Approaches/Practices

There were suggestions to include sea level rise as a factor in local and state planning – plans of conservation and development and other plans – and to allow towns to consider sea level rise when considering permit applications for development or construction activities in coastal zones. It was suggested to require property sellers to verify, on real estate disclosure forms, that all structures on a given piece of property have all the necessary permits and to further explicitly note that property ownership does not include the right to construct structures below the high tide line. It was suggested to protect and, when possible, acquire marshland, dunes and coastal wetland as barriers against storm

[31] The passage into law earlier this year of Senate Bill 376, now known as Conn. Public Act 12-101, is highly relevant to this debate which exists in the larger public sphere as well as among participants of the conference. The act, which amended Connecticut's Coastal Management Act, states "A coastal site plan for a shoreline flood and erosion structure shall be approved if the record demonstrates and the commission makes specific written findings that such structure is necessary and unavoidable for the protection of infrastructural facilities, cemetery or burial grounds, water-dependent uses fundamental to habitability or primary use of such property or inhabited structures or structure additions constructed as of January 1, 1995, that there is no feasible, less environmentally-damaging alternative and that all reasonable mitigation measures and techniques are implemented to minimize adverse environmental impacts."

surges and buffers against sea level rise and coastal flooding, and to take steps to reduce storm water runoff. It was urged that towns have up-to-date Hazard Mitigation Plans in place and noted that federal grant funds (distributed by FEMA) are usually contingent upon having such a plan. Planning also forces communities to identify if they are prepared and how they can improve their preparedness and ultimately their resilience.

Economic Incentives

How do we balance the economic needs of towns, the state, businesses, and homeowners with the urgency of adaptation? Innovative funding mechanisms will be necessary to support implementation of local/regional action. Monetary incentives/disincentives such as flood insurance taxes or the incorporation of risks into property value may be powerful means to promote adaptation. Participants proposed to take advantage of brownfields in Bridgeport and New Haven as opportunities to develop natural areas/buffers. Such measures would raise property values and help coastal communities build resilience.

The Role of Insurance Companies

The potential role of insurance companies was a major discussion point. Some participants suggested that these companies should leverage their power to incentivize the incorporation of adaptive building technologies and strategies. Refusal to provide insurance might prevent rebuilding in vulnerable or previously affected areas. Insurance policies that require adaptive structural changes or other strategies with adaptation benefits could be tied to reductions in premiums. Other participants suggested that the insurance industry could potentially be a new source of funding to implement actions that reduce vulnerabilities and are thus likely to result in lower damage claims.

Public Awareness and Education

The public needs to recognize that a changing climate is going to create a new suite of problems and exacerbate existing ones. Connecticut's coastal residents and communities are for the most part affluent, and getting homeowners to recognize that they are assuming a risk when they choose to live on the shore will not be an easy task. Engineering solutions cannot solve all the problems associated with a changing climate, and coastal communities will need ultimately to view climate adaptation, not merely as a series of costly mandates, but as beneficial policies that will enhance the resilience and livability of these communities. A review of recent behavioral science research and other relevant publications associated with public perceptions of climate change should be conducted to target strategies that maximize the effectiveness of communication approaches.

In Connecticut, municipal land use commissions and boards are comprised of public volunteers who make decisions on local issues related to climate change adaptation, and need to be better educated to understand the full implications of permitting more development in flood zones, in waterfront areas, and near critical natural resources as sea level continues to rise. Efforts need to be made to encourage more working professionals, scientists, and engineers to become involved with local government and advocate policy change. It was suggested that with greater public education and awareness, people and infrastructure could be relocated and plans for the management and/or adaptive reuse of vulnerable areas could be generated before large-scale disasters occur, leaving abandonment as the only recourse at that point. It was pointed out that some individuals perceive a significant disconnect between themselves and their environment, and perceiving no consequences from their activities. Changing this mindset will go a long way towards addressing climate change problems.

Inclusive Approaches

The issue of inclusivity and need for more holistic approaches was identified. Rather than treat climate adaptation as an end unto itself, it would be desirable to connect or incorporate adaptation planning into existing environmental management and conservation planning activities. Strategies such as coastal habitat restoration can be integrated into on-going processes focused on systemic waterfront/community improvement, green infrastructure, and providing public access, recreational, and tourism opportunities.

Municipal policies need to consider the reuse of groundwater and treated effluent for applications such as landscaping, lawn watering, and water features like public fountains rather than drawing on potable water sources and Connecticut's rivers and aquifers. Future withdrawals from watercourses will further lower water levels, causing increased warming and higher rates of evaporation. It is important to consider the impact of potentially increasing storm frequency and intensity on inland development and infrastructure and the implications of this shift on stormwater generation. This highlights the need to manage better or reduce stormwater runoff in these areas. Finally, in coastal areas saltwater intrusion into freshwater resources will become a more frequent occurrence that will need to be mitigated or resolved. The Association of State Floodplain Managers and the local Chambers of Commerce may be important actors in addressing the resulting issues that arise.

Environmental Justice

Several conference participants noted the importance of keeping in mind the environmental justice implications of sea level rise and climate change adaptation. Although Connecticut as a whole and the coastline communities in particular are among the most affluent in the United States, pockets of extreme poverty exist in both the small towns and major cities. It is these impoverished populations that disproportionately include racial and ethnic minorities, the elderly, and the disabled, which are likely to be overwhelmingly impacted by climate change and unable to easily adapt. We have only to look at the tragedy which unfolded in New Orleans during and after Hurricane Katrina in 2005 to appreciate the extreme vulnerability of these populations within our stratified society and to understand the socio-economic landscape of death and destruction. Although few direct suggestions emerged from this conference to directly address the environmental justice themes embedded in climate change adaptation efforts, this is surely a topic that deserves additional examination and targeted work.

IV. Lessons Learned

The attendance at this conference testifies to the considerable interest in the *legal solutions to coastal climate change adaptation in Connecticut,* and this interest was not merely held by individuals living or working within the state of Connecticut. Attendees hailed from Connecticut as well as several other Northeast and mid-Atlantic states, filling the meeting room to capacity. Registration closed several days early because it was feared that despite moving the venue to a larger room there would be insufficient space. A post-conference survey clearly indicated that while academically oriented presentations were interesting and useful to a point, there is an unmet demand and need for follow-up conversations to occur between seasoned (and not-so-seasoned) practitioners who are in the business of planning for and implementing climate change adaptation. There is no clear venue for such conversations to transpire among municipalities, regional entities, the state, or even federal managers. Nor are there clear forums to share stories regarding the successes and failures of climate adaptation

strategies. The session on state and municipal strategies for climate adaptation and the opportunities for networking were the most valued aspects of the conference. Respondents expressed desire for more discussions on the range of legal and policy approaches to climate change adaptation, reinforcing the need and urgency for such exchanges.

V. Concluding Thoughts on Legal and Policy Solutions for Adaptation in Connecticut

The *Legal Solutions* conference drew considerable attention, maybe because of the paucity of forums to discuss climate change adaptation between local leaders and practitioners, state agencies, and academics. It is clear that the "home rule" doctrine has significant influence on the ways in which Connecticut can prepare and adapt to a changing climate. Local governments appeared to have a strong desire to see the state in a leadership role, providing guidance and facilitating municipal adaptation activities, through changes in the regulatory context and to some extent through state enforcement efforts.

Climate adaptation for coastal states, like Connecticut, represents one of the most complex challenges that will be faced in this century. All levels of government will be required to work together to develop feasible and effective approaches. Participants expressed interest in a range of novel approaches and practices that may be feasible at the local level in the present regulatory environment. One size will not fit all, however. Connecticut municipalities have different environmental, social and political environments and different adaptation abilities and needs as well. Assembling a suite of adaptation options would be a useful first step to address the broad range of municipal adaptation needs and desires. Economics will play a large role in adaptation efforts and monetary incentives and disincentives at the individual and community levels will no doubt be powerful tools to promote adaptation activities and the adoption of new and more resilient technologies. Insurance companies will likely play an important role in this regard. Public outreach efforts will be critical to engage and educate the public, encouraging them to play an active role in climate change adaptation planning and implementation and, at the same time, address some of the pernicious environmental justice issues which our society faces and will be exacerbated by climate change.

Ultimately, we will most likely never be able to stop adapting to climate change impacts. Efforts to adapt and enhance the resilience of the state and each of its communities will have to become an ongoing process – a process that will involve anticipating and being prepared for change, whatever those changes may be, and decreasing the vulnerabilities of people and communities in a fair and equitable manner. Resilience is not about stability and recovery to a previous state of being, but rather about flexibility and adaptation, continuous reinvention in order to persist. By forging broad and inclusive approaches that integrate ongoing planning efforts with existing and new environmental strategies, we will be taking a step in the right direction, but it is clear that this step will need to be followed by many more.

Adapting to Climate Change: Mapping Connecticut's Coastal Responses to a Global Problem

Mark A. Boyer[1]

Abstract: Climate change is the signature global issue of our time. This is not just because of climate change itself, but also because of the host of socio-economic and physical impacts that are emerging from rising temperatures globally. But fundamentally for scholars of international relations, climate change confronts the policy limitations of sovereignty and its implications for global action directly. Because of the lack of effective global and even national climate change policy action, policy initiatives to confront climate change must focus on levels below the global, even though economic models suggest that global policy provision might be the most efficient way to target the implications of climate change. As part of a larger project on climate change policy in the northeastern United States, this study centers on how coastal municipalities in Connecticut have engaged with climate adaptation concerns and the degree of diversity that exists among those policy approaches.

"America must not ignore the threat gathering against us. Facing clear evidence of peril, we cannot wait for the final proof."
George W. Bush (October 7, 2002)[2]

I. Introduction

If we took away the date and the name of the speaker above, it would be easy to read this as an argument for governmental action to cope with climate change. But the irony is obvious. This quote was taken out of context from a 2002 speech that was part of the Bush administration's building

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[2] George W. Bush, Speech (Oct. 7, 2002) (transcript available at http://articles.cnn.com/2002-10-07/politics/bush.transcript_1_weapons-terrorism-and-practices-terror-murderous-tyrant/5?_s=PM:ALLPOLITICS).

argument for military intervention in Iraq to eliminate that country's alleged weapons of mass destruction. Bush's quote is ironic in the climate change context, as threat perceptions are a primary motivating factor for municipal policy action on climate change adaptation, even if that motivation has spurred little action at the federal level to date. The Bush administration, as we know, was openly hostile to federal level policy action on climate change, whether focusing on mitigation or adaptation. As a result, climate change policy action in the United States has by default devolved to state and local governments. Thus, even though the threat is real, the federal government has been largely absent from policy action to cope with coastal impacts from climate change.

This paper seeks to accomplish several tasks that will hopefully lead to a better understanding of climate change policy and to more effective strategies for what is arguably the signature global issue of our time. First, this article discusses the global climate change policy dilemma from the standpoint of public goods theory and some related conceptual perspectives. Second, the article argues that traditional international relations perspectives provide little guidance for dealing with the climate change policy dilemma, when we recognize the limits of global policy action on this issue. Policy-makers must therefore examine the ways states, sub-state governmental units, and non-state actors engage climate change in the wake of ineffective, or largely non-existent, federal and global action. Adaptation responses in Connecticut's 24 coastal municipalities are the focus here, but this article is part of a larger project that is mapping climate change policy action for all 169 Connecticut municipalities. As Gore and Robinson argue, examining municipal level climate responses focuses attention on the governmental units that have become climate change policy leaders. By examining developments in the Northeast, more specifically, we are also looking at policy developments that are viewed as leading-edge programs nationally.[3]

It is also worth noting that this research project proceeds from the recognition that climate change policy action is both possible and necessary in the coming years. It is *possible* in the sense that "we created the problem, so we should solve it." And even those who harbor doubt as to the veracity of anthropogenic causes,[4] might want to apply technological fixes to adapt more effectively to the physical, social, and economic challenges caused by rising global temperatures. And it is *necessary* from a normative, transgenerational social responsibility perspective: should this problem really be left for those who follow? Certainly, authors like Hiskes[5] and Bryner[6] make strong cases that the current generation of policy-makers has a responsibility to protect the environmental rights – the rights to clean air, water and environmental quality, more generally – of our descendants. But beyond the normative argument, it is also necessary to engage climate change impacts from the perspective of grappling with the very real risks that climate change presents to almost any model of economic prosperity, physical security, and sustainability.

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[3] Christopher Gore & Pamela Robinson, *Local Government Response to Climate Change: Out Last, Best Hope?*, *in* CHANGING CLIMATES IN NORTH AMERICAN POLITICS 138-158 (Henrik Selin & Stacy VanDeveer eds., 2009). The reader should also note that this paper's author proceeds intellectually from an international relations scholarly foundation, and thus frames the analysis broadly within the context of interactions between global and local socio-political forces.

[4] *See* Dessler & Parsons, Schneider, Archer, Hoggan, Bolin and others for an array of discussions of climate science and the politicized discourse that has surrounded the scientific debate for over two decades. ANDREW E. DESSLER & EDWARD A. PARSON, THE SCIENCE AND POLITICS OF GLOBAL CLIMATE CHANGE (2006); STEPHEN H. SCHNEIDER, SCIENCE AS A CONTACT SPORT (2009); DAVID ARCHER, GLOBAL WARMING: UNDERSTANDING THE FORECAST (2007); JAMES HOGGAN, CLIMATE COVER-UP (2009); BERT BOLIN, A HISTORY OF THE SCIENCE AND POLITICS OF CLIMATE CHANGE (2007).

[5] RICHARD P. HISKES, A HUMAN RIGHT TO A GREEN FUTURE (2009).

[6] GARY BRYNER, PROTECTING THE GLOBAL ENVIRONMENT (2011).

II. Climate Change in a Public Goods Context

Few issue areas in international relations research and policy-making fit better into a public goods theory framework than climate change, regardless of whether focusing on mitigation and adaptation concerns.[7] The GHG emissions produced by individual, commercial, and public sector action around the world create externalities that are often, if not always, global in character. Many of the vulnerabilities created by emissions (e.g., rising global temperatures, increasing extreme weather incidents, and changing weather patterns) are consumed by people around the world regardless of whether they contributed to the production of the emissions that cause these climatic changes. And although the demands for climate change adaptation to cope with vulnerabilities are most directly witnessed in local municipalities, their incidence is also widely dispersed around the globe. Thus, there is at least an argument that both mitigation and adaptation to climate change are global public goods in ways that few other public goods are global in character.[8]

Additionally, the pursuit of environmental quality (and climate change policy specifically) possesses a more transboundary, and often global, character than many other policy areas. The "shared fate," transboundary effects of global climate change force environmental policy into international and global policy arenas whether countries like it or not. But this statement ignores the degree to which improvements in environmental quality rest with individual action and also local initiative. These transboundary considerations push many environmental problems toward the purer public goods end of the conceptual continuum, even if the problems engendered in this policy area continue to exhibit impurities in significant ways.[9] They are rarely, however, purely private in character as the impacts created by climate change are widespread and the product of globally generated climatic processes (even if the on-the-ground impacts are local and unevenly distributed). As discussed below, even with this global character, climate change policy action is most often located at much lower governmental levels in many countries.[10]

III. Understanding the Climate Change Policy Environment

Regardless of where one resides on the spectrum of political preference about the appropriate role for governmental action generally, economists have long shown a high degree of consensus about the most efficient locus of governance for public goods provision. As Tullock puts it, "the governmental unit chosen to deal with any given activity should be large enough to 'internalize' all the externalities which

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[7] For more in depth discussion of public goods theory as it applies to climate change, the reader might turn to Todd Sandler, GLOBAL CHALLENGES 99-106 (1997) or Mark A. Boyer, *Global Climate Change and Local Action: Understanding the Connecticut Policy Trajectory,* 13 INT'L STUD. PERSP. (forthcoming 2012).

[8] Drawing on the classic public goods literature of Samuelson, Olson, and others, pure public goods are defined as jointly produced and non-excludable. Jointness means that consumption of a public good by one individual does not diminish the amount of the commodity available for consumption by someone else. Non-excludability means that once a good is produced, non-contributors cannot be prevented from consuming the good. Paul Samuelson, *The Pure Theory of Public Expenditure*, 36 REV. ECON. AND STAT. 387-89 (1954); MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION (1965).

[9] Impurities can include congestion costs where goods exhibit some aspects of private consumption or where exclusion of potential consumers is possible (such goods are often referred to as club goods).

[10] For discussions of the impurities of environmental goods (both in terms of jointness and non-excludability), *see* Todd Sandler, *Intergenerational Public Goods: Strategies, Efficiency and Institutions*, *in* GLOBAL PUBLIC GOODS: INTERNATIONAL COOPERATION IN THE 21ST CENTURY 20-50 (Inge Kaul, Isabelle Grunberg, & Marc A. Stern eds., 1999); DAVIS B. BOBROW & MARK A. BOYER, DEFENSIVE INTERNATIONALISM: PROVIDING PUBLIC GOODS IN AN UNCERTAIN WORLD ch. 7 (2005).

that activity generates."[11] Building directly on this idea, Olson argues that "we can be reasonably certain that a broad array of governmental institutions is a necessary condition of Pareto optimal provision of collective goods, and that neither the extreme centralist nor the extreme decentralist position makes sense" all of the time.[12] In other words, economic efficiency would dictate that policy action be located at the level of government where a given externality most broadly exists. Government's role, then, is to figure out how best to regulate that externality and assess community members for its production (in the case of public goods) or reduction (in the case of public bads).

The global political impasse, witnessed in the inability of the UN Framework Convention on Climate Change (UNFCCC) process to develop binding mandates, also produces conditions where climate impacts exist and will continue to develop diffusely around the globe. Thus, some would argue that the industrialized powers that created climate change have exported their externalities to places unable to cope with them in effective ways. While the reduction of GHGs is indeed a rather pure public bad, climate impacts (although indeed spread around the world) are most often dealt with in more localized ways that raise equity (and significant financial) concerns for the localities confronting them.

Hence, this project focuses on a basic climate change governance dilemma*:* even though climate change policy might appropriately and efficiently be located at the global level, effective policy action is unlikely under the existing global policy architecture. Policy action, if it is to occur, will by default devolve to a complex array of individual countries, lower levels of government within countries, NGOs, and other policy actors including individuals.

One of the components for effectively understanding the emerging patterns of climate governance is considering how governmental (and nongovernmental) actors relate to one another. A lengthy discussion of intergovernmental relations is beyond the scope of this paper, but it is important to note the ways that diverse governmental units have engaged climate change. This includes some understanding of the fluid matrix of authority that exists across jurisdictions and governmental levels and also the degree to which we are indeed at a point in the development of climate policy where engagement with the issue and its challenges should best be considered as *policy experimentation,* as described by Vincent Ostrom,[13] Matthew Hoffman,[14] and others.

Putting a name to the empirical reality of diversified governance, Elinor Ostrom has further developed the concept of polycentricity, particularly as it applies to environmental issues and climate change. As she argues, "a polycentric system for coping with global climate change is emerging and is likely to expand in the future."[15] And until recently, the contributions made by multiple and diverse public and private actors in service of climate change action have been largely ignored by both the scholarly and policy-making communities. Put simply, "the efforts of many organizations at less-than-global scale can help reduce emissions to some extent, and they can also spur their own governments to take necessary national and international efforts."[16] Coping with climate impacts that require *adaptation* policies by localities is no different, as local jurisdictions will meet the demands for climate

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[11] Gordon Tullock, *Federalism: Problems of Scale*, 6 PUB. CHOICE 19-29 (1969).

[12] Mancur Olson, *The Principles of "Fiscal Equivalence": The Division of Responsibilities among Different Levels of Government,* 59 AM. ECON. REV. 479-87 (1969).

[13] Vincent Ostrom, *Polycentricity (Part 2)*, *in* POLYCENTRICITY AND LOCAL PUBLIC ECONOMIES 119-38 (Michael D. McGinnis ed., 1999).

[14] MATTHEW J. HOFFMAN, CLIMATE GOVERNANCE AT THE CROSSROADS: EXPERIMENTING WITH A GLOBAL RESPONSE AFTER KYOTO (2011).

[15] Elinor Ostrom, *Polycentric Systems for Coping with Collective Action and Global Environmental Change*, 20 GLOBAL ENVTL. CHANGE 550-57 (2010).

[16] Elinor Ostrom, *Nested Externalities and Polycentric Institutions: Must We Wait for Global Solutions to Climate Change Before Taking Action at Other Scales?* 49 ECON. THEORY 353-69 (2010), *available at* http://www.springerlink.com/content/72345271408211 3q/fulltext.pdf, DOI 10.1007/s00199-010-0558-6.

adaptation in the short-term until policy, and the requisite funding, more fully emerges at higher governmental levels.

A polycentric perspective on the effective pursuit of climate governance, and its actual implementation in the policy realm, in the end encourages "experimental efforts at multiple levels, as well as the development of methods for assessing the benefits and costs of particular strategies."[17] Demonstrating the empirical veracity of Elinor Ostrom's arguments about the value and actual use of multi-scale approaches, Betsill and Bulkeley's work has examined the role played by Cities for Climate Protection (CCP) and how this NGO factors into our understanding of why cities around the world have developed independent climate action plans.[18] From their work, the impact of transnational networks for climate action and how the networks interact with localities to spur climate policy action is clear. Additionally, Hoffman's recent study of climate change "governance experiments" provides a quite extensive understanding of what policies are in place below the global and federal levels.[19] Hoffman's work ably demonstrates the shifting locus of climate change policy and the diversity of approaches being implemented below the national level.[20]

Further informing a polycentric view of the climate policy environment, the recent work of Neumann and Sending[21] and Sending and Neumann[22] helps conceptualize the "why" and "how" of climate change policy action. Starting from a perspective emphasizing collective welfare and recognizing the jurisdictional boundaries that exist down to the municipal level, Neumann and Sending provide the analyst with an understanding of why localities have stepped up on climate policy. Put simply, sub-national jurisdictions have stepped into the void of policy action at the global and federal level to service the welfare of localities and their citizenry. In essence, states and municipalities in many regions of the United States are developing quite effective climate change policies, because of a perception that such action is vital to the welfare of the citizenry that policy officials are charged to serve. In this way, then, Neumann and Sending may indeed be correct in arguing that such policy action is not about a transfer of power from the national level to other governmental units, but rather an exercise of the policy power resident in those sub-national jurisdictions all along.[23] As the data will show later in this article, the sense of climate threat that exists for coastal municipalities in Connecticut is

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[17] Elinor Ostrom, *A Multi-Scale Approach to Coping with Climate Change and Other Collective Action Problems*, 1 SOLUTIONS 27-36 (2010), *available at* http://www.thesolutionsjournal.com/node/565 .

[18] Michelle M. Betsill & Harriet Bulkeley, *Transnational Networks and Global Environmental Governance: The Cities for Climate Protection Program*, 48 INT'L STUD. Q. 471-93 (2004); Michelle M. Betsill & Harriet Bulkeley, *Cities and the Multilevel Governance of Global Climate Change*, 12 GLOBAL GOVERNANCE, 141-59 (2006).

[19] HOFFMAN, *supra* note 14.

[20] The reader might be interested in reading Orr's (2011) recent review essay that compares the findings of Hoffman's project with two other recent works that come at the issues from quite different perspectives. *See* Shannon K. Orr, Book Review Essay, *Reimagning Global Climate Change: Alternatives to the UN Treaty Process*, 11 GLOBAL ENVTL. POL. 134-38 (2011).

[21] Iver B. Neumann, & Ole Jacob Sending, *"The International" as Governmentality*, 35 MILLENNIUM 677-701 (2007); IVER B. NEUMANN & OLE JACOB SENDING, GOVERNING THE GLOBAL POLITY (2010).

[22] Ole Jacob Sending & Iver B. Neumann, *Governance to Governmentality: Analyzing NGOs, States, and Power*, 50 INT'L STUD. Q. 651-72 (2006).

[23] To date, there is indeed a growing focus on American states as engines of climate change policy. Rabe has shown how states have taken the lead on climate change over the past decade and the implications of this action for intergovernmental interaction in the contemporary American federal system. Urpelainen, for instance, developed a game theoretic analysis of why US states have pursued independent climate policies, even in the face of what he argues is the relative ineffectiveness of such initiatives. BARRY G. RABE, STATEHOUSE AND GREENHOUSE (2004); Barry G. Rabe, *States on Steroids: The Intergovernmental Odyssey of American Climate Policy*, 25 REV. POL'Y RES. 105-28 (2008); Johaness Urpelainen, *Explaining the Schwarzenegger Phenomenon: Local Frontrunners in Climate Policy*, 9 GLOBAL ENVTL. POL. 82-105 (2009).

spurring them to exercise that power in demonstrative ways. Further expanding on the motivations for policy action, the next section briefly discusses some of the existing scholarship about policy drivers in local communities.

A. A Note about Local Policy Drivers

As Donahue argues:

> In a democracy, citizens' preferences about the outcomes of public policy are premier. Governments respond to these desires by determining what public services citizens want, levying taxes to pay for them, and ultimately providing them. As Teibout (1956) notes, though, a central problem of public finance theory is that "no market-type solution exists to determine the level of expenditures on public goods." The field of public finance thus faces an important question: what determines the level of public services?[24]

Specific to this analysis, what determines the level of municipal engagement with climate adaptation? Conventional arguments discussed briefly below provide only part of the picture of climate adaptation on Connecticut's coast.

Along these lines, Feiock and West identify a set of explanatory drivers of local policy adoption.[25] They are:

- ***Need/Response Policymaking Model****:* focuses on governments responding to an objective need for a policy.
- ***Diffusion of Innovation Model***: focuses on the degree to which some governments become policy leaders regarding the adoption of innovative approaches to policy problems and the degree to which others then follow and diffuse such innovation.
- ***Political Institutions Model:*** focuses on electoral competition and governmental structure as influential in understanding policy choice.
- ***Federalism Model***: focuses attention on the degree to which localities adopt and implement policy mandates from above (mostly state governments).
- ***Economic Model***: argues that more affluent communities with greater fiscal resources will be policy innovators.
- ***Interest Group Influence Model***: competing demands from constituencies produce demands for policy change.
- ***Administrative Capacity***: focuses attention on the expertise and personnel resources as drivers of innovation in adoption and implementation.

In addition, there is Teibout's model of policy as citizens "voting with their feet" where residents' demand for public goods yields competition at the local level for the provision of public services.[26] As towns seek to preserve tax base for revenue generation, they are compelled to compete with

[24] Amy K. Donahue, A Review of Conceptual Approaches to Estimating Citizen Demand for Local Public Services 416 (2010) (unpublished manuscript). *See* Charles M. Teibout, *A Pure Theory of Local Expenditure,* 64 J. OF POL. ECON. 416-24 (1956).

[25] Richard C. Feiock & Johnathan P. West, *Testing Competing Explanations for Policy Adoption: Municipal Solid Waste Recycling Programs*, 46 URB. AFF. REV. 399, 400-404 (1993).

[26] Teibout, *supra* note 24.

surrounding towns to keep their citizens happy with the level of services in their home communities. Obviously, Teibout's original argument underlies several of the models identified by Feiock and West.

So as these various explanatory models suggest, there exists a diversity of explanations for cross-jurisdictional differences in policy approaches. Some of those variations can be seen in the data discussed below regarding Connecticut's coastal towns.

B. Methodology

The following discussion and analysis is part of a larger project that examines the ways state and local governments in the northeastern United States are engaging with climate change in the vacuum of coherent and proactive global and federal policy. There are several facets of this project. One piece focuses on the evolution of Connecticut climate policy and what implications it has for other regions of the United States.[27] That portion of the project centers on interviews of policy-makers involved in the development of Connecticut climate policy.

A second portion of the project builds on earlier work done by Connecticut's Department of Energy and Environmental Protection (DEEP) to map climate change across the 169 municipalities in the state.[28] The current project seeks to update and further populate that mapping effort with policy data being shared between DEEP and the UConn research team.[29] The data analyzed in this paper are only for the 24 Connecticut coastal towns.

Data collection for the "169" project has taken three primary forms. First, the UConn research team was provided access to the data currently populating the ctclimatechange.com database and built its database around the existing policy data. The second step was examination of town documents, primarily available on town websites. Such documents included Plans of Conservation and Development (POCD), zoning documents, stormwater management and erosion plans, and other documents related to sustainability practices. The data collected from documentary sources were then augmented by phone calls to planning, zoning, and management officials in each town. As a result, the UConn research team feels confident that the data presented here for coastal municipalities is a comprehensive, if macro-level, body of information on adaptation policies on the Connecticut coastline. Data collection for the remaining 169 towns is ongoing, as is data collection on mitigation efforts for the coastal towns.

IV. Examining Connecticut Coastal Climate Adaptation

The first step in understanding what coastal towns are doing to cope with climate change is to examine the policy frame created at the state level in the early 2000s. Although too lengthy to recount here, Connecticut was an early entrant in the development of climate policy in the United States. Spurred partly by the Climate Action Plan adopted by the New England Governors/Eastern Canadian Premiers in 2001,[30] Connecticut's Republican governor in the early 2000s, John Rowland, signed onto

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[27] Boyer, *supra* note 7. Please note that the interview data used for that publication was collected under an approved University of Connecticut IRB protocol. For details of that protocol, please contact the author.

[28] DEEP's work to date on that project is located at CT Climate Change, Initial Actions and Climate Action Map, http://ctclimatechange.com/index.php/towns/climate-action-map-testing/ (last visited July 2, 2012).

[29] The UConn research team is led by this paper's author and is comprised of several other graduate and undergraduate research assistants mentioned in the first footnote above.

[30] For more detail on the NEG/ECP process and programs, *see* The New England Governors' Conference, Inc., NEG/ECP Climate Change Program, http://www.negc.org/main/?do=page&id=39 (last visited July 3, 2012).

the plan and was then pushed from below to implement an aggressive set of state-level climate policies centering around a pro-jobs, pro-growth rationale for climate action.[31]

More specifically, two legislative acts provide the policy frame for a wide array of actions across the state. The first of these is the Connecticut Coastal Management Act (CCMA) enacted in 1980.[32] The second is Connecticut Public Act No. 08-98 (An Act Concerning Connecticut Global Warming Solutions) passed in 2008. While this second act focused mostly on approaches to GHG mitigation, it also set in place a policy review process for understanding climate impacts and existing policy actions around the state aimed at coping with climate impacts.[33] Coastal towns in Connecticut, then, have undertaken their adaptation programs in the context of these two policy frameworks. So while Connecticut is a home rule state where the primary sub-state governmental units are each of the 169 municipalities, the state (in this policy venue, mostly in the form of the DEEP) provides support for the towns through information sharing, the development of best practices, and, to some degree, policy coordination. But in the end, the primary locus of policy action is the town with these two acts as the primary legislative policy frame.

The next step in understanding the Connecticut coastal climate adaptation experience is to examine some summary data about the 24 coastal municipalities. Table 1 displays that data.

Table 1. Summary Connecticut Coastal Town Data.

Municipality	Pop. density (People/ sq. mile)	Income per capita ($)	% college or higher	Rep.	Dem.	Minority party	Unaffil.	Dominant party	Mun. Envt. Staff
Branford	1,274	41,744	43.7%	15.36%	33.58%	0.18%	50.87%	D	7
Bridgeport	9,014	19,802	15.2%	6.94%	63.16%	0.23%	29.66%	D	6
Clinton	829	37,186	37.2%	25.29%	28.07%	0.97%	45.67%	D	3
Darien	1,595	94,953	73.2%	48.67%	19.17%	0.12%	32.05%	R	4
East Haven	2,438	28,820	20.9%	15.60%	36.53%	0.17%	47.69%	D	3
East Lyme	564	34,733	34.5%	22.98%	30.29%	0.17%	46.56%	D	5
Fairfield	1,980	55,579	58.6%	29.41%	28.58%	0.30%	41.72%	R	11
Greenwich	1,274	92,014	62.2%	37.68%	25.57%	0.95%	35.80%	R	20
Groton	1,294	31,697	32.2%	19.49%	29.67%	0.25%	50.58%	D	5
Guilford	476	48,459	54.7%	22.71%	32.80%	0.23%	44.25%	D	5
Madison	507	48,623	62.8%	31.32%	26.72%	0.50%	41.45%	R	3
Milford	2,294	38,549	37.8%	21.59%	28.00%	0.41%	50.00%	D	8
New Haven	6,830	21,176	32.2%	4.11%	68.81%	0.56%	26.52%	D	10
New London	4,603	21,829	23.5%	17.27%	43.20%	1.16%	38.37%	D	3
Norwalk	3,722	41,419	38.4%	2.07%	34.24%	1.94%	43.87%	D	12
Old Lyme	331	50,249	52.9%	29.53%	28.31%	0.38%	41.78%	R	3
Old Saybrook	683	42,390	41.5%	32.11%	28.17%	0.40%	39.32%	R	4

[31] *See* Boyer, *supra* note 7, for much more detail about how Connecticut climate policy developed.

[32] *See* Conn. Dept. of Energy & Envtl. Protection, Overview of Connecticut's Coastal Management Program, http://www.ct.gov/dep/cwp/view.asp?A=2705&Q=323536 (last visited July 3, 2012), for more discussion of the CCMA.

[33] *See* An Act Concerning Connecticut Global Warming Solutions, 2008 Conn. Legis. Serv. P.A. 08-98 (H.B. 5600) (June 2, 2008).

Stamford	3,227	46,928	43.5%	22.15%	41.21%	1.31%	35.34%	D	4
Stonington	476	41,246	42.8%	21.62%	31.58%	0.23%	46.57%	D	5
Stratford	2,855	31,571	28.8%	18.83%	32.09%	0.25%	48.83%	D	5
Waterford	591	36,626	36.1%	19.92%	30.49%	0.26%	49.33%	D	5
West Haven	5,051	25,722	22.3%	18.22%	46.36%	0.37%	35.05%	D	4
Westbrook	434	41,667	35.3%	9.94%	57.37%	0.20%	32.49%	D	5
Westport	1,320	92,854	74.2%	27.91%	36.06%	0.12%	35.90%	D	16

From this data, a few patterns emerge that may inform our understanding of why some towns engage with climate change in significant ways and others somewhat less so.

- The population density data quickly reveal the points of urbanization: Bridgeport, New Haven, New London, West Haven. Clinton, East Lyme, Guilford, Madison, Old Lyme, Old Saybrook, Stonington, Waterford, and Westbrook show significantly lower population density.

- Somewhat surprisingly, given the "Gold Coast" nickname often heard for the coastal communities, there is a relatively normal distribution of per capita income across the towns. At the high end, Darien, Westport, and Greenwich show per capita incomes above $90,000. At the low end, Bridgeport, New Haven, New London, and West Haven all have per capita income levels below $30,000. These same four, as noted above, have the greatest population density. The remaining 17 municipalities range between those income extremes.

- Educationally, Darien, Fairfield, Greenwich, Guilford, Madison, Old Lyme, and Westbrook show the most educated populations; Bridgeport, East Haven, New London, and West Haven, the least educated.

- There is a high degree of dominance by the Democratic Party across these 24 towns. Seventeen towns are solidly Democratic, with one more (Clinton) marginally Democrat-dominant. Of the Republican-dominated towns, only two (Darien and Greenwich) can be described as clearly dominated by the GOP; while four (Fairfield, Madison, Old Lyme, and Old Saybrook) only lean that way. It is also worth noting two other issues regarding party affiliation: (1) in all 24 towns, there is a high percentage of registered voters listing themselves as unaffiliated. In many cases, the size of that group could sway even dominant towns in the opposite partisan direction; and (2) New England Republicans tend to be more centrist in their approach to governance than those found in the American South or West.[34] Thus, one might argue that it is easier to find centrist coalitions in New England politics than in other regions in the United States. Those tendencies may also mitigate general Republican resistance to climate change action in contrast to what is observed at the national level.

- Lastly, there is wide variation in the number of municipal staff assigned to environmental issues across the 24 towns. These numbers include staff with planning and zoning,

[34] Howard L. Reiter & Jeffrey M. Stonecash, COUNTER REALIGNMENT: POLITICAL CHANGE IN THE NORTHEASTERN UNITED STATES (2011).

conservation, inland wetlands, and sustainability duties for at least part of the employment responsibilities. Greenwich and Westport show the largest number of staff assigned to environmental tasks, suggesting that tax base may drive some of the variation here. Clinton, East Haven, Madison, New London, and Old Lyme show the lowest numbers of environmental staff. For Clinton, Madison, and Old Lyme, one might speculate that their low population density demands less staff to service citizen needs. But for New London and East Haven that argument does not follow and one might assume that the small number of environmental staff reflects the relatively small tax base and is also the result of decisions to focus on other pressing needs in each town. It is worth noting, though, that the more urbanized towns of Milford, New Haven, and Norwalk all register among the higher environmental staff numbers.

Table 2 moves us directly into the analysis of climate adaptation policy actions taken by the 24 towns. This table presents an aggregated quantitative view of policy action. Please note that the categories in the first five columns of data were adopted from the ctclimatechange.org map of town climate actions. The summed total of all five categories is reported in the "Total" column and thus provides a rough gauge of the level of attention paid to climate adaptation in a given town. Looking at Table 2, the first thing that stands out is the degree of engagement for climate adaptation that exists across all 24 towns. At the high end, Clinton, Groton, and Guilford have each taken at least 10 different policy actions, demonstrating a high degree of policy attention to adaptation concerns. At the low end, Norwalk and Old Lyme have only engaged in three initiatives each. But it is also worth noting that the higher end appears to be the more dominant pattern of behavior among the coastal towns with 13 towns engaging in eight or more actions and three others engaging in seven policy actions.

Table 2. Policy Action Inventory for 24 Coastal Towns (X = missing data)

Municipality	Town policy actions assessing vulnerability to climate change	Town policy actions on planning for impacts of climate change	Town policy actions for purchasing and capital improvement projects to meet future threats	Changes in zoning or building codes for future safety	Town map of vulnerable areas	Total	Municipal staff in P&Z, conservation, inland wetlands, and sustainability departments.
Branford	1	2	1	2	2	8	7
Bridgeport	1	2	2	2	1	8	6
Clinton	2	2	1	5	1	11	3
Darien	1	2	1	3	1	8	4
East Haven	1	1	2	2	2	8	3
East Lyme	1	2	2	2	1	8	5
Fairfield	2	2	1	2	1	8	11
Greenwich	1	1	1	1	1	5	20
Groton	2	2	3	2	1	10	5
Guilford	2	2	4	2	1	11	5
Madison	1	1	1	2	2	7	3
Milford	2	2	1	3	1	9	8
New Haven	1	3	1	1	2	8	10
New London	2	3	2	1	1	9	3
Norwalk	0	1	X	1	1	3	12
Old Lyme	X	1	X	1	1	3	3
Old Saybrook	2	2	0	2	1	7	4

Stamford	2	2	1	1	1	7	4
Stonington	0	1	0	2	1	4	5
Stratford	0	1	1	1	1	4	5
Waterford	1	2	1	2	2	8	5
West Haven	0	2	1	2	1	6	4
Westbrook	0	3	1	3	1	8	5
Westport	0	1	2	1	1	5	16

From a social science perspective, then, there is little macro-level variation across towns regarding their level of policy engagement with climate adaptation. At the most aggregated level, this would suggest that the threat presented by climate change to each town's way of life provides a rather uniform policy motivator for town officials. This might also be taken as evidence in support of the Need/Response model discussed above. Further, when comparing the total level of policy engagement with staff (the last two columns of Table 2), there does not appear to be a correlation between staff capacity and adaptation policy engagement. Thus, one can speculate that drivers other than staff expertise are at work. And going back to the data in Table 1, there also does not appear to be a correlation between party dominance and town engagement with climate adaptation. Further analysis of demographic descriptors with climate policy will be needed to flesh out these drivers in more detail at the aggregate level.

The Appendix provides us with much greater detail about the actual policy actions taken by the 24 towns. And Table 3 provides more detailed explanations for each of the categories shown in Table 2 and the Appendix. Clearly, the data displayed in the Appendix provides only a glimpse of the rich policy picture of climate adaptation in coastal Connecticut, but it does provide us with some further clues as to what the 24 towns are doing. It also fills in some detail to the aggregate results displayed in Table 2, as it follows that table's structure. Please note that the first four policy categories in the Appendix correspond to the first four in Table 2 and the policy counts are still located in the column next to the text portion for that policy category in the Appendix.

Table 3. Coastal Town Adaptation Tables Explanatory Notes

Town policy actions assessing vulnerability to climate change	Drawn primarily from town Plans of Conservation and Development (POCD), but also includes sustainability and coastal management plans, and info from town calls.
Town policy actions on planning for the future impacts of climate change	Both planned and implemented measures to combat future impacts of climate change were counted, which was largely anticipated to be in the form of increased flooding, erosion, damage to coastal property, stormwater pollution, and degradation of shellfish and wetland habitats. Resources used were POCDs and zoning documents. Membership in ICLEI counted as a planning action, since it indicated that towns recognized climate change as a problem, and wanted to use ICLEI as a resource.
Town policy actions for purchasing and capital improvement projects to meet future threats	Drawn from POCDs, zoning documents, and town calls. This category focused on physical improvements to town infrastructure that would help prepare for future threats.
Changes in zoning or building codes for future safety	Drawn from POCDs, zoning documents, stormwater management plans, erosion plans, and town calls. This category focused on changes in zoning regulations to account for increased flood risk, or restrict development in areas (such as coastal flood zones) with high risk of property damage during storms/flooding.
FEMA compliant or greater	*Basic compliance*: member of FEMA's National Flood Insurance Program, Regular Program (NFIP). This means that

	the town uses FEMA's Flood Insurance Rate Maps (FIRM). Towns that use the FIRM maps work with FEMA in a limited capacity. *Overcompliance*: member of FEMA's Community Rating System (CRS), part of the National Flood Insurance Program. Towns have to show they've made improvements in zoning to reduce flood risk, in order to participate in this selective program. CRS member towns get discounted flood insurance in regular and high flood risk zones. *Former member of FEMA's Community Rating System*: towns in this category recently belonged to the CRS, and are still listed on the FEMA website (though marked as "rescinded"). This means they are no longer fully compliant with FEMA's higher standards for the CRS program, and cannot receive flood insurance discounts. Still, it indicates initiative on the town's part to be proactive on flood risk reduction.
Town map of vulnerable areas	Gathered from POCDs, town GIS mapping online (where available), or from the town listing FEMA Flood Insurance Rate Maps on their website. There was a lot of variety in terms of mapping vulnerable areas. For some towns, this meant forecasting future sea level rise due to climate change, and for others, it meant including a map of vulnerable wetlands and standard 100- or 500-year flood zones (without reference to climate change).
Municipal staff in conservation, sustainability, planning departments	Drawn from town websites, and POCDs. Towns that had full staff directories were more comprehensive than those that only listed department heads on the websites. There is a possible undercount of those that only listed department heads, as larger towns likely also have support staff (especially in Planning & Zoning, the largest department).

A first point to note in the Appendix is that all 24 towns are at least FEMA compliant in their flood zone mapping and many aspire to do more, although they have not yet taken concrete action to move beyond the FEMA guidelines. Five towns (East Haven, East Lyme, Stamford, Stonington, and Westport), however, have done so and have engaged in such activities as joining FEMA's Community Rating System. This action allows residents to receive a 5% discount on federal flood insurance. These actions and the aspirations of many towns suggest that town officials are indeed responding to the flood vulnerability that they face on the coast, especially when one considers that these towns are located in a region that has a history of significant coastal storm impacts.

Almost all towns have integrated climate adaptation concerns into their town's Plans of Conservation and Development (POCD), showing a clear indication that coastal town officials are indeed paying close attention to adaptation issues as they work to serve their citizenry now and into the foreseeable future. Moreover, towns like Bridgeport (BGreen 2020), Fairfield (Fairfield Town Green), Groton (Groton Coastal Climate Change Project), Guilford (Municipal Coastal Plan), and Stamford (yearly climate change assessments) have undertaken policy packages that go beyond the baseline of thinking about threats. Those towns appear to be more actively engaging the problem.

In support of their efforts, other towns (like Branford, Bridgeport, Greenwich, New Haven, New London, Stamford, and Westbrook) belong to ICLEI (Local Governments for Sustainability (http://www.iclei.org/)). As stated on its website, ICLEI provides "technical consulting, training and information services to build capacity, share knowledge and support local government in the implementation of sustainability at the local level." Thus, joining ICLEI represents a conscious effort on

the part of town officials to work with others to pursue sustainable practices at the local level. Given that ICLEI requires subscription fees to join, membership also represents a demonstrative decision about the use of fiscal resources to support sustainability efforts.

Not surprisingly, there is also a high degree of engagement with adaptation policies across the towns regarding sewer systems and storm water management. Whether because of flash flooding concerns from localized rainfall, larger scale concerns resulting from significant storms or winter snow melt (issues hammered home during winter 2010-2011 and the "two-storm" challenge of fall 2011), or coastal erosion issues, almost all of the coastal towns are actively focused on coping with such vulnerabilities in operational ways.

Lastly regarding Table 2 and the Appendix, it is worth noting that some towns exhibit two policy actions regarding the mapping of vulnerable areas. In these cases, towns like Branford, East Haven, Madison, New Haven, and Waterford have performed vulnerable area mapping both as part of their POCD process and also as part of FEMA's flood insurance mapping. So while the same data might be used for both actions, the towns are putting forth "extra effort" to identify the most vulnerable areas in their towns. One might also expect that such remapping efforts have produced, and will continue to produce, some angst among town residents as the flood plains become larger under the new mapping processes. One coastal official recounted a town meeting in his community as follows:

> people who didn't think they needed flood insurance now all of the sudden have to have it. Now obviously it's a money thing, but it's also a risk management thing and that's a big focus now in the discussion. Much of the emphasis is about … risk management.[35]

As this quote suggests, although confronting the need for climate adaptation may be the result of proactive steps by town officials, it does not mean that residents will always be on-board with climate change policy directions. Thus, leadership from town officials and coalition-building within and among localities is and will continue to be important efforts in moving adaptation policies forward.

V. Concluding Analysis

When taking these data in aggregate, a pattern emerges of adaptation policies that are being adopted and implemented among Connecticut's coastal towns. Clearly, these 24 towns are well engaged with climate adaptation and are continuing to expand those efforts. What is less clear from the foregoing data, however, are the exact policy drivers prompting such actions. Some clues exist in the data, but more work is required to understand the idiosyncrasies of the experiences in particular towns. That work will entail further data collection both in terms of documentary work and interviews with a broad array of town policy officials. Nonetheless, some patterns of policy causality are beginning to emerge among Connecticut's coastal towns. These include:

- ***Threats and vulnerability*:** There is a high degree of engagement with adaptation policy among the coastal towns. A focus on adaptation is relatively consistent across those towns regardless of the demographic and political patterns shown in Table 1's summary data. Thus, it is safe to argue that the local threats engendered by climate change are driving a significant portion of the policy push in this area. In this way, the Realists in the international relations field are right:[36] threats drive action, and sometimes quite quickly;

[35] Interview with Michael Murphy, Director of Planning and Development, Town of Groton, CT (Dec. 12, 2010).
[36] In the international relations field, realists see action as largely generated by threats posed to policy actors.

- ***Policy entrepreneurs*:** The impact of individuals in the policy process cannot be underestimated.[37] The reader should not discount the impact of policy officials committed to climate change action in a variety of the coastal towns, including elected officials whose sights are set on higher state or national office. Policy officials with personal commitments to environmental concerns apply their expertise, energy, and problem-solving skills in ways that move the agenda forward. This may seem like an obvious conclusion, but it remains an important factor in understanding policy variation across jurisdictions and governmental levels;

- ***Framing and the policy environment*:** Policy entrepreneurs must recognize the policy environment within which they work and thus frame policy arguments to gain support. Framing climate policy as an economic development engine was crucial to moving Connecticut's state-level policy forward in the earlier 2000s. Framing will remain important for local officials, as residents confront rising insurance costs for example, and town officials must argue the necessity of those added expenses.

- ***Local political culture:*** Some communities may act because their political culture is more receptive to environmental action than others. More data is needed on this set of factors before conclusions can be more definitively drawn about its potency. As data collection moves away from coastal towns in the larger, 169 town research project, it will be interesting to see if the consistency of policy engagement that exists on the coast continues inland, where the demonstrative threat is lower. Local politics might then play a greater role than appears to be happening on the coast.

- ***Climate policy vacuum:*** The lack of action at both global and federal levels facilitates (or demands?) local policy initiatives. This causal variable can almost be left unsaid, but the ramifications are striking in at least two ways. First, as discussed early in this paper, local action is filling the void of federal action, but may be doing so in redundant and inefficient ways. Second, over the longer-term, as climate impacts become more significant and thus more costly, towns will be forced to fill yet another unfunded "mandate." But this mandate will not be coming from above, but rather from on-the-ground demands of servicing the welfare of their local citizens. The budget and programmatic impacts will be real and severe as climate impacts escalate.

In sum, Connecticut's coastal communities may indeed be leaders in climate adaptation, but they may soon begin to confront the limits of what they can do without intensive help from both state and federal authorities, both in terms of fiscal resources and expertise. Clearly, state authorities are cognizant of the issues and pressures at hand, but the climate policy gridlock at the federal level remains a major obstacle to coping effectively with climate change. An optimistic policy scenario suggests that as the threats become ever more real and demonstrative, policy-makers at all levels will respond appropriately. Unfortunately at least for the short-term, many officials at the federal level are still reluctant to apply George Bush's threat-action linkage to the climate change policy problem.

[37] For further discussion, see Barry G. Rabe, *States on Steroids: The Intergovernmental Odyssey of American Climate Policy,* 25 REV. POL'Y RES. 105-28 (2008).

VI. Appendix

Policy Action Inventory with Policy Details

		Town policy actions assessing vulnerability to climate change		Town policy actions on planning for the future impacts of climate change		Town policy actions for purchasing and capital improvement projects to meet future threats		Changes in zoning or building codes for future safety	FEMA compliant or greater	Town map of vulnerable areas	Town envir. staff
	#	*Policy Detail*	#	*Policy Detail*	#	*Policy Detail*	#	*Policy Detail*			
Branford	1	Plans of Conservation and Development (POCD) connect sea level rise with climate change and include flood zone maps	2	POCD calls for town to prepare for the sea level rise and flooding as an emerging conservation issue. Town participates in ICLEI's Clean Air & Climate Program to track and reduce GHG emissions.	1	Sewer system to be expanded and upgraded	2	New areas prone to flooding due to sea level rise identified. Zoning discourages development in floodplains. Zoning encourages gradual retreat from low-lying areas.	Basic compliance: member of FEMA's National Flood Insurance Program (NFIP), Regular Program	GIS town map online. Future land use map in POCD.	7
Bridgeport	1	Town's sustainability plan, "BGreen 2020," calls climate change Bridgeport's greatest environmental challenge. The sea level rise will result in greater flooding. Higher temperatures will have economic consequences, increase heat-related illness, and damage fish and shellfish habitats.	2	Town's sustainability plan, "BGreen 2020," makes recommendations to combat climate change, calling it a threat to economy, health, and national security. Town is a member of ICLEI.	2	Stormwater management system to be cleaned in order to prevent flooding. Old water fixtures in older housing will be changed out to conserve water and reduce the load on the town's water treatment facilities.	2	Zoning enacted to transform unused industrial sites into mixed-use development sites. Green landscaping measures (like street trees and green roofs) retain stormwater and reduce urban heat.	Basic compliance: member of NFIP, Regular Program. Town aspires to join the NFIP's Community Rating System (CRS).	FEMA flood zone map in POCD.	6

Clinton	2	POCD says town must prepare for future sea level rise. The town's Coastal Plan says town is threatened by flooding and sea level rise.	2	POCD and Coastal Plan set out plans for adaptation and mitigation of sea level rise and flooding.	1	Sewer minimization program should be established to discourage development in wetlands. Inadequate sewer systems should be upgraded. New construction and improvement projects should be required to provide as much stormwater infiltration as engineering practices allow.	5	Development discouraged in tidal wetlands (to protect and restore degraded shellfish habitats). Establishment of a sewer minimization program to prevent groundwater contamination. Public education program on maintaining septic systems. Upgrade of existing stormwater discharge structures by adding treatment structures and vegetative swales. Maintain coastal high hazard flood areas as open space to protect private property.	Basic compliance: member of NFIP, Regular Program.	FEMA flood zone map in Coastal Plan.	3

Darien	1	A 2007 slideshow on climate change ranks climate change induced flooding as the key threat to the town. Climate change is causing larger and more frequent floods, exacerbated by development, impervious surfaces, undersized culverts, and inadequate stormwater management systems.	2	POCD recommends town include storm drainage zoning as part of any new development or redevelopment plan. Town should consider large-scale flood control projects .	1	Town will consider large-scale flood control projects.	3	Prohibit development close to ponds and rivers. Zoning limits creation of impervious surfaces. Developers required to provide an erosion and stormwater drainage plan.	Basic compliance: member of NFIP, Regular Program	FEMA flood zone map in POCD.	4
East Haven	1	POCD says private development in coastal hazard areas is vulnerable, and further development should be discouraged. Tidal wetland areas and existing open space on the coast needs to be preserved, as developing it would increase chances of property damage.	1	POCD chapter on the shoreline sets out zoning recommendations for coastal development to reduce risk of flood damage.	2	Periodic flooding of some neighborhoods can be ameliorated by structural improvements in the drainage system. Town should also ask state and federal governments to purchase severely flood-damaged property.	2	Discourage development of coastal hazard and flood zones. Zoning to protect inland wetland areas from development that impairs floodwater management, increases erosion, and harms groundwater or wildlife.	Former member of FEMA's CRS (part of the NFIP from 2003-2010).	Future land use map in POCD. FEMA flood zone map.	3

East Lyme	1	POCD emphasizes need for green energy and to be responsive to flood hazards.	2	2010 POCD addresses flood risk and need for green energy. The town's Planning Commission expected to complete a "Climate Adaptation and Sustainability Plan" in 2011.	2	Zoning will control the alteration of natural flood plains. Town should regulate construction of flood barriers that unnaturally divert flood waters or increase flood hazard in other areas.	2	Zoning protects aquifers, groundwater, and prevents erosion. New development must result in no increase in stormwater runoff.	Member of FEMA's CRS. Residents receive a 5% discount on flood insurance.	GIS town map online.	5
Fairfield	2	Town zoning regulations account for flood vulnerability, both coastal and inland. The town's Shellfish Report covers conservation and restoration of threatened shellfish habitats.	2	Town zoning regulations detail flood area zoning for coastal and inland property, and call for stormwater erosion control. The Fairfield Town Green (an ad hoc committee addressing impacts of climate change) published the Fairfield Shelfish Report, which addresses environmental conservation of shellfish habitats to protect economic interests.	1	Zoning regulations require developers to supply new sewer and water supply systems to protect from flood contamination	2	New development and redevelopment projects must control for stormwater runoff to protect water quality. Zoning regulations protect against soil erosion.	Basic compliance: member of NFIP, Regular Program.	FEMA flood zone map.	11

Greenwich	1	POCD says town is vulnerable to increased flooding because of increased development, more impervious surfaces, and sea level rise.	1	POCD addresses global warming sea level rise. Town will consider joining ICLEI.	1	The Greenwich Flood and Erosion Control Board is authorized to plan, construct, repair, and maintain a flood or erosion control system, but will likely need to work with state and federal governments.	1	Regulations protect land and property in flood zones.	Basic compliance: member of NFIP, Regular Program. Town aspires to join the NFIP's CRS	FEMA flood zone map in POCD.	20
Groton	2	The Groton Coastal Climate Change Project assesses vulnerability and offers recommendations for the impact of climate change. The POCD addresses flooding risks.	2	The Groton Coastal Climate Change Project makes recommendations to combat the impact of climate change. POCD addresses flooding.	3	Existing buildings should be flood-proofed. Vulnerable land that can act as a flood buffer should be purchased by the town. Flood tide gates should be installed on the coast.	2	Zoning incentives to retreat from areas vulnerable to flooding. Redevelopment restrictions prevent building in areas vulnerable to flooding.	Basic compliance: member of NFIP, Regular Program.	Natural resource map of flood zones in POCD.	5
Guilford	2	The Municipal Coastal Plan assesses the town's vulnerability to sea level rise and provides policy recommendations. The POCD addresses flooding, erosion, and the safety of the water supply.	2	Municipal Coastal Plan includes policy recommendations in response to the climate change-induced sea level rise. POCD addresses flooding, erosion, and safety of water supply.	4	The Department of Public Works building should be relocated outside of the coastal flood zone. Town should acquire sensitive land. Town should improve storm damage systems. Town should dredge the harbors.	2	Zoning controls the growth rate of residential development, and reduces the amount of impervious surfaces allowed in commercial development, to avoid an increase in stormwater runoff. Zoning should minimize extensive changes in topography (steep slopes, wetlands, wetland buffers).	Basic compliance: member of NFIP, Regular Program. Town aspires to join the NFIP's CRS.	GIS town map online.	5

Madison	1	POCD notes coast's vulnerability to hurricanes, floods, and erosion	1	POCD recommends zoning restrictions to protect wetlands, floodplains, watercourses; prevent further coastal erosion; and prevent damage to coastal property during storms.	1	Town should discourage or prevent the use of flood or erosion control structures, except when necessary to protect property or water resources (structures such as sea walls actually deflect storm energy onto property).	2	Zoning prevents development on wetlands, floodplains, watercourses, and steep slopes. Zoning encourages coastal property owners to build as far from eroding shore areas as possible.	Basic compliance: member of NFIP, Regular Program.	Map of vulnerable coastal area in POCD FEMA flood zone map.	3
Milford	2	The 2002 POCD assesses vulnerability to flooding. The town's Health Department has assessed the public health impacts of global warming, and is a member of the CT DEEP's subcommittee on climate change adaptation.	2	POCD makes recommendations to improve zoning to minimize flood damage. The Health Department has been proactive in public education and preparedness about climate change induced public health risks.	1	Town will pursue state and federal funds to repair and restore damaged floodplains and drainage systems.	3	Zoning protects tidal wetlands. Town will create a Stormwater Management Ordinance. Zoning forbids multi-unit residential development in flood hazard areas	Basic compliance: member of NFIP, Regular Program.	GIS town map online.	8
New Haven	1	Town conducted vulnerability assessments for transportation and public health	3	Town acts to prevent and mitigate flooding. Town's Climate Action Plan seeks to reduce emissions in transportation and energy. Town is a member of ICLEI.	1	Salt marsh restoration will improve productivity of floodplains.	1	Zoning limits construction of new buildings within FEMA flood zones.	Basic compliance: member of NFIP, Regular Program. Town aspires to join the NFIP's CRS.	GIS town map in Hazard Mitigation Plan. FEMA flood zone map in POCD.	10

New London	2	Town has a Comprehensive Stormwater Management Plan to address flood threats. POCD makes policy recommendations to counteract flood and water pollution risks.	3	The Comprehensive Stormwater Management Plan outlines plans to repair flood basins and other stormwater systems as well as increase public awareness about the dangers of flooding. Town is a member of ICLEI.	2	Town should support installation of new sanitary pump facilities, using CT DEEP grants that provide 75% support. A systematic maintenance system for catch basins and street sweeping would reduce pollution from runoff.	1	Zoning regulates building in flood zones.	Basic compliance: member of NFIP, Regular Program.	Coastal flood zone map in POCD.	3
Norwalk	0		1	Town has prepared for some of the FEMA projected flooding.			1	Development restricted in FEMA flood zones.	Basic compliance: member of NFIP, Regular Program. Former member of FEMA's CRS (part of the NFIP from 1993-1998).	Env. and infra-structure map in POCD.	12

Old Lyme	0		1	The town has adopted the Connecticut River Estuary Regional Planning Agency's Hazard Mitigation Plan which specifically addresses flood zones and flood responses. In addition to flooding efforts, POCD plans to protect important coastal resources like tidal wetlands and other natural resources that can mitigate flooding effects.			1	Zoning regulated in FEMA flood zones. Buildings near tidal wetlands are required to have a coastal management plan. The town has planned to meet state zoning requirements outlined by the Coastal Management Act.	Basic compliance: member of NFIP, Regular Program.	FEMA flood zone map.	3
Old Saybrook	2	Town has a Natural Hazard Mitigation Plan to address the effects of the sea level rise on town property. POCD addresses flood hazards.	2	POCD says a policy should be developed to "preserve forestlands and bodies of water which naturally absorb significant amounts of carbon dioxide." It also calls for the protection of coastal wetlands and management of floodwater channels to reduce the effects of flooding.	0	Funding barrier will be hard to overcome. Specifically, the number of properties and people affected by the sea level rise predictions will be very difficult to handle.	2	New zoning and building permits prohibit the creation of new lots in flood areas unless the lot contains some upland area as well. Zoning complies with FEMA guidelines.	Basic compliance: member of NFIP, Regular Program.	Coastal resources and floodplains map online.	4

Stamford	2	The town planning department has completed a climate change vulnerability assessment. POCD's Sustainability Amendment addresses threat of climate change.	2	POCD describes adaptation and mitigation efforts that need to be undertaken, including storm warnings, storm drain systems, a climate budget, controlling development, yearly climate change assessments, tracking research in the field. Town is a member of ICLEI.	1	Too early to tell. Ms. McKenna thinks it is definitely possible once climate change becomes more on town-level agendas.	1	Minimum building height above sea level raised by one foot in 2002, as part of CRS.	Over-compliance: member of FEMA's CRS. Residents receive a 15% discount on flood insurance in high hazard areas.	Coastal flood zone map in town plan	4
Stonington	0		1	Town planning addresses flood prevention and drainage	0	At this point, the town is in preliminary discussions about climate change, and therefore it is hard to tell if purchasing capital and projects will be able to respond to climate change threats.	2	Building restricted in coastal high hazard flood zones. Zoning complies with FEMA flood maps.	Over-compliance: member of FEMA's CRS. Residents receive a 5% discount on flood insurance in high hazard areas.	Flood zone map in POCD.	5
Stratford	0		1	Town upgraded drainage infrastructure in 2011, which significantly reduced flood damage from Hurricane Irene.	1	Evacuation procedures, drainage projects, and floodplain management are all priorities.	1	Zoning complies with FEMA guidelines on floodplains to prevent and minimize flood damage	Basic compliance: member of NFIP, Regular Program.	Coastal flood zone map in POCD.	5

Waterford	1	Town will complete a vulnerability assessment as part of the hazard mitigation plan in 2012.	2	POCD calls for monitoring the sea level rise, and general policies to minimize flood damage and prepare for and respond to flooding. The town is also a member of a coastal resilience program through The Nature Conservancy.	1	Town will make improvements to react to identified threats.	2	Building and zoning codes comply with FEMA regulations. Minimum building height above sea level raised by one-foot in threatened areas.	Basic compliance: member of NFIP, Regular Program.	Flood zone map in POCD. Potential Category 3 storm flooding map in POCD.	5
West Haven	0		2	Most of town's efforts in response to climate change have to do with flooding. Specifically, the Inland Wetlands Conservation Project protects valuable flood barriers. A drainage project through the DOT will significantly increase the town's ability to cope with flooding.	1	Town is improving drainage systems through the DOT, and capital improvements to meet future threats will continue if funding for projects is granted at the state level.	2	Zoning and building codes prevent and mitigate flooding in accordance with FEMA policies. GIS identifies conservation areas that are threatened by development and flooding.	Basic compliance: member of NFIP, Regular Program.	FEMA flood zone map in POCD	4

Westbrook	0		3	POCD calls for adoption and implementation of a "Hazard Mitigation Plan" that would address flood risks related to sea level rise. Town should coordinate with federal guidelines like FEMA's CRS. The town is also going to be part of a study group for a Climate Policy Adaptation Study through NEMO and CLEAR.	1	Town plans to upgrade emergency shelters and emergency response.	3	Zoning complies with FEMA guidelines for floodplains to minimize flood damage. Town raised freeboard requirements for commercial buildings within floodzones. Flood certifications are required when building permits are issued.	Basic compliance: member of NFIP, Regular Program. Former member of FEMA's CRS (part of the NFIP from 2005-2011).	Flood zone map in POCD.	5

Westport			1	Town belongs to the Southwestern Regional Planning Agency's hazard mitigation plan, but has no other municipal level actions.	2	Town has upgraded the fire department in terms of both personnel and equipment. The town also was able to respond to the recent storms efficiently by opening and operating their shelters quickly and efficiently as well as monitoring safe evacuations from threatened areas. These actions coupled with the response and aid from FEMA inspired confidence in Westport's ability to respond to and address future threats.	1	Zoning encourages gradual retreat from coastal low-lying areas citing concern for climate change and sea level rise.	Over-compliance: Member of FEMA's CRS. Residents receive a 10% discount on flood insurance in high hazard areas.	Flood zone map online.	16

A Local Solution for Climate Change: The Climate Adaptation Board

Carl L. Zimmerman and Katharine Owens [1]

Abstract: Climate change will impact coastal water resources like wetlands and watercourses, and tidally influenced areas in Connecticut because of sea level rise and potential weather pattern changes. The impacts will occur across a variety of temporal and spatial scales. Climate change adaptation is a multi-faceted political, legal, and land use issue that will potentially change the character of many communities. It is also a thorny governance problem because of conflicting jurisdictions, limited natural resources, and changing land uses. Existing governance entities that conduct natural resource governance have jurisdictional overlap, do not match the scale of the necessary climate adaptation, or are not organized to handle rapid or variable rates of climate change onset. Potential governance solutions should incorporate the "home rule" tradition in Connecticut and New England. The authors propose a new governance entity called the Climate Adaptation Board that emphasizes the advantages of municipal level governance for climate change adaptation. It is modeled after the unique Municipal Inland Wetland Agencies which are volunteer governance entities that regulate inland wetlands and watercourses within the towns of Connecticut.

I. Introduction

Climate change is the anthropogenic modification of the earth's atmosphere through the addition of carbon dioxide and other gases that alter the earth's heat budget and cause resulting changes in the climate and biosphere. A variety of dynamic and emergent health, societal, economic, ecological, and environmental impacts will potentially occur from climate change processes in Connecticut. Planning is

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already beginning in the state for direct impacts such as sea level rise, flood events and coastal erosion in and around local water resources, coastlines, wetlands and watercourses, and adjacent lands. [2]

Because water and natural resource areas act as commons area with competition between a variety of economic interests, political actors, and environmental services, land use governance systems already exist in Connecticut to manage these areas but they were not designed for dynamic environmental and land use change. Multiple governance systems in Connecticut have jurisdiction around these vulnerable water resources, coastal areas, and adjacent areas linked to these resources.[3] Potential jurisdictional and citizen conflicts over land use and divergent policy implementation approaches could occur during periods of rapid climate change. Further emergent impacts may occur at multiple temporal and spatial scales.

Connecticut has an unusual home rule political culture in water and natural resource management, and strong municipal governments. While climate change impacts will occur at multiple scales and have jurisdictional overlap, many of the direct land use impacts such as land and building inundation and infrastructure impacts will affect citizens at the site or local level. The authors propose that the current multi-jurisdictional governance approach of water resources and adjacent land in Connecticut will not be effective for handling climate change adaptation in coastal areas because jurisdictional areas are organized around activities, and not dynamic risk assessment and responses to climate change processes and impacts.[4] Rapid and flexible responses, which reflect community values to enhance legitimacy, are necessary for managing impacts at the site and local levels.

To help coastal Connecticut manage climate change and the future variability of dynamic environmental conditions, this article proposes an alternative municipal governance system called the Climate Adaptation Board (CAB) which could increase the municipal capacity to manage dynamic and chaotic climate change impacts and land use adaptation to areas in and around wetlands and watercourses. Ideally, this approach should be legitimate, equitable, and effective.[5] The CAB's gains legitimacy because it is complimentary to Connecticut's home rule and direct democracy traditions, it is equitable because it matches the scale of impacts with the scale of governance, and it is potentially effective because it is modeled on Connecticut's system of wetlands governance.

This system is modeled after the Municipal Inland Wetland Agencies (MIWA) through which each of the 169 towns manages their own wetlands and watercourses with an unpaid executive board with enforcement powers that determines allowable activities and development around local natural resources.[6] A bottom-up governance approach for natural and water resource areas impacted by climate change could be a useful model for other communities and regions as well.

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[2] *See generally*, CONN. DEP'T OF ENVTL. PROTECTION, FACING OUR FUTURE: ADAPTING TO CONNECTICUT'S CHANGING CLIMATE (2009), *available at* http://www.ct.gov/dep/lib/dep/air/climatechange/adaptation/09032ofacingourfuture.pdf .

[3] Under Connecticut's Inland Wetlands and Watercourses Act, municipal wetland agencies have authority over activities within wetlands and watercourses, as well as activities in surrounding upland areas likely to affect wetlands and watercourse. CONN. DEP'T OF ENVTL. PROTECTION, GUIDELINES FOR UPLAND REVIEW AREA REGULATIONS UNDER CONNECTICUT'S INLAND WETLANDS AND WATERCOURSES ACT 1 (1997), *available at* www.ct.gov/dep/lib/dep/water_inland/wetlands/upland_review_document_june1997.pdf.
Upland areas designated as within the jurisdiction of the Municipal Inland Wetlands Agency are referred to as "Upland Review Areas." [hereinafter UPLAND REVIEW AREA GUIDELINES].

[4] *See* CONN. GEN. STAT. § 22a-38(13) (defining "regulated activity" not wetland areas).

[5] *See* W. Neil Adger, Nigel W. Arnell, & Emma L. Tompkins, *Successful Adaptation to Climate Change Across Scales*, 15 GLOBAL ENVTL. CHANGE 77-86 (2005).

[6] CONN. GEN. STAT. § 22a-42.

II. Connecticut Geography

Connecticut is a small urban state with approximately 600 miles of coastline, and it was originally settled in the 17th century. Population centers are on the coastal regions and along the large tidally influenced rivers. Just over a million people live in the 24 towns on the Connecticut shore of the Long Island Sound[7] and many of these coastal communities are wealthy: some are among the richest communities in the country.[8] The shoreline communities have variable population densities, land use, and zoning. Despite the presence of urban centers like Greenwich, Stamford, Bridgeport, the New Haven area, and Hartford, no town in Connecticut has a population greater than 140,000.[9] Extensive residential developments exist in coastal Connecticut, especially in wealthy Fairfield County. The potential financial impacts of sea level rise are enormous: as of 2007, about $400 billion in insured assets are present along coastal Connecticut.[10]

Connecticut sits on a passive coastal margin like much of the Atlantic coast of North America and consists of wide coastal plains and relatively flat continental shelves offshore.[11] The coastal areas of Connecticut and the surrounding regions are not virginal tracts; rather they have been subject to land use modifications and alteration for centuries. For instance, approximately 33% of the New England and Mid-Atlantic coast exhibits some type of coastal structures or development, according to data derived from an overflight and aerial surveillance in 2009.[12] When sea levels increase vertically, flat areas get inundated faster than areas with greater slopes. Glacial processes from repeated Ice Ages heavily influence the landscape with a variety of glacial features including moraines and outwash areas that are rich in sediments overlaying bedrock areas. Many of the shore regions are adjacent to higher ground, called uplands, which are typically composed of bedrock.

The shoreline areas of coastal Connecticut can be classified into four types: (A) rocky coasts; (B) bluffs with narrow fronting beaches; (C) mainland beaches connected to the mainland with fronting bluffs, dunes, or extensive wetlands; and (D) barrier island beaches. Shore types A and B are less vulnerable to sea level rise because of their resistant erosion (Type A) and their vertical elevation difference (Type B). Shore type D is sensitive to sea level rise because of the dynamic nature of barrier islands but Connecticut has only a small number of these features.[13] Much of the Connecticut shore is type C which is relatively flat, consists of sediments that erode quickly compared to bedrock; and is vulnerable to sea level rise.

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[7] While 24 towns border Long Island Sound, 33 towns have coastal access sites. Long Island Sound Resource Center, Coastal Access Guide, Town Search, http://www.lisrc.uconn.edu/coastalaccess/searchtown.asp (last visited June 14, 2012).

[8] *See* Conn. Dep't of Econ. and Community Dev., Connecticut Income Data, http://www.ct.gov/ecd/cwp/view.asp?a=1106&q=250652 (last visited June 14, 2012).

[9] CONN. DEP'T OF PUBLIC HEALTH, ESTIMATED POPULATIONS IN CONNECTICUT AS OF JULY 1, 2010, *available at* http://www.ct.gov/dph/lib/dph/hisr/hcqsar/population/pdf/pop_towns2010.pdf.

[10] CONN. DEP'T OF ENVTL. PROTECTION, NATURAL HAZARD MITIGATION PLAN FOR 2007-2010 iv (Dec. 2007) *available at* www.ct.gov/dep/lib/dep/water_inland/hazard_mitigation/plan/hazardmitigationplan.pdf.

[11] "Passive" in this context refers to the lack of interaction between plates which reduces the risks of earthquakes and subsidence events offshore.

[12] U.S. GEOLOGICAL SURVEY, NATIONAL ASSESSMENT OF SHORELINE CHANGE: HISTORICAL SHORELINE CHANGE ALONG THE NEW ENGLAND AND MID-ATLANTIC COASTS 26 (2010), *available at* http://pubs.usgs.gov/of/2010/1118/pdf/ofr2010-1118_report_508_rev042312.pdf.

[13] The adjacent state of Rhode Island has extensive barrier island features.

III. Environmental Impacts of Climate Change

Long-term sea rise (i.e., vertical changes in the surface of the ocean) is part of an ongoing historical environmental trend. Worldwide sea levels are rising around 1.7 mm/year.[14] Along the Connecticut coast at New London, sea levels increased 2.13 mm (+/-0.15 mm) per year between 1939 and 1999.[15] Utilizing different models and scenarios, average sea levels have been projected to increase between 20 cm and 120 cm. The adjacent state of Rhode Island utilizes sea level rise estimates of between three and five feet (i.e., between 1 and 1.66 meters) for planning purposes which, if accurate, will cause changes in the near shore areas such as land and habitat inundation, infrastructure damage, and property losses.[16] For New England, the historical coastline is eroding at a median rate of 0.4 m per year in the landward direction. About 70% of the sampled transects in this study are eroding in both the short-term (decadal) and long-term (geologic time). Only 3% of sampled sites are eroding more rapidly than 3 m/yr in the landward direction.[17]

The expected impacts of climate changes to coastal Connecticut include higher sea levels, more variable and severe weather conditions, and rainfall changes. The climate of the northeastern United States in the coming century is expected to become warmer with winter and summer temperatures rising from 6°F to 14°F above historic averages.[18] Winter precipitation may increase an average of 20 to 30%, with a much greater proportion of winter precipitation expected to fall as rain rather than as snow.[19] The flashiness of precipitation will increase and more storm events are likely to occur. For instance, the extreme coastal flooding that now occurs only once a century could strike New York City on average once every decade and every year or two in Boston and Atlantic City.[20] Connecticut has seen several historic flood events in the past decade though the precise link with climate change is unknown and difficult to quantify.

IV. Land Use Impacts and Adaptation

In referring to adaptation, this article emphasizes environmental issues such as sea level rise and extreme weather events. It does not address climate change adaptation in its entirety, including health or infrastructure adaptations. The environmental, economic, and political impacts of climate change will occur over spatial scales and may unfold in chaotic, unpredictable, and variable time frames. The unpredictable impacts will enhance disputes over property damage, the utilization of natural systems, and water access as citizens and different levels of government struggle with resource losses and funding adaptation responses. Many direct and critical impacts of climate change (coastal inundation of houses, damage to infrastructure, changes in runoff patterns) will be primarily experienced at the site, local, and intra-municipal levels by the citizens of Connecticut and others in coastal areas.

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[14] U.S. ENVTL. PROTECTION AGENCY, U.S. CLIMATE CHANGE SCIENCE PROGRAM, COASTAL SENSITIVITY TO SEA LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 2 (2009), *available at* http://www.epa.gov/climatechange/effects/coastal/pdfs/SAP_4-1_SynthesisandAssessmentProduct.pdf.

[15] *Id.* at 19.

[16] NOAA COASTAL SERVICES CENTER, LOCAL STRATEGIES FOR ADDRESSING CLIMATE CHANGE 12 (Feb. 2009), *available at* https://www.csc.noaa.gov/magazine/climatechangestrategies.pdf.

[17] USGS, *supra* note 12, at 27.

[18] PETER C. FRUMHOFF ET AL., CONFRONTING CLIMATE CHANGE IN THE U.S. NORTHEAST: SCIENCE, IMPACTS, AND SOLUTIONS x (2007), *available at* http://www.northeastclimateimpacts.org/pdf/confronting-climate-change-in-the-u-s-northeast.pdf.

[19] *Id.* at 8.

[20] *Id.* at 15.

A. Stormwater and Runoff Changes

If as expected the typical design[21] storms increase and rainfall becomes more "flashy" than expected, stormwater systems away from coastlines may become more vulnerable to flooding, erosion, and infrastructure damage. Rapid expenditures of money for infrastructure repair may become common. New urban development and the associated construction of impervious surfaces, like rooftops, roads, and parking lots, make flood risk potentially even more severe because the addition of impervious cover alone in a watershed can increase runoff exponentially.[22] Climate change will impact stormwater infrastructure both in single storm events and over greater durations as stream and receiving water change to meet altered precipitation, runoff, and evapo-transpiration patterns. The U.S. Army Corp of Engineers believes that, "**climate change could affect all sectors of water resources management**, since it may require changed design and operational assumptions…" and long-term assumptions of continual environmental change.[23]

B. Coastal Impacts and Adaptations

Coastal impacts will occur because of sea level rise, a very slow process, and the increasing frequency of large storms, which are sudden and unpredictable. The process of sea level rise will take decades.[24] In addition, emergent environmental and social impacts may occur that are unpredictable and require an avenue for adaptive management. For instance, conflicts may occur over the zoning enforcement of adaptive management methods, and the reaction to the variable property impacts (i.e., abandonment versus adaptation versus accommodation) which depend on the financial resources and political connections of local citizens. Intra-community conflicts over perceived fairness of the municipal governance system may become more common.

As with other land use problems, the adaptation issues, problems, and conflicts related to climate changes are multivariate and multi-dimensional. Unexpected emergent processes and impacts must be accounted for with climate change and sea level rise adaptation. Therefore, adaptation solutions for climate change in Connecticut include different components of land use management, engineering, conservation, and governance with different time horizons and spatial scales. Solutions can be grouped into the following categories: (1) shoreline armoring and elevation change, (2) accommodation, and (3) retreat.[25] Already in Connecticut, conflicts exist between state environmental professionals who favor "soft" and non-structural planning-oriented solutions, and local officials and property rights advocates who want the flexibility to control their own property and limit takings.[26] A recently passed law in Connecticut attempts to balance these two sides by incorporating sea level rise planning into state policy for the first time while discouraging structural protection schemes.[27] This is a policy that is far

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[21] A design storm is the volume, rate, or depth of precipitation that an engineered water resources system is designed to handle.

[22] *See* Chester Arnold & James Gibbons, *Impervious Surface Coverage,* 62 J. OF THE AM. PLAN. ASS'N 243-58, (1996).

[23] U.S. ARMY CORPS OF ENGINEERS, USACE CLIMATE CHANGE ADAPTATION PLAN AND REPORT 2011 4 (Sept. 2011), *available at* http://www.corpsclimate.us/docs/usaceadaptnplanreport2011v02.pdf (emphasis in original).

[24] *Id.* at 33.

[25] JAMES TITUS, U.S. ENVTL. PROTECTION AGENCY, ROLLING EASEMENTS 1 (2011), *available at* www.epa.gov/cre/downloads/rollingeasementsprimer.pdf.

[26] Jan Spiegel, *Coastal Management Legislation Balances Environmental Concerns with Property Rights*, THE CT MIRROR, May 9, 2012, *available at* http://www.ctmirror.org/story/16289/coastal-management-legislation-balances-environmental-concerns-property-rights (last visited June 15, 2012).

[27] An Act Concerning the Coastal Management and Shoreline Flood and Erosion Control Structures, 2012 Conn. Legis. Serv. P.A. 12-101 (S.B. 376) (June 8, 2012).

harder to implement in urban areas than rural areas. Nevertheless, the Connecticut Department of Energy and Environmental Protection (DEEP) has jurisdiction on coastlines where impacts will be felt first by citizens within local towns. The law of erosion or law of accretion is a common law concept (both marine and riverine) where the property boundary moves with the natural boundary line and it appears to apply here.[28] No matter how far the coastline migrates into the Connecticut municipalities, DEEP will have jurisdiction at the coastal interface between land and water.

V. Issues in Governance and Natural Resource Management

A. Bottom-up vs. Top-down Governance

Water and natural resources areas, such as coastal wetlands and watercourses, are complex natural resource systems that are difficult to manage and govern because of overlapping jurisdictions, multiple ownership, and the functioning of their resource and land use areas as a commons.[29] These areas have a limited capacity to provide environmental services and products. Conflicts over natural and water resource commons may become more dynamic and unpredictable with additional problems interlinking between scales of governance. These changes can be difficult to manage due to variability in process scales and spatial distribution of resources.[30] Top-down governance structures have many strengths when it comes to managing natural resource commons including the application of significant financial and human resources to problems such as climate change, the consistency in the application of laws over different regions, and the ability to control local governance. But large institutions, such as state governments, can also be slow to adapt to dynamic changes and blunt in their governance approach with smaller governmental entities: a critical consideration in a home rule state such as Connecticut. A potential problem with centralized resource governance is the inability to recognize that individual ecological regions are composed of a unique mix of biophysical and social attributes: another critical consideration in a state like Connecticut with remarkable geographic, social, and economic diversity.[31]

Local governance has many benefits that are particularly useful for water and natural resource areas potentially impacted by climate change. When detailing the benefits of local decision-making, researchers focus on closeness to the issues, local knowledge, and participation. Community resource management puts management in the hands of local populations, who have more interest in sustainable use than higher-level managers or corporations.[32] For instance, "local communities are more cognizant of the intricacies of local ecological processes and practices; and they are more able to

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[28] JOHN JACOB & STEPHANIE SHOWALTER, THE RESILIENT COAST: POLICY FRAMEWORKS FOR ADAPTING THE WETLANDS TO CLIMATE CHANGE AND GROWING COASTAL AREAS OF THE U.S. GULF OF MEXICO 23 (2007), *available at* http://www.urban-nature.org/publications/documents/ResilentCoastWetlands-sm.pdf.

[29] *See* Elinor Ostrom & Harini Nagendra, *Insights on Linking Forests, Trees, and People from the Air, On the Ground, and in the Laboratory*, 103 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE U.S.A. 19,224-19,231 (2006).

[30] *See* Krister Andersson & Elinor Ostrom, *Analyzing Decentralized Resource Regimes from a Polycentric Perspective*, 41 POL'Y SCI. 71-93 (2008).

[31] *See* Harini Nagendra & Elinor Ostrom (Lead Author); Peter Saundry (Topic Editor), *Governing the Commons in the New Millennium: A Diversity of Institutions for Natural Resource Management*, *in* ENCYCLOPEDIA OF EARTH (Cutler J. Cleveland, ed. First published in the Encyclopedia of Earth Aug. 12, 2008; Last revised Date August 12, 2008), http://www.eoearth.org/article/Governing_the_commons_in_the_new_millennium:_A_diversity_of_institutions_for_natural_resource_management (last visited June 15, 2012).

[32] *See* Anna Lowenhaupt Tsing, J. Peter Brosius & Charles Zerner, *Assessing Community-based Natural-resource Management*, 28 AMBIO 197–99 (1999).

effectively manage those resources through local or 'traditional' forms of access."[33] There are also advantages to decentralized systems and local knowledge.[34] Several scholars contend that localized decision-making is the key to achieving social justice and ecological sustainability and that incorporating indigenous knowledge is critical.[35]

That being said, local governance is challenging. Some researchers posit that local governance is no better than any other kind of governance. Researchers argue against what they call the "local trap" of "development researchers and practitioners falsely assum[ing] that localized decision-making is inherently more socially just or ecologically sustainable." It can be argued that there is nothing inherent about scale, whether positive or negative.[36] Others cite evidence that so-called participation can devolve into a scenario where locals are "co-opted simply to slot into [pre-determined] externally defined objectives."[37] To answer these problems, scholars promote a "sophisticated governance system [which] recognizes the multi-scale aspects of natural resource governance as well as the presence of countervailing incentives, and seeks to correct them."[38] In Connecticut, the local MIWAs, if aggregated geographically, have avoided the "local trap" by independently governing and policing their own municipalities. They successfully permit, enforce, and work with other levels of government and balance land use impacts and natural resource protection in and around wetlands and watercourses.[39]

B. Matching Scale of Governance to Process Impacts

The environmental (inundation, flooding, weather pattern changes, flash flooding) and social (loss of housing, recreational resources, community buildings, infrastructure damage) impacts of climate change may occur across many scales. For the communities of Connecticut, many of the impacts are experienced within municipalities or even at the site level. "Bridging organizations" or boundary-spanning strategies can provide governance links across scales and at multiple levels.[40] Elinor Ostrom, a Nobel Prize winner, describing research on climate change and adaptation, encourages polycentric governance approaches that "facilitate achieving benefits at multiple scales as well as experimentation and learning from experience with diverse policies."[41] She proposes that climate change in particular should be addressed through "small- to medium-scale units that are linked together through diverse information networks."[42] Andersson and Ostrom posit that a "sophisticated governance system

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[33] *Id.* at 197.
[34] *See* Andersson & Ostrom, *supra* note 30.
[35] *Id. See also*, Nancy Peluso, *Traditions of Forest Control in Java: Implications for Social Forestry and Sustainability*. 32 NAT. RESOURCES J. 883–918 (1992) and Tsing, *supra* note 32.
[36] *See* Mark Purcell & Christopher Brown, *Against the Local Trap: Scale and the Study of Environment and Development Progress*, 5 DEV. STUD. 279–97 (2005).
[37] Peris Jones, *Urban Regeneration's Poisoned Chalice: Is There an Impasse in Community Participation-Based Policy?* 40 URBAN STUD. 581, 599 (2003).
[38] Andersson & Ostrom, *supra* note 30, at 88.
[39] *See* CONN. DEP'T OF ENVTL. PROTECTION, STATEWIDE INLAND WETLANDS AND WATERCOURSES ACTIVITY REPORTING PROGRAM, STATUS AND TRENDS FOR THE YEAR 2007 (2010), *available at* http://www.ct.gov/dep/lib/dep/water_inland/wetlands/stat_trends__2007_full_doc.pdf [hereinafter STATUS AND TRENDS REPORT].
[40] *See generally*, Nitaya Kijtewachakul, Ganesh P. Shivakoti, & Edward L. Webb, *Forest Health, Collective Behaviors, and Management,* 33 ENVTL. MGMT. 620-36, (2004). *See also*, Carl Folke et al., *Adaptive Governance Of Social-Ecological Systems,* 30 ANN. REV. ENVTL. RESOURCES 441-73 (2005).
[41] Elinor Ostrom, *Polycentric Systems for Coping with Collective Action and Global Environmental Change*, 20 GLOBAL ENVTL. CHANGE 550, 550 (2010).
[42] *Id.* at 556.

recognizes the multi-scale aspects of natural resource governance as well as the presence of countervailing incentives, and seeks to correct them."[43]

There may be inherent challenges of the governance of natural resource systems include matching scales of biogeophysical systems with scales of management systems, avoiding scale discordance; and accounting for cross-scale dynamics.[44] To address such challenges, scholars recommend using boundary spanning between scientists, decision-makers, and political actors at different scales, as well as using "scale-dependent comparative advantages – coordinating the allocation of resources, technical expertise, and decision-making authority to best capitalize on scale-specific capabilities," and "employ[ing] adaptive assessment and management strategies constructing long-term, iterative, experiment-based processes of integrated assessment and management."[45] To achieve the goals of climate change adaptation policies, "multi-stakeholder processes must formally feed into decision-making forums or they risk being viewed as irrelevant by policy-makers and stakeholders."[46]

VI. Governance of Natural Resources In Connecticut

Some of the critical properties of governance necessary for management of the non-linear and dynamic impacts of climate change are (1) the ability of an organization to learn, (2) matching the scale of biophysical systems with management scale, and (3) the deployment of resources at the appropriate scale. As a New England state, Connecticut shares in the regional tradition of direct democracy and local governance.[47] Connecticut has a strong tradition of "home rule" governance. It is a philosophy of sufficient importance that a website called the Connecticut's Heritage Gateway has its own section on Home Rule.[48] As part of the home rule philosophy, Connecticut disbanded much of the power of county governments in the 1960s. Furthermore, larger metropolitan-style governments are not popular with the citizens of Connecticut. The citizens of Connecticut identify with their local government despite the inherent inefficiencies of this approach for managing regional land use problems and political issues.[49] As such, governance in and around natural and water resources within Connecticut is controlled primarily by the 169 towns and the state government.

The coastal areas of Connecticut are on the front lines of climate change impacts and most of the potential impacts such as inundation, flooding, and infrastructure damage are experienced at fine scales within municipal boundaries such as the local or site scale. Natural and water resources, along with adjacent areas potentially impacted by climate change, are concurrently managed within a complicated system of overlapping local and state jurisdictions.

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[43] Andersson & Ostrom, *supra* note 30, at 88.

[44] *See* David Cash & Susanne Moser, *Linking Global and Local Scales: Designing Dynamic Assessment and Management Processes*, 10 GLOBAL ENVTL. CHANGE 109-20 (2000).

[45] *Id.* at 118.

[46] Evan Fraser et al., *Bottom Up and Top Down: Analysis of Participatory Processes for Sustainability Indicator Identification as a Pathway to Community Empowerment and Sustainable Environmental Management*, 78 J. OF ENVTL. MGMT. 114, 114 (2006).

[47] *See* JOSEPH ZIMMERMAN, THE NEW ENGLAND TOWN MEETING: DEMOCRACY IN ACTION (Praeger Pub.: Westport, CT 1999).

[48] Connecticut's Heritage Gateway, *City, Town, Burough, County*, http://www.ctheritage.org/biography/topical_govsince1818/city.htm (last visited Jan. 15, 2012). At the time of publication, this webpage is no longer available. The Connecticut Humanities Council has launched a new website at http://connecticuthistory.org/.

[49] *See* Neil O. Littlefield, *Municipal Home Rule – Connecticut's Mature Approach*, 37 CONN. BAR J. 390 (1963).

A. Jurisdictions within Coastal Areas

In the state of Connecticut, wetlands and watercourses are regulated simultaneously by the state (a top-down governance system) and from within the municipalities (local or bottom-up control) in an overlapping and complicated governance structure. The Connecticut Department of Energy and Environmental Protection (DEEP), Office of the Long Island Sound (OLISP) has jurisdiction over tidal wetlands[50] and navigable waters of the state through the Structures, Dredging and Fill Act[51] and the Tidal Wetlands Act.[52] OLISP issues permits for activities to citizens from across the coastal areas of Connecticut and may also review the impact of activities in surrounding uplands.

In addition, the Connecticut Coastal Management Act[53] (CMA) lays out the legislative findings of general goals and policies for coastal areas and Long Island Sound which include maintaining the "natural relationship between eroding and depositional coastal land forms … and … minimiz[ing] the adverse impacts of erosion and sedimentation on coastal land uses through the promotion of nonstructural mitigation measures."[54] The CMA identifies those land use activities that require review by municipalities and which are exempt. Shoreline flood and erosion control structures which are likely important in inundation controls have a particularly severe threshold for approval under the CMA as an applicant needs to meet seven criteria designated by DEEP. For example, a control structure is not consistent with the CMA unless, among other thing, there has been a "*clear* and *compelling* demonstration that nonstructural alternatives such as vegetative stabilization … are not possible" and that "… there is clear evidence of *significant* erosion or flooding."[55] DEEP has direct jurisdiction over activities occurring in *tidal wetlands* and/or waterward of the coastal jurisdiction line, while a municipality regulates upland activities under local planning and zoning authority landward of the coastal jurisdiction line.[56] (See Figure 1).

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[50] CONN. GEN. STAT. § 22a-29(2). (Wetland is defined as "areas which border on or lie beneath tidal waters, such as, but not limited to banks, bogs, salt marsh, swamps, meadows, flats, or other low lands subject to tidal action, including those areas now or formerly connected to tidal waters, and whose surface is at or below an elevation of one foot above local extreme high water; and upon which may grow or be capable of growing some, but not necessarily all, of the following: Salt meadow grass …")

[51] *Id.* §§ 22a-359–22a-363(f). This act authorizes DEEP to regulate dredging, erection of structures, and fill and give regard to fish and wildlife and the prevention of shore erosion and coastal flooding for the tidal, coastal, or navigable waters of the state on the water side of high tide. *See* National Oceanic and Atmospheric Administration, Digital Coast, Legislative Atlas, *Structures Dredging And Filling Act*, http://www.csc.noaa.gov/legislativeatlas/lawDetails.jsp?lawID=197 (last visited June 15, 2012).

[52] CONN. GEN. STAT. §§ 22a-28–22a-35a.

[53] *Id.* §§ 22a-90–22a-111.

[54] *Id.* § 22a-92(2)(J).

[55] Office of Long Island Sound Programs, *Shoreline Flood and Erosion Control Structures Consistency Checklist*, *in* CONNECTICUT DEP'T OF ENVTL. PROTECTION, CONNECTICUT COASTAL MANAGEMENT MANUAL (2000), *available at* http://www.ct.gov/dep/lib/dep/long_island_sound/coastal_management_manual/manual_08.pdf.

[56] Office of Long Island Sound Programs, *Fact Sheet for State and Municipal Regulatory Jurisdictions*, *in* COASTAL MANAGEMENT MANUAL, *supra* note 55.

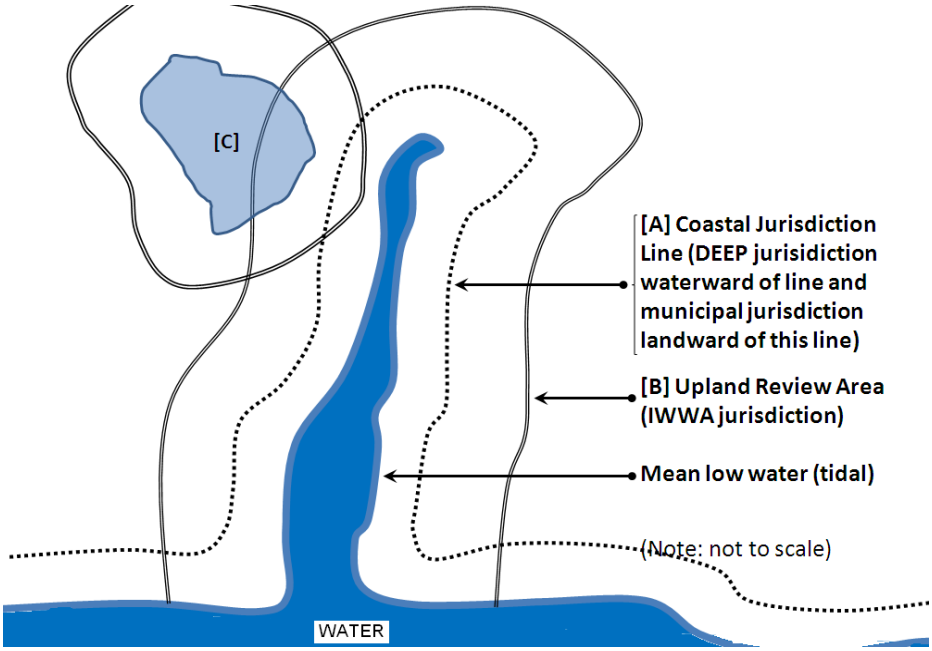

Fig. 1: Coastal jurisdiction relationship between the state of Connecticut and municipalities.

B. Municipal Authority

Municipalities are strong in Connecticut. The rights of the municipalities include powers for taking and acquiring property; providing public services, management of drainage, responsibility for keeping streets open, and providing for the protection of the environment.[57] In addition, Connecticut law provides protection for municipalities in the case of losses: "When it becomes necessary and feasible for a municipality to safeguard itself from losses, to acquire, purchase, foreclose on, manage or operate, hold or dispose of development property ... incidental to the protection of its interests under any law, mortgage contract or agreement."[58] The Connecticut Legislature has given far-reaching powers to the municipality.

Municipalities in the state of Connecticut have created several commissions that can have jurisdictional influence in natural resource and water resource commons areas influenced by climate change including the Municipal Inland Wetlands Agencies (MIWAs), Planning and Zoning Commissions (PZ), and the less common Conservation Commissions (CC). The governance of non-tidal, inland wetlands and watercourses[59] is guided by the Inland Wetlands and Watercourses Act (IWWA)[60] which allocates jurisdiction of land use activities in and around wetlands and watercourses to town-level permitting entities (i.e., MIWAs).

Connecticut has 170 MIWAs representing the 169 towns of Connecticut. Each utilizes a bottom-up approach, is run by volunteers or unpaid appointees, and is independent of the federal[61] and state

[57] *Id.* § 7-148(c).
[58] *Id.* § 7-483(g).
[59] Watercourses are defined in Conn. Gen. Stat. § 22a-38(16) using general terms such as "... rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs, and all other bodies of water, natural or artificial..."
[60] CONN. GEN. STAT. §§ 22a-36–22a-45
[61] The U.S. Army Corps of Engineers is the lead federal permitting agency for activities in wetlands and navigable waters of the United States.

wetland and water resource management systems.[62] Each also has potential influence on the management of coastal areas. The MIWAs may review activities outside their primary inland wetlands[63] and watercourses jurisdiction within an administrative review area or buffer[64] called the Upland Review Areas (URA).[65] Activities in the URA and areas beyond may be evaluated by the MIWA for potential physical impact to local water resources including wetlands and watercourses.

Because the watercourse definition is broad and does not include a scientific classification system like that available for wetlands, most "bodies of water" fall under the regulatory authority of municipalities. This is true even if the body of water is immediately adjacent to coastal areas, which can extend municipal jurisdiction into areas generally under the management of DEEP. Case law has not resolved this jurisdictional issue, but a joint guidance letter from DEEP's Inland Water Resources Division and OLISP noted, "Fortunately, this legal uncertainty has rarely been of more than theoretical importance, as most municipalities have not regularly asserted jurisdiction over tidal, coastal or navigable waters."[66]

Planning and Zoning Commissions are typically combined in the towns of Connecticut. The Planning Commission has powers and duties related to long-term management of the towns. Responsibilities include development of a Plan of Conservation and Development on a 10-year cycle. This plan identifies the most attractive land uses and can designate areas for conservation and preservation. In addition, the Planning commission has responsibilities for infrastructure planning, making recommendations for important and sensitive land uses like street and bridge locations, and regulating the subdivision of land.[67] The Zoning Commission has specific powers and duties related to the density, height, size, location, and placement of buildings, including water dependent uses. In addition, the Zoning Commission can create districts that have specific criteria (e.g., village districts) and can create special exemptions for density limits.[68] The Conservation Commissions have relatively limited power and are intended to help with planning and management, research, and inventory of local natural and cultural resources.[69]

Since the 1940s the state of Connecticut has recognized the need to address regional issues for development and efficiency purposes. The core of this process remains "comprehensive planning."[70] This is defined as simultaneous planning of distinct elements such as housing, economic development, transportation, land use, and water and sewer services.[71] The primary governance entity bridging the scale gap between municipalities and the state in Connecticut are the regional planning organizations

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[62] The DEEP Wetlands Management Section provides training and technical support for the MIWAs but does not evaluate permits.

[63] Wetlands in Connecticut are defined by soil drainage class and floodplain soils. *See* Conn. Gen. Stat. § 22a-38(15).

[64] In Connecticut, buffers are typically 100 feet.

[65] *See* UPLAND REVIEW AREA GUIDELINES, *supra* note 3.

[66] Letter from Charles Berger, Director, Inland Water Resources Division, and Charles Evans, Director, Long Island Sound Programs, to Richard Holloway, Chairperson, Town of Chester Inland Wetland and Watercourse Agency re: Municipal Inland Wetlands And Watercourses Jurisdiction Over Tidal, Coastal, And Navigable Waters (July 2, 2001) (on file with authors).

[67] Michael Zizka, *What's Legally Required: A Guide to the Legal Rules for Making Local Land use Decisions in the State Of Connecticut*, CT DEP BULLETIN 39 (7th ed., 2004).

[68] *Id.*

[69] CONN. GEN. STAT. § 7-131a.

[70] CONN. ASS'N OF REGIONAL PLANNING ORG., THE GEOGRAPHIC SCOPE OF CONNECTICUT'S REGIONAL PLANNING 8 (2010), *available at* http://www.hvceo.org/GEOGRAPHIC_SCOPE_OF_CT_REGIONAL_PLANNING.pdf.

[71] *Id.*

(RPO) that are charged with providing assistance to municipalities. Three types of RPO are allowed under Connecticut law: Regional Council of Elected Officials, Regional Council of Governments, and Regional Planning Agencies.[72] The RPOs must include representatives from the local communities within the organization.[73] RPO boundaries are determined by the Connecticut Office of Planning and Management. RPOs are organized around metropolitan areas so no RPOs are organized around coastal areas in particular – potentially problematic when handling impacts caused by climate change. In fact, there are five different RPOs that border the coastal areas of Long Island Sound.

Table 1: Primary duties of governance entities

Governance Entity	Role	Level
Municipal Inland Wetlands Commission (MIWA)	Permits activities for inland wetlands and watercourses.	Municipality/Town
Planning and Zoning Commission (PZ)	Creates conservation and development plans; districts; infrastructure plans; zoning for building placement and density.	Municipality/Town
Conservation Commission (CC)	Inventories natural resources, plays advisory role.	Municipality/Town
Regional Planning Organization (RPO)	Community planning for group of municipalities.	Regional
Connecticut Department of Energy and Environmental Protection (DEEP)	Permits activities in tidal wetlands and provide coastal management planning guidance.	State
United States Army Corps of Engineers (USACE)	Permits fill in navigable waterways.	Federal

Table 2: A comparison of adaptation type, time and spatial scale, solutions and governance entities.[74]

Adaptation Type	Time scale	Spatial Scale	Type of Solution	Governance
Shoreline armoring (rip rap)	Short, periodic	Site	Engineering	DEEP, USACE, PZ
Elevation change (fill, berming, embankments)	Short, periodic	Site	Engineering, Zoning	DEEP, MIWA, PZ
Accommodations (setbacks, rolling easements, cluster development)	Medium	Neighborhood	Planning and Zoning	PZ, CC
Retreat (abandonment, infrastructure changes, property compensation)	Long, periodic	Town	Planning	PZ, CC, Coastal Management, DEEP, USACE

VII. Municipal Inland Wetlands Agency

A. Overview of Governance Structure

The Connecticut MIWAs are a potential local model for climate adaptation governance that adheres to the tradition of home rule in New England. The MIWAs represent a unique natural resource governance system within the United States as each municipality in Connecticut governs and enforces activities in their own inland wetlands and watercourses. While the Connecticut DEEP provides a set of "model regulations" as guidance for each town, the towns create their own statutes. The MIWAs are

[72] State of Connecticut, Office of Policy and Management, *Regional Planning Organizations (RPOs) In Connecticut*, http://www.ct.gov/opm/cwp/view.asp?a=2986&q=383046 (last visited June 15, 2012).
[73] *See* CONN. GEN. STAT. §§ 4-124j, 4-124k.
[74] Adapted from TITUS, *supra* note 25.

staffed by volunteers and unpaid appointees and are independent of both the DEEP and USACE.[75] The Connecticut DEEP only provides educational and technical assistance. Rulings from a MIWA in Connecticut are not appealed to the state DEEP but directly to Connecticut Superior Court.

A justifiable managerial concern is that this sort of local governance entity lacks the sophistication to handle complicated technical and legal issues under the IWWA. Despite the possible chaos and inefficiencies of having 170 different governing entities for wetlands and watercourses within Connecticut, the MIWAs have shown the ability to improve and adapt over time (Figure 2) both in terms of progressing towards becoming a No- Net Loss state[76] and reducing the average size of impacts per application. Under the management of the MIWAs, the rate of wetland loss has decreased over time in the state of Connecticut (Figure 2) and citizen member have shown the capacity to engage in a "sophisticated governance system" as envisioned by Andersson and Ostrom.

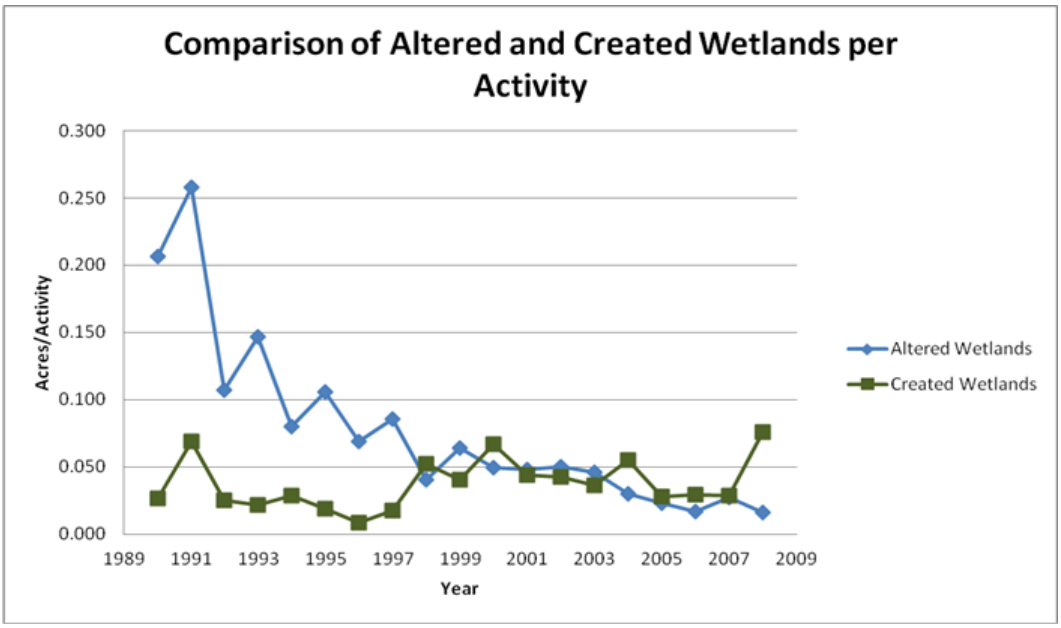

Fig. 2: The changing relationship between wetlands created and altered in Connecticut per averaged reported activity over the past twenty years

Volunteer commissioners and citizen applicants have also demonstrated that they can handle legal and scientific subtleties that balance land-use and resource protection. In the evaluation process, called the "factors for consideration,"[77] they need to balance the short- and long-term environmental impacts of activities; the potential for safety and health issues; and the potential for impact on the reasonable usage of a property. At the same time, they need to determine whether "feasible and prudent" alternatives for activities exist. To do so, they must evaluate engineering, construction, and environmental information.

The IWWA statutes include a section on agricultural exemptions. Many, but not all, land use activities associated with farming are allowed in and around wetlands "as of right."[78] Farmers, however, must first obtain a "jurisdictional ruling" from a MIWA regarding whether their agricultural activity falls

[75] The Commissioner of DEEP does review permits for state activities.
[76] STATUS AND TRENDS REPORT, *supra* note 39, at 1.
[77] *See* CONN. GEN. STAT. § 22a—41.
[78] *Id.* § 22a-40(1).

within an exemption. If the activity is exempt, farmers have no further interaction with the agency. For non-exempt activities, farmers must go through the regular application procedures.

Despite the potential for abuse of this exemption process and the complexity faced by volunteer commissions seeking to determine exemptions, impacts to wetlands and watercourses from agricultural activities have been extremely small in the past several reporting years.[79] In addition, MIWAs have enforcement powers that they utilize such as the ability to write tickets and conduct cease and correct orders against persons impacting wetlands and watercourses without a permit. This provides some evidence that local actors can be trusted to manage natural resources in an environmentally sustainable manner.

Agricultural activities share characteristics with climate change. They are ephemeral, driven by dynamic events, and somewhat random on a site basis. The experience of the MIWAs shows that volunteer commissions often incorporate a great deal of expertise and capacity, and have consistently protected natural resources over time. Many municipalities have also implemented a new statute that allows *de minimis* activities to be handled outside the normal regulatory structure and thus reduce regulatory headaches of ordinary citizens for a simple fence post of only a few square feet.[80] While this may not prove that local actors will manage climate adaptation accordingly, it demonstrates the capacity for sustainable decision-making among local actors.

Other characteristics identified in the literature as important in climate adaptation in and around natural and water resources areas include collaboration, equity, accountability and transparency, legitimacy, and water/land planning integration are found in MIWAs (Table 3). The MIWAs utilize agency members that are local appointees which enhances equity and accountability. Meetings are easily attended by citizens and neighborhood groups because of municipal scale. Local jurisdiction enhances legitimacy because the appointees are from the same town.

B. Problems with the Current Governance Structure

A governance system managing, planning, and permitting for climate change adaptation around water and natural resource areas needs to be adaptive, flexible, and scaled properly. As demonstrated earlier, the current jurisdictional structure in Connecticut has potentially significant regulatory overlap for coastal wetlands and watercourses areas. This overlap between the MIWAs, DEEP and Municipal Planning and Zoning Commissions creates a system where no single policy or governance structure is available to handle climate change oriented processes. This yields a slow and inflexible regulatory and governance framework during times of rapid environmental and land use changes.

Governance of the coastline in Connecticut is managed by the DEEP but problems exist with this approach. Civil servants manage the permitting of activities directly; therefore, decision-making is not at the local level. The DEEP's jurisdiction is limited to a thin coastal strip and may overlap with municipal authority. Finally, the DEEP's focus is not on protecting site-level impacts but coastal planning and limiting structural solutions. The RPOs have some municipal level decision-making input, but are problematic as governance vehicles because they are strictly planning-oriented and lack authority to permit impacts in and around natural resource areas. Furthermore, as currently structured, their geographic layout is not oriented around climate change and coastal impacts. The municipal scale of governance appears to be best suited for climate change adaptation in Connecticut because decision-making is by local officials on local issues and hence is closest to the home rule philosophy. In addition, different political actors join the executive boards of MIWAs ensuring a diversity of interests. Finally, these groups have local knowledge and expertise about natural resource processes and

[79] STATUS AND TRENDS REPORT, *supra* note 39, at 1.
[80] *See* CONN. GEN. STAT. § 22a-42a(c)(2).

communities. While the state of Connecticut is pursuing a "soft" non-structural approach to shoreline protection, accommodating impacts and conflicts over natural resource commons will be left to the municipalities. An alternative entity is needed to manage the potentially shifting jurisdiction of the coastline between the state and municipalities and the impacts of climate change at the local scale, and to maintain legitimacy during periods of high conflict and potentially rapid change.

VIII. Climate Adaptation Board

To emphasize a local governance approach in Connecticut, the structure of the municipally controlled MIWAs could be repurposed for climate change adaptation regulation and planning through the creation of a local, municipal level, volunteer board of governance called the Climate Adaptation Board (CAB). The board would serve as a bridging entity that incorporates knowledgeable volunteers in a local governance structure that complements the multiple levels of governance currently in place related to water and natural resources. It should retain the transparency, legitimacy, and equitability associated with the MIWA system which is part of the home rule governance tradition in Connecticut, and allow for a governance system that is aligned with local values for natural resource management and land use decision-making while being adaptable in a municipal context. A state governance entity may be less able to handle the differences in local values and physical layout associated with different community types across the urban and rural development gradient.

The CAB should occupy a hybrid governance position and should consist of local volunteers and one member each from the municipal level PZ, MIWA, CC, and emergency management office, as well as the local floodplain administrator. The CAB, of course, would have the opportunity to enlist experts as needed for planning assistance. The proposed CAB would have jurisdiction within coastal municipalities for specified rapid deployment, high-value activities determined by statute (i.e., structural improvements or potentially controversial "retreat" techniques like abandonment) and would provide recommendations and guidance for longer-term climate change adaption planning where risk assessment issues and adaptive management methods are critical. In addition, the CAB could provide recommendations to PZ and Public Works Departments for longer-term adaptation strategies that may need to change quickly from planning to implementation phases because of climate change uncertainties, particularly in rate and magnitude.

The CAB should have authority over jurisdictional inland and tidal water resource areas for those activities related to rapid, climate change adaptation. A more aggressive law could limit the state jurisdiction to the present coastal jurisdiction line so that the state jurisdiction line does not advance into municipal areas. A less aggressive law would allow for the state jurisdiction line to move with sea level rise and erosion. Similar to the agriculture exemption model of the IWWA, these activities (e.g., berming around houses) related to climate change adaptation would be reviewable by the CAB. The CAB would have the authority to bring applicants in for jurisdictional ruling as is done by the MIWA. If not part of the specific adaptation activity list, the applicant would be channeled back into the regular local and state permitting processes. The components of proposed land use activities beyond the scope of climate adaptation would also be moved into the normal municipal permitting process where speed and flexibility are not as important. If the CAB has jurisdiction over an activity, then a more severe test would exist for an expedited regulatory process.

Following the model of the URA from the MWIAs, the area of jurisdiction or administrative review could be limited to a fixed vertical distance above high tide and a fixed horizontal distance away from coastal tidal wetlands, watercourses, and upland review areas. If "rolling" jurisdictional areas impacted by horizontal changes in the shoreline and vertical changes in the water levels were part of the structure of the CAB then jurisdiction lines could be changed periodically via a GIS mapping system to accommodate the spatial changes in local jurisdictional water resources and adjacent uplands. Updated

maps could be published periodically allowing the public to understand the spatial changes in their environment and the jurisdiction of the CAB. Regional infrastructure planning such as the rerouting of state highways or utility right of ways would fall to RPOs or state-level governance entities, but finer scale activities such as local road changes would be left to the CAB. Input and cross-communication between the different levels of government would be encouraged and facilitated to the greatest degree possible which is already occurring.

IX. Evaluating the CAB

Evaluating the chances of success or failure of a Climate Adaption Board is difficult because the unfolding of spatial, meteorological, and temporal processes related to climate change is fraught with variability and uncertainties. Policy implementation, in addition, is laden with its own complexity as decades of scholarship have shown, even under ideal circumstances,[81] and important social or governance criteria may not lend themselves directly to quantitative measures. Nevertheless, researchers have developed criteria for adaptability in climate change and effectiveness in water policy. In this section, the results of several studies on climate change and water policy are discussed and compared with the system proposed above, a Climate Adaptation Board mirroring the structure of the Connecticut MIWA system. The research used in this assessment either relates to climate change adaptability exclusively, or focuses on interrelated policy areas, such as natural resource management of water quantity or achieving sustainability in general.

In evaluating climate change adaptability, criteria for evaluating success include "effectiveness, efficiency, equity, and legitimacy."[82] Judging adaptations at different scales "will involve new and challenging institutional processes."[83] In addressing local management of water shortages in Ontario, scholars found several key factors influence management effectiveness, including clarification of agency roles and responsibilities, integration of management and land use planning, recognition of both urban and rural stakeholders. Also noted was the importance of the local communities in fostering local partnerships and local transparency which is critical in translating knowledge into action in local communities.[84]

International research has shown leaders can prepare a system for change by exploring alternative system configurations and developing strategies for choosing from among possible futures.[85] Leadership functions include the ability to span scales of governance, orchestrate networks, integrate and communicate understanding, and reconcile different problem domains.[86] Scholars have created an

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[81] *See* Katharine Owens, *Understanding How Actors Influence Policy Implementation: A Comparative Study of Wetland Restorations in New Jersey, Oregon, the Netherlands, and Finland* (unpublished thesis 2008); HANS BRESSERS & KRIS LULOFS, GOVERNANCE AND COMPLEXITY IN WATER MANAGEMENT: CREATING COOPERATION THROUGH BOUNDARY SPANNING STRATEGIES (2010); MICHAEL HILL & PETER HUPE, IMPLEMENTING PUBLIC POLICY (2002); DENNIS PALUMBO & DONALD CALISTA, OPENING UP THE BLACK BOX: IMPLEMENTATION AND THE POLICY PROCESS (1990); and JEFFERY PRESSMAN & ARON WILDAVSKY, IMPLEMENTATION: HOW GREAT EXPECTATIONS ARE DASHED IN OAKLAND; OR, WHY IT'S AMAZING THAT FEDERAL PROGRAMS WORK AT ALL, THIS BEING A SAGA OF THE ECONOMIC DEVELOPMENT ADMINISTRATION AS TOLD BY TWO SYMPATHETIC OBSERVERS WHO SEEK TO BUILD MORALS ON A FOUNDATION OF RUINED HOPES (1973).

[82] Adger, *supra* note 5, at 77.

[83] *Id.*

[84] *See* Janet Ivey et al., *Community Capacity for Adaptation to Climate-Induced Water Shortages: Linking Institutional Complexity and Local Actors*, 33 ENVTL. MGMT. 36-47 (2004).

[85] *See* Per Olsson et al., *Shooting the Rapids: Navigating Transitions to Adaptive Governance of Social-Ecological Systems*, ECOLOGY AND SOC'Y 11(1): 18 (2006), *available at* http://www.ecologyandsociety.org/vol11/iss1/art18/.

[86] *Id.*

extensive list of policy options to reduce the potential risks of global climate change: incorporate climate change in long-term planning, inventory existing practices, promote awareness, and integrate ecosystem planning and management. [87]

These studies provide an extensive list of systems characteristics for climate adaptability, sustainability, and water management. While it may seem daunting, many of these characteristics exist in the MIWA model. Table 3 highlights characteristics important to adaptation, effective water governance, and sustainability as well as research supporting the importance of these characteristics. The column on the far right denotes if this characteristic is already encompassed in the MIWA model, is not applicable, or if it has the potential for inclusion in a CAB.

As illustrated by Table 3, a CAB modeled on Connecticut MIWAs has the potential to fulfill many key characteristics of success. The CAB could be structured to include other areas of importance, such as identifying alternative pathways for response, involvement in planning and design, and inventorying existing practices. Whether a CAV can effectively deal with climate change may only be determined after the fact. That being said, the CAB model represents an adaptive governance structure based on characteristics researchers have shown to be important in similar processes and capable of rapid response in times of crisis.

Table 3: Research describing characteristics important to adaptation compared to the Wetland Agency Model, with some characteristics broadened.

	Ivey et al. [88]	**Cuthill and Fein** [89]	**Adger et al.** [90]	**Olsson et al.** [91]	**MIWA Model**
Characteristic					
Collaborative process with leaders, stakeholders (urban and rural), local users, and citizens linking to government	X	X			X
Clear roles and responsibilities	X				X
Multi-level and government-spanning	X		X	X	(Municipal only)
Equitable policy and processes		X	X		X
Accountable and transparent process	X	X			X
Efficient			X		X
Legitimate			X		X
Collecting and disseminating information, including local knowledge	X	X			X
Identifying alternative pathways for response/create windows of opportunity	X			X	(potentially)
Integrate ecosystem planning, design, and management, including water/land planning integration	X				X

[87] Joel Smith & Stephanie Lenhart, *Climate Change Adaptation Policy Options*, 6 CLIMATE RES. 193, 195 (1996).
[88] Ivey, *supra* note 83.
[89] Michael Cuthill & John Fien, *Capacity Building: Facilitating Citizen Participation in Local Governance,* 64 AUSTRALIAN J. OF PUB. ADMIN. 63-80 (2005).
[90] Adger, *supra* note 5.
[91] Olsson et al., *supra* note 84.

X. Conclusions

A local governance structure, modeled after Connecticut's MIWA, could provide Connecticut with the capacity to adapt to climate change. The advantages of this system are that the CAB exemptions would follow local policy, economics, and land use philosophy rather than top-down policy goals. This authority would provide faster adaptation for the dynamic and emergent climate change problems which are primarily experienced at the site or local scale, and eliminate the need for multi-governmental hierarchical agreement on some specific adaptation land use activities. The CABs would provide spatially adaptable jurisdictions when environmental change is occurring at rapid or variable rates. It would also involve citizens in authentic participatory local governance. Finally, the CAB could act as conduits for state and federal funding such as from FEMA to local- or site-specific problems and provide a single local entity for risk assessment planning. In this way, the CAB system should overcome problems with the governance structure in place, providing governance that can span the boundaries of current local and state wetlands policies in the state. Namely, by providing a risk assessment component, allowing timely reactions to negative externalities of climate change, overriding jurisdictional conflicts in the case of climate adaptation, and allowing communities to react to changes in a way that incorporates their local values. Ultimately, the ability of the volunteer governance board to learn and improve, like the MIWAs, will guide their success. Training and support of these citizens will likely improve outcomes within the municipalities of Connecticut that utilize governance structures like the proposed CAB.

Coastal Management in the Face of Rising Seas: Legal Strategies for Connecticut

Jessica Grannis, Julia Wyman, Meagan Singer, Jena Shoaf, Colin Lynch[1]

Abstract: Adapting to sea level rise impacts will require governments to change how they regulate coastal development. This will require policymakers, at both the state and local level, to integrate adaptation into a complex web of overlapping and "siloed" regulatory frameworks that all assume static climate conditions, including floodplain regulations, coastal regulations, and wetlands regulations. This article examines two adaptation approaches that could be applied in Connecticut: a local-level approach using zoning and floodplain regulations, and state-level approach modeled after cutting-edge sea level rise regulations adopted by neighboring Rhode Island. For each method, the authors examine what measures can be implemented now given existing legal authorities delegated to state agencies and municipalities; what measures will require additional delegations or amendments to existing statutes or regulations; and what level of government is best suited to implement different measures (state or local).

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I. Introduction

A. Problem: The Physical and Governance Challenges Posed by Climate Change

In 2009, Connecticut released *Facing Our Future*, the state's plan for adapting to climate change.[2] In 2011, as Tropical Storm Irene ripped across the state, Connecticut saw a glimpse of its future with a changing climate. Whole towns had to be evacuated, homes were torn from their foundations and turned into battering rams, and thousands lost power. Heavy inland rain and coastal storm surges caused entire communities to flood with waist-deep waters.[3]

Although Irene was a severe storm event, these types of impacts may become a normal occurrence along Connecticut's shorelines as sea levels rise. Based upon conservative estimates, Connecticut projects between four inches and 2.9 feet of sea level rise (SLR) over the next century.[4] A more recent assessment, factoring in rapid ice sheet melt, estimates 9 to 29 inches by mid-century.[5] SLR will cause extensive physical impacts along Connecticut shorelines. It will drive storm surges

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[2] CONN. DEP'T OF ENVTL. PROT., FACING OUR FUTURE: ADAPTING TO CONNECTICUT'S CHANGING CLIMATE (Mar. 2009), *available at* http://www.ct.gov/dep/lib/dep/air/climatechange/adaptation/090320facingourfuture.pdf [hereinafter FACING OUR FUTURE].

[3] Linda Conner Lambeck & Tom Cleary, *Chaos in Connecticut: Irene Causes House Collapses, Extreme Flooding*, GREENWICH CITIZEN, Aug. 28, 2011, http://www.greenwichcitizen.com/local/article/Chaos-in-Connecticut-Irene-causes-house-2145228.php [hereinafter *Chaos in Connecticut*].

[4] ADAPTATION SUBCOMMITTEE TO THE GOVERNOR'S STEERING COMMITTEE ON CLIMATE CHANGE, THE IMPACTS OF CLIMATE CHANGE ON CONNECTICUT AGRICULTURE, INFRASTRUCTURE, NATURAL RESOURCES AND PUBLIC HEALTH 9 (2010), *available at* http://ctclimatechange.com/wp-content/uploads/2010/05/Impacts-of-Climate-Change-on-CT-Ag-Infr-Nat-Res-and-Pub-Health-April-2010.pdf.

[5] SLR projections vary, but the Intergovernmental Panel on Climate Change's 2001 report predicts that global warming of between 2.5°F and 10.4°F could lead to SLR of between four inches and 2.9 feet by 2100. *Natural Coastal Shoreline Environment*, *in* FACING OUR FUTURE, *supra* note 2. Although often cited, IPCC estimates do not account for continental ice sheet melt, which could cause sea levels to rise several feet higher. *See* Martin Vermeer & Stefan Rahmstorf, *Global Sea Level Linked to Global Temperature*, 106 PROC. NATL. ACAD. SCI. U.S.A. 21527-21532 (2009); *see also* Stefan Rahmstorf, *A Semi-Empirical Approach to Projecting Future Sea Level Rise*, 315 SCI. 368, 369 (Jan. 19, 2007).

further inland and increase flood elevations. Some coastal lands will become permanently inundated, shorelines will erode, important coastal resources such as tidal wetlands will be destroyed, and storms such as Irene may become more intense.[6]

Adapting to these impacts in Connecticut will be particularly important, but also difficult. Connecticut's shorelines feature both extensive coastal development[7] and critical natural resources. Tidal wetlands and beaches provide recreational opportunities, serve as natural flood buffers, filter polluted runoff, and serve as breeding grounds for Connecticut's valuable fishing and aquaculture industry. In deciding how to adapt to continued accelerated SLR, state agencies and local governments will need to balance the competing demands of economic development and environmental conservation placed on coastal lands. Both bring important benefits: coastal development increases the government tax base and provides valuable economic growth to the state, while coastal resources provide important ecological services that are difficult, if not impossible, to restore once lost. Coastal resources, however, are already being squeezed out by a combination of rapid coastal development,[8] sea level rise, and erosion; impacts that will be exacerbated by climate change and associated human responses. For example, as flooding and erosion increasingly threaten structures, private landowners will seek to build hard shoreline armoring, such as sea walls, which prevent the inland migration of wetlands, beaches, and dunes, leading to their permanent inundation and eventual loss.

Because of these trade-offs, Connecticut may need to employ different adaptation strategies for different areas depending on what is at risk (i.e., critical facilities, non-critical development, or sensitive natural resources). There are three primary strategies to adapt to SLR: protection, accommodation, and retreat. Governments may want to *protect* areas with intense development or critical facilities with hard shoreline armoring. In some less-intensely developed areas, governments may want to *accommodate* development by requiring that structures be designed to be more resilient to impacts. In areas with sensitive natural resources and limited development, governments may want to employ a *retreat* strategy by preventing armoring, requiring that structures be gradually relocated inland as impacts occur, and preserving and enhancing coastal resources.

Implementing any type of adaptation strategy, however, poses substantial governance challenges. Regulation in the coastal zone is typically implemented through a complex maze of overlapping, misaligned, and out-of-date statutes that assume static climate conditions. For example, although flooding will be one of the primary impacts of SLR, current practices for regulating development in floodplains only consider *historic* conditions; and similar approaches to mitigating flood impacts are applied in all areas of the floodplain regardless of what is at risk.[9] Regulations also tend to be "siloed" to address one specific problem; for example, regulations designed to lessen the ecological impacts of coastal development are often separate and unrelated to floodplain regulations or wetlands

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[6] *Natural Coastal Shoreline Environment* 1-2, *in* FACING OUR FUTURE, *supra* note 2.

[7] Connecticut has over $405 billion of insured shoreline development, consisting of mainly low-density, high land value, single-family homes along low-lying shorelines. CONN. DEP'T OF ENVTL. PROT., NATURAL HAZARDS MITIGATION PLAN 2007-2010 iv (2007), *available at* http://www.ct.gov/dep/lib/dep/water_inland/hazard_mitigation/plan/hazardmitigationplan.pdf [hereinafter CT 2007 NATURAL HAZARDS MITIGATION PLAN].

[8] Coastal development, especially when located just above the extreme high tide line (EHTL), limits or eliminates the opportunities for wetlands to migrate inland with shoreline change. This phenomenon has been dubbed "coastal squeeze." R.R. Twilley, *Mangrove Wetlands*, *in* SOUTHERN FORESTED WETLANDS: ECOLOGY AND MANAGEMENT 445-73 (M. Messina and W. Connor eds., 1997).

[9] Floodplain regulations typically employ an accommodation approach, allowing continued development as long as structures are floodproofed or elevated.

regulations.[10] Thus, policymakers are put in the difficult position of having to figure out how to both integrate adaptive measures into separate and sometimes competing regulatory frameworks, while also updating regulatory methods to consider changing climate conditions.

B. Solution: Adapting to Impacts Through Land use Regulations

This article examines legal strategies to help state and local governments reconcile these governance challenges when adapting to SLR. In the context of Connecticut state law, this article examines how land use regulations can be used to ensure that coastal development is more resilient to SLR impacts and less harmful to coastal ecosystems. The article provides case studies of two different approaches to SLR adaptation developed in two nearby states, a local approach developed for Maryland, and a state-level approach implemented in Rhode Island. Each approach is then tested against Connecticut law to determine (1) what measures are legally feasible in Connecticut, (2) what measures can be implemented immediately given existing authorities and what measures will require additional delegations or amendments to existing statutes or regulations, and (3) what level of government is best suited to implement the different measures (state or local).

Part two of this article starts by providing background on the existing legal frameworks that govern development in Connecticut's coastal floodplains. A complex patchwork of overlapping laws governs development in tidal wetlands and watercourses, coastal areas, and floodplains. These laws divide permitting authority between different local entities (Zoning Commissions and Inland Wetlands Agencies), and between local entities and the state Department of Energy and Environmental Protection (DEEP). Because of these overlaps, an effective adaptation strategy will require coordination among these different regulatory entities and integration of adaptation measures into multiple regulatory and planning frameworks. Although this article focuses on *regulatory* frameworks, we recognize that a successful adaptation strategy will require state and local governments to use all the "tools" in their "tool kit"—regulations, incentives, public investments, and education and outreach.

Part three of this article examines a *local* approach. Connecticut is a "home rule" state, which, in the land use context, means that local governments are delegated broad and sometimes exclusive powers to regulate development within their communities.[11] This article analyzes the legal feasibility of implementing a model SLR ordinance that was developed for Maryland (hereinafter "model ordinance") in Connecticut. The model ordinance is designed to help local governments (1) augment land use regulations in their floodplains to address the risks posed by SLR, and (2) build in regulatory flexibility to allow municipalities to tailor regulations to meet their adaptation goals and implement different adaptation measures based upon the different types of development or resources that are at

[10] *See, e.g.*, Maryland Critical Areas Act, MD. CODE ANN., NAT. RES. §§ 8-1801 to 8-1817; NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION & U.S. GEOLOGICAL SURVEY, PROCEEDINGS FROM THE SEA LEVEL RISE AND INUNDATION COMMUNITY WORKSHOP, LANSDOWNE, MD, DEC 3-5, 2009, 23 (Mary Culver et al., eds. 2010) ("The current environmental and coastal hazard laws focus on single-issue management, and the laws provide inadequate tools for multi-sector and multi-purpose management.").

[11] Home Rule Amendment, CONN. GEN. STAT. §§7-187 to -201; CONN. CONST. Art. 10, § 1.

risk.[12] It allows local governments to divide their floodplain into three different zones: a Protection Zone (designed to allow hard shoreline armoring), an Accommodation Zone (designed to enhance existing flood mitigation techniques to address SLR (such as freeboard requirements)), and a Conservation Zone (designed to facilitate retreat by limiting new development and redevelopment in order to preserve coastal ecosystems).[13] Each zone employs different land use tools, or development standards, to achieve the stated goals. For example, in the Conservation Zone the tools employed include downzoning to low-density uses such as open space or recreational uses; restrictions on rebuilding after storm damage; and maximum practicable setbacks. In order to implement such an approach several legal issues must be addressed: local governments need adequate authority delegated from their state legislatures to implement each tool; the tools employed must be consistent with state law; and the tool must be consistent with constitutional requirements. This article analyzes whether the model ordinance can be implemented under both Connecticut's existing municipal delegations to zone and plan, and in a manner that is consistent with a variety of state laws governing development in coastal areas, wetlands, and floodplains.

Part four examines a state-level approach as adopted by Rhode Island. Rhode Island regulates development along the coast through a "rolling" coastal management statute. Under such a statute, "regulators impose land use restrictions by reference to a dynamic feature, such as the tideline, a dune crest, or a vegetative line."[14] These coastal features are considered to "roll" because they fluctuate with natural processes and move inland as sea levels rise. Rhode Island added section 145 to its Coastal Resources Management Program to specifically require consideration of 3- to 5-feet of sea level rise in "the siting, design, and implementation of public and private coastal activities." Rhode Island also has a flexible framework that employs different regulations based upon considerations of coastal features (wetlands, beaches, dunes, barrier islands, bluffs, rocky shores) and adjacent coastal uses (conservation, low-intensity, commercial, or water-dependent uses). This model is germane to

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[12] The model ordinance and further discussion of some of the state and federal legal issues can be found in a report being prepared for the Maryland Department of Natural Resources. *See generally* Jessica Grannis, Eric Swanson, Christine Wyman, Jena Shoaf, & Meagan Singer, *A Model Sea Level Rise Overlay Zone for Maryland Local Governments* (forthcoming; currently on file with the Georgetown Climate Center) [hereinafter Grannis, *MD Model SLR Overlay Zone*]. The model ordinance was designed to test tools identified in the Georgetown Climate Center's Adaptation Tool Kit. For a further discussion of each tool used in the model ordinance and a discussion of the some of the legal and policy barriers see JESSICA GRANNIS, GEORGETOWN CLIMATE CENTER, ADAPTATION TOOL KIT: SEA-LEVEL RISE AND COASTAL LAND USE at 14 (August 2011), *available at* http://www.georgetownclimate.org/resources/adaptation-tool-kit-sea-level-rise-and-coastal-land-use [hereinafter GRANNIS, ADAPTATION TOOL KIT].

[13] This concept of incorporating adaptation goals into the design of zoning districts was initially proposed by Tom Ankersen, Director of the Conservation Clinic at the University of Florida Levin College of Law. *See* Thomas T. Ankersen, et al., presentation to the Charlotte Harbor National Estuary Program, *Comprehensive Plan Policies, Land Development Regulations, and a Parcel-Specific Implementation Strategy to Address Sea Level Rise Impacts in Florida* (May 27, 2010), *available at* http://www.flseagrant.org/coastalplanning/wp-content/uploads/2012/03/sea_level_rise_Cons.Clinic_2010_v.2.pdf.

[14] J. Peter Byrne & Jessica Grannis, *Coastal Retreat Measures*, *in* THE LAW OF ADAPTATION TO CLIMATE CHANGE 23 (Michael B. Gerrard & Katrina F. Kuh eds., forthcoming 2012) [hereinafter Byrne, *Coastal Retreat Measures*]. The term "rolling easement" has been championed by Jim Titus of EPA to describe the collection of land use policies that function to ensure that coastlines can migrate naturally inland as the seas rise, and was adopted from a Texas Supreme Court decision describing the public access easement created by the Texas Open Beaches Act. 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, 1313, 1364-68 [hereinafter, Titus, *Rising Seas*]. *See also* Feinman v. State, 717 S.W. 2d 106 (Tex. App. 1986).

Connecticut because, like Rhode Island, Connecticut must balance economic development along intensely developed shorelines while preserving sensitive coastal resources.

Finally, in Part five, recommendations are provided on regulatory options for Connecticut's municipalities and state agencies. This article examines what Connecticut can do now to adapt given existing state law; where state agencies or municipalities will need additional authority; and what long-term strategies Connecticut can work towards.

II. Legal Background: Connecticut Coastal Laws

A. Connecticut Jurisdictional Boundaries

In order to implement regulatory measures to adapt to SLR, regulating entities must have sufficient legal authority, and adaptive measures must be consistent with state law and the constitution. In this section, background is provided on the existing regulatory frameworks that govern development in Connecticut's coastal floodplains, and the divisions of authority between different local entities and the state Department of Energy and Environmental Protection (DEEP) is also explained.

In Connecticut, municipal governments are the primary entities charged with regulating land use, through the Zoning Enabling Act (ZEA).[15] However, when regulating development in areas vulnerable to SLR, Connecticut municipalities will have to comply with two special laws: the Connecticut Coastal Management Act (CCMA),[16] which governs development in coastal areas and the Inland Wetlands and Watercourses Act (IWWA),[17] which requires local governments to create special Inland Wetlands Agencies (IWAs).[18] IWAs are charged with regulating development adjacent to inland wetlands and tidal watercourses. Additionally, local authority over state tidelands (i.e., the wet sand beach) is preempted; DEEP has primary authority to regulate in tidelands pursuant to the Tidal Wetlands Act[19] and the Structures, Dredging and Fill Act.[20]

These statutes divide land use authority between a mix of local and state entities and create areas of overlapping jurisdiction. As the graphic below illustrates (Figure 1), the division of authority between local and state entities is based upon the following geographical markers (on the graphic moving from right to left):

[15] CONN. GEN. STAT. § 8-2.
[16] Connecticut Coastal Management Act, CONN. GEN. STAT. §§ 22a-90 to -111.
[17] Inland Wetlands and Watercourses Act, CONN. GEN. STAT. §§ 22a-36 to -45.
[18] *Id*. § 22a-42(c); *See also* HARBOR MANAGEMENT ACT (HMA), CONN. GEN. STAT. §§ 22a-113k to -113t, which allows local governments to create special Harbor Management Commissions (HMCs) to guide development in designated harbor areas to promote the "most desirable use of [local harbors] for recreational, commercial, industrial and other purposes." CONN. GEN STAT. § 22a-113m. HMCs do not have regulatory authority; however, HMCs can influence development in harbor areas because both Zoning Commission and DEEP permitting decisions must be consistent with the Harbor Management Plan, and HMCs can object to a project, requiring the Zoning Commission to approve the project by a two-thirds majority to allow the project to proceed.
[19] Tidal Wetlands Act, CONN. GEN. STAT. §§ 22a-28 to -35.
[20] Structures, Dredging & Fill Act, CONN. GEN. STAT. §§ 22a-359 to -363.

- Waterward of the Mean High Water Line (MHWL) (depicted in blue): DEEP has exclusive authority over all land-disturbing activities conducted waterward of the MHWL (essentially areas of the wet beach).[21]
- Extreme High Tide Line (EHTL) to the MHWL (depicted in green): Local entities share regulatory authority with DEEP over lands between the EHTL and the MHWL.[22] The EHTL is defined as the maximum height reached by a rising tide.[23] In these areas of overlapping jurisdiction, permit applications must be filed with and meet the standards and criteria of both state and local regulating entities.[24]
- EHTL to Coastal Boundary (depicted in yellow): Local governments have exclusive authority to regulate development in areas stretching landward of the EHTL. Within the coastal boundary (defined as all lands 1,000 feet inland of the MHWL),[25] the CCMA (described in more detail below) requires municipalities to impose special coastal development regulations.[26]

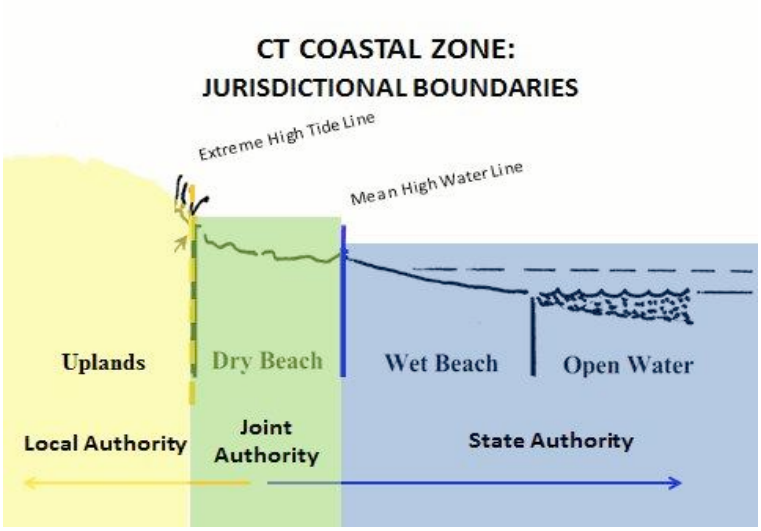

Fig. 1. Depiction of jurisdictional boundaries between Connecticut municipalities and the state Department of Energy and Environmental Protection.[27]

[21] Office of Long Island Sound Programs, Fact Sheet for State and Municipal Regulatory Jurisdictions, *in* CONN. DEP'T OF ENVTL. PROT., CONNECTICUT COASTAL MANAGEMENT MANUAL (2000) *available at* http://www.ct.gov/dep/lib/dep/long_island_sound/coastal_management_manual/manual_08.pdf. [hereinafter CT COASTAL MANAGEMENT MANUAL].

[22] *Id.* In general, and especially on gently sloping shorelines, the EHTL lies inland of the MHTL.

[23] Extreme high tides include "spring high tides and other high tides that occur with periodic frequency but does not include storm surges … such as those accompanying a hurricane or other intense storm." CONN. GEN. STAT. § 22a-359(c).

[24] CT COASTAL MANAGEMENT MANUAL, *supra* note 21.

[25] Connecticut's "coastal boundary" is defined as the furthest inland of (1) the 100-year flood zone; (2) 1,000 feet from the mean high water mark; or (3) 1,000 feet from the inland boundary of tidal wetlands. CONN. GEN. STAT. § 22a-94(b).

[26] *Id.* § 22a-92(d).

[27] In June 2012, the Connecticut Legislature enacted Senate Bill 376, *An Act Concerning the Coastal Management Act and Shoreline Flood and Erosion Control Structures,* which amends the CCMA. 2012 Conn. Legis. Serv. P.A. 12-101 (S.B. 376) (West 2012). Several of the amendments affect the analysis in this article: (1) The Act extends DEEP jurisdiction from the high tide line to the "coastal jurisdiction line," defined as "the location of the

In implementing SLR regulations it will be important for policymakers to understand these overlapping authorities in order to ensure that adaptive measures are coordinated between the different regulatory bodies and integrated into all relevant regulations and planning documents that govern development in coastal floodplains.

B. Local Authority

1. Zoning Enabling Act

Under existing laws, Connecticut municipalities will play an integral role in regulating for SLR because they are granted almost exclusive authority to regulate land use. The ZEA grants Connecticut municipalities broad powers to enact land use regulations for "public health, safety, convenience and property values"[28] This authority is exclusive landward of the EHTL, and grants municipalities sufficient authority to use zoning to regulate for SLR impacts. First, the Connecticut General Statutes specifically authorize local governments to enact zoning regulations to protect their communities from dangers such as fires, panic, and *floods*.[29] SLR will increase risks of flooding and erosion, which will imperil lives, property, and the state's natural resources.[30] Regulations that attempt to mitigate these impacts serve to protect the health, safety, convenience, and property values of the community. Additionally, local governments are authorized to consider future conditions when enacting land use regulations, so long as the regulations are supported by sufficient evidence showing the threats posed by the projected conditions.[31] Finally, the statute explicitly authorizes local governments to use many of the specific tools used in the model ordinance (described above), including size and height limitations; density, footprint, and use restrictions; and overlay zones.[32] Connecticut courts have construed this delegation broadly to include additional tools not listed in the statutory language.[33] While Connecticut municipalities are delegated broad powers to regulate land use, these powers are

topographical elevation of the highest predicted tide for the period beginning in 1983 and ending in 2001." *Id*. *amending* Con. Gen. Stat. § 22a-359(c). (2) The Act requires municipalities to consider SLR when updating their Plans of Conservation and Development. *Id*. *amending* Con. Gen. Stat. § 16a-27. Rise in sea level is defined as "the arithmetic mean of the most recent equivalent per decade rise in the surface elevation of the tidal and coastal waters of the state…" *Id*. *amending* Con. Gen. Stat. § 22a-93. (3) The Act amends provisions relating to permits for erosion and flood control structures. When denying a permit for such structures, DEEP or the relevant municipality must propose on the record the "types of feasible alternatives or mitigation measures and techniques that the applicant may investigate." The Act also explicitly lists relocation of uninhabited structures and living shorelines as feasible alternatives that should be considered. *Id*. *amending* Con. Gen. Stat. § 22a–92. (4) The Act also allows armoring to be permitted, when "necessary and unavoidable," to protect inhabited structures and cemeteries constructed as of 1995. *Id.* Previously, the CCMA only allowed armoring for structures existing at the time the CCMA was enacted in 1980. *See* CT COASTAL MANAGEMENT MANUAL, *supra* note 21, at 2.

[28] *Id.* § 8-2(a).

[29] *Id.* Additionally, Sec. 8-2(b) requires that all municipalities contiguous to Long Island Sound consider the environmental impact of any proposed development on the Sound. *Id.* § 8-2(b).

[30] *See* CT 2007 NATURAL HAZARDS MITIGATION PLAN, *supra* note 7; *see also Chaos in Connecticut*, *supra* note 3.

[31] *See* discussion of substantive due process requirements *infra* note 70.

[32] CONN. GEN. STAT. § 8-2(a).

[33] *See* Gideon Associates v. Coventry Planning & Zoning Com'n, No. CV010077060S2003, 2003 WL 21805742, at *7 (Conn. Super. Ct. July 24, 2003) (finding that the zoning delegation in § 8-2 authorized a municipal zoning commission to enact a zone change/downzone); Nicholas v. Zoning Com'n of Town of Ledyard, No. 522997, 1995 WL 27500, at *2 (Conn. Super. Ct. Jan 18, 1995) (finding that the zoning delegation in § 8-2 authorizes a municipal zoning commission to enact a reasonable development moratorium).

constrained by the requirements of the other state laws discussed below, and any local implementation of SLR adaptations must also be consistent with these laws.

2. Connecticut Coastal Management Act

When executing their zoning powers, coastal municipalities must comply with special requirements imposed by the Connecticut Coastal Management Act.[34] The CCMA governs development occurring between Connecticut's coastal boundary and the MHWL. When considering applications for activities that are located fully or partly within the coastal boundary, local permitting authorities must comply with both the municipal zoning ordinance and the statutory goals and policies of the CCMA to consider "the potential impact of coastal flooding and erosion patterns on coastal development so as to minimize damage to and destruction of life and property and reduce the necessity of public expenditure to protect future development from such hazards."[35]

The CCMA employs several tools to ensure that development projects consider impacts to coastal resources. First, the teeth of the CCMA are in the site plan review requirements. Municipalities must require permit applicants to submit a coastal site plan.[36] Regulators must review site plans to ensure that the proposed project is consistent with the CCMA and is designed to avoid or minimize "adverse impacts to coastal resources." Listed adverse impacts relevant to SLR adaptations include

> degrading natural erosion patterns; ... degrading natural or existing drainage patterns; ... increasing the hazard of coastal flooding through significant alteration of shoreline configurations; ... degrading or destroying essential wildlife, finfish or shellfish habitat; ... and degrading tidal wetlands, beaches and dunes, rocky shorefronts, and bluffs and escarpments through significant alteration of their natural characteristics or function.[37]

Second, the CCMA grants municipalities explicit power to utilize specific tools to regulate development in coastal areas, which were not previously delegated in the ZEA, including downzoning, setbacks and special-use zones.[38] These tools could play an important role in allowing municipalities to implement special regulations to protect vulnerable coastal areas and resources from SLR impacts within their jurisdiction.

The state has little regulatory authority landward of the EHTL. The CCMA only authorizes DEEP to review and comment on coastal site plan decisions and contemplated changes to municipal coastal plans; local governments, however, are not legally required to heed any comments or suggestions and

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[34] CONN. GEN. STAT. §§ 22a-90 to -111. The CCMA is the central law guiding the state's comprehensive Coastal Management Program and was adopted pursuant to the requirements placed on coastal states by the federal Coastal Zone Management Act.

[35] *Id.* at § 22a-92(a)(5).

[36] Coastal site plan review applications require significant detail, including a detailed description of the proposed activity and its location, identification of all coastal resources on and adjacent to the site, an assessment of how the proposed activity is consistent with the CCMA, methods of proposed stormwater management, an evaluation of the potential beneficial and adverse impacts of the proposed project and a description of proposed methods to mitigate or lessen, any unavoidable adverse impacts. CONN. GEN. STAT. § 22a-105(c). For further guidance *see* Office of Long Island Sound Programs, *Coastal Site Plan Review Application Checklist*, in *CT Coastal Management Manual, supra* note 21.

[37] CONN. GEN. STAT. § 22a-93(15); *see also* Office of Long Island Sound Programs, Fact Sheet for Adverse Impacts, in *CT Coastal Management Manual, supra* note 21.

[38] *Id.* § 22a-103(c).

DEEP can only appeal municipal decisions in court by arguing that they are arbitrary and capricious.[39] Under the current CCMA framework, state supervision is unlikely to be an effective tool for requiring adaptation within the coastal boundary; these tools may only be effective for promoting adaptation within willing local jurisdictions. While the state can use its oversight powers to review and comment on the vulnerability of projects to SLR and to help municipalities consider SLR in their coastal planning documents, there is no requirement that municipalities adopt DEEP recommendations.

3. Inland Wetlands and Watercourses Act

Connecticut local governments are also required to regulate all land-disturbing activity within the state's inland wetlands and watercourses pursuant to the Inland Wetlands and Watercourses Act.[40] Although SLR will not directly affect inland wetlands unless inundated, the statute also covers all rivers, streams, and other tidally influenced waterways, which will be affected by rising seas. The IWWA requires each municipal government to create an Inland Wetlands Agency (IWA)[41] charged with protecting and maintaining inland wetlands and watercourses "for their conservation, economic, aesthetic, recreational, and other public and private uses and values."[42] Activities affecting designated wetland areas must comply with separate inland wetland permitting requirements.[43] IWAs cannot issue a permit for activities that may have a significant impact on wetlands or watercourses unless there is "no feasible or prudent alternative."[44] Thus, before issuing a permit, IWAs "must determine that the alternative presented by the applicant is not only sound from an engineering standpoint but is also economically reasonable in light of the social benefits derived from the activity."[45] Although "cost may be considered in deciding what is prudent … a mere showing of expense will not necessarily mean an alternative is imprudent."[46] When permitting a project, IWAs can also impose limitations, conditions, and modifications to mitigate potential environmental impacts.[47]

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[39] *See* CONN. GEN. STAT. §§ 22a-102(d), 103(b), 104(e). DEEP has general supervisory authority to assure continuing, effective, coordinated and consistent administration of the requirements and purposes of the CCMA. *Id.* § 22a-97(b).

[40] CONN. GEN. STAT. §§ 22a-36 to 22a-45. The IWWA defines "wetland" as "land, including submerged land, not regulated pursuant to [the TWA]," and designates wetlands by soil type. *Id.* § 22a-38(15). The IWWA defines "watercourses" as "rivers, streams … and all other bodies of water … which are contained within, flow through or border upon this state or any portion thereof, not regulated pursuant to [the TWA]." *Id.* § 22a-38(16). IWA's jurisdiction may extend to non-wetlands areas that are *likely to impact* or affect wetlands and watercourses. 1995 CONN. PUB. ACTS No. 95-383; 1996 CONN. PUB. ACTS No. 96-157; Queach Corp. v. Inland Wetlands Comm'n of Town of Branford, 779 A.2d 134, 138-39 (Conn. 2001) (citing section 2.1jj(2) of Branford's IWWA regulations).

[41] CONN. GEN. STAT. § 22a-42(c). IWAs share regulatory and permitting authority with municipal zoning and planning agencies and generally require separate permit applications. Municipalities may authorize existing planning or zoning commissions to assume the regulatory authority of an IWA, thereby allowing for a combined permit process. In practice, however, IWAs are almost always separate commissions.

[42] *Id.* § 22a-36.

[43] IWAs are authorized to promulgate regulations for activities within the boundaries of inland wetlands and watercourses. *Id.* § 22a-42(c).

[44] The statute requires IWAs to consider the environmental impact of the proposed activity, including injury or interference with safety, health, or reasonable use of property, and any impacts reasonably related to the proposed activity on wetlands and watercourses, among other factors. *Id.* § 22a-41. The IWWA defines "feasible" as that which is "able to be constructed or implemented consistent with sound engineering principles." *Id.* § 22a-38(17); *see also* definition of "prudent." *Id.* § 22a-38(18).

[45] Samperi v. Inland Wetlands Agency of City of West Haven, 628 A.2d 1286, 1296 (Conn. 1993).

[46] CONN. GEN. STAT. § 22a-38(18).

[47] *Id.* § 22a-42a(d)(1).

IWAs could play an integral role in adapting tidal watercourses. IWAs have an explicit regulatory mandate to protect the environmental values provided by wetlands and watercourses, some of which may be vulnerable to SLR impacts. Thus, an effective adaptation strategy should consider how to integrate SLR adaptation into municipal wetlands ordinances as well as zoning ordinances and floodplain ordinances.

C. State Permitting Authority: Tidal Wetlands Act and the Structures, Dredging and Fill Act

Adaptation activities adjacent to intertidal areas will likely have to be implemented at a state level or will require coordination with DEEP under existing state law. DEEP is given exclusive authority to permit activities in tidal wetlands pursuant to the Tidal Wetlands Act (TWA),[48] and coastal or navigable waters under the Structures, Dredging and Fill Act (SDFA).[49]

The TWA gives DEEP regulatory jurisdiction over all land-disturbing activities, including dredging, filling, and construction to one foot above the EHTL of a tidal wetland.[50] To carry out state policy objectives for tidal wetland protection, the statute creates criteria for granting, denying, or conditioning permits that specifically take into account the impacts of any proposed activity upon tidal resources, erosion, flooding, and other natural disasters.[51] These criteria have been further outlined in DEEP regulations on tidal wetlands.[52] The SDFA gives the state regulatory jurisdiction over all land-disturbing activities waterward of the EHTL.[53] Such regulated activities may only be conducted within this zone after the applicant has secured a permit from DEEP.[54]

In making permitting decisions under both acts, DEEP must consider: the potential effect on the area's natural resources; effects on and prevention of shore erosion and coastal flooding; use and development of adjoining lands; coastal and inland navigation for all vessels; pollution control; water

[48] *Id.* §§ 22a-28 to 22a-35. Under the TWA, "wetland" is defined as "areas which border on or lie beneath tidal waters" and which support certain wetland vegetation. *Id.* § 22a-29(2).

[49] *Id.* §§ 22a-359 to 22a-363.

[50] The TWA defines "regulated activity" as any of the following: "draining, dredging, excavation, or removal of … aggregate of any kind … from any wetland or the dumping, filling or depositing thereon of any … aggregate of any kind … either directly or otherwise, and the erection of structures, driving of pilings, or placing of obstructions, whether or not changing the tidal ebb and flow." *Id.* § 22a-29(3). Certain listed activities, such as emergency response activities, are exempted from regulation.

[51] *Id.* § 22a-30(c).

[52] DEEP has outlined specific criteria for regulated activities, including wetland preservation, recreational and navigational uses, erosion and sedimentation, marine fisheries, shellfisheries, and wildlife, and protection of life and property from natural disasters. CONN. AGENCIES REGS. § 22a-30-10(g).

[53] CONN. GEN. STAT. § 22a-359(a). Regulated activities include dredging, erecting structures, placing fill, obstructing or encroaching or carrying out of any maintenance work incidental thereto. *Id.* § 22a-361(a)(1). Section 22a-363b(a) lists exempt activities.

[54] *Id.* § 22a-361(a)(1).

quality; recreational use; management of coastal resources; and, the rights and interests of all persons concerned with the proposed activity.[55]

D. Connecticut Constitutional Takings Law

Finally, land use regulations designed to mitigate impacts from SLR have the potential to significantly impact property values; and, thus, must be evaluated in light of constitutional prohibitions against regulations that "take" private property. Both the Connecticut and federal Constitutions prohibit regulations that effectively expropriate private property without just compensation.[56] Many state courts adhere to the U.S. Supreme Court's takings jurisprudence; however state courts *may* interpret their state constitutions more restrictively than the U.S. Constitution. Historically, Connecticut courts have been more protective of private property rights; however, these old state law cases pre-date and may be superseded by more recent U.S. Supreme Court cases that have clarified federal takings analysis.[57] Thus, it is necessary to understand both the Connecticut and federal tests for regulatory takings to determine how Connecticut courts may analyze new SLR regulations.

Federal courts, interpreting the Fifth Amendment's Takings Clause, apply two relevant tests: the *per se* "total takings" test, and the *Penn Central* balancing test. In *Lucas v. South Carolina Coastal Council*, the U.S. Supreme Court articulated the total takings rule: where a regulation deprives a property owner of "*all* economically beneficial use" it is a takings *per se* and the government must pay the landowner just compensation.[58] The regulation must essentially render the property valueless. There is, however, an exception to this rule: a regulation will not be a taking where the limitation on use "inheres in the title itself in the background principles of property and common law" (such as public trust and nuisance).[59] Where a regulation does not amount to a total taking, the court applies a balancing test (articulated in the case *Penn Central Transportation Co. v. New York City)*, in which the court weighs three factors: (1) the economic impact of the regulation, (2) the character of the government action, and (3) the "reasonable investment-backed expectations" of the landowner.[60]

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[55] *Id.* §§ 22a-359(a), 22a-30(c). *See also* CONN. AGENCIES REGS. § 22a-30-10. In addition to issuing individual permits on a site-specific basis, DEEP has also developed three expedited area-wide permit processes: general permits, Certificates of Permission (COP), and emergency authorizations. Expedited permits provide an avenue by which DEEP can implement adaptations, such as protection measures, on an area-wide basis; however, they could also be used to frustrate local adaptation initiatives. For example, a landowner may be able to build hard shoreline armoring under a DEEP expedited permit, even in areas where the locality wanted to limit or prohibit armoring. CONN. GEN. STAT. § 22a-363; *see also* Conn. Dep't of Energy & Envtl. Prot., *General Permits: An Environmental Permitting Fact Sheet*, http://www.ct.gov/dep/cwp/view.asp?a=2709&q=324154&depNav_GID=1643 (last visited June 19, 2012).

[56] The Fifth Amendment to the U.S. Constitution provides that no "private property be taken for public use, without just compensation." U.S. CONST. amend. V; *see also* U.S. CONST. amend. XIV, § 1 (applying the Fifth Amendment's protection of property to state actions). Similarly, the Connecticut Constitution provides that "[t]he property of no person shall be taken for public use, without just compensation therefore." CT. CONST. art. I, § 11. *See also* Vartelas v. Water Resources Commission, 146 Conn. 650, 654 (Conn. 1959).

[57] Connecticut courts also divide their analysis of whether a regulation amounts to a taking based upon the state constitution or the federal constitution, which seems to suggest that different standards apply. *See* Rural Water Co., Inc. v. Zoning Bd. of Appeals of Town of Ridgefield, 947 A.2d 944 (Conn. 2008).

[58] 505 U.S. 1003, 1019 (1992).

[59] *Id*. at 1027.

[60] Penn Central Transportation Co. v. New York City, 438 U.S. 124 (1978).

Connecticut courts apply a similar analysis in reviewing regulatory actions for violations of the state's constitution, applying two relevant tests: a practical confiscation test,[61] and a three-factor balancing test.[62] Under the practical confiscation test, Connecticut courts find takings where a regulation deprives a property owner of "any worthwhile rights or benefits" in their land.[63] For regulations that do not amount to confiscatory taking, Connecticut courts apply a balancing test similar to that articulated in *Penn Central*. Connecticut courts consider (1) the degree of diminution of the value of the land, (2) the nature and degree of public harm to be prevented, and (3) alternatives available to the landowner.[64]

While the court's analysis under a balancing approach is substantially the same in both state and federal courts, Connecticut courts have in the past applied a more restrictive confiscatory (or total) takings test than federal courts. In *Lucas,* the U.S. Supreme Court was clear—application of the *per se* test should be limited to regulations that cause a 100% diminution in value; anything less than a complete elimination in value requires application of the *Penn Central* balancing test.[65] Pre-*Lucas* state court cases, however, have applied the confiscatory takings analysis in cases where the regulation caused less than a 100% diminution in value. For example, in *Dooley v. Town Planning and Zoning Commission of Town of Fairfield*, a 1964 case, the Connecticut Supreme Court found that a floodplain ordinance worked a taking even though the regulation at issue only resulted in a 75% diminution in the property's value. The court found that town's designation of a floodplain district was a taking because it "froze the area into a practically unusable state."[66] Similarly in *Bartlett v. Zoning Commission of Town of Old Lyme*, a 1971 case, the Connecticut Supreme Court struck down a wetlands protection ordinance that resulted in the diminution in the property's value from $32,000 to $1,000.[67] Furthermore, unlike federal courts, early Connecticut court opinions have not recognized a nuisance exception to takings. They have struck down regulations even where they were designed to prevent significant injuries to the community.[68]

It is unclear how *Lucas* will affect Connecticut's constitutional takings jurisprudence. Since *Lucas*, Connecticut courts have not significantly analyzed a regulation that worked a total taking. More recent cases do, however, seem to reinterpret the holdings of *Bartlett* and *Dooley,* while not explicitly overturning these cases. For example, in *Bauer v. Waste Management of Connecticut, Inc.*, a 1995 case, the court cites to *Dooley* and *Bartlett*, but restates the confiscatory takings rule as "involv[ing]

[61] *Lucas,* 505 U.S. at 1018-20 (defining federal "per se" taking as a total diminution in value).
[62] *Penn Central,* 438 U.S. at 124.
[63] Brecciaroli v. Conn. Comm'r of Env. Prot., 362 A.2d 948, 951 (Conn. 1975).
[64] Chevron Oil Co. v. Zoning Board of Appeals of Town of Shelton, 365 A.2d 387, 391 (Conn. 1976).
[65] *See* Tahoe-Sierra Pres. Council, Inc. v. Tahoe Reg'l Planning Agency, 535 U.S. 302, 330 (2002). In an explanatory footnote in *Lucas*, the Supreme Court stated that the *per se* rule would not apply if the diminution in value were *95%* instead of 100%. *Lucas*, 505 U.S. at 1019, n.8.
[66] Dooley v. Town Planning and Zoning Comm'n of Town of Fairfield, 191 A.2d 770, 773 (Conn. 1964).
[67] 282 A.2d 907 (Conn. 1971). While the Court recognized the public importance of wetlands (as "vital economic resources," that provided recreational benefits, wildlife shelters, and helped to maintain property values), it nonetheless found that the ordinance caused a confiscatory taking because it prohibited all use of the property "other than wooden walkways, wharves, duck blinds, public boat landings and public ditches." *Id.* at 910. *But cf.* Breccaroli v. Conn. Commissioner of Envtl Prot., 362 A.2d 948 (Conn. 1975) (upholding DEEP's denial of a permit to fill the wetlands portion of a lot under the TWA, where denial did not result in a confiscatory taking because the landowner could still seek to build on the non-wetlands portion of the lot).
[68] In *Dooley*, even though the court recognized the "laudable" purpose of flood control, the court found that the private property owner could not be made to sacrifice for the community welfare and that eminent domain would be a more appropriate mechanism to achieve this community benefit. 191 A.2d at 773-74.

situations that require a landowner to leave his property in *essentially its natural state*."[69] In *Bauer,* the court seems to require a complete wipe out of economic use, not merely a substantial diminution in value. Because the courts have not clearly rejected *Bartlett* and *Dooley,* it is difficult to predict what standard a state court will apply in analyzing SLR regulations, especially regulations that substantially diminish land values. With SLR regulations, retreat policies have the highest likelihood of triggering a confiscatory takings analysis. The implication of Connecticut takings law with respect to these particular policies is discussed below, in Section III(B)(2).

III. A Local Approach to SLR Adaptation for Connecticut

A. Design of the Model SLR Zoning Ordinance

As the primary regulators of land use in Connecticut, local governments will play a critical role in adapting to climate change. This part of the article examines whether Connecticut municipalities can implement policies proposed in a model SLR ordinance developed for Maryland by the Georgetown Climate Center.[70] The model was designed to help local governments integrate adaptive land use measures into existing frameworks for regulating coastal floodplains. The model enhances regulations in two ways. First, it extends the boundaries of the regulated floodplain to cover areas that have historic risk of flooding and that will become increasingly at-risk as sea levels rise. Second, the model gives regulators more flexibility to tailor regulations to their adaptation goals by dividing the floodplain into three different SLR zones. Each of these zones implements regulatory tools designed to effectuate one of three adaptation goals: protect, accommodate, and retreat.

The first challenge that local governments will face in implementing this approach is determining where to draw the boundaries for each zone. In the near term, local governments should use existing floodplain boundaries. Connecticut has yet to develop SLR maps that are scientifically rigorous

[69] Bauer v. Waste Mgmt. of Connecticut, Inc., 662 A.2d 1179, 1197 (1995) (*citing Bartlett,* 282 A.2d 907; and *Dooley,* 191 A.2d 770). Although these more recent cases may be factually distinguishable (because they did not involve an important public purpose, such as threats to the health, safety, and welfare, and often involved landowner fault), they show that the Connecticut courts may be tracking more closely with the U.S. Supreme Court's analysis articulated in *Lucas*. In *Norwood v. Zoning Bd. of Appeals of the Town Of Branford,* the court found that the denial of a variance to a zoning ordinance that rendered a lot unbuildable did not amount to a takings because it only represented a financial loss. 772 A.2d 624, 628-29 (Conn. 2001). The ordinance did not render the lot worthless, and the lot "could have value as an addition to an abutting lot[.]" *Id. See also* City of Bristol v. Tilcon Minerals, Inc., 931 A.2d 237, 257 (Conn. 2007) (finding there cannot be a confiscatory taking without "total destruction of a property's economic value or substantial destruction of an owner's ability to use or enjoy the property")*; but cf* Pike v. Zoning Bd. of Appeals of Town of Hampton, 624 A.2d 909 (1993) (finding a taking where use as a side yard and twelve other possible uses were not possible, constituting severe reduction in value if not destruction of value).

[70] *See generally* Grannis, *MD Model SLR Overlay Zone*, *supra* note 12.

enough to be used for regulatory purposes.[71] Additionally, using existing designations will ensure that local communities maintain compliance with the National Flood Insurance Program (NFIP). Under the NFIP, the Federal Emergency Management Agency (FEMA) develops Flood Insurance Rate Maps (FIRMs) that divide the floodplain into three different zones that govern what regulations apply: A-zones, V-zones, and X-zones. To participate in the NFIP local governments must impose special regulations in A-zones (which include inland areas of the 100-year floodplain), and V-zones (which include areas of the 100-year floodplain that are subject to wave action).[72] Although X-zones (encompassing the 500-year floodplain) are mapped, FEMA does not require that these areas be regulated for flood risks.[73]

Because the NFIP only considers *historic* flood risks, FIRMs will be insufficient to ensure protection against rising sea levels. However, NFIP maps can be used as a starting point for enhancing regulations. The model SLR ordinance proposes that local governments extend the boundaries of the regulated floodplain to include the 500-year floodplain[74] and divide the 100-year floodplain into three different zones: a "Protection Zone," an "Accommodation Zone," and a "Conservation Zone." Each

[71] Governments face challenges in generating SLR maps for regulatory purposes. Technical challenges stem from the scientific uncertainty about the rate of SLR, the geographical extent and timing of SLR impacts, and how SLR will affect storm surges. In using maps for regulatory purposes, municipalities also face legal challenges because they must comply with constitutional substantive due process requirements. Although the legal hurdle is low, substantive due process requires that regulations be "rationally related to a legitimate public interest." *See* Village of Euclid v. Ambler Realty, Co., 272 U.S. 395 (1926). Connecticut courts are deferential to local policy decisions to amend their zoning regulations; however, courts have required local governments to provide *sufficient evidence* documenting the probability of the threat when imposing new regulations to address future conditions. *Compare* Nicholas v. Zoning Comm'n of Town of Ledyard, No. 522997, 1995 WL 27500, at *2 (Conn. Super. Ct. Jan. 18, 1995), *and* Corsino v. Grover, 170 A.2d 267, 310 (Conn. 1961) (holding that the commission was under a duty to reasonably anticipate future conditions which could affect the public welfare adversely), *with* Toll Bros., Inc. v. Bethel Planning & Zoning Comm'n, No. HHBCV030523881S, 2006 WL 3114387, at *3 (Conn. Super. Ct. Oct. 19, 2006) (finding that the zoning commission had insufficient evidence that future traffic would cause a threat to public health). Thus, in the short term, local governments will be on the strongest legal footing where they rely on existing maps to regulate in areas with clearly documented historic risk of flooding, such as FIRMs supported by a Flood Insurance Study. Governments can then use less rigorous SLR studies and vulnerability assessments to prove how SLR will increase risks in flood-prone areas, thereby justifying increased regulations in areas at historic risk of flooding. As SLR mapping improves, the state or local governments may be able to adopt maps for regulatory purposes that could withstand a substantive due process challenge.

[72] The 100-year floodplain covers areas with a 1% or greater chance of flooding in any given year based upon historic data. In A-zones, local governments must impose minimum floodplain regulations (e.g., elevating or flood-proofing structures and eliminating basements). In V-zones, local governments must impose slightly more rigorous regulations to mitigate impacts from wave action (e.g., elevation on pilings and anchoring). Federal Emergency Management Agency, Map Service Center, *Definitions of FEMA Flood Zone Designations,* https://msc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=floodZones&title=FEMA%20Flood%20Zone%20Designations (last visited June 19, 2012).

[73] The X-zone, or the so-called the 500-year floodplain, includes areas that have a 0.2% to 1% chance of flooding in any given year based upon historic flood data. *Id.*

[74] *See generally* Grannis, *MD Model SLR Overlay Zone, supra* note 12, at § IV(2). Although the X-zone is not a perfect proxy for how SLR may impact a community, these are areas that FEMA's Flood Insurance Studies demonstrate are at risk from a statistical suite of storms that are characteristic for Connecticut. Cedar Falls, IA recently extended floodplain regulations to their 500-year floodplain to address impacts from repeated riverine flooding. CEDAR FALLS ZONING ORD. § 29-156, *available at* http://library.municode.com/index.aspx?clientId=10264. To implement these new requirements the City had to work with FEMA to update their FIRMs to show elevations for the 500-year flood.

zone augments regulations by employing specific development standards designed to effectuate each adaptation goal.

In dividing the floodplain in this manner, local governments will have to weigh competing policy considerations and determine what their adaptation goals are for different parts of their communities. Local governments should consider: existing floodplain designations (V-zones, coastal A-zones, A-zones); the extent of existing development; the quality of natural resources in the area and the ecosystem services provided; the area's vulnerability to SLR and other climate change impacts; and, the extent of existing armoring and the feasibility and likelihood of future armoring. The Protection Zone could include intensely developed areas, like city centers, which may have limited adaptation options due to the location of critical facilities, historic properties, and large areas of public and private development. These may be areas with extensive existing armoring or degraded ecosystems. The Accommodation Zone could include moderate to intensely developed areas with non-critical public and private development that are less vulnerable to impacts than the Conservation Zone, but are unsuitable for armoring. The Conservation Zone could include less developed, highly vulnerable areas that have sensitive natural resources. These areas are also likely to be unsuitable for hard-shoreline protections, due to both economic and environmental costs.

Second, governments will need to determine what tools or development standards to employ in each zone. In the Protection Zone, municipalities may want to allow additional armoring by:

- Designating areas as appropriate for armoring in advance of impacts, and permitting armoring by right or creating a streamline permitting process for armoring in these areas.
- Requiring that armoring be designed to protect against elevated flood heights due to increased sea levels.
- Requiring that projects mitigate impacts to natural resources and public access.

This will allow the community to identify areas it wants to protect in advance, ensure areas are protected against heightened flood elevations, budget to build and maintain public armoring projects, and provide developers with certainty that armoring will be allowed when they are making investment decisions. To do so, however, municipalities will have to coordinate with DEEP because the ability to armor is limited by state law.

The Conservation Zone is designed to gradually relocate existing development away from highly vulnerable areas while protecting the surrounding environment. To do so, local governments could:

- Downzone to only allow low-density and low-intensity uses, such as low-density residential, agricultural, recreational, open space, or water-dependent uses.
- Require maximum practicable setbacks that require shoreline structures to be placed as far landward or upland on the site as feasible to maximize protection from flooding, erosion, and surges.
- Restrict rebuilding of storm-damaged structures.
- Restrict hard-shoreline armoring.

The Accommodation Zone is designed to allow for continued development, while requiring that the siting and construction of new and redeveloped structures consider future SLR impacts. Here, local governments could:

- Downzone to lower density and intensity uses, such as residential and commercial development.

- Require maximum practicable or erosion-based setbacks for waterfront properties.
- Increase freeboard requirements consistent with estimates for projected SLR. Local governments should also consider varying elevation requirements based upon the type of structure or use (critical or non-critical).[75]
- Establish size and height maximums to only allow smaller structures that are more easily moveable and pose less threat of collateral damage in the event the structure is destroyed in a storm.

Local governments may have difficulty completely revamping their land use ordinances in the manner proposed. Therefore, the model ordinance was designed to be as "plug and play" as possible. The hope is the model will help communities begin to think about different ways to regulate flood-prone areas in the face of rising seas. And, that it will help them incorporate those provisions of the model that are feasible for their community and that will be effective at helping them address their particularized vulnerabilities.

B. Potential State Law Barriers to Implementation of Tools Included in Model SLR Ordinance

In Connecticut, implementation of many of these tools at a local level will present two major challenges. First, because Connecticut law divides permitting authority between the state and a variety of municipal commissions, implementation will require significant coordination between a variety of regulatory entities. To be effective, measures may need to be integrated into multiple ordinances and plans, and regulatory approaches will need to be coordinated among different local commissions and the state.

Second, state laws may prohibit or restrict implementation of certain tools, such as downzoning, rebuilding restrictions, and limitations on hard shoreline armoring. The inability of local governments to implement specific tools may limit the ability of localities to regulate in a more flexible manner. Policymakers may need to consider how to amend existing laws to give both state and local regulators more options to respond to SLR threats.

1. Protection Zone

Any viable adaptation strategy will require consideration of armoring policies. In areas with intense development and critical facilities it may not be cost effective or desirable to try to move or raise development. Thus state and local governments will need to consider where they want to allow hard armoring, what development standards to require when permitting hard armoring, and how they want to mitigate the associated environmental impacts of armoring. Governments may also need to consider what level of government is best suited to regulate armoring. Because the state has exclusive permitting authority seaward of the MHWL, armoring decisions may best be addressed at a state level.

Under existing frameworks in Connecticut, local control over armoring is limited and state law may prohibit local designation of areas where they want to allow hard shoreline armoring. First, armoring

[75] Structures must typically be elevated one-foot above the base flood elevation (computed elevation which floodwater as anticipated to rise during the 100-year storm event). Federal Emergency Management Agency, *Base Flood Elevation*, http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/base_flood_elevation.shtm (last visited June 19, 2012). This elevation is called "freeboard." But see note 98, *infra*, regarding potential policy challenges to implementing increased freeboard requirements.

projects often get built in intertidal areas and thus invoke state permitting requirements. Local authority to regulate armoring in tidally influenced waters below the MHWL is preempted by both the SDFA and the TWA, and local authority is shared with DEEP waterward of the EHTL.[76] Therefore, consistent application would require local governments to coordinate with DEEP in order to ensure that state armoring decisions match local designations.

Second, the laws regulating shoreline flood and erosion control structures[77] may prohibit any permitting entity from allowing armoring on an area-wide basis. Under the CCMA, local governments may only grant permits where the applicant can show that the armoring is "necessary and unavoidable," and the statute favors non-structural approaches to flood and erosion control.[78] IWAs are also limited in the means by which they can permit armoring within inland wetlands and watercourses. The IWWA prohibits any activities that may have a significant effect on inland wetlands and watercourses. Shoreline flood and erosion control structures may only be permitted where there is no "feasible or prudent alternative."[79] Likewise, in lands below the MHWL, DEEP is granted exclusive permitting authority, and state policy encourages natural protection of tidal habitats.[80] While the policies articulated by all of these acts do not prohibit hard armoring outright, they seem to require that permitting decisions be made at a site-specific, rather than area-wide basis,[81] and may prohibit any permitting entity (whether state or local) from designating whole zones as appropriate for armoring without site-specific review. For these reasons, creation of Protection Zones at a local level may be infeasible given existing law in Connecticut.

2. Conservation Zone

In the face of competing demands to develop in areas with sensitive natural resources, policymakers will also have to consider how to adapt areas of their shoreline that provide important ecological services. It may not be environmentally sustainable or cost-effective over the long term to protect or build ever-higher structures in certain portions of the coast that are less developed and more vulnerable to impacts. In these areas, policymakers may want to reduce their community's vulnerabilities by limiting new development and redevelopment and preserving the flood buffers provided by natural shorelines.

To do so, the Conservation Zone includes tools designed to protect ecosystems and to gradually reduce development in highly vulnerable areas. In this zone, armoring will need to be limited or prohibited. As sea levels rise and lands become inundated, hard armoring prevents the ability of ecosystems to naturally adapt by cutting off their ability to migrate inland. Additionally, local governments will need to reduce the number of people and structures in harm's way. They can do this by downzoning to allow only low-density development, such as low-density residential (e.g., one unit per 20 acres), open space, recreational, or other water-dependent uses; and by restricting rebuilding. The model SLR ordinance proposes that localities prohibit the reconstruction of structures that are damaged twice in storm events.

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[76] CONN. GEN. STAT. §§ 22a-359(a), 22a-32.
[77] *Id.* § 22a-109(c).
[78] *Id.* § 22a-92(b)(2)(J).
[79] *Id.* § 22a-41(b)(1).
[80] The SDFA states that the coast should be protected to promote the "prevention or alleviation of shore erosion and coastal flooding." *Id.* § 22a-359(a). The TWA similarly states that loss of natural tidal habitats is found to "disturb the natural ability … to reduce flood damage and adversely affect the public health and welfare." *Id.* § 22a-28.
[81] *Id.* § 22a-106(b(1).

Aside from the political constraints localities face in implementing these tools, existing state laws also pose a barrier. First, prohibitions on armoring on an area-wide level may be problematic for reasons similar to those presented for the Protection Zone. To ensure that the Conservation Zone remains armor-free, local governments would have to coordinate with DEEP to ensure that state policies seaward of the EHTL mirror local prohibitions. Additionally, the CCMA, IWWA, TWA and SDFA seem to forbid bare prohibitions on armoring on an area-wide basis. Although the CCMA encourages the use of non-structural mitigation measures,[82] the Act requires authorities to grant permits where the applicant can show that the armoring is "necessary and unavoidable."[83] This statutory language may prohibit local governments from restricting armoring in an entire zone—undermining the concept of area-wide designations as contemplated in the model ordinance.

Second, Connecticut state law may prohibit both downzoning and rebuilding restrictions. The ZEA limits the ability of local governments to phase out "nonconforming uses." Downzoning creates nonconformities because after the ordinance is amended some existing uses no longer comply with the new zoning requirements.[84] In many jurisdictions, nonconforming uses are allowed to continue, but local governments can phase these uses out over time using rebuilding restrictions that require properties to come into compliance with new zoning restrictions when the use is abandoned or destroyed.[85] However, Connecticut law is more limited. The ZEA states that municipal zoning ordinances "shall not provide for the termination of any nonconforming use solely as a result of nonuse for a specified period of time without regard to the intent of the property owner to maintain that use."[86] Connecticut courts have found that "[o]nce a nonconforming use is established, the only way it can be lost is through abandonment."[87] The mere discontinuance of a use where there is no intent to abandon is not enough—it must be found that the owner clearly intended to "relinquish permanently the nonconforming use."[88] Because a property owner whose land is destroyed does not intend to abandon his or her use, Connecticut law may require that municipalities allow legally nonconforming uses to be reestablished.[89] Connecticut courts may read this precedent to find that rebuilding restrictions violate the ZEA. However, none of the cases on nonconforming uses address the situation where a use is destroyed by a natural hazard. Regulators have a much stronger justification for discontinuing a use that has a susceptibility to recurring damage from natural hazards.

The CCMA and IWWA may also prohibit rebuilding restrictions. The CCMA explicitly prohibits the use of the coastal site plan review process to restrict rebuilding.[90] Similarly, the IWWA allows certain uses "by right" (meaning the permitting authority must issue a permit where an applicant can show that their project conforms to the applicable regulations for the specific zone where their property is located), including existing residential homes.[91] Downzoning to prohibit these uses or to prevent their reestablishment after storm damage may violate these provisions.

Finally, whether warranted or not, Connecticut takings law may also pose a barrier to rebuilding restrictions and downzonings. These types of policies have the potential to completely wipe out all

[82] *Id.* § 22a-92(b)(2)(J).
[83] *Id.*
[84] BARLOW BURKE, THE LAW OF ZONING AND LAND USE CONTROLS 93 (2d ed. 2009).
[85] *Id.*
[86] CONN. GEN. STAT. § 8-2(a).
[87] Taylor v. Zoning Bd. of Appeals of Town of Wallingford, 783 A.2d 526, 532 (Conn. App. Ct. 2001).
[88] Cummings v. Tripp, 527 A.2d 230, 243 (Conn. 1987).
[89] *See* 112 Merwin Avenue, LLC v. Planning and Zoning Bd. of City of Milford, No. CV064006676S, 2007 WL 2570444, at *6-8 (Conn. Super. 2007)
[90] CONN. GEN. STAT. § 22a-105(e).
[91] *Id.* § 22a-40; Knapp v. Inland Wetlands Comm'n of Town of Prospect, 508 A.2d 804, 805-06 (Conn. App. Ct, 1986).

economic value. *Historically,* Connecticut courts have interpreted the state's Takings Clause strictly and found regulations to work an unconstitutional taking on the basis of a substantial diminution in property value. Even where some economic value remains, Connecticut courts have applied a *confiscatory takings* analysis to strike down regulations designed to protect wetlands and floodplains.[92] This precedent may have a chilling effect on municipalities fearful of being challenged in court.

Despite some adverse case law, however, these fears may be unwarranted—plaintiffs face a high hurdle in succeeding in a takings claim. First, regulations that do not substantially diminish the value of regulated lands will be analyzed under a balancing approach. The public benefits of the regulation will be weighed against the economic impact to the landowner. Municipalities will be on strong ground where they can show that development in highly vulnerable areas of the coast constitutes a threat to the public health, safety, and welfare; and where they can demonstrate the important public benefits provided by natural resources in these areas.

Second, even where a regulation causes a substantial diminution in the value of some lands, municipalities can craft regulations to avoid takings liability. Connecticut municipalities could argue that the confiscatory takings test should only apply to regulations that result in a 100% diminution in the economic use of the property, per the Supreme Court's holding in *Lucas* and more recent Connecticut cases.[93] Connecticut municipalities could also craft regulations that leave some residual economic use. After enactment, municipalities can also avoid the harsh results of application of the zoning ordinance through the variance process. Using variances, municipalities can allow some development where a strict application of the zoning ordinance will result in unusual hardship to the landowner.

Although untested, jurisdictions may also defend rebuilding restrictions on public nuisance grounds.[94] The science justifying the public benefits of land use and environmental controls has dramatically evolved since the early state law cases of *Dooley* and *Bartlett* were decided in the 1970's. Floodplain and wetlands regulations are more legally defensible today because regulators have a clearer understanding of both the environmental impacts of development to sensitive ecosystems and the costs of maintaining development in high-risk areas. Certain uses in particularly vulnerable areas of the coast may become a nuisance as flooding, erosion, and storm damages increase, and structures come to pose a threat to adjacent structures and emergency response personnel.[95] Municipalities should have some means to phase out uses that pose increasing dangers and costs to the community.

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[92] *See* discussion above at Section II(D). Connecticut courts have also struck down setback regulations where enforcement of the setback provisions would prohibit development for any reasonable purpose. Chevron Oil Co. v. Zoning Bd. of Appeals of Town of Shelton, 365 A.2d 387 (Conn. 1976).

[93] *See* discussion of more recent Connecticut case law examining the practical confiscation test, *supra* note 67.

[94] Esposito v. S.C. Coastal Council, 939 F.2d 165 (4th Cir. 1991) (holding that a taking does not occur when a regulation today removes from the bundle of property rights the right to rebuild a house should it ever be destroyed by a storm, because existing uses can continue and the impact on those uses is speculative). *See also* Oswalt v. County of Ramsey, 371 N.W.2d 241, 246 & n.3 (Minn. Ct. App. 1985) (holding that municipalities can phase out a nonconforming use without paying compensation and that limiting repairs of partially destroyed structures is an acceptable method to phase out nonconforming uses, but declining to decide whether a regulation prohibiting the reconstruction of houses in a floodplain is a taking).

[95] For example, Massachusetts courts review regulatory takings more liberally and have upheld very restrictive land use regulations in the 100-year floodplain. In *Gove v. Zoning Bd. of Appeals of Chatham*, the County survived a takings challenge to a regulation that prohibited development in the 100-year floodplain on the grounds that development posed risks to adjacent parcels during storm events and posed dangers to rescue personnel during evacuations. The court upheld the regulation because it did not prevent all economic use but allowed some residual uses such as recreational, agricultural, and commercial fishing. 831 N.E.2d 865, 871-75 (Mass. 2005).

Finally, rebuilding restrictions could also be defended from takings claims on the grounds that they are not triggered until a home is twice damaged. A landowner can still make economic use of their property until such time as their property is damaged. Where feasible, the landowner can relocate the property out of the high-hazard area and thus avoid the rebuilding prohibitions. Once a structure is damaged twice, there is a clear evidence of the threat to the property from natural hazards. Additionally, municipalities could argue that it is not the regulation that has caused the confiscation, but the physical forces of erosion and sea level rise.[96]

3. Accommodation Zone

The tools outlined in the Accommodation Zone may be the best option for Connecticut local governments in the short term given existing state law. The Accommodation Zone employs traditional tools that are already used to increase the resilience of development to flood impacts, such as downzoning, increasing setbacks, increasing building elevation requirements (i.e., increasing freeboard), and limiting the size and height of structures.[97] The model ordinance proposes that local governments downzone the Accommodation Zone to only allow lower density residential and commercial development, thereby limiting the extent of development in harm's way. Under the model SLR ordinance, setbacks are established through the site plan review process and structures are required to be setback as far upland as practicable on the lot to maximize protection from flooding. Alternatively, where historic erosion rates are available, local governments can establish erosion-based setbacks where the setback is calculated by multiplying the erosion rate for the area by the life of the structure (e.g., 60 years).[98] The model also requires additional freeboard to account for SLR.[99] Localities can vary freeboard requirements based upon the type of structure—requiring lesser elevations for residential and commercial structures and greater elevations for critical facilities (e.g., hospitals, fire and police stations) and public infrastructure (e.g., bridges, roads).[100] Finally, the model ordinance proposes that local governments limit the footprint and height of structures allowed in the Accommodation Zone to lessen the potential collateral damage that structures can cause if damaged in storm events. Several Connecticut local governments already employ these tools, albeit without consideration of SLR, and homeowners in participating communities that adopt these measures can

[96] *See e.g.,* Bauer v. Waste Mgmt. of Connecticut, Inc., 662 A.2d 1179 (1995) (In *Bauer,* the Connecticut Supreme Court rejected the plaintiffs argument that the town's refusal to allow a landfill operator to exceed its height limits when the landfill had reached capacity constituted a taking. The court held that "it [was] not the regulation that deprived Waste Management of all beneficial use of its land, but rather it was Waste Management's prior use of its land, namely, the deposit of ninety feet of refuse on that land." *Id.* at 1197.)

[97] This finding is similar to our analysis of Maryland state law. *See generally* Grannis, *MD Model SLR Overlay Zone, supra* note 12, at § VII.

[98] *See e.g.,* Kaua'i County, Hawaii, County Code, Ordinance 863 Establishing a New Article 27, Chapter 8, § 1 (1987), *available at* http://collaborate.csc.noaa.gov/climateadaptation/Lists/Resources/Attachments/12/Kauai_Shoreline_Setback_Bill_Final.pdf.

[99] It is important to note that increasing freeboard can have the unintended consequence of making properties ineligible for FEMA mitigation grants. FEMA offers grants to elevate at-risk structures; each project, however, must be justified using a cost-effectiveness analysis. The extra cost of elevating a structure to higher freeboard standards (e.g., 2 feet instead of 1 foot) can exceed the benefits allowed under FEMA's formula and make the project ineligible for funding. Dave Carlson, Delaware's *Hazard Mitigation Plan*, presentation to Delaware's Sea Level Rise Advisory Committee (Jan. 19, 2012).

[100] Janet Freedman, *Rhode Island Efforts Towards Mitigation and Adaptation to Climate Change,* presentation to Groton Coastal Climate Adaptation Workshop (Jan. 27, 2010), *available at* http://www.icleiusa.org/action-center/planning/Janet_ICLEI%20RI%20climate%20change%20planning.pdf.

be eligible to receive insurance premium discounts under the Community Rating System (a subprogram of the NFIP).[101]

There do not appear to be many barriers to implementation of these tools under existing Connecticut law. The ZEA explicitly allows local governments to regulate setbacks, structure design, density, footprint, and use restrictions as well as overlay zones.[102] The tool that could be problematic is downzoning. The ZEA's provision requiring preservation of nonconforming uses may limit a municipality's ability to downzone.[103] While municipalities may have to allow for the reestablishment of nonconforming uses, downzoning can still be used to ensure that structures are rebuilt to a smaller, less vulnerable footprint. Additionally, where structures are destroyed beyond 50%, they will be required to conform to more restrictive development standards, such as freeboard and size and height limits.[104]

The Accommodation Zone is also unlikely to run afoul of Connecticut takings law. The zone's provisions allow some economic use of property and can be justified with compelling public health, safety, and welfare justifications. Setbacks established through site plans can allow some development. Elevation requirements may increase the costs of development or redevelopment, but can be shown to provide important flood protections.

Additionally, local governments can use the CCMA's site plan review process to require consideration of potential SLR impacts when permitting development in coastal areas. Under the CCMA, municipalities must require site plans for all development projects within the coastal boundary.[105] In reviewing site plans, Section 22a-92(a)(5) requires the permitting authority to consider "the *potential* impact of coastal flooding and erosion patterns on coastal development so as to minimize damage to and destruction of life and property and reduce the necessity of public expenditure to protect future development from such hazards."[106] When approving any activity proposed in a coastal site plan, the CCMA requires that the municipality find that the activity's "potential adverse impacts" on coastal resources are acceptable.[107] The statute's reference to "*potential* impact of coastal flooding," should allow for consideration of the increased risks posed by SLR.[108] Site plans can be used as a mechanism to encourage developers to consider the risks to projects from different SLR scenarios. Additionally, using site plans, municipalities can impose conditions to require that development projects incorporate measures to mitigate SLR risks. These policies present the best options for Connecticut local governments to require adaptation through regulatory approaches given existing state law.

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[101] *See generally*, Federal Emergency Management Agency (FEMA), *Community Rating System*, http://www.fema.gov/business/nfip/crs.shtm (last visited June 19, 2012).

[102] CONN. GEN. STAT. § 8-2(a), (m).

[103] *Id.* § 8-2(a).

[104] When permitting repairs to "substantially damaged" structures (i.e., structures where the cost to repair the structure exceeds 50% of the structure's fair market value), the structure must be brought into compliance with NFIP minimum requirements. FRENCH & ASSOCIATES, LTD, MANAGING FLOODPLAIN DEVELOPMENT THROUGH THE NATIONAL FLOOD INSURANCE PROGRAM 8-18 – 8-22 (1998), *available at* http://www.fema.gov/pdf/floodplain/is_9_complete.pdf.

[105] *See* discussion of site plan review *supra* note 35.

[106] CONN. GEN. STAT. § 22a-92(a)(5).

[107] *Id.* § 22a-106(a). In making this decision, the municipality is required to take into account the criteria listed in § 22a-106(b)(1)-(3).

[108] This approach has been adopted in Maine and by Hull, Massachusetts. For a further discussion of using site plan review to account for SLR, *see* Grannis, *MD Model SLR Overlay Zone*, *supra* note 12, at 48.

IV. State Level Approach to Climate Change: Rhode Island Case Study

State agencies also have an important role to play in adapting to SLR. Rhode Island serves as an interesting comparison for Connecticut in considering potential state-level regulatory responses. As Rhode Island is a limited home rule state, many of the climate change approaches adopted in Rhode Island are administered on the state level. Like Connecticut, Rhode Island's coastline is highly developed, densely populated, and rich in history. To accommodate the needs of a productive coastline, while also ensuring preservation of the coast, Rhode Island has created a flexible framework that employs different regulations based upon considerations of coastal features (wetlands, beaches, dunes, barrier islands, bluffs, rocky shores) and adjacent coastal uses (conservation, low-intensity, commercial, or water-dependent uses).

Rhode Island, like other states such as Texas, Maine, Massachusetts, North and South Carolina, and Oregon, has adopted a variation of the "rolling easement"[109] (referred to here as "rolling coastal management statutes").[110] Coastal managers recognized that beaches and coastal wetlands were being lost at dramatic rates because natural migration processes were being disrupted by engineered

[109] The concept of the rolling easement was initially developed in Texas in the 1950s; it was conceived not as an environmental measure, but rather was designed to protect the public's access to the beach. Richard J. McLaughlin, *Rolling Easements as a Response to Sea Level Rise in Coastal Texas: Current Status of the Law after* Severance v. Patterson, 26 J. LAND USE & ENVTL. LAW 365, 369-70 (2011). The Texas Open Beaches Act (OBA) was a response to a ruling by the Texas Supreme Court which held that private land owner property rights extended down to the low water mark. There was a public outcry and the legislature responded the next year by ensuring public access to the dry sand beach by enacting the OBA. *Id.* at 370. The legislature, relying on principles of public trust and historic public use, created a process for establishing public access rights across private dry sand beaches up to the vegetative line. TEX. NAT. RES. CODE ANN. §§ 61.012, 60.016. In several decisions, the Texas Court of Civil Appeals found that, once established, the OBA easement "rolled" inland and encumbered formerly unencumbered land as a result of the natural process of erosion and, thus, found that the law did not cause a taking of private property. *See* Arrington v. Tex. Gen. Land Office, 38 S.W.3d 764 (Tex.Ct. App.2001); Matcha v. Mattox, 711 S.W.2d 95 (Tex.Ct. App. 1986); Feinman v. State, 717 S.W.2d 106 (Tex.Ct. App. 1986). The rolling public access easement created by the OBA has recently been called into question by the Texas Supreme Court in *Severance v. Patterson*, 345 S.W.3d 18 (Tex. 2010). The court in *Severance* found that the boundaries of the easement do not "roll" in dramatic avulsive storm events, as opposed to gradual accretion, due to common law distinctions between avulsion and accretion. The Texas Supreme Court reheard arguments in this case after popular outcry, but the Court largely affirmed its prior decision. Severance v. Patterson, No. 09-0387, 2012 WL 1059341 (Tex. Sup. Ct. Mar. 30, 2012).

[110] It is important to note that a "rolling coastal management *statute*" may not face the same challenges as the "rolling public access easement" created by OBA. "These statutes have been called 'rolling easement statutes' because of their similarities to the Texas Open Beaches Act. Texas courts interpreted the Open Beach Act as creating a rolling public access easement over dry sand beaches. Other states have enacted similar laws that employ a rolling boundary that triggers land use restrictions. However, these land use statutes do not create a true easement, in the legal meaning of the term, because they create no right in the public to use private property. Instead, they manage coastal land uses based upon a project's proximity to the shoreline and recognize the dynamic migrating nature of the shoreline." Byrne, *Coastal Retreat Measures*, *supra* note 14, at n. 67. Where such a statute does not try to assert public access rights upland of public tidelands, it will not constitute a permanent physical invasion of lands and may be upheld under common law doctrines of public trust and nuisance. *See also* 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) and JIM TITUS, U.S. EPA, CLIMATE READY ESTUARIES, ROLLING EASEMENTS PRIMER (2011), *available at* http://www.epa.gov/cre/downloads/rollingeasementsprimer.pdf [hereinafter TITUS, ROLLING EASEMENT PRIMER].

structures, such as revetments, jetties, and bulkheads.[111] To respond to such threats these states implemented rolling coastal management statutes, which are designed to balance public and private rights in tidelands. These statutes allow landowners to develop lands adjacent to the coast, but impose regulations on development to ensure that it does not detrimentally impact coastal resources, such as by building protective structures that prevent natural shoreline processes.

A. Rolling Coastal Management Statutes: A Brief History

Rolling coastal management statutes can provide a useful adaptation strategy because they address the temporal uncertainty of SLR. They accommodate continued development but preserve the right of the state to enforce a retreat policy as climate impacts occur and intensify.[112] As a legal concept, rolling coastal management statutes are closely related to the Public Trust Doctrine (PTD). The PTD has a long legal lineage and can be traced back through the Magna Carta to the Roman Empire.[113] The PTD reflects the principle that each state has a responsibility to preserve and hold in trust state-owned tidelands, waters, and natural resources.[114] The PTD establishes a rolling border between state tidelands and privately held uplands that fluctuates with a natural coastal feature. While this border varies from state to state, the majority view is that the lands below the mean high water mark (i.e., the wet sand beach) belong to the state and are held in trust by the government for public use (for fishing, navigation, and sometimes recreational use). Lands above the mean high water mark (i.e., the dry sand beach) are typically held privately.[115] States outside the majority have adopted a myriad of rules: some set a public/private border at the mean lower water mark, others allow private ownership of tidal flats, and others do not allow private ownership of beaches. Even in those states, however, the public retains limited rights to submerged lands and the state retains its traditional duties.[116]

Rising sea levels threaten this balanced division between public and private interests in coastal lands. If sea levels are allowed to rise unchecked, they will permanently inundate some areas and convert private lands to public lands. However, if landowners choose to hold back the sea by building hard protective structures, public lands will gradually erode, which could have far-reaching economic and environmental consequences. Rolling coastal management statutes attempt to balance these extremes by applying a deferred-retreat strategy. The essence of a rolling coastal management statute is that it codifies the rights between a coastal landowner and the public in tidelands based upon common law boundaries that fluctuate with natural coastal processes. Typically, rolling coastal management statutes use this boundary to establish various land use regulations, such as setbacks, and landowners are prevented from taking any measures to prevent tidelands from migrating inland (such as by building sea walls).[117] With a rolling coastal management scheme in place, both the property owner and the government are "winners": the property owner is able to continue economic use of his or her property within certain legal parameters until impacts occur (which may be decades in

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[111] Megan Higgins, *Legal and Policy Impacts of Sea Level Rise to Beaches and Coastal Property*, 1 SEA GRANT L. & POL'Y J. 43 (2008), *available at* http://nsglc.olemiss.edu/SGLPJ/Vol1No1/3Higgins.pdf.

[112] *See generally* TITUS, ROLLING EASEMENT PRIMER, *supra* note 110. For nearly 30 years, James Titus has been investigating the issue of rising sea levels for the U.S. Environmental Protection Agency; he is one of the leading experts on the impacts of rising sea levels.

[113] COASTAL STATES ORGANIZATION, PUTTING THE PUBLIC TRUST DOCTRINE TO WORK 4 (2d ed. 1997).

[114] *Id.* at 5.

[115] Titus, *Rising Seas, supra* note 14, at 1365-66.

[116] *Id.* at 1366.

[117] TITUS, ROLLING EASEMENT PRIMER, *supra* note 110, at 7.

the future), and the government is able to preserve the public's present and future interest in tidelands, to ensure access to the shore and provide important ecological services.

B. How Rolling Coastal Managements Statutes have been Implemented in Rhode Island

1. History of the Coastal Resources Management Council

Rhode Island has adopted a "rolling" approach to coastal management. In 1971, the Rhode Island legislature created the Coastal Resources Management Council (the "Council") and delegated authority to it to manage and protect the state's coastal resources.[118] In creating the Council, the legislature recognized that certain actions, such as the unregulated development of shore-side properties, was having an irreversible impact on the resources the legislature was constitutionally mandated to protect – public trust lands. The legislation granted the Council broad discretion to ensure the preservation of all of Rhode Island's coastal resources.[119] To implement this authority, the Council adopted the state's coastal zone management program, known as the Coastal Resources Management Program (CRMP).

2. The "Rolling" Provisions of the CRMP

The Coastal Resources Management Program has a complex regulatory structure that manages specific development activities in various coastal settings. While complex, this administrative setup gives the Council flexibility to regulate in a manner that balances public interests with economic uses of the coast. The CRMP identifies six different water "types": conservation areas, low-intensity use, high-intensity boating, multipurpose waters, commercial and recreational harbors, and industrial waterfronts.[120] The state has also designated ten categories of coastal "features": tidal waters; beaches and dunes; undeveloped barriers; moderately-developed barriers; developed barriers; coastal wetlands; headlands, bluffs and cliffs; rocky shores; manmade shores; and areas of historic/archaeological significance.[121] The CRMP then places limitations on or requirements for different activities based on the water "type" and coastal "features" where the activity is proposed. These include the construction of residential structures, docks and piers; beach nourishment; and construction of commercial or industrial buildings. This type of "zoning" of coastal lands could be

[118] The Council is tasked with the responsibility "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." R.I. GEN. LAWS § 46-23-1(a)(2). The Council has "exclusive jurisdiction below mean high water for all development, operations, and dredging, consistent with [legislative findings] and except as necessary for the department of environmental management to exercise its powers and duties." *Id.* § 46-23-6(2)(ii)(A).

[119] R.I. GEN. LAWS § 46-23-6(1)(i). The strategies, methodologies and regulations that the Council employs in its management are outlined in *The State of Rhode Island Coastal Resources Management Program*, commonly known as the "Redbook." Rhode Island courts have consistently upheld the authority of the Council against legal challenge. In *Milardo v. Coastal Resources Management Council*, the court recognized that a quasi-legislative power was granted to the Council when it was established and upheld the Council's denial of a permit to construct an individual sewer on his property. 434 A.2d 266, 271 (R.I. 1981). The court extended this holding in *Santini v. Lyons,* recognizing the Council's broad authority to protect precious coastal resources, even when those who own coastal properties face a heavier burden then those outside the jurisdiction of the Council. 448 A.2d 124 (R.I. 1982).

[120] 16-2 R.I. CODE R. §§ 200.1—200.5.

[121] *Id.* § 210.

helpful in implementing a SLR adaptation strategy by helping communities establish adaptation goals for different types of lands and different states of development.

The CRMP also employs different development standards based upon the type of waters and the types of coastal features. Most of the rolling land use restrictions apply to construction in conservation areas, low-intensity use waters, and multipurpose waters. For example, residential structures are prohibited within conservation areas except for already-developed barriers and areas of historic/archaeological significance. In coastal beaches,[122] the CRMP prohibits construction of most structures.[123]

The Council has implemented a three-fold approach to preserving and restoring coastal areas damaged by erosion and upland development. First, the Council has established a policy to restore damaged wetlands and, when possible, build new ones.[124] By creating and restoring wetland areas, the state encourages the growth of a natural buffer zone to protect coastal areas from the effects of sea level rise. Second, the Council prohibits new armoring and the repair of armoring in certain water "types."[125] The CRMP prohibits the use of armoring to recoup property lost through gradual erosion.[126] The CRMP also requires the removal of armoring that is severely damaged or abandoned, and the Council may seek the owner's cooperation or require that the armoring be removed.[127] Third, the CRMC requires a "rolling" setback for shoreline properties. Structures must be setback a "minimum distance from the inland boundary of a coastal feature" calculated based on long-term shoreline change rates.[128] These policies will ensure that the shoreline is allowed to migrate landward unimpeded even as sea levels rise; however, they still allow landowners to continue to use and maintain their lands until impacts occur.

3. The CRMP Addresses Climate Change and Sea Level Rise

Rhode Island was one of the first states to explicitly address sea level rise in its coastal management program. In 2008, the Council amended the CRMP to include Section 145, entitled

[122] "Coastal beaches include expanses of unconsolidated, usually unvegetated sediment commonly subject to wave action, but may also include a vegetative beach berm." *Id.* §210.1(A).

[123] *Id.* § 210.1(D)(1) ("The construction of new structures other than accessways, walkover structures, and beach facilities, are prohibited in setback areas.").

[124] *Id.* § 210.3(C)(2) ("To offset past losses in coastal wetlands and unavoidable alterations to surviving coastal wetlands: (a) disturbed wetlands should be restored as directed by the Council or enhanced when possible; and (b) in areas selected on the basis of competent ecological study, the Council will encourage the building of new wetlands.").

[125] *Id.* § 300.7(D)(1) ("The Council shall prohibit new structural shoreline protection methods on barriers classified as undeveloped, moderately developed, and developed and in Type 1 waters.").

[126] *Id.* § 300.7(D)(4) ("Structural shoreline protection facilities are prohibited when proposed to be used to regain property lost through historical erosion or storm events.").

[127] *Id.* § 210.6(C)(3) ("The Council shall endeavor to determine the ownership of abandoned or deteriorating shoreline protection structures and shall encourage the owners of such structures to restore or remove them. The Council may order restoration or removal where it finds that the structure poses a hazard to navigation, interferes with the public's right of access to and along the shore, causes flooding or wave damage to abutting properties, or degrades the scenic qualities of the area.").

[128] *Id.* § 140(A) In Rhode Island, the requisite setback requirements for sites along the coast are based on calculated long-term shoreline change rates. This allows for the dune to roll back with sea level rise and storm forces, and also allows a structure to maintain a 30-year life expectancy. *See* Puchalski v. Coastal Resources Management Council, 2001 WL 1006699 (R.I. Super. Aug. 8, 2001).

"Climate Change and Sea Level Rise."[129] Through Section 145, the Council made many important acknowledgements: They recognized the strong scientific evidence of climate change and the long-term threats posed to the state by a changing climate.[130] They recognized the immense threats that climate change and rising seas pose to terrestrial and marine environments and acknowledged the challenge that coastal managers face in "cop[ing with] and adapt[ing] to the new regime."[131] And, they acknowledged that sea level rise will displace coastal populations, threaten infrastructure including roads and bridges, and cause intensified coastal flooding threatening recreation areas, public space, and the natural environment, such as coastal wetlands.[132] This state-level acknowledgement provided a critical foundation for building stronger climate change management tools, on both the state and local level. Connecticut faces similar threats and even if Connecticut does not adopt a statewide policy, like that articulated by Section 145, an acknowledgement by the state of the challenges faced by coastal managers in the wake of climate change could provide municipalities with a stronger footing to enact local regulations.

Section 145 also provides a model for "mainstreaming" climate adaptation. The regulations require the Council to consider SLR in planning and management. The Council must "accommodate a base rate of expected 3- to 5-foot rise in sea level by 2100 in the siting, design, and implementation of public and private coastal activities and to insure proactive stewardship of coastal ecosystems under … changing conditions."[133] In the regulations, the Council acknowledged that the statute's SLR projections were a low estimate. Section 145 directs the Council to periodically reevaluate the rate based upon new scientific evidence. The regulations also allow the Council to "take into account different risk tolerances for differing types of public and private coastal activities"[134] When considering regulation options in Connecticut, the state and municipalities should consider policies that are robust and can incorporate changes in emerging science.

In response to the adoption of Section 145, the state's Building Code Standards Committee also adopted new regulations incorporating freeboard calculations (a height above the anticipated flood level) within V-zones (i.e., coastal high hazard zones).[135] Specifically, this allows the state building codes and standards committee to consult with the building code commissioner "to adopt, maintain, amend, and repeal code provisions … for storm and flood resistance. Such code provisions shall, to the extent reasonable and feasible, take into account climactic changes and potential climactic changes and sea level rise."[136]

4. Other State Policy and Initiatives that Address Climate Change and Sea Level Rise

The Council has been active in other non-regulatory climate change efforts. The Council has worked with the University of Rhode Island Environmental Data Center and others to obtain LiDAR (Light Detection And Ranging) mapping of the state.[137] LiDAR data will assist the state in establishing

[129] CRMP, Section 145: Climate Change and Sea Level Rise, adopted on January 15, 2008, effective on February 17, 2008.
[130] 16.2 R.I CODE § 145(B).
[131] *Id.* § 145(B)(10).
[132] *Id.* § 145(B)(12)-(14).
[133] *Id.* at § 145(C)(3).
[134] *Id.*
[135] R.I. GEN. LAWS § 23-27.3-100.1.5.5.
[136] *Id.*
[137] Rachel M. Gregg, *Planning for Sea Level Rise in Rhode Island's Coastal Management Program* (July 1, 2010), case study available on the Climate Adaptation Knowledge Network, http://www.cakex.org/case-studies/1546 (last visited June 20, 2012).

accurate elevations for mapping SLR scenarios and projecting the landward migration of flood hazard zones along the coast.[138] The Council also worked with the University of Rhode Island Graduate School of Oceanography and Rhode Island Sea Grant to create the first Ocean Special Area Management Plan (OSAMP), which included a chapter on Global Climate Change.[139] These collaborative state efforts have allowed Rhode Island to begin to develop the science and data needed to prepare for a future with a changing climate.

Lastly, in 2010, the Rhode Island legislature passed a bill that created a statewide climate change commission.[140] Now in effect, the Climate Change Commission consists of 28 members including representatives of the legislature, state agencies, business organizations, environmental organizations, and community groups. The Climate Change Commission is tasked with studying the projected impacts of climate change within the state, identifying and reporting on methods of possible adaptations that will increase economic and ecosystem sustainability to identified threats, and identifying potential mechanisms to mainstream climate adaptation into existing state and municipal programs, including policy plans and infrastructure development and maintenance.[141]

V. Conclusion: Charting a Path Forward

From this analysis it is clear that Connecticut has a broad range of existing tools that it can use *now* to take incremental steps to begin to build resilience within its communities. Innovative tools for regulating floodplains and coastal areas are being developed in jurisdictions across the country that can be used as models for best practices.

To conclude, this section provides some recommendations for charting a path forward at both a state and local level. First, actions that Connecticut municipalities can take now using existing authorities are examined. Second, this section discusses actions that policymakers can consider in the medium term that would require amendments to existing laws and policies. Third, recommendations are provided for charting a long-term vision for regulating coastal development in the face of rising seas. Finally, lessons learned are shared for other jurisdictions struggling with similar challenges in adapting to climate change.

A. What Connecticut Can Do now with Existing Authority

Rhode Island provides a useful example for how Connecticut municipalities could begin to mainstream adaptation by encouraging consideration of SLR through the CCMA's site plan review process.[142] Under the CCMA, permitting authorities must "minimize adverse impacts on coastal resources" and consider "the potential impact of coastal flooding and erosion patterns on coastal development."[143] The authority could be interpreted broadly to allow local governments to use the site plan review process to protect their communities from potential SLR impacts. Like Rhode Island,

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[138] *Id.*

[139] *Id.* Special Area Management Plans (SAMPs) are broadly defined in the Coastal Zone Management Act as "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 decision making."

[140] The Rhode Island Climate Risk Reduction Act of 2010, R.I. GEN LAWS §§ 23-84-1–23-84-3, *available at* http://www.rilin.state.ri.us/billtext10/housetext10/h7719aaa.htm.

[141] R.I. GEN. LAWS § 23-84-3.

[142] *See* Grannis, *MD Model SLR Overlay Zone*, *supra* note 12.

[143] CONN. GEN. STAT. § 22a-92(4)-(5).

Connecticut municipalities could require that all development proposals consider a range of anticipated SLR scenarios. This could be used to ensure that development proposals consider a range of adaptation options, and allow regulators to condition development based upon landowner agreements to use resilient design techniques, not armor, or remove structures that come to encroach on public lands as the seas rise.

Municipalities could increase their communities resilience by amending floodplain ordinances to require that development incorporate more protective flood mitigation measures, such as additional freeboard, smaller footprints, greater setbacks, and only allowing lower-intensity uses (as suggested in the Accommodation Zone). These approaches would have the added benefit of qualifying the community for the Community Rating System, which provides insurance premium discounts for homeowners in participating communities.

At the state level, agencies could undertake many non-regulatory initiatives to support municipal efforts. While Connecticut may not be in as strong a position as Rhode Island to adopt statewide policies, state agencies can offer guidance for municipalities and incentives to encourage them to begin to adapt. DEEP could develop necessary data, mapping and other tools to support local decision-making. State agencies could also adjust property acquisition policies to provide added incentives to encourage landowners to sell vulnerable properties and retreat from the shoreline; this may relieve municipalities from having to enact politically and legally challenging downzonings.

B. What Connecticut Could Do with Amendments to Existing Laws or Regulations

With minor amendments to the CCMA, TWA and SDFA, the state could develop more streamlined processes for regulating shoreline armoring and encouraging soft-armoring alternatives. The state could employ an approach similar to that adopted in Maryland—the Living Shorelines Protection Act.[144] Under this approach the state could delegate authority to DEEP to streamline permitting for hard armoring, make permitting decisions on a regional scale, and encourage soft-armoring alternatives where feasible.[145] At a minimum, municipalities and DEEP could coordinate to identify areas appropriate for hard protection due to the location of critical facilities and infrastructure and encourage and fund soft projects in other areas of the coast with sensitive natural resources.

C. Connecticut Should Develop Long-Term Strategies to Encourage Retreat

While Connecticut has options to regulate armoring and to require more resilient construction, implementation of retreat policies may be more politically and legally challenging. As a result, policymakers may need to think about a long-term strategy to develop flexible legal frameworks to promote retreat. To allow municipalities to downzone and limit rebuilding, the state legislature should amend provisions that restrict local governments' ability to phase out nonconforming uses, or explicitly allow them to phase out nonconforming uses which come to constitute a nuisance due to threats to public health, safety, and welfare. Additionally, due to the political challenges, Connecticut may want to consider coupling regulatory approaches with incentive-based approaches to encourage

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[144] Since the writing of this article, Connecticut enacted legislation amending its state's Coastal Management Act requiring that local governments consider impacts from SLR and authorizing the use of "living shorelines." *See* An Act Concerning the Coastal Management and Shoreline Flood and Erosion Control Structures, 2012 Conn. Legis. Serv. P.A. 12-101 (June 8, 2012).

[145] *See* Maryland Living Shorelines Protection Act, MD. CODE ANN. ENVIR. § 16-201; *see also* discussion of how Living Shoreline Act can be used to promote adaptation in Grannis, *MD Model SLR Overlay Zone, supra* note 12, at 19-20.

relocation of development inland. For example, policymakers may want to reevaluate how they allocate hazard-mitigation funding after storm events: they could target funds to buy out storm-damaged structures and limit rebuilding in highly vulnerable areas. Connecticut could also consider transferrable development rights (TDR) programs. Downzoning may be more politically palatable and more legally defensible where municipalities allow affected landowners to recoup some of their investment by selling TDRs.[146] A TDR program could be created that would allow affected landowners to sever their development rights and sell those rights to upland developers to increase densities in less vulnerable areas of the community or region.[147]

D. Lessons for Other Jurisdictions

This case study demonstrates that local governments especially have broad existing powers that they can use now to adapt their communities to the threats posed by climate change. Communities across the nation are grappling with the increasing threats posed by natural hazards, and best practices from these communities can serve as models for others seeking to adapt their floodplains and coastal regulations.

However, the path to creating a more resilient community may not be easy or clear—legal obstacles may unnecessarily deter government action. To determine what options are feasible for a given state or community, policymakers will need to navigate a complex maze of overlapping laws to answer many legal questions: what level of governments is best suited to implement particular adaptation tools; what level of coordination will be required between levels of government; what legal barriers exist; and what implementation challenges require changes to existing laws and regulations. One of the lessons learned from Connecticut is that although municipalities have a broad range of powers that they can use to adapt, they may need additional authority to allow them to regulate with more flexibility to address the impacts that are already being felt along their shorelines.

[146] CONN. GEN. STAT. § 8-2e.

[147] *See* GRANNIS, ADAPTATION TOOL KIT, *supra* note 12, at 57-59.

Legal Options for Municipal Climate Adaptation in South Boston: An Example for Connecticut Coastal Jurisdictions

Nicole Rinke[1] and Sarah Fort[2]

Abstract: The City of Boston has been a leader in considering options to address climate change adaptation and has been working with Harvard Law School's Emmett Environmental Law & Policy Clinic (ELPC) to identify potential strategies that may be employed to address sea level rise and other climate change impacts within the City. While the legal landscape, both at the municipal and state level, differs between Massachusetts and Connecticut, Connecticut municipalities can learn and borrow from the efforts in Boston to inform their own adaptation initiatives. With permission of the ELPC, this paper borrows heavily from a white paper others at ELPC wrote for Boston in 2010/2011. The current paper discusses how several strategies the ELPC has identified for Boston could be modified and employed by jurisdictions in Connecticut.

I. Introduction

Municipalities in Connecticut, like many municipalities in other coastal states, are beginning to look seriously at their options for adapting to climate change. Climate change impacts in the northeastern United States will include sea level rise, rising temperatures, and increased storm events.[3] As municipalities in Connecticut consider their options for climate change adaptation, they can learn and borrow from the efforts of other jurisdictions.

The City of Boston has been a leader in considering measures for climate change adaptation for nearly a decade and has been working with Harvard Law School's Emmett Environmental Law and Policy Clinic (ELPC) to identify and implement a range of municipal strategies. In August 2011, the Clinic

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[2] Sarah Fort graduated with honors from Harvard Law School in 2012. As a student, Ms. Fort focused on environmental law and local government law. During the fall of 2011, Ms. Fort was enrolled in the Harvard Emmett Environmental Law & Policy Clinic and focused her research on integrating climate change impacts into environmental impact review processes. Beginning in the fall of 2012, Ms. Fort will serve as a law clerk for the Honorable F. Dennis Saylor IV.

[3] *See generally*, THE NORTHEAST CLIMATE IMPACTS ASSESSMENT SYNTHESIS TEAM, CONFRONTING CLIMATE CHANGE IN THE U.S. NORTHEAST: SCIENCE, IMPACTS AND SOLUTIONS (2007), *available at* http://www.northeastclimateimpacts.org/pdf/confronting-climate-change-in-the-u-s-northeast.pdf.

published a paper describing legal options for municipal climate adaptation specifically for South Boston – an area of Boston that will be heavily impacted by sea level rise (the "ELPC White Paper").[4] Many of the strategies ELPC identified for Boston are replicable in Connecticut, either at the municipal or state level. By looking at these examples, Connecticut jurisdictions can begin to develop their own tools for adaptation and develop a model for how they may borrow from the strategies being employed elsewhere.

This paper will begin with an introduction to climate change adaptation in Boston. It will then discuss several of the strategies that ELPC proposed for Boston and how those strategies could be used in Connecticut municipalities including: (1) zoning and specifically the use of overlay zones; (2) the imposition of resilient building design standards via zoning; (3) development review; (4) procurement; and (5) wetlands regulations. Although this represents only a small subset of the numerous strategies ELPC identified for Boston, these examples provide a useful model for how jurisdictions might borrow from and tailor the strategies being used in other jurisdictions to adapt to climate change.

II. Climate Change Adaptation in Boston[5]

Climate change is already occurring in the Boston metropolitan region and is projected to produce increasingly serious consequences over the course of this century. The magnitude of these impacts will depend on the climate change mitigation measures adopted around the world. Even with aggressive cuts in greenhouse gas emissions, however, some changes in Boston's environment are inevitable.

Climate change is expected to cause approximately 2.5 to 5 feet of sea level rise in Boston Harbor by the end of the century.[6] This will lead to saltwater intrusion and inundation of many low-lying areas and coastal resources that currently provide flood protection. More frequent and more intense storms are likely to compound the problems caused by sea level rise and lead to greater coastal flooding and erosion.[7]

These changes are expected to affect many aspects of Boston's residential, commercial, and industrial development as well as its transportation, water, waste, and communications infrastructure. For example, large portions of the City are located on filled lands situated at low elevations that are vulnerable to sea level rise and to flooding from storm events. Similarly, the increase in stormwater runoff resulting from increased precipitation could raise pollution levels in coastal waters, affecting opportunities for public recreation at beaches and on waterways. Climate-related changes are also expected to impact public health. Water pollution will increase exposure to carcinogens and E. coli bacteria, and saturated buildings will increase exposures to mold, bacteria, and allergens.[8]

In March 2009, Mayor Menino established the Boston Climate Action Leadership Committee and Community Advisory Committee (the "Committees") to begin to address climate change adaptation.

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[4] WENDY B. JACOBS, LEAH R. COHEN, AND JENNIFER MCGRORY, HARVARD LAW SCHOOL EMMETT ENVIRONMENTAL LAW & POLICY CLINIC, LEGAL OPTIONS FOR MUNICIPAL CLIMATE ADAPTATION IN SOUTH BOSTON (2011), *available at* http://www.law.harvard.edu/academics/clinical/elpc/publications/climate-adaptation-final_8-25-11.pdf (hereinafter ELPC WHITE PAPER).

[5] This section borrows heavily from the ELPC WHITE PAPER, *id.* at 4-6.

[6] Ellen Douglas and Chris Watson, *The Rising Tide in Boston: Sea Level Rise and Coastal Flooding due to Climate Change*, presentation at the Boston Harbor Sea Level Rise Forum (Nov. 9-10, 2010). Two and a half and five feet of sea level rise represent two different low- and high-range scenarios of sea level rise by 2100. However, the plausible range of sea level rise for Boston Harbor may be greater. *Id.*

[7] UNION OF CONCERNED SCIENTISTS, CONFRONTING CLIMATE CHANGE IN THE U.S. NORTHEAST: MASSACHUSETTS, 2-3 (2007), *available at* http://www.climatechoices.org/assets/documents/climatechoices/massachuetts_necia.pdf.

[8] *See, e.g.*, PHOEBE CHANG, THE EFFECTS OF COASTAL STORMS, SEA LEVEL RISE AND BASEMENT FLOODING IN EAST BOSTON (2010) (unpublished paper, on file with ELPC).

The Committees were charged, in part, with evaluating the risks from sea level rise and other consequences of climate change and recommending actions for the City and its residents to take to reduce these risks. The Committees issued their final report, entitled *Sparking Boston's Climate Revolution*, in April 2010.[9] The City reported on its work on those recommendations in its 2011 Climate Action Plan update, *A Climate of Progress*.[10]

In addition to publishing its paper, Harvard Law School's Emmett Environmental Law & Policy Clinic and its students (collectively, the "Clinic") are assisting the City with its ongoing efforts to adapt to the impacts of sea level rise and more frequent and more intense storms in Fort Point Channel and South Boston.[11]

III. Adaptation in Connecticut – Applying Strategies from Boston

Connecticut has also been proactive in recognizing the importance of and preparing for climate change adaptation. In December 2008, the Governor of Connecticut formed the Adaptation Subcommittee of the Governor's Steering Committee on Climate Change.[12] The subcommittee released a report in 2010 analyzing the impacts of climate change on various sectors throughout the state[13] and is in the process of developing a preparedness plan.[14]

Connecticut municipalities can learn and borrow from the strategies Boston is considering to adapt to climate change. While the framework of municipal and state law varies slightly in Connecticut from Massachusetts and specifically Boston, many of the strategies that apply in Boston can be adapted to the legal framework in Connecticut. For example, although some variations will be required, the strategies that the Clinic developed for Boston regarding (1) zoning and the use of overlay zones; (2) zoning and the imposition of resilient building design standards; (3) development review; (4) procurement; and (5) wetlands regulations, can be implemented, to some degree, in Connecticut at the state or jurisdictional level. While these are the only strategies discussed here for adoption in Connecticut, others identified by the Clinic in the ELPC White Paper may also warrant consideration. These examples, however, provide a useful starting point for exploring adaptation options in Connecticut and establishing a model for how Connecticut may be able to adapt the strategies being employed in other jurisdictions.

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[9] BOSTON'S CLIMATE ACTION LEADERSHIP COMMITTEE AND COMMUNITY ADVISORY COMMITTEE, SPARKING BOSTON'S CLIMATE REVOLUTION (2010), *available at* http://www.cityofboston.gov/Images_Documents/Sparking%20Bostons%20Climate%20Revolution%20Summary%20Report_tcm3-16527.pdf.

[10] CITY OF BOSTON, A CLIMATE OF PROGRESS: CITY OF BOSTON CLIMATE ACTION PLAN UPDATE 2011 (2011), *available at* http://www.cityofboston.gov/Images_Documents/A%20Climate%20of%20Progress%20-%20CAP%20Update%202011_tcm3-25020.pdf.

[11] ELPC WHITE PAPER, *supra* note 4.

[12] *See* Connecticut Climate Change, http://ctclimatechange.com/index.php/adaptation/ (last visited June 11, 2012).

[13] THE ADAPTATION SUBCOMMITTEE OF THE GOVERNOR'S STEERING COMMITTEE ON CLIMATE CHANGE, IMPACTS OF CLIMATE CHANGE ON CONNECTICUT AGRICULTURE, INFRASTRUCTURE, NATURAL RESOURCES AND PUBLIC HEALTH (2010), *available at* http://ctclimatechange.com/wp-content/uploads/2010/05/Impacts-of-Climate-Change-on-CT-Ag-Infr-Nat-Res-and-Pub-Health-April-2010.pdf.

[14] *See* Connecticut Climate Change, GSC Adaptation Subcommittee, http://ctclimatechange.com/index.php/ct-happenings/gsc-adaptation-subcommittee/ (last visited June 11, 2012).

A. Zoning – Overlay Zones

Although the degree differs by state, municipalities generally have relatively strong zoning power. The Boston Zoning Enabling Act empowers Boston to zone for public health and safety.[15] Pursuant to this authority, Boston can leverage its zoning power to adapt to climate change. Specifically for South Boston, the ELPC White Paper recommends that the City expand its use of overlay zones.[16]

Overlay zones are special zoning districts that supplement traditional zoning to protect a specific resource across zones. Boston already utilizes overlay zones to protect groundwater and to promote improvements to stormwater runoff. Specifically, the City of Boston has adopted a Groundwater Conservation Overlay District (GCOD) to "prevent the deterioration of … groundwater levels" and "to reduce surface water runoff and water pollution."[17] The current overlay zone applies to several areas in Boston, but within South Boston it only applies to the Fort Point Waterfront district.[18] Given the predictions of sea level rise and increased storm events, ELPC recommended that Boston expand the scope of its groundwater protection zones to cover additional areas that are anticipated to be impacted by climate change and sea level rise.[19]

In addition, Boston could apply more rigorous standards to the Fort Point Waterfront District. Under the current standards for the GCOD, proposed projects within the Fort Point Waterfront District are subject to less stringent standards than projects proposed within other parts of the GCOD. While projects elsewhere in the GCOD must demonstrate the ability to capture at least one inch of rainfall across the covered area of the property, proposed projects in Fort Point must only demonstrate that the project results in no negative impact to groundwater levels on the project site and adjacent lots.[20]

Municipalities in Connecticut could likewise adopt overlay zones to protect groundwater and improve stormwater management. Like Boston, Connecticut municipalities enjoy traditional police powers and several towns, such as Newton and North Stonington, have already adopted overlay zones to provide for enhanced groundwater protection.[21] The use of these zones could be expanded to cover additional areas that are likely to become more susceptible to high water and to provide enhanced opportunities for infiltration and groundwater management.

Notably, Connecticut municipalities have also been specifically empowered to zone for coastal protection via the Coastal Management Act (CMA).[22] Adopted in 1980, the CMA specifically provides for the use of overlay zones to advance coastal protection.[23] Several Connecticut municipalities, such as

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[15] An Act Authorizing the City of Boston to Limit Buildings According to Their Use or Construction to Specified Districts, 1956 Mass Acts ch. 665.
[16] ELPC WHITE PAPER, *supra* note 4, at 25.
[17] Boston, Mass., Zoning Code, Art. 32 § 1, *available at* http://www.bostonredevelopmentauthority.org/zoning/downloadZone.asp.
[18] *Id.*, Appendix A, *available at* http://www.bostonredevelopmentauthority.org/pdf/ZoningCode/Maps/groundwater_overlay_zoning.pdf .
[19] ELPC WHITE PAPER, *supra* note 4, at 25.
[20] *Id.* at 26.
[21] Campion v. Board of Aldermen of City of New Haven, 899 A.2d 542, 551 (Conn. 2006) (discussing the two potential sources of zoning authority in Connecticut); Town of North Stonington, Zoning code, Section 1104 (Aquifer Protection Overlay Area), *available at* http://www.northstoningtonct.gov/Pages/NStoningtonCT_BC/PZ/zoningregs/SECTION1100.pdf; Town of Newton, Zoning Regulations, Art. II, Sec. 1 (Aquifer Protection District), *available at* http://www.newtown-ct.gov/public_documents/newtownct_zoneregs/zoning#ARTICLE2.
[22] CONN. GEN. STAT. §§ 22a-90 – 22a-111.
[23] *Id.* § 22a-103.

Stonington and Greenwich, have already adopted coastal overlay zones.[24] These zones can be increased in extent and standards within them changed to address issues associated with climate change and sea level rise in coastal areas.

B. Zoning – Resilient Building Design Standards

Another important strategy for climate change adaptation is the imposition of resilient building design standards. Unfortunately, the effectiveness of this approach might be limited because many of the strategies municipalities might be interested in to adapt to climate change will relate to the regulation of structures rather than to the regulation of land use and, therefore, may be preempted by state building codes. In order to employ this strategy, then, local jurisdictions must carefully consider and navigate potential preemption issues.

In Massachusetts, the structural and mechanical elements of buildings are governed by the State Building Code and local jurisdictions are preempted from regulating in the same arena.[25] In the context of climate change strategies, the line between building regulations and land use regulations is not always clear. For example, freeboard, which simply refers to elevating a building above base flood elevation, is a popular adaptation strategy in coastal areas.[26] It would seem that freeboard, like provisions regarding density and massing of buildings, would be within the purview of the zoning power. However, in Massachusetts, the Attorney General's office has opined that local jurisdictions are preempted from regulating freeboard by the State Building Code.[27]

A similar tension exists in Connecticut between the building code and municipal zoning regulations. The State Building Code governs building and fire safety and applies to all municipalities throughout the state.[28] Municipalities are preempted from passing ordinances that deal with the same subject matter as the building code.[29] On the other hand, municipalities are empowered to pass zoning ordinances regulating land use including the size, height, location and density of structures.[30] Although the zoning power is broad and includes public health and safety,[31] in certain instances the scope of zoning power and the subject matter of the building code might overlap and be subject to

[24] Greenwich Municipal Code, Div. 9, Sec. 6-111 (Coastal Overlay Zone), *available at* http://greenwichct.virtualtownhall.net/Public_Documents/GreenwichCT_LandUse/regulations/pzRegsDivision09.pdf; Town of Stonington Zoning Regulation, Sec. 7.3 (Coastal Area Management Overlay District), http://www.stonington-ct.gov/Pages/StoningtonCT_Planning/regs/ZR_E23_7_1_11.pdf.

[25] Enos v. City of Brockton, 236 N.E.2d 919, 921 (Mass. 1968).

[26] *See* Storm Smart Coasts, Massachusetts, Using Freeboard to Elevate Structures Above Predicted Floodwaters, http://ma.stormsmart.org/before/regs/using-freeboard-to-elevate-structures-above-predicted-floodwaters/ (illustrating freeboard and the impact on insurance rates) (last visited June 12, 2012).

[27] *See* Letter from Thomas F. Reilly, Attorney General, to Bonnie T. Pena-Andrade, Falmouth Town Clerk, re: Falmouth Fall Annual Town Meeting of November 13, 2001 — Case # 1921 (Mar. 15, 2002), *available at* www.mass.gov/ago/docs/municipal/1000/mlu-1921.rtf.

[28] CONN. GEN. STAT. § 29-253(a); *see also* State of Connecticut Attorney General's Opinion No. 92-023 (Aug. 20, 1992), *available at* http://www.ct.gov/ag/cwp/view.asp?A=1770&Q=281352.

[29] Pisani v. Old Lyme Zoning Bd, 2002 WL 1446643, at *4 (Conn. Super. Ct. June 3, 2002).

[30] CONN. GEN. STAT. § 8-2(a).

[31] *Id.* ("Such regulations shall be designed to lessen congestion in the streets; to secure safety from fire, panic, flood and other dangers; to promote health and the general welfare; to provide adequate light and air; to prevent the overcrowding of land; to avoid undue concentration of population and to facilitate the adequate provision for transportation, water, sewerage, schools, parks and other public requirements"); *see also*, 9 Conn. Prac., Land Use Law & Prac. § 4:9 (3d ed. 2006).

preemption.[32] Municipalities in Connecticut, like municipalities in Massachusetts, will therefore have to carefully consider preemption issues when considering modifications of their zoning requirements to better account for climate change.[33]

C. Development Review

Boston reviews projects proposed within the City for compliance with the zoning code and to ensure that any impacts they may have on the environment are mitigated.[34] This allows the City to identify and address impacts that may not be squarely addressed in substantive zoning requirements, but may nevertheless pose important impacts to the surrounding environment and community.

Specifically, Article 80 of the Zoning Code requires the Boston Redevelopment Authority (BRA) to review the effect of the design of any proposed development on the surrounding community, including its impacts on the environment and tidelands.[35] Article 80 does not explicitly require consideration of sea level rise or other climate-related impacts. Nevertheless, in order to comply with the Mayor's directive, the Boston Redevelopment Authority and the Boston Environment Department have begun to address climate change impacts, particularly sea level rise, through the City's design review process.

For example, in its comments on the Seaport Square Project in 2008 the City asked the project proponent to discuss adaptation to climate change.[36] In response, the Environmental Impact Report (EIR) included a discussion of several measures incorporated into the design of the project to address climate change effects, including sea level rise, storm surge, heat waves, and droughts.[37] Similarly, the Spaulding Rehabilitation Hospital, which recently relocated to a waterfront location at the Charlestown Navy Yard, gave considerable weight to projections of sea level rise in its design decisions.[38] Spaulding's design team acknowledged the project's vulnerability to sea level rise and, as a result, raised the base elevation of the building, relocated sensitive uses from the ground floor to upper levels, and utilized

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[32] *See, e.g.*, *Pisani*, 2002 WL 1446643 at *4 (recognizing the potential overlap between zoning and building safety and questioning whether the underlying administrative action brought the building code and the zoning regulations into conflict). *See also*, AG Opinion No. 92-023, *supra* note 28 (discussing preemption of local municipal ordinance regulating fire safety by state building code).

[33] *See e.g.,* AG Opinion No. 92-023, *supra* note 28 (State Fire Safety Code and State Building Code preempt the field and municipalities do not have the authority to require fire sprinklers).

[34] *See* Boston, Mass., Zoning Code, Article 80 (Development Review and Approval), *available at* http://www.bostonredevelopmentauthority.org/pdf/ZoningCode/Article80.pdf.

[35] BOSTON REDEVELOPMENT AUTHORITY, A CITIZEN'S GUIDE TO DEVELOPMENT REVIEW UNDER ARTICLE 80 OF THE BOSTON ZONING CODE 7 (2004), *available at* http://www.bostonredevelopmentauthority.org/PDF/Documents/A%20Citizens%20Guide%20to%20Article%2080.pdf.

[36] EPSILON ASSOCIATES, INC., SEAPORT SQUARE DRAFT PROJECT IMPACT REPORT, *Boston Environment Department Comments on the PNF and Responses to Comments* § 9.4.4 (2009), *available at* http://seaportsquare.com/PDFS/DPIR_EIR/9-ResponsetoComments.pdf.

[37] EPSILON ASSOCIATES, INC., SEAPORT SQUARE FINAL PROJECT IMPACT REPORT, § 2.7: *Climate Change/Sea Level Rise* (2010), *available at* http://seaportsquare.com/PDFS/DPIR_EIR/Submittal-FEIR-6-30-2010.pdf. The BRA approved Seaport Square in September 2010 after the project passed Article 80B Large Project Review. BRA, *Seaport Square*, http://www.bostonredevelopmentauthority.org/DevelopmentProjects/devprojects.asp?action=ViewProject&ProjectID=1305 (last visited June 12, 2012).

[38] EPSILON ASSOCIATES, INC., SPAULDING REHABILITATION HOSPITAL DRAFT ENVIRONMENTAL IMPACT REPORT/DRAFT PROJECT IMPACT REPORT, 4-84 and 4-143 (2010).

windows that could be opened rather than sealed so that rooms could be naturally ventilated in the event of a climate change-related mechanical failure.[39]

The ELPC has proposed a framework for Boston that would formalize the inclusion of adaptation issues into environmental review. Specifically, ELPC has suggested an amendment of the City's Design Review Guidelines to ask project applicants to identify climate change impacts that can be expected to affect a proposed project and in turn affect the project's impact on the surrounding environment. Many municipalities in Connecticut also have design review processes that could allow, or be amended to allow, the consideration of climate change impacts.[40] In addition, in the coastal zone, municipalities are required to conduct environmental reviews to specifically address impacts to coastal resources.[41] Pursuant to the Connecticut Coastal Management Act (CMA), all proposed projects in the coastal zone must submit a plan that includes an evaluation of beneficial and adverse impacts to the municipal board for review and approval.[42] The board can only approve a project if it makes written findings that the plan incorporates all reasonable measures to mitigate any adverse impacts of the proposed activity on coastal resources.[43] In conducting CMA reviews, municipalities can and should incorporate climate change impacts into their review of projects and the examples from Boston provide a good template for how that review might occur.

D. Procurement

Procurement policies are a powerful way for municipalities to incorporate adaptation measures into public purchasing decisions and to influence behavior in the private sector by making the market more sensitive to adaptation. In Boston, the Mayor has directed the City to incorporate climate change impacts into its procurement decisions.[44] Hence, the City mandates the use of environmentally friendly cleaning products and practices[45] and the City developed Environmentally Preferable Procurement (EPP) guidelines[46] relating to building maintenance and operations.[47] The approach provides a useful model for similarly incorporating climate change adaptation into environmental review.

The EPP guidelines state that although environmentally preferable materials may initially be more costly, departments are entitled to, and should, consider complete life-cycle costs including acquisition, warranties, operation, supplies, maintenance, insurance and other liability, and disposal.[48] EPP products often have a higher purchase price than their less efficient counterparts, but can save money over their lifetime, because they use less energy, often have a longer life, and typically incur less maintenance cost. These elements must be built into the bid to be factored in the award.[49] Each

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[39] *Id.* at 4-143.

[40] *See e.g.* Code of the Town of Wethersfield, Article XXVII (Design Review Advisory Committee), *available at* http://wethersfieldct.com/government/code-regulations/design-review.

[41] CONN. GEN. STAT. § 22a-105.

[42] *Id.* § 22a-105(c).

[43] *Id.* § 22a-106(d).

[44] CITY OF BOSTON, AN ORDER RELATIVE TO CLIMATE ACTION, ¶ 5 (April 13, 2007), *available at* http://www.cityofboston.gov/Images_Documents/Clim_Action_Exec_Or_tcm3-3890.pdf.

[45] CITY OF BOSTON, AN ORDER RELATIVE TO GREENING CITY BUILDING MAINTENANCE & OPERATIONS 1 (July 3, 2008), *available at* http://www.cityofboston.gov/Images_Documents/EO_GreeningCityOps_tcm3-2732.pdf.

[46] CITY OF BOSTON, ENVIRONMENTALLY PREFERABLE PROCUREMENT, *available at* http://www.cityofboston.gov/Images_Documents/GreenProcurementPolicy_tcm3-14276.pdf.

[47] *See* CITY OF BOSTON, AN ORDER RELATIVE TO GREENING, *supra* note 45, at 2-3.

[48] *See* CITY OF BOSTON, ENVIRONMENTALLY PREFERABLE PROCUREMENT, *supra* note 46, at 6.

[49] *Id.* Although the purchasing of goods is centralized with Boston's Purchasing Department, procurement for services is decentralized and handled by individual departments. *Id.* at 5.

department is responsible for implementing the EPP policies and for ensuring that its procurement decisions are consistent with EPP.[50] While the City must generally award a contract to the lowest cost bidder, only the lowest cost bidder who meets the specified criteria is eligible for the contract.[51]

The ELPC has drafted a procurement policy for the City's consideration that draws on and expands the EPP. Notably, the ELPC proposal incorporates life cycle cost analysis into the process. The inclusion of life cycle costs in the City's procurement is a powerful tool for climate change adaptation because, as with environmentally preferable products, it would allow the City to account for the fact that some adaptive decisions might have higher initial costs, but may ultimately cost less over the life span of the project or contract. Connecticut jurisdictions can similarly adopt or encourage the State to adopt procurement policies to encourage the incorporation of climate change adaption into the public purchasing process.

E. Wetlands Regulations

Wetlands are an important resource in combating and adapting to climate change as they provide flood control and stormwater management. Massachusetts adopted a Wetlands Protection Act (WPA) to protect wetlands statewide.[52] Municipalities have the authority to enact their own wetlands regulations that go beyond the established level of protection at the state level.[53] Boston has not yet adopted more protective wetlands regulations, but ELPC has submitted a draft ordinance for the City's consideration. The proposed ordinance suggests that the City expand the area of wetlands protected by the WPA by expanding the definition of "land subject to coastal storm flowage," which is protected by the WPA, based on lands in the existing floodplain as well as lands that will be in the floodplain as sea level rises. It also suggests that the City consider protecting buffer zones around land subject to coastal storm flowage in order to provide additional protection for these areas.

In Connecticut, the State has exclusive jurisdiction over the permitting and regulation of development in tidal wetlands. In 1972, Connecticut adopted provisions to separately protect tidal wetlands and inland wetlands. While it provided for municipal regulation of inland wetlands, it retained exclusive state jurisdiction over the permitting of development in tidal wetlands.[54] Nevertheless, local jurisdictions may be able to indirectly exert control over coastal wetlands via their authority under the CMA.

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[50] *Id.* at 6.

[51] In Massachusetts, a contract for services must generally be awarded via an invitation for quotes (IFQs), an invitation for bids (IFBs), or a request for proposals (RFPs). Under the IFQ and IFB processes, the contract must be awarded to the qualified vendor offering the best price. MASS. GEN. LAWS c. 30B, §§ 4(b), 5(g). If a Department utilizes the RFP process, it awards the contract to the bidder offering the most advantageous proposal, which may not represent the lowest cost. MASS GEN. LAWS. ch. 30B, § 6(g). Under either scenario, a department's discretion to reject a bid is based largely (RFPs) or entirely (IFQs, IFBs) on the criteria specified in the bid. *See generally* OFFICE OF THE INSPECTOR GENERAL, THE CHAPTER 30B MANUAL: LEGAL REQUIREMENTS, RECOMMENDED PRACTICES, AND SOURCES OF ADVICE FOR PROCURING SUPPLIES, SERVICES, AND REAL PROPERTY (6th ed., 2011), *available at* http://www.mass.gov/ig/publications/manuals/30bmanl.pdf.

[52] MASS GEN. LAWS. ch. 131, § 40.

[53] Golden v. Board of Selectmen of Falmouth, 265 N.E.2d 573, 576 (Mass. 1970); *see also*, Lovequist v. Conservation Comm'n of the Town of Dennis, 393 N.E.2d 858 (Mass. 1979) (holding that Town's wetlands bylaw imposing more stringent standards than the WPA was validly enacted pursuant to its Home Rule authority).

[54] *See* CONN. GEN. STAT. §§ 22a-30 and 32; *c.f.* CONN. GEN. STAT. § 22a-42 (expressly requiring municipal regulation of inland wetlands). *See also* Lauricella v. Planning & Zoning Bd. of Appeals of Town of Greenwich, 342 A.2d 374, 380 (Conn. Com. Pl. 1974) ("The state has preempted all authority over our tidal wetlands.").

The CMA authorizes coastal municipalities to amend their zoning regulations to provide for the enhanced protection of coastal resources and to approve site plans for proposed development within the coastal boundary. Although the State has held that it retains authority over site plans for wetlands development,[55] municipalities can supplement the level of protection provided to coastal wetlands at the state level via additional land use controls that indirectly protect tidal wetlands, such as by adopting setbacks, requiring buffers, requiring infiltration, or limiting impervious coverage near wetlands.[56] In addition, municipalities could petition the State to amend the state law governing tidal wetlands to expand the zone designated as coastal wetlands, to grant municipalities authority to enact more stringent rules, or to tighten the restrictions that apply to coastal wetlands.

IV. Conclusion

Climate change adaptation presents local jurisdictions with unique planning challenges that can only be met with equally creative solutions. Boston and municipalities within Connecticut will be facing many of the same challenges as climate change becomes an increasing reality. While certain differences exist between the legal framework in Connecticut and in Massachusetts, many of the strategies Boston has available to it may be deployed in Connecticut jurisdictions. While only providing a few suggestions, this summary provides a model for how Connecticut municipalities may be able to draw from the work in other jurisdictions as they move forward with developing their own approaches to adaptation.

[55] *See* Office of Long Island Sound Programs Fact Sheet for State and Municipal Regulatory Jurisdictions, *in* CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION, CONNECTICUT COASTAL MANAGEMENT MANUAL (2000), *available at* http://www.ct.gov/dep/lib/dep/long_island_sound/coastal_management_manual/manual_08.pdf.

[56] For a complete list of suggestions for municipal protection of wetlands, *see* Office of Long Island Sound Programs Fact Sheet for Tidal Wetlands, in CONNECTICUT COASTAL MANAGEMENT MANUAL, *supra* note 55.

The Relocation of Development from Coastal Hazards through Publicly Funded Acquisition Programs: Examples and Lessons from the Gulf Coast

David A. Lewis[1]

Abstract: The encroachment of development along shorelines and the naturally hazardous conditions endemic to coastal areas are a dangerous and increasingly costly combination in an era of sea level rise and climate change. Coastal states and communities considering long-term sea level rise and shoreline erosion adaptation strategies should begin to evaluate relocating development away from hazard areas by acquiring fee simple title to vulnerable properties. Acquisition of vulnerable structures has occurred on scales large and small in response to flood hazards elsewhere. This article examines the experiences of acquisition programs in Louisiana and Mississippi following hurricanes and recommends, among other things, that states and communities considering a program of acquiring vulnerable properties first undertake a robust spatially informed planning process that engages and involves affected communities.

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I. Introduction

Residential development along shorelines has long been vulnerable to coastal hazards such as flooding, storm surge, and erosion.[2] In the face of sea level rise and climate change, the vulnerability of coastal residences to these hazards is certain to increase in the near future.[3] However, coastal communities and states are not powerless to address coastal hazards. Indeed, policymakers and scholars have devoted significant attention to developing adaptation responses to coastal hazards.[4] This article analyzes the policy of using public funds to acquire vulnerable property from willing private sellers in order to relocate development from coastal hazard areas.

For decades, the relocation of vulnerable development away from coastal hazards was largely overlooked relative to other policy options.[5] Recently, however, relocating development has become an increasingly viable and necessary response to changing coastal conditions.[6] Relocating vulnerable development from coastal hazard areas reduces flood risk, curtails long-term flood management costs,

[2] New Jersey is perhaps the state with earliest recorded use of the ocean shoreline for recreational purposes. One report shows efforts as early as 1801 to attract tourists to Cape May at the southern tip of New Jersey. *See* C.F. Wicker, *History of the New Jersey Coastline*, *in* PROCEEDINGS OF THE FIRST CONFERENCE ON COASTAL ENGINEERING 299 (1950). Not long after tourists found the New Jersey beach, and certainly by no later than the middle of the 1800s, reports emerged of coastal erosion adversely affecting development along Cape May. *Id*. at 316. Shortly thereafter, protection of development from coastal hazards began. *Id*. at 318. As Americans "discovered" the coasts in the middle and later parts of the 1900s, responses to coastal hazards followed. *See generally* Orrin H. Pilkey & Howard L. Wright, *Seawalls Versus Beaches*, 4 J. COASTAL RES. 41 (1988) (describing the history of domestic shoreline management practices beginning in the 1950s).

[3] *See generally* Robert J. Nicholls, *Coastal Flooding and Wetland Loss in the 21st Century*, 14 GLOBAL ENVTL. CHANGE 69 (2004); S.F. Balica, et al., *A Flood Vulnerability Index for Coastal Cities and its Use in Assessing Climate Change Impacts*, NAT. HAZARDS § 5.1 (2012).

[4] In the context of climate change, responding to changing or worsening natural disasters is often referred to as "adaptation." *See* OFFICE OF OCEAN & COASTAL RESOURCE MGMT., NATIONAL OCEANIC & ATMOSPHERIC AGENCY, ADAPTING TO CLIMATE CHANGE: A PLANNING GUIDE FOR STATE COASTAL MANAGERS 2 (2010), *and* So-Min Cheong, *Policy Solutions in the U.S.*, 106 CLIMATIC CHANGE 57 (2011).

[5] *See also* Ellen P. Hawes, *Coastal Natural Hazards Mitigation: The Erosion of Regulatory Retreat in South Carolina*, 7 S.C. ENVTL. L. J. 55, 58 (1998), Martin M. Randall, *Coastal Development Run Amuck: A Policy of Retreat May Be the Only Hope*, 18 J. ENVTL. L. & LITIG. 145, 166 (2003), FEDERAL EMERGENCY MANAGEMENT AGENCY, NATIONAL FLOOD INSURANCE PROGRAM COMMUNITY RATING SYSTEM COORDINATOR'S MANUAL 520-2 (2007) ("The surest way to protect a building from flood damage is to remove it from the floodplain.") [hereinafter CRS MANUAL], *and* Derek J. McGlashan, *Managed Relocation: An Assessment of Its Feasibility as a Coastal Management Option*, 169 GEOGRAPHICAL J. 6, 7 (2003).

[6] *See* J. Peter Byrne & Jessica Grannis, *Coastal Retreat Measures*, *in* THE LAW OF ADAPTATION TO CLIMATE CHANGE U.S. AND INTERNATIONAL ASPECTS (Michael Gerrard & Katrina F. Kuh eds., 2012). Professor Byrne and Jessica Grannis use the term "retreat" to characterize the policy of moving development away from high-hazard coastal areas, but explicitly invite relabeling their term. Prof. Cheong employs the term "relocation" to mean "the movement of people and properties away from hazard-prone areas to a safer location." Cheong, *supra* note 4, at 2. This paper prefers the term "relocation" to "retreat." *See also* Sandra S. Nichols & Carl Bruch, *New Frameworks for Managing Dynamic Coasts: Legal and Policy Tools for Adapting U.S. Coastal Zone Management to Climate Change*, 1 SEA GRANT L & POL'Y J. 19, 21 (2008).

and avoids the adverse environmental impacts of other hazard mitigation responses. Relocation can be implemented through any one or more of several different policy pathways, and the publicly funded acquisition of vulnerable residential development is one such pathway to relocation. This article presents lessons from previous, publicly funded, acquisition programs and is intended for an audience of state and local officials interested in leveraging federal programs that support acquisition as a coastal adaptation strategy and the experience of other communities in implementing such acquisition programs.

The first recommendation for state and local governments considering an acquisition-based relocation strategy is to develop a plan that incorporates extensive community input *before* the occurrence of any coastal disaster that necessitates a major response. The spatial variation of coastal hazards should inform the acquisition plan, identifying high-hazard areas where relocation is a priority as well as less vulnerable areas able to accommodate the new development necessitated as a result of relocating from coastal hazard areas. Redevelopment in conjunction with relocation can serve as an economic driver for the acquisition program and a stimulus for local economies still suffering from the effects of the recession. Equally important is the engagement of the affected community in the planning and implementation process. For acquisition programs to work, the affected communities must "own" the process and not feel as though it is dictated to them by bureaucrats.

A second recommendation involves the implementation of the acquisition program. The state and/or local government sponsors of an acquisition program should consolidate and coordinate administrative efforts so that private property owners deal with one point of contact throughout the planning and implementation processes. Concurrently, policymakers must balance the inherent tensions between the speedy and efficient distribution of public funds, so that property owners do not spend years waiting to move forward and public funds are not misappropriated. Phasing acquisitions and developing pilot programs are sensible steps to showing the viability of the strategy.

Finally, any acquisition-based relocation program should be integrated into a comprehensive risk-based land use planning analysis that reduces perverse subsidies provided to coastal development. Public programs encouraging the relocation of development away from vulnerable coastal hazard areas will not be effective if other policy programs subsidize or otherwise encourage vulnerable development to remain in place. Efforts to acquire vulnerable properties should be coordinated with reductions in subsidies in coastal hazard areas as well as with zoning and other land use controls that promote redevelopment in non-hazardous areas.

Part II of this article describes the risk-reduction purpose for relocating vulnerable residential development away from coastal hazard areas. This section outlines the benefits and barriers to acquisition programs. Acquisition programs have numerous benefits, of which the most significant is the long-term reduction in exposure to coastal hazards. Acquisition programs also have many drawbacks. Likely the most significant drawback is the potential of acquisition programs to disrupt communities. Balancing hazard-reduction benefits with potential adverse social impacts will likely be the most important and difficult task of implementing an acquisition program.

Part III introduces the policy framework for federally funded, state and local government-led acquisition grant programs. State and local governments typically control land use policymaking and lead disaster planning, but the federal government has long intervened when land use decisions implicate responses to natural disasters. Federal intervention is especially notable in the context of coastal hazards. State and local governments will likely initiate and lead relocation and acquisition programs, but the federal programs described here will be beneficial to any such efforts.

Part IV analyzes acquisition programs, including large-scale responses in coastal Louisiana and Mississippi following Hurricanes Katrina and Rita as well as smaller programs from riverine contexts throughout the United States. Communities have many policy and design options for implementing an acquisition program, and the contrasting experiences of Louisiana and Mississippi offer interesting

insights. Louisiana had an enormous fund to engage in a buyout program and elected simply to offer each property owner the opportunity either to remain and rebuild or to sell to the state and relocate. The two options were given to all property owners with damaged homes regardless of future hazards and without concern for spatial or other planning objectives because Louisiana's fundamental objective was to compensate residents for losses rather than reduce future risks. Mississippi, in contrast, developed a highly detailed plan to relocate specific properties with the specific intent to reduce risk, but has so far been unable to fund and implement the plan. Louisiana took advantage of national political conditions favoring disaster recovery, whereas Mississippi has seen its plan stalled by increasing federal fiscal austerity. Louisiana implemented a bottom-up approach, allowing property owners to make individualized risk assessments, whereas Mississippi's strategy was a top-down risk-informed planning approach. Only after the next storm will we learn whether the Louisiana or Mississippi approach is more successful.

Finally, Part V identifies potential legal issues and offers recommendations for state and local governments considering acquisition programs. The legal issues identified will help to avoid problems that might delay or jeopardize the success of an acquisition program. The recommendations seek to allow future acquisition programs to learn from the experiences of Louisiana and Mississippi. These recommendations will help state and local governments achieve the broad goals of reducing the loss of life and property from climate-induced coastal disasters, enjoying community buy-in, and operating cost-effectively.

II. Risk Reduction through Acquisition Programs

A. The Problems Facing Coastal Development: Hazards, Subsidies, and Climate Change

Residential development in flood-prone coastal hazard areas is problematic for three reasons. First, by locating in hazardous areas, coastal residents subject their homes and property to floods, thereby creating flood risk.[7] Flooding on its own does not create risk; rather, the presence of development in areas subject to coastal hazards creates risk.[8] Second, to compensate for flood risk, residents in hazard-prone areas obtain subsidies such as structural protection (*e.g.*, levees and shoreline armoring), below-market flood insurance, emergency response relief, and post-disaster rebuilding funds.[9] These subsidies provide some short-term benefit to the "protected" property but also eliminate the incentive to build more safely, create a perverse incentive attracting additional development to the hazard area,

[7] This article distinguishes between "risk" and "hazard." "Risk," an empirical measure of consequences (i.e., expected losses) from floods, is calculated as the product of the unit-less probability that a flood-related loss will occur and the currency-denominated magnitude of the expected loss. *See* Wolfgang Kron, *Flood Risk = Hazard × Values × Vulnerability*, 30 WATER INT'L. 58, 61 (2005). Risk is therefore described in currency units. A "flood hazard" is an event that causes a flood. Flood hazards include both one-time events (*e.g.*, hurricanes, strong storms) and ongoing events (*e.g.*, waves, tides, currents) that create flood losses. *See* David R. Godschalk et al., *Avoiding Coastal Hazard Areas: Best State Mitigation Practices*, 7 ENVTL. GEOSCIENCES 13, 14 (2000).

[8] For decades, it has been recognized that "floods are 'acts of God,' but flood losses are largely acts of man." Gilbert F. White, *Human Adjustments to Floods*, *in* GEOGRAPHY, RESOURCES, AND ENVIRONMENT: SELECTING WRITINGS OF GILBERT F. WHITE 12 (Robert W. Kates & Ian Burton eds., 1986). Notes another commentator, "flooding does not cause economic damages to uninhabited beaches or to wetlands in riverine floodplains." Daniel Barnhizer, *Givings Recapture: Funding Public Acquisition of Private Property Interests on the Coasts*, 27 HARV. ENVTL. L. REV. 295, 307 (2003).

[9] *See* Barnhizer, *supra* note 8, at 324-37. Professor Barnhizer refers to these various subsidy programs as "givings" which are the inverse of "takings" under the Fifth Amendment.

and require continuing subsidies.[10] In addition, subsidies raise the market value of coastal property and increase the costs of efforts to engage in publicly funded acquisition of vulnerable properties. Third, climate change and land use impacts are exacerbating the conditions causing coastal hazards.[11] Along shorelines, erosion and inundation are two hazards that damage property.[12] Already a problem demanding significant policy response, the twin shoreline hazards of erosion and inundation are worsening as a result of climate change-induced sea level rise. Throughout low-lying coastal areas inland of the immediate shoreline, flood hazards result from intense storms, land use alteration (primarily the conversion of vegetated areas to impervious surfaces), and the modification of river systems.[13] Each of these inland flood drivers is worsening as well.

Existing flood hazards are severe enough in many cases to warrant a different response than the status quo; climate change threatens to increase the risks considerably over the coming decades.[14] Climate change is increasing the rate of sea level rise and worsening the dual concerns of erosion and inundation for properties along ocean and estuarine shorelines.[15] Climate change is also likely

[10] *Id.* at 327. Moreover, some coastal flood protections worsen flood effects on neighbors. Coastal flood protection structures frequently interrupt sediment flows, "starve" neighboring areas of sand, and exacerbate erosion elsewhere. *Id.*

[11] James G. Titus, *Does the U.S. Government Realize that the Sea Is Rising? How to Restructure Federal Programs so that Wetlands and Beaches Survive*, 30 GOLDEN GATE U.L. REV. 717, 725, 732 (2000).

[12] *See* James G. Titus et al., *State and Local Governments Plan for Development of Most Land Vulnerable to Rising Sea Level along the US Atlantic Coast*, 4 ENVT'L. RES. LET. 1, 2 (2009).

[13] *See* Burrell E. Montz, *Generation of Flood Hazards and Disasters by Urban Development of Floodplains*, *in* 1 FLOODS 116, 118-19 (Dennis J. Parker, ed., 2000) (identifying four ways urbanization can increase flood potential: (1) impervious surfaces inhibit rainwater infiltration sending excess waters to surface drainage systems, (2) increased runoff across impervious surfaces travels at higher velocities and reduces the lag time between discharge and flow, (3) urbanization fills in wetlands, floodplains, and river banks, constricting space available for flows, and (4) construction of stormwater drainage systems that release large quantities of flow at one time).

[14] Climate change is worsening the hazards confronting coastal and flood-prone development and is also expanding the geographic scope of development subject to hazards, but climate change is not creating altogether new hazards that coastal and flood-prone development have not dealt with before. Thus, many efforts to adapt to the risk worsened by climate change-induced hazards— collectively, such efforts are "adaptation policies"—can draw from previous methods for dealing with floods. In general, four types of risk-mitigating adaptation policies exist for development in flood-prone areas: (1) keep development in place, but construct or install infrastructure that protects against floodwater inundation and stabilizes against erosion; (2) keep development in place, but elevate it above floodwaters and build it to withstand erosion, waves, and storm surge; (3) move development to safer areas; and (4) keep development in place, but insure it against losses or damages. The first, second, and fourth options have proven to be both prohibitively expensive and largely ineffective at reducing the risk to development in flood-prone areas. *See* ELI LEHRER, COMPETITVE ENTERPRISE INSTITUTE, REFORMING THE NATIONAL FLOOD INSURANCE PROGRAM AFTER 35 YEARS OF FAILURE 11 (2008), *available at* http://cei.org/sites/default/files/Eli%20Lehrer%20-%20Reforming%20the%20National%20Flood%20Insurance%20Program.pdf. Indeed, the heavily-subsidized protection and insurance strategies create the perverse incentives to develop in high-hazard areas, are fiscally unsustainable, and cannot be maintained indefinitely.

[15] Development along the Gulf Coast faces the threat of increasing sea level rise, induced in part by warming temperatures, expanding oceans, and melting polar ice. ORRIN H. PILKEY & ROB YOUNG, THE RISING SEA (2009). Although not climate-related, tsunamis also pose a risk to coastal areas across the United States, including along the Gulf Coast. *See, e.g.,* Tom Parsons & Eric Geist, *Tsunami Probability in the Caribbean Region*, 165 PURE & APPLIED GEOPHYSICS 2089 (2008).

increasing the intensity of storms that cause coastal storm surge and inland flooding.[16] The current system of protecting subsidized coastal development in place cannot continue indefinitely in the era of climate change. Long-term efforts to reduce risk must include relocation of both existing and future development away from coastal hazards.

B. Proposed Solution to the Problems Facing Coastal Development: Relocate

Coastal policymakers and property owners should begin to develop and implement plans to break the cycle of subsidizing development in coastal hazard areas. As Hurricane Irene's effects demonstrated in the fall of 2011, flood risks are not limited to the Gulf Coast. It is likely only a matter of time before coastal hazards cause tremendous losses to coastlines from New England to the Florida Keys to the Rio Grande similar to those that occurred along the Gulf Coast following Hurricanes Katrina, Rita, and Ike.[17] Relocating development away from high-hazard areas is one way to end the current flood protection subsidies for development and to reduce flood risk in those areas.[18] As partially introduced above, "relocation" is the planned movement of development from areas with a high probability of flooding to areas with a lower probability of flooding in order to reduce flood risks.[19] Such relocation can take a variety of forms: it may be voluntary or mandatory; it may be state-led, federally funded, or locally encouraged; it may be through zoning, acquisition of vulnerable structures, insurance-based payouts, or some combination of these and other programs.[20] The Gulf Coast states were unprepared for the magnitude of devastation in 2005 (Hurricanes Katrina and Rita) and 2008 (Hurricane Ike), but there is no reason other states should not begin preparing today. Relocation efforts should be coordinated and should begin right away, but relocation will not be easy.

Relocation has had some past success, and, as flood hazards worsen because of climate change, relocation will become an increasingly attractive and necessary adaptation option. One relocation strategy may involve physically moving flood-prone structures to a safer location.[21] Another strategy may involve acquiring and demolishing structures and infrastructure and encouraging building anew

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[16] Following Hurricane Katrina's devastating impact on the Gulf Coast of Louisiana, scientists acknowledged the difficulties in correlating any one particular storm's intensity and impacts with global climate change. *See* Pew Center on Global Climate Change, Was Katrina's Power a Product of Global Warming?, http://www.pewclimate.org/specialreports/katrina.cfm (last visited May 15, 2011). Hurricanes have devastated low-lying coastal areas before anthropogenic climate change began and would certainly have continued to do so absent any human-caused changes. However, climate scientists have identified that Hurricane Katrina and similar storms emerged from an ocean energy system that is increasingly likely to yield storms of greater intensity and duration than those that existed before human-induced climate change: climate change will result in destructive coastal storm events. *See* Kerry Emanuel, *Increasing Destructiveness of Tropical Cyclones over the Past 30 Years*, 436 NATURE 686 (2005).

[17] In addition to the tragic loss of nearly 2,000 lives, the three Gulf Coast storms combined caused tens to hundreds of billions of damage to property, repeatedly brought the regional economy to a standstill, and strained the resources of the National Flood Insurance Program. *See infra* Part IV.B.1.

[18] Randall, *supra note 5, at 1425; accord.* CRS MANUAL, *supra* note 5, at 520-2.

[19] Byrne & Grannis, *supra* note 6.

[20] *Id*.

[21] *See* McGlashan, *supra* note 5, at 7. Professor McGlashan notes that structures as large as the several hundred foot tall Cape Hatteras Lighthouse have been moved intact. *Id.* at 14. *See also* CRS MANUAL, *supra* note 5, at 520-2 (describing the difficulty of moving structures in tact).

elsewhere.[22] The latter relocation strategy is referred to as "acquisition" throughout this paper. Acquisition occurs in three steps: first, a government body, using public funds,[23] purchases vulnerable property; second, any structures on the acquired property are demolished, thereby reducing the risk of future losses; and, third, the government (or a non-profit conservation organization) perpetually maintains the acquired properties for conservation or recreational uses.[24]

Most acquisition programs are voluntary,[25] and all require providing compensation to the private property owner from whom the property is acquired, provided the acquired property is not a nuisance.[26] Nonetheless, acquisition programs can be highly unpopular and have the potential to create social and economic disruptions in the communities where acquisitions occur.[27] The social and community aspects of acquisition programs must not be overlooked. In this vein, the design of an acquisition program should be cognizant of community preferences, concerned about discrimination, and focused on

[22] *See* Hawes, *supra* note 5, at 58. Hawes notes that acquisition as a means of effecting relocation policies will likely be the most common approach in the United States given the protections of private property under the Fifth Amendment. However, other relocation-inducing policies might include zoning ordinances, differential tax assessments, and withholding or disinvesting in coastal public infrastructure. *See id*. *See also* JESSICA GRANNIS, ADAPTATION TOOL KIT: SEA LEVEL RISE AND COASTAL LAND USE (2011).

[23] Conceivably, a non-government organization, such as a conservation organization, could lead an acquisition program. However, the programs discussed throughout this paper will focus on government-led acquisition.

[24] GRANNIS, *supra* note 22, at 47.

[25] Hawes, *supra* note 5, at 58. A government implementing an acquisition program could exercise its eminent domain authority to acquire property from private property owners without their voluntary participation. Such practice is rare, and compensation is nonetheless required. *See* Grannis, *supra* note 22, at 47. Moreover, by limiting acquisition to a strictly voluntary basis, state and local governments utilizing federal funds will avoid having to comply with the federal Uniform Relocation Assistance and Real Property Acquisition Act, provided the owner of the acquired property is not renting to tenants who do not voluntarily relocate. *See* 49 C.F.R. § 24.101(b).

[26] Compensation is required primarily because of the Fifth Amendment's prohibition against the taking of property without just compensation. *See* Byrne & Grannis, *supra* note 6 and Part II.D.4, *infra*. An exception to the compensation requirement arises when conditions created by development in the coastal hazard area create a nuisance. *See* Mugler v. Kansas, 123 U.S. 623 (1887) (in which the Supreme Court declared "all property in this country is held under the implied obligation that the owner's use shall not be injurious to the community."). When a nuisance exists, it would appear that a state or local government may exercise its police powers (rather than its eminent domain powers) and require that the property owner abate the nuisance, or after notice, abate the nuisance itself. Nuisance abatement is not subject to the just compensation clause. *See* Steven J. Eagle, *Does Blight Really Justify Condemnation?*, 39 URB. LAW. 833 (2007). The Supreme Court has spoken indirectly on the exercise of the police power for nuisance abatement, suggesting that no compensation is necessary if a regulation does not deprive a private property owner of a right he did not previously enjoy by virtue of "background principles" of nuisance and property law. *See* Lucas v. S.C. Coastal Comm'n, 505 U.S. 1003, 1030 (1992) (noting that the owner of a nuclear power plant, for instance, does not have a takings claim if the government forces the closure of a plant located astride a dangerous earthquake fault line because the government always had the power to make the "*background principles* of nuisance and property law explicit." (emphasis added)). Justice Thomas elaborated on this notion in a more recent dissent, arguing that "whether the State can take property using the power of eminent domain is therefore distinct from the question whether it can regulate property pursuant to the police power." Kelo v. City of New London, 545 U.S. 469, 519-20 (2005) (Thomas, J., dissenting).

[27] Ronald W. Perry & Michael K. Lindell, *Principles for Managing Community Relocation as a Hazard Mitigation Measure*, 5 J. CONTINGENCIES & CRISIS MGMT. 49 (1997) (describing lessons from the relocation of a community in Arizona in order to reduce flood risks). The authors note that relocations for the purpose of reducing risks from natural hazards are distinct from relocations for the purposes of urban renewal or highway development. Natural disaster motivated relocations have the express purpose of protecting the vulnerable populations that are being relocated whereas relocations for new developments typically treat the relocated populations as a problem. *Id*. at 53.

providing fair compensation and transition assistance, especially to low-income or otherwise disadvantaged community members.[28]

C. Benefits of Acquisition Programs

The relocation of flood-prone development through acquisition is an overlooked adaptation policy option that deserves renewed consideration. Acquisition programs have precedential benefits, offer long-term financial savings, and, relative to alternative adaptation policies, reduce environmental externalities. Acquisition programs are versatile (applicable in a variety of different types of communities) and scalable (applicable for tens or thousands of buildings). Finally, acquisition programs can be part of a broader redevelopment effort in low-hazard areas to replace any development acquired and demolished. Redevelopment associated with acquisition can have significant and healthy economic stimulus effects. Each of these five categories of benefits is considered in more detail below.

1. Precedential Benefits

Acquisition programs have worked elsewhere. The federal government, numerous states, and multiple municipalities have previously used acquisition programs to move development away from hazardous coastal areas.[29] Acquisition has also been a successful response to riverine floods.[30] Previous acquisition efforts have involved as few as tens of structures to more than ten thousand. The latter instance occurred in Louisiana following Hurricanes Katrina and Rita.[31] Smaller acquisition efforts have occurred along the Mississippi River,[32] on the coastal plain of North Carolina,[33] and elsewhere.

2. Long-Term Financial Benefits

Over the long-term, acquisition has the potential to have significant positive fiscal benefits

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[28] *See id.* at 56. *See also* Mark Stallworthy, *Sustainability, Coastal Erosion and Climate Change: An Environmental Justice Analysis*, 18 J. ENVTL. L. 357 (2006); NATIONAL WILDLIFE FEDERATION, HIGHER GROUND 34-35 (1998). *But see* J. Andrew G. Cooper & J. McKenna, *Social Justice in Coastal Erosion Management: The Temporal and Spatial Dimensions*, 39 GEOFORUM 294 (2008). Professor Cooper distinguishes many of the coastal policies advanced in the name of shoreline defense from broader environmental justice concerns related to adverse effects of pollution on low-income or otherwise politically disenfranchised communities. Coastal policies favoring discrete local interests may be contrary to future generations' interests or the interests of non-coastal residents. Moreover, social justice concerns can be used to obfuscate the true subsidizing nature of flood protection infrastructure and the benefits this often confers on wealthy oceanfront property owners at the burden of taxpayers as a whole. For examples of how low-income and minority communities have been involved in acquisition programs in the United States, *see infra* note 234.

[29] *See* David Owens, *Land Acquisition and Coastal Resource Management: A Pragmatic Perspective*, 24 WM. & MARY L. REV. 625 (1983). Professor Owens addresses numerous important questions relating to the large-scale acquisition of privately owned coastal property for the purpose of conservation and risk reduction. He also discusses the failures of an effort to acquire large tracts of the Outer Banks.

[30] See JAMES FRASER, ET AL., IMPLEMENTING FLOODPLAIN LAND ACQUISITION PROGRAMS IN URBAN LOCALITIES 11-13 (2003) (presenting case studies of four independent relocation programs along flood-prone rivers).

[31] *See* Part IV.A, *infra*.

[32] *See* Dennis M. Knobloch, *Moving a Community in the Aftermath of the Great 1993 Midwest Flood*, 130 J. CONTEMP. WATER RES. & EDUC. 41 (2005).

[33] FRASER, *supra* note 30, at 13-21.

compared to alternative adaptation approaches.[34] As sea levels rise and storms worsen, stabilization infrastructure (e.g., seawalls, levees, and the like) approaches are likely to become prohibitively expensive to construct and maintain and may increase risks.[35] Flood insurance has never proven to be economically viable without subsidy.[36] Likewise, elevating an existing structure may be nearly as costly as relocating it altogether, especially if the relocation occurs either within the same parcel as the existing structure or to a nearby location.[37] Acquisition is a long-term, cost-effective approach when compared to the alternatives.[38]

3. Environmental Benefits

A related third argument in support of acquisition has to do with environmental externalities: structural stabilization creates externalities whereas relocation has the potential to correct them.[39] For instance, some protective measures such as placement of beach fill (alternatively "renourishment" or "replenishment"), levees, and sea walls adversely affect the recreational, tourism, and habitat value of

[34] *See* Kenneth J. Bagstad, et al., *Taxes, Subsidies, and Insurance as Drivers of United States Coastal Development*, 63 ECOLOGICAL ECON. 285, 289 (2007). David A. Moser, *Assessment of the Economic Benefits from Flood Damage Mitigation by Relocation and Evacuation*, United States Army Corps of Engineers Research Report 85-R-1 43 (1985). This USACE report describes the theoretical basis for acquiring and relocating structures from the floodplain and applies the theory to several communities that had suffered flood losses and were considered candidates for acquisition as an alternative to continued maintenance of structural flood controls. *Id.* at 32-42.

[35] Byrne & Grannis, *supra* note 6. *See also* Barnhizer, *supra* note 8, at 326.

[36] *See* Aparna K. Majmudar, *The National Flood Insurance Program: Maintaining Its Head Above Water*, 16 U. MIAMI INT'L & COMP. L. REV. 183, 195 (2009).

[37] *Compare* Jeffrey A. Michael, *Episodic Flooding and the Cost of Sea Level Rise*, 63 ECOLOGICAL ECON. 149, 251 (2007) (describing the variable costs of home elevation) *with* McGlashan, *supra* note 5, at 14 (summarizing the costs of relocating or demolishing homes as part of the Upton-Jones program).

[38] For instance, in coastal Mississippi the United States Army Corps of Engineers estimated the immediate acquisition of approximately 2,000 parcels would cost approximately $400 million and avert $22 million to $33 million in damages (a ratio of costs to damages of approximately 15 to 1), whereas the construction of a 30-foot levee around the high-risk zone would cost in excess of $5 billion and avoid approximately $209 million (a cost to damages ratio of 23 to 1). Note that the acquisition costs included a very generous 25% contingency. Moreover, the annual operations and maintenance costs for the levee were expected to be in excess of $60 million whereas the annual operations and maintenance costs for the acquisition program were expected to be approximately $10,000. *See* USACE, MISSISSIPPI COASTAL IMPROVEMENTS PROGRAM (MSCIP) HANCOCK, HARRISON, AND JACKSON COUNTIES, MISSISSIPPI: COMPREHENSIVE PLAN AND INTEGRATED PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT, VOL. 1 at 3-150, Table 3-20 (June 2009) [hereinafter MsCIP EIS]. These calculations are discussed in greater detail in Part IV.C, *infra*.

[39] *See* Jeffrey J. Opperman, et al., *Sustainable Floodplains Through Large-Scale Reconnection to Rivers*, 326 SCI. 1487 (2009) (describing environment effects of flood controls in riverine systems). *See also* Titus, *supra* note 11, at 740. *See also* Randall, *supra* note 5, at 181.

coastal ecosystems and impair natural coastline retreat.[40] Acquisition of vulnerable property, when combined with sensible spatial planning and the removal of externality-creating flood infrastructure, can improve environmental conditions.[41]

4. Versatility and Scalability

Acquisition is beneficial because it is both scalable and versatile. Acquisition is scalable because it can be an appropriate policy response in areas with tens of structures[42] or areas with tens of thousands of structures.[43] It is versatile because it can be implemented across a variety of geographic settings or by a variety of government institutions.[44] For instance, acquisition policies can apply to flood-prone ocean,[45] estuarine,[46] or riverine areas,[47] to a mix of different land uses (e.g., residential or

[40] Titus, *supra* note 11, at 740. The author explains how under a condition of sea level rise, shoreline ecosystems would naturally migrate landward if unimpeded by structures such as bulkheads, sea walls, and levees. However, the migration process is stalled when those structures exist and shoreline ecosystems are effectively "drowned." *Id.* at 725-35. *See also* Niki L. Pace, *Wetlands or Seawalls? Adapting Shoreline Regulation to Address Sea Level Rise and Wetland Preservation in the Gulf of Mexico*, 26 J. LAND USE 327, 333-41 (2011). The United States Army Corps of Engineers (USACE) prepared a comprehensive environmental impact statement (EIS) comparing the construction of a thirty-foot levee to the acquisition of vulnerable properties for coastal Mississippi. *See* MSCIP EIS, *supra* note 38, at 3-151 to 3-161. With regard to the environmental effects of the levee, the USACE EIS notes that the "esthetic of [the] coastal environment dramatically affected due to the presence of large, intrusive embankment, displacement of residences and businesses and negative alteration of visual environment… Existing natural resources would be significantly degraded due to [the] large footprint of [the] levee and alteration of traditional flow paths, wildlife corridors, and loss of habitat… [And s]ignificant negative impacts to the overall total quality of the environment." *Id*. With regard to the acquisition of vulnerable parcels the USACE concluded "Very significant opportunity for ecosystem restoration… Conversion to greenspace could significantly improve aesthetic values of the coastal area… [L]ong-term biological resources, including threatened and endangered species would be significantly improved due to [the] removal of development, and its potential replacement with coastal wetlands or green space… Long-term positive improvement expected due to increased flood storage capacity and removal of septic systems… *Significant opportunity for improvement of the coastal environment*." *Id*. (emphasis added).

[41] *See* Titus, *supra* note 11, at 740 and Opperman, et al., *supra* note 39, at 1487.

[42] DeKalb County, Illinois and FEMA acquired a 66-unit mobile home development following a flood of the Kishwaukee River. *See* MOLLY O'TOOLE & TRACI LEMAY, DEKALB COUNTY ALL HAZARDS MITIGATION PLAN 6-3 (2008), *available at* http://www.dekalbcounty.org/HazardMit/Plan.pdf.

[43] The State of Louisiana acquired greater than 10,000 structures along the Gulf Coast of Louisiana following Hurricanes Katrina and Rita. ROAD HOME, HOMEOWNER ASSISTANCE PROGRAM WEEK 246 SITUATION & PIPELINE REPORT 1 (Mar. 22, 2011) [hereinafter SITUATION & PIPELINE REPORT].

[44] The federal government through FEMA is frequently involved as an administrative partner and funder of acquisition programs. *See* FEMA, HAZARD MITIGATION ASSISTANCE UNIFIED GUIDANCE (2010) [hereinafter FEMA, UNIFIED GUIDANCE]. The USACE is also occasionally a federal partner. *See, e.g.,* USACE, RELOCATION PLANNING PROJECT MASTER PLAN: KIVALINA, ALASKA (2006). Local, state and federal government entities often partner to pool resources for a single acquisition program. For instance, in Harris County, Texas (the location of Houston), the USACE, U.S. Dept. of Housing and Urban Development, FEMA, Texas Parks and Wildlife Department, and the City of Houston Parks and Recreation Department partnered to acquire 440 properties at a cost of $40 million over a decade. *See* FEMA, MITIGATION BEST PRACTICES 713 (2011) [hereinafter FEMA, BEST PRACTICES].

[45] More than 100 homes were relocated from coastal North Carolina. *See* Spencer M. Rogers, *Relocating Erosion-Threatened Buildings—A Study of North Carolina Housemoving*, COASTAL ZONE '93 CONFERENCE PROCEEDINGS 1392 (1993).

[46] The Lummi Nation in Washington State received FEMA funding to purchase vulnerable homes along the Puget Sound. The Lummi were primarily concerned with flooding from a tsunami, and the acquired structures had never been flooded. *See* LUMMI NATION, MULTI-HAZARD MITIGATION PLAN 218 (2008).

commercial),[48] and to a spectrum of development densities.[49] Acquisition is similarly versatile because state and local governments can implement acquisition policies in the absence of either strong federal leadership or specific federal appropriations.[50]

5. Redevelopment Opportunities

Finally, if combined with redevelopment efforts outside of flood-prone areas, acquisition may provide a much-needed stimulus to the construction and real estate industries.[51] This benefit of acquisition programs may prove particularly attractive to coastal communities where the real estate and construction industries have suffered from the economic downturn, or where contracts for structural protection projects are awarded to engineering and construction firms outside of the local labor market.

D. Barriers to Acquisition Programs

Despite these benefits acquisition policies have in reducing flood risk, the worsening of flood hazards as a result of climate change, and the enormous costs flood hazards impose, implementing acquisition programs will face significant political, fiscal, technical, and constitutional barriers. However, each of these barriers is surmountable.

1. Political Barriers

Municipality-led pro-growth policies and private property owner resistance are likely the foremost barriers to implementing an acquisition strategy.[52] Despite ongoing natural processes and recent disasters suggesting development in flood prone areas—particularly in the coastal zone—is increasingly hazardous, vulnerable areas nevertheless continue to be very popular places to build and live.[53] Rapid growth in coastal areas during the first decade of this century continued the trends of the 1980s and

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[47] East Grand Forks, Minnesota partnered with FEMA to acquire 370 flood-damaged properties along the Red River. *See Best Practices, supra* note 44, at 94.

[48] DeWitt County, Illinois initiated an acquisition program with FEMA funding assistance that acquired forty homes and three commercial structures. *See Best Practices, supra* note 44, at 157.

[49] Mecklenburg County, North Carolina (home to Charlotte) acquired and demolished a 192-unit apartment building that had suffered repeated flood damage. *See* Mecklenburg County, *County Buys Cavalier: Most Floodprone Buildings in the County to Be Torn Down*, CHARMECK (Mar. 19, 2008) *available at* http://charmeck.org/mecklenburg/county/NewsArchives/2008Stories/Pages/080318Cavalier.aspx.

[50] *See* Fraser, *supra* note 30, at 13-21.

[51] *See id*. at 16 (describing the development of new housing following flooding in eastern North Carolina to encourage owners of damaged homes to participate in an acquisition program). The redevelopment opportunity necessitated by acquisition programs is relatively understudied, but one of the most significant incentives such a policy could offer. *See also* MSCIP EIS, *supra* note 38, at 3-153 to 3-154 (anticipating approximately 120,000 new construction jobs and $20 billion in additional sales volume as a result of a large-scale acquisition program in coastal Mississippi).

[52] *See* Rutherford H. Platt, *Evolution of Coastal Hazards Policies in the United States*, 22 COASTAL MGMT. 268, 271-72 (1994) (arguing private interests frequently use the specter of takings to achieve local land use policy objectives that tend to lead to diminished environmental regulation). *See also* Hawes, *supra* note 5, at 86.

[53] Barnhizer, *supra* note 8, at 295 (reporting that 26 million additional people will likely reside in coastal counties by 2025). *See also* Randall, *supra* note 5, at 145, 147.

1990s.[54] Many municipal governments encourage, at least implicitly, development in hazardous areas.[55] For instance, a coastal municipal government typically has strong, albeit perverse, incentives to encourage development along shorelines because such development is often highly valuable real estate and therefore contributes significantly to that municipality's tax base.[56] Relocation will likely be unpopular among local government officials if relocation has the effect of reducing property tax receipts even if it reduces long-term flood risks. Moreover, the availability of *in situ* alternatives, such as protection, elevation, and insurance, reduce vulnerable property owners' urgency to relocate.

Among private landowners and the local government politicians that property owners elect, a political culture highly defensive of property rights suggests strong resistance will meet any pre-disaster efforts to mandate relocation.[57] Property owners and residents of towns in flood-prone areas rightfully and understandably have strong connections to their homes and communities.[58] Previous relocation programs have demonstrated that individual and collective decisions to relocate are emotional, and relocation can cause significant social and economic upheaval.[59] It is for these reasons that relocation programs typically occur on a voluntary basis. On a post-disaster basis, the common response is to promise to rebuild in place, and property owners often feel entitled to federal assistance for doing so.[60] When disasters cause harm and damage, communities often rally around each other, and there is a real risk that in some instances post-disaster relocation might hamper the individuals' and communities' emotional recovery. Relocation programs during the urban renewal era provide evidence

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[54] NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION, POPULATION TRENDS ALONG THE COASTAL UNITED STATES: 1980-2008 2 (2010). Professor Owens, as recently as 1983, described conditions in coastal North Carolina where coastal populations had decreased. *See* Owens, *supra* note 29, at 657. Yet, since that time growth in the coastal zone has been dramatic. *See also* Bryan J. Boruff, Christopher Emrich & Susan L. Cutter, *Erosion Vulnerability of U.S. Coastal Counties*, 21 J. COASTAL RES. 932 (2005). Coastal floodplains and riverine floodplains are very different. Riverine floodplains have historically been the locus of settlement and development, whereas coastal floodplains have only been intensely developed in the last half century. *See* Barnhizer, *supra* note 8, at 307 n.39. The relationship between coastal development and development-created flood risk is supported empirically by the total spending on disaster relief in coastal areas. In the entire decade of the 1980s, the federal government spent $3.9 billion on disaster recovery. In the period from 1990 to 2003, the federal government spent on average $3 billion per year. *See* Bagstad, et al., *supra* note 34, at 289.

[55] *See* Bagstad, et al., *supra* note 34, at 285.

[56] *See* Hawes, *supra* note 5, at 62. *See also* Owens, *supra* note 29, at 635 n.45 and National Wildlife Federation, *supra* note 28, at 35. The primary concern with acquisition programs' effect on local property taxes occurs when the owners that sell their property cross into a different jurisdiction to resettle. This is a nearly impossible problem to solve without redrawing political boundaries or fundamentally reshaping local property tax regimes.

[57] *Id.*

[58] *See* Maria Lewicka, *Place Attachment: How Far Have We Come in the Last 40 Years?*, 31 J. ENVTL. PYSCH. 207 (2011) (finding that people value highly place of residence). *See also* Rachel G. Kleit & Lynne C. Manzo, *To Move or Not to Move: Relationships to Place and Relocation Choices in HOPE VI*, 17 HOUSING POL'Y DEBATE 271 (2006) (addressing concerns about relocating residents of public housing and those residents perception of place).

[59] *See* Perry & Lindell, *supra* note 27, at 53. *See also* Harvey Rice, *Texas Homeowners Groups Accused of Hindering FEMA Buyouts*, HOMELAND1 ,Jan. 17, 2010, http://www.homeland1.com/business-continuity/articles/744936-Texas-homeowners-groups-accused-of-hindering-FEMA-buyouts/ (describing a dispute between an individual homeowner seeking to sell his property to FEMA and the homeowners association that attempted to block the sale). Worth mentioning is the extremely negative reaction that accompanied the *Kelo* decision announcing an expanded application of the Fifth Amendment for involuntary public acquisition of private property. *See generally* Ilya Somin, *Limits of Backlash: Assessing the Political Response to Kelo*, 93 MINN. L. REV. 2100 (2009). Communities implementing an acquisition program for flood risk reduction purposes would be unwise to get entangled in constitutional issues if such issues are avoidable, and such issues are largely avoidable if all participants in the acquisition program are voluntary.

[60] Randall, *supra* note 5, at 153-55 (describing problems with structures suffering from repetitive flood losses).

than attempts to engage in relocation should be undertaken with great care, careful planning, and community participation.[61]

Despite these considerable political and cultural barriers, counterarguments to the wisdom of allowing flood-prone development to rebuild or remain in place exist at all points along the political spectrum.[62] For instance, a fiscally conservative position questions providing subsidies to vulnerable development in areas certain to suffer future losses.[63] Likewise, an environmentally conservative response to rebuilding in hazardous areas questions the wastefulness of such a policy as well as the harm flood-prone development causes floodplain and coastal ecosystems.[64]

Pro-growth objections to relocation can be ameliorated with a concurrent redevelopment program that provides incentives or opportunities to develop elsewhere and continue the flow of property tax receipts. Moreover, for property rights advocates, state- or locally led relocation efforts might be more politically palatable than federally led programs because of the long-standing concerns about the propriety of federal intrusions into land use policymaking.[65] Overcoming the political barriers to relocation will entail appealing to varied political interests and reframing the relocation narrative away from interference with private property rights. While overcoming political opposition represents an enormous—likely the biggest—challenge to implementing acquisition, it is not insurmountable as evidenced by the success of previous acquisition programs and the demand for subsidies for acquisition programs.[66]

Indeed some communities, or at least some portions of communities, might desire the opportunity to receive compensation for leaving behind flood risks. For instance, a group of residents in Virginia demanded that their local government acquire their property as a result of the government's putative failure to control flooding.[67] An Illinois town devastated by the 1993 floods along the Mississippi River relocated nearly in its entirety to higher ground less than a mile away.[68] It is likely that the communities that will demand the opportunity to participate in an acquisition program will have experienced

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[61] *See* Perry & Lindell, *supra* note 27, at 53. *See also* PAUL L.NIEBANCK & MARK R. YESSIAN, RELOCATION IN URBAN PLANNING: FROM OBSTACLE TO OPPORTUNITY (1968).

[62] *See* Evan Lehrmann, *Obama Seeks Subsidized Rate Reductions in Flood Insurance Program*, E&E, Sept. 20, 2011 (noting that conservatives and environmental groups lobbied together to increase NFIP premiums to reduce subsidies to coastal development).

[63] *See* Justin Gillis, *Weighing the Risk of Sea-Level Rise*, N.Y. TIMES, Mar. 14, 2012, http://green.blogs.nytimes.com/2012/03/14/weighing-the-risk-of-sea-level-rise (identifying a coalition of conservative advocates for flood insurance reform such as the Competitive Enterprise Institute and Americans for Tax Reform). *See also* Americans for Smart Natural Catastrophe Policy, http://www.smartersafer.org/coalition (last visited Mar. 30, 2012).

[64] *See id*. (also identifying groups such as Environmental Defense Fund, National Wildlife Federation, the Nature Conservancy and other environmental groups as part of the left-right coalition of interests advocating flood insurance reform). Notes the Coalitions' website: "Measures such as subsidizing artificially low rates for homeowners' insurance policies help to encourage construction in environmentally sensitive and unsafe areas." *Id*.

[65] *See* Ashira P. Ostrow, *Land Law Federalism*, 61 EMORY L.J. (2012) [forthcoming]. Increased federal participation in floodplain regulation, though part of the traditionally local land use regulation realm, is justified given that the federal government acts as the insurer of last resort in the event of disasters. Prudent risk management suggests parties bearing flood risk should have some control over the vulnerability factors that account for the risk. *See* Bagstad, et al., *supra* note 34. In the flood risk context, land use and development policies are the primary vulnerability factors in the flood risk calculation.

[66] *See* Part IV, *infra*. *See also* Best Practices, *supra* note 44 (describing more than fifty instances of FEMA-funded acquisition programs).

[67] *See* Nichols & Bruch, *supra* note 6, at 21.

[68] *See* Knobloch, *supra* note 32, and *infra* notes 216-19 and accompanying text.

previous floods and perhaps even significant damage. It is also likely that communities desirous of the opportunity to be bought out will have economic opportunities independent of coastal tourism such that the tie to the water can be severed more easily.

Neither the conservation arguments nor the redevelopment arguments address satisfactorily the primary concern that acquisition programs threaten the social fabric of communities and disrupt people's natural attachment to their homes. The disruptive nature of acquisition programs is a significant obstacle to widespread relocation of structures away from flood-prone areas. Acquisition programs operate in tension with community preservation, and there are tradeoffs. On the one hand, acquisition can reduce losses from deadly and devastating flood hazards; on the other, acquisition, if poorly planned, can pull apart or strain communities. Perhaps the most satisfying response to mitigating the concerns of community disruption is to ensure high rates of public participation in the design of the acquisition. Communities can be relocated intact, or nearly so.[69]

2. Fiscal Barriers

Acquisition policies, like almost all adaptation methods, require substantial public spending.[70] The high upfront costs of acquisition programs present a second and highly significant barrier to implementation. Public spending austerity measures will limit any governments ability to compensate property owners for relocation using public funds.[71] Many, if not most, governments that would consider implementing acquisition presently face difficult decisions about budgeting in light of the current economic situation,[72] and policies that will both reduce property tax revenues and require large expenditures will be highly unpopular. Similarly, the federal government has undertaken significant steps to reduce spending, and future federal dollars will likely be scarcer than before.[73] Federal spending limitations are especially true in light of the National Flood Insurance Program currently owing more than $17 billion in repayments to the general treasury.[74] Finally, the political priority of spending for climate-related programs, in relation to other funding priorities (e.g., healthcare, defense, and

[69] Perhaps the most notable example of an entire community being relocated is Valmeyer, Illinois. Valmeyer, which is located along the Mississippi River, was largely destroyed in the 1993 flood, and in the following years rebuilt itself less than two miles away on a bluff overlooking the floodplain. *See* Knobloch, *supra* note 32, and *infra* notes 216-19 and accompanying text.

[70] *See* Owens, *supra* note 29, at 641. *See also* Byrne & Grannis, *supra* note 6. The primary costs include acquiring the fee to the property and providing relocation assistance to participating homeowners. However, administrative costs, including the hidden costs of coordinating among the various government agencies, are not insignificant. Administrative costs include verifying ownership and clearing title, obtaining legal services, and ensuring verification with regulatory requirements. For example, in the MsCIP EIS the USACE estimated 4434 properties would need to be acquired in Jackson County, Mississippi for a total of $483.3 million. MsCIP EIS, *supra* note 38, at 287. Relocation costs, required under the Uniform Relocation Assistance and Real Property Acquisition Act, would have added an additional $107.6 million. *Id*. The USACE also included a 25% contingency.

[71] *See* Lisa Mascaro, *New Storm Brews in Congress over Paying for Disaster Relief*, L.A. TIMES, Aug. 29, 2011, http://articles.latimes.com/print/2011/aug/29/nation/la-na-fema-spending-20110830.

[72] *See* PHIL OLIFF, CHRIS MAE, AND VINCENT PALACIOS, CENTER ON BUDGET & POL'Y PRIORITIES, STATES CONTINUE TO FEEL RECESSION'S IMPACT 4 (2012). Coastal states with fiscal year 2012 budget gaps include Connecticut, Maine, Louisiana, Alabama, California, Washington, New Jersey, and New York. Virtually every coastal state faces a fiscal year 2013 budget gap. *Id*. at 5.

[73] Mascaro, *supra* note 71.

[74] *See* RAWLE O. KING, CONG. RES. SERV., NATIONAL FLOOD INSURANCE PROGRAM: BACKGROUND, CHALLENGES, AND FINANCIAL STATUS 15 (2011). The NFIP had no debt to the general treasury in 2004, and in the decades before had never carried a debt in excess of $1 billion. Following the Gulf Coast hurricanes of 2005, the NFIP's debt jumped to nearly $17 billion and has remained at that level for nearly eight years. *Id*.

education), is unknown at this time.

One solution for overcoming the high cost of acquisition is to frame any such program as a long-term cost savings. Whereas vulnerable development currently requires indefinite subsidy to remain in place, relocated development will require none. Another solution for the high initial cost of acquisition is to frame the strategy as a stimulus: new development and/or redevelopment opportunities will abound in the areas *to which* vulnerable development relocates. Redevelopment will require construction jobs and associated infrastructure spending and might be a boon for the real estate and construction industries still reeling from the recent recession.

3. Technical Barriers

Two categories of technical barriers to acquisition programs exist. First, uncertainty regarding the magnitude of many coastal hazards, especially in light of the ambiguity surrounding climate predictions more generally,[75] results in ambiguity over which properties should be acquired and how soon relocation is warranted. Second, relocating entire communities and associated supporting infrastructure will present engineering challenges.

Disagreement exists regarding the certainty of coastal hazards. Vulnerability varies geographically,[76] and advocates espousing both private property rights and the status quo will likely exploit that uncertainty. Inaccurate or out-of-date maps of flood hazards and irregular, inexplicable seasonal fluctuations in local weather and wave conditions contribute to the uncertainty.[77] A major concern with flood maps is that most were developed on the basis of historic rather than future floods.[78] Areas that may appear to be outside of the floodplain today may be subject to floods in the future. Related uncertainty exists over the extent to which coastal hazards are the product of anthropogenic climate change instead of background, "natural" fluctuations in sea level rise and storm intensity.[79] The scientific community has made great strides in resolving ambiguities surrounding flood hazards, and improvements in technology are yielding more reliable maps and better hazards information to facilitate planning.[80] Hazards maps will be essential for planning future redevelopment and identifying which areas should be protected in place. Even if implementing governments are unwilling to adopt an aggressive stance on acquisition, overcoming the information gaps is wise with regard to ongoing coastal hazards management. While some information gaps cannot be filled in the near future because of inherent uncertainties in climate science and the behavior of natural hazards, it is not necessary to wait for complete certainty before moving forward with a response to obvious risks.

4. Constitutional Barriers

Acquisition programs will operate in the shadow of the Takings Clause, found with the Fifth Amendment to the U.S. Constitution, which imposes constitutional limits on state and local governments' ability to acquire private property by physical taking and to regulate the use of private

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[75] *See* Nichols & Bruch, *supra* note 6, at 20 (noting that the extent, severity or timing of climate effects on coastlines is still unknown, and as a result, the exact nature of the responsive action is also unknowable).

[76] *See* Boruff, et al., *supra* note 54, at 932 (quantifying vulnerability of different segments of the United States' coasts). *See also* Michael, *supra* note 37, at 149.

[77] *See* Barnhizer, *supra* note 8, at 349.

[78] *Id*. at 337.

[79] *See* Robert L. Glicksman, *Global Climate Change and the Risks to Coastal Areas from Hurricanes and Rising Sea Levels: The Costs of Doing Nothing*, 52 LOY. L. REV. 1127, 1142 (2006).

[80] *See* David R. Maidment, *FEMA Flood Map Accuracy*, *in* PROCEEDINGS OF THE WORLD ENVT'L & WATER RESOURCES CONGRESS 2009: GREAT RIVERS (2009).

property.[81] Three of those constitutional limits are discussed here.

The requirement that the acquiring government entity must provide "just compensation" to the former property owner is the first and most significant limitation under the Fifth Amendment's Taking Clause on any government-led acquisition of private property by physical taking.[82] Acquisition programs fall squarely in the realm of physical takings, and there will be little to debate about whether just compensation would be required for the government to engage in the relocation of private property owners by acquisition. Just compensation will be required for any acquisition program. If a constitutional dispute emerges in the context of an acquisition program, it will likely involve either the valuation method or the specific amount required to provide just compensation for individual landowners or classes of landowners.

The so-called regulatory taking doctrine is the second Takings Clause limitation on acquisition programs. A regulation that stops short of a physical taking can nonetheless also require the government to provide just compensation to private property owners if the regulation constitutes either a permanent physical occupation,[83] a deprivation of all economic value,[84] or if the regulation "goes too far."[85] Relocation via land use controls such as zoning or via the government's disinvestment in public infrastructure may constitute a regulatory taking. Relocation via acquisition, however, is unlikely to result in regulatory taking claim because most acquisition programs as contemplated herein will constitute physical takings. When a court finds that a physical taking has occurred, it will apply the physical taking, rather than the regulatory taking, analysis.[86]

The third constitutional limitation under the Fifth Amendment is the requirement that takings be for "public use." Under a fairly recent (and highly controversial) ruling in 2005, the meaning of "public use" is very broad and means "public purpose."[87] The acquisition of vulnerable residential development in coastal hazard areas will almost certainly meet the public purpose standard of the Takings Clause.[88]

Relative to other relocation strategies, acquisition is not likely subject to ambiguities regarding the application of the Fifth Amendment's Takings Clause. The Takings Clause will apply and just compensation will be required for the properties that any government entity acquires. Perhaps the surest way to avoid any constitutional entanglements is to limit acquisition programs to purchasing

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[81] *See* Marc R. Poirier, *Takings and Natural Hazards Policy: Public Choice on the Beachfront*, 46 RUTGERS L. REV. 243 (1993).

[82] U.S. CONST. amend V. ("[N]or shall private property be taken for public use, without just compensation"). *See also* Byrne & Grannis, *supra* note 6.

[83] *See* Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982).

[84] *See* Lucas v. S.C. Coastal Comm'n, 505 U.S. 1003 (1992).

[85] *See* Pennsylvania Coal Co. v. Mahon, 260 U.S. 393, 416 (1922). The U.S. Supreme Court later elaborated on when a government regulation might go too far in *Penn Central Transportation Co. v. New York City*, 438 U.S. 104 (1978), establishing a three-part balancing test considering the character of the government action, the reasonable investment backed expectations of the property owner and the economic impact of the regulation. Regulatory takings can also emerge in the land use context when the regulating government requires some sort of exaction. *See* Nollan v. Cal. Coastal Comm'n, 483 U.S. 825 (1987) and Dolan v. City of Tigard, 512 U.S. 374 (1994).

[86] Admittedly the line between physical and regulatory takings can be "blurry." *See* Robert Meltz, *Takings Law Today: A Primer for the Perplexed*, 34 ECOLOGY L.Q. 307, 364 (2007) and Andrea L. Peterson, *The False Dichotomy between Physical and Regulatory Takings Analysis: A Critique of* Tahoe-Sierra*'s Distinction between Physical and Regulatory Takings*, 34 ECOLOGY L.Q. 381 (2007).

[87] Kelo v. City of New London, 545 U.S. 469, 498 (2005) (Kennedy, J., concurring).

[88] The U.S. Supreme Court has been largely deferential to the legislature in determining what constitutes a public purpose. *See id.* at 499.

exclusively from property owners who volunteer to sell.[89]

III. The Policy Framework for Government Acquisition Programs

Although state and local governments will likely initiate and lead acquisition programs, the federal government, through existing programs, has the capacity to support such efforts. The federal government supports acquisition programs through financial assistance and through incentives to create and maintain a planning process and documents for hazard mitigation. These two forms of federal support are introduced below.

A. Federal Emergency Management and Hazard Mitigation Assistance

For more than two decades, the federal government has recognized the benefits of acquiring vulnerable properties to mitigate flood hazards and has appropriated funding for that purpose.[90] Congress has allocated funding and established policy programs that award grants to state and local governments to implement acquisition programs in areas vulnerable to flood hazards.[91] The administration of such federal funding is controlled through Federal Emergency Management Agency (FEMA) administrative regulations and informal guidance.[92] Acquisition programs that receive federal funding are implemented through state or local government programs.

FEMA administers five federal disaster assistance grant programs, which together are referred to as Hazard Mitigation Assistance (HMA).[93] The primary support for acquisition is the Hazard Mitigation Grant Program (HMGP), which provides post-disaster property acquisition assistance to local governments through states on a quasi-competitive grant basis.[94] Separately funded pre-disaster acquisition programs also exist.[95] The acquisition provisions of the various HMA programs are among the most proactive elements of the federal disaster planning and mitigation toolbox and have been

[89] Regulations governing the distribution of federal funds for acquisition programs require that property owners participate voluntarily. *See infra* note 110 and accompanying text. Moreover, by requiring voluntary participation by property owners, state and local governments implementing acquisition programs with federal funds avoid the requirement to comply with the federal Uniform Relocation Assistance and Real Property Acquisition Act. *See* 49 C.F.R. § 24.101(b) and *infra* note 250 and accompanying text.

[90] *See* KEITH BEA, CONG. RES. SERV., FEDERAL STAFFORD ACT DISASTER ASSISTANCE: PRESIDENTIAL DECLARATIONS, ELIGIBLE ACTIVITIES, AND FUNDING 15 (2010).

[91] *See* FEMA Unified Guidance, *supra* note 44.

[92] *Id*. *See also* 44 C.F.R. part 80 (providing for the requirements for federally funded acquisition programs under the Hazard Mitigation Grant Program).

[93] These include grants through the Pre-Disaster Mitigation (PDM), Severe Repetitive Loss (SRL), Flood Mitigation Assistance (FMA), and Repetitive Flood Claims (RFC) programs. *See* FEMA Unified Guidance, *supra* note 44, at 2.

[94] *Id.* at 51. HGMP awards are granted after disasters are declared and following analysis of the scope of the disaster.

[95] Federally funded and administered *pre-disaster* property acquisition and relocation assistance is available through the PDM program. *See* FEMA Unified Guidance, *supra* note 44, at 2. The U.S. Dept. of Housing and Urban Development also provides grants for flood acquisitions. *See* EUGENE BOYD, CONG. RES. SERV., COMMUNITY DEVELOPMENT BLOCK GRANT FUNDS IN DISASTER RELIEF AND RECOVERY (2011).

employed in flood-prone areas throughout the country many times since their inception.[96]

The HMGP has its basis in statute. In 1988 Congress passed the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), substantially updating and amending disaster relief legislation dating to the 1970s.[97] The Stafford Act included many new elements of disaster relief and emergency management and established the HMGP.[98] Following a declared disaster, the HMGP authorizes the President to contribute federal funding to "hazard mitigation measures which substantially reduce the risk of *future* damage, hardship, loss or suffering."[99] The Stafford Act also sets forth cost sharing and cost caps for federal public assistance under this provision,[100] and Congress has subsequently increased these cost caps through later amendments to the Stafford Act.[101] Following 1993 amendments to the Stafford Act, the HMGP authorizes FEMA to "provide property acquisition and relocation assistance" to eligible states and/or communities with qualifying mitigation plans,[102] but limits properties eligible for participation in the acquisition program and limits future use of properties receiving assistance.[103]

The various HMA programs are subject to a largely unified regulatory regime,[104] with only minor differences, which are addressed at the end of this section. Under HMA grants, state and local government grant recipients purchase homes from either flood-affected or flood-prone residents, demolish those homes, and set aside those acquired, vulnerable lands in a permanently undevelopable state.[105] The HMA programs require voluntary property owner participation; HMA grants cannot fund the acquisition of property through eminent domain.[106] The grants are administered by FEMA in cooperation with state and local governments.[107] Grants are required to be "cost-effective,"[108] but this

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[96] *See* Best Practices, *supra* note 44 (describing more than fifty instances of FEMA-funded acquisition programs). *See also* David A. Lieb & Jim Salter, *FEMA Flood Buyouts Top $2B since 1993*, ABC NEWS, July 12, 2011, http://abcnews.go.com/US/wireStory?id=14055874#.T3iF779Wpee (reporting that FEMA has funded the acquisition of more than 36,000 properties since 1993). *See* Fraser, et al., *supra* note 30. However, although HMA supports locally-administered acquisition programs for the purposes of reducing flood losses, HMA also supports efforts to mitigate other types of disasters including wildfires and tornadoes, and competition for these scarce funds is intense.

[97] H.R. REP. NO. 100-517 at 4 (1988).

[98] 42 U.S.C. § 5170c (2006).

[99] *Id*. (emphasis added).

[100] *Id*.

[101] In 1988, the limits of federal assistance were the greater of $1 million or 10% of public assistance grants. Amendments increased these limits according to a sliding scale with a decreasing federal percentage for increasing total amounts. H.R. REP. NO. 100-517 at 8 (1988). Today, HMGP awards are capped at 7.5% of $35.3 billion, or up to $2.65 billion. 42 U.S.C. § 5170c.

[102] 42 U.S.C. § 5165. The 1993 amendments were intended, in part, to "plac[e] hazard mitigation on an equal footing with repair and reconstruction. This is intended to give communities a more balanced choice between repair and reconstruction and relocation or other non-structural measures." H.R. REP. NO. 103-358 at 5 (1993).

[103] The limitations and requirements of the HMGP are substantially similar to those of the PDM, SRL, FMA, and RFC programs. *See* FEMA Unified Guidance, *supra* note 44, at 74.

[104] HMA grants include the HMGP, PDM, SRL, FMA, and Repetitive Flood Claims programs. *See* FEMA Unified Guidance, *supra* note 44. Each program is subject to a different enabling statute and varying appropriation levels, but the administrative regulations and guidance affecting the disbursement of funds is largely uniform. *Id*.

[105] 44 C.F.R. § 80.19(a).

[106] *Id*. § 80.11(a).

[107] Other entities besides state and local governments are eligible to receive HMA grants, but state and municipal governments are the most common. *See id*. § 80.3. In the ordinary course, the state receives the federal grant and passes the funds through to the applicant local government(s). The state and local government grant recipients are referred to as, respectively, the "grantee" and the "subgrantee" in the HMA regulations and guidance.

requirement has been broadly interpreted, and grant applications do not require a formal cost-benefit analysis.[109]

For a property to be eligible for acquisition through an HMA-funded program, (1) the property owner must volunteer to participate in the acquisition;[110] (2) the property must contain an at-risk structure;[111] (3) incompatible easements must be extinguishable upon transfer;[112] (4) the acquired property may not be contaminated with hazardous materials;[113] (5) the property may not be part of a planned project such that it will be used in a manner incompatible with FEMA's required deed restrictions;[114] and (6) the property may not be subdivided prior to acquisition such that only a portion of the subdivided property undergo an ownership transfer unless the non-transferred portion of any such subdivision is outside of a delineated flood hazard zone.[115]

After acquisition, FEMA requires (1) acquired properties to be held in fee simple by the acquiring government;[116] (2) acquired properties to be dedicated and maintained in perpetuity as open space, recreational uses, or wetlands subject to a deed restriction limiting future development;[117] (3) no new structures be built on the acquired property, subject to limited exceptions;[118] (4) no future application

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[108] FEMA Unified Guidance, *supra* note 44, at 37.

[109] *Id.* at 11.

[110] Under the Stafford Act, neither FEMA nor the grantees' administering body is required to limit HGMP awards to voluntary recipients only. However, FEMA's regulations recite that "eligible acquisition projects are those where the property owner participates voluntarily, and the grantee/subgrantee will not use its eminent domain authority to acquire the property." 44 C.F.R. § 80.11(a). On residential properties that are rented, tenants need not be voluntary participants in the program. *See* FEMA Unified Guidance, *supra* note 44, 89-91. Displaced tenants may be eligible for additional financial assistance.

[111] 44 C.F.R. § 80.11(b). "At-risk structures" include those that have already been damaged or destroyed as well as those not yet damaged or destroyed. In addition, unimproved land adjacent to land with at-risk structures is also eligible. *Id*. Note that "structure" is not defined in 44 C.F.R. part 80, but it is defined in 44 C.F.R. part 59 (the regulations for the National Flood Insurance Program) along with many other terms common to part 80. In part 59, "structure" means a "walled and roofed building … that is principally above ground." *Id.* § 59.1.

[112] *Id.* § 80.17(b).

[113] Incidental household waste and demolition materials are excepted from this requirement. *Id.* § 80.17(a).

[114] *Id.* § 80.17(e).

[115] *Id.* § 80.11(c). Permitting acquired properties to be subdivided to allow future development on portions of the parcel outside the delineated (historic) floodplain presents some problems in coastal areas where the floodplain is dynamic. Portions of the shoreline that are currently out of, but adjacent to, the exiting floodplain are likely to be in the floodplain as sea levels rise. *See* Titus, *supra* note 5, at 725-26 (explaining the process of shoreline migration). This is one way in which policies that may make sense for riverine floods do not translate well to the coastal setting. One way to counteract such a potential loophole is to adopt a strategy from the NFIP rules and define the floodplain based on future rather than historical flood conditions. This can be done by incorporating erosion rates into flood maps. *See* FEMA, NATIONAL FLOOD INSURANCE PROGRAM MANUAL: COMMUNITY RATING SYSTEM 40, 45 (2011) (defining the V-Zone Risk Factor Rating and authorizing communities with shorefront erosion zones to establish setbacks from dunes, bluffs, and shoreline vegetation by using a "published or calculated long-term erosion rate.").

[116] *Id.* § 80.11(d). FEMA's regulations require that acquired properties be maintained in perpetuity "for the conservation of floodplain functions," and may be conveyed subsequently only with the approval of FEMA and only then to a public organization subject to a conservation easement or to a private conservation organization. *Id.* § 80.19(b).

[117] *Id.* § 80.17(e).

[118] *Id.* § 80.19(a)(2). Allowed structures include public facilities, public restrooms, or other compatible structures approved in writing in advance by FEMA. Allowable structures are not eligible for federal flood insurance or any other post-flood federal financial assistance. *Id.* § 80.19(a)(3)-(5).

for disaster assistance be made or received for the acquired property;[119] and (5) relocated structures be moved outside of flood-hazard areas.[120]

Grant recipients are also subject to numerous administrative requirements.[121] The grant recipient administering the HMGP award must enter into an agreement with FEMA affirming compliance with these provisions. Grant recipients are required to administer the HMGP awards pursuant to hazard mitigation plans and to demonstrate a "commitment to mitigation activities."[122] The HMGP will not fund 100% of an acquisition or relocation program; grant recipients must provide up to 25% of matching funds.[123]

In addition to the voluntary participation requirement for acquisition, property owners may be eligible for additional relocation assistance,[124] especially if the purchase offer is less than the cost to the occupant-seller of buying another residence outside of the flood prone area.[125] Finally, property owners must be informed of the market value for their house, the methodology the grant recipient uses to calculate the value, the basis for the offer, and the final offer amount.[126] The government body funding the acquisition is responsible for removing structures.[127]

Grant recipients are authorized to administer HMGP funding in conjunction with other federal assistance programs, including but not limited to Community Development Block Grant (CDBG) funding.[128] When multiple funding sources are available, the government implementing the acquisition program is required to simplify application processes as much as possible for property owners.[129]

One important difference among the various HMA programs pertains to the limitations on eligibility for potential grant recipients. A community is eligible for the HMGP only if it is located in an area that the President has declared a disaster.[130] Pre-Disaster Mitigation (PDM) grants, on the other hand, are available on a pre-disaster basis.[131] Three other HMA programs are available for communities that meet the criteria as being repetitive loss or severe repetitive loss communities.[132] However, for these programs an applicant community must participate in the NFIP before applying for any for assistance from any of these three HMA programs.

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[119] 42 U.S.C. § 5170(b)(2)(B).
[120] FEMA Unified Guidance, *supra* note 44, at 75.
[121] *See* 44 C.F.R. §§ 80.13-80.21. Additional requirements include providing FEMA with proof of the buyouts (§ 80.21), obtaining title insurance (§ 80.17(b)), and consulting with other federal agencies, such as the U.S. Army Corps of Engineers and the state's Department of Transportation (§80.13(b)), among others.
[122] 42 U.S.C. § 5170(c)(2).
[123] Limited sources of federal funds are authorized for match. *See* FEMA Unified Guidance, *supra* note 44, at 8. Eligible federal funds include the Community Development Block Grants. *Id*. at 9.
[124] 44 C.F.R. § 80.17(c)(5).
[125] *Id.* § 80.17(c)(6). Under the SRL, the property owner will receive compensation equal to the greatest among (1) the current market value of the property, (2) the original purchase price, and (3) any outstanding loan amount. The SRL is the only acquisition program with this unique purchase offer requirement. 42 U.S.C. § 4102a.
[126] 44 C.F.R. § 80.17(c)(7).
[127] *Id.* § 80.17(d).
[128] FEMA Unified Guidance, *supra* note 44, at 79. Recall that funding may also come from other federal entities such as HUD (via Community Development Block Grants specifically designated for disaster mitigation purposes), as well as from state and local sources.
[129] FEMA Unified Guidance, *supra* note 44, at 79.
[130] *Id*. at 2. This restriction represents a significant limitation on communities seeking to implement an acquisition program where no disaster has yet occurred. States such as Connecticut, where recent coastal disasters are rare but risks are high, are essentially limited to the PDM program unless participating in the NFIP and eligible for SRL, FMA, or RFC grants.
[131] *Id.* at 59.
[132] *Id.* at 21, 61-73.

Another important difference between the HMGP and some of the other programs is the method for awarding funds. A significant portion of PDM funds are awarded by Congressional earmark to specific communities or for specific projects, whereas FEMA awards the HMGP funds following application from eligible and interested communities.[133]

B. The Role of Hazard Mitigation Plans

Before FEMA will award HMA grants, the state and local government in which the applicant is located usually must have an approved Hazard Mitigation Plan (HMP).[134] HMPs come in three types, each of which is defined in FEMA's regulations. The most basic type of plan, the "Standard" State HMP, must include a description of the planning process (which is to include interested stakeholders and to be integrated with other planning efforts), detailed risk assessments of hazards throughout the state, a mitigation strategy for reducing losses from hazards identified in the risk assessment, and procedures for coordinating with local government mitigation plans, adopting the plan, and maintaining the plan.[135] The state must update its Standard HMP every three years.[136] The second class of state HMPs is the "Enhanced Plan."[137] An Enhanced Plan increases the availability of federal assistance to states and requires additional documentation beyond the Standard HMP along with assurances that the state is taking proactive steps to mitigate risks from disasters.[138] The third and final class of HMP is the "Local Mitigation Plan."[139] Local jurisdictions applying for HMGP or PDM grants must have a FEMA-approved plan before submitting an application for federal funds.[140] Local plans must be detailed, describing, for instance, numbers and types of buildings and infrastructure vulnerable to identified hazards as well as dollar estimates of potential losses from hazards.[141] Local HMPs must also include a mitigation strategy, a description of the plan-making process, and documentation of adoption by the local government.[142]

The process through which a state or local government creates its HMP is a crucial component of ensuring a successful acquisition program. Creating an HMP is more than a mere formality required for eligibility for federal financial assistance; rather, creating a plan serves many important functions. In addition, the plan-making process is not a static, one-time event. The HMP is, or ought to be, a continuing dialogue between state or local government, its constituents and FEMA.

The HMP drafting process has numerous benefits.[143] The drafting process is an opportunity to

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[133] *Id*. at 51. *See also* Bea, *supra* note 90, at 17.

[134] *See* 44 C.F.R. § 201.3(c)(1) and FEMA UNIFIED GUIDANCE, *supra* note 44, at 19. Exceptions exist and some tribes and sub-state entities can obtain waivers from the HMA requirements by promulgating hazard mitigation plans independent from the state. *Id*.

[135] 44 C.F.R. § 201.4.

[136] *Id*. § 201.4(d).

[137] *Id*. § 201.5.

[138] *Id*.

[139] *Id*. § 201.6.

[140] *Id*. § 201.6(a).

[141] *Id*. § 201.6(c)(2)(ii)(A)-(B).

[142] *Id*. § 201.6(c)(3)-(5). Local Hazard Mitigation Plans must be updated every five years. *Id*. § 201.6(d)(3).

[143] *See* Laurie Pearce, *Disaster Management and Community Planning, and Public Participation: How to Achieve Sustainable Hazard Mitigation*, 28 NAT. HAZARDS 211 (2003); Zhenghong Tang, et al., *Moving from Agenda to Action: Evaluating Local Climate Change Action Plans*, 53 J. ENVT'L. PLAN. & MGMT. 41, 57 (2009); David R. Godschalk, et al., *Public Participation in Natural Hazard Mitigation Policy Formation: Challenges for Comprehensive Planning*, 46 J. ENVTL. PLAN. & MGMT. 733 (2003). *See generally* FEDERAL EMERGENCY MANAGEMENT AGENCY, GETTING STARTED: BUILDING SUPPORT FOR MITIGATION PLANNING (2002).

inform constituents of coastal hazards and the risks the community or state faces. Information presented in the drafting process can be quantitative. Risk, the product of probability that a hazard will cause a loss and the magnitude of the loss, is a matter of dollars and cents.[144] Presenting risk in dollar terms turns abstract theoretical concepts into a conversation with a practical significance. The plan-making process is also an opportunity to dispel myths about the roles of various government agencies and rumors about the procedures and opportunities of an acquisition program. Drafting an HMP opens a forum for discussing and vetting alternative mitigation strategies. In creating an HMP the planners and their constituents are forced to prioritize concerns, identify unknowns, and allocate resources. The HMP can provide some certainty about a path forward for constituents nervous about potential losses from hazards. Perhaps most importantly, a robust and open HMP planning process provides an opportunity for those facing coastal hazards to make their concerns and preferences heard and to take ownership of loss mitigation strategies. Citizens should be empowered to serve the HMP process in official roles, such as leading committees, running hearings, and contributing research. The process should not be exclusively in the hands of state and federal officials.[145]

IV. Acquisition Programs: Large-Scale Responses

A. Acquisition as a Response to Flood Hazards: Pre-Disaster or Post-Disaster

Acquisition is most effective at reducing flood losses if it occurs before a disaster strikes. After disasters, emotions tend to run high, victims are eager to rebuild, and competing pressures limit opportunities to plan acquisition, relocation and redevelopment programs.[146] Quite frequently the urgent desire to restore normalcy—rebuilding a damaged home or returning to the routine of everyday business—overtakes long-term concerns about whether the most appropriate policy is to rebuild in an area subject to frequent and intensifying hazards.[147] On a pre-disaster basis, acquisition decisions can be made on the basis of safety and quantifiable risk reduction.[148]

However, the distinction between pre- and post-disaster mitigation is somewhat misleading because responses after one storm are largely indistinguishable from responses before the next.[149] Coastal areas susceptible to flooding once are likely to be susceptible to flooding thereafter even if structural controls are developed, and under most probable climate change and sea level rise scenarios,

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[144] *See* Kron, *supra* note 7, at 61.

[145] *See* Laurie Pearce, *The Value of Public Participation During a Hazard Impact, Risk and Vulnerability (HIRV) Analysis*, 10 MITIGATION & ADAPTATION STRATEGIES FOR GLOBAL CLIMATE CHANGE 411, 415 (2005); Gerard Hutter, *Strategic Planning for Long-Term Flood Risk Management: Some Suggestions for Learning How to Make Strategy at Regional and Local Level*, 12 INT'L. PLAN. STUD. 273 (2007).

[146] *See generally* Robert Olshansky, *Planning after Hurricane Katrina*, 72 J. AM. PLAN. ASS'N. 147 (2006) and Robert Olshansky et al., *Planning for the Rebuilding of New Orleans*, 74 J. AM. PLAN. ASS'N. 273 (2008) (both sources describing the planning and emergency response climate in New Orleans following Hurricane Katrina).

[147] *See* Robert B. Olshansky, Laurie A. Johnson, & Kenneth C. Topping, *Rebuilding Communities Following Disaster: Lessons from Kobe and Los Angeles*, 32 BUILT ENV'T. 354 (2006).

[148] Achieving meaningful levels of citizen participation is also likely to be easier on a pre-disaster basis. After a storm, many affected residents scatter to other parts of the state or to other states altogether, *see* Elizabeth Fussell, et al., *Race, Socioeconomic Status, and Return Migration to New Orleans after Hurricane Katrina*, 31 POPULATION & ENV'T 20, 21 (2010), or are preoccupied with picking up the pieces of their disrupted lives.

[149] The pre-disaster versus post-disaster distinction is relevant with regard to the availability of federal funding, however, as HMGP are available only post-disaster whereas PDM grants are available pre-disaster. *See supra* note 95 and accompanying text.

the geographic scope of vulnerable areas will increase[150] For instance, efforts to rebuild along the Gulf Coast were largely framed as a response to the hurricanes that already struck (past tense), but those same efforts easily could have been framed as a response to hurricanes yet to come (future tense), with the caveat that future hurricanes and storm surge may cause damage in areas not badly affected by the last storm. Nearly all of the examples of acquisition programs considered below are ostensibly post-disaster insofar as the impetus to begin a relocation program emerged only after a major disaster. But the primary benefits of the acquisition program are losses avoided during the next disaster.[151]

Louisiana and Mississippi present an interesting contrast of implementation policies for an acquisition program. In 2006, Louisiana received several billion dollars of federal money to begin the process of rebuilding the Gulf Coast. As part of those rebuilding efforts, Louisiana provided each homeowner that suffered major losses from either of the hurricanes the option of receiving federal money to rebuild in place or to sell and relocate elsewhere. Louisiana did not attempt to encourage those who suffered the most damage or those in areas likely to suffer future damages any additional incentive to relocate; instead, all homeowners faced the same options: rebuild or relocate. More than 10,000 households elected to relocate. Mississippi, in contrast, through the U.S. Army Corps of Engineers, developed a detailed plan to relocate thousands of structures from the most vulnerable areas as part of a phased program that would take thirty to forty years to fully implement. Though the Mississippi program is as of today neither funded nor implemented, it offers an interesting counterpoint to the unplanned approach Louisiana adopted. Which approach more successfully reduces flood risks may not be known until after the next hurricane. A detailed analysis of each of the two states' programs follows.

B. The Homeowner Option: Louisiana's Road Home Program

By virtually any measure, Louisiana undertook the most ambitious acquisition program in U.S. history. However, the acquisition program was not purely intended to reduce risk; rather, Louisiana's program was designed to compensate residents (mainly homeowners) who had suffered either partial damage or a total loss to their primary dwelling. The scale of the program (10,000 households voluntarily relocated) and the purpose of the program (compensation rather than risk-reduction) present useful illustrations for state and local governments undertaking disaster-oriented acquisition programs in the future.

1. The Flooding and the Response

Within the span of four weeks in the fall of 2005, two major hurricanes—Katrina and Rita—caused major destruction to Louisiana.[152] Nearly 2,000 people died, nearly 20,000 businesses were destroyed, and more than 200,000 homes were destroyed or severely damaged.[153] Housing losses alone exceeded

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[150] *See* Michael, *supra* note 37, at 149. *See also* Bagstad et al., *supra* note 34, at 288 (describing the problem of repetitive loss structures along coastlines).

[151] Bagstad et al., *supra* note 34, at 289. When acquisition programs target the most vulnerable properties, savings range from $2-5 for every $1 spent acquiring at risk property. *Id.*

[152] *See* Simon Romero & Jere Longman, *Storm Lashes Coast, Levees Breached in New Orleans*, N.Y. TIMES, Sept. 24, 2005.

[153] LOUISIANA RECOVERY AUTHORITY, THE ROAD HOME HOUSING PROGRAMS: ACTION PLAN AMENDMENT FOR DISASTER RECOVERY FUNDS 2 (2006). *See also* N. ERIC WEISS, CONG. RES. SERV., REBUILDING HOUSING AFTER HURRICANE KATRINA: LESSONS LEARNED AND UNRESOLVED ISSUES 2 (2006) and Jeffrey A. Groen & Anne E. Polivka, *Going Home After Hurricane Katrina: Determinants of Return Migration and Changes in Affected Areas*, 47 DEMOGRAPHY 821 (2010).

$32 billion from the two storms and their aftermath.[154] Without any doubt, a significant response was necessary to both restore order and prepare for the next storm.

Congress responded to the disaster by appropriating $11.5 billion in CDBG for states along the Gulf Coast, with $6.2 billion allocated specifically for Louisiana.[155] Congress later made available an additional $3 billion of CDBG funding for Louisiana exclusively.[156] In addition to the CDBG funding allocated in 2006, Louisiana also secured nearly $1.2 billion through the HMGP at that time.[157] These federal funds were pooled with a smaller amount of state funding to provide financial assistance to fund the Homeowner Assistance Program (HAP). A cornerstone of the broader "Road Home Program" post-hurricane recovery effort, HAP sought to rebuild the communities that the storms devastated by focusing on homeowners who suffered losses.[158]

Under HAP, eligible homeowners[159] could receive at most $150,000 in assistance[160] and had three options for the delivery of that assistance: (1) rebuild or repair their home in place (Rebuild), (2) sell their home and purchase[161] another home in Louisiana (Sell and Stay), or (3) sell their home and move out of the state (Sell and Move).[162] Grant recipients electing to Rebuild were not required to elevate the flood damaged structure although additional funding was available if the recipient so desired, and elevation was encouraged. Many HAP grant recipients did elect to elevate upon selecting the Rebuild option.[163]

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[154] Louisiana Recovery Authority, *supra* note 153, at 2.

[155] Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico, and Pandemic Influenza Act, Pub. L No. 109-148, 119 Stat. 2680 (2005). Subsequently, Congress appropriated additional CDBG bringing Louisiana's total to approximately $13.4 billion. *See* Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, Pub. L. No. 109- 234, 120 Stat. 418 (2006) [hereinafter *2006 Defense Department Appropriations Act*]; Department of Defense Appropriations, Pub. L. No. 110-116 , 112 Stat. 1295 (2007).

[156] Allocations and Requirements for the Supplemental Grant to the State of Louisiana Under Division B of the Department of Defense Appropriations Act, 2008, 72 Fed. Reg. 70,472 (Dec. 11, 2007).

[157] *Id*. Eventually only $750 million of the $1.2 billion HMGP award would be used for the Road Home program. The balance would be reallocated for "traditional" HMGP purposes as awarded by the state. Memorandum from Paul Rainwater to Eligible HMGP Applicants (May 29, 2008), *available at* http://www.gohsep.la.gov/mitigation/20081603Allocations.pdf.

[158] The Louisiana Office of Community Development, Disaster Recovery Unit oversees the Road Home Program, which is administered by ICF International, a private consulting firm, under a $912 million contract. *See* EILEEN NORCROSS & ANTHONY SKRIBA, THE ROAD HOME: HELPING HOMEOWNERS IN THE GULF AFTER KATRINA, MERCATUS POLICY SERIES POLICY COMMENT NO. 19 (2008), *available at* http://mercatus.org/sites/default/files/publication/GPI_PS_Road_Home_Policy_Brief.pdf.

[159] To be eligible, a homeowner had to show (1) ownership of the applicable home prior to the hurricanes, (2) the applicable home was a single or double unit structure, and (3) the applicable home either was "destroyed" or suffered "major" damage. Major damage is usually defined as more than $5,200 damage. *See* ROAD HOME, ROAD HOME HOMEOWNER PROGRAM POLICIES 7.0, 3 (2010) [hereinafter HOMEOWNER POLICIES].

[160] The actual amount awarded was determined by a series of complicated formulas. In general, a dollar amount of damage to a home was assessed, the amount of insurance received was subtracted from the damage assessment, and the difference was awarded to the grantee subject to the $150,000 cap. *See id.*

[161] Those choosing Option 2 who do not purchase another home within the state within the specified timeline were converted to Option 3 and would receive the (lower) Option 3 amount. *See* Homeowner Policies, *supra* note 159, at 49.

[162] Each Option included numerous constraints on how funds were allocated. For instance, if a home was more than 50% damaged, the award was calculated differently than if it was less than 50% damaged. *See* Homeowner Policies, *supra* note 159, at 26.

[163] SITUATION & PIPELINE REPORT, *supra* note 43 (reporting that 32,186 recipients of Road Home grants elected to elevate their home). All statistics reported in the *Situation & Pipeline Report* are through March 15, 2012. However, award distributions have slowed to a mere trickle.

The Road Home Program accepted applications from Louisiana homeowners from its inception in July 2006 until July 2007.[164]

Applicants to the Road Home Program generally followed a multi-step, sometimes multi-year, process to obtain a grant.[165] First, the homeowner submitted an application. Next, Road Home staff reviewed the application and sent a letter to the applicant. Upon receipt of the letter, the applicant had to call and schedule an appointment to meet with an advisor, who would submit the application for processing. While an application was processing, Road Home staff verified the application's accuracy, calculated the amount of assistance for which the applicant was eligible, and sent the homeowner a letter with an assistance amount. With the award amount, the homeowner would then choose one of the three options. Once an option was selected, the Road Home administrative staff would move the application towards closing, which for a property owner electing either Relocate option entailed title transfer activities. Grant recipients had limited ability to appeal an award.[166]

2. The Road Home Program: Empirical Results

Louisianans submitted nearly 230,000 applications in the year-long period during which homeowners could seek assistance.[167] Of those applications submitted, approximately 129,750 received funding, with more than $8.9 billion disbursed to eligible homeowners so far.[168] Nearly 92% of the eligible Road Home applicants elected to Rebuild.[169] Approximately one quarter of those choosing to Rebuild also elevated their homes.[170]

Slightly fewer than 10% of those eligible for Road Home assistance sold their homes (10,633 total as of November 2011).[171] Those choosing the Relocate options were not homogeneously spread across coastal Louisiana: 88% of homeowners who chose to Relocate were in only two of thirty-seven parishes, St. Bernard and Orleans, and 93% of homeowners who elected to Relocate were in just five parishes, the five easternmost coastal parishes (which include Saint Bernard and Orleans).[172] Not surprisingly, these five parishes were among the six parishes with the highest percentages of damaged housing units.[173]

The average award was $66,000 for Rebuild grantees, $88,000 for Sell and Stay grantees, and $75,000 for Sell and Move grantees; those Relocating received on average nearly $19,000 more than

[164] HOMEOWNER POLICIES, *supra* note 159, at 15.

[165] RICK EDEN & PATRICIA BOREN, RAND CORPORATION, TIMELY ASSISTANCE: EVALUATING THE SPEED OF ROAD HOME GRANTMAKING 7 (2008).

[166] *See* HOMEOWNER POLICIES, *supra* note 159, at 25 (setting forth appeal procedures), 30 (limiting appeals), 46 and 55 (precluding appeals for assignments).

[167] SITUATION & PIPELINE REPORT, *supra* note 43, at 1.

[168] *Id*. For various reasons, 14,500 completed applications received no award. *Id*. at 8.

[169] *Id.* at 1. Of the eligible property owners receiving awards, 119,126 elected to Rebuild; these grant recipients received in total $8.028 billion. *Id*.

[170] *Id*. Of the grant recipients electing to Rebuild, 32,186 also elected to elevate their homes. *Id*.

[171] *Id*. The Road Home program tracked whether eligible applicants were "low or moderate income" households (LMI). LMI applicants totaled 43% of all eligible applications, and 47% of those choosing the Relocate options. *See id*. at 5.

[172] The five easternmost coastal parishes are St. Tammany, Orleans, St. Bernard, Plaquemines, and Jefferson.

[173] The parish with the highest percentage of damaged units was Cameron Parish, which is in the western part of Louisiana along the Texas border. Of the housing units in Cameron Parish, 90% experienced damage and 72% experienced major/severe damage. The five easternmost coastal parishes contributing the vast majority of those homeowners opting to sell their homes experienced damage rates ranging from 53% to 81%. Importantly, the available statistics do not indicate what percentage of those choosing to sell their homes had damaged homes. *See* FEMA, CURRENT HOUSING UNIT DAMAGE ESTIMATES: HURRICANES KATRINA, RITA, AND WILMA 16 (2006).

those Rebuilding.[174]

3. The Road Home Program: Failure?

Several studies have analyzed post-Katrina rebuilding efforts and repopulation results,[175] but none have looked explicitly at the Road Home Program's ability to reduce flood risk by encouraging those in areas vulnerable to future flooding to Relocate.[176] The Road Home Program's Relocate option achieved a nearly 10% participation rate among eligible homeowners even though hurricanes damaged half of the total housing stock in eligible parishes.[177] Five factors help explain the Program's low rates of participation in the Relocate options:

(1) **Homeowners electing to Relocate were under-compensated.** Under-compensation occurred in several ways. Anyone with damages in excess of HAP's $150,000 award limit automatically received inadequate compensation.[178] Those electing to Relocate were subject to an automatic 30% reduction in award if they had failed to carry adequate flood insurance,[179] and high percentages of homeowners were uninsured.[180] Homeowners electing to Sell and Move (out of the state) were expressly penalized: Sell and Move grant recipients could receive no more than 60% of the uncompensated value of their home, a 40% penalty for moving out of the state.[181] Sell and Stay grantees (who could move anywhere else in the state) were subject to the

[174] SITUATION & PIPELINE REPORT, *supra* note 43, at 15. In Jefferson Parish, for example, those Relocating received on average $51,000 more than those Rebuilding, and in St. Tammany Parish the difference was $31,000. *Id*.

[175] *See* Jeffrey A. Groen & Anne E. Polivka, *supra* note 153. *See also* Peter Burns & Matthew O. Thomas, *New Orleans Five Years Later: Key Questions in the Rebuilding of an American City*, ANNUAL MEETING OF THE AM. POLITICAL SCI. ASS'N (2010), Christina Finch, Christopher T. Emrich & Susan L. Cutter, *Disaster Disparities and Differential Recovery in New Orleans*, 31 POPULATION & ENV'T 179 (2010), Davida Finger, *Stranded and Squandered: Lost on the Road Home*, 7 SEATTLE J. SOC. JUST. 59 (2009), Everett Fineran, *Louisiana Road Home Program: A Path of Unintended Consequences*, 26 BUFF. PUB. INT. L. J. 105 (2007), Fussell, et al., *supra* note 148, Jonathan D. Stringfield, *Higher Ground: An Exploratory Analysis of Characteristics Affecting Returning Populations after Hurricane Katrina*, 31 POPULATION & ENV'T 43 (2010).

[176] Groen & Polivka note that residents in high damage areas were unlikely to return after the storm to their parish of residence before the storm, a finding consistent with the popularity of the Relocate options in parishes experiencing high percentages of damage. *See* Groen & Polivka, *supra* note 153. Another report concludes that whether a New Orleans resident experienced housing damage was the single greatest predictor of whether they returned to New Orleans following the storm. *See* Fussell, et al., *supra* note 148, at 34.

[177] *See* Norcross & Skriba, *supra* note 158, at 2 n. 12.

[178] Under-compensation affects both the homeowners receiving the inadequate awards as well as their neighbors who see home values go down as a result of a low purchase price. Outside of the Road Home Program, homeowners' associations have been vocal opponents of buyout programs. *See* Rice, *supra* note 53. Moreover, although the Road Home Program's Relocate options' inherent favoritism of residents with lower home values is laudable (as those homeowners are presumably those with lower incomes), it only sets up a situation where owners of high-value homes are in the future subsidized in other ways (e.g., NFIP, repetitive loss rebuilding assistance, etc.).

[179] Awards from insurers were factored into the Road Home Program awards so that homeowners did not receive duplicate compensation. *See* Homeowner Policies, *supra* note 159, at 12. *See also* Finger, *supra* note 175, at 61.

[180] *See* Norcross, *supra* note 158, at 3 n. 14. In Orleans Parish 40% of residents had flood insurance. In St. Bernard's Parish just 57% of residents had flood insurance.

[181] *See* Homeowner Policies, *supra* note 159, at 28. There were limited exceptions to this penalty. For instance, applicants who were elderly, disabled, or active duty military under orders to move out of state were not penalized. *Id*. at 28.

same 40% penalty if they could not purchase housing within the state by 180 days after receiving their award.[182] In addition to systemic under-compensation, many complained of unfair and inconsistently applied valuation techniques.[183] Finally, the complicated and often opaque award calculation procedures limited grantees' ability to forecast their award and formulate rational decisions, stalling rebuilding efforts and frustrating the displaced.[184]

(2) **The Road Home Program lacked any compulsory mechanism for relocating residents in the most vulnerable areas and did not coordinate rebuilding efforts at the neighborhood scale.** From the HMGP's inception, FEMA regulations have interpreted the Stafford Act to prohibit compulsory buyouts despite the absence of such a prohibition in the statute itself.[185] The Road Home Program guidelines lacked authority to require those in the most vulnerable areas to Relocate. Homeowners deciding between rebuilding or relocating faced uncertainty over the decision of others in their neighborhood: the Rebuild option became less attractive if neighbors did not also return.[186] There were no mechanisms in the Road Home Program's compensation efforts to coordinate Rebuilding efforts in lower hazard areas.[187]

(3) **A strong bias towards returning and rebuilding permeated the post-Katrina recovery process.** Much of the Gulf Coast's post-disaster recovery effort could be characterized as "place-based" as opposed to "people-based." Rebuilding New Orleans and surrounding damaged areas in situ was a symbolic (and cathartic) response to the destruction of the hurricanes.[188] At least one economist has argued that the knee-jerk post-disaster rebuilding preference along the Gulf Coast is arguably a poor one.[189] Those electing to Rebuild were eligible for additional assistance for agreeing to elevate and/or flood-proof their homes, whereas those electing to Relocate were not.[190]

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[182] *See* Norcross & Skriba, *supra* note 158, at 12. Homeowner Policies, *supra* note 159, at 49.

[183] *See* Finger, *supra* note 175, at 70.

[184] *See* Norcross & Skriba, *supra* note 158, at 7.

[185] *Compare* 44 C.F.R. § 80.11(a) (limiting eligible projects to those where "the property owner participates voluntarily" and the applicant government "will not use its eminent domain authority to acquire the property for the open space purposes should negotiations fail") *with* 42 U.S.C. § 5170C(b) (no mention of limiting grants of hazard mitigation assistance to governments acquiring properties exclusively from voluntarily selling property owners).

[186] *See* Norcross & Skriba, *supra* note 158, at 17 (explaining the prisoners' dilemma-type situation many residents faced as they made the decision of whether to Rebuild or Relocate).

[187] Without coordinated land use planning as part of an acquisition program, acquired properties will be interspersed among remaining properties. *See* DAVID R. GODSCHALK ET AL., NATURAL HAZARD MITIGATION: RECASTING DISASTER POLICY AND PLANNING 205 (1999) (Referring to uncoordinated acquisition of property as the "Swiss cheese effect"). This phenomenon creates numerous problems including blight, difficulty providing municipal services, inability to fully restore floodplain function, and community fragmentation.

[188] UNIVERSITY OF NEW ORLEANS, REPETITIVE LOSS AREA ANALYSIS: JEFFERSON PARISH, MAPLEWOOD SUBDIVISION AREA 16 (2006). Norcross & Skriba, *supra* note 158, at 6. ("Alarmed by the rate of out-migration, [Louisiana] wanted as many residents as possible to return, in order to 'restore Louisiana's impacted communities.' Program designers and federal officials feared 'devastated communities [would] be blighted by abandoned homes, clouded land titles, and disinvestments if a large portion of the financial assistance was not provided … as incentive for homeowners to remain in affected areas.'").

[189] Edward L. Glaeser, *Should the Government Rebuild New Orleans, or Just Give Residents Checks?*, 2 ECONOMISTS' VOICE 4 (2005).

[190] *See* Homeowner Policies, *supra* note 159, at 28-29. This elevation bonus was the only incentive applicants had to engage in risk-reducing behavior.

(4) **The Road Home Program gave preference to homeowners over renters.** The Road Home Program was targeted most directly towards homeowners. Federal funds allocated to the Program included only 15% for rebuilding rental properties and no funding program existed for helping renters recover.[191]

(5) **The Road Home Program's application review process was slow and the Program's administration arguably was poor.** The most common criticism of the Road Home Program generally is that the disbursement process was very slow and its administration poor:[192] many applicants waited years for compensation, and many went through multiple rounds of appeals and return visits or correspondence with Program administrators; there were few incentives for the private contractors running the Program to move speedily; the Program policies were not publicly available and inconsistently followed; and applicants often were unaware of the status of their application.[193] Homeowners electing to Relocate, in particular, waited on average 100 days longer than those rebuilding in place.[194] The Road Home Program and its state government overseers actively resisted transparency early in the implementation of the Program.[195]

4. The Road Home Program: Success?

For all the criticism the Road Home Program received, it did manage to disburse nearly $9 billion to Louisiana's affected residents. From the perspective of proactive, pre-disaster hazard mitigation (that is, in anticipation of the next hurricane to strike the Gulf Coast), the Program funded the acquisition of more than 10,600 homes damaged or destroyed by the 2005 hurricanes, nearly 10% of the homes receiving assistance.[196] In the areas that the hurricanes damaged the most, rates of participation in the Relocation option were even higher. Finally, despite the apparent penalties for selecting either of the

[191] Other programs provided assistance to renters, but there was nothing in the $8 billion Road Home Program for renters. Applicants electing to Relocate but remain in Louisiana in a rental unit received the same penalty as those who elected to Sell and Move. *See* HOMEOWNER POLICIES, *supra* note 159, at 28.

[192] *See* Fineran, *supra* note 175 and Finger, *supra* note 175. *See also* David Hammer, *Auditor: State's Home Elevation Program Not Well Managed*, TIMES-PICAYUNE, July 18, 2011, http://www.nola.com/politics/index.ssf/2011/07/auditor_states_main_home_eleva.html.

[193] Eden & Boren, *supra* note 165. In a report to Congress a year after the storm, merely twenty-eight checks had been written from the Road Home Program despite the Program's receipt of 77,000 applications at that point. *See* Weiss, *supra* note 153. By 2012, more than 129,750 payments had been made, and only 295 applications remained outstanding. SITUATION & PIPELINE REPORT, *supra* note 43, at 1. As of Eden and Boren's study in 2008, the average wait time (duration from application date to disbursement date) for applicants was 250 days.

[194] Eden & Boren, *supra* note 165, at 20. The acquisition program in Louisiana was delayed as the state established a government entity to take title for the acquired lands. *Id*. RAND also notes that the Relocate options took longer to close because the state actually took title as opposed to the Rebuild option where the state merely cut a check. *Id*.

[195] *See* Finger, *supra* note 175, at 75. Interestingly critics from both the left (Finger) and right (Fineran) disparaged the program for its lack of transparency. *Compare id. with* Fineran, *supra* note 175.

[196] Unfortunately available data are not spatially detailed enough to identify whether those relocating were in the most vulnerable areas, so it is difficult to state with any certainty the extent to which the Program reduced flood risk. *See* SITUATION & PIPELINE REPORT, *supra* note 43.

Relocate options, homeowners received greater awards by choosing to Relocate.[197] A full assessment of the successes of the Road Home Program's Relocate provisions may be premature. The purpose of the Relocate option was to allow owners of flood-damaged homes to avoid future losses, and not until after the next storm will a better understanding of the benefits of that option emerge.

C. Big Plans: Mississippi's Post-Katrina Acquisition Program

Unlike Louisiana's compensation-oriented response to the 2005 hurricanes, Mississippi developed a planned effort to reduce risk by acquiring vulnerable properties. Mississippi's planned acquisition program differs from Louisiana's ad hoc approach primarily in that Mississippi's efforts have not yet been undertaken.

1. The Flooding and the Post-Flood Plan

Hurricane Katrina devastated large stretches of coastal Mississippi just as it destroyed southeastern Louisiana.[198] The coast of Mississippi experienced a thirty-foot storm surge, which ultimately killed more than two hundred people and caused damage to tens of thousands of housing units.[199] Also like Louisiana, Mississippi received substantial federal disaster recovery funding and implemented a multi-sector rebuilding program.[200] Mississippi did not provide owners of damaged homes the equivalent of the Sell and Stay or Sell and Move options that were available to Louisiana homeowners; that is, Mississippi did not explicitly offer a Relocate option post-disaster in its HAP.[201]

However, the post-disaster response in Mississippi did include a planning effort, which from an acquisition or relocation perspective, is perhaps the most ambitious ever. The United States Army Corps of Engineers ("Corps" or "USACE"), at the direction of Congress, undertook a study and planning effort to reduce future flood risks to coastal Mississippi developments.[202] With regard to the benefits of acquisition on coastal risks, the Mississippi Coastal Improvement Plan (MsCIP) is unambiguous: "The most effective alternative for reducing the risk from future hurricane surge events is to remove all structures and relocate population centers from the high risk zones."[203]

The MsCIP is a comprehensive plan for the approximately 75-mile stretch of Mississippi Gulf

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[197] However, this statistic might mask the economics of the Relocate option. Many choosing to Rebuild likely did not start with a basis of no value and moreover retained the land value of their property, whereas Relocate awards included both land and building value.

[198] John Jopling, *Two Years After the Storm: The State of Katrina Housing Recovery on the Mississippi Gulf Coast*, 77 MISS. L. J. 873, 873 (2008).

[199] OFFICE OF GOVERNOR HALEY BARBOUR, THREE YEARS AFTER KATRINA: PROGRESS REPORT ON RECOVERY, REBUILDING AND RENEWAL 4 (2008).

[200] Jopling, *supra* note 198, at 876. Mississippi received approximately $5.05 billion in CDBG from Congress.

[201] *See id.* The Mississippi HAP program also received significant criticism for excluding renters. It applied, initially, only to homeowners in single-family homes. *Id.* at 887.

[202] 2006 Defense Department Appropriations Act, *supra* note 155 ("the Secretary shall conduct an analysis and design for comprehensive improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and other related water resource purposes at full Federal expense").

[203] MsCIP EIS, *supra* note 38. The EIS reports that approximately 32,500 structures were more than 50% damaged and an additional 15,000 to 25,000 were significantly damaged within Mississippi's coastal region. The USACE also reports that rebuilding following Katrina was slower than expected because of higher construction costs and uncertainty related to flood insurance availability. *Id.*

Coast.[204] The MsCIP recognizes the broad problems of "significant damage to structures and infrastructure … due to hurricane-induced storm surge" and "significant erosion of the coastal landscape with subsequent damage to … man-made infrastructure," and the opportunity to "reduce the susceptibility of residential, commercial, and public structures and infrastructure to hurricane-induced storm damages [in the coastal zone]."[205] The MsCIP also recognizes concerns pertaining to damage of coastal ecosystems, and opportunities to restore and recover ecological assets.[206] Significantly, the MsCIP also makes the assumptions, among others, that sea level will continue to rise and that demand for waterfront living will not abate.[207] From this identification of problems, opportunities, and assumptions came potential problem-solving "measures." One of the primary measures recommended is the "Long-term High Hazard Risk Reduction Plan" (HARP), a recommendation to engage in the "acquisition of high-risk properties over a 30 to 40 year period."[208]

2. The MsCIP Acquisition Plan

The HARP proposal entails a two-part property acquisition strategy. HARP Phase I involves the acquisition of properties that either have been frequently flooded or are at very high probability of future damage due to storm surge.[209] HARP Phase I will seek to acquire 2,000 of 15,000 parcels in the high-hazard area at a total cost of approximately $407 million.[210] These parcels include primarily residential uses, but some public buildings are also identified as explicitly recommended to be relocated.[211] The HARP Phase I targets currently undeveloped parcels in high-risk areas so that acquisition can occur before development occurs on those parcels and increases the market value of those parcels. The MsCIP estimates that the 2,000 targeted parcels could be acquired in a five-year period.[212]

HARP Phase II takes a more reactive approach and would allow a future disaster to be the impetus

[204] *Id.* at 1-4. For comparison purposes, Connecticut's coastline is approximately 330 miles because of the state's many small bays and estuaries. *See* Connecticut Dept. of Energy & Envtl. Protection, *Interesting Connecticut Facts*, http://www.ct.gov/dep/cwp/view.asp?A=2688&Q=322362 (last visited Mar. 30, 2012).

[205] MsCIP EIS, *supra* note 38, at S-4.

[206] *Id*. Indeed much of the MsCIP's focus is on restoring ecological function. Acquisition is but one part of a twelve-point strategy. Nine of the other points pertain to restoring ecological function of various barrier island, dune, and wetland systems. *Id*. at S-10. By dollar amount, the acquisition program constitutes 40% of the total plan. *Id*. at S-11.

[207] *Id.* at S-6 ("The demand for waterfront and near-waterfront living will not decrease in the future as a result of hurricanes (i.e., people will always want to live by the water)."). *See also* USACE, MISSISSIPPI COASTAL IMPROVEMENTS PROGRAM (MSCIP) HANCOCK, HARRISON, AND JACKSON COUNTIES, MISSISSIPPI: COMPREHENSIVE PLAN AND INTEGRATED PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT – NON-STRUCTURAL RESPONSE, APPX. D 264 (June 2009) [hereinafter MSCIP APPX. D].

[208] MsCIP EIS, *supra* note 38, at S-12.

[209] *Id*. at 3-54. Flood risks were determined using detailed, plan-specific process. The USACE and its consultants did not rely exclusively upon existing FEMA flood maps, but created new models using the latest flood data. In general, the "catastrophic damage zone," the area where most structures were totally destroyed or severely damaged, was within 800 feet of the beachfront.

[210] *Id.* at 3-54, 4-30.

[211] *Id.* at 3-55. The EIS notes that public facilities frequently take on secondary importance during disasters, serving as points of refuge, staging areas for emergency provision distribution, and headquarters for emergency service coordination and response. *Id.* at 3-56.

[212] *Id.* at 3-54. The Mississippi coastal floodplain includes 59,000 parcels. Acquiring even a small percentage of the total number of vulnerable parcels in a short timeframe could have adverse effects on the local tax base and would be prohibitively expensive from a public funds perspective.

for wide-scale relocation.[213] The MsCIP recognized that the rebuilding process following Katrina's destruction "might already be too far advanced to relocate a significant number of residents at this time."[214] HARP Phase II thus entails acquiring structures "after the next significant storm event, and before another major reconstruction effort within the high-hazard surge-plain begins."[215]

The USACE presented the HARP plans to the public in a series of meetings, and the immediate message from the public was largely opposed to large-scale acquisitions.[216] Affected residents indicated preferences for non-structural elements such as evacuation planning and building code enhancements.[217] A general public consensus was that acquisition should be limited to those areas having a 1% annual chance of inundation from a hurricane or storm surge.[218]

The HARP proposal recognized that not all structures in the high-hazard areas shared the same vulnerability: "well-armored" structures, such as concrete high-rises are more survivable than single-family cottages.[219]

3. HARP: Setting the Stage for Future Acquisition Programs

The most significant finding in the HARP planning and environmental impact statement preparation process is the recognition that acquisition is a more cost-effective long-term strategy than protection of properties in high-hazard areas through seawalls, levees and other structural means.[220] Moreover, the MsCIP EIS found that the benefits (the avoided damages) of acquiring and relocating vulnerable structures were greater than the avoided damages of structural protection.[221]

The MsCIP EIS noted additional benefits of the HARP Phase I. For instance, the MsCIP found that the acquisition of properties would result in regional economic benefits of $3.29 billion from increased real estate transactions.[222] The MsCIP also estimated that the Phase I acquisition program would yield a net of 5,200 new jobs.[223]

The MsCIP EIS also addressed concerns about the displacement of low-income and/or minority

[213] *Id.* at 3-55.
[214] *Id*.
[215] *Id.*
[216] *Id.* at 3-54. *See also* Coleman Warner, *Buyout or Sellout: A Federal Plan to Purchase Properties along Mississippi's Coast has Bay St. Louis Residents Thinking Twice about Rebuilding*, TIMES-PICAYUNE (Sept. 23, 2007). Residents feared that the plan to engage in large-scale buy-outs would impair recovery two years after the hurricane. One resident interviewed in the Warner article stated, "This is too much, too late. If they were going to do something like this, it might have been beneficial soon after the storm… Uncertainty right now is the last thing we need. People need confidence." *Id*.
[217] MsCIP EIS, *supra* note 38, at 3-54.
[218] *Id.*
[219] *Id.* at 4-25. The implications of the differential vulnerability raise a host of secondary concerns. Concrete high-rises are less vulnerable in the short-term (and therefore more appropriate for the high-hazard areas), but are more expensive and difficult to relocate in the long-term. Under scenarios where rising and receding shorelines are a larger concern than hurricanes and storm surge, concrete high-rises may be a less appropriate long-term adaptation response.
[220] *Id*. at 4-31. Phase I of HARP pencils out to about $407 million to acquire 2,000 structures and the property on which those structures are located. The USACE estimates the acquisition program would take five years to implement, with a rate of 400 structures per year and a cost of $24 million per year. Damages were expected to range from $22-33 million per year.
[221] *Id*. at 5-11.
[222] *Id*. at 5-10. Contrary to many affected residents' immediate concerns about the impact on the economy, the redevelopment needs would result in substantial net regional economic benefits.
[223] *Id*.

populations as part of a targeted acquisition program. The EIS found that the adverse impact on low-income populations under a structural protection-based strategy would likely be *greater* than under an acquisition and relocation program.[224] This conclusion is based on the recognition that redeveloping in place will necessitate meeting higher building code standards, which will tend to increase significantly the cost of housing. Finally, the MsCIP EIS notes that the acquisition and removal of structures from floodplains will have significant positive environmental and ecological benefits. Relocation of structures will provide opportunities for wetland restoration and the restoration of other sensitive habitat.[225]

The MsCIP's recommendations regarding the HARP Phase I acquisition program have not yet been implemented. The USACE submitted its findings to Congress in early 2011, and is awaiting legislation appropriating funding for the project. Public discussions regarding the viability of a large-scale acquisition program in coastal Mississippi predictably were "emotionally charged."[226] Similarly, portrayals of the HARP acquisition proposals in the popular press were mixed, with some residents expressing strong reservations to any such policy and others indicating support, if reluctantly.[227]

Coastal Mississippi has not yet implemented a large-scale acquisition and relocation program, but it is arguably closer to doing so than any other jurisdiction at this time. The MsCIP is the first comprehensive, state-wide plan recognizing the need to relocate development away from high-hazard coastal areas. It recognizes the benefits of such an approach and the increasing need for relocation to occur.

D. Acquisition in Response to Non-Coastal Floods

Acquisition of flood-damaged or flood-prone development has been a not uncommon response to devastating non-coastal flooding. Acquisition programs first received significant attention following the record-breaking 1993 Mississippi River flood, after which FEMA sponsored buyout programs for numerous communities across the Midwest.[228] The 1993 floods killed more than thirty people and caused $16 billion in damage.[229] In response to the floods, FEMA and analogous state agencies funded the acquisition of 7,700 properties in the amount of $56.4 million.[230]

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[224] *Id*. at 4-23 to 4-24. Concerns remain, however, regarding the affordability of housing for residents as the housing stock is diminished. *See* USACE, MISSISSIPPI COASTAL IMPROVEMENTS PROGRAM (MSCIP) HANCOCK, HARRISON, AND JACKSON COUNTIES, MISSISSIPPI: COMPREHENSIVE PLAN AND INTEGRATED PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT, REAL ESTATE, APPX. C 277 (2009) [hereinafter MSCIP APPX. C] ("The availability of decent safe and sanitary housing is a potential problem. Large scale construction of new residences will most likely be required.").

[225] MsCIP EIS, *supra* note 38, at 3-39.

[226] *Id*. at 3-54.

[227] *See* Warner, *supra* note 216. Some residents advocated for a speedy implementation of the plan (if at all); others wanted the buyouts to be mandatory (if at all) because delivery of municipal services to far-flung, low-density, patchwork development would be even more costly if some property owners elect to remain in the floodplain. *Id*.

[228] *See* Nicholas Pinter, *One Step Forward, Two Steps Back on U.S. Floodplains*, 308 SCI. 207 (2005).

[229] *Id*.

[230] *Id*. Before enacting the PDM program, in the late 1980s and early 1990s, Congress authorized the acquisition of damaged properties through the NFIP in a program known as the Upton-Jones Amendment. Under Upton-Jones, a claimant could receive up to 100% of the insured value of a damaged structure for demolishing it following a claimable event; alternatively, the claimant could receive up to 40% of the value of the structure to relocate it from the high-hazard floodplain. *See* McGlashan, *supra* note 5, at 14. The vast majority of the claims paid out under this program were for demolition, and the majority of the claims were from North Carolina. *Id*. Many of the relocated structures were simply placed on large tractor-trailer-pulled beds and driven via public roads to new locations. *See* Rogers, *supra* note 45. Congress declined to reenact the Upton-Jones Amendment in 1995, and it is today little more than a historical footnote.

In at least one instance, an acquisition program in response to the 1993 Mississippi River floods led to the relocation of an entire town.[231] Valmeyer, Illinois was virtually devastated by the August 1993 flood.[232] After nearly two years of planning and coordinating—almost all of it led by the affected community—Valmeyer was rebuilt on a 500-acre parcel of agricultural land just 1.5 miles linearly from where the original town had been flooded. Significantly, however, the new town is 400 feet higher in elevation, situated on a bluff overlooking the floodplain.[233] Nearly 60% of the pre-flood population of Valmeyer moved to the new town and as of 2005, the population of the town had nearly returned to its pre-flood level.[234]

Although the Mississippi Basin and the upper Midwest have received a disproportionate amount of attention and funding for acquisition programs, such programs have occurred elsewhere. For example, Hurricane Floyd caused significant damage along the coastal plain of North Carolina in September 1999.[235] Following the flood, the heavily damaged cities of Kinston and Greenville undertook acquisition programs.[236] In Kinston, more than 700 property owners volunteered to sell, and in Greenville approximately 450 property owners volunteered to relocate.[237] The acquisition programs and post-hurricane recovery efforts were recognized as opportunities for economic and community development.[238]

Since those 1993 floods, FEMA has spent in excess of $2 billion to acquire approximately 36,700

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[231] *See* Knobloch, *supra* note 32, at 41.

[232] *Id*. The town had survived fifty years alongside the Mississippi River protected by USACE-built levees. In the years before the 1993 floods, businessmen, politicians, and residents of Valmeyer grew frustrated with the limitations on development in the levee-protected floodplain and sought "solutions" to circumvent the limitations on new development in flood hazard areas. Less than a decade later, the entire town stood more than sixteen feet underwater and nearly entirely devastated by a flood. Mr. Knobloch, the author of the piece describing his town's dealings with floodplain restrictions, a flood, and the aftermath of relocating, was mayor of Valmeyer at the time of the flood. He was also among the staunch local supporters for allowing more development in the floodplain. *Id*. at 42.

[233] *Id*. at 45.

[234] *Id*. at 44. Valmeyer represents one of the best examples of an entire community or town being relocated following flooding. Allenville, Arizona is another such example. Allenville, a predominantly low-income black community, was situated along the Gila River and experienced severe flooding following the development of reservoirs upstream. *See* Perry & Lindell, *supra* note 27, at 50-53. Moore's Beach, New Jersey is another example of wholesale community relocation — or perhaps properly described as abandonment. United States Geologic Survey topographic maps show the small town of Moore's Beach situated on the estuarine shoreline of the Delaware Bay as far back as the 1890s. However, by the late 1980s, only one family remained in full time residence, and by the time this author visited the site in 2004, no structures remained. *See Flood Insurance Cutbacks Imperil Jersey Beach Homes*, NY TIMES, May 27, 1987. Finally, the USACE and leaders of the Inuit village of Kivalina, Alaska engaged in deep discussions to relocate the entire village from its current, vulnerable barrier island location to the mainland. *See* USACE, *supra* note 34. *See also* ORRIN H. PILKEY & ROBERT YOUNG, THE RISING SEA 14 (2009). Kivalina is currently the plaintiff in a high-profile common law suit against numerous polluters of greenhouse gases pending in the United States Ninth Circuit Court of Appeals. *See* Kivalina v. ExxonMobil Corp., No. 08-1138 (9th Cir. 2011).

[235] FRASER ET AL., *supra* note 30, at 13.

[236] *Id*. at 13-15. Both Kinston and Greenville are located along rivers and well-inland of any estuarine or ocean floodplains.

[237] *Id*. Like Allenville and Kivalina, the Kinston acquisition program involved relocating primarily low-income and minority residents. In the floods that originally destroyed Kinston, residents rallied to save community focal points such as a church. *Id*. at 17. Civic landmarks can be the focal point of community rallying and encouraging or incentivizing people to leave those features behind can be extraordinarily difficult even in the face of future floods.

[238] *Id*. at 15.

properties nationally, primarily in the Midwest and along the Mississippi.[239] Additional federal funding was contributed to these acquisition programs through CDBGs.[240] From 2003, the year the Pre-Disaster Mitigation grant program became a full-fledged FEMA program,[241] until 2010, the PDM funded nearly seventy projects in seventeen states in an aggregate amount in excess of $45 million.[242] The vast majority of these PDM acquisition efforts were very small. For instance, one project in the state of Washington sought to acquire just three coastal houses.[243] On a slightly larger scale, Gurnee, Illinois acquired forty-five properties over the course of two grants.[244] Likewise, DeKalb, Georgia received five grants over four years, totaling $4.5 million to acquire just one flood prone subdivision.[245] On a similar scale, Canton, Maine, acquired thirty-five structures under a 2005 grant and received a second grant in 2007 for an additional $2.1 million.[246] These PDM acquisitions demonstrate the versatility and scalability of acquisition as a response to flood hazards.

V. Legal Issues and Recommendations for Future Acquisition Programs

Given the projected effects of climate change and the subsidies coastal development receives, development will persist in hazardous areas absent intervention. Now is the time to begin planning a wide-scale acquisition program for other states. This final section identifies concerns acquisition programs might raise and offers lessons from acquisition programs along the Gulf Coast, in the Mississippi River Basin and elsewhere. This review does not aim to be comprehensive; rather, it intends to merely start the conversation about how best to use acquisition programs to encourage relocation away from high-hazard coastal areas.

A. Issue-Spotting: Some Concerns with Acquisition Programs

In Louisiana, the much-maligned Road Home Program managed to fund the acquisition of more than 10,000 flood-damaged homes. In Mississippi, a plan with ambitions of a similar scale remains on the drafting table, waiting to be implemented. The biggest difference between the two is the availability of funding: Louisiana received an enormous U.S. taxpayer-funded grant to engage in

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[239] *See* Lieb & Salter, *supra* note 79.

[240] *Id*.

[241] The PDM had existed for the six years before 2003 as a much smaller (by dollar amount) "pilot" program. *See* FRANCIS X. MCCARTHY & NATALIE KEEGAN, CONG. RES. SERV., FEMA'S PRE-DISASTER MITIGATION PROGRAM: OVERVIEW AND ISSUES 4 (2009).

[242] Fiscal year 2010 is the most recent year for which a full year's worth of data is available. *See* Best Practices, *supra* note 44.

[243] *See* Lummi Nation, *supra* note 46, at 218.

[244] Best Practices, *supra* note 44, at 231. Gurnee obtained both state and federal funding to complete its acquisition program, but relied on local and private funding as well.

[245] *Id.* at 77. DeKalb County's Jackson Square Condominium acquisition shows that, while difficult, buyouts of multi-family structures are possible as well. Anecdotally, the more common model involves the acquisition of privately owned single-family structures, perhaps because the ownership structures are easier for the acquiring government entities to untangle and because of the lower likelihood of an individual holdout stalling the acquisition process. However, multi-family structures are likely to be vulnerable to flooding concerns as well, and acquiring governments should not overlook the interests of residents of such housing types, especially multi-family rental units. Of course, due care must be given to finding replacement housing for these residents and renters in multi-family residences should be encouraged to participate in the public process alongside homeowners.

[246] Maine Emergency Management Agency, *Risk Assessment*, *in* MAINE HAZARD MITIGATION PLAN 3-14 (2010).

acquisition; Mississippi is still awaiting funds for its planned, large-scale relocation program.[247]

Careful preparation and planning cannot overcome the importance of appropriations in the success of an acquisition program. Without the capital to provide compensation to property owners, acquisition programs simply do not exist. The appropriations question is a political one and is very difficult to resolve. Legal concerns with acquisition programs exist. Some of the most significant are considered here.

(1) **Claims of Discrimination.** Coastal areas contain both extraordinarily wealthy enclaves and some very poor communities.[248] Because acquisition programs will likely be funded by a declining-balance appropriation, a limited pool of acquisition funds can aid more households in lower-income areas than in wealthy ones. Acquisition program designers will have to take great care to ensure that an acquisition program does not have a disproportionately discriminatory effect on a racial basis, certainly; but also avoid discriminating on the basis of wealth. If an acquisition program skews too heavily towards buying out high-value properties, it could be subject to criticisms of being "welfare for the wealthy." On the other hand, if an acquisition program skews too heavily towards low-income areas, it could engender suspicions that it is a "slum-clearing" effort or is making way for larger homes to remain behind. In Louisiana, the Road Home Program dealt with discrimination lawsuits that created unhelpful distractions and damaged trust between the program coordinators and the affected communities.[249] Intensive opportunities for public participation and outreach can be one way to overcome such concerns.

(2) **Fair Market Compensation.** Acquisition and renewal efforts have regularly confronted the problem of property owners believing they are undercompensated.[250] Many such property owners engage in the acquisition program begrudgingly, having already lost or suffered much. Receiving a "low-ball" offer from the government can seem like insult on top of injury, and can be a major rallying point for opponents to acquisition programs. The appraisal process must be exceedingly transparent, and opportunities for appeals must be both speedy and accessible.[251]

(3) **Lack of Participation.** As the famous baseball player Yogi Berra quipped, "If the fans don't come out to the ball park, you can't stop them."[252] So too is it with an acquisition program that relies entirely upon voluntary participation. No amount of planning, participation, or careful design can overcome determined resistance on the part of the affected community. In the face

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[247] Mississippi did engage in some relocation after Hurricane Katrina, but the scale was much smaller than Louisiana's. *See* April M. Havens, *Jackson County's Home Buyout Program Nearing Completion*, MISSISSIPPI PRESS, Jan. 10, 2012 (reporting that Jackson County Board of Supervisors purchased fifty-six flood-prone or flood-damaged single family owner-occupied and rental properties).

[248] *See* Bagstad et al., *supra* note 34, at 286 (describing wealth disparities among residents of coastal Louisiana).

[249] *See* Martha Carr, *State Settles Road Home Discrimination Case*, TIMES-PICAYUNE, July 6, 2011, http://www.nola.com/politics/index.ssf/2011/07/state_settles_road_home_discri.html.

[250] The federal Uniform Relocation Assistance and Real Property Acquisition Policies (42 U.S.C. §§ 4601-4655) (URA) was passed for the purpose of ensuring constitutional compliance with federal programs involving the acquisition of private property. *See* Alexander v. Dep't. of Housing & Urb. Development, 441 U.S. 39, 50 (1979). However, the URA does not apply when property owners voluntarily sell real property to the federal government. *See* 49 C.F.R. § 24.101(b). Compliance with the URA may be necessary if the owner of the acquired property leases to residential tenants who do not relocate voluntarily.

[251] The Louisiana program suffered in its early years because the program lacked transparency. *See* Finger, *supra* note 175, at 75.

[252] STEVEN D. PRICE, 1001 FUNNIEST THINGS EVER SAID 63 (2006).

of a lack of participation, acquisition program coordinators might offer inducements to participate such as expedited application processing, or some form of limited-time financial inducement (e.g., relocation assistance, paying the closing costs for purchasing a new home). Acquisition advocates might also publicize the risks of remaining in place, offering documentation of losses, and a lack of certainty about the availability of funding in the future. A targeted public information campaign could be part of the early phases of the acquisition effort. There may also be opportunities to mandate relocation through either non-conforming use provisions in zoning ordinances or involuntary buyouts. These efforts should only be undertaken after voluntary programs have been given an opportunity to succeed or for the highest hazard areas where losses are virtually certain.

(4) **Continued Growth in High-Hazard Areas**. Finally, acquisition programs may confront the concern that despite efforts to relocate development away from high-hazard areas, demand to live near the water will continue. As the USACE noted in the introduction to the MsCIP, demand for coastal living is unlikely to diminish despite the widespread publication of and increasing certainty of losses from coastal hazards.[253] To counteract such continued growth, communities implementing acquisition programs will have to implement restrictive zoning and other land use controls.[254] Comprehensive analysis of such efforts is beyond the scope of this research, but suffice it to say diminishing coastal development demand will be politically difficult, and will likely engender opposition similar to the development of acquisition programs.

B. Lessons from Previous Acquisition Programs.

Past and planned acquisition programs demonstrate that communities can reduce the risks of coastal and other flooding hazards by removing development from high-hazard areas.[255] Moreover, past acquisition programs offer insight for implementing and improving upon future property acquisition programs, whether post-disaster or pre-disaster. These recommendations are grouped into three categories: (1) Draft a Spatially-Informed, Publicly-Inclusive Hazard Mitigation Plan, (2) Implement the Acquisition Program, and (3) Reduce Subsidies to Development in Coastal Hazard Areas.

1. Draft a Spatially-Informed, Publicly-Inclusive Hazard Mitigation Plan

a. Prepare a Comprehensive Acquisition Plan before a Disaster Occurs

A state or local government seeking to relocate vulnerable property via an acquisition program should develop a plan to set forth its objectives and success criteria. Ideally, the acquisition plan would be part of or at least consistent with the jurisdiction's comprehensive land use plan and any relevant hazard mitigation plan. Finally, and as discussed further below, the plan should also be informed by the spatial variation of risk.

A common theme from the Louisiana, Mississippi, and Mississippi River experiences is the

[253] *See* MsCIP EIS, *supra* note 38, at S-6. *See also* National Wildlife Federation, *supra* note 28, at 35.

[254] *See* Nichols & Bruch, *supra* note 6, at 19 (setting forth a number of policy strategies for managing coastal development in the face of climate change).

[255] MsCIP EIS, *supra* note 38, at 4-31. Although formal studies have not been conducted for Valmeyer, it is now located well outside of the floodplain and almost certainly has much lower flood risk than it did in late July 1993 before the Mississippi River flooded and destroyed the town.

importance of emergency management and planning officials having devoted significant thought and preparation effort to an acquisition program *before* a disaster occurs. Louisiana's Road Home Program was bogged down by delays in part because the scale of devastation had not been contemplated before the storm. Mississippi missed an opportunity to act before rebuilding occurred because no acquisition plan was on the shelf to implement after the disaster struck. The former mayor of Valmeyer underscored the importance of planning best: "It is much easier to convince people that living in the shadow of a major waterway is a risk when they are standing knee-deep in flood water. It is also more expensive for government agencies to deal with situations like this in a reactionary mode."[256]

b. Engage the Public in Planning the Acquisition Program

The plan must involve the affected public from the very beginning, and, at a minimum, community members should have a continuing opportunity to provide feedback and concerns. Preferably, the affected community would be integrally involved in designing and implementing the plan and the subsequent acquisition program rather than relying on state or non-affected officials.

Land use decision-making is inherently local, and members of the public are typically deeply passionate about their homes and their community. The post-Hurricane Floyd acquisition programs in coastal North Carolina stalled when the communities being bought out felt government officials were dictating an outcome to them.[257] In Valmeyer, on the other hand, nearly the entire town was involved in some part of the acquisition and relocation planning process.[258] Relocating Valmeyer was an opportunity for the community to face and overcome a common problem. The more attached a community is to their place and to each other, the more important it is to include them in the process of relocation. Acquisition is more than simply appointing a government agency or a consultant to cut checks and send people on their way.

c. Incorporate Risk-based Land Use Planning

The acquisition plan should recognize the spatial variability of coastal risks and offer differing incentives accordingly. Alternatively, a compulsory relocation mechanism may be appropriate in extreme circumstances (such as for properties that have received federal assistance in the past).

The primary design difference between the Louisiana and the Mississippi post-hurricane risk-reduction programs examined above is Mississippi's response sought to prioritize its acquisition based on a spatially determined hazard assessment whereas Louisiana's Road Home Program response did not include spatial risk assessment.[259] Under the Louisiana Road Home Program, each grant recipient faced the same programmatic benefit for accepting a buyout; that is, the program did not distinguish its award based on the recipient's risk. Although the benefit of the Road Home Program is unknown until the next storm hits, if properties in identified high-hazard areas had a greater incentive to relocate than those in low-hazard areas and more homeowners had elected to relocate, the benefit of the acquisitions likely would have been greater. The USACE attempted to rectify this concern in Mississippi

[256] Knobloch, *supra* note 32, at 45.
[257] Fraser et al., *supra* note 30, at 13-15.
[258] Knobloch, *supra* note 32, at 44-45.
[259] The USACE-led MsCIP analog for Louisiana did include numerous references to relocation and acquisition as possible non-structural flood mitigation measures, but did not propose anything approaching the magnitude of the MsCIP. *See* USACE, LOUISIANA COASTAL PROTECTION AND RESTORATION (LACPR) FINAL TECHNICAL REPORT NONSTRUCTURAL PLAN COMPONENT APPENDIX A1-1 (2009) [hereinafter LACPR FINAL TECHNICAL REPORT].

by identifying priority relocation areas and planning the massive acquisition effort in phases.[260] Although MsCIP has yet to be implemented, the benefits of the spatial design components are manifest: Mississippi can target acquisition funds to high-hazard areas where the payback is the greatest rather than dispense funds in an *ad hoc*, unplanned manner where the risk-reduction benefit of each dollar spent is unknown.[261]

d. Identify Hazards and Vulnerable Development

The first step in using spatial analysis to inform acquisition efforts is to identify the flood hazards, the development subject to those hazards, and any information pertaining to past insurance payouts for flood losses. Digital flood maps are likely the best source of hazard-identification data. Cadastral and census data will likely form the basis for identifying the vulnerable development areas and the magnitude of vulnerabilities. When combined in a geographic information system (GIS) software package and analyzed using models such as HAZUS,[262] acquisition program coordinators can create quantitative and spatial analyses of vulnerability. When flood probability information is overlaid on the vulnerability maps, program coordinators will have the risk profiles upon which acquisition targets can be based.

e. Establish Acquisition Priority Zones

Quantitative risk assessments should inform areas targeted for acquisition, but such areas should also be based heavily on community preferences, the availability of alternative mitigation measures, and other planning concerns. For instance, a community might wish to prioritize acquiring properties contiguous with existing nature preserves to create habitat corridors or properties that would facilitate public access to the beach or properties that meet other spatial planning objectives. In this phase of the planning process, the acquisition program coordinators should be most mindful of concerns regarding unfair or illegal discrimination.

Priority zones can be established in phases, as in the MsCIP. Maps can be established that show relatively high-priority acquisition areas in the near-term as opposed to one or more lower-priority, long-term acquisition areas. This portion of the analysis should be used in coordination with amendments to local zoning maps so that additional new development does not continue in the targeted acquisition areas, and future acquisition efforts are made easier through attrition.[263]

f. Identify Redevelopment Areas

Finally, spatial planning can be used to inform the redevelopment process. The same hazard and vulnerability criteria and analysis that formed the basis of the risk assessment can be used to identify

[260] *See generally* MSCIP APPX. D, *supra* note at 185, 202-49 (showing maps depicting flood hazards and phases for acquiring flood prone properties).

[261] Notes the LACPR: "The State now owns thousands of properties by acquisition through the Road Home Program and the disposition of those properties will affect future flood-risk levels in the region. The nonstructural program must begin with an assessment of these ongoing recovery efforts, specifically the Road Home Program, to develop a strategy for integrating risk reduction across other agencies' mission areas." LACPR FINAL TECHNICAL REPORT, *supra* note 259, at 215.

[262] Heather Beckmann & David M. Simpson, *Risk Assessment and GIS in Natural Hazards: Issues in the Application of HAZUS*, 6 INT'L J. RISK ASSESSMENT & MGMT. 1466 (2006) (raising concerns with the use of HAZUS as a hazards modeling tool).

[263] *See supra* Part IV.B.4.

areas of low hazard where new development should be focused. Redevelopment areas should harmonize with other community plans and zoning regulations. In addition to using risk assessments to inform redevelopment areas, planners should incorporate transportation and other infrastructure data as well as spatial information pertaining to economic development objectives and opportunities.

2. Implement the Acquisition Program

a. Coordinate Federal-State Bureaucratic Communication to the Affected Community

Acquisition programs will fall under the purview of numerous federal and state agencies. For instance, such programs will likely be subject to the oversight and input of federal and state emergency management agencies, environmental agencies and natural resource agencies (e.g., the U.S. Fish & Wildlife Service), archaeological and historic resource agencies, and likely many more. The MsCIP listed more than two dozen participating agencies,[264] and the mayor of Valmeyer noted the overwhelming complication of one community coordinating input, oversight, and approvals among twenty-five state and federal agencies.[265] The government designers of an acquisition program, whether state or local, should ensure that all communication from "the government" to "the community" is consistent and coordinated, ideally through a single point of contact. Moreover, the relationship between the implementing government agents and the community should be established and strong before any disaster occurs.

b. Ensure the Acquisition Program Begins Well

First impressions matter, and with something as potentially controversial as an acquisition program, starting strong is essential. The first few acquired properties should receive disproportionate attention and administrative resources, and should be handled with excess care to ensure the acquisition efforts begins smoothly. Program implementers should look for an eager-to-move project to use as a "pilot" and should craft a messaging campaign around its successes. Overcoming obstacles and challenges once the program is fully functioning is much more achievable if the program coordinators have positive coverage of an early project to point to as precedent.

One strategy for achieving an early success is to relocate public buildings such as a school, fire station, or municipal building. By undertaking an effort to relocate community resources to a safer area, the government implementing the acquisition program is showing that the plan is not a forced relocation of unwilling residents, but a sensible reduction of risk. Moreover, it can demonstrate that life can carry on as normal after the relocation. Relocating public facilities first was one strategy in the MsCIP.[266]

c. Create an Offload Market for Acquired Properties that are not in Vulnerable Areas

Under the current federal regulations, properties acquired with HMA funds may not be built upon again,[267] but that does not mean that those properties must remain valueless. Planners should be creative about revenue-producing land uses that can be flooded. For instance, it may be possible to convert parcels acquired in urban areas into parking lots or athletic fields. Large areas of contiguous

[264] MsCIP EIS, *supra* note 38, at 1-23 to 1-26.
[265] Knobloch, *supra* note 32, at 44.
[266] *See* MsCIP EIS, *supra* note 38, at 3-56.
[267] 44 C.F.R. § 80.17(e).

acquired areas could be converted to agricultural use. Another significant benefit of acquiring large contiguous floodplain areas is the ability to restore the natural function of those floodplains.

Program coordinators may also identify volunteers who wish to sell, but who face comparatively lower flood probability. In order to overcome the "patchwork" of unwanted parcels interspersed among occupied areas,[268] it may be possible to use unrestricted, non-federal funds to purchase these properties and resell them or convert them to affordable housing or some other locally desirable use.

d. Balance Speed and Efficiency

An acquisition program, once up and running, needs to move quickly enough to provide participating property owners with satisfactory payment and relocation assistance, but not too fast that it is susceptible to errors.[269] The Road Home Program received extensive criticism for its inefficiencies and delay.[270] Setting and sticking to disbursement benchmarks may have provided the right incentives for the contractors running the program. Moving too fast, however, makes oversight and coordination difficult. It should be noted that so far the Road Home Program largely avoided allegations of fraud or impropriety, no small feat for a program disbursing $9 billion in small increments to displaced residents. Moving slowly may be partially responsible for avoiding improprieties in order to engage in careful auditing and fraud detection. Likewise, the MsCIP proposal planned to take as long as forty years because there was widespread recognition that the program would develop momentum over time,[271] and pushing communities to relocate too early in the program would engender opposition and resentment.

e. Use an Acquisition Program in Tandem with Concentrated Redevelopment Efforts in Low-Hazard Areas.

As one long-time observer of coastal hazards has noted for a decade or more, hurricanes are often "urban renewal" programs for coastal areas.[272] Although this statement was directed at the areas leveled by the storm and in which development subsequently springs forth anew multiple times bigger, the post-disaster rebuilding phenomenon can be harnessed to make acquisition programs more

[268] One problem in Louisiana following the disbursement of Road Home funds was the emergence of communities where many members elected to Relocate while others elected to Rebuild. Those Rebuilding were subject to significantly thinned out neighborhoods and were often surrounded by vacant or underutilized parcels that drove property values down and contributed to blight. Post-acquisition elements of the plan should account for these concerns and include measures to put vacant, but still viable land back to productive and community-benefitting uses.

[269] *See* Olshansky et al., *supra* note 147, at 369. Prof. Olshansky notes that the most important aspect of balancing speed and efficiency is the option of the implementing agency to be flexible: to occasionally work quickly or occasionally be deliberative, as the needs may be.

[270] *See, e.g.,* Fineran, *supra* note 175 and Finger, *supra* note 175.

[271] *See* MsCIP EIS, *supra* note 38, at 3-55.

[272] DAVID M. BUSH, ORRIN H. PILKEY & WILLIAM J. NEAL, LIVING BY THE RULES OF THE SEA xi (1996). *See also After Hurricane, Loss of Beach to Erosion Appears to Be Inevitable*, NY TIMES, Aug. 31, 1998 ("'I've not seen a hurricane have a big impact on development just other than to bring in bigger and better buildings,' Dr. [Orrin] Pilkey said. 'That's really fundamentally the impact these things have. *It's really an urban renewal project*.'" (emphasis added)); Mike Lafferty, *Beaches Show Nature Always Knows Best*, ORLANDO SENTINEL, Oct. 8, 2004 ("'I'd be willing to lay money that there is going to be an urban renewal project [on the beach] and nobody will learn anything.'" (quoting Dr. Pilkey)); Orrin H. Pilkey, *When Will We Ever Learn the Lessons of Hurricanes?* CNN OPINION, Aug. 26, 2011 ("[T]he most recent hurricanes hitting the East Coast—Hugo (1989) and Fran (1996) for example—have been urban renewal projects.").

palatable, *provided the redevelopment occurs in areas with significantly lower hazards*.

Relocation/redevelopment programs may emerge through a transfer of development rights scheme,[273] growth incentive zoning,[274] expedited permitting, land grants, or other inducements for safer development. The scope of the redevelopment effort is significant; it may be inappropriate for redevelopment to occur in the same jurisdiction the acquisition is taking place.[275] State or regional coordination may help overcome these obstacles.

The MsCIP recognized that redevelopment would be a natural part of its planned acquisition programs and factored the environmental and economic benefits of such redevelopment into the EIS. The relocation of Valmeyer was premised on the notion that the town would be redeveloped elsewhere. The Road Home Program, on the other hand, did not account for redevelopment at all.

3. Reduce Subsidies to Development in Coastal Hazard Areas

a. Avoid Perverse Incentives Encouraging Rebuilding Over Relocation

For an acquisition program to be successful, relocation and redevelopment outside of coastal hazard areas must be preferable to rebuilding or remaining in place. Acquisition will likely not work if subsidies to development in coastal hazard areas continue unabated. The Louisiana Road Home Program provided more compensation to homeowners who chose to remain in place. In addition, such homeowners received more technical assistance and other attention. As a result, the rebuild option was more attractive than the buyout option. When losses do occur, the disaster response program should send a clear signal to owners of damaged property that acquisition is the preferred response.

b. Roll-back Subsidies Encouraging or Promoting Development in High-Risk Areas

Structural protection and non-actuarial insurance programs offset the incentives of an acquisition program. Both structural protection and insurance reduce the costs to property owners of occupying high-hazard areas, and such strategies also create a false sense of security that development in high-hazard areas is not vulnerable.[276] Moreover, structural protection and insurance also both increase the value of protected property, which makes acquisition of protected properties more costly. Unfortunately, this step is a difficult one to achieve, and removing subsidies may not be appropriate everywhere; however, it is essential to ensuring a long-term sustainable risk-management program.

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[273] *See* Grannis, *supra* note 16, at 57. Transfer of Development Rights (TDRs) are well-established land use tools for shifting development pressures from areas where development is undesirable to areas where development is desirable. *Id*. Often, these tools are combined with conservation easements and zoning regulations to shape development.

[274] The Town of Barnstable, Massachusetts (on Cape Cod) has developed a policy tool called a "growth incentive zone" to encourage development in certain pre-selected areas. *See* Cape Cod Commission, ch. G: Growth Incentive Zone Regulations (2010) ("The purpose of creating [growth incentive zones] is to direct development and redevelopment into areas with existing development and adequate infrastructure and away from sensitive resource areas… A proposed [growth incentive zone] shall contain existing development and infrastructure, with opportunities for redevelopment, infill, and intensification of existing uses.").

[275] *See* MSCIP APPX. C, *supra* note 202, at 278 ("Large scale construction of new residences will most likely be required.").

[276] *See* Bagstad et al., *supra* note 34, at 287-89.

c. Move the Entire Community, if Necessary

If community cohesion is the overwhelming barrier to an acquisition program, it may be necessary and desirable to relocate the entire community en masse. A recurring theme in disaster response is the way in which a community pulls together to rebuild.[277] Acquisition programs threaten to disrupt the social fabric of the community, and any benefit a community finds in rebuilding by pulling together is lost once residents begin to leave permanently. One way to circumvent this concern is to develop a plan to relocate an entire community.

Valmeyer adopted just such a strategy, and the residents of that town were deeply involved in the planning and the implementation phase of the relocation process.[278] Coordinating an acquisition and relocation strategy en masse will present numerous technical and scheduling challenges, but it can be beneficial to preserving community identity and avoiding concerns regarding social or economic discrimination.

VI. Conclusion

Acquisition offers an opportunity to reduce the risks coastal development faces from flood hazards. The hurricanes that have hit the Gulf Coast in the past decade are the proverbial canary in the coal mine. Other states would be wise to begin preparing for similar disasters along the shores of the Long Island Sound, the Chesapeake Bay, the Gulf Coast, and the Atlantic Ocean. Acquisition programs have additional benefits including long-term cost savings, opportunities to reduce adverse environmental impacts, and restore floodplain functions. However, acquisition of residential properties has the potential to have negative social and economic effects on coastal communities and must be carefully planned and implemented to avoid those negative impacts. Because of these drawbacks and the difficulty in achieving success through acquisition programs, acquisition cannot be the only solution or the solution everywhere. But it deserves continued and deeper consideration.

Nearly twenty years have passed since the floods along the Mississippi River prompted relocation as a response to flood hazards. In the nearly seven years since hurricanes ravaged the Gulf Coast, the Road Home Program became as much pre-disaster preparation for the next hurricane as post-disaster response to Katrina and Rita. As flood-damaged communities continue to recover, elements of past acquisition efforts can inform long-term adaptation strategies elsewhere. The contrasting acquisition strategies of Louisiana and Mississippi in responding to one major coastal disaster event that affected both states is revealing. Louisiana offered its flood-impaired residents the opportunity to receive compensation for relocating, but did not coordinate or apply any sort of spatial hazard or risk analysis to its acquisition program. Mississippi, on the other hand, engaged in detailed mapping, planning, and risk assessment to devise a comprehensive acquisition strategy, but has not yet implemented its plan. Only time—and the next major storm—will determine which of the two approaches is more effective.

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[277] *See* Fraser et al., *supra* note 30, at 17 (describing Kinston, North Carolina residents rallying around saving their church from flood waters). Similar lessons emerge from other types of natural disasters. *See* Judy Keen, *Joplin Finds Hope Amid Ruins*, USA TODAY, May 25, 2011 (describing community rallying in Joplin, Missouri following devastating tornadoes that struck the town). *See generally* W. Neil Adger, et al., *Social-Ecological Resilience to Coastal Disasters*, 309 SCI. 1036 (2005).

[278] *See supra* note 234 and accompanying text (describing multiple community-wide relocation efforts).

Climate Adaptation and the Fifth Amendment of the U.S. Constitution: A Regulatory Takings Analysis of Adaptation Strategies in Coastal Development with Application to Connecticut's Coastal Management Regime

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Abstract: As climate change impacts are realized at the governance level, states and local governments are moving towards adaptation strategies that include increasing restrictions on how land is used in coastal zones. The purpose of this article is to review state regulatory strategies that are attempting to adapt to climate change in light of limits placed on those strategies by the Fifth Amendment to the United States Constitution: the prohibition against the taking of private property by government action without a public purpose and just compensation. This article highlights the importance in identifying the roles governments can take beyond the role of "regulator" as a means of mitigating regulatory takings challenges. The analysis presented is then applied generally to Connecticut's coastal management regime.

I. Introduction

As governing bodies internalize the impacts of climate change, states and local governments are developing adaptation strategies that expand restrictions on how land is used in coastal zones. Reputable climate change science indicates sea level rise will impact coastal environments in dynamic and non-linear ways,[3] suggesting the past cannot be used as an accurate predictor of the future.

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[3] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT 23 (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf; U.S. GLOBAL CHANGE RESEARCH PROGRAM, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 18 (2009), *available at* http://www.globalchange.gov/what-we-do/assessment/previous-assessments/global-climate-change-impacts-in-the-us-2009.

Understanding this, governance structures need to implement strategies today that adequately speak to the reality of sea level rise, including the associated risks for coastal communities (increased frequency and intensity of storms, etc.).[4]

As governments adapt policy directions to a changing coastal environment, they must take account of existing policy and legal frameworks. One framework is the federal constitutional prohibition on the public taking of private land without compensation.[5] Because most government actions aimed at dealing with sea level rise implicate local land use decisions, the issue of regulatory takings – the "taking" of private property by government indirectly through regulation – is an important planning consideration. Regulatory takings considerations are "important" not just because of the potential financial costs to a government when a regulatory taking is found, but also because of the relational problems that develop between public and private interests when new regulation of land alters preexisting expectations. It is important for governments to have both a clear sense of their options when approaching the regulation of coastal lands in response to impending sea level rise and also a clear sense of how these options will impact stakeholders. Being able to link the best options to the local conditions, including mitigating impacts of land use planning on private landowner expectations, should be a priority for government planning in this area.

This article takes a slightly different approach to the regulatory takings question by focusing more on the *role of government* as a way of deciphering the impact government planning has on regulatory takings. Scholarly articles have already discussed regulatory takings cases in some detail,[6] including some that have advanced interesting legal theories about how the role of government might impact a regulatory takings claim.[7] This article reorganizes and advances these concepts in a more comprehensive and directed framework, highlighting how the role government adopts while developing its policy direction can have significant impact on the likelihood of a regulatory taking claim being made, or if such a claim is made, the likelihood of its success in a judicial setting. By identifying and focusing on the role of government at the beginning of a policy direction, this article also provides a basic framework for public land use planners to use in proactively developing policies addressing sea level rise induced by climate change while staying outside the regulatory takings framework, at least when the goal is to avoid a takings claim.

To meet the above-stated goals, this article is broken down into several main sections. First, an overview of the science, policy, and legal aspects of climate change is provided. Second, selected adaptation strategies are identified to place the regulatory takings analysis in greater context. Third, the current state of regulation and development in Connecticut is summarized to provide the framework for the subsequent regulatory takings analysis that focuses on Connecticut as a case study. Fourth, a regulatory takings analysis is provided. This analysis begins with a quick overview of takings jurisprudential law, analyzes how the different 'roles' of government can impact a regulatory takings analysis, and then applies this analysis to the legal and physical conditions currently found in Connecticut. The article concludes with some recommendations reinforcing the main points made about public policy development in coastal areas with an eye towards avoiding regulatory takings claims and, when unavoidable, successfully defending such claims.

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[4] *Id.*

[5] U.S. CONST. amend. V.

[6] *See generally* J. Peter Byrne, *Rising Seas and Common-Law Baselines: A Comment on Regulatory Takings Discourse Concerning Climate Change*, 11 VT. J. ENVTL. L. 625 (2010); Kenneth Miller, *Penn Central for Tomorrow: Making Regulatory Takings Predictable*, 39 ENVTL. L. REP. 10,457 (2009).

[7] *See generally* Joseph L. Sax, *Some Unorthodox Thoughts About Rising Sea Levels, Beach Erosion, and Property Rights*, 11 VT. J. ENVTL. L. 641 (2010); 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).

II. Overview of Climate Change Science, Policy Responses, and Legal Issues

A. Science of Climate Change

Scientific consensus has been growing regarding the existence and role climate change plays in sea level rise.[8] Global average sea level rise over the past 100 years has been calculated to be approximately eight inches.[9] Meanwhile, the *rate* of sea level rise has been increasing, doubling over the last 15 years in comparison to the rate observed over the past century.[10] Under certain worst-case scenarios, melting of major ice sheets would significantly impact sea level: beginning with a 20-foot average rise from the melting of the Greenland or West Antarctica ice sheets to an approximate 200-foot average rise from the melting of the East Antarctica sheet.[11] More locally, coastal areas of the northeastern United States can expect sea level increases of between 2 to 5 inches by the 2020s, 7 to 12 inches by the 2050s, and 12 to 23 inches by the 2080s.[12] Sea level is rising and the rate of sea level rise is increasing. Even those of us with a basic comprehension of mathematics principles knows that as a rate of change increases there is generally less time available to proactively plan for a response to that change.[13]

B. Policy Responses to Climate Change

In general, three types of policy responses are discussed when dealing with the question of climate change: prevention, mitigation, and adaptation. This paper focuses squarely on adaptation strategies associated with climate change, specifically adaptation strategies dealing with coastal land use planning under the assumption of increasing and dynamic sea level rise. It is important to state these assumptions explicitly because they affect the *manner* by which policy planning in coastal areas is conducted. For example, if sea level rise was occurring at a steady rate, then policymakers could rely on straightforward development tools, such as minimum setback requirements derived from annual erosion rates – say a 30-year setback based on historic rates of erosion. However, in a world where the *rate* of sea level rise is increasing, minimum setback calculations may be inadequate to protect future development for the entire 30 years. Policy planners have to make adjustments for such contingencies in their planning efforts, as the role of adaptation planning is made more complicated because the dynamics of sea level rise is complicated.

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[8] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 3.
[9] U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 3.
[10] *Id.*
[11] *Id.* at 114.
[12] *See* NEW YORK CITY PANEL ON CLIMATE CHANGE, CLIMATE RISK INFORMATION 17-18 (2009), *available at* http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf (There are no direct studies for the State of Connecticut but this report covers the New York City region, which shares much of the same coastal impact areas as Connecticut).
[13] An often-used example of reaction time to exponential (non-linear) growth is the following lily pad example: An invasive species of lily pad is growing in a pond. The lily pad doubles every day. In 30 days the lily pad will completely cover the pond. Generally no one takes the lily pad problem seriously until the pad covers half the pond. On what day does it cover half the pond? Answer: the 29th day (indicating one only has 1 day to react to the problem). *See* DAVID B. FIRESTONE & FRANK C. REED, ENVIRONMENTAL LAW FOR NON-LAWYERS 7-8 (3d ed. 2004).

James Titus and colleagues have provided what is probably the most comprehensive review of public policy adaptation strategies to sea level rise.[14] Most of the adaptation strategies identified by the literature focus on government developing policies to manage interactions between natural phenomena – such as shore erosion – and human interactions with these phenomena.[15] These "shoreline management techniques" are usually divided into categories that include hard/structural stabilization methods; soft/non-structural stabilization methods; hybrid forms of stabilization techniques; and general policy/planning techniques. Regulatory tools include zoning and other "police powers" the government has to control land use. Examples include the establishment of setbacks and more comprehensive zoning, such as erosion overlay districts.

All of the adaptation strategies identified above highlight the regulatory role and how it defines government perception of response options. When we think about an unexpected element of land use planning like sea level rise, most government responses highlight the need to drastically alter the expectations of interested parties (mostly private landowners) through proscriptive changes to existing zoning regulations. One of the major goals of this article (as discussed in more detail in Section V below) is to encourage government to think about the roles available to it beyond regulator when planning adaptation strategies. In fact, it is suggested that stepping outside the traditional government role of regulator can yield significant benefits for the parties involved: the government in terms of limiting regulatory takings claims, and the public by ensuring policies implemented to adapt to sea level rise are equitable by considering the interests of all parties involved. A short summary of the legal issues arising in coastal development follows to provide background for the remainder of the article.

C. Legal Issues Related to Coastal Development

Coastal land use planning is, fundamentally, a relationship between private and public interests; the private landowner holds certain rights in their property that are sometimes limited by the power of the state and local government to enact reasonable restrictions on those interests for the benefit of the public-at-large. Land use planning is primarily a state and local concern, reserved to the states by the Tenth Amendment to the U.S. Constitution,[16] and has been upheld as a constitutionally allowed prohibition on the private use of land so long as the exercise of that power is deemed "reasonable."[17]

The foundation for local government land use authority is the state's "police power" – the authority of the state to make reasonable regulations that control for the health, safety, and welfare of the citizenry.[18] However, the upper extent to which land can be regulated by government without running afoul of the law is a question that is in flux and thus gives rise to the regulatory takings jurisprudence seen today. At the heart of this flux is a philosophical dichotomy regarding the relationship between government and private property rights.

Regulatory takings jurisprudence is, in many respects, the natural evolution of this philosophical dichotomy that underpins real property rights; whether property rights are "natural" and thus preexist

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[14] James G. Titus et al, *State and Local Governments Plan for Development of Most Land Vulnerable to Rising Sea Level Along the U.S. Atlantic Coast*, 4 ENVTL. RESEARCH LETTERS 1-7 (2009), *available at* http://iopscience.iop.org/1748-9326/4/4/044008/pdf/1748-9326_4_4_044008.pdf; *See also* James G. Titus, *supra* note 7.

[15] *Id.*

[16] U.S. CONST., amend. X.

[17] *See* Euclid v. Ambler Realty Co., 272 U.S. 365 (1926) (upholding reasonable zoning regulation powers that placed limitations on private property for the benefit of the public at large). What is deemed "reasonable" extensions of the state's power to regulate private property in the context of regulatory takings is explained in further detail in the *Takings Analysis and Adaptation Strategies*, Part V of this article below.

[18] *Id.*

political institutions,[19] or whether property rights are defined by and through social institutions like government.[20] If one follows the natural rights argument, then real property is sacrosanct in the sense that changes in government and social policy over time cannot impact previous expectations of property rights founded in the property law of the particular jurisdiction. Contrarily, if real property rights flow from social institutions instead of preexisting these institutions, then property rights are subject to reshaping and refinement by these social institutions over time.

A proxy for understanding this ideological tug-of-war between private property rights and government regulation of those rights can be seen in the Fifth and Tenth Amendments to the U.S. Constitution. The main limit placed on the Tenth Amendment's reservation of police power to state governments derives from the Fifth Amendment's takings clause.[21] As mentioned earlier, a valid exercise of police powers provides the foundation for local government to place limits on how private property might be put to use.[22] Changes to the way in which governments have chosen to regulate private property over time support the concept that real property rights flow from social institutions rather than being a pre-political right.[23] The Fifth Amendment provides the counterbalance, suggesting there are irreducible real property rights that cannot be subjected to certain forms of government intervention without meeting eminent domain conditions, supporting the concept that certain "natural" and inalienable rights exist within real property.[24]

Governments are often caught somewhere in the middle of this ideological spectrum, often trying to determine how far their Tenth Amendment right to regulate real property goes without stepping over a boundary where a Fifth Amendment line is drawn and a taking is found to exist. The ultimate arbiter of where an unintended government act leads to a taking is the judicial branch of government. Judicial cases have helped to frame some methods for aiding in the determination of where that line between the Tenth and Fifth Amendment is drawn. However, these rules are sometimes unclear and applied unevenly, possibly because the justices are often looking at the issue through different lenses depending on how they view the foundation of private property rights.[25] Those justices who believe property rights predate government are likely to lean more towards Fifth Amendment protections; justices believing property rights flow from government are – all things being equal – more likely to lean towards Tenth Amendment powers of the state to define property rights.

A historical summary of regulatory takings jurisprudence will be provided in Section V below as this article develops its discussion on the importance of focusing on the role government takes in approaching coastal land use adaptation strategies. However, it is important to point out now that

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[19] *See* WILLIAM BLACKSTONE, COMMENTARIES *1; James W. Ely, Jr., *Economic Liberties and the Original Meaning of the Constitution*, 45 SAN DIEGO L. REV. 673, 703 (2008).

[20] *See* JEREMY BENTHAM, THEORY OF LEGISLATION: PRINCIPLES OF THE CIVIL CODE 137–39 (Hildreth ed. 1931) ("[T]here is no such thing as natural property[;] … it is entirely the work of law… Property and law are born together, and die together. Before laws were made there was no property; take away laws, and property ceases." *Id.* at 111-13); ERIC FREYFOGLE, ON PRIVATE PROPERTY XV (2007).

[21] U.S. CONST., amend. V.

[22] *See generally* Euclid, 272 U.S. 365 (1926) (holding that a city zoning ordinance was constitutional when it legitimately exercised police powers asserted for maintaining public welfare).

[23] *Id.*

[24] Early in our history, there was a strong differentiation between a valid police power to regulate and a Fifth Amendment prohibition against the taking of private property without a public purpose and just compensation. *See* The Legal Tender Cases, 79 U.S. (12 Wall) 457, 551 (1870) ("[The Takings Clause] has always been understood as referring only to a direct appropriation, and not to consequential injuries resulting from the exercise of lawful power."). The "lawful power" that the Court defers to is the police power of the state to regulate for health and for safety. *See also* Mugler v. Kansas, 123 U.S. 623, 661 (1887).

[25] *See* J. Peter Byrne, *Stop the* Stop the Beach *Plurality!*, 39 ECOLOGY L.Q. 619 (2011).

regulatory takings jurisprudence has developed very much in-line with the philosophical dichotomy between property rights mentioned above. Indeed, "regulatory takings" as a distinct category of takings derived from the idea that the otherwise lawful exercise of Tenth Amendment powers of state government to regulate can go too far into fundamental property rights of private landowners as to exact a "taking" of that private property, even where the government has no intention of seeking ownership of the private property in question.[26] Legal commentators have discussed the development of case law over the recent decades as a reflection of this underlying philosophical difference, noting how decisions often reflect a preference for private property rights over government regulation and vice-versa.[27]

A recent example of this battle between private property right protection under the Fifth Amendment and government capacity to define property rights (and thus limitations on those rights) under the Tenth Amendment is the U.S. Supreme Court Decision in *Stop the Beach Renourishment, Inc. v. Florida Department of Environmental Protection*.[28] This case dealt with a number of legal questions regarding a regulation that ultimately altered private property right expectations. Some of those legal questions – specifically the ones dealing with judicial takings – are not important for the points being made here. Rather, our focus is on how the Court framed the government's capacity to regulate in a manner that impacts private property rights, specifically how those private property rights are categorized during judicial review.

In *Stop the Beach Renourishment,* the U.S. Supreme Court reviewed a Florida State Supreme Court analysis to determine, to what extent, if any, the state court deviated in its analysis of settled property law in the state.[29] According to the U.S. Supreme Court plurality opinion, a taking can be found where a judicial body misapplies historical state property law concepts in a takings analysis. In this case, the U.S. Supreme Court found no misapplication of state property law because: (1) the Florida statute at issue allowed for Florida to obtain ownership rights over beach nourishment projects to the extent of the land mass added by the public project; (2) this additional land was considered an avulsion under Florida property law; (3) Florida property allows for avulsions to accrue to the state and not the private property owner; and (4) the Florida Supreme Court correctly applied Florida property law when it held the state was entitled to the property.[30]

The focus of the U.S. Supreme Court analysis here is on tracking the state court to ensure that court relies on established principles of state property law. If the state is determined to make a decision outside of previously defined state property rights, then the U.S. Supreme Court is suggesting a taking of private property in violation of the Fifth Amendment will be found. Placing this precedence into a framework for coastal adaptation strategies, it seems that any strategy that deviates from established principles of property law within that particular state has a stronger chance of being labeled a taking of private property.

To summarize, government has the capacity to regulate private property, and this capacity is best defined within the Tenth Amendment police powers reserved to the states in the U.S. Constitution. How far governments can go in regulating private property is a question without a definitive answer. The Fifth Amendment places an upper limit suggesting there is a "line" that exists where government goes too far in regulating private land; when government crosses this line, an unconstitutional taking

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[26] *See* Pennsylvania Coal Co. v. Mahon, 260 U.S. 393 (1922). Justice Holmes wrote: "[t]he general rule … is that while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking." *Id.* at 415.

[27] *See* BLACKSTONE, *supra* note 19.

[28] 130 S. Ct. 2592 (2010).

[29] *Id.* at 2596.

[30] *Id.*

has occurred. Foundationally, the line between acceptable government regulation and regulation that goes too far depends in part on how private property is perceived as a concept. Where private property exists as a right outside of society, the expectation is that less room would be given to government to impede on traditional notions of private property rights. On the contrary, where private property is seen as an extension of social institutions, more governmental freedom to define property rights as societal norms and conditions change is expected. While the genesis of regulatory takings jurisprudence is summarized in Section V below, recent U.S. Supreme Court decisions – like *Stop the Beach Renourishment* – have provided some evidence that Fifth Amendment rights will be given precedence over evolving ideas about property rights.

When thinking about adaptation policies to climate change, the more conservative direction taken by the Court in *Stop the Beach Renourishment* can be troubling for coastal planners. If actions today must always accord to historical property rights as the U.S. Supreme Court seems to suggest, then government is limited in its capacity to develop property right limitations that respond to rising seas in ways that violate those traditional property right expectations – unless government is willing to pay for these protections. The solution suggested in this article is that government, in some ways, can sidestep this debate by viewing its role outside that of a traditional regulator and considering options for developing adaptation policies that are not inherently regulatory in nature. By doing this, government can help itself by expanding the options available for adapting to climate change without automatically drawing itself into a regulatory takings claim. The traditional legal analysis that flows from a regulatory setting need not define policy directions chosen by government bodies to deal with the realities of climate change. Rather, governments should look to rights established through common and state property law to aid them in developing non-regulatory frameworks. Prior to discussing these non-regulatory frameworks in detail, a summary of government's rights and obligations are highlighted so these concepts can be carried forward to better understand the non-regulatory framework discussion.

As mentioned, government certainly has the power to regulate private property, but that power is limited. Beyond regulation, government also has certain *rights* and *obligations* that are unique to coastal areas. In terms of *rights*, government is the owner of submerged land.[31] State governments can assert proprietary rights in submerged land against the ownership rights of a private landowner who abuts the submerged land.[32] In this setting, both parties have "equal" and sometimes competing rights as landowners. Notice the distinction here between government acting as landowner of property and government acting as a regulator. In the landowner setting, government is on par with the private landowner (landowner and landowner), while in the regulator setting, the government sits above the landowner enacting and enforcing proscriptions (regulator and regulated). Usually, in both cases, the disputes between private landowner and the government are resolved by judicial review.[33] However, when acting as a property owner, the government cannot be said to be regulating; therefore, the aggrieved private landowner (and the courts) must look to resolutions for the grievance outside of a regulatory framework.

[31] *See* Submerged Lands Act, 43 U.S.C. §1301.

[32] Landowners abutting saltwater bodies are often referred to as "littoral" landowners, while those abutting freshwater bodies are often referred to as "riparian" landowners. Use of either term is meant to indicate a private landowner whose property abuts water.

[33] As is shown in greater detail later in this article, regulatory takings claims are often brought by an affected landowner after the government has acted in its authority to regulate when the regulation changes preexisting ideas – right or wrong – held by the private landowner in relation to what they believed they could do with their property. Alternately, if government is acting as landowner and the dispute is one of property rights and obligation *as between* landowners, then the dispute is resolved through a judicial setting.

In terms of *obligations*, government is the trustee of the public's rights in the coastal zone and, as such, it has trustee obligations towards ensuring those public rights are maintained and protected.[34] The public trust doctrine, a foundational "background principle of law" as contemplated in the *Lucas* decision,[35] emanates from Roman law and has been carried forward through England to the United States through common law tradition.[36] Like other background principles of property law – including custom and nuisance – the doctrine does not alter existing property rights of private landowners but rather clarifies exactly what property rights are actually owned by the private landowner.[37] The public trust doctrine may also be read as one of those historical antecedents of property law that exists in most states and identified by the U.S. Supreme Court as a means to determine the expectations of private property landowners under a takings analysis.[38] Traditional rights established under the doctrine have included fishing, fowling, and navigation;[39] however, states have expanded the kinds of rights that attach to the public trust.[40] Consider the potential difference in analyzing a government action that has been defined in terms of protecting an established public trust right rather than a government action that is based upon regulating in the general public's interest. For example, in a recent case interpreting the impact of Texas Open Beach Act,[41] the Texas Supreme Court upheld the rights of the public that run with the submerged lands based on background principles of the state's property law.[42] Where those rights are clearly attached to historical public trust rights, then they carry forward over time. So, if a shoreline recedes gradually throughout time due to sea level rise, then the defined public trust rights – and commensurate obligations – also move landward with the rising seas. This means a state can enforce public trust obligations on land that was heretofore dry private land

[34] Illinois Cent. R.R. v. Illinois, 146 U.S. 387, 452 (1892) (states hold title to submerged lands "in trust for the people of the state, that they may enjoy the navigation of the waters, carry on commerce over them, and have liberty of fishing therein freed from the obstruction or interference of private parties."). Protection of public rights can be expansive beyond the immediate submerged lands. For example, government as trustee can enforce acts that are tantamount to a public nuisance because they inhibit the ability of the public to access and use the ocean as a public resource. One can envision a situation where an established public right to access the nearshore beach is frustrated because of rising sea levels. If the established right of access to the shoreline impacts heretofore uninhibited private property rights, government can enforce the established right of access as trustee of the public right; no legislation or other regulation is required to enforce the public right of access.

[35] *See* Meg Caldwell & 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, 552–55 (2007).

[36] Illinois Central Railroad, 146 U.S. 387 (1892).

[37] *See* Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1029 (1992).

[38] *Id.*; Stop the Beach Renourishment, 130 S.Ct. 2592 (2010). *Lucas* held that a federal court could review state property law when that property law is forming the basis of a background principle of law – for example, public nuisance – to prevent a regulatory takings challenge. *Lucas*, 505 U.S. at 1031-32. *Stop the Beach Renourishment* claims federal courts have the right to review state property law changes suggesting deviations from historical principles of common law rights would encroach on private property rights. *Stop the Beach Renourishment*, 130 S. Ct. at 2610. Traditional public trust doctrine rights that exist in coastal states would clearly meet either the *Lucas* or *Stop the Beach Renourishment* definitions of historical property law rights.

[39] Caldwell, *supra* note 35, at 552.

[40] *See generally* Robin Kundis Craig, *A Comparative Guide to the Western States' Public Trust Doctrines: Public Values, Private Rights, and the Evolution Toward an Ecological Public Trust*, 37 ECOLOGY L.Q. 53 (2010) (comparing the western states' public trust doctrines); Robin Kundis Craig, *A Comparative Guide to the Eastern Public Trust Doctrines: Classification of States, Property Rights, and State Summaries*, 16 PENN ST. ENVTL. L. REV. 1 (2007) (comparing the eastern states' public trust doctrines).

[41] TEX. NAT. RES. CODE ANN. §§ 61.001 – 61.254.

[42] Severance v. Patterson, 2012 Tex. LEXIS 260 (2012).

without enacting any statutes or taking any regulatory position – the public trust rights simply move with the tide.[43]

The point of identifying the public trust obligations here is to show how those obligations can form yet another important relationship – a non-regulatory relationship – between the state as trustee of a public resource and the private landowner. Leaving the details for later, it is enough acknowledge the government's public trust responsibilities as a background principle of state property law. Thus, enforcement of public trust responsibilities by the state generally cannot form the basis of a regulatory takings claim because the government is enforcing responsibilities that derive from background principles of property law.

Conceptually, the state, when acting as trustee, should be thought of as a third party intervening in a dispute between two parties with property rights. The two parties would be the private landowner and the general public who have public trust property rights (*jus publicum* rights) within the coastal zone. An example might include a private landowner who is attempting to armor her property against the rising sea by building a sea wall. Assuming the sea wall will cause greater erosion to the adjoining lands around the home, including sandy public beach areas, the public may have a vested right in the public beach resource, and so the state is compelled to act or "step-in" as trustee to protect the public interests at stake. Whatever the government might choose to do as an intervention in their trustee capacity, the government is not regulating in the traditional sense. Even where the government might intervene by using its regulatory power, the *basis* of the intervention is the public trust doctrine, which is a background principle of property law.

The struggle between the Fifth and Tenth Amendments to the U.S. Constitution creates uncertainty about judicial declarations of government regulation in the coastal zone, where ultimate decisions about regulatory takings are made. Those who desire to understand these interactions should begin by understanding the role government adopts when it acts to alter coastal land use expectations. The "hat" government wears – whether as regulator, property owner, or trustee – makes a difference when determining the legal issues present. The details of these interactions have been introduced now, and will be more fully explored later. Prior to delving into the takings analysis in greater detail, this article will quickly review general adaptation strategies that have been used in managing sea level rise, and then overview the approach Connecticut takes to development and regulation in its coastal region. The adaptation strategy summary follows.

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[43] It is important to note that the *Severance* case distinguished the rights to the submerged land for the public, and any public rights to adjacent dry land – including express or impiled easements of access – that might be sought in association with the submerged land rights. In *Severance,* the Texas Supreme Court was dealing with a consideration of the impact a storm event (avulsion) might have on raising the tides significantly inland in a discrete period of time. While the newly submerged land is clearly public land, the more difficult question entertained by the Court had to do with the rights to the immediately adjacent uplands bordering the submerged land, specifically whether the public had an *automatic* right of easement to use these uplands for access to the new seashore. The Court indicated the easement for access does not automatically "roll" with the submerged land – particularly in avulsive events – but rather must be proven using background principles of property law to justify the existence of the easement in the new upland area. One of the main difficulties in this case surrounds the question of what property rights inure to the private property owner when they purchase coastal property. While this question may be somewhat unsettled for parts or the whole of Texas shoreline, there are a variety of states who have a longstanding tradition of limiting the rights of littoral property owners when it comes to their expectations with sea level rise. Oregon has long held that private property owners along the beach have no property interests in upland between the high water mark and vegetation line because of the longstanding common law doctrine of custom recognized by the state. *Stevens v. City of Cannon Beach*, 854 P.2d 449, 457 (1993).

III. Common Adaptation Strategies

The purpose of this section is to review some of the common strategies used by governments to adapt to sea level rise. The goal is to provide insights on how common adaptation strategies fit within the regulatory takings analysis identified in this article. This section is divided into two major categories of adaptation strategies based on the approach taken to rising seas. Each approach is analyzed focusing on the governmental role being taken in implementing the strategy: whether government is acting primarily through its regulatory role or outside of it.

Coastal communities are attempting to proactively plan for the development of land that is most vulnerable to sea level rise and this is certainly true of governments along the U.S. Atlantic coast.[44] The main types of regulatory tools being employed by local governments focus on proscriptions enacted through their power to regulate land use development.[45] For this discussion, the focus of regulatory adaptation strategies will be based on whether the policy is geared primarily towards either *protecting* the shore or *retreating* from the shore.[46]

A. Protecting the Shore

There are a variety of tools that government can utilize to protect the shoreline from rising seas. These include *shoreline armoring* which "involves the use of structures to keep the shoreline in a fixed position or to prevent flooding when water levels are higher than the land."[47] Development of seawalls, bulkheads, retaining structures, and revetments are all methods for fixing the shoreline.[48] Dikes, dunes, tide gates, and storm surge barriers are methods used to prevent flooding when the water levels are higher than the land.[49] *Elevating land surfaces* is another way of protecting the shore; beach fill, dune creation/protection, land filling, structure elevation, and dredging are used to prevent inundation.[50] There are also *hybrid approaches* to protecting the shore, which include the development of groins and breakwaters as ways of mitigating shore erosion.[51]

Some of the methods for shoreline protection mandate government adopt a specific role. For example, development of private structures meant to keep rising water at bay, seawalls for instance, are generally adopted through a process of permitting that is controlled by local land use authority.[52] Government is generally acting in its regulatory role when reviewing applications from private landowners to develop. This is particularly true when government prohibits development under zoning regulations such as overlay districts. However, when government adopts the role of property owner in choosing whether to armor against the tide – on a state-owned beach property adjacent to privately

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[44] Titus, *supra* note 14.
[45] *Euclid*, 272 U.S. 365 (1926).
[46] U.S. CLIMATE CHANGE SCIENCE PROGRAM SYNTHESIS AND ASSESSMENT PRODUCT 4.1, COASTAL SENSITIVITY TO SEA-LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 88-97 (2009), *available at* http://epa.gov/climatechange/effects/coastal/pdfs/SAP_4-1_SynthesisandAssessmentProduct.pdf [hereinafter MID-ATLANTIC SLR REPORT].
[47] *Id.* at 88.
[48] *Id.* at 89.
[49] *Id.* at 91.
[50] *Id.* at 91-92.
[51] *Id.* at 92.
[52] *See generally Euclid*, 272 U.S. 365 (1926).

owned beach property, for example[53] – it is not acting in a regulatory capacity. Its choice to act (or not) should generally not give rise to a regulatory takings claims no matter the impact the government decision has on private land. The same should be true when government is acting in its role as trustee of the public trust rights that accompany the shoreline. The government may have obligations towards the defined rights reserved by the public in the near shore, but these trust obligations do not extend to the private interests of littoral landowners.

The elevation of land surfaces, particularly beach nourishment, creates an interesting set of issues when viewed through the lens of the different roles government might take in approaching this problem. For example, a private landowner (or group of landowners) may wish to nourish the existing shoreline in order to stem ongoing sea level rise. Government acting in its regulatory capacity would generally review the local regulations to determine if the activity falls within normal permitting guidelines. If the government has enacted a regulation prohibiting such activities, then it would likely deny the proposed activity setting up a potential regulatory takings claim (depending on what interests and rights the private landowners claim are diminished by the government action).

If government is instead acting as a property owner in the above example, then it has other options in dealing with the proposed nourishment project. For example, the private landowners adding sand to the existing shoreline would likely push the tide line seaward. Since the government is the owner of submerged lands seaward of the tide line,[54] such an act would frustrate proprietary property rights of the government. In such a situation, the government may choose to prevent the nourishment project by advancing its property rights, or at least use its property rights as the means to engage the private landowners to develop a mutually agreeable solution to the problem. In either case, the interaction between the public and private interests is quite different when the government takes on the role of a property owner as opposed to the role of a regulator.

This tension between public and private interests was at the heart of the *Stop the Beach Renourishment* case mentioned earlier.[55] In this judicial takings case, private landowners claimed harm due to the State of Florida's decision to nourish a beach, as the nourishment resulted in the private landowners' property being disconnected with the water. The nourishment project added sand between the statutorily defined baseline separating public and private land,[56] and once the project had been completed, the delineated boundary was fixed so long as the state maintained the renourished beach.[57] While no judicial taking was ultimately found by the U.S. Supreme Court, the basis for the takings claim (removing the littoral landowners' right to be connected to the water) was *legislative.* The state was thus taking a *regulatory stance* in allowing the beach nourishment project under Florida's Beach and Shore Preservation Act.[58] While Florida has a longstanding statutory tradition of enacting public works projects for beach protection, specifically nourishment, it is interesting to consider the alternative evolution this case could have had from a legal standpoint had Florida simply defended the private landowner complaints from the role of property owner rather than regulator.[59]

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[53] There are other forms of "armoring" that can take place within the submerged land areas of the ocean. For example, jetties, groins, and breakwaters are methods or armoring often used by governments to protect public trust obligations depending on the circumstances presented that take place almost exclusively within publicly owned submerged lands.

[54] 43 U.S.C. §1301.

[55] *Stop the Beach Renourishment,*130 S.Ct. 2592 (2010).

[56] FLA. STAT. ANN. § 161.41.

[57] *Id.* § 161.191.

[58] *Id.* §§ 161.011 to 161.76.

[59] *See* Sax, *supra* note 7. This case is factually instructive because the government action in deciding to nourish the beach (and thus protect the abutting private landowners from sea level rise) was challenged by the private landowners as a taking. The government was acting pursuant to its statutory authority, which the U.S. Supreme

B. Retreating From the Shore

Choosing to protect the shore keeps humans within the ocean's zone of influence because the policy holds back the water in one fashion or another. What shore protection does not do is hold back storm surges that can accompany rising seas from human habitation that is near the seashore.[60] Shore protection also does little to prevent the continuing rise of the ocean.[61] In this way, shore protection creates a kind of "arms race" where there is a constant battle between rising seas and the need to continually hold back its approach. An alternate policy direction in dealing with sea level rise is to remove human development from the impending danger. Retreat allows for the ocean to take its natural course, while also allowing human habitation – including investments in infrastructure – to move landward away from the advancing coastline.[62] If shore protection is about managing the environment, retreat is about managing human expectations.[63]

Retreat policies can take a variety of forms. For example, government can compel retreat by limiting coastal development through the following legal mechanisms: *minimum setbacks* from the sea that correspond to historical rates of erosion;[64] *elevation setbacks* (flood hazard regulations) where development can only occur above a set minimum elevation;[65] *density restrictions* on development in a coastal area;[66] and *size limitations* of buildings in sensitive coastal habitats.[67] In each of these cases, depending on the impact regulations have on a particular private landowner, regulatory takings claims are a potential. The government action contains regulatory characteristics, and the ultimate enforcement of these kinds of restrictions will undoubtedly impact private landowner expectations.

Other forms of retreat are less regulatory in nature, focusing more on the government's role as protector of public safety (potentially including the trustee role under the public trust doctrine). Examples of these forms of retreat include: *buying programs* where the government uses its eminent domain power to purchase sensitive coastal areas in order to protect the public,[68] *conservation easements* where government (or other entities) purchase the right to keep portions of the land in an undeveloped state,[69] and *rolling easements* where development may be allowed but the risk of loss is shifted from the public to the private landowner.[70] In certain states rolling easements have been

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Court ultimately determined was based on a background principle of law. It would be interesting to see the evolution of this case had Florida simply defended the action on the grounds of a valid exercise of rights as a property owner of submerged lands.

[60] U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 3.

[61] *Id.*

[62] *See generally* Titus, *supra* note 7.

[63] MID-ATLANTIC SLR REPORT, *supra* note 46, at 93. "Retreat" may occur as an unplanned event after a disaster, and also as a planned event in anticipation of sea level rise. The form of retreat being described in this section is based on a planned retreat in anticipation of sea level rise.

[64] *Id.* at 95; *see also* Sax, *supra* note 7.

[65] *Id.*

[66] *Id.* at 96.

[67] *Id.*

[68] This is obviously a form of "taking' of private property if the landowner is unwilling to sell, but one likely justified under the eminent domain power of government. U.S. CONST., amend. V. One question in such eminent domain proceedings would be the value of the property, including whether fair market value would be assessed assuming the land is undevelopable (and possibly soon submerged land) or in some other manner. Because of these issues, it would benefit both the private and public interests to seek accommodations through negotiation on the buyout of the property.

[69] MID-ATLANTIC SLR REPORT, *supra* note 46, at 95.

[70] *Id. See also* Titus, *supra* note 7.

legislatively incorporated into the background principles of property law under that state's public trust doctrine.[71]

There are other policy options undertaken by government beyond the examples of shore protection and retreat identified above. In fact, it is probably more accurate to define the options available to government as a spectrum that spans a variety of interests, but, ultimately, they are all variations on required action in response to sea level rise. What is important here is that the governmental entity understands its role in ensuring the public is protected from the risks associated with climate change, including the fact that these risks can increase over time. As part of that understanding, government needs to balance the public and private interests at stake when managing these risks.

This article will now look at the specific makeup of Connecticut's coastal policy related to sea level rise, summarizing the development along its coast and the policies Connecticut employs to control coastal development. This summary will then be followed by a detailed review of takings analysis applied to some of the adaptation strategies described above, with specific application to current approaches employed by Connecticut.

IV. Connecticut Coastal Development

A. Current Picture of Connecticut Coastal Development

As it stands today, development along the Connecticut shoreline decreases as one travels east along the coast; consistently highest from Greenwich to Bridgeport to New Haven, and then dramatically dropping off as one continues east from New Haven to the Connecticut and Rhode Island border. The following analysis will examine this trend by comparing developed and undeveloped coastal areas, while also revealing recent growth rates that suggest a contrary trend of future development. The coastal map below provides a discernable illustration of the ensuing discussion (Figure 1).

[71] *See* TEX. NAT. RES. CODE ANN. §§ 61.001 – 61.254. (Texas Open Beach Act). The *Severance* case, mentioned earlier in this article, places some limitations on rolling easements, indicating the extent of public rights to the immediately adjoining uplands may be limited in certain instances, particularly where the public right transfers to new areas of upland due to an avulsive event – like a storm – that drastically moves the sea inland in a punctuated event. The new immediately adjacent upland (which may have been wholly private upland without any public rights immediately prior to the event) may or may not have public rights of access attached to it. Rather than happening automatically, the state must prove an easement exists based on background principles of its state property law. *Severance*, 2012 Tex. LEXIS 260.

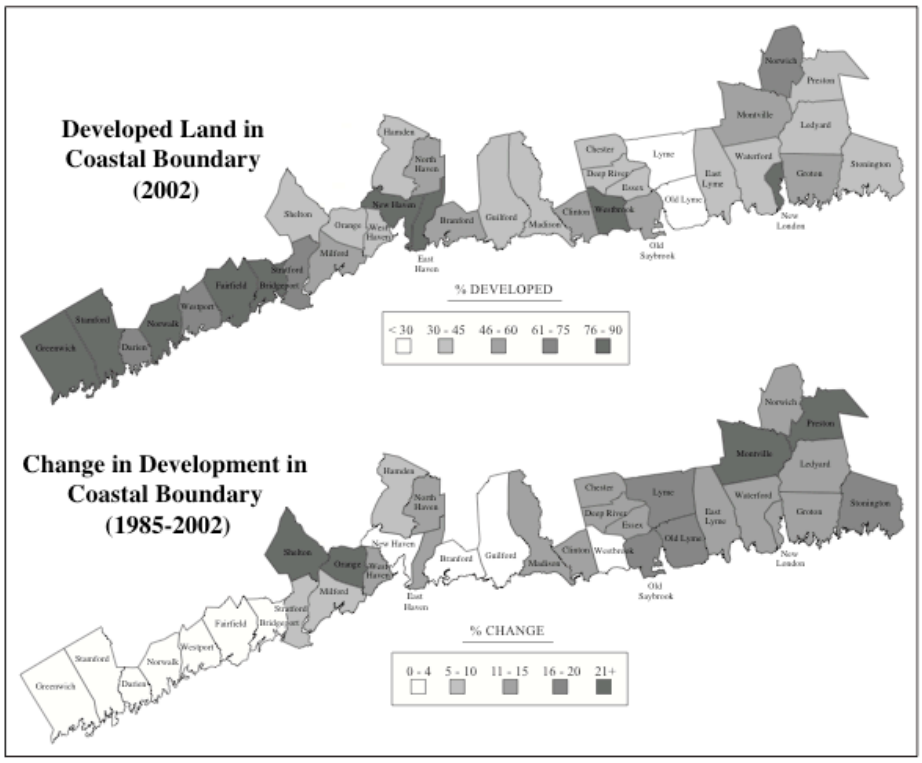

Fig. 1. Coastal Connecticut showing development change: total development (2002) and rate of development (1985-2002).[72]

A majority of Connecticut's coastal development contains concentrated areas of highly developed commercial and industrial uses amongst expansive residential areas of varying density.[73] Commercial and industrial development tends to be highest in large seaport communities such as Stamford, Bridgeport, New Haven, and New London.[74] Residential areas encompassing the immediate shoreline, particularly to the west, contain affluent communities with high real estate market values.[75] Eastern

[72] Data reflected in figure obtained from: Center for Land Use Education and Research, University of Connecticut, Coastal Area Land Cover Analysis Project (CALCAP), *available at* http://clear.uconn.edu/projects/CALCAP/index.htm.

[73] SOUTH WESTERN REGIONAL PLANNING AGENCY, TABLE OF REGIONAL LAND USE AND ZONING PERCENTAGE, *available at* http://www.swrpa.org/Uploads/Land_Use_Area_Table.pdf (summary of residential, industrial, and commercial land use (from west to east): In the South Western Regional Planning Area, residential use comprises 62% of lands and commercial and industrial uses occupy 3%); risingsea.net, *The Likelihood of Shore Protection: Connecticut*, http://risingsea.net/ERL/CT.html (last visited July 10, 2012) (in the Greater Bridgeport Regional Planning Area, residential use comprises 52% of lands, and commercial and industrial uses occupy 5%; to the east, in the Connecticut River Estuary Planning Region, residential use comprises 20% of lands and commercial and industrial uses occupy 2%; in the Southeastern Planning Area, residential uses comprise 15% of land, and commercial and industrial uses occupy just 1%).

[74] *Id.*

[75] U.S. Dept. of Commerce, Bureau of Economic Analysis, *Bearfacts*, http://www.bea.gov/regional/bearfacts/action.cfm?yearin=2009&areatype=MSA&fips=14860, (last visited July 10, 2012) (reporting that in 2009, Bridgeport-Stamford-Norwalk ranked first in the nation in per-capita personal income).

coastal communities have generally observed less development in the past as a result of heavy reliance on septic services, as well as a strong desire by local residents and wealthy vacation homeowners to maintain the rural, small town atmosphere along the coast.[76] Even with these development constraints in place, eastern coastal communities are exhibiting faster rates of growth in recent years than western portions of the state, particularly along the Connecticut and Thames estuaries[77] (See Figure 1 above).

A majority of the undeveloped Connecticut shoreline, classified as "protected open space,"[78] is held by public entities and occurs eastward of New Haven, beginning in the open spaces of Young's Pond Park, East River Wildlife Management Area and Connecticut's largest public beach park – Hammonasset State Park.[79] This trend continues through the easternmost communities of Middlesex and New London Counties,[80] where active partnerships between municipalities and land conservancies have helped to preserve undeveloped coastal areas.[81] Although undeveloped land is comparably less in western coastal communities, several dozen public recreation areas are scattered along this portion of the coast, many of which have already undergone adaptation strategies including shoreline protection.[82]

B. Current System of Coastal Land Use Regulation in Connecticut

Connecticut's Coastal Management Program was approved in 1980 and functions under the statutory umbrella of the Connecticut Coastal Management Act (CCMA).[83] In addition to the CCMA, the state's management program also regulates activities in tidal, coastal, and navigable waters and tidal wetlands under the Structures Dredging and Fill Act[84] and the Tidal Wetlands Act.[85] Upon its enactment, the CCMA established a two-tiered coastal zone consisting of a "Coastal Area"[86] defined by

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[76] Each community is required by Connecticut law to create and update conservation and development plans. CONN. GEN. STAT. ANN. §8-23. For an example of the reasons identified by Connecticut eastern coastal communities for less development, *see generally* TOWN OF OLD LYME CONNECTICUT: PLAN OF CONSERVATION AND DEVELOPMENT (2010), *available at* http://www.oldlyme-ct.gov/Pages/OldLymeCT_BComm/O%20Lyme%20POD%20web%2012-28-10.pdf.

[77] Since 1990, when 61% of the Southeastern Regional Land Area was undeveloped, about 1% of the region has been developed every two years. Center for Land Use Education and Research, *supra* note 72.

[78] 31% of Connecticut's total shoreline is held in protective forms of ownership, of which, 23% is held by public entities, 4% held by land trusts, and 1% held by conservation easements. CONN. DEP'T OF ENVTL. PROTECTION, DRAFT CONNECTICUT COASTAL AND ESTUARINE LAND CONSERVATION PROGRAM PLAN 15 (2007), *available at* http://www.ct.gov/dep/lib/dep/long_island_sound/coastal_management/celcp_plan.pdf.

[79] *Id.*

[80] *Id.* (In the Connecticut River Estuary planning area committed open space accounts for 17% of the land area; and in the Southeastern Connecticut planning area this figure is slightly lower at 13%).

[81] *Id.*

[82] Regional planners from the South Western and Greater Bridgeport Regional Planning Agencies have commented on public and private commitments to using armoring or beach nourishment strategies to protect the region's treasured parks and private clubs along the coast. *Id.*

[83] CONN. GEN. STAT. ANN. §§22a-90 – 22a-111. The Connecticut Coastal Management Program is administered by the Office of Long Island Sound Programs (OLISP) within the Department of Energy and Environmental Protection (DEEP).

[84] *Id.* §§22a-359 to 22a-363f.

[85] *Id.* §§22a-28 to 22a-35.

[86] *Id.* §22a-94 (The "Coastal Area" consists of 36 coastal communities).

a "Coastal Boundary."[87] In general, coastal zone development is regulated at the local level through municipal planning and zoning boards under the policies of the CCMA, with technical assistance and oversight provided by the Office of Long Island Sound Programs (OLSIP).[88]

Connecticut's Department of Energy and Environmental Protection (DEEP) has direct regulatory jurisdiction from tidal wetlands seaward.[89] Under the state's public trust doctrine,[90] the public has a right to access the portion of any beach extending from the mean high tide line to the water.[91] Under local zoning and planning authority,[92] municipalities have regulatory jurisdiction of upland activities down to the mean high tide line.[93] In general, there will be an area of overlapping jurisdiction from the high tide line down to the mean high water line where both the DEEP and the municipality will regulate proposed activities.[94]

All development and planning in the coastal zone must comply with the legal standards and policies set forth in the CCMA.[95] Exactly who is responsible for direct compliance and which legal process applies to coastal development applications depends on the nature and location of the proposed activity.

Activities occurring within state jurisdiction must obtain a permit directly from the OLISP.[96] But, construction of flood or erosion control structures seaward of the high tide line requires a coastal permit from the DEEP.[97] Although both statutory and regulatory policies strongly discourage building such structures,[98] property owners are increasingly pressuring state and local regulatory agencies to allow structures that do not meet the criteria of the CCMA.[99] In fact, the Office of Long Island Sound Programs recently noted "such structures are increasingly being built without state or local authorization, stressing the already over-burdened enforcement programs in the state."[100]

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[87] *Id.* at §22a-94(b) (Located within the Coastal Area, the "Coastal Boundary" is generally described as the 100-year frequency coastal flood zone or the area within the 1,000 ft. linear setback from the mean high water mark or tidal wetland, whichever is farthest).

[88] *Id*. at §22a-90.

[89] *Id.* at §§22a-32 to 22a-35 (Tidal Wetlands Act); §§22a-359 to 22a-363f (regulating the placement of structures, as well as dredging and filling of tidal coastal navigable waters).

[90] CONN. GEN. STAT. ANN. §§ 22a-16 to 22a-17.

[91] Leydon v. Town of Greenwich, 777 A.2d 552, 557 n.17 (Conn. 2001).

[92] CONN. GEN. STAT. ANN. §§ 8-1 to 8-13a.

[93] *Id.* §§ 22a-105; *see also* Office of Long Island Sound Programs, *State and Municipal Regulatory Jurisdictions Fact Sheet* 1, *in* CONN. DEP'T OF ENVTL. PROTECTION, CONNECTICUT COASTAL MANAGEMENT MANUAL (2010), *available at* http://www.ct.gov/dep/cwp/view.asp?A=2705&Q=323814.

[94] *Id.*

[95] CONN. GEN. STAT. ANN. §22a-90 *et seq.*

[96] *Id.*

[97] *Id.* §§ 22a-359 to 22a-363f.

[98] *Id.* §22a-92. Programs staff and/or local boards are responsible for ensuring that certain "adverse impacts must be avoided or, if avoidance is not possible, must be minimized for the project to be lawfully approved." Activities may proceed if they can be demonstrated as "unavoidable and necessary to protect water-dependent uses, infrastructural facilities, or an inhabited structure(s) that predates January 1, 1980, the effective date of the Connecticut Coastal Management Act (CCMA)." Office of Long Island Sound Programs, *Shoreline Flood and Erosion Control Structures Fact Sheet* 2-3, *in* CONNECTICUT COASTAL MANUAL, *supra* note 93.

[99] CONN. DEP'T OF ENVTL. PROTECTION, UPDATED ASSESSMENT AND STRATEGY OF THE CONNECTICUT COASTAL MANAGEMENT PROGRAM 14 (2010), *available at* http://www.ct.gov/dep/lib/dep/long_island_sound/coastal_management/2010_assessment_and_strategies_notice_draft.pdf [hereinafter UPDATED ASSESSMENT].

[100] *Id.*

The "coastal site plan review process" is the fundamental planning mechanism for coastal development permitting under local jurisdiction.[101] The review process was developed to help communities meet their statutory obligations set forth in the CCMA. The review process is required for certain "site plans, plans and applications for activities or projects located fully or partially within the coastal boundary."[102] As such, the majority of public and private property is managed under the site plan review process administered by municipalities, rather than under the direct authority of the DEEP-OLISP.

Municipalities are required to refer site plan reviews to the OLISP under two circumstances: first, if the application includes a shoreline flood and erosion control structure; and second, if the application includes any proposed municipal plan of conservation or development, municipal coastal program, or zoning regulation (or changes thereto).[103] Under these two conditions, the OLISP staff has the right to make recommendations through a standard review process.[104] The commissioner of the DEEP has the right to appeal a municipal decision; however, the final authority over coastal development lies solely with the municipal land use board or commission responsible for defending that coast.[105]

Coastal management, like land use planning in Connecticut, is fundamentally controlled at the local level. This leaves the role of the state, through DEEP, to be one of persuasion and recommendation, rather than proscription. This approach is clear in the policies and standards set forth in the CCMA[106] as well as other coastal area development statutes. For example, coastal communities are required to develop local conservation and development plans conforming to state standards outlined in the State Plan of Conservation and Development.[107] However, there is no state-mandated review of local plans so the state does not ensure the local plans conform to state standards.[108] As a result, local plans function as an instrument the state uses to *influence*, rather than approve coastal development.

In summary, local decision-making authority allows municipalities in Connecticut considerable influence on statewide coastal land use and development because there are no state laws mandating the development and implementation of specific setbacks, overlay districts, or other land use policies to direct coastal development away from hazardous areas. According to DEEP, the only requirement is that all coastal communities implement the coastal hazards policies of the CCMA in their planning and zoning decisions.[109] Looking forward, Connecticut DEEP has acknowledged its need to obtain modern data and develop new policy directions to improve its capacity to deal with sea level rise and other

[101] CONN. GEN. STAT. ANN. §22a-105.
[102] *Id.*
[103] CONN. GEN. STAT. ANN. §22a-109 (defining requirements for application and approval of shoreline flood and erosion control structures) and §22a-104(c) (requirements for any proposed municipal plan of conservation or development, municipal coastal program, or zoning regulation, etc.); *see also* Office of Long Island Sound Programs, *Mandatory Referrals Fact Sheet* 1, *in* COASTAL MANAGEMENT MANUAL, *supra* note 93.
[104] CONN. GEN. STAT. ANN. §22a-109.
[105] *Id.* §22a-110.
[106] *Id.* §22a-92; *see also* Office of Long Island Sound Programs, *Coastal Site Plan Review Fact Sheet* 4, *in* COASTAL MANAGEMENT MANUAL, *supra* note 93 ("Even if the project does not require mandatory referral, we strongly recommend consultation with OLSIP regarding coastal site plans for major development proposals, all waterfront proposals, and proposals where wetlands, beaches and dunes, coastal bluffs and escarpments or coastal waters could be affected.").
[107] CONN. GEN. STAT. ANN. §§22a-42 to 22a-42a.
[108] UPDATED ASSESSMENT, *supra* note 99, at 19.
[109] *Id.* at 18.

climate related phenomena in coastal areas.[110] In subsequent sections, the Connecticut regulatory framework summarized here will be placed in the larger context of generally accepted coastal development strategies. In addition, suggestions will be made to support strategies specific to Connecticut's regulatory regime.

V. Regulatory Takings Analysis of Adaptation Strategies

In this section, we explore how federal constitutional limitations impact government's policy responses to sea level rise brought on by climate change. To begin, a background discussion of the Fifth and Fourteenth Amendments to the U.S. Constitution (hereinafter generally referred to as "taking" or "takings") are discussed including an outline of the several kinds of government actions that can result in a taking of private property. This discussion will be supplemented with relevant case law highlighting the major principles distinguishing government actions that result in takings from actions that are insulated against takings claims. Specific emphasis is placed on how government conduct is categorized; for example whether the government is acting as an owner of tidelands, a trustee of tidelands on behalf of the public, or as a regulator of private landowners whose property abuts tidelands. Finally, the analysis developed in this section will be applied to the current legal/policy framework that exists in the State of Connecticut.

A. Background on Takings

What is traditionally referred to as "takings law" deals with limitations on government actions that result in a diminished use of a citizen's private property without that citizen's consent.[111] The basis for this protection stems from the Fifth and Fourteenth Amendments to the U.S. Constitution.[112] Most States, and specifically Connecticut, have adopted similar takings limitations in their respective State Constitutions.[113] It is important to note that not all government intrusions into private property rights result in a taking. Indeed, there are many examples where government actions affect private property rights but do not trigger constitutional scrutiny. These examples will be more fully described in the next section where government conduct is placed into different categories based on the *role* adopted by government in relation to the actions it is taking to protect coastal resources. But first this section will summarize the major categories of takings so they can later be referenced when the several categories of government conduct are explained.

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[110] Consider the inferences made in the following statement made by OLISP staff after describing how modern data can help to identify particularly sensitive coastal area, "areas may require prioritization in terms of regulatory changes or recommendations for adaptive management options not presently at the forefront of the regulated community's mind." *Id*. at 20.

[111] For purposes of this article it is presumed the government actions being discussed here do not qualify as *eminent domain* actions, meaning this article is not discussing the instances where a government is purposefully and intentionally attempting to "take" private property for a public purpose and willing to pay fair market value for the private property in question. Rather, all government actions described herein relate to government actions that *result* in an impingement of private property rights without the intention of government to exercise its eminent domain power.

[112] U.S. CONST., amends. V, XIV. The Fourteenth Amendment makes the prohibition on government takings applicable to the states.

[113] CONN. CONST. art. I, § 11.

More traditional takings claims tend to focus on *physical occupation*, where a government entity either condemns private land for a government purpose without compensation[114] or where the government would allow, through *regulation*, for the permanent physical occupation of private property, again without compensation.[115] As noted in *Loretto*, the government can sustain a permanent physical occupation so long as it meets the requirements of eminent domain: the permanent physical occupation is for a "public purpose" and the government pays the landowner just compensation (fair market value) for the occupation.[116] Whether by directly taking the property or by allowing for the occupation of private property, the government act of *possessing* the property – in whole or in part – distinguishes these forms of taking from regulatory takings where government does not actually possess the property interest of the private landowner.

A regulatory taking – taking through regulation rather than physical possession – is a less clear form of takings analysis especially when it relates to government planning that impedes use of private property. Jurisprudential foundations for regulatory takings began in the early 20th Century, where court decisions began to recognize a taking could occur by regulation, meaning government actions that did not result in the physical occupation of private property could result in the unconstitutional taking of that property.[117] The U.S. Supreme Court identified that while the regulation of private property was within the normal police powers of government, "... if regulation goes too far it will be recognized as a taking."[118]

The Supreme Court has recognized three general categories of regulatory takings: permanent physical occupations,[119] regulations that deprive landowners of all economic use of their property,[120] and regulations that deprive landowners of some use or value of their land.[121] The first category of regulatory takings described here – permanent physical occupation – is seldom the basis for seaside landowners complaining about government policies that impact their use of land. Rather, most of regulatory takings claims made by these landowners stem from the second and third categories of regulatory takings claims: those categories claiming some or all of the use of the private land has been proscribed through government regulation.

Powers not delegated to the United States by the Constitution are reserved to the states by the Tenth Amendment to the U.S. Constitution.[122] Utilizing a wide variety of these reserved powers, including the police power, state governments have often passed laws limiting the use of private property. However, the ability of a state or local government to defend against a regulatory takings claim based on these police powers has been limited by the U.S. Supreme Court. Two cases, *Penn Central* and *Lucas,* helped to identify the difference between when the exercise of police power to regulate land does not require compensation, and when government overreaches to the point that a regulatory taking occurs.

Penn Central established a three-part test to evaluate when regulation that deprives a landowner of some use or value of their land (category three, described above), may result in an unconstitutional

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[114] *See* ROBIN KUNDIS CRAIG, THE CLEAN WATER ACT AND THE CONSTITUTION: LEGAL STRUCTURE AND THE PUBLIC'S RIGHT TO A CLEAN AND HEALTHY ENVIRONMENT 149 (2d ed. 2009).
[115] *See* Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982).
[116] *Id.* at 435-40.
[117] *See* Pa. Coal Co. v. Mahon, 260 U.S. 393 (1922).
[118] *Id.* at 415.
[119] *Loretto*, 458 U.S. 419 (1982).
[120] Lucas v. S.C. Coastal Council, 505 U.S. 1003 (1992).
[121] Penn Cent. Transp. Co. v. New York City, 438 U.S. 104 (1978); Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Agency, 535 U.S. 302 (2002).
[122] U.S. CONST., amend. X.

taking of private property without just compensation.[123] Under the *Penn Central* test courts evaluate the following factors: the economic impact of the regulation on the landowner; the extent to which the regulation interferes with legitimate investment-backed expectations; and the character of the government action.[124] *Penn Central* acknowledged that government regulating through its police power can impact the value of private property. However, that impact must be balanced against the evaluative criteria identified above.[125] When the weight of the evidence tips the analysis of those criteria in favor of the private property owner, then a regulatory taking may be found. The question left somewhat unresolved in *Penn Central* is what facts might tip the scales towards a regulatory takings rather than towards a constitutional exercise of police power. This was partially discussed later by the U.S. Supreme Court in the *Lucas* case.

In *Lucas*, the owner of a developable piece of coastal property was prevented from developing the property based on a new regulation by the state agency responsible for protecting coastal resources.[126] The private landowner, Lucas, challenged the new regulation prohibiting all future development partially on the ground that the regulation deprived him of all viable economic use of his property.[127] The U.S. Supreme Court identified the rights of states to enact regulations through their police power, but limited this power by stating that a regulation that removes all viable economic use of property results in a regulatory taking,[128] thus creating the second category of regulatory takings described above.

Although *Lucas* held a regulation that deprives landowners of all viable economic use of their property might result in an unconstitutional taking, the Court identified a major exception in rendering the decision. Specifically the Court noted the following: "[w]here the State seeks to sustain regulation that deprives land of all economically beneficial use, we think it may resist compensation *only if the logically antecedent inquiry into the nature of the owner's estate shows that the proscribed use interests were not part of his title to begin with.*"[129] The Court here is focusing on principles of state property law, indicating a regulation that removes all economic use of the property will be a taking unless that regulation reflects "… background principles of the State's law of property and nuisance already placed upon land ownership."[130] As the Court in *Lucas* further explained in outlining the "background principles of law" exception to a regulatory taking, "A law or decree with such an effect must, in other words, do no more than duplicate the result that could have been achieved in the courts – by adjacent landowners (or other uniquely affected persons) under the State's law of private nuisance, or by the State under its complementary power to abate nuisances that affect the public generally…"[131]

To review, there are generally three categories of regulatory takings: a *Loretto*-type regulation resulting in a physical occupation of private property; a *Lucas*-type regulation diminishing all economic use of the private property; and a *Penn Central*-type regulation diminishing some use or value of the private property. The *Loretto*-type category of regulatory takings is clear; if a regulation allows for the physical occupation of one's property, then a taking will result. In some ways, this can be seen as government taking affirmative steps to allow for the occupation of private property by some entity

[123] Penn Cent. Transp. Co. v. City of New York, 438 U.S. 104 (1978).
[124] *Id.* at 124.
[125] *Id.*
[126] *Lucas*, 505 U.S. at 1008-09.
[127] *Id.*
[128] *Id.* at 1031-32.
[129] *Id.* at 1027. (emphasis added)
[130] *Id.* at 1029.
[131] *Id.*

other than the owner. (In *Loretto* it was the allowance of cable company equipment to be affixed to the private property through regulation.)[132]

Both the *Lucas*- and *Penn Central*-types of regulatory takings are less clear; neither offer an obvious path regarding what kinds of police power actions might constitute a total deprivation of economic use nor, under the *Penn Central* analysis, do they clearly spell out how the interests of the respective parties are to be weighted.[133] It should be of little surprise then that governments approach regulatory takings issues cautiously. What governments have seemed to focus on instead are the background principles of state property law as a means of defending their actions against regulatory takings claims.[134] As identified in the *Lucas* case and pointed out above, these background principles of property law generally include common law property traditions adopted by the state such as nuisance and custom. However, there are other general common law traditions and principles in property law that specifically apply to coastal issues including the state as owner of submerged lands and also as trustee of public rights within and around the coastal zone.

Some of these common law traditions of property law identified above are discussed in greater detail in the next section. The perspective taken is one of categorizing the government conduct in relation to the coastal region at issue: specifically the government as "regulator" of private land; government as the "owner" of public resources; and finally government as "trustee" of public resources. The reason why this approach is taken is because it focuses the analysis on the *role* government adopts when instituting a policy action, thereby more easily defining the basis of the government activity. If the basis relies on background principles of property law, then it may be clearer to see whether the activity falls within or outside a regulatory takings challenge. The hope is that government agencies, by focusing more closely on the categorization of their policy-planning role, will be more readily capable of developing policies that steer clear of regulatory takings claims.

B. Categorization of Government Conduct

Focusing on the role government adopts when approaching a coastal problem, like sea level rise, can be especially helpful in steering clear of regulatory takings claims, since the manner of the government interaction with the private landowner impacts the likelihood of establishing a regulatory takings claim. As a simple example, if the government is acting in its capacity as regulator, then it is more likely that regulatory takings are triggered simply because the government is clearly engaged in *regulation*. However, if the government is acting in a capacity outside its role as regulator, then it is harder to show the government conduct equates to regulation of the kind that triggers a regulatory takings claim.

While some may see the distinction described above as semantics, there is clear tactical value in establishing a policy approach that begins by defining the role government chooses in coastal policy development, when it comes to takings claims. The reason relates back to the earlier comment about the relative "muddiness" of regulatory takings jurisprudence. When it is unclear how courts will handle facts related to a regulatory takings claim, it is important for governments to be able to help courts

[132] *Loretto*, 458 U.S. at 435-40.

[133] In the *Penn Central* opinion, Justice Brennan, writing for the majority opinion, noted that instead of setting forth clear standards, the Court had adopted "ad hoc factual inquiries" to determine whether a regulatory taking had occurred. Penn Cent. Trans. Co., 438 U.S. at 124. The idea left in *Penn Central* is that regulation that passes some degree of damage to the economic value of the property will result in an unconstitutional taking, but there is no uniform measure offered of when this will occur. *Lucas* aids in the analysis by stating the obvious: removal of all viable economic use of the property through regulation equates to a taking. *Lucas*, 505 U.S. at 1031-32. However, anything short of this is a bit of a crap shoot.

[134] *See* Byrne, *supra* note 6.

establish the conceptual framework from which a regulatory takings analysis will occur. The conceptual framework adopted by the court – and also between the disputing parties – will form the foundation of the regulatory takings analysis. If the analysis begins from a governmental role that is not regulatory in nature, then government comes to the defense of its actions in a stronger position.

Even when the government action is clearly regulatory in nature, it is important to acknowledge this up-front because it allows government to more accurately define the purpose of the regulation. For example, government regulation that is reinforcing background principles of existing property law – say preventing a public nuisance – would be outside a regulatory takings claim because the government is proscribing a use that was not part of the private landowner's title.[135] Again, the purpose here is to focus on categorizing government conduct so that a clear articulation of policy direction can be made at the outset of government actions. A clear articulation will help government bodies defend against takings claims both substantively, by ensuring their actions are in accordance with law, and procedurally, by helping government clearly identify its role in a court proceeding should a takings challenge be forthcoming. In the next several sections, the different categories of government conduct are discussed in greater detail.

1. Government as Regulator of Private Property

Viewing government as a regulator of private property suggests government is taking actions that fit within the definition of regulation. This means government is acting within its traditional role of legislation and administration. Government action within such traditional regulatory roles tends to trigger regulatory takings considerations.[136] To quickly review, regulatory takings can happen by: physical occupation, removal of all economic value, or removal of some value or use of the private property. If we look at a continuum where the Fifth Amendment taking is placed at one end of the spectrum, and the Tenth Amendment police power is placed at the other end, we can begin to think about the kinds of regulations that might be more likely to result in a regulatory takings (those regulations nearer to the Fifth Amendment end), as opposed to the kinds of regulations that might reflect background principles of law and be well within the traditional police powers of the Tenth Amendment.[137] The key here is to determine what kinds of government regulatory stances are most insulated from takings challenges.

As stated earlier, the Tenth Amendment reserves to state governments the power to enact legislation and regulations for the health, safety, and welfare of the citizenry.[138] As also stated earlier, the U.S. Supreme Court has indicated there are limits to government's ability to claim a Tenth Amendment privilege; specifically, such a privilege cannot be claimed for regulations that result in a prohibition of all economically beneficial use of land.[139] So where is the safe ground? It seems the safest ground is when a regulation, at its inception, is derived wholly as a rendition of preexisting state property rights. Or, in other words, the safe ground exists more clearly when government is enforcing background principles of state property law through legislation or regulation.[140] A clear example of this

[135] *Lucas*, 505 U.S. at 1027.

[136] *Id.* (South Carolina passed legislation for the management of coastal resources. The South Carolina Coastal Commission passed regulations under the legislative power granted to it by the State legislature to protect coastal resources by limiting development.)

[137] In this conceptual exercise, it is presumed a government power falling squarely within the meaning of the Tenth Amendment *does not* invoke a Fifth Amendment takings. Governments can certainly act in their authority to protect the public that also results in a regulatory taking in the process. *See Lucas*, 505 U.S. at 1031-32.

[138] U.S. CONST., amend. X

[139] *Lucas*, 505 U.S. at 1022-23.

[140] *Id.*

is when a state government chooses to incorporate a common law principle into its statutory scheme, such as when a common law public nuisance doctrine is codified by the legislature. Enforcement of this codified public nuisance would generally not result in a regulatory takings claim because the action is based on background principles of property law, in this case the doctrine of public nuisance.[141] So long as the public nuisance is proven to have existed within the state's tradition of property law throughout history, the private landowner cannot claim a regulatory taking because she never had the property right to commit the public nuisance in the first place.[142]

While the codification of common law public nuisance traditions may be a clear example, other examples of government acting in its role as a regulator are less clear under a takings analysis. This is especially true when legislative and administrative policy deviates from common law traditions. Professor J. Peter Byrne sets forth a strong summary of how this occurs, especially in relation to managing policies geared at dealing with property rights within the coastal zone under conditions of sea level rise.[143] As professor Byrne notes, "… nuisance litigation notoriously fails to adequately weigh the broad public interests present in environmental disputes."[144] Professor Byrne supports this proposition by making the case that current statutory and regulatory enactments related to coastal public policy reflect a greater understanding of the threats posed to the public due to climate change.[145] This includes not only threats to littoral landowners themselves, but also to adjacent landowners when one engages in practices such as armoring to protect against rising seas.[146] He also highlights the threats such actions pose to government as both a property owner of submerged lands[147] and as a caretaker of environmental concerns including ecosystem services.[148]

What Professor Byrne is highlighting in his essay is the idea that statutory frameworks, including administrative implementation of statutory goals, is often a superior means of inculcating the advancements of society into a legal framework. In the context of sea level rise, advancements in science have allowed us to better forecast the likelihood and impacts of climate change.[149] This kind of information would not be available under traditional common law. Thus, a modern government has tools to use this forecasting to create proactive policies to protect the fundamental health, safety, and welfare of citizenry that is the hallmark of the Tenth Amendment to the U.S. Constitution. By focusing narrowly on common law doctrines as the basis of background principles, judicial review can place government in the awkward position of "retrofitting" forward-looking policies into a background principles framework of common law tradition.

Recent court cases, where the government is prohibiting the use of armoring devices, seem to highlight this problem of relying on common law principles to justify forward-looking government regulations.[150] The courts have either chosen not to recognize a littoral landowner's common law right

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[141] *See* Caldwell, *supra* note 35, at 557–58.
[142] *Id.*
[143] *See* Byrne, *supra* note 6.
[144] *Id*. at 634.
[145] *Id*. at 639.
[146] *Id.*
[147] *Id.* at 637 (citing United States v. Milner, 583 F.3d 1174, 1187 (9th Cir. 2009) for the proposition that a sovereign has a vested right to gains from a rising sea, thus property owner's armoring prevents this natural increase in sovereign land). This proposition is discussed further below when reviewing the government's role as an owner of public property.
[148] *Id.* at 638-39.
[149] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 3.
[150] *See* Shell Island Homeowners Ass'n v. Tomlinson, 517 S.E.2d 401 (N.C. Ct. App. 1999); Grundy v. Thurston County, 117 P.3d 1089 (Wash. 2005).

to protect their property from erosion[151] or otherwise found the "common enemy rule" (a common law right) did not apply to seawater and therefore the private landowner had no property right being impinged by the prohibition against armoring.[152] In both cases, the court felt compelled to analyze the regulatory takings claims through common law doctrine, and, in order to uphold the government regulation, the courts chose to find the non-existence of a property right that prior precedent had suggested always existed.[153]

In reviewing the courts' analyses in these cases, some interesting points arise in relation to policymaking from the government perspective. If government takes on the role of regulator, it presumably wishes to incorporate the most complete knowledge about dangers to the public when creating regulations. In order to mitigate risks associated with sea level rise, governments are looking to policies that place restrictions on coastal property rights including the right to armor. The government may choose these restrictions to protect both the public as well as ecological values associated with natural coastal landscapes. However, when government acts proactively through proscriptive powers, it steps into the sphere of regulatory takings. Once inside, government must rely on the courts' ability and willingness to update traditional views of background principles of property law (like public nuisance) to include more forward-looking risks to the public like climate change. Recent case law suggests courts are having some difficulty doing this, especially in jurisdictions where there has been little expansion of traditional public nuisance principles adopting forward-looking factors and environmental risks in the definition of what constitutes a nuisance. For governments in these situations, they may be better off identifying a role beyond that of regulator.

2. Government as Owner of Public Property

Traditionally, governments tend to look at the problems of sea level rise and see policy prescriptions focusing on prohibitions of coastal land use. The idea is that sea level rise will create problems in coastal areas running the gamut from public safety (as the water inundates the land, developments including coastal infrastructure will be at risk) to environmental concerns (sea level rise will create incentives for protection measures like armoring, which limit the coastline's ability to maintain important ecological features and functions). To timely deal with these problems, governments must use their regulatory authority to proscribe the kinds of conduct that will lead to these negative outcomes.

The purpose of this section is to highlight a slightly different approach government may opt to take to mitigate the impacts of sea level rise on coastal areas. In addition, this approach (government acting in its capacity as the owner of submerged land) can limit regulatory takings challenges; it may not limit *challenges* from aggrieved littoral landowners impacted by government actions, but it will limit the *likelihood* such challenges will succeed in a court of law since government, when acting as an owner of property, has rights like any other landowner in order to protect its property interest.[154] Of equal importance, when government is acting as a landowner, it is not regulating and, therefore, its actions logically should not result in a regulatory taking.[155]

[151] *Tomlinson*, 517 S.E.2d at 414.
[152] *Grundy*, 117 P.3d at 1090.
[153] *See* Byrne, *supra* note 6, at 639.
[154] Port of Seattle v. Oregon & W. R. Co., 255 U.S. 56, 63 (1921) ("The character of the [s]tate's ownership in the land and in the waters is the full proprietary right.").
[155] Int'l Society for Krishna Consciousness, Inc. v. Lee, 505 U.S. 672, 678 (1992) (Where the government is acting as a proprietor different standards apply than when it is acting simply in its regulatory capacity.).

This argument of government as landowner with proprietary interests at stake equal to those claimed by private littoral landowners is succinctly laid out by Professor Sax.[156] Simply put, the government is the owner of submerged land seaward of a defined boundary (usually the *mean high water mark* but the *mean low water mark* in certain states), while the private party claims ownership of the land landward of this boundary.[157] In summarizing this relationship between private and public owners of adjacent property, Professor Sax states the following:

> Under ordinary circumstances, there is nothing particularly obscure or mysterious about these rights. For example, the littoral owner has a right to occupy and make economically productive use of his land. The state is entitled to have the public use the foreshore (the wet beach between high and low tide) for passage and recreation, and to employ coastal wetlands seaward of the MHTL as habitat. Assuming a rather stable situation at the water's edge, with the boundary moving modestly back and forth over time, these two uses can coexist with little or no conflict.[158]

In a world where sea level rise is brought on by dynamic forces including climate change, this ideal state of equilibrium between private and public interests is frustrated. Today the demarcation line is moving, which means the respective rights of the property owners are also changing. Policymakers may wish to strategically take advantage of their rights as a property owner, and choose this role as a basis for achieving policy goals since the progression of sea level rise will highlight competing common law rights in private and public landowners. For example, if the private upland owner decides to utilize his common law right to defend against the rising tide by armoring,[159] this will impact the public's right to the natural movement of the water landward, adding to what would be publicly submerged land but for the private armoring preventing the sea's encroachment on the land. Conversely, if the public landowner wishes to fill portions of their submerged land, this will impact the private littoral landowner's common law right to "touch" the water's edge. The problem of sea level rise is further frustrated by different views on the right to protection. For example, certain jurisdictions favor the "common enemy doctrine" allowing owners to protect themselves against rising waters even at the detriment to an adjacent owner (supporting armoring for instance).[160] Other jurisdictions favor the "civil law rule," requiring the natural flow to occur unimpeded (supporting advancement of submerged land).[161] In all examples presented here, none offer an ideal solution *between* property owners.

This pitting of opposing common law interests results in both parties having similar proprietary rights at stake. Rather than having to decide between equal property rights, a court will likely be

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[156] *See* Sax, *supra* note 7.
[157] *Id*. at 641-42.
[158] *Id*. at 642.
[159] The right to armor or otherwise protect against the rising sea is not an absolute right that exists for all littoral landowners in all jurisdictions as has been indicated elsewhere in this article (*see* Part III). The traditional common law right is being highlighted here for the purposes of the example.
[160] *See* Pflum v. Wayne County Bd. of Comm'rs, 892 N.E.2d 233 (Ind. Ct. App. 2008).
[161] Page Motor Co., Inc. v. Baker, 438 A.2d 739, 742 (Conn. 1980) ("Some jurisdictions have adopted the civil law rule which holds that 'the right of drainage of surface-waters, as between owners of adjacent lands, of different elevations, is governed by the law of nature.'" (quoting Rutkoski v. Zalaski, 96 A. 365 (Conn. 1916)).

persuaded to seek accommodations between the parties,[162] which is precisely what government should be hoping to achieve in policy development related to sea level rise.[163] There are a variety of options available to accommodate the interests at stake.[164] The key difference here is that both parties are placed in a context where the focus is on resolving competing property rights, rather than the regulatory setting that creates positions between the public and private interests and invokes claims of regulatory takings.

The role of government as property owner is one way to move the focus away from regulation and towards creating equitable outcomes. While it is unlikely that a government can adopt holistic policies to deal with sea level rise based *solely* on its status as a property owner, allowing for the distinction to be part of the policymaking process can have significant advantages in how a government entity proceeds in implementing a proactive policy geared towards adapting to the effects of sea level rise brought on by climate change.

3. Government as Trustee of Public Property

For over a century, it has been well established that states hold title to submerged lands within navigable waters, and the states hold these lands in trust for the benefit of the public.[165] Public benefits generally include traditional rights of navigation, commerce, and fishing.[166] Importantly, the trustee obligations of the state in managing these public rights are not easily alienable. Thus, even when the state attempts to transfer the private interests (*jus privatum*) in submerged lands to a private party, the public rights of access and use remain and the state's duties as trustee remain as well.[167] Collectively this duty of the state to manage the public rights in navigable submerged lands is known as the *public trust doctrine*.

In some ways, the public trust doctrine creates an ongoing obligation that forces state action to protect the public interest. As trustee, the state is obligated to ensure the rights of the public in coastal areas are realized. These rights have traditionally included fishing, commerce, and navigation as mentioned above; still, individual states have chosen to expand their public rights in the coastal zone under the public trust doctrine.[168]

The public trust doctrine as a "background principle" of state property law is an important factor for governments to consider when defending against regulatory takings claims. In essence, where the government is acting through its obligations as trustee to enforce public rights in the coastal zone, the actions related to that enforcement are grounded in background principles of state property law; therefore the actions cannot be seen as triggering a regulatory taking because the state is simply

[162] *Id*. at 741 ("[T]he landowner, in dealing with surface water, is entitled to take only such steps as are reasonable, in light of all the circumstances of relative advantage to the actor and disadvantage to the adjoining landowners, as well as social utility. Ordinarily, the determination of such reasonableness is regarded as involving factual issues to be determined by the trier."); *See also* Keys v. Romley, 412 P.2d 529, 535-36 (Cal. 1966) (The court here describing the use of reasonableness via tort analysis as a means of resolving a problem of water between property owners rather than using property concepts to simply define the rights of the parties.).

[163] The presumption in this statement is that government has a primary role in *equitably* resolving interests that arise between all of its citizens. This includes, where practicable, protecting the property right interests of littoral landowners.

[164] Rolling easements where the easement right is purchased by the government is one that has a strong balance of interests. *See* Titus, *supra* note 14.

[165] Ill. Cent. R.R. Co. v. Illinois, 146 U.S. 387 (1892).

[166] *Id.* at 452.

[167] *Id.* at 452-53.

[168] *See generally* Craig, *supra* note 40.

protecting the public rights that flow from the doctrine itself.[169] As some legal commentators have noted, "… the doctrine provides the most fundamental basis for responding to the threats of coastal armoring…,"[170] because the doctrine reflects the role government plays in ensuring established public rights in the coastal zone. This is an important conceptual difference in how the state approaches coastal issues – the difference between enforcing *regulations* and enforcing *trustee obligations*. When the state acts as a trustee, its actions begin with a background principle of property law, thus all actions that follow can be linked back to the original trustee obligations. A state can argue it is simply carrying out non-discretionary trustee duties. Much like the arguments above where the state adopts the role of property owner to defend its actions, the public trust doctrine creates an important conceptual distinction between the state choosing to regulate private land, which can create regulatory takings issues, and the state simply engaging in its obligations as trustee on behalf of the public.

Use of the public trust doctrine as a defense varies by state depending primarily on the extent to which that state has developed its public trust doctrine interests.[171] Some states have expanded their public trust rights to include access rights that "roll" with sea level rise,[172] while others have included ecological values as important attributes of the public trust in coastal areas.[173] For example, if a government recognizes the rights of the public to access recreational opportunities including traditional beach use of the near shore, then it seems reasonable that same government can take steps to protect the maintenance of the sandy beach. This may include state nourishment projects to mitigate the erosion of sandy beaches, as well as defending against private landowners attempting to armor when armoring is clearly shown to aid in the destruction of public rights. Again, the important factor here is linking the state action to accepted public rights in the coastal area. For some states the public trust doctrine will serve as a more expansive tool against regulatory takings claims because of expanded public rights in the coastal zone. In other states the use of the public trust doctrine may be more limited because of limitations in the development of public trust doctrine rights.

The aforementioned takings analysis, relying heavily on the categorization of government conduct outlined previously in this article, will now be applied to adaptation approaches available in the State of Connecticut.

VI. Analysis of Adaptation Approaches in Connecticut

As noted in Section IV above, according to estimates of development intensity along the Connecticut coast somewhere between 50% and 80% of what may reasonably be defined as coastal land is in a developed to likely developed state.[174] However, development is not uniform along Connecticut's coast. A general trend shows greater development intensity along the western portion of

[169] *Lucas*, 505 U.S. 1003 (1992).
[170] Caldwell, *supra* note 35, at 552.
[171] Craig, *supra* note 40.
[172] TEX. NAT. RES. CODE ANN. §§ 61.001 – 61.254 (Texas Open Beach Act, which states in relevant part, "[I]f the public has acquired a right of use or easement to or over an area by prescription, dedication, or has retained a right by virtue of continuous right in the public, the public shall have the free and unrestricted right of ingress and egress to the larger area extending from the line of mean low tide to the line of vegetation bordering on the Gulf of Mexico."); *See also* TEX. CONST. art. I, § 33(b). (Ensuring the public right to access the dry sand beach in the Texas State Constitution).
[173] Caldwell, *supra* note 35, at 552 ("there is a growing public recognition that one of the most important public uses of the tidelands…is the preservation of those lands in their natural states." (quoting Nat'l Audubon Soc'y v. Super. Ct., 658 P.2d 709, 718-19 (Cal. 1983)).
[174] Center for Land Use Education and Research, *supra* note 72 (indicating 51% development in 2002); Titus et al, *supra* note 14 (indicating approximately 80% of land developed within 1 meter of high water mark).

the state, with generally lower development intensity along the eastern coastal portion of the state.[175] Where development has occurred in greatest intensities, including urban centers along the western portion of the Connecticut coast, traditional armoring techniques such as seawalls are more prevalent.

The particular counties and locales identified in Part IV have a variety of adaptation strategies at their disposal. Some strategies may be applied more generally between counties regardless of existing conditions and other techniques that are more easily tailored to specific areas. Zoning overlay districts are an option for all seaside communities throughout Connecticut. The overlay district could be established to cover a defined coastal zone that is fluid, meaning property situated within the established definition of a coastal zone would be included in the overlay district. Should the coastal zone move upland over time due to climate change, upland properties would be absorbed into the overlay district if and when conditions surrounding the property met the definition. Once established, all properties existing within the overlay district would be subject to additional regulation based on their proximity to the coastal zone. Depending on the intensity of development in a particular area, the local government could use the various techniques described in this article (regulation, advancement of property rights, trustee obligations) and others (negotiation and reconciliation) to manage the adaptive process to sea level rise.

The use of an overlay district would highlight the special considerations that need to be applied to land use management within the district. A trustee obligation under the public trust doctrine may call for rolling easement-type regulations that ensure the preservation of the coastal resource to include protection of the public's right to access coastal attributes. While this may be done best at the state level, like in Texas,[176] it certainly can be explored by local planners as one way of beginning the process to alter property right expectations of private owners along the coast.[177] A rolling easement may represent the best compromise between public planning for sea level rise while accommodating existing private property right expectations regarding use of coastal property.[178]

Connecticut can also take advantage of its rights as property owner in submerged lands. This can be advantageous to local planners who are looking for leverage in negotiating with private landowners in particular communities. The rights accruing to the public with sea level rise are not easily overcome by private landowner's claim of an unrestricted right to armor against rising seas. Understanding reasonableness standards would be the basis of judicial evaluation between property owners in such situations, the property right approach may yield a much better bargaining position for local governments, which can lead to important compromises between property owners that support adaptive policies more efficiently than other available options.

As indicated above, the local conditions will dominate the discussion of how government "best" proceeds in adaptive policies towards sea level rise. Existing conditions of heavy development and armoring limit policy choices. Less developed areas allow for greater options in proactively implementing adaptive policies. The key suggestion here for Connecticut, or any state government, is there are options in adaptive strategies that offer a high likelihood of avoiding regulatory takings claims. The key is to begin planning now so the adaptive strategies are proactive rather than entirely reactive; otherwise, retreat will likely be the only option left on the table.

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[175] Center for Land Use Education and Research, *supra* note 72.

[176] TEX. NAT. RES. CODE ANN. § 61.011(a).

[177] Given Connecticut's preference for local land use planning, including coastal development (*See* Part IV infra), a set of state-initiated options through relevant agencies (DEEP and OSLIP) that create incentives for adoption by local municipalities may be the superior means of implementing this kind of coastal planning regulation.

[178] *See* Titus, *supra* note 7.

VII. Conclusion

It should be clear from this article that state and local governments have a variety of tools at their disposal to develop meaningful, proactive policies geared towards adapting to coastal climate change. Chief among these goals should be protecting the public against the impacts of sea level rise. To do this well, government must look at current land use policies along the coastal zone and consider what actions might best be applied to adapt to a dynamic and changing coastal landscape. Because coastal land use patterns are varied amongst the states and, further, because most land use decisions are made at the local governance level, the kinds of strategies employed to deal with coastal climate change will vary. Still, there are general lessons that can be learned about *how* government chooses to approach policy development in this area.

As suggested in this article, one commonality amongst all coastal states is the impact public policy will have on private landowners' expectations towards the use of land. When expectations of land use are changed at the governance level, constitutional questions arise; most prominently the Fifth Amendment prohibition in the U.S. Constitution on the public taking of private property without just compensation.

With a sense that proscriptive public policies can trigger regulatory takings claims, public agents would do well to consider the *role of government* when creating public policy prescriptions. Specifically, government should look to its roles in the coastal zone beyond that of regulator; government also has rights as both property owner and trustee of the public's rights in coastal zones. Developing policy solutions that incorporate these other roles of government can serve multiple purposes. Most directly, when acting in a non-regulatory role, government actions are less likely to be seen as impinging upon Fifth Amendment takings rights of private citizens. This alone can save government substantial costs in defending against lawsuits and other forms of legal posturing. More importantly, when government is acting in a non-regulatory fashion, it can approach the problem of sea level rise from a more equitable standpoint, allowing for the development of solutions that balance public and private interests. The example of government advancing its rights as a property owner and allowing for courts to use a reasonableness standard to create remedies between the property rights at issue was offered as one example; there are many others.

The reality of sea level rise creates a need for immediate and decisive action. Government can choose to be reactive to unfolding events, but this can lead to problematic outcomes for coastal communities, especially given the dynamic nature of climate change and the unpredictability of future rates of sea level rise. Proactive policies implemented locally need to internalize future costs of rising seas today, and this can include options such as armoring against the coming tide, retreating from it, or a combination of options. Existing conditions at the local level will impact these choices. For example, highly developed coastal areas of western Connecticut stand in contrast to the more undeveloped portions of eastern Connecticut. Because of the legacy issues involved with prior development (or a lack thereof), local planners have different conditions that create different options, some more limited than others.

In sum, the realities of existing conditions of coastal development need to be fully considered when creating policies towards rising seas. This article does not spell out what precisely should be done by local planners, but rather *how* planners should consider their *governmental role* in approaching solutions. Considering the roles of government beyond that of regulator will serve planners well as they deal with local conditions and adapt existing policies to deal with climate change, while avoiding regulatory takings claims to the extent practicable in the process.

When Retreat is the Better Part of Valor: A Legal Analysis of Strategies to Motivate Retreat from the Shore

Hyo (Charlene) Kim[1] and Caroline A. Karp[2]

Abstract: Flooding represents Connecticut's most prevalent, serious and expensive natural hazard. Accelerated sea level rise, in combination with increasingly frequent extreme weather events caused by global warming-induced climate change, is very likely to result in increased inundation, flooding, and erosion of coastal lands. However, FEMA's Flood Insurance Rate Maps (FIRMs) rarely account for the projected effects of climate change and therefore significantly underestimate the risk of flooding and erosion. This article describes the projected effects of global warming-induced climate change on coastal flooding and flood-related risks in Connecticut in order to emphasize the scope and magnitude of the risk to coastal communities, and the resulting economic risk to the state. The authors present a heuristic tool to describe an array of regulatory, information, and market-based strategies that could be used to govern development in the coastal zone and conclude that Connecticut and its municipal governments have several independent bases of legal authority to regulate current and future development in high hazard areas. The article concludes with recommendations on regulatory, information, and market-based strategies to motivate retreat from the shore.

I. Introduction

There is broad scientific consensus that anthropogenic emissions of greenhouse gases (GHG) since the Industrial Revolution have caused a measureable increase in global average temperature, and that global warming is very likely to affect climate and hydrological processes in spite of efforts to reduce

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GHG emissions in the short term.[3] Global warming-induced climate change may result in climate extremes and disasters depending on interactions between climate, the environment, and a variety of human factors that affect exposure and vulnerability.[4] As a result, it is widely agreed that coastal states like Connecticut should proactively attempt to adapt and reduce their exposure and vulnerability to the more likely effects of climate change in order to increase their resilience to climate extremes, while continuing to mitigate GHG emissions.[5] The challenge for Connecticut and similarly situated coastal states is at least two-fold:

(1) To effectively reduce risks to people, property, critical ecosystems and ecosystem services associated with existing development in coastal and riparian areas by (a) protecting existing development where necessary,[6] (b) accommodating to changing environmental conditions, or (c) retreating from and abandoning the shoreline or floodplain.[7]

(2) To effectively manage or prevent *new* development in high-risk coastal and riparian areas by accommodating to changing environmental conditions or promoting retreat from and abandonment of the shore.[8]

The objective of this article is to examine the viability of legal challenges to state and local efforts that anticipate and attempt to address the projected effects of climate change on public and private property, public trust interests, the environment, and ecosystem services in the coastal zone. This article considers the extent to which the State and local governments, in cooperation with the private sector, can prohibit development in the coastal zone and/or compel coastal property owners to retreat from the shore.

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[3] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC), CLIMATE CHANGE 2007: SYNTHESIS REPORT 51 (2007); THOMAS R. KARL ET AL., GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 9 (2009); PETER FRUMHOFF ET AL., CONFRONTING CLIMATE CHANGE IN THE U.S. NORTHEAST: SCIENCE, IMPACTS, AND SOLUTIONS 19 (2007); CONN. DEP'T OF ENVTL. PROT., CONNECTICUT'S 2010 NATURAL HAZARDS MITIGATION PLAN UPDATE 26 (2010).

[4] *See* IPCC, SUMMARY FOR POLICY MAKERS IN MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION 4 (2012). Climate extremes refers to both extreme weather and extreme climate events.

[5] *See* NAT'L ACAD. OF SCI., ADAPTING TO THE IMPACTS OF CLIMATE CHANGE 19 (2010) (Adaptation is defined as "adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects."); CONN. DEP'T. OF ENERGY & ENVTL PROT., COASTAL HAZARDS IN CONNECTICUT: COASTAL HAZARDS PRIMER (2012).

[6] *See* LESLEY KATZ GENOVA ET AL., THE LIKELIHOOD OF SHORE PROTECTION ALONG THE ATLANTIC COAST OF THE UNITED STATES VOL 1: MID-ATLANTIC 67-72 (James Titus et al. eds., 2010) (Authors conclude that "most of the State's densely developed areas, public facilities, and tribal lands are certain to be protected" and that "affluent lower density residential areas are also assumed to be almost certainly protected because of residents' ability to personally finance protection and also to influence local and state authorities to allow or fund the necessary structures." However, protection is uncertain or unlikely for military property, agricultural lands, undeveloped areas and open space).

[7] *See* J. DRONKERS ET AL., IPCC, STRATEGIES FOR ADAPTATION TO SEA LEVEL RISE iv (1990) ("Retreat involves no effort to protect the land from the sea. The coastal zone is abandoned and ecosystems shift landward… Accommodation implies that people continue to use the land at risk but do not attempt to prevent the land from being flooded. This option includes erecting emergency flood shelters, elevating buildings on piles, converting agriculture to fish farming, or growing flood or salt tolerant crops. Protection involves hard structures such as sea walls and dikes, as well as soft solutions such as dunes and vegetation, to protect the land from the sea so that existing land uses can continue").

[8] *Id*.

Part I briefly summarizes the most recent and best available information about the projected effects of climate change on Connecticut's coastal communities. Parts II and III are directed primarily to state and local officials since much of the responsibility for land use, risk prevention, emergency response, and post-disaster remediation is likely to fall on state and local governments. Part II presents a framework to describe a spectrum of policy options to enable Connecticut to prepare for some of the most probable and severe consequences of climate change in the coastal zone. Part III presents a user-friendly "takings" test and considers the extent to which the policy options presented in Part II are likely to expose state and local governments to successful "takings" claims pursuant to the U.S. and Connecticut Constitutions. Part IV offers some recommendations to better position the State and local governments to respond to climate change-induced risks to development in high-risk areas of the coastal zone.

II. Projected Climate Change Impacts in Connecticut

Anthropogenic emissions of carbon dioxide (CO_2) and other greenhouse gases (GHGs) are widely understood to have resulted in an observable increase in global average temperature over the past 50 years.[9] The Intergovernmental Panel on Climate Change's 2007 *Synthesis Report Summary for Policymakers* states that "[m]ost of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations" and that human influences have:

- *Very likely* contributed to sea level rise during the latter half of the 20th century;
- *Likely* contributed to changes in wind patterns, affecting extra-tropical storm tracks and temperature patterns;
- *Likely* increased temperatures of extreme hot nights, cold nights and cold days; and
- *More likely than not* increased risk of heat waves, area affected by drought since the 1970s, and frequency of heavy precipitation events."[10]

A number of agencies and highly respected climate scientists also warn about "dangerous interference with climate"[11] and inevitable and potentially "unpleasant surprises."[12]

In Connecticut and southern New England, global warming and its effects on climate are likely to result in:

- **Rising sea levels, which will be amplified by land subsidence**. Rising sea level is likely to result in loss of coastal property related to inundation, erosion, and storm surge; saltwater intrusion into drinking water supplies and septic fields; tidally driven surcharge into

[9] IPCC, *supra* note 3, at 51.

[10] *Id. See also* U.S. ENVTL. PROT. AGENCY, CLIMATE CHANGE INDICATORS IN THE UNITED STATES 4-7 (2010) (The EPA reports measurable effects of anthropogenic greenhouse gas emissions on U.S. and global temperature extremes including heat waves, drought and precipitation; sea surface temperature and sea level rise, snow cover; and change in growing season).

[11] James Hansen et al., *Dangerous Human-Made Interference with Climate: A GISS Model E Study*, 7 ATMOSPHERIC CHEMISTRY & PHYSICS 2287 (2007); *see also* James Hansen, *Game Over for the Climate*, N. Y. TIMES, May 9, 2012, http://www.nytimes.com/2012/05/10/opinion/game-over-for-the-climate.html; William Anderegg et al., *Expert Credibility in Climate Change*, 107 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. 12107 (2010).

[12] Wallace Broecker, *Unpleasant Surprises in the Greenhouse?,* 328 NATURE 123 (1987).

municipal wastewater treatment systems and other water quality problems; and loss of barrier beaches, coastal dunes, tidal wetlands and their associated ecological services.[13]

- **Increased frequency of coastal storms and extreme weather events**. Increased frequency of extreme weather events is likely to result in coastal erosion, loss of barrier beaches, dunes, dune buffers, and wetlands; wind and flood damage to public and private structures in floodplains; contamination of drinking water supplies; and coastal water quality problems related to untreated wastewater and storm runoff.[14]

- **Increased air and water temperature resulting in increased frequency and duration of precipitation and droughts**. These hydrologic changes are likely to drive warmer winters, more days over 100°F, higher fire risk, and shifting plant and animal phenology that will cause public health, economic, environmental and ecological problems.[15] Increased frequency and/or intensity of rain or snow events will result in increased risk of flooding, erosion and environmental problems related to storm runoff.

These effects, combined with the expectation that climate change will accelerate until GHG emissions stabilize and are mitigated,[16] will likely lead to repetitive losses of private property and infrastructure—especially in littoral and riparian floodplains where development and population are concentrated. Although Long Island physically shields most of Connecticut's shoreline from strong coastal storms, an estimated five million people in New York and Connecticut currently live within 15 miles of the Long Island coastline and associated river systems and are therefore potentially at risk of coastal inundation and flooding.[17] The non-profit, non-partisan *Climate Central Project* reports that over 8,000 Connecticut homes currently lie less than one foot above sea level, which puts them at over a 15% risk of flooding by inundation or storm surge by 2020 based on conservative estimates of sea level rise.[18]

The population in Connecticut that is actually at risk may be significantly larger, however, than *Climate Central*'s estimate for several important reasons:

- The best available U.S. Geological Survey (USGS) maps of elevation above sea level for Connecticut are based on digital elevation models, which are "frequently inaccurate" and generate maps at 10-foot contours (+/– 5 feet).[19] Reliance on these maps to identify the properties that lie at one foot above sea level could seriously underestimate the risk of exposure to inundation or storm surge-based flooding. In the absence of more accurate LIDAR maps or Federal Emergency Management Agency (FEMA) Flood Insurance Rate

[13] FRUMHOFF ET AL., *supra* note 3, at 19.
[14] *Id.*
[15] *Id.*; NAT'L ACAD. OF SCI., ADVANCING THE SCIENCE OF CLIMATE CHANGE: SEA LEVEL RISE AND THE COASTAL ENVIRONMENT 235 (2010) [hereinafter ADVANCING THE SCIENCE OF CLIMATE CHANGE]; *See* CONN. DEP'T OF ENVTL PROT., COASTAL HAZARDS IN CONNECTICUT: THE STATE OF KNOWLEDGE AND MANAGEMENT IN 2009 38 (2010). Readers may also refer to Connecticut's Official Climate Change Website for updated information and reports on Connecticut's response to climate change.
[16] IPCC, *supra* note 3, at 51.
[17] KATZ GENOVA, *supra* note 6, at 5.
[18] BEN STRAUSS ET AL., SEA LEVEL RISE, STORMS & GLOBAL WARMING: A CLIMATE CENTRAL REPORT 6 (2012); *See* Climate Central, Surging Seas: Connecticut, http://sealevel.climatecentral.org/surgingseas/place/states/CT (last visited June 27, 2012) for additional maps and related information.
[19] KATZ GENOVA, *supra* note 6, at 9.

Maps (FIRMs), the U.S. Environmental Protection Agency's 2007 study mapped all properties within 1,000 feet of the shore to approximate the 500-year floodplain.[20]

- King tides or extratidal high water events – where the daily high tide exceeds the highest predicted high tide – are occurring more frequently. This is happening in part because the National Oceanic and Atmospheric Administration's (NOAA) long-term mean sea level (MSL) predictions are based on tidal averages for the 19-year period from 1983 through 2001,[21] which do not reflect *actual* sea level or the current trend in the rate of sea level rise. NOAA uses a running monthly mean of actual sea level to partly correct for this[22] but the risk of erosion and flooding of coastal properties may be underestimated to the extent that regulators rely on NOAA's long term record of Mean High Water (MHW) to govern development in the coastal zone.

- The IPCC projected that global average sea level could rise 0.2 to 0.6 meters (0.6 to 1.9 feet) above present by 2100.[23] However the U.S. National Academy of Science (NAS) reports that sea level could rise by 0.6 to 1.6 meters (1.9 to over 5 feet) by 2100[24] based on the observed rate of ice melt from the Greenland ice shelf and the Antarctic.[25] Using climate change scenarios published by the New York Panel on Climate Change (NPCC) and the Northeast Climate Impacts Assessment (NECIA),[26] the Adaptation Subcommittee to Governor Malloy's Steering Committee on Climate Change estimated that sea level could rise along Connecticut's coast by 1.04 to 1.4 meters (3.4 to 4.6 feet) by 2100 under the "rapid ice melt" scenario.[27] (See Figure 1, which presents projected trends in sea level rise in Bridgeport and New London based on current low and high GHG emissions scenarios, relative to the background rate of sea level rise).[28]

- Flood heights related to inundation and storm surge could range from 10 to 15 feet above the observed MHW in Connecticut by 2020 depending on location and category of storm.[29] In addition, the 2007 Northeast Climate Impacts Assessment study projected that the

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[20] *Id*.
[21] Va. Inst. of Marine Sci., Extratidal Water Levels, http://www.vims.edu/bayinfo/tidewatch/background/index.php (last visited July 1, 2012).
[22] *Id*.
[23] IPCC, *supra* note 3, at 51.
[24] ADVANCING THE SCIENCE OF CLIMATE CHANGE, *supra* note 15, at 7-10.
[25] NASA, *Arctic Sea Ice Continues Decline, Hits 2nd-Lowest Level,* Oct. 4, 2011, http://www.nasa.gov/topics/earth/features/2011-ice-min.html (last visited July 1, 2012); NASA, *Is Antarctica Melting?*, Jan. 12, 2010, http://www.nasa.gov/topics/earth/features/20100108_Is_Antarctica_Melting.html (last visited July 1, 2012).
[26] *See* ADAPTATION SUBCOMM. TO THE CONN. GOVERNOR'S STEERING COMM. ON CLIMATE CHANGE, THE IMPACTS OF CLIMATE CHANGE ON CONNECTICUT AGRICULTURE, INFRASTRUCTURE, NATURAL RESOURCES, AND PUBLIC HEALTH 2 (2010) [hereinafter ADAPTATION SUBCOMMITTEE REPORT.] (The Subcommittee on Adaptation was established to advise the Governor's Steering Committee on Climate Change pursuant to Connecticut's Global Warming Solutions Act (2008 Conn. Pub. Acts No. 08-98, § 7)).
[27] *Id*. at 8.
[28] ADVANCING THE SCIENCE OF CLIMATE CHANGE, *supra* note 15, at 235.
[29] VIVIEN GORNITZ ET AL., ENVTL DEF. FUND, BRACING FOR CLIMATE CHANGE IN THE CONSTITUTION STATE: WHAT CONNECTICUT COULD FACE 22 (2004); TONY DUTZIK & NATHAN WILCOX, ENVTL CONN. RESEARCH & POLICY CTR., GLOBAL WARMING AND EXTREME WEATHER: THE SCIENCE, FORECAST, AND THE IMPACTS ON AMERICA 8 (2010).

current 100-year flood and 100-year coastal flood will occur in Connecticut every 56 to 61 years and every 32 years, respectively, as a result of global warming-induced changes in the hydrological cycle.[30]

- The FEMA National Flood Insurance Program (NFIP) uses "statistical analyses of records of river-flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses" to map the areal extent of historical 100-year floods or Special Flood Hazard Areas (SFHAs) where there is at least a 1 in 4 chance of flooding during a 30-year mortgage.[31] The SFHAs, or "A-zones," and areas at risk from high velocity waves due to storm surge (V-zones) are then mapped on the FIRMs showing the risk premiums for each zone.[32] However, the FIRMs are likely to misrepresent the risk of flooding to the extent they rely on historically averaged USGS, NOAA, or Meteorological Service data instead of digital and/or ground-truthed data as noted above. More importantly, many of the FIRMs seriously underestimate the risks of inundation and storm surge flooding since they "fail to incorporate information about future development, coastal erosion, inundation zones above and below dams, or climate change,"[33] including the projected frequency of the 100 year flood based on climate change.

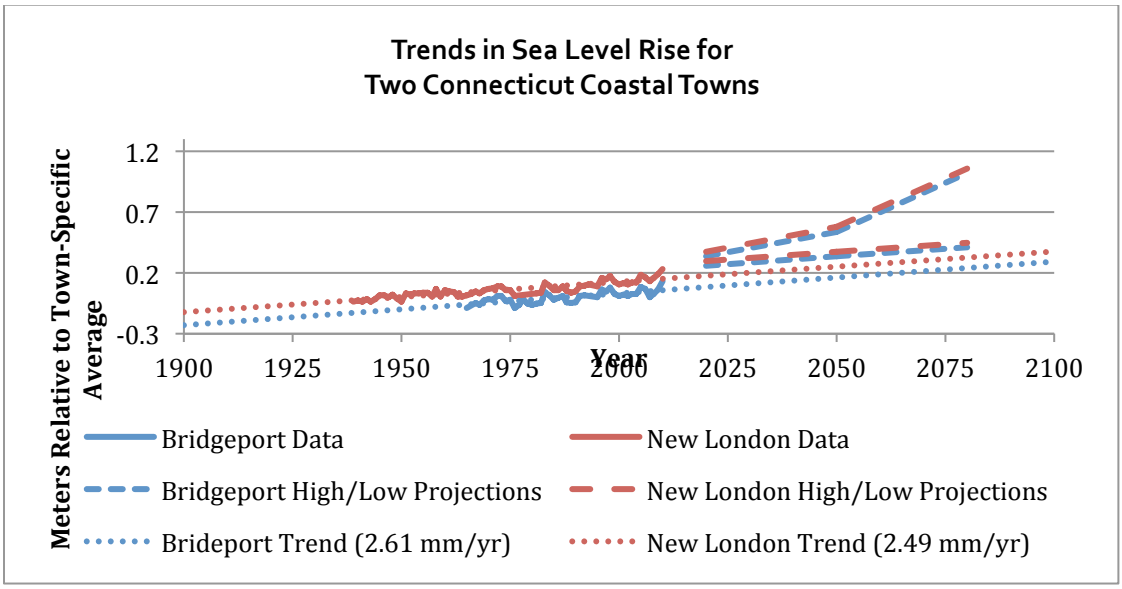

Fig. 1: Trends in Sea Level Rise for Bridgeport and New London, Connecticut.[34]

[30] FRUMHOFF ET AL., *supra* note 3, at 19.

[31] FloodSmart.gov, Defining Flood Risks, http://www.floodsmart.gov/floodsmart/pages/flooding_flood_risks/defining_flood_risks.jsp (last visited July 1, 2012).

[32] FEMA, Flood Insurance Rate Maps, http://www.fema.gov/hazard/map/firm.shtm (last visited July 1, 2012) (The SFHA or "A zone" is defined as an area subject to inundation by a flood that has a ≥1% chance of being equaled or exceeded during any given year. A "base flood" has a 26% chance of occurring during a 30-year period…the length of many mortgages. A "V zone" is in the 100-year flood zone with additional risk due to high-velocity waves associated with storm surge.).

[33] WILL HEWES & ANDREW FAHLUND, AMERICAN RIVERS, WEATHERING CHANGE: POLICY REFORMS THAT COST LESS AND MAKE COMMUNITIES SAFER 3 (2011).

[34] *See* Permanent Service for Mean Sea Level, http://www.psmsl.org/ (last visited July 1, 2012) (Sea level data for Bridgeport and New London were obtained from psmsl.org, which is overseen by National Oceanography Centre

In addition, there is compelling empirical evidence that Connecticut should use a precautionary approach to estimate the population exposed to erosion and flooding risk based on the number of properties that *actually* suffered flood damage from the March 2010 floods[35] and Tropical Storm Irene,[36] noting that the population living in Connecticut's coastal zone is predicted to increase by 15% to 20% by 2020.[37] More specifically, note that an estimated 66 percent of the 387,813 properties in Long Island, New York were actually at risk of storm surge-related flooding during Topical Storm Irene although they were not located in a SFHA.[38] In Bridgeport, Connecticut, 45% of the Town's properties were actually at risk of flooding from Hurricane Irene although they were not located in a SFHA.[39]

In sum, climate-related disasters are likely to become increasingly destructive and increasingly expensive for coastal states because of increased development, population density, and embedded wealth in the coastal zone.[40] Although no trend can be inferred from two consecutive years, twelve natural disasters costing over $1 billion each occurred in the United States in 2011, which represents a 30% increase over similar events in 2010.[41] Lloyd's of London and Risk Management Solutions, Inc. recently predicted that insurable flood losses along the Gulf and Atlantic coastlines would increase 80% by 2030 with a one-foot rise in the sea level.[42]

The economic consequences for Connecticut and other coastal states are potentially extremely serious. Tropical Storm Irene, which was *one* of Connecticut's three federally declared disasters in 2011, cost the State at least $235 million[43] or over $65 per person—far higher than the $4.56 per person reported in FEMA's Preliminary Damage Assessment.[44] Since there are only 40,000 NFIP policies in

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(NOC), which is a component of the UK Natural Environment Research Council (NERC). Additionally, plotted values are relative to the most recent Mean Sea Level data, a methodology used by NOAA); *See* GORNITZ ET AL., *supra* note 29, at 6 (Projections for both cities were based on general predictions of sea level rise for Connecticut from this paper).

[35] *See* THE ASSOCIATED PRESS, *CT Flood Victims Facing Tuesday Deadline*, Jul. 25, 2010 (Over 3,600 people had filed flood-related claims with FEMA related to the March 2010 storms as of July 25, 2010, and over $4 million had been disbursed for home repairs and temporary housing. Governor J. Rell's office reported that only 7% of residents reporting damage were fully insured).

[36] Matthew Sturdevant, *The CT Claims Tally For Irene: $235M*, HARTFORD COURANT, May 25, 2012 (Over 60,000 claims were reportedly filed for damage related to Hurricane Irene as of May 2012 according to the Connecticut Insurance Agency).

[37] KATZ GENOVA, *supra* note 6, at 5.

[38] CoreLogic, *Hurricane Irene - Flood Risks Outside FEMA High-Risk Flood Zones*, http://www.corelogic.com/landing-pages/hurricane-irene-flood-risks-outside-fema-high-risk-flood-zones.aspx (last visited July 1, 2012).

[39] *Id.*

[40] *See* U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES: 2012 33 (2012) (Refer to Table 25: Population in Coastal Counties 1980 to 2010, which reports that 48% of the U.S. population currently lives in a coastal watershed county as of the 2010 census and that almost 50% of the nation's gross domestic product ($4.5 trillion in 2000) is generated in these Gulf and Atlantic coastal areas)

[41] HOMELAND SECURITY NEWS WIRE, *2011: Costliest Ever Year for Earthquakes, Weather-related Disasters*, Jan. 19, 2012, http://www.homelandsecuritynewswire.com/dr20120119-2011-costliest-ever-year-for-earthquakes-weatherrelated-disasters.

[42] LLOYD'S OF LONDON AND RISK MANAGEMENT SOLUTIONS, COASTAL COMMUNITIES AND CLIMATE CHANGE: MAINTAINING INSURABILITY (2008).

[43] Sturdevant, *supra* note 36.

[44] FEMA, PRELIMINARY DAMAGE ASSESSMENT, CONNECTICUT—TROPICAL STORM IRENE, FEMA 4023-DR (2011).

Connecticut[45] based on 2010 data, a significant portion of the State's flood-related losses was probably uninsured. In fact, Governor Malloy's Two Storm Panel estimated that Tropical Storm Irene in August 2011 and the Halloween Nor'easter eight weeks later in October 2011 could cost the State over $1 billion including the cost of underwriting uninsured losses.[46] Considering the damage associated with these two storms – which earned the State the dubious distinction of being ranked eighth of "the top ten states ravaged by extreme weather in 2011"[47] – it is important to note that FEMA estimated that a 100-year storm in Connecticut could result in almost $19 billion in property losses and business interruptions associated with just the 32,000 properties located in SFHAs.[48] The Adaptation Subcommittee to the Governor of Connecticut's Steering Committee on Climate Change recognized that "the FEMA HAZUS analysis does not take into account the climate change-induced, synergistic effects of increased groundwater tables and sea level rise on future flooding, which could increase the 100-year flood property losses and business interruptions."[49]

Although Connecticut's economic exposure to climate change-related risks in the coastal zone may be large,[50] Connecticut's *vulnerability* and *resilience* depend on a variety of linked environmental, structural, social, and institutional factors that vary across space and time[51] Connecticut is well

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[45] EQECAT, INC., *Hurricane Irene Loss Estimate: A Closer Look*, Sept. 13, 2010, http://www.eqecat.com/catwatch/hurricane-irene-loss-estimate-closer-look-2011-09-13/. Note that NOAA reports that Connecticut had 22,885 NFIP-insured properties as of 2010. *See* NOAA, State of the Coast, *Federally Insured Assets Along the Coast,* http://stateofthecoast.noaa.gov/insurance/welcome.html (last visited July 1, 2010).

[46] EQECAT, *supra* note 45.

[47] CLIMATE CENTRAL, *Texas Top 10 States Ravaged by Extreme Weather in 2011*, Dec. 20, 2011, http://www.climatecentral.org/news/top-ten-states-hit-hardest-by-2011s-extreme-weather/; JOE MCGEE ET AL., REPORT OF THE TWO STORM PANEL PRESENTED TO: GOVERNOR DANNEL P. MALLOY 3 (2012) [hereinafter REPORT OF THE TWO STORM PANEL.]

[48] *Adaptation Subcommittee Report*, *supra* note 26, at 18; *See* Benjamin Strauss et al., *Tidally Adjusted Estimates of Topographic Vulnerability to Sea Level Rise and Flooding for the Contiguous United States*, 7 ENVTL. RES. LETTERS 021001 (2012). (Authors conservatively estimate that almost 12,000 housing units are currently located less than one meter above local mean high water in Connecticut, which ranks the State at 12th in the U.S. in terms of population at risk).

[49] ADAPTATION SUBCOMMITTEE REPORT, *supra* note 26, at 18.

[50] *Id.*; Surging Seas, *supra* note 18; Hewes & Fahlund, *supra* note 33. *See* James Titus & Charlie Richman, *Maps of Lands Vulnerable to Sea Level Rise: Modeled Elevations Along the U.S. Atlantic and Gulf Coasts*, 18 CLIMATE RESEARCH 205 (2001) for more information regarding the possible impacts of climate change on Connecticut in terms of public health, the economy, agriculture, and the environment.

[51] *See* W. Neil Adger et al., *Social-Ecological Resilience to Coastal Disasters*, 309 SCI. 1036 (2005) ("Resilience means the capacity of linked social-ecological systems to absorb recurrent disturbances so as to retain essential structures, processes and feedbacks… Hazards in coastal areas often become disasters through erosion of resilience"). Physiographic or environmental factors include but are not limited to elevation above sea level, river drainage and geomorphology, angle of exposure to wind and tides, wetlands protection, vegetative buffering of littoral and riparian areas, and habitat and biological diversity. Structural factors include but are not limited to land use/land cover, amount of impervious surface and the extent and type of coastal armoring and its effects on erosion and accretion. Some social factors that affect resilience include population density, demographics, economic and livelihood diversity, recognition of ecosystem services provided by the natural environment and the public's attitudes toward land use regulation, allocation of risk and distributional equity. (*See* Neil Adger et al., *Are There Social Limits to Adaptation to Climate Change?* 9 CLIMATIC CHANGE 335 (2009) for discussion of the roles that values, knowledge, risk perception and culture play in adaptability). Institutional factors, which are the focus of this paper, include but are not limited to public/private investment in mitigation and adaptation; existence of legal and market-based incentives that promote reduction of risk; and ability of public and private institutions to interact to govern human activities and protect human, social, manmade and natural capital and ecosystem services.

positioned to address some aspects of its exposure to climate change-related risk but it is vulnerable in some key respects—as are most societies. By way of illustration, the Two Storm Panel reported that over 750,000 residents lost power during Tropical Storm Irene in August 2011 and 880,000 lost power eight weeks later during the Halloween Nor'easter in October 2011, some for over two weeks. [52]

Connecticut is also vulnerable in terms of its pattern of development in the coastal zone and the extent to which Connecticut business and property owners protect themselves against foreseeable climate change related risk. For instance, Connecticut ranks 8th among the 23 coastal states in the contiguous U.S. in terms of absolute population living at or close to sea level.[53] However the State ranks 5th among the 23 coastal states in terms of population density located less than one vertical meter above sea level.[54] Urbanization and congestion greatly affect vulnerability in terms of emergency response and ability to escape. Cities and towns may also experience more extreme physical damage due to loss of natural coastal ecosystems, shoreline engineering, and the close proximity of many structures and associated infrastructure.[55] Demographics and socio-economic status also affect the State's ability to respond to and recover from risk. For instance, 23% of the State's 2010 population currently lives in coastal floodplains, 9% of which lives at or below the poverty level.[56] However, there are over 9,000 people per square mile in Bridgeport and 4,900 people per square mile in New London, 21% and 17% of whom live at or below the federal poverty level, respectively,[57] compared to a population density of approximately 1,000 people per square mile in the Long Island Sound watershed as a whole.[58] Poverty, owner occupancy, and cultural differences regarding perception of risk can affect investment in risk avoidance, and language barriers can complicate emergency response efforts.[59]

Connecticut is also vulnerable to the extent that property owners do not comply with the NFIP's mandatory insurance requirement and/or do not self-insure against flooding and other potential extreme climate and weather-related risks that are not covered by standard homeowners' insurance policies.[60] A 2006 study indicated that approximately 49% of single-family homes located in SFHAs carried mandatory flood insurance compared to 1% of properties outside of SFHAs,[61] which leaves the property owner and the state and federal governments to absorb uninsured losses. Connecticut is vulnerable as well to repetitive loss properties (RLPs) because of historic settlement patterns on coastal

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[52] REPORT OF THE TWO STORM PANEL, *supra* note 47, at 3.

[53] Strauss et al., *supra* note 48, at 10.

[54] *Id.* at 11. (*See* Table A.5 *Coastal state dry land population density within various TIDEL intervals:* 716 (CT) comp. to 1811 (NY) people per km^2 between 0-1 m above sea level.).

[55] William Donner & Havidán Rodríguez, *Population Composition, Migration and Inequality: The Influence of Demographic Changes on Disaster Risk and Vulnerability*, 87 SOCIAL FORCES 1094 (2011).

[56] NOAA, STATE OF THE COAST: POPULATION IN COASTAL FLOODPLAINS 1970-2010 (2011). *See* BEN WISNER.ET AL., AT RISK: NATURAL HAZARDS, PEOPLE'S VULNERABILITY AND DISASTERS 11 (2d. ed. 2004)

[57] U.S. Census Bureau, State & County QuickFacts, http://quickfacts.census.gov/qfd/index.html (last visited July 10, 2012).

[58] NOAA, POPULATION TRENDS ALONG THE COASTAL UNITED STATES: 1980-2008, 24 fig. 20 (2008).

[59] Donner & Rodríguez, *supra* note 55.

[60] FloodSmart.gov, When Insurance is Required, http://www.floodsmart.gov/floodsmart/pages/about/when_insurance_is_required.jsp (last visited June 27, 2012) (The NFIP requires homes and buildings located in SFHAs that have mortgages from federally regulated or insured lenders to carry federal flood insurance. The NFIP also strongly recommends flood insurance to owners and renters who live outside FEMA-designated SFHAs because they "file over 20% of NFIP claims and receive one-third of disaster assistance for flooding.")

[61] RAWLE O. KING, CONG. RES. SERV., NATIONAL FLOOD INSURANCE PROGRAM: BACKGROUND, CHALLENGES, AND FINANCIAL STATUS 10, 19 (2011).

and riparian floodplains prior to 1974.[62] Nationally, RLPs represent 1% of the properties located in SFHAs but over a third of the claims paid,[63] 90 percent of which were built before 1974 and therefore receive insurance premium discounts and are also exempt from the NFIP's floodplain management standards.[64] Although mandatory insurance has not worked very well in terms of reaching the regulated community for various reasons,[65] the existence of federal flood insurance and federally subsidized disaster assistance may also have the perverse effect of encouraging development in high flood and erosion hazard areas by subsidizing the cost of flood insurance and grandfathering in properties that are exempt from flood management plans.[66] Similarly, federal disaster assistance may create a *charity hazard* to the extent it indemnifies property owners' uninsured losses and fails to promote internalization of risk.[67]

There is compelling evidence that the business community is not well prepared for this future either. For example, New Haven's railroad station and airport, as well as many of Bridgeport's bridges, turnpike interchanges, sewage disposal plants, and oil tanks lie in high-risk flood zones.[68] In addition, a 2007 survey of Connecticut businesses conducted by the Ad Council found that among 100 businesses with 2-999 employees, 91% said it was important to take steps to prepare for disasters, while only 38% actually had a disaster management plan in place.[69]

III. Preparing for Climate Change in the Coastal Zone

This section presents a framework to describe a spectrum of policy options to enable Connecticut to prepare for some of the most probable and severe consequences of extreme climate- and weather-related risks based on its recent experience from the March 2010 flood, Tropical Storm Irene, and the two winter storms of 2011. This analysis of policy options assumes that climate change-related acceleration in sea level rise and increasing frequency of extreme storm events will occur and are likely to result in:

- Increased number of properties exposed to tide and storm-related flooding, erosion and wind and water damage;
- Increased pressure on natural coastal features such as wetlands, barrier beaches, and dunes that currently protect man-made structures and provide important provisioning, supporting, regulating, and cultural ecosystem services; and

[62] Connecticut had 1,467 RLPs responsible for 4,384 claims totaling over $50 million as of January 2011. *See id.* at Appendix A.
[63] *Id.* at 17-18. (*See also* NOAA, *supra* note 45, reporting that Connecticut's total claim payouts from 1978 to 2010 were $87,187,779. If true, the RLPs represent over 57% of paid claims during this period.)
[64] *Id*.
[65] *Id.* at 13-14. Many property owners who are actually at risk do not carry flood insurance for various reasons including the cost of premiums, lack of knowledge, or optimism about their exposure to risk and/or the moral hazard created by the NFIP. A moral hazard exists to the extent that federal assistance lowers the incentive to avoid risk. *Id.* at 14-16.
[66] JAMES TITUS, COASTAL SENSITIVITY TO SEA-LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 163-176 (James Titus, ed. 2009). *See also*, SmarterSafer Coalition, http://www.smartersafer.org/ (last visited July 10, 2012).
[67] *See* Craig E. Landry & Mohammad R. Jahan-Parvar, *Flood Insurance Coverage in the Coastal Zone*, 78 J. RISK & INS. 361, 364 (2011). A *charity hazard* exists to the extent that un- and under-insured property owners in high hazard areas rely on federal and state governments to rescue them in the event of a disaster.
[68] GORNITZ ET AL., *supra* note 30, at 28.
[69] *Id*.

- Increasingly serious social, economic and ecological consequences resulting from cost of repair/replacement of critical coastal infrastructure including drinking water, wastewater and transportation systems.

Federal, state, and local governments have ample legal authority to address these climate-related impacts on the coast, especially to the extent that they threaten human security interests. The federal government has several independent bases of Constitutional authority to respond to or act in a precautionary and preemptive manner to protect U.S. citizens and territory from potentially catastrophic results of climate change on the nation's coasts. For instance, the Preamble to the U.S. Constitution establishes the current form of federal government in order to "insure domestic Tranquility, provide for the common defense, promote the general Welfare, and secure the Blessings of Liberty to ourselves and our Posterity."[70]

The Constitution elaborates on this authority in Article I, sec. 8, which assigns Congress broad, though not unlimited and frequently contested, authority "to regulate commerce … among the several States" and "[t]o make all Laws which shall be necessary and proper" to execute its enumerated powers.[71] The Commerce Clause is considered to be the source of the navigational servitude, which assigns to the federal government the exclusive authority to regulate the navigable waters of the United States in the interest of regulating the "channels" of commerce.[72] The federal government's authority over navigability under the Rivers and Harbors Act is understood to include "flood protection, watershed development, recovery of the cost of improvements through utilization of power … [Its] authority is as broad as the needs of commerce."[73] In addition, the Commerce Clause, in combination with the "necessary and proper" clause, is the source of Congress' authority to enact most of the nation's public health-related, environmental laws, such as the federal Clean Water, Safe Drinking Water, Clean Air, and Endangered Species Acts, as well as the Federal Emergency Management Act and the National Flood Insurance Program, which already do and will continue to affect development in coastal and riparian floodplains.

The federal government is actively pursuing a wide range of GHG mitigation and climate change adaptation measures even in the absence of effective federal climate legislation – both because and in spite of recent climate change-related litigation.[74] Some of these measures are likely to affect Connecticut's efforts to address the projected effects of climate change on the State's coastal and

[70] U.S. CONST. pmbl.

[71] U.S. CONST. art. I §8.

[72] Gibbons v. Ogden, 22 U.S. 1 (1824). *See* PPL Montana, LLC v. Montana, 132 S. Ct. 1215 (2012) for clarification of the sources and extent of federal and state claims to navigable waters and submerged lands. The Court takes care to revisit the definition of *navigability*, which "… must be assessed as of the time of statehood, and … concerns the river's usefulness for 'trade and travel,' rather than for other purposes." *Id. at 1233.*

[73] United States v. Appalachian Elec. Power Co., 311 U.S. 377, 426 (1940). Also see PPL Montana, 132 S.Ct. at 1228, 1229, 1233 where the Court cites U.S. v. Appalachian Elec. Power Co. with approval in several instances regarding federal jurisdiction.

[74] *See* Massachusetts v. EPA, 549 U.S. 497 (2007). EPA subsequently issued a finding of "endangerment" under § 202(a) of the Clean Air Act; finalized GHG vehicle emissions standards in collaboration with the National Highway Traffic Safety Administration; and promulgated the *Mandatory Reporting of Greenhouse Gases Rule. See* http://www.epa.gov/climatechange/ (last visited July 10, 2012). *See also* American Electric Power, Co. v. Conn., 131 S.Ct. 2527 (2011); Center for Biological Diversity v. Kempthorne, 607 F.Supp.2d 1078 (D. Ariz. 2009); Comer v. Murphy Oil USA, Inc., 839 F.Supp.2d 849 (S.D. Miss. 2012); Coalition for Responsible Regulation, Inc. v. EPA, 2012 WL 2381955 (D.C. Cir. June 26, 2012), and Native Village of Kivalina v. ExxonMobil Corp., No. 09-17490 (9th Cir. argued 11/28/2011, decision pending) (video of oral argument available at http://www.ca9.uscourts.gov/media/view_video_subpage.php?pk_vid=0000006167).

riparian floodplain. For instance, the White House Council on Environmental Quality currently co-chairs the federal Interagency Climate Change Adaptation Task Force to develop a national strategy on adaptation to climate change and recommend ways in which federal agencies can contribute to adaptation.[75] The Department of Defense is actively engaged in planning related to climate change because of its strategic concerns with respect to national security, its obligations to reduce GHG emissions under various presidential Executive Orders,[76] and its obligations to operate and maintain military installations such as the U.S. Navy, U.S. Army, and Coast Guard facilities in New London, Groton, New Haven, and Milford, Connecticut.[77] In addition, the Department of Homeland Security, which was established by the Homeland Security Act of 2002, now has central responsibility for coordinating the federal response to natural disasters and disaster preparedness,[78] including reducing the nation's vulnerability to climate change-related risk.[79] Similarly, President Obama's Executive Order 13,603 National Defense Resources Preparedness[80] directs federal agencies to identify and be able to mobilize key natural resources, including energy, food, potable water, and water resources, in the interest of national security, and has been construed to assign the federal government broad emergency powers to manage natural resources to protect national security.[81] The federal government has also invested in state and local efforts such as the EPA's Climate-Ready Estuaries and Water Utilities Initiatives[82] to begin to address regional effects of climate change.

The State of Connecticut also has extensive legal authority to protect the public health, safety, welfare, and morals of its citizens using its Tenth Amendment police power jurisdiction, subject to constitutional restraints on state power such as the due process and property clauses of the Fifth

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[75] See Council on Environmental Quality, *Climate Change Adaptation Task Force*, http://www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation (last visited June 27, 2012).

[76] *See* Exec. Order No. 13,514, 74 Fed. Reg. 52,117 (Oct. 8, 2009); *See* Exec. Order No.13,604, 77 Fed. Reg. 18,885 (Mar. 22, 2012).

[77] *See* TASK FORCE CLIMATE CHANGE / OCEANOGRAPHER OF THE NAVY, U.S. NAVY, CLIMATE CHANGE ROADMAP (2010). (One of the U.S. Navy's mid-term goals is to: "address sea level rise impacts on infrastructure and real estate through strategic investments, develop and implement installation adaptation strategies to address water resource challenges, consider impact of climate change on future missions and force structure…" *Id.* at 8.). *See also* WADE SMITH ET AL., NOBLIS, CLIMATE CHANGE PLANNING FOR MILITARY INSTALLATIONS: FINDINGS AND IMPLICATIONS (2010). Smith et al. present observations about the DoD's "potential" vulnerability to extreme tidal and weather events associated with climate change at various bases with respect to military operations, personnel safety, installations and compliance with federal environmental laws on military bases. *Id.* at 35.

[78] Dep't of Homeland Sec., Preparedness, Response & Recovery, http://www.dhs.gov/files/prepresprecovery.shtm (last visited June 27, 2012).

[79] *Id*. *See also* DEP'T OF HOMELAND SEC., DEPARTMENT OF HOMELAND SECURITY STRATEGIC SUSTAINABILITY PERFORMANCE PLAN 19 (2010) which says in relevant part:

> DHS will take a proactive approach in evaluating climate change risks in the planning, design, construction, and renovation of its facilities. DHS will consider the following strategies for addressing and prioritizing considerations involving climate change risks and vulnerabilities: As part of other facility security, vulnerability, and/or condition assessments, include evaluations related to climate change vulnerabilities; Develop a climate change adaptation plan at the Department and Component level; and Address sea level rise in new and existing facility design and renovations. Possible strategies include elevating existing facilities or building with larger setbacks to accommodate the rise.

[80] Exec. Order No. 13,603, 77 Fed. Reg. 16,651 (Mar. 22, 2012).

[81] *See generally* Jim Garrison, *Martial Law by Executive Order*, HUFFINGTON POST, Mar. 21, 2012.

[82] *See* EPA, Climate Ready Estuaries, http://water.epa.gov/type/oceb/cre/index.cfm (last visited June 28, 2012); and EPA, Climate Ready Water Utilities, http://water.epa.gov/infrastructure/watersecurity/climate/ (last visited June 28, 2012).

Amendment.[83] The Connecticut Coastal Management Act (CMA),[84] in combination with other statutory environmental authority, articulate public and private interests in coastal resources and provide a comprehensive approach for planning, managing, and regulating development in the coastal zone. In addition, the State has broad common law authority to protect its citizens' public trust interests in access to water, lands, and natural resources below mean high water, subject to federal regulatory power over navigation.[85] The public trust doctrine may also protect Connecticut's efforts to use beach nourishment to rebuild the lost shoreline without fear of takings claims by littoral owners.[86]

However, Connecticut's cities and towns retain primary responsibility over land use, pursuant to the Home Rule[87] and Zoning Acts,[88] although local jurisdiction is subject to statutory preemption by the State.[89] While responsibility for land use decisions in coastal and riparian floodplains appears to be clearly distributed, it is increasingly well understood that governance of climate change related impacts on the coastal zone will rely less on hierarchical government regulation than on coordinated and cooperative public-private actions at shoreline, floodplain, and watershed scales.[90] Connecticut's acceptance of delegation to conjointly administer a variety of federal environmental laws[91] and its participation in the Long Island Sound National Estuary Program[92] represent two of many examples of

[83] BLACK'S LAW DICTIONARY 1156 (6th ed. 1990).

[84] CONN. GEN. STAT. §§ 22a-90 – 22a-111.

[85] *See* Conn. Dep't of Energy & Envtl. Prot., The Public Trust Doctrine, http://www.ct.gov/dep/cwp/view.asp?A=2705&Q=323792 (last visited July 1, 2012) ("Connecticut's shore belongs to the people ... The general public may freely use these lands and waters, whether they are beach, rocky shore, or open water, for traditional public trust uses such as fishing, shellfishing, boating, sunbathing, or simply walking along the beach. In Connecticut, a line of state Supreme Court cases dating back to the earliest days of the republic confirm that private ownership ends at mean high water line, and that the state holds title to the lands waterward of mean high water, subject to the private rights of littoral or riparian access.") *See also* PPL Montana, 132 S.Ct. at 1235 where the Court distinguishes federal and State jurisdiction as follows:

> Unlike the equal-footing doctrine, however, which is the constitutional foundation for the navigability rule of riverbed title, the public trust doctrine remains a matter of state law, subject as well to the federal power to regulate vessels and navigation under the Commerce Clause and admiralty power... Under accepted principles of federalism, the States retain residual power to determine the scope of the public trust over waters within their borders, while federal law determines riverbed title under the equal-footing doctrine. (internal citations omitted).

[86] Stop the Beach Renourishment, Inc. v. Fla. Dep't. of Envtl. Prot.,130 S. Ct. 2592 (2010). The unanimous Court distinquished between "avulsion" (sudden and perceptible loss or addition of soil) and "accretion" (gradual and imperceptible) and held that the beach nourishment project undertaken by Florida constituted an *avulsive* event that rebuilt the lost shoreline to the former mean high water mark and therefore did not invade any property rights of littoral property owners.

[87] CONN. GEN. STAT. §§ 7-187 - §7-201.

[88] CONN. GEN. STAT. §§ 8-1 - §8-13a.

[89] *See* State of Connecticut, Office of the Attorney General, Opinion No. 2001-022 (Oct. 15 2001) (In the case of conflict, local ordinances are preempted by State statutes that address the same subject matter and where the State has occupied the field).

[90] Elinor Ostrom, *Beyond Markets and States: Polycentric Governance of Complex Economic Systems,* 100 AM. ECON. REV. 3, 1 (2010); Arun Agrawal & Maria Carmen Lemos, *A Greener Revolution in the Making? Environmental Governance in the 21st Century,* 49 ENV 5, 36 (2007).

[91] *See* TRANSTECH MANAGEMENT, INC., DELEGATION OF FEDERAL ENVIRONMENTAL RESPONSIBILITY FOR HIGHWAY PROJECTS (2002) (as an example of the fact that Connecticut has accepted primacy for implementation and enforcement of the environmental provisions of a variety of federal laws, including but not limited to, the Clean Water Act, Clean Air Act, Coastal Zone Management Act, and the Federal Highway Transportation Act).

[92] *See* CONN. GEN. STAT. §22a-90-91(6) ("*The key to improved public management of Connecticut's coastal area is coordination at all levels of government* and consideration by municipalities of the impact of development on both

Connecticut's recognition of the importance of cooperative efforts to promote responsible, precautionary development and use of the coastal zone. In addition, Connecticut has assigned some key coordinating functions to 15 Regional Planning Organizations (RPOs) that could become increasingly important to State efforts to respond to the effects of climate change on coastal communities.[93] These functions include coordinating federally funded transportation and energy projects that affect multiple cities and towns; acting as an information hub with respect to economic, environmental, and social data; and supporting land use planning.[94]

However, in the absence of a consistent national policy regarding adaption to sea level rise and other climate change related risks, the State of Connecticut has three general choices:

(1) Do nothing, i.e., allow interactions between governments, property owners, insurance carriers, and real estate markets to evolve in the face of environmental change.
(2) Protect existing development in high-risk areas via armoring and/or shoreline engineering where retreat appears practicably infeasible or undesirable for strategic, economic, and/or political reasons.
(3) Provide incentives to encourage retreat and/or prohibit (re-)development in areas at high-risk of storm surge or inundation flooding where retreat is expected to better protect public health, safety, and welfare, and to be more cost effective than armoring and shoreline engineering.

The "no action" or "business as usual" approach should always be considered as the baseline case that protects the status quo. Unsurprisingly, governments are often inclined to pursue "laissez-faire" and "technological response" options in order to protect existing property rights, property markets, and large capital investments in coastal and water dependent uses. At the other extreme, coercive regulatory efforts are seldom popular unless there is compelling expert consensus about and public awareness of the exigency of the risk, and agreement about trade-offs between cost-effectiveness (efficiency) and the distributional (equity) effects of proposed solutions which are sufficient to trigger and support political action.[95] The *Report to the Governor on the Two Storms* and Connecticut's Natural Disaster and Hazard Mitigation Plans suggest that the "business as usual" approach is likely to be an increasingly expensive and non-viable alternative and that the destructive floods of 2010, Tropical Storm Irene, and the winter storms of 2011 may have created a political window to support direct policy and regulatory action.

A. The "No Action" or "Business as Usual" Approach

The New York Sea Level Rise Task Force concluded that many federal- and state-funded actions and programs that allow "property owners to rebuild or replace structures in high-risk environments [act to] protect or subsidize high-risk coastal development by shifting the cost of flood protection and

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coastal resources and future water-dependent development opportunities when preparing plans and regulations and reviewing municipal and private development proposals." (emphasis added)) and Long Island Sound Study, About Us, http://longislandsoundstudy.net/about/about-the-study/ (last visited July 10, 2012).

[93] CONN. GEN. STAT. §16a-4a.

[94] Conn. Assoc. of Reg'l Planning Orgs, The Geographic Scope Of Connecticut's Regional Planning, www.hvceo.org/carpo.php (Adopted May 13, 2010).

[95] *See* Nathaniel O. Keohane, et al., *The Choice of Regulatory Instruments in Environmental Policy*, 22 HARV. ENVTL. L. REV. 313 (1998); Lawrence H. Goulder & Ian W. H. Parry, *Instrument Choice in Environmental Policy*, 2 REV. ENVTL. ECON. & POL'Y 152 (2008).

storm recovery from property owners and local governments to state and federal taxpayers."[96] Such programs and actions include the NFIP, state-permitted shoreline armoring projects, and federal and state post-disaster recovery assistance. Moreover, the Task Force found, "These programs distort market forces and favor coastal development. One unintended effect of programs that support development in coastal floodplains will be increased risk of negative impacts from storm surge and inundation due to sea level rise."[97]

Connecticut, like other coastal states, is dependent on the NFIP and, increasingly since March of 2010, federal disaster assistance to help respond to the economic consequences of destructive natural disasters. The NFIP allows coastal communities to participate in the federally subsidized flood insurance program if they adopt the NFIP Flood Insurance Rate Maps (FIRMs) and agree to adopt and enforce floodplain management ordinances, particularly with respect to new construction.[98] The NFIP then requires federally regulated or insured lenders to require property owners who live in SFHAs in participating communities to purchase federal flood insurance.[99] This requirement appears to be poorly enforced.[100] In addition, low premiums which are intended to encourage participation in the NFIP; direct exemptions for properties built before 1974; failure to include other at-risk properties in the insurance pool; and claims on behalf of repetitive loss properties (RPLs) and properties outside the SFHAs, in combination with claims related to Hurricanes Katrina, Rita and Wilma in 2005 are largely responsible for the NFIP's current $17.8 billion debt.[101] Although supplementary private flood insurance is available,[102] few private insurance companies currently consider climate-related catastrophic risks in issuing policies,[103] and the private insurance and re-insurance industries (which insure the property casualty insurance providers) have been raising premiums, declining to renew policies, and denying coverage for coastal residents across the country.[104]

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[96] THE NEW YORK STATE SEA LEVEL RISE TASK FORCE, REPORT TO THE LEGISLATURE 43 (2010).

[97] *Id*.

[98] FEMA, *The National Flood Insurance Program,* http://www.fema.gov/plan/prevent/floodplain/index.shtm (last visited June 29, 2012).

[99] Tropical Storm Irene Preliminary Damage Assessment, *supra* note 44; Erwann Michel-Kerjan & Howard Kunreuther, *Redesigning Flood Insurance*, 333 SCI. 408 (2011).

[100] Landry & Jahan-Parvar, *supra* note 67, at 373. Lenders may be failing their legal obligation under the NFIP to tell mortgagees that federal flood insurance is required. Only 34% of over 6,000 respondents living in SFHAs in this study held a mortgage, and only 12% of these property owners claim they were told that the were required to carry flood insurance.

[101] *See* King, *supra* note 61, and PROPERTY CASUALTY INSURERS ASSOCIATION OF AMERICA (PCIAA), TRUE-MARKET RISK RATES FOR FLOOD INSURANCE 5 (2011) (The PCIAA notes that "NFIP's rate-setting method is very different from that of private insurers. The NFIP bases its rates on its average annual administrative and cash-flow losses for very broadly defined types of flood zones… The NFIP cannot deny insurance to "repetitive loss properties"… It does not purchase reinsurance, impose a catastrophe load, or build up or maintain a surplus to cover unexpectedly large events. The NFIP also does not seek a rate of return for the capital employed in the program nor does it include a tax provision in its rates. Furthermore, NFIP rates cannot be raised beyond an annual maximum of 10%…We conclude that the federal government is providing overall flood insurance at one-half the true-risk cost; specifically, in higher-risk areas, it is providing flood insurance at one-third the true-risk cost").

[102] *See*, e.g., the Russell Agency, which offers quotes for NFIP flood insurance ($250,000 cap on coverage for the dwelling and $100,000 for the contents), as well as quotes for private coverage (up to $5 million for properties that could be rebuilt for ≤$600,000) and excess flood insurance coverage (unlimited cap) (quote on file with author).

[103] SHARLENE LEURIG, CERES, CLIMATE RISK DISCLOSURE BY INSURERS: EVALUATING INSURER RESPONSES TO THE NAIC CLIMATE DISCLOSURE SURVEY 30 (2011).

[104] Sandra S. Nichols & Carl Bruch, *New Frameworks for Managing Dynamic Coasts: Legal and Policy Tools for Adapting U.S. Coastal Zone Management to Climate Change*, 1 SEA GRANT L. & POL'Y J. 19, 21 (2008).; *See* Leurig, *supra* note 103, at 6 (The author found that only 11 of 88 insurance companies surveyed reported having formal

The NFIP is currently up for re-authorization and has been extended through July 31, 2012[105] as the Senate considers the Flood Insurance Reform and Modernization Act of 2011 (S. 1940). If the bill passes, many problems associated with the NFIP will be corrected in terms of mapping high hazard flood risk areas, requiring more complete participation in the insurance pool, obligating lenders to inform borrowers about mandatory flood insurance coverage, limiting insurance liability for repetitive loss properties, and requiring conformance with elevation and building requirements to enable property owners to stay in place.[106] However, the proposal to significantly reduce the amount of funding available to re-build or condemn repetitive loss properties may actually increase the moral hazard problem to the extent that flood insurance is unavailable or unaffordable, or easily affordable but still perceived to be unnecessary. However, this may also provide an incentive for the State to reconsider flood and storm-related insurance policies in Connecticut, especially since the NFIP was recently found to be offering federal flood insurance at premiums that are one-half to one-third of the "true risk" cost.[107]

B. Protect Existing Development Via Armoring and/or Shoreline Engineering

Connecticut, like all coastal states, has invested in a variety of hard and soft shoreline engineering projects to promote and protect coastal development. The State works closely with the U.S. Army Corps of Engineers (USACE) to maintain port access and navigability as well as to engineer and modify the shoreline to protect and promote water-dependent uses; stabilize riverbanks and the shoreline; and prevent beach erosion.[108] The State also authorizes private property owners to undertake structural solutions to stabilize the shoreline, subject to permit requirements.[109] As a consequence of this approach to developing the coast, Titus et al. found that 80% of the dry land within one meter above mean high water has been developed in Connecticut and is either already protected or likely to be protected using a variety of defensive infrastructure projects.[110] Unsurprisingly, federal, state, and local governments as well as utilities are under pressure to rebuild infrastructure and restore services as swiftly as possible following a natural disaster[111] although these public investments signal to property owners that federal and state taxpayers will continue to insulate coastal development from climate change-related risks in high-risk areas.

However, it is becoming more widely understood and accepted that the "stay in place" option using shoreline armoring and flood-proofed construction that can withstand velocity waves and hurricane wave wash[112] can exacerbate coastal erosion; eliminate public trust access to the shoreline, the beach, and sub-tidal lands; and interfere with natural landward migration of barrier beaches, tidal marshes, and associated vegetation as sea level rises.[113] Connecticut's current policy is "to promote nonstructural

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policies with respect to climate change).

[105] *See* National Flood Insurance Program Extension Act, Pub. L. No. 112-123 (2012).

[106] S. 1940, 112th Congress (2012).

[107] PCIAA, *supra* note 101, at 6. *See also*, King, *supra* note 61.

[108] U.S. ARMY CORPS OF ENGINEERS, UPDATE REPORT FOR CONNECTICUT 1 (2012).

[109] CONN. GEN. STAT. §22a-92(b)(2)(F) and (J).

[110] J.Titus, et. al, *State and Local Governments Plan for Development of Most Land Vulnerable to Rising Sea Level along the U.S. Atlantic Coast*. 4 ENVTL. RES. LETT. 5 (2009).

[111] REPORT OF THE TWO STORM PANEL, *supra* note 47, at 14-16 (The Panel recommends studying "infrastructure hardening" including "undergrounding utilities," strengthening poles, and removal of hazardous trees.)

[112] *See* CONN. AGENCIES REGS. § 25-68h-1(a) (Definitions) and § 25-68h-2 (Floodplain management standards).

[113] James Titus & Michael Craghan, *Shore Protection and Retreat*, *in* COASTAL SENSITIVITY TO SEA-LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 87 (James Titus ed., 2009); JON BOOTHROYD, CONGRESSIONAL CAUCUS BRIEFING: UNDERSTANDING COASTAL GEOLOGIC HAZARDS, SEA LEVEL RISE AND CLIMATE CHANGE IN THE NORTHEASTERN U.S. (2009);

solutions to flood and erosion problems except … where structural alternatives prove unavoidable and necessary to protect existing inhabited structures, infrastructural facilities, or water dependent uses … and where there is no feasible, less environmentally damaging alternative."[114] Along these lines, Connecticut and the USACE have undertaken a variety of projects in recent years to restore ecosystem function by removing dams, jetties, and seawalls.[115] In addition, the President's Council on Environmental Quality (CEQ) issued draft guidance pursuant to the Water Resources Development Act of 2007 that directs all federal agencies that oversee water resources. For example, the USACE is to "maximize net national economic, environmental, and social benefits of water resources management; consider monetary and non-monetary benefits; avoid the unwise use of floodplains; and protect and restore natural ecosystems."[116] Therefore it may make sense for planners to observe the evolution of climate adaptation plans at U.S. Navy and Coast Guard installations in Connecticut to the extent they serve as sentinels of the changing federal and state philosophy regarding floodplain management.

In sum, the "business as usual" and "technological response" options clearly tend to support the status quo. Both distribute the cost of increased exposure to catastrophic losses associated with development of the coastal zone to federal, state and local taxpayers for the benefit of private property owners who receive the benefits at a disproportionately small share of the cost associated with the risks of life near the shore — an archetypal tragedy of the commons[117] that could and should be avoided based on the scientific consensus about climate change, the costs of failing to act, and widely accepted notions of fairness.

C. Compel or Provide Incentives to Encourage Retreat

Coastal development is not in itself a nuisance, especially low-density development that strives to minimize negative externalities and protect natural coastal features such as dunes and tidal wetlands and the broad array of non-market ecosystem services associated with them. However, the earliest pattern of development along the Atlantic coast was to occupy land along rivers and close to the shore in the interests of maintaining access to potable water, fisheries and trans-Atlantic commerce.[118] This development trend has resulted in high population density in Connecticut's coastal and riparian floodplains.[119] Unsurprisingly, few people will willingly abandon desirable and valuable properties in the coastal zone, including the floodplains, as long as it remains affordable to stay and there are no compelling reasons to leave. Ultimately however, the State of Connecticut, its municipal governments, taxpayers, and the business community could reasonably conclude that the ongoing incremental and capital costs associated with pursuing "remain in place" policies for properties located in high flood and erosion hazard areas exceed the value of insured coastal property, which was estimated to represent 62% of the State's insured property or $479 billion in 2007 dollars.[120]

Megan Higgins, *Legal and Policy Impacts of Sea Level Rise to Beaches and Coastal Property*, 1 SEA GRANT L. & POL'Y J. 1, 44 (2008).

[114] CONN. GEN. STAT. §22a-92(b)(2)(F) and (J) (2012).

[115] U.S. ARMY CORPS OF ENGINEERS, SECTION 206 PROGRAM - AQUATIC ECOSYSTEM RESTORATION: MILL RIVER AND MILL POND HABITAT RESTORATION PROJECT, STAMFORD, CONNECTICUT 6 (2004).

[116] Council on Environmental Quality, *Principles & Guidelines* in *Updated Principles and Guidelines for Water and Land Related Resources Implementation Studies,* http://www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation (last visited June 29, 2012)

[117] Garret Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

[118] *See* WILLIAM CRONON, CHANGES IN THE LAND: INDIANS, COLONISTS, AND THE ECOLOGY OF NEW ENGLAND (1983).

[119] Strauss, et al., *supra* note 48, at 11.

[120] George Bradner, Presentation to Urban Land Institute Boston Conference: Real Estate & Economic Impacts of Sea Level Rise in Connecticut (Jan. 25, 2012) (*See* slides 88-89 of 139, citing AIR Worldwide.)

The State of Connecticut, its municipal and regional governments, quasi-governmental agencies, and private sector partners have many legal legs to stand on to react to the social, economic and environmental consequences of existing patterns of development in the face of sea level rise. For instance, coastal properties which are damaged by sea level rise and associated inundation and wave–related flooding or extreme climate and weather events may well result in or contribute to failed and exposed septic systems, construction debris, biological and chemical contamination, and physical damage to other public and private properties and infrastructure. These types of externalities may violate federal, state or local laws and cause sufficient harm to public health, safety, and the environment to trigger a regulatory response.

Flood and erosion damage to the built environment can also result in common law public nuisance claims to the extent it results in "unreasonable interference with a right common to the general public"[121] or "violates public rights and produces a common injury."[122] In addition, development in coastal and riparian floodplains that physically interferes with the State's proprietary interests in public uses of the shore below mean high water,[123] or which harms the citizens' "public trust in the air, water and other natural resources of the state of Connecticut" [124] exposes the developer/property owner to whatever legal remedies the Commissioner of the Connecticut Department of Energy and Environmental Protection (CT DEEP) and the Attorney General have at their disposal to protect the State's proprietary and public trust interests in the environment, natural resources, and functioning ecosystems.[125]

The State and its subsidiary governments, however, can also act preemptively and in a precautionary manner to try to anticipate and reduce some of the social, economic, and environmental consequences associated with global warming and climate change while they are still on the horizon. At one extreme, governments and many quasi-public agencies have some constrained authority to purchase or condemn private property in order to accomplish legitimate public purposes [126] (e.g., to build sidewalks or retire Repetitive Loss Properties (RLPs)). At the other extreme, governments can and often do rely on low cost information-based strategies such as public education, public opinion surveys and imploring the public to "do the right thing" (e.g., "Please protect dune vegetation"). Other relevant examples of information-based strategies include requiring property owners to disclose known flooding and erosion risks at the point of sale, and recording flood and flood insurance information in the Land Evidence Records. Governments can also exercise their statutory authority to regulate private use of private property and/or use market-based techniques to signal the state's preferences regarding private behaviors that affect public interests in coastal and riparian floodplains.

Table 1 (below) presents a range of strategies available to Connecticut based on its authority and duty to protect public health, safety, and welfare, including the environment. The strategies shown in Table 1 are organized along a spectrum that suggests when a command and control, market-based, or

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[121] Restatement (Second) Of Torts § 821B(1) (1979).

[122] *See* Richard Faulk, *Public Nuisance: Defining the Tort*, NUISANCELAW.COM, June 29, 2012, citing Ganim v. Smith and Wesson Corp., 780 A.2d 98 (Conn. 2001) ("Thus, water pollution that affects only a few (e.g., fifty or a hundred lower riparian owners) people of their ability to use the water [does] not necessarily become a public nuisance. If the pollution, however, prevents the use of a public beach or causes a large fish kill such that an entire community is affected, it becomes a public nuisance.").

[123] *See* Joseph L. Sax, *Some Unorthodox Thoughts About Rising Sea Levels, Beach Erosion, And Property Rights*, 11 VT. J. ENVTL. L. 641, 643 (2010).

[124] CONN. GEN. STAT. §22a-15 (Declaration of policy).

[125] *Id*. at §§ 22a-6a; 22a-6e; 22a-6b; 22a-16; 22a-18; 22a-19 (Remedies); and 22a-17 (Defenses).

[126] Kelo v. City of New London, 545 U.S. 469, 481 (2005). (The State's authority to *condemn* or "take private property for public use with just compensation" derives from Article I, §11 of the Connecticut Constitution and the 5th Amendment of the U.S. Constitution as applied to the states by the 14th Amendment.)

information-based strategy might be chosen based on perception of risk and competing concerns about exigency, equity, and efficiency. Market-based strategies that allow participants to make individual decisions and trade on their competitive advantages are generally considered to be more efficient than regulatory strategies such as mandatory setbacks and mandatory insurance,[127] which treat all similarly situated regulated property owners the same way (equity). In principle, however, governments will tend to prefer command and control strategies when there is scientific certainty and political consensus about the cause, consequences and urgency of the problem and/or there is an accepted solution that can apply to everyone in the same situation at an acceptable level of administrative effort and cost.[128] Conversely, governments will tend to prefer low cost, information-and market-based strategies that allow individuals to make (informed) choices if the risk is not considered to be urgent, or there is scientific uncertainty and/or lack of political will, or the solutions are unknown and require flexibility and innovation.[129]

Table 1: Examples of (Non) Governmental Options to Motivate Retreat from the Shore.

Equity **Efficiency**

Exigency and Perception of risk

More ←----------→ **Less**

	COMMAND + CONTROL	MARKET: BUY +MAKE	MARKET: TAXES + SUBSIDIES	INFORMATION	
ACQUIRE RLPs and AT-RISK PROPERTY VIA EMINENT DOMAIN	LIMIT ABILITY TO REBUILD AFTER >50% LOSS and LIMIT EXPANSION OF EXISTING AND NEW DEVPT (DOWNZONE, LOT MERGER)	ACQUIRE AND PROTECT BUFFERS VIA PDRs AND EASEMENTS and INCENTIVIZE RELOCATION VIA TDRS	MANDATE MULTI-YEAR RISK- and MARKET-BASED INSURANCE PREMIUMS or PROHIBIT ACCESS TO STATE – SUPPORTED INSURANCE POOL	REQUIRE DISCLOSURE OF FLOOD, INUNDATION AND STORM DAMAGE HISTORY BY SELLERS, REALTORS, BANKS	CLIMATE EDUCATION; LABEL EVACUATION ROUTES
	REQUIRE AND ENFORCE SETBACKS AND BUFFERS *(EROSION CONTROL* AND *ROLLING EASEMENTS)*	LIMIT STATE RESPONSIBILITY FOR REBUILDING PUBLIC INFRA-STRUCTURE AFTER REPETITIVE LOSS	ADOPT RISK-BASED SPECIAL TAX ASSESSMENTS THAT RUN WITH THE LAND and/or OFFER TAX REBATES TO REWARD EROSION CONTROL EASEMENTS	REQUIRE *FIRM* DESIGNATION TO BE RECORDED IN LAND EVIDENCE RECORDS	
	DESIGNATE AND ENFORCE *UNBUILDABLE AREAS*	'HARD' AND 'SOFT' ARMORING; ENGINEER THE SHORELINE	CHARGE FOR "GIVINGS" THAT ALLOW CONTINUED OCCUPATION OF HIGH HAZARD AREAS		

[127] ROBERT N. STAVINS, RESOURCES FOR THE FUTURE, MARKET-BASED ENVIRONMENTAL POLICIES: WHAT CAN WE LEARN FROM U.S. EXPERIENCE (AND RELATED RESEARCH)? 4 (2003); NATIONAL CENTER FOR ENVIRONMENTAL ECONOMICS, U.S. ENVIRONMENTAL PROTECTION AGENCY, THE UNITED STATES' EXPERIENCE WITH ECONOMIC INCENTIVES FOR PROTECTING THE ENVIRONMENT 69 (2001).

[128] *Id.* at 2.

[129] *Id.* at 2-3.

IV. The Legal Implications of Managed Retreat

Coastal states and local governments are likely to be increasingly inclined to encourage retreat from coastal and riparian floodplains—especially in undefended cities and towns, if the projected consequences of global warming and climate change continue to materialize over the next ten to forty years (2020-2050). Therefore the goal of this section is to consider the extent to which the State and local governments are likely to be vulnerable to successful legal claims brought by private property owners pursuant to the Fifth Amendment of the U.S. Constitution and Article I, sec. 11 of the Connecticut Constitution if they choose to pursue increasingly extreme measures to relocate people and public infrastructure out of high flood and erosion hazard areas.

This section presents a user-friendly Fifth Amendment "takings" test based on current Supreme Court jurisprudence (Figure 2) in order to gauge the government's exposure to legal liability for (A) Acquiring or "taking" private property via eminent domain to retire the riskiest properties and establish buffers and easements to protect existing uses of the coastal zone; (B) Regulating development or prohibiting re-development in high flood and erosion hazard areas even if it results in "diminution of value," "loss of investment-backed expectations," or even "loss of all economically beneficial use;" and/or (C) Motivating responsible development and retreat using information- and market-based strategies.

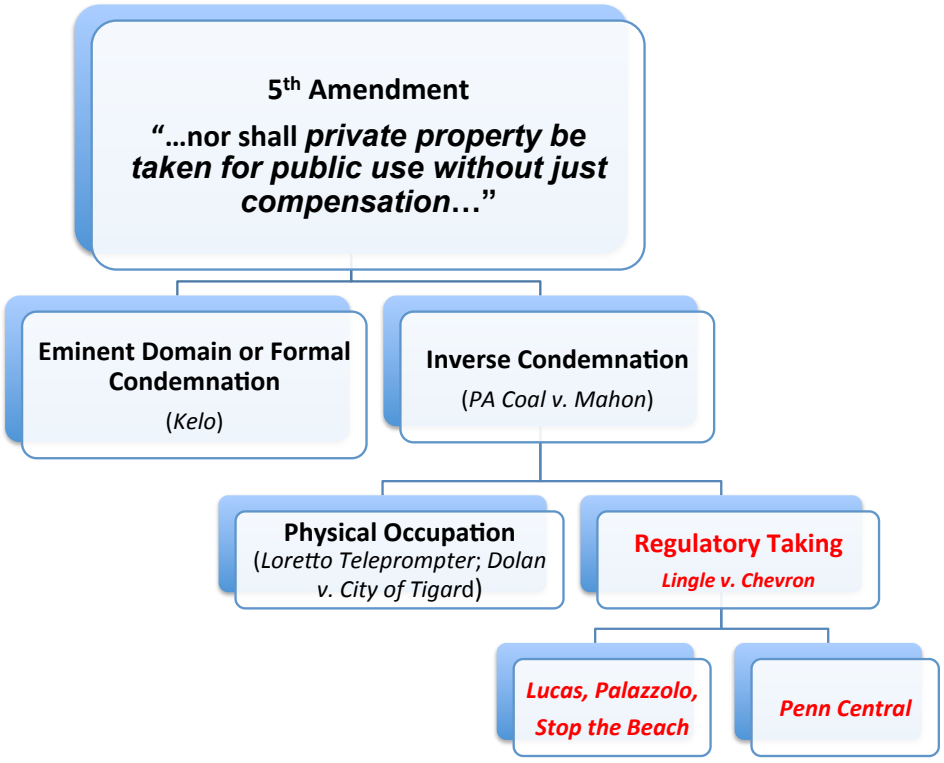

Fig. 2: Diagram of Fifth Amendment Takings Analysis.

A. *"Taking" Private Property by Eminent Domain*

The first question, *Can State and local governments "take" or condemn at-risk private property in*

areas that are currently at high risk of storm surge, inundation, or storm-related damage or that are expected to be at increased risk of climate change-related impacts in the future?, is relatively non-controversial and easy to answer following the U.S. Supreme Court decision in *Kelo v. City of New London*.[130] The Fifth Amendment of the U.S. Constitution, which states "... nor shall private property be taken for public use without just compensation," and Article I, sec. 11 of Connecticut's Constitution[131] plainly authorizes the State to condemn or take private property for a "legitimate public purpose," as long as just compensation is paid. In addition, the Court will ordinarily defer to the government's assessment of whether there is a legitimate public purpose, even if it does not like the transaction—as in *Kelo*, where the New London Development Corporation seized Suzette Kelo's property by eminent domain as part of a very public planning process intended to revitalize the City's waterfront.[132]

It is also important to note that FEMA's Flood Mitigation Assistance program explicitly recognizes condemnation as a legitimate measure to "reduce or eliminate the long-term risk of flood damage to ... structures insured under the National Flood Insurance Program."[133] Thus, these condemnation proceedings are extremely unlikely to trigger successful Fifth Amendment due process or takings challenges by property owners such as Suzette Kelo who do not wish to sell, especially where the State or local government is able to document a history of repetitive loss, or that the property poses an elevated level of risk to life, property, or protected resources because of its location in high flood and erosion hazard areas.[134]

However, condemnation of private property is an extremely expensive and inefficient mechanism to use to protect the State's coastal population, infrastructure, and ecosystems. An estimated 12,000 housing units currently lie less than one meter above local sea level, and at least 32,000 properties are located in the State's 100-year floodplain.[135] Therefore, public funds should be used strategically and opportunistically to work with willing buyers to acquire undeveloped land, distressed properties that are subject to foreclosure, and/or partial estates in land such as development rights and conservation easements. These acquisitions can serve as buffers to protect inland properties and allow natural coastal features, such as barrier beaches, dunes, and tidal wetlands, room to migrate landward.[136]

Since the State can almost certainly condemn and take title to private property to protect public health and safety, a related question is whether the State can compel property owners to sell their

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[130] 545 U.S. 469, 481 (2005).

[131] Conn. Const. Art. I §11.

[132] *See Kelo*, 545 U.S. at 481 (citing Justice Douglas in Berman v. Parker, 348 U.S. 26 (1954) with approval regarding deference to legislative assertions of public purpose:

> We do not sit to determine whether a particular housing project is or is not desirable. The concept of the public welfare is broad and inclusive... The values it represents are spiritual as well as physical, aesthetic as well as monetary. It is within the power of the legislature to determine that the community should be beautiful as well as healthy, spacious as well as clean, well-balanced as well as carefully patrolled. In the present case, the Congress and its authorized agencies have made determinations that take into account a wide variety of values. It is not for us to reappraise them. If those who govern the District of Columbia decide that the Nation's Capital should be beautiful as well as sanitary, there is nothing in the Fifth Amendment that stands in the way.

[133] FEMA, Flood Mitigation Assistance Program, http://www.fema.gov/government/grant/fma/index.shtm (last visited May 2, 2012).

[134] *See, e.g.,* Conn. Dept. of Energy & Envtl. Prot., Coastal Hazards Mapping Tool, http://www.ct.gov/dep/cwp/view.asp?a=2705&q=480782&depNav_GID=2022 (last visited May 2, 2012).

[135] Strauss, et al., *supra* note 21 at 1.

[136] *See* James Titus, *Greenhouse Effect and Coastal Wetland Policy: How Americans Could Abandon an Area the Size of Massachusetts at Minimum Cost,* 15 ENVTL. MGMT. 1, 12 (1991) for strategic approaches to acquiring title in coastal land.

property to the State with the option of leasing it back until the property is declared uninhabitable due to catastrophic damage or changes in the shoreline.[137] This transaction, which has been used in Maine, can help offset the cost of condemnation and seems very likely to be invulnerable to Fifth Amendment claims to the extent the government takes the property for "a legitimate public purpose" and pays "just compensation."[138] In addition, the State and local governments can accept or purchase development rights (PDRs) and conservation, rolling, and/or erosion easements[139] from willing sellers in order to buffer and protect critical coastal habitats and water-dependent uses of the shore. Local governments can promote the use of easements via "land use taxes" or tax exemptions that offer property owners a discounted property tax rate to maintain large tracts of open space and undeveloped land as buffers in high hazard areas, or to allow public access rights to "roll" landward as long as the land is kept in the designated use and serves an identified public purpose.[140]

B. Regulating Development in High Flood and Erosion Hazard Areas in the Coastal Zone

The second question, *Can state governments (or subordinate governments with delegated authority) regulate or prohibit development of property in high flood and erosion hazard areas even if the regulation results in (1) diminution of value, (2) loss of investment-backed expectations, or (3) even loss of all economically beneficial use?,* is more difficult to explain. Briefly, the answer is "yes" to all three questions for reasons articulated below.

Realistically, very few property owners will abandon desirable and valuable properties, even if they are located in high flood and erosion hazard areas, unless or until motivated or obligated to do so. However, the financial consequences of natural disasters for Connecticut are quite serious: the State's estimated insured losses between 2000 and 2009 exceeded $422 million,[141] whereas the State's insured losses for four storms in 2011 was over $594.5 million according to the State's Insurance Commissioner.[142] The Commissioner also cited a report estimating that the State's *insured losses* might be in the vicinity of $4 billion in the event of a Category 3/4 storm hitting New Jersey-New York, southern Connecticut, and Long Island, and that uninsured economic losses in the region might be over $90 billion.[143] As a result, state and local officials might well feel obliged to consider more strictly regulating existing development and/or preventing future development that might be susceptible to repetitive losses in the aftermath of destructive floods. However, government efforts to regulate private use of private property to protect the environment and public interests in natural resources have

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[137] Lisa St. Amand, *Sea Level Rise and Coastal Wetlands: Opportunities for a Peaceful Migration*, 19 BOS. COLL. ENVTL. AFFAIRS L. REV. 1, 3 (1991).

[138] BARBARA VESTAL ET AL., U.S. ENVTL. PROT. AGENCY, ANTICIPATORY PLANNING FOR SEA-LEVEL RISE ALONG THE COAST OF MAINE 5-3 (1995).

[139] *See* Conn. Dep't of Agric., *Farmland Preservation Program*, www.ct.gov/doag/ (last visited June 29, 2012) for a description of PDRs and (agricultural) conservation easements.

[140] *See* Conn. Office of Pol'y and Mgmt. (OPM), *Statutes Governing Property Assessment and Taxation*, http://www.ct.gov/opm/cwp/view.asp?a=2985&q=383128 (last visited June 29, 2012). (OPM issues guidelines for property tax exemptions and prescribes the process for obtaining maritime heritage land classification.

[141] ISO Property Claim Services, *The Financial Effects of Natural Disasters*, http://www.iso.com/insurance/natural-disasters/ (last visited June 29, 2012).

[142] *See* Bradner, *supra* note 120. (Slide 87/139 citing ISO-PCS). The Commissioner indicated that the $594.5 million figure did not include $8.6 million paid by the NFIP for Tropical Storm Irene-related losses. *Id.*

[143] *Id*. (Slide 90/139 citing AIR Worldwide.)

been increasingly subject to Fifth Amendment "regulatory takings" challenges[144] since the 1970s. These challenges, which are "fundamentally conflicts over legal transitions,"[145] have often had a "chilling effect" on government efforts intended to guide the location, type, and intensity of land use and development.

Therefore the basic underlying question is, to what extent can governments regulate private uses of private property that cause harm to public health, safety or welfare? Several U.S. Supreme Court cases frame the drift of the Court's thoughts about Fifth Amendment "regulatory takings" claims with respect to land use regulation. First and foremost, a long line of cases beginning with *Mugler v. Kansas* in 1887 has held that "all property in this country is held under the implied obligation that the owner's use of it shall not be injurious to the community."[146] The public nuisance limit on private use of private property is absolute – governments may continue to enact and enforce laws that prohibit injurious uses of private property, even if those laws reduce the value of the property.[147] Similarly, the Court has upheld municipal zoning as a legitimate exercise of police power since *Euclid v. Ambler,* even if it reduces the value of private property.[148] Justice Holmes, writing for the majority in *Pennsylvania Coal v. Mahon* (1922), agreed that, "[g]overnment hardly could go on if to some extent values incident to property could not be diminished without paying for every such change in the general law. As long recognized, some values are enjoyed under an implied limitation and must yield to the police power."[149] However, Justice Holmes went on to say,

> But obviously the implied limitation must have its limits or the contract and due process clauses are gone. One fact for consideration in determining such limits is the extent of the diminution… The general rule … is that *while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking*.[150]

The Supreme Court has returned to the question of what constitutes a *regulatory taking* of private property many times since Congress passed the first wave of environmental laws in the early 1970s. Therefore, a step-wise articulation of the current Fifth Amendment regulatory takings test based on U.S. Supreme Court decisions as of spring 2012 is presented below and applied to the command and control, market-based, and information-based strategies described in Part III and Table 1.

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[144] The "regulatory takings" concept refers to a claim by a property owner that a government regulation denies her "all economically beneficial use" of her property thereby effectively taking her property for public use and entitling her to "just compensation" pursuant to the 5th Amendment of the U.S. Constitution.

[145] Holly Doremus, *Takings and Transitions*, 19 J. LAND USE 1, 3 (2003). ("Regulatory takings claims are fundamentally conflicts over legal transitions. They arise when the rules change, those changes are costly (in economic or other terms), and the people bearing the costs believe that they are being unfairly singled out. The problem is not the content of the new rules in the abstract, but simply that the rules are different than they once were.")

[146] Mugler v. Kansas, 123 U.S. 623 (1887). *See also Lucas,* 505 U.S. at 1027-29.

[147] *Lucas,* 505 U.S. at 1029-30. Justice Scalia, writing for the majority, explicitly overruled the "benefit-harm" test and held that "prevention of a harmful and noxious use" cannot insulate the government from compensating a property owner who has lost "all economically beneficial use" of her property UNLESS the state can show that "there are limitations inherent in [the property owner's] title" or that "background principles of the State's law of property and nuisance already place [restrictions] upon land ownership."

[148] Village of Euclid, Ohio v. Ambler Realty Co., 272 U.S. 365 (1926). (Note that Lingle v. Chevron USA, Inc., 125 S. Ct. 2074 (2005) explicitly repeals the *Nectow v. City of Cambridge* and *Agins v. City of Tiburon* decisions to the extent that they require the Court to consider whether a zoning ordinance "*substantially advances legitimate state interests*" as part of the 5th Amendment takings test.)

[149] Pennsylvania Coal v. Mahon, 260 U.S. 393, 413-15 (1922).

[150] *Id*. (emphasis added)

Regulatory Takings* Test Post-*Palazzolo

I. Did a regulatory action result in physical invasion, seizure, or limitation on "right of exclusive possession"? If so, the government action is COMPENSABLE.

II. Did a regulatory action deprive the property owner of "all economically beneficial use" of her property "as a whole"? If so, the government action results in a COMPENSABLE *per se* or *categorical* taking unless:

a. The government successfully argues that the regulated activity would have been considered a public nuisance under accepted principles of property and nuisance law, or

b. The property owner had no expectation of Fifth Amendment protection because of limitations inherent in the title at the time title was acquired EXCEPT "future generations, too, have a right to challenge unreasonable limitations on the use and value of land."

III. Even if the property owner did not lose all the economic value of her property, did the government action interfere with "a reasonable investment-back expectation" to develop the property? The government's action might result in a COMPENSABLE taking depending on an "ad hoc factual inquiry."

The first branch of the regulatory takings test is "Did a governmental action result in physical occupation, seizure, or limitation on the property owner's right of exclusive possession?"[151] The clear answer is that any government action that results in seizure; physical occupation, no matter how small; or limitation on the property owner's "right of exclusive possession" is compensable under both federal and state Constitutions.[152] For instance, state or local government conditions on a property owner's right to develop, such as requiring the property owner to maintain the public's visual access along the shore between the owner's sea wall and the mean high water line[153] or providing a public greenway and bike path across private property,[154] are compensable if they result in allowing unprivileged public access to private property.

However, conflicts are increasingly likely to occur between owners of littoral estates and members

[151] *See Lucas*, 505 U.S. 1003 and Lingle v. Chevron, 125 S. Ct. 2074 (2005) for clear presentations of the *regulatory takings* test. *Lucas* and *Lingle* take great pains to clarify the difference between the substantive due process arguments regarding the legitimacy of the government's police power authority that influenced *Mugler*, 123 U.S. 623 (1887) through *Euclid* and *Agins v. the City of Tiburon*, and the post-*Lucas* emphasis on "loss of all economically beneficial use", in combination with *Penn Central's* ad hoc analysis. *See* Robert Dreher, *Lingle's Legacy: Untangling Substantive Due Process from Takings Doctrine,* 30 HARV. L. REV. 371 (2007) for a more thorough discussion of the significance of *Lingle*.

[152] *See Kelo*, 545 U.S. 469 (2005); Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982); Nollan v. California Coastal Commission, 483 U.S. 825 (1987); Dolan v. City of Tigard, 512 U.S. 374 (1994).

[153] *Nollan*, 483 U.S. 825 (1987).

[154] Dolan v. City of Tigard, 512 U.S. 374 (1994). (Note that the Court acknowledged that the City of Tigard could have required Dolan to establish and maintain a greenway within the 100-year floodplain of the creek in order to reduce runoff that would contribute to flooding, but did not understand the City's argument for the dimensions of the greenway or why the greenway should be public as opposed to private.)

of the public who assert their protected public trust interests in commercial or recreational use of the shore as sea level rises and beaches erode. Therefore it is extremely important to understand the boundary between public and private lands in the coastal zone.[155] At common law, littoral property owners whose property abuts the sea "have the right to access and use the water, the right to an unobstructed view of the water, and the right to receive incremental accretions to the littoral property."[156] However, these littoral (and riparian) property rights are bounded by the state's permanent "ownership" of the submerged lands and the shore below mean high (or low water) in trust for the public.[157] Therefore, the property owner's common law claim to accreted land above mean high water and objections to public passage along newly created wet beach are extinguished if the submerged lands are exposed by sudden, avulsive events such as storm-related erosion[158] or filled by beach nourishment projects.[159] In dicta, the *Stop the Beach Renourishment* Court reaffirmed earlier decisions holding that States effect a taking if they "use their property in such a way that it destroys private property, or re-characterize as public property what was previously private property" but it did not find that Florida's beach nourishment program offended either principle.[160]

The Texas Supreme Court recently addressed a related question: "Can the State enforce removal of a house left stranded on the beach after an avulsive event such as Hurricane Rita if the house interferes with public use of the 'wet beach' between mean low and high water, or the 'new' dry sand beach?"[161] The Court held that "the State's [public trust] right to submerged land, including the wet beach, is firmly established, regardless of the water's incursion onto previously dry land"[162] and that,

> "a person purchasing beachfront property in Texas does so with the risk that her property may eventually, or suddenly, recede into the ocean. When beachfront property recedes seaward and becomes part of the wet beach or submerged under the ocean, the property owner loses that property to the public trust… Regardless of these changes, the boundary

[155] *See* Sax, *supra* note 123, at 643.

[156] *Stop the Beach Renourishment*, 130 S. Ct. at 2598 citing 1 H. Farnham, Law of Waters and Water Rights §62, pp. 278– 280 (1904). (Note that "the precise property rights [of littoral and riparian property owners relative to the public's interests in the public trust lands] vary among jurisdictions" since state law defines property interests in navigable waters and submerged lands. *Id*.). As stated by the DEEP, "[t]he adjacent landowner has the exclusive riparian or littoral right of access to navigable water. This does not mean that the owner can exclude others from the adjacent waters, but that only the owner may get to the water from his or her upland, as by constructing a dock or other structures where appropriate and appropriately authorized. In terms of access, navigable waters are equivalent to a public road, and a dock serves the same purpose as a private driveway. A littoral landowner may not exclude the public from lawful uses of the public trust area, just as an upland owner cannot exclude the public from driving or walking on the street in front of his or her house." Conn. Dep't of Energy & Envtl. Prot., *The Public Trust*, http://www.ct.gov/dep/cwp/view.asp?a=2705&q=323792&depNav_GID=1635 (last visited July 1, 2012).

[157] *See* DEEP, *supra* note 156. ("The public trust area comprises submerged lands and waters waterward of the mean high water line in tidal coastal, or navigable waters of the state of Connecticut… In general, if an area is regularly wet by the tides, [it is] probably safe to assume that it is in the public trust. The public trust area … is defined as "public beach" by the Connecticut Coastal Management Act, C.G.S. 22a-93(6).")

[158] *Stop the Beach Renourishment,* 130 S. Ct. at 2611.

[159] *Id. See also* City of Long Branch v. Jui Yung Liu, 4 A.3d 542 (2010) where the New Jersey Supreme Court held that a government-funded beach nourishment program that expanded the beach by adding sand below mean high water did not create a compensable claim for the littoral owner.

[160] *Stop the Beach Renourishment,* 130 S. Ct. 2592 (The Court held that the beach renourishment project was conducted in conformance with the state's Beach and Shore Preservation Act and established a permanent "erosion control line" which thereby eliminated the littoral property owners' future claims to accretion.).

[161] Severance v. Patterson, 2012 WL 1059341 (Tex. Mar. 30, 2012).

[162] *Id*. at *2.

remains fixed (relatively) at the mean high tide line.[163]

This plain statement of the public trust doctrine almost certainly applies in Connecticut as well based on the DEEP's articulation of the public trust doctrine.[164] As a result, the *Stop the Beach Renourishment*, *PPL Montana, City of Long Branch,* and *Severance* decisions tend to substantiate Connecticut's authority to undertake beach nourishment below the mean high water mark and to prevent rebuilding or flood-proofing private structures on the "wet beach." Arguably, the public trust doctrine could also be used to prevent proposed development in high flood or erosion hazard areas exposed to avulsive events (e.g., FIRM V-zones) that impinge on public trust interests in the "wet beach" and submerged lands.

It is important to note, however, that the Texas Supreme Court also held that the State's public trust interest in access along the shore cannot "roll" landward to follow the new vegetation line onto a newly formed dry sand beach in the absence of an express easement or history of public use "over time immemorial" that allows passage across the privately owned littoral estate above mean high water.[165] This interpretation of the public trust doctrine in Texas accords with Connecticut's description of the boundary between littoral and public trust rights on the shore. If so, Connecticut cannot use the public trust doctrine to allow public passage along private property landward of the mean high water line, and may not be able to rely on it to prohibit re-building or flood-proofing if the house is located on the dry beach although the State has other common law and statutory bases of authority to prohibit re-building in this instance.

If the answer to the first question is "no", the government's regulatory action has not resulted in occupation or seizure of private property, the next question is whether the regulatory action deprived the property owner of "all economically beneficial use" of her property. Government actions that deprive the property owner of "all or 99.9% of the economically beneficial use of the property"[166] constitute compensable *categorical* or *per se* takings unless the government successfully proves that:

- The property owner retains some "economically beneficial use;"[167]
- The regulated activity would have been considered a public nuisance under accepted

[163] *Id*. at *8.
[164] *See* DEEP, *supra* note 156. *See also* Titus & Craghan, *supra* note 113, at 6.
[165] *Severance*, 2012 WL 1059341 at *14 (The Court said, "a public beachfront easement in West Beach, although dynamic, does not roll under Texas law. The public loses that interest in privately owned dry beach when the land to which it is attached becomes submerged underwater.")
[166] *See* Lucas, 505 U.S. at 1019 (n 8) and 1028.
[167] *Id*. *See also* Palazzolo v. Rhode Island, 533 U.S. 606 (2001) (property owner retained upland portion of property worth $200,000); Hall v. Board of Environmental Protection, 528 A.2d 453, 455 (Me. 1987) (Maine Supreme Court held that just compensation was not required when the Maine Board of Environmental Protection denied a property owner a residential construction permit because the property owner had maintained a camper connected to utilities during the summer and could still sell or lease his land).

background principles of common law;[168] or

- The property owner had no expectation of Fifth Amendment protection because of legitimate limits in her title at the time title was acquired,[169] although "[f]uture generations, too, have a right to challenge unreasonable limitations on the use and value of land."[170]

Before applying this branch of the regulatory takings test to a variety of strategies that State and local planners might consider to motivate property owners to retreat from the shore, it is important to note that *per se*, categorical takings or total economic *wipe-outs* related to regulation are rare. Therefore, if the answer to the second question is that the property owner has not lost "all economically beneficial use" of her property, the *Penn Central* test applies. In *Penn Central*, the U.S. Supreme Court described a three-pronged *ad hoc* factual inquiry to determine whether the governmental action is compensable, which requires examining: (1) the reasonableness of the buyer's/developer's investment-backed expectation; (2) the nature or character of the governmental action; and (3) the economic impact of the regulation.[171]

The *Penn Central* test is difficult for a plaintiff/claimant to satisfy. For instance, Penn Central Transportation Corp. was unable to persuade the Supreme Court that it had a "reasonable investment-backed expectation" in being able to gut and re-develop Grand Central Station since the historic shell provided Penn Central with the functional elements of a rail station.[172] In *Palazzolo*, Justice Kennedy noted that the plaintiff's "claim is not barred by the mere fact that title was acquired after the effective date of the state-imposed restriction."[173] However, Justice O'Connor, joined by the four dissenters, noted that the claimant's knowledge of the regulatory regime in place at the time that he acquired title and "the nature and extent of permitted development ... may also shape the reasonableness of the claimant's investment-backed expectations ... [for] if existing regulations do nothing to inform the analysis, then some property owners may reap windfalls and an important indicium of fairness is lost."[174] The case was remanded to the Rhode Island Superior Court[175] where the State repeated its arguments that Rhode Island's public trust doctrine and wetlands laws were well established by the time that Anthony Palazzolo acquired title to the property in 1978, and that he retained significant

[168] *See Pennsylvania Coal*, 260 U.S. at 417 (from the dissent by Justice Brandeis: "The right of the owner to use his land is not absolute. He may not so use it as to create a public nuisance...Every restriction upon the use of property imposed in the exercise of the police power deprives the owner of some right theretofore enjoyed, and is, in that sense, an abridgment by the state of rights in property without making compensation. But restriction imposed to protect the public health, safety, or morals from dangers threatened is not a taking. The restriction here in question is merely the prohibition of a noxious use. The property so restricted remains in the possession of its owner. The state does not appropriate it or make any use of it. The state merely prevents the owner from making a use which interferes with paramount rights of the public."). *See* Milardo v. Coastal Resources Management Council, 434 A.2d 266, 269 (R.I. 1981) (state denial of ISDS permit was held not to be a taking); and Palazzolo v. State ex rel. Tavares, 785 A.2d 561 (R.I. 2001) (recognizing that [under Rhode Island Gen. Laws Ch. 118, §10 (1896)] "any ... unauthorized encroachment upon the public tide waters was "deemed to be a public nuisance")

[169] *See Lucas*, 505 U.S. at 1028 where Justice Scalia cites *Pennsylvania Coal,* 260 U.S. at 413 with approval for the proposition that "the property owner necessarily expects the uses of his property to be restricted, from time to time, by various measures newly enacted by the State in legitimate exercise of its police powers; "[a]s long recognized, some values are enjoyed under an implied limitation, and must yield to the police power."

[170] *See Palazzolo,* 533 U.S. 606.

[171] *Id*.

[172] *Id*.

[173] *Id*.

[174] *Id*. at 635 (O'Connor, J., concurring).

[175] *Palazzolo*, 785 A.2d at 561.

options to develop the upland portion of the property that he had not acted upon.[176] As one influential law professor said, "after the *Palazzolo* and *Lake Tahoe* decisions, we are left with the clear statement that in the most extreme cases (permanent physical occupation and newly-declared rules denying all economic use) compensation is automatically required, but the vast majority of the cases must be evaluated individually to see if the burdens of regulation are fairly distributed."[177] In sum, the *ad hoc Penn Central* inquiry is important though it has not been very useful to plaintiffs in recent regulatory takings cases since they have not often been able to prove that they suffered an "unfair" economic injury related to their investment.[178]

Returning to second question, *Did the regulatory action deprive the property owner of "all economically beneficial use" of her property?*, the most extreme and contentious regulatory options that federal, state, or local governments could pursue to compel retreat from the shore would arguably be to prohibit rebuilding seriously damaged coastal properties on the same footprint, or to prohibit new development in flood- or erosion-prone areas. These issues are discussed separately. However, both strategies can be shown to be insulated from Fifth Amendment regulatory takings challenges based on the exceptions presented above.

As a preliminary matter, regulatory actions seldom result in "loss of all of economically beneficial use" – defined by Justice Scalia in *Lucas v. South Carolina Coastal Council* as 99.9% of the value of the property.[179] This is true even when a statute is properly applied to prohibit development of coastal property to protect public trust interests in critical natural resources such as tidal wetlands and dunes;[180] in part, because the Supreme Court has held that property cannot be segmented for the purpose of a takings analysis.[181] Furthermore, the Courts may determine that remaining uses of the property, such as the ability to use the land for fishing and swimming, constitute economically beneficial uses that still inhere in the property.[182] For example, in *Hall v. Board of Environmental Protection*, the fact that a property could sustain a camper connected to public utilities was enough for the Maine Supreme Court to determine that the owners had not been deprived of all economically beneficial use.[183]

In addition, FEMA's "50% rule"[184] obligates FEMA-compliant states and municipalities to require owners of "substantially damaged" property[185] to rebuild to meet flood protection requirements. It is

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[176] *Id*.

[177] Doremus, *supra* note 145, at 11.

[178] *See* Lingle v. Chevron, 125 S. Ct. 2074 (2005). The Court states that the *takings* tests should focus on the effect of the regulation on the property owner, not the effectiveness of the regulation.

[179] *See Lucas*, 505 U.S. 1003.

[180] *See Palazzolo*, 533 U.S. 606. (Palazzolo was found to have retained over $200,000 of potentially developable upland).

[181] *Id. See also* Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Agency, 535 U.S. 302 (2002).

[182] Harold Skelton, *Houses on the Sand: Takings Issues Surrounding Statutory Restrictions on the Use of Oceanfront Property*, 18 BOS. COLL. ENVTL. AFFAIRS L. REV.1, 131 (1990).

[183] Hall v. Board of Environmental Protection, 528 A.2d 453, 455 (Me. 1987).

[184] *See* FEMA, GUIDANCE NO. 4511.61 E, THE 50% RULE:THE ELIGIBILITY OF FACILITIES FOR REPLACEMENT UNDER 44 CFR 206.226(D)(1), *available at* http://www.fema.gov/government/grant/pa/9524_4b.shtm ("A facility is considered repairable when disaster damages do not exceed 50% of the cost of replacing a facility to its predisaster condition, and it is feasible to repair the facility so that it can perform the function for which it was being used as well as it did immediately prior to the disaster."). *See also* Conn. Dep't of Permitting and Land Use, *Important Information for Owners of Buildings in Flood Zones*, *available at* http://www.ci.milford.ct.us/public_documents/MilfordCT_Permitting/flood%20docs/017AA618-000F8513.

[185] FEMA, *Substantial Damage*, http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/sd.shtm (last visited July 10, 2012) (FEMA defines "substantial damage" as the loss of property value due to destruction or the cost of improvements worth ≥50% of the market value, which is cumulative over a ten-year period).

important to note that the NFIP does not prohibit rebuilding unless "development would increase flood heights"[186] — although owners who cannot comply with flood-proofing standards are effectively denied the ability to rebuild although they may or may not be insured for their loss.[187] Connecticut relies on the municipalities to determine if a damaged structure is in a NFIP flood hazard area (FIRM A or V zones). Moreover, municipalities are tasked with enforcing the state building code with respect to the determination of "substantial damage" and "substantial improvement."[188] FEMA NFIP-compliant states and their municipalities can enforce the "50% rule" to compel property owners to move landward or to meet more stringent "flood-proofing" building codes.[189]

A number of states, including Massachusetts, Maine, South Carolina, and North Carolina, categorically prohibit all new development in areas that currently experience or are predicted to experience flooding or erosion hazards.[190] Prohibiting new construction or rebuilding may trigger takings challenges, especially if the prohibition is total. Property owners are most likely to argue that their "right" to rebuild after a substantial loss represents a "traditional incident of ownership" and/or that they have a "reasonable investment-backed expectation" to be allowed to rebuild.[191] However, it is important to note that neither David Lucas (the developer) nor Justice Scalia questioned the merits of South Carolina's 1988 Beachfront Management Act which prohibited new development on barrier beaches for a suite of social, economic, ecological, and environmental reasons, as long as the law applied prospectively to property owners who knew or should have known that the law applied to them when they acquired the property (the "limitation inherent in title" rule).[192] In 2005, the Massachusetts Supreme Court upheld the Town of Chatham's Zoning Board of Appeals, which had denied a permit to develop an undeveloped "marginal parcel of land" in a flood hazard zone that was also in a groundwater overlay district.[193] South Carolina's current coastal management laws prohibit new construction in

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[186] FEMA, FLOODPLAIN MANAGEMENT REQUIREMENTS: A STUDY GUIDE AND DESK REFERENCE FOR LOCAL OFFICIALS 6-8 (2010), *available at* http://www.fema.gov/plan/prevent/floodplain/. (FEMA goes on to say that, "[t]hese performance-oriented standards of the NFIP have never been ruled as a taking. This is highly significant, given that more than 19,000 communities administer floodplain management ordinances." *Id*.)

[187] *Id*. (A FEMA study found that only 2% of the property owners in Connecticut's flood hazard zones had purchased federal flood insurance in 2004.).

[188] CONN. DEPT. ENVTL. PROTECTION, NFIP REQUIREMENT: THE LOWEST FLOOR 1 (2009); NEW YORK DEP'T OF ENVTL. CONSERVATION, FLOODPLAIN MANAGEMENT REQUIREMENTS AFTER A FLOOD, *available at* http://www.dec.ny.gov/lands/24267.html.

[189] Also note that the NFIP "encourages states and communities to implement flood-plain management programs that go beyond NFIP minimum requirements since local flood hazards vary and what makes sense in one state or community may not make sense in another". *See* FLOODPLAIN MANAGEMENT REQUIREMENTS, *supra* note 195, at 6-1. Maine's *Coastal Sand Dunes Rules* reportedly prohibit rebuilding structures that are more than 50% damaged by storms unless the property owner can prove that the structure can remain stable even with an additional two-foot rise in sea level. *See* Charles Colgan & Samuel Merrill, *The Effects of Climate Change on Economic Activity in Maine: Coastal York County Case Study*, 17 POL'Y REV. 2 (2008).

[190] Mary Cooper Ellis, *Managed Retreat: Coastal Development in an Era of Climate Change*, LANDSCAPE ARCHITECTURE (2008), *available at* http://www.asla.org/lamag/lam08/march/ecology.html.

[191] *See Palazzolo*, 533 U.S. 606. (Although note that Justice Scalia skewered Palazzolo for wasting the court's time with speculative claims about his "reasonable investment-backed expectations.").

[192] *See Lucas*, 505 U.S. at 1027-32.

[193] Gove v. Zoning Board of Appeals of Chatham, 831 N.E.2d 865 (Mass. 2005) (The Court held that a regulatory taking occurs where a regulation deprives an owner of "all economically beneficial use" of private property, except to the extent that "background principles of nuisance and property law" independently limit the owner's use of the property. The Court also noted that the developers purchased the parcel of land knowing that local ordinances limited development.)

state-designated "erosion zones" and rebuilding of any property within the erosion zone that is two-thirds destroyed.[194]

Connecticut's Coastal Management Act (CMA) is more circumspect, but also clearly authorizes municipal boards in charge of reviewing coastal site plans to "approve … condition, or deny permission to build" based on the impact of the proposed activity on "coastal resources and future water-dependent development activities."[195] Connecticut's statute also references preventing harm to other littoral property owners, public uses of the shore, established resource users, and critical ecosystems as issues to be considered in approving or denying a permit.[196]

This is important for two reasons. The U.S. Supreme Court noted in *Lucas* that the government is not required to compensate landowners for regulatory actions that result in "loss of all economically viable use" if the regulated activity would have been considered a public nuisance under accepted principles of property and nuisance at common law. State and/or municipal governments are likely to have many public health and safety grounds on which to base decisions to deny permits to rebuild following extreme erosion and flood events. These include the safety of adjacent properties, capacity of coastal soils to assimilate (sanitary or industrial) wastes, and the contamination of wetlands and other areas critical in terms of their ecosystem services. Furthermore, the CMA explicitly refers to the State's trust responsibility to protect key public trust resources such as the fisheries and public trust rights, including access to the shore.[197]

In sum, state and municipal governments are likely to have compelling statutory, public nuisance and public trust arguments to justify denying permits to rebuild or develop in flood and erosion hazard areas. These arguments should be sufficient to insulate them from liability even if the court finds that the owner has lost all economically beneficial use of her property. Since this is true, it is easier to determine whether specific strategies such as (1) requiring setbacks and buffers, (2) prohibiting shoreline armoring, (3) downzoning, (4) limiting public expenditures in repair/replacement of public infrastructure after repetitive losses, or (5) mandating (or denying access to) insurance coverage are likely to constitute compensable takings. These strategies are considered in sequence.

1. Mandatory Setbacks and Buffers

Mandatory building setbacks and buffers are unlikely to generate successful regulatory takings claims since these requirements allow owners of coastal properties to continue to occupy and use their property but deny them the ability to develop seaward of a designated line in order to protect the shoreline and adjacent properties and ecosystems. Today, many states require new development to be set back from the shore by various setback lines which are determined by elevation above mean high water, erosion rates, distance from wetlands and receiving waters, or how the shore may change.[198] Vegetated buffers and setbacks protect public users and aquatic life from runoff and leaching of biological and chemical wastes generated on the private property and, ideally, provide sufficient land area to enable the property owner to retreat and/or relocate essential structures post-disaster such as

[194] Skelton, *supra* note 182, at 131.

[195] CONN. GEN. STAT. § 22a-105(e). On April 12, 2012, the Connecticut House Committee on the Environment recommended the passage of Substitute Bill 5128: An Act Concerning Certain Revisions to The Coastal Zone Management Statutes. This bill would amend §22-105(e) of the Coastal Management Act by endorsing the authority of boards to deny permission to build "provided any such denial shall constitute a taking for which the owner shall be compensated."

[196] *Id.* §22-105(a)–(e).

[197] *See id.* § 22a-92

[198] James Titus, *Rising Seas, Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches Without Hurting Property Owners*, 57 MD. LAW REV. 1279, 1311 (1998).

the house, basement, on-site septic systems and parking. Setbacks also act to encourage coastal retreat by discouraging property owners from investing in their property to the point where their land is worth protecting from the sea.[199] However, establishing setbacks may be considered economically inefficient, as the designation of setback lines requires policy makers to draw a literal, although imaginary, line in the sand. By the time sea levels rise to where communities recognize that they are protected by the setback, new setbacks are often necessary. Moreover, lease revenue that could have been generated on the property seaward of the setback line has been forgone.[200] The same, of course, could be said about policies prohibiting development altogether.

Setbacks are unlikely to face successful regulatory takings challenges *unless* the state or local government presses the property owner to dedicate the undeveloped land for public access[201] because (1) the courts will examine the property as a whole when determining takings,[202] and (2) if lots are larger and deeper than the established setback line, the property's value may be reduced, but not by 99.9%. Thus, it is important to establish the definitions of and legal justifications for setbacks and buffers in order to avoid *ad hoc* decision-making.

2. Coastal Armoring and Defended Shorelines

Connecticut's Coastal Management Act has very clear language discouraging the use of coastal armoring and structural shoreline engineering techniques "except in those instances where structural alternatives prove unavoidable and necessary to protect existing inhabited structures, infrastructural facilities, water dependent uses."[203] Connecticut's policy of preventing coastal property owners from building erosion control structures such as bulkheads, levees, jetties, and other sea wall revetments could encourage retreat to the extent property owners clearly understand and accept the State's countervailing interests in safeguarding life, protecting property, and minimizing adverse environmental impacts. Massachusetts' Public Waterfront Act[204] is a model statute that codifies the State's public trust doctrine with respect to public rights in the shore, tidelands and navigable waters. As a result, its Coastal Beach regulations presume the importance of beaches for "storm damage prevention, flood control and the protection of wildlife habitat" and state that coastal projects "shall not" increase erosion or interfere with littoral drift, although beach nourishment is permitted.[205] Rhode Island's Coastal Resources Management Program prefers nonstructural erosion control and flood prevention methods such as vegetative buffers and beach nourishment to hardened structures and sandbags,[206] though enforcement and political pressure from property owners is a chronic problem.[207]

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[199] *Id.*
[200] *See* VESTAL ET AL., *supra* note 138.
[201] See discussion of *Nolan* and *Dolan*, *supra* notes 152-154.
[202] *See Palazzolo*, 533 U.S. 606.
[203] Conn. Gen. Stat. §22a-92(b)(2)(F).
[204] MASS. GEN. LAWS ch. 91, §§1-63, The Massachusetts Public Waterfront Act assigns the Massachusetts Department of Environmental Protection the responsibility to, among other things, (1) Preserve pedestrian access along the water's edge for fishing, fowling and navigation, (2) Protect and promote tidelands as a workplace, (3) protect areas of critical environmental concern from unnecessary encroachment by fill and structures, (4) protect the rights of waterfront property owners to access the water, and assure removal or repair of unsafe or hazardous structures.
[205] 310 MASS. CODE REG. § 10.27.
[206] R.I. CODE REG. § 16-2-300.7.

Littoral property owners in Rhode Island must consider all reasonable and practical alternatives (e.g., relocating the structure and nonstructural methods) when proposing structural shoreline protection methods[208] It is important to note that regulation of shoreline construction is addressed in these states without reference to the federal Clean Water Act and Coastal Zone Management Act incentives for state nonpoint source programs,[209] which encourage states to control runoff associated with impervious surfaces, shoreline and stream channel modification, and loss of coastal and riparian wetlands.

Under the public trust doctrine, as mentioned above, states have a duty to administer public trust resources, such as coastal lands, navigable waters, and natural resources, which are held in trust by the state for the benefit of all citizens. Therefore, Connecticut should be able to rely on the public trust doctrine, as well as its statutory authority, to deny proposals to armor the shoreline and to limit or remove impervious surface that interfere with public trust interests. Property owners may argue that prohibiting coastal armoring amounts to a compensable taking since littoral owners have the right to wall out the sea under the common law.[210] However, the State should be invulnerable to *takings* claims to the extent it can show that the *cumulative impact* of coastal armoring and runoff from impervious surfaces associated with the proposed construction project will contribute to erosion and/or contamination of the "wet beach" or tidelands or impede access to the public beach.

3. Cluster Zoning, Downzoning, and Upzoning

Cluster or open space zoning provides developers with a density bonus for "clustering" buildings on the site in order to maximize open space.[211] Downzoning refers to the process of re-zoning the permitted land uses in a designated area by changing the pattern or reducing the density of development from the previous zoning classification. For example, Stonington, Connecticut has adopted Flood Hazard and Aquifer Overlay Districts and changed zoning from RM20 (high-density single-family) to RC-120 (rural residential) in FIRM V-zones that are also in Aquifer Overlay Districts with the goal of preventing saltwater intrusion into the drinking water supply aquifer.[212] This zoning change limits the ability to subdivide the land and therefore may reduce the profits available to landowners and developers. *Upzoning* does the reverse. Both techniques have been used to protect agricultural lands and open space, prevent sprawl, and promote urban renewal. Currently, the State's zoning laws allow municipalities to determine local land uses for periods of up to five years[213] but these techniques could also be used to provide the basis for a regional Transferable Development Rights (TDR) system or land bank that provides density bonuses or tax incentives to relocate away from A- and V- zones to town centers at higher elevation with public infrastructure.

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[207] See Tracey C. O'Neill, *CRMC Votes for South Kingston Sea Wall*, RIFUTURE.ORG, May 9, 2012, http://www.rifuture.org/crmc-votes-for-public-safety-against-ocean-mist.html; *Dave Fisher and Tim Faulkner, Barriers Fall for Matunuck Beach Armoring*, ECORINEWS, May 14, 2012, http://www.ecori.org/front-page-journal/2012/5/10/barriers-fall-for-matunuck-beach-armoring.html.

[208] R.I. CODE REG. § 16-2-300.7.

[209] *See* Clean Water Act §319, 33 U.S.C. § 1329 (Nonpoint source management programs) and § 6217 of the Coastal Zone Act Reauthorization Amendments of 1990, 16 U.S.C. § 1455b. (Coastal Nonpoint Pollution Control Program).

[210] *See generally*, J. Peter Byrne, *Rising Seas and Common Law Baselines: A Comment on Regulatory Takings Discourse Concerning Climate Change*, 11 VT. J. OF ENVTL. L. 640 (2010).

[211] *See* Randall Arendt, *"Open Space" Zoning: What It Is & Why It Works*, PLAN. COMM'RS J. (1992), *available at* http://www.plannersweb.com/articles/are015.html.

[212] TOWN OF STONINGTON, CONNECTICUT, ZONING MAP ATLAS, PARCELS, ROADWAYS AND ZONING DISTRICTS (July 2010), *available at* http://www.stonington-ct.gov/Pages/StoningtonCT_Planning/zoning_map_atlas/index.

[213] CONN. GEN. STAT. § 8-17a.

Property owners affected by downzoning may well argue that the resulting decrease in their property value from the loss of potential development amounts to a regulatory taking.[214] However, downzoning is not likely to result in a compensable taking since the Courts have traditionally recognized zoning as a legitimate exercise of the states' police power to protect public health, safety, and welfare.[215] Furthermore, property owners are rarely, if ever, "denied all economically beneficial use" of their property by a zoning change, especially since the court will view the effect of the regulation on the property as a whole.

4. Limiting Public Expenditures in Repair/Replacement of Public Infrastructure

Connecticut could encourage property owners to retreat from high hazard areas by expanding upon insurance and building limits established by the federal Coastal Barrier Resources Act of 1982 (COBRA) and the Coastal Barrier Improvement Act of 1990 (CBIA).[216] COBRA specifically prohibits access to the NFIP for structures built or substantially improved after 1983, and also prohibits federal disaster relief and cost-sharing for repair/replacement of capital infrastructure in designated coastal barrier beach areas (CBRs) and Otherwise Protected Areas (OPAs).[217] Connecticut already cooperates with FEMA to enforce COBRA's insurance prohibitions and NFIP-consistent building permits in identified CBRS and OPA areas.[218] However, the State could do more to compel property owners in CBRS and OPA areas to obtain private flood insurance. The State could also limit its own expenditures on repair and replacement of public infrastructure subject to repetitive loss in high hazard areas.

Private property owners affected by abandoned or un-maintained infrastructure such as roads, bridges and buried utilities subject to washout will certainly be tempted to file takings claims, arguing that such policies reduce access to and therefore the value of their property. However, unless such policies deprive owners of "all economically beneficial use" of their land, takings challenges are likely to fail. It is also interesting to note that public "givings" or "windfalls," such as risk-spreading in terms of flood insurance and public investments in infrastructure that enable property owners to inhabit risky environments, are rarely if ever subtracted from "takings" or "wipeout" claims.[219] The State could approach this issue by shifting ownership and/or the maintenance and repair/replacement cost of "stranded" infrastructure to owners of repetitive loss properties and "hold-outs" in high flood- and erosion- hazard zones.

Connecticut has formal procedures for "abandonment" and "discontinuance" of roads that date back to 1799.[220] However it is unclear whether private property owners can legitimately claim entitlement to government benefits such as continued investments in and maintenance of public

[214] *See* Jesse Richardson, *Downzoning, Fairness, and Farmland Protection*, 19 J. OF LAND USE L. 59 (2003).
[215] *See generally,* Village of Euclid, Ohio v. Ambler Realty Co., 272 U.S. 365 (1926); Hadacheck v. Sebastian, 239 U.S. 394 (1915).
[216] *See* Federal Emergency Management Agency, Coastal Barrier Resource System, http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/cbrs.shtm (last visited June 30, 2012).
[217] *Id.*
[218] *See* CONN. DEPT. OF ENVTL. PROTECTION, COBRA ZONES (2009).
[219] *See generally*, Abraham Bell and Gideon Parchomovsky, *Givings*, 111 THE YALE L. J. 547, 590-93 (2001) and DONALD HAGMAN & DEAN MISCZYNSKI, WINDFALLS FOR WIPEOUTS: LAND VALUE CAPTURE AND COMPENSATION (1978).
[220] *See* Richard Roberts, *Discontinuation and Abandonment:The End of the Road?,* CONN. LAW. 14:3 (Nov 2003), *available at* http://www.halloran-sage.com/Knowledge/articleDetail.aspx?storyid=1999.

infrastructure.[221] In some cases, where local transportation policies left property owners unable to access networks of public roadways or even their own property, courts have found the policies to constitute a compensable taking.[222] In addition, state and local governments may encounter tort liability when "active" roads are left unmaintained.[223] Historically, however, courts have held that local governments are not obligated to provide certain services.[224] Additionally, when local governments are faced with scarce resources and fewer available funds, it may be more difficult to determine whether funding decisions by municipalities amount to takings—especially if the decision in question is one that will ultimately save the municipality resources.[225]

5. Mandating Flood Insurance

As indicated earlier, the NFIP is over $17 billion in debt due in part to low premiums and high percent of uninsured property owners; exemptions of various at-risk properties from the insurance pool; repetitive loss properties (RPLs) and disaster relief associated with Hurricanes Katrina, Rita Wilma in 2005.[226] Requiring all property owners to pay a flood insurance premium through their homeowner's policy could generate legal challenges to the extent that not all property owners face flood risks. But limiting the flood insurance requirement to property owners in NFIP-designated A and V Zones significantly decreases the likelihood of a successful takings challenge.[227] Mandatory flood insurance does not deprive property owners of "all economically beneficial uses" of land and, in fact, adds value. Moreover, the NFIP has successfully survived takings challenges in the past. In 1979, the D.C. Circuit Court of Appeals held that a community's participation in the NFIP and its subsequent adoption of floodplain management ordinances did not constitute a compensable taking.[228] In 1989, the Oklahoma Supreme Court held that floodplain management regulations adopted in compliance with the NFIP did not deprive property owners of all economically beneficial uses of their land.[229]

In sum, state and municipal governments have many strategies at their disposal to motivate responsible development of FEMA-designated SFHAs and high flood and erosion hazard areas. Most of these strategies do not require additional statutory authority. The major exceptions appear to be with respect to the State's current ability to enforce compliance with mandatory risk-based flood insurance coverage and to expand (or deny) flood insurance coverage requirements to properties that are located at or below two meters above present sea level.

In addition, Connecticut and its subordinate governments acting with expressly delegated authority,

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[221] Craig Anthony Arnold, *Legal Castles in the Sand: The Evolution of Property Law, Culture, and Ecology in Coastal Lands*, 61 SYRACUSE L. REV. 213 (2011). *See also,* Estate of Hage v. U.S., 93 Fed. Cl. 709 (2010), protracted and unresolved takings litigation by a rancher claiming "ownership" of or continued access to water rights on public lands.

[222] J. Peter Byrne and Jessica Grannis, *Coastal Retreat Measures*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE (Michael B. Gerrard & Katrina F. Kuh, eds.) (forthcoming 2012)

[223] *Id. See also* Chandler, Jr. & Others vs. County Commissioners of Nantucket County, 772 N.E.2d 578 (Mass. 2002) (Plaintiff beachfront property owners on Nantucket successfully defeated a plan by the County Commissioners to condemn private property parallel to the beach above mean high water to "preserve historic public rights of way to the sea.").

[224] Byrne & Grannis, *supra* note 225.

[225] *Id.*

[226] King, *supra* note 62.

[227] Charles Griffith, *The National Flood Insurance Program: Unattained Purposes, Liability in Contract, and Takings*, 35 WILLIAM AND MARY L. REV. 727, 748-63 (1994).

[228] *See* Texas Landowners Rights Ass'n v. Harris, 453 F.Supp. 1025, 1027 (D.D.C. 1978).

[229] *See* April v. City of Broken Arrow, 775 P.2d 1347 (Okla. 1989).

are very likely to be invulnerable to Fifth Amendment takings claims even if these regulations result in "diminution of value," "loss of investment-backed expectations," or "loss of all economically beneficial uses of the property." This is the likely outcome because the government will almost invariably be able to justify regulations that limit private use of private property based on (1) its police power obligation to protect public health, safety, and welfare; (2) its common law authority to protect its citizens from public nuisances created by flooding and erosion of the coastal zone that results in biological or chemical contamination of coastal waters, debris fields on the shore, and/or loss of critical aquatic habitat and associated ecosystem services; and (3) its common law duty to administer the public trust for the benefit of its citizens.

C. Motivating Responsible Development and Retreat

As Garrett Hardin famously observed, governments should always consider the "no action" or "business as usual" option as well as "appeal to conscience" before resorting to "legislated temperance," "mutual coercion," and markets.[230] This spectrum of options is illustrated in Table 1. As noted earlier, information- and market-based strategies are often relied on in the absence of consensus about risk and the desire to maximize individual flexibility and innovation.[231] Examples of these strategies include public education (about global warming and climate change-related risks); public opinion surveys intended to educate and/or elicit information about public attitudes (regarding climate science or adaptation and mitigation strategies); and appeals for volunteerism. Other potentially important information-based techniques include using real estate disclosure forms and land recording requirements to better communicate the risks associated with occupying high flood and erosion hazard areas. This strategy might be unpopular and politically infeasible because it might tend to reveal the "true", risk-adjusted value of real property. However, information-based strategies fundamentally cannot trigger successful regulatory takings claims even if they reduce the market value of the property since they operate by requiring property owners to internalize the consequences of their decisions. Note that this strategy could also motivate property owners to acquire additional flood insurance, especially if the State considered requiring property owners to carry multi-year policies and record the information in the Land Evidence Records.

V. When Retreat is the Better Part of Valor: Key Findings and Recommendations

> *If the waves crash up against the beach, eroding dunes and destroying homes, it is not the awesome power of Mother Nature. It is the awesome power of Mother Nature as altered by the awesome power of man, who has overpowered in a century the processes that have been slowly evolving and changing of their own accord since the earth was born*.[232]

Coastal states like Connecticut should continue to actively and proactively plan for adaptation to the projected impacts of global warming and climate change. These plans should almost certainly include preparing for measured retreat from low-lying coastal and riparian floodplains over the next few decades—especially in light of the "highly likely" economic and environmental consequences of pursuing a "business as usual" approach to coastal development in densely populated coastal watersheds. This section summarizes the key findings associated with this paper and offers

[230] Hardin, *Tragedy of the commons*, *supra* note 119. *See also*, LESTER B. LAVE, THE STRATEGY OF SOCIAL REGULATION: DECISION FRAMEWORKS FOR POLICY (1982).
[231] *See* Goulder & Parry, *supra* note 97.
[232] BILL MCKIBBEN, THE END OF NATURE 51 (1989).

recommendations on regulatory, information, and market-based strategies to motivate retreat from the shore.

A. Key Findings

Scientists from many different disciplines as well as the professional environmental planning community overwhelmingly agree that global warming and climate change are occurring and that the rate of change is accelerating. The U.S. National Academy of Sciences and Governor Malloy's Steering Committee on Climate Change recently estimated that sea level could rise along Connecticut's coast by 1.04 to 1.4 meters (3.4 to over 4.6 feet) by 2100 under the "rapid ice melt" scenario.[233] Recent technical papers by the Environmental Defense Fund and the Union of Concerned Scientists indicate that in the shorter term, the current 100-year coastal flood will occur in Connecticut every 32 years as a result of global warming-induced changes in the hydrological cycle, and that flood heights related to inundation and storm surge could range from 10 to 15 feet above the observed Mean High Water (MHW) line in Connecticut by 2020 depending on the location and category of storm.[234] Moreover, some of the risks associated with extreme climate and weather events are perhaps already observable based on the damage experienced in New England during the 2010-11 sequence of storms.

Trend is not destiny.[235] However, in the absence of planning, natural disaster-related damage to public infrastructure, private property, and the environment will challenge State and local taxpayers and tax the resilience of built and natural environments. Economically, the cost of doing nothing is very high. Tropical Storm Irene and the 2011 ice storm each cost the State of Connecticut nearly $1 billion, and FEMA estimates that a single 100-year storm could cost the State a little over $18 billion in property losses and business interruptions related solely to the 32,000 properties located in SFHAs.[236]

Connecticut clearly takes the recent pattern of destructive storm and weather events seriously. Various Governor-appointed commissions and task forces have published at least five major studies since 2010 focused on the State's vulnerability to climate change-induced risks, and its resilience or ability to respond and recover from climate and weather-related hazards. These studies suggest that it is prudent to continue to mitigate GHG emissions by participating in the Regional Greenhouse Gas Initiative (RGGI), with proceeds from the RGGI auctions going toward investments in energy efficiency, renewable energy, and demand management (measured as change in per capita energy use and emissions) in order to meet the State's commitment "to reduce greenhouse gases by 10% by 2020 and 80% by 2050" pursuant to the Connecticut Global Warming Solutions Act.[237]

However the current collective level of effort to mitigate emissions will not significantly "bend the curve" of "business as usual" GHG emissions. Therefore, the federal, state and local governments and the private sector share responsibility to act strategically to protect public health, safety and welfare as the effects of climate change continue to be expressed. These institutions have access to a wide variety of regulatory, market, and information-based strategies to help motivate retreat from the shore (See Parts III and IV). The following section presents key recommendations based on the summary of climate change-related risks and a review of public and private sector authority to respond in a precautionary manner to those risks.

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[233] *See* ADVANCING THE SCIENCE OF CLIMATE CHANGE, *supra* note 16, at 7-10; and ADAPTATION SUBCOMMITTEE REPORT, *supra* note 27.

[234] *See* GORNITZ ET AL., *supra* note 30; and FRUMHOFF ET AL., *supra* note 3, at 19.

[235] Rene' Dubos, *Trend is Not Destiny,* 34 ENGINEERING AND SCI. 5 (1971)

[236] REPORT OF THE TWO STORM PANEL, *supra* note 47.

[237] *See* An Act Concerning Connecticut Global Warming Solutions, 2008 Conn. Legis. Serv. P.A. 08-98 (H.B. 5600) (June 2, 2008).

B. Some Key Recommendations

Connecticut is most vulnerable to extreme climate and weather events along the shore and in low-lying coastal floodplains where 23% of the State's population lives. Much attention is focused on rapidly eroding, flood-prone beaches where the rate of change is most dramatic and easily visible. However, several densely populated, older industrial cities with large, poor ethnic populations are also located in this zone. These cities represent a significant portion of the State's social, economic and strategic assets. Although it may be tempting to commit public funds to defend the shore from inevitable sea level rise, climate change represents an opportunity to re-imagine the future of coastal cities such as New London, New Haven, and Bridgeport in terms of their infrastructure, architecture and relationship to water. The federal government's efforts to stabilize its Department of Defense and Coast Guard investments in the coastal zone may provide a useful signal about how and how rapidly to adapt to sea level rise and associated flooding and erosion risks.

Since the various threats associated with global warming and climate change will play out over a period of decades, the risks are not yet sufficiently urgent to warrant evacuation of the coastal zone. However, inexorable sea level rise and associated inundation and wave-related flooding and erosion justify considering how to pursue the following goals:

1. Buffer the shore in order to protect inland properties, water-dependent and customary public uses of the shore and tidal waters, coastal ecosystems (dunes, wetlands), and ecosystem services; and
2. Encourage property owners, residents, and businesses to retreat from the shore and coastal floodplains.

These goals are related to the extent that both assume that it will eventually be necessary to retreat from the shore because of the expense, uncertainty and negative externalities associated with armoring the coast, protecting and maintaining public infrastructure, and flood-proofing public and private property. (See Table 1 for the heuristic model used to describe the spectrum of regulatory, information and market-based strategies that could be used to accomplish these goals, depending on one's perception of the magnitude of the risk and preferences regarding equity and efficiency.)

Strategies that could be used to address Goal 1: *Buffer the shore in order to protect inland properties, customary public uses of the shore, coastal ecosystems (dunes, wetlands) and ecosystem services* include the following:

- **The federal, state and local governments should continue to partner with conservation groups to purchase coastal property, development rights and conservation, erosion and rolling easements. Strategic acquisitions could eventually secure a coastal buffer or "living shoreline" that would allow coastal features (i.e., barrier beaches, dunes, and wetlands) to migrate shoreward and protect coastal habitats, customary uses of the shore, and inland portions of coastal cities.** Purchasing fee interests and development rights in waterfront property is expensive and ineffectual, but there are no legal barriers to government acquisition of private property from willing sellers for defensible public purposes. Maine's approach of purchasing fee simple interests in waterfront properties and leasing them back to the owner as a way to recover costs and balance public and private interests in the shore seems worth exploring. The CT DEEP should continue to discourage

coastal armoring in conformance with the Coastal Management Act. In addition the State should evaluate the public costs associated with allowing the almost 1,500 Repetitive Loss Properties (RLPs) to rebuild in place and decide which of them to condemn, if any, and whether to convert those properties to wetlands or vegetated open space that could provide some level of flood storage.

- **The State, as the administrator of trust resources, should clarify and reaffirm the boundary between the public trust and private littoral lands and enforce the use of setbacks in a way that protects guaranteed public access to and use of the shore below the *observed* mean high water line.** Connecticut's Coastal Management Act clearly articulates the State's duty to protect the public's public trust interests in water, air and the environment. Therefore the State and/or local governments will likely be required to deny continued use of private property that becomes stranded on the "wet beach" and interferes with the State's proprietary interest in the tidelands and with public trust uses of the shore. The public trust doctrine represents a "background principle of property law" that should be consistently argued as a viable defense against takings claims. Erosion and rolling easements represent clever though administratively expensive market-based strategies to balance public trust interests and littoral rights to the shore. The DEEP and local governments should first routinely enforce setbacks in coastal and riparian flood and erosion hazard areas and secondly institute land use tax incentives to encourage property owners to voluntarily negotiate erosion and rolling easements. (Note that State and local governments should be careful not to impose exactions that result in public rights of way across private property *unless* the government is willing to pay just compensation, even if the property owner agrees, since the *Palazzolo* Court held that constitutionally protected rights are never forfeited.[238])

- **The State should define a *Coastal Growth Boundary*, identify a *TDR Receiving Area*, and identify and enforce development restrictions on *unbuildable land.*** The State and local governments should identify features that make properties "unbuildable." Some attributes of unbuildable land include close proximity to important natural features such as wetlands, dunes and drinking water supply aquifers; location in extreme flood and erosion hazard zones based on actual and projected (not historic) flood data; presence of critical or essential habitat for Federal or State-listed threatened and endangered species; or interference with recognized water-dependent uses. Municipal governments should be enabled and encouraged to establish *Flood and Erosion Hazard Overlay Districts* and to adopt and enforce ordinances to reduce development in these areas. Properties located within *Flood and Erosion Hazard Overlay Districts,* which are likely to include more properties than FIRM A and V zones since the FIRMs tend to be based on historic data rather than projections of climate-related sea level rise, should be required to carry multi-year flood insurance and pay an "erosion surcharge" as necessary.

[238] *See* Palazzolo, 533 U.S. at 624 ("Just as a prospective enactment, such as a new zoning ordinance, can limit the value of land without effecting a taking because it can be understood as reasonable by all concerned, other enactments are unreasonable and do not become less so through passage of time or title… A State would be allowed, in effect, to put an expiration date on the Takings Clause. This ought not to be the rule. Future generations, too, have a right to challenge unreasonable limitations on the use and value of land.")

- **The State should seriously consider establishing a Transferable Development Rights (TDR) program as a way to relocate proposed development away from coastal floodplains, and toward higher elevations.** The State and towns could identify "sending" areas but the 15 Regional Planning Organizations appear to be institutionally well-positioned to establish "receiving" areas and manage a land bank to the extent they already coordinate federally funded transportation and energy projects that affect multiple cities and towns; act as an information hub with respect to economic, environmental and social data; and support land use planning. TDRs could be used to help divert sprawling suburban development proposed to occur within *Coastal Growth Boundaries* to help re-build core cities in the coastal zone. Cluster and mixed use zoning, in combination with LEED-Neighborhood Development standards, can also be used to direct new development toward town centers to take advantage of existing public infrastructure.

- **The State should examine and clarify its authority to limit its financial responsibility for repair/replacement of public infrastructure subject to repetitive loss in the coastal zone following the federal COBRA model**. The State clearly has the authority to "abandon" and "discontinue" State roads and this should theoretically extend to other State resources and utilities, e.g., public water, wastewater treatment, to the extent that the State regulates withdrawals, diversions and discharges.[239]

Most climate change scenarios are projected to increase in intensity over the course of the next 10 to 90 years. Therefore, market and information-based techniques may be very effective in the near term at accomplishing Goal 2. *Encouraging property owners, residents and businesses to retreat from the shore and coastal floodplains* by getting property owners to internalize the risks of living in areas at high risk of storm surge, flooding, and wind and rain damage.

- **The federal government has many key roles to play in altering incentives to develop in areas that are or will be at high risk of erosion and inundation and storm surge flooding.** The NOAA-sponsored Sea Grant and Coastal Management Programs have been very influential at the state-level in terms of gathering physiographic, natural resource and demographic data, communicating information about climate change-related risk, and administering development and resource management programs in the coastal zone. The State should coordinate and model its adaptation strategies on the Climate-Ready Estuaries Program and other federal adaptation initiatives.

- **The federal and state flood and erosion insurance programs should be reformed in order to enable the State to reduce its exposure to uninsured losses related to extreme climate and weather events**. The National Flood Insurance Program (NFIP) continues to contribute to risky patterns of development in the coastal zone by subsidizing insurance premiums as a way to increase insurance coverage; exempting homes purchased before 1994 from many NFIP regulations;[240] indemnifying owners of the riskiest properties by allowing rebuilding after catastrophic and repetitive losses; and misrepresenting flooding

[239] See CONN. GEN. STAT. §22a-377(b)-1. (Connecticut regulates withdrawals and diversions from waters of the state and recognized that it needed broader authority to be able to reallocate water to the extent that some diversions were "grandfathered".)

[240] See R.D. Blanchard-Boehm, K.A. Berry, and P.S. Showalter, *Should Flood Insurance Be Mandatory? Insights in the Wake of the 1997 New Year's Day Flood in Reno-Sparks, Nevada*, 21 APPLIED GEOGRAPHY 199, 217 (2001).

risks by failing to account for widely accepted projections of sea level rise and related flooding risks in the NFIP Flood Insurance Rate Maps.

Some of these problems could be corrected by allowing the NFIP's private insurance partners to assess risk-based premiums that match market rates; requiring property owners to carry multi-year policies that run with the land; enforcing NFIP provisions that require lenders to police flood insurance for property owners who hold a federally insured mortgage; and enforcing COBRA and FEMA prohibitions on rebuilding infrastructure and private property that experience catastrophic damage or repetitive losses. The NFIP only requires homeowners in Special Flood Hazard Areas (SFHAs) to purchase flood insurance, but there is evidence that only 20% of eligible property owners carry mandatory insurance,[241] which means that these policies cover only 35-40% of the full risk.[242]

The State could address this situation, in part, by requiring all property owners whose properties lie less than two meters (6 feet) above sea level to purchase multi-year federal and/or private flood insurance as a way to increase the pool of insured properties. This would ensure that property owners in present and future high flood and erosion hazard areas recognize and internalize more of the cost of responding to catastrophic coastal events. Moreover, when coastal communities and a broader range of property owners participate in the NFIP pool, the State is in a better position to support community efforts to adopt more stringent regulatory ordinances to reduce the State's exposure to climate change-related risks.[243]

Alternatively, Connecticut could impose a moratorium to bar new development from participating in the NFIP until (1) NFIP flood insurance premiums reflect the "true risk" cost of living in FIRM A and V zones and/or (2) flood insurance is required for a broader range of at-risk properties. The State should also consider adopting the federal COBRA model and prohibit access to federal flood insurance for properties located in local *Flood and Erosion Hazard Overlay Districts* as a way to compel property owners to seek flood insurance from private insurance carriers that charge risk-based premiums. However these strategies potentially expose the State to greater economic risk in the event of a flood-related disaster to the extent that a larger population of property owners elects not to seek flood insurance and require emergency disaster assistance.

- **The State should amend the real estate disclosure form and Land Evidence recording requirements to more completely disclose flood, erosion and climate change-related risks associated with real property.**[244] These relatively simple and related information-based techniques could potentially achieve some of the same goals as flood insurance and regulation by giving prospective buyers and lenders adequate information on which to base the purchase of real estate, thereby signaling the "risk-adjusted" value of real property. (See discussion of the spectrum of strategies presented in Table 1.) Property owners should

[241] Martin Halek & Mark J. Browne, *Managing Flood Risk: A Discussion of the National Flood Insurance Program and Alternatives*, *in* PUBLIC INSURANCE AND PRIVATE MARKETS (Jeffrey R. Brown, ed. 2010).
[242] *Id.*
[243] It is important to note that policies mandating insurance coverage or performance bonds may be prohibitively costly for many low-income property owners who are also likely to be the least able to afford relocation if rebuilding prohibitions were set in place. Transferable development rights (TDRS), combined with a land bank, could be used to "insure" land for relocation of property owners who must be relocated.
[244] *See, i.e.*, Florida Association of Realtors, Seller's Real Property Disclosure Statement (2005) (Florida Real Estate Disclosure Form requires sellers to disclose whether the property is located in a special flood hazard area, requires flood insurance, and present or past flood or drainage problems).

> be required to record the most current FIRM designation associated with their property, as well as information regarding the history of flood damage in the Land Evidence Records. Ideally, this "risk-based" information should be collected by local tax assessors, updated as part of the routine tax re-assessment process, and used to form the basis for local risk-based special assessments and/or performance bonds levied and administered by the CT DEEP[245] to (1) protect public trust interests in water, access to the shore and subtidal lands, and the environment, and (2) help the State address public nuisances created by damage to properties located in high flood and erosion hazard areas.

In sum, it is important for coastal states like Connecticut to recognize that they have many well-established constitutional, common law, and statutory bases on which to justify precautionary action. Connecticut can also draw on the experiences of other jurisdictions in designing market-based, information and regulatory strategies to motivate responsible development in high-risk coastal zones. Of course, Connecticut's decisions regarding which strategies it ultimately chooses to pursue will depend on the way it balances its perception of the political and economic risks associated with trying to address climate change-related risks in a precautionary manner against the risks of failing to do so.

[245] CONN. GEN. STAT. §22a-107 (requiring performance bond as a condition to coastal site plan approval.)