Planning for Sea Level Rise in the Matanzas Basin

Appendix H1:

Integrated Adaptation Framework and Toolbox

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I. Contents

II. Introduction

This paper forms part of a larger research and engagement project for adaptation to sea-level rise around the Matanzas Basin and the Guana Tolomato Matanzas National Estuarine Research Reserve in northeastern Florida. The paper gives an introduction to the area before it characterizes some important types of tools for the area to adapt to sea-level rise while seeking to maintain many of the assets of the area. Next, the paper presents a conceptual framework for assessing areas for the most relevant types of policies likely applicable in that area and then loosely applies this conceptual framework in the study area. The paper concludes with a segment on the importance of integrating policies to promote the goals the communities involved wish to pursue in adaptation.

III.

While there is sometimes significant overlap in the adaptation options recommended here as a focus in various areas, this approach allows for more detailed treatment of the advantages and drawbacks of strategies as well as consideration of the potential interactions—positive and negative—of adaptation options. This paper also presents a conceptual model based on a model by Deyle and Butler.[1] This conceptual model is then loosely applied to general regions of the study area to help guide consideration of which types of adaptation policies might typically be most appropriate in the area. However, this conceptual model is only a guide; unique circumstances, history, politics, environments or other considerations may indicate consideration of policies outside of those initially resulting from consideration of the framework.

IV. Overview of the Matanzas Basin

The Matanzas Basin and the Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) focus around the Matanzas River, which separates barrier islands from the mainland. Many parts of these barrier islands are small spits of sand occupied by single-family residential homes, as well as low- and mid-rise hotels. The Matanzas Basin contains large tracts of undeveloped land, much of which is in salt marsh, tidal flats, and other low-lying topography very vulnerable to inundation by even modest amounts of sea-level rise. Large amounts of the most vulnerable land are already in conservation areas, state forests, and parks. In addition, there are freshwater prairie and pine plantations. The area also contains some urban areas, including St. Augustine, a town founded in 1565. In distinction to the age of St. Augustine, the southern end of the area is home to Palm Coast, which began development in 1969. The towns of Marineland and Flagler Beach occupy coastal locations between St. Augustine and Palm Coast. The small town of Vilano Beach is just north of St. Augustine.

Even with these urbanized areas, the overall character of the region is much less densely developed than most portions of the coast on other parts of Florida's peninsula with beaches. This, and the large amount of land already in parks and conservation areas makes the region

[1] Robert E. Deyle and William H. Butler, Resilience Planning in the Face of Uncertainty: Adapting to Climate Change Effects on Coastal Hazards, in Disaster Resiliency: Interdisciplinary Perspectives. Pp. 178-203 (2013).

largely unique. A countervailing problem is that even with more open area, the region's flat topography means that there are few places to which to move that are significantly safer from hazards like erosion, inundation, storm surge, and flooding.

St. Augustine possesses strong identity of place. Its diverse cultural history and the preservation of that history in the town's design and architecture contribute to making St. Augustine a renowned tourist destination as well as a coveted place to live. In fact, the tourist draw forms the lifeblood of St. Augustine, with 6.2 million visitors a year generating $42 million in sales tax revenue in 2008.

With all these benefits, St. Augustine was also sited near the Atlantic Ocean and in between two tidally influence rivers at elevations that range from just over three feet to about six and one-half feet. Even now, rain storms frequently cause minor flooding in some historic sections of St. Augustine. Hurricanes have on several occasions overtopped the sea wall that protects St. Augustine from the Atlantic Ocean to the east.

Despite these challenges that already exist for St. Augustine, it is expected that due to the unique history of the town, all possible efforts will be made to protect St. Augustine from losses to SLR and associated hazards of storm surge and flooding. In fact, St. Augustine has already begun to try to better protect itself from flooding and storm surge through improvements to its drainage system and increasing the height of its sea wall.

Even though new or rebuilt development must now be elevated above the base-flood elevation as determined by the Federal Emergency Management Agency, the city's many historic structures are exempted from this requirement, making them even more susceptible to flooding.

A significant challenge already for St. Augustine is ownership of more than half of its property by government, religious, and educational institutions. While these bring their own value to the area, they do not pay property tax, which forms a critical source of funding for local governments in Florida. One way to address this issue is to increase local government reliance on fees and assessments for infrastructure, from which government, religious, and educational institutions are not exempt.

V. Overview of Adaptation Options

The attached MS Excel spreadsheet contains information on a number of adaptation options from an extensive list of reviewed literature sources on SLR adaptation strategies. While the spreadsheet has the strength of including many different adaptation strategies, the presentation is rather overwhelming. To make the information more relevant and accessible for use in the project Planning for Sea Level Rise in the Matanzas Basin, the following divides adaptation tools into a number of different headings and gives some narrative background that places these tools in context and helps make clearer some of the inter-relationships between different adaptation tools.

Often people and communities assume that "protection" or "armoring" will be the primary, if not only, adaptation option pursued.[2] More pragmatic thinking that incorporates costs and legal issues calls into question such an easy assumption. Consideration of all the costs makes it appear likely that strong protection, including sea walls, repeated nourishment, and significant infrastructure changes/improvements, will need to be limited in geographic scope. Thus, prioritizing where to focus on protection versus other adaptation activities that are less expensive and more environmentally sound is really a prerequisite to good adaptation planning.

As part of examining how to treat different areas based on hazards, existing investment and infrastructure, and environment/habitat values, the discussion that follows assumes that a local government will, after this analysis, divide areas into one of three possible categories. First would be "Protection Areas." These will typically be either areas of existing, dense urban/commercial/industrial development with relatively low habitat/environmental value and whose continuation is critical to the area or areas that are relatively safe from sea-level rise and related coastal hazards, making them appropriate for future growth. Second would be "Accommodation Areas." These will typically be areas of some existing level of development that may be too difficult or expensive to protect over the medium or long term and whose loss over time will promote important human safety, habitat, and environmental services goals. "Strategic Relocation/Avoidance Areas" will be areas with high vulnerability, high habitat and environmental services value, and that usually have relatively little or no current development.

a. Planning & Zoning Tools

Adding sea-level rise and adaptation language to comprehensive planning should be a first step in the long process of adapting to climate change. As part of this, local governments should strongly consider longer planning time horizons than currently required by state law; for example, planning horizons of 10-20 years may not capture much change in coastal hazards due to SLR, but a 50-year or greater planning horizon can begin to do so.

Comprehensive plan statements about climate change or sea-level rise adaptation typically require further ordinances or zoning actions to implement. Thus, most planning and zoning tools can conceivably be used to adapt to increasing sea levels. Because there are so many possible planning and zoning tools, this subsection only addresses a few of the most important that are not addressed under another category. Resources for potential comprehensive plan language for sea-level rise and/or climate change include:

- The presentation "Sea Level Rise Ready: Model Comprehensive Goals, Objectives, and Policies to Address Sea-level Rise Impacts in Florida."[3]

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[2] *See generally:* Cela, M., J. Hulsey, and J.G. Titus 2010. "South Florida." In James G. Titus, Daniel L. Trescott, and Daniel E. Hudgens (editors). The Likelihood of Shore Protection along the Atlantic Coast of the United States. Volume 2: New England and the Southeast. Report to the U.S. Environmental Protection Agency. Washington, D.C., available at http://risingsea.net/ERL/shore-protection-and-retreat-sea-level-rise-South-Florida.pdf.

[3] This presentation is available at http://www.law.ufl.edu/academics/clinics/conservation-clinic/program-areas/coastal-development-ecosystem-change/.

- Existing comprehensive plan language or ordinances of Florida local governments, including:
    - Broward County
    - City of Key West
    - City of Satellite Beach
    - Collier County
    - Monroe County
    - Pinellas County
    - Sarasota County
    - Village of Islamorada

Links and citations to the language in these plans/ordinances appears below in Appendix II.

i. Overlay Zones

Overlay zoning is essentially a "meta-tool" in that the overlay simply defines a geographic area where special zoning or other adaptation tools apply. As implied by the name, an overlay zone does not alter the underlying zoning; rather it simply adds to or modifies the underlying zoning of, say, commercial or industrial or low-density residential. In Florida, statutory "Adaptation Action Areas," if developed, represent overlay zones. Historic preservation often is implemented through historic overlay zones that limit exterior changes to contributing buildings within the historic overlay zone.

Overlay zones for adaptation could include special building design considerations (such as is already the case with the Coastal Construction Control Line), limitations on building size, type of use, etc. The great strength of overlay zones is that they allow for careful crafting of a suite of zoning tools that all work towards a common goal. For example, an accommodation overlay might focus on requirements that new construction be built well above the existing 1% chance flood elevation determined by FEMA; require contribution to a drainage district that coincides with the overlay area; forbids any expansion and sets amortization schedule for any uses including hazardous materials; and limits rebuilding or substantial improvements to non-critical uses. All together, these efforts all serve to promote continued use of an area but with increasing efforts to drain it even as it is recognized that sporadic, recurring flooding will increase. Thus, overlay zones—such as adaptation action areas—can serve as a primary vehicle for defining in zoning and permitting programs which areas will fall into the general categories of protect, accommodate, and strategic relocation or avoidance.

ii. Development Limitations

Limitations on development location and types are appropriate zoning tools for Protection, Accommodation, and Strategic Relocation/Avoidance Areas. The overlay zones each type of area could serve as the appropriate vehicle to implement development limitations.

In protection areas, a local government may still wish to restrict certain types of development due to the coastal hazards exacerbated by SLR. For example, despite a goal of protecting an area, protection sometimes may not rise to a level sufficient to protect from significant storm surge. Thus, development restrictions may be in order to prohibit new, limit the expansion, or even phase out certain uses that present the greatest threats to the safety, health, and welfare of the

local population. Uses typically limited in hazardous areas include: hospitals, nursing homes/assisted care facilities, fire and police stations, any facility storing or handling hazardous materials, and critical infrastructure facilities (such as substations, water supply treatment facilities, and waste water facilities). Due to the need to service large, dense populations in some Protection Areas, it may not always be possible to entirely limit all the listed uses, but any exceptions should be drawn as narrowly as feasible and include special requirements to protect the public and ensure, to the extent possible, the integrity of the allowed facilities (for example, by requiring anchoring against floating for storage tanks or elevating and floodproofing systems in critical facilities).

iii. Conditional Use Permitting

Florida's comprehensive land planning and regulation scheme allows local governments to include "conditional uses" in their zoning and land development regulations. While some generalizations can be drawn based on state law, ultimately the procedural mechanisms for conditional uses should be established according to the established practices of each local government.

A conditional use is one permitted in a zoning area provided that the applicant can demonstrate that certain conditions or facts exist.[4] Often conditional uses in codes are defined as those uses that are generally compatible with the area but which require extra review and imposition of conditions in order to further certain ends of the planning/zoning process.[5] In the case of the Model Code, such ends include the protection of Florida springs.

Approval of a conditional use permit occurs through an evidentiary process which is usually outlined in the local government's land development regulations.[6] Land development regulations must specify what facts and conditions, if proven by the evidence at a hearing, will allow for issuance of a permit for a conditional use. [7]

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[4] ENVTL. AND LAND USE SECTION OF THE FLORIDA BAR, TREATISE ON FLORIDA ENVIRONMENTAL AND LAND USE LAW, Vol 3, 25.4-1.

[5] *See, e.g.* Egan Adams and Henson & Henson, Inc. v. Monroe County, Case No. 96-1717, 1996 WL 1060308 at *4 (Fla. Div. of Admin. Hearings, Dec. 20, 1996).

[6] *See, e.g.* Clearwater Beach Community Church v. City of Clearwater, Case No. 89-0111, 1989 WL 644272 at *4(Florida Div. of Admin. Hearings, July 12, 1989) (quoting from a local government process for approval of a conditional use).

[7] The existence of a conditional use requires that there be objective criteria that can be used to judge a conditional use permit application. City of Melbourne v. Hess Realty Corp., 575 So.2d 774, 774-75, 775-76 (Fla. 5th DCA 1991).

Conditional use zoning could play a useful role in protection, accommodation, or relocation zones. In a protection area, permit criteria could include a requirement to contribute to a "protection fund" to help pay for infrastructure measures that offer protection from flooding and SLR. In an accommodation area, the same could be true, as well as creating permit criteria that might limit the duration a use is allowed to exist or other measures that reduce the impact of flooding events and rising seas. In a relocation area, redevelopment permit criteria could include limits on the time a use is allowed to continue, that require delivery of a performance bond to ensure funds for removal of structures when necessary, that require a contribution to a local "relocation assistance fund," or other measures promoting relocation from the area.

In some instances, permit criteria for condition use zoning may be deemed to be exactions, so care must be taken in those instances to meet the guidelines for crafting exactions that do not cause a "taking" of private property. For further information on exactions and their interaction with the concept of "conditional uses," see Section V.e.vi, *infra.*

iv. Downzoning and Non-Conforming Uses

Downzoning, or reduction of existing zoning to decrease allowable density or development types, presents an obvious action especially for Accommodation Areas and Strategic Relocation/Avoidance Areas. Downzoning and classification of existing uses as non-conforming is a relatively common legal strategy in planning in Florida. Courts have consistently ruled that downzoning is not a "taking" of property under the U.S. Constitution's protections of private property when there was no "vested right" to development, such as occurs when a valid permit to build has already been issued but construction has not yet occurred. Downzoning ordinances typically contain express exemptions for any vested rights to avoid this problem.

When existing uses violate the new downzoned requirements, that use becomes a non-conforming use. Non-conforming uses are often phased out over time by limitations on their expansion or rebuilding. As long as a sufficient amortization time has been allowed to recoup investment expectations in the existing use, eliminating the right to rebuild or even requiring removal of the existing use at some point in the future has usually been viewed as acceptable by courts. However, sometimes local governments will grandfather existing uses, especially residential uses, and allow rebuilding if the destruction of the property was involuntary.

Even when rebuilding of non-conforming uses after involuntary destruction is not allowed, it may be possible to use a properly designed Transfer of Development Rights (TDR) program to preserve value for property owners and avoid a takings claim.

Thus, downzoning, like development limitations, can be a strong tool for adapting to SLR and evolving coastal hazards. Downzoning can be used to prevent development of permanent residential structures or to limit their size and density in Strategic Relocation/Avoidance Areas. It may also be used to decrease existing building types and densities in Strategic Relocation/Avoidance Areas and in Accommodation Areas.

v. Transfer of Development Rights

Transfer of Development Rights (TDR) programs define an area where the right to develop is restricted or eliminated, but property owners are granted the right to transfer the development rights from the restricted property to other property owners in a "receiving zone," where the transferred rights can be used to increase development density. TDRs have been discussed and implemented in many locales, but they are challenging to structure in a way that works. Many TDR programs have not succeeded due to poor execution or market signals that run contrary to the design of the program (for example, the market may not be demanding greater development in the receiving area, meaning that transferrable rights have little or no value).

U.S. Constitutional takings law forms the background for case law on the implementation of TDR programs in Florida. As early as 1978, the U.S. Supreme Court in its foundational takings case of *Penn Central*[8] mentioned TDRs. The Court observed that a possibility of transferring and selling development rights is clearly valuable and counts to mitigate any financial burden that a zoning change creates for a property owner.[9] In the Court's words: "While [transferable development] rights may well not have constituted 'just compensation' if a 'taking' had occurred, the rights nevertheless undoubtedly mitigate whatever financial burdens the law has imposed on appellants and, for that reason, are to be taken into account in considering the impact of regulation." The Court's statement that TDRs in this case mitigated the financial impact of permit denials in *Penn Central* would seem to clearly indicate that the value of TDRs goes to determine whether or not a taking occurred and not to whether or not just compensation has been paid. In light of this 1978 statement in *Penn Central*, the value of TDR credits should offset value lost due to prohibitions in a TDR program. Surprisingly, in the 1997 case of *Suitum v. Tahoe Regional Planning Agency*,[10] the Court may have cast doubt on this by stating in that case that the Court was not asked to rule upon, nor would it rule upon, whether any value that may inhere in TDR credits counts towards determination of whether a taking has occurred or whether a taking that was found to have occurred has been compensated via the TDR credit's value.[11] Despite the 1997 statement in *Suitum*, the value of TDR credits arguably still mitigates the economic impact of any restrictions forming part of a TDR program.

The first Florida case to address TDRs and takings was *Hollywood v. Hollywood, Inc.*[12] The court in *Hollywood* upheld a drastic downzoning of part of the claimant's land while another was upzoned, and a TDR was offered as a *quid pro quo* for dedication to the city of the downzoned portion of claimant's property.[13]

In the next major Florida case addressing TDRs, *Glisson*, the court found that regulations allowing existing uses, limiting density, restricting specific areas, and providing for TDRs did

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[8] 438 U.S. 104 (1978).

[9] *Id.* at 137.

[10] 520 U.S. 725 (1997).

[11] Suitum v. Tahoe Reg'l. Planning Council, 520 U.S. 725, 728 (1997).

[12] 432 So. 2d 1332 (Fla. 4th DCA 1983), review denied 442 So. 2d 632 (Fla. 1983).

[13] *Id.* at 1338.

not effect a facial taking.[14] The regulations in question were passed under the authority of the Local Government Comprehensive Planning and Land Development Regulation Act.[15] *Glisson* has been cited in an administrative case in Florida for the proposition that inclusion of TDRs, among other things, in a comprehensive plan in an effort to avoid "as applied" takings challenges does not render the plan "confiscatory."[16]

Together *Hollywood* and *Glisson* clearly indicate that a TDR program which does not remove all value from property will not fail under a facial takings challenge. These cases also make unlikely that a TDR program which leaves a reasonable amount of value or return on the affected property would fail in an as-applied challenge.

A subsequent Florida case—Shands v. City of Marathon[17]—indicated that a TDR program could virtually automatically defeat a takings claim based on the argument that all economic value had been taken from the property.[18] This case also explicitly noted that a Lucas-type taking had not occurred because, in part, TDR credits were available. *Id. at* 724, 725.

TDRs also qualify as an innovative strategy for programs that the Florida Communities Trust helps establish and fund[19] as well as offering a method government entities can use in a settlement offer for a Bert Harris claim.[20]

Thus, despite the challenges, TDRs should still be considered as part of an overall effort as they can aid in preserving value for property owners despite strong restrictions on the use of property.

vi. Set Back Requirements

Currently Florida law provides little or no setback for coastal construction. Florida's CCCL program provides a setback in the form of the 30 year erosion projection line. The 30-year erosion projection (30-yr. EPL) is intended to prevent issuance of permits for non-shore-protection structures "proposed for a location which, based on . . . projections of erosion in the area, will be seaward of the seasonal high-water line within 30 years."[21] However, this setback line accomplishes little due to deficiencies in how it is determined and the exceptions to its application.[22] In addition, in riparian areas not subject to the CCCL[23]

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[14] Glisson v. Alachua Cty., 558 So. 2d 1030 (Fla. 1st DCA 1990), review denied, 570 So. 2d 1304 (Fla. 1990).

[15] FLA. STAT. ch. 163, Pt. II (2013).

[16] Monroe County Chowder and Marching Society, Inc., et. al. v. DCA, 1994 WL 1027567, *380 (Fla.Div.Admin.Hrgs.1994).

[17] 999 So. 2d 718, 723 (3d DCA 2008).

[18] Id. ("Thus, if the land use regulations provide a mechanism by which a landowner can obtain a variance or transferrable development rights, then the regulations do not deny the landowner of *all* economically viable use of property and there is no facial taking.").

[19] Fla. Stat. 380.503(6), 380.508(4)(f), 380.511(2) (2013).

[20] Fla. Stat. 70.001(4)(c) (2013).

[21] FLA. STAT. § 161.053(5)(b) (2013).

[22] For further detail on the shortcomings of the 30-year erosion projection line, see Thomas Ruppert, Eroding Long-Term prospects for Dynamic Beach Habitat in Florida: A Coastal Resiliency

and "fronting the Gulf of Mexico or Atlantic coast shoreline of the state, exclusive of bays, inlets, rivers, bayous, creeks, passes, and the like," Florida statutes also create a setback line 50 feet from the mean high water line.[24] As weak as this setback is, it, like the CCCL's 30-year erosion projection line, is subject to exceptions that weaken it still further.[25]

Many other states have implemented set back regimes. These are usually either a setback established as a selected number of feet from the mean-high water line or vegetation line or the setback may be based on technical studies of erosion and potential inundation. One setback line designed to be very effective in protecting people and property as well as furthering adaptation options appears in Kauai County's code in Hawaii. The Kauai County Code establishes setbacks related to the depth of a building lot and the size of the building; the setbacks range from 70 times the annual erosion rate plus 40 feet to 100 times the annual erosion rate plus 40 feet.[26] One of the most famous setback line examples comes from Maine, which enacted Maine's Dune Rules. These rules require that structures greater than 2,500 square feet must be located so as not to be threatened by planning for an estimated two-foot sea-level rise over the next 100 years.[27]

Setbacks based on estimated levels of sea-level rise combined with current erosion rates multiplied by the life span of the structure[28] could be implemented in Accommodation Areas and Strategic Relocation/Avoidance Areas. This would minimize hazards to people and property and delay the difficult actions necessary to protect or remove development.

vii. Increased Floodplain Management Requirements

Current concerns about increases in premiums and fees under the National Flood Insurance Program offer an important opportunity for local governments to increase the level of flood protection while marketing these efforts to the public not only as enhancements to protection of people and property but also as a way to decrease flood insurance premiums in the area by increasing the local government's rating in the NFIP's Community Rating System (CRS) Program. A better CRS score for the local government results in an across-the-board discount for all flood policy premiums in the area.

The CRS activities that will most readily contribute to an increased CRS score and larger premium discounts include protection of open space, additional elevation requirements, and other stricter regulatory regimes. Many of the tools/policies recommended as part of the GTMNERR project and included would contribute to larger CRS discounts if implemented.

Conundrum, 1 Sea Grant Law 7 Pol'y J. 65, 80-82 (2008), available at http://nsglc.olemiss.edu/SGLPJ/Vol1No1/4Ruppert.pdf.

[23] As noted above, the CCCL program only applies to sandy beaches fronting on the Atlantic Ocean, the Gulf of Mexico, or the Straits of Florida. FLA. STAT. § 161.053(1)(a) (2013).

[24] FLA. STAT. § 161.052(1) (2013).

[25] FLA. STAT. § 161.052(2)-(6) (2013).

[26] Chapter 8, Article 27 of the Kaua'i County Code 1987, as amended.

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[27] Code of Maine Rules, Chapter 355.

[28] In Pennsylvania these are estimated at 50 years for residential, 75 years for commercial, and 100 years for industrial. See, Center for Island Climate Adaptation and Policy, Shoreline Impacts, Setback Policy & Sea Level Rise 9 (2009).

Increasing the stringency of existing floodplain management in a local government's jurisdiction will contribute not only to better flood insurance rates and lower flood losses, it also helps adapt to SLR. As sea levels increase, the stormwater drainage systems in low-lying coastal areas become less and less effective at draining due to decreased elevation difference between inflowing stormwater and the water body to which the system drains.[29] Thus, many of the actions taken to adapt to SLR can help reduce general flooding loss (e.g. higher elevations for buildings; oversizing drainage systems; floodproofing of commercial buildings; reducing density of development in floodplains, generally stricter regulation of floodplains, etc.) Placing additional restrictions on development in floodplains will decrease the number of people and structures in harm's way as sea levels increase and floodplains expand.

viii. Rebuilding Requirements

When a disaster does occur and properties are lost or destroyed, an opportunity presents itself to make the area more resilient to both SLR and future disasters. For this to happen, it helps if the community has proactively prepared a Post-Disaster Redevelopment Plan (PDRP) that can help "to eliminate inappropriate and unsafe development in the coastal areas when opportunities arise."[30] A PDRP should seek to "restrict development activities where such activities would damage or destroy coastal resources, and . . . protect human life and limit public expenditures in areas that are subject to destruction by natural disaster."[31] These goals can be accomplished in part through limitations on rebuilding in hazardous areas after a storm. The rebuilding limitations may be through many of the tools already listed here, including downzoning/conditional use, increased setbacks, overlay zones, exactions, etc. The St. Johns County Local Mitigation Strategy indicates that in areas subject to repeated damage, rebuilding will be limited to conservation and recreational uses (LMS language as adopted into the LMS from the City of St. Augustine Beach Comprehensive Plan Conservation/Coastal Element Policy CC.4.2.1).

ix. Establishment of Minimum Standards for Protective Structures

In many coastal areas, especially those with many miles of canals, private property owners own and maintain large amounts of sea walls. As many of these structures are privately owned and built, they are not uniform in design standards or the elevation to which they provide protection. This is proving a challenge in places such as Miami Beach, where tidal flooding can sometimes overtop sea walls. If one property owner's sea wall is too low, this can lead to flooding far beyond that property owner's parcel despite much higher levels of walls and protection on public property and other private properties. Particularly in areas slated for protection or accommodation, a mix of incentives, permitting regulations, and assistance programs should be implemented to develop minimum elevation requirements and design standards for sea walls so that one private property owner's failure to maintain or upgrade a sea wall does not allow flooding of other properties.

x. Building Moratoria

Moratoria on permitting and building can play a role in adaptation. Moratoria prohibit permitting or building for a limited amount of time and have been upheld by courts when used as a stopgap measure while information is gathered and policy developed and implemented.

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[29] In the most extreme cases—already occurring in many areas in southeast Florida, southwest Florida, and around Tampa Bay—sea water is backing up through drainage systems and causing flooding.

[30] Fla. Stat. § 163.3178(2)(f)(2014).

[31] Fla. Stat. § 163.3178(1)(2014).

While moratoria are not subject to a claim of a permanent taking of property,[32] property may be able to make a claim for a temporary taking of property.[33]

Thus, to avoid a rush to secure building permits and create vested rights when a local government makes known its intention to develop SLR adaptation zoning, it may be useful for a local government to institute a moratorium for the period necessary to do data gathering and policy development and drafting; however, to avoid potential takings claims, any moratorium should preferably be less than one year in duration.

b. Building Design

Too often coastal permitting, including Florida's Coastal Construction Control Line, focuses more on *how* to build in hazardous areas rather than focusing on avoiding hazards by looking at *where* to build. The *where*-to-build issue should be of utmost importance in strategic relocation/avoidance areas and carefully considered in accommodation areas. Of course this does not mean that the *how* question is any less important; he question of *how* to build should be considered in all areas in Florida.

How to build should include building for dynamic water forces in storm surge areas. The question in this case becomes which storm surge areas should be included for the most stringent building requirements in the Florida Building Code (FBC). Currently the minimum requirements for such construction are contained in segments of the FBC that usually are only applied based on the requirements of Florida's Coastal Construction Control Line (CCCL) program and a community's flood plain ordinance and flood maps that are part of a community's participation in the National Flood Insurance Program.[34] Both of these routes to implementation of FBC requirements contain shortcomings. The CCCL program only applies along the state's sandy beaches and only as far inland as the CCCL. This leaves areas potentially subject to threats of storm surge and inundation without the requirements. The shortcoming here is that the flood maps and "velocity zones" are only based on the so-called 100-year storm. This means that areas affected by stronger storms with greater impact may not planned for adequately.

Thus, a local government has two options which can be implemented either independently or in conjunction:

1. Increase the geographic applicability of current FBC building requirements beyond the areas in FEMA flood zones or in the CCCL.
2. Increase the building standards contained in the FBC to require even stronger structures.

The first option is probably the most important of the two requirements and maybe easier to implement using existing data on storm surge risk. For example, it could be implemented by extending "velocity zone" building requirements to all areas within a storm surge estimated for up to category 2 or 3 storm surges. Another way to do this is to require adherence to V-Zone construction standards in the new "Coastal A-Zone" being mapped in newer Flood Insurance Rate Maps in many coastal areas.[35]

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[32] Tahoe-Sierra Pres. Council, Inc. *et al.* v. Tahoe Reg'l Planning Agency, 535 U.S. 302 (2002).

[33] First English Evangelical Luther Church v. County of Los Angeles, 482 U.S. 304 (1987). In addition, Florida's Bert J. Harris, Jr., Private Property Rights Protection Act has been amended to allow for claims of a temporary taking of property for moratoria exceeding one year. Fla. Stat. 70.001(3)(e)2 (2014).

[34] Out of Florida's 475 local governments, only 15 do not participate in the NFIP.

[35] For further information, see the information in Appendix III.

In addition to building stronger, a local government could promote building in ways that promote relocation or removal of structures in accommodation areas or strategic relocation/avoidance areas. For example, this might mean ensuring that buildings are designed to either be more easily deconstructed or moved in whole or in parts to a new location. The challenge here would be to design the building standards and measures to implement such requirements; the author is not aware of existing materials on the legal requirements or technical design requirements necessary to implement such a program at the local level. At a minimum in Florida, such structures would have to conform to Florida's building code and any local additions to the state-wide building code. Research and development may be necessary from both architects and engineers to provide guidance for such construction before a local government could impose such requirements.

c. Coastal Habitat and Ecosystem Protection

Both accommodation and strategic relocation/avoidance areas should emphasize that the delineation is based on the local government's police power to promote the protection of the safety, health, and welfare of the local government's constituents. Denial of permitting for armoring or other limitations protect the community's safety, health, and welfare by discouraging inappropriate development, limiting rebuilding of unsafe development, decrease the likelihood of putting fire, police, and ambulance personnel in harm's way due to rescue missions, and protect people and the environment through allowing natural systems to migrate naturally due to coastal changes.

Protection of coastal habitats and ecosystem services can be achieved through use of the various other tools listed in this compilation.

d. Armoring & Protection Tools

Establishing a local permitting requirement for hard coastal armoring (i.e.—seawalls, bulkheads, riprap, revetments) is a basic way for a local government to control armoring. Several local governments in Florida exercise local control over coastal armoring.[36] These permitting programs complement rather than supersede state and federal permitting for armoring activities. The legal basis of local governments' authority to conduct permitting of coastal armoring is the local government's general police powers that can be exercised for the health, safety, and welfare of the local governments' constituents.

If a local government identifies areas focused on protection, accommodation, and strategic relocation/avoidance, it can structure its local permitting program for armoring. In protection areas, this might include minimum elevations for armoring that account for SLR and storm surge. Accommodation areas could allow armoring or not depending on the area. The permitting process should indicate that no permits for new or rebuilt armoring would be allowed in strategic retreat/avoidance areas. Ideally a permit program for armoring structures should specify that the permit for the structure has a specific duration. Prior to expiration of the permit, the property holder should be required to apply for another permit to remove the structure, maintain it in place, or modify it.[37]

A similar local program for allowing beach nourishment could also be instituted. In protection and accommodation areas, nourishment would be allowed as long as it meets state requirements. In strategic

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[36] *See, e.g.* Sarasota Comprehensive Plan (Chapter 2), Env. Policy 1.1.2 and Brevard County regulations, 62-4213(d)(2014).

[37] Such time-limited permits are used in California. This also allows California to revisit mitigation requirements tied to the shoreline armoring. Megan M. Herzog & Sean B. Hecht, *Combatting Sea-Level Rise in Southern California: How Local Governments Can Seize Adaptation Opportunities While Minimizing Legal Risk*, 19 Hastings West Northwest J. Envtl. L. & Pol'y 463, 24-25 (2013).

relocation/avoidance areas, the local government could stipulate that only nourishment that does not include any funds from the local government would be allowed. This limitation serves multiple purposes. First, if the local government has a comprehensive policy against infrastructure spending to subsidize development in at-risk areas, this helps implement such a policy. Second, it helps avoid situations in which state permits for construction are permitted in areas where a permit might not issue were it not for beach nourishment. Third, since it allows federal- or state-funded nourishment, it still allows federal and state government to respond to erosion caused by federal- or state-run inlets that might be causing erosion for which the federal or state government is legally liable.

e. Financial Tools

i. Voluntary Sale and Acquisition

Some federal, state, and local programs exist that provide public funding to purchase property in fee simple or to purchase easements from willing sellers. Florida, at Florida Statutes section 295.105(17)(d), explicitly allows the use of "Florida Forever" funds for acquisition of land for adaptation to sea-level rise via the Florida Communities Trust Fund. Use of state funds may have an additional benefit to the state of decreasing state exposure if the property is insured through Citizens Property Insurance, Florida's state-backed and subsidized wind insurer.

Voluntary buyout still faces economic hurdles. Buyout of a fee-simple interest in property removes property from the tax rolls and increases government costs for management of the property. This can be avoided by only purchasing a conservation easement rather than a fee simple interest in the property. Even purchase of an easement, though, may decrease the value of the property and thus decrease property tax revenue.

Voluntary sale and acquisition of fee simple title or easements presents challenges in a region- or area-wide approach because of "holdouts" or those that choose not participate. This can create "checkerboard" areas of properties where some have sold title or easements but others have not. This can increase the per-lot cost of providing public services and also eliminate potential local government savings on the construction and repair of infrastructure.

Any acquisition effort should be based on a plan informed by careful analysis of which lands will provide the greatest value in mitigating flood and storm losses and provide the greatest value in ecosystem services and potential habitat migration. An acquisition should not be focused solely on buying out developed properties at risk of flooding or erosion as this simply converts the buyout program into a subsidy to property owners rather than focusing on larger public goals.

ii. Requirements and Assistance to Improve Private Armoring and Defenses

In protection and accommodation areas, local governments may wish to actively promote either needed armoring or the repair/upgrade of existing armoring. The latter is important because an area protected by armoring is only as safe from surge or tidal flooding as the lowest-elevation armoring in the area. This poses only a financial and not legal issue of all the armoring is owned by the local government. However, most armoring is usually a privately owned asset. As such, local government's reasonable authority to influence the design or construction of such armoring only arises when the owner requires a permit. This means it is essential that a local government establish a permitting program for armoring to help ensure compliance with minimum standards for construction and levels of protection that work in conjunction with the local government's vision for protective strategies in areas.

While this could be a sufficient way to address areas that do not currently have armoring now but are anticipated to in the future, the question remains as to how to address areas that already have extensive private armoring that does not meet minimum standards. While permit requirements could be enacted to requiring meeting minimum standards for properties that need permits to install or make repairs, additional programs may be needed to address properties that will not require permits for rebuilding/repair/replacement of coastal armoring prior to the time an area is in danger of flooding due to non-conforming sea walls. A local government could set up a regulatory program in which coastal protection structures that do not meet minimum standards are declared "nonconforming" and then utilize the same types of mechanisms otherwise used to address nonconforming uses in down-zoned/rezoned areas.[38] Alternatively, options to encourage voluntary action include a local government providing financial cost-share assistance, low-interest loans, or other financing mechanisms for those owners that wish to upgrade their shoreline armoring. Funding for these or similar types of programs could be developed through general tax revenues, a Municipal Services Benefit Unit, a Municipal Services Taxing Unit, or a special taxing district dedicated to coastal protection.

Finally, while it is not yet feasible under current law, potential exists to develop a state-wide program similar to the Property Assessed Clean Energy (PACE) program that allows property owners to secure financing for clean-energy installations; such financing is then paid for by being assessed to the *property* rather than the owner of the property and having the payments on the financing collected as part of the property's property tax assessment.

iii. Acquisition Through Eminent Domain

Federal, state, and local governments possess the power of eminent domain, which allows them to "take" private lands for public purposes as long as the governmental entity pays "just compensation" for the land. Adaptation to climate change and sea-level rise present "public purposes" and are even specifically mentioned in Florida's land acquisition program as acceptable reasons for acquiring private property.[39] However, the Florida Communities Trust Fund may use its funding only for voluntary acquisitions acquired without the threat of eminent domain, and Florida Forever funding rarely uses eminent domain, focusing instead on voluntary acquisitions.

Due to the high value of coastal lands, acquisition through eminent domain is of limited use in light of budgetary constraints. Limitations on use of existing state acquisitions through eminent domain further constrain this option. Finally, exercise of eminent domain increases local government costs (due to need to manage the acquired land) even as it will decrease tax revenues as publicly acquired property is removed from the property tax rolls of local governments.

Exercising eminent domain can present political problems as well. Local property owners may strongly oppose the exercise of eminent domain. This will have greater political impact the closer the governmental unit is to the local level. Local opposition will likely be far stronger if the justification is for sea-level rise adaptation rather than for infrastructure such as roads or powerlines or other infrastructure that is more easily understood and valued by the public. In fact, general "resilience" and protection of coastal dwellers and property from hazards such as flooding, surge, and erosion might offer better public justifications for eminent domain acquisition than focusing on the SLR that exacerbates these harms.

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[38] See Section V.a.iv., *supra*, for more information on nonconforming uses.

[39] *See, e.g.* Fla. Stat. section 296.105(17)(d) (2013).

One development that might actually contribute to the ability to use eminent domain effectively is a decrease in some existing property values due to changes to the National Flood Insurance Program (NFIP). The Biggert-Waters Act of 2012 moves the NFIP towards flood insurance premiums based on actual risk rather than subsidies.[40] Subsequent changes in 2014 altered some of the timing and application of actual risk premium rates in the NFIP, but still, as subsidies decrease and rates increase dramatically—but more slowly than under the Biggert-Waters Act of 2012—for some properties, this will likely decrease the market value of those properties, making acquisition more financially feasible.

iv. Capital Improvement Plans: Accounting for SLR in Capital Expenditures

Local governments should account for existing and projected vulnerabilities when planning infrastructure projects.[41] The time span for considering future vulnerabilities will vary. Many commentators advocate using the design life of the structure being developed. In some cases, this may be adequate, such as when replacing an existing road that serves development and transportation needs that already exist and are unlikely to be displaced by increased vulnerabilities during the design life of the bridge. However, in some cases, the design life of the structure/project may not be sufficient; this may occur when the project to be built will itself *promote additional development that will continue to need the project beyond the project's design life*. In other words, if you build an entirely new road to an area or increase the capacity of a road that formerly limited development potential, the new development that results from the project should essentially be construed as perpetual in nature since it is unreasonable to expect that all resulting private development will simultaneously reach its design life and be abandoned when the current project reaches the end of its design life.

Efforts to decrease capital outlays in the most hazardous areas will meet with strenuous resistance from property owners in such areas. Success would depend on strong general support from the local government; the best hope for generating this support is to educate the tax-paying public about the financial unsustainability of dedicating ever-larger amounts to protect the most hazard-prone areas. Current state planning law[42] and the comprehensive plans of local governments in the GTMNERR project study area already advocate minimizing public subsidies to infrastructure in hazardous areas.[43]

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[40] *See, e.g.* "Insurance Issues" page at Florida Sea Grant: https://www.flseagrant.org/climatechange/coastalplanning/insurance-issues-coast/.

[41] The United States Army Corps of Engineers already has a process to do this when the Corps constructs projects funded by Congress. For links to Corps guidance documents, see "Responses to Climate Change" available at http://www.corpsclimate.us/ccaceslcurves.cfm (last visited May 20, 2014).

[42] Fla. Stat. § 163.3177(6)(g)6 (2014) ("Limit public expenditures that subsidize development in coastal high-hazard areas.").

[43] *See, e.g.* St. Johns County Comprehensive Plan, Infrastructure Element Objective H.1.4. (2014); City of St. Augustine Comprehensive Plan - Capital Improvements Element Objective 2 and Capital Improvements Policy 2.1 (2014).

While a capital improvement plan that decreases investment in the most hazardous areas is a wise long-term financial move in many cases, it may cause short-term economic pain both to private property owners as well as to local government tax revenue as property values might decline. It is important to note that economic pain to both private property owners and local governments will still result eventually even if a capital improvement plan does not account for losses/costs due to sea-level rise or other reasons for increased vulnerability, such as increasing intensity of rain events or SLR. However, existing legal precedents limit what types of infrastructure may be subjected to no maintenance or removal without the responsible governmental entity incurring liability.[44] On the other hand, it appears that some types of infrastructure may still be maintained but do not have to be upgraded to address SLR.[45]

Accounting for SLR in infrastructure decisions would actually save money in the long-term, but it might also cost more in the short term in some situations if it requires building entirely new infrastructure rather than just maintain existing. For example, it might be necessary for a local government to entirely relocate a wastewater treatment plant rather than upgrade an existing facility. In addition to this initial increased capital outlay, the local government will also incur additional costs for rerouting sewer lines and adding pump stations (assuming that, in Florida, a safer location will be at a higher elevation).

Infrastructure planning may also impact decisions made by private property owners and influence market transactions by making and publicizing long-term planning policy and decisions. For example,

At minimum, even if public infrastructure must be maintained, the capital improvement plan should prohibit spending to increase capacity or change infrastructure in a way that would encourage increased private investment in either Accommodation Areas or Strategic Relocation/Avoidance Areas.

v. Insurance Considerations

Insurance is increasingly taking on a pivotal role in the on-going discussion about how to adapt to climate change. Discussion of insurance, however, varies depending on whether the insurance is publicly developed and backed or private in nature.

It has been noted that local governments often struggle when they act to incur immediate costs for long-term benefits, even if the benefits far outweigh the costs.[46] Some of the reasons for this also contribute to similar challenges for government-sponsored insurance systems such as Florida's Citizens Property Insurance or the National Flood Insurance Program.

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[44] *See, e.g.* Jordan v. St. Johns County, 63 So. 3d 835 (Fla. 5th DCA 2011).

[45] *See, e.g.* Thomas Ruppert & Carly Grimm, *Drowning in Place: Local Government Costs and Liabilities for Flooding Due to Sea-Level Rise*, Vol, 87, No. 9, Florida Bar Journal 29.

[46] Booz Allen Hamilton, Inc., NAT'L OCEANIC AND ATMOSPHERIC ADMIN. COASTAL SERVS. CT., Hazard and Resiliency Planning: Perceived Benefits and Barriers Among Land Use Planners (2010), available at http://csc.noaa.gov/publications/social_science/NOAACSCResearchReport.pdf.

The political problems with attempting to run a government insurance program have been highlighted by the partial rollback in spring 2014 of changes made to the National Flood Insurance Program (NFIP) in 2012. These changes, in part, sought to put the NFIP on the road to solvency from its current $24 billion debt. Due to public outcry over sometimes-dramatic rate increases, a public firestorm led to the partial rollback of the 2012 changes. Some fear that the partial rollback fails to do enough to address the financial instability of the NFIP.

The 2014 partial rollback of the 2012 NFIP changes is known as the 2014 Grimm-Waters Act (a.k.a.—The Homeowners' Flood Insurance Affordability Act or HFIAA). Under the HFIAA, rates will still continue to rise for NFIP coverage. The HFIAA still allows for up to 18% yearly increase in premiums for primary residences and up to 25% yearly increases for other properties. Under HFIAA, purchasers of so-called "pre-FIRM" subsidized structures (those built prior to 1975 or the community's first Flood Insurance Rate Map—FIRM) structures will be able to take over the subsidized policy of the seller rather than moving immediately to the full-risk, actuarial rate, as was occurring under the 2012 changes. The HFIAA limits the maximum increase for base premiums for these properties to 18% per year. However, HFIAA did not change the 2012 law's impacts on severe-repetitive loss properties, substantially damaged or improved properties, or for non-primary residences. These three types of properties still will be subject to premium increases of up to 25% per year on the base premium. The 2012 law had eliminated all "grandfathering," or allowing post-FIRM structures to continue using the FIRMs effective when they were built even if a later, updated FIRM would have resulted in a higher premium. The 2014 HFIAA reinstated grandfathering for these properties, meaning that they will be able to continue using older FIRMs if they result in a lower premium than newer FIRMs. However, homes newly mapped into a Special Flood Hazard Area will be placed on a path to full-risk actuarial rates with the amount of increase in premium per year depending on whether the structure is a primary residence or not.

In any case, it is clear that the world of insurance is finally becoming a driving factor in resilience, much as many commentators—and the reinsurance industry—have said it must and would. In fact, FEMA has begun working with several partners, including insurers, to develop a community resilience index that considers environmental, economic and social resilience.[47] However, despite extensive discussions and analysis of how SLR and climate change may affect the private insurance and reinsurance industries as well as segments of financial markets such as bond ratings, most of the tangible change to date that implicates coastal hazards has taken place in the NFIP.

Those who work on adaptation issues need to be cognizant of how these changes impact communities and property owners to integrate this thinking into the research, policy recommendations, and outreach and extension activities.

In the specific context of this project, the flood insurance changes potentially alter some calculations. The increased NFIP premium costs alter the long-term affordability of flood

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[47] Council on Climate Preparedness and Resilience, Executive Office of the President of the United States, Priority Agenda Enhancing the Climate Resilience of America's Natural Resources, 45 (October 2014), available at http://www.whitehouse.gov/sites/default/files/docs/enhancing_climate_resilience_of_americas_natural_resources.pdf.

insurance for many homes and businesses, particularly those built below the "Base Flood Elevation." This can lead, over time, to significantly higher premiums. Since many properties, especially typical residential properties, are purchased via a mortgage with the monthly payment cost as more important than the listed selling price, adding a large monthly cost for flood insurance will, all other factors being equal, translate into a lower value for the property. The decrease in affordability and property value will often lead to one of two results: 1) the insurance becomes so unaffordable that the property is abandoned (or purchased cash and used without any flood insurance coverage) or 2) the property is purchased despite the existing building, and a new building, built to current code standards and above Base Flood Elevation, is constructed. Under the first scenario, local, state, and federal land acquisition programs might be able to help property owners by providing some money for their property even as the acquisition program can help promote resilience and environmental goals by purchasing the property at a price that allows acquisition funding to go farther than it would were property values still propped up by subsidized insurance rates. Under the second scenario, there will be a continued need for the local and state government to maintain infrastructure serving the development, which may become more expensive over time as more frequent flooding or other coastal hazards impacts occur.

vi. Impact Fees and Exactions

Impact fees, sometimes referred to "development fees," are one type of exaction. Impact fees are, however, very limited as to how they can be used in Florida. They must be used by the agency collecting them for costs related to providing services necessitated by the development paying the impact fee and the property paying the impact fees must receive a benefit from the use of the impact fee. An impact fee collected for wastewater, for example, cannot be used to fund provision of roads. Since impact fees typically fund infrastructure development, they are not usually going to be good tools for SLR adaptation unless one plans to allow new development in unprotected places and charge an impact fee to develop new armoring or other protection that will benefit those properties paying into the fee. This would probably not be a sound strategy since, if it is so clear that the property being developed is or soon will be at risk due to SLR, it makes more sense to limit development there rather than have the local government take responsibility for protecting it. Current law in Florida limiting impact fees makes it unlikely that impact fees will be a good way to promote adaptation to SLR.[48]

Other types of exactions include permit conditions and conditional permitting. In each of these, a permit could be granted based on fulfillment of one or more specified conditions. In the first instance, the condition(s) would be on a case-by-case basis and the conditions would ensure that development would comply with statutory protections. In the second instance (conditional use

[48] This seems unfortunate since some states have developed interesting uses for development fees in the coastal context. For example, while shoreline armoring is very limited today in California, when permits are granted, the permit may come with a condition that requires "a permitee to pay an in-lieu sand mitigation fee sufficient to replace the amount of beach area and sand that the armoring project will destroy over the project's design life." Megan M. Herzog & Sean B. Hecht, *Combatting Sea-Level Rise in Southern California: How Local Governments Can Seize Adaptation Opportunities While Minimizing Legal Risk*, 19 Hastings West Northwest J. Envtl. L. & Pol'y 463, 24 (2013). Such mitigation fees for armoring have been upheld against *Nollan-Dolan* challenges in California. *See*, id. at 25, notes 188-89.

permitting), the permit would issue as of right as long as one or more conditions specified in the zoning regime are met.[49] Opinions vary widely among lawyers on how likely successful challenges to such exactions are when such exactions are used as part of adaptation to SLR.[50] For instance, law professor and historian Michael Wolf indicates that development exactions (such as conservation easements or fee title interests or impact fees on permitted development) present "serious takings risks."[51] Professor Wolf is quick, however, to point out that "serious takings risk" do not mean these tools are off limits but that they need to be used sparingly and carefully to avoid a taking.

Carefully designing and using exactions can still promote SLR adaptation while avoiding a takings claim. For example, in California it is typical to require a deed restriction against any future shoreline armoring in order to get a coastal development permit.[52]

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[49] Not all "conditional use permitting" is necessarily an exaction. If the conditions that must be fulfilled do not require any specific dedication of money or property rights by the applicant, the conditions would likely not be subject to challenge as an exaction.

[50] *Compare, e.g.* Michael Allan Wolf, *Strategies for Making Sea-Level Rise Adaptation Tools 'Takings Proof'*, 28 Land Use & Envtl. L. 157 (2013) *with* Megan M. Herzog & Sean B. Hecht, *Combatting Sea-Level Rise in Southern California: How Local Governments Can Seize Adaptation Opportunities While Minimizing Legal Risk*, 19 Hastings West Northwest J. Envtl. L. & Pol'y 463, 32-34 (2013).

[51] Michael Allan Wolf, *Strategies for Making Sea-Level Rise Adaptation Tools 'Takings Proof'*, 28 Land Use & Envtl. L. 157 (2013).

[52] *See, e.g.* Section III. Special Conditions of permit application 5-11-260, California Coastal Commission (Filed January 19, 2012) (on file with author). The special conditions in this permit include:

- No Future Blufftop or Shoreline Protective Devices:

A. By acceptance of this Permit, the applicant agrees, on behalf of himself and all successors and assigns, that no bluff or shoreline protective device(s) shall ever be constructed to protect the development approved pursuant to Coastal Development Permit No. 5-11-260 including, but not limited to, the residence, foundations, patios, balconies, landscape and hardscape and any other future improvements in the event that the development is threatened with damage or destruction from erosion, bluff retreat, landslides, sea level rise, or other natural coastal hazards in the future. By acceptance of this Permit, the applicant/landowner hereby waives, on behalf of himself and all successors and assigns, any rights to construct such devices that may exist under Public Resources Code Section 30235.

B. By acceptance of this Permit, the applicant/landowner further agrees, on behalf of himself and all successors and assigns, that the landowner(s) shall remove the development authorized by this Permit, including the residence, foundations, patios, balconies and any other future improvements if any government agency has ordered that the structures are not to be occupied due to any of the hazards identified above. In the event that portions of the development fall to the beach before they are removed, the landowner shall remove all recoverable debris associated with the development from the beach and ocean and lawfully dispose of the material in an approved disposal site. Such removal shall require a coastal development permit

C. In the event the edge of the bluff recedes to expose the foundation of the principal bluff facing structure but no government agency has ordered that the structures are not to be occupied, a geotechnical investigation shall be prepared by a licensed coastal engineer and geologist retained by the applicants, that

While exaction of a "rolling easement" often arises as a suggestion, in the Florida context, the easiest way to potentially accomplish that has already been discussed: exact a deed restriction prohibiting future armoring. While this is an exaction and thus subject to the constitutional tests of *Nollan* and *Dolan*, it likely passes these constitutional tests. *Nollan* requires that there be an "essential nexus between the exaction and the reason for which a permit could be denied; assuming that laws and regulations in place would allow denial of the permit due to the threat of erosion, the threat of harm from SLR, the loss of public access laterally across the beach, or the loss of the beach/damage to the beach ecosystem, then the exaction has an essential nexus to each of these as the prohibition on armoring seeks to maintain the beach and ensure that it can migrate unimpeded, thus protecting the beach ecosystem and lateral public access. *Dolan* requires that there be "rough proportionality" between the exacted cost and the likely harm from the development; in this instance the proportionality appears in that the limitation on armoring is the minimum restriction that protects interests of the state (protecting the beach, protecting lateral public access) while minimizing any burden to the property owner until the potential harm to the beach or to public access from armoring would present itself. Furthermore, for most properties in Florida built after 1985 with a Coastal Construction Control Line permit, current state law does not allow armoring anyway.[53]

Another exaction that can promote more responsibility on the part of property owners for future risks associated with coastal property is signing of a waiver/release form as a requirement to receive a permit. This potentially presents some legal issues. As an exaction subjected to stricter judicial scrutiny than typical land use or zoning decisions, such a requirement should be carefully drafted. In addition, while an exacted "assumption of the risk" form signed by the applicant would provide even more protection for the local government, this policy was referred to as "coercive and repugnant" by one court that reviewed it, though this commentary by the court has no specifically legal binding impact;[54] furthermore, the court provided no analysis, evidence, or support for use of the epithets "coercive and repugnant" when referring to this strategy that seems to maximize allowable land uses, for the benefit of the private property owner, while simultaneously shielding the public from incurring increased liability for private development decisions. This policy was ended by the local government using it when the local government settled the legal case in which the policy was criticized. However, the California Coastal Commission has made signing of "assumption of the risk" agreements virtually standard

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addresses whether any portions of the structure are threatened by bluff and slope instability, erosion, landslides or other natural hazards. The report shall identify all those immediate or potential future measures that could stabilize the principal structure without bluff protection, including but not limited to removal or relocation of portions of the structure. The report shall be submitted to the Executive Director and the appropriate local government official. If the geotechnical report concludes that the structure or any portion of the structure is unsafe for occupancy, the permittee shall, within 90 days of submitting the report, apply for a coastal development permit amendment to remedy the hazard which shall include removal of the threatened portion of the structure.

[53] *See, e.g.* Thomas Ruppert., *Eroding Long-Term Prospects for Florida's Beaches: Florida's Coastal Construction Control Line Program*, 1 Sea Grant Law & Policy Journal 65, 88 FN141 (2008), available at http://nsglc.olemiss.edu/SGLPJ/Vol1No1/4Ruppert.pdf.

[54] Jordan v. St. Johns County, case no. CA05-694 (Seventh Judicial Circ., Fla.) (21, May 2009) FN 2.

operating procedure when issuing development or redevelopment permits in hazard-prone areas along the coast.[55]

vii. Performance Bond for Structure Removal

When development or redevelopment is allowed, state and/or local regulations should be modified to require a long-term financial bond that provides financial resources should structures on the property be destroyed or condemned due to the impact of coastal hazards. It has often been noted that removing structures and infrastructure is an expense of relocation strategies, and if such expense is not allowed for, there could be instances in which property owners might prefer to abandon a property to the local government rather than fulfill their responsibility as property owner to ensure that their property does not contribute to pollution through a structure falling prey to surge, flooding, or erosion.

There are existing precedents in state statute for payment of a performance bond to ensure compliance with permit requirements. The state's water management districts often require performance bonds to ensure proper maintenance of permitted stormwater management systems. In addition, when the "Beach and Shore Preservation" chapter of Florida Statutes was modified to allow for limited use of geotextile tubes as part of dune restoration, this change included several permit requirements that could potentially require significant financial expenditures by permit applicants.[56] To ensure that these conditions are met, the statute requires that the "property owners shall provide financial assurances in the form of surety or performance bonds or other financial responsibility mechanisms that the authorized geotextile containers will be removed if the requirements of this subsection and the permit conditions are not met. The permittee shall file a notice of formal permit conditions in the public records of the county where the permitted activity is located."[57] The same type of financial tools should be used to ensure that building or rebuilding in coastal areas prone to sea-level rise inundation or other coastal

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[55] *See, e.g.* Section III. Special Conditions of permit application 5-11-260, California Coastal Commission (Filed January 19, 2012) (on file with author). The special conditions in this permit include:

Assumption of Risk, Waiver of Liability and Indemnity: By acceptance of this permit, the applicant acknowledges and agrees (i) that the site may be subject to hazards from bluff and slope instability, erosion, landslides, waves, and sea level rise; (ii) to assume the risks to the applicant and the property that is the subject of this permit of injury and damage from such hazards in connection with this permitted development; (iii) to unconditionally waive any claim of damage or liability against the Commission, its officers, agents, and employees for injury or damage from such hazards; and (iv) to indemnify and hold harmless the Commission, its officers, agents, and employees with respect to the Commission's approval of the project against any and all liability, claims, demands, damages, costs (including costs and fees incurred in defense of such claims), expenses, and amounts paid in settlement arising from any injury or damage due to such hazards.

See, also, Megan M. Herzog & Sean B. Hecht, *Combatting Sea-Level Rise in Southern California: How Local Governments Can Seize Adaptation Opportunities While Minimizing Legal Risk*, 19 Hastings West Northwest J. Envtl. L. & Pol'y 463, 38 (2013).

[56] Fla. Stat. § 161.085(9)(a) (2014).

[57] Fla. Stat. § 161.085(9)(b) (2014).

hazards is appropriately removed and disposed of if necessary without the public being left with the bill for such cleanup and removal.

viii. Tax and Assessment Strategies

Many commentators have called for "market" strategies for adaptation, including use of tax policy to help drive adaptation. This section includes discussion of both taxes and property assessments, which, by law, are treated very differently.[58]

Tax strategies primarily fall along two lines: either reducing taxes in exchange for desired actions by property owners or imposing additional taxes to offset the higher-than-normal governmental costs to help protect the property or provide services and to help internalize the greater likelihood of disaster costs associated with properties in hazardous areas.

Many possible tax incentive strategies remain the exclusive domain of federal and state government. For example, at the state level, it is impossible for local governments to give any breaks on tax assessment to properties for conservation unless such breaks are explicitly permitted by Florida's constitution. The Florida Constitution, Article VII, section 3(f) allows for an ad valorem property tax exemption for property encumbered by a perpetual conservation easement, as defined by general law. The Florida Constitution also provides that "land used for conservation purposes shall be classified by general law and assessed solely on the basis of character or use."[59] Florida Statute section 704.06 defines "conservation easement" very broadly. However, Florida Statute section 196.26, which delineates which properties receive a property tax exemption based on the above Florida Constitution's provision, indicates that the exemption only applies to land "that is used exclusively for conservation purposes."[60] In addition, land parcels under 40 acres only qualify for the exemption under certain constrained circumstances. Thus, use of property tax incentives to promote the voluntary sale of "rolling" or other conservation easements by home owners or other property owners along Florida's coastlines is of severely limited value.

The tax strategies offering the most promise for managing adaptation could very well be additional property taxes imposed through tools such as Municipal Services Benefit Units (MSBUs) or Municipal Services Taxing Unites (MSTUs). MSTUs and MSBUs operate very differently. As they are taxes, MSTUs are subject to a constitutional requirement that they be uniform. In addition, since they are taxes related to property, they are also subject to millage caps that limit their ability to generate revenue. At the same time, MSTUs have the advantage of being flexible as to how they are used; a local government can collect them from an area and the benefits resulting from their use do not need to directly correspond to the cost that each specific property contributed in taxes.

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[58] For an easily readable summary of the differences between taxes and special assessments and fees, see the Florida Legislature's Office of Economic and Demographic Research, 2013 Local Government Financial Information Handbook, pp. 9-16, available at http://edr.state.fl.us/Content/local-government/reports/lgfih13.pdf.

[59] Florida Const., Art. VII, sec. 4(b) (2013).

[60] Fla. Stat. § 196.26(2) (2013).

On the other hand, MSBUs are *not* taxes. Thus, they can vary—indeed they *must*—from property to property in relation to the amount of benefit to each property of the activity or activities funded by the MSBU. Since they are not taxes, MSBUs are not subject to millage caps, meaning local governments can use them to generate more funds. However, local government must spend the money in a way that provides specific benefits to properties that are assessed these charges. One potential issue that requires further research is whether and how extensively an MSBU commits the local government to providing the service that the MSBU funds. Depending on the results of this research, local governments may wish to exercise caution to not establish an MSBU that could commit the local government to undertaking a service that the local government might not be able to sufficiently fund based on the MSBU funding stream.

Both MSTUs and MSBUs will likely primarily be viewed as relevant to scenarios in which protection of coastal property is the dominant "adaptation" action since both MSTUs and MSBUs can generate revenue that would be used to protect property. However, they might also be able to play other roles in an integrated adaptation effort. For example, even if used to generate revenue for protection activities such as beach nourishment, building of sea walls, and installation of increased drainage/stormwater-pumping capacity, increased property assessment burden may be reflected in reduced property value. This could become a significant factor in determining overall property value in scenarios where an MSBU imposes an extremely high assessment for expensive property protection activities. In fact, over longer time spans, it may be possible to use MSBUs as a way to shift unreasonable increases in infrastructure costs to support properties from the general tax fund increasingly onto the property owners choosing to own the properties. A community might choose to do this if the community wants the costs of living on a hazard-prone property to reflect the costs of that risk or the costs to the local government to mitigate the risk and protect the property.

It might also be possible to use revenue from MSBUs and MSTUs in a local program to assist in relocation of properties, buyout of properties, or insurance programs to insure coastal property value. To the author's knowledge, none of these strategies have been extensively researched or implemented, but they deserve attention as potential means to balance and manage the costs and benefits of coastal adaptation among the public and private property owners.

f. Education Tools

While not specifically regulatory in nature, the potential importance of educating the public about coastal hazards and the vulnerability of properties as well as regulatory limitations to protect people and property from SLR might have an effect on property purchasing and public actions. Two specific forms of public education are suggested: 1) flooding/surge/SLR markers and 2) notice of coastal hazards to prospective property purchasers or permit applicants.

Flooding/storm surge/SLR markers could be added in trafficked public spaces along with additional information made available via QR codes and web addresses. As an example, the Red Cross installed storm surge markers in some areas, including in a park in Wakulla County, Florida, to mark the estimated elevation of various categories of storm surge. Public areas could include markers and interpretive information for storm surge and 100-year flood levels as well as these same levels as increased by local SLR for the next 100 years. In addition, NOAA and FEMA are collaborating on some pilot projects to establish flood markers; lots of the issues and controversy are similar, so any effort to mark potential or past surges will be similar to that of

past flooding (info at http://www.fema.gov/know-your-line-high-water-mark-initiative). Santa Rosa County in Florida is one of the current pilot projects.

Another possibility for increasing knowledge of SLR and its impacts is to require coastal hazards notices be supplied to potential property purchasers or permit applicants in identified areas.[61] Properly informing potential purchasers of coastal property about the risks and limitations inherent in coastal property will help consumers make more informed decisions, might possibly result in some decrease in property value, and may have long-term legal implications when takings claims arise.

VI. Adaptation Options Most Relevant to the Study Area

Due to the large variety of potential adaptation tools listed above and even more that are not listed, it helps to narrow the scope of inquiry of policies to consider. One way to do this is evaluate areas to ascertain the most likely appropriate goals for the area based on existing conditions and projected future conditions (i.e.—based on the vulnerability assessment). Other social, political, and economic factors will also be relevant to final determination as to how to deal with adaptation in any given area, but an initial assessment based on the following can help make the list of potential policies to consider more manageable in the short run. Minimum conditions to include and consider are:

- Existing density
    - Existing level of public and private infrastructure and investment
    - Existing contribution to local tax base
    - Existing zoning
- Existing vulnerability
    - Existing and recent flooding
    - Current and recent erosion trends
    - Storm surge zones and storm surge return intervals
- Existing burdens due to flood insurance cost
- Existing environments and habitats
- Projected scenarios related to SLR for all of the above
- Estimates of costs for various adaptation strategies, their efficacy and likely time of service under the considered scenarios

Based on the above general information it is possible to use a systematic approach for classifying areas based on the criteria in Deyle & Butler, Table 3. This results in a simplified approach that denominates general types of areas based on values for "Coastal Shoreline Vulnerability" (CSV), Urban System Value" (USV), and "Natural System Value" (NSV). For each type of area based

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[61] For more information on the technical aspects of how to do this, *see* Thomas Ruppert, Reasonable Investment-Backed Expectations: Should Notice of Rising Seas Lead to Falling Expectations for Coastal Property Purchasers?, 26 J. Land Use & Envt'l. L. 239 (2011). For information on how Florida's current notice/disclosure law for coastal property purchasers is failing and recommendations to fix this, see, Kevin Wozniak, Garin Davidson, and Tom Ankersen, Florida's Coastal Hazards Disclosure Law: Property Owner Perceptions of the Physical and Regulatory Environment, Florida Sea Grant Technical Publication 194 (2012), available at https://www.flseagrant.org/publications/hazard-resilience/.

on the mix of values for these three variables,[62] Deyle & Butler developed a weighting scale for each of eight considerations. These include:

1. Minimize risk to human development
2. Minimize capital and operating costs
3. Minimize opportunity costs of regulation
4. Minimize environmental stresses
5. Minimize interference with ecological adaptation
6. Maximize adaptive flexibility
7. Maximize political feasibility
8. Minimize legal challenges

While full development of spreadsheets to undertake the analysis suggested by Deyle & Butler for all the identified adaptation options extends beyond the scope of this work, the conceptual process offered by Deyle & Butler informs the adaptation options suggested as most appropriate for the four general types of areas covered by Deyle & Butler.[63]

While this general conceptual framework provides a starting point for focusing discussion about the most likely policy options for consideration in an area, it is not a clear prescription. Cases may arise in which specific considerations not captured by the general framework will, based on history, community values, historical/cultural/economic resources, existing laws and regulations, or other considerations, outweigh the general classifications resulting from the conceptual framework presented here and lead to consideration or implementation of policies not originally recommended by the early classification according to the conceptual framework presented here.

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[62] Deyle & Butler in Table 3 show only four types of areas as they included here only "low" and "high" ratings for each of the three variables. In their Table 2, they present three options for each: low, moderate, and high. If one were actually to use the three variables of "Coastal Shoreline Vulnerability," Urban System Value," and "Natural System Value," and rate each variable as low, moderate, or high, twenty-seven different combinations are possible (3^3). For this exercise, the simplified version of Deyle & Butler is used. This simplified version would give rise to eight possible area types (2^3), but Deyle & Butler did not consider in Table 3 the scenario of all "high" values for each, all low values for each, or scenarios where "Urban System Value" and "Natural System Value" were either both high or both low. A table with all eight combinations used by Deyle 7 Butlers is available in the Appendix.

[63] Deyle & Butler specifically considered in their Table 3 the following general types of areas:

1. Coastal Shoreline Vulnerability—HIGH; Urban System Value—LOW; and Natural System Value—HIGH.

2. Coastal Shoreline Vulnerability—HIGH; Urban System Value—HIGH; and Natural System Value—LOW.

3. Coastal Shoreline Vulnerability—LOW; Urban System Value—LOW; and Natural System Value—HIGH.

4. Coastal Shoreline Vulnerability—LOW; Urban System Value—HIGH; and Natural System Value—LOW.

a. Coastal Shoreline Vulnerability—HIGH; Urban System Value—LOW; and Natural System Value—HIGH.

The classification of CSV-High, USV-Low, and NSV-High approximates an area where there is less dense or no significant human development, significant coastal hazards (due to high wave energy and erosion; high storm surge potential; or flooding and drainage problems), and high value to the natural systems (i.e.—turtle nesting beaches, important recreational/tourist beaches, ecologically important estuaries, etc., or areas critical to allow upland/inland migration of such resources).

Several parts of the Matanzas Basin generally fit this description, especially the northern coastal section north of the Town of Vilano Beach as well as the less-densely developed shorelines between St. Augustine Beach and Flagler Beach, and Marineland and Palm Coast as well as several of the areas inland of the intra-coastal waterway. Even if protection is desired in these areas, one of the biggest challenges would be how to fund such efforts. These areas represent areas least able to afford the significant costs incurred through protection efforts due to their lack of contributing significant tax base. Furthermore, protection of "natural" areas could prove difficult if "protecting" them results in altering the very attributes for which they are valued.

For these areas, the most appropriate adaptation options might focus on accommodation and relocation/avoidance of human development (potentially excepting more appropriate development and infrastructure such as limited development to promote recreational use of such areas) so that the resources of value in these areas may migrate. The focus should be on keeping new development out of these areas; seeking to ensure that existing development understands its risk over the long term and increasingly carries any burden for public infrastructure that costs more to maintain/repair than equivalent typical infrastructure in less hazard-prone areas; and informing the public and property owners of any potential future vulnerability in the area. The most likely appropriate policies include:

1. Development restrictions and prohibitions
    a. Downzoning to prevent high- or medium-density growth.
    b. Conservation zoning to decrease development.
    c. Redevelopment restrictions (no increase in development footprint; increased setbacks from the water; increased building code requirements [strength and elevation] variances to road setbacks; notice requirements to property owner [not just to owner's agent]; and other tools from below).
    d. Increased setbacks from the water for any allowed development or redevelopment.
    e. Expansive land preservation requirements for properties within this area; base open space requirements on size of parcel.
    f. Prohibition on construction or expansion of any medical facilities, nursing homes, or assisted-living facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas; all 100-year and 500-floodplains as well as category 1-3 storm surge areas should be rezoned to make all medical facilities, nursing homes, or assisted-living facilities non-conforming uses.
    g. Prohibition on construction or expansion of any critical facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas unless it can be

demonstrated that such development is essential to human health and safety and no options for placement outside of the prohibited zones are feasible; in such case, the facility must be elevated 3 feet above the 500-year floodplain elevation and have road access elevated above the 500-year floodplain elevation.

   h. If and when development or redevelopment is permitted, permit conditions that require recording of a deed restriction prohibiting armoring.[64]
   i. Building moratorium; must be of limited duration and done in order to allow time for study of an area and policy development and implementation.

2. Zoning changes
   a. Overlay zoning (used to implement many of the tools listed), such as Adaptation Action Areas.
   b. Development of transfer of development rights (TDR) programs that makes these areas "sending" zones for development rights and identifies areas with low coastal shoreline vulnerability as receiving zones (care would have to be exercised to not create conflict with preservation of upland habitats and corridors).
   c. Requirements that development allowed in specified areas consist of construction designed to be moved on roads no smaller that the adjacent road or be designed to be dismantled and reassembled for movement off of the site (a further modification of this might be to require fee-simple ownership of a parcel that is maintained as vacant or otherwise eligible to receive the moved structure, but this is much more likely to be legally challenged; research has not been done to investigate whether such a condition might withstand judicial scrutiny).
3. Infrastructure limitations and changes
   a. Strict limitations on any extension of public services and infrastructure into floodplains and Category 1-3 storm surge zones (may also want to take SLR explicitly into account to delineate areas appropriate for limiting expansion of public infrastructure).
   b. Relocation of public buildings and infrastructure when no private property rights are directly implicated (i.e.—no potential takings claim for removal of infrastructure are likely).
4. Strengthened floodplain management rules (i.e.—extend floodplain regulations from the 100-year floodplain to the 500-year floodplain; add a requirement for at least 3 feet of freeboard in all 100-year and 500-year floodplains with an identified Base Flood Elevation; require at least a 3 foot elevation above grade for buildings in 100-year or 500-year floodplains that do not have a mapped Base Flood Elevation; no development/redevelopment/fill allowed in any 25-year floodways, where mapped; no hazardous uses or hazardous materials storage permitted within any 100-year floodplain; hazardous storage and uses within 500-year floodplain should be subject to strict structural requirements to prevent release of hazardous substances [e.g.—storage tanks sealed and secured/armored against floating, floodproofed buildings, etc.].
5. Financial tools
   a. Development fees for any new development allowed; the challenge is that Florida is very strict in how development fees must be used, meaning that fees must be

[64] This has become a fairly standard practice of the California Coastal Commission when approving development or redevelopment along its coast.

used to develop infrastructure; thus, may be best not to use this as it may contravene extension of public infrastructure.

b. Create Municipal Services Benefit Units (MSBUs) or Municipal Services Taxing Units (MSTUs) or new/higher rate stormwater fees to offset increasing infrastructure costs; each of these has legal strengths and weaknesses that require further analysis prior to implementation.
c. Acquisition of property; this may be voluntary, through eminent domain, or through exactions (although this presents some possible legal hazards); acquisition may be in fee, of a conservation easement, or of a specially drafted "rolling" easement, though a standard for these that has been tested by courts in Florida does not yet exist.
d. Implementation of removal/clean up financial assurances for any allowed private development or redevelopment.

6. Provide additional information to the public
    a. Place floodplain, surge elevation, and SLR markers on public property with links (QR codes) to additional information and maps for flood zones, surge maps, and SLR maps.
    b. Add a requirement of signed and recorded acknowledgement of receipt of coastal hazards information as part of the permitting process; provided information should include, at a minimum, current flooding risk, SLR information and maps, erosion rates (if seaward of a CCCL), as well as information that—based on changing coastal, drainage, and flooding conditions—state, federal, and local laws may change, including the cost and availability of flood insurance and homeowner's insurance.[65]
7. Exactions—these potentially present legal challenges as courts carefully review exactions for a nexus with the reason for which a permit could be denied and also ask whether the exaction has "rough proportionality" with the impact that the development would have on the reasons for potentially denying the permit; commentators are divided on what this really means for local government, so this approach may involve more legal risk. Nonetheless, local governments may consider the possibility of carefully structuring exactions of recorded deed restrictions that prohibit future hard armoring.

b. Coastal Shoreline Vulnerability—HIGH; Urban System Value—HIGH; and Natural System Value—LOW.

These areas will tend to be coastal, low-lying urban or dense suburban development that has significantly impacted the local natural systems. Examples in the study area include the urban areas of Vilano Beach, the coastline from St. Augustine to Crescent Beach, and Marineland. In some of these areas it will present a challenge to determine the border between areas rated as CSV-High,USV-High,NSV-Low and CSV-High,USV-Low,NSV-Low. However, the challenge

[65] Additional suggestions for information to include in a notice to property owners appears in Thomas Ruppert, *Reasonable Investment-Backed Expectations: Should Notice of Rising Seas Lead to Falling Expectations for Coastal Property Purchasers?*, 26 J. Land Use & Envtl. Law 239, 272-74 (2011).

of determining borders between different areas also allows for an opportunity to emphasize the tremendous amount of overlap between policies that can be utilized in different areas. The focus in these areas is on protection and accommodation, but some parts, under longer planning horizons, should also begin to consider potential relocation if long-term protection may not be technically or economically feasible.

For these areas, some of the most pertinent adaptation options include:

1. Planning
    a. Inclusion of sea-level rise in the local comprehensive. This should be done at least in the "Coastal Management," "Future Land Use," and "Capital Improvement" elements of the plan.
    b. To increase the efficacy of the comprehensive plan, extend the planning horizon to a minimum of 50 years for certain issues and/or elements.
    c. Consider adopting "Adaptation Action Areas" as a way to prioritize actions to protect areas that will be protected.
2. Protection activities
    a. Evaluation of priority areas for protection via sea walls, nourishment, and improved drainage, with analysis including up to what level of sea-level rise and storm surge protection is technically and economically feasible.
    b. Granting of armoring permits with requirement that they protect up to a predetermined level of surge and sea-level rise.
    c. Development of assistance program to private landowners with existing sea walls that do not meet the elevation standards established for public protections; program may include cost-share, low-interest financing assistance, etc. for the private owners to voluntarily bring their sea wall or other defenses into compliance with established criteria.
    d. Drainage system modifications (backflow preventers and pumps).
    e. Beach nourishment (especially for tourism areas).
    f. Elevating public infrastructure such as roads; local governments must exercise caution in doing this as the local government will be held liable for any additional flooding it causes through such activity.[66]
    g. Elevating entire area through landfilling. This is what Galveston, Texas did after the 1900 hurricane. However, the legal challenges today are much more challenging than they were back in 1900, so the legal feasibility of a local government telling property owners that they have to raise their buildings or have them partially buried in place is highly suspect.
3. Long-term planning—Determine which areas will most likely be defensible for a planning horizon of 50-100 years and which are not. For those deemed not feasible for sufficient protection, implement the following restrictions to avoid additional growth unless otherwise noted.

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[66] Kendry v. State Road Dep't, 213 So. 2d 23 (4th DCA 1968). See also, Hansen v. City of Deland, 32 So. 3d 654, 655 (5th DCA 2010) (noting that a county takes private property when it directs a concentrated flow of water from one property onto another, permanently depriving the owner of all beneficial enjoyment of their property).

a. Either downzoning to prevent any increase in density growth (if area assumed to be one that will not be technically or financially viable for sufficient protection over the long term, potentially defined as at least 75-100 years; increases in density are seen to be as counterproductive to eventual needs for relocation) or intensification of land use, with a bias towards downzoning to prevent densification. This bias against greater density could be overcome by demonstrating that the opportunity costs [i.e.—losses associated with not increasing density, both by property owners and by local government] would be outweighed by the benefits of such development even after offsetting and paying for increased local government costs, such as infrastructure development/maintenance and legal and administrative costs. Such downzoning should be accompanied by a carefully structured "non-conforming use" policy that allows sufficient amortization time to allow a recouping of investment from uses changed from conforming to non-conforming uses. Many good examples of non-conforming use policies and legally sufficient amortization periods are available in the literature.
b. Identification and publication of areas in which the local government will conduct "maintenance" but does not intend to make significant expenditures for "up grading" of existing drainage capacity or at what point in the future (by date or event) this policy would take effect.[67] This would only apply to those areas not reasonably defensible, economically or technically, over the longer term.
c. Identification of areas prioritized for maximum protection efforts. To be realistic, these should be coupled with short- to medium-term development of appropriate cost and effectiveness analyses based on sea-level rise scenarios. This helps ensure that the citizenry and local government do not simply "prioritize" all areas for protection without the ability to realistically realize this goal from both technical and financial perspectives.

4. Zoning
    a. Overlay zoning (used to implement many of the tools listed), such as Adaptation Action Areas
    b. Development of transfer of development rights (TDR) programs that makes areas *not* deemed technically or financially feasible for long-term protection to be "sending" zones for development rights. The "receiving" zones for the transferred development rights could be one of two options. First, they could be areas with low coastal shoreline vulnerability. Second, a receiving zone could also be an existing protected urban area that is being further densified in order to generate further tax base to engage in protection activities. This second approach, if used at all, should be used with extreme caution since it arguably is creating the

[67] While such a policy may be cause for property owner law suits against the local government, an analysis of such potential legal liability indicates that local governments may not be liable for damages from flooding due to a decision not to upgrade drainage facilities, though a legal analysis is no guarantee of how courts might rule on a given case. *See*, Thomas Ruppert, *Drowning in Place: Local Government Costs and Liabilities for Flooding Due to Sea-Level Rise*, Florida Bar Journal, Vol 87, No. 9 (2013).

conditions for even greater potential loss and suffering should a catastrophic event occur.[68]

c. Increased setbacks from the water for any allowed development or redevelopment.
d. More stringent stormwater requirements for construction. Increased on-site or off-site stormwater mitigation requirements can help decrease the need for such extensive public funding of stormwater improvements to address the decreasing efficiency of existing stormwater systems as tail water levels increase. Stormwater system design calculations should account for 40-60 years of SLR as well as an increase in the frequency and amount of heavy rain events.
e. Prohibition on construction or expansion of any medical facilities, nursing homes, or assisted-living facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas; all 100-year and 500-floodplains as well as category 1-3 storm surge areas should be rezoned to make all medical facilities, nursing homes, or assisted-living facilities non-conforming uses.
f. Prohibition on construction or expansion of any medical facilities, nursing homes, or assisted-living facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas; all 100-year and 500-floodplains as well as category 1-3 storm surge areas should be rezoned to make all medical facilities, nursing homes, or assisted-living facilities non-conforming uses.

5. Increase information available to the public
    a. Inclusion of signed and recorded acknowledgement of receipt of coastal hazards information and other notice information[69] as part of the permitting process or to potential purchasers of affected property,
    b. Provide flood maps showing both the current and estimated 100-year and 500-year flood maps with a specific amount of sea-level rise included. These maps could be either informational or regulatory in nature.
    c. Provide on-site (when in an area with heavy foot traffic) or offsite (if little foot traffic) public displays discussing significant infrastructure projects undertaken to protect the area from drainage/flooding problems, surge, or SLR as well as the estimated level of protection provided under various SLR and storm surge scenarios.
    d. Develop local funding mechanisms such as loan and grant programs for elevating of private residences in areas most heavily developed and most reasonably able to be protected over the medium term.
6. Financial Tools
    a. Identification of "adaptation action areas" to be used for varying purposes; one possible purpose is to realize use of Municipal Services Benefits Units or

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[68] This also runs contrary to the obvious policy recommendations that should flow from the realization that the dramatic increases in disaster costs—both economic and human—are clearly linked to our increasing development in high-risk areas.

[69] Information that could be provided in such a notice and ways of structuring such notice are covered in Thomas Ruppert, *Reasonable Investment-Backed Expectations: Should Notice of Rising Seas Lead to Falling Expectations for Coastal Property Purchasers?*, 26 J. Land Use & Envtl. Law 239 (2011).

Municipal Services Taxing Units, which both decrease the cost to the general public coffers for higher infrastructure maintenance/repair/rebuilding costs and simultaneously force properties in hazardous areas to integrate some of that hazard in their costs.

b. Development fees for adaptation for any new development allowed.

7. Development Restrictions (some applicable to all development and others particularly to development not deemed likely viable for protection beyond a 50-100 year time frame)[70]
    a. Requirement to sign a waiver/release form for certain types of potential claims against the local government in exchange for a permit.[71]
    b. Requirements that development allowed in specified areas consist of construction designed to be moved on roads no smaller that the adjacent road or be designed to be dismantled and reassembled for movement off of the site (a further modification of this might be to require fee-simple ownership of a parcel that is maintained as vacant or otherwise eligible to receive the moved structure, but this is much more likely to be legally challenged; research has not been done to investigate whether such a condition might withstand judicial scrutiny).
    c. Prohibition on construction or expansion of any medical facilities, nursing homes, or assisted-living facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas; all 100-year and 500-floodplains as well as category 1-3

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[70] It is important here to distinguish between "development restrictions" and "exactions" since many of the actions mentioned under these headings overlap. Unfortunately it may not always be clear if something is an "exaction" or just a "restriction." However, one general rule is that an action is much more likely to be an "exaction" if it is added to a permit by the issuing authority rather than being specifically stated in the permitting criteria. So, a "development restriction" as that term is used here is usually a condition expressly written into permitting criteria so that there is no discretion by the permitting authority as to whether the condition is met or not: if the condition is not met, a permit cannot be issued. An "exaction" is where a condition is *not* written specifically into the criteria that determine whether a permit can be issued. However, the permit could still be denied based on an impact of the proposed project that runs contrary to permit-issuance criteria. In such a case, a permit condition could be proposed to be added to the permit; this "exaction" must have an "essential nexus" with the reason/impact that would justify denial of the permit and the impact of the exaction must be "roughly proportional" to that of the proposed development. Thus, whether a policy results is a "development restriction" or an "exaction" depends in part on whether it is written into the criteria that determine whether a permit can be issued. However, whether something is an "exaction" or "development restriction" may also have to do with the nature of the condition/limitation. For example, a permit-issuance criteria requiring an applicant to provide an easement for public access that did not previously exist would very likely be found to be an exaction, even if written into the permitting criteria. This is because "exactions" are also found when an applicant is forced to give up in order to receive a government benefit, such as a permit.

[71] This potentially presents some legal problem. Such an effort could be viewed as an exaction and thus subjected to stricter judicial scrutiny than typical land use or zoning decisions. In addition, while an "assumption of the risk" form signed by the applicant would provide even more protection for the local government, this policy was referred to as "coercive and repugnant" by one court that reviewed it, though this commentary by the court has no specifically legal binding impact. Jordan v. St. Johns County, case no. CA05-694 (Seventh Judicial Circ., Fla.) (21, May 2009) FN 2. This policy was ended by St. Johns County as part of the settlement of the case. However, requiring signing and recording of an "assumption of the risk" form is common practice in California, whose program doing this was the inspiration for St. Johns County to implement its policy.

storm surge areas should be rezoned to make all medical facilities, nursing homes, or assisted-living facilities non-conforming uses.

d. Prohibition on construction or expansion of any critical facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas unless it can be demonstrated that such development is essential to human health and safety and no options for placement outside of the prohibited zones are feasible; in such case, the facility should be elevated above the 100 year or even 500-year floodplain elevation and have road access elevated above the 500-year floodplain elevation.

8. Strengthened floodplain management rules (i.e.—extend floodplain regulations from the 100-year floodplain to the 500-year floodplain; add a requirement for at least 3 feet of freeboard in all 100-year and 500-year floodplains with an identified Base Flood Elevation; require at least a 3 foot elevation above grade for buildings in 100-year or 500-year floodplains that do not have a mapped Base Flood Elevation; no development/redevelopment/fill allowed in any 25-year floodways, where mapped; no hazardous uses or hazardous materials storage permitted within any 100-year floodplain; hazardous storage and uses within 500-year floodplain should be subject to strict structural requirements to prevent release of hazardous substances [e.g.—storage tanks sealed and secured/armored against floating, floodproofed buildings, etc.].
9. Inclusion of sea-level rise in the local comprehensive. This should be done at least in the "Coastal Management," "Future Land Use," and "Capital Improvement" elements of the plan.

c. Coastal Shoreline Vulnerability—LOW; Urban System Value—LOW; and Natural System Value—HIGH.

Only a few parts of the study area would fall within the CSV low; USV low; NSV high scenario as many of the non-urbanized areas are also very low lying.

The focus in these areas should be on analysis to understand the habitat value of such areas under SLR scenarios and the value of such areas for future development if they are assured of long-term (i.e.—50-100 years) relative safety and access in spite of flooding, surge, and SLR. Once these areas are identified there will be a need to evaluate and decide on whether their ecosystem importance or their development growth potential should be the most important factor in the future analysis and planning. When the future habitat values of such areas are deemed most important, typical land use restrictions may be used to prevent most development in such areas and protect the natural values present. However, if there is a need for developable area, it may be appropriate to channel future development into some of these areas not as critical for future habitat migration or connection. Thus, these areas could potentially be split into two: 1. Ecosystem Preservation and 2. Intensive Development Area. The latter might seem counterintuitive when it is noted that the "Natural System Value" was rated "high." However, as areas where "Coastal Shoreline Vulnerability" is "low" are so infrequent near the coast in this region, it may be necessary to admit that some such areas, despite important ecological value, will be sacrificed to development. If this occurs, the development should be as dense as possible to decrease its overall footprint on the landscape and maximize the use of safer land in

accommodating human development while minimizing services delivery costs and maximizing tax revenue.

The most appropriate policy options to consider for land to be protected for its natural system value include:

1. Strict development prohibitions coupled with delineation as a "sending" area for a transfer of development rights (TDR) program; this helps maintain some value for owners of such land.[72]
2. Designation of areas as qualifying for voluntary sales of conservation easements or sales of development rights.
3. Program to provide notice to potential purchasers of land in the area of the conservation and restricted status of the land.
4. Prohibitions on increases in public infrastructure that directly serves properties in the area (with possible exceptions for encouraging low-infrastructure-intensity recreational uses such as parks and nature areas; creating public access for passive recreational use of natural areas can result in increased public support for funding and protection of such areas).
5. Rolling easement and conservation easement purchase from willing sellers (more feasible and likely to occur when implemented in conjunction with other development restrictions).

For areas that might be slated for future development, policies could include those listed immediately below as well as many those listed in the following section for "Coastal Shoreline Vulnerability—LOW; Urban System Value—HIGH; and Natural System Value—LOW":

1. Increased wetland and ecosystem buffer zones.
2. Significantly increased floodplain management requirements (including increased building elevation requirements to require construction at least 3 feet above grade within the 500-year floodplain; no new development within the 100-year floodplain).
3. Protection of migration "corridors" as necessary to maintain effectiveness and viability of habitat/environment protection areas around areas identified for denser development.
4. Increased information to the public:
    a. Development and dissemination of maps showing designated areas for natural systems protection and including basis for their creation (current flood/surge risk and flood/surge risk as exacerbated by SLR); maps showing areas deemed safe from 50-100 years of SLR.
    b. Add a requirement of signed and recorded acknowledgement of receipt of coastal hazards information as part of the permitting process; provided information should include, at a minimum, current flooding risk, SLR information and maps, erosion rates (if seaward of a CCCL), as well as information that, based on

[72] Outright development prohibitions, while a strong measure, recognize that the potential for allowing development with the expectation that it will be removed later presents great challenges. *See, e.g.* Carolyn Kousky, *Managing Shoreline Retreat*, Climatic Change 124:9-20 (2014).

changing coastal, drainage, and flooding conditions, state, federal, and local laws may change.[73]

c. Add a requirement of signed and recorded acknowledgement of receipt notice of coastal hazards, regulations, sea-level rise, and possible future changes of regulations for property sales within identified coastal hazard areas.

d. Coastal Shoreline Vulnerability—LOW; Urban System Value—HIGH; and Natural System Value—LOW.

The tools and policies suggested as most relevant for CSV-Low, USV-High, NSV-Low here are almost identical to those in the CSV-High, USV-High, NSV-Low. This is because even relatively "low" coastal shoreline vulnerability still often means, especially in the study area at hand, an area with connections to, and maybe *through*, an area that is CSV-High, USV-High, NSV-Low. Thus, while the most relevant adaptation tools may be essentially the same, much less aggressive application of them may be necessary or advisable when Coastal Shoreline Vulnerability is low.

The study area is so low in elevation, it is not clear that many areas of current "high" urban system value could qualify as being safe for development, due either to proximity to the coast, being within a floodplain/surge zone, or at such low elevation that sea-level rise might increase drainage, flooding, and surge problems. This challenge is quickly apparent by reviewing the maps of land at or below 3 feet of elevation. This presents one of the greatest challenges of the study area: The land available to local governments and residents to move to from current locations or to accommodate new residents and grow the tax base is also very low-lying, and thus eventually subject to drainage, flooding, and storm surge problems, especially during the next 80-100 years if current predictions of 3-5 feet of sea-level are realized.

Essentially, this means that even if new building and investment takes place in these relatively "safe" areas, many policies for areas that plan to "accommodate" sea-level rise should also be included. Areas potentially included in this category include those at least 4 feet above current sea levels. For urban areas in the study area, this would likely include:

- Areas of St. Augustine on the mainland and west of the San Sebastian River, with some areas close to the river not included;
- Unincorporated areas south of St. Augustine and Highway 207 and east of the Matanzas River;
- Some easterly portions of Anastasia Island;
- Unincorporated land south of Moultrie Creek (St. Augustine Shores);
- Narrow band of the extreme southerly portion of Anastasia Island (but potentially should be excluded due to erosion and storm surge concerns);

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[73] Additional suggestions for information to include in a notice to property owners appears in Thomas Ruppert, *Reasonable Investment-Backed Expectations: Should Notice of Rising Seas Lead to Falling Expectations for Coastal Property Purchasers?*, 26 J. Land Use & Envtl. Law 239, 272-74 (2011).

- Palm Coast east of I-95

Policies most appropriate for consideration in this area include:

1. Planning
    a. Inclusion of sea-level rise in the local comprehensive. This should be done at least in the "Coastal Management," "Future Land Use," and "Capital Improvement" elements of the plan
    b. To increase the efficacy of the comprehensive plan, extend the planning horizon to a minimum of 50 years for at least certain issues and/or elements
2. Density-oriented development and redevelopment policy
3. Low "as-of-right" zoning with significant bonus incentives for use of TDR credits.
4. Implementation of a development code that focuses on requiring design appropriate to mixed-use, denser urban areas; this will promote the need to utilize TDRs, making any TDR program more viable.
5. Clustered development to promote easier protection of development that is allowed and that might become vulnerable in the future; this could include exceptions to open-space requirement conditioned on securing of TDR credits..
6. Protection activities (potentially relevant for areas that might need protection in the future even though their current coastal shoreline vulnerability is low)
    a. Evaluation of priority areas for protection via sea walls, nourishment, and improved drainage, with analysis including up to what level of sea-level rise and storm surge protection is technically and economically feasible
    b. Granting of armoring permits with requirement that they protect up to a predetermined level of surge and sea-level rise
    c. Drainage system modifications (backflow preventers and pumps)
    d. Beach nourishment (especially for tourism areas)
    e. Elevating public infrastructure such as roads; local governments must exercise caution in doing this as the local government will be held liable for any additional flooding it causes through such activity[74]
    f. Elevating entire area through landfilling. This is what Galveston, Texas did after the 1900 hurricane. However, the legal challenges today are much more challenging than they were back in 1900, so the legal feasibility of a local government telling property owners that they have to raise their buildings or have them partially buried in place is suspect. However, if done proactively in an area that was not yet developed, such legal hurdles would not exist. In that case, the government could elevate the roads and then require all floor elevations to be a minimum height above the crown of the road, leading to the need for development to do its own elevating.[75]

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[74] Kendry v. State Road Dep't, 213 So. 2d 23 (4th DCA 1968). See also, Hansen v. City of Deland, 32 So. 3d 654, 655 (5th DCA 2010) (noting that a county takes private property when it directs a concentrated flow of water from one property onto another, permanently depriving the owner of all beneficial enjoyment of their property).

[75] One potential complication with such an approach is that it may contradict good floodplain management practice of avoiding placing fill in floodplains as this decreases the storage capacity of the floodplain, ultimately contributing to increases in the flood elevation.

7. Long-term planning—determine which areas will most likely be defensible for a planning horizon of 50-100 years and which are not. For those not likely defensible, implement the following restrictions to avoid additional growth unless otherwise noted.
    a. Either downzoning to prevent any increase in density growth (if area assumed to be one that will not be technically or financially viable for sufficient protection over the long term, defined as at least 100 years; increases in density are seen to be as counterproductive to eventual needs for relocation) or intensification of land use, with a bias towards downzoning to prevent densification. This bias against greater density could be overcome by demonstrating that the opportunity costs [i.e.—losses associated with not increasing density, both by property owners and by local government] would be outweighed by the benefits of such development even after offsetting and paying for increased local government costs, such as infrastructure development/maintenance and legal and administrative costs. Such downzoning should be accompanied by a carefully structured "non-conforming use" policy that allows sufficient amortization time to allow a recouping of investment from uses changed from conforming to non-conforming uses.
    b. Identification and publication of areas in which the local government will conduct "maintenance" but does not intend to make significant expenditures for "up grading" of existing drainage capacity or at what point in the future (by date or event) this policy would take effect.[76] This would only apply to those areas not reasonably defensible, economically or technically, over the longer term.
8. Zoning
    a. Overlay zoning (used to implement many of the tools listed), such as Adaptation Action Areas
    b. More stringent stormwater requirements for construction. Increase on-site or off-site stormwater mitigation requirements can generally help alleviate the need for such extensive public funding of stormwater improvements to address the decreasing efficiency of existing stormwater systems as tail water levels increase. Stormwater system design should account for 40-60 years of SLR as well as an increase in the frequency of heavy rain events.
    c. Prohibition on construction or expansion of any medical facilities, nursing homes, or assisted-living facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas; all 100-year and 500-floodplains as well as category 1-3 storm surge areas should be rezoned to make all medical facilities, nursing homes, or assisted-living facilities non-conforming uses.
    d. Prohibition on construction or expansion of any medical facilities, nursing homes, or assisted-living facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas; all 100-year and 500-floodplains as well as category 1-3 storm surge areas should be rezoned to make all medical facilities, nursing homes, or assisted-living facilities non-conforming uses.

[76] While such a policy may be cause for property owner law suits against the local government, an analysis of such potential legal liability indicates that local governments may not be liable for damages from flooding due to a decision not to upgrade drainage facilities, though a legal analysis is no guarantee of how courts might rule on any specific given case. *See*, Thomas Ruppert, *Drowning in Place: Local Government Costs and Liabilities for Flooding Due to Sea-Level Rise*, Florida Bar Journal, Vol 87, No. 9 (2013).

9. Increase information available to the public
    a. Inclusion of signed and recorded acknowledgement of receipt of coastal hazards information and other notice information[77] as part of the permitting process or to proposed purchasers of affected property
    b. Provide flood maps showing both the current and estimated 100-year and 500-year flood maps with a specific amount of sea-level rise included. These maps could be either informational or regulatory in nature.
    c. Provide on-site (when in an area with heavy foot traffic) or offsite (if little foot traffic) public displays discussing significant infrastructure projects undertaken to protect the area from drainage/flooding problems, surge, or SLR.
10. Financial Tools
    a. Identification of "adaptation action areas" to be used for varying purposes; one possible purpose is to realize use of Municipal Services Benefits Units or Municipal Services Taxing Units, which both decrease the cost to the general public coffers for higher infrastructure maintenance/repair/rebuilding costs and simultaneously force properties in hazardous areas to integrate some of that hazard in their costs.
    b. Development fees for adaptation for any new development allowed.
11. Development Restrictions (some applicable to all development and others particularly to development not deemed likely viable for protection beyond a 50-100 year time frame)
    a. Requirement to sign a waiver/release form for certain types of potential claims against the local government in exchange for a permit[78]
    b. Requirements that development allowed in specified areas consist of construction designed to be moved on roads no smaller that the adjacent road or be designed to be dismantled and reassembled for movement off of the site (a further modification of this might be to require fee-simple ownership of a parcel that is maintained as vacant or otherwise eligible to receive the moved structure, but this is much more likely to be legally challenged; research has not been done to investigate whether such a condition might withstand judicial scrutiny).
    c. Prohibition on construction or expansion of any medical facilities, nursing homes, or assisted-living facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas; all 100-year and 500-floodplains as well as category 1-3

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[77] Information that could be provided in such a notice and ways of structuring such notice are covered in Thomas Ruppert, *Reasonable Investment-Backed Expectations: Should Notice of Rising Seas Lead to Falling Expectations for Coastal Property Purchasers?*, 26 J. Land Use & Envtl. Law 239 (2011).

[78] This potentially presents some legal problem. Such an effort could be viewed as an exaction and thus subjected to stricter judicial scrutiny than typical land use or zoning decisions. In addition, while an "assumption of the risk" form signed by the applicant would provide even more protection for the local government, this policy was referred to as "coercive and repugnant" by one court that reviewed it, though this commentary by the court has no specifically legal binding impact. Jordan v. St. Johns County, case no. CA05-694 (Seventh Judicial Circ., Fla.) (21, May 2009) FN 2. This policy was ended by St. Johns County as part of the settlement of the case. However, requiring signing and recording of an "assumption of the risk" form is common practice in California, whose program doing this was the inspiration for St. Johns County to implement its policy.

storm surge areas should be rezoned to make all medical facilities, nursing homes, or assisted-living facilities non-conforming uses.

d. Prohibition on construction or expansion of any critical facilities in the 100- or 500-year floodplains or within category 1-3 storm surge areas unless it can be demonstrated that such development is essential to human health and safety and no options for placement outside of the prohibited zones are feasible; in such case, the facility should be elevated above the 100 year or even 500-year floodplain elevation and have road access elevated above the 500-year floodplain elevation.

12. Strengthened floodplain management rules (i.e.—extend floodplain regulations from the 100-year floodplain to the 500-year floodplain; add a requirement for at least 3 feet of freeboard in all 100-year and 500-year floodplains with an identified Base Flood Elevation; require at least a 3 foot elevation above grade for buildings in 100-year or 500-year floodplains that do not have a mapped Base Flood Elevation; no development/redevelopment/fill allowed in any 25-year floodways, where mapped; no hazardous uses or hazardous materials storage permitted within any 100-year floodplain; hazardous storage and uses within 500-year floodplain should be subject to strict structural requirements to prevent release of hazardous substances [e.g.—storage tanks sealed and secured/armored against floating, floodproofed buildings, etc.].Inclusion of sea-level rise in the local comprehensive. This should be done at least in the "Coastal Management," "Future Land Use," and "Capital Improvement" elements of the plan.

e. National Flood Insurance Program

As discussed above in Section V.e.v., the NFIP is beginning to have increased impact on property in floodplains in Florida. While the impact to property values resulting from higher NFIP premiums creates hardship for some property owners, this more transparent evidence of risk also presents an opportunity in efforts to reduce overall exposure to risk. Local governments should be evaluating where property value impacts are the greatest, where property values were already modest, and where the impact to property value of flood insurance changes is largest. The local government should then evaluate whether such areas should be focused on for more resilient redevelopment or whether they should be focused on for voluntary acquisition programs as well as other policies encouraging relocation to safer areas, such as downzoning or building limitations coupled with a transfer of development rights (TDR) program. In fact, through participation in the NFIP's Community Rating System (CRS), a community can market these challenging legal policy changes by focusing on how they improve the CRS score of the community, thus resulting in lower NFIP premiums for all NFIP policy holders in the local government's area. In addition, improved CRS ratings result in decreased flood insurance losses during a flooding event.

VII. Inter-Relationships Between Adaptation Options: Integrating Strategies

As becomes clear by even a cursory review of the list of adaptation options, it is difficult to neatly separate them into distinct boxes. For example, some of the most important tools, such as financial incentives, infrastructure limitations, or overlay zones, actually include many other listed adaptation options. In addition, many tools can either work to reinforce each other or could work against each other. For example, increased setbacks from the water combined with increased elevation and design requirements for structures work together to positively adapt. On the other hand, funding a voluntary conservation easement acquisition in an area at the same time that the local government is willing to allow increases in the density of existing development in the same area is working at cross purposes.

The complex interrelationships between potential policies and their legal, ecological, economic, and social impacts inevitably requires detailed analysis and extensive public input at the local level as these do not lend themselves to simple generalizations. This complexity is part of the limitation inherent even in the most useful analysis frameworks such as the one noted above by Deyle & Butler. With this caveat in mind, what follows are some additional observations about adaptation options appropriate to achieve general goals for an area.

This discussion is organized below according to the goals sought to be achieved in an area. The four categories of goals considered are: 1. Avoidance of an area that is not yet developed, 2. Relocation out of an area that is already developed, 3. Accommodation of hazards in an area that is already developed or developing, and 4. Protection of an already developed or developing area.

a. Avoidance of Area Not Yet Developed

Obviously the most important issue is a ban on development in areas designated for avoidance of hazards. However, a complete ban on development by itself would very likely result in successful takings claims against the local government. Several potential policies can mitigate the effort to prevent the most harmful development.

First, rather than an outright ban, the area could be rezoned to encourage only limited types of development that encourage recreational uses—private, public, or commercial—that require minimal facilities and infrastructure. Such a policy could be a larger part of promoting tourism in the area even as it increases quality of life for residents and maintains value in property parcels so that owners do not suffer a "taking" of their property and the local government continues to receive property taxes.

Second, limitations on development should be coupled with designation of the area as a "sending" zone for TDR credits. Thus, assuming proper creation of "receiving" zones in both accommodation and protection areas along with incentives to create value for the TDR credits, the availability of property in an avoidance area to "send" TDR credits helps create value in the property and avoid a "taking" of the property due to property limitations.

Third, infrastructure polices should be reviewed. Public infrastructure should be removed from these areas when it is possible to do so without interfering with the rights of property owners that have come to depend on such infrastructure. When proactive removal is not possible or reasonable due to current use of the infrastructure or plans to allow its use for recreational purposes, the local government may still consider adopting an ordinance the defines certain

limits and challenges to maintenance of the infrastructure that, once surpassed, will result in imposition of financial limits on the amount the local government will expend to maintain the infrastructure.

To ensure the above policies work in harmony together, a local government should ensure that any downzoning or limitation on zoning still allows sufficient zoning density that can then be transferred out of the area via the TDR program. Also, if zoning is developed to encourage limited development to promote recreational use (e.g. parking lots, restrooms, camping sites, transient/minimalist food/vendor sites, etc.), it may be desirable to not include parcels under this zoning in the TDR sending area.[79]

In an avoidance area, it is important to ensure that there is a strict policy of no expansion of existing public infrastructure.[80]

b. Relocation Out of an Area

To decrease any new development or redevelopment, it is possible to create a system similar to the "Rate of Growth Ordinance" (ROGO) used in Monroe County to limit the expansion of development in the Florida Keys. The ROGO, for example, allows a limited number of permits each year. Your place in the "line" to get a permit under ROGO is determined by points rather than the date you submit your application. Points allocated to a property include factors such as the type/amount of vegetation and how readily available are services. Applicants may also gain points for donating land to the County and for the amount of time they have already been on the waiting list. In the case of the GTMNERR study area, a points system could be developed according to the values and desired outcomes of the public process and what values and issues the community wishes to support.

c. Accommodation of Hazards in an Area

Careful enforcement of floodplain regulations can help to decrease flood losses and protect life and property. For example, for many years Monroe County did not effectively police prohibitions against adding new living space in areas below the Base Flood Elevation. This has resulted in many homes with illegally constructed living areas that are much more prone to flood damage than they would be were they above the Base Flood Elevation.

d. Protection of an Area

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[79] The allowance of using property has already maintained some value in the property, thus obviating the need for the TDR credit value. Also, it is best to limit the amount of TDR credits as this makes it easier to promote a viable market for them.

[80] As noted earlier, it may be appropriate to establish exceptions for this to allow for appropriate, minimal development to foster recreational use.

Areas slated to be "protected" from SLR and the related coastal hazards of erosion, surge, and flooding should only be designated for "protection" based on careful technical and financial analyses that support any community desire to see the area protected. This can help avoid the knee-jerk reaction of a community of assuming that all areas will be protected in all scenarios even though this might not be technically and financially feasible.[81]

Areas destined for protection should, when technical and financial analyses support the long-term protection potential of area, be designated as "receiving zones" for a region's TDR program. As part of this, the receiving zone should have modest underlying zoning density that can be dramatically increased through purchase of TDR credits. Such a policy works to ensure that a TDR program creates real value for parcels in a TDR "sending zone" that are subject to severe or complete prohibitions on commercial or residential development. Additionally, it might be considered whether open space requirements, if they exist in the area slated for protection, should be eligible to be overcome through use of TDR credits, thus allowing still further density and again contributing to the important need for value of TDR credits assigned to property based on restrictions to the property.

When allowing armoring or nourishment, a local government could create a nourishment or armoring district that assesses fees on property owners. Further legal analysis is required to examine the potential types of mechanisms that could legally accomplish this as well as the benefits of drawbacks of different funding mechanisms. Currently many local governments fund nourishment efforts through bed taxes, but such a method does not necessarily accurately relate the amount of the cost to a property to either the need for nourishment created by specific properties nor the benefit to properties of the nourishment. While there is the financial argument often made that an entire beach-front community benefits from "protecting" the beach through beach nourishment, this fails to acknowledge that beaches themselves do not need "protecting" from movement of the beach; only properties located on the beach need protection from movement of the beach. Beaches can move landward without problems as long as they are not subjected to "coastal squeeze" due to human development that prevents beach or habitat migration. Additionally, many local governments also currently use MSTUs or MSBUs to generate funding for the local share of beach nourishment. While other strengths and weaknesses of these options were discussed above, each also sends different signals to the market and property owners about hazards and resilienc.

VIII. Appendix I

All possible combinations of "Coastal Shoreline Vulnerability" (CSV), Urban System Value" (USV), and "Natural System Value" (NSV) (cells with **bold type** not included Table 3 of Deyle & Butler):

CSV – HIGH	CSV – LOW

[81] *See, e.g.* Cela, M., J. Hulsey, and J.G. Titus 2010. "South Florida." In James G. Titus, Daniel L. Trescott, and Daniel E. Hudgens (editors). The Likelihood of Shore Protection along the Atlantic Coast of the United States. Volume 2: New England and the Southeast. Report to the U.S. Environmental Protection Agency. Washington, D.C., available at http://risingsea.net/ERL/shore-protection-and-retreat-sea-level-rise-South-Florida.pdf.

NSV – HIGH **USV – HIGH**	**NSV – LOW** **USV – LOW**
CSV – HIGH NSV – LOW USV – HIGH	CSV – LOW NSV – HIGH USV – LOW
CSV – HIGH NSV – HIGH USV – LOW	CSV – LOW NSV – LOW USV – HIGH
CSV – HIGH **NSV – LOW** **USV – LOW**	**CSV – LOW** **NSV – HIGH** **USV – HIGH**

IX. Appendix II

Summary of Select Climate Change and/or Sea-Level Rise Language in Comprehensive Plans, Land Development Codes, and Codes of Ordinances in Florida coastal local governments (as of Summer 2014)

- Broward County: (appears in Climate Change Element)
  - **Policy 19.3.4** "Broward County shall identify public investments and infrastructure at risk from sea level rise and other climate change related impacts by 2015, and update this assessment every 5 years. Specifically, the County shall analyze vulnerability to facilities and services, including but not limited to: buildings; water and wastewater treatment plants, transmission lines and pumping stations; stormwater systems; roads, rail, bridges, and all transportation and transit infrastructure; power generation facilities and power transmission infrastructure; critical airport and seaport infrastructure; hospitals; city halls, police and fire stations."
  - **Policy 19.3.5.** "Broward County shall evaluate the costs and benefits of adaptation alternatives in the location and design of new infrastructure as well as the fortification or retrofitting of existing infrastructure."
  - **Policy 19.3.7.** "Broward County shall continue to improve analysis and mapping capabilities for identifying areas of the County vulnerable to sea level rise, tidal flooding, and other impacts of climate change. Acquire increasingly accurate Light Detection And Ranging (LiDAR) data, or other state-of-the-art elevation data, and other necessary modeling data and programs every 5 years to update the Priority Planning Area for Sea Level Rise Map in the County's Land Use Plan and improve available information needed to make informed decisions regarding adapting to the impacts of climate change.
  - **Policy 19.3.8.** "Broward County shall, by 2015, develop new 100 year stormwater elevation projections in the Broward County 100 year flood map for use in stormwater management permitting and other planning processes, which incorporate current and projected conditions for sea level rise.
  - **Policy 19.3.9.** "Broward County, in conjunction with its municipalities and partner agencies, shall work to ensure that adaptation to climate change impacts, especially sea level rise, is incorporated into the planning, siting, construction,

replacement and maintenance of public infrastructure in a manner that is cost-effective and that maximizes the use of the infrastructure throughout its expected life span.

- **Policy 19.3.11.** "Broward County shall evaluate opportunities to protect coastal investments and infrastructure, as necessary and feasible, from the impacts of climate change. Specifically, the County will maintain shoreline protection and erosion control by:
  a) Continuing the appropriate use of beach nourishment and sand bypassing;
  b) Facilitating the installation and maintenance of native beach dune vegetation along appropriate areas of beach;
  c) Revisiting redevelopment policies with the objective of providing additional coastal buffer area between developed areas and the shoreline; and
  d) Considering hard structures, such as seawalls, only when alternative options are unavailable."
- **Policy 19.3.12.** "Broward County shall by 2012, designate areas that are at increased risk of flooding due to, or exacerbated by, sea level rise over the next 50 years within the Broward County Land Use Plan Priority Planning Areas for Sea Level Rise Map, and work to make these areas more climate resilient by discouraging density increases and encouraging the use of adaptation and mitigation strategies."
- **Policy 19.3.13**. "Broward County shall by 2017, work with its local municipalities to designate Adaptation Action Areas, per Florida State Law, using the Priority Planning Areas for Sea Level Rise Map as a basis for identifying areas especially vulnerable to sea level rise, in order to develop policies for adaptation and enhance the funding potential of infrastructure adaptation projects."
- **Policy 19.3.14**. " Broward County shall encourage local municipalities to develop policies to improve resilience to coastal and inland flooding, salt water intrusion, and other related impacts of climate change and sea level rise in their Comprehensive Plans, Sustainability Action Plans, Vision Plans, Stormwater Master Plans, Adaptation Action Areas Plans, Climate Change Plans and other citywide plans."
- **Objective 19.4** includes many policies focused on ecosystems and habitats and climate change. Some of the most relevant for SLR adaptation specifically include:
- **Policy 19.4.12.** "Broward County, in cooperation with its municipalities and appropriate local agencies, shall evaluate water and stormwater management operation strategies in the context of sea level rise, in order to lessen negative impacts to open spaces, wetland mitigation areas, and natural systems, improve the ability of these systems to adapt to climate change, and optimize the ability of these systems to create additional benefits to the County's residents and visitors."
- Policy 19.4.13. "Broward County should consider policies which would allow coastal and water dependent ecosystems to migrate or adapt to maintain healthy wildlife and fish populations consistent with new climate regimes."

- **Policy 19.4.14.** "Broward County should establish policies and regulations to protect coastal ecosystems from contamination resulting from inundation, structural failure, or abandonment of residential, industrial, and municipal assets resulting from sea level rise, storm events, or other climate related impacts."
- **Policy 19.4.15** "Broward County should support the efforts of state environmental and planning agencies to jointly develop, assess, and recommend a suite of planning tools and climate change adaptation strategies for local municipalities to maximize opportunities to protect the beach and dune systems, coastal wetlands, and other coastal resources from the impacts of sea level rise."
- Objective 19.5 has numerous policies related to "Mitigation, Protection and Adaptation of Water Resources and Services." Among these, some of the most relevant specifically to SLR include:
- **Policy 19.5.4.** "Broward County shall coordinate with local municipalities, water providers and water managers to ensure the adequacy of water supply facilities and infrastructure to effectively capture, store, treat, and distribute potable water under variable climate conditions, including changes in rainfall patterns, sea level rise, and flooding, with potential water quality and quantity impacts."
- **Policy 19.5.7.** "Broward County shall support recurring and continued development of local integrated models and continuous data collection, to help predict and track the impacts of sea level rise on groundwater levels, saltwater intrusion, and drainage infrastructure through enhanced development and application of local hydrologic models and the use of down-scaled climate models."
- **Policy 19.5.9.** "Broward County shall work to protect existing well fields, surface or subsurface storage facilities, control structures, water and wastewater treatment plants and transmission infrastructure from increased coastal flooding, sea level rise, saltwater intrusion, and other potential future climate change impacts, and plan for infrastructure replacement and relocation as needed."
- **Policy 19.5.10.** "Broward County shall continue source-water (well field) monitoring and protection programs to mitigate water supply loss due to saltwater intrusion. Specifically, Broward County should address potential impacts on the coastal aquifer from water quality changes and flooding of coastal and tidally influenced bodies of water that may occur due to more intense storms, higher surface water temperatures, and rising sea levels."
- **Policy 19.5.13.** "Broward County shall study whether to build, modify or relocate water, wastewater and stormwater transmission infrastructure to allow for strategic retreat from areas at risk to sea level rise."
- **Policy 19.7.5.** "Broward County shall work with the Florida Division of Emergency Management and other agencies to incorporate sea level rise and increasing storm surge impacts into the remapping of potential hazard areas in coastal zones by 2015. Revised hazard area designations should better reflect the risks to communities associated with climate change and allow reevaluation of suitability for development or redevelopment in these areas."
- **Policy 19.7.6.** "Broward County shall cooperatively develop model codes and policies to encourage posthazard redevelopment in areas with less vulnerability

to storm surge, inundation, flooding, sea level rise and other impacts of climate change, and incentivize locally appropriate mitigation and adaptation strategies."

- In addition: 1) Broward County adopted Resolution 2008-442, which established a "Climate Change Task Force." 2) Land Use Plan Policy A.03.06 indicates that "Broward County shall, in coordination with its local municipalities, designate Adaptation Action Areas, per Florida State Law, using the Priority Planning Areas for Sea Level Rise Map as a basis for identifying areas especially vulnerable to sea level rise, in order to enhance the funding potential of infrastructure adaptation projects and develop policies for adaptation."

- Charlotte County: Future Land Use (FLU) – Goals, Objectives and Policies (http://www2.charlottefl.com/CompPlan/main/view_doc.aspx?docid=5#contentelement_7842)
  - FLU Policy 1.1.4 Strategy for Sustainability: Performance Standards, which is used to determine the county's role in climate change: "The County shall initiate efforts to quantify its impacts on climate change and the effect of the policies of this Plan to address this issue, and shall report on the results of this effort as a part of the 2017 Evaluation and Appraisal Report. At a minimum, this evaluation will include a methodology to quantify the existing average per capita vehicle miles traveled for Charlotte County and an evaluation of how these policies helped to reduce this performance criterion over the evaluation period." (http://www2.charlottefl.com/CompPlan/main/view_doc.aspx?docid=5#Strategy_for_Sustainability:_Performance_Standards)
  - FLU Policy 1.1.5 Strategy for Sustainability: Reducing the Carbon Footprint [While this policy does not mention "climate," it relates to climate change since the objective is to reduce the carbon footprint of development.]: "The County shall take the following actions as part of an overall strategy to reduce the carbon footprint of development and infrastructure in Charlotte County: . . . ."
  - FLU Policy 2.4.7 Short-term Actions to Address the Effects of Climate Change [which specifically includes sea-level rise]: "The County shall amend the Code of Laws and Ordinances within one year of the effective date of this comprehensive plan to require that all proposed development address ways to minimize damage from coastal erosion, 100-year floods, tidal surges from hurricanes and coastal storms, and a projected year 2050 0.5 meter sea level rise (FLUM Series Map #15). These measures may include elevating structures on pilings and elevating roadways to mitigate the impacts of anticipated storm surges, flooding, and sea level rise." (http://www2.charlottefl.com/CompPlan/main/view_doc.aspx?docid=5#Short-term_Actions_to_Address_the_Effects_of_Climate_Change)
  - FLU Policy 2.4.8 Long-term Strategy to Address the Effects of Climate Change: "Upon completion of the Department of Community Affairs pilot project for 'Integrating Hazard Mitigation into MPO Long Range Transportation Planning', and 'Best Practices Guidebook' that is being prepared by Florida State University, Charlotte County shall review the findings of this document and adopt policies determined necessary and appropriate to implement the recommendations regarding inundation protection, accommodation, avoidance,

and relocation of impacts from erosion, inland flood, storm surges, and wildfires."

- The Future Land Use Element's "Appendix I: Land Use Guide" contains a "Sea Level Rise" map: http://www2.charlottefl.com/compplan/external/1-FLU/Maps/FLUM15.pdf.

- Collier County: (language in Conservation & Coastal Management Element of the Collier County Growth Management Plan) **Goal 10**: To protect, conserve, manage, and appropriately use the county's coastal barriers including shorelines, beaches and dunes and plan for, and where appropriate, restrict activities where such activities will damage or destroy coastal resources. **Objective 10.4**: Restore and then maintain, when appropriate, developed coastal barriers and developed shorelines, by establishing mechanisms or projects which limit the effects of development and restores the natural functions of coastal barriers, including beaches and dunes. **Policy 10.4.13**: Development and redevelopment proposals shall consider the implications of potential rise in sea level. **Objective 10.6**: Conserve the habitats, species, natural shoreline and dune systems contained within the County's coastal zone. **Policy 10.6.2**: The owners of shoreline development projects that require an EIS shall provide an analysis that demonstrates the project will remain fully functional for its intended use after a six-inch rise in sea level. In addition, language in Land Development Code, Section 3.03.05 indicates that shoreline developments must "remain fully functional for its intended use after a 6-inch rise in sea level." (note that these requirements to consider potential sea-level rise only apply to projects when an Environmental Impact Statement (EIS) is required.) (Available at **https://library.municode.com/index.aspx?clientId=13992**).
- Fort Lauderdale. While Ft. Lauderdale does not have sea-level rise or climate change explicitly mentioned in either its current comprehensive plan or land development code as of early fall 2014, both are frequently mentioned in the long range visioning document "Fast Forward" and the shorter-term document "Press Play." In addition, during early fall 2014, the Ft. Lauderdale City Commission will be having a final vote on proposed changes to the Coastal Management Element and Administration and Implementation Element of their comprehensive plan. These amendments explicitly focus on addressing climate change and especially sea-level rise as they impact Ft. Lauderdale.
- Islamorada, Village of: -§ 30-1543: Shoreline environmental and development criteria Geared to protecting structures from "the effects of long-term sea level rise." https://library.municode.com/index.aspx?clientId=19975
- Key West, City of:
  - **Transportation Element Policy 2-1.3.4**: "Climate Change Preparedness. The City shall consider current science and predictions for sea level rise and other climate change issues in planning future roadway improvements."
  - **Conservation Element**
    - **Policy 6-1.12.1: Review the Impact of Changing Conditions on Conservation Policy**. "The City shall monitor and evaluate significant changes, including climate change, in the characteristics of natural resources within the City. Policy implications of such changes shall be examined and corrective measures shall be pursued. Conservation policies shall be refined as needed in order to remain responsive to evolving problems and issues."
    - **Objective 6-1.15**: Planning for Resiliency and Adaptation in Natural Areas. The City shall research and pilot conservation actions which enhance the resiliency

and adaptation of fisheries, wildlife and wildlife habitats. This may include identification of Adaptation Action Areas.

- **Capital Improvements Element** §9-3: MONITORING AND EVALUATING THE CAPITAL IMPROVEMENTS ELEMENT. … The monitoring and evaluation procedure shall incorporate the following considerations: …. 15. Climate Change Preparation: The City Planner and City Engineer shall review the latest science and predictions for sea level rise and other climate change related issues and recommend any needed action to address currently scheduled or future projects.

- Longwood, City of: (Appears in Code of Ordinances rather than Comprehensive Plan)
  - Section 11.0.0. "The purpose is to establish goals, programs and procedures that will help the City of Longwood become a more sustainable community. This program shall establish new environmental goals for the City of Longwood to define a certification-based "green building" program with incentives and define new measurement parameters and reporting criteria to track the City of Longwood, Florida's performance towards its environmental goals. This program will promote economic and environmental health in the City of Longwood and provide leadership to both the private and public sectors in the arena of green building practices including resource efficiency and disaster mitigation." https://library.municode.com/index.aspx?clientId=13823
- Miami, City of: (appears in Code of Ordinances)
  - § 22.5-51(3) "The purpose of this article is to provide the framework to reduce negative impacts to human health and the environment through environmentally preferable purchasing in order to: … Reduce the city's contribution to global climate change by purchasing goods and services that lead to a reduction in greenhouse gas emissions from commodities." https://library.municode.com/index.aspx?clientId=10933
- Miami Beach, City of: While Miami-Beach does not have sea-level rise or climate change addressed directly in its comp plan or ordinances, it has garnered attention for integrating sea-level rise into a commitment to spend $300-400 million for stormwater project to address tidal flooding.
- Miami-Dade County: (Appears in County Code of Ordinances) § 2-1944 Establishes a Climate Change Advisory Task Force and states, "The primary responsibility of the CCATF is to advise the Board of County Commissioners as to strategies and policies with respect to the continued implementation of the adopted plan and its updates, as well as adaptation measures to be taken in response to the challenge of global warming climate change."
- Monroe County: (appears in Code of Ordinances) Part II Land Development § 118-12 Shoreline setback "The purpose of this section is to allow for reasonable access between the land and water, provide secure boat storage, ensure good water quality, provide an appearance consistent with community character, protect structures from the effects of longterm sea level rise, protect beaches and shores from erosion, protect over-water views, avoid adverse impacts on navigation, and protect marine and terrestrial natural resources." https://library.municode.com/index.aspx?clientId=14298 In addition, Monroe County has adopted an "Energy Conservation and Climate Element" for its comprehensive plan. http://keyscompplan.com/facts-information-resources/comprehensive-plan-documents/. A few of the key parts of this are:

- **Policy 1502.1.1.** "Prior to incorporating a new project to the Capital Improvements Element, Monroe County shall assure that it is reviewed for recommendations to increase resiliency and account for the impacts from climate change, including but not limited to, sea level rise and storm surge. Monroe County shall evaluate financial expenditures to fund repairs, reconditioning of deteriorating infrastructure and new infrastructure improvements within or proximate to vulnerable areas to manage public investments appropriately. Monroe County shall focus on level of service standards, as one of the points of analysis, to assure that infrastructure useful life and service expectations can be met in the face of climate change impacts."
- **Policy 1502.1.4.** "Within five (5) years after the adoption of the 2030 Comprehensive Plan, Monroe County shall identify criteria to define adaptation action areas (AAA), or a similar concept to be defined by the County, which may include infrastructure. Within five (5) years after the adoption of the 2030 Comprehensive Plan, Monroe County shall identify proposed adaptation action areas (AAA), or a similar concept to be defined by the County. Pursuant to Chapter 163, F.S., AAA are those areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning. In the AAAs, strategies will be developed to address vulnerabilities from these effects as well as the rate of impact and available adaptation options. In conjunction with later updates to the 2030 Comprehensive Plan, Monroe County shall update existing, or map new, potential impacts of sea-level rise for consideration in long-term planning decisions."
- **Policy 1502.1.5.** "Within five (5) years after the adoption of the 2030 Comprehensive Plan, Monroe ounty shall initiate an inventory of existing and planned infrastructure up to the 2030 horizon, based upon the vulnerability mapping identified in Policy 1502.1.4, for capacity to accommodate projected sea-level rise over the life expectancy of that infrastructure. Monroe County shall identify the infrastructure within those areas, its useful life and any retrofits or capital projects necessary to address the impacts of sea level rise. These strategies may include defense, accommodation, or and retreat projects, or not building planned infrastructure in vulnerable locations, to address the impacts of sea level rise. Monroe County will consider developing design criteria, in conjunction with a broader asset management planning process."
- **Policy 1502.1.6.** "Within five (5) years after the adoption of the 2030 Comprehensive Plan, Monroe County shall consider incorporating a planning, design and permitting standard for infrastructure and public facilities that may include a sea level rise assumption of 3"-7" by 2030 as developed by the Southeast Regional Climate Compact. The County shall review and update sea level rise projections when new and pertinent data is available."
- **Policy 1502.1.7.** "Monroe County shall ensure that new, renovated and replacement public facilities and infrastructure, such as streets and bridges, water and wastewater treatment plants, police stations and fire stations, and any other public facilities that the County has authority over, are designed in a

manner which considers the useful life of public facilities and infrastructure. The County shall also consider the potential impacts from climate change, including rising sea levels and shoreline stabilization needs, on its infrastructure and public facilities."

- **Policy 1502.1.9.** "Monroe County shall coordinate with appropriate agencies to monitor changes to minimum road elevation standards which may be specific to Monroe County due to its unique exposure to climate change and sea level rise impacts. This could also include enhanced stormwater management requirements and resurfacing requirements for certain transportation segments."
- **Policy 1502.1.10.** "Within five (5) years after the adoption of the 2030 Comprehensive Plan, Monroe County shall review land development regulations that address stormwater management considerations for sea level rise impacts. To the extent practicable, Monroe County shall incorporate green infrastructure or passive alternatives that maximize land preservation over impervious or "active" infrastructure. Such alternatives could include the reconditioning and reuse of septic tanks, increased use of rainwater harvesting techniques, such as cisterns and other water storage techniques. Monroe County shall determine if land development regulation amendments are needed to address increased retention requirements and other topographic or infiltration considerations which may influence stormwater management requirements. Monroe County shall also consider the ability to meet water quality requirements related to stormwater management regulations and if there are any impacts from climate change that may jeopardize the County's ability to meet those requirements."
- **Policy 1503.4.1.** "Within five (5) years after the adoption of the 2030 Comprehensive Plan, Monroe County shall review its post-disaster redevelopment plan and land development regulations to include, as appropriate, consideration of climate change impacts, repetitive loss structures and shoreline stabilization needs."
- **Policy 1503.4.2.** "In coordination with the next update to emergency management policies, Monroe County shall determine any impacts to hurricane evacuation timeframes exacerbated by a 3"-7" increase in sea-level rise by 2030 on transportation facilities."
- **Policy 1504.1.2.** "Within five (5) years after the adoption of the Plan, Monroe County shall determine if any additional or revised land acquisition or land development regulations are needed to implement land acquisition or preservation programs that prioritize the benefits gained from protecting and enhancing natural lands in mitigating the impacts of erosion of shorelines. Monroe County shall encourage the state and federal government to acquire lands which provide natural resource protection for listed species and which address natural resource impacts such as shifting habitats from a rising sea."
- Finally, Monroe County has also adopted a "Climate Action Plan" that provides background and then recommendations, rated from "high" to "low" priority based on importance of their implementation.

- New Smyrna Beach: (appears in Comprehensive Plan, Coastal Management Element) Work with Volusia County to Develop Strategies for responding to sea level rise, including: Analysis of the estimated sea level rise and its effects on estuaries, wetlands, barrier islands

and uplands; Identification of structures and areas of possible risk; Determination of additional data and research needed; Assistance from state and federal agencies; Consideration of additional buffer areas from wetlands, water bodies and dunes in order to protect life and property; Evaluation of locating public facilities in areas projected to be affected by rising sea level; and Consideration of the effects on potable water sources, saltwater intrusion, septic systems, wastewater treatment facilities and the water table. **http://library1.municode.com/minutes/home.htm?infobase=50022&doc_action=whatsnew**.

- Pinellas County (appears in comprehensive plan)
  - **Governing Principles**: Prepare for Disasters and Climate Change, Principle 1: Planning for development must respect the restrictions imposed by the County's susceptibility to natural disasters, and should anticipate potential alterations to the urban and natural environment induced by long-term changes in the climate." The coastal management element, Chapter 6 recognizes the reality of sea-level rise but does not establish any particular Goals, Objectives, or Policies based on it.
  - **Objective 4.6** of the Coastal Management Element states that "[i] n an effort to nsure the long-term viability and sustainability of its coastal resources and land uses, Pinellas County will remain apprised of, and plan where appropriate for rising sea levels."
  - **Policy 4.6.1** "Pinellas County will evaluate the data and findings regarding sea-level rise on at least a five-year basis."
  - **Policy 4.6.2**.: "Based on evaluations directed by Policy 4.6.1, Pinellas County will continue to refine and incorporate long-term planning strategies, and amend land development regulations as necessary, to responsibly plan for the effects of rising sea levels."
  - **Policy 4.6.3**.: "Pinellas County recognizes the potential need for adequate coastal buffering in its response to future sea level rise, and will give preference to low environmental impact methods of shoreline protection, such as beach nourishment, where feasible and appropriate."
  - **Policy 4.6.4**.: "Pinellas County will encourage, and participate in, coordinated intergovernmental and interagency efforts to develop responsible strategies for addressing the potential negative effects of rising sea levels."
  - **Policy 4.6.5**: "Pinellas County will share information with local municipalities regarding the implications of sea level rise and development decisions along the coast and other vulnerable areas." Natural Resources and Conservation Element:
  - **Policy 6.1.14**: "In association with the update to the Land Development Code, Pinellas County will evaluate how best to promote development and redevelopment proposals that demonstrate a sustainability commitment through such means as: reducing the amount of impervious surface on an already developed sit, maximizing or restoring natural floodplain functions and habitat, demonstrating innovation in stormwater management techniques, and/or recognizing the potential for changing long term floodplain conditions due to the anticipated impacts of climate change."
  - **Objective 7.2**: Pinellas County will plan responsibly for climate change and will educate citizens and stakeholders so that they are partners in determining this County's future." Policies 7.2.1 through 7.2.6 reflect Objective 7.2. Natural Resource and Conservation Element,
  - **Policy 7.2.3** establishes that "association with the update to the Land Development Code, determine whether there is a need to further amend the Comprehensive Plan and land

development regulations to protect public and private coastal infrastructure and investment from the inland advancement of coastal waters, and to coordinate land use planning decisions with the expectations of sea level rise."

- Ponce Inlet, Town of: (appears in support document related to code of ordinances) "It is universally accepted that sea-level fluctuations over the past hundreds of thousands of years have been responsible for drastically shaping the topography of eastern Volusia County including the modern barrier island system. However, there is considerable debate over the role of sea-level rise causing recent observed and measured erosion. Certainly, local factors such as wave action and long-shore sand transport are the dominant factors determining whether a given stretch of coastline will accrete or erode. Nevertheless, it is irrefutable that given a sufficient rise in sea level, low lying coastal areas will be flooded. Several major studies funded by various agencies of the U.S. Government (Environmental Protection Agency, 1983; Revelle, 1983; National Research Council, 1985) indicate that the level of the world's oceans will rise between approximately two and 11 feet by the year 2100. The processes responsible for this are not well understood. It is widely believed, however, that the warming of the earth's atmosphere ("greenhouse effect") is the principal cause." https://library.municode.com/index.aspx?clientId=11438
- Sarasota County:
  - Page 2-25 of the Environment Chapter mentions climate change and associated sea-level rise as a contributor to beach erosion
  - page 2-29 for a small section on SLR itself
  - page 2-50 about considering SLR in Bay management strategies
  - 2-71 re: sandy coasts
  - 2-130 re: incorporating SLR in Beach and Inlet Management strategy
  - 2-154 re: hurricane vulnerability
  - Several GHG resolutions: 2 030 Challenge: https://www.scgov.net/Sustainability/County%20Does/2030%20Challenge%20Resolution%202006-157.pdf ; Community Energy Use and GHG emissions resolution- https://www.scgov.net/Sustainability/County%20Does/Community%20Energy%20Use%20and%20Greenhouse%20Gas%20Emissions%20Resolution%202010-243.pdf ; Green Building resolution- https://www.scgov.net/Sustainability/County%20Does/Green%20Building%20Resolution%202005-048.pdf ; EV resolution- https://www.scgov.net/Sustainability/County%20Does/Plug-In%20Electric%20Hybrid%20Vehicle%20Resolution%202005-278.pdf
- Satellite Beach, City of: (appears in the Comprehensive Plan's Coastal Management/Conservation Element) **Objective 1.3**--The City shall continue to limit use of public funds and discourage use of funds by other levels of government that subsidize new, private development or redevelopment in the Coastal High Hazard Area. **Policy 1.3.2** - The City shall coordinate with service providers to replace and mitigate damaged infrastructure within the Coastal High Hazard Area and other parts of the Adaptation Action Area consistent with other policies of the Comprehensive Plan. (Refer to Policy 1.12A.2 in which the Adaptation Area is established.) **Objective 1.4A--**The City shall strive to reduce the exposure of human life and public and private property to natural hazards while reducing the cost of flood insurance. **Policy 1.4A.1** - The City shall initiate a public process to identify Adaptation Action Areas (AAAs) in accordance with Sections 163.3164(1) and

163.3177(6)(g)10 Florida Statutes. The purpose of the AAAs is to increase grant and other funding opportunities and identify creative solutions to achieve the following goals: Protect the health, safety and welfare of residents, Prevent damage to public and private property, and Reduce National Flood Insurance Program premiums to property owners. **Policy 1.4C.3** - The City shall encourage population concentrations away from known or predicted coastal high hazard areas consistent with the goals, objectives and policies of the Future Land Use Element in the Satellite Beach Comprehensive Plan. This policy is not intended to prohibit or discourage maintenance or replacement of existing development within the CHHA. **Objective 1.12A**. Development and redevelopment within the City shall be permitted only when consistent with sound planning practices that shall protect life and property from the effects of coastal erosion, flooding, sea level rise, or damage to environmental systems. **Policy 1.12A.1** – The City of Satellite Beach designates the Coastal High Hazard Area as "the area defined by the SLOSH model to be inundated from a Category 1 Hurricane". **Policy 1.12A.2** – The City of Satellite Beach designates the Adaptation Action Area (AAA) as that area which includes the CHHA and other areas of the City as may be identified by the City Council in the future as being subject to coastal erosion, flooding, sea level rise, or damage to environmental systems.

X. Appendix III

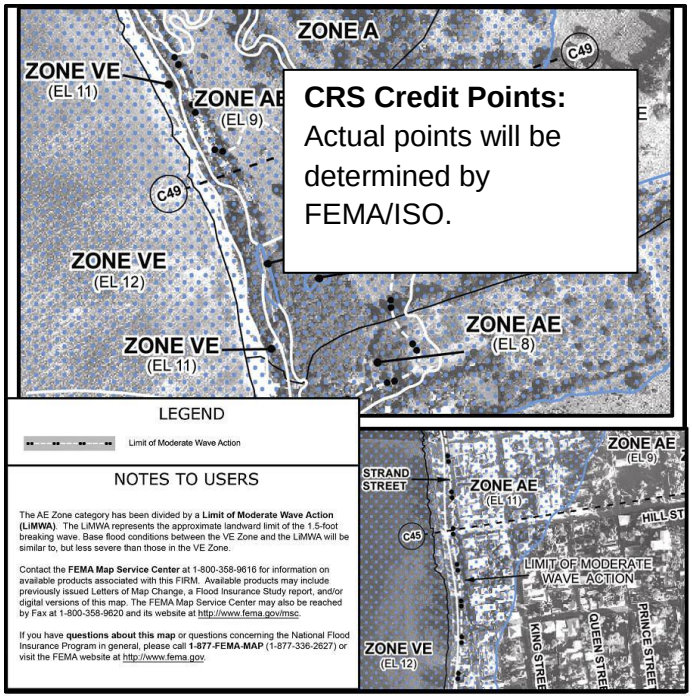
Information from the Florida Division of Emergency Management:

Coastal A Zone – FPM ordinance amendments and local technical code amendments (FBC, R)

Alternative A: apply Zone V standards in Coastal A Zones if FEMA has delineated a Limit of Moderate Wave Action

Alternative B: apply Zone V standards within an area designated by the community as the "Coastal A Zone"

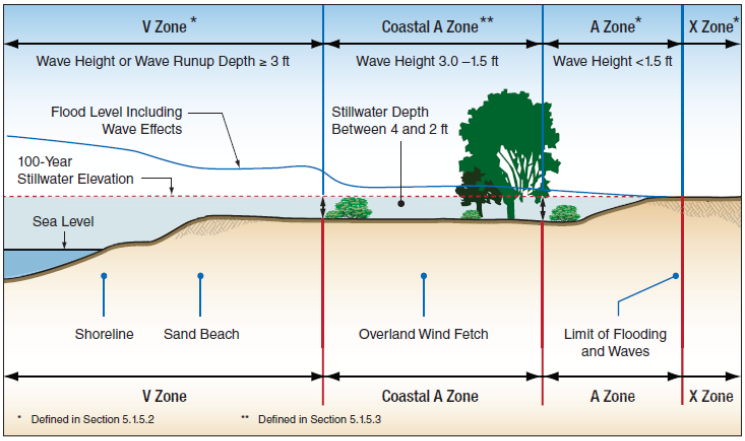
Description: Post-flood evaluations, engineering calculations and laboratory tests indicate that conventional construction sustains considerable damage when exposed to waves between 3-ft and 1.5-ft. FEMA draws the inland boundary of the coastal high hazard area (Zone V) where analyses and modeling indicate waves that occur during the base flood will be less than 3 ft high. The NFIP minimum requirements for buildings do not



recognize the risk associated with waves less than 3 ft high.

Several years ago FEMA adopted a policy that new studies to revise maps in coastal communities would determine if areas are subject to waves between 3-ft and 1.5-ft. If such conditions are identified, then FEMA will delineate the inland extent of the 1.5-ft wave as the Limit of Moderate Wave Action (LiMWA). Although not labeled as such on FIRMs, these areas between the LiMWA and the Zone V boundary (or shoreline) are referred to as "Coastal A Zones" (CAZ). FEMA Procedure Memorandum No. 50 on the decision to identify these areas as an informational layer on Flood Insurance Rate Maps is available online http://www.fema.gov/library/viewRecord.do?id=3481.

Keep in mind that even if your current effective Flood Insurance Rate Maps do not show a LiMWA now, the maps may be revised in the future as part of FEMA's nationwide initiative to update FIRMs.



Two alternative ways to adopt Coastal A Zone provisions are shown below:

A. Alternative A requires application of Zone V standards within the CAZ if FEMA has delineated a LiMWA.

B. Alternative B requires application of Zone V standards within an area designated by the community as "Coastal A Zone." The community selects the area, which may be done by specifying a distance inland from the shore, by identifying a specific geographic area, or by delineating specific areas on a map.

How the 2010 FBC, Building addresses CAZ: The FBC Building, by reference to ASCE 7 (for loads) and to ASCE 24, requires the designer to determine if Coastal A Zone conditions exist at a site. ASCE 24 defines the Coastal A Zone as follows: "Area within a special flood hazard, landward of a V Zone or landward of an open coast without mapped V Zones. In a Coastal A Zone, the principal source of flooding must be astronomical tides, storm surges, seiches, or tsunamis, not riverine flooding. During the base flood conditions, the potential for breaking wave heights shall be greater than or equal to 1.5 ft."

If a site is determined to have CAZ conditions, then ASCE 24 requires buildings to be treated the same as buildings in coastal high hazard areas (Zone V), with one exception – openings are required in breakaway walls.

How the 2010 FBC, Residential specifies CAZ: The FBC, R does not require determination of CAZ conditions. However, R322.2 does specify that areas that have been "delineated as subject to wave heights between 1 ½ ft (457 mm) and 3 feet (914 mm) shall be designated as Coastal A Zones." This means the CAZ applies only if a LiMWA is delineated on the FIRM or if a community otherwise designates an area as subject to such wave conditions.

In terms of allowable foundation types and enclosures, the FBC, R treats CAZs like Zone A (i.e., solid foundations (perimeter walls, stem walls) and elevation on fill are permitted). The only provision specific to CAZ requirement is in R322.2.1, elevation requirements, which specifies that if the CAZ has been designated, then lowest floors shall be elevated to or above the base flood elevation plus 1 foot, or the design flood elevation, whichever is higher.

ALTERNATIVE A. Use this set of amendments if FEMA has delineated a LiMWA and your community already has or elects to adopt requirements so that Zone V standards apply within CAZ.

Because the FBC, Building, by reference to ASCE 24, already treats CAZ like Zone V, accomplishing this alternative only requires amendment of the floodplain management regulations and the FBC, Residential.

Step A-1. See the General Instructions to select the appropriate Whereas clause(s). Insert the following brief description of the higher standard:

> apply coastal high hazard area requirements in areas delineated by FEMA as subject to wave heights between 3 feet and 1.5 feet high,

Step A-2. In Section 2 of the ordinance package (which contains the floodplain management regulations), add a new definition to Section 202 and modify Section 304 as shown so that manufactured homes in Coastal A Zones also have foundations that comply with R322.3 (Zone V).

> **Coastal A Zone.** Flood hazard areas that have been delineated as subject to wave heights between 1 ½ feet (457 mm) and 3 feet (914 mm). Such areas are seaward of the Limit of Moderate Wave Action shown on the Flood Insurance Rate Map.

> **304.2 Foundations**. All new manufactured homes and replacement manufactured homes installed in flood hazard areas shall be installed on permanent, reinforced foundations that:
>
> (1) In flood hazard areas (Zone A) other than coastal high hazard areas and Coastal A Zones, are designed in accordance with the foundation requirements of the *Florida Building Code, Residential* Section R322.2 and this ordinance.
>
> *(2)* In coastal high hazard areas (Zone V) and Coastal A Zones, are designed in accordance with the foundation requirements of the *Florida Building Code, Residential* Section R322.3 and this ordinance.

Step A-3. In Section 2 of the ordinance package (which contains the floodplain management regulations), modify sections 307.5, 307.6, 307.7, and 307.8 as follows:

- In the titles of those sections, change to "coastal high hazard areas (Zone V) and Coastal A Zones"

- In the introductory sentences, change to "coastal high hazard areas and Coastal A Zones"

Step A-4. Add a new Section 4 to the ordinance package to adopt local technical amendments to the FBC, Residential as follows.

SECTION 4. The *Florida Building Code, Residential* is hereby amended by the following technical amendments.

Add new Sec. R322.2.1 and renumber and modify the subsequent section, as follows:

R322.2.1 Coastal A Zones. Buildings and structures in flood hazard areas designated as Coastal A Zones shall be designed and constructed in accordance with Section R322.3.

R322.2.2 ~~1~~ Elevation requirements.

1. Buildings and structures in flood hazard areas not designated as Coastal A Zones shall have the lowest floors elevated to or above the design flood elevation.

~~2. Buildings and structures in flood hazard areas designated as Coastal A Zones shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or to the design flood elevation, whichever is higher.~~

2. ~~3.~~ In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated at least as high above the highest adjacent grade as the depth number specified in feet on the FIRM, or at least 2 feet (610 mm) if a depth number is not specified.

3. ~~4.~~ Basement floors that are below grade on all sides shall be elevated to or above the design flood elevation.

Exception: Enclosed areas below the design flood elevation, including basements whose floors are not below grade on all sides, shall meet the requirements of Section R322.2.2.

Modify Sec. R322.3.4 as follows:

R322.3.4 Walls below design flood elevation. Walls and partitions are permitted below the elevated floor, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical, and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a design safe loading resistance of not less than 10 (470 Pa) and no more than 20 pounds per square foot (958 Pa); or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), the construction documents shall include documentation prepared and sealed by a registered design professional that:

   4.1. The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the design flood.

   4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructural). Water loading values used shall be those associated with the design flood. Wind loading values used shall be those required by this code.

5. <u>If located in flood hazard areas designated as Coastal A Zones, the walls are provided with flood openings that meet the criteria in R322.2.2.</u>

ALTERNATIVE B. Use this set of amendments if FEMA has not delineated a LiMWA and your community already has or elects to adopt requirements so that Zone V standards apply within CAZ specified by a geographic designation or local map.

Because the FBC, Building, by reference to ASCE 24, already treats CAZ like Zone V, accomplishing this alternative only requires amendment of the floodplain management regulations and the FBC, Residential.

Instructions: **{Note}** Where this note appears in the text below, insert the appropriate description, such as the following **examples** (other examples may exist – be sure to make specific to your community):

- Within two hundred (200) feet of the mean high tide line
- Within areas identified on *(identify community's own adopted map)*
- Seaward of *(select appropriate boundary, such as a road)*

Step B-1. See the General Instructions to select the appropriate Whereas clause(s). Insert the following brief description of the higher standard:

apply coastal high hazard area requirements in certain designated areas that are subject to moderate wave action,

Step B-2. In Section 2 of the ordinance package (which contains the floodplain management regulations), add a new definition to Section 202 and modify Section 304 as shown so that manufactured homes in Coastal A Zones also have foundations that comply with R322.3 (Zone V).

Coastal A Zone. Flood hazard areas that are **{see Note}**

304.2 Foundations. All new manufactured homes and replacement manufactured homes installed in flood hazard areas shall be installed on permanent, reinforced foundations that:

(1) In flood hazards areas (Zone A) other than coastal high hazard areas and Coastal A Zones, are designed in accordance the foundation requirements of the *Florida Building Code, Residential* Section R322.2 and this ordinance.

(2) In coastal high hazard areas (Zone V) and Coastal A Zones, are designed in accordance with the foundation requirements of the *Florida Building Code, Residential* Section R322.3 and this ordinance.

Step B-3. In Section 2 of the ordinance package (which contains the floodplain management regulations), modify sections 307.5, 307.6, 307.7, and 307.8 as follows:

- In the titles, change to "coastal high hazard areas (Zone V) and Coastal A Zones"
- In the introductory sentence, change to "coastal high hazard areas and Coastal A Zones"

Step B-4. Add a new Section 4 to the ordinance package to adopt local technical amendments to the FBC, Residential as follows.

SECTION 3. The *Florida Building Code, Residential* is hereby amended by the following technical amendments.

Modify Sec. R322.2 and add new Sec. R322.2.1 and renumber, as follows:

R322.2 Flood hazard areas (including A Zones). All areas that have been determined to be prone to flooding but not subject to high velocity wave action shall be designated as flood hazard areas. Flood hazard areas that have been delineated as subject to wave heights between 1 ½ feet (457 mm) and 3 feet (914 mm) and flood hazard areas that are **{see Note}** shall be designated as Coastal A Zones. All buildings and structures constructed in whole or in part in flood hazard areas shall be designed and constructed in accordance with Sections R322.2.1 through R322.2.3.

R322.2.1 Coastal A Zones. Buildings and structures in flood hazard areas designated as Coastal A Zones shall be designed and constructed in accordance with Section R322.3.

R322.2.2 ~~1~~ Elevation requirements.

1. Buildings and structures in flood hazard areas not designated as Coastal A Zones shall have the lowest floors elevated to or above the design flood elevation.

~~2. Buildings and structures in flood hazard areas designated as Coastal A Zones shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or to the design flood elevation, whichever is higher.~~

2. ~~3.~~ In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated at least as high above the highest adjacent

grade as the depth number specified in feet on the FIRM, or at least 2 feet (610 mm) if a depth number is not specified.

3. ~~4.~~ Basement floors that are below grade on all sides shall be elevated to or above the design flood elevation.

Exception: Enclosed areas below the design flood elevation, including basements whose floors are not below grade on all sides, shall meet the requirements of Section R322.2.2.

Modify Sec. R322.3.4 as follows:

R322.3.4 Walls below design flood elevation. Walls and partitions are permitted below the elevated floor, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical, and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a design safe loading resistance of not less than 10 (470 Pa) and no more than 20 pounds per square foot (958 Pa); or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), the construction documents shall include documentation prepared and sealed by a registered design professional that:

   4.1. The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the design flood.

   4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructural). Water loading values used shall be those associated with the design flood. Wind loading values used shall be those required by this code.

5. <u>If located in flood hazard areas designated as Coastal A Zones, the walls are provided with flood openings that meet the criteria in R322.2.2.</u>