



City of Palm Coast

Agenda

BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE

City Hall
160 Lake Avenue
Palm Coast, FL 32164
www.palmcoastgov.com

*Chairman Jeffery Seib
Vice Chair Marcia Foltz
Committee Member Edward Beier
Committee Member Robert Knapp
Committee Member Glenn Partelow*

Thursday, May 23, 2019

5:00 PM

COMMUNITY WING OF CITY HALL

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CALL TO ORDER AND PLEDGE OF ALLEGIANCE

ROLL CALL

MINUTES

1 MEETING MINUTES OF THE MARCH 28, 2019 BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE

OLD BUSINESS

2 CLIMATE CHANGE AND SEA LEVEL RISE COMMITTEE PRIORITIES

NEW BUSINESS

3 REGISTERING PALM COAST, FL AS A MONARCH CITY USA

4 REGISTERING PALM COAST, FL AS A KEEP FLORIDA BEAUTIFUL AND KEEP AMERICA BEAUTIFUL CITY

PUBLIC PARTICIPATION

DISCUSSION OF MATTERS NOT ON THE AGENDA

ADJOURNMENT

City of Palm Coast, Florida Agenda Item

Agenda Date: April 25, 2019

Department	PLANNING	Amount
Item Key	6304	Account
		#
Subject	MEETING MINUTES OF THE MARCH 28, 2019 BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE	
Background :		
Recommended Action :		
Approve as presented		



City of Palm Coast Minutes BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE

City Hall
160 Lake Avenue
Palm Coast, FL 32164
www.palmcoastgov.com

*Chairman Jeffery Seib
Member Marcia Foltz
Committee Member Edward Beier
Committee Member Robert Knapp
Committee Member Glenn Partelow*

Thursday, March 28, 2019

5:00 PM

COMMUNITY WING OF CITY HALL

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CALL TO ORDER AND PLEDGE OF ALLEGIANCE

Chair Seib called the March 28, 2019 meeting of the Beautification and Environmental Advisory Committee (BEAC) to order @ 5:00PM.

ROLL CALL

Present and responding to the roll call were:

Glenn Partelow

Edward Beier

Marcia Foltz

Jeffrey Seib

Robert Knapp

City Staff:

Beth Dawson - Landscape Architect

Jordan Myers - Environmental Planning Technician

Irene Schaefer - Planning Clerk

*Irene Schaefer administrated the oath of office to the BEAC's newest member
Mr. Robert Knapp.*

MINUTES

1 MEETING MINUTES OF THE FEBRUARY 28, 2019 BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE MEETING

Pass

Motion made to approve as presented made by Committee Member Partelow and seconded by Committee Member Beier

Approved - 5 - Committee Member Edward Beier, Member Marcia Foltz, Chairman Jeffery Seib, Committee Member Glenn Partelow, Committee Member Robert Knapp

OLD BUSINESS

2 ENVIRONMENTAL AGENDA 2019-2

Mr. Seib gave a presentation which is attached to these minutes. Discussion ensued of what climate change initiatives could be included in an action plan that would be adopted by the City of Palm Coast. Discussion of the wording to be included in a statement plan that would be submitted to the City Council members for their review and comment.

The BEAC members discussed the positive effects of using solar energy including potential individual cost savings.

The members also discussed a potential recommendation to the City Council for a climate change advisory committee that would be appointed by the City Council to create a climate change initiative.

Ms. Dawson informed the BEAC members that the City's Comprehensive Plan is coming up for review in 2022 and that the review process will start in 2021.

Ms. Foltz mentioned that the City has a 10 year water supply plan that has to be reviewed every 5 years.

Mr. Seib discussed protection of the water supply during a storm surge event. Ms. Foltz discussed that the impact of a storm surge event in the City of Palm Coast would not necessarily be of the same impact as a similar event in south Florida due to the fact that our water source (the Florida aquifer) is 1000 feet down into the earth.

Pass

Motion made to approve that we have a pro-active strategy recognizing the threat of climate change. In addition, the BEAC members recommend that the City Council appoint a panel/commission composed of: the general public, the business community, and environmental interests. Agenda to seek out expert opinion and review and report to City Council. Prepare potential action plans utilizing marginal, optimal, and worst case scenarios

of climate change impact and public policy response made by Committee Member Partelow and seconded by Committee Member Beier

Approved - 5 - Committee Member Edward Beier, Member Marcia Foltz, Chairman Jeffery Seib, Committee Member Glenn Partelow, Committee Member Robert Knapp

NEW BUSINESS

3 ELECTION OF A VICE CHAIR TO THE BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE

Pass

Motion made to approve election of Ms. Marcia Foltz as Vice Chair of the BEAC made by Committee Member Partelow and seconded by Committee Member Beier

Approved - 5 - Committee Member Edward Beier, Member Marcia Foltz, Chairman Jeffery Seib, Committee Member Glenn Partelow, Committee Member Robert Knapp

4 ELECTION OF A BEAUTIFICATION AND ENVIRONMENTAL ADVISORY COMMITTEE MEMBER TO THE ARTS COMMISSION

Discussion ensued among the BEAC members regarding the importance of art in public places to invoke thought and discussion.

Pass

Motion made to approve election of Chair Jeffrey Seib as the new liaison to the Arts Commission made by Committee Member Beier and seconded by Vice Chair Foltz

Approved - 5 - Committee Member Edward Beier, Member Marcia Foltz, Chairman Jeffery Seib, Committee Member Glenn Partelow, Committee Member Robert Knapp

PUBLIC PARTICIPATION

Chair Seib opened the meeting to public comment at 5:51PM and seeing no one approach the podium he then closed the public comment section of this meeting at 5:52PM.

DISCUSSION OF MATTERS NOT ON THE AGENDA

The newest member of the BEAC, Robert Knapp was asked to give some information about himself and his background.

Chair Seib discussed the prior month's public participant who requested support for his Eagle Scout project of nesting boxes. Ms. Dawson informed the members she had not heard from the person and that if anyone heard from him to refer him to Ms. Myers as he will need to make a presentation before the Green Team members (City Hall Staff). Chair Seib gave information on the various sizing of the nesting boxes' openings which provides protection from predators and he provided other related information he learned from his master's program studies.

Ms. Dawson reminded the members of the upcoming Ethics and Sunshine rules training on April 23rd and if the members will be attending they should RSVP by April 17th. Both Members Partelow and Foltz mentioned they will not be able to attend the April 23rd training.

ADJOURNMENT

Motion made that the meeting be adjourned by Mr. Partelow and the motion was seconded by Mr. Beier.

The meeting was adjourned at 6:00PM.

*Respectfully Submitted by:
Irene Schaefer, Recording Secretary*

City of Palm Coast, Florida Agenda Item

Agenda Date: APRIL 25, 2019

Department	PLANNING	Amount
Item Key	6329	Account
		#
Subject	CLIMATE CHANGE AND SEA LEVEL RISE COMMITTEE PRIORITIES	
Background :	Continued discussions between the BEAC members regarding their priorities with regard to climate change and the rising sea levels. Please see below link and attached PDFs for discussion purposes. https://www.asla.org/climatepolicies.aspx	
Recommended Action :	Discussion purposes	

Climate Change Impacts on Law and Policy in Florida

Thomas Ruppert¹ and Erin L. Deady²

¹Florida Sea Grant, University of Florida, Gainesville, FL; ²Erin L. Deady, P.A., West Palm Beach, FL

Climate change and sea level rise have made obsolete the notion that law and policy develop in the context of a relatively stable natural environment. The need of communities to adapt to climate change and sea level rise reflects the need for laws and policies governing those communities to facilitate rather than undermine such adaptation. This chapter provides an overview of law and policy issues at three levels of government—state, local, and federal. It highlights changes in state law and policy in Florida that relate to climate change and sea level rise. The chapter also focuses on local governments, and includes sections about regional collaborations of local governments, financial issues and climate change/sea level rise at the local level, examinations of impacts on infrastructure, and impacts on the public's use of beaches in Florida. The chapter concludes with discussion of a policy change related to climate change and sea level rise at the federal level that impacts local governments.

Key Messages

- The state of Florida engagement with climate change began early, with energy law in 2006. Since then the focus of engagement in climate and sea level rise has shifted from energy to disaster planning and flooding. This shift to focus on flooding and resilience resulted from local government experience of roads and drainage being the first types of infrastructure to suffer from rising seas.
- Local governments, with much of their focus on infrastructure, have been some of the greatest centers of action on climate change, with many adopting extensive comprehensive plan policies that are increasingly being implemented through ordinances. Collaboration among local governments has resulted in increased focus on climate change and sea level rise as well as harmonized approaches to the challenges.
- Among the challenges that Florida faces is protecting the state's beaches, which are the lifeblood of Florida's tourism industry.
- Federal actions (from federally-supported research and data to federal policy changes to the National Environmental Protection Act and the new Federal Flood Risk Management Standard) have been both drivers and supporters of state and local activities on climate change and sea level rise, though recent changes at the federal level have eliminated some of these drivers.

Keywords

Climate change; Sea level rise; Infrastructure; Flooding; Local government; Policy; Law; Planning; Resiliency; Adaptation

Introduction

Law has typically developed on the assumption that as much as society and law may change, the natural world around us is, for the most part, a world of basic stationarity.¹ (Craig 2010) Climate change and sea level rise, however, mean that this fundamental assumption about the natural world does not apply any longer, and law and policy need to enable necessary adaptations to changes in physical and related conditions. This chapter reviews areas of law and policy in Florida impacted by climate change and sea level rise, including related changes in state law, provides a focus on local government action and regional collaborations in Florida, and includes a brief overview of federal actions and policy with greater emphasis on federal policy changes that affect local governments. Local governments form the real focus of this chapter since most of the impacts and most of the adaptations to climate change and sea level rise directly implicate local governments as the seat of comprehensive land use planning, infrastructure, public finance, and the level of representational government closest to people when they feel the impacts of climate change or sea level rise.

Climate change and sea level rise can and will impact law and policy in almost any substantive area and discipline in the long run. However, this chapter maintains a relatively narrow focus for two reasons. First, the authors wish to keep this summary short and readable. Second, a number of issues that could fall under the rubric of climate change or sea level rise policy already appear in other chapters of this book. For example, land use and land cover discussions appear in Chapter 2; water policy related to climate change and sea level rise is included in Chapter 3; some discussion of urban infrastructure policy occurs in Chapter 11; energy policy and impacts appear in Chapter 5; impacts on insurance, both the National Flood Insurance Program and the Florida's Citizens Insurance, are analyzed in Chapter 6.

State Law, Climate Change, and Sea Level Rise

At the level of state government, Florida has had a relationship with climate change and sea level rise for longer than most might think. Florida was an early adopter when then-governor Jeb Bush signed into law the Renewable Energy Technologies and Energy Efficiency Act in 2006. A major component of the Act was the creation of the new Florida Energy Commission in an advisory role related to state energy policies. The first report of the Commission (Florida Energy Commission 2007)² was required to include recommended steps and a schedule for the development of a state climate action plan.

¹ See, e.g. Robin Kundis Craig, "Stationarity is Dead"—Long Live Transformation: Five Principles for Climate Change Adaptation Law, 34 Harv. Env't'l L.R. 9 (2010).

² 2007 Florida Energy Commission, Report to the Legislature. Available at <http://www.dms.myflorida.com/content/download/54452/228726/file/2007>.

The Commission's report noted the scientific community's consensus that human-caused increases in greenhouse gases need to be addressed and recommended setting targets to reduce them. This would require an inventory of greenhouse gases but it would put the state in a position to lead by example through education and unification of Florida's energy governance. In 2007, under the administration of then-Governor Charlie Crist, the focus on climate continued at the state level, with executive orders setting targets and actions to reduce greenhouse gas emissions statewide.³

Climate change activity continued in 2008 and throughout the Crist administration. One bill created a cap and trade program for utilities, set up a renewable portfolio standard for energy, and addressed automobile efficiency and emissions.⁴ Another addressed issues such as green building, efficient land use patterns, energy conservation, greenhouse gas emissions in planning, and provided for the Florida Building Commission to make recommendations on energy efficiency.⁵ In 2009, the statutorily-created "Florida Energy & Climate Commission" began meeting.

Under the subsequent administration of Governor Rick Scott, state agencies continue working on climate change-related issues. Rather than concentrating resources on policy development through more publicly-focused commissions or task forces, the administration has turned its attention more to the disaster planning and recovery aspects of climate change. The Florida Fish and Wildlife Conservation Commission is doing a significant amount of data collection and monitoring related to habitat and species impacts.⁶ The Department of Economic Opportunity, both through its own statutory mission and with funding from the federal government, has been doing extensive work on sea level rise, including pilot planning efforts in several communities.⁷ Its approach has been to also provide technical assistance for local governments and to offer review and comment on compliance with legislation passed in 2015 related to addressing "Peril of Flood" issues in comprehensive plans. The Department of Economic Opportunity has also created numerous guides and compilations of resources for local governments that want to start addressing sea level rise in their policy framework.⁸ The Florida Department of Environmental

³ This discussion of climate change history and policy in Florida owes much to Erin Deady, Esq., and the article "The Link Between Future Flood Risk and Comprehensive Planning," in *The Environmental and Land Use Law Section Reporter of the Florida Bar*, Vol. 37, No.2, 7-14, (Sept. 2015). Thomas Ruppert was co-author with Erin Deady on this article.

⁴ Laws of Florida, 2008-227.

⁵ Laws of Florida, 2008-191.

⁶ See, e.g. Florida Fish and Wildlife Conservation Commission, Climate Change, available at <http://myfwc.com/conservation/special-initiatives/climate-change/>.

⁷ See, e.g. Florida Dept. of Econ. Oppt'y, Adaptation Planning, available at <http://www.floridajobs.org/community-planning-and-development/programs/community-planning-table-of-contents/adaptation-planning>.

⁸ Various products of the work of the Department of Economic Opportunity can be found on their "Adaptation Planning" website at <http://www.floridajobs.org/community-planning-and-development/programs/community-planning-table-of-contents/adaptation-planning>.

Protection has primarily been limited to work related to climate change impacts on coral reefs.⁹

In 2011, HB 7207, a nearly 200-page bill, became law and essentially overhauled the state's growth management policy, which is laid out in Chapter 163, Florida Statutes (F.S.). Included in the changes were many viewed as contentious by planners and conservationists, with a fundamental reorganization of the Florida Department of Community Affairs into a new Florida Department of Economic Opportunity; a shift that retained some planning and growth management functions but clearly focusing more on the state's economic development policy. In addition, the law reduced state oversight of local planning decisions and actions, concentrating more on resources and issues with statewide significance. Relative to climate change, the law eliminated many, but not all, of the energy efficiency and greenhouse gas reduction provisions from Chapter 163, F.S.; these had been added only three years before in 2008 with the passage of HB 697. Although many of these provisions were eliminated, there are several that remain even today to consider in the planning context:

- Comprehensive planning standards on data in Section 163.3177(1)(f), F.S. "All mandatory and optional elements of the comprehensive plan and plan amendments shall be based upon relevant and appropriate data and an analysis by the local government that may include, but not be limited to, surveys, studies, community goals and vision, and other data available at the time of adoption of the comprehensive plan or plan amendment."
- A project could be considered "sprawl" if: (VIII) plan or plan amendment allows for land use patterns or timing which disproportionately increase cost in time, money or energy of providing and maintaining facilities/services, including roads, potable water. Section 163.3177(6)(a)9.a.(VIII), F.S.
- "Discourage the proliferation" of sprawl if: project incorporates a development pattern or urban form that achieves four (4) or more of the following ... promotes conservation of water and energy. Section 163.3177(6)(a)9.b.(IV).
- Conservation element: must contain principles, guidelines, and standards for conservation that provide long-term goals to protect air quality. Section 163.3177(6)(d)2., F.S.

The 2011 law eliminated Chapter 9J-5 from the Florida Administrative Code (F.A.C.), which was an implementing rule providing detailed guidance on comprehensive plan implementation pursuant to Chapter 163, F.S. While the implementing rule was eliminated, some of that guidance was incorporated into Chapter 163, F.S. The stated goal was to eliminate duplication between the Chapter itself and the implementing rule by consolidating the policies into one location. The sections of the F.A.C. that were eliminated included details and requirements related to post-disaster and resilience planning, evaluation of erosion and accretion trends and their impacts, public access, infrastructure, and other considerations. The new requirements are more flexible

⁹ See, e.g. Florida Dept. of Environmental Protection, Climate Change and Coral Reefs, available at http://www.dep.state.fl.us/coastal/programs/coral/climate_change.htm.

than what was required pursuant to Chapter 9J-5, F.A.C.¹⁰ How this flexibility ultimately impacts local government post-disaster redevelopment planning is still an evolving matter.

The 2011 law also opened some doors. It added the option for local governments to address sea level rise adaption as part of the Coastal Management Element of local government comprehensive plans through the establishment of optional adaptation action areas. Potential criteria for such an area are broad and include, but are not limited to: areas for which the land elevations are below, at, or near mean higher high water; areas with a hydrologic connection to coastal waters; or areas that are designated as evacuation zones for storm surge.¹¹ This addition is reinforced by a definition for “adaptation action area” or “adaptation area,” which is “a designation in the coastal management element of a local government’s comprehensive plan which identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels for the purposes of prioritizing funding for infrastructure needs and adaptation planning.”¹²

Finally, the 2011 law did not prohibit longer timeframes for planning,¹³ but the minimum required planning horizons in Florida’s comprehensive planning law (5 and 10 years) remain too short to effectively include consideration of climate change and sea level rise impacts, even when taking into account infrastructure or development with usable life spans of many decades.¹⁴

In summary, the changes to comprehensive planning law in 2011 do not prevent Florida’s local governments from engaging in detailed, proactive efforts to increase their resilience to coastal hazards, such as erosion, storms, and sea level rise; but they allowed for a more discretionary function than a prescriptive one. However, the flexible and discretionary mechanisms for resilience and coastal planning may be politically challenging at the local level. One view is that without the “stick” of mandatory requirements, local governments will choose not to address them at all. Another view is that incrementally providing local governments tools to address these issues within the state’s comprehensive planning law provides a basis for doing so for those that want to, and allows greater local control and self-determination. Several local governments have proactively utilized provisions in Chapter 163, F.S. to create optional elements of comprehensive plans far exceeding the requirements in Chapter 163 and addressing a range

¹⁰ Section 163.3178(2)(f), F.S. contains language somewhat similar to the former requirement of Chapter 9J-5 of the Florida Administrative Code requirement for post-disaster redevelopment plans. The statute provides that the coastal management element shall contain a “redevelopment component which outlines the principles which shall be used to eliminate inappropriate and unsafe development in the coastal areas when opportunities arise.”

¹¹ Laws of Florida, 2011-139, codified at Section 163.3177(6)(g)10, F.S. (2016).

¹² Laws of Florida, 2011-139, codified at Section 163.3164(1), F.S. (2016).

¹³ The new law allowed “additional planning periods for specific components, elements, land use amendments, or projects.” Section 163.3177(5)a, F.S. (2016).

¹⁴ Section 163.3177((5)(a), F.S. stating, “Each local government comprehensive plan must include at least two planning periods, one covering at least the first 5-year period occurring after the plan’s adoption and one covering at least a 10-year period.”

of topics including climate change, adaptation, energy, or combinations of all of these on some level.¹⁵

As discussed in chapter 6 of this book, changes to the National Flood Insurance Program in 2012 and 2014 hit Florida extremely hard. As part of its efforts to deal with the impacts of such changes, the 2015 Florida Legislature passed a law entitled “An Act Relating to the Peril of Flood.”¹⁶ While important parts of the law directly address flood insurance issues, other portions focus on flooding issues, disaster planning and recovery, and pre-disaster mitigation. Under the 2015 law, coastal management elements must include “A redevelopment component that outlines the principles that must be used to eliminate inappropriate and unsafe development in the coastal areas when opportunities arise.”¹⁷ While the redevelopment component itself is not new, what is required to be addressed in the component has been enhanced. The requirements include:

1. Employing development and redevelopment principles, strategies, and engineering solutions that reduce the flood risk in coastal areas that result from high-tide events, storm surge, flash floods, stormwater runoff, and the related impacts of sea level rise.
2. Encouraging the use of best practices development and redevelopment principles, strategies, and engineering solutions that will result in the removal of coastal real property from flood zone designations established by FEMA.
3. Identifying site development techniques and best practices that may reduce losses due to flooding and claims made under flood insurance policies issued in the state.
4. Being consistent with, or more stringent than, the flood-resistant construction requirements in the Florida Building Code and applicable flood plain management regulations set forth in 44 C.F.R. part 60.
5. Requiring that any construction activities seaward of the coastal construction control lines established pursuant to Section 161.053, F.S. be consistent with Chapter 161, F.S.
6. Encouraging local governments to participate in the National Flood Insurance Program Community Rating System administered by FEMA to achieve flood insurance premium discounts for their residents.

Because of the law passed in 2011, Section 163.3178(2)(f)1., F.S. now includes sea level rise as one of the root causes that must be addressed in the “redevelopment principles, strategies, and engineering solutions” to reduce flood risk. Local governments required to have coastal management elements in their comprehensive plans appear to have broad discretion as to how they comply with this new mandate. The law does not specify a date by which local governments must comply. Section 163.3191(1), F.S. still requires local governments to evaluate their plans at least once every seven years to determine if amendments are necessary to reflect relevant

¹⁵ Section 163.3177(1)(a), F.S. stating, “The comprehensive plan shall consist of elements as described in this section, and may include optional elements.”

¹⁶ Laws of Florida, 2015-69.

¹⁷ Laws of Florida, 2015-69, section 1, codified at Section 163.3178(2)(f), F.S. (2016).

changes in state law. That said, a local government also has the authority pursuant to Section 163.3191(2), F.S. to make a determination that amendments are necessary sooner than that seven-year requirement. With that, local governments do have discretion in how they want to comply with these new future flood risk requirements and could do so sooner than their next required evaluation and appraisal report, if they chose to.

While explicitly now requiring flood risk from sea level rise to be addressed in comprehensive plans (coastal management elements), this shouldn't be considered the single driving force for local governments to address climate change and sea level rise. As outlined previously, policy development based on solid data, infrastructure risk planning, limiting expenditures in coastal areas susceptible to storm damage, protection of air quality, elimination of sprawl, and other notions of balanced planning should be considered holistically when updating comprehensive plans. The importance of considering the state's policy and regulatory structure as a floor, not a ceiling, when dealing with climate and sea level rise issues is a shift that is already starting to occur at the local level.

Another area of state law that should be integrating the reality of sea level rise but has largely failed to do so is Florida's "Coastal Construction Control Line" (CCCL) permitting program.¹⁸ Part of the CCCL program's stated goal is "to preserve and protect [Florida's beaches] from imprudent construction which can jeopardize the stability of the beach-dune system, accelerate erosion, provide inadequate protection to upland structures, endanger adjacent properties, or interfere with public beach access."¹⁹ Building requirements associated with the CCCL program have increased the resistance of coastal construction to storm events generally. However, the CCCL program has many shortcomings that, as demonstrated by the risks to and loss of structures permitted under it, do seem to allow imprudent construction.²⁰ The CCCL program statutes never mention sea level rise, and the regulations that implement it do not account for sea level rise in permitting of new "major habitable structures." In fact, regulations implementing the CCCL program only mention sea level rise once: regulations allow consideration of sea level rise when determining whether to issue a permit to allow armoring or hardening of the shoreline.²¹ Thus, state laws and regulations do not allow the CCCL program to account for sea level rise when

¹⁸ The CCCL program appears in statute at Chapter 161, Part I (161.011 – 161.242) (2016).

¹⁹ FLA. STAT. § 161.053 (2016).

²⁰ Florida's experience with loss of and damage to many coastal homes during Hurricane Matthew's glancing blow to Florida in 2015 demonstrated shortcomings of the CCCL program. Many homes or structures damaged or lost due to coastal erosion were permitted under the CCCL program. *See also, e.g.* Thomas Ruppert, *Eroding Long-Term Prospects for Dynamic Beach Habitat in Florida*, 1 *Sea Grant Law & Policy Journal* 65 (2008), available online at <http://www.olemiss.edu/orgs/SGLC/National/SGLPJ/SGLPJ.htm>. This cited article was based on a more comprehensive document that reviewed several structures permitted under the CCCL program and includes photos of the structures. This is available as the link "White Paper on Dynamic Turtle Nesting Habitat Accommodation in Florida" and "Appendices to the White Paper on Dynamic Turtle Nesting Habitat Accommodation in Florida" at <https://www.law.ufl.edu/academics/dynamic-habitat-accommodation-the-policy-framework-for-migrating-shorelines>.

²¹ Fla. Admin. Code 62B-41.005(7)(c) (2016).

deciding what types of development are permissible, where development may be sited, or how it is designed but do allow for consideration of sea level rise when deciding whether to allow coastal armoring.

Florida has extensive state requirements for stormwater and wetlands permitting through the state's Environmental Resource Permit (ERP) program.²² The ERP program regulates activities that alter the flow of surface waters, such as construction creating stormwater; the ERP also regulates dredging and filling in wetlands or surface waters. However, the rules for implementing the ERP program do not currently consider future conditions specifically related to changing rainfall patterns or increasing sea levels. Thus, the ERP program, when permitting construction in wetlands in coastal areas, may be permitting construction that will soon experience significant impacts from sea level rise. Likewise, without taking changing rainfall patterns into account, such as the increased incidence of heavy rainfall events, design requirements for stormwater systems will, in the future, likely not achieve the level of service intended.

Finally, in the 2017 legislative session, SB 464/HB 181 (now Section 252.3655, F.S.) passed creating an interagency workgroup to share information on the current and potential impacts of natural hazards throughout the state. The goal is to coordinate the ongoing efforts of state agencies in addressing the impacts of natural hazards, and collaborate on statewide initiatives to address the impacts of natural hazards. "Natural hazards" was specifically defined to include, extreme heat, drought, wildfire, sea-level change, high tides, storm surge, saltwater intrusion, stormwater runoff, flash floods, inland flooding, and coastal flooding. The workgroup is to meet quarterly to share information, leverage agency resources, coordinate ongoing efforts, and provide information for inclusion in the annual progress report to the Governor, the President of the Senate, and the Speaker of the House of Representatives starting January 2019.

Local Government: The Real Seat of Climate Change and Sea-Level Rise Action in Florida

Evolving approaches to climate and sea level rise policy at the state level, depending on what administration is in place, have left some local governments wondering how to address this important challenge. Whether driven by local politics or efforts to comply with state or federal planning requirements, there is recognition that, on some level, policy discussion must occur. Some of the most impacted communities have also begun to work together regionally to address the issue regardless of what legislative or administrative requirements may or may not exist.

Local governments have a visceral connection to climate change and sea level rise; when exceptionally heavy rainfall events occur—when heat waves hurt people, when droughts limit

²² State permitting is also conducted in conjunction with U.S. Army Corps of Engineers permitting. *See* Florida Department of Environmental Protection, "What is the Environmental Resource Permit (ERP) Program?", available at <http://www.dep.state.fl.us/WATER/wetlands/erp/index.htm>.

water supplies, and when sea level rise causes flooding—more often than not the first ones to hear from the residents impacted are local governments. As one person put it: “If the road in front of your house is flooded, you will probably call the local government before you call the state or federal government.” Some local governments have responded by taking the lead in developing planning language and local resolutions and ordinances that account for climate change and sea level rise.

In terms of implementation of the 2015 Peril of Flood legislation, 195 local governments are required to have a coastal management element in their comprehensive plans (161 municipalities and 34 counties). As of May 2017²³:

- 43 (22%) explicitly address sea level rise in their comprehensive plans
- Eleven mention Adaptation Action Areas (AAAs) in their comprehensive plans (six of these are located in southeast Florida)
- Six have a physical designation:
 - Satellite Beach designates coastal high hazard areas as AAAs
 - Village of Pinecrest designates AAAs
 - Broward County sand bypass project at Port Everglades
 - Ft. Lauderdale 16 areas 38 stormwater projects
 - Yankeetown
 - Fernandina Beach

The following local governments have addressed the new Peril of Flood requirements in Section 163.3178, F.S. within their comprehensive plans or updates to them. Several others are in process (Levy and Santa Rosa). But as of May 2017, the following now have some language, either proposed or final and adopted, related to redevelopment principles, plans, or strategies that address future flood risk including sea level rise.

- North Miami
- Miami Beach
- Lake Park
- Ponce Inlet
- Sunny Isles Beach
- St. Petersburg
- Boynton Beach
- Jupiter Inlet Colony
- West Palm Beach
- Jupiter
- Yankeetown

²³ Erin L. Deady, *Why the Law of Climate Change Matters: From Paris to a Local Government Near You*, Florida Bar Journal (November 2017), available at: <https://www.floridabar.org/news/tfb-journal/>.

- Palm Beach
- Clearwater
- Broward County
- Pinecrest

Some local governments also have optional elements of their comprehensive plans addressing adaptation, sea level rise, energy, or a combination. For instance, Broward County has a “Climate Change Element” and Monroe County has an “Energy and Climate Element.” Both have similar characteristics in that they address things such as greenhouse gas reductions on the mitigation side through energy policies and otherwise; but they also address linkages between a changing climate and the built environment, such as infrastructure and land use. Using the optional element approach to address these issues within a comprehensive plan probably affords a local government the widest latitude to address their issues at the most individual level through direct policies and commitments to further develop data to support future policy or both.

Additionally, several local governments in Florida are using their own resources or grant funding to develop datasets upon which to develop new climate-related policies. Some are doing this in furtherance of the Peril of Flood legislation, and some just because it makes good planning sense. Partnerships between not-for-profit organizations and local governments, or just local governments themselves are a driving factor in opportunities local governments are seizing to address these issues. A dual dynamic is also evolving whereby the policy structure is being put into place, but concurrently, local governments are starting to implement actual strategies to build resiliency into their communities. This implementation aspect is taking on many forms including stormwater master planning; actual project development for roads or other drainage infrastructure; identification, analysis and retrofits of actual vulnerable facilities; beach and shoreline protection; and the raising or flood-proofing of structures.

Regional Collaboration

In 2010, southeast Florida created what has become one of the best-known regional collaborations on climate change in the United States. Palm Beach, Broward, Miami Dade, and Monroe counties joined together to officially form the Southeast Florida Regional Climate Change Compact (Compact). The Compact had its genesis in part from a realization that parallel lobbying efforts by the counties could be strengthened by working from similar baselines.²⁴ While the official voting members of the Compact’s Steering Committee include two members from each county and one member from a municipality from each county, several other organizations have actively worked in coordination with the Compact, including the U.S. Army

²⁴ David L. Markell, *Sea-Level Rise and Changing Times for Florida Local Governments*, 42 Colum. J. Envtl. L. (forthcoming 2016).

Corps of Engineers, the National Oceanic and Atmospheric Administration, the U.S. Environmental Protection Agency, the South Florida Regional Planning Council, the South Florida Water Management District, and The Nature Conservancy, among others.

One of the first activities of the Compact was development by the “Sea Level Rise Technical Ad Hoc Working Group” of a white paper on sea level rise projections for Compact members in their planning efforts. This document was updated in the Compact’s 2015 “Unified Sea Level Rise Projection” paper.²⁵ While the Compact has generated dozens of valuable documents, this one has played an important role in helping bring together Compact members and others on the committee that developed and updated it.

Another crucial document, both in development and implementation, is the Compact’s Regional Climate Action Plan, or RCAP. Developed in 2012, the RCAP was again a broadly collaborative project involving nearly 100 subject-matter experts.²⁶ The RCAP contains recommendations in seven broad areas: sustainable communities and transportation planning; water supply, management and infrastructure; natural systems; agriculture; energy and fuel; risk reduction and emergency management; and outreach and public policy. The RCAP also contains 110 recommendations intended to be implemented “through existing local and regional agencies, processes and organizations.”²⁷ The RCAP has resulted in several workshops as well as an implementation guide, and the Compact has completed surveying of municipalities to determine levels of implementation of RCAP recommendations. The RCAP is, as of late 2017, going through an update process scheduled for completion in December 2017.

The extensive collaboration at the highest level of county government represented by the Southeast Florida Regional Climate Change Compact is not the only model for regional work to address climate change. In northeast Florida, an early effort of the Northeast Florida Regional Council to promote discussion by the business community about the potential risks of sea level rise led to members of the business community beginning to address not only the risks of sea level rise but also of climate change. The Northeast Regional Council and its related Regional Council Institute have been facilitating the work of Public/Private Regional Resiliency Committee.²⁸

Florida’s Tampa Bay region has also been working towards greater regional collaboration with the Tampa Bay Regional Planning Council and its “One Bay Resilient Communities”

²⁵ Available at <http://www.southeastfloridacclimatecompact.org/wp-content/uploads/2015/10/2015-Compact-Unified-Sea-Level-Rise-Projection.pdf>

²⁶ Southeast Florida Regional Compact Counties, *A Region Responds to a Changing Climate: Regional Climate Action Plan* (Oct. 2012), <http://www.southeastfloridacclimatecompact.org/wp-content/uploads/2014/09/regional-climate-action-plan-final-ada-compliant.pdf>. *See also*, David L. Markell, *Sea Level Rise and Changing Times for Florida Local Governments*, 42 *Colum. J. Envtl. L.* (forthcoming 2016).

²⁷ Southeast Florida Regional Compact Counties, *A Region Responds to a Changing Climate: Regional Climate Action Plan* vi (Oct. 2012).

²⁸ <http://www.rcinef.org/P2R2.html>.

working group; together with Florida Sea Grant, they facilitated creation of the Tampa Bay Climate Science Advisory Panel. In August 2015, this panel released a report entitled “Recommended Projection of Sea Level Rise in the Tampa Bay Region.” This effort, focused on developing a regional sea level rise projection scenario similar to the one produced by the Southeast Florida Regional Climate Change Compact, served as a way to bring together a plethora of local actors, including local governments, state and federal agencies, academic institutions, and non-profit entities. The resulting sea level rise projections are now being integrated into policy and codes by some local governments in the region.

Sea level rise and climate change do not respect political borders at the local level any more than at the global level. Developing regional approaches to climate change can help build momentum for efforts to reduce the causes of climate change, while also making it possible to more rationally address the impacts that sea level rise will have on our communities.

Drainage and Road Infrastructure—the Canaries in the Coal Mine

Climate change and sea level rise were once thought to be issues for the future. But communities in Florida and elsewhere have seen that climate change and sea level rise are already impacting them.²⁹ Local governments are struggling with water supply issues brought on by more severe dry seasons and increased saltwater intrusion, heavier rainfall and flooding, warmer temperatures, and flooding exacerbated by rising seas. This subsection looks at how the challenges of roads and drainage are an example of the challenges that local governments—and all of us that live in them—face. This subsection focuses primarily on sea level rise rather than the full spectrum of climate change impacts.

Roads and drainage systems are among the most basic infrastructure that makes areas inhabitable. Development of an area requires road access. And for decades, most development in Florida has required dealing with issues related to stormwater.³⁰ Roads and drainage, typical of infrastructure, are most conspicuous in how little people think or talk about them when everything is working well.

But roads and drainage have long presented challenges in certain parts of Florida. Drainage has been a challenge due to the very flat nature of much of Florida, resulting in efforts to drain land that is miles from the ocean but just a few feet above sea level. Roads may present problems either due to lack of drainage or, along the coast, hazards such as erosion.

While not specifically about sea level rise per se, an instructive case about the challenges that local governments face regarding roads and other infrastructure presented itself in 2011 northeast

29 See, e.g. 2014 National Climate Assessment, Overview Introduction, available at <http://nca2014.globalchange.gov/highlights/overview/overview#intro-section-2>.

30 Programs impacting stormwater regulation include: Florida’s implementation the National Pollution Elimination Discharge System, the Florida Department of Environmental Protection’s Nonpoint Source Management Program, and the Environmental Resource Permit (ERP) Program managed by Florida’s five water management districts.

Florida.³¹ Property owners sued St. Johns County for a “taking” of private property because the Atlantic Ocean had been undermining the only road access to their homes since long before most of the homes were built; the County had been unable to keep the road in an equivalent condition to other county roads. After the property owners lost at the trial court level, an appellate court ruled that “[t]he County must provide a reasonable level of maintenance that affords meaningful access, unless or until the County formally abandons the road.”³² However, in many areas where the road used to be there was nothing left but wet sand beach, and part had been entirely washed away by a new inlet. Estimates of the cost at that time for a beach nourishment project, which would have been a precursor to reconstructing the road, were over \$13 million up front and \$5.7-8.5 million every 3-5 years for maintenance. This would have been a major financial burden for a county that then had a population of about 170,000.

Ultimately the case settled with the property owners and the county in very similar positions to the ones they were in prior to several years of litigation. The county had, however, expended nearly \$1 million just in litigation costs to defend against an action by owners of a handful of homes that were built or purchased on land that already had almost 50 years’ history of obvious erosion problems. St. Johns County, during the litigation, passed a new ordinance that would have required building permit applicants to sign a “hold harmless” agreement in order to receive a building permit.³³ The trial court judge called this policy “repugnant,” but an almost identical policy has been consistently used for over a decade in California when issuing permits to build along the coast. During Hurricane Matthew in 2016, the road and properties at issue in the St. Johns case were heavily damaged. Virtually all the remaining road that had been repaired and repaved under the settlement agreement three years earlier was wiped out. A breach in the spit of sand created a new inlet that cut off three homes from the mainland and left them almost in the waters of the Atlantic Ocean.

The settlement agreement bound the county, in case of a “catastrophic weather event,” to “make timely and good faith efforts to obtain state, federal, and/or other available funds to restore, to the greatest extent reasonably possible, [the road].” Additionally, the county and property owners came to an agreement on levels of service for the road in the future, recognizing the environmental challenges impacting the quality of the road. As part of the settlement, the following were agreed to:

- County agreed to use “good faith” efforts to maintain Old A1A in “As Is” condition;
- County agreed to use “timely and good faith efforts” to keep access open;
- County agreed to include the existing paved portion of Old A1A in the pavement management schedule and repave it as needed;

³¹ *Jordan v. St. Johns County*, 2011 Fla. App. LEXIS 11337 (Fla. Dist. Ct. App. 5th Dist., June 22, 2011); *St. Johns County v. Jordan*, 2011 Fla. LEXIS 2819 (Fla., Dec. 5, 2011). The case settled in 2013.

³² *Id.* at 838.

³³ St. Johns County Ordinance 2008-45.

- County agreed to resurface a 0.3-mile portion of Old A1A to create a connection with New A1A;
- County agreed to remove diminished road access as an impediment to obtaining building permits;
- Property owners agreed to give the county notice and an opportunity to buy properties along this roadway before selling to others;
- County agreed to repeal the requirement that prospective home builders sign “hold harmless” agreements to get building permits;
- Property owners agreed to grant easements to restore access to parcels outside of the existing paved area;
- Agreed to allow transit over county-owned parcels to facilitate access to parcels outside of the existing paved area;
- Agreed to consider recommendations of the Summer Haven Municipal Services Taxing Unit regarding the use of funds; and
- County agreed to pay \$75,000 to partially reimburse plaintiff-owners’ costs.

Ultimately, the case in St. Johns County points out a new reality that local governments need to consider: the need to provide and maintain infrastructure services to existing or future development needs to be considered as a potentially massive legal and financial liability looming over local governments. This case in St. Johns County indicates a potential for local government liability when a road cannot, in the local government’s assessment, realistically be repaired due to some combination of environmental challenges and cost. Currently, this court decision is binding on all trial courts in Florida, but local governments may seek to take a proactive approach to try to minimize potential liability in similar situations.³⁴ It is also important to note that St. John’s County has had an ordinance in place since 2012 that indicates when forces of nature and environmental conditions create difficulties in maintaining a road according to usual design and maintenance standards, the county will apply different criteria.³⁵ The 2012 ordinance also specifies that in some cases “roads in environmentally-challenging locations” may have unpaved surfaces; substandard lane widths or single lanes; vehicle type, size, and weight limitations; periods of time when the roads may be submerged, be buried by soil, covered by sand or blocked by vegetative debris; and no assurance that emergency vehicles can use or routinely use the road for access. Finally, the 2012 ordinance notes several other things, including that property owners with existing improvements that are accessed by roads that are in environmentally-challenging locations may encounter access issues; that access may be limited by naturally occurring

³⁴ See, e.g. Thomas Ruppert, John Fergus & Alex Stewart, *Environmentally Compromised Road Segments—A Model Ordinance* (October 2015), available at https://www.flseagrant.org/wp-content/uploads/Envirtly_Comp_Rds-FINAL_10.20.15_1.pdf.

³⁵ St. Johns County Ordinance No. 2012-35 (December 2012), available at <http://www.sjccoc.us/minrec/OrdinanceBooks/2012/ORD2012-35.pdf>.

conditions beyond the control of the county; and that the county has no obligation to build or improve any roads areas designated as “environmentally challenging.”

In Monroe County, a case study is currently underway (now in its implementation phase) to “pilot” a methodology in two neighborhoods to determine a basis for a future sea level rise level of service for road improvements and construction. Completed in January 2017, the effort has analyzed the current levels of inundation routinely seen in these neighborhoods, which were severely impacted king tides in 2015 and 2016. The effort has developed numerous options based on elevation targets (with stormwater features) to ensure that alternatives can be permitted and implemented.³⁶ From a policy perspective, Monroe County is selecting a future scenario of sea level rise and basing design criteria to reduce flooding to a specified return frequency. The County adopted a Resolution that includes design standards capturing these concepts and incorporating the consideration of future sea level rise for the useful life of the project.³⁷ The concept is to apply typical “level of service” approaches to account for future flood risk. The county has also planned a more comprehensive analysis of the same methodology countywide to develop a phased approach to retool roads based on level of vulnerability in the future.

In terms of flooding, drainage presents similar challenges to that of roads, but the impacts to drainage typically occur first. Problems in the lowest areas begin with sea water rising to the level of outfall pipes which leads to a slowing of drainage. Next, pipes fill with sea water, and as sea levels continue to rise, eventually water backs up out of storm drains and into streets. Many local governments experiencing such drainage problems begin by placing one-way valves that prevent sea water from moving backward into the system. Once that no longer works, pumps are the next logical option. Finally, water quality requirements at the state level and local permitting will like require new or enhanced stormwater features accompany the rehabilitation or retrofit of a road. These stormwater features will be necessary not only to address water quality but also to mitigate any potential impacts to adjacent property owners. The need for such stormwater infrastructure could have a large influence on the ultimate design and cost of a road improvement project.

So far, Florida law does not yet impose the level of liability for drainage whereby sea level rise and legal liability could potentially impact local governments financially the way the St. John’s County case discussed above could. Under current law and jurisprudence, it appears that Florida local governments might only be liable for flooding if they fail to maintain their stormwater systems.³⁸ With regard to services, Florida courts distinguish between upgrading and

³⁶ Monroe County, FL, “Monroe County Pilot Roads Project: The Sands and Twin Lakes Communities” (January 2017), available at: <http://monroecountyfl.iqm2.com/Citizens/FileOpen.aspx?Type=1&ID=1038&Inline=True>.

³⁷ Monroe County, FL, Resolution 028-2017.

³⁸ Thomas Ruppert and Carly Grimm, *Drowning in Place: Local Government Costs and Liabilities for Flooding Due to Sea-Level Rise*, Florida Bar Journal, Vol 87, No. 9 (2013). However, as this article points out, a lack of local government liability hinges on whether courts find that flooding due to SLR results from

maintenance of infrastructure. Courts have held that the decision to upgrade infrastructure is considered a planning level function to which absolute immunity applies.³⁹ This should be contrasted with courts holding that failing to maintain infrastructure is an operational activity that exposes the government to potential liability.⁴⁰ Therefore, when a local government upgrades, there is now a duty to maintain and operate the system so that it will properly function.⁴¹ That said, liability is a fact-specific inquiry considering the project design, function, history and infrastructure operations.⁴² In the face of changing future conditions, such as changing rainfall volumes and tidal inundation, these principles are likely to morph, especially when previously constructed projects can no longer function as designed.⁴³

A crucial question for the future is how the law will evolve as local (as well as state and federal) governments find it increasingly expensive and difficult to provide infrastructure services to existing properties in areas more and more subject to coastal hazards. This presents a serious policy conundrum that requires balancing extremely important and fundamental issues, such as rights to access and use of private property, the responsibility of private property owners, fairness to taxpayers, honoring the long-standing admonition in state law to avoid subsidizing development in hazardous areas, and the financial solvency of local governments.

Beaches and Tourism

Florida is the world's number one tourist destination; tourism generates \$67 billion of activity in the state. Florida's beaches are the single biggest draw for tourists. Thus, access to beaches for those who do not own coastal property is essential to maintaining the tourism lifeblood in Florida's economic veins. In Florida, many beaches that are considered "public" because the public uses them are actually comprised of private properties with boundaries that reach down to the mean high water line. Under state common law, in some areas the public has established a customary right to use the dry sand beach on private property for recreational purposes if that use has been longstanding, uninterrupted, and without dispute.⁴⁴

Florida's Department of Environmental Protection (DEP) has statutory authority to protect established public use of dry sand beaches when the department authorizes coastal construction.⁴⁵

a lack of maintenance, which results in local government liability, or from a need to upgrade the system, which very likely means that there is no local government liability for flooding damage.

³⁹ *Dep't of Transportation v. Konney*, 587 So.2d 1292,1296 (Fla. 1991).

⁴⁰ *Dep't of Transportation v. Neilson*, 419 So.2d 1071,1073 (Fla. 1982).

⁴¹ Erin L. Deady, *Why the Law of Climate Change Matters: From Paris to a Local Government Near You*, *Florida Bar Journal* (November 2017), available at: <https://www.floridabar.org/news/tfb-journal/>.

⁴² *Id.*

⁴³ *Id.*

⁴⁴ *City of Daytona Beach v. Tona-Rama, Inc.*, 294 So.2d 73 (Fla. 1974).

⁴⁵ Fla. Stat. §§ 161.021(1), 161.041(1)(a), 161.052(12), 161.053(1)(a), 161.053(4)(e) (2016). Note that the definition in section 161.021(1) protects established customary use rights of the public and states that it

Assessing the extent to which the DEP considers lateral public access in the CCCL permitting process presents challenges since few permits mention lateral public access or include permit conditions to protect it.⁴⁶ However, DEP officials have indicated that when lateral public access issues arise, they usually are addressed through design modifications during the permitting process. The most serious challenge remains in that DEP asserts that its current statutory authority to address lateral public access only allows the department to look at the current situation; DEP indicates it lacks authority to look into the future and consider potential or likely erosion or the impacts of sea level rise. This failure to look towards the future of the beach and lateral public access to the beach during the permitting of coastal construction may threaten the future of publicly accessible beaches.

The potential right of the public to customary use of dry sand beach areas has been a point of contention in some areas of Florida. While disputes have arisen around many parts of Florida, they have been particularly acrimonious and continuous for the past few years in Walton County, which is located in Florida's Panhandle.⁴⁷

In July 2016, Lionel and Tammy Alford filed a suit challenging Walton County Ordinance 2016-23 ("Customary Use Ordinance").⁴⁸ The suit involved a facial challenge to the Customary Use Ordinance alleging that the County was without authority to enact it. They claimed that certain County regulations pertaining to the dry sand beach on their property violate their free speech rights (Count I) and substantive due process rights (Count II), and they sought declaratory relief (Count III). The Alford's contended that the Obstruction Amendments, which prohibit obstructions on the beach, including "ropes, chains, signs, or fences," effectively prevented them from conveying messages to public beachgoers regarding the boundary of their property, as well as religious and political messages, and precluded them from excluding the general public from their private property.

In October 2016, during the pendency of the case, the County enacted a new ordinance recognizing the public's customary right to use the beaches. Walton Cty. Code Ch. 23, "Customary Use Ordinance" (Ord. No. 2017-10) (amended Mar. 28, 2017, effective April 1, 2017). In December 2016, the Alford's amended their Complaint to add Count IV, challenging the Customary

applies to the access referred to in section 161.041(1)(a), but the latter section's definition only specifies access seaward of the mean high water line.

⁴⁶ Thomas Ruppert, *Eroding Long-Term Prospects for Florida's Beaches: Florida's Coastal Management Policy*, 111-13 (2008), available at https://www.law.ufl.edu/_pdf/academics/centers-clinics/clinics/conservation/resources/coastal_management_finalreport.pdf. For two examples of permits that do mention public access, see DEP permit #DA-708 and permit #BO-721.

⁴⁷ Customary use battle rages on 30A, *nwfdailynews.com* (Sept. 11, 2016), available at <http://www.nwfdailynews.com/news/20160911/customary-use-battle-rages-on-30a>. See also, e.g. Erika Kranz, *Sand for the People: The Continuing Controversy Over Public Access to Florida's Beaches*, 83 Fla. Bar J. 10 (June, 2009).

⁴⁸ *Alford v. Walton County*, U.S. District Court for the Northern District of Florida, Case No: 3:16-cv-00362-MCR-CJK

Use Ordinance and seeking a declaration that the ordinance is void ab initio on grounds that customary use is a common law doctrine reserved to the courts for determination on a case-by-case basis, and therefore, the County exceeded its authority and acted ultra vires by legislating customary use on a county-wide basis.

On September 26, 2017 the court entered an order finding for the Plaintiffs stating: “It is declared that the beach obstruction amendments to the Walton County Code, specifically, § 22-54(g)(2)(a)(3), to the extent it defines “obstructions [as] including but not limited to ropes, chains, signs, or fences,” and § 22-55 to the extent it states, “Obstructions include, but are not limited to ropes, chains, signs, or fences,” are facially unconstitutional in violation of the First Amendment and are STRICKEN. This does not impact any other provision of the Walton County Waterways and Beach Activities Ordinance.”

On August 15, 2017 numerous condominium associations and individuals also challenged the Walton County Ordinance in Federal Court as violative of Due Process, Equal Protection and Takings claims.⁴⁹ These claims are different than those litigated in the previous litigation with discovery not concluding until February 2018. Given the broader application of these claims, at this time, it is clear Walton County’s Customary Use Ordinance remains in contention.

Regardless of how the issues are settled in Walton County or elsewhere, a new combination of court precedent and sea level rise could threaten the public’s right to use beaches to which the public currently has a customary right of recreational use, thus potentially undermining Florida’s tourism industry. Hurricanes and tropical storms took an extremely heavy toll on beaches in Volusia County during 1999 and 2004. After significant loss of beach sand, Volusia County responded to the eroded, narrower, and more landward position of the dry sand beach by landward adjustment of the driving access lanes on the beach in parts of the county. This readjustment positioned the driving lanes within the confines of some private parcels. Three property owners sued the county for trespass and for a “taking” of their private property that resulted from maintaining parking and driving on the dry sand beach within their property boundaries and allowing public use.⁵⁰ The trial court ruled for Volusia County, and the landowners appealed to Florida’s Fifth District Court of Appeals.

The appeals court noted that “customary use” might apply to the beach in question. However, the Fifth District Court of Appeals also noted that whether the public’s customary use right to the dry sand beach moved landward along with the dry sand beach was unclear. After all, said the court, in instances of “avulsion” or sudden and dramatic loss of beach due to a hurricane or strong storm, property boundaries do not move. But with erosion, property boundaries usually move with the shifting mean high water line. In either case, the court intimated the possibility

⁴⁹ Seaside Town Council et al v. Walton County, U.S. District Court for the Northern District of Florida, Case No.: 3:17cv682-MCR/CJK

⁵⁰ Alfred J. Trepanier, etc. et al. v. County of Volusia, 965 So.2d 276, 278-79 (5th DCA 2007).

that an established customary use easement providing the right of the public to recreational use of the privately owned dry sand beach might not migrate landward with the dry sand beach area.⁵¹

Due to the case-specific and fact-intensive nature of determining a right to customary use of the dry sand beach by the public, the Fifth District Court of Appeal sent the case back to the trial court for additional fact finding. The trial court then made findings of fact that supported the position that the public had established a customary right to use of the dry sand beach portion of the property owners' parcels.⁵² The court noted that over the past century, evidence amply indicated that the location of the dry sand beach had varied dramatically, and that at times in the past the dry sand beach had indeed been located within the property boundaries of the plaintiff property owners' parcels. This finding of fact essentially skirted the key issue raised by the Fifth District Court of Appeals: whether an established public easement for use of the dry sand beach migrates with the dry sand beach onto and could be applied to private property to which it had not previously been applied.

Currently, the ambiguous holding of the Fifth District Court of Appeals in the Volusia County case (*Trepanier et al. v. County of Volusia*), which potentially puts at risk public easements by custom as sea level rise impacts beaches, is the law for all trial courts in Florida; however, if a trial court ruling depending on the *Trepanier* case is appealed in a district outside of Florida's Fifth District Court of Appeals, the case will not bind that appeals court. Ultimately, as the court noted, this issue carries so much significance for Florida that it will eventually have to be decided by the Florida Supreme Court.

Federal Policy and Action Impacting Local Governments

While the heart of adaptation for most people and communities will be their local government, federal law and policy still play important roles that affect communities. As mentioned earlier, major federal changes contributing as drivers for policy movement in Florida are the 2012 and 2014 changes to the National Flood Insurance Program.

The federal government has seen its role, in part, as being a generator of information and data that supports climate change and sea level rise analysis. For example, the National Aeronautics and Space Administration has an extensive network of satellites and other resources that generate

⁵¹ The court noted that "if it can be shown that, by custom, use of the beach by the public as a thoroughfare has moved seaward and landward" onto private property, the right of the public remains. However, the court continued by saying that "it is not evident, if customary use of a beach is made impossible by the landward shift of the mean high water line, that the areas subject to the public right by custom would move landward with it to preserve public use on private property that previously was not subject to the public's customary right of use." *Alfred J. Trepanier, etc. et al. v. County of Volusia*, 965 So.2d 276, 294 (5th DCA 2007). The court may have meant that an established right to customary use *does* move with the dry sand beach but does not if the movement of the beach was due to avulsion. However, due to the court's language, this is not entirely clear.

⁵² *Trepanier v. County of Volusia*, No. 2000-10528-CIDL, ¶¶4-5, 7th Judicial Circuit of Florida (March 30, 2010), 2010 WL 2849823 (Fla.Cir.Ct.).

climate data. The National Oceanic and Atmospheric Administration and the National Weather Service also generate data relevant to climate and sea level rise science. The United States Global Change Research Program is a program in which numerous federal agencies participate and that was mandated by Congress in the 1990 Global Change Research Act to “assist the nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.” In addition to conducting its own research, federal agencies often support independent researchers in conducting their own work via grant funding.

Additionally, over the last several years, the federal government has pushed federal agencies to consider climate change in their missions.⁵³ At the federal level, international agreements and policy have also had an impact on federal initiatives. The Paris Agreement of 2015 came into force during November 2016 (on 5 October 2016, the threshold for entry into force of the Paris Agreement was achieved), meaning that countries that are part of the agreement, including the United States, are obligated to meet their “nationally determined contributions” of greenhouse gas reductions.⁵⁴

The Paris Agreement’s central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 °C. Additionally, the agreement looks to strengthen the ability of countries to deal with the impacts of climate change. To reach these goals, appropriate financial flows, a new technology framework, and an enhanced capacity building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Paris Agreement also provides for enhanced transparency of action and support through a more robust transparency framework. In 2018, participating parties will assess efforts in relation to the goals set and prepare the nationally determined contributions. There will also be a report card of sorts every five years to assess the collective progress.

Other federal activities that relate to or have contributed to climate change or sea level rise activities at the state and local level in Florida are detailed next.

U.S. Army Corps of Engineers (“Corps”)

The Corps has considered sea level change in its planning activities since 1986. This is separate from the regulatory aspects of its mission, but in 2000, sea level change considerations were included within its Planning Guidance Notebook. In 2009 the Corps released its first Engineer Circular (EC), 1165-2-211, “Incorporating Sea-Level Change Considerations in Civil Works Programs,” and EC 1165-2-212 “Sea-Level Change Considerations for Civil Works Programs”.

⁵³ Executive Order 13653 (Nov. 1, 2013), available at <https://www.whitehouse.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change>.

⁵⁴ United Nations / Framework Convention on Climate Change (2015) *Adoption of the Paris Agreement*, 21st Conference of the Parties, Paris: United Nations.

Most recently in December 2013, EC 1100-2-8162 extended this guidance. In July 2014, the Corps created guidance (Engineer Technical Letter 1100-2-1) covering “Procedures to Evaluate Sea Level Change: Impacts, Responses and Adaptation.” Guidance is still in effect today.⁵⁵ The Corps also has available a tool (called “Beach-fx”) to create vulnerability assessments of non-developed natural coastlines or beach protection projects, which was updated for use with the new sea level guidance.⁵⁶

Considered “regulations,” these policies establish a framework “for incorporating the direct and indirect physical effects of projected future sea level change across a project lifecycle in managing, planning, engineering, designing, constructing, operating, and maintaining Corps projects and systems of projects.”⁵⁷ Again, this does not apply to the Corps’ regulatory review duties of permits; but rather, the need to take into account changing sea levels only currently applies to projects the Corps is bound to undertake under congressional funding and direction, more commonly known as civil works projects.

National Environmental Policy Act (“NEPA”)

On December 24, 2014, the White House’s Council on Environmental Quality released revised draft guidance on how federal agencies should evaluate greenhouse gas emissions and the impacts of climate change when conducting reviews pursuant to National Environmental Policy Act (NEPA) evaluation. This guidance updated and expanded previous guidance from 2010 and applied to all proposed federal actions, including land and resource management activities.

Focusing on the climate change and sea level aspects, the new guidance directed agencies to consider the implications of climate change impacts on the proposed action, including potential adverse environmental effects that could result from drought or sea level rise. While agencies have wide discretion in how to consider climate change and sea levels, two key considerations are: 1) reliance on agency experience and expertise to determine whether an analysis of greenhouse gas emissions and climate change impacts would be useful, and 2) application of the “rule of reason” to ensure that the type and level of analysis is appropriate for the anticipated environmental effects of the project. The focus is on the long-term viability of the project, tying design alternatives to climate change effects on a proposed federal action of the useful life of that project. This is especially true in cases when it will be located in a vulnerable area or impact vulnerable populations or resources. With the NEPA guidance, the main message is that while the level of analysis is somewhat flexible, addressing the issue is not.

⁵⁵ U.S. Army Corps of Engineers, Engineering and Construction Bulletin (September 16, 2016), available at: http://www.iwr.usace.army.mil/Portals/70/docs/frmp/eo11988/EDB_2016_25.pdf

⁵⁶ U.S. Army Corps of Engineers, Analyzing Evolution and Cost-Benefits of Shore Protection Projects, available at: <http://www.erdc.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/476718/beach-fx/>

⁵⁷ U.S. Army Corps of Engineers, Dept. of the Army, Sea-Level Change Considerations for Civil Works Programs, EC 1165-2-212 (October, 1, 2011).

In August 2016, the Council on Environmental Quality released final guidance⁵⁸ for federal agencies on how to consider the impacts of their actions on climate change in their NEPA reviews and how all types of federal actions will impact climate change. The guidance builds from the 2010 draft guidance and 2014 revised draft guidance, and incorporates comments and feedback received. Additionally, finalization of the 2014 revised draft guidance was specifically called for by the State, Local and Tribal Leaders Task Force on Climate Preparedness and Resilience's recommendations to the president. The new final guidance also:

- Advises agencies on how to quantify projected greenhouse gas emissions of proposed federal actions whenever the necessary tools, methodologies, and data inputs are available;
- Encourages agencies to determine the appropriate level (broad, programmatic, or project- or site-specific) and extent of quantitative or qualitative analysis required to comply with NEPA;
- Has agencies consider alternatives that would make the action and affected communities more resilient to the effects of a changing climate; and
- Promotes use of existing information and science when assessing proposed actions.

The guidance is applicable when a federal agency initiates any new NEPA review, and agencies should exercise judgment when considering whether to apply this guidance to the extent practicable to an ongoing NEPA process. Finally, agencies are encouraged to consider applying this guidance to projects in the environmental impact statement or environmental assessment preparation stage. The standard is if it would inform the alternatives analysis or address comments raised through the public comment if (based on science) the review would be incomplete without application of the guidance, and the additional time and resources needed would be proportionate to the value of the information included.

It should be noted that the President's March 28, 2017 Executive Order, "Promoting Energy Independence and Economic Growth," directed the Council on Environmental Quality to rescind this guidance.⁵⁹ Given that courts have demanded climate consideration in agency NEPA analyses already, this could cause the administration future legal challenges, despite the directive to rescind it.⁶⁰

The Federal Flood Risk Management Standard

Two significant issues at the federal level that already impact local communities and will continue to even more so in the future include the National Flood Insurance Program and the Federal Flood Risk Management Standard. The National Flood Insurance Program is discussed

⁵⁸ Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews.

⁵⁹ The White House Office of the Press Secretary, Executive Order on Promoting Energy Independence and Economic Growth (March 28, 2017), available at: <https://www.whitehouse.gov>

⁶⁰ See *e.g.*, *Ctr for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008).

in detail in Chapter 6, so this section of the book will focus on the Federal Flood Risk Management Standard (FFRMS).

The FFRMS is contained in the 2015 Executive Order 13690 – Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input. as an amendment to Executive Order 11988 – Floodplain Management, which was issued in 1977. The goal of modifying the 1977 executive order was to ensure that, in light of increased flooding around the country and especially in coastal areas suffering from sea level rise, federal investments do not contribute to flooding and are wisely sited to maximize the utility of the federal investment.

The original 1977 executive order’s purpose was “avoiding [federal] actions in or impacting the base floodplain and minimizing potential harm if [federal] action must be located in the base floodplain.”⁶¹ To accomplish this, several steps were delineated for a federal action, including: 1) determining if the project will be in a floodplain; 2) identification of practical alternatives to locating in a floodplain; 3) if location in the floodplain is necessary, identify potential impacts; 4) minimize harm to the floodplain; 5) reevaluation of the proposal in light of previous steps; and 6) release of findings prior to implementation. The 2015 executive order altered these steps as part of a movement beyond “emphasis on flood control and protection to a broader focus on flood risk management.”⁶²

The 2015 executive order applies to “federally-funded projects,” which means “actions where federal funds are used for new construction, substantial improvement, or to address substantial damage.”⁶³ This is a more limited application than the 1977 executive order, which applied to “federal actions,” including when agencies of the federal government engage in (1) acquiring, managing, and disposing of Federal lands, and facilities; (2) providing federally undertaken, financed, or assisted construction and improvements; and (3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.”⁶⁴

The 2015 Executive Order 13690’s FFRMS made three primary changes to Executive Order 11988. First, it modified the way that floodplains are determined. Whereas Executive Order 11988 used the 100-year floodplain as its base, Executive Order 13690 expanded the floodplain used both vertically and horizontally. This occurs in three possible ways. The preferred method,

⁶¹ In the context of Executive Order 11988, “base floodplain” refers to the area subject to flooding by the base flood, which, as with the National Flood Insurance Program, (also known as the “100-year” floodplain).

⁶² Guidelines for Implementing Order 11899, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, 14 (Oct. 8, 2015).

⁶³ Guidelines for Implementing Order 11899, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, 16 (Oct. 8, 2015).

⁶⁴ E.O. 11988, Section 1 (1977).

if the science is available, is the climate-informed science approach, which consists of customized analysis of the area in question under potential future climate scenarios. Another method is the freeboard value approach, which requires projects be built two feet above the base flood (100-year flood) elevation or three feet above the base flood elevation for critical projects.⁶⁵ Finally, agencies may use the “500-year” elevation approach, which is an elevation equivalent to the 0.2%-annual-chance-flood elevation.⁶⁶ Whichever method is used, the agency must include not only the increase in *elevation* of the floodplain but also the corresponding *horizontal expansion* of the floodplain.

Second, the 2015 executive order 13690 incorporated the idea of “critical action determinations” by agencies. A critical action “shall mean any activity for which even a slight chance of flooding would be too great.”⁶⁷

And third, the 2015 executive order added significant focus on the use of natural features and nature-based approaches “to reduce flood risks, as well as minimize the impacts of Federal actions to natural and beneficial floodplain values and to lives and property.”⁶⁸

The 1977 executive order was implemented by regulation for very few federal agencies; most agencies implemented it through policy changes. This is also true for the modifications established by Executive Order 13690; only five agencies—FEMA, Housing and Urban Development, the Army Corps of Engineers, the Tennessee Valley Authority, and the Federal Energy Regulatory Commission—are currently anticipated to adopt new rules to implement the FFRMS. Other agencies will incorporate the FFRMS changes into policy and procedures guiding their work.

The FFRMS is very important to local governments because many projects are built with a contribution of federal funds, and this will trigger use of the FFRMS. One potentially devastating scenario for local governments is that a disaster strikes and the local government begins rebuilding destroyed or substantially damaged infrastructure or buildings. Then, upon seeking eligible reimbursement from the federal government, the local government realizes that it only built facilities to the 100-year floodplain rather than the standards of the FFRMS, and thus is not eligible for federal funds. While, as of late 2016, this scenario has not happened given that no federal agency has yet finalized its implementation of the FFRMS, local governments should be aware that implementation will occur in the near future as (FEMA has completed a draft rule for FFRMS implementation, and other agencies are approaching that mark. In August of 2017,

⁶⁵ “Critical Action” is defined in the Implementing Guidelines to E.O. 11988.

⁶⁶ Exec. Order No. 13,690, 80 FR 6425, § 6(1)(c) (2015).

⁶⁷ *Id.* § 2(j) (2015); Guidelines for Implementing Order 11899, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, 35, 38-39 (Oct. 8, 2015).

⁶⁸ Guidelines for Implementing Order 11899, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, 41 (Oct. 8, 2015).

President Trump signed an executive order that eliminated the Federal Flood Risk Management Standard.⁶⁹

Great uncertainty surrounds the future of federal involvement and support of climate change and sea level science and adaptation. The evidence is mounting that the Trump administration has taken a very different stance on climate change and sea level rise than the previous administration. Regardless of how the federal response may change, local governments in Florida will continue to increase their activity on adapting to rising seas since they are seeing more flooding each year.

Conclusion

Florida has taken many steps at the state, regional, and local levels to begin addressing the challenges of climate change and sea level rise. However, the current state requirements alone remain far from sufficient to build a more resilient future for Florida. Over the past few years, major rainfall events have caused massive flooding in Florida's Panhandle and in southeast Florida; and after a decade without a major hurricane, we have seen the paths of destruction left by Hurricane Matthew off Florida's East Coast and Hurricane Irma through much of the peninsula.

While events of the past have slowly pushed Florida and its local governments towards more resilience, such as stronger building codes, the state must now confront two realities that merge to create a tremendous policy challenge. First, even after past events, Florida has, as a state, been largely unwilling to address where we build; the focus after disasters has been almost entirely on how we build. While strengthening building standards is good, we need further discussion about what types of land uses may or not be appropriate in certain hazardous areas. Second, the past is not a good indicator of the future. Currently, permitting programs and planning take place almost exclusively based on data of past trends. Whether it be rainfall, calculation of five-year, 25-year, or 100-year storm events, or erosion rates, we look to a past that is no longer indicative of the future we need to face.

To address these weaknesses, permitting programs should look to the future. This raises many questions. For example, should water supply and storage be expanded to account for the possibility of increasingly severe droughts? And even if there are more severe droughts, should permitting of drainage systems be modified to account for heavier rainfall events when the rains do come? Amid the many questions there are also some clear needs. Construction of drainage systems needs to account for future sea levels rather than being engineered solely for today's sea level. Sea level projections should be incorporated into both local planning decisions as well as

⁶⁹ Presidential Executive Order on Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure, Executive Order ----, (August 15, 2017), available at <https://www.whitehouse.gov/the-press-office/2017/08/15/presidential-executive-order-establishing-discipline-and-accountability>.

into the state of Florida's Coastal Construction Control Line permitting program to inform what is built, perhaps allowing some uses in at-risk areas but not allowing more sensitive uses. Some policy options most appropriately fit in state programs and others at the local level, but we need to work together at the local and state level to effectively incorporate climate change and sea level rise into all relevant areas of policy and planning in Florida.

Finally, in the aftermath of hurricanes Harvey, Irma, and Maria in 2017, it remains to be seen if Federal and state responses will shift to better link the future of flood risk with climate and sea level rise considerations. After Hurricane Sandy, there were some shifts in policy and a noticeable rise in legal cases that shaped some recovery and resiliency strategies. The Florida House has established a Select Committee on Hurricane Response and Preparedness. The extent to which that committee delves into the issues of future flood risk related to climate change, for both coastal and inland communities, remains to be seen.

How Countries, States, and Florida Address Sea Level Rise

A Compendium of Climate Adaptation Research



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FLORIDA: GENERAL RESEARCH & PLANNING

Preparing for a Sea Change in Florida

Florida Coastal and Ocean Coalition

This report by the Florida Coastal and Ocean Coalition details how climate change could impact the state's coastal areas, and it broadly outlines possible adaptation solutions. It is intended to provide guidelines for concrete, science-based action on the critical issues Florida faces in light of climate change and to stimulate informed debate for the preservation of Florida's natural resources.

Four primary categories of impacts are discussed: sea-level rise, extreme weather events, higher ocean temperatures, and ocean acidification. The potential effects of sea-level rise are fully described, including beach erosion, saltwater intrusion, and the submersion of marshes and coastal property. Discussions of extreme weather events include severity, altering water flows, exacerbating runoff, and damaging coastal habitats. For each of the four impact areas, recommendations are outlined for state and local government responses, including specific agency actions, as well as regional and federal responses.

The Florida Coastal and Ocean Coalition is a group of environmental organizations working together to conserve, protect and restore Florida's coastal and marine environment. Member organizations include the following: Caribbean Conservation Corporation, Environmental Defense Fund, Gulf Restoration Network, Natural Resources Defense Council, National Wildlife Federation, Ocean Conservancy, Reef Relief, and the Surfrider Foundation.

Source:

http://www.flcoastalandocean.org/PreparingforaSeaChange/Climate_Change_Guide_for_Florida_Preparing_for_a_Sea_Change.pdf



Florida: Public Opinion on Climate Change

- I. Lead Agencies
 - a. Yale School of Forestry and Environmental Studies
 - b. University of Miami
 - c. National Science Foundation
 - d. Columbia University Center for Research on Environmental Decisions
- II. Project description
 - a. The goal of the study was to measure the perceptions of Florida residents about the causes and consequences of climate change, and about potential solutions. The main findings are presented in this report and are intended to aid policy makers, educators, the private sector, and environmental organizations in their planning efforts in response to climate change.

Source:

<http://environment.yale.edu/uploads/FloridaGlobalWarmingOpinion.pdf>



Florida and Climate Change: The Costs of Inaction

- I. Location: Tufts University
- II. Lead Agencies
 - a. Global Development and environment institute
 - b. Stockholm environment institute – US Center
- III. Project Description
 - a. The report is the first detailed analysis on the potential consequences of continued climate change for the state's economy. The report concludes that, if left unchecked, climate change will significantly harm Florida's economy in the next several decades, and that impacts on just three sectors – tourism, electric utilities, and real estate – together with effects of hurricanes would shrink Florida's Gross State Product by 5% by the end of this century.

Source:

http://www.aee.tufts.edu/gdae/Pubs/rp/Florida_hr.pdf?bcsi_scan_EAC41357C45D053C=0&bcsi_scan_f



Climate Change and Land Use in Florida, Interdependencies and Opportunities

- I. Lead Agencies
 - a. Century Commission for a Sustainable Florida
 - b. UF
- II. Project Description
 - a. This report shows that land use and climate change in Florida are deterministically linked issues. Changes in land use over the next decade can adversely affect climate change, while climate change itself will alter the form and function of the landscape. With its burgeoning growth Florida stands at a crossroads with respect to its options for climate mitigation and adaptation. Failure to develop and implement appropriate plans for proactive adaptation could cost billions in lost revenue, while endangering the health and wellbeing of our children, grandchildren and beyond. Alternatively, tremendous opportunity exists for economic development through land management for climate mitigation and participation in carbon markets. While all adverse effects of global warming cannot be avoided through mitigation, proactive adaptation can confer resilience to managed and natural ecosystems, while creating jobs and opportunities for enhancing the wellbeing of Floridians.

Source:

<http://snre.ufl.edu/home/files/Climate%20change%20and%20land%20use%20in%20Florida%20V8-1s.pdf>

- I. Lead Agencies
 - a. Florida Institute for Conservation Science
 - b. The Nature Conservancy
 - c. Florida Native Plant Society
 - d. U.S. Fish and Wildlife Service
 - e. The Jelks Family Foundation
 - f. Disney's Animal Kingdom
- II. Project Description
 - a. The Florida Institute for Conservation Science has initiated a project to study and communicate issues related to the impacts of (and adaptation to) sea level rise in Florida. The first phase of this project included a scientific symposium, which was held January 18-20, 2010, at Archbold Biological Station. This meeting brought together scholars from several disciplines to share information on sea level rise and its impacts in Florida and to develop recommendations for further research and for changes in policy and management. Future phases of this project include technical publications, communications with policy makers and the public, and a larger conference focused on policy and management and involving a diversity of stakeholders and decision makers. The latter conference is tentatively scheduled for August 2010 at Fairchild Tropical Botanic Garden in Miami.

Source:

<http://flconservationscience.org/programs/symposiums.html>

SLR Ready: Model Comprehensive Plan Goals, Objectives, and Policies to Address SLR Impacts in Florida



- I. Lead Agencies
 - a. UF Conservation Clinic
 - b. Florida Sea Grant
 - c. Charlotte Harbor National Estuary Program
- II. Project Description
 - a. The purpose is to present selected model comprehensive planning goals, objectives, and policies (GOP's) to address sea level rise adaptation in a hypothetical city/county in Florida (Southwest Florida).

Source:

http://www.flseagrant.org/coastalplanning/wpcontent/uploads/2012/03/sea_level_rise_Cons.Clinic_2010_v.2.pdf

Florida's Energy and Climate Change Action Plan

- I. Principle conclusions from the Action Team Process
 - a. Florida's resources, communities, and economy are expected to experience significant impacts if the current trajectory of global greenhouse gas emissions is not reversed



- b. Early actions to address global climate change has significant energy security benefits for Floridians, while positioning the state to become a regional and hemispheric hub of green technology innovation and investment
- c. Energy efficiency, demand-side management, and energy conservation present florida with numerous opportunities to reduce energy costs, increase the buying power of Florida’s families, and make the state’s business sector more cost-competitive in the global market
- d. Investments today in low-carbon energy sources will stimulate Florida’s economy and redirect current expenditures on imported fossil fuels toward Florida-based energy sources retaining significant flows of money within local economies
- e. Market-oriented regulations – many already authorized in Florida law – will efficiently guide a low-carbon economy while protecting energy consumers, maintaining Florida’s agricultural competitiveness, and building more sustainable communities

II. Phase 2

- a. Provides 50 separate policy recommendations, plus an additional set of comments toward the current regulatory work to develop Florida’s cap-and-trade program to reduce harmful greenhouse gas emissions
- b. The total net cost savings of all Action Team recommendations combined is more than \$28 billion from 2009-2025
- c. The action team recommends 50 policy actions relating to:
 - i. Energy supply and demand
 - ii. Transportation and land use
 - iii. Agriculture, forestry, and waste management
 - iv. Government policy and coordination
 - v. Adaptation strategies associated with climate change

Source:

<http://www.flclimatechange.us/ewebeditpro/items/O12F20136.PDF>

Climate Change in Coastal Areas in Florida: Sea Level Rise Estimations & Economic Analysis to Year 2080

Funded by National Commission on Energy Policy and Reported by FSU

Additionally, assessments of the potential economic impacts that this phenomenon could have are presented. Using representative storms, estimates are provided of the damage that could be inflicted from storm surge and flooding, both of which will become more intense and more frequent as a consequence of climate change. The value of the land that will be affected by these intensified events was used to provide the basis for the economic assessment.

This is the scientific assessment report that supports the synthesized brief "Climate Change in Coastal Florida - Economic Impacts of Sea-Level Rise," published by the National Commission on Energy Policy.

Source:

<http://www.manatee.wateratlas.usf.edu/upload/documents/FSU%208%2014%202008%20final.pdf>

Florida Department of Transportation

Development of a Methodology for the Assessment of Sea Level Rise Impacts on Florida's Transportation Modes and Infrastructure

The purpose of this report is to provide a methodology for assessing the impacts of SLR on FL transportation infrastructure for planning purposes. Research was conducted by FAU by a DOT grant. Scope of the project includes a summary of global and state observations and projections of SLR, a discussion of the methodology used in developing consensus on SLR in Southeast FL, a recommended methodology for projecting SLR in FL, and

identifying potentially vulnerable infrastructure, global to regional downscaling approaches, and data gaps in existing SLR scientific knowledge.

- I. Methodology
 - a. FAU recommends using the US Army Corps of Engineers (USACE) guidance for forecasting SLR in FL
 - b. Considers scenarios of possible future rates of mean sea level change over various planning horizons
 - c. Includes maps from Port Everglades, Dania Beach, and others
- II. SE FL Regional Climate Change Compact Consensus Projections
 - a. Planning Horizon:
 - i. 2030 = 3-7 SLR in inches (low-high)
 - ii. 2060 = 9-24 SLR in inches
- III. FAU Research techniques
 - a. FAU used the Weiss Overpeck 1-meter SLR projection for FL to illustrate a downscaling technique developed to identify potentially vulnerable transportation infrastructure
 - b. FAU researchers applied the evaluation techniques to Dania Beach, Punta Gorda, and Key Largo, FL.
 - c. Research includes a discussion of the potential impacts of SLR to transportation infrastructure, including drainage, roadway base, and surface water impacts, and a summary of adaptation strategies and tools
 - d. SLE generally use Satellite altimetry and tidal data
 - e. Two main types of data used for land analysis in SLR studies are LiDAR and contour DEMs (Digital Elevation Model)
- IV. Short-term recommended actions
 - a. Developing a sketch planning tool to apply the USACE methodology to produce statewide and regional projections of SLR and downscaling techniques to identify and assess potentially vulnerable infrastructure
 - i. Downscaling evaluation approach = 4 step process
 - ii. State SLR projections
 - 1. Integration of FDOT state roadway data and State SLR Projections for the years 2030, 2060, and 2100 using USACE methodology
 - 2. Preliminary identification of state road segments potentially vulnerable to a 3 ft of SLR
 - 3. Creation of inventory of potentially vulnerable state roadways
 - iii. Regional SLR projections
 - 1. Evaluate roadways with more detailed topographic information
 - 2. Integration of regional FDOT state roadways data and low resolution LiDAR data
 - 3. Evaluation of current and year 2100 topographic conditions
 - 4. Identification of specific roadway sections potentially vulnerable to SLR
 - iv. Localized SLR projections
 - 1. Integration of regional FDOT state roadways data and high resolution LiDAR data
 - 2. Evaluation of year 2100 topographical conditions of specific roadway links/identification of specific roadway sections potentially vulnerable to SLR

- v. On The Ground (OTG) evaluation
 - 1. Verification of vulnerability using construction drawings & survey data
 - V. Long-term recommended actions
 - a. Developing a no-regrets and gradual adaptive management strategy in transportation planning and integrating SLR projections with groundwater, surface water, and storm surge models to better assess the vulnerabilities of transportation modes and infrastructure
 - VI. Data Gaps
 - a. Data to understand land forms and where and how water will flow
 - b. Monitoring data and environmental drivers
 - c. Consistent SLR scenarios and projections across agencies to support local planning
 - d. Data to characterize vulnerabilities and impacts of SLR
 - e. Community characteristics – data on demographics, societal vulnerabilities, economic activity, public attitudes and understanding of risks, etc
 - f. Legal framework and administrative structure
 - VII. Tools needed for adaptation and planning of transportation infrastructure
 - a. Communication tools for stakeholder engagement, visioning, and consensus building
 - b. Tools to monitor and model current and future rates of SLR
 - c. Visualization and scenario-building tools
 - d. Implementation tools to build institutional capacity and implement adaptation plans
 - e. Interagency coordination on research, policy agendas, and funding are needed to provide the package of data, tools, and processes
 - f. Regional coordination of transportation planning
 - g. GIS maps as tools to identify infrastructure potentially at risk from SLR

Source:

http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_PL/FDOT_BDK79_977-01_rpt.pdf

Adaptive Response Planning to Sea Level Rise in Florida and Implications for Comprehensive and Public-Facilities Planning

- I. Background
 - a. We will experience SLR for centuries if not millennia because of the lag in achieving temperature equilibrium between the atmosphere and the oceans
 - b. The long timescales of SLR suggest that coastal management, including spatial planning, needs to take a long-term view on adaptation to SLR and climate change, especially with long-life infrastructure
 - c. Areas that are not build out are where other options (besides protections) may be feasible

- d. Recently published projections of SLR by 2100 relative to approximately 1990 range from less than 1 foot to more than 15 feet
 - i. Based on analysis of current trends or derived from an array of scenarios and model projections build on different assumptions about future greenhouse gas emissions

II. Purpose and Focus

- a. Focus on implications of SLR on planning and management of 3 major elements of local infrastructure
 - i. Water supply systems that draw from aquifers or surface waters close to the coast
 - ii. Centralized wastewater management systems located in low-lying areas near the coast, including those with surface water discharges of treated wastewater
 - iii. Highways, bridges, and causeways in coastal areas
- b. Interest with the state of adaptive response planning for such infrastructure

III. Regional Consideration

- a. Differences in both relative and eustatic sea level observations
- b. Local land subsidence or uplift are primarily responsible for differences in observed SL
- c. Regional variations in wind patterns and ocean currents, as well as seawater temperature, salinity, and density, also may affect observed rates of eustatic SLR

IV. Potential Impacts

- a. 4 major impacts
 - i. Inundation and shoreline recession
 - ii. Increased flooding from severe weather events
 - iii. Saltwater contamination of ground water and surface water supplies
 - iv. Elevated coastal ground water tables
- b. For a 1-foot rise in SL, the shore will recede by 50-100 feet
- c. Infrastructure that lies in the path of shoreline recession may be adversely affected in several ways
 - i. Intermittent flooding from spring tides
 - ii. Scouring and undermining of above-ground facilities, road bases, and bridge abutments
 - iii. Interfere with navigation under bridges and may increase the exposure of bridges to saltwater spray with resultant increases in spalling of concrete and more rapid corrosion of steel bridge components and rebar in older bridges
 - iv. As flood zones shift higher and further landward, facilities previously sited in what were considered to be safe zones, may experience floods formerly classified as 100-year events
 - v. Structures designed to withstand the force of storm waves and moving floodwaters of a given intensity will be more likely to be subjected to stronger forces

V. Adaptive response options

- a. 3 categories: protection, retreat, and accommodation
 - i. Highly developed coastlines will be protected from SLR with a combination of hard and soft engineering measures
- b. Protection
 - i. The physical measures that can be used to protect developed areas from erosion and inundation include construction of flood protection works, beach nourishment, dune building, and marsh building

c. Retreat

- i. “rolling easement” under which human activities are required to yield the right of way to naturally migrating shorelines
 - ii. FL law empowers the state DEP to require the adjustment, alteration, or removal of any structure that intrudes onto sovereignty lands of the state below the mean high water line of any tidal water body
 - 1. The agency has rarely, if ever, invoked this authority
 - iii. Question of what to do with infrastructure threatened by inundation and shoreline recession
- d. Accommodation
 - i. SLR can be accommodated over the short term by elevating structures and/or the land upon which they are built
 - ii. Longer-term SLE accommodation will require directing new development away from areas that are anticipated to be affected by inundation, shoreline recession, and advancing coastal flood boundaries
 - 1. Setbacks
 - iii. Prohibit development in larger hazard zones that are and will be susceptible to both shoreline and coastal storm flooding

VI. State policies

- a. 35 states have prepared or are in the process of preparing climate action plans concerned with mitigating greenhouse gas emissions
- b. 6 states (AZ, CA, MD, NC, OR, and WA) explicitly do or will address climate change adaptation in those plans

VII. FL Planning/Policy Findings

- a. There are no explicit requirements that state, regional, or local planning entities address SLR in land use or infrastructure planning
- b. Statutory planning time frames are generally too short to directly encompass SLR impacts
- c. There are provisions within these planning frameworks that offer appropriate contexts within which SLR adaptive response planning could be addressed

Source:

http://www.coss.fsu.edu/durp/sites/coss.fsu.edu.durp/files/WPS_08_02_Deyle.pdf

Initial Estimates of the Ecological and Economic Consequences of Sea Level Rise on the Florida Keys through the year 2100

I. Method

- a. Future shoreline locations and distributions of major habitats of Big Pine Key in the year 2100 were estimated using sea level rise scenarios described in the scientific literature
- b. In every scenario the island became smaller, marine and intertidal habitat moves upslope at the expense of upland habitat, and property values are diminished; Inundation would displace native species dependent on upland habitat and threaten property
- c. Use of LIDAR and SLAMM
- d. Scenarios
 - i. 1: 18 cm, best-case: \$11 billion in property value and 58,800 acres are at risk of inundation

- ii. 2: 35 cm
 - iii. 3: 59 cm
 - iv. 4: 100 cm
 - v. 5: 140 cm
- II. Results/recommendations
 - a. Need to identify long-term impacts of SLR on the FL keys and to begin taking near-term steps to minimize the negative consequences of those impacts
 - b. Approach for protecting natural areas and ecosystems
 - i. Identification of “core areas” with the best chances of persistence during SLR
 - ii. Intensive management of core areas to minimize loss of biodiversity
 - iii. En-situ conservation, including relocation of vulnerable species to less vulnerable areas
 - c. Identifying core areas
 - i. Elevation
 - ii. Representation
 - iii. Replication
 - iv. Connectivity
 - v. Effective management
- III. “No regrets” strategy for managing Florida Keys natural areas for SLR
 - a. Fire management
 - i. SLR is expected to accelerate forest succession, and the careful application of prescribed fire is the only economically viable and ecologically appropriate antidote to that succession
 - b. Invasive exotic species management
 - c. Wetland restoration
 - i. Filing or plugging ditches may be essential to prevent unnaturally rapid infiltration of interior wetland, transitional, and upland habitats by saltwater
 - ii. Restoring hydrological connectivity by removing obsolete roadbeds and installing culverts under functional roads

Source:

<http://frp.org/SLR%20documents/FINAL%20-%20Aug%2021%20-WITH%20COVER.pdf>

Climate Change and the FL Keys

- I. Lead Agencies
 - a. NOAA
 - b. Socioeconomic Research and Monitoring Program
 - c. Florida Keys National Marine Sanctuary Program
- II. Project Description
 - a. The study provides alternative estimates, using scenario-planning techniques, of the medium- and long-term socioeconomic effects that may arise from climate change in the Florida Keys. The researchers used four global scenarios from a 2000 report by the Intergovernmental Panel on Climate Change (IPCC); however, the scenarios for the Keys were updated based on scientific developments since 2000. Projections for the Keys were

developed for each scenario looking at population trends, income, remaining land, coral cover, and total income. A series of policy recommendations are included at the conclusion of the report.

Source:

http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/climate_change/welcome.html

Comprehensive Everglades Restoration Plan

- I. Predictions
 - a. Models estimate that sea level could rise by 3-5 feet which could jeopardize an estimated 13.5 million people that live within 25 miles of shoreline
- II. Lead Agencies
 - a. US Army Corps of Engineers
 - b. South Florida Water Management District
- III. CERP
 - a. Outlines a framework to guide the restoration, protection, and preservation of the water resources of central and southern Florida
 - b. One of the main goals of CERP is to redirect 1.7 billion gallons of freshwater a day into the areas that need it the most, such as the Everglades
 - c. Approved by Congress and awarded \$7.8 billion dollars of funding for projects.
- IV. Purpose

- a. CERP Climate Change Team was created with a vision to “minimize future negative impacts and adaptation costs... [by collaborating] to quickly identify climate change sensitivities in natural areas and developed areas” in order to create and implement adaptation policies by 2015.
 - b. CERP Partners are providing various tools and information to create sea level rise guidance for the everglades
- V. Outcomes
- a. Using the CERP framework to begin to adapt to the effects of climate change may hold promise because federal, state, and local partnerships have already been established and there is a pre-established source of funding for future projects.

Source:

<http://www.evergladesplan.org/>

Participatory Scenario Planning for Climate Change in Southern Florida’s Greater Everglades Landscape

- I. Location: MIT
- II. Lead agencies:
 - a. U.S. Fish and Wildlife Service
 - b. U.S. Geological Survey
- III. Project Description
 - a. Project developed a set of spatially-articulate potential future land use maps that allows the exploration of the interaction between global climate change, human population settlement preferences, and state and local policies. In particular, one can begin to judge the effectiveness of current conservation strategies against a landscape in which people - as well as species - are likely to relocate in response to climate change.

Source:

http://training.fws.gov/CSP/Resources/climate_change/resources.html

Climate Change Action Plan for the Florida Reef System 2010-2015

I. Purpose

- a. The action plan is intended to guide coordination of reef management across many jurisdictions and serve as a more detailed, Florida-specific companion to the climate change goal and objectives in “NOAA Coral Reef Conservation Program Goals and Objectives 2010-2015”
- b. 3 main goals: increase resiliency through active management, enhance communication and awareness, and conduct targeted research.
- c. Identifies ways to increase reef resiliency to climate change and minimize negative impacts on reef-dependent industries such as diving and snorkeling tourism, and commercial and recreational fishing
- d. Outlines a holistic, adaptable five-year program that Florida’s reef managers can undertake in collaboration with reef users and other stakeholders to minimize the damage and associated impacts of climate change. It is intended to be adopted and updated at least every five years.

II.

Top ten priority climate change actions for the Florida reef system

- a. Improve regulations and management that facilitate adaptation to climate change and ocean acidification

- b. Develop and implement a marine zoning plan that incorporated resilience-based concepts
- c. Integrate climate change predictions and uncertainties into Florida's comprehensive planning laws and procedures
- d. Continue and expand the FRRP disturbance response monitoring
- e. Decrease the likelihood of negative fishing, diving, and other reef use impacts by increasing law enforcement presence and regulatory compliance
- f. Develop scientific climate change fact sheets
- g. Forecast the potential social and economic effects of climate change on reef-dependent industries and communities to measure their vulnerability and resilience and determine cost-to-benefit ratios of any proposed climate change mitigation/adaptation measures
- h. Increase awareness
- i. Monitor environmental variables linked to coral bleaching and other climate change impacts
- j. Develop scientific models of the Florida reef system to help predict its response to physical, chemical, and socio-economic shifts associated with climate change

Source:

<http://www.frrp.org/SLR%20documents/FL%20Reef%20Action%20Plan-WEB.pdf>

Ecological Effects of SLR in the Florida Panhandle and Coastal Alabama

- I. Intended purpose:
 - a. Improve scientific understanding of the factors and scales necessary to evaluate shore zone modification and help develop a predictive tool of ecosystem modification due to SLR
- II. Project Background
 - a. Pilot EESLR project began in NC in 2005
- III. Project Implementation
 - a. Workshop was held in January 2008
 - b. 5 groups
 - i. Geomorphology and physical processes
 - ii. Subtidal habitats
 - iii. Terrestrial biological resources
 - iv. Water quality and hydrology
 - v. Modeling

- IV. General strategic recommendations
 - a. Perform targeted studies of biological and physiological tolerances to change
 - b. Utilize historical understanding of community retreat
 - c. Improve understanding of benthic, nearshore, and upstream habitat connectivity
 - d. Improve understanding of the present and future distribution of habitats and the ability of species to migrate
 - e. Use standardized parameters to help drive models
 - f. Ensure adequate time scales so that time scales of concern for ecological effects are as long as the time scales for planning critical infrastructure
- V. Project outcomes and conclusions
 - a. Use relevant scientific data to determine the factors and scales necessary to evaluate shore zone modification and develop a predictive tool of ecosystem modification due to SLR

Source:

<http://www.cop.noaa.gov/stressors/climatechange/features/SLRWhitePaper3-09.pdf>

Retrospective and Prospective Model Simulations of SLR Impacts on Gulf of Mexico Coastal Marshes and Forests in Waccasassa Bay, Florida

- I. Study Purpose
 - a. Florida has extensive low elevation coastal habitats
 - b. SLAMM simulation to improve understanding of the magnitude and location of these changes for 58,000 ha of the Waccasassa Bay region of Florida's central Gulf of Mexico coast
 - c. Prospective runs of SLAMM using .64 m, 1 m, and 2 m SLR scenarios predict substantial changes over this century in the area covered by coastal wetland systems including net losses of coastal forests (69%, 83%, and 99%), inland forests (33%, 50%, and 88%), but net gains of tidal flats (17%, 142%, and 3,837%)
- II. Background
 - a. The 4 primary processes used to predict wetland fate with SLR are inundation, erosion, overwash, and saturation

- b. Conducted both retrospective and prospective SLAMM analyses for an approximately 58,000ha area surrounding and including Waccasassa Bay Preserve State Park in the Big Bend region of Florida

- c. Compare results of SLAMM hindcast with those from data from 13 permanent plots monitored since 1992

III. Results

- a. Implication from findings at the site level is that undeveloped, unprotected, lands inland from the coastal forest should be protected to accommodate upslope migration of this natural community in response to rising seas
- b. Results from SLAMM hindcast agree with field observations of the effects of SLR on the study area along the Gulf coast of Florida
- c. 30% of the coastal forest was adjusted to saltmarsh in the model based on the elevation input layer – in actuality not really noticeable in some cases yet
- d. Model predicts community composition when wetlands have come to equilibrium with a given sea level, meaning that it will not accurately predict short-term transitional effects
- e. SLAMM also predicted higher conversion of coastal forest into saltmarsh than predicted by Castaneda and Putz

Source:

<http://coaps.fsu.edu/~mhannion/Geselbracht.pdf>

Bursting the Bubble of Doom and Adapting to SLR

I. Lead Agencies

- a. RWPaskinsn Consulting, Inc.
- b. FSU
- c. Timothy Dixon
- d. Reed Noss
- e. Anthony Oliver-Smith
- f. Francis Putz
- g. Thomas Ruppert
- h. Kenneth Edward Sassaman
- i. Michael Volk

II. Project Description

- a. The report discusses the adaptive management process that specifies one or more essential actions necessary to reduce the vulnerability of built and natural environments to rising seas.

Source:

http://www.spacecoastclimatechange.com/documents/resources/Bursting_the_Bubble_of_Doom_and_Adapting_to_slr.pdf

Integrated Modeling for the Assessment of Ecological Impacts of SLR

- I. Lead Agencies
 - a. UCF
 - b. Dewberry, Inc.
 - c. Northwest Florida Water Management District
 - d. Florida State University
 - e. University of Florida
 - f. University of South Carolina
 - g. NOAA
- II. Project Description
 - a. The study team, led by Scott Hagen, Ph.D., of the University of Central Florida, will develop sea level rise computer models to predict the impacts storms and rising water pose to the northern Gulf's coastline, including shoreline and barrier island erosion. The results of the study will be incorporated into coastal ecosystem planning for restoration efforts and other natural resource management decisions in the region. It may also help oil spill responders better understand oil that may reside in the subsided ecosystems.

Source:

<http://www.cop.noaa.gov/stressors/climatechange/current/slr/abstracts.aspx>

Effects of Climate Change on Florida's Ocean and Coastal Resources
A Special Report to the Florida Energy and Climate Commission and the People of Florida

The Florida Oceans and Coastal Council prepared this report in 2009 to provide a foundation for future discussions of the effects of global climate change on Florida's ocean and coastal resources, and to inform Floridians about the current state of scientific knowledge regarding climate change. The report provides a high-level overview of the impacts to infrastructure, human health and the economy, as well as key drivers such as increasing air temperatures, warming ocean temperatures, and sea level rise. For each driver, effects such as altered severity and frequency of hurricanes and precipitation patterns, are discussed in terms of probable and possible outcomes. Research priorities for the Council that support the impacts and effects identified are outlined.

The report is meant to provide important and easy to understand information for legislators, policymakers, governmental agencies, and members of the public who are working to address, or who are interested in, issues related to climate change in Florida.

Source:

<http://www.floridaoceanscouncil.org/reports/>

Assessment of Redefining Florida's Coastal High Hazard Area

- I. Purpose
 - a. This report examines how the 2006 legislative change to coastal high hazard area (CHHA) policies introduced by HB 1359, changed the CHHA boundaries and may impact resiliency and land development in Florida's coastal communities
 - b. The focus of this report is to assess the impact of the new boundary definition for the CHHA
 - c. The policy case study also raises serious questions about the role of science and planning analysis in the policy formulation process.
- II. Background
 - a. New language HB 1359: the coastal high hazard area is the area below the elevation of the category 1 storm surge line is established by a SLOSH computerized storm surge model.
- III. Methodology
 - a. Research is based on Florida's three treasure coast counties
 - b. Part II: provides a brief summary of the CHHA regulations, criticisms raised by opponents, and the controversy that spurred its re-examination
 - c. Part III: summarizes the GIS methodology and the qualitative data used in the assessment of the impact of the new boundary delineations in the three treasure coast counties of Martin, St. Lucie, and Indian River
 - d. Part IV: presents findings followed by the research conclusions, which frame the analysis in the context of maintaining and improving community resiliency to hurricanes and in terms of its potential to encourage additional land development
 - e. Part V: presents a discussion of the evolving CHHA policy, why we believe HB 1359 represents a change in policy direction, and questions the adoption of the SLOSH category 1 criterion

IV.

Findings

- a. The new definition based on the SLOSH model for a category 1 hurricane redefines the spatial geography of the zone in ways that may compromise resiliency
 - i. It would remove CHHA regulations from some of the most vulnerable coastal lands, specifically coastal areas adjacent to the ocean, with the evacuation zone, but situated at higher base elevations
 - ii. It adds land that is zones for conservation or recreation use and which is already protected from imprudent development by its zoning designations and wetland regulations
 - iii. Change in boundaries might kindle redevelopment activity of “soft-sites” as several key parcels and desirable neighborhoods will become eligible for upzoning reconsideration
- b. The most striking difference between the two boundary definitions is the shape of the regulated area. The new CHHA is topographically based and thus includes parts of this coastal strip that are below the storm surge level, but excludes areas of higher elevation despite proximity to the ocean or intercoastal waterway. Therefore the CHHA is no longer a contiguous blanketed area, but rather resembles “swiss cheese” where lands above the topographic level of the storm surge for a category 1 storm are removed from the CHHA zone

V. Recommendations

- a. The time has come to holistically consider the environmental, hazard mitigation, land use, and economic development issues related to coastal planning
- b. In terms of the coastal high hazard area, it should be broadened to embrace diverse aspects of natural hazard mitigation. Defined at a regional scale through a coastal sector plan that reflects variability of local geo-morphology an socio-political linkages among neighboring jurisdictions
- c. The CHHA regulation ought to be reexamined and perhaps new language should be developed that revisits the purpose and objectives of the CHHA holistically

Source:

<http://docs.cdsi.fau.edu/cues/CHHAFINALREPORT-MAY212008.pdf>

Florida’s Resilient Coasts: A State Policy Framework for Adaptation to Climate Change

I. Lead Agencies

- a. FAU
- b. Center for Urban and Environmental Solution
- c. National Commission on Energy Policy

II. Project Description

- a. The project presents a comprehensive policy framework which will assist Florida state government 1) in assessing the likely impacts of climate change on its coastal regions and communities and then 2) developing and adopting policies and programs that will enable the state, its communities, and its residents to adapt to and adaptively manage those impacts over the near and long term.

Source:

www.communicationsmgr.com/projects/1349/docs/FAUResilientCoasts.pdf

Florida Water Management and Adaptation in the Face of Climate Change

- I. The report addresses water resources and adaptation issues across the state. The primary objectives of this report are: (1) to identify Florida's water resources and water-related infrastructure that are vulnerable to climate change; (2) show demographics in the state that are vulnerable to climate change impacts with a focus on water resources and sea level rise; and (3) highlight some of the alternative technologies currently being used to solve water resource supply issues in the state that are likely to expand and be challenged under various scenarios of climate change. Lead Agencies
- II. It is of use to Water Management districts and local governments concerned with planning for the future of water sources and municipal supply
- III. The white paper's Appendix discusses SLR methodology. It cites IPCC assumptions and science, but also notes a Quadratic SLR Acceleration Formula by Heimlich et al (2009). It goes on to note a 1 to 3 foot rise for Florida planning purposes but mentions that constant monitoring and model updating will be required for an accurate, ongoing estimate
- IV. This white paper highlights climate change issues relevant to water management, but also recognizes the financial challenges to implement adaptation measures to address climate change solutions. Implementing adaptation measures will require an unprecedented level of resource leveraging and coordination among academic, governmental, non-governmental, and private sector entities.

Source:

http://floridacclimate.org/docs/water_managment.pdf

FLORIDA CITIES

City of Punta Gorda Adaptation plan

- V. Location: City of Punta Gorda
- VI. Lead Agencies
 - a. Charlotte Harbor National Estuary Program
 - b. Southwest Florida Regional Planning Council
- VII. Project Description
 - a. This report identifies the alternative adaptations that could be undertaken to address the identified climate change vulnerabilities for the City of Punta Gorda. These adaptations are presented in the order of prioritized agreement from the public meetings. Only the highest agreement adaptation in each vulnerability area is fully developed for potential implementation. One of the utilities of this approach is that it provides a variety of adaptation options, which the City could select for implementation, adaptive management, and subsequent monitoring.

Source:

<http://www.georgetownclimate.org/resources/city-of-punta-gorda-adaptation-plan>

City of Satellite Beach
Municipal Adaptation to Sea-Level Rise

- I. Project Purpose
 - a. In the fall of 2009, the City of Satellite Beach, Florida, authorized a project designed to:
 - i. Assess municipal vulnerability to rising sea level
 - ii. Initiate the planning process to properly mitigate impacts
- II. Facts
 - a. High precision satellite altimeters indicate sea level has been rising at 3.3+/- 0.4 mm per year
 - b. Three basic option in responding to sea-level rise
 - i. Protect
 - ii. Retreat
 - iii. Accommodate
 - c. Results indicate about 5% of the City landscape will submerge during the initial +2ft rise, with inundation generally restricted to fringing wetlands and finger canal margins proximal to the Banana River
 - d. The “tipping point” towards catastrophic inundation is +2ft, forecast to occur around 2050.
 - e. The City has about 40 years to formulate an implement a mitigation plan
- III. Methodology
 - a. Bathtub model – based upon the flooding of static terrain
 - b. Not a serious weakness because:
 - i. Project designed as a pilot program to provide base-line
 - ii. Likely magnitude of geomorphic change would not be significant

- iii. Presence of extensive coastal armoring along municipal shorelines
- IV. Adaptive management
 - a. On-going and iterative process that specifies one or more essential actions necessary to reduce the vulnerability to rising seas
- V. Initial steps
 - a. Comprehensive Planning Advisory Board approved a series of updates and revisions to the City's Comp Plan
 - i. If approved, the amendments will provide a legal basis for implementing an adaptive management plan and specific actions designed to mitigate the City's vulnerability to sea-level rise
- VI. Three steps
 - a. Development of a 3-D model or "base map" of the City
 - b. Compilation and mapping of "critical infrastructure and assets"
 - c. Quantification of the extent to which the City and its critical assets would be inundated by sea-level rise

Source:

http://spacecoastclimatechange.com/documents/100730_CSB_CRE_Final_Report.pdf

Municipal Adaptation to SLR – Satellite Beach

- I. Location: Satellite Beach
- II. Lead Agencies
 - a. RWParkinson Consulting, Inc
- III. Project Description
 - a. In the fall of 2009, the City of Satellite Beach, Florida, authorized a project designed to: assess municipal vulnerability to rising sea level and initiate the planning process to properly mitigate impacts.
- IV. Integration into Local Plan Framework
 - a. Comprehensive Planning Advisory Board to approve a series of updates and revisions to the City's Comp Plan. If approved, the amendments will provide a legal basis for implementing an adaptive management plan and specific actions designed to mitigate the City's vulnerability to sea-level rise
- V. Methodology/Predictions
 - a. Plan uses the bathtub model, based upon the flooding of static terrain. High precision satellite altimeters indicate sea level has been rising at 3.3+/- 0.4 mm per year. Results indicate about 5% of the City landscape will submerge during the initial +2ft rise, with inundation generally restricted to fringing wetlands and finger canal margins proximal to the Banana River. The "tipping point" towards catastrophic inundation is +2ft, forecast to occur around 2050.
- VI. Project/Actions/Conclusions
 - a. The City has about 40 years to formulate an implement a mitigation plan

Source:

http://spacecoastclimatechange.com/documents/100730_CSB_CRE_Final_Report.pdf

Yankeetown, FL
Coastal Forests Retreat

- I. UF research
 - a. Investigating coastal forest decline and replacement by saltmarsh in Yankeetown since mid-1990s
 - b. Results: consequence of chronic stresses of SLR coupled with the punctuated disturbances of storms and droughts
 - i. Salt is the primary culprit
- II. Salt
 - a. Health and diversity of the river side forests is testimony to occasional cleansing by fresh water
 - b. Greenhouse experiments involving potted plants grown in salt solutions in colorful plastic swimming pools confirmed the ranking of tree species' salt tolerance observed in the field
 - i. Salt tolerance increase with tree size
 - c. For salt-sensitive species, even the occasional sea surge, especially if followed by dry conditions, can be fatal
- III. Important to remember that the forests are being replaced by saltmarshes, which have their own virtues

Source:

<http://people.biology.ufl.edu/fep/SeaLevelRiseFlorida2012inThePalmetto.pdf>



FLORIDA COUNTIES & REGIONS

Lee County Climate Change Vulnerability Assessment

- I. Five Future Scenarios for 2100
 - a. A condition that involves a future in which mitigative actions are undertaken to reduce the human influence on climate change
 - b. A 90% probable future predicted by the intergovernmental panel on climate change
 - c. A 50% probable future predicted by IPCC
 - d. A 5% probable future predicted by IPCC
 - e. A “very worst” future in which no actions are taken to address climate change
- II. Report assesses significant potential climate-related changes in air and water and the effects of those changes on climate stability, sea level, hydrology, geomorphology, natural habitats and species, land use changes, economy, human health, human infrastructure, and variable risk projections
- III. Prioritized ranking for climate change vulnerabilities
 - a. Altered hydrology
 - b. Climate instability/storm severity
 - c. Habitat and species changes
 - d. Geomorphic (landform) changes
 - e. Sea level rise and water temperature and chemistry changes
 - f. Infrastructure impacts and land use changes
 - g. Air temperatures and chemistry changes and human health
 - h. Human economy
 - i. Variable risk
- IV. 5 major stressors of climate change
 - a. Changes in the ratio of atmospheric gases
 - b. Changes in air temperature and water vapor
 - c. Changes in water body temperature
 - d. Changes in water chemistry
 - e. Changes in sea level

Source:

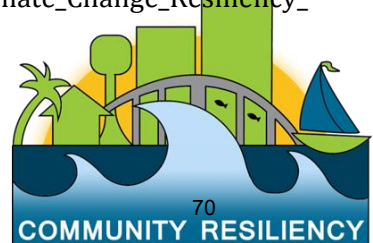
<http://www.leecounty.com/gov/dept/sustainability/Documents/Lee%20County%20Climate%20Change%20Vulnerability%20Assessment%20Final%20201.pdf>

Lee County Climate Change and Resiliency Strategy

- I. Lead Agencies
 - a. SW FL Water Management District
- II. Project Description
 - a. The CCRS includes a process for identifying potential climate change resiliency strategies through coordination and consultation with local government leadership in 39 Lee County departments and divisions, including constitutional offices. Identification of resiliency strategies that could be utilized by Lee County to reduce the negative effects of climate change will also help in positioning the County to take advantage of potential climate prosperity opportunities. The CCRS is a toolbox that contains a wide variety of ideas and opportunities for the County to employ in climate change planning, energy savings, and cost savings. The CCRS informs the County of options and opportunities but it does not prioritize those actions or direct County policy. Prioritization would require a full public planning process incorporating public participation as part of a full adaptation plan.

Source:

http://www.swfrpc.org/content/Natural_Resources/Ecosystem_Services/Lee_County_Climate_Change_Resiliency_Strategy.pdf



Sarasota County, FL: Current and Future Vulnerability to Hurricane Storm Surge and Sea Level Rise

- I. Goal:
 - a. Develop a comprehensive vulnerability assessment framework that integrates geospatial analysis and stakeholder input to facilitate enhanced community resilience through planning
- II. Elements
 - a. Vulnerability assessment including SLR
 - b. Decision-support methodology incorporating scientific understanding with value-based human dynamics
 - c. Inject SLR scenarios into long-range planning activities
- III. Methodology
 - a. SLOSH model: Sea, Lake, Overland Surges from Hurricanes Model
 - b. Prior Research
 - c. Impact of each category storm – results determined by percentage of total population in surge zone in specific neighborhoods
 - d. Focus groups divided into subgroups:
 - i. Business
 - ii. Environmental
 - iii. Planners
 - iv. Facilities & infrastructure
 - v. Government officials
- IV. Results
 - a. Broken down into subgroups
 - i. Overall: location of development, location of urban service boundary, infrastructure inside hazard zone, cost of shifting development
 - ii. Business: ID beach specific businesses, rebuilding with FEMA restrictions, moving critical and essential facilities, and imposing mitigation restrictions
 - iii. Environmental: mitigate SLR impacts on environmental areas, transfer development rights, develop land swaps, replenish wetlands for surge mitigation
 - iv. Planners: increase density outside hazards zones, incentives to steer development, strategies to retreat from coast, and limited by economic realities
 - v. Facilities & infrastructure: mitigate now (move dated infrastructure, ensure functional flexibility, revise existing plan), plan better for future (cautiously place infrastructure in hazard zones, evacuation)
 - vi. Government officials: evaluate placement of urban service boundary, mitigation need vs. cost of moving (facilities & infrastructure), locate high density residential outside hazard zones, and transportation add more N to S on Highway 75
- V. Conclusions
 - a. Development constricted to hazards zones
 - b. Specific adjustments: Relax urban service boundaries; Steer development out of hazards zone; Relocate/replace infrastructure; Explore evacuation alternatives
 - c. Urban growth boundaries in coastal communities could contribute to hurricane hazards exposure

Source:

<http://www.scgov.net/pdrp/documents/PSUHurricaneStudy070609.pdf>



Sarasota, FL: Influence of Potential Sea Level Rise on Societal Vulnerability to Hurricanes Storm-surge Hazards, Sarasota County, FL

- I. Purpose
 - a. Concern: climate change, specifically potential SLR, could influence the impacts of future hurricanes
 - b. Assessment: variations in socioeconomic exposure in Sarasota County, FL, to contemporary hurricane storm-surge hazards and to storm-surge hazards enhanced by SLR scenarios
 - c. Finding: significant portions of the population, economic activity, and critical facilities are in contemporary and future hurricane storm-surge hazard zones
- II. Recent modified projections suggest global SLR by .8-2.0 meters by 2100
- III. In addition to increase in storm-surge inundation zones due to SLR, the potential for future hurricanes disasters is exacerbated by the continuing trend of populations migrating to coastal areas
- IV. Paper
 - a. Examines the influence of SLR on societal vulnerability to hurricane storm-surge hazards
 - b. Objective: determine if and how SLR predictions may alter the potential socioeconomic impacts of future storms and how these impacts may vary among communities
 - c. Growth and development may intersect with SLR to increase vulnerability to hurricane storm surge
- V. Hazard Assessment
 - a. To delineate hurricane storm-surge hazard zones, we used outputs from the SLOSH model provided by NHC (National Hurricane Center)
 - b. To delineate the effect of SLR on hurricane storm-surge, we developed hazard scenarios based on the 4 contemporary storm-surge hazard zones for each Saffir-Simpson hurricane category that are each then enhanced by SLR projections
- VI. Vulnerability assessment
 - a. 28 communities in Sarasota County
 - b. GIS to determine the amount and percentage of the following socioeconomic attributes in the various hazard zones of each city: Residents, employees, critical and essential facilities, parcel value, and land use
- VII. Results
 - a. Population and asset exposure in enhanced storm-surge hazard zones
 - i. Trend: addition of SLR scenario to hurricane storm-surge zones often results in a doubling of pop and asset exposure
 - ii. Trend: addition of SLR to contemporary category 1&2 hurricane storm-surge causes societal exposure to be equal to or greater than what is in the hazard zone of the next higher contemporary Saffir-Simpson hurricane category
- VIII. Discussion
 - a. Important for public officials to understand the societal risk of their communities to the combination of SLR and hurricane storm surge
 - b. First steps in determining socioeconomic risk = understanding societal exposure of assets in relationship to the various storm-surge hazard zones, how SLR alters this exposure, and the ways this increased asset exposure varies from community to community

Source:

<http://stormsmart.org/wp-content/blogs.dir/1/files/group-documents/22/1290533117-Frazier etal 2010 GIS.pdf>

Planning for SLR and Hurricane Storm Surge in Sarasota County

- I. Location: Sarasota County
- II. Lead Agencies
 - a. Penn State University
 - b. University of Idaho
 - c. NOAA
 - d. US Geological Survey
 - e. National Science Foundation
- III. Project description
 - a. A three-year study that led to the creation of a collaborative methodology that local government officials and stakeholders can use as they plan for the changes expected to result from the future rise in sea level. This new model integrates scenarios about storm surge, population growth and economic and infrastructure development into the long-range planning options for coastal communities.

Source:

<http://www.scgov.net/pdrp/documents/PSUHurricaneStudy070609.pdf>



Sea Level Rise in the Tampa Bay Region

- I. Purpose
 - a. Tampa Bay Regional Planning Council (TBRPC) was contracted by the Southwest Florida Regional Planning Council (SWFRPC) through a grant from USEPA to participate in a nationwide project promoting awareness of, and planning for, SLR
 - b. National effort to encourage the long-range thinking necessary to plan for SLR and impacts
 - c. SLR project hopes to stimulate government planning for adaptation to SLR effects on uplands and wetlands
- II. Tool
 - a. Maps that visualize the anticipated response of local governments to SLR, based on current land use designations and future planning policies
 - b. Current 5-ft contour line was used as mean sea level shoreline for mapping purposes
- III. Predictions
 - a. 2050
 - i. 50% probability 15 cm
 - ii. 90% 4.6 cm
 - iii. 10% 28 cm
 - b. 2100
 - i. 50% 34 cm
 - ii. 90% 10 cm
 - iii. 10% 65 cm
 - c. 2200
 - i. 50% 81 cm
 - ii. 90% 22 cm
 - iii. 10% 196 cm
- IV. Policies
 - a. Currently no specific SLR policies exist on the local level

Source:

http://www.tbrpc.org/mapping/pdfs/sea_level_rise/Tampa%20Bay%20-%20Sea%20Level%20Rise%20Project%20Draft%20Report%20without%20maps.pdf

Land Use Impacts and Solutions to SLR in East Central Florida

- I. Purpose
 - a. East Central Florida Planning Council (ECFRPC) was contracted by the Southwest Florida Regional Planning Council (SWFRPC) through a grant from USEPA to participate in a nationwide project promoting awareness of, and planning for, SLR
 - b. Bring more local awareness to the issue of SLR and aid local governments of Brevard and Volusia counties in long-term planning for SLR so that both property and the environment can be preserved
- II. Methods
 - a. Maps created for the coastal zones of Brevard and Volusia counties that distinguish the shores that are likely to be protected from erosion, inundation, and flooding, from those shores where natural shoreline retreat likely will take place
 - b. Maps have two audiences:
 - i. State and local planners and others concerned about long-term consequences
 - ii. Policy makers and citizens concerned about long-term climate change
 - c. Maps illustrate the areas that planners within this region expect will be protected from erosion and inundation in the coming decades
- III. Results
 - a. Little doubt that a continuation of rising sea level will affect Brevard and Volusia counties
 - b. Effects:
 - i. Affect not only residents, but may have a major effect on tourist destinations as well, which may result in dramatic effects on the economic well being of the counties
 - ii. Inundation and higher flood elevations
 - iii. Shoreline erosions
 - iv. Salt water intrusion and contamination of the aquifer may occur resulting in the contamination of wells
 - c. There is a 90% probability that there will be over a foot rise in sea level by 2150 along the Florida coast
 - d. Local issue:
 - i. Erosions is considered critical when there is a threat of loss of one of the following four interests: recreation, wildlife habitat, upland development, or important cultural resources
 - ii. Almost half of the beaches in the study area are considered critically eroding or eroding substantially
- IV. Recommendations
 - a. Even if satisfied preserving approximately 1/3 of coastal wetland ecosystems, they are most likely to protect property values, and the commercial, industrial, tourism, and residential economies if we start factoring the implications of rising sea level into the planning process now, rather than later
 - b. Currently, land use regulations address flood mitigation and not SLR
 - i. Many of these can be used as SLR planning
 - c. Currently no specific SLR policies exist on the local level

Source:

http://research.fit.edu/sealevelriselibrary/documents/doc_mgr/446/East_Central_SLR_Adaptation_-ECFRPC_2004.pdf



Climate Change and Sea-Level Rise in Florida

An Update of the Effects of Climate Change on Florida's Ocean & Coastal Resources

- I. Prepared by the Florida Oceans and Coastal Council: Tallahassee, FL
- II. Purpose
 - a. Provide a foundation for discussions of the effects of SLR on FL's oceans and coastal resources and to inform Floridians about the current state of scientific knowledge regarding SLR and how it is likely to affect FL
 - b. Two main processes are causing SLR: expansion of ocean water caused by increasing ocean temperature and the addition of "new" water from melting reservoirs of ice
 - c. Causing SLR by 2100 to range b/n .5 meter to more than a meter
- III. Changes in Barrier Islands, Beaches, and Inlets
 - a. Continued SLR will exacerbate erosion
 - b. SLR may shift the beach profile, and therefore the shoreline, landward
 - c. Correlation b/n the long-term erosion rates and SLR rates
 - d. Island breaching
 - e. SLR = increase size of bays, increase tidal prism
- IV. Changes in Estuaries, Tidal Rivers, and Coastal Forests
 - a. Tidal wetlands may be keeping pace with current rates of SLR change by accreting vertically, migrating upward, or both if there is a source of sediment or space landward of current wetlands
 - b. Low-lying coastal forests will be lost during the next 1-3 centuries as tidal wetlands expand across low-lying coastal areas and the retreat of forests is blocked by urban development
- V. Higher storm surge and impacts on coastal infrastructure
 - a. The risk of flood damage to coastal infrastructure is likely to increase in parallel with SLR
- VI. Threats to coastal water supply and wastewater treatment
 - a. Surficial coastal aquifers are already experiencing saltwater intrusion
- VII. Increase in beach erosion and renourishment
 - a. Erosion will increase, and beaches will require more frequent renourishment
 - b. Dangers to species that are reliant on beach – sea turtles
- VIII. Increased Flooding Risks
 - a. What is currently considered a 100-year flood event will likely become a 50- or 20-year event as sea level continues to rise
- IX. 2010 recommendations for Florida research
 - a. In the following categories: oceanography, geology and hydrology, ecology, and decision making

Source:

<http://www.floridaoceanscouncil.org/reports/>



Comprehensive SW FL/Charlotte Harbor Climate Change Vulnerability Assessment

- I. Report Purpose
 - a. Assess significant potential climate changes in air and water and the effects of those changes on climate stability, sea level, hydrology, geomorphology, natural habitats and species, land use changes, economy, human health, human infrastructure, & variable risk projections in SW Florida
 - b. Outputs communicated to local governments, stakeholder groups, and the public
 - i. For use in developing coastal and land use planning
 - ii. For use in avoidance, minimization, mitigation, and adaptation of climate change impacts throughout the CHNEP study area
 - c. SWFRPC and CHNEP conducted the vulnerability analysis
- II. 5 major stressors of climate change addressed in this document:
 - a. Changes in the ratio of atmospheric gases
 - b. Changes in air temperature and water vapor
 - c. Changes in water body temperature
 - d. Changes in water chemistry
 - e. Changes in sea level
- III. 12 categories
 - a. Air temperature and chemistry
 - b. Altered hydrology
 - c. Climate instability
 - d. Geomorphic changes
 - e. Habitat and species changes
 - f. Sea level rise
 - g. Water temperature and chemistry
 - h. Human ecology
 - i. Human health
 - j. Infrastructure
 - k. Land use changes
 - l. Variable risk
- IV. Projections: Stanton and Ackerman extremes
 - a. Rapid stabilization case
 - i. 2025 – 1.8
 - ii. 2050 – 3.5
 - iii. 2075 – 5.3
 - iv. 2100 – 7.1
 - b. Business-as-usual case
 - i. 2025 – 11.3
 - ii. 2050 – 22.6
 - iii. 2075 – 34
 - iv. 2100 – 45.3

Source:

http://www.swfrpc.org/content/Natural_Resources/Ecosystem_Services/Vulnerability_Assessment_Final.pdf



Sea Level Rise in the Treasure Coast Region

- I. Purpose
 - a. Report is designed to support the EPA's national effort encouraging the long-term thinking required to deal with the issues associated with sea level rise
 - b. The report creates maps of the Treasure Coast Region that distinguish the shores that are likely to be protected from erosion, inundation, and flooding from those areas where natural shoreline retreat is likely to take place
- II. Goal
 - a. To diminish losses to life and property from coastal hazards such as erosion and inundation, and to ensure the long-term survival of coastal wetlands
- III. Predictions
 - a. 2025: 2.8 inches to 10.7 inches
 - b. 2200: 21.0 inches to 177.3 inches
 - c. Based on EPA report which relied on various scientific opinions regarding sea level changes affected by factors such as radiative forcing caused by both greenhouse gases and sulfate aerosols, global warming, and thermal expansion, polar temperatures and precipitation, and the contributions to sea level from Greenland, Antarctica, and small glaciers.
- IV. Proposed policies
 - a. Consider the impact of sea level rise in all land use amendments in coastal areas less than 10 feet in elevation
 - b. Obtain detailed topographic maps showing one foot contours in the coastal zone to assist in planning for sea level rise
 - c. Develop a plan to protect or relocate all critical public facilities that are located in areas projected to be impacted by sea level rise in the next 50 years
 - d. Closely monitor updates to sea level rise forecasts and predictions
 - e. Develop a sea level rise response plan that specifically identifies the areas where retreat, accommodation, and protection will be implemented

Source:

http://www.tcrpc.org/special_projects/TCRPC%20SLR%20Report%2012-05-05.pdf



South Florida Water Management District

Climate Change & Water Management

- I. Purpose
 - a. Provide high-level foundation for future discussions of the effects of global climate on water management planning and operations
 - b. Focus the global concepts of climate change at the regional level by providing an overview of how it may affect South Florida's resources and the mission responsibilities of the SFWMD
- II. Includes
 - a. Initial vulnerability assessment of the potential threats of climate change and SLR to water supply, flood control, coastal ecosystems, and regional water management infrastructure
- III. Organization & Techniques
 - a. Impacts divided into 4 areas: rising seas; temperature and evapotranspiration; rainfall, floods, and draught; and tropical storms and hurricanes.
 - b. Planning period of approximately 50 years – to 2060 – is generally used
- IV. Predictions
 - a. Over the next 50 yrs, South Florida may experience seas that are in the range of 5 to 20 inches higher than current levels
 - b. Two primary factors for SLR
 - i. Thermal expansion
 - ii. Melting ice

Source:

http://research.fit.edu/sealevelriselibrary/documents/doc_mgr/447/South%20Florida%20Water_Management_&_CC_-_SFWMD_2009.pdf

Developing a Sea Level Rise Vulnerability Framework for South Florida

Indicators, Metrics, and Models

- I. Lead Agencies
 - a. FIU
 - b. US Geological Survey
- II. Project Description
 - a. The workshop, the result of an existing collaboration between USGS, FIU, and FAU, focused on conceptualizing and evaluating vulnerability and quality of life (QOL) metrics in the context of sea level rise (SLR), and changing land development patterns. This collaboration is an extension of a long-term effort by the USGS, NPS and others to develop the Ecosystem Portfolio Model (EPM), a Geographic Information System-based multi-criteria decision-support web tool meant to evaluate land use plans and proposed land use/land cover changes.

Source:

http://www2.fiu.edu/~ipor/climatechange/FAU_FIU_USGS_JUNE2010_WORKSHOP_REPORT.pdf



South Florida SLR Project

- I. Lead Agencies
 - a. South Florida Regional Planning Council
 - b. EPA
 - c. SW FL Regional Planning Council
 - d. Treasure Coast Regional Planning Council
- II. Project Description
 - a. This project examined the effects of long-term sea level rise on seven coastal counties in Florida, including Broward, Monroe, Miami-Dade, Indian River, Palm Beach, Martin, and St. Lucie counties. The primary objective was to examine what South Florida might look like in 200 years under climate change scenarios that would cause significant sea level rise. Sea level rise is expected to significantly affect Florida's coastal tourism industry. Public and private infrastructures located in vulnerable areas are likely to be damaged and/or destroyed with increased sea levels and erosion.

Source:

[http://www.sfrpc.com/gis/SFRPC%20SLR%20Study%20\(September%202005\).pdf](http://www.sfrpc.com/gis/SFRPC%20SLR%20Study%20(September%202005).pdf)



Past and Projected Trends in Climate and Sea Level for South Florida

- I. Lead Agencies
 - a. South Florida Water Management District
- II. Project Description
 - a. This report represents the culmination of several investigations aimed at assessing the current state of knowledge on these issues as they pertain to south Florida. The first section provides an assessment of natural climate variability and how it influences the south Florida climate. This is followed with an in-depth analysis of historical trends in precipitation and temperature, and their projections produced by General Circulation Models (GCMs) and Regional Climate Models (RCMs). Next, sea level rise trends and projections are reviewed including examination of potential changes to storm surges and coastal drainage capacity, followed by a brief summary of exploratory hydrological modeling conducted to understand the water resources impacts of these projected changes.

Source:

http://my.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/ccireport_publicationversion_14jul11.pdf



Florida Forever Work Plan

- I. Lead Agencies
 - a. Suwannee River Water Management District
- II. Project Description
 - a. The plan contains a list of lands that sequester carbon, provide habitat, protect coastal lands or barrier islands, and otherwise mitigate to help adapt to the effects of sea level rise.

Source:

www.srwmd.state.fl.us/documents/Land%20Acquisition%20and%20Management/FloridaForeverWorkplan_2008.pdf



Southeast Florida Regional Climate Change Compact

A Region Responds to a Changing Climate

A collaborative effort among Broward, Miami-Dade, Monroe, and Palm Beach Counties to develop a climate change action plan. Specific accomplishments include the development of regionally-consistent methodologies for mapping sea-level rise impacts, assessing vulnerability, and understanding the sources of regional greenhouse gas emissions. The compact calls for concerted action in reducing greenhouse gas emissions and anticipating and adapting to regional and local impacts of a changing climate.

- I. Policy recommendations will be implemented through several approaches:
 - a. The development of policy guiding documents by local and regional governing bodies
 - b. The development of operational guidance documents
 - c. The development of consistent goals and measures throughout the various governments in the region
 - d. A coordinated multi-disciplinary outreach and education program
 - e. Processes for focused and prioritized investments
- II. Methodology
 - a. Based on the USACE July 2009 Guidance Document
 - b. Two key planning horizons:
 - i. 2030 – SLR projected to be 3-7 inches
 - ii. 2060 – SLR projected to be 9-24 inches
 - c. A SLR of one foot is projected to occur between 2040-2070 with sea level continuing to rise into the future
 - d. Review projection after 4 years
 - e. Mapping was completed to include different sea level rise inundation scenarios to help identify areas at potential risk and aid in planning for adaptation strategies
- III. Structure of the Regional Climate Action Plan: 6 categories
 - a. Sustainable communities and transportation planning
 - b. Water supply, management, and infrastructure
 - c. Natural systems and agriculture
 - d. Energy and fuel
 - e. Risk reduction and emergency management
 - f. Outreach and public policy
- IV. Next steps

Source:

http://webapps.broward.org/NewsRelease/Attachments/3467_237_12072011_DRAFT%20SE%20Florida%20Regional%20Climate%20Change%20Action%20Plan.pdf

A Unified Sea Level Rise Projection for Southeast Florida

- I. Objective
 - a. Work toward developing a unified SLR projection for the SE Florida region for use by the SE FL regional climate compact counties and partners for planning purposes to aid in understanding potential vulnerabilities and to provide a basis for outlining strategies for the SE FL region
- II. Conclusions and Recommendations
 - a. Provides guidance for the compact counties and their partners to initiate planning to address the potential impacts of SLR on the region
 - b. Strategic long-term (beyond 2060) policy discussions will be needed to include development of guidelines for public and private investments which will help reduce community vulnerability to sea level rise impacts beyond 2060
 - c. Recommendations from the Technical Ad hoc Work Group
 - i. The SE FL Unified SLR Projection should be based on the US Army Corps of Engineers (USACE) July 2009 guidance document using key west data (1913-1999) as the foundation of the calculations and referencing the year 2010 as the starting date for SLR projections
 - ii. This projection should be used for planning purposes, with emphasis on the short and moderate term planning horizons of 2030 (USACE- 3-7 inches) and 2060 (USACE- 9-24 inches)
 - iii. A science-based narrative for 2060 and beyond provides context for the current state of scientific understanding and the potential issues which must be considered when looking toward the end of the 21st century and beyond
 - iv. The unified SE FL sea level rise projection will need to be reviewed as the scientific understanding of ice melt dynamics improves. The projection should be revised within four years of final approval.
 - v. Users of the projection should be aware that at any point in time, sea level rise is a continuing trend and not an endpoint
 - vi. The acceleration of sea level rise can be slowed and the magnitude reduced by actions to reduce greenhouse gas emissions
- III. Adoption
 - a. This document was adopted by the SE FL regional climate change compact staff steering committee on May 6, 2011 for use by the regional climate change work groups in development of the SE FL regional climate change action plan

Source:

<http://www.broward.org/NaturalResources/ClimateChange/Pages/SoutheastFloridaRegionalClimateCompact.asp>

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Development of an Adaptation Toolbox to Protect Southeast Florida Water Supplies from Climate Change

- I. Purpose
 - a. Connection between sustainable water supplies and Everglades restoration
 - b. Outline potential effects of SLR scenarios for coastal southeast Florida and develop a toolbox of options for adaptation for water, wastewater, and stormwater utilities to apply
 - c. Developed milestones to trigger infrastructure investments, as climate changes may occur more rapidly or more slowly than currently projected
- II. Climate change in Florida
 - a. Temperatures are higher, but extremes are greater
 - b. Additional research and high-resolution climate modeling for the Florida peninsula is needed
 - c. Global projections of SLR of 2-4 feet by 2100 are in line with the results seen from the FL stations
 - d. South Florida among the world's most vulnerable coastal regions to climate change especially as it relates to SLR
 - e. Rising seas also means rising groundwater, so more intense rainfall will increase the risk of flooding, not only in the low-lying coastal areas, but also in the interior flood plains due to the loss of soil storage capacity for percolation
 - f. Primary goal of CERP is to restore the natural freshwater flow to the everglades, which becomes even more imperative in light of potential SLR impacts
- III. Tools to protect water resources
 - a. Install local stormwater pumping
 - i. Localized pumping stations will need to be installed to drain water to reduce ponding.
 - b. Water conservation
 - i. Useful in reducing the need for expansion of water supplies because they encourage reduced per capita water usage
 - c. Armoring the sewer system
 - i. An effective infiltration and inflow reduction program will combat the need for expensive membrane treatment for water reclamation in the short term
 - d. Wastewater reclamation and reuse
 - e. Aquifer recharge
 - i. Various methods of recharging surficial aquifers:
 - 1. Stormwater diversion to impoundments located on permeable land
 - 2. Treated water discharge into surface waters for aquifer recharge
 - 3. Direct injection of treated stormwater or surface water from reservoirs
 - 4. Percolation ponds or wetlands using tertiary treated wastewater
 - 5. Direct injection of highly treated wastewater using reverse osmosis
 - f. Protection of existing water sources
 - i. Limiting wellfield withdrawals
 - ii. Coastal salinity structures, horizontal wells, and hydrodynamic barriers
 - g. Desalination
 - h. Aquifer storage and recovery

- i. Management tool (not alternative water supply)
- i. Regionalization of alternative water supplies and reclamation projects

Source:

<http://www.evergladeshub.com/lit/pdf11/Bloetscher11envRev19-397-417-ProtectWatSupClimChge.pdf>



U.S. STATES

California

Hazard Mitigation Plan

Sea level rise is a profiled hazard but is grouped with coastal flooding and erosion. Potential losses are outlined and current mitigation actions are discussed. There are also boxes from the 2010 update about the progression of SLR, coastal flooding and erosion actions. They also fully profile Climate Related Hazards which include avalanches, coastal flooding, coastal erosion, sea level rise, droughts and water shortages and extreme heat.

Projects:

- Local Coastal Programs
 - Analyze the effects of 55 inch sea level rise and its implications for coastal erosion
- Vulnerability of Transportation Systems
 - Identify impacts of flooding on tunnels, and airport runways, washout of coastal highways and rail lines, and submersion of dock and port facilities from a 55-inch rise in sea level.
- San Francisco Bay Conservation and Development District (BCDC) Climate Change Planning Program
 - Update sea level rise maps to show areas vulnerable to 16 inches of sea level rise at mid-century and 55 inches at the end of the century. Develop strategies for adapting to a dynamic and changing bay. Provide planning assistance to local governments

Source:

http://hazardmitigation.ca.gov/plan/state_multi-hazard_mitigation_plan_shmp



CA Climate Change Regulation

- I. Primarily focuses on monitoring greenhouse gas emissions and shifting to renewable energy resources
- II. Governor's Executive Order # S-13-08 addresses sea level rise
 - a. Directs state agencies to plan for sea level rise and climate impacts through coordination of the state Climate Adaptation Strategy

Source:

<http://www.climatechange.ca.gov/>



2009 California Climate Adaptation Strategy Report to the Governor

- I. Projections:
 - a. 12-18 inches by 2050
 - b. 21-55 inches by 2100
 - c. This projection accounts for the global growth of dams and reservoirs and how they can affect surface runoff into the oceans, but it does not account for the possibility of substantial ice melting from Greenland or the West Antarctic Ice sheet, which would drive sea levels along the CA coast even higher
- II. Objectives:
 - a. Analyze climate change risks
 - b. Identify sector-specific, and cross-sectoral adaptation strategies that help reduce vulnerabilities
 - c. Explore cross-cutting supportive strategies
 - d. Formalize criteria for prioritizing identified adaptation strategies
 - e. Specify future direction
 - f. Provide recommendations for immediate and near-term priorities for implementing identified adaptation strategies
 - g. Inform and engage the CA public about climate risks and adaptation strategies
- III. Key recommendations:
 - a. A Climate Adaptation Advisory Panel (CAAP) will be appointed to assess the greatest risks to CA from climate change and recommend strategies to reduce those risks building on CA's Climate Adaptation Strategy
 - b. CA must change its water management and uses because climate change will likely create greater competition for limited water supplies needed by the environment, agriculture, and cities
 - c. Consider project alternatives that avoid significant new development in areas that cannot be adequately protected (planning, permitting, development, and building) from flooding, wildfire, and erosion due to climate change.
 - d. All state agencies responsible for the management and regulation of public health, infrastructure or habitat subject to significant climate change should prepare as appropriate agency-specific adaptation plans, guidance, or criteria by sept. 2010
 - e. All significant state projects, including infrastructure projects, must consider the potential impacts of locating such projects in areas susceptible to hazards resulting from climate change.
 - f. The CA emergency management agency (Cal EMA) will collaborate with CNRA, the CAT, the Energy Commission, and the CAAP to assess CA's vulnerability to climate change, identify impacts to state assets, and promote climate adaptation/mitigation awareness through the Hazard Mitigation Web Portal, and My Hazards Website as well as other appropriate sites
 - g. Using existing research the state should identify key CA land and aquatic habitats that could change significantly during this century due to climate change
 - h. The best long-term strategy to avoid increased health impacts associated with climate change is to ensure communities are healthy to build resilience to increased spread of disease and temperature increases
 - i. The most effective adaptation strategies relate to short and long-term decisions
 - j. State fire fighting agencies should begin immediately to include climate change impact information into fire program planning to inform future planning efforts

- k. State agencies should meet projected population growth and increased energy demand with greater energy conservation and an increased use of renewable energy
- l. Existing and planned climate change research can and should be used for state planning and public outreach purposes; new climate change impact research should be broadened and funded

Source:

<http://www.climatechange.ca.gov/adaptation/>



Sea Level Rise Adaptation Strategy for San Diego Bay

- I. Project Partners
 - a. ICLEI – Local Governments for Sustainability USA
 - b. The San Diego Foundation
 - c. Tijuana River National Estuarine Research Reserve – Coastal Training Program
- II. Projections
 - a. Between 10-17 inches in 2050 and 31-69 inches in 2100
- III. The assessment was conducted through a combination of modeling, mapping, and intensive consultation with the project’s Technical Advisory committee
- IV. Next steps
 - a. Many of the recommendations in this strategy are intended for consideration and implementation in each of the participating local jurisdictions in their own planning processes
 - i. such as Climate Mitigation and Adaptation Plans in the City of San Diego and Port of San Diego, and in bayfront planning in Chula Vista
 - b. Both the Port of San Diego and the City of San Diego are developing adaptation policies in their climate action plans, targeted for adoption in 2012, and the City of National City also recently adopted a climate action plan
- V. Guiding Principles and Development principles
 - a. Established to align the region with the State’s approach
- VI. Planning process deliverables
 - a. Existing conditions report
 - b. Vulnerability assessment
 - c. Policy recommendations
 - d. Adaptation strategy

Source:

http://www.icleiusa.org/climate_and_energy/Climate_Adaptation_Guidance/san-diego-bay-sea-level-rise-adaptation-strategy-1/san-diego-bay-sea-level-rise-adaptation-strategy

Goleta Beach 2.0: Managed Retreat to Mitigate Coastal Erosion

- I. Project summary/overview
 - a. In 2009, the Goleta Beach 2.0 Concept planning process was established to reexamine managed retreat options for the park in order to mitigate coastal erosion
 - b. Goleta Beach 2.0 managed retreat may prove to be the most resilient strategy for the beach as sea level rises
 - c. Two major strategies:
 - i. A structural solution
 - ii. Major retreat
 - d. Environmental review picked structure solution (i.e. permeable pier addition) as preferred option
 - e. CA coastal commission voted in july 2009 to turn down the plan
 - i. Told to rethink retreat option
- II. Project outcome and conclusions
 - a. Several areas that are vulnerable to coastal erosion
 - i. Prime erosion zone
 - ii. Major utility lines (within those zones)
 - b. Configured ten future actions to enhance Goleta Beach County Park
 - c. Goleta Beach 2.0 has not yet resulted in a specific engineering plan, but it has outlined a conceptual plan that will lead to an engineering proposal and environmental review

Source:

<http://www.countyofsb.org/parks/parks07.aspx?id=16864>



San Francisco Bay Conservation and Development Commission

- I. Role of Bay Plan
 - a. Serves as mandatory state policies that are enforced by the Commission through its regulatory authority
 - b. Some Bay Plan policies are declarations of the Commission's intention to undertake future studies or planning
 - c. Other policies offer advice to local governments, other agencies, and organizations in dealing with Bay management issues
 - d. Both state law and the Bay Plan stipulate that any such recommendations are advisory only and cannot be enforced by the Commission
- II. Changes since previous amendments to Bay Plan
 - a. IPCC – represents a wide range of scientific opinion, its conclusions are generally conservative but widely accepted
 - b. Effects of climate change are now being observed
 - c. Research determines that climate change is largely caused by humans

Source:

<http://www.bcdc.ca.gov/>



Chula Vista, California: Adaptation Planning with No Budget and No Experience

Chula Vista's climate change adaptation plan was developed in 2011. It recommended 11 strategies in seven focus areas to help the city adapt to the impacts of climate change. The focus areas are: infrastructure and resources; energy management; public health; business and economy; water management; wildfires; and ecosystems and biodiversity.

I. Process of Institutionalization

- a. In 2008, the San Diego Foundation commissioned a study called Focus 2050, modeled on the study by the same name undertaken for King County, Washington. The study uses climate change projections, generated by scientists at the Scripps Institution of Oceanography, to explore what the San Diego region will be like in 2050 if current trends continue.
 - i. The Focus 2050 report was vital because it distilled the technical information about climate change impacts in the region and made it digestible for a broader readership
- b. In 2010, Chula Vista began to work on developing an adaptation Plan
 - i. Formed the Climate Change Working Group (CCWG) comprised of residents, businesses, nonprofits, and community organization representatives
- c. In 2011, the CCWG recommended 11 strategies in 7 focus areas to help the community adapt to the impacts of climate change.
 - i. The Conservation Department, a branch of the Department of Public Works, has spearheaded the process of institutionalization
- d. After developing the strategies, the working group hosted a public forum where they presented information about climate change on poster boards, and the public could ask questions and give feedback

II. Who made it happen?

- a. The Resource Conservation Commission (RCC) – a standing, city-council-appointed committee – played a key role in institutionalizing the adaptation plan

III. Progress report

- a. As of October 2011, “of the more recent 11 climate adaptation strategies and their 30 associated implementation components, only one component dealing with storm water pollution prevention and reuse and two components dealing with biological monitoring have been delayed due to funding shortages”

Source:

<http://www.chulavistaca.gov/clean/conservation/Climate/ccwg1.asp>



Delaware

The City of Lewes: Hazard Mitigation and Climate Adaptation Action Plan

Lewes participated in Project Impact an initial FEMA hazard mitigation effort. The pilot project resulted in the first-ever community action plan that successfully combines the two planning processes. The City created a Mitigation Planning Team, a unique group able to help the city mitigate the effects of natural hazards. Thus far the City has had great success in wildfire mitigation and disaster preparedness efforts.

- I. Purpose and Goal
 - a. Increase overall awareness
 - b. Enhance the understanding of Lewes' vulnerability to climate change
 - c. Provide assistance and guidance to the City of Lewes to develop a plan for hazard mitigation and climate adaptation that will improve community sustainability and resiliency
 - d. Design a methodology that combines hazard mitigation planning and climate change adaptation
 - e. Create a final action plan that the city can use to implement the chosen initiatives
- II. Implementation guidance
 - a. Alignment with existing priorities and co-benefits
 - b. Administration and staffing
 - c. Potential implementation steps
 - d. Timeline information
 - e. Financing and budget
 - f. Monitoring
- III. Range of regional climate condition: sea level rise
 - a. Global or eustatic sea level rise is based on the rising waters due to the thermal expansion of water and the melting of land-based ice commonly called glaciers.
 - i. The IPCC estimated that global sea level rise will increase from 0.59 ft to 1.9 ft based solely on thermal expansion of water (IPCC, 2007, p. 45). However, many scientists consider these estimates to be low due in part to the fact that they do not include glacial melt. More recent estimates that incorporate additional components of sea level rise, including land-based ice melt, suggest that eustatic sea level rise could be as high as 4.6 ft
 - b. The historic sea level rise observations and trend for Lewes indicates that Lewes has seen about 1 foot (0.32m) of sea level rise over the past century.
- IV. the State of Delaware's Department of Natural Resources and Environmental Control is currently working with the range of future sea level rise between 1.6 ft and 4.9 ft by 2100 for planning purposes

Source:

<http://www.ci.lewes.de.us/Hazard-Mitigation-Climate-Adaptation-Action-Plan/>



Preparing for SLR Development of a SLR Initiative
SLR Initiative Project Compendium September 2011

- I. Mission of Delaware Coastal Programs Section
 - a. To preserve, protect, develop, and enhance the resources of our coastal zone through effective administration of the Delaware Coastal Management Program and the Delaware National Estuarine Research Reserve
 - i. Manages coastal resources through innovative research projects, grant programs, and policy development
 - ii. Administers the coastal zone federal consistency certification program
 - iii. Provides special area management program
 - iv. Provides assistance to state and local governments for local land use planning
 - v. Offers other special on-the-ground projects related to Delaware's coastal resources
- II. Predictions
 - a. Based on the US Climate Change Science Program's 2009 document which recommends that states should prepare for sea level to rise by at least one meter by 2100
 - b. Current rate of SLR measured by a tide gauge in Lewes Delaware is 13 inches per 100 years
- III. SLR Initiative goal:
 - a. Providing scientific and technical support for decision-making
 - b. Implementing on-the-ground project in partnership with stakeholders
 - c. Providing educational and outreach opportunities for stakeholders and the public
 - d. Improving existing policies and management practices and/or developing new policies and management practices where necessary
- IV. Purpose of SLR Initiative Compendium of Projects
 - a. To provide an at-a-glance inventory of the projects and initiatives that are being conducted as part of the DE Coastal Programs' SLR Initiative. It is intended to help increase collaboration between agencies, reduce redundancy, and overlap in projects relating to SLR and to relay information about new (or soon to be available) data, information, and tools
- V. Scientific and Technical Support
 - a. DE Coastal Programs have partnered with the National Wildlife Refuge System, the University of DE, local Estuary programs, and other state agencies to fill gaps in our knowledge about coastal storms, tide levels, and marsh sediment accretion
 - b. Projects/Studies
 - i. Bombay Hook Hydrology/sediment movement study
 - ii. Coastal Impoundment Accretion Rate Study
 - iii. Coastal Monitoring Gap Analysis
 - iv. Coastal Storm History
 - v. Development of Coastal Inundation Maps
 - vi. Digital Coast
 - vii. Hydrologic Monitoring of the Kitts Hummock Area
 - viii. Marsh Loss Analysis (interior Open Water Creation)
 - ix. Marsh Vulnerability Index
 - x. Prime Hook NWR Salinity/Nutrient/Sediment/Water level study

xi. Sediment Elevation Tables

VI. Implementation

- a. DE Coastal Programs staff have partnered with the City of New Castle and the Town of Bowers Beach to help them improve their preparedness for coastal storms and future SLR
- b. Projects:
 - i. City of New Castle Coastal Resiliency Project: dike maintenance and improvement plan
 - ii. Development of a coastal flood monitoring system for DE
 - iii. Development of a coastal resiliency action plan for bowers beach

VII. Policy Development

- a. Development of a Statewide SLR Adaptation Plan
- b. Mid-Atlantic Regional Council on the Oceans (MARCO)
 - i. DE, NY, NJ, MD, and VA
- c. Sustainable Coastal Communities – incorporation of coastal hazard and natural resource considerations into local comprehensive plans

VIII. Communication, training, and public involvement

- a. Comprehensive marketing & outreach strategy for SLR
- b. SLR Map Viewer
- c. Statewide Survey to gauge public knowledge and opinions on SLR and its impact in DE

Source:

<http://www.dnrec.delaware.gov/coastal/Documents/SeaLevelRise/SLRCompSept2011.pdf>



Development of a Coastal Resiliency Action Plan for Bowers Beach, DE
A Plan to Address Existing and Future Coastal Hazards

- I. Background:
 - a. Project is designed to assist the community in their efforts to reduce hazard vulnerability that currently exists and that could potentially increase in the future due to the impacts of climate change
- II. Project Goal
 - a. To develop a community-wide action plan that increase the resiliency of Bowers Beach, DE to the current and future affects of coastal storms and climate change
 - b. Develop a proactive plan that outlines the specific vulnerabilities of the community and the best actions to be pursued to address these issues
- III. Work Plan
 - a. Analyze the physical, social, economic, and environmental vulnerability at the community level
 - b. Phase 1: data collection and synthesis
 - i. Identify where outside expertise should be brought in to provide additional technical assistance
 - c. Phase 2: vulnerability assessment
 - i. Will include detailed workshops to conduct a more detailed vulnerability assessment
 - ii. The assessment will be used as a guide for developing mitigation strategies and prioritizing mitigation projects to be included in the Bowers Beach Coastal Resiliency Action Plan
 - d. Phase 3: strategy development
 - i. Will utilize the detailed results of the vulnerability assessment to develop a final prioritization of needs and a set of strategies to address these needs
 - e. Phase 4: implementation
 - i. Long term effort to implement the action plan.

Source:

<http://www.dnrec.delaware.gov/coastal/Documents/CoastalResiliency/Bowers%20Beach%20Grant%20Project.pdf>



Georgia

SLR On GA's Coast: A Study from the River

- I. Purpose of Study
 - a. In 2008, the River Basin Center was awarded a three-year grant to research the impacts of SLR on the Georgia coast and provide guidance for future development of the area
- II. Methods:
 - a. Computer model was created to forecast the results of a 1 meter rise in sea level by 2100
 - b. Used Sea Level Affecting Marshes Mode (SLAMM)
- III. Findings:
 - a. First year focused on the Georgia coast as a whole, defined by the 6 counties of Chatham, Bryan, Liberty, McIntosh, Glynn, and Camden
 - b. The study also provided aerial images of how specific coastlines may be affected
- IV. Next
 - a. The River Basin Center is currently developing a guidance document that will assist government officials in planning for future development along the Georgia coastline

Source:

http://www.georgiaconservancy.org/uploads/Coast/SeaLevelRise-fact_sheet-lowres.pdf



Tybee Island

The University Carl Vinson Institute of Government and Georgia Sea Grant are developing a climate adaptation plan for the barrier island community of Tybee Island through funding from the National Oceanic and Atmospheric Administration.

The recommendations developed by the project, titled the Sea Grant Community Climate Adaptation Initiative, will help the City of Tybee Island prepare for and adapt to sea level rise through appropriate local ordinances, infrastructural improvements and other municipal actions.

Source:

http://georgiaseagrant.uga.edu/article/5_8_12_Tybee/



Louisiana

Recommendations for Anticipating Sea-Level Rise Impacts on LA Coastal Resources during Project Planning and Design

Objective of the technical report is to make recommendations for incorporating sea-level rise into the planning and engineering of habitat restoration and storm protection projects.

The Technical Report recommends that CPRA staff assume that Gulf sea-level rise will be 1 meter (3.3') by 2100, with a bounding range of 0.5-1.5 meters (1.6' - 4.9'). This needs to be combined with predictions of subsidence and marsh vertical accretion. (Both of which are not the primary subject of the paper due to their evolving nature.)

I. Objective

- a. the objective of the technical report is to make recommendations for incorporating sea-level rise into the planning and engineering of habitat restoration and storm protection projects
 - i. summarizes the state of the science on patterns of increase to support recommendations
 - ii. describe how recommended rates of local sea-level rise should be combined with the highly variable spatial patterns in coastal subsidence and wetland vertical accretion to predict relative sea-level rise at specific points in the LA coastal zone

II. Historical sea-level rise

- a. They have chosen to follow the weight of scientific opinion that sea-level rise is in fact accelerating

III. Projections of future sea-level rise

- a. Suggests an assumption that Gulf sea-level rise will be 1 meter (3.3') by 2100, with a bounding range of 0.5-1.5 meters (1.6' - 4.9')
- b. Consistent with other similar efforts ongoing in other states

IV. Sum of Factors influencing sea-level rise

- a. The change in the surface elevation change of the Gulf of Mexico
- b. Local land surface elevation change, which in LA is exclusively represented as subsidence
- c. Marsh vertical accretion, which can offset some sea-level rise impacts

V. Summary and Recommendations

- a. SLR for the available period of record is best represented as a single, non-linear function, which has important implications for relating RSLR and GSLR estimates, and especially for assumptions of the differential representing local land surface change
- b. Use local observations of historical sea-level rise from contemporary satellite altimetry just offshore of coastal LA, in order to account for the substantial east-west gradient in documented rates
- c. Calculate the acceleration constant that assumes a MSL increase of 1 meter by 2100 as the most heavily-weighted project alternative, while also testing MSL increase of .5 meters and 1.5 meters to account for uncertainty in the literature
- d. Add in local subsidence values obtained from the most proximate local source
- e. Use the sum of the above three elements to establish an inundation function, especially the rate of inundation for the period of analysis, in order to predict local response of marsh vertical accretion as those models and data products become available

Source:

<http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=240>

Maryland

Commission on Climate Change

On April 20, 2007, Governor Martin O'Malley signed Executive Order 01.01.2007.07 establishing the Maryland Commission on Climate Change (MCCC). The MCCC was charged with developing a Climate Action Plan to address the drivers and consequences of climate change, to prepare for its ensuing impacts in the State, and to establish firm benchmarks and timetables for Plan implementation. To accomplish its goals, the MCCC worked with the Center for Climate Strategies in conducting an extensive stakeholder-based process. This process used public input to formulate, analyze, and build consensus for forty-two mitigation and nineteen adaptation policy recommendations for the state of Maryland to pursue. The MCCC completed its work in August 2008 with the release of its final Climate Action Plan (2008 Plan). Since August 2008, Maryland State agencies have been working to implement each of the forty-two mitigation strategies and nineteen adaptation strategies through the development of an implementation plan for each of the policy recommendations.

One of the Plan's policy recommendations, to adopt science-based regulatory goals to reduce Maryland's greenhouse gas (GHG) emissions, was realized with the passage of the Greenhouse Gas Emissions Reduction Act of 2009 (GGRA). The law requires Maryland to reduce its GHG emissions to 25 percent below 2006 levels by 2020. It directs the Maryland Department of the Environment to work with other lead State agencies to prepare an implementation plan to meet this goal as a first step toward achieving longer term science-based reductions. An interim plan will be submitted to the Governor and the General Assembly during the 2012 legislative session, and the final plan (GGRA Plan) will be submitted on or before December 31, 2012. The GGRA Plan builds on the 2008 Plan and ensuing implementation work of the State agencies.

Source:

<http://www.mdclimatechange.us/>



Maryland's Coastal Zone Enhancement Plan: Coastal Zone Management Act Section 309 Assessment and Strategy 2011-2015

- I. Chesapeake and Coastal program (CCP)
 - a. In 2007 the state of Maryland consolidated the administrative and management functions of the CZMA and EPA section 117 awards as well as State's Chesapeake and Atlantic Coastal Bays Trust Fund to a single program –CCP
 - b. The program is better able to leverage core competencies from different programs, avoid duplicate efforts, leverage and efficiently prioritize resources to advance the goals of the CZMA
 - c. CCP is administered by the State Department of Natural Resources
 - i. Partnership among the local, regional, and state agencies
 - ii. Also collaborates with many private organizations such as local land trusts and economic development groups
 - d. CCP conducts research, provides technical services and distributes federal and state funds to enable on-the-ground projects that benefit Maryland's coastal communities
- II. Select Accomplishments
 - a. This is the 4th assessment and strategy that the Maryland program has submitted under Section 309 of the federal coastal zone management act
 - b. The overall goals of the 2006-2010 section 309 strategy were to:
 - i. Integrate coastal hazard planning into state and local programs and policies
 - ii. Improve the understanding and management of near shore resources
 - iii. Develop a framework for future ocean planning and management efforts
 - iv. Advance CZMA goals related to cumulative and secondary impacts at the local community level
 - c. In April 2007 – established the Maryland Commission on Climate Change (MCCC)
 - d. In August 2008, the MCCC released the State's Climate Action Plan which included 19 policy recommendations aimed at reducing the State's vulnerability to sea level rise and coastal storms
 - e. Lists key implementation activities for those policy recommendations as of September 2010

Source:

http://www.dnr.state.md.us/ccp/funding/pdfs/SFY13_TrustFundAnnualReport.pdf



Massachusetts

Hazard Mitigation Plan

Outlines “Climate Change Impacts” as a future natural hazard. It outlines some of the background as well as projections for increased temperature and precipitation, risks to public health and harm from sea level rise. It also talks about the Massachusetts law the “Global Warming Solutions” Act.

Projects:

- Massachusetts Office of Coastal Zone Management’s StormSmart Coasts Program
 - This is a technical assistance program that was designed to help communities address the challenges arising from erosion, storms, floods, sea level rise, and other climate change impacts. The program operates on two levels – a website that provides a suite of tools for successful coastal floodplain management and direct technical assistance to communities through its pilot projects program

Source:

<http://www.mass.gov/eopss/docs/mema/disaster-recovery/mass-haz-mit-plan2010-official.pdf>



New Hampshire

Keene, New Hampshire: The Economics of Energy Efficiency

Keene first developed a climate mitigation plan in 2004. It was followed in 2007 by a climate adaptation plan. The city worked with ICLEI – Local governments for Sustainability to produce both of the plans. The climate adaptation plan has been incorporated into Keene’s master plan and, by extension, into other key plans and decisions that tier from the master plan.

Because adaptation strategies are incorporated into the master plan, all city plans and ordinances that tier from the master plan must also consider climate change. For example, every year the city revisits its capital improvements plan that projects major capital facilities needs six years out. The operating budget process is similar, each department’s operating budget must have a tie back to the master plan, forcing a conversation around sustainability and climate adaptation.

Source:

http://www.ci.keene.nh.us/sites/default/files/Keene_Report_ICLEI_FINAL_v2_1.pdf



New York

Hazard Mitigation Plan

The State Plan does not talk about sea level rise. However, it recommends that when conducting a risk assessment a Jurisdiction evaluate (1) the likelihood of an event occurring, (2) the impact on the population, and (3) the impact on property within the Jurisdiction. Jurisdictions should also **take into account the affect that climate change** may have on their vulnerability to each hazard, for example increased frequency of occurrence and/or severity.

Source:

http://www.nyc.gov/html/oem/html/about/planning_hazard_mitigation.shtml



North Carolina

Hazard Mitigation Plan

This plan mentions sea level rise under long term hazards. This section is roughly 4 pages explaining climate change, sea level rise, changes in weather patterns. Within these it explains the impacts, addressing climate change and what NC will do to address climate change.

Source:

<http://www.nccrimecontrol.org/index2.cfm?a=000003,000010,001623,000177,002107,001563>



North Carolina Sea-Level Rise Assessment Report

Report on the known state of SLR for North Carolina. Asked the following questions: an explanation of how SLR is measured; relative SLR ranges for different sections of the North Carolina coast; relative SLR ranges for North Carolina expressed in time slices for years 2025, 2050, 2075, and 2100; relative SLR rate curves for North Carolina through 2100; discussion of confidence interval; recommendations for what needs to be done for improved SLR monitoring in the state of NC; and recommendations as to how frequently the state of NC should update its projected SLR ranges and rates.

I. Data

- a. IPCC 4th assessment report contains forecasts for global average SLR ranging from .18 meters to .59 meters by the year 2100
- b. There is consensus that the rate of SLR will increase during the 21st century and beyond

II. Factors influencing sea level rise

- a. Global sea-level change
- b. Local vertical land movements (subsidence or uplift)
- c. Changes in tidal range
- d. Changes in coastal currents
- e. Changes in water temperature
- f. Gravitational effects

III. 4 studies provide data on rates of RSL rise in North Carolina

- a. First three studies utilize geological data whereas the study covering the shortest time interval utilizes instrumental data
- b. Cumulative data from these 4 investigations indicate that RSL change varies as a function of latitude along the NC coast, with higher rates of rise in the north, and lesser rates of rise in the south
- c. This is a function of the local geology as well as differential crustal subsidence and uplift
- d. Panel has chosen to use the tide gauge data for projections because the tide gauge data represents a more direct indicator of sea level

IV. Projections

- a. The IPCC reports rely on emissions scenarios as the basis for projecting future SLR ranges
- b. Recommendation of the Panel that a single set of sea-level curves be adopted for planning purposes
- c. Panel feels most confident in the data retrieved from the Duck gauge, given its installation, continuous length of service and lack of influence by maritime navigation projects
- d. Panel believes that the Rahmstorf method is robust and 1.4 meters is a reasonable upper limit for projected rise
- e. Panel recommends that a rise of 1 meter be adopted as the amount of anticipated rise by 2100, for policy development and planning purposes

V. Recommendations

- a. Believes that an acceleration in the rate of SLR is likely
- b. Recommended that the long-term tidal observations be maintained and new stations added to the long-term record to provide better geographic coverage of our coast
- c. New, better-distributed water level gauges are maintained or installed to develop long-term records

- d. In other areas new water level gauges should be installed to achieve comprehensive geographic coverage
- e. State should consider installing tide monitoring stations in the estuarine system, and establishing a program for continuously monitoring and measuring land subsidence on the coastal plain

Source:

<http://dcm2.enr.state.nc.us/slr/NC%20Sea-Level%20Rise%20Assessment%20Report%202010%20-%20CRC%20Science%20Panel.pdf>



North Carolina DENR Climate Change Initiative Strategy Framework

The goal of this initiative is to address climate change in a comprehensive way, using mitigation and adaptation strategies to increase resilience of North Carolina's resources to these complex changes.

I. Steps:

- a. Develop a focused approach to address climate change policy actions at state, regional, and federal levels
- b. Identify short-term, mid-term, and long-term potential impacts
- c. Coordinate strategies with other local, state, federal, and nongovernmental partners

II. Climate Change Mitigation Strategies

- a. Reduce human-induced contributions to climate change, such as greenhouse gas emissions, as recommended by the Climate Action Plan Advisory Group
- b. Become an environmental leader in energy and water efficiency and carbon management

III. Climate Change Adaptation Strategies

- a. Proactively prepare for and adapt to changes we can't prevent
- b. Develop a comprehensive adaptation strategy across DENR programs, to effectively identify and address potential impacts to the environment and natural resources that DENR is charged with protecting
- c. Sea level rise adaptation: goals and objectives
 - i. Coastal habitat protection plan
 1. Underway: update coastal habitat protection plan to address climate change impacts on each habitat type
 - ii. Coastal management
 1. Completed: conduct a public survey to assess state residents' perceptions about sea level rise, its threats to the NC coast, and what action respondents think should be taken to prepare and adapt
 2. Underway: hold a public science forum to present the coastal resource commission report
 3. Underway: develop a public education and outreach campaign
 4. Underway: monitor and assess variable rates of sea level rise at sentinel sites on representative coastal ecosystems in different regions of NC coast and inform resource management decisions at reserve sites and in NC coastal communities
 - iii. Climate ready estuaries
 1. Underway: assess general public and public officials' awareness and concern about climate change, sea-level rise, and possible actions
 2. Underway: develop a communications strategy for outreach and engagement in the targeted counties
 3. Underway: create blueprint to build a climate ready estuary system with steps to improve the area's resilience and adaptation capacity
 4. Underway: recommend priority actions for Comprehensive Conservation and Management Plan to APNEP Policy Board
 5. Underway: coordinate strategies with other coastal programs (CHPP, DCM)
 6. Underway: work with regional and federal partners on climate change adaptation actions (NCCF, TNC, EPA, NOAA)

Source:

http://www.climatechange.nc.gov/pages/ClimateChange/NCDENR_Climate_Change_Initiative_strategy_framework_June_2010.pdf



Oregon

Oregon Global Warming Commission: Report to the Legislature 2011

- I. Summary
 - a. Update on success of legislated climate change actions
 - b. State agencies collaborated with each other and OCCRI (Oregon Climate Change Research Institute) to produce the first comprehensive Oregon policy framework for climate change adaptation planning in December 2010
 - c. Worked with state agencies and local governments to implement existing policies and commenting on federal climate change policies
- II. Goals:
 - a. 2020 – 10% below 1990 levels
 - b. 2050 – 75% below 1990 levels (nearly 90% below 2010 levels)
- III. Transformational themes: the Next Big Ideas
 - a. Embed carbon in the planning process
 - b. Embed carbon in the price of energy – partial reliance on carbon taxes
 - c. Leverage the inherent carbon efficiencies of cities – “complete communities”
 - d. Leverage the inherent carbon efficiencies of buildings – zero net carbon building designs are being demonstrated
 - e. Ramp down oil, shift transportation loads to electricity and gas
 - f. Ramp down coal, shift electric loads to efficiency and renewable
 - g. Capture carbon across the board
 - h. Total of 169 recommendations in the full Interim Roadmap to 2020 report
- IV. Key Sectors
 - a. Energy
 - b. Transportation and land use
 - c. Industrial
 - d. Agriculture
 - e. Forestry
 - f. Materials management

Source:

http://www.oregon.gov/energy/GBLWRM/docs/OGWC_2011_Leg_Report.pdf?ga=t



South Carolina

Shoreline Change Initiative

- I. Project summary/overview
 - a. Aims to improve upon the existing regulatory coastal management framework established by the Beachfront Management Act of 1988
 - b. 23 experts, including scientists, managers, planners, and non-governmental representatives formed the shoreline change advisory committee
- II. Implementation
 - a. Overview of existing shoreline regulations and four goals and 13 specific actions to improve coastal management in SC
 - b. Goals:
 - i. Minimize risk to beachfront communities (5 recommendations)
 - ii. Improve the planning of beach renourishment projects (3 recommendations)
 - iii. Maintain prohibitions and further restrict the use of hard stabilization structures (3 recommendations)
 - iv. Enhance the management of sheltered coastlines (2 recommendations)
- III. Outcomes and conclusions
 - a. Staff will review recommendations and provide specific responses to help local and state officials develop a coordinated shoreline management response to SLR, coastal storms, and erosion

Source:

http://www.scdhec.gov/environment/ocrm/shoreline_change.htm



Texas

Hazard Mitigation Plan

- I. Mentioned briefly in coastal erosion hazard.
- II. Projects:
 - a. None

Source:

<http://www.txdps.state.tx.us/dem/documents/txHazMitPlan.pdf>



Washington

Hazard Mitigation Plan

Sea level rise is profiled as an impact of climate change. There is a brief discussion of the property, jurisdictions and businesses at risk.

Projects:

None

Source:

http://www.emd.wa.gov/plans/washington_state_hazard_mitigation_plan.shtml



Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy
Department of Ecology

Washington State is addressing the challenge of climate change and has adopted policies to reduce energy use, limit greenhouse gas emissions, and build a clean energy economy. The document lays out a framework to protect their communities, natural resources, and economy from the impacts of climate change and build their capacity to adapt to expected climate changes.

- I. Document Structure
 - a. Describes existing and new state policies and programs that better prepare WA to respond to the impacts of climate change
 - b. Calls on state agencies to make climate adaptation a standard part of agency planning and to make scientific information about climate change impacts readily accessible to decision makers in the public and private sectors
 - c. Recommends that state agencies strengthen existing efforts and build partnerships to help local and tribal governments, private and public organizations, and individuals reduce their vulnerability to climate change impacts
- II. Strategies and actions for the following areas:
 - a. Human health
 - b. Ecosystems, species, and habitats
 - c. Ocean and coastlines
 - d. Water resources
 - e. Agriculture
 - f. Forests
 - g. Infrastructure and the built environment
 - h. Research and monitoring
 - i. Climate communication, public awareness, and engagement
- III. Predictions – SLR
 - a. Relative SLR will be greatest in south Puget Sound and least on the northwest tip of the Olympic Peninsula
 - b. Puget Sound: medium estimate is 6 inches by 2050 and 13 inches by 2100
 - c. Central and Southern WA coasts: medium estimate is 5 inches by 2050 and 11 inches by 2100
 - d. Olympic Peninsula: medium estimate is 0 inches by 2050 and 1 inches by 2100
 - e. Increases of up to 3 feet for the northwest Olympic Peninsula, 3.5 feet for the central and southern coast, and 4 feet for Puget Sound by 2100 cannot be ruled out at this time due to large ranges for accelerating rates of ice melt from Greenland and Antarctica

Source:

<https://fortress.wa.gov/ecy/publications/publications/1201004b.pdf>

Olympia, Washington: Vulnerable to Sea Level Rise from Climate Change

- I. Olympia's concern and policy
 - a. Downtown Olympia sits at only 18-20 feet above sea level, making it vulnerable to rising sea levels
 - b. City of Olympia has developed a variety of strategies to reduce its vulnerability to flooding of the downtown area due to sea level rise
 - i. In the early 1990s, the city council passed a resolution for the city to mitigate and prepare for climate change
 - ii. Maps and simulation models were produced to show the effects on the city of rising sea levels due to climate change
 - iii. The city council created an interdepartmental Global Warming Task Force
 - iv. The task force recommended short-term action and long-term action plans. Long term included:
 1. Updating the comprehensive plans to address the impacts of sea level rise, increasing the height of the seawall, and developing an institutional framework for addressing climate change
- II. What was the process
 - a. The Global Warming Task Force's first assignment was to prepare a background report on the implications of climate change for Olympia
 - b. The final report identified where the City of Olympia had authority to act, steps the city had already taken, and possible future actions
 - c. This finding prompted the city to undertake a follow-up report, released in 1993, called "the preliminary assessment of sea level rise in Olympia, Washington: Technical and Policy Implications" which more specifically identified rising sea levels and potential flooding as a problem
 - d. In 2009, the Climate Impacts Group released "the Washington Climate Change Impacts Assessment" with updated regional sea level rise predictions for 2100
 - i. The predictions varied, from an increase of 2 inches to 50 inches
 - e. City council played a key role in institutionalizing the climate adaptation policies

Source:

<http://olympiawa.gov/community/sustainability/climate-change>



COUNTRIES

Australia

Queensland Coastal Plan

- I. Implementation
 - a. The management policies are primarily intended to be implemented by the managers of state and local government controlled coastal land and owners of private coastal land.
 - b. The state planning policy (SPP) will inform future regional plans as well as local government planning schemes and decisions on development applications.
 - c. for those local governments whose jurisdiction includes part of the coastal zone, the SPP will also provide detailed guidance about how to design and local development to avoid coastal hazard risks - especially those increased by climate change related sea-level rise
- II. Review of the State Policy for coastal management
 - a. a report will be provided on the state of the coast zone at least every four years as part of Queensland's comprehensive report on the state of the environment.
 - b. report will include an assessment of the conditions of coastal resources and evaluate the efficiency and effectiveness of coastal management strategies, programs, and activities in relation to the protection, restoration, and enhancement of the coastal zone
- III. Application of SPP
 - a. coastal hazards (CH)
 - i. specific policy outcome:
 - 1. communities and development are protected from adverse CH impacts, taking into account the projected effects of climate change, the protective function of the natural environment, and the preference for allowing the natural fluctuations of the foreshore and foreshore ecosystems to continue
 - ii. defining coastal hazard areas
 - 1. CH areas are to be identified in accordance with the methodology set out in the CH guidelines using the following factors to account for the projected impacts of climate change by the year 2100:
 - a. a sea-level rise factor of 0.8 meters & an increase in the maximum cyclone intensity by 10 per cent
 - 2. review of the methodology in the CH guideline and the factors to account for the projected impacts of climate change will be initiated within 6 months of either the
 - a. release of a new assessment report by the UN IPCC that refers to global emissions, temperature, or sea-level rise trends
 - iii. development limited in coastal hazard areas
 - iv. development limited in erosion prone areas
 - v. development only allowed in certain areas if congruent with coastal protection work
 - vi. development limited specifically in high and medium coastal hazard areas

Source:

<http://www.derm.qld.gov.au/coastalplan/>

Canada

Halifax Climate SMART: The Climate Sustainable Mitigation and Adaptation Risk Toolkit

- I. Project summary/overview
 - a. Two goals
 - i. To develop a plan to reduce HRM's greenhouse gas emissions
 - ii. To create a management plan to prepare the municipality for projected climate change impacts
 - b. Overall objective:
 - i. Mainstream climate change mitigation and adaptation strategies into overall municipal decision-making
 - c. Intended to serve as a prototype for future projects
- II. Project implementation
 - a. Toolkit to help guide the municipality to mainstream climate change mitigation and adaptation into overall municipal decision making
 - b. Includes:
 - i. Risk assessment tool
 - ii. Community-based vulnerability assessment and risk management tool
 - iii. Cost/benefit assessment tool
 - iv. Environmental impact assessment tool
 - v. Communications and outreach tool
 - c. Original objectives of the Climate SMART initiative have been continued by various groups in an ad hoc fashion
 - d. Project outcomes and conclusions
 - i. Overall objectives:
 - 1. Reduce HRM's greenhouse gas emissions
 - 2. Increase HRM's resilience to climate change through a vulnerability assessment and incorporated adaptation measures
 - 3. Incorporate extreme weather event and disaster preparedness in HRM

Source:

<http://www.halifax.ca/climate/>



Tasmania

Climate Change Vulnerability Assessment and Adaptation Planning for Mangrove Systems

- I. Background
 - a. The IPCC 4th assessment projected a global sea level rise of up to .59 m by 2099, and subsequent authorities have projected up to 1 m or more.
 - b. Mangrove accretion rates are usually less than these projected rates of SLR, resulting in dieback at the seaward edge and inland migration
 - c. Procedures are needed to assess the vulnerability of mangrove systems to climate change impacts; to plan actions that help those systems adapt to those impacts; and to support adaptation efforts by mangrove-dependent communities
- II. Purpose
 - a. Methods manual is intended for use by conservation practitioners and mangrove managers to carry out an assessment of mangrove vulnerability to climate change, leading to informed and effective adaptation planning
 - b. Objectives: describe methodologies and give examples for carrying out such a vulnerability assessment; and to demonstrate how the results can be analyzed and applied to prioritize adaptation actions
 - c. This manual provides guidance for each of the components listed below on what it is, why to do it, how to collect data, how to analyze results, how to interpret vulnerability, and what are the component's strengths and limitations
- III. Methods
 - a. Agencies: Global Environmental Facility, UN Environmental Programme, and World Wildlife Fund
 - b. Tested mangrove vulnerability assessment methodologies and adaptation strategies in 3 countries: Cameroon, Tanzania, and Fiji
- IV. Pilot projects:
 - a. Involved interdisciplinary data collection using both high and low technology methods and analysis of how each method helped to understand the vulnerability of a particular mangrove ecosystem
 - b. Also used these vulnerability assessment results to identify and test a range of adaptation options
 - c. Findings guided the development of this generalized methodology
- V. Mangrove Climate Change Vulnerability assessment Methodology Components:
 - a. Forest assessment of mangroves
 - b. Recent spatial changes of mangroves
 - c. Ground elevations in and hind mangroves
 - d. Relative sea level trends
 - e. Sedimentation rates under mangroves
 - f. Adjacent ecosystem resilience
 - g. Climate (rainfall) modeling
 - h. Compilation of local community knowledge
- VI. Synthesizing data
 - a. Vulnerability ranking based on results from each component
 - b. Facilitates the identification of adaptation actions that reduce the identified vulnerabilities and increase resilience
 - c. Three categories of action: reduction of existing threats, direct adaptation actions, and ongoing monitoring

Source:

<http://worldwildlife.org/publications/climate-change-vulnerability-assessment-and-adaptation-planning-for-mangrove-systems>



MISCELLANEOUS

FEMA Climate Change Adaptation Policy Statement

Purpose is to establish an agency-wide directive to integrate climate change adaptation planning and actions into Agency programs, policies, and operations.

- I. Challenges posed by climate change
 - a. Could significantly alter the types and magnitudes of hazards faced by communities and the emergency management professionals serving them
 - b. Impacts on mitigation, preparedness, response, and recovery operations
 - c. Resiliency of critical infrastructure and various emergency assets
 - d. Climate change could trigger indirect impacts that increase mission risks
- II. 7 initial actions to help integrate climate change adaptation considerations into our programs and operations
 - a. To enhance climate research, monitoring, and adaptation capabilities, FEMA will continue to establish partnerships with other agencies and organizations that possess climate science and climate change adaptation expertise
 - b. FEMA will continue to study the impacts of climate change on the national flood insurance program (NFIP) and incorporate climate change considerations in the NFIP reform effort
 - c. FEMA will evaluate how climate change considerations can be incorporated into grant investment strategies with specific focus on infrastructure and evaluation methodologies or tools such as benefit/cost analysis
 - d. FEMA will seek to understand how climate change will impact local communities and engage them in addressing those impacts
 - e. FEMA will promote building standards and practices, both within FEMA programs and in general, that consider the future impacts of climate change
 - f. Through partnerships with the climate science community, FEMA will evaluate the potential impact climate change may have on existing risk data and the corresponding implications for Threat Hazard Identification Risk Assessment (THIRA) development and operational planning
 - g. FEMA will continue to pursue a flexible, scalable, well equipped, and well trained workforce that is educated about the potential impacts of climate change

Source:

<http://stormsmart.org/wp-content/blogs.dir/1/files/group-documents/22/1328980794-FEMAGCAPolicyStatement12312.pdf>



Incorporating Sea Level Change Scenarios at the Local Level

NOAA

- I. Scenario approach
 - a. Using the information provided, communities can develop a process that incorporates a range of possibilities and factors. With this information various scenarios can be developed, both in terms of projections and responses, to meet the specific circumstances of a community. Moreover, working through the scenario development process provides the data and information that officials will need to make communities readily adaptable to changing circumstances
- II. Define the context
 - a. What type of plan is being developed
 - i. Considering a range of possibilities lends itself to the adaptive management style required in a changing environment
 - b. What scale is meaningful
 - i. Local projections should be used for most local and regional coastal planning and mapping application
 - c. What is the current political environment
 - i. Adaptive scenarios incorporate components that are measured (highly likely) and those that are predicted (less certain)
- III. Determine which components to include in local projection scenarios
 - a. Most scenarios are based on a combination of historical local information, global rates, and models that predict future conditions
- IV. Research what other communities are doing
- V. Calculate sea level change scenarios
 - a. Scenarios that incorporate global projections and local change rates
 - b. Scenario chosen should be relevant to the timescale of decisions being made
 - c. The selected sea level change increments should be derived from a reputable source and the vertical distance between increments supported by the vertical accuracy of the land elevation data, particularly if maps of sea level change will be produced
- VI. Understand uncertainty
- VII. Consider changes to flood frequency and duration
 - a. Officials must factors in all current flood-producing events, because sea level rise will likely increase the reach, frequency, and duration of “normal” flooding
 - b. Tide heights, storm surge, extreme water levels
- VIII. Consider potential impacts
- IX. Communicate the impacts
 - a. Encourage the citizens to become knowledgeable and involved in the process
 - b. Visualization
 - i. NOAA’s Coastal County Snapshots: www.csc.noaa.gov/snapshots
 - ii. Sea Level Rise and Coastal Flooding Impacts Viewer: www.csc.noaa.gov/SLR

Source:

<http://csc.noaa.gov/digitalcoast/publications/slscenarios>



Protecting the Public Interest through the National Coastal Zone Management Program: How Coastal States and Territories Use No-Build Areas along Ocean and Great Lake Shorefronts

NRDC

I. Study Purpose

- a. To better understand and communicate how states CMPs (Coastal Management Plans) manage ocean and Great Lake shorefront development
- b. Looks specifically at where states are employing shorefront no-build areas to protect the public interest
- c. A compilation of the laws and regulations of those states with federally approved CMPs that include no-build areas, typically on dry, privately owned land, along their ocean and/or Great Lake shorefronts as they were in effect in December 2011
- d. Reports considers a loose and broad definition of “development” that includes residential structures, hotels, motels, commercial establishments, industrial facilities, and the like

II. Findings

- a. 94% of the 33 coastal states with federally approved CMPs have a role in regulating shorefront development on dry land
- b. 81% of the states that regulate ocean or Great Lake shorefront development (outside of submerged lands) employ no-build areas along some portion of their shorefront
- c. Today, roughly 36% of the states that employ no-build areas are using erosion rates to delineate them along some portion of their shorefront
- d. In addition to erosion rates, shorefront no-build areas are delineated and defined based on:
 - i. Fixed distances measured horizontally from reference features that range from 20 to 200 feet
 - ii. Designated natural resource areas, such as beaches, dunes, and bluffs
 - iii. Other areas designated based on plane coordinates or mapped districts or zones
- e. Only Maine explicitly factors the potential for increases in SLR during the 21st century into a provision that establishes the state’s shorefront no-build areas

Source:

<http://coastalmanagement.noaa.gov/resources/docs/nobuildareas.pdf>



An Assessment: Policy Tools for Local Adaptation to SLR

- I. Location: Marine Policy Institute at Mote Marine Laboratory
- II. Lead Agencies:
 - a. Gulf Coast Community Foundation of Venice
- III. Project Description
 - a. high-level foundation for future discussions of the effects of global climate on water

Source:

[http://www.mote.org/clientuploads/MPI/Synopsis-Policy%20Tools%20for%20Local%20Adaptation%20to%20Sea%20Level%20Rise\(fin\).pdf](http://www.mote.org/clientuploads/MPI/Synopsis-Policy%20Tools%20for%20Local%20Adaptation%20to%20Sea%20Level%20Rise(fin).pdf)

Adapting to Climate Change: A Planning Guide for State Coastal Managers

- I. Location
 - a. NOAA - Office of Ocean and Coastal Resource Management
- II. Project Description
 - a. The purpose of this guide is to help U. S. state and territorial (state) coastal managers develop and implement adaptation plans to reduce the impacts and consequences of climate change and climate variability (climate change) in their purview. It was written in response to a request from state coastal managers for guidance from the National and Oceanic and Atmospheric Administration (NOAA) on adaptation planning in the coastal zone. It is intended as an aid, not as a prescribed directive, and a state may choose to use individual steps or chapters or the entire guide, depending on where they are in the planning process.

Source:

<http://coastalmanagement.noaa.gov/climate/docs/adaptationguide.pdf>



Increasing Community Resilience to Future Hurricane Storm Surge

Collaborative Decision Support in Sarasota, FL

- I. Lead Agencies
 - a. Penn State University
 - b. US Geological Survey
- II. Project Description
 - a. The goal of the proposed research is to develop a methodology that helps local government officials and planners understand a range of options that allow coastal communities to grow their populations and develop their economies and infrastructures with less risk of significant loss from future hurricane storm surges. To reach that goal, the investigators will conduct a case study based in Sarasota, Florida where they will work with officials, planners, and other stakeholders to include scenarios of sea level rise in long-range planning activities and extend those activities to horizons more in line with sea level rise projections.

Source:

http://www.cpo.noaa.gov/index.jsp?pg=./cpo_pa/cpo_pa_index.jsp&pa=sarp&sub=projects/abstracts/2007/byarnal.jsp



Effects of Near-term SLR on Coastal Infrastructure

- I. Lead Agencies
 - a. Strategic Environmental Research and Development Program (SERDP)
 - b. Environmental Security Technology Certification Program (ESTCP)
- II. Project Description
 - a. The primary goal of this project is to quantify the potential impact and risk to coastal military infrastructure from near-term sea-level rise and the attendant increases in hurricane activity. Specific objectives include: (1) identify and quantify the responses of coastal system components to sea-level rise over the next century; (2) refine a large-scale numerical model for quantifying the hazard risk to coastal military facilities; (3) develop probability models for quantifying and managing uncertainty; and (4) enable cost-effective mitigation and adaptation strategies.

Source:

<http://www.serdp.org/Program-Areas/Resource-Conservation-and-Climate-Change/Climate-Change/Vulnerability-and-Impact-Assessment/RC-1700>



Implications of Takings Law on Innovative Planning For Sea Level Rise in The Gulf of Mexico

I. Lead Agencies

- a. Texas Sea Grant
- b. Florida Sea Grant
- c. Louisiana Sea Grant
- d. Mississippi/Alabama Sea Grant Consortium

II. Project Description

- a. This project will specifically seek to address this fear through (1) legal analysis of existing takings jurisprudence and laws, (2) development of legal arguments that consider the imperative of sea-level rise, and (3) identification and development of specific, innovative land use policies designed to withstand takings claims.
- b. In Phase I of the project, the co-PIs will provide a fresh, comprehensive examination of takings law in Florida, Alabama, Mississippi, Louisiana, and Texas to provide a foundation for addressing the source of regulatory hesitancy in Phase II and developing innovative land use planning policies for adaptation to the GOM's changing landscape in both the short and long term that are resistant to takings claims in Phase III.

Source:

<http://www.masgc.org/page.asp?id=511>



A Parameterized Climate Change Projection Model for Hurricane Flooding, Wave Action, Economic Damages, and Population Dynamics

- I. Lead Agencies
 - a. Texas Sea grant
 - b. Florida Sea grant
 - c. Louisiana Sea grant
 - d. Mississippi/Alabama sea grant consortium
- II. Project goal
 - a. Our project goal is to quantify the potential impact of sea level rise and hurricane intensification on hurricane-induced economic damages and on population dynamics at the coast.
- III. Objectives
 - a. To develop a general, parameterized response model for hurricane flood elevation and wave damage potential as a function of SLR and hurricane intensification.
 - b. To determine potential acceleration in hurricane flood elevation and wave height probability as a function of SLR and hurricane intensification.
 - c. To determine potential acceleration in hurricane-induced economic damages and population affected at the coast due to accelerating flood elevation and wave height probability.
 - d. To determine potential short and long-term shifts in population dynamics at local and regional levels as well as the socioeconomic dimensions of such shifts.

Source:

<http://www.masgc.org/page.asp?id=509>



World Resources 2010-2011: Decision Making in a Changing Climate – Adaptation Challenged and Choices

- I. Lead Agencies
 - a. World Resources Institute (WRI)
 - b. United Nations Development Programme
 - c. United Nations Environment Programme
 - d. World Bank
- II. Project description
 - a. This publication explores five key elements - public engagement, decision-relevant information, institutional design, tools for planning and policymaking, and resources - that we believe will significantly strengthen the ability of national governments to make effective adaptation decisions. Our arguments for why decision makers should focus on these elements are based upon the results of a wide-ranging and interactive research program. Over 100 adaptation experts, public officials, sector-based practitioners, and civil society representatives, from more than 30 countries, contributed to our research effort.
- III. Project/actions/conclusions
 - a. Updating the comprehensive plans to address the impacts of sea level rise, increasing the height of the seawall, and developing an institutional framework for addressing climate change

Source:

http://pdf.wri.org/world_resources_report_2010-2011.pdf



State and Local Governments Plan for Development of Most Land Vulnerable to Rising Sea Level along the US Atlantic Coast

I. Overview

- a. On the basis of 131 state and local land use plans, we estimate that almost 60% of the land below 1 meter along the US Atlantic coast is expected to be developed and thus unavailable for the inland migration of wetlands
- b. Results suggest that shore protection does have a cumulative impact. If SLR is taken into account, wetland policies that previously seemed to comply with federal law probably violate the Clean Water Act
- c. This letter maps and quantifies a baseline, business-as-usual scenario of coastal development and shore protection for the Atlantic coast of the US from MA to FL.

II. Purpose

- a. With this analysis, planners from the local to national level can assess the extent to which coastal wetlands might migrate inland or be lost (and identify infrastructure that would eventually require remedial attention) and then evaluate other options

III. Predictions

- a. Global SLR of approximately 20-60 cm during the 21st century if polar ice sheets remain stable but possibly more than 1 meter if ice sheets become unstable
- b. Two pathways: shore protection and retreat

IV. Results and Implications

- a. Considering our entire study area, 42% of the dry land within 1 meter above the tidal wetlands is developed and most likely to be protected given business-as-usual
- b. Almost 60% of the lowest dry land is likely to be developed and eventually protected as SLR.
- c. By contrast, only 9% of this land has been set aside for conservation purposes that would allow coastal ecosystems to migrate inland
- d. Maps provided by this study can serve as an initial benchmark for evaluating the environmental consequences of the business-as-usual response to SLR and possible alternatives that would better preserve the environment and comply with the law.

Source:

<http://iopscience.iop.org/1748-9326/4/4/044008/fulltext/>



Hotspot of Accelerated Sea-Level Rise on the Atlantic Coast of North America

- I. Research purpose
 - a. Presents evidence of recently accelerated SLR in a unique 1,000-km long hotspot on the highly populated North American Atlantic coast north of Cape Hatteras and show that it is consistent with a modeled fingerprint of dynamic SLR
- II. Findings
 - a. Between 1950-1979 and 1980-2009, SLR rate increases in this northeast hotspot were about 3-4 times higher than the global average
 - b. They analyzed tide-gauge records along the North American Atlantic coast for increasing rates of SLR
- III. Results
 - a. SLR superimposed on storm surge, wave run-up, and set-up will increase the vulnerability of coastal cities to flooding, and beaches and wetlands to deterioration

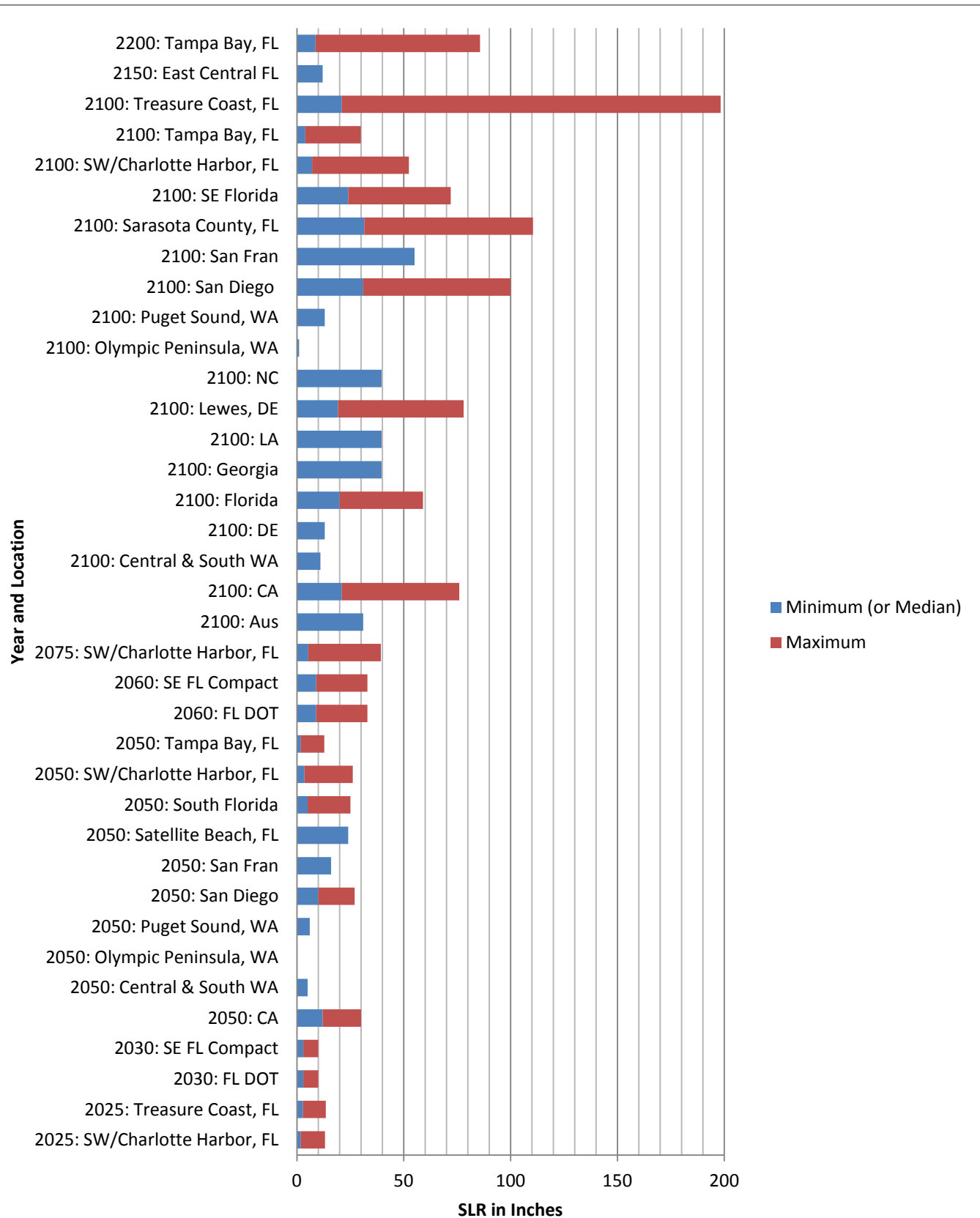
Source:

<http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1597.html>



SLR HORIZON YEAR AND PROJECTIONS TABLE

Year and Location	Minimum (or Median)	Maximum
2025: SW/Charlotte Harbor, FL	1.8	11.3
2025: Treasure Coast, FL	2.8	10.7
2030: FL DOT	3	7
2030: SE FL Compact	3	7
2050: CA	12	18
2050: Central & South WA	5	
2050: Olympic Peninsula, WA	0	
2050: Puget Sound, WA	6	
2050: San Diego	10	17
2050: San Fran	16	
2050: Satellite Beach, FL	24	
2050: South Florida	5	20
2050: SW/Charlotte Harbor, FL	3.5	22.6
2050: Tampa Bay, FL	1.8	11
2060: FL DOT	9	24
2060: SE FL Compact	9	24
2075: SW/Charlotte Harbor, FL	5.3	34
2100: Aus	31	
2100: CA	21	55
2100: Central & South WA	11	
2100: DE	13	
2100: Florida	20	39
2100: Georgia	39.6	
2100: LA	39.6	
2100: Lewes, DE	19.2	58.8
2100: NC	39.6	
2100: Olympic Peninsula, WA	1	
2100: Puget Sound, WA	13	
2100: San Diego	31	69
2100: San Fran	55	
2100: Sarasota County, FL	31.5	79
2100: SE Florida	24	48
2100: SW/Charlotte Harbor, FL	7.1	45.3
2100: Tampa Bay, FL	3.9	26
2100: Treasure Coast, FL	21	177.3
2150: East Central FL	12	
2200: Tampa Bay, FL	8.7	77



City of Palm Coast, Florida Agenda Item

Agenda Date: MAY 23, 2019

Department	PLANNING	Amount
Item Key	6641	Account
		#
Subject REGISTERING PALM COAST, FL AS A MONARCH CITY USA		
Background : A recommendation was made by the Palm Coast Garden Club member to register Palm Coast as a Monarch City USA during a recent event within the Town Center. Below is the link to Monarch City USA website: http://monarchcityusa.com/		
Recommended Action : Discussion purposes.		

City of Palm Coast, Florida Agenda Item

Agenda Date: MAY 23, 2019

Department	PLANNING	Amount
Item Key	6642	Account
		#
Subject	REGISTERING PALM COAST, FL AS A KEEP FLORIDA BEAUTIFUL AND KEEP AMERICA BEAUTIFUL CITY	
Background :	A recommendation was made by a Palm Coast Garden Club member that Palm Coast join the Keep Florida Beautiful https://www.keepfloridabeautiful.org/ and the Keep America Beautiful https://www.kab.org/ campaigns, during a recent event held at Town Center.	
Recommended Action :	Discussion purposes	