

# Community Resiliency Analysis for Martin and Okaloosa County, Florida

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Economic Opportunity:  
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## Introduction

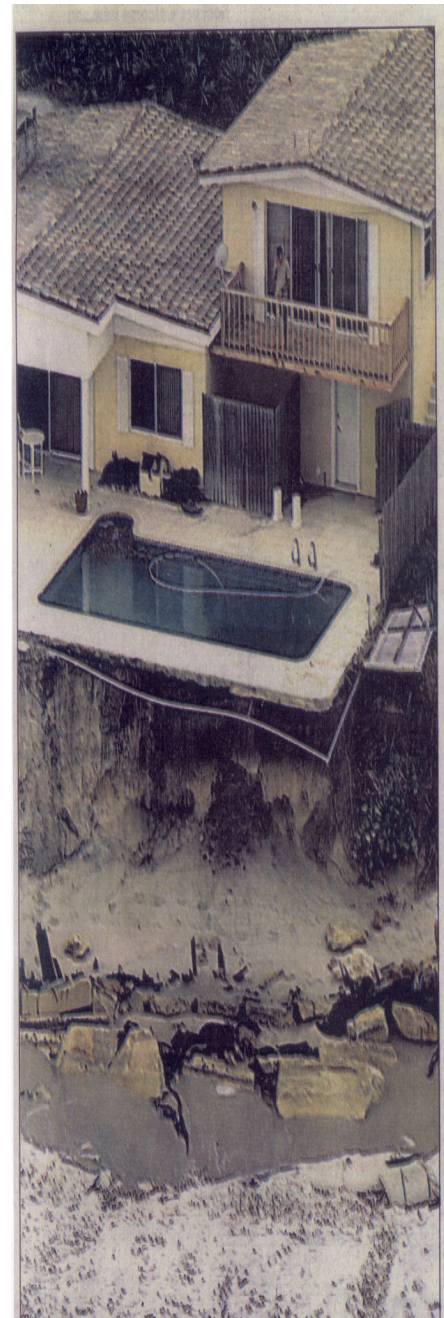
As Hurricane Irene demonstrated recently along the Eastern seaboard, even a relatively mild storm can cause enormous damage to coastal communities. When coastal properties become uninhabitable and roads impassable, the entire community sees the loss of economic output. Beach front properties are highly coveted, but also vulnerable to erosion, inundation, storm damage, and insurance risk. How does a coastal community balance the value of coastal economic development with the increasing costs of storm repairs as the shoreline shifts and changes? How do public officials in coastal communities encourage inland migration of coastal development activity to minimize loss of property or lives?

Figure 1. Damage from Hurricane Floyd, 09/1999

In most Florida communities, waterfront property was developed decades ago, and initial development of a parcel is rarely the condition faced by local planning or permitting authorities. Over the past fifteen years, stricter rules governing beachfront construction that reflect acknowledgment of a constantly changing shoreline have been implemented throughout Florida. As a result, the shoreline looks very different than it would have had construction continued unabated.

Today, most coastal communities face few planning decisions that would convert undeveloped land to new development. Rather, likely scenarios are redevelopment of previously built areas as part of economic revitalization efforts, or rebuilding after a disaster, most likely a hurricane. Landowners face a choice after storm damage: to rebuild a pre-storm structure, or pursue other options. Coastal communities need to be prepared with flexible options and desirable alternatives for the landowner. By having the building blocks in place in advance, a landowner can weigh the outcomes and determine if building elsewhere may be in his or her best interest.

Communities with clear objectives to achieve coastal resiliency have tools at their disposal. Coastal resiliency implies reducing the risk of loss of life and property, and reducing the municipal costs of servicing coastal properties and infrastructure. In both cases, gradually reducing density along



the coast while increasing density elsewhere provides a clear transition process for both the property owner and community.

Which planning tools are likely to achieve the coastal resiliency objectives? Economic concerns or potential legal ramifications often outweigh the most well-intentioned planning strategies, and many planning exercises work beautifully on paper but drown in bureaucracy on the way to implementation. With scarce resources, it is important that communities weigh both the social and economic costs of different strategies, as well as the social and economic benefits. This study evaluates the costs and benefits, at the County level, for seven planning strategies: transfers of development rights, purchase of development rights, buy-outs, rolling easements, conservation easements, land use designation changes, and armoring.

An underlying assumption to the analysis is that development rights have value, and the free market recognizes this value. In communities where landowners can change the development rights associated with their land readily and without committing to achieving community objectives, development rights will not have economic value, and cannot be used effectively as incentives. Likewise, there will be little opportunity to create incentives if a community has zoned properties to achieve high density in areas where there is no demand. Current practices toward granting development rights that are at odds with existing Comprehensive Plans or Zoning require careful and realistic consideration. To achieve success with any incentive-based planning tool, development rights must be treated as having economic value.

A series of Technical Memoranda precede this report. The Technical Memos set out the underlying assumptions, literature citations, and legal precedent where appropriate, and rationale for the measures used in each cost-benefit calculation. This report briefly summarizes the underpinnings of the analysis, and shows how the results of the cost-benefit analysis may be generalized to other cities and communities not included in the project scope.

## Summary of Cost Benefit Analysis

The analysis process began with a series of decision rules designed to ensure transferability to other coastal areas. The universe of parcels included was determined to be all parcels in the Coastal High Hazard Area (CHHA). Analysis was first completed at the parcel level on every single family residential (SFR) parcel, for each strategy. The parcel-level cost benefit analysis estimates the measurable impacts a policy change has on all people (or communities) in each county over a twenty year period. These impacts are monetized to quantify the impacts in dollar terms. The dollar value of each impact is discounted into current (net present value) dollars for comparison across policy alternatives.

Examination of the results found that benefit-cost ratios followed distinct spatial patterns, based on their proximity to specific amenities, such as beach recreation areas, or conservation lands. For land use types besides single family residential, the cost and benefits previously applied to all residential properties are applied to a subset of multi-family residential and commercial

properties for regions characterized as having a high, medium, or low number of viable mitigation strategies. Thus all commercial properties within a prototypical area were assembled for geographical areas with high, average, and low access to the amenities driving the benefit-cost ratio. The purpose of this approach is to isolate the effects of commercial property characteristics versus residential, in the same location.

A list of costs and benefits associated with each strategy was generated, including

1. Acquisition costs – to buy land, easements, or development rights
2. Construction costs – for armoring or demolition
3. Administrative costs – to oversee programs such as Transfers of Development Rights, conservation easements, or land acquisition.
4. Avoided costs of municipal services – for properties that no longer need fire, water or sewer services
5. Amenity values – values the public is willing to pay for open space, conservation land, recreational amenities, or ecological protection
6. Foregone revenues – such as future rents if a property is not rebuilt after a storm

**Table 1** summarizes the specific cost-benefit measures applied to each strategy.

**Table 1. Application of Values to Coastal Resiliency Strategy**

Impact	Coastal Resiliency Strategy						
	Transfers of development rights	Purchase of development rights	Rolling easements	Conservation easements	Land use designation changes	Buy-outs	Armoring
<b>Criteria</b>							
Construction Cost of Armoring			X		N/A		X
Acquisition Cost of Land or Easement		X	X	X	N/A	X	
Foregone Tax Revenue			X	X	N/A	X	
Administrative Costs	X						
Avoided Costs of Municipal Service	X	X	X		N/A	X	
Rental Income			X		N/A		X
Costs of Accelerated Development	X				N/A		
Exchange of Development Values	X				N/A		
Value of Conservation Land and Open space	X	X	X	X	N/A	X	X
Wetland Values; Amenity Values or Migration	X	X	X	X	N/A	X	X
Beach – Ecological Value	X	X					X
Beach - Recreation Values	X	X	X	X	N/A	X	X

Research was completed to calculate measures for each cost and benefit at the parcel level, and to determine which parcels are candidates for which strategies. Technical memoranda were prepared supporting the measures chosen for each cost and benefit calculation, and calculations were completed.

A strategy is considered viable if benefits exceed costs. Analysis was performed to identify which strategies were viable for each parcel. Cost-effectiveness varied widely at the parcel level, and followed distinct spatial patterns. Properties closest to most amenities have the most strategies that are feasible. Generally speaking, properties with the highest property values have the fewest strategies that are cost-effective.

Costs and benefits vary widely at the parcel level. An oceanfront home faces different options for coastal resiliency than a parcel that is further distanced from the direct energy of waves, and offers different ecological services, aesthetics, and engineering challenges. Cost-Benefit Analyses described herein are conducted at the parcel level, using automated GIS techniques for thousands of parcels in each County. Benefits vary by option and by parcel as described for each strategy and may include social benefits such as continued access to public beaches and recreational values, or environmental benefits such as habitat for sea turtle nesting or wetland migration, while costs may include engineering costs as well as foregone revenue from taxes, or loss of wetland migration paths.

The ratio of benefits to costs gives a measure of the return for costs expended; if the benefit: cost ratio is 2:1, the implication is that, on average, for each dollar of cost, two dollars in benefits were returned. The examples in **Figures 2 and 3** show how benefit ratios vary for two different strategies in the same county. The strategies illustrated here, Transfers of Development Rights (TDRs) and Armoring, are discussed in detail in the following section, but are used here to show how benefit ratios vary across parcels and strategies.<sup>1</sup> TDRs have benefits greater than 1.0, or benefits that exceed costs, for 2,490 residential parcels in the Okaloosa CHHA, while for 456 residential parcels, the ratio is less than 1.0, or costs exceed benefits. Over all Okaloosa CHHA parcels, the average is 1.69; for every \$100 in community costs, the community receives \$169 in benefits. The ratio varies widely across parcels, ranging from 0.24 to more than 5.0 (See **Figure 2**, where red columns indicate parcels that are not viable, and blue columns indicates the number of parcels with positive ratios). In contrast, **Figure 3** shows that Okaloosa County has relatively large number of parcels that are not viable candidates for armoring, with an average benefit ratio of 1.15, and maximum benefits under 3.

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<sup>1</sup> A prototypical Transfer of Development Rights (TDR) Program allows landowners to transfer the right to develop from one parcel of land to a different parcel of land, and helps shift development from sensitive areas to designated growth areas with access to services. Shoreline armoring means engineered structures built along the water's edge intended to stop or slow erosion of the shoreline.

Figure 2. Cost Benefit Ratios of Okaloosa County Parcels for TDRs

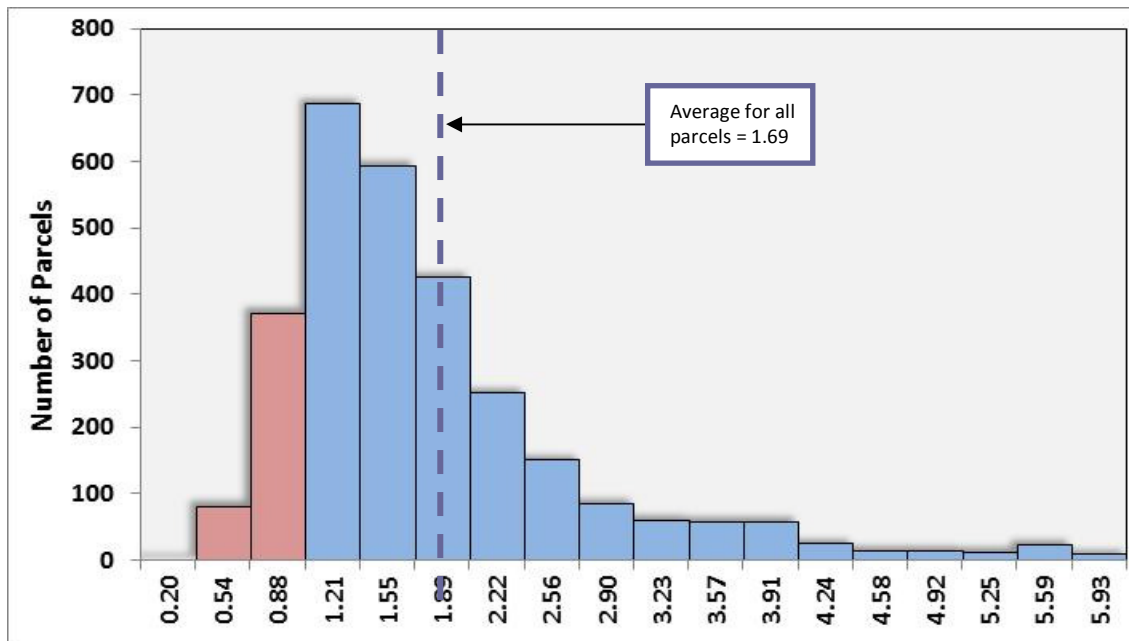
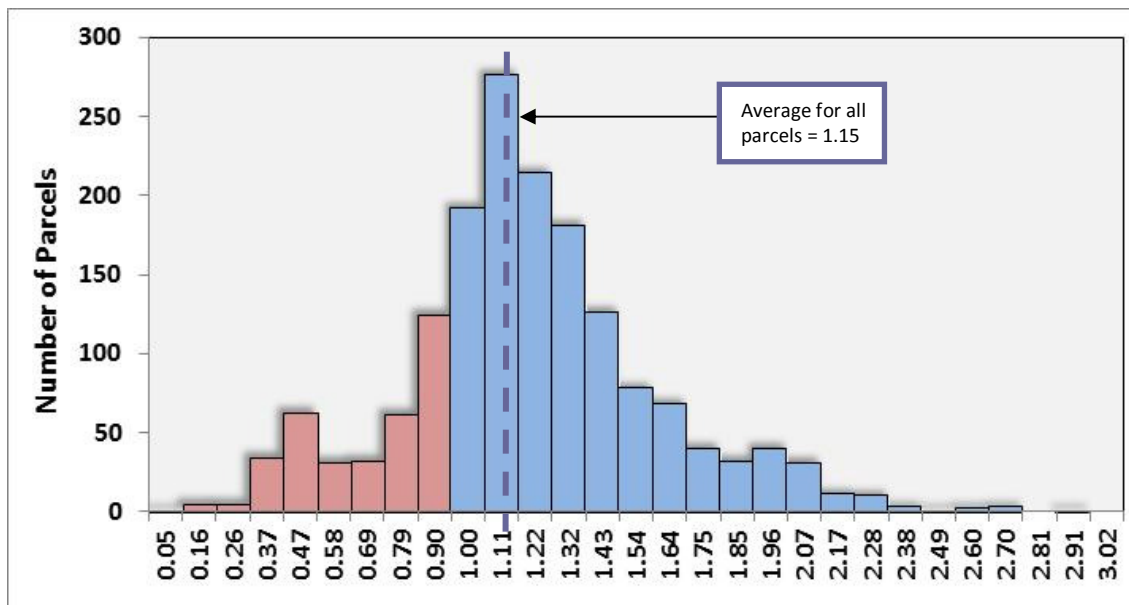


Figure 3. Cost Benefit Ratios of Okaloosa County Parcels for Armoring



Overall, the analysis found that multiple strategies were cost-effective for the vast majority of single family residential parcels. In Okaloosa County, for example, out of 3,000 CHHA parcels, all but 38 had more than one cost-effective strategy. For multi-family, commercial and industrial land use types, spatial patterns generally mirrored SFR results. Some land use types showed greater variation in benefit-cost ratios than SFR parcels; others showed more amplified benefits.

In general, land use type (SFR, commercial, etc) is not as important to benefit-cost ratio as location of the parcel. Property value is not as important to benefit-cost ratio as proximity to amenities.

The following sections identify key characteristics of each policy that drive the cost benefit results, as well as specific features that may make that policy an effective strategy.

### **Incentive-Based Approaches**

An underlying assumption to the analysis is that development rights have value, and the free market recognizes this value. In communities where landowners can change the development rights associated with their land readily and without committing to achieving community objectives, development rights will not have economic value, and cannot be used effectively as incentives. Likewise, there will be little opportunity to create incentives if a community has zoned properties to achieve high density in areas where there is no demand. Current practices toward granting development rights that are at odds with existing Comprehensive Plans or Zoning require careful and realistic consideration. To achieve success with any incentive-based planning tool, development rights must be treated as having economic value.

Incentive based approaches are cost effective for most property types and parcels. The average benefit ratio for Transfers of Development Rights (TDRs) is 1.69 and 1.77 for Okaloosa and Martin Counties, respectively. While Purchase of Development Rights (PDRs) has higher benefit ratio averages of 3.61 and 3.21 for Okaloosa and Martin Counties, PDRs are considered beyond the reach of political will in most communities. Local ordinances that allow for flexibility in trading development rights between near-shore parcels and inland properties, without restrictive criteria, may have the greatest single impact in attaining coastal resiliency

### **Transfers of Development Rights**

Transfers of Development Rights or “TDRs” may be used to promote coastal resiliency by providing landowners with alternatives to rebuilding in the CHHA after a storm. As set forth in the Technical Memorandum, TDRs have failed to be used in most communities because of the burdensome regulations and narrowly defined rules that have accompanied their introduction. TDRs are most likely to be effective if the landowner sees opportunity for flexibility in exercising his rights of property ownership. Research within Florida has found that many TDR transactions have occurred outside a formal program, as an ad hoc situation to achieve the objectives of both the landowner and local government.

Although TDRs have typically been envisioned as a tool to control residential density on undeveloped land, it may be more useful to think of TDRs as a tool to migrate intense land uses inward. Accordingly, land uses other than residential may be just as appropriate for TDR transactions. If the current land use on a beachfront piece of property is commercial, the community has just as much interest in transferring this land use landward as if it is residential. Thus after a storm, the owner may rebuild on the property, transfer, or sell the development rights so

that an inland piece of property may be developed or redeveloped at a substantially higher density.

A useful example arose in Satellite Beach, Florida, when City officials negotiated with the owner of a destroyed oceanfront hotel. Rather than rebuild, the owner donated the parcel as public land, and rebuilt at higher density inland. The oceanfront site has reverted to natural land, and the properties across the street will be the next oceanfront parcels as the natural site continues to erode. Thus tax values will also migrate inland, as rebuilding events occur gradually over decades.

All parcels within the CHHA were considered potential TDR candidates. Generally speaking, the costs and benefits are driven by development values, administrative costs, and nonmarket costs to the community of accelerated development in the receiving area for development.

### **Purchase of Development Rights**

As set forth in the introduction of this section, development rights have value in communities that utilize development rights as having value. In theory, development rights can be bought and sold: a landowner who has accumulated development credits in excess of what he or she requires can sell the credits to another landowner, or to the local government, to be used elsewhere. A purchase of development rights by local government can be viewed as analogous to a corporation buying back its stock; if the County wishes to limit development, reducing the total quantity of development rights available increases the value of remaining development rights in circulation.

All parcels within the CHHA were considered potential PDR candidates. The costs and benefits of PDRs are driven by development values, administrative costs, and nonmarket costs to the community of accelerated development in the receiving area for development.

### **Ownership-Based Approaches**

Ownership approaches have the highest returns overall in both Counties, but have fewer applicable candidates. Benefit ratios for conservation easements average over 50 for both counties. Rolling easements average benefit ratios of 2.47 and 1.49 for Okaloosa and Martin Counties respectively, but nearly every qualified parcel shows a benefit ratio greater than one. Land acquisition benefit ratios average below one, indicating that only a few parcels are good candidates for acquisition.

### **Conservation Easements**

Conservation easements restrict the right to future development of defined parcels, or portions thereof, in exchange for cash or tax benefits. Conservation easements negotiated with the objective of coastal resiliency are likely to be motivated primarily by tax benefits combined with a desire for the land to remain undeveloped.

All parcels within the CHHA with proximity to wetlands, conservation lands, or the shoreline, were considered potential conservation easement candidates. The cost of a conservation easement is the market value of the future net income lost due to restrictions on future development; past transactions were used to estimate approximate costs. The benefits of conservation easements are estimated based on the value of ecosystem services that are generated by the specific easement.

### **Rolling Easements**

Rolling Easements exchange foregone future revenues from development or continued use for a current payment. A rolling easement can be applied to a property deed at the time of development (which would lower the property value) or it can be purchased in a fashion analogous to a conservation easement. In effect, a rolling easement allows a landowner a gentle transition to a future moment in time when rebuilding will no longer be an option; until that moment, the landowner may continue to rent, develop or otherwise use the property in permissible uses as if the easement had not been granted. The easement prevents the owner from taking steps to delay or prevent the encroachment of the coastline. A critically important component of a rolling easement is that it provides advanced notice to property owners that their land must at some point revert to public or natural use. It is in this capacity that rolling easements can be used most beneficially with developed parcels.

All waterfront parcels within the CHHA below the elevation of the evacuation route were considered potential rolling easement candidates. The costs associated with a rolling easement scenario include monetary consideration given in exchange for the rolling easement payment, and likely demolition costs of any structures on the property. For current conditions, the demo cost would be zero, as rolling easements assume that only a future condition would create a need to exercise the easement option. In subsequent reports that consider future conditions, demo costs will be a factor.

Social benefits depend on location of the parcel and may include the value of preserved or reclaimed environmentally sensitive lands and/or public access to open lands, as well as avoided costs of municipal services to vulnerable shoreline properties.

### **Land Acquisition**

Land has been acquired in both Martin and Okaloosa County to achieve community objectives where repeated flooding events have occurred or environmentally sensitive lands have been purchased to protect native habitats. Land acquisition programs require taxpayer funding: environmental stewardship programs typically rely on a local millage dedicated to that purpose, while flooding properties may be purchased by the City/County using federal grant money. In the former case, a citizen panel often reviews potential parcels for purchase and prioritizes based on established protocol and specific characteristics, within a predetermined budget amount. Land that is acquired must also be maintained in perpetuity, and is removed from the tax rolls permanently, so there are considerations beyond the immediate purchase transaction that must be considered in an acquisition decision.

In the case of Coastal Resiliency, prioritization of acquisition efforts is likely to focus on parcels with repeated inundation or projected inundation at high frequency, in vulnerable evacuation zones, or subject to critical erosion events (in many cases, these attributes overlap). Acquisition for coastal resiliency implies that the parcel is restored to its natural state. The costs include the actual purchase price, legal costs, and loss of tax revenue to the County. If demolition or restoration is necessary, that is an additional cost.

All waterfront parcels within the CHHA below the elevation of the evacuation route were considered potential acquisition candidates. The benefits may include avoided costs of damage repair, environmental or recreational benefits to the public depending on the site location, and avoided costs of continued municipal services. In many cases in other states, the acquiring body rents the parcel for a few years to maintain revenue temporarily, which may offset demolition costs.

### **Land Use Designation Changes**

Land Use designation changes include changes to the zoning of a parcel or to the future land use as designated in the county's Comprehensive Plan. All of the planning strategies discussed in this report incorporate some sort of land use assumption; that development rights associated with the existing land use can be sold or transferred to a different locale, or that a portion of the existing property rights can be sold or transferred under an easement. If used instead as a stand-alone policy strategy, land use designation changes that would improve coastal resiliency are likely to also diminish property rights. There are sufficient legal precedents defeating measures that diminish property rights without compensation to negate the need for analysis of land use designation changes as a separate strategy. Accordingly, land use designation changes outside of those embedded as part of a larger strategy were not analyzed for full cost-benefit calculations.

### **Physical Protection**

Physical protection generally may be a viable strategy for a similar number of parcels as ownership based approaches, but with lower average benefit ratios of 1.15 and 1.77 for Okaloosa and Martin Counties respectively. Some negative impacts of physical measures, such as increased erosion on adjacent properties were not quantified in this analysis.

### **Shoreline Armoring**

For purposes of this report, shoreline armoring means engineered structures built along the water's edge intended to stop or slow erosion of the shoreline. Although armoring structures are mostly effective at meeting this objective, there are numerous negative consequences associated with their construction. Among these are accelerated erosion of adjacent properties, habitat displacement, and limited beach access to the public. As a result, the use of coastal armoring is typically considered the last or most extreme option in addressing a coastal erosion problem.

A primary motivator for armoring is the assumption that, without it, a property may be uninhabitable within a short period of time. Costs and benefits of armoring are calculated using

the topography of the parcel in question, all of which must border coastal waters to be considered. The value associated with extending the period of time that a property may be useful can be measured using rents; a benefit associated with the armoring is the market value of rents a beachfront parcel could generate if protected.

## Cost Benefit Analysis under future scenarios

To evaluate the effects of future scenarios, the CHHA line was migrated inland 1 meter of elevation. In some areas this equates a few feet inland, while in other areas this is a much greater distance inland, depending on local slope. This analysis estimates the net present value of the costs and benefits generated by policy alternatives applied after significant inundation has occurred. When cost benefit calculations post inundation are compared to previous estimates, substantial changes to viable strategies can be identified. Important trends across policies include:

- The vast majority of parcels have less than two viable strategies. Under the current-day scenario, the opposite was true – over 70% of parcels had two or more viable strategies.
- One reason is that many properties are lost to inundation, either because the parcel is inundated or access to it is blocked by inundation.
- Another reason is that properties with proximity to more amenities under current CHHA lost a greater proportion of viable strategies under the future CHHA.
- A notable consequence is that properties with proximity to fewest amenities may have no cost-effective strategies as shorelines move inland.
- The change in viability for each strategy varied by county, and is directly linked to local topography.

**Table 2** shows the sharp increase in the number of parcels with no viable strategy. It also shows the large percent reduction in the number of parcels with four and five viable strategies.

Table 2. Frequency of Viable Strategies by Parcel

Number of Cost-effective Strategies	Martin		Okaloosa	
	Current CHHA - Number of parcels	1 meter Higher CHHA - Number of parcels	Current CHHA - Number of parcels	1 meter Higher CHHA - Number of parcels
0	14%	86%	3%	74%
1	8%	3%	9%	2%
2	29%	5%	27%	4%
3	34%	6%	41%	13%
4	14%	1%	18%	5%
5	0%	0%	1%	1%
	100%	100%	100%	100%

**Figures 4 and 5**, on the following pages, show an aerial view of the changes described in table 2 for Okaloosa and Martin Counties, respectively.

## Transferability to other cities and communities

Speaking in broad terms, most parcels have multiple planning strategies available to them currently.

1. Properties with proximity to beaches, open land, conservation areas and parks have greatest flexibility in current planning scenarios to pursue multiple avenues of coastal resiliency. Communities which encourage inward migration of development rights from these parcels, or easements along these parcels, are most likely to achieve coastal resiliency in a manner that is market-driven and cost-effective for the property owner and larger community.
2. TDRs and PDRs are cost effective for most property types and parcels, although PDRs are considered beyond the reach of political will in most communities. Local ordinances that allow for flexibility in trading development rights between near-shore parcels and inland properties, without restrictive criteria, may have the greatest single impact in attaining coastal resiliency.
3. Rolling and Conservation Easements have the highest returns overall in both Counties, but have fewer candidates.  
Land use type (SFR, commercial, etc) is not as important to benefit-cost ratio as location of the parcel. Property value is not as important to benefit-cost ratio as proximity to amenities.

Figure 4. Coastal Resiliency Strategy Effectiveness Rating - Okaloosa County

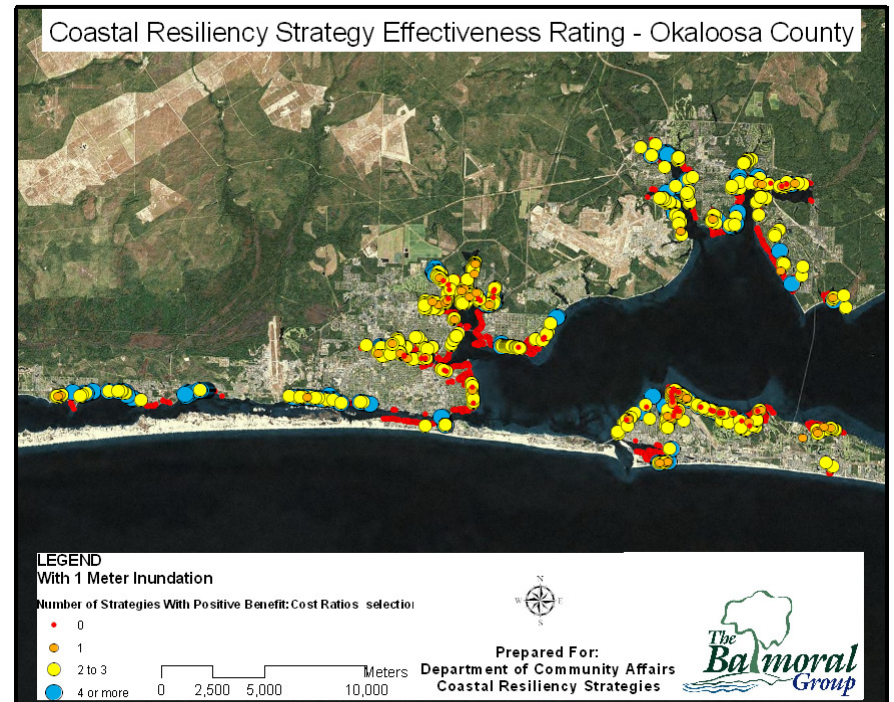
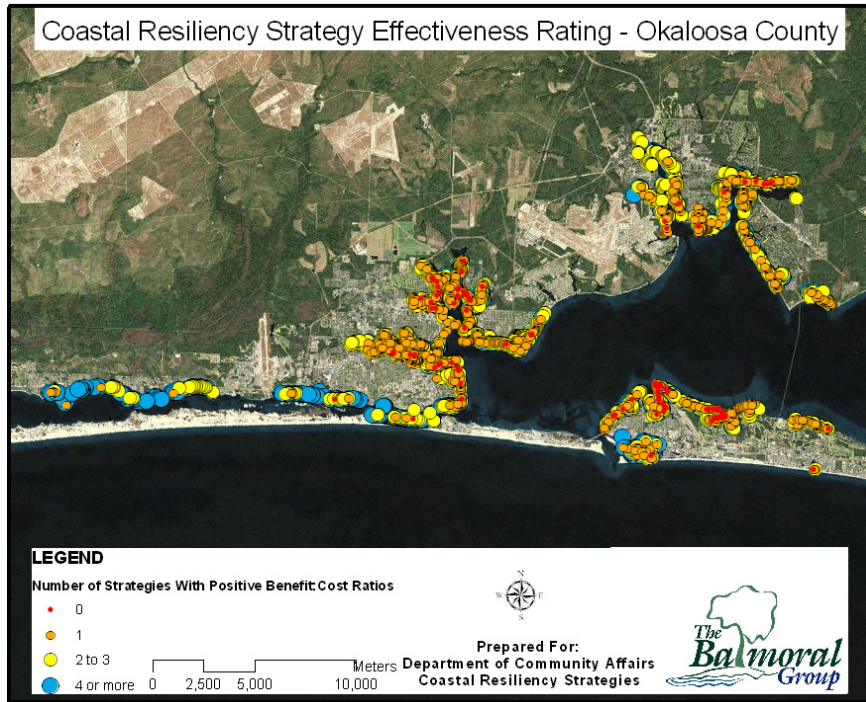
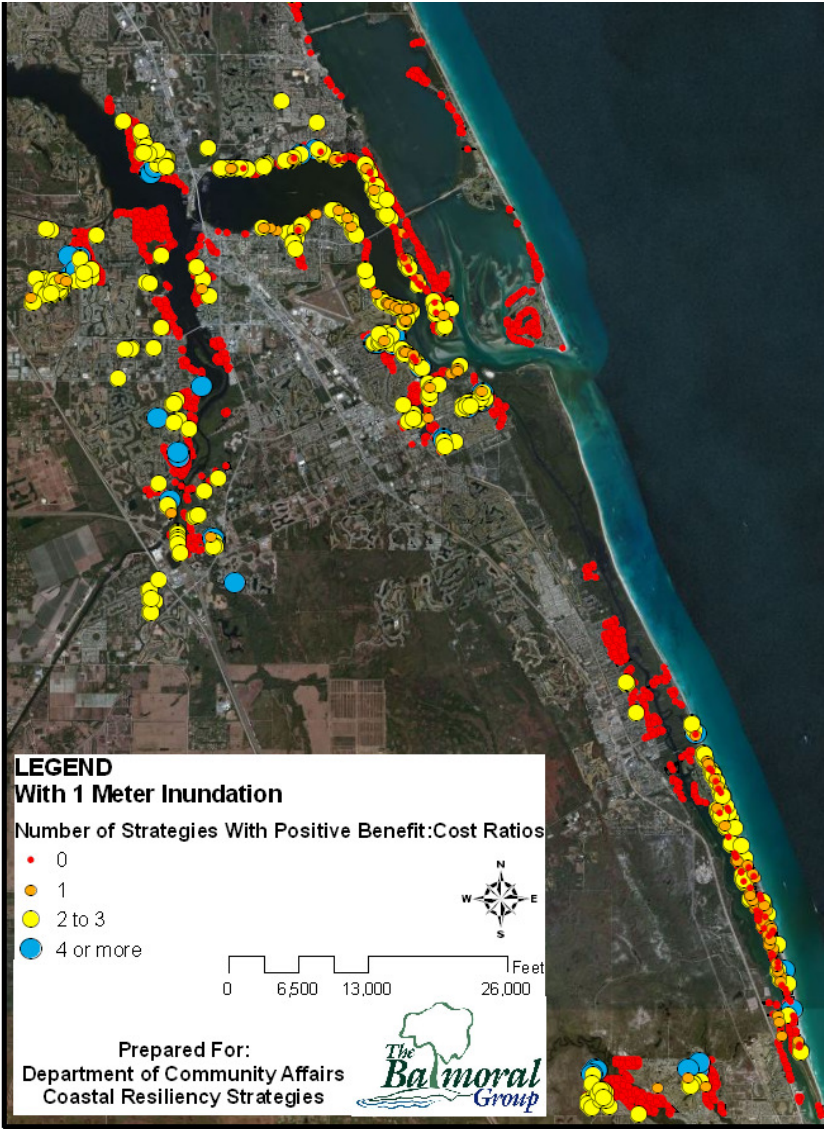
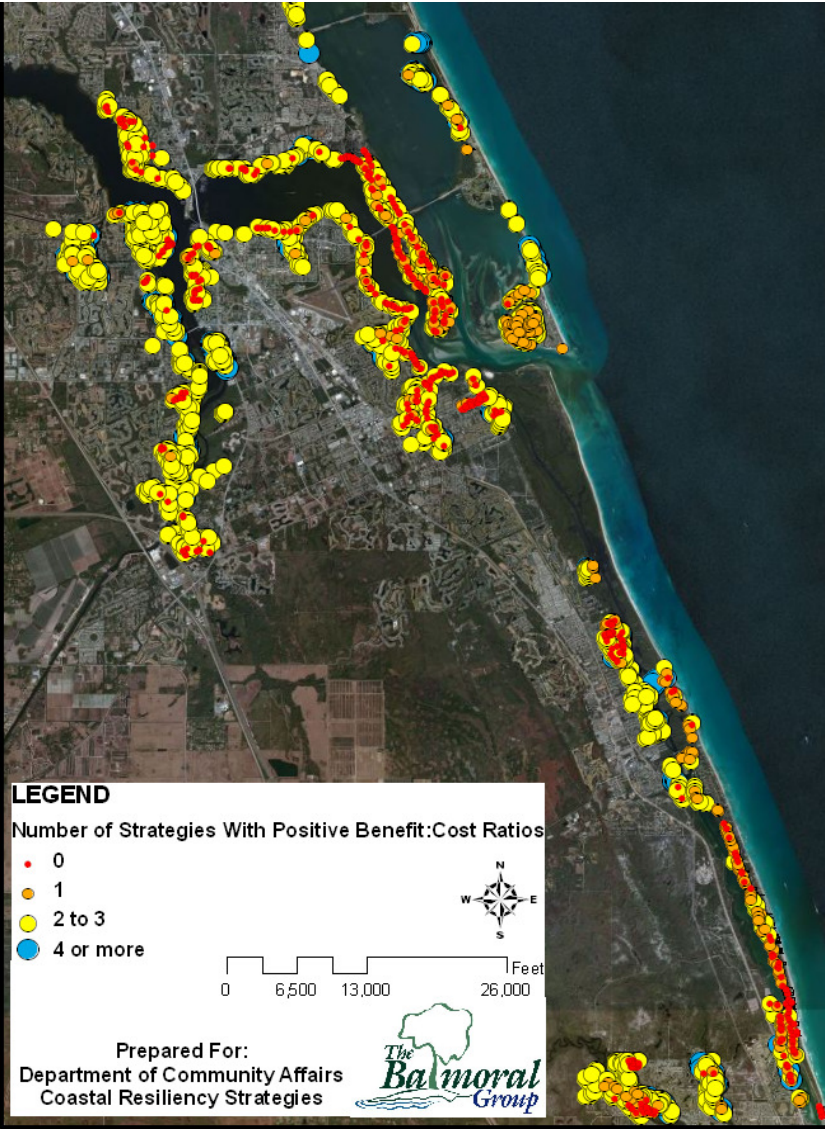


Figure 5. Coastal Resiliency Strategy Effectiveness Rating - Martin County



## Options for Planning Language

Local and municipal governments can include in their Comprehensive Plans language that will create resiliency to a changing coastline. The logical elements that could be modified to incorporate suggested changes are the Coastal Management elements. Integrating “Adaptation Action Area” language to reflect the State’s recent revisions will allow communities maximum flexibility in adapting to coastal changes over time, regardless of when or if they occur. Damage from storms can be mitigated by gradually encouraging migration of development rights away from low-lying and oceanfront areas.

There are two conceptual approaches planners can use to adopting coastal resiliency techniques. The first is using incentives to make parcels at higher elevation more valuable for development, and the second is by slowly planning to migrate public services away from the most vulnerable areas over time.

The former can be accomplished through a combination of the strategies evaluated in this study. Using rolling easements and conservation easements can be used to secure parcels which in the future are more appropriate as public open space, not requiring municipal services. At the same time, structuring development rights bonuses to provide maximum return from inland development can slowly reduce shoreline density. The second can be accomplished through long-term planning that recognizes areas of greatest vulnerability and long-term maintenance costs.

A prior Technical Memorandum detailed alternative approaches to Comp Plan language that have been designed for Florida Coastal Communities. The Appendix includes two templates for consideration.

## Conclusions

Long-term coastal resiliency has presented quandaries for local government officials who must balance an oft-perceived conflict between coastal resiliency and public expenditures of scarce resources. This study evaluated the costs and benefits of six planning strategies for each parcel in two coastal counties, and found that viability of strategies is more prevalent than conflict. Viability of different strategies is parcel-specific, but based primarily on location and proximity to specific amenities. Planners can use this information to identify realistic spatial patterns to apply various planning strategies in their own communities.

Template language that may be used to start the process is provided, which communities may adopt to suit their local needs. The more options that are provided to landowners, the more likely that market forces will drive development away from the areas most expensive to maintain, and toward areas of desired development. Planners should focus on providing a combination of options to landowners, and avoid limiting the strategies available to their community through narrowly-defined ordinances or policies.

## Appendix

### Template I

Goal 1 - Create a “Vulnerable Area” temporal and spatial planning overlay; i.e., develop the temporal and spatial context for sea-level rise adaptation planning in the City/County.

- Objective 1.1: [Spatial Overlay] Identify the areas of the City that are vulnerable to sea level rise (SLR) where the protection, accommodation, and retreat strategies should be used.
  - Vulnerable Area defined: The vulnerable area represents the area that encompasses the cumulative geographic reach of all sea level rise impacts projected for the planning horizon(s) as determined through data and analysis. The vulnerable area can encompass areas not currently identified as flood hazard areas (e.g. a future floodplain).
  - Policy 1.1.1: The City/County shall use data and analysis to establish a SLR adaptation overlay district encompassing all areas within the City that are vulnerable to SLR consisting of three coastal zones:
    - A. SLR Adaptation Overlay Protection Zone
    - B. SLR Adaptation Overlay Accommodation Zone
    - C. SLR Adaptation Overlay Managed Relocation Zone
  - Policy 1.1.2: Require all sellers of real property within the SLR Overlay District to provide notice to purchasers that structures and properties are located within an area that is vulnerable to sea level rise within the planning horizon.
- Objective 1.2: Expand planning horizons for sea-level rise adaptation to capture the anticipated impacts of SLR based on current SLR models.
  - Policy 1.2.1: Utilize a (\_\_\_) year planning horizon<sup>2</sup> when considering the adoption of any protection, accommodation, and managed retreat strategy within the City/County.
- Objective 1.3: Ensure consideration has been given to whether existing and planned public and private infrastructure and land development within the vulnerable area is “sea-level rise ready”.
  - Policy 1.3.1: The City/County shall inventory all existing and planned infrastructure and land development within the vulnerable area for its capacity to accommodate projected sea-level rise over the life expectancy of the infrastructure and development.
  - Policy 1.3.2: No capital improvements within the vulnerable area shall be financed or constructed without having first been reviewed to determine the extent to which the

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<sup>2</sup> Under Florida law local governments must develop planning horizons based on a 10 year interval for most planning purposes. Some transportation and infrastructure planning occurs on longer planning horizons. Current law does not preclude longer planning horizons should a local government choose to adopt them.

proposed improvement is sea-level rise-ready, taking into account the sea-level rise adaptation zone in which it is located, and whether it will contribute to additional development within the vulnerable area.

Goal 2: To ensure adequate protection<sup>3</sup> of the built environment through soft and hard shoreline stabilization that seeks to maintain a static shoreline position within the City/County.

- Objective 2.1: Identify areas of the built environment vulnerable to sea level rise where shoreline stabilization strategies will be appropriate.
  - Policy 2.1.1: The City/County shall develop a comprehensive shoreline stabilization strategy to address protection of the built environment where it has been determined to be feasible and in the best interest of the City/County to protect economic investment and public and private infrastructure.
  - Policy 2.1.2: Based on projected rates of sea level rise within the SLR planning horizon the City shall inventory all existing shoreline stabilization structures and determine their capacity to maintain functionality throughout the SLR planning horizon.
  - Policy 2.1.3: The City/County shall inventory all public buildings and infrastructure that are vulnerable to sea level rise within the SLR planning horizon and determine whether such buildings and structures should be protected through shoreline stabilization.
- Objective 2.2: Compensate for the loss of ecosystem services resulting from hard shoreline stabilization in the City/County.
  - Policy 2.2.1: The City/County shall require adequate mitigation for shoreline stabilization through the construction of living shorelines in front of hard shoreline stabilization structures where it is feasible do so.

Goal 3: To accommodate<sup>4</sup> increasing sea levels and the additional flooding that will result by adapting the built environment and enhancing the resiliency of the natural environment where it is economically and ecologically practicable to do so.

- Objective 3.1: Assure that all aspects of the built environment within the accommodation zone can withstand additional permanent or periodic inundation based on sea level rise projections through structural and non-structural solutions.<sup>5</sup>

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<sup>3</sup> Protection means the use of any means of constructed physical barrier or other managed system to prevent the landward migration of tidally influenced water bodies

<sup>4</sup> Accommodation contemplates a suite of policy tools that emphasize maintaining and adapting components of the built environment to periodic and permanent inundation over time. Accommodation policy also emphasizes retention and expansion of existing and potential floodways to manage flooding and to facilitate coastal ecosystem migration through and around the built environment.

<sup>5</sup> To a significant extent existing floodplain regulations already contemplate, indeed encourage, accommodation within the built environment.

- Policy 3.1.1: The City/County shall require all new construction within the Accommodation Zone to adhere to performance standards designed to enable development to withstand permanent and/or temporary inundation due to rising sea levels.
- Objective 3.2: Reduce the density and intensity of development and redevelopment in the accommodation zone landward of unprotected shorelines
  - Policy 3.2.1 The City/County shall develop design guidelines that promote compact development and redevelopment that maximizes the use of floodways and flood storage within the zone of accommodation.
  - Policy 3.2.2: The City/County shall limit the building footprint for all new residential structures within the accommodation zone to (    ) square feet and commercial structures to (\_\_\_\_) square feet.
- Objective 3.3: Facilitate coastal ecosystem migration through the maintenance and restoration of adequate open space within the zone of accommodation.
  - Policy 3.3.1: The City/County shall establish riparian buffers that reflect projected rates of sea level rise within the planning horizon for all tidally influenced water bodies. Such buffers shall be designed to allow the conversion of adjacent uplands to wetlands while retaining transitional ecotones where ecologically feasible.
  - Policy 3.3.2: The City/County shall develop priority areas for land acquisition based on their strategic capacity to absorb floodwaters and support coastal ecosystem migration.

Goal 4: To reduce vulnerability in the built environment and preserve coastal ecosystems through changes in land use and the orderly abandonment and /or landward relocation of structures and associated infrastructure.

- Objective 4.1: Reduce the density and intensity of future land use along unprotected shorelines within the managed relocation zone.
  - Policy 4.1.1: Within the managed relocation zone, the City/County shall eliminate new investment in public infrastructure likely to be subject to the impacts of sea level rise within the planning horizon.<sup>6</sup>
  - Policy 4.1.1: Within the managed relocation zone the City/County shall reduce residential land use densities to no more than \_\_\_\_ units per acre and commercial structures to \_\_\_\_ square feet per acre.<sup>7</sup>

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<sup>6</sup> While uncertainty remains about the magnitude and timing of sea level rise, development decisions that are being made today are committing public and private capital to land use patterns and associated infrastructure and facilities with design lives that reach well into the period of time when the impacts of sea level rise will be felt.” (Deyle, et al., Adaptive Response Planning to Sea Level Rise in Florida and Implications for Comprehensive and Public-Facilities Planning, available at: [http://www.gulfofmexicoalliance.org/working/coastal\\_resil/slr\\_comm\\_response.pdf](http://www.gulfofmexicoalliance.org/working/coastal_resil/slr_comm_response.pdf))

- Policy 4.1.3: The City/County shall create a transferable development rights program within the managed relocation overlay that transfers densities and intensities outside of the managed relocation zone.
- Objective 4.2: Preserve coastal ecosystems by ensuring that natural shoreline migration processes may continue unimpeded.
  - Policy 4.2.1: The City/County shall prohibit hard shoreline stabilization techniques within Managed Relocation Zone.
  - Policy 4.2.2: All permits for new development within the managed relocation zone shall include, as a condition of development approval, a covenant or other real property instrument that runs with the land, that requires the abandonment and removal of structures and fixtures once they are inundated for at least \_\_ months per year, or are no longer habitable as determined by the building official, whichever comes first.
- Objective 4.3: To develop programs to encourage abandonment of undeveloped properties and relocation of existing structures within the “Managed Relocation Zone” consistent with projected rates of shoreline recession over the SLR planning horizon.
  - Policy 4.3.1: The City/County shall prioritize and seek to acquire properties or interests in properties within the managed relocation zone based on their relative vulnerability to SLR and the extent to which they may impede coastal ecosystem migration.
  - Policy 4.3.2: Identify and establish a land bank for the purposes of relocating critically important infrastructure and municipal support facilities outside of the vulnerable area.
  - Policy 4.3.3: The City/County shall promote the acquisition of rolling conservation easements within the managed relocation zone.<sup>8</sup>

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<sup>7</sup> This may require down-zoning or down-planning current densities and intensities with the proposed overlay zone. Down-zoning and down-planning can be controversial and give rise to legal claims, though courts have generally upheld them where they are supported by data and analysis and represent sound public policy, broadly applied.

<sup>8</sup> A voluntary, parcel-specific rolling conservation easement obliges a property owner to forgo any rights to protect upland structures such that the fee simple property shall “forever yield to the sea.” The easement may also require removal of the structure. Such an easement may provide significant tax advantages to the property owner.

## Template II

**Section 4** - The City/County adopts the following amendments to the Goals, Objectives and Policies of the ***Coastal Management/Conservation Element***:

- **Objective 1.3:** In order to direct development and population concentrations away from the area seaward of the Coastal Construction Control Line and within the Coastal High Hazard area, the City/County will continue to prevent use of public funds and discourage use of funds by other levels of government as financial assistance for new, private development or redevelopment that result in increased densities or intensities in these areas.
- **Objective 1.4A:** The City/County will strive to minimize the potential for future damage to structures seaward of the Coastal Construction Control Line and within the Coastal High-Hazard Area by having adopted a post-disaster reconstruction plan aimed at reducing or eliminating the exposure of human life and rebuilt public and private property to subsequent natural hazards.
  - **Policy 1.12.4** - The City/County, alone or with others, will acquire public land as financially feasible to achieve the following:
    - improve flexibility in addressing sea level rise

**Section 5.** The City/County adds the following Goal, Objectives, and Policies of the ***Coastal Management/Conservation Element***:

**GOAL 2:** Adaptive protection of private and public interests from adverse impacts due to long-term changes in sea level.

- **Objective 2.1:** The City/County will evaluate available data related to adverse impacts from long-term changes in sea level. This process will be undertaken every five years or earlier as deemed necessary by the CPAB.
  - **Policy 2.1.1** - The City/County will initiate efforts to address the issues of barrier island sustainability.
  - **Policy 2.1.2** - The City/County will incorporate into the City/County's planning agenda for major public capital investments, changes in sea level within a 100-year planning horizon.
- **Objective 2.2:** The City/County will initiate actions to actively address adverse impacts of sea level rise as the impacts are identified.
  - **Policy 2.2.1** - The City/County will explore relocating critical infrastructure outside erosion or flood prone areas based on projections of sea level rise.
  - **Policy 2.2.2** - The City/County will review its Land Development Regulations to accommodate redevelopment in areas projected to become at risk from impacts of sea level rise, using a continuous 100-year planning horizon.

- Policy 2.2.3 - The City/County will encourage a community-wide dialogue about what the City/County's long-term response should be to sea level rise.
- **Objective 2.3** : The City/County will investigate and implement, as opportunity and resources allow, actions to reduce the City/County's use of energy and increase use of alternative energy sources.
  - Policy 2.3.1 – The City/County will continue to implement energy-saving strategies in its facilities throughout the City/County as opportunity and resources allow.
  - Policy 2.3.2 – The City/County will investigate the utility of alternative energy sources and other emerging technologies.
  - Policy 2.3.3 – The City/County will encourage residents and businesses to implement cost-effective energy saving techniques.

**Section 6** - The City/County/County adopts the following amendments to the Goals, Objectives and Policies of the **Capital Improvements Element**:

- Policy 1.1.10 – To the degree opportunity and resources allow, the City/County will design stormwater improvements and other capital improvements to function properly for 50 years or the design life of the improvement, whichever is greater, in the face of sea level rise as best estimated at the time of the design.
- Policy 1.3.1 – The City/County will make improvements or assist others in making improvements appropriate and necessary to protect and re-nourish dunes, beach areas, and shorelines; maintain or replace public facilities, and provide improved recreational opportunities east of the Coastal Construction Control Line (CCCL) and within the Coastal High Hazard Area. These improvements shall specifically exclude improvements that subsidize or otherwise encourage additional development in these areas.

# **Cost-Benefit Analysis for Coastal Resiliency Planning Strategies**

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**DCA Agreement No. 11-DR-CH-14-00-22-001**

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