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Working Towards Resilient Coastal Communities

City of Deerfield Beach Vulnerability to Sea Level Rise Assessment Report



Prepared on: March 14

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City of Deerfield Beach Vulnerability to Sea Level Rise Assessment Report for CM238

Working Towards Resilient Coastal Communities



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Report Summary

The City of Deerfield Beach Vulnerability Report

Introduction

In the past century, sea level rise in South Florida rose 8-10 inches. In the future, the rate of sea level rise is expected to accelerate due to processes associated with global climate change. Broward County is highly vulnerable to sea level rise (SLR) due to its low lying topography. As a result, inundation, episodic flooding, drainage issues in low-lying areas and saltwater intrusions are significant threats. This document contains the vulnerability assessment of major municipal infrastructure in the City of Deerfield Beach during one and two foot SLR scenarios using a regional inundation digital elevation model (DEM) which incorporates 2007 LiDAR elevation data. Vulnerable areas are displayed by a grid with a 50 foot cell size, categorized as “possible” and “more likely”:



The individual colors are used to describe the uncertainty associated with the variability of the tidal data measurements and LiDAR elevation measurements. The purple areas have a 75-100% certainty of identifying elevations below the high tide and therefore are “More likely” to be vulnerable. Orange areas have a 25-74% certainty of being at elevations below the high tide and represent areas of “Possible” vulnerability.

Municipal Infrastructure Assessments

Mapping of different sea level rise scenarios can help to identify areas at potential risk and aid in planning for a sustainable community. This Geographic Information Systems (GIS) based study specifically assessed the following municipal infrastructure for the potential impacts of sea level rise:

1. Airports
2. Bridges
3. City Arterial Roads
4. City Hall
5. City Parks
6. Regional Parks
7. Community Redevelopment Areas (CRAs)
8. Evacuation Routes
9. Fire Rescue Stations
10. Hospitals
11. Law Enforcement Assets
12. Schools
13. Potable Water Treatment
14. Waste Water Treatment

This work was funded, in part, through a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program.

Municipal Scale Inundation Maps

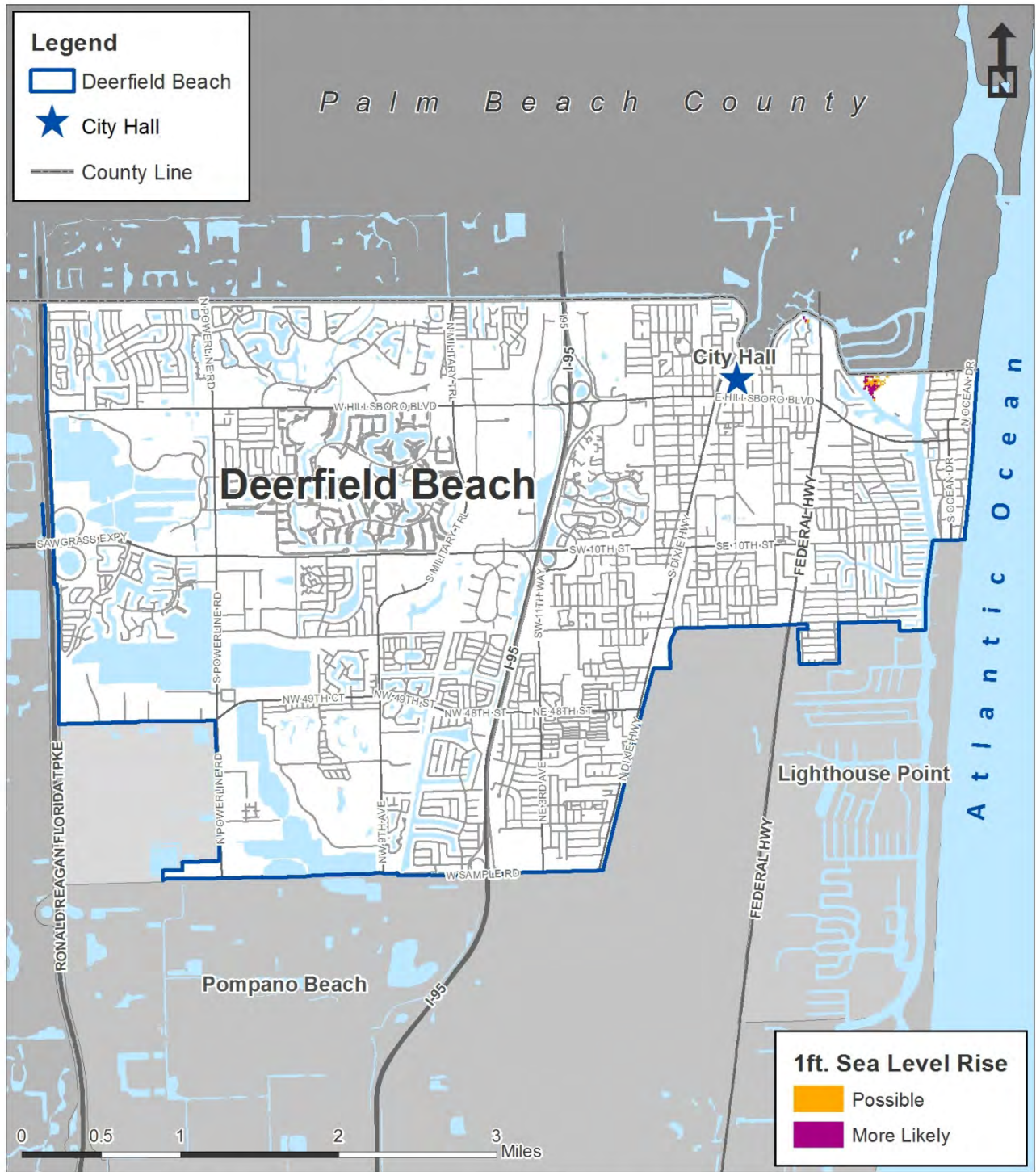
Municipal scale inundation maps provide at-a-glance overviews of areas within the Deerfield Beach municipal boundary that are low lying and likely to be vulnerable to flooding associated with sea level rise. The maps on the following pages show Deerfield Beach overlaid with the inundation grid for the one and two foot sea level rise scenarios. These maps primary purpose is to aid in the assessment of vulnerabilities to sea level rise.

The following table summarizes the area of land (in acres) vulnerable during both the one and two foot scenarios, as shown in the municipal scale inundation maps. The table breaks down the vulnerable acres for each scenario into “more likely,” “possible,” and total. Additionally, the table shows the percentage of the total area of the city that is vulnerable. Note that percent values are rounded to the nearest two decimal places.

City of Deerfield Beach Vulnerability to Sea Level Rise Table							
City of Deerfield Beach	Total Area (Acres)	Area Vulnerable during the One (1) Foot Scenario (Acres)		Total Area Vulnerable during the One (1) Foot Scenario (Acres)	Acreage Vulnerable during the Hk c (2) Feet Scenario (Acres)		Total Area Vulnerable during the Two (2) Feet Scenario (Acres)
		More Likely	Possible		More Likely	Possible	
		10370.66	3.89	4.24	8.13	11.21	2.45
		0.04%	0.04%	0.08%	0.11%	0.02%	0.13%

CITY OF DEERFIELD BEACH INUNDATION MAP

One Foot Sea Level Rise



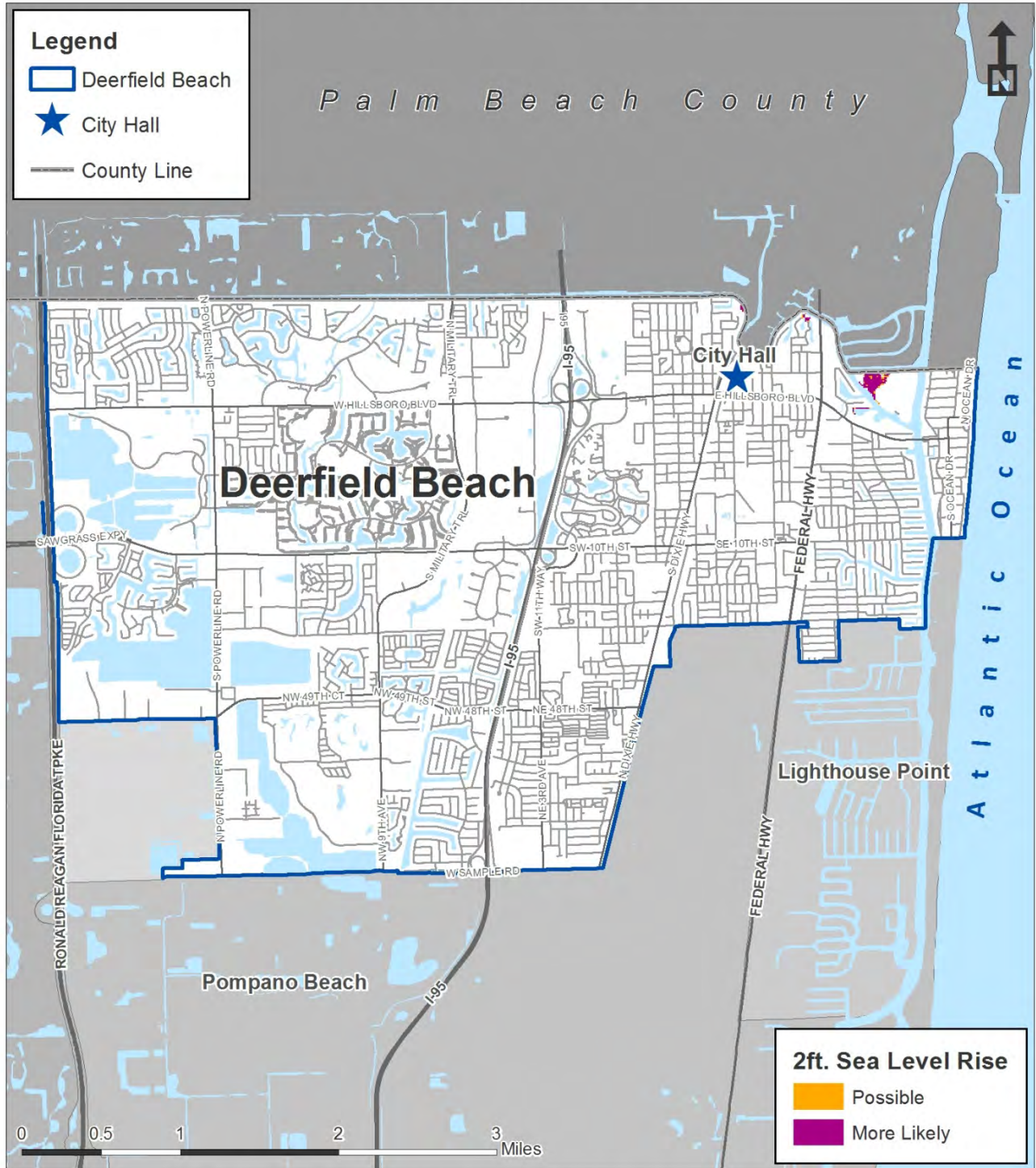
This map is for conceptual purposes only and should not be used for legal boundary determinations.

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CITY OF DEERFIELD BEACH INUNDATION MAP

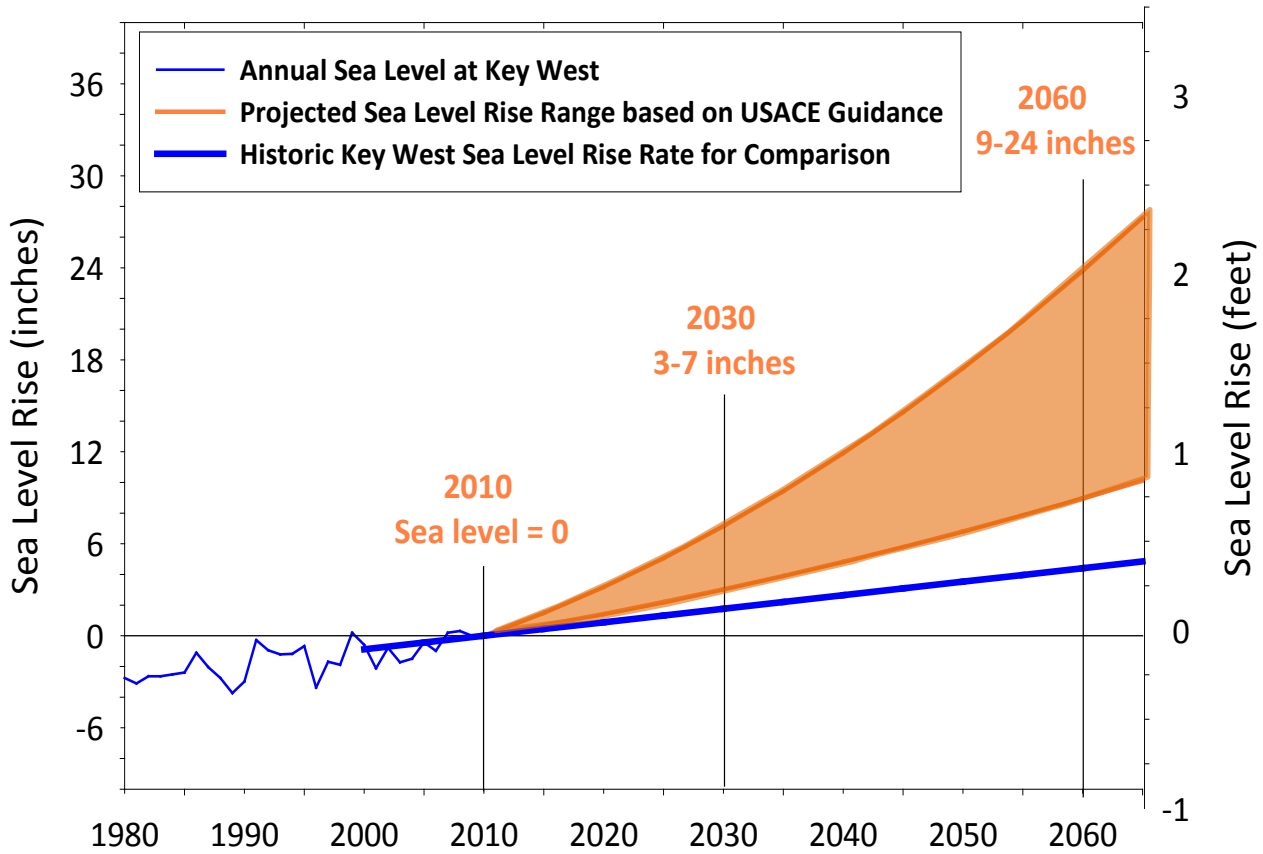
Two Foot Sea Level Rise



This map is for conceptual purposes only and should not be used for legal boundary determinations.

Unified Sea Level Rise Projection

The Southeast Florida Regional Climate Change Compact, collaboration among Monroe, Miami-Dade, Broward and Palm Beach Counties, convened a group of scientists and local experts to develop the Unified Southeast Florida Sea Level Rise Projection. This projection allows us to assign timeframes to the given sea level rise scenarios with a one foot sea level rise projected to occur between 2040-2070 and a two foot rise likely to occur between 2060 – 2115.



Unified Southeast Florida Sea Level Rise Projection for Regional Planning Purposes - This projection uses historic tidal information from Key West and was calculated by Kristopher Esterson from the United States Army Corps of Engineers using USACE Guidance (USACE 2009) intermediate and high curves to represent the lower and upper bound for projected sea level rise in Southeast Florida. Sea level measured in Key West over the past several decades is shown. The rate of sea level rise from Key West over the period of 1913 to 1999 is extrapolated to show how the historic rate compares to projected rates.

Vulnerability Assessment Methodology

Municipal infrastructure (fire rescue stations, schools, city owned arterial roads, etc.) was overlaid with the sea level rise inundation grid to review which infrastructure may be located at or below projected sea levels during the one or two foot scenarios. This process was expedited with the creation of a python script that quickly locates infrastructure which may be vulnerable during a given sea level rise scenario. Each location was reviewed visually for confirmation. The report uses inundation maps developed in collaboration with the Southeast Florida Regional Climate Change Compact with vulnerability methods and oversight by the GIS Section of the Planning and Redevelopment Division. All measurements of area and length are based on GIS datasets of the county and depend on these for accuracy. Additionally, measurements and percent values given in this report are rounded, which may contribute to minor inconsistencies.

Results

The following findings pertain to the vulnerability assessments performed for each of the City of Deerfield Beach municipal infrastructure in the list. Detailed maps and tables follow.

1. Airports:
There are no airports in the City of Deerfield Beach.
2. Bridges:
Included is a graphic that provides the location of all 17 bridges located in the City of Deerfield Beach overlaid by the inundation grid. The idea is to provide at-a-glance overviews of the vulnerability of bridges with the understanding that most navigable bridges are located on tidally-influenced water bodies. Sea level will reduce the clearance under these bridges thereby reducing the number and size of craft that can pass under them.
3. City Arterial Roads:
No city maintained arterial roads in the City of Deerfield Beach showed vulnerability to sea level rise during the one or two foot scenarios.
4. City Hall:
The City of Deerfield Beach city hall showed no vulnerability to sea level rise during the one or two foot scenarios.
5. City Parks:
Only one city-owned park in the City of Deerfield Beach was found to be potentially vulnerable to sea level rise, Hillsboro Park. Hillsboro Park has an estimated 10% of area located at or below projected sea levels during the two foot scenario. There are likely no vulnerabilities during the one foot scenario. This report includes an overview map of the City of Deerfield Beach with the location of the vulnerable city park, a table to assess the vulnerable park, and a large-scale map of the park during the two foot scenario.

6. Regional Parks:
Only one regional park in the City of Deerfield Beach has areas that lie at or below projected sea levels up to the two foot scenario, Deerfield Island Park. Deerfield Island Park has an estimated 14% of the total area vulnerable during the one foot sea level rise scenario. The park has an estimated 21% of the total area vulnerable during the two foot scenario. Included is an overview map of the City of Deerfield Beach with the location of the vulnerable regional park, a table to assess the vulnerable park, and a large-scale map of the park during the one and two foot scenarios.
7. Community Redevelopment Areas (CRA)
No CRAs in the City of Deerfield Beach showed vulnerability to sea level rise during the one or two foot scenarios.
8. Evacuation Routes:
No evacuation routes in the City of Deerfield Beach showed vulnerability to sea level rise during the one or two foot scenarios.
9. Fire Rescue Stations:
No fire rescue stations in the City of Deerfield Beach showed vulnerability to sea level rise during the one or two foot scenarios.
10. Hospitals:
No hospital building footprints in the City of Deerfield Beach showed potential vulnerability to sea level rise during the one or two foot scenarios.
11. Law Enforcement Assets:
No law enforcement assets maintained by the City of Deerfield Beach showed potential vulnerability to sea level rise during the one or two foot scenarios.
12. Schools:
No school building footprints in the City of Deerfield Beach showed potential vulnerability to sea level rise during the one or two foot scenarios.
13. Potable Water Treatment:
No potable water treatment plants in the City of Deerfield Beach showed potential vulnerability to sea level rise during the one and two foot scenarios.
14. Waste Water Treatment:
There are no waste water treatment plants in the City of Deerfield Beach.

Conclusion

The information contained in this report is intended to be used for planning purposes to begin to identify and address municipal infrastructure at risk. Understanding that a one foot sea level rise could occur in the next 30 years, adaptation strategies should be developed for locations identified as vulnerable in the first scenario. In addition to the vulnerability of infrastructure identified to lie at or below projected sea levels up to a two foot scenario; the municipality may also be at risk due to secondary threats such as flooding events and ponding, storm drainage, erosion, bridge clearance, etc. Sea level may continue to rise beyond two feet. The Deerfield Beach municipal authorities should begin the development of policies to address these risks and institutionalize the consideration of climate issues for adaptation strategies.

Definitions

ArcGIS: Software for working with maps and geographic information.

Arterial Roads: A major or main road, but not a highway.

DEM: Digital Elevation Model – A digital model or 3D representation of a terrain’s surface using topographic information.

Geographic Information Systems (GIS): A system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.

LiDAR: A remote sensing technology whereby elevation is measured by illuminating a target with a laser and analyzing the reflected light.

PPA: Priority Planning Areas – Identifies areas influenced by tidal water bodies at increased risk of inundation under a 2 foot sea level rise scenario, projected to occur as soon as 2060.

Python Script: A widely-used general purpose programming language. It is used in ArcGIS to automate processes whereby new geographic information is created from existing data.

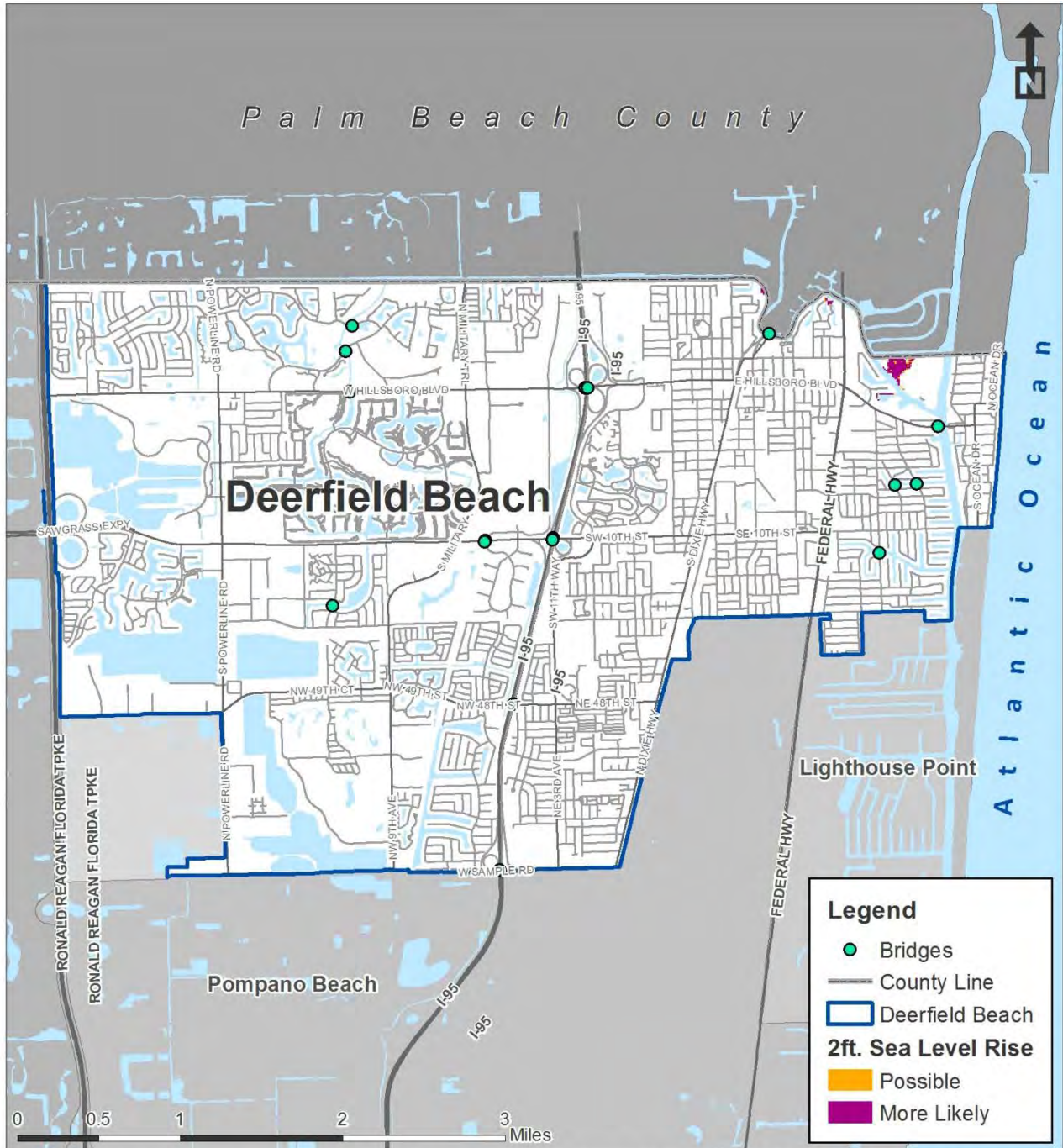
SLR: sea level rise grid

- “More Likely”: areas that have a 75-100% certainty of identifying elevations below the high tide and therefore are “More likely” to be vulnerable
- “Possible”: Orange areas have a 25-74% certainty of being at elevations below the high tide and represent areas of “Possible” vulnerability.

Vulnerable Area: The phrase “Vulnerable Area” as used in this document refers to land elevation at or below a given sea level rise scenario (one to two foot) as determined by the unified sea level rise projection grid.

Bridges

Vulnerability Assessment



This Map identifies areas at increased risk of inundation up to a two foot sea level rise scenario, projected to occur as soon as 2060.

This map is for conceptual purposes only and should not be used for legal boundary determinations.

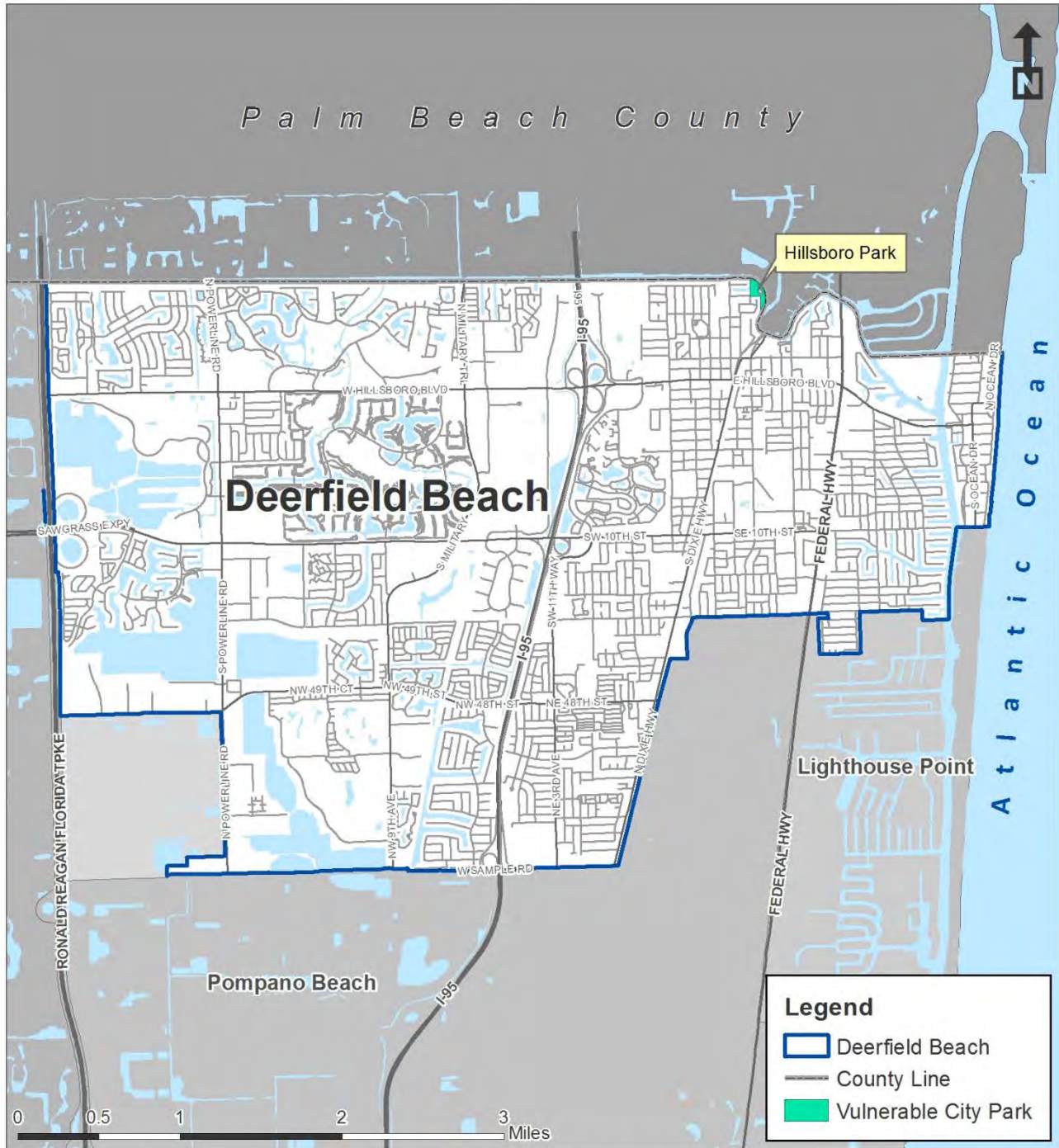


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City Parks

Vulnerability Assessment



This Map identifies areas at increased risk of inundation up to a two foot sea level rise scenario, projected to occur as soon as 2060.

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Table of Vulnerable City Parks

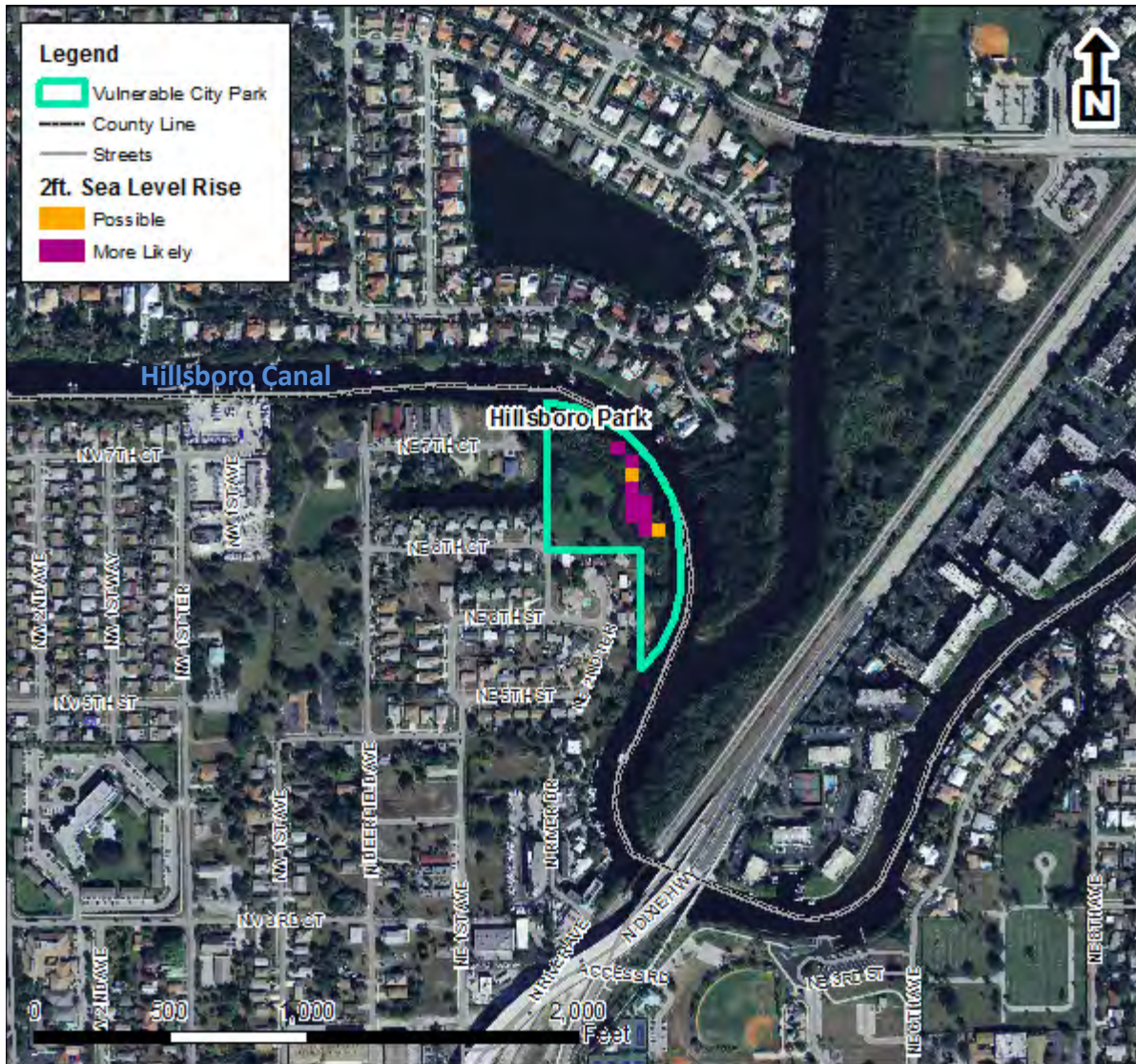
The following table provides information on the only city owned park with vulnerabilities, Hillsboro Park. The park was assessed for the one and two foot sea level rise scenarios. The table provides the acreage of vulnerable area, and the total area of the park with vulnerability expressed in percent. These estimates are based on the area of the entire park and do not subtract the area of water bodies within the park to determine the percent value.

Hillsboro Park			Total Acres
			5.77
SLR Scenario	Possible	More Likely	Percent Total
1 Foot	0.00	0.00	0%
2 Foot	0.11	0.46	10%

Hillsboro Park

Two Foot Sea Level Rise Scenario

NW 1st Ave., Deerfield Beach FL, 33441



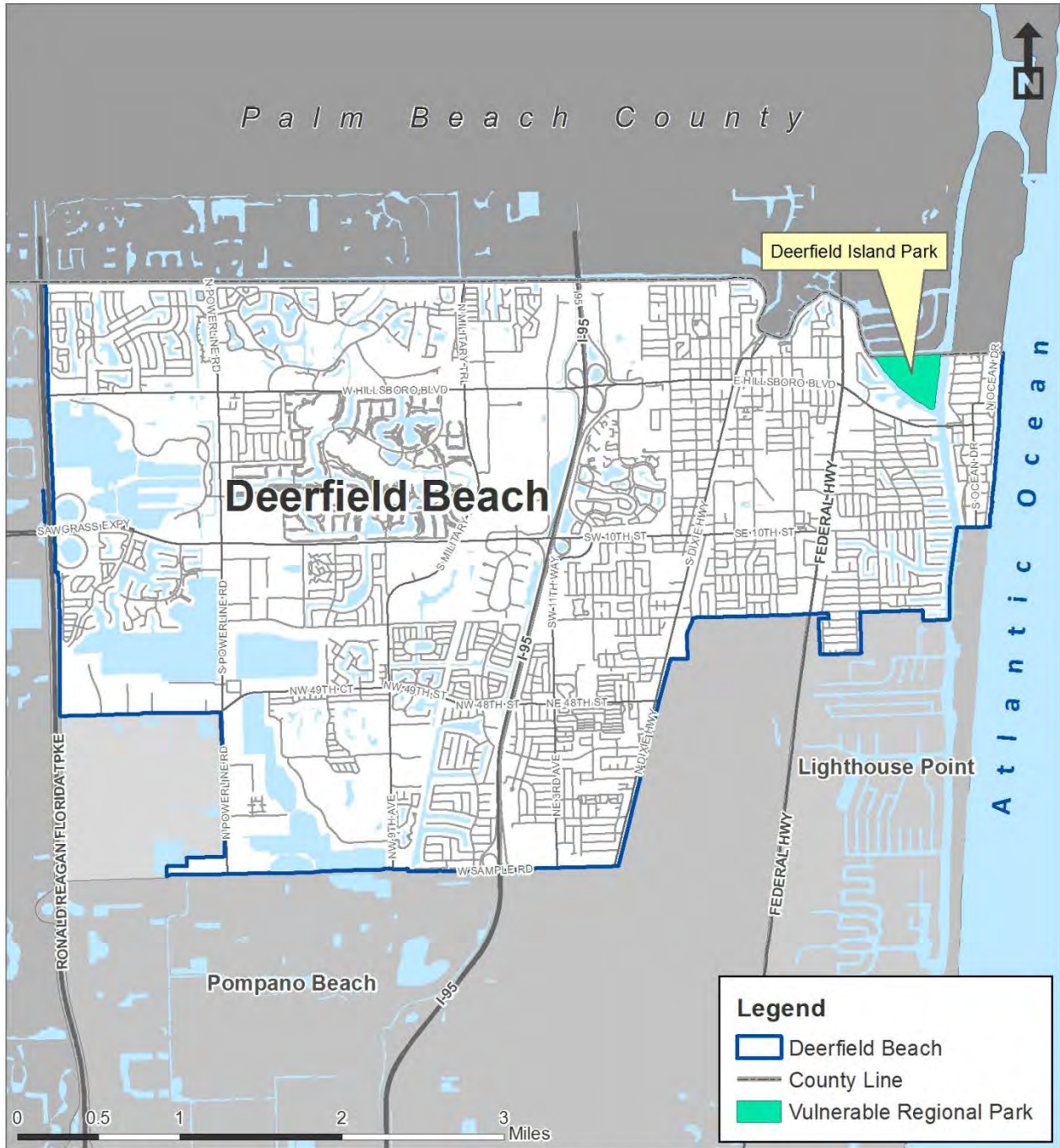
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This Map provides a view of Hillsboro Park during the two foot sea level rise scenario. The park has an estimated 10% of area located at or below projected sea levels during the two foot scenario. Note that the park is located adjacent to the tidally influenced Hillsboro Canal. There are likely no impacts to the park during the one foot sea level rise scenario.

Regional Parks Vulnerability Assessment



This Map identifies areas at increased risk of inundation up to a two foot sea level rise scenario, projected to occur as soon as 2060.

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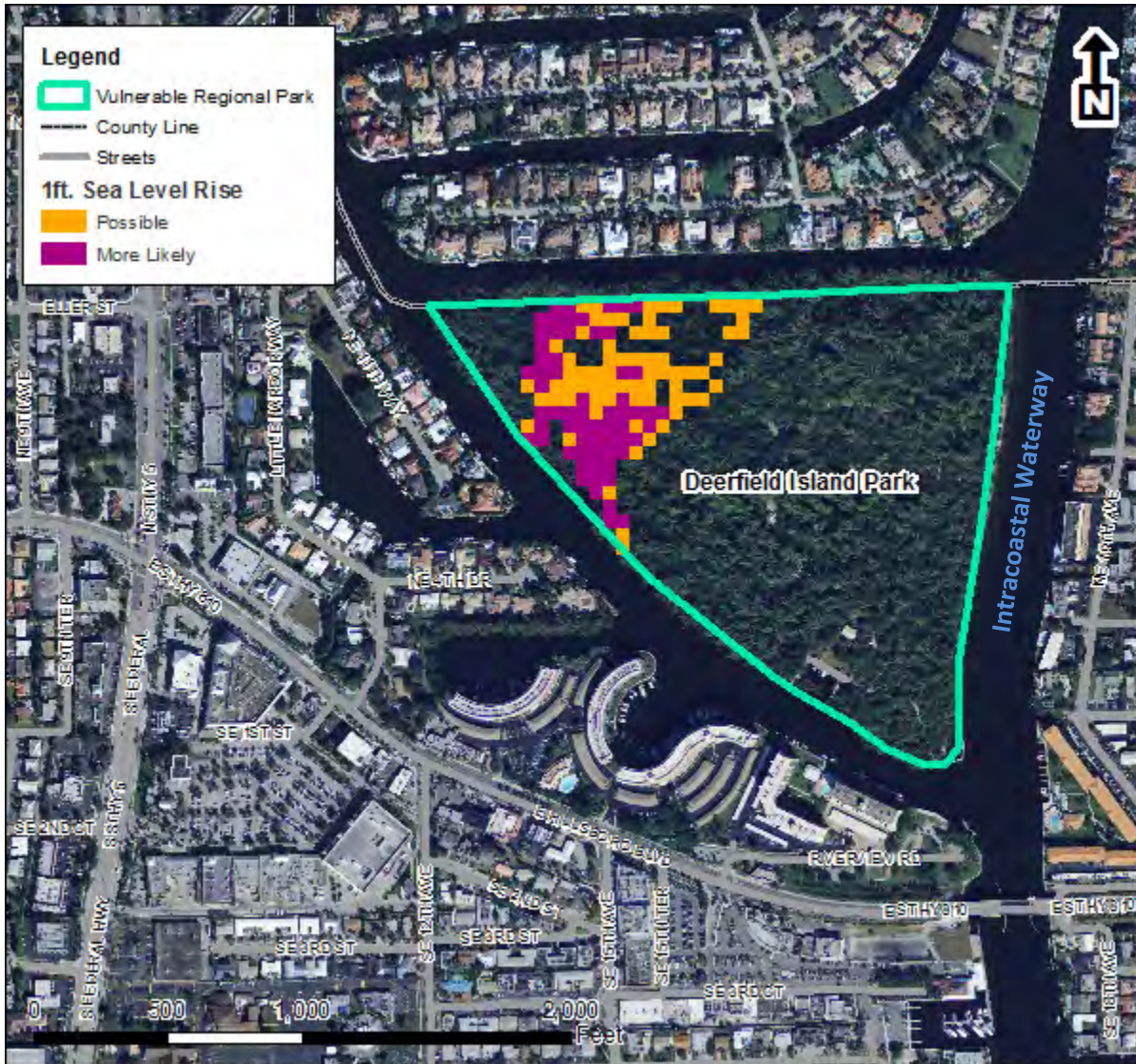
Date: 12/3/2013
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Table of Vulnerable Regional Parks

The following table provides information on the only regional park within the City of Deerfield Beach that may have vulnerabilities, Deerfield Island Park. The park was assessed for the one and two foot sea level rise scenarios. The table provides the acreage of vulnerable area, and the total area of the park with vulnerability expressed in percent. These estimates are based on the area of the entire park and do not subtract the area of water bodies within the park to determine the percent value.

Deerfield Island Park			Total Acres
			52.81
SLR Scenario	Possible	More Likely	Percent Total
1 Foot	3.99	3.59	14%
2 Foot	1.79	9.29	21%

Deerfield Island Park
One Foot Sea Level Rise Scenario
One Deerfield Island, Deerfield Beach FL, 33441



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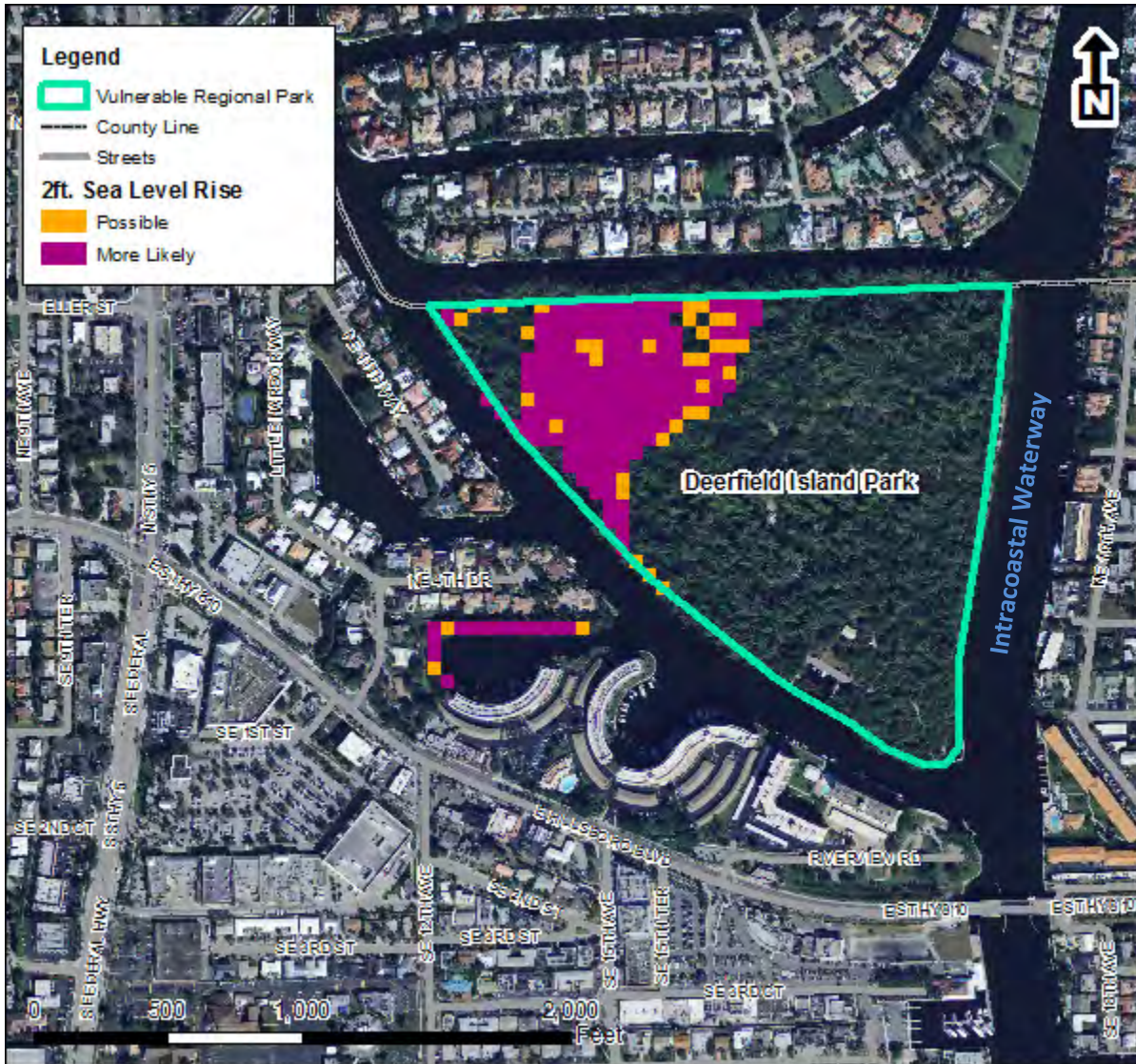
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This Map provides a view of Deerfield Island Park during the one foot sea level rise scenario. The park has an estimated 14% of area located at or below projected sea levels during the one foot scenario. Note that Deerfield Island is completely surrounded by the tidally influenced Intracoastal Waterway and secondary canals.

Deerfield Island Park
Two Foot Sea Level Rise Scenario
One Deerfield Island, Deerfield Beach FL, 33441



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This Map provides a view of Deerfield Island Park during the two foot sea level rise scenario. The park has an estimated 21% of area located at or below projected sea levels during the two foot scenario. Note that Deerfield Island is completely surrounded by the tidally influenced Intracoastal Waterway and secondary canals.