



# DUNE PROTECTION & MANAGEMENT PLAN

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**PREPARED BY**  
City of Hallandale Beach

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## Statement of Purpose

Coastal dunes are habitat for wildlife and support a high biodiversity of flora and fauna. Hallandale Beach provides critical nesting grounds for threatened and endangered sea turtles and serve as an important habitat for shorebirds and other wildlife. Functional dune systems keep beaches healthy by accreting sand and minimizing beach erosion rates. Established dunes protect coastal infrastructure and upland properties from storm damage by blocking storm surge and absorbing wave energy. In Broward County, beaches provide protection for more than \$4 billion dollars of shoreline property, structures and infrastructure.

In addition to the environmental benefits of dunes, dunes also provide economic and recreational co-benefits to the community. Hallandale beaches are a significant employment center for the City. Broward County beaches, including Hallandale Beach, attract more than 12.8 million visitors annually and contribute more than \$6 billion to the local economy each year. A healthy dune system is an invaluable asset to coastal communities like Hallandale Beach.

The purpose of the City of Hallandale Beach Dune Protection & Management Plan (“the Plan”) is to outline the framework and specifications that the City will use to foster and maintain healthy, stable, and natural dune system that is appropriate for its location and reduces public safety and maintenance concerns. The Plan shall guide the City’s efforts in managing the urban, man-made dune as close to a natural system as possible and ensuring the dune provides storm protection, erosion control, and a biologically-rich habitat for local species.

## Objectives

This plan was developed by the City and reviewed with the help of stakeholders, as well as local experts to meet the following primary objectives:

- Restore and expand the existing dune system;
- Prevent dune loss and beach erosion;
- Create a long-term maintenance plan for the dune system;
- Engage coastal property owners to improve the dune system;
- Increase public education and awareness of the importance of dune restoration and maintenance;
- Identify funding for dune restoration projects; and
- Plan for the impacts of sea level rise.

## Background

Hallandale Beach’s marine shoreline and beach is located within Broward County’s “Segment III” which spans from Port Everglades southward to Hallandale Beach and the Miami-Dade/Broward County-line. Segment III is separated by monuments and Hallandale Beach’s monuments include R124-R128 which is comprised of approximately 4,350 feet (0.82 mile) of Segment III beaches.

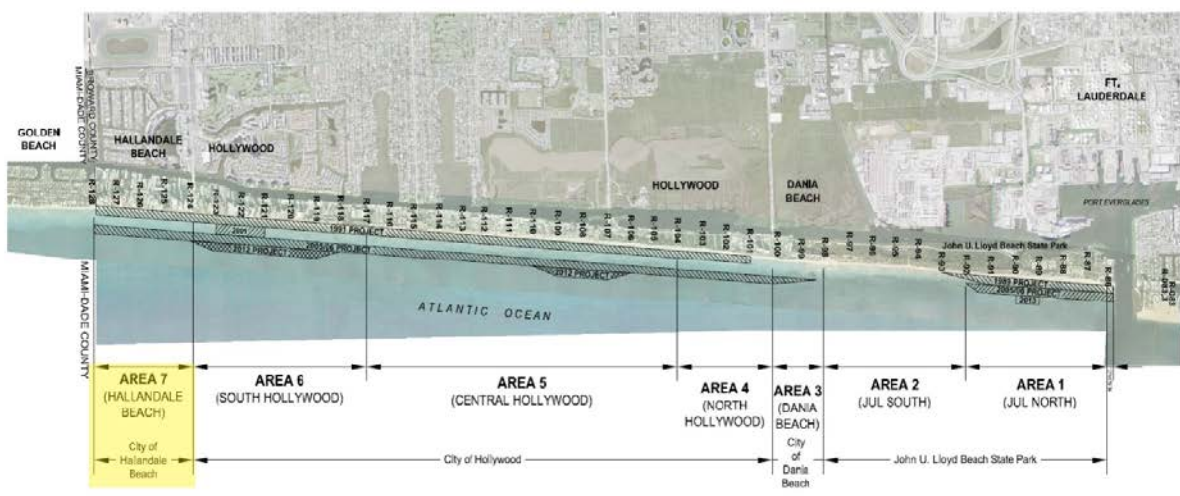


Figure 1: Broward County Segment III

### Ecological Condition

The City of Hallandale Beach's dune system is narrow and fragmented, with varying levels of restoration efforts having been expended. The entire dune system in Hallandale Beach is held in trust by the State. However, the City manages the dunes at South City Beach Park, the dunes at North City Beach Park are maintained by a third-party through an agreement, and all other dunes have historically been managed by adjacent private property owners.

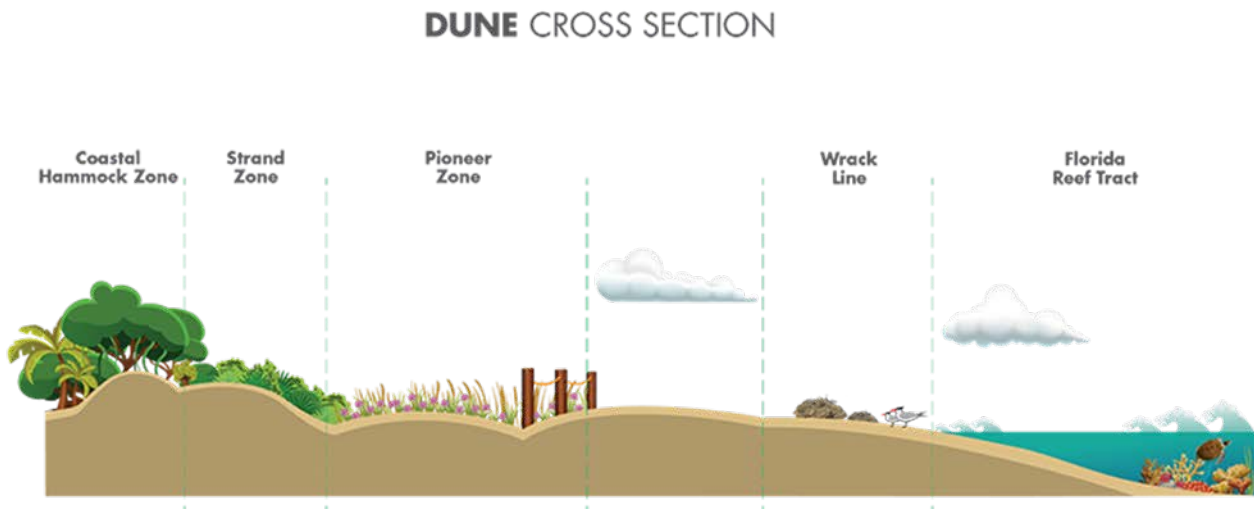


Figure 2: Dune Cross Section (Source: City of Miami Beach)

Except for a few locations, most the City's existing dunes are narrow and only consist of a Pioneer Zone. In those existing Pioneer Zone areas, sea oats (*Uniola paniculate*) is the preferred species. As our dunes are mostly Pioneer Zones, there is little to no Strand Zone, and no existing Coastal Hammock as part of Hallandale Beach's dune and coastal system.

## Future Conditions

Locally, the Southeast Florida Regional Climate Change Compact (SFRCCC) adopted a unified sea level rise projection for the Southeast Florida region that includes Broward and Hallandale Beach. The unified sea level rise projections are as follows:

- Short term: 10 to 21 inches of sea level rise by 2040
- Mid-term: 21 to 54 inches of sea level rise by 2070
- Long-term: 40 to 136 inches of sea level rise by 2120.

Sea level rise projections based on the emission scenarios are shown below:

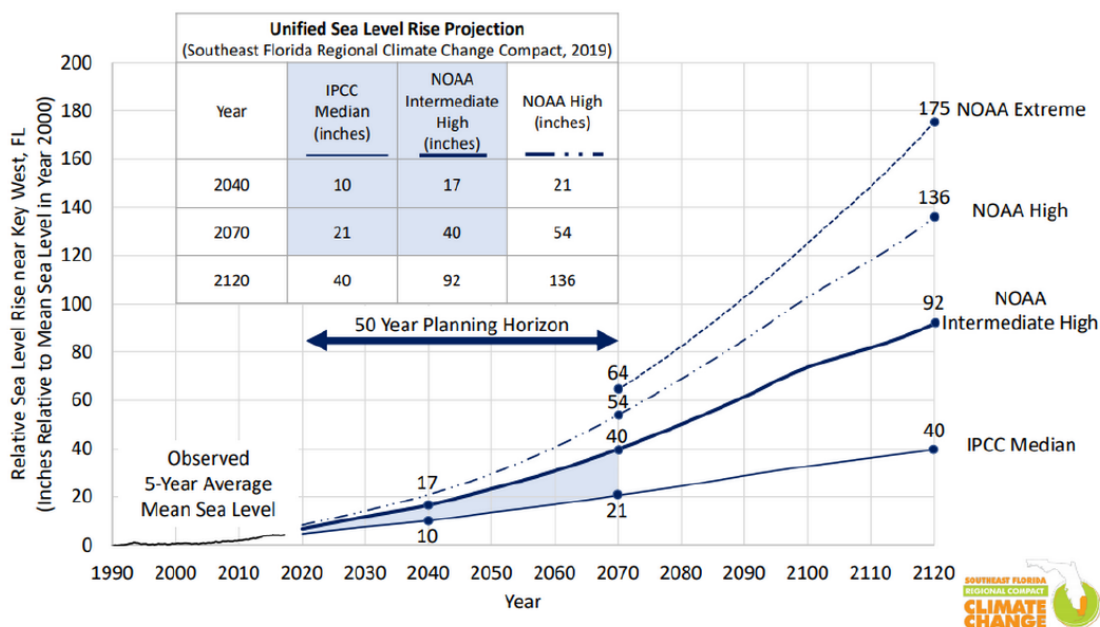


Figure 3: Unified Sea Level Rise Projections (Source: South Florida Regional Climate Change Compact)

Future changes in sea level rise will also affect the intensity and scale of storm surges from tropical storms and hurricanes. Higher sea levels can cause storm surges to travel farther inland than in the past, causing damage to shorelines and increasing coastal erosion. The combined impacts of these events in the Southeast U.S. region has the potential to cost up to \$60 billion per year by 2050.

The Segment III Beach Management Study concluded that Hallandale Beach will require approximately 11,000 cubic yards of sand per year to offset the gross loss rate due to erosion.

## Design and Maintenance of the Dune System

To create this plan, the existing beach/dune conditions were evaluated utilizing information obtained from onsite reconnaissance and aerial photography to review. The varying conditions of the existing dune were considered to establish management zones. These management zones are based on the presence/health of dune vegetation, continuous dune formation, width of the vegetated dune, and overall beach management goal of establishing a consistent City dune system for storm protection value, habitat health, resilience, and aesthetic value. These zones (as shown on the following aerials)



and their associated conditions are the basis for the differing recommendations for the long-term management. The zones have been broken down as follows:

- Chronically-Eroded Beach Zone
- Enhance Discontinuous Dune Zone
- Maintenance of Existing Dune Zone

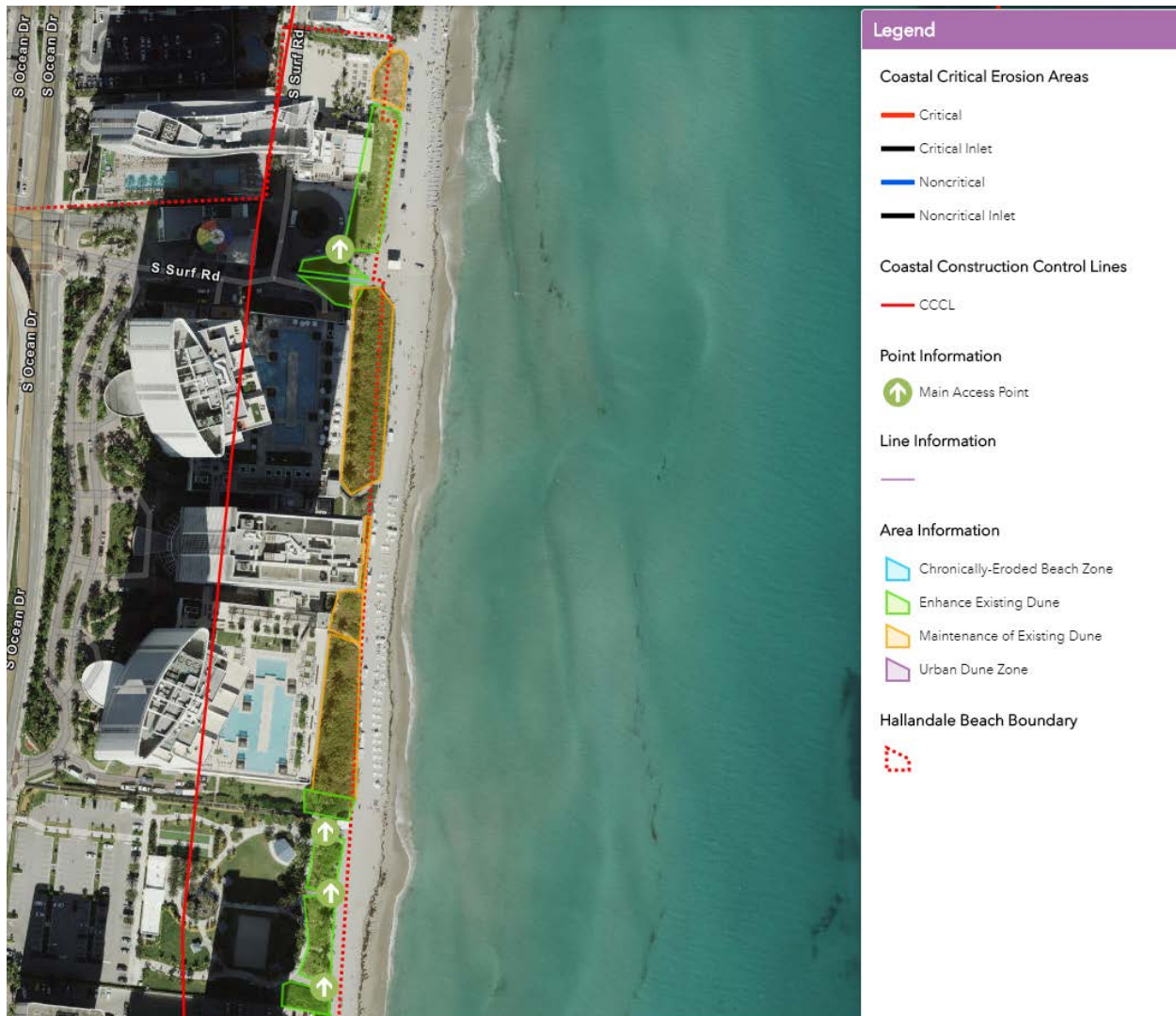


Figure 4: Northern Section of Hallandale Beach Dune System

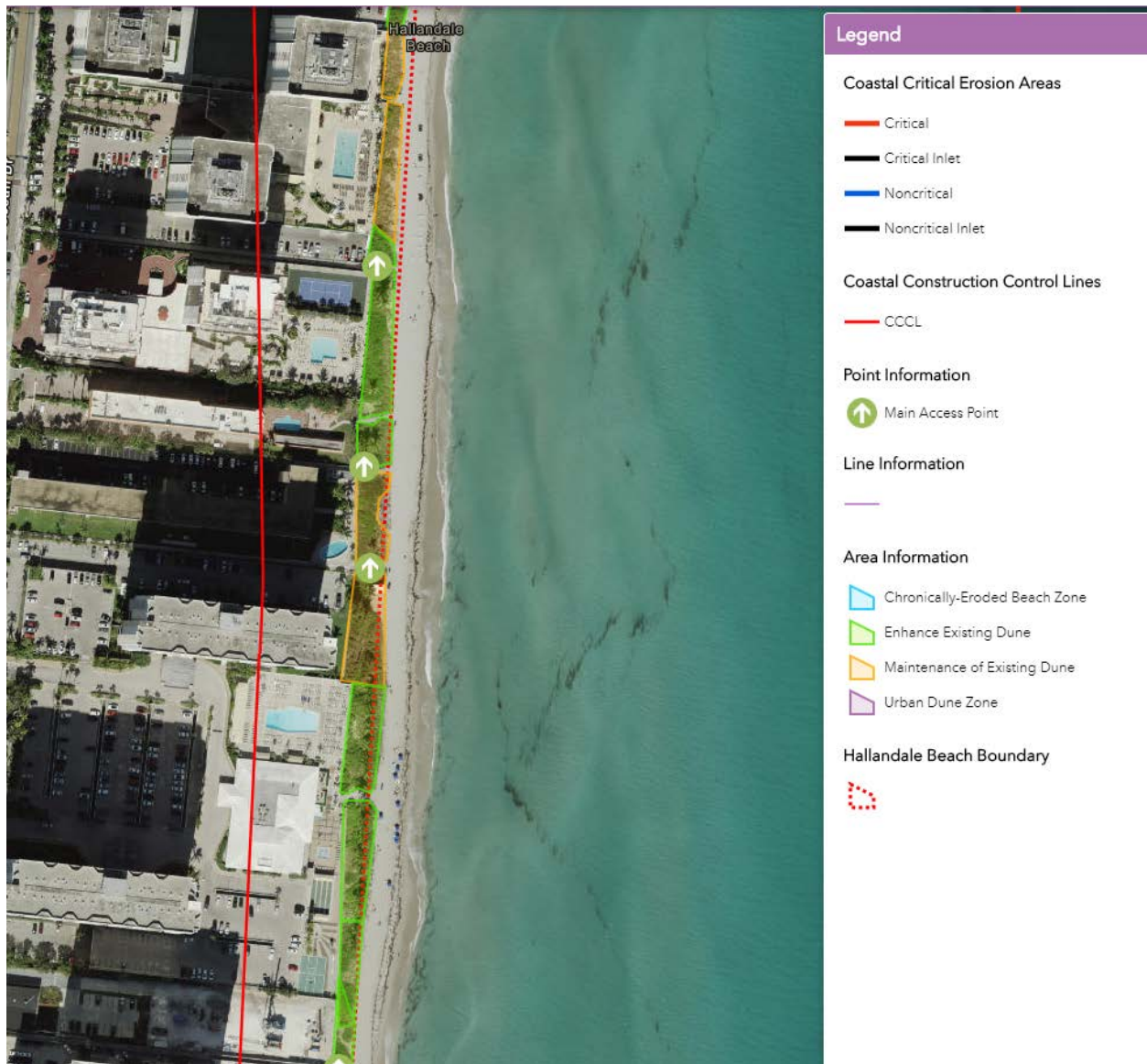


Figure 5: Middle Section of Hallandale Beach Dune System

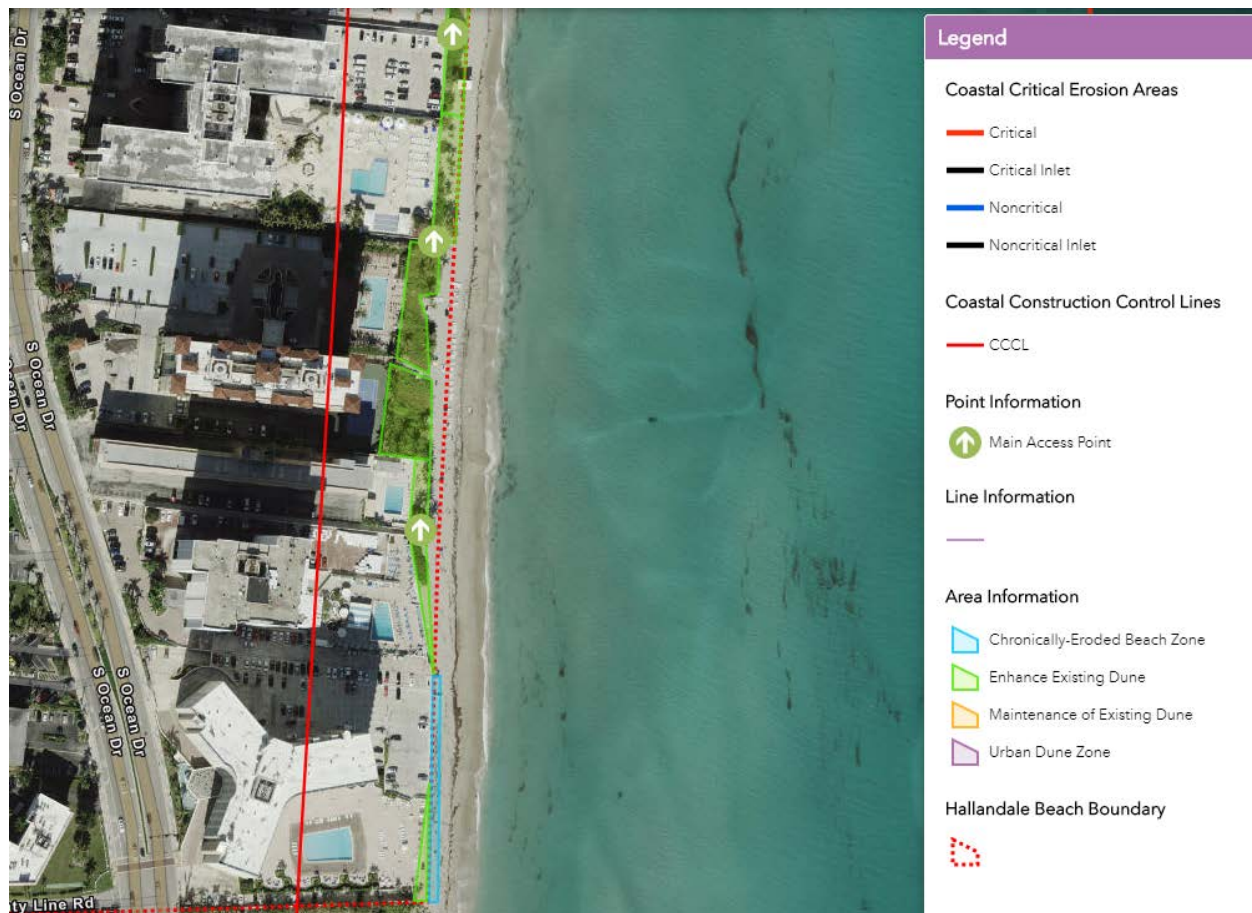


Figure 6: Southern Section of Hallandale Beach Dune System

### Design Standards

The following standards are recommended for dune preservation, maintenance, and creation based on the review of available information, site investigations, habitat creation/improvement, aesthetics/viewshed, and increased storm protective value. Overall, a 2:1 (beach to dune) ratio is recommended for the functionality of dune protection and habitat services.

Most of Hallandale Beach has some vegetation along the Atlantic Shoreline, except for the Southern Section. Vegetation in the City's dune system is either native dune vegetation or exotic invasive plants. Existing beach assessed and categorized as areas needing to "enhance existing dune," "maintenance of existing dune," or "chronically eroded beach zone" via online GIS tool.

### Maintenance of Existing Dune Zone

Areas marked as "maintenance of existing dune" were selected because:

- Sea oats already planted and present and
- No trees/palms currently planted leading to assumptions regarding viewshed.



### Management Recommendations

- Ensure post-and-rope barrier is continuous around the east face and access points of the dune to minimize pedestrian footpaths within the dune and vehicular erosion of the seaward edge of the dune;
- Remove non-native plant species. Large barren areas after removal should be replanted with species selected from the Recommended Palette provided to prevent erosion or recolonization by non-native plant species;
- Plant sea oats or other pioneer zone species in areas not yet colonized by dune species to reduce patchiness;
- Prune or limb-up tree species as necessary to provide window-pane views;
- Large scale maintenance events should be conducted between November 1<sup>st</sup> and March 1<sup>st</sup> (outside of marine turtle nesting season), as heavy equipment will likely be required. It is preferred that the activities be conducted within February, close to the beginning of Florida's wet season; and
- Semi-annual inspection events should be conducted thereafter with maintenance activities provided on an as-needed basis.

### Enhance Existing Dune

Areas marked as "enhance existing dune" were selected because:

- They are City-Owned dunes and/or
- Trees/palms presently impacting potential viewshed concerns and/or
- Invasive plants are present and in need of removal and/or
- Little to no existing dune vegetation is present.

### Management Recommendations

- Plant species should be selected from the Recommended Palette provided;
- Planting areas of larger than 80 square feet should utilize a minimum of three plant species;
- Where the dune is wide enough and where property owners allow, Strand Zones and Coastal Hammock Zones should be planted utilizing species from the Recommended Palette and placement following Figure 2;
- Seaward edge planting should be largely in line with existing stable vegetation;
- Any management actions which would require machinery should be conducted between November 1<sup>st</sup> and March 1<sup>st</sup> (outside of marine turtle nesting season), as heavy equipment will likely be required. It is preferred that the activities be conducted within February, close to the beginning of Florida's wet season;
- Propose fill to maintain consistent dune crest/elevation;
- Propose and maintain post-and-rope barrier along eastern face of dune and at access points;
- Evaluate management of beach in conjunction with proposed improvements (see Beach Access section);
- In areas where the vegetation has overgrown the existing beach access points, trim back the vegetation to provide approximately 6 feet of clearance;
- Non-native species should be identified and removed. If large barren areas are present after removal, or if required by the FDEP, they should be replanted with plants from the

Recommended Palette quickly to prevent erosion or recolonization by non-native plant species; and

- Semi-annual inspection events should be conducted thereafter with maintenance activities provided on an as-needed basis.

#### *Chronically Eroded Beach Zone*

Areas marked as “chronically eroded beach zone” were selected because:

- Area is anecdotally underwater during high tide and/or
- There is little to no city-owned right of way within which to encourage dunes.

#### *Management Recommendations*

The chronically-eroded beach zone is subject to erosion and escarpment on a cyclical basis. Given the narrow nature of this portion of the beach, foot traffic and maintenance vehicle impacts to proposed vegetation must be reviewed. Until such time as a full beach nourishment is completed, which will potentially support construction of a dune, minimal vegetation improvements are proposed. As such, the following outlines the recommendations for the chronically eroded beach zone:

- Planting should prioritize Pioneer Zone species (see Recommended Palette) with greater tolerance for saltwater inundation and salt spray;
- Dune width should be adjusted at 2:1 ratio of beach-to-dune width previously mentioned;
- Given the dynamic nature of this portion of the beach, post-and-rope barrier should not be proposed;
- Beach access through vegetation should be at an angle to assist in preventing storm surge impacts to upland properties; and
- If any non-native species are present, they should be removed.

#### *Recommended Dune Vegetation and Planting Guidelines*

Dune vegetation should be selected based on appropriateness for the proposed location, both within the State of Florida and within the cross-section of the dune (Figure 2). The Recommended Plant Palette for each cross-section of the dune system (Table 1) includes species native to the region which are salt-tolerant, drought tolerant, and are naturally found in coastal dune habitats. Please note that the recommended species do not preclude other native salt tolerant species from being proposed or allowed to grow within the dune. For instance, sea purslane (*Halimolene portlacoides*) may seed itself in a functional dune despite being unavailable from nurseries. For privately maintained dunes, a planting plan should be submitted for review/approval by City staff and FDEP under the Coastal Construction Control Line permitting program.

The City’s beaches and dune systems currently contain coconut palms, a Category II invasive species. As these palms serve the religious purpose to uphold the Eruv, they are permitted to remain in existing dunes. However, all other Category I and II invasive plant species, as classified by the Florida Exotic Pest Plant Council, are not permitted within the dune system and should be removed. If the Eruv is damaged by a storm event, the supporting trees should be replaced with a species listed in the Recommended Plant Palette.

Table 1: Recommended Planting Palette for Hallandale Beach Dune System

**Recommended Planting Palette**

*Pioneer Zone*

<b>Plant Common Name</b>	<b>Plant Scientific Name</b>	<b>Plant Height</b>	<b>Type</b>	<b>Availability</b>	<b>Wildlife or Habitat Value</b>
<i>Sea Oats</i>	<i>Uniola paniculata</i>	3-4 feet	Grassy Shrub	Widely available	critically important dune stabilizer
<i>Bitter Panic Grass</i>	<i>Panicum amarum</i>	2-5 feet	Grass	Native Plant Nurseries	dune stabilizer
<i>Salt meadow Cordgrass</i>	<i>Spartina patens</i>	2-3 feet	Grass	Widely available	dune stabilizer

*Strand Zone*

<b>Plant Common Name</b>	<b>Plant Scientific Name</b>	<b>Plant Height</b>	<b>Type</b>	<b>Availability</b>	<b>Wildlife or Habitat Value</b>
<i>Saw Palmettos</i>	<i>Serenoa repens</i>	4-6 feet	Shrub	Widely Available	larval and nectar plant for butterflies; berries food source for other wildlife
<i>Cocoplum</i>	<i>Chrysobalanus icaco</i>	10-15 feet	Shrub	Widely available	flowers attract butterflies, bees, beetles; fruits attract birds
<i>Sea Lavender</i>	<i>Tournefortia gnaphalodes</i>	3-6 feet	Shrub	Native Plant Nurseries	nectar plant for butterflies
<i>Dune Sunflower</i>	<i>Helianthus debilis</i>	1-2 feet	Shrub	Widely available	dune stabilizer, attracts bees, butterflies, and other pollinators
<i>Beach-bean</i>	<i>Canavalia rosea</i>	6-12 inches	Vine	Native Plant Nurseries	dune stabilizer
<i>Coastal Morning-glory</i>	<i>Ipomoea violacea</i>	1-6 inches	Vine	Native Plant Nurseries	N/A
<i>Railroad Vine</i>	<i>Ipomoea pes-caprae hrasiliensis</i>	3-9 inches	Vine	Widely available	nectar plant for butterflies

*Coastal Hammock Zone*

<b>Plant Common Name</b>	<b>Plant Scientific Name</b>	<b>Plant Height</b>	<b>Type</b>	<b>Availability</b>	<b>Wildlife or Habitat Value</b>
<i>Sea Grape</i>	<i>Coccoloba uvifera</i>	10-50 feet	Tree	Widely available	food and cover for wildlife; nectar and larval plant for butterflies
<i>Cabbage Palm</i>	<i>Sabal palmetto</i>	10-40 feet	Palm Tree	Widely available	food and cover for wildlife; nectar plant for butterflies
<i>Gumbo Limbo</i>	<i>Bursera simaruba</i>	30-50 feet	Tree	Widely available	Food and cover for wildlife; larval plant for butterflies
<i>Inkwood</i>	<i>Exothea paniculata</i>	25-35 feet	Tree	Native Plant Nurseries	Food and cover for wildlife; attracts butterflies and fruit eating birds

<i>White Stopper</i>	<i>Eugenia axillaris</i>	10-20 feet	Shrub	Widely available	Provides food and cover for wildlife
<i>Blolly</i>	<i>Guapira discolor</i>	1-25 feet	Tree	Widely available	Provides food and cover for wildlife; birds eat the fruits
<i>Marlberry</i>	<i>Ardisia escalloniodes</i>	8-15 feet	Shrub	Native Plant Nurseries	Provides food and cover for wildlife; birds eat the fruits
<i>Wild Coffee</i>	<i>Psychotria nervosa</i>	4-6 feet	Shrub	Widely available	provides food and cover for wildlife; nectar plant for butterflies
<i>White Indigo Berry</i>	<i>Randia aculeata</i>	6-8 feet	Shrub	Widely available	provides food and cover for wildlife; larval and nectar plant for butterflies
<i>Buttonwood</i>	<i>Corocarpus erectus</i>	20-40 feet	Tree	Widely available	Host for epiphytes; food and cover for wildlife including butterflies



## Irrigation

Irrigation should be included only for those areas where new vegetation is proposed. Existing, established dunes should not be irrigated. If they have existing irrigation systems, it is recommended that they be removed to prevent accelerated growth. Irrigation should be provided until new vegetation is established, which is typically 6 months. Irrigation frequency is recommended daily for the first 2 weeks, every other day for the following 2 months, then weekly until established. Irrigation can be provided by the following two methods:

- Temporary Irrigation System: An on-grade temporary irrigation system may be proposed for large areas of dune planting. As noted, a temporary irrigation system is located on grade, typically of a low-cost PVC pipe system, which can be removed once vegetation growth is established; or
- Manual Irrigation: For discrete areas of planting, manual irrigation utilizing a water truck is recommended.

## Non-Native Species

Non-native, or invasive/exotic plant species have an adverse effect on native plant communities, including loss of native plants due to non-native plant infestations and alteration of endangered species habitat. Non-native plant species can destabilize a dune community, resulting in reduced storm resilience. Non-native species should be removed and disposed of off-site when observed in the dunes. No on-site shredding or chipping will be allowed. Mechanized equipment may be used for removal when it is possible to gain access without impacting the existing dune. Post and rope barriers may be temporarily removed for mechanical invasive removal, but the post and rope must be replaced upon completion of each section.

Non-native species observed in Hallandale Beach dunes include:

- *Scaevola taccada*<sup>1</sup> (Hawaiian half-flower or beach naupaka)
- *Sphagneticola trilobata* (wedelia or creeping oxeye daisy)

Other non-native species commonly found within South Florida's dune system include:

- *Casuarina equisetifolia* (Australian pine)
- *Schinus terebinthifolius* (Brazilian pepper)

All invasive removal should be done manually either by hand or by machine. The use of herbicides, such as glyphosate, is prohibited.

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<sup>1</sup> There is a native *Scaevola* species which one should be careful to not remove during any invasive removal projects. The native *Scaevola plumeri* is considered a threatened species. The native *Scaevola* has much shorter leaves than the invasive *Scaevola*, among other distinguishing characteristics.



*Figure 7: Non-native Invasive Plant Species*

#### Maintenance

A comprehensive dune maintenance plan, with input from the Parks Department, should be prepared and should include the following:

- Semi-annual dune inspection to:
  - Identify non-native species for removal
  - Assess damage to post and rope fence for repair/replacement
  - Evaluate mature trees for potential “limbing up”

- Replanting of native, dune species where large areas of non-native species have been removed;
- Exotic species removal within the dune. Removal should include the root system to avoid regrowth;
- Remove trash and man-made debris from dune areas; and
- A Post-Storm Action Plan (assessment/maintenance to remove broken or dead tree limbs, removal of storm debris, repair damage to rope and post border, etc.).

### Timing

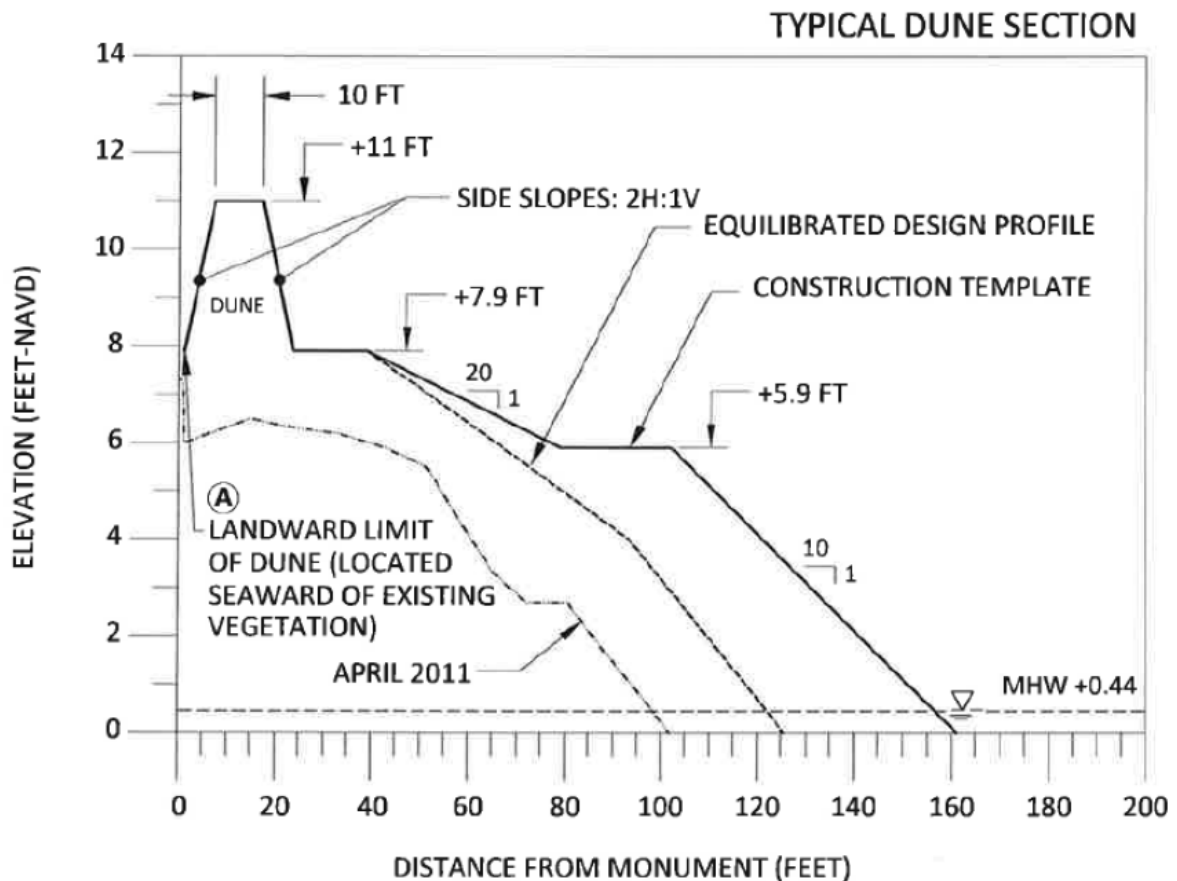
Large scale projects that will require heavy equipment should be conducted between November 1<sup>st</sup> and March 1<sup>st</sup>, outside of marine turtle nesting season and prior to hurricane season. It is recommended that projects be implemented close to March 1<sup>st</sup> in order to take advantage of South Florida's wet season, which will help establish the plants, thus reducing watering needs. Semi-annual inspection events of all dune areas should be conducted thereafter with maintenance activities provided on an as-needed basis. It is recommended that the results of the initial (3-4) inspection events be tracked closely and inspection frequency re-evaluated based on those results.

### Dune & Beach Profile

Broward County beach nourishment activities are planned in the future for the City of Hallandale Beach. This beach nourishment segment (Segment III) is anticipated to include a dune. As a starting point for dune design, Broward County will reference to Segment II beach nourishment project in Florida Lauderdale (Permitted by FDEP under Joint Coastal Permit No. 0314535-001-JC). Figure # illustrates a typical beach/dune cross section of Segment II that can be anticipated for Segment III in Hallandale Beach. The profile includes:

- A dune crest width of ~10 feet
- A dune crest maximum height of +11.0 feet NAVD
- Dune side slope of 2:1
- A beach slope of 20:1





Source: Broward County Shore Protection Project Segment II—FDEP Approval Package Sheet 21 of 21 (Permit #03114535-001-JC)

Figure 8: Typical Dune Section from Broward County

### Beach Access

Both public and private beach access points exist throughout the City's beach and dune system. The conditions of the access points vary greatly, depending on location and condition of the adjacent dune, from narrow overgrown vegetated corridors to wide sand expanses that cause windblown or over-washed sand to move onto the landward sidewalk.

The following guidelines address Beach Access management throughout the preceding segments of the City beach:

- Unnecessary footpaths should be closed with vegetation planting to minimize the potential for storm-related breaches of the protective dune feature;
- New access points should be installed at an angle in order to prevent windblown sand and dune breaches. These access points should be installed at an oblique angle from southeast to northwest or northeast to southeast, depending on prevailing wind conditions;
- Beach access paths can, as appropriate, be augmented with an independent vegetation buffer at the seaward endpoint;
- Public access point widths should be maintained at 6 feet;
- Emergency vehicular access points, as designated by the City, should be maintained at a minimum of 10 ft width; and
- Access points narrowed by overgrowth should be cut back and trees limbed up when possible.



## Impacts of Wildlife

In South Florida, many threatened, endangered, and endemic species depend on a healthy beach and dune system. The Southeast Beach Mouse (*Peromyscus polionotus niveiventris*), the Piping Plover (*Charadrius melodus*), the Least Tern (*Sternula antillarum*), the Rim Rock Crowned Snake (*Tantilla oolitica*), Loggerhead Turtle (*Caretta caretta*), Green Sea Turtle (*Chelonia mydas mydas*), and Leatherback Turtle (*Dermochelys coriacea*) are examples of State and/or Federally listed threatened or endangered animal species which depend on our beach and/or dune habitat. Likewise, Sea Lavender (*Tournefortia gnaphalodes*), one of the plants listed in the Recommended Palette, is an endangered plant species native to the dunes. In addition to those threatened or endangered species, many other species depend on the beach environment, especially the Strand and Coastal Hammock Zones for food, cover, nectar, and/or larval resources.



Figure 9: Threatened and Endangered Animals Depending on Beach & Dune Systems in Hallandale Beach

Many species in the Recommended Palette provide *significant* food and cover resources for wildlife including: Saw Palmettos, Cocoplum, Cabbage Palm, White Stopper, Marlberry, Blolly, Wild Coffee, & White Indigo Berry. Other species in the Recommended Palette provide *moderate* amounts of food and cover resources for wildlife including: Sea Grape & Gumbo Limbo.

Many of the species in the Recommended Palette are either larval or nectar sources for moths and butterflies including: Saw Palmettos, Sea Lavender, Sea Grape, Cabbage Palm, White Stopper, Wild Coffee, White Indigo Berry, and Buttonwood. Those moths and butterflies, which could be brought to Hallandale Beach's dunes by following this Plan, are pictured in Figure 10.

As this Dune Protection and Management Plan is implemented, educational signage should be erected surrounding restored dunes to help visitors and residents both identify wildlife and understand the many benefits of functional dune systems.





*Figure 10: Butterflies and Moths attracted by plants in the Recommended Planting Palette*

By selecting native plants which also provide habitat value, critical habitat which has largely been destroyed and/or displaced by development is reestablished.

### Implementation Plan & Budget

To restore and maintain Hallandale Beach's city-wide dune system, coordination will be needed with all private property owners. Those dunes which the City owns and maintains (South City Beach Park) will be prioritized to complete restoration first, including the installation of a Strand Zone and Coastal Hammock Zone. The restoration of South City

Beach Park's dune system will occur 2020-2021. A large-scale beach nourishment of Segment III is expected for 2021. After the nourishment project is complete, all remaining dune restoration efforts should be completed by 2025.

Upon completion of this Plan's dune restoration efforts, regular operations and maintenance will be followed as to avoid having to do another large-scale restoration effort to maintain the native habitat and natural infrastructure.

#### Budget

Item	Cost
Invasive Plant Removal & Disposal	\$150,000
New Plants & Installation	\$80,000
Equipment & Temporary Irrigation	\$10,000
Post & Rope Barrier	\$4,500
Educational Signage	\$10,000
<b>TOTAL UPFRONT COST TO RESTORE DUNES</b>	<b>\$254,500</b>
<b>Annual Operations &amp; Maintenance of Dunes</b>	<b>\$5,000</b>

Potential funding opportunities for implementation:

- Broward County's Dune Restoration Grant Program
- Community Foundation of Broward ECO Broward Grant
- Florida Department of Economic Opportunities Small Cities Community Development Block Grant
- Florida Resilient Coastlines Grant
- Funders Network for Smart Growth and Livable Communities Partners for Places Grant
- Infrastructure General Obligation Bond
- Sustainability Revolving Fund (yet to be created)
- Budget allocation

#### Regulatory

FDEP CCCL permit approvals for beach dune improvements are required. Activities are not anticipated on state-owned lands seaward of the Erosion Control Line. Below are options available for permitting of the proposed activities:

- A FDEP Field permit may be obtained for planting of dune species and non-exempt trimming. The FDEP may issue Field Permits for the construction of limited minor structures (such as a wood gazebo), improvements, or activities, including the placement of beach-compatible sand fill up to 200 cubic yards;
- Activities that are not exempt from FDEP CCCL permitting criteria and do not qualify for authorization under a Field Permit are required to obtain a formal FDEP administrative permit. One form of CCCL permit is the Area Wide Permit that may be granted to local municipalities for special classes of activities in areas under the general jurisdiction or responsibility, if these activities will not cause a measurable interference with the natural functioning of the beach-dune system or with marine turtles or their nesting sites. Such activities include dune restoration and access for enhancing accessibility. An FDEP Area Wide Permit can be sought for beach planting and removal, and potentially other dune maintenance activities.