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305 RESILIENT

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Resilient Urban Land Use Planning Toolkit

Contents


1

1 Introduction to the Urban Land Use Planning Toolkit

Land use planning can influence mitigation of disasters through strategic plans, policies, and ordinances. The ability to control local land use planning decisions allows local governments to improve resilience of communities and residents in preparation for climate change and sea level rise. Changes to land use plans and policies can impact existing developments now, and/or be activated after a disaster. **The emphasis in this toolkit is on pre-planning for post-disaster recovery. The toolkit provides guidance and examples of advance land use planning prior to extreme events to support a robust recovery.**

Land Use Planning for Incremental Adaptation

This toolkit contains a menu of land use actions that local governments can implement pre-disaster to facilitate post-disaster recovery and potentially minimize negative impacts, particularly in the face of climate-induced flooding and sea level rise. In this context, **land use planning** refers to rules and guidelines governing how public and private land can be adapted to promote physical security of urban communities. This definition is inspired by the American Planning Association.

As explained in the Adaptation Action Areas planning guide for Florida's local governments, adaptation planning and action is incremental. Planning relies on using the best available data at the time and on understanding the useful life of the investment.

Figure 1 presents three incremental adaptation approaches relevant to land use planning: Protect, Accommodate, and Managed/Long-Term Retreat, in conjunction with accommodation and other options. In South Florida local governments have taken significant measures to adapt to and mitigate the effects of climate change. While managed retreat is not part of the local governments' short- and medium-term plan, it is an option for long-term planning.

Protect
- Hard protection (sea walls)
- Soft protection (living shorelines)

Managed / Long-Term Retreat
- Land acquisition
- Land management
- Promotion of open space

Accomodate
- Siting and design standards
- Existing structure retrofits
- Stormwater management

Figure 1:
Land Use Planning and Adaptation Approaches

This toolkit provides:

(1) **Strategies** that can be integrated into a Comprehensive or General Plan, Master Plan, Comprehensive Neighborhood Plan, or Comprehensive Emergency Management Plan, or that can be reflected in policies, ordinances, and local mitigation activities. Planning documents and local policies guide local development, inform investor decision-making, and are vital for prudent and resilient development. Though the strategies vary in timeframe, some may extend to periods that are shorter or longer than the plans for which they are intended. For instance, Comprehensive Plans are typically created every 25 years with updates every seven years, yet some strategies may be suited for immediate integration into a city's planning documents.

(2) **Case study examples** of how some of the strategies have been implemented by cities. Case studies may include multiple strategies.

Intended Audience

This Resilient Urban Land Use Planning Toolkit is developed for municipal planners, emergency management officials, and other urban stakeholders focused on disaster-related pre-planning and long-term recovery activities in Greater Miami and the Beaches.

How to Use this Document

Though some readers may review the entire document from front to back, others may choose to consult different sections as interest and need require. The toolkit is divided into three general parts:

- **Considerations and legal guidance** for pre-disaster land use planning strategies.
- **Land use planning strategies and illustrative case studies**, with links to more information. The land use strategies vary and include adopting urban development and design guidelines, designating temporary land uses, embedding rebuild and recovery planning, using natural buffers to enhance protective functions, managing municipally-owned critical infrastructure, and restricting development in vulnerable or hazardous areas.
- **Appendices containing selected resources, graphics, local resiliency actions**, and links to all strategies and case studies.

Land Use Planning Toolkit Framework

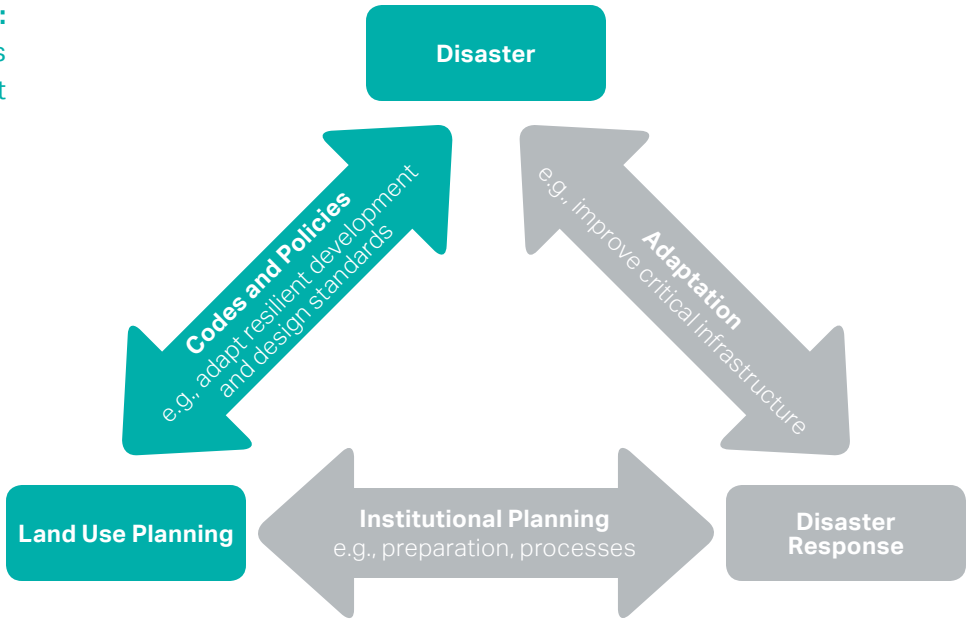
Examples of land use planning approaches that facilitate disaster recovery and potentially minimize negative impacts of disasters include the components shown in the table below.

Table 1:
Framework for Land Use Planing / Disaster Resilience Strategies

	When Strategies, Applied Now, Would Take Effect		
	Now, on Existing Structures	Future, Pre-Event on Proposed Development	Future, Post-Event on Existing Structures
Adopt resilient urban development and design standards	X	X	X
Establish a recovery ordinance to designate temporary land uses			X
Embed rebuild and recovery planning			X
Use natural buffers to enhance protective functions	X	X	
Move / install municipally-owned critical infrastructure to non-vulnerable areas	X	X	X
Restrict development in vulnerable or hazardous areas		X	X

Figure 2 illustrates the portion of the disaster-related actions that this toolkit addresses.

Figure 2:
Disaster-Related Actions Addressed in this Document



What's Not Included in the Land Use Planning Toolkit

This document does not include emergency response planning. Examples of actions related to disaster management that are NOT included in this set of focused land use planning strategies include:

- Guidelines for disaster planning preparation across lifeline infrastructure sectors, such as: establish mutual aid agreements, inventory and plan use of shared resources, purchase and stage spare parts on hand, confirm interoperability of communications, and coordinate critical recovery milestones and timeline goals.
- Guidance to facilitate post-disaster recovery, such as: sign vendor agreements with private contractors, coordinate with community stakeholders, and establish shelter-in-place program.


2
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2 Considerations for Land Use Planning Strategies

Prerequisite for Implementation: Identify Vulnerable and Hazardous Areas

Land use planning for resilience requires an understanding of the locations and conditions of existing and future vulnerable areas. Therefore, a preliminary step is to analyze land use vulnerabilities and identify existing plans where policy updates can be made. Such studies have already been published, such as the Analysis of the Vulnerability of Southeast Florida to Sea Level Rise (Southeast Florida Regional Climate Change Compact Inundation Mapping and Vulnerability Assessment Work Group, 2012). The City of Miami Beach has undertaken a sea level rise vulnerability assessment, and as of early 2019, Miami-Dade County was about to embark on one. Municipal staff can use exposure maps and other results from vulnerability assessments to understand current and future impacted sites and identify potential planning changes to reduce risk.

Components of a Complete Strategy

Each proposed action in this document relies on a toolkit of associated development and implementation strategies. For example, a successful local government initiative to restrict development in vulnerable/hazardous areas may include evaluating existing development and vulnerable/hazardous conditions; coordinating with stakeholders; drafting plans and policies that may trigger establishing new codes, regulations, and ordinances; outreaching to and educating the community; and establishing a program. Actions can be carried out by individual jurisdictions or joint compacts between municipalities. Examples of components of a complete strategy may include the following:

- **Program/Operation:** Program and operation actions require a program with stakeholder support, resources, public involvement, and a defined outcome. Many of these types of actions will require local level programs, with possible assistance and coordination from the regional level.
- **Plans and Policies:** These actions seek to develop policies or plans which support resilience capacity-building and can be adopted at the local level. They may trigger Codes, Regulations, and Ordinances.
- **Codes, Regulations, and Ordinances:** These actions are the technical application of Plans and Policies. These are specific changes that alter the requirements for practice within a jurisdiction, such as building codes or zoning.
- **Coordination:** Coordination actions bring together multiple stakeholders to make common decisions that are mutually beneficial. These types of actions are most common in multi-jurisdictional issues such as flooding and may be facilitated at the regional level.
- **Education/Outreach/Advocacy:** Education actions actively seek to gather and communicate new information to assist stakeholders and encourage voluntary actions.

Overview of Planning Tools and Strategies

Planning strategies considered in this toolkit include zoning, permitting, and market-based tools.

Zoning and permitting tools include the following:

- Accessibility
- Adaptation Action Areas – designates flood-prone and vulnerable areas within the coastal management element of a local government's Comprehensive Plan to prioritize funding for infrastructure needs and adaptation planning
- Aesthetic implications of new resilient design options
- Building code and resilient design adaptation options, such as elevation requirements
- Coastline armoring
- Conditional development and exactions
- Coastal Construction Control Line permitting program – regulates structures and activities altering coastal dunes systems or causing beach erosion
- Downzoning
- Environmental Resource Permit program – sets requirements for activities impacting surface waters, such as construction creating stormwater, dredging, and the filling of wetlands
- Historic preservation
- Overlay zones
- Rebuilding restrictions
- Setbacks and buffers.

Market-based tools to promote pre-planning for disaster and robust recovery include the following:

- Mandatory risk disclosures in real estate transactions
- Payments for ecosystem services
- Transferable development rights
- Tax incentives.

Overview of Legal and Liability Risks

Examples of legal and liability risks as identified by the City of Coral Gables (2016) and Drury (2018) that are associated with land use planning regulations include the following:

- Regulatory takings – restriction of rights due to government regulation limiting uses of private property, depriving property owners of economic value or utility
- Substantive due process principles – protection by the U.S. Constitution against irrational and unreasonable regulations
- Florida's Bert J. Harris, Jr. Private Property Rights Protection Act[1] – protection by Florida state law for private property owners
- Public Trust Doctrine – provision by the U.S. Constitution and the Florida Constitution creating a legal duty on behalf of the State to preserve and control natural resources for public use
- Anticipated increase in private litigation.

According to the City of Coral Gables' 2016 study, the legal and liability risk for adaptation regulatory decisions—including managed retreat strategies—are mitigated by substantial competent evidence and factors such as sound scientific data, including predictive data of sea level rise. The study summarizes: "The more imperative the governmental interest, the farther a regulation can go without amounting to a taking. Accordingly, regulations that prevent public harm or public nuisances are less likely to amount to a taking."

[1] The Act specifies that if "a specific action of a governmental entity has inordinately burdened an existing use of real property or a vested right to a specific use of real property, the property owner of that real property is entitled to relief, which may include compensation for the actual loss to the fair market value of the real property caused by the action of government."

Recent Legislation Requiring Pre-Disaster Planning

In 2015, the Florida Legislature passed SB 1094, "An Act Relating to the Peril of Flood." The legislation requires pre-disaster planning and consideration of future flood risk from storm surge and sea level rise in certain portions of local government Comprehensive Plans. In accordance with SB 1094, Florida Statute section 163.3178(2)(f)1 now includes sea-level rise as one of the causes of flood risk that must be addressed in the "redevelopment principles, strategies, and engineering solutions" to reduce flood risk.

SB 1094 specifies components that must be contained in the coastal management element required for a local government Comprehensive Plan. **Each Comprehensive Plan must contain a coastal redevelopment component that addresses how to eliminate inappropriate and unsafe development in the coastal areas when opportunities arise.** As of 2018, there is no deadline for compliance, but jurisdictions have the legal authority to amend Comprehensive Plans sooner than the seven-year requirement.

According to the Adaptation Clearinghouse, as of 2015 the Comprehensive Plan's redevelopment component must now:

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

Resources and Funding

The Florida Department of Environmental Protection offers two resources related to coastal planning: grant funding to local governments for coastal adaptation and resiliency planning through its Florida Resilient Coastlines Program, and funding for local government resiliency projects through its Coastal Partnership Initiative grant program.

For additional, selected land use planning and resiliency resources, please refer to **Table 3** on page **35**.


3

3 Strategies and Case Studies

Strategy: Adopt Resilient Urban Development and Design Standards

Application to Framework

	When Strategies, Applied Now, Would Take Effect		
	Now, on Existing Structures	Future, Pre-Event on Proposed Development	Future, Post-Event on Existing Structures
Adopt resilient urban development and design standards	**X**	**X**	**X**
Establish a recovery ordinance to designate temporary land uses			X
Embed rebuild and recovery planning			X
Use natural buffers to enhance protective functions	X	X	
Move / install municipally-owned critical infrastructure to non-vulnerable areas	X	X	X
Restrict development in vulneable or hazardous areas		X	X

Description

Use vulnerability assessments to guide resilient urban development and design.

Development and design strategies can help mitigate the impacts of natural disasters and facilitate recovery. Examples of resilient urban development and design include enhancing minimum design requirements for new buildings in flood-prone zones, incorporating sea level rise guidance within the capital planning process, and increasing freeboard requirements to a minimum level. Thoughtfully selected standards help distribute and share disaster-related risks with other city stakeholders.

Affected stakeholders should be engaged in appropriate and proportional participatory decision-making processes when considering options and consequences of updated urban development and design guidelines. Full consideration should be given to access and security issues.

See XXXXX for example actions by focus area for urban development and design.

Table 2:
Overview of Urban Development and Design Strategies

Focus Area	Example Actions
General - Buildings and Infrastructure	• Increase base flood elevation and freeboard for new development • Elevate low-lying buildings to reduce risk from potential flood damage • Reduce wind impacts and roof uplift by using structural roof ties/ straps (e.g. Simpson StrongTie) and components to provide a continuous structural load connection - roof to wall, wall to floor, and floor to foundation • Retain stormwater in designated outdoor area
Vertical Commercial / Institutional Buildings	• Apply wet flood-proofing measures to first floors, vertical evacuations (allowing flood waters to enter structure's enclosed areas) • Mandate specific future adaptation preparations/foundation work for new capital projects • Develop retrofit strategies based upon loss drivers, exposure change rate and risk finance opportunities for existing infrastructure. Include adaptive reuse to incentivize private investment. Capture residual risk with risk insurance.
Residential Buildings	• Apply dry floodproofing measures (not allowing flood waters to enter structure's enclosed areas) • Ensure ground surface slopes away from residential building • Connect chimneys and carports to structure to resist loads
Horizontal Lifeline Infrastructure	• Elevate and protect controls systems and floodproof administrative buildings
Streetscape and Right-of-way	• Implement green infrastructure for retention/storage and design for washover/erosion control best practices • Install larger-diameter storm sewers and culverts • Promote effective stormwater infiltration, conveyance and storage

Case Studies

Miami Beach, FL – Development Regulations – Grade Elevations and Height

The 2016-4010 ordinance establishes the Base Flood Elevation (BFE) at 8.0 ft. NGVD (6.44 ft. NAVD) throughout the city. Previously, FEMA FIRM panels indicated a base flood elevation in certain areas of the city of 7.0 feet NGVD, and a review provided by AECOM indicated that a large storm event would create a flood risk situation even at a flood elevation of 8.0 feet NGVD. In order to ensure the health, safety and welfare of the City of Miami Beach, it was recommended that existing low-lying infrastructure and future construction projects for structures, including buildings, be elevated in order to reduce risk or maintain low risk from potential flood damage.

More information

Miami Beach, FL – Comprehensive Plan – Peril of Flood

The 2016-4027 ordinance amended the City's Comprehensive Plan in order to comply with state law and improve the City's ability to mitigate the impacts of sea level rise. In 2015, the Florida Legislature adopted Senate Bill 1094, entitled "Peril of Flood", which requires the Coastal Management elements of local government Comprehensive Plans to include regulations related to the mitigation and reduction of flood risks in coastal areas. Additionally, in 2011 the Florida Legislature passed the Community Planning Act (CPA), which amended Section 163.3177, Florida Statutes, which allows local governments the option of planning for coastal hazards and the potential impacts of sea level rise within the Comprehensive Plan. This provided local governments with the option of designating Adaptation Action Areas (AAA). AAAs experience coastal flooding and are vulnerable to the related impacts of rising sea levels, with the purpose of prioritizing funding for infrastructure and adaptation planning.

More information

Miami Beach, FL – Sea Level Rise and Resiliency Review Criteria Ordinance

The 2017-4123 ordinance amendment establishes Sea Level Rise and Resiliency Review Criteria within Chapter 133, entitled "Sustainability and Resiliency," of the Land Development Regulations. This criteria will facilitate the discussion of incorporating criteria to address and plan for effects of sea level rise, climate adaptation, and mitigation between the applicant and Land Use Board staff during the review process, and subsequently at land use board review.

More information

Miami Beach, FL – Commercial Heights Standards Ordinance

The 2017-4124 ordinance amendment allows buildings in commercial districts to be developed up to an additional five (5) feet of height, provided that the first floor has a minimum of 12 feet from the base flood elevation (BFE) plus maximum freeboard, to the top of the second-floor slab. This would provide for the ability of the ground floor to be placed at a lower level, while providing sufficient ceiling high for the ground floor to be raised when roadways or sidewalks are raised.

More information

Miami Beach, FL – Freeboard Ordinance

The 2016-4009 ordinance amended Chapter 54 "Floods", by establishing a minimum and maximum freeboard above base flood elevation for all properties. It requires the ground floor of new buildings to be located a minimum of 1 foot and up to 5 feet above the FEMA base flood elevation or have enough headroom to raise the floor in the future without affecting the maximum permissible height of the building.

More information

Monroe County, FL – Sea Level Rise Design Standard and Flooding-Days Threshold

Based on a pilot study completed in 2017, Monroe County adopted a Resolution, including a design standard accounting for sea level rise and a maximum threshold of seven days of annual flooding for the useful life of the project. The final report also included a draft Ordinance building upon recent legal precedent, adding a design standard and local conditions analysis for feasibility. The pilot study analyzed the impacts of tidal flooding in two neighborhoods severely impacted by King Tides in October 2015 and October 2016 and produced numerous road elevation/stormwater options based on specific flooding scenarios. As of 2018, the County is also nearing the issuance of another procurement for a more comprehensive countywide analysis to develop a phased approach for addressing road elevation projects based on their future level of vulnerability.

More information

New York City, NY – Urban Waterfront Adaptive Strategies

New York City identified a range of adaptive strategies that can increase the resilience of urban coastal areas to coastal hazards associated with sea level rise. Given the diversity of geography and uses within urban areas, each stretch of the waterfront faces specific types and levels of risk and presents different opportunities and constraints. The manual evaluates the type and magnitude of costs and benefits associated with each strategy and establishes a framework by which communities can evaluate the effectiveness and appropriateness of different approaches for particular coastal areas.

Strategies include interventions upland, at the shoreline, or in the water, which frequently involve many individual sites and landowners, and are often built and maintained by public agencies. The objectives of various reach strategies include stabilizing land against erosion and daily tide levels, reducing wave forces, blocking the flooding of upland neighborhoods, and removing development from vulnerable areas. Some strategies can reduce risks from multiple hazards, while others may not. Strategies that involve land use, siting, and project design considerations include elevation of land and streets, development of waterfront parks, creation or restoration of "living shorelines," and strategic retreat.

More information

Los Angeles, CA – Building Forward LA

Building Forward LA is an initiative that aims to refresh and futurize policies and processes that influence how city buildings are designed and built. The program encourages buildings to integrate advancements and innovations in design, engineering, and construction to improve the environment and be resilient to future changes. This initiative has finished taking public feedback and the set of recommendations is in development.

More information

New Orleans, LA – Comprehensive Zoning to Require Stormwater Retention on Private Land

In New Orleans, the City Planning Commission updated its Comprehensive Zoning Ordinance (CZO) to require most new development projects to manage the first 1.25 inches of stormwater on their site (and to submit their design plan for managing stormwater with their development permits). By making stormwater management a regular requirement of private parcels of land, the city is sharing the risk and responsibility of effectively managing stormwater—building additional redundant capacity citywide and resulting in a more effective approach to managing one of the city's key threats.

More information

Norfolk, VA – Resilient Zoning Codes

The City of Norfolk is undertaking a comprehensive rewrite of the zoning code. The new code aspires to be a user-friendly document that incorporates modern best practices, supports and encourages resilient development, promotes environmentally friendly development, and recognizes the different characters of districts throughout the city. The City's Planning Department has been central in the development of this resilience strategy and has set the ambitious goal of using this zoning code rewrite to create the new gold standard for integrating resilience principles into land use planning. The rewrite will serve as a model for coastal zoning nationwide.

More information

Philadelphia, PA – Green Streets Design Manual

Acknowledging the effects of climate change causing storms of greater frequency and severity, the Philadelphia Water Department developed a Green Streets Design Manual to provide standards and guidance to developing green streets that manage stormwater runoff. This features detailed design templates that can be applied to a variety of urban street conditions. The manual contains information on a variety of techniques, including stormwater tree trenches, stormwater planters, stormwater bump-outs, and pervious pavement. Philadelphia has a focus on Green Streets as a solution to stormwater management in the impervious landscape of the city, while still providing safe and functional transportation pathways to vehicles and pedestrians.

More information

Strategy: Establish a Recovery Ordinance to Designate Temporary Land Uses

Application to Framework

	When Strategies, Applied Now, Would Take Effect		
	Now, on Existing Structures	Future, Pre-Event on Proposed Development	Future, Post-Event on Existing Structures
Adopt resilient urban development and design standards	X	X	X
Establish a recovery ordinance to designate temporary land uses			**X**
Embed rebuild and recovery planning			X
Use natural buffers to enhance protective functions	X	X	
Move / install municipally-owned critical infrastructure to non-vulnerable areas	X	X	X
Restrict development in vulneable or hazardous areas		X	X

Description

Establish a pre-event recovery ordinance to allow temporary land uses to facilitate and expedite post-disaster recovery. Revise local plans and development codes and grant emergency powers for staff actions which can ensure post-disaster recovery for local governments.

Jurisdictions will need to make several decisions about temporary land-use regulations, including who shall have the authority to issue permits, which temporary uses will be allowed, which zones will allow temporary land uses, and how long temporary land uses will be allowed. Ordinances and long-term planning documents can provide for a range of temporary land uses, including:

- Emergency response staging areas
- Neighborhood aid and recovery stations "resilience hubs"
- Shelter
- Debris management

There are various approaches related to temporary land uses. For example, jurisdictions can establish the authority for declaring a temporary building permit moratorium during an emergency. Building flexible space into the long-term park planning process could expand, and make more efficient, the city's ability to process thousands of tons of storm debris. Additionally, while considering institutional spaces in the long-range planning process, cities should think about identifying and allocating space for centralizing neighborhood aid and recovery efforts. Examples of these being developed have been called "Resilience Hubs" and "Community Emergency Operations Centers." Catalyst Miami, a local community advocacy and empowerment organization, has started to work with governments and community members to develop Resilience Hubs in five target communities (Hialeah, Homestead-Naranja, Little Haiti, Miami Gardens, Overtown) that will serve such purpose. While cities plan new facilities and their place in communities, these functions can be planned for and considered in the long-range planning process.

Case Studies

Los Angeles, California – Temporary Land Use Approval During Emergencies

Los Angeles's municipal code includes the following regulations which allow land-use approval for properties damaged in a local emergency: Zoning Code, Article 6, Temporary Regulations Relating to Land-Use Approvals for Properties Damaged in a Local Emergency. Effective since 1994, the ordinance establishes "reasonable and uniform regulations to protect the public welfare and to provide a streamlined method for consideration of applications for temporary use approvals and other land use approvals" in an emergency, as declared by the Governor.

More information

Boulder County, CO – Temporary Emergency Permits

Boulder's Land Use Department can grant Temporary Emergency Permits when immediate action is necessary to protect public health, safety, welfare, property and the environment. They can be used for structure stabilization, bank stabilization, retaining or protective walls, and/or roof and siding protection.

More information

San Luis Obispo County, CA – Emergency Permits

San Luis Obispo County can issue emergency permits to authorize work to occur immediately in order to remedy an emergency situation. The work must be necessary to prevent or lessen the loss or damage to life, health, property, or essential public services.

More information

County of Santa Barbara – Emergency Permits

County of Santa Barbara temporarily defers the requirements for obtaining permits when an emergency action is required. An emergency is defined as "a sudden unexpected occurrence demanding immediate action to prevent or mitigate loss or damage to life, health, property, or essential public service."

More information

San Francisco – Recovery Coordination with Private and Public Utilities

The San Francisco Office of Resilience and Recovery partners with the San Francisco Lifelines Council to study the geographic "choke point" areas where infrastructure restoration is more challenging because of heavy concentration and interdependency. The San Francisco Lifelines Council is made up of private and public utility providers, first responders and senior public-sector officials who together work to ensure that the City and the region can recover quickly from unexpected disruptions. The Lifelines Council continues to advance mitigation efforts that could collectively improve lifeline system performance in the City after future disasters.

More information

Los Angeles – Establish Post-Disaster Restoration Targets for Critical Infrastructure

Los Angeles is establishing a process to assess service restoration that considers vulnerable populations and uses critical infrastructure interdependencies and supply chains. Performance goals will be established for water, sewer, electricity, gas, communications, and transportation systems. These targets will be incorporated into the City's Continuity of Operations Plans.

More information

Strategy: Embed Rebuild and Recovery Planning into Comprehensive Plans

Application to Framework

	When Strategies, Applied Now, Would Take Effect		
	Now, on Existing Structures	Future, Pre-Event on Proposed Development	Future, Post-Event on Existing Structures
Adopt resilient urban development and design standards	X	X	X
Establish a recovery ordinance to designate temporary land uses			X
Embed rebuild and recovery planning			**X**
Use natural buffers to enhance protective functions	X	X	
Move / install municipally-owned critical infrastructure to non-vulnerable areas	X	X	X
Restrict development in vulneable or hazardous areas		X	X

Description

Embed pre-disaster rebuild and recovery planning into comprehensive and neighborhood plans.

Comprehensive and neighborhood plans can specify the tactical approach and overall vision for facilitating a robust recovery. Though this can be done at the municipal scale, it is equally important to do so at the neighborhood scale so that the resulting plan reflects specific goals and desires of a neighborhood. These plans can go by many names: vision plans, master plans, neighborhood Comprehensive Plans. At whichever scale, pre-disaster for post-event recovery plans may cover the following topics, as relevant:

- When, where, and how rebuilding will occur after a natural disaster.
- Which areas will be rebuilt according to existing plans and codes and which will be re-planned.
- Whether rebuilt homes will be encouraged or required to be better able to withstand the effects of future hazard events.
- How risk will be shared across city stakeholders.

As of 2015, Florida jurisdictions must incorporate coastal management pre-disaster planning into their Comprehensive Plans. There are various ways to fulfill this requirement. Some jurisdictions have developed a separate element within the Comprehensive Plan to provide for future conditions planning. Others have added new policies throughout existing elements to address climate change and sea level rise or use a combination of both strategies.

Local governments may also designate Adaptation Action Areas within the coastal management element of a Comprehensive Plan. These are 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. Designated Adaptation Action Areas help prioritize funding for infrastructure needs and adaptation planning.

Case Studies

Sarasota, FL – Incorporating Climate Change and Sea Level Rise into Comprehensive Plan

The City of Sarasota's Comprehensive Plan, adopted in 2017, details a wide range of climate change and sea level rise planning strategies in the Environmental Protection and Coastal Island Element. This section promotes the reduction of GHG emissions community wide and in city operations as well as requires sea level rise and storm surge data to be considered in the planning for future infrastructure. If proposed development is within a vulnerable area, resiliency strategies must be incorporated into the design.

More information

New Orleans, LA – Incorporating Pre-Disaster Planning into Master Plan

The New Orleans' current Master Plan has actions laid out to invest in pre-disaster planning for post-disaster recovery. This includes developing a Comprehensive Plan for post-disaster recovery that incorporates critical infrastructure systems, land use, housing, economic development, and public health services; implementing and regularly maintain a citywide parcel and building survey that can be quickly updated after a disaster; and establishing a disaster recovery fund for the City.

More information

Galveston, TX – Community-Driven Recovery Planning

In response to Hurricane Ike, the City of Galveston created the Galveston Community Recovery Committee, which included 330 city-appointed representatives serving on five focus groups (Economic; Environment; Housing and Community Character; Human Services; and Infrastructure, Transportation, and Mitigation). This committee worked with Federal, State, and local partners over 12 weeks to develop a City recovery plan in early 2009. GCRC continued to meet periodically over the next two years, during which, implementation of 30 of the 42 projects in the original plan commenced. Though the committee was established after a disaster, similar committees could be established in advance.

More information

Palm Beach County, FL – Post-Disaster Redevelopment Plan

The plan outlines goals and issues for post-disaster redevelopment in local government, economic and private sectors, social and environmental concerns, and redevelopment and mitigation.

More information

Fairfax County, VA – Pre-Disaster Recovery Plan

After a disaster, the County's Pre-Disaster Recovery Plan would guide the establishment of a temporary recovery agency. Depending on the scope and scale of the disaster, a number of branches would be activated and assigned responsibility for addressing recovery objectives. Fairfax County utilized the National Disaster Recovery Framework as an operational model.

More information

Strategy: Use Natural Buffers to Enhance Protective Functions

Application to Framework

	When Strategies, Applied Now, Would Take Effect		
	Now, on Existing Structures	Future, Pre-Event on Proposed Development	Future, Post-Event on Existing Structures
Adopt resilient urban development and design standards	X	X	X
Establish a recovery ordinance to designate temporary land uses			X
Embed rebuild and recovery planning			X
Use natural buffers to enhance protective functions	**X**	**X**	
Move / install municipally-owned critical infrastructure to non-vulnerable areas	X	X	X
Restrict development in vulneable or hazardous areas		X	X

Description

Use natural buffers to enhance functions that protect urban property and resources.

Natural buffers within or on the perimeter of urban and coastal areas offer an array of benefits to city residents and property. Maintaining or even creating these wetlands, vegetation, and other features both protects and enhances urban resiliency. Relevant ecosystem services may include, but are not limited to: water retention or water infiltration; afforestation; urban vegetation; floodplains; sand dunes; mangrove and other coastal vegetation, and pollination. Many ecosystem services that are relevant to urban resilience may be provided well outside its geographical area.

Case Studies

Philadelphia – Waterfront Master Planning Incorporates Wetlands

Philadelphia's master plan for its waterfront includes the creation of wetlands to help protect Philadelphia from the rising sea. Although Philadelphia is not directly on the coast, it is vulnerable to coastal flooding because tides affect the Delaware and Schuylkill Rivers, which surround the city. By 2045, Philadelphia is projected to face more than 200 tidal floods a year—nearly 20 of them more extensive than the tidal flooding typically seen today.

More information

New Orleans, LA – Master Plan for a Sustainable Coast

New Orleans's Coastal Master Plan establishes risk reduction targets for 500-year storm protection that can only be achieved through a combination of structural approaches to flood protection, such as levees and coastal restoration, and non-structural approaches, including home elevations and flood-proofing measures.

More information

New York City, NY – Ecosystem-based Disaster Risk Management

New York City is investing $5.3 billion in green infrastructure on roofs, streets and sidewalks. The goal of these new green spaces is to absorb more rainwater and reduce the burden on the city's sewage system. The sewage system is ageing and often fails, resulting in untreated stormwater and sewage entering streets and waterbodies. By investing in these natural buffers to the local systems, there should be increased resilience to flooding as well as an improvement in water quality.

More information

Lewisboro, NY – Development Restrictions in Wetlands and Buffer Areas

Lewisboro imposes an environmental review process that discourages development in wetlands, watercourses, and buffer areas, and that requires consideration of the benefits that wetlands provide as a results of climate change. Their language is "The [Insert Permit Authority – e.g. Planning Board] shall consider the ecological benefits (including but not limited to providing natural barriers against sea level rise, storm surge, and extreme precipitation) of wetlands, watercourses, and/or buffer areas." (Town of Lewisboro, N.Y., Code §§ 217-5–217-8 (2004).)

More information

Pittsboro, NC – Riparian Buffer Protection Ordinance

This ordinance protects and preserves existing riparian buffers throughout Pittsboro's local watershed. The objectives for the ordinance include water quality improvements, water supply protection, and support minimizing flood damage in flood prone areas.

More information

Duluth, GA – Stream Buffer Protection Ordinance

The Duluth ordinance establishes buffer zones for land development near streams. It requires maintaining a 50-foot undisturbed buffer on both banks of the stream and an additional setback for 25 feet beyond the undisturbed buffer in which all impervious cover shall be prohibited.

More information

Whatcom County, WA – Wetland and Stream Buffer Restrictions

The County establishes buffer zones for land development near wetlands, streams, wildlife habitat, and geologically hazardous zones (described in "Strategy: Restrict Development in Vulnerable or Hazardous Areas").

More information

Strategy: Move / Install Municipally-Owned Critical Infrastructure

Application to Framework

	When Strategies, Applied Now, Would Take Effect		
	Now, on Existing Structures	Future, Pre-Event on Proposed Development	Future, Post-Event on Existing Structures
Adopt resilient urban development and design standards	X	X	X
Establish a recovery ordinance to designate temporary land uses			X
Embed rebuild and recovery planning			X
Use natural buffers to enhance protective functions	X	X	
Move / install municipally-owned critical infrastructure to non-vulnerable areas	**X**	**X**	**X**
Restrict development in vulneable or hazardous areas		X	X

Description

Move or install municipally-owned critical infrastructure to non-vulnerable areas in order to reduce risk of damage to assets and services.

In the context of this document, critical infrastructure refers to essential assets and services for the economy, society, and health. These include: hospitals, water and wastewater services, key government facilities, and key food purveyors. Cities can assess the vulnerability and value of critical infrastructure as a way to inform decisions to move existing infrastructure or install new infrastructure in less vulnerable areas. Additionally, cities can retrofit existing infrastructure facilities pre-disaster to reduce the risk of widespread harm following a disaster. Examples of retrofits may include: elevate and protect electrical controls systems, elevate structures above freeboard, and dry floodproof critical facilities.

Additionally, according to the Florida Bar Environmental and Land Use Section (Deady, 2018), Adaptation Action Areas specified within Comprehensive Plans can designate local infrastructure needing special consideration when planning for the life of government investments such as roads, bridges, facilities, and stormwater infrastructures. Policies for planning within the Adaptation Action Area include: utilization of best available data and resources; regional collaboration; and vulnerability assessments to identify "at risk" public infrastructure, investments, and assets that could be impacted by rising sea levels.

Case Studies

Fort Lauderdale, FL – Designated Infrastructure-related Adaptation Action Areas

Fort Lauderdale has designated infrastructure-related Adaptation Action Areas within the Coastal Management Element of its Comprehensive Plan.

More information

Strategy: Restrict Development in Vulnerable or Hazardous Areas

Application to Framework

	When Strategies, Applied Now, Would Take Effect		
	Now, on Existing Structures	Future, Pre-Event on Proposed Development	Future, Post-Event on Existing Structures
Adopt resilient urban development and design standards	X	X	X
Establish a recovery ordinance to designate temporary land uses			X
Embed rebuild and recovery planning			X
Use natural buffers to enhance protective functions	X	X	
Move / install municipally-owned critical infrastructure to non-vulnerable areas	X	X	X
Restrict development in vulneable or hazardous areas		**X**	**X**

Description

Limit or prohibit development in areas that are designated as vulnerable or hazardous to minimize impacts to coastal resources and property from storms and sea level rise.

Chapter 163 of Florida Statutes requires that local coastal governments plan for, and where appropriate, restrict development where development would damage or destroy coastal resources. Additionally, the statute requires that local governments protect human life and limit public expenditures in areas that are subject to destruction by natural disaster. Local governments may satisfy Chapter 163 requirements through conformity with the Florida Building Code, the Coastal Construction Control Line, and the density allowed by the Future Land Use Plan.

Restricting development is especially important if land use codes have not been updated to reduce risk. Downzoning, conservation easements, transfer of development rights programs, voluntary land acquisitions, eminent domain land acquisitions, and removal of structures where the right to protection was waived (i.e., via permit condition) are examples of strategies designed to encourage managed retreat. As part of a managed retreat strategy, new land use designations and zoning ordinances can encourage building in more resilient areas or gradually remove and relocate existing development. Planners should exercise care with managed retreat strategies, as the design carries consequences for social justice and disadvantaged communities.

Case Studies

Edgemere, NY – Rededicate Existing Land Use and Limit New Residential Development in Vulnerable Areas

New York City will limit new housing in vulnerable areas in the low-lying, waterfront Rockaways community of Edgemere. The City is dedicating City-owned vacant land in the north of Edgemere, along the coast of Jamaica Bay, for non-residential, public uses, such as new open spaces and the development of coastal protection features. The City will amend the Urban Renewal Plan to memorialize this land use change. Concurrently the City will explore zoning and land use tools to limit development on privately owned land in the most vulnerable areas of Edgemere, including parcels north of Norton Avenue, while protecting the rights of current residents and property owners.

More information

Whatcom County, WA – Geologically Hazardous Development Restrictions

County policies concerning geologically hazardous areas are contained in the Comprehensive Plan, Chapter 11 – Environment. The Plan highlights the responsibility local governments have for balancing private property rights and the need to protect the public's health, safety, and welfare. The Plan also establishes specific policies aimed at:

- Minimizing public investments for infrastructure in known hazard areas,
- Using best available science to research and investigate hazards and educate the public,
- Informing the public of the potential effects of geological hazards,
- Establishing decision-making criteria for development in hazard areas based on established levels of risk,
- Uses that do not require human habitation when adverse impacts can be minimized or mitigated, and
- Prohibiting critical public facilities in known natural hazard areas unless the public benefits outweigh the risk.

Whatcom County manages and protects geologically hazardous areas primarily by implementing the standards contained in WCC 16.16.300, et seq. The stated purpose of the regulations is to minimize hazards to the public and to reduce the risk of property damage from development activities on or adjacent to geologically hazardous areas. The regulations also regulate land use so as to avoid the need for construction of flood control devices on alluvial fans and allow for natural hydrologic changes.

More information

Whatcom County, WA – Critical Areas Ordinance Update / Frequently Flooded Areas

County policies concerning Frequently Flooded Areas (FFAs) are contained in the Comprehensive Plan, Chapter 11 – Environment. The Plan emphasizes using natural processes to manage floods, moving away from trying to control flooding through major engineering projects. The Plan also establishes specific policies aimed at:

- Minimizing the potential loss of life, damage to property, the expenditure of public funds, and degradation of natural systems resulting from development in hazardous areas.
- Discouraging new development in the floodplain.
- Protecting and enhancing natural systems when flood hazard management measures are used.
- Recognizing natural wetlands such as swamps, bogs, saltwater marshes, and ponds for their value in cleaning water, reducing flood damage, providing valuable habitat for plants, fish and wildlife, and as sites for groundwater recharge.

More information

Norfolk, VA – Vision 2100 Land Management through Risk and Asset Lens

Norfolk's Vision 2100 creates four "vision" areas which look at the city's neighborhoods through both a risk and asset lens. The plan organizes the city based on neighborhoods' risk and asset profiles and proposes distinct strategies for each, such as transferable development rights for homeowners in chronic flood areas; reduced development in high risk areas; and re-focusing investment in "high and dry" areas that have the potential to increase economic opportunity for the city's poorest residents.

More information

Gardiner, NY – Floodplain Ordinance

Gardiner's zoning laws require permits for development in floodplains and specify factors the permit issuer must consider when deciding to grant or deny permits. (Town of Gardiner, N.Y., Code § 220-19 (2008).)

More information

Charlotte, NC – Floodplain Development Permit

A Floodplain Development Permit is required for all development within the City's floodplain. Additional rules and permitting requirements apply to new construction, additions or renovations.

More information

Cherry Hills, CO – Floodplain Permits

Floodplain development permits are required for all development within the floodplain. These were established "to promote the public health, safety and general welfare, to minimize flood losses in areas subject to flood hazards so as to minimize future flood blight areas and prolonged business interruptions and to promote the wise use of floodplain areas."

More information


A

APPENDIX A: Selected Land Use Planning and Legal Resources

In addition to the links to more information provided for each case study, **Table 3** provides links to selected land use planning and legal resources.

Table 3:
Selected Land Use Planning and Legal Resources

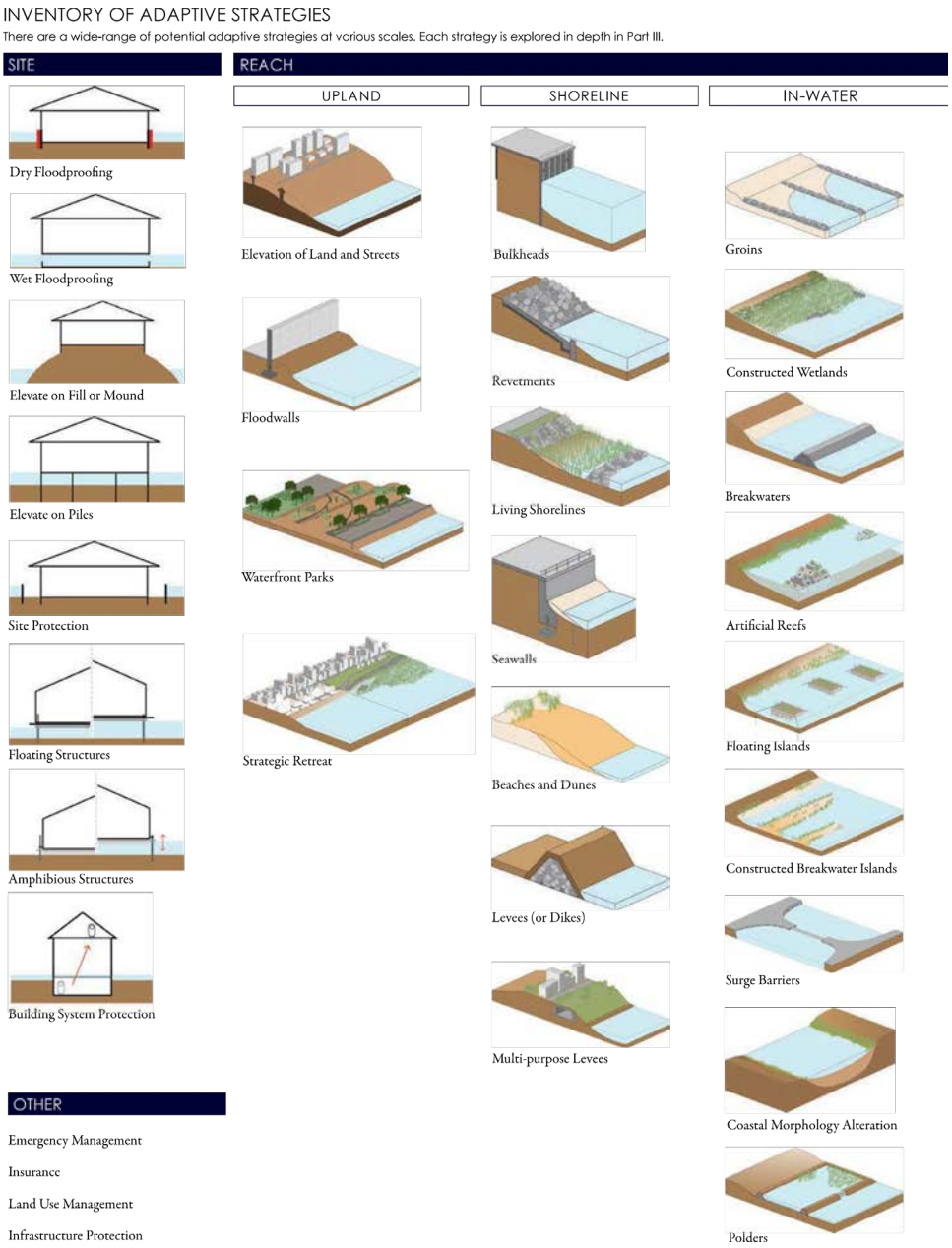
Title / Resource	Author / Source	Location
Adaption Action Areas: A Planning Guidebook for Florida's Local Government	South Florida Regional Planning Council (2014)	https://floridadep.gov/fco/florida-resilient-coastlines-program/documents/adaptation-action-areas-planning-guidebook
Adaptation Planning - Planning for Coastal Flooding and Sea Level Rise	Florida Department of Economic Opportunity	http://www.floridajobs.org/community-planning-and-development/programs/community-planning-table-of-contents/adaptation-planning
Bert J. Harris, Jr., Private Property Rights Protection Act: An Overview, Recent Developments, And What The Future May Hold	Ketterer and Suarez-Rivas, Florida Bar Journal (2015)	https://www.floridabar.org/the-florida-bar-journal/the-bert-j-harris-jr-private-property-rights-protection-act-an-overview-recent-developments-and-what-the-future-may-hold/
Florida Resilient Coastlines Program	Florida Department of Environmental Protection	https://floridadep.gov/fco/florida-resilient-coastlines-program
Legal Considerations Surrounding Adaptation to the Threat of Sea Level Rise	City of Coral Gables (2016)	http://www.southeastfloridaclimatecompact.org/wp-content/uploads/2016/12/Legal-Considerations-Surrounding-Adaptation-to-the-Threat-of-Sea-Level-Rise.pdf
Local Law Provisions for Climate Change Adaptation	Sabin Center for Climate Change Law (2016)	http://columbiaclimatelaw.com/files/2016/06/Gundlach-and-Warren-2016-05-Local-Law-Adaptation.pdf
Municipal and County Sea Level Rise-Related Comprehensive Plan Provisions	Florida Sea Grant (2015)	https://www.flseagrant.org/wp-content/uploads/Ruppert-Updated-Sea-Level-Language_7.2.15.pdf
Social Justice Implications of US Managed Retreat Buyout Programs	A. R. Siders (2019)	https://link.springer.com/article/10.1007%2Fs10584-018-2272-5
Southeast Florida Regional Climate Action Plan Compact	Southeast Florida RCAP	http://www.southeastfloridaclimatecompact.org/regional-climate-action-plan/
Update on the Legal and Planning Issues of Climate Change Facing Florida	Deady, Florida Bar, Environmental and Land Use Law Section (2018)	http://eluls.org/wp-content/uploads/2018/07/The-Environmental-and-Land-Use-Law-Section-Reporter-July-2018.pdf
Urban Waterfront Adaptive Strategies	New York-Connecticut Sustainable Communities Consortium (2013)	https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban_waterfront.pdf


B

B APPENDIX B: Selected Graphics

Figure 3:

Source - Urban Waterfront Adaptive Strategies, NYC Planning (page 5)




C

APPENDIX C: Resiliency Actions Underway in Greater Miami and the Beaches

Greater Miami and the Beaches are planning, implementing, and continuing in a wide variety of resiliency actions. A sample list of resiliency actions documented through the 100 Resilient Cities program is listed below.

As of January 2018:

1. Miami-Dade County is currently performing a vulnerability assessment of key infrastructure and capital investments.
2. Miami-Dade County is currently working with Rand Corporation to visualize how sea level rise and future land use decisions will impact flooding risks.
3. Miami-Dade County adopted a Green Sustainable Buildings Ordinance for new construction.
4. The City of Miami is partnering on a Resilient Redesign for the Shorecrest neighborhood.
5. The City of Miami is strengthening flood risk mitigation in the Future Land Use and Coastal Management elements of the City's Comprehensive Neighborhood plan.
6. The City of Miami Beach updated the land use and development code to incorporate climate adaptation and resilience, including increased freeboard, base flood elevation, roadway, ground, and seawall heights.
7. The City of Miami Beach is developing design guidelines for historic preservation in the face of sea level rise and climate change.
8. The City of Miami Beach land use codes have been updated to take sea level rise projection into account and plan for climate adaptation.
9. The City of Miami Beach is maintaining extensive sand dunes that minimize risk from storm surge and provide habitat.
10. The Miami-Dade County Water and Sewer Department is investing billions on improving critical infrastructure, and sea level rise is a key part of the design criteria.
11. Miami-Dade County created a Sea Level Rise Task Force who recommended that the County prepare an Enhanced Capital Plan to increase the resilience of the County's infrastructure.
12. Updating the City of Miami's stormwater master plan while implementing stormwater upgrades in highly vulnerable areas.
13. The City of Miami is creating a rapid action plan for flood risk mitigation of critical infrastructure.
14. The City of Miami Beach is committing to investing half a billion dollars to raise roads and improve stormwater drainage.
15. The City of Miami Beach recently completed a vulnerability assessment for its infrastructure.
16. The countywide Recovery Plan addresses policies that promote an all-hazards disaster recovery process amongst all stakeholders.

In January 2010, Broward, Miami-Dade, Monroe, and Palm Beach Counties united to form the Southeast Florida Regional Climate Change Compact (RCAP) as a way to coordinate mitigation and adaptation activities across county lines. The RCAP website provides links to a status page for each of the participating municipalities that contains a snapshot of self-reported RCAP implementation activities. (In 2014 and 2016, the Compact conducted basic surveys of RCAP implementation in which municipalities indicated which recommendations they had completed.)

Table 4 contains links to RCAP resources, as well as direct links to resiliency resources for selected cities and counties.

Table 4:
Greater Miami and the Beaches Resiliency Resources

Jurisdiction	Website
Southeast Florida Regional Climate Compact – Climate Action Plan	http://www.southeastfloridaclimatecompact.org/regional-climate-action-plan/
Southeast Florida Regional Climate Compact – Municipalities	http://www.southeastfloridaclimatecompact.org/municipalities/
City of Aventura	https://cityofaventura.com/192/Go-Green
City of Coral Gables	https://www.coralgables.com/sustainability
City of Doral	https://www.cityofdoral.com/all-departments/public-works/green-initiatives/
City of Miami Beach	http://www.mbrisingabove.com/your-city-at-work/resilient-land-use-and-development/city-wide-initiatives/
City of North Miami	http://www.northmiamifl.gov/departments/cpd/sustainability.aspx
City of South Miami	https://www.southmiamifl.gov/512/Going-Green
Miami-Dade County	https://www.miamidade.gov/planning/resilience.asp
Town of Bay Harbor Islands	https://www.bayharborislands-fl.gov/sustainable-building-program
Village of Pinecrest	https://www.pinecrest-fl.gov/our-village/green-initiatives


D

D APPENDIX D: Links to All Strategies


E

E APPENDIX E: Links to All Case Studies

MIAMI-DADE COUNTY

THE CITY OF MIAMI FLORIDA INCORPORATED

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PIONEERED BY THE ROCKEFELLER FOUNDATION 100 RESILIENT CITIES