

Florida Community Resiliency Initiative Pilot Project

Adaptation Plan *for Clearwater, Florida*

May 2017



This publication was funded in part, through a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program, by a grant provided by the Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration Award No. NA13NOS4190053. The views, statements, findings, conclusions and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida, NOAA or any of their sub-agencies.

EXECUTIVE SUMMARY

The City of Clearwater is one of the three communities involved in the pilot phase of the Community Resiliency Initiative being conducted by the Florida Department of Economic Opportunity (DEO) and funded by the National Oceanic and Atmospheric Administration (NOAA). The Initiative helps communities to assess vulnerabilities to projected increases in coastal flooding and develop strategies to make affected areas more resilient.

This document builds on the Coastal Vulnerability Assessment developed by Dewberry Consultants, LLC (Vulnerability Assessment) as part of Task 1. At the City's request, it describes key legal and policy constraints and supports for responses to vulnerabilities identified by Dewberry and identifies possible ways for Clearwater to respond to those vulnerabilities. Although it presents an array of potential responses and suggests steps for integrating them into the City's project planning and budgeting process, this document does not examine the feasibility, costs or benefits of particular responses, nor does it select or prioritize responses.

The adaptation planning process

The National Oceanic and Atmospheric Administration's U.S. Climate Toolkit describes adaptation planning as proceeding in five steps:

- 1) Identify climate-related changes and risks;
- 2) Assess vulnerabilities;
- 3) Investigate possible responses;
- 4) Prioritize responses to achieve near- and longer-term adaptation goals; and
- 5) Execute and evaluate outcomes.¹

Clearwater completed steps 1 and 2 with Dewberry's help and is currently engaged in step 3. For Clearwater to complete steps 3 and 4—and eventually 5—it should use the recommendations in this report to develop plans for specific projects, which can be assessed and prioritized based on analyses that consider their feasibility, costs, benefits, and cost-effectiveness relative to alternatives.

¹ U.S. Climate Resilience Toolkit, *Overview: Steps to Resilience*, <https://perma.cc/PAA4-3BMP> (last updated Nov. 16, 2016); *see also* Katherine Jacobs, Tom Wilbanks, et al., National Academies of Sciences, *Adapting to the Impacts of Climate Change* 135 fig. 4.1 (2010) (suggesting similar process), <https://perma.cc/D3DX-G3RR>. The Centers for Disease Control and Prevention (CDC) has developed a similar framework for improving community resilience. *See* Centers for Disease Control and Prevention, *CDC's Building Resilience Against Climate Effects (BRACE) Framework*, <https://perma.cc/E6PG-538W>, (last updated Oct. 22, 2015).

Key features in adaptation planning

After describing sea level rise (SLR) in Florida and the Community Resiliency Initiative, this document describes key features of the context in which Clearwater will adapt, including:

- General information about adaptation planning;
- The City’s legal context;
- Summaries of key vulnerabilities identified by Dewberry;
- Key features of Clearwater that will inform and limit adaptation decisions; and
- Potential responses to Clearwater’s vulnerabilities.

Recommendations

The following list summarizes the potential responses described at greater length in section 5 of the report:

Stormwater and Wastewater Management

- ⇒ Consider following the lead of Pinellas County in reviewing Clearwater’s current stormwater design manual and exploring updates that would expressly address SLR and its impacts;
- ⇒ Making reference to SLR scenarios in Dewberry’s Vulnerability Assessment, examine the full array of options for hardening vulnerable water reclamation facilities to storms and flooding, comparing net present value of short-term engineering solutions (e.g., erecting flood barriers around key structures, elevating electrical components) with more extensive redesign options (e.g., elevating an entire plant);
- ⇒ Address CSX activity that promotes erosion, either informally or by asking the City’s legal staff to develop a challenge to dumping that requires a Clean Water Act section 404 permit;
- ⇒ Request funding for a study to establish a “business as usual” baseline for comprehensive system maintenance budgets that assume no design changes under high and highest SLR scenarios on a 30-year time horizon; then explore design changes in areas vulnerable to flooding (currently or foreseeably) and compare their expected cost-effectiveness with “business as usual”;
- ⇒ Adopt a Capital Improvements Element policy that only permits additional maintenance spending on facilities or components repeatedly subject to SLR-driven impacts if the responsible department has examined alternative design standards and found that they would yield no net benefit over a 5, 10, or 20 year timeframe;

- ⇒ Evaluate the costs and benefits of installing green infrastructure / low impact development in rights of way as a means of reducing strain on stormwater system and improving compliance with water quality standards;
- ⇒ Explore possible acquisitions of land—including land that is partly or fully developed—for restoration of floodplain; evaluate cost of acquisitions against costs avoided in “business as usual scenario” (see above);
- ⇒ Explore areas where imposition of setbacks in advance of further development could avoid strain on stormwater management system;
- ⇒ Coordinate with Pinellas County regarding enforcing compliance with MS4 permit on parcels of the county that are surrounded by the City;
- ⇒ In collaboration with Pinellas County and other localities in SWFWMD’s jurisdiction, propose that the Southwest Florida Water Management District (SWFWMD) revise its current approach to assessing funding proposals, which only credits outcomes relating either to quality or quantity, but not both.

Flood Insurance and Freeboard

- ⇒ Impose freeboard requirements in all FEMA-designated flood zones and consider imposing them in areas expected to become vulnerable to storm surge over the next 25 years according to Dewberry’s Vulnerability Assessment;
- ⇒ Explore options for applying FEMA Hazard Mitigation funds to buyouts of properties that are especially vulnerable to repeated and severe flooding;
- ⇒ Revise the local criteria for “substantial damage” and “substantial improvement” to pertain to damage or improvements occurring over a period of five or ten years;

Coastal Management and Development

- ⇒ Make freeboard a condition of permits for installation, modification, or maintenance of sea walls and other forms of coastal hard armoring;
- ⇒ Require sellers of private property in Clearwater to provide buyers with a summary description of expected SLR-related flooding impacts on property and infrastructure servicing that property;
- ⇒ Make analysis of SLR and flooding impacts on planned structures a condition of permits for development or redevelopment of coastal property;
- ⇒ Commission or conduct an inventory of all sea walls that assesses their expected useful life under the SLR scenarios described in Dewberry’s Vulnerability Assessment;

- ⇒ Commission or conduct an assessment of existing and/or planned infrastructure and buildings identified as at risk for flooding impacts to determine whether they can accommodate expected flooding under the SLR scenarios described in Dewberry’s Vulnerability Assessment as likely to occur within their useful life.

Roads and Bridges

- ⇒ Adopt an ordinance authorizing reduced maintenance of roads and bridges under particular environmental and budgetary circumstances;
- ⇒ Link adoption of that ordinance to establishment of an Adaptation Action Area (AAA) that encompasses portions of the barrier islands and other coastal areas of Clearwater where roads are identified as vulnerable to nuisance flooding in a 2-foot SLR scenario.

Disaster Recovery

- ⇒ Impose restrictions on post-disaster rebuilding in areas expected to become more vulnerable to coastal flooding, whether in the form of setbacks, design requirements (e.g., base flood elevation and freeboard), or simple prohibitions;
- ⇒ Condition permission to rebuild after a disaster on demolition of or agreement not to install sea walls or other forms of hard armoring;
- ⇒ Condition permission to develop or rebuild post-disaster on a covenant to abandon or remove structures located in disaster-prone areas following a subsequent, similar natural disaster;
- ⇒ Promote the dedication of conservation easements in areas vulnerable to repeat flooding.

Conclusion

This Adaptation Plan serves several purposes. It describes key features of the policy and legal frameworks that underlie adaptation efforts in Florida, and highlights key vulnerabilities and circumstances relevant to any effort to address those vulnerabilities. Finally, it recommends various means of better adapting Clearwater to rising seas.

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Introduction

Florida communities, like Clearwater are already experiencing the adverse impacts of rising seas, more intense storms, and heavier downpours. The Florida Department of Economic Opportunity's Coastal Resiliency Initiative helps communities assess vulnerabilities to projected increases in coastal flooding and develop strategies to make affected areas more resilient.

This report is intended to complement Dewberry's Vulnerability Assessment and to provide Clearwater with a framework for pursuing coastal resiliency. The Vulnerability Assessment draws on data from federal agencies and on inputs from Clearwater officials and community members in order to characterize the nature, implications, and certainty of the most important ways in which Clearwater is vulnerable to the impacts of sea level rise (SLR) and changing weather patterns. The present document identifies relevant tools available to Florida localities that might serve to effectuate appropriate responses to those vulnerabilities. At the City's request, it also identifies legal, political, economic, among other limits on Clearwater's potential resiliency initiatives.

The adaptation planning process

The National Oceanic and Atmospheric Administration's U.S. Climate Toolkit describes adaptation planning as proceeding in five steps:

- 1) Identify climate-related changes and risks;
- 2) Assess vulnerabilities;
- 3) Investigate possible responses;
- 4) Prioritize responses to achieve near- and longer-term adaptation goals; and
- 5) Execute and evaluate outcomes.²

Clearwater completed steps 1 and 2 with Dewberry's help and is currently engaged in step 3. For Clearwater to complete steps 3 and 4—and eventually 5—it should use the recommendations in this report to develop plans for specific projects, which can be assessed and prioritized based on analyses that consider their feasibility, costs, benefits, and cost-effectiveness relative to alternatives.

Key features in adaptation planning

Reference material. On October 17, 2016 the Sabin Center for Climate Change Law, Dewberry and state and local partners convened a Preliminary Workshop to introduce and

² U.S. Climate Resilience Toolkit, *Overview: Steps to Resilience*, <https://perma.cc/PAA4-3BMP> (last updated Nov. 16, 2016); *see also* Katherine Jacobs, Tom Wilbanks, et al., National Academies of Sciences, *Adapting to the Impacts of Climate Change* 135 fig. 4.1 (2010) (suggesting similar process), <https://perma.cc/D3DX-G3RR>. The Centers for Disease Control and Prevention (CDC) has developed a similar framework for improving community resilience. *See* Centers for Disease Control and Prevention, *CDC's Building Resilience Against Climate Effects (BRACE) Framework*, <https://perma.cc/E6PG-538W>, (last updated Oct. 22, 2015).

discuss development of a Strategic Resiliency Plan. Some of the information covered in this document may be familiar to participants in that workshop, but has been included to provide a resource that officials and others can draw on as a reference point. For instance, the Preliminary Workshop introduced the Protection-Accommodation-Retreat adaptation rubric and a number of land use policy tools (including setbacks, transferrable development rights and conservation easements) suitable for coastal localities that want to adapt themselves to rising seas. However, many residents of Clearwater and at least some political representatives are likely unfamiliar with this material. Accordingly, we have referenced herein a robust universe of material, including material relevant to prioritizing particular resiliency measures. So that users of this report can get easy access to the documents referenced in its footnotes, those documents have been stored using permanent internet hyperlinks.

Legal reference material. This document does not contain legal advice for Clearwater. Its descriptions of legal issues such as sovereign immunity and takings law do not tell a lawyer for the City everything they would need to know in order to anticipate the legal implications of a particular policy agenda. Descriptions of legal issues instead provide a summary—for lawyers and non-lawyers—of how the law might push, tether, or prohibit particular parties in relation to various rights and obligations implicated in actions intended to better adapt to changing environmental circumstances.

Summaries of key vulnerabilities. Dewberry’s Vulnerability Assessment provides an accessible, authoritative snapshot of the challenges facing Clearwater now and in the foreseeable future. This document’s short summaries of key vulnerabilities draw on that Assessment and on comments made during the Preliminary Workshop. Readers can refer the adaptation measures discussed in section 5 of this document directly to Dewberry’s Assessment, but section 3’s summaries make internal cross references available as well.

“Need to know” items for adaptation planning in Clearwater. Discussion at the Preliminary Workshop brought to light a variety of features of Clearwater that will shape adaptation efforts. The most important and relevant of these features are captured in section 4:

- The City’s economy relies heavily on development on and near its shorelines;
- The City’s shorelines are heavily developed and lack natural buffers;
- Patches of Pinellas County are intermixed into the area bounded by Clearwater’s service area;
- Clearwater’s approach to budgeting does not currently make thorough use of forecasts or baselines, which limits the City’s ability to translate present and looming vulnerabilities into features of cost-benefit or cost-effectiveness analyses or proposed projects; and
- City residents have a complex relationship with flood insurance and related requirements.

Potential responses to key vulnerabilities. Much of this document describes important parts of the context in which adaptation efforts would occur. Section 5 discusses adaptation measures that could serve adaptation efforts in Clearwater.

Selected Recommendations

The following list summarizes some proposals set forth in this report and notes the section(s) that discuss a particular proposal more fully.

- *Provide notice of likely future changes*

No single adaptation agenda item is more important for Clearwater than conveying to local residents, businesses, and leaders of all sorts information about how rising seas and changing weather is going to affect topography, public safety, the cost and location of infrastructure, and the level of services available from different systems in different parts of the City. Notice of this sort can be given by establishing restrictions on development, by requiring disclosure of known risks in real estate transactions, by surveying the capacity and state of repair of existing coastal armoring, and others. Discussions of how to implement these and other forms of notice in Clearwater appear in sections 2.1.1 (Key planning elements), 2.1.3 (Planning timeframes), 2.1.4 (Adaptation Action Areas), 2.2.2 (Takings), and throughout all parts of section 5.

- *Budget to capture relevant costs and future costs and benefits*

Preliminary Workshop participants made clear that the current approach to budgeting does not illuminate several costs and benefits that are relevant to adaptation. For instance, no budget line item captures the effects of inundation on stormwater and wastewater conveyances. If Clearwater could discern the capital and maintenance costs attached to those effects, it would be better able to anticipate how spending will have to change as sea water encroaches. This in turn could help identify areas where redesign—instead of more intensive maintenance—might be appropriate. Discussions of potential changes to budgeting focus on the City’s wastewater and stormwater management systems in section 5.1, but also appear in sections 4 (Local context and priorities) and 5.4 (Roads and bridges).

- *Align planning timeframes to SLR scenarios and assets’ useful life*

A recent change to Florida law invites localities to use whatever time horizon they see fit for planning purposes in relation to a Policy in their comprehensive plan or even to an individual project. Armed with the insights contained in Dewberry’s Vulnerability Assessment, Clearwater can make sure that decisions about land use, capital investments, conservation, and other subjects do not ignore the basic fact of rising seas or its implications for, among other things, storm risk, coastal erosion, and nuisance flooding. Sections 2.1.3 (Planning timeframes), 5.2.1 (Stormwater and wastewater management),

5.2.3 (Coastal management and development), and 5.2.5 (Disaster recovery) present versions of this suggestion.

- *Designate Adaptation Action Areas (AAAs)*

An Adaptation Action Area (AAA) is a highly flexible form of zoning overlay that the Florida legislature created for the purpose of facilitating local adaptation planning in the face of the impacts of SLR. Because Florida law leaves it to localities to devise criteria for designating AAAs, Clearwater has the option not only to choose where to draw the boundary but whether to do so in a way *that is expressly subject to change as environmental circumstances change*. As discussed in sections 2.4 and 5.2.4, such an approach can send a powerful signal about future conditions *and* regulatory responses to those conditions. Furthermore, it can do so in a way that does not greatly alter existing plans or rules.

- *Combine several measures to address stormwater management system vulnerabilities*

Section 5.2.1 offers a number of suggestions for better adapting Clearwater’s current approach to stormwater management: revised budgeting to account for SLR impacts; public education; installation of Low Impact Development / Green Infrastructure on public property and encouragement of the same on private property; land acquisitions to restore areas to flood plain; and coordinating with Pinellas County to increase enforcement of system maintenance requirements and to propose in tandem that the Southwest Florida Water Management District not insist on scoring water quantity and quality aspects of grant proposals separately.

- *Explore options for altering the criteria for “substantial improvement”³ and adopt the proposed freeboard requirement*

Preliminary Workshop participants described that Clearwater residents take a strategic approach to the criteria used by the Federal Emergency Management Agency (FEMA) and the City to determine when a structure must be elevated above Base Flood Elevation (BFE) because it has been “substantially improved,” i.e., there has been an addition valued at 50% or more of the structure’s value. Participants also emphasized the sensitivity of residents to flood insurance issues. Whatever further steps the City takes toward closing that loophole, the City should in any case try to determine the frequency and scale of residents’ use of it. That information would help inform both with the strategic decision to close the loophole partly or fully, and with tactical decisions about how to accomplish that closure. Finally, participants noted that a freeboard requirement is pending—it should be adopted and vigorously enforced.

³ This is done by investing in improvements incrementally such that no single increment adds more than 49% of the structure’s value in a single year.

- *Make disaster recovery a trigger for changes to land use regulation and infrastructure provision by codifying triggering language in comprehensive plan elements*

Disasters highlight topography, systems, and structures that are vulnerable. Thus, in addition to causing damage, disasters also convey information. Section 5.2.5 suggests how comprehensive plan provisions that promote or require adaptation measures can make the occurrence of a disaster their trigger. Such measures might include increased setback requirements, only granting permits for coastal redevelopment if the property owner eliminates hard armoring or agrees to abandon the property in part or *en toto* after the next storm, and preceding any restoration of infrastructure with a review that recommends an appropriate level of service and maintenance schedule.

- *Use the revision to the City’s Flood Insurance Rate Maps (FIRMs) as a prompt and a premise for at least some of the foregoing changes*

FEMA’s updated FIRMs for Clearwater expand the previous zones for wave action and 100-year flood events—but do not take into account the fact of SLR or its implications for ongoing changes to those zones. Preliminary Workshop participants made clear that residents are skeptical of the basis for rates charged for flood insurance. Nonetheless, given that the City cannot avoid FEMA’s adjustment to the City’s flood zones, it might try to find a way to make use of the change. Section 5.2.2 suggests several options, such as seeking Hazard Mitigation Grant Program funds for additional buyouts or conducting the examination of “substantial improvement” criteria discussed above.

A note of caution: This document does not contain instructions for Clearwater about how to respond to its changing environmental circumstances. It does not contain an exhaustive list of adaptation options, or a complete map of the legal issues the City might encounter if it opts for one approach instead of another. Instead, it contains information about the challenges that Clearwater already faces and can expect to face as sea levels rise, information about approaches other localities have taken to similar challenges, and proposals and measures—all of which would need to be fleshed out and refined before they could be considered for implementation by one or more of the City’s departments.

Background: Sea Level Rise in Florida and the Community Resilience Initiative

Florida communities are experiencing adverse effects of sea level rise (SLR), stronger coastal storms, and more intense precipitation events,⁴ and these effects are expected to become increasingly severe in the coming years and decades.⁵ Seeing what is happening now and recognizing what lies ahead, a number of Florida communities are working to adapt to present and projected impacts.⁶ Although Florida communities have taken somewhat diverse approaches to adaptation, their efforts have generally aligned with the approach suggested in the National Oceanic and Atmospheric Administration’s U.S. Climate Toolkit: 1) identify climate-related changes and risks, 2) assess vulnerabilities, 3) investigate possible responses, 4) prioritize responses to achieve near- and longer-term adaptation goals, and 5) execute and evaluate outcomes.⁷

The Florida Department of Economic Opportunity (DEO) is leading the pilot phase of the Community Resiliency Initiative in partnership with the Florida Department of Environmental Protection and with support from the Division of Emergency Management and the National Oceanic and Atmospheric Administration. The Initiative provides technical assistance to coastal communities in Florida that want to integrate effective adaptation and improved resiliency into their plans for development in the midst of SLR. By inviting localities to take the lead, the Initiative ensures that the efforts it supports are consistent with local circumstances and priorities regarding public safety, the economy, natural resources, and others.

Clearwater is one of three localities participating in the pilot phase of the Community Resiliency Initiative, which entails tasks that correspond to the first three steps of the Climate Toolkit approach to adaptation listed above. The tangible outputs of the Initiative will be a Coastal Vulnerability Assessment and this Adaptation Plan. The Coastal Vulnerability Assessment Dewberry completed in Task 1 integrates multiple layers of mapping information—topography, facilities and infrastructure locations, weather and flooding patterns, and SLR

⁴ L.M. Carter et al., *Ch. 17: Southeast and the Caribbean*, in *Climate Change Impacts in the United States: The Third National Climate Assessment* 396, 400–05 (J.M. Melillo et al., eds., 2014), <https://perma.cc/8AG2-7ASJ>; Florida Oceans and Coastal Council, *Climate Change and Sea-Level Rise in Florida: An Update of “The Effects of Climate Change on Florida’s Ocean and Coastal Resources.”* [2009 Report] (2010), <https://perma.cc/44Q3-EUMJ> (discussing effects of SLR on coastal ecosystems and infrastructure).

⁵ U.S. Global Change Research Program, Chapter 1: Overview and Report Findings, in *Climate Change Impacts in the United States: The Third National Climate Assessment* 8 (Jerry M. Melillo, Terese (T.C.) Richmond, and Gary W. Yohe eds., 2014), <https://perma.cc/6S2L-66DV>.

⁶ See, e.g., Kathryn Frank et al., *Planning for Sea Level Rise in the Matanzas Basin: Opportunities for Adaptation* (Aug. 2015), <https://perma.cc/X593-XYNX>; James W. Beever III et al., *Southwest Florida Regional Planning Council, Lee County Climate Change Resiliency Strategy* (Oct. 6, 2010), <https://perma.cc/B5XT-EBGZ>.

⁷ U.S. Climate Resilience Toolkit, *Overview: Steps to Resilience*, <https://perma.cc/PAA4-3BMP> (last updated Nov. 16, 2016); see also Katherine Jacobs, Tom Wilbanks, et al., *National Academies of Sciences, Adapting to the Impacts of Climate Change* 135 fig. 4.1 (2010) (suggesting similar process), <https://perma.cc/D3DX-G3RR>. The Centers for Disease Control and Prevention (CDC) has developed a similar framework for improving community resilience. See Centers for Disease Control and Prevention, *CDC’s Building Resilience Against Climate Effects (BRACE) Framework*, <https://perma.cc/E6PG-538W>, (last updated Oct. 22, 2015).

projections for the coming decades—and reflects stakeholders’ input regarding the location and nature of local vulnerabilities.⁸ Faculty and staff at Columbia Law School’s Sabin Center for Climate Change Law and Professor Keith Rizzardi of the St. Thomas School of Law developed this Adaptation Plan using Dewberry’s Coastal Vulnerability Assessment and based on the input gathered from stakeholders in a Preliminary Workshop on October 17, 2016. Whereas Dewberry’s consultation with stakeholders clarified the location and nature of particular vulnerabilities, the Preliminary Workshop put those vulnerabilities into a policy and legal context and began to identify potential responses.

This Background description has noted the programmatic context for Clearwater’s ongoing adaptation efforts. The rest of this Adaptation Plan proceeds in five sections. Section 1 summarizes the generic adaptation framework and goals that are basic to this Plan. Section 2 describes the relevant legal context—it covers not only materials that were presented to stakeholders at the Preliminary Workshop but also additional information about requirements and limits for local action in support of adaptation. Section 3 reviews the vulnerabilities that Dewberry identified and that Preliminary Workshop participants discussed in more detail. Section 4 discusses local and regional circumstances relevant to both vulnerabilities and potential responses, with a particular focus on coastal development and the impacts of nuisance flooding on the management of stormwater, roads, and bridges. Section 5 discusses priority-setting and potential responses to local vulnerabilities.

1. Conceptual Framework for Adaptation

This section is included to provide information for decision makers and the public about adaptation policy. It introduces general answers to several key questions: What does adaptation to SLR involve? What does it aim to achieve? What policy tools are available to pursue those aims? What measures should take priority over others?

1.1. What does adaptation to SLR involve?

Answers to the first question sometimes use different terminology, but consistently describe the same basic measures for coastal communities confronting SLR:

- **protecting** current land uses and activities in vulnerable areas;
- **accommodating** SLR by modifying current uses and activities to reduce vulnerabilities;
- **retreating** from places vulnerable to SLR; or

⁸ Dewberry’s Coastal Vulnerability Assessment based its projections of SLR on those issued by NOAA in 2012 and the Army Corps of Engineers in 2015. Clearwater Vulnerability Assessment at 9; *see also* Adam Parris et al., NOAA, Global Sea Level Rise Scenarios for the United States National Climate Assessment: NOAA Tech Memo OAR CPO-1 (Dec. 2012), U.S. Army Corps of Engineers, Climate Change Adaptation: Sea-Level Change Curve Calculator (2015.46).

- **avoiding** development in locations where structures or people would be vulnerable.⁹

Protecting part of a coastline means interposing barriers between rising seas and landward infrastructure, assets, and people with the goal of preventing SLR from disrupting or otherwise forcing changes to existing landward patterns of economic and other activity. This category of adaptation measures uses “hard armoring,” such as sea walls or revetments (see Figure 1 below), and “soft armoring,” such as beach renourishment or living shorelines. Although hard armoring measures can give the impression of preserving a given shoreline segment permanently and cheaply, such measures tend to displace wave action rather than abating it, causing the waves’ force to carve away—“scour”—the soils or sands adjacent to or seaward of the armored area, while also preventing natural erosion processes from replacing what is scoured away.¹⁰ This tends to create expensive problems over time.

Figure 1. Revetment in Santa Cruz, California (note the absence of a sand beach).¹¹



Soft armoring, sometimes also called “natural infrastructure,” is generally favored by scientists, planners, and civil engineers relative to hard armoring, but is usually feasible only where

⁹ South Florida Regional Planning Council, *Adaptation Action Areas: A Planning Guidebook for Florida’s Local Governments Regional Climate Action Framework: Implementation Guide 50–62* (2015), <https://perma.cc/2H39-7WUC>; John R. Nolon, *Protecting the Environment Through Land Use Law: Standing Ground 221* (2014).

¹⁰ South Florida Regional Planning Council, *Adaptation Action Areas: Policy Options for Adaptive Planning for Rising Sea Levels 17–18* (Nov. 2013), <https://perma.cc/U2NZ-TZMG> (“Many studies report that hard armoring does more damage in because flooding and erosion on neighboring properties can be exacerbated and natural resources such as beaches and wetlands can be damaged or stunted from migrating naturally”); Molly Loughney Melius et al., *2015 California Coastal Armoring Report: Managing Coastal Armoring and Climate Change Adaptation in the 21st Century 8–11*, (2015) <https://perma.cc/9AQA-4EXH> (describing adverse effects of hard armoring).

¹¹ Gary B. Griggs, *The Effects of Armoring Shorelines—The California Experience*, in *Puget Sound Shorelines and the Impacts of Armoring—Proceedings of a State of the Science Workshop*, May 2009 (Hugh Shipman et al., eds. 2010), <https://perma.cc/FN54-7425>.

development (i.e., asphalt, concrete foundations, structures, and infrastructure) can be displaced by restored wetlands or “living shorelines,” or has not encroached too close to the water’s edge.¹²

Accommodation means changing how land in the path of SLR is used so that the assets and people engaged in or reliant on those uses are made less vulnerable. Examples of physical accommodation include elevating buildings, moving mechanicals from basements to upper floors or rooftops, up-rating machinery and infrastructure to endure inundation by saltwater, and retrofitting stormwater management systems with one-way valves that allow stormwater to drain into the ocean but prevent seawater from flowing to low-lying City streets (see Figures 2 and 3, below). Clearwater has installed backflow preventers like the one shown in Figure 3 in several locations; their effectiveness remains unclear.

Figure 2. Building floodproofing options for different FEMA-designated zones.¹³

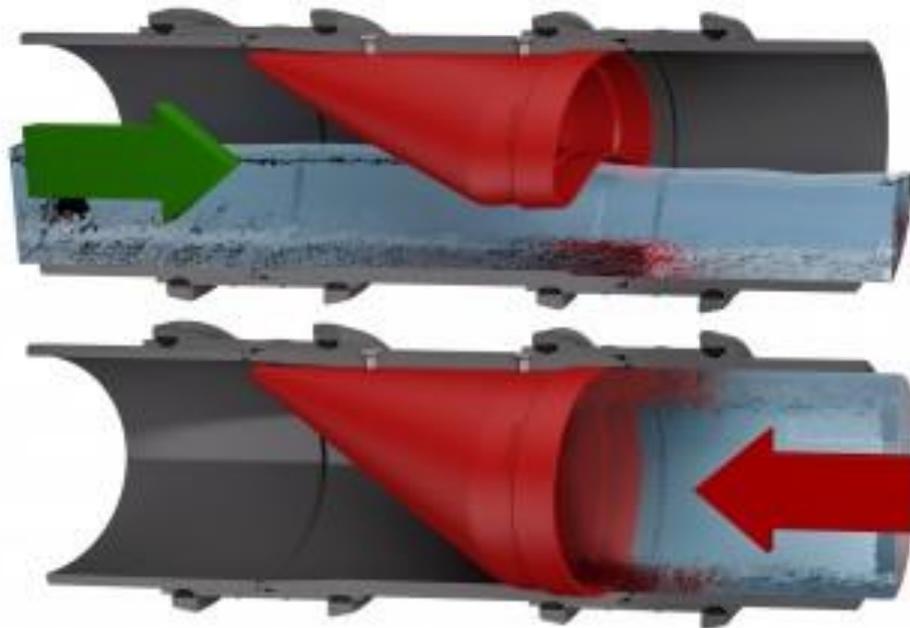
	A ZONE		V ZONE
FLOOD PROTECTION STRATEGY	DRY FLOODPROOFING WATERTIGHT STRUCTURE e.g. FLOOD SHIELDS	WET FLOODPROOFING WATER TO RUN-IN / RUN-OUT e.g. FLOOD VENTS	ELEVATED STRUCTURE VIRTUALLY OPEN STRUCTURE e.g. OPEN LATTICE
GROUND FLOOR CONFIGURATION			
	<p>LOWEST OCCUPIED FLOOR ALLOWED TO BE EXCAVATED BELOW GRADE NOT PERMITTED FOR ENTIRELY RESIDENTIAL BUILDINGS</p>	<p>LOWEST OCCUPIED FLOOR TO BE AT OR ABOVE DESIGN FLOOD ELEVATION</p>	<p>BOTTOM OF LOWEST STRUCTURAL MEMBER TO BE AT OR ABOVE DESIGN FLOOD ELEVATION</p>
PERMITTED USE BELOW DFE	<ul style="list-style-type: none"> ✓ PARKING ✓ ACCESS ✓ STORAGE ✓ NON-RESIDENTIAL ✗ RESIDENTIAL 	<ul style="list-style-type: none"> ✓ PARKING ✓ ACCESS ✓ STORAGE ✗ NON-RESIDENTIAL ✗ RESIDENTIAL 	<ul style="list-style-type: none"> ✓ PARKING ✓ ACCESS ✓ STORAGE ✗ NON-RESIDENTIAL ✗ RESIDENTIAL

“BFE” indicates base flood elevation; “DFE” indicates design flood elevation, which is BFE plus freeboard requirements designed for particular areas and building types.

¹² Robert Verchick & Joel Scheraga, *Protecting the Coast*, in *The Law of Adaptation to Climate Change: United States and International Aspects* 18–19 (Michael B. Gerard and Katrina Kuh, eds., 2012).

¹³ See, e.g., City of New York Department of City Planning, *Coastal Climate Resilience: Designing for Flood Risk* 16–17 (June 2013), <https://perma.cc/7VWS-BLFL>.

Figure 3. Diagram of tidal backflow prevention insert.



Flexible insert gives way to water flowing from one direction but blocks water flowing from the other.

Accommodation also encompasses changes not just to physical structures but to systems and information—such as revised emergency planning protocols or mandatory notices in real estate transactions for vulnerable properties—and patterns of use—such as shifting commuter car traffic away from a coastal route to a more landward one.

Partial or full retreat involves abandoning land made vulnerable by rising seas and is appropriate in situations where SLR makes continued use and maintenance of existing structures—even in modified form—prohibitively costly. Retreat is conceptually simple, but establishing criteria and implementing decisions to retreat is nearly always complex and politically difficult.¹⁴ In particular, efforts to undertake retreat often raise contentious questions about ownership, value, and liability in relation to assets—above or below ground—that are to be moved, demolished, or left behind. Even more fundamentally, retreat tends to strain community cohesion and residents’ shared sense of place.

Retreat necessarily involves avoiding new development in the area being abandoned to rising seas. Whether such avoidance follows retreat or precedes any effort to develop a

¹⁴ See C. Kousky, *Managing shoreline retreat: a US perspective*, 124 *Climatic Change* 9, 9 (2014), <https://perma.cc/982B-J5BH> (“Retreat could be left to the market . . . however, the market is unlikely to lead to optimal levels or types of retreat in all locations.”).

vulnerable area in the first place, it entails a prohibition on development. Thus while the result of this strategy is avoiding new vulnerabilities, it can usefully be thought of as a prohibition on imprudent development.¹⁵

In rare instances, a community might adopt measures that fit squarely and exclusively into just one of the foregoing four adaptation categories. The Quinault Tribe of Washington State, for instance, is not repairing the sea wall that is losing the battle to protect its village of Taholah from the encroaching Pacific Ocean.¹⁶ Instead, the tribe is simply retreating. That is, they are moving the whole village, which is home to about 700 people, to higher ground.¹⁷ But their case is exceptional; more often, coastal communities looking to adapt will make use of all four of the foregoing types of measures in combination.

1.2. What does adaptation aim to achieve?

Using some combination of the approaches described above, coastal communities vulnerable to SLR generally pursue one or more—or all—of the following five goals:

- make infrastructure and the built environment robust to expected changes;
- make systems—physical or organizational—that are vulnerable to SLR more flexible by altering and/or moving their components;
- enhance the ability of natural systems to reduce vulnerabilities;
- identify maladaptations and begin undoing them; and
- inform the public about the short- and long-term risks that SLR will create.¹⁸

Some of these goals obviously complement each other: for instance, making built systems more flexible can involve enhancing neighboring natural systems' capacity for resilience. However, some of these goals can potentially conflict: for instance, making infrastructure robust to change can mean reinforcing rather than undoing maladaptations. Just as conflicting adaptation measures make each other less cost-effective, ensuring that adaptation efforts are mutually supportive is a means of avoiding unnecessary expense.¹⁹

¹⁵ *Id.* (“realistically, the actual choice may be allowing development to occur and persist past the optimal time or at a greater intensity versus preventing it altogether.”).

¹⁶ NOAA, U.S. Climate Resilience Toolkit, *Case Studies: Quinault Indian Nation Plans for Village Relocation*, <https://perma.cc/3PC4-79B3> (last updated Dec. 2, 2016).

¹⁷ *Id.*

¹⁸ Richard J.T. Klein & Richard S.J. Tol, *Adaptation to Climate Change: Options and Technologies, An Overview Paper*, United Nations Framework Convention on Climate Change Secretariat, FCCC/TP/1997/3, at 6 (Oct. 1997), <https://perma.cc/N52P-7EM6>.

¹⁹ See National Academies of Sciences, *supra* note 7, at 135 fig. 4.1 (noting importance of identifying opportunities for synergies and co-benefits across sectors).

1.3. What policy tools are available to pursue these aims?

In the Preliminary Workshop conducted on October 17, 2016, we reviewed various policy tools available to localities seeking to adapt to SLR:

- Transferable Development Rights;
- Incentives;
- Setbacks and Buffers;
- Building Codes and Design;
- Floodplain Regulations;
- Zoning and Overlay Zones;
- Hard- and Soft-Armoring Permits;
- Conditional Development;
- Rebuilding Restrictions;
- Stormwater Utility;
- Special Assessments;
- Impact Fees;
- Conservation Easements;
- Real Estate Disclosures;
- Coastal Land Acquisition Programs; and,
- Land Trusts.

The South Florida Regional Planning Council’s *Adaptation Action Areas Planning Guidebook*, and *Policy Options for Adaptive Planning For Rising Sea Levels*, both of which are available online,²⁰ describe each of these tools. For example, whereas a conventional setback simply demarcates the line beyond which private property owners may not develop their property, a tiered setback restricts particular types development based on risk: bigger and less resilient structures must be set back farther than smaller and more resilient ones.²¹ A tiered approach to setback can be combined with use of annual erosion lines to demarcate where each tier begins.²² Georgetown Climate Center’s 2011 Adaptation Tool Kit also provides a helpful set of summaries and more thorough descriptions of how each of these tools can be applied to the task of adapting to SLR.²³

In addition to describing these tools and noting examples of their use in particular localities (e.g., transferrable development rights in Monroe County, an overlay zone in Yankeetown, a stormwater utility in Bay County), the *AAA Planning Guidebook* also provides two tables that align each tool with a particular “management category” (for instance, “setbacks and buffers” align with shoreline conservation and also with stormwater management).²⁴ As these tables show, a given tool can be useful for more than one category of infrastructure management or adaptation.

1.4. What measures should take priority over others?

²⁰ Adaptation Action Areas Guidebook, *supra* note 9, at 50–62, <https://perma.cc/2H39-7WUC>; Policy Options for Adapting Planning, *supra* note 10, at 12–26, <https://perma.cc/U2NZ-TZMG>.

²¹ Adaptation Action Areas Guidebook, *supra* note 9, at 54.

²² *Id.*

²³ Jessica Grannis, Georgetown Climate Center, Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use How Governments Can Use Land-Use Practices to Adapt to Sea-Level Rise 2–4, 19–62 (Oct. 2011), <https://perma.cc/L4KJ-PM6E>.

²⁴ Adaptation Action Areas Guidebook, *supra* note 9, at 62, 132.

Translating adaptation goals and tools into a plan for action means making a series of decisions, first about what the community wants, then about how much the community is willing to spend, and finally about how and when to allocate that spending among competing priorities. In practical terms, the last of these means deciding both what measures would be most cost-effective and the order in which they should be undertaken. The South Florida Regional Planning Council, recognizing that social, political, and economic factors—as well as technical ones—are highly relevant to the process of setting adaptation priorities, recommends use of the STAPLEE framework for decision-making.²⁵ STAPLEE is intended to help organize a process that takes all of the following considerations into account:

- Social - The action should be consistent with community values and should not unfairly or disproportionately affect a vulnerable segment of the population.
- Technical - The action should be technically feasible, help to reduce losses in the long term, and have minimal cumulative and secondary impacts.
- Administrative - The action should be implementable by the state or local government.
- Political - The action should be politically acceptable.
- Legal - The state or local government must have the legal authority to implement/enforce the action.
- Economic - The action should be cost-effective and be likely to pass a benefit-cost analysis.
- Environmental - The action should meet statutory considerations and public desire for sustainable and environmentally healthy communities.²⁶

The Georgetown Climate Center’s Adaptation Toolkit provides a summary illustration (see Figure 4 below) of how a version of the STAPLEE framework can be used to evaluate applications of the tools listed above.

²⁵ Adaptation Action Areas Guidebook, *supra* note 9, at 63; *see also* NOAA, *Adapting to Climate Change: A Planning Guide for State Coastal Managers* 52–53 (2010), <https://perma.cc/E4M2-M6Y7>; FEMA, *Developing the Mitigation Plan: Identifying Actions and Implementing Strategies* (2003), <https://perma.cc/56PU-K5CS> (listing STAPLEE factors in detail).

²⁶ NOAA, *Adapting to Climate Change: A Planning Guide for State Coastal Managers* 52–53 (2010), <https://perma.cc/E4M2-M6Y7> (citing FEMA, *Developing the Mitigation Plan: Identifying Actions and Implementing Strategies* (2003), <https://perma.cc/56PU-K5CS>).

Figure 4. SLR Policy Tools and Criteria for Decisionmaking.²⁷

Potential Responses	Evaluation Criteria			Governance Criteria	
	Economic	Environmental	Social	Administrative	Legal
PLANNING TOOLS					
1. Comprehensive Plans*	*	*	*	*	*
REGULATORY TOOLS					
2. Zoning and Overlay Zones*	*	*	*	*	*
3. Floodplain Regulations*	*	*	*	*	*
4. Building Codes and Resilient Design	~	~	~	~	+
5. Setbacks/Buffers	~	+	~	~	~
6. Conditional Development and Exactions	~	+	+	~	~
7. Rebuilding Restrictions	~	+	~	~	~
8. Subdivisions and Cluster Development	+	+	~	~	+
9. Hard-Armoring Permits	!	!	~	~	~
10. Soft-Armoring Permits	~	~	~	~	~
11. Rolling Coastal Management / Rolling Easement Statutes	~	+	~	~	!
SPENDING TOOLS					
12. Capital Improvement Programs	~	+	~	~	~
13. Acquisitions and Buyout Programs	!	+	~	~	+
14. Conservation Easements	+	+	+	~	~
15. Rolling Conservation Easements	~	~	+	!	!
TAX AND MARKET-BASED TOOLS					
16. Tax and Other Development Incentives	~	+	+	~	~
17. Transferable Development Credits	+	+	+	!	+
18. Real Estate Disclosures	~	~	~	~	~

Advantageous (+)	The tool maximizes benefits and is feasible.
Neutral (~)	The tool may present some disadvantages or some feasibility problems.
Disadvantageous (!)	The tool may be difficult to implement because of costs or infeasibility.

Figure 4 simplifies the type of characterization that the STAPLEE process might arrive at for the tools listed in the left column, and serves to illustrate the utility of anticipating how a given

²⁷ Georgetown Adaptation Tool Kit, *supra* note 23, at 10–11. The asterisks beside items 1, 2, and 3 indicate that communities will necessarily use these tools, and that they do not therefore need to be evaluated as advantageous or disadvantageous.

adaptation tool is likely to fare when proposed to different groups of stakeholders. For instance, some tools—such as rolling easements—might be socially acceptable but limited in application and subject to legal uncertainty.²⁸ By bringing into focus the benefits, sources of support, and potential sources of opposition to application of a given tool, STAPLEE can help guide decision makers as they convene stakeholders and present arguments about why using particular tools to pursue particular goals can strike an optimal balance for the community.

In addition to encouraging a planning process that deals with all contentious issues as early as possible, adaptation planning literature counsels that communities should seek “no regrets,” “low regrets,” and “flexible” solutions when deciding about allocations and timing.²⁹ Each of these terms emphasizes the importance of not locking a community’s scarce resources into investments whose value could be undermined by foreseeable potential changes to the climate and shoreline.³⁰ They also reflect the crucial fact that adaptation is an ongoing process rather than a finite one.³¹

2. Legal Context

Various aspects of the law governing Clearwater compel, support, permit, or limit its authority to pursue an adaptation agenda. This section does not provide an exhaustive list of relevant legal structures and provisions, but it identifies several that are especially salient and that should or must be considered as Clearwater takes steps to adapt to SLR.

Several features of Florida law, described briefly here, deserve special attention because they are both unique to Florida and significant to any adaptation agenda. They include local comprehensive plans, legal authority for the establishment of Adaptation Action Areas,³² SB 1094 (“Peril of Flood”),³³ and the Bert Harris Jr. Private Property Rights Protection Act.³⁴

2.1. Comprehensive planning

²⁸ See Thomas Ruppert, Use of Future Interests in Land as a Sea-Level Rise Adaptation Strategy in Florida (Aug. 2012), <https://perma.cc/6SJM-58B5>.

²⁹ William H. Butler et al., *Low-Regrets Incrementalism: Land Use Planning Adaptation to Accelerating Sea Level Rise in Florida’s Coastal Communities*, J. Planning Edu. & Res. 1, 9–10 (2016); see also Donald Watson, *Literature Review: Principles and Practices of Coastal Adaptation in the Era of Climate Change*, in Coastal Change, Ocean Conservation and Resilient Communities 23, 25–26 (2016) (emphasizing need to plan for uncertainty, in part by enabling multiple programmatic options).

³⁰ NOAA, Adapting to Climate Change: A Planning Guide for State Coastal Managers 53 (2010), <https://perma.cc/E4M2-M6Y7>.

³¹ National Park Service, Coastal Adaptation Strategies Handbook 2 (2016), <https://perma.cc/PAN7-EA6V>.

³² HB 7202, Florida Community Planning Act of 2011, *codified at* Fla. Stat. § 163.3177.

³³ SB 1094, *codified at* Fla. Stat. §§ 163.3178, 195.088.

³⁴ Fla. Stat. § 70.001.

Comprehensive plans have a constitutional quality for Florida localities.³⁵ Each Florida locality must maintain a comprehensive plan,³⁶ and all development in that locality must conform to the local Plan’s provisions.³⁷ Those provisions appear in particular “elements,” some of which are mandatory.³⁸ Florida’s 2011 Community Planning Act removed several restrictions on local governments’ authority to revise elements of their comprehensive plans,³⁹ a process that involves two public hearings and approvals by the local governing authority, as well as receipt and review of comments by state agencies and affected localities regarding potential adverse effects.⁴⁰ The rest of this subsection discusses: (1) particularly important planning elements and the statutory language that guides their formulation; (2) data and analysis appropriate for planning; (3) timeframes for planning; and (4) Adaptation Action Areas—a form of zoning overlay that localities can use to coordinate adaptation plans and efforts.

2.1.1. Key planning elements

Nearly all of Clearwater’s Comprehensive Plan elements relate to adaption efforts in some fashion,⁴¹ but this section focuses on two elements that are indispensable to the actions discussed in section five of this document: future land use and coastal management.

Future Land Use Element. Florida law does not expressly instruct localities to incorporate consideration of SLR or adaptation goals into their future land use element, but several Florida Statutes provisions provide a solid legal basis for adding to or revising the existing element’s Goals, Objectives, and Policies for that purpose. First and most fundamentally, a future land use element “shall establish the long-term end toward which land use programs and activities are ultimately directed.”⁴² This directive would support, for instance, including a Goal pursuant to which *Clearwater shall ensure that land uses are compatible with sea level rise scenarios projected by the National Oceanic and Atmospheric Administration and the U.S. Army Corps of Engineers through 2050.* Other Florida Statutes provisions further encourage including language

³⁵ David L. Markell, *Emerging Legal and Institutional Responses to Sea-Level Rise in Florida and Beyond*, 42 Colum. J. Envtl. L. 1, 6–7 (2016) (citing *Machado v. Musgrove*, 519 So. 2d 629, 632 (Fla. 3d DCA 1987)).

³⁶ Fla. Stat. § 163.3167(1)(b)(2) (2015) (“Each local government shall maintain a comprehensive plan”). *See also id.* § 163.3177(1) (2015) (plans are meant to “provide the principles, guidelines, standards, and strategies for the orderly and balanced future economic, social, physical, environmental, and fiscal development of the area. . .” and to “establish meaningful and predictable standards for the use and development of land and provide meaningful guidelines for the content of more detailed land development and use regulations.”).

³⁷ *Id.* § 163.3161(6) (“no public or private development shall be permitted except in conformity with comprehensive plans”).

³⁸ *Id.* § 163.3177(1)(a). Mandatory elements include: capital improvements; future land use; transportation; general sanitary sewer, solid waste, drainage, potable water, and natural groundwater aquifer recharge; conservation; recreation and open space; housing; intergovernmental coordination; and, for coastal localities, coastal management. *Id.* § 163.3177(6).

³⁹ Fla. L. c. 77-331, Community Planning Act of 2011, *amending* F.S. §§ 163.3161, 163.3217.

⁴⁰ Fla. Stat. § 163.3184.

⁴¹ Clearwater’s current comprehensive plan is available here: <https://perma.cc/7H2Y-9QUF>.

⁴² Fla. Stat. § 163.3177(6)(a).

of this sort, whether as a Goal or Objective. Florida Statutes § 136.3177(6)(a)3, for instance, instructs that “[t]he future land use plan element shall include criteria to be used to: . . . Coordinate future land uses with the [sic] topography and soil conditions, and the availability of facilities and services.” And, similarly, paragraph (6)(a)8 requires future land use map amendments to be based on “analysis of the suitability of the plan amendment for its proposed use considering the character of the undeveloped land, soils, topography, and historic resources on site.”

Other statutory language would support more focused plan element amendments. For instance, section 163.3177(6)(a)3.g, which directs that the “element shall include criteria to be used to: . . . Provide for the compatibility of adjacent land uses,” has clear importance for shoreline armoring and coastal development permitting. Hard armoring is arguably incompatible with either soft armoring or a lack of armoring on adjacent parcels. Similarly, hard armoring or other forms of development reduce the buffering capacity of a shoreline vis-à-vis proximate landward property.

Some of the statutory provisions discouraging urban sprawl also lend themselves to plan element amendments focused on SLR adaptation. In particular, among the indicators of sprawl (which “the future land use plan element shall discourage”), are “[f]ail[ure] to adequately protect and conserve natural resources, such as wetlands, floodplains . . . shorelines, beaches, estuarine systems, and other significant natural systems;” and “[a]llow[ance] for land use patterns or timing which disproportionately increase the cost in time, money, and energy of providing and maintaining facilities and services”⁴³

Coastal Management Element. The state-level legal underpinnings of this element are unique for *requiring* consideration of SLR. Senate Bill 1094 (SB 1094), enacted in 2015 and addressing “the Peril of Flood,” revised Florida Statutes to instruct coastal localities to include a redevelopment component in their coastal management elements. Even prior to 2015, that element was to “outline[] the principles that must be used to eliminate inappropriate and unsafe development in the coastal areas when opportunities arise.”⁴⁴ SB 1094 specified that the “principles, strategies, and engineering solutions” described in that component must address flood risk arising from several sources, *including SLR*. Although these requirements are phrased a bit elliptically, they can properly be read as providing state sanction for coastal localities seeking to limit—or even “eliminate”—development that is “inappropriate and unsafe” because it is foreseeably vulnerable to the adverse impacts of SLR.

A redevelopment component is the logical place to include guidelines and restrictions that do not take effect until they are triggered by an event, such as flooding of a particular depth, a natural disaster, or even just encroachment of the shoreline to a particular height. Florida’s

⁴³ Fla. Stat. § (6)(a)9a(IV) & (VIII).

⁴⁴ Fla. Stat. § 163.3178(2)(f).

Department of Community Affairs published a resource that can help inform such provisions, titled *Post-Disaster Redevelopment Planning: A Guide for Florida Communities*.⁴⁵ SB 1094’s requirements provide communities with good reason to adopt such measures, and also with a potent tool for inoculating restrictions on development against takings claims (discussed below).

* * *

It is important to recognize that merely mentioning SLR in these and other comprehensive plan elements will not suffice to steer Clearwater to adapt. A recent survey of references to SLR in plan elements across hundreds of Florida localities identified a number of instances where “SLR language appears in a comprehensive plan and indicates that a government ‘shall’ do something” but the language calling for action “is often not self-executing.”⁴⁶ As a result, the local government’s comprehensive plan language “appears more proactive than the tangible actions of a local government in day-to-day operations.”⁴⁷ The University of Florida’s Conservation Clinic has developed model planning language to help localities that are inclined to do more.⁴⁸ Their model makes the protect-accommodate-retreat rubric described above into the basis for planning zones: similar issues get different treatment in the managed retreat zone than they do in the protect zone. Selections from that model, which are excerpted in several places below, can be useful even when taken out of that context.

2.1.2. Appropriate data and analysis for planning

Comprehensive plans must be informed by an analysis of “relevant and appropriate data,”⁴⁹ which Florida law requires to be gathered from “professionally accepted sources” or generated by the local government itself “so long as methodologies [for gathering data] are professionally accepted.”⁵⁰ Usable data thus include not just the NOAA and Army Corps datasets underlying Dewberry’s Vulnerability Assessment but also data published by the Intergovernmental Panel on Climate Change, the Southeast Florida Regional Compact on Climate Change,⁵¹ or other similarly authoritative sources.⁵² Florida law also requires changes to comprehensive plans to be

⁴⁵ Florida Department of Community Affairs, *Post-Disaster Redevelopment Planning: A Guide for Florida Communities* (Oct. 2010), <https://perma.cc/923X-V4R5>.

⁴⁶ Thomas Ruppert & Alexander Stewart, *Summary and Commentary on Sea Level Rise Adaptation Language in Florida Local Government Comprehensive Plans and Ordinances 4* (July 2015), <http://perma.cc/7VU6-ZGF4>.

⁴⁷ *Id.*

⁴⁸ Krystle Macangdang & Melisa Newmons, *Sea Level Rise Ready: Model Comprehensive Plan Goals, Objectives and Policies, to Address Sea Level Rise in Florida* (May 2010), <https://perma.cc/JF7U-N4FY>. Among other things, this model language formulates Goals, Objectives, and Policies for inclusion in planning elements based on the protect-accommodate-retreat rubric. *Id.* at 11.

⁴⁹ Fla. Stat. § 163.3177(1)(f).

⁵⁰ *Id.*

⁵¹ Southeast Florida Regional Climate Compact, *Unified Sea Level Rise Projection*, (Oct. 2015), <https://perma.cc/49LA-WP6A>.

⁵² FEMA flood insurance rate maps (FIRMs) would also be an authoritative source. However, FIRMs currently represent a snapshot in time that ignores SLR. FEMA, *Coastal Frequently Asked Questions: Flood Hazard Mapping Questions*, <https://perma.cc/HYN7-XMY5> (last updated Aug. 17, 2016) (“In accordance with the current Code of

supported by analysis, and that such analysis must reflect reasonable and proportionate applications of the data cited.⁵³ “Scientific certainty” is *not* a required feature of supporting data or their analysis.⁵⁴

The flexibility given to localities regarding data and analysis means that Dewberry’s Vulnerability Analysis will not operate as either a “floor” or a “ceiling” for planning purposes. Should Clearwater refer to the Vulnerability Assessment as supporting particular language or parameters, the City would only need to articulate a logical link between the Assessment and the action—it would not be legally prevented from adopting language that embodied more or less cautious expectations about SLR than contained in the Assessment.

2.1.3. Planning timeframes

Until the legislature enacted SB 1094 in 2015, Florida law instructed localities to use two time frames for planning: five years and ten years. This directive has allowed localities to effectively ignore slow-developing future circumstances that fall outside of this timeframe, such as SLR. SB 1094 changed this by providing that “[a]dditional planning periods for specific components, elements, land use amendments, or projects shall be permissible and accepted as part of the planning process.”⁵⁵ This invitation to designate time frames freely has vital implications for plans involving assets or facilities whose useful life exceeds 10 years and whose location makes them potentially vulnerable to SLR. Armed with this option, local governments considering the costs and benefits of infrastructure design parameters, planning restrictions, and capital investment options, among other things, can ensure that SLR projections inform their plans. The University of Florida’s Conservation Clinic has drafted model comprehensive plan language that ensures all adaptation planning employs an appropriate timeframe:

[Model] Policy 1.2.1: [Planning Horizon] Utilize a (___) year planning horizon when considering the adoption of any protection, accommodation, and managed retreat strategy within the City/County.⁵⁶

Notably, because SB 1094’s provisions do not *require* use of timeframes of more than 10 years, the law permits a locality to treat information about looming SLR impacts as beyond the

Federal Regulations, FEMA does not map flood hazards based on anticipated future sea levels or climate change.”). Unless and until FIRMs integrate SLR projections, their utility for planning purposes should be considered limited to the short term.

⁵³ The statutory language is somewhat muddier: “To be based on data means to react to it in an appropriate way and to the extent necessary indicated by the data available on that particular subject at the time of adoption of the plan or plan amendment at issue.” *Id.*

⁵⁴ See *Haire v. Florida Dep’t of Agric. & Consumer Servs.*, 870 So. 2d 774, 786 (Fla. 2004) (quoting approvingly from opinion below the proposition that “legislatures are not limited to acting only where there is scientific certainty.”).

⁵⁵ Fla. Stat. § 163.3177(5)(a).

⁵⁶ Krystle Macangdang & Melisa Newmons, *Sea Level Rise Ready: Model Comprehensive Plan Goals, Objectives and Policies, to Address Sea Level Rise in Florida* (May 2010), <https://perma.cc/JF7U-N4FY>.

mandatory planning timeframe. A locality looking to exclude consideration of SLR from consideration when making decisions about investments in, say, a facility or infrastructure asset with a 30- or 50-year useful life could therefore do so without legal consequence under this provision. Such an exclusion would be imprudent, however, given the certainty of some amount of future SLR, and given that Dewberry’s projections identify where and how much particular locations, assets, and systems are likely to become vulnerable over the coming decades. Such an exclusion might also subject a locality to other legal action. (See section 2.2, below.)

2.1.4. Adaptation Action Areas

In addition to giving localities more flexibility and autonomy when updating their planning elements, the 2011 Comprehensive Planning Act also authorized localities to designate as Adaptation Action Areas (AAAs) locations “that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels.”⁵⁷ The 2011 Act contemplates two purposes for this designation: “prioritizing funding for infrastructure needs” and “adaptation planning.”⁵⁸ Designating one or more AAAs could also serve Clearwater by providing the basis for various forms of notice to all property owners, permittees, and others with investments or interests in land or assets encompassed by the AAA boundary regarding SLR-related vulnerabilities and potential future changes to land use restrictions. In short, an AAA is a highly flexible and potent version of a zoning overlay,⁵⁹ which localities can rightly present to residents as expressly and specifically sanctioned by state law, and as a potentially important step toward seeking state and federal funds for adaptation efforts.

A further point about establishing the boundary of an AAA deserves further mention here. Florida law suggests but does not mandate criteria for AAA designation.⁶⁰ Whether Clearwater uses those suggested criteria and/or others, it should consider expressly stating that while the criteria for AAA designation will not change, the AAA’s boundary will be reviewed and updated periodically (e.g., every six years, which would align with the schedule of Clearwater’s capital improvement element)⁶¹ *as underlying features change*. Such a statement would serve as notice that the AAA is likely to expand or shift as SLR and related topographic changes proceed along current trend lines. It would also serve as notice that, even without revisions to the

⁵⁷ F.S. § 163.3164(1) (defining AAA).

⁵⁸ *Id.*

⁵⁹ For descriptions of zoning overlays and examples of their application, see Anne Siders, Columbia Center for Climate Change Law, *Managed Coastal Retreat: A Legal Handbook on Shifting Development Away from Vulnerable Areas* 96–97 (Oct. 2013), <https://perma.cc/Z5A2-ALQB>; Jessica Grannis et al., A Model Sea-Level Rise Overlay Zone For Maryland Local Governments Expert Review Report v.3 (Nov. 2011), <https://perma.cc/67RX-PPWJ>; Douglas Codiga & Kylie Wager, Center for Island Climate Adaptation and Policy, *Sea-Level Rise and Coastal Land Use in Hawai‘i: A Policy Tool Kit for State and Local Governments* 24–26 (2011), <https://perma.cc/9QJR-HT25>.

⁶⁰ Fla. Stat. § 163.3177(6)(g)10: “Criteria for the adaptation action area may include, but need not be limited to, areas for which the land elevations are below, at, or near mean higher high water, which have a hydrologic connection to coastal waters, or which are designated as evacuation zones for storm surge.”

⁶¹ Clearwater, Capital Improvements Element, at I-1, <https://perma.cc/UZ47-HVGB> (last updated Aug. 20, 2013).

comprehensive plan, the substance of policies imposed within the AAA could eventually be applied to locations it did not initially encompass.

2.2. Litigation Risk

Historically, local governments could seek safety from legal challenges by simply maintaining the legal/planning status quo. Now, as SLR shifts the ground under local governments' feet, there is no way to maintain the status quo in both physical and legal/planning terms. The result is potentially a "damned if you do, damned if you don't" situation with respect to litigation risk. If local governments act to address SLR, they could be sued by property owners claiming injury from limitations on the property's use or adverse effects on property values. But local governments could also be sued for *failing* to address SLR, either by persisting with a long-standing but imprudent approach to use of publicly-owned land or facilities, or by failing to amplify spending or maintenance schedules to the degree made necessary by SLR to keep some element of coastal protection or infrastructure in good repair.⁶² This subsection does not provide a thorough description of litigation risks related to adaptation, and is not intended to provide legal advice, but its summary of key factors highlights what courts may consider when deciding whether a government can be found liable for the effects of adaptation-related decisions.

2.2.1. Sovereign immunity

Sovereign immunity protects Florida local governments from legal challenge for some but not all of their actions.⁶³ Courts use four guideposts to determine whether a given action is immune, but "Florida courts have struggled to find consistency in their application of the waiver [of sovereign immunity]."⁶⁴ The first is the "operational/planning test" articulated by Florida's Supreme Court for determinations of whether an action by a state or local government reflects "quasi-legislative policy-making," which is immune from suit.⁶⁵ The test has four conjunctive parts, meaning that a government action must qualify in all four ways to merit sovereign immunity.⁶⁶ If all four answers are affirmative then the action involves "planning," is

⁶² This is a developing area of law. In general, governments are not to be held liable for nonfeasance. See *DeShaney v. Winnebago County Department of Social Services*, 489 U.S. 189 (1989). However, there have lately been departures from this premise in recent decisions requiring local governments to maintain infrastructure in the face of changing coastlines. See Thomas Ruppert & Carly Grimm, *Drowning in Place: Local Government Costs and Liabilities for Flooding Due to Sea-level Rise*, 87 Fla. Bar J. 29 (Nov. 2013), <https://perma.cc/6SUM-36Q9>.

⁶³ *Wallace v. Dean*, 3 So.3d 1035, 1045 (Fla. 2009) (citing Florida Constitution article II § 3, providing for separation of powers among coordinate government branches).

⁶⁴ James Wilkins, *Is Sea Level Risk "Foreseeable"? Does It Matter?*, 26 J. Land Use & Envtl. L. 437, 450 (2011). For a thorough discussion of sovereign immunity in Florida, see William N. Drake, Jr. & Thomas A. Bustin, *Governmental Tort Liability in Florida: A Tangled Web*, Fla. Bar J., Feb. 2003; Thomas A. Bustin & William N. Drake, Jr., *Judicial Tort Reform: Transforming Florida's Waiver of Sovereign Immunity Statute*, 32 Stetson L. Rev. 46 (2003).

⁶⁵ *Wallace v. Dean*, 3 So.3d at 1041 (citing *Commercial Carrier Corp. v. Indian River County*, 371 So.2d 1010 (Fla. 1979)).

⁶⁶ *Commercial Carrier*, 371 So.2d at 1018: 1) Does the challenged act, omission, or decision necessarily involve a basic governmental policy, program, or objective? 2) Is the questioned act, omission, or decision essential to the

discretionary, and is immune from suit. If any of the answers is negative then the action is “operational,” meaning that the law *prescribes* governmental conduct rather than leaving that conduct to the government’s *discretion*, and does not immunize the government from suit for injury arising from that conduct.⁶⁷ Florida courts’ application of this test has not been especially consistent or predictable.⁶⁸

The second guidepost complicates the first. It divides governmental functions into four categories, two of which entail liability. They are 1) legislation, permitting, licensing, and executive functions; 2) law enforcement and protection of public safety; 3) capital improvements and property management; and 4) providing professional, educational, or general services for citizens’ health and welfare.⁶⁹ The Florida Supreme Court has stated that governments engaged in the first two types of functions have no duties for which they might be liable,⁷⁰ and that governments engaged in the fourth function—providing direct services—owe the same duties and bear the same risk of liability as private entities so engaged.⁷¹ As for the third function, it seeks to distinguish between (a) initial decisions to acquire, build, or upgrade a property or facility and (b) subsequent decisions to maintain that property or facility. Whereas governments’ decisions to build or upgrade are immune, maintenance efforts carry liability just as they would for a private owner or operator.⁷²

The third guidepost to note is actually an exception to the upgrade/maintain distinction just discussed. It relates to a government’s duty to prevent or warn about dangerous conditions arising from a facility the government owns or operates. It applies if a government 1) creates a dangerous condition, which 2) is not readily apparent to whomever it injures, and 3) the government knew of the condition yet 4) failed to warn the public or avert the danger it created.⁷³ Thus, even if a government demonstrates that it merely maintained a facility rather than

realization or accomplishment of that policy, program, or objective, as opposed to one which would not change the course or direction of the policy, program, or objective? 3) Does the act, omission, or decision require the exercise of basic policy evaluation, judgment, and expertise on the part of the governmental agency involved? And 4) Does the governmental agency involved possess the requisite constitutional, statutory, or lawful authority and duty to do or make the challenged act, omission, or decision?

⁶⁷ *Cf.* United States v. Varig Airlines, 467 U.S. 797, 808 (1984) (describing basis for operational/planning distinction as follows: “The discretionary function exception . . . marks the boundary between Congress’ willingness to impose tort liability on the United States and its desire to protect certain governmental activities from exposure to suit by private individuals.”).

⁶⁸ See Theresa K. Bowley, *A Blanket of Immunity Will Not Keep Florida Dry: Proposed Adjustments to Florida’s Drainage Regulations and Sovereign Immunity Laws to Account for Climate Change Impacts*, 10 Fla. A&M U.L. Rev. 387, 403 (2015), <https://perma.cc/F7BY-VX83>.

⁶⁹ *Trianon Park Condo. Ass’n v. City of Hialeah*, 468 So. 2d 912, 919 (Fla. 1985).

⁷⁰ *Id.* at 921.

⁷¹ *Id.*

⁷² *Id.*; see also Thomas A. Sawaya, *Capital Improvements and Property Control Functions*, 6 Fla. Prac. Pers. Inj. & Wrongful Death Actions § 9:9 (2014).

⁷³ Henry P. Trawick, Jr., *Modification of Planning Versus Operational Approach*, 4 Fla. Pl. & Pr. Forms § 37:3 (2015).

upgrading it, it can nonetheless be found liable if a plaintiff's injury arises from facts consistent with these four conditions. Florida courts have also restated this third principle more generally: "Where a defendant's conduct creates a foreseeable zone of risk, the law generally will recognize a duty placed upon defendant either to lessen the risk or see that sufficient precautions are taken to protect others from the harm."⁷⁴

2.2.2. Takings—including via inverse condemnation

Takings law protects private property owners from government actions that fail to provide them with "just compensation" for the condemnation or appropriation of their real property or for regulation that deprives their real property of all or almost all of its use and economic value. In Florida, there are two sources of takings law: the Fifth Amendment to the U.S. Constitution and the Bert Harris Private Property Rights Protection Act.⁷⁵ This subsection does not provide an extensive explanation of takings law in relation to SLR; such explanations are available from other sources,⁷⁶ and provide only limited value for discussions like this one of specific programmatic SLR adaptation efforts. Instead, this subsection covers two important points—one practical, one legal.

The practical point arises from takings law being complex, unpredictable in its application to particular cases, and the source of highly fact-specific legal disputes. These features have two important implications for localities. First, plaintiffs who feel strongly about their takings claim against the locality, or about their desire to remain where they are with all the services they have typically received, may bring a lawsuit even if the legal claim is tenuous. Second, fending off such claims will likely involve marshaling detailed factual information and expert testimony—expenses that a locality must incur even if it prevails in court unless the takings claim is so egregiously implausible that the court sees fit to award the locality attorneys' fees. In short: localities planning to undertake SLR adaptation measures should anticipate takings challenges.

The legal point relates to the decision in *Jordan v. St. Johns County*, a decision from Florida's Fifth District Court of Appeal.⁷⁷ That case dealt with the question of whether the county had committed an inverse condemnation and a taking with its temporary moratorium on maintenance on a 1.6-mile stretch of the only road, "Old A1A," that connected a housing

⁷⁴ *Kaisner v. Kolb*, 543 So. 2d 732, 735 (Fla. 1989).

⁷⁵ Fla. Stat. § 70.001.

⁷⁶ See, e.g., Siders, *supra* note 59, at 13–17; Michael Allen Wolf, *Strategies for Making Sea-Level Rise Adaptation Tools "Takings-Proof"*, 28 J. Land Use 157 (2013), <https://perma.cc/WVH8-QZLP>; see also David Dana, *Incentivizing Municipalities to Adapt to Climate Change: Takings Liability and FEMA Reform as Possible Solutions*, 43 B.C. Envtl. Aff. L. Rev. 281 (2016), <https://perma.cc/KB7M-V3WJ>; J. Peter Byrne & Kathryn A. Zyla, *Climate Exactions*, 75 Md. L. Rev. 758 (2016), <https://perma.cc/5NYY-YNZK>; Sean Hecht, *Taking Background Principles Seriously in the Context of Sea-Level Rise*, 39 Vt. L. Rev. 781 (2014-2015), <https://perma.cc/YE5F-2RQN>; Christopher Serkin, *Passive Takings: The State's Affirmative Duty to Protect Property*, 113 Mich. L. Rev. 345 (2014), <https://perma.cc/W3RU-XH9B>.

⁷⁷ 63 So. 3d 835 (Fla. 5th DCA 2011), *rev. declined*, 77 So. 3d 647 (Fla. 2011).

subdivision on a barrier island to the mainland.⁷⁸ Due to repeated storms and persistent erosion, that maintenance threatened to devour the whole of the county’s annual transportation budget.⁷⁹ The court in that case agreed with the county that its temporary moratorium was rationally related to public safety and ruled that the moratorium did not amount to an inverse condemnation. The court also stated that Florida law does not give courts the authority to issue injunctions instructing perpetual performance of a duty. However, the court did not reject all of the plaintiff’s arguments. It declared that “the County has a duty to reasonably maintain Old A1A as long as it is a public road dedicated to public use,” and must ensure that the road provides “meaningful access.”⁸⁰ It did not further define “reasonably maintain” or “meaningful access,” and even stated that “[w]e do not hold that the County has the duty to maintain the road in a particular manner or at a particular level of accessibility.”⁸¹ It also left open the possibility that a future claim for taking via inverse condemnation *could* prevail: “governmental inaction—in the face of an affirmative duty to act—can support a claim for inverse condemnation.”⁸² Importantly, the court did not decide whether the county had actually fulfilled its duties or effectively abandoned the road, but remanded the case to the trial court to resolve the underlying factual disputes. Rather than continue the fight, the parties settled.

What does *Jordan v. St. Johns County* mean for Clearwater? In addition to illustrating the likelihood of litigation arising from ad hoc deferrals or moratoria on maintenance for key roads and infrastructure, it also serves to highlight the value of addressing issues like prohibitively high maintenance costs in the context of the planning process. The *Jordan* decision took note of the fact that the county never formally voted to terminate road maintenance,⁸³ and hinted strongly to the parties that a formal decision to abandon the road would absolve the county of the duties on which the plaintiffs’ claims were based.⁸⁴ Not only would addressing the issue legislatively have provided more legal cover, it would also been an opportunity to identify potential areas of compromise or settlement among the parties and to embody that compromise in a long-term plan for adapting (likely by eventually abandoning) both the road and barrier island.

⁷⁸ *Jordan*, 63 So. 3d at 837; *see also* *Rubano v. Dept. of Transp.*, 656 So.2d 1264, 1266-67 (Fla. 1995) (“A taking may occur when governmental action causes a lack of access to one’s property even when there is no physical appropriation of the property itself.”).

⁷⁹ *Ruppert & Grimm, supra* note 59, at 29 (“According to the county, the only feasible way to protect the road from the ‘ravages of the ocean’ was an expenditure by the county of more than \$13 million to elevate the height of the road by placing large amounts of sand along its entire length from the right-of-way down to the mean high-water mark. The county argued it would have to spend an additional \$5 to \$8 million every three to five years to maintain that protection. . . . more than the entire county budget for repair and maintenance of 800 miles of roads in the county.”).

⁸⁰ *Jordan*, 63 So. 3d at 838.

⁸¹ *Id.*

⁸² *Id.* at 839.

⁸³ *Id.* at 838.

⁸⁴ *Id.*

Although *Jordan* dealt with a road, it is easy to imagine similar disputes over other types of infrastructure, such as electricity, stormwater, or wastewater. Thus Clearwater might consider more than one application of some or all of the language in a model ordinance proposed in response to *Jordan* by a group of Florida attorneys expert in adaptation and land use.⁸⁵ That model ordinance creates a special category for roads like Old A1A: “any road categorized as ‘environmentally compromised’ under this ordinance shall be the subject of a requested design/maintenance exception.”⁸⁶ It provides thorough definitions of key terms, such as “environmentally challenging location” and “environmentally compromised local road segment,” which support decisions to reduce a given road segment’s level of service based on the cost of its upkeep relative to that of other local road segments. By making the relative cost of upkeep rather than simple dollar-amounts the threshold for level of service reduction, the approach taken by the model ordinance creates flexibility for a local government confronted with both budget constraints and multiple acute adaptation issues.

3. Vulnerabilities

This section summarizes key findings from Dewberry’s Vulnerability Assessment regarding the nature and severity of particular SLR impacts: flooding, precipitation changes, beachfront changes, and groundwater changes. Each of those impacts is a source of vulnerabilities, which are also noted here.

3.1. Flooding

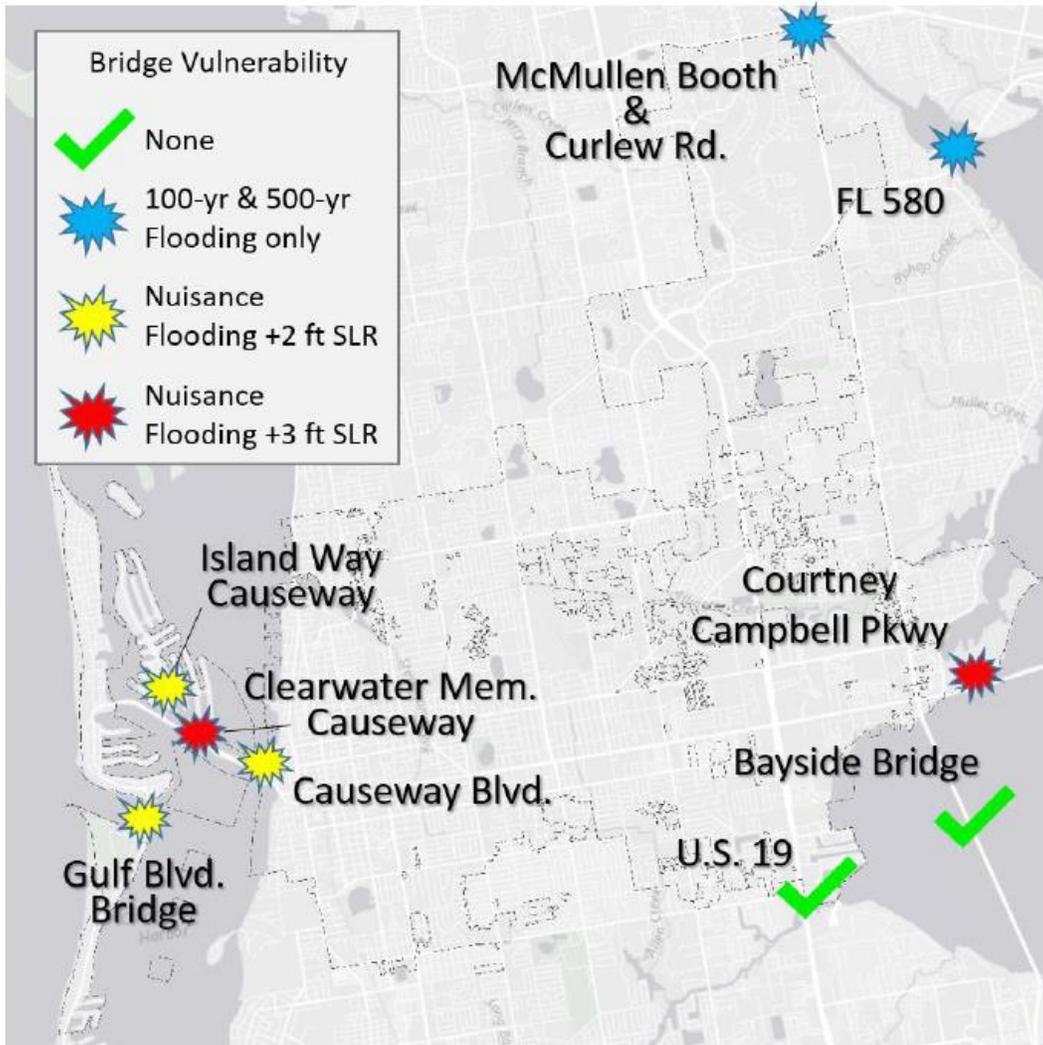
Dewberry’s Vulnerability Assessment examined the scope and effects of three categories of flooding in particular: nuisance (defined as NAVD88 water elevation of three feet and occurring once or twice monthly), 100-year (NAVD88 = 6–10 feet), and 500-year (NAVD88 = 10–14 feet). It also identified “tipping points”—particular heights of SLR at which flooding impacts are expected to become especially severe. The greatest vulnerabilities lay within four areas: Clearwater’s “coastal storm area,” which is defined by Clearwater’s Coastal Management element as encompassing the barrier islands; much of the Gulf-facing western waterfront; large segments of the Bay-facing, eastern waterfront; and the causeways and bridges that link those areas.

Flooding, including nuisance flooding, already affects the passability of roads, causeways, and bridges, and will do so to a steadily increasing degree. (See Figures 5 and 6 from the Vulnerability Assessment below.)

⁸⁵ Thomas Ruppert et al., *Environmentally Compromised Road Segments—A Model Ordinance*, <https://perma.cc/3RLM-DY7K> (last visited Jan. 6, 2017).

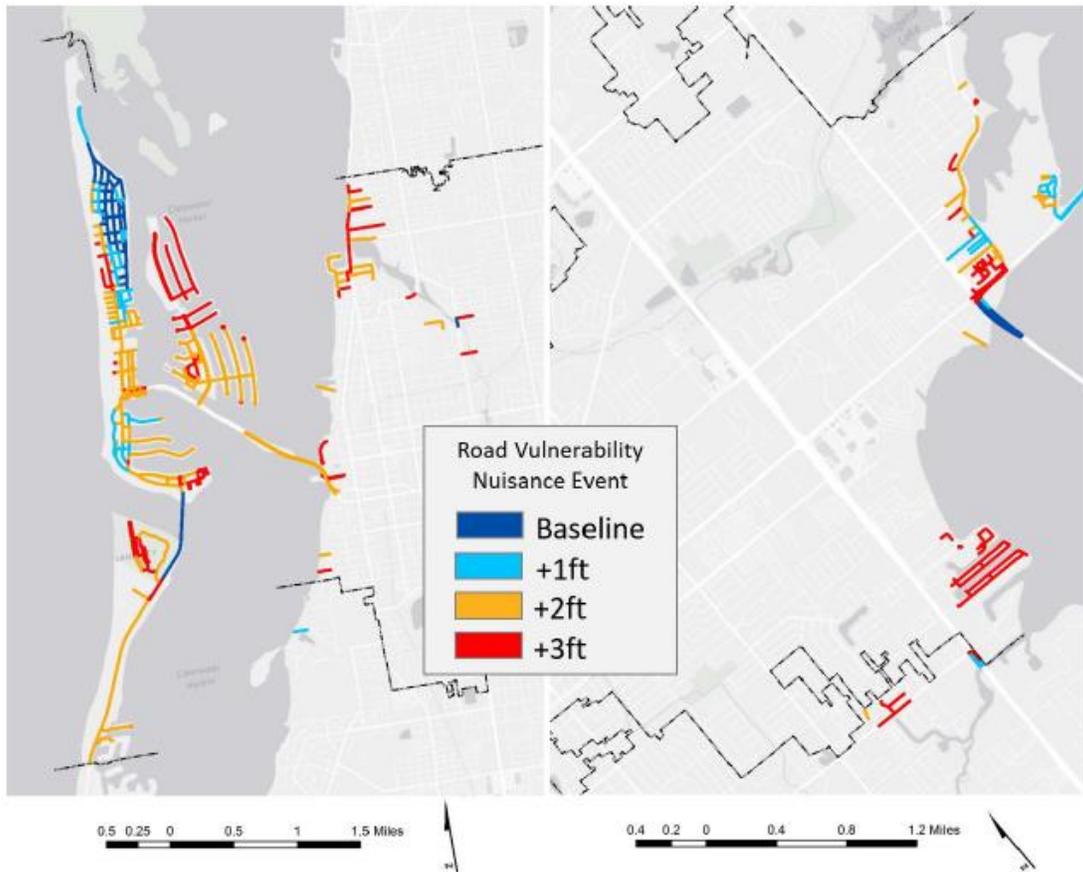
⁸⁶ *Id.* at para. 1.

Figure 5. Bridge flooding vulnerability.⁸⁷



⁸⁷ Clearwater Vulnerability Assessment at 30 fig. 14.

Figure 6. Changes in vulnerability of roads and bridges to nuisance flooding.⁸⁸

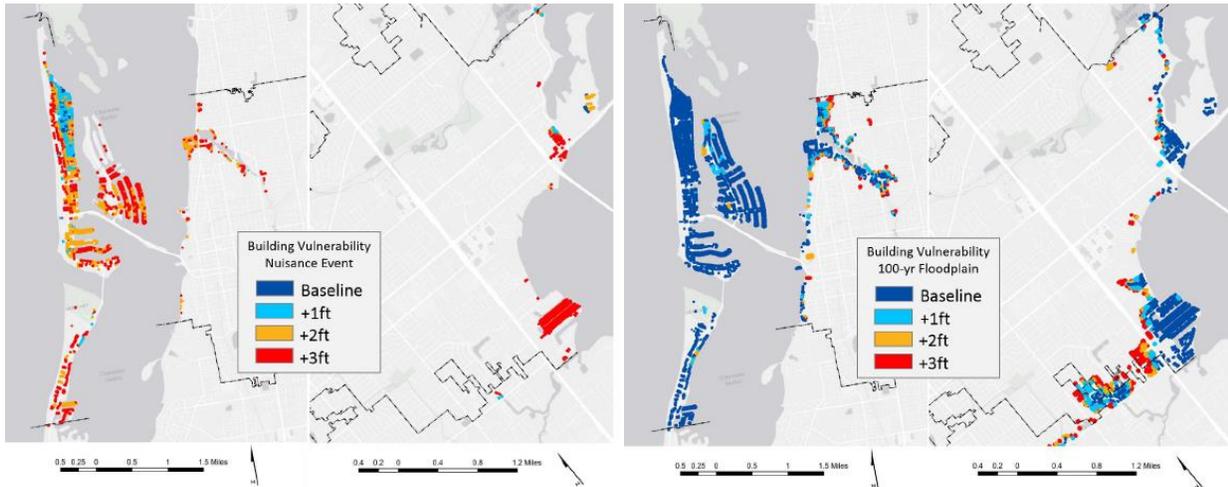


Flooding will also affect buildings within and beyond the coastal storm area. For both buildings and roads, Dewberry projects that the impact of flooding will increase steeply once SLR reaches approximately two feet, which it projects will occur between 2070 and 2100 (see Figure 7 below).⁸⁹

⁸⁸ *Id.* at 20 fig. 7.

⁸⁹ *Id.* at 20, 33.

Figure 7. Buildings affected by nuisance flooding (left) and 100-year flood (right)



Two of Clearwater’s three water reclamation facilities (WRFs) are expected to become vulnerable to 100- and 500-year floods, though not to nuisance flooding.⁹⁰ The wastewater collection system, apart from these facilities, is also increasingly vulnerable to inflow and infiltration from flooding and from rising groundwater levels.

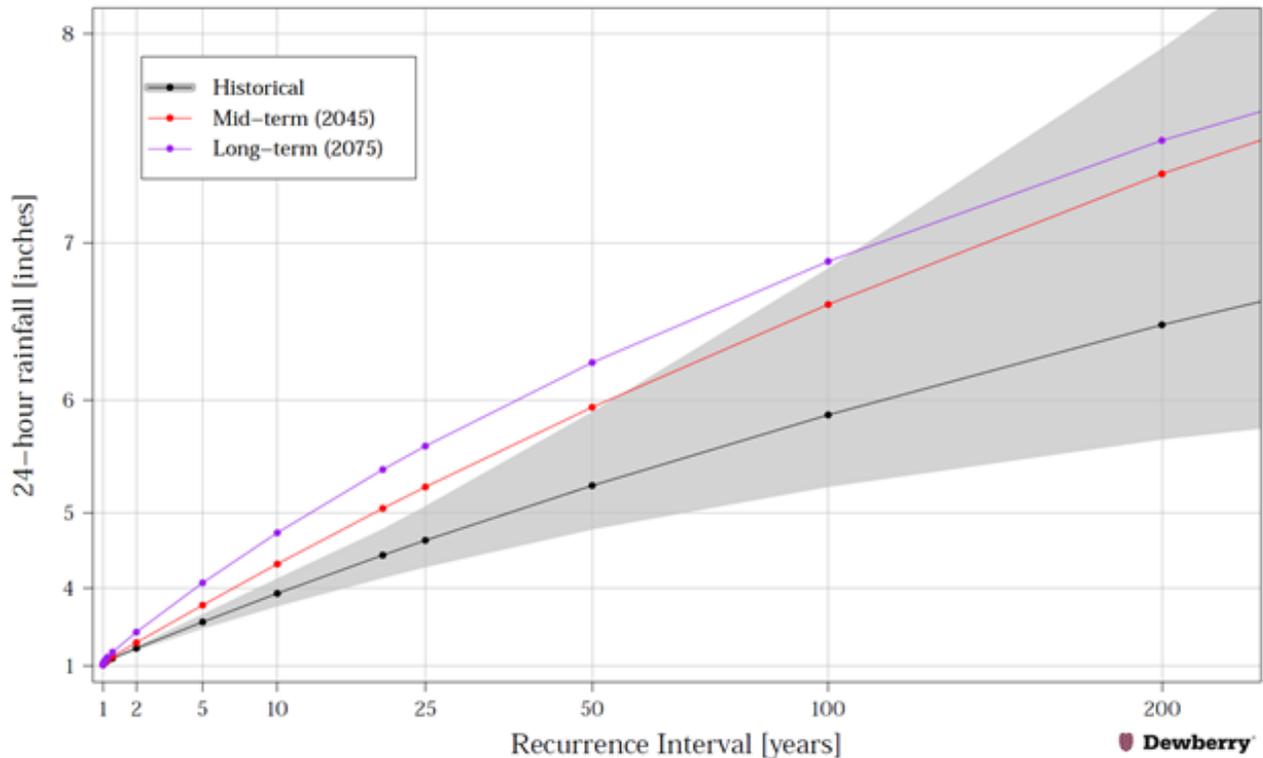
Clearwater’s stormwater system, which is wholly gravity-driven, is also already experiencing impacts as a result of nuisance flooding. Those impacts include frequent inflow of seawater via the system’s outfalls and the repeated attachment of barnacles to flooded pipes—a problem that substantially reduces outflow through those pipes and so requires near-constant maintenance.

3.2. Precipitation changes

By downscaling (i.e., deriving local estimates from) national and regional projected changes in precipitation, Dewberry identified clear likelihoods of heavier precipitation events in the near future (see Figure 8).

⁹⁰ *Id.* at 30.

Figure 8. Estimated annual 24-hour peak precipitation amounts for 1980–2009 (historical; black line with gray shading showing the error range), 2030–59 (mid-term outlook; red line), and 2060–89 (long-term outlook; purple line).

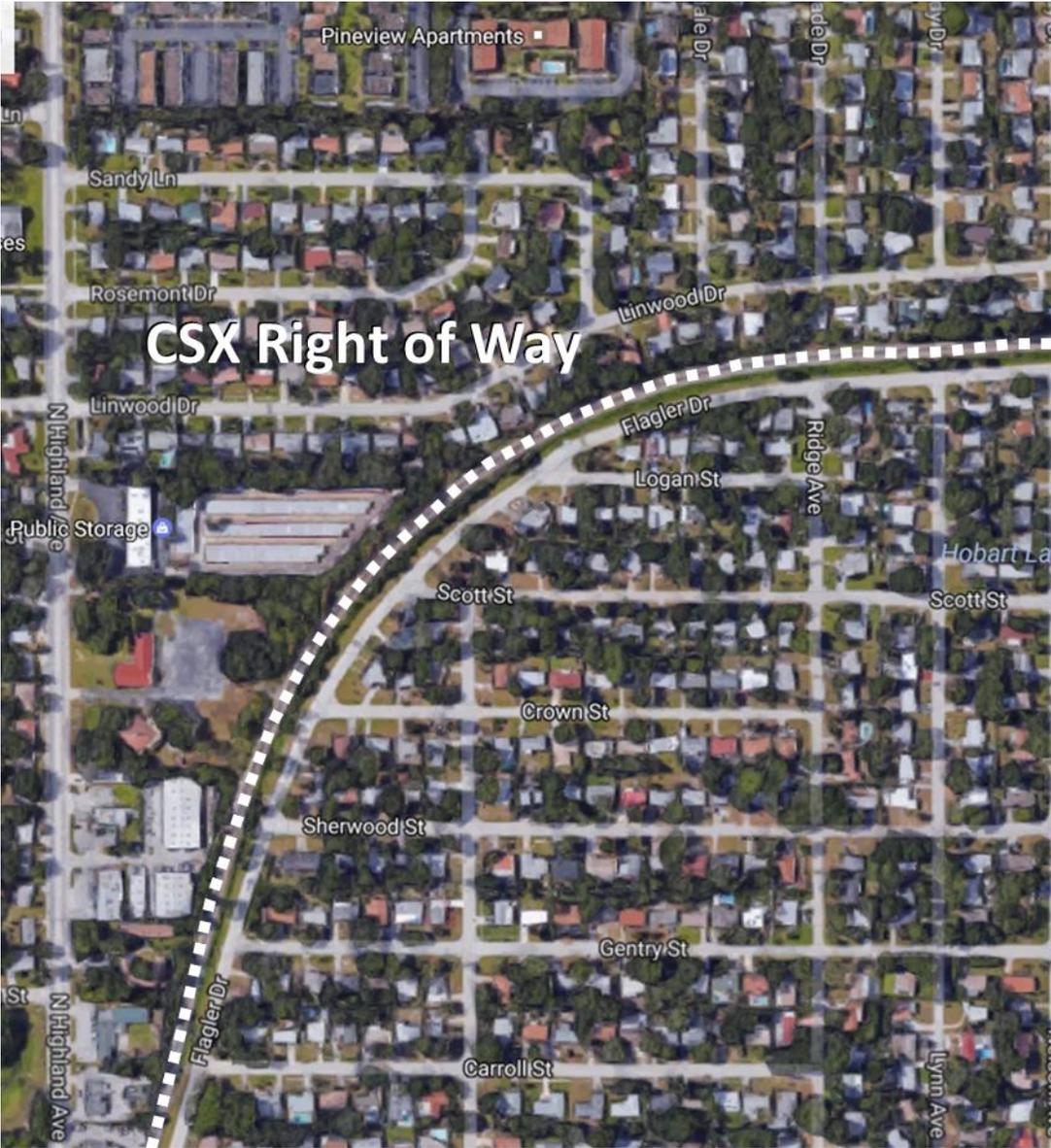


Increases in precipitation consistent with this projection would quickly exceed the current capacity of Clearwater’s stormwater system.⁹¹ This change in environmental circumstances would compound the flood-related system impairments noted above.

Greater rates of erosion can also be expected to result from more intense precipitation. Participants in the October 17, 2016 Preliminary Workshop noted that erosion is already a problem in particular areas owing to the lack of setbacks for residential properties and to CSX’s erosion-promoting practices of dumping railroad ties in Linwood and its aggressive use of herbicides on ground adjacent to its right of way. (See Figure 9.) In addition to restricting flow rates and requiring greater maintenance efforts, this erosion will also raise the risk of noncompliance with water quality regulations.

⁹¹ Clearwater Vulnerability Assessment at 42.

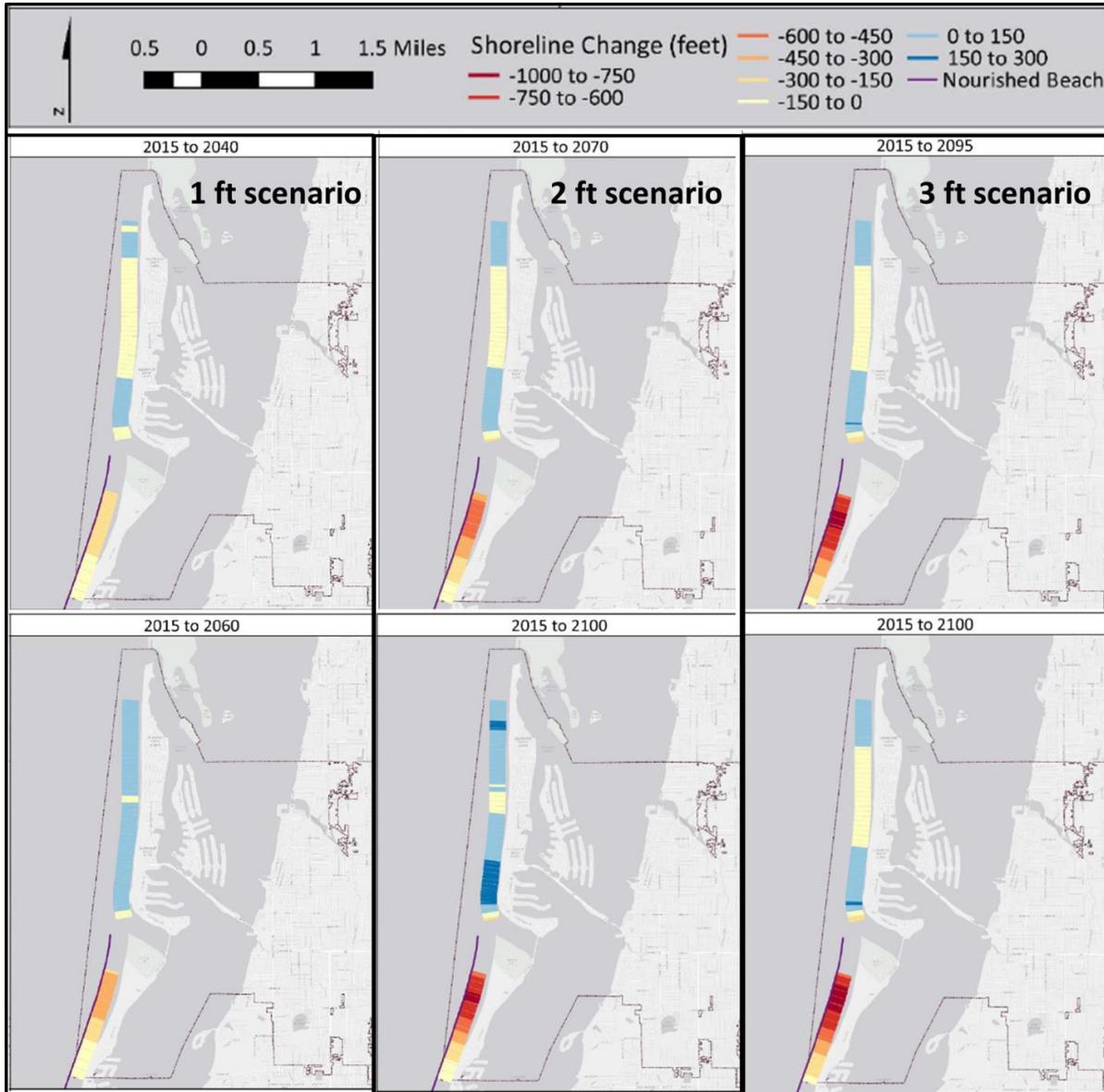
Figure 9. Segment of CSX railroad tracks that runs through Linwood.



3.3. Beachfront changes

Unless they are nourished with increasing frequency, beaches south of Clearwater Pass are expected to retreat steadily as SLR occurs. Dewberry’s modeling (see Figure 10 below) projects a loss of up to 150–300 feet by 2040, 300–450 feet by 2060, 450–600 feet by 2070, and as much as 1000 feet by 2100. Beaches north of the pass are expected to stabilize over the same timeframe.

Figure 10. Projected shoreline changes.⁹²



⁹² Clearwater Vulnerability Assessment at 34–36.

3.4. Groundwater changes

Dewberry’s review of relevant literature and data concluded that Clearwater’s freshwater aquifers are vulnerable to saltwater intrusion. However, in keeping with Clearwater’s instruction, Dewberry did not develop a more detailed picture of that vulnerability, but the Vulnerability Assessment noted both that Clearwater was “uniquely vulnerable” to such intrusion owing to its location and also that the City is currently engaged in the study of options for offsetting that intrusion through groundwater replenishment.⁹³

4. Local Context and Priorities

The development of plans for adaptation measures, and implementation of those plans, will necessarily occur in a context where technical and fiscal feasibility inform but do not determine decisions. Political, economic, social, and other considerations will likely play at least as great a role, if not greater. The STAPLEE framework summarized in part 1.4 above was devised to help communities take all of these various factors into account. This subsection notes features and circumstances that are specific to Clearwater and that give shape to the political, economic, and social features of any analysis of adaptation options in Clearwater.

Maintaining or even increasing shoreline development is an economic priority.

Clearwater’s Future Land Use element describes a “sub-tropical climate” and “buildable land” as the City’s “main natural resources,” and goes on to state that “[t]he economic base of the City is tourism, retirement income, retailing and services. These sectors of the economy need to be maintained and enhanced.”⁹⁴ A map of property values in Clearwater illustrates just how much the City’s beaches and the hotels, condominiums, vacation homes, and shoreline amenities support the City’s economy and tax base. The 2011 Clearwater Greenprint sustainability framework document puts it this way: “Clearwater’s economy and culture depend, in one way or another, upon the natural beauty and peaceful urban environment that attracts tourists, shoppers, residents, and businesses.”⁹⁵ Clearwater’s *Beach by Design* planning document, which makes no mention of SLR or flooding, further attests to this priority, as does Clearwater’s Coastal Management element Goal E.5, which provides that “[t]he preservation of economic activity within the coastal storm area is a priority for the city.”⁹⁶ In keeping with this general prioritization of beach-oriented economic activity and with the detailed components of *Beach by*

⁹³ *Id.* at 43.

⁹⁴ Clearwater Future Land Use Plan Element, at A-1, <https://perma.cc/D3XG-2BJU>; *see also id.* at A-18 (“Tourism is a substantial element of the City’s economic base and as such the City shall continue to support the maintenance and enhancement of this important economic sector.”).

⁹⁵ Renaissance Planning Group, Clearwater Greenprint: A Framework for a Competitive, Vibrant, Green Future (Dec. 2011), <https://perma.cc/4Q8P-ZD4H>; *see also.* Clearwater Coastal Management Plan Element, at E-9, <https://perma.cc/8DA8-2P2Q> (“Overall density shall be retained in Clearwater’s coastal storm area, except as otherwise permitted in the Future Land Use Element of the Comprehensive Plan.”).

⁹⁶ Clearwater Coastal Management Plan Element, at E-12, <https://perma.cc/8DA8-2P2Q>.

Design, several new resort hotels were recently completed or under construction in 2016 and approvals have been granted for various other projects that would further develop the coastline.

Foreseeable SLR is at odds with some bridges' design parameters. Road access to Clearwater and to its barrier islands relies on bridges. The state is responsible for the design and maintenance of some of those bridges (Memorial Causeway and Courtney Campbell Causeway; Route 580; and U.S. 19), the City for others (Clearwater Pass Bridge; and those linked to Island Estates). Expected SLR is incompatible with maintaining historical levels of service for several of these bridges, which were all designed without the expectation that sea levels would change. Raising the bridges to ensure that traffic passing over them is not impeded by floods and that passage under them remains available to boats of various sorts would require expanding the footprints of their approaches. This would in turn require acquiring private property and displacing its owners and their structures. Where the bridge is the responsibility of the state or county, it would also involve advocating for and coordinating implementation of redesign and reconstruction.

Few if any buffers separate development from the shoreline. Clearwater's shorelines are developed, and that development has left little if any buffer between structures and shorelines. Because hard armoring affords easiest access to the water for recreational and commercial purposes in non-beachfront areas, hard armoring is most residents' and businesses' preferred response to local shoreline erosion. Preliminary Workshop participants did not indicate whether any shoreline property owners had reported amplified rates of shoreline erosion owing to wave action displaced by this armoring.

Clearwater's planning area contains patches of Pinellas County. Roughly 15% of the area encompassed by Clearwater's service area contains patches of Pinellas County as well as the City of Clearwater. This complicates the tasks of planning and implementation, not least by making the City partly reliant on the county for enforcement activity whose absence chiefly affects the City rather than the county.

Budgeting. Several aspects of Clearwater's approach to budgeting deserve mention:

- Clearwater's project evaluation process often compares costs and benefits.
- Maintenance schedules are typically independent unless a conflict arises from other co-located infrastructure (e.g., a length of stormwater pipe that runs alongside electrical equipments under a roadway), whereas larger projects are reviewed by affected departments at various design stages.
- City utilities departments use "rate studies" to anticipate capital expenses and maintenance requirements over a 10-year time horizon. The first six years within the rate study planning period are then adopted into the City's Capital Improvement budget.

Flood insurance. National Flood Insurance Program (NFIP) policy holders in Clearwater frequently improve their homes in increments that narrowly avoid the City’s 50% non-cumulative limit on “substantial improvement,” and therefore any requirement that the homes be elevated. The City enjoys high NFIP Community Rating scores but its local ordinances and planning documents do not currently impose any freeboard requirement for structures in located flood zones.

5. Priority-Setting, Potential Responses, and Implementation

Previous sections have described basic goals for adaptation, categories of adaptation measures, legal considerations for Florida localities looking to implement such measures, vulnerabilities particular to Clearwater, and features of the Clearwater community and economy that will likely enable, inform, and constrain ambitions for local adaptation. This section discusses priority setting, then turns to potential responses to the vulnerabilities identified in section 3, keeping in mind the context discussed in section 4.

5.1. Priority-Setting

Successful adaptation planning builds on the best available relevant information, aims to maximize adaptation-related benefits without committing irreversibly to incurring large costs (“no- or low-regrets”), gets stakeholders involved, and keeps them informed. Practically speaking, what does this mean?

First, adaptation planning involves evaluating not only how much it would cost to install or undertake a particular measure, but also what options that measure would foreclose and how it compares to alternative means of providing some or all of the same benefits. Properly accounted for, the costs of a sea wall include not only the materials and labor involved in its installation, but also the costs of its future upkeep, the costs it imposes on adjacent properties, and the lost chance to make some other use of the shoreline and of the money spent on the sea wall. In short, any evaluation of an adaptation measure is incomplete unless it considers that measure’s relative cost-effectiveness for its purpose and whether the measure will raise or lower the cost of likely future options for development or adaptation.

In addition, adaptation planning involves identifying both potential responses to vulnerabilities and stakeholders that will be affected by those responses. The STAPLEE factors described in section 1.4 above should guide this step: Even if a given measure is unlikely to deprive anyone of economic value, will it nonetheless cut against a social tradition or preference? Even if a measure is likely to only affect a small handful of people or businesses, is it likely to generate extensive legal battles? Furthermore, even if a measure has the potential to be popular, such popularity is not guaranteed: planners might focus on identifying and evaluating an adaptation measure in terms of its aggregate costs, effects, legal viability, and administrative feasibility, but lose sight of the need to craft outreach and prepare responses to questions from stakeholders in order to assure its political popularity.

Balancing and organizing all relevant considerations is all much easier said than done, not least because the foregoing description assumes a linear progression of steps, rather than a nonlinear, sometimes redundant set of processes taking place at the same time. The inevitable complexity and messiness of identifying, analyzing, promoting, and implementing multiple adaptation measures while carrying on with other business favors an approach that brings adaptation efforts under a common analytical and political roof. Adaptation Action Areas (AAAs) lend themselves to this sort of administrative consolidation by providing a clearly delineated physical context and administrative and legal scope for whatever changes adaptation will entail.

5.2. Potential Responses

The following potential responses to vulnerabilities identified by Dewberry could be implemented independent of one another or in any number of combinations. In several instances, combinations would likely increase individual responses' effectiveness while reducing their cost.

5.2.1. Stormwater and wastewater management

SLR and intensifying precipitation will put more and more pressure on Clearwater's stormwater management system over the coming years and decades. Discussion in the Preliminary Workshop identified several issues facing the City's stormwater and wastewater managers, including issues related directly to changes in the climate. Climate-related issues include WRFs at risk of flooding, stormwater system components that cannot reliably prevent seawater inundation and that suffer corrosion and barnacle infestation as a result; and increasing amounts of erosion due to more intense storms. Non-climate related issues include the public's (lack of) understanding of system operation; erosion and trash impeding stormwater system intake; potential CSX misconduct that also impedes drainage function; regulatory priority being given to water quality protection as a result of the statewide consent decree relating to compliance with Total Maximum Daily Load (TMDL) thresholds for nutrients; budgeting that systematically compares the cost-effectiveness of ongoing maintenance with the redesign of vulnerable system components; the lack of affordable properties to acquire for service as reclaimed floodplain; and interactions with Pinellas County and the Southwest Florida Water Management District (SWFWMD).

Some of these issues can be addressed without a programmatic reassessment and changes. For instance, hardening WRFs against flooding can be done independent of system-wide analysis or changes, and reviewing the City's current stormwater manual and updating it to address SLR and related impacts—as Pinellas County recently did.⁹⁷ However, most of these issues lend

⁹⁷ Compare City of Clearwater, Stormwater Drainage Criteria Manual (July 1, 2015), <https://perma.cc/C3FC-EN7A>, with Pinellas County, Pinellas County Stormwater Manual (Feb. 2017), <https://perma.cc/CA5J-PHQA>; see also Pinellas County Florida, Planning, Stormwater Manual Under Development, <https://perma.cc/LC8W-ST3P> (accessed Apr. 14, 2017).

themselves to holistic rather than piecemeal address, especially because Clearwater can reasonably assume that environmental factors will drive the costs of maintaining and operating its wastewater and stormwater management systems higher and higher over the coming years. Taking a holistic approach would entail budgetary analysis, followed by programmatic changes. These steps, discussed below, would follow logically from a new Policy in Clearwater’s Capital Improvements Element under Objective I.1.2, “Management of Clearwater’s coastal storm area shall limit public expenditures to those necessary to serve existing and planned development.” That Policy could prescribe, for instance, that:

Maintenance or capital spending shall only be provided for the upkeep of infrastructure components repeatedly damaged, degraded, or routinely impaired as a result of SLR’s impacts, such as nuisance flooding, after considering alternative design standards and determining that design changes would not yield net savings over the useful life of the component or components.

The University of Florida Conservation Clinic offers two alternative approaches that are more straightforward and harder-hitting:

[Model] Policy 1.3.2: No capital improvements within the vulnerable area shall be financed or constructed without having first been reviewed to determine the extent to which the proposed improvement is sea-level rise-ready, taking into account the sea-level rise adaptation zone in which it is located, and whether it will contribute to additional development within the vulnerable area.

[Model] Policy 4.1.1: Within [the most vulnerable areas], the City/County shall eliminate new investment in public infrastructure likely to be subject to the impacts of sea level rise within the planning horizon.

Budgeting for adaptive measures could begin by characterizing the full scope of all costs and benefits attributable to system management, regardless of whether they count as a capital expense or variable cost, and regardless also of whether they currently appear in a wastewater or stormwater budget or under some other budgetary header. The timeframe for this scoping exercise should align with the expected useful life of system components. The next step would be to determine the budgetary baseline for business as usual, i.e., creating answers to two questions. First, how much will Clearwater have to spend on capital equipment and maintenance over the next 20, 30, or 50 years if it maintains the current system with no changes to design parameters or equipment specifications? And second, what would such maintenance likely deliver in terms of system performance? This baseline would draw on past budgets and would, ideally, designate instances or levels of spending that are attributable to SLR. Capturing all costs and benefits of system management, and identifying which of those costs can be expected to increase with SLR and intensified precipitation, would provide analytical support for the budgetary component of any adaptation proposal that involves substantial capital expenses—for

instance, the replacement of all existing pipes with lined pipes in areas subject to inundation by groundwater and nuisance flooding. Without access to a budgetary baseline, it would be harder to present such a proposal as a means either of saving money by eliminating maintenance costs and avoiding foreseeable failures, or of maintaining system performance at current levels of service amid SLR and more intense precipitation.

Programmatic changes discussed at the Preliminary Workshop include:

- Identification of areas where system upgrades, lining existing pipe segments, or development of green infrastructure,⁹⁸ would have a relatively short payback period;
- Widespread adoption of best management practices (BMPs) known to be effective, along with public outreach to explain the role of those BMPs in system performance and costs;
- Exploration of potential land acquisitions to use as restored floodplain, even if the land is somewhat developed;
- Identifying locations where setbacks within a property line would be especially valuable for stemming erosion into ditches and pipes relied upon for stormwater control;
- Coordinate with Pinellas County regarding compliance with the municipal stormwater runoff permit that governs Clearwater *and* enclaves of enclaves;
- Identify linkages between water quality obligations and stormwater management system performance and highlight those linkages in proposals for capital spending to upgrade stormwater system components, both to the City Council and to SWFWMD.

While it is not necessary to undertake these measures in combination, several of them could be mutually reinforcing. For instance, collaborating with Pinellas County and other localities to argue for SWFWMD project scoring changes would lay the groundwork for funding proposals that serve Clearwater’s and Pinellas’ goals for both water quality compliance and wastewater and stormwater management.

5.2.2. Flood insurance and freeboard requirements

Updated flood insurance rate maps (FIRMs) are expected to revise and expand the scope of FEMA-designated flood zones, causing more residents to become obligated to purchase insurance and to take on the restrictions that go along with an NFIP policy. Participants in the Preliminary Workshop noted that a draft amendment to the Coastal Management Element would

⁹⁸ For a description of green infrastructure (“GI”) or low impact development (“LID”), see HDR, US 19 Redevelopment Plan, Appendix B at 131–42, <https://perma.cc/PY69-V5AU>; *see also* City of Clearwater Engineering Department, Stormwater Drainage Criteria Manual 10 (July 2015), <https://perma.cc/58JB-ZPN5> (noting features and stormwater control and treatment applications of green infrastructure components).

require freeboard, and that there might be an appetite for changes to the City’s “substantial improvement” requirement that closes the loophole discussed above.

Participants also made clear that flood insurance policy is a political “third rail,” and that they expect adaptation efforts focused on it to generate resistance and objections rather than progress. Nonetheless, the City should seriously consider how it might make use of the impending FIRM revision and the prospect of future premium increases. The NFIP-related tools that would deliver the most effective (if not the most popular) adaptation planning results would be: (i) the use of Hazard Mitigation program funds to buy out properties in low-lying areas susceptible to repeated flooding, and (ii) the revision of substantial damage and improvement criteria so that they take into account cumulative events over five or ten years. The most likely vehicles for introducing such changes would be either the redevelopment component of the Coastal Management Element or an update to Clearwater’s or Pinellas County’s Post Disaster Recovery Plan.

5.2.3. Coastal management and development

As noted above, Clearwater’s residents, businesses, and leaders consider real estate development in vulnerable areas to be essential to Clearwater’s economic health. Thus it will be difficult—at best—to restrict hard armoring of shorelines, to impose shoreline buffers or setbacks, or to displace existing shoreline development for the sake of creating living shorelines. Preliminary Workshop participants suggested that, rather than prohibiting future hard armoring, permits for armoring could be made conditional: for example, permittees could be required to comply with freeboard requirements for structures on their property before installing or restoring hard armoring. Other options for making coastal properties more resilient and better adapted focus on information. Informational requirements are directly useful and can also be important first steps toward substantive resilience and adaptation. Consider these four examples:

1. The City could require that property purchasers and/or developers be given full information about the expected future levels of SLR, as projected in Dewberry’s Vulnerability Assessment, and the implications of SLR on utility rates and levels of service for infrastructure serving the property, as determined by the appropriate City departments.

2. The City might also require that any development or redevelopment be preceded by an environmental impact analysis (i) the time horizon for which aligns with the expected life of the new structures or facilities, and (ii) that evaluates relevant impacts arising from the SLR projections in Dewberry’s Vulnerability Assessment.

3. Rather than imposing requirements on private property owners or developers, the City could conduct a review of the sufficiency of existing shoreline stabilization measures vis-à-vis the SLR projections in Dewberry’s Vulnerability Assessment. The University of Florida Conservation Clinic has drafted model language that would provide for such a review:

[Model] Policy 2.1.2: Based on projected rates of sea level rise within the sea-level rise planning horizon the City shall inventory all existing shoreline stabilization structures and determine their capacity to maintain functionality throughout the SLR planning horizon.⁹⁹

4. If the sort of review suggested in #3 seems politically feasible and likely to provide the City and individual property owners and developers with useful information, the City might consider a similar but more extensive review of planned and existing infrastructure and development or redevelopment proximate to shorelines. Here again, the University of Florida Conservation Clinic's model language could be useful:

[Model] Policy 1.3.1: The City/County shall inventory all existing and planned infrastructure and land development within the vulnerable area for its capacity to accommodate projected sea-level rise over the life expectancy of the infrastructure and development.¹⁰⁰

5.2.4. Roads and bridges

Preliminary Workshop participants described how road maintenance schedules have had to change in response to road degradation owing to inundation of utility channels under roadways as well as nuisance flooding. They also described that the vulnerabilities identified by Dewberry in relation to local bridges would persist because those bridges have been or are slated to be maintained and/or rebuilt without any design changes, chiefly to avoid expanding their approaches. Though these problems are different, they can both be addressed by a similar response, namely an ordinance or Capital Improvements Element revision along the lines prescribed by Ruppert et al. for circumstances where road and bridge maintenance at a prescribed level of service becomes prohibitively expensive.¹⁰¹ That model language specifies gradations in level of service and provides notice regarding a locality's response to degradation or repeated impassability in a way that protects against accusations that the locality has informally but effectively abandoned a segment of infrastructure. Combining such language with an AAA, whose boundaries effectively announce the scope of expected SLR impacts in the foreseeable future, would provide the public with notice not only of changes to road service or maintenance but also of potential changes to land use options and infrastructure availability in the medium- and longer term. This notice would play a salutary role in any lawsuit (not just one focused on vehicle access) brought over an alleged regulatory taking in the vicinity of roads and bridges that Clearwater has identified as subject to reduced maintenance schedules.

5.2.5. Disaster recovery

⁹⁹ Macangdang & Newmons, *supra* note 56.

¹⁰⁰ *Id.*

¹⁰¹ Ruppert et al., *supra* note 81.

Enduring a natural disaster may be bad, but failing to learn from one is worse. Natural disasters play a vital role in adaptation efforts: they signal the nature and potential dangers of future events, and they create a moment of decision for communities about whether and how to reconstitute what existed before disaster struck. For these reasons, and because including a disaster-trigger in a land use restriction can shield that restriction from takings claims,¹⁰² disasters and post-disaster recovery feature prominently in adaptation literature. Recommendations for how to employ disaster scenarios (chiefly, coastal storms with accompanying flooding) in adaptation planning tend to include:

- Restrict rebuilding of structures damaged by flooding that would be vulnerable to SLR or to future flooding, whether by simply prohibiting redevelopment, imposing design requirements, or imposing setbacks on affected properties;¹⁰³
- Condition rebuilding on a prohibition against shoreline armoring, thereby ensuring that the land, even if developed, will act as a buffer in the next storm;¹⁰⁴
- Encourage dedication of conservation easements or pursue public acquisition of property repeatedly struck by floods or affected by SLR-driven flooding.¹⁰⁵

As noted in section 4, Clearwater’s physical, political, economic, and social circumstances appear to preclude any planning language or ordinance that either requires the owners of coastal property to move, or directly reduces the resale value of their properties. However, these limitations do not prevent Clearwater from employing measures that impose post-disaster redevelopment requirements relating to structural design, setback, and/or armoring.

In areas vulnerable to SLR and storm events that may not house the likely political resistance of the barrier islands (such as the Japanese Gardens mobile home park) Clearwater could use a similar approach, but one that aims not at shaping redevelopment so much as prohibiting it. The University of Florida Conservation Clinic’s model language—with some modifications—could be useful for this purpose:

[Model] Policy 4.2.2. All permits for new development within a Managed Relocation Zone shall include, as a condition of development approval, a covenant or other real property instrument that runs with the land, that requires the abandonment and removal of structures and fixtures once they are inundated

¹⁰² See *Esposito v. S.C. Coastal Council*, 939 F.2d 165, 170 (4th Cir. 1991) (rejecting argument that statutory restrictions on post-disaster coastal redevelopment amounted to an unlawful taking), *cert. denied* 505 U.S. 1219 (1992)

¹⁰³ See *Siders*, *supra* note 59, at 85–86.

¹⁰⁴ *Id.*

¹⁰⁵ See Georgetown Adaptation Tool Kit, *supra* note 23, at 31–33.

for at least [___] months per year, or are no longer habitable as determined by the building official, whichever comes first.¹⁰⁶

Whether the ultimate stated aim is to harden redevelopment to SLR and future disasters or to prevent redevelopment in order to avoid SLR impacts and the danger of future disasters, restrictions like these have the salutary effect of giving notice to residents and businesses of the City's expectation that present circumstances will change. Informing the public in this way builds understanding of the need for adaptation, illustrates the City's approach to it, and does so in a way that would support a legal defense should any landowner argue to a court that a land use regulation "inordinately burdens" private use of a parcel of private property.

One way to arrive at measures like these would be to revisit both Clearwater and Pinellas County's Post-Disaster Redevelopment Plans (PDRP), and to update Clearwater's based on the data and analysis in Dewberry's Vulnerability Assessment.

5.3. Implementation

The potential responses discussed above include revisions to elements of the City's Comprehensive Plan (Goals and Objectives, as well as Policies), new ordinances, new approaches to budgeting, and new permitting requirements, among other things. They do not include specific projects, such as the floodproofing of a WRF, acquisition of specific parcels for restoration of floodplains, or the creation of living shorelines. Deriving projects like these from the recommendations in subsection 5.2 above would require further steps, including the assessment of the particular risks and costs attributable to a particular vulnerability, as well as the benefits of available responses, followed by examination of how different responses might aid or conflict with other policy goals or existing capital investment plans.

The following description is an illustrative example of steps involved in implementation of the living shoreline policy goal:

Clearwater could seek immediate funding for a study of sea walls and a survey of the coastal property owners that maintain and rely on them. This would inform the City about (1) sea walls' age, maintenance status, cost of upkeep, and viability in light of SLR projections; (2) property owners' expectations for their sea walls' longevity and cost of upkeep, and their willingness to replace a sea wall with a living shoreline; and (3) property owners' willingness to dedicate some or all of their property as a conservation easement. This study would inform decisions about several possible projects. It would reveal locations where installation of a living shoreline might be financially and practically viable. It would also indicate whether the City should impose new permit restrictions, impact fees, or some other measure related to the installation or modification of sea walls. And, by indicating how well coastal property owners understand the likely future costs of maintaining their properties' coastal armoring, it would

¹⁰⁶ Macangdang & Newmons, *supra* note 56.

highlight opportunities for public education to correct any unreasonable expectations that property owners might have about the future of their sea walls and property values.

Conclusion

This Adaptation Plan serves several purposes. It describes key features of the policy and legal frameworks that underlie adaptation efforts in Florida. Drawing on Dewberry’s Vulnerability Assessment and the discussion with City staff at the October 17, 2016 Preliminary Workshop, it provides an overview of vulnerabilities and circumstances relevant to any effort to address those vulnerabilities. Finally, in addition to these descriptions, it provides suggestions for potential use by decision makers seeking to develop and implement adaptation measures. Those suggestions draw on inputs from Clearwater, and on local and statewide efforts in Florida to identify opportunities to apply legal and policy tools to adaptation goals.

Appendices:

A. Methodology, Lessons Learned, & Recommendations

B. Preliminary Workshop Summary

Appendix A: Methodology, Lessons Learned, & Recommendations

This appendix contains three sections related to Task 2 of the pilot phase of the Community Resiliency Initiative, performed by the Sabin Center for Climate Change Law at Columbia Law School (“Sabin Center”). The first section describes the Sabin Center’s methodology for developing an Adaptation Plan for the City of Clearwater. The second section describes lessons learned in the course of carrying out Task 2. The third section sets forth recommendations for the Florida Department of Economic Opportunity (“DEO”) as it decides whether and how to shift from the pilot phase to fuller implementation of the Community Resiliency Initiative.

1. Methodology

While Dewberry Consultants LLC (“Dewberry”) conducted Task 1, the Sabin Center conducted preliminary research into adaptation law and policy generally, adaptation law and policy as implemented by Florida localities, and Florida law related to comprehensive planning, climate change adaptation, takings, and municipal liability.

In advance of the October 2016 Preliminary Workshop, the Sabin Center reviewed Dewberry’s Vulnerability Assessment for Clearwater, as well as Clearwater’s comprehensive plan elements and various reports and documents that described its economic profile and recent hazard mitigation and/or disaster recovery efforts. This review informed the presentation the Sabin Center developed for the Preliminary Workshop, as well as its structuring of the discussion conducted at that Workshop.

The Sabin Center’s presentation to Preliminary Workshop participants, which covered adaptation policy and relevant areas of Florida law, provided the basis for a facilitated discussion of potential responses to the vulnerabilities identified by Dewberry’s Vulnerability Assessment and described in further detail by participants.

Following the Preliminary Workshop, the Sabin Center provided a summary document to participants (attached as Appendix B to the Adaptation Plan) and conducted further research into areas that local officials at the Preliminary Workshop and in subsequent communication characterized as pressing or especially important for Clearwater. This research examined the academic literature and federal, state, and local governmental agency reports for discussions of those areas of consideration. It sought in particular to locate descriptions of how other jurisdictions had dealt with similar circumstances and issues. Using the original research and analysis conducted in advance of the Preliminary Workshop, details and insights collected from local officials during the Preliminary Workshop, and the articles and reports located through supplemental research, the Sabin Center developed Clearwater’s draft Adaptation Plan and sought local officials’ feedback on that Plan.

On receipt of clarifications and requests from Clearwater officials in response to the draft, the Sabin Center sought further information about the city’s budgeting and project planning

processes. Integrating that information into a revised version of the report corrected minor misstatements and clarified the meaning of several recommendations.

2. Lessons Learned

The following observations and insights are based on the experience of gathering information about and developing an Adaptation Plan for Clearwater. They could be useful for future adaptation planning efforts by other Florida localities and/or DEO.

Coordination among project team members. Project team members from DEO, Dewberry, and the Sabin Center each had distinct perspectives and unique resources available to them. Coordination among team members with legal, engineering, and policy expertise is important for aligning approaches so as to achieve the project's overarching goals.

Scoping. The scope of issues relevant to a locality's options and goals for adaptation can be extremely wide. Similarly, it is possible to delve in great depth into particular issues—whether they are programmatic, procedural, legal, engineering, or other. The Adaptation Plan reflects an iterative process, which began with a kickoff call, continued with the Preliminary Workshop and follow-up documentation of that Workshop's discussion, and wrapped up after integrating feedback from Clearwater into the draft Adaptation Plan. However, given the breadth and depth of possible approaches to adaptation, additional iterative steps might have been helpful to refine the scope of the Adaptation Plan. Additional iterative steps in subsequent efforts should include: two questionnaires, one sent before the Workshop to ask participants about their goals and expectations for the Workshop and the project as a whole, and another sent after the Workshop to ask participants about how they and/or their departments would like to make use of the Adaptation Plan.

This process educated local officials about adaptation policy generally. Clearwater officials brought varying levels of familiarity with adaptation policy frameworks and approaches to their participation in Task 2. The Preliminary Workshop provided an opportunity to establish a common understanding of adaptation policy, and for officials to hear from their colleagues about how those policy options might apply to different aspects of city operations and planning.

Florida law relating to adaptation requires explanation. Clearwater officials were appreciative of the points presented in the Preliminary Workshop about how key provisions of Florida law encourage and support adaptation. That presentation highlighted in particular ways that local governments can draw on state law provisions to support new policies in formal ways and also in less formal ways, i.e., by explaining a policy decision as being consistent with state law.

Gathering information. Plan elements, ordinances, and some locality-specific reports were publically available. However, details about important features of Clearwater's adaptation profile and political and regulatory decision making processes could only be gathered from local

officials. While the Preliminary Workshop served as a good means of identifying and collecting much of that information, future adaptation planning efforts would be aided by the collection of a standard set of documents relating to:

- Key features of the budgeting process, and in particular the budgeting procedures followed by city departments responsible for utilities such as stormwater and wastewater;
- Clearwater's recent experiences with federally-funded disaster planning, mitigation, and recovery; and
- Examples of adaptation planning reports or materials developed by other localities that Clearwater officials have found to be informative and/or worth imitating in part or as a whole.

Framing the nature of adaptation planning. Some local officials seemed to understand the task of adaptation planning as a temporary intervention in the normal course of business, rather than the first instance of an approach to land use and capital investment planning that would involve permanent changes relative to past practice. As discussed in the Adaptation Plan, the most basic and important aspect of adaptation is to recognize that the coastlines and climate of the future will not only depart from those of the past but will continue to change—and so will require coastal localities to adapt continuously. This point should be conveyed early in the process and reinforced at each stage. Doing so will help participants to make the best possible use of the time with and access to experts, chiefly by shaping the Vulnerability Assessment and Adaptation Plan generated in the course of the project to be maximally useful for Clearwater.

Concerns about implementation. Clearwater officials expressed concern about how to justify adaptation measures to senior officials, local political leaders, and the public. The Adaptation Plan's suggestions about construing budgetary baselines that indicate the expected costs of inaction can address this concern to some extent. However, because the underlying problem is a lack of understanding among the public about the inevitable costs of adapting to sea level rise, the best solutions will be those that improve public understanding not only of the problem but of the forms that adaptation to it will likely take. Clearwater's leaders can shoulder some part of this public education, but state officials are in an even better position to do so.

3. Recommendations for DEO

Localities are well positioned to identify the vulnerabilities to which adaptation is necessary. They are also uniquely well-informed about how best to set priorities for addressing those vulnerabilities. However, leadership from a statewide authority like DEO, the Department of Environmental Protection, or the Department of Transportation is critical to the success of adaptation to sea level rise in Florida. Statewide leadership can facilitate coordinated and potentially synergistic efforts among multiple localities. It can take pressure off of local officials who might otherwise face insurmountable political hurdles. And it can help make useful information, expertise, and funding accessible to those in need of it in a way that individual

Appendix A: Methodology, Lessons Learned & Recommendations

localities generally cannot do. This leadership role is even more critical now, as the federal government agencies that have served these centralizing roles to date are being directed away from further engagement. Consistent with these essential objectives, DEO should:

- Create an online database that shares the experiences of Florida localities already engaged in adaptation planning and implementation. In contrast to databases maintained by the Georgetown Climate Center and the Climate Adaptation Knowledge Exchange,¹⁰⁷ a Florida-specific database would provide Florida localities with a manageable volume of resources, all of which reflect efforts to contend with similar challenges in the same legal and policy context. DEO might consider collaborating with the Southeast Florida Regional Climate Compact in this effort, as the Compact has already established a database of this sort.¹⁰⁸
- Create a web portal that makes available technical information such as building codes, stormwater and wastewater equipment specifications, and disaster mitigation plans that have been shown to be especially effective in the face of rising seas and strengthening storms. Locating resources (or even just links to resources) like these in one place in an organized way would facilitate not just access but also comparisons of technical approaches across jurisdictions.

¹⁰⁷ Climate Adaptation Knowledge Exchange, <http://www.cakex.org/>; Georgetown Climate Center, State and Local Adaptation Plans, <http://www.georgetownclimate.org/adaptation/plans.html>.

¹⁰⁸ Southeast Florida Regional Climate Change Compact, RCAP Database, <http://rcap.southeastfloridaclimatecompact.org/>.

Appendix B: Preliminary Workshop Summary

Coastal Resiliency Initiative, Preliminary Workshop Clearwater, Florida | October 17, 2016

Summary

The Preliminary Workshop conducted on October 17, 2016 served several interwoven objectives, including:

1. Developing a common framework for understanding physical and policy options for adapting to sea level rise (SLR);
2. Clarifying political and regulatory circumstances relevant to adaptation efforts;
3. Characterizing particular adaptation issues in terms of their urgency, scale (physical and budgetary), relevance to particular constituencies, and ease or difficulty of address;
4. Identifying types of strategies—and in some instances, specific strategies—suitable for addressing particular adaptation issues.

This summary organizes items covered during the Workshop in terms of those four objectives. It also notes several preliminary decisions taken, based in part on discussion of those items.

Framework for policy options

Responses to vulnerabilities resulting from SLR involves either (1) protecting current land uses and patterns of activity in vulnerable areas (protect), (2) reducing vulnerabilities by modifying those uses and patterns (accommodate), or steering clear of vulnerabilities by (3) moving existing people and structures (retreat) or (4) deciding against development (avoid). Implementing these approaches cost-effectively involves steering private decisions, as well as grounding decisions about the location and design of infrastructure in the best available information about future circumstances—topography, weather, and fiscal constraints, among others. Imposing restrictions on development can create legal risk for a locality. So too can the use of infrastructure funding to encourage accommodation, avoidance, or retreat from vulnerable locations. However, legal risks will increasingly also attend failures to do so.

Relevant circumstances: political and regulatory

Any plans for adaptation measures, and any implementation of those plans, will necessarily occur in a political and regulatory context. Workshop participants noted the following features of that context:

- Political:
 - likely intransigence from hotel and condo owners, especially on the barrier island, to restrictions on current development;
 - optics and messaging challenges owing to climate change skepticism;
 - doubts about flood insurance's prudence;
 - general preference for hard protective measures over alternatives;

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- Regulatory:
 - State agencies will generally defer to localities’ adoption of adaptation-oriented provisions in disaster recovery, development, and re-development planning elements;
 - current comprehensive plan sunsets in 2018;
 - patchwork jurisdiction with Pinellas County (85% is Clearwater; 15% Pinellas) means collaboration is necessary for enforcement, programmatic changes, and sometimes grant requests in stormwater management and water quality contexts;
 - cost-benefit analysis sometimes but not always required for project evaluation;
 - projects and maintenance efforts that affect one another, and whose effects are heightened in a context of more frequent flooding, are often not coordinated;
 - maintenance budgets respond in somewhat ad hoc fashion to changes owing to sea level rise;
 - TMDLs developed pursuant to statewide consent decree give control plan development and implementation priority;
 - “substantial improvement” criteria in flood zones currently provides a loophole for avoiding code compliance;
 - high Community Rating scores but currently no freeboard requirement for structures in flood zones.

Adaptation issues and responsive strategies

The Workshop’s “structured discussion” segments considered adaptation issues and responsive strategies. The issue areas covered were: stormwater management, wastewater management, flood insurance and freeboard requirements, disaster recovery, roads and bridges, coastal management, and justifications for adaptation measures to the City Council and the public. Participants did not discuss revenues at length because—it was agreed early on—any discussion of how to pay for particular measures would come after specification and prioritization of those measures and would not be likely to prevent implementation. The following table, which is organized by issue area, lists key points from the participants’ discussion. It is not an exhaustive record of that discussion. The arrows in the right column indicate that the paragraph relates to the issue at left.

<i>Issue area</i>	<i>Issues identified</i>	<i>Responsive strategies discussed</i>
Stormwater management	- Nuisance flooding is already straining the capacity of the current system, which is gravity-driven, and is expected to become more frequent and severe	➔ Flood plain restoration (past instance entailed buyout of mobile home park; few obvious places to repeat this solution), installation of catchment ponds and labyrinth weir, use of sports fields as overflow basin; Greater use of green infrastructure (including pervious pavements and retention basins) to reduce inflow volumes

Appendix B: Preliminary Workshop Summary

<p>Stormwater management (continued)</p>	<ul style="list-style-type: none"> - Noncompliance by residents of Pinellas County patches with stormwater-related restrictions - Lack of setbacks in residential areas promotes erosion into system, which in turn requires more maintenance effort - Trash in grates, traps impedes flow - Constant inundation of some pipes supports growth barnacles, which reduce flow unless cleared out (again, higher maintenance effort) - CSX rail ties (left to fall into adjacent ditches) and vegetation control regime both promote erosion and impede flow - Consent decree-driven TMDLs for bacteria, nitrogen, require address 	<ul style="list-style-type: none"> ➔ Greater coordination with Pinellas re implementation of MS4 permit ➔ Berms, buffers and other BMPs have reduced erosion ➔ Inform public of linkage between litter and flooding ➔ Re-engineer and/or line pipes; budgeting for more maintenance ➔ Gather evidence of CSX conduct, approach CSX informally to warn that legal challenge could follow ➔ Growing flood risk will bring water quality issues closer to stormwater management issues; projects to deal with one should consider implications for the other
<p>Flood insurance and freeboard</p>	<ul style="list-style-type: none"> - Many homeowners whose homes are in flood plains don't hold insurance - Update to current flood insurance rate map, due out sometime in 2017, is expected to put more structures in flood zones - Currently, no freeboard requirement - "Substantial improvement" provisions of local floodplain management ordinance currently allow for building owners to 	<ul style="list-style-type: none"> ➔ Participants agreed that this topic is a "third rail" to be avoided if possible ➔ By changing the appropriate scope for the Community Rating Area, this change might prompt discussion about either flood insurance or additional measures aimed at maintaining/raising Clearwater's CRA rating ➔ Update to coastal management planning element includes a proposed freeboard requirement ➔ This issue is complex and its address will require thorough and persuasive justification. Participants discussed several options, including an audit of permits to identify egregious instances

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Flood insurance and freeboard (continued)	<p>make improvements without bringing their buildings up to code</p> <ul style="list-style-type: none"> - “Substantial damage” provision of local floodplain ordinance does not currently treat repeat losses cumulatively 	<p>of putting assets in highly vulnerable areas</p>
Coastal management	<ul style="list-style-type: none"> - Residents and commercial property owners generally rely on hard armoring and current restrictions limit sea wall heights 	<p>➔ Participants agreed that it would be difficult to persuade anyone to replace sea walls with living shorelines, especially mangroves; any such replacement would likely go forward in a large area rather than parcel-by-parcel; Conservation easements could facilitate a transition from hard armoring</p>
Wastewater management	<ul style="list-style-type: none"> - Rising groundwater levels cause infiltration of wastewater system, sometimes overwhelming it - TMDLs for bacteria 	<p>➔ Line pipes; Install green infrastructure to reduce stormwater’s contribution to the problem</p> <p>➔ The need to comply with TMDLs in Clearwater and neighboring localities presents an opportunity to approach SWFWMD as a group to suggest revised criteria for project funding—specifically, integration of scoring for flood protection and water quality factors</p>
Roads, bridges	<ul style="list-style-type: none"> - Four bridges are being rebuilt to old specifications, in part because raising them or expanding their capacity would have required acquiring larger footprints for ramps - Potholes are becoming a more frequent problem due to the effects of regular inundation and the positioning of other utilities under/beside roads 	<p>➔ Expanding ferry service could preempt arguments against planned neglect or demolition of bridges that are regularly made impassible by nuisance flooding or storm events</p> <p>➔ Coordinating maintenance schedules and integrating considerations that inform the location of stormwater, wastewater, electric, and road system components could reduce maintenance costs for all four systems</p>
Disaster recovery	<ul style="list-style-type: none"> - SB 1094 requires adoption of redevelopment component in coastal management plan 	<p>➔ This requirement presents an opportunity for Clearwater to designate locations, developments, or</p>

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	<p>element; it also authorizes localities to adopt long-term time horizons for all manner of planning decisions</p>	<p>projects as subject to redevelopment restrictions, and to conform those restrictions to expectations about the future viability of various uses</p>
<p>Disaster recovery (continued)</p>	<ul style="list-style-type: none"> - Old EOC was in a flood plain; new EOC (Sheriff’s office) is also in a flood plain - Many beachfront structures are single-story structures built on slabs; mobile home parks are situated in areas identified as extremely vulnerable to flooding (nuisance and storm-related) 	<ul style="list-style-type: none"> ➔ Identify a better EOC location based in part on Dewberry’s vulnerability assessment and announce / characterize decision to move EOC in terms of flood hazard mitigation ➔ Participants discussed possibility of presenting strict redevelopment limits as a bet—“if you win, none of this will happen and the restrictions won’t matter; if you lose, then down-zoning is appropriate”
<p>Justifying adaptation measures</p>	<ul style="list-style-type: none"> - Skepticism and expense will breed resistance to projects aimed at adaptation - Current approaches to maintenance budgets do not capture costs due to SLR 	<p>(see below)</p> <ul style="list-style-type: none"> ➔ Capture past, current, and prospective costs of nuisance flooding, inundation (e.g., barnacle clean-outs), etc. This will document the reality of SLR-driven costs and will also provide a baseline for future decisions—“if we don’t change how we do X, we can expect to incur \$Y in costs annually.” Develop budgets that estimate project costs in terms of not only their benefits but also costs that they avoid, i.e. their cost-effectiveness relative to alternatives

Decisions

- Should the work product submitted to Clearwater be a free-standing document that identifies and analyzes a range of adaptation options? or should it be broken into components intended for specific uses in some planning Elements but not others?
Preliminary answer: freestanding document.
- How should priorities be set for choosing among adaptation strategies?
Preliminary answer: selection criteria include feasibility, salience for the public, urgency, cost.
- What adaptation issues, options and strategies should take priority?

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Preliminary answer: stormwater management and disaster recovery restrictions on (re)development.

- Are legislative changes necessary to enable or support preferred strategies?

Preliminary answer: Legislative approval from the City Council will be necessary to implement some but not all strategies. No new state-level legislation seems to be required.