Funded Through: DEP AGREEMENT NO. CM238

Working Towards Resilient Coastal Communities

City of Oakland Park

Vulnerability to Sea Level Rise Assessment Report

Prepared on: May 14

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City of Oakland Park Vulnerability to Sea Level Rise Assessment Report for CM238

Working Towards Resilient Coastal Communities

This report was funded in part, through a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program, by a grant provided by the Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration Award No. # *NA11NOS4190073.* The views, statements, findings, conclusions and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida, NOAA or any of their subagencies.

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Report Summary

The City of Oakland Park 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 Oakland Park 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 hide 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

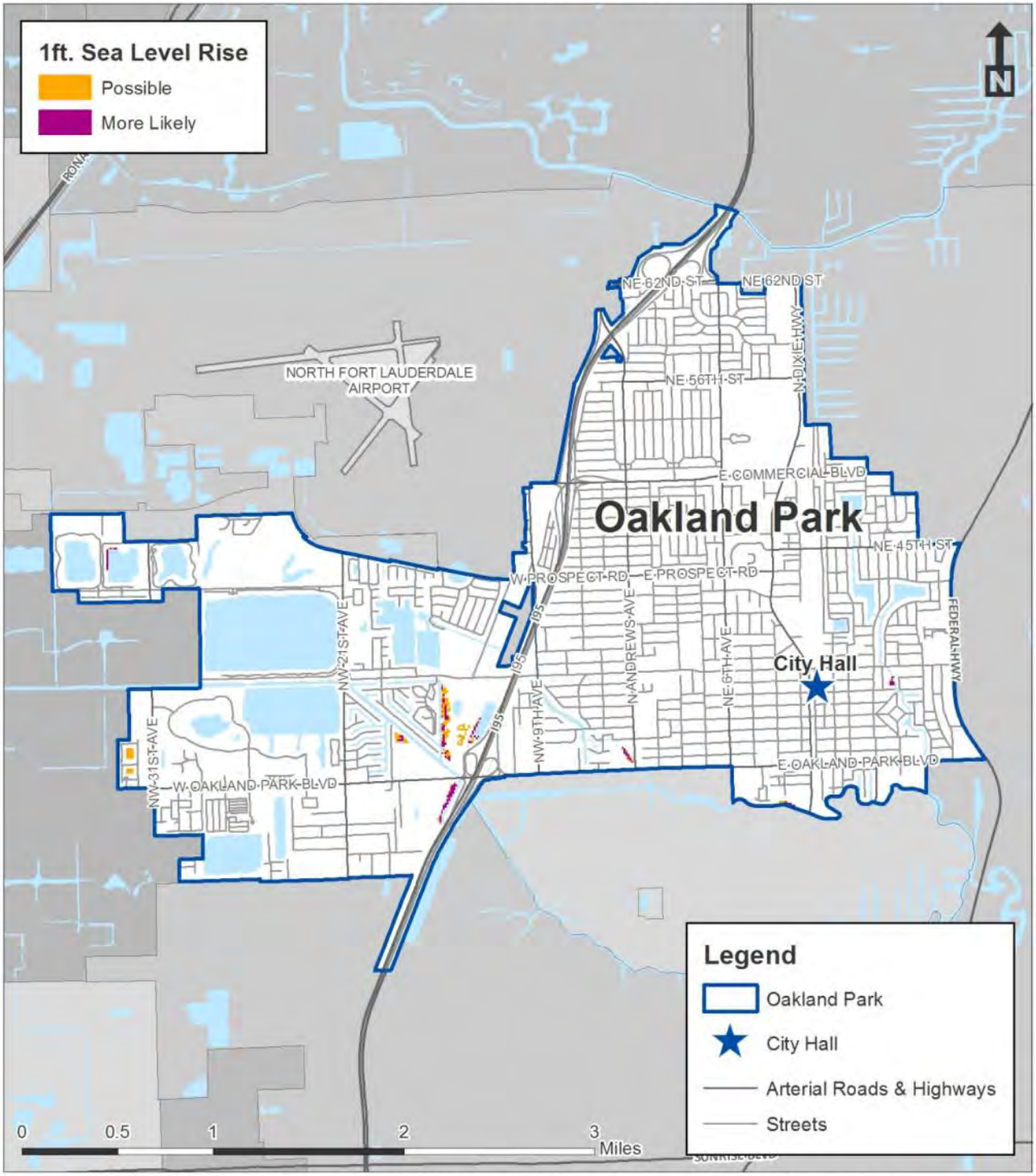
Municipal scale inundation maps provide at-a-glance overviews of areas within the City of Oakland Park Municipal boundary that are low lying and likely to be vulnerable to flooding associated with sea level rise. The maps on the following pages show the City of Oakland Park overlaid with the inundation grid for a one and two foot sea level rise scenario. 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) affected 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 Oakland Park Vulnerability to Sea Level Rise Table							
City of Oakland Park	Total Area (Acres)	Area Vulnerable during One (1) Foot Scenario (Acres)		Total Area Vulnerable during One (1) Foot Scenario (Acres)	Acreage Vulnerable during Two (2) Foot Scenario (Acres)		Total Area Vulnerable during Two (2) Foot Scenario (Acres)
		More Likely	Possible		More Likely	Possible	
	5250.50	8.38	11.48	19.86	46.61	43.85	90.46
		0.16%	0.22%	0.38%	0.89%	0.84%	1.72%

CITY OF OAKLAND PARK 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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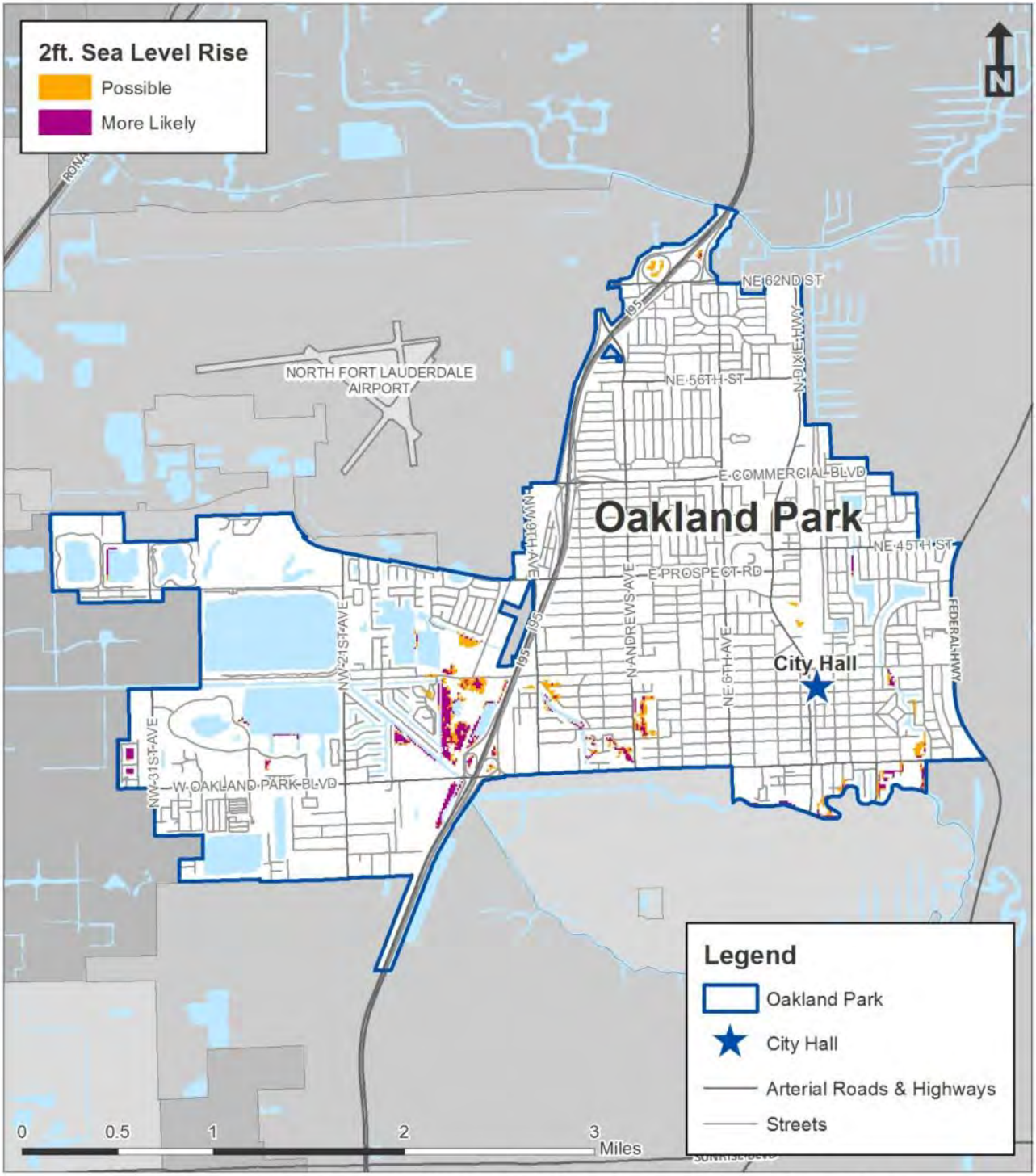
Natural Resources Planning and Management Division

Date: 12/11/2013
DEP Agreement No. CM238 DEP 55-236(08/11)

CITY OF OAKLAND PARK INUNDATION MAP

Two Foot Sea Level Rise



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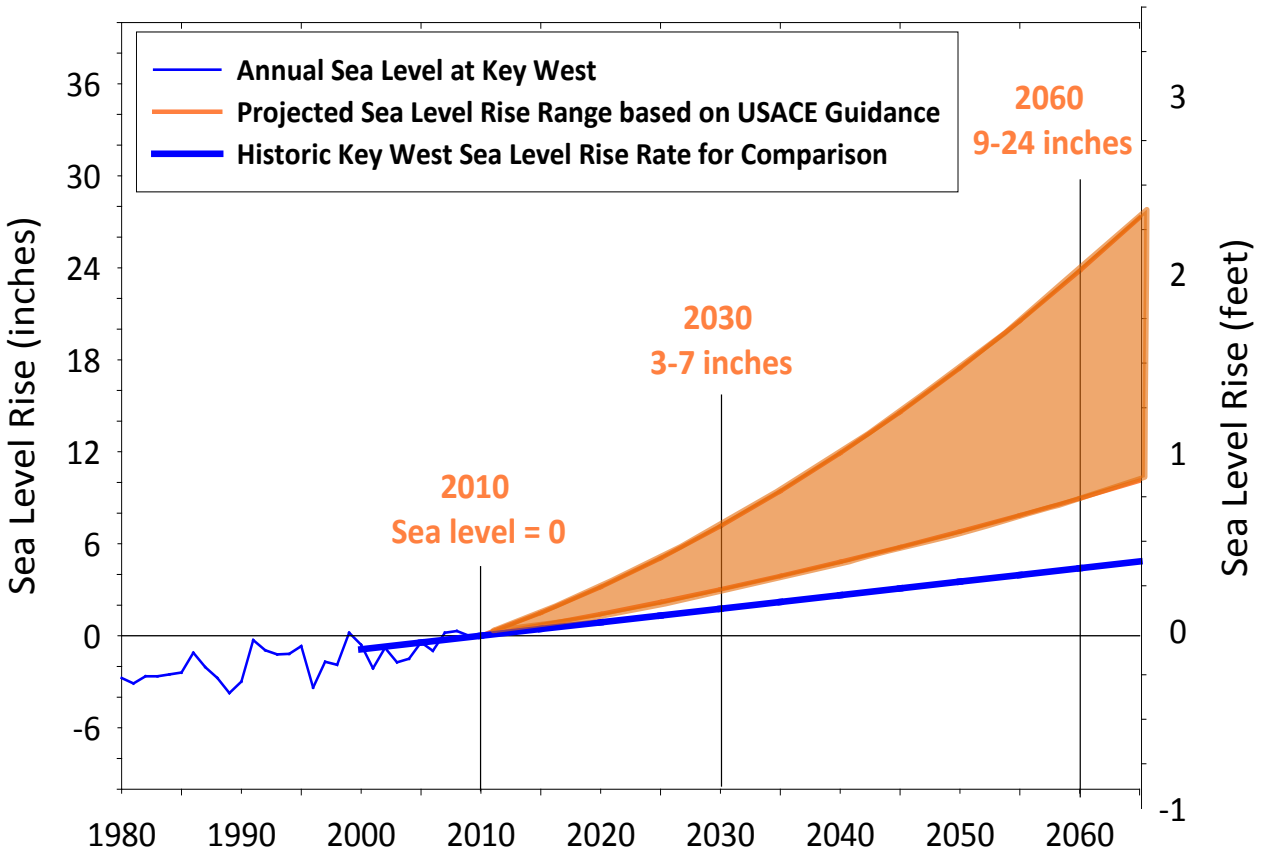
Unified Sea Level Rise Projection

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 a one or two foot scenario. 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 Oakland Park municipal infrastructure in the list. Detailed maps and tables follow.

1. Airports:
   There are no airports in the City of Oakland Park.

2. Bridges:
   Included in this report is a graphic that provides the location of all 28 bridges located in the City of Oakland Park 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:
   A total of two segments of arterial roads maintained by the City of Oakland Park were found to be potentially vulnerable to sea level rise. No segments have areas located at or below projected sea levels during the one foot scenario. Two segments showed vulnerabilities during the two foot scenario. The affected segments are NE 38th St. and NE 16th Ave. Included is an overview map of the City of Oakland Park with the locations of all vulnerable city maintained arterial road segments, a table to assess each vulnerable segment expressed in percent, and large-scale maps of the vulnerable segments.

4. City Hall:
   The City of Oakland Park city hall showed no vulnerability to sea level rise during the one or two foot scenarios.

5. City Parks:
   A total of three city-owned parks in the City of Oakland Park were found to be potentially vulnerable to sea level rise. No parks were found to be vulnerable during the one foot scenario. Three parks were vulnerable during the two foot scenario. Included in this report is an overview map of the City of Oakland Park with the locations of all three vulnerable city parks, a table to assess each vulnerable park, and large-scale maps of the vulnerable parks.

6. Regional Parks:
   John D. Easterlin Park has areas that lie at or below projected sea levels during both the one and two foot scenarios. During the two foot scenario, as much as 55% of the park may be vulnerable. Included is an overview map of the City of Oakland Park with the location of John D. Easterlin Park, a table to assess the vulnerable park, and large-scale maps of the park during the one and two foot scenarios.

7. Community Redevelopment Areas (CRA):
   The Oakland Park CRA has areas with elevations located at or below projected sea level during the one and two foot scenarios. Some of the affected areas are adjacent to North Fork Middle River. Included is an overview map of the City of Oakland Park with the location of the vulnerable CRA, a table to provide information on the vulnerable CRA, and large-scale maps of the CRAs during a one and two foot scenario.

8. Evacuation Routes:
   A segment of State Highway 816 (Oakland Park Blvd.), which is a designated evacuation route that runs through the City of Oakland Park, was found to be potentially vulnerable to sea level rise. Included is an overview map of the City of Oakland Park with the location of the vulnerable evacuation route, and a table to provide information on the vulnerable route.

9. Fire Rescue Stations:
   No fire rescue stations in the City of Oakland Park showed potential vulnerability to sea level rise during the one or two foot scenarios.

10. Hospitals:
    There are no hospitals in the City of Oakland Park.

11. Law Enforcement Assets:
    Law Enforcement Assets and streets within a 1000-foot radius of aforementioned assets were analyzed for potential vulnerability to one and two foot scenarios of sea level rise. Inundated streets are likely to cause access issues. The Oakland Park Police station (Broward Sheriff's Office) has a marginal area immediately adjacent to NE 12th Ave located at or below projected sea levels during a two foot sea level rise scenario. The area does not appear to be vulnerable during a one foot scenario. The building footprint does not appear to be vulnerable. Included is an overview map of the City of Oakland Park with the location of the Oakland Park Police station, a table to provide information on the vulnerable asset, and a large-scale map of the vulnerable area.

12. Schools:
    No school building footprints in the City of Oakland Park 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 Oakland Park showed potential vulnerability to sea level rise during the one and two foot scenario.

14. Waste Water Treatment:
    There are no waste water treatment plants in the City of Oakland Park.

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 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 Oakland Park 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.

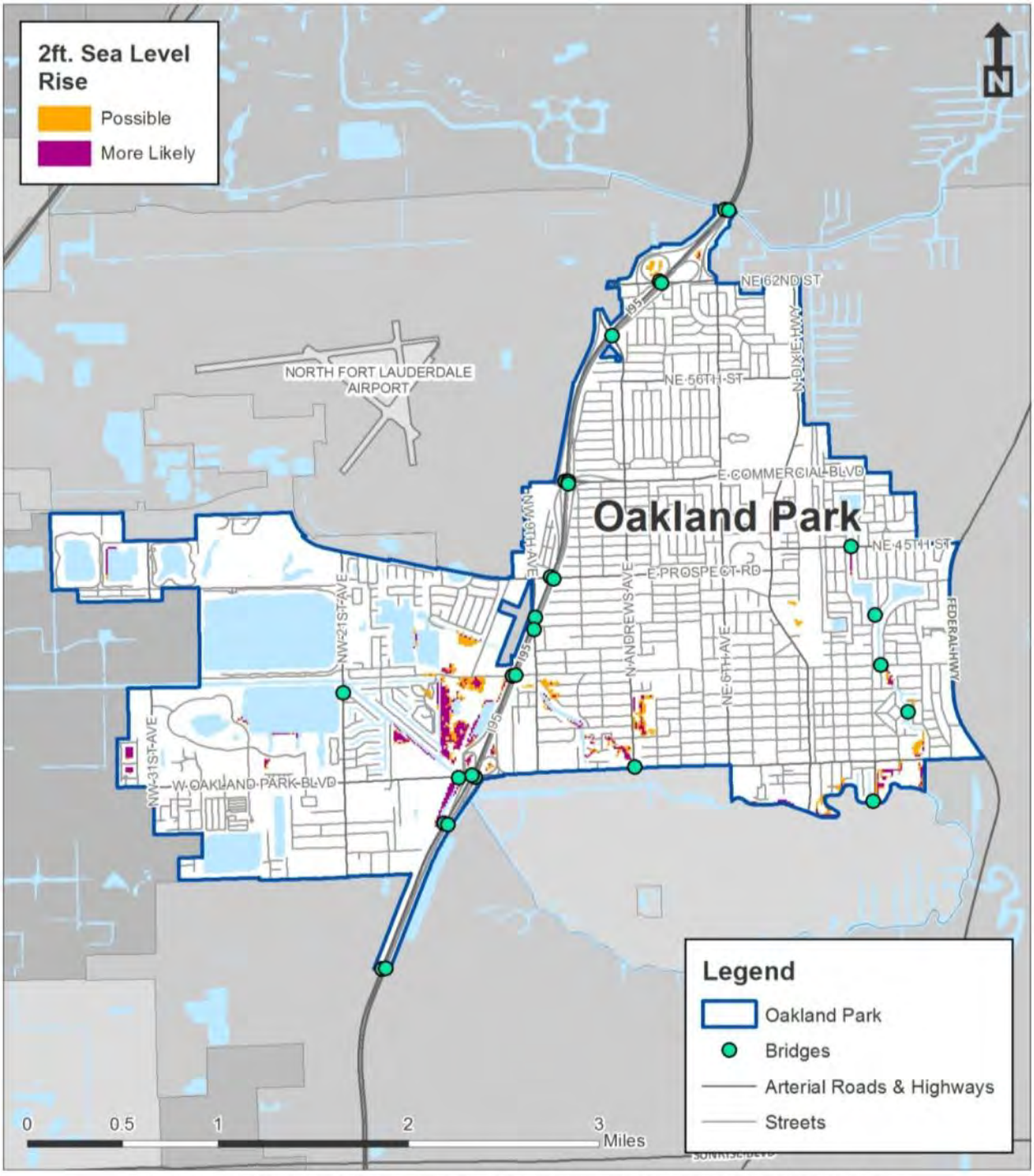
SLR: sea level rise grid

- "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 hide 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



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Prepared By: Hannes Ziegler
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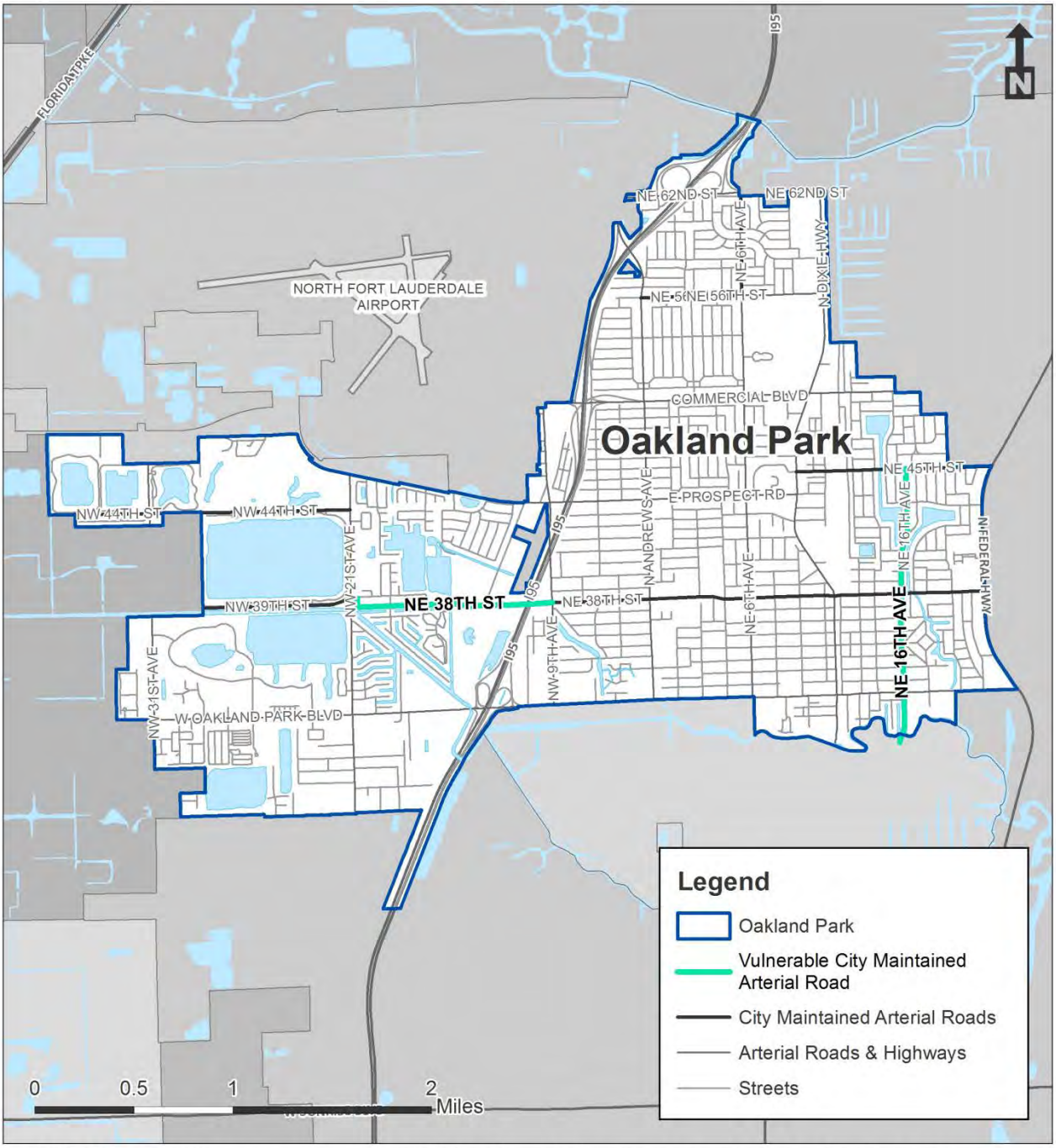
Date: 12/16/2013
DEP Agreement No. CM238 DEP 55-236(08/11)

City Arterial Roads

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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Environmental Protection and Growth Management Department
Natural Resources Planning and Management Division

Date: 5/23/2014
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Table of Vulnerable City Arterial Roads

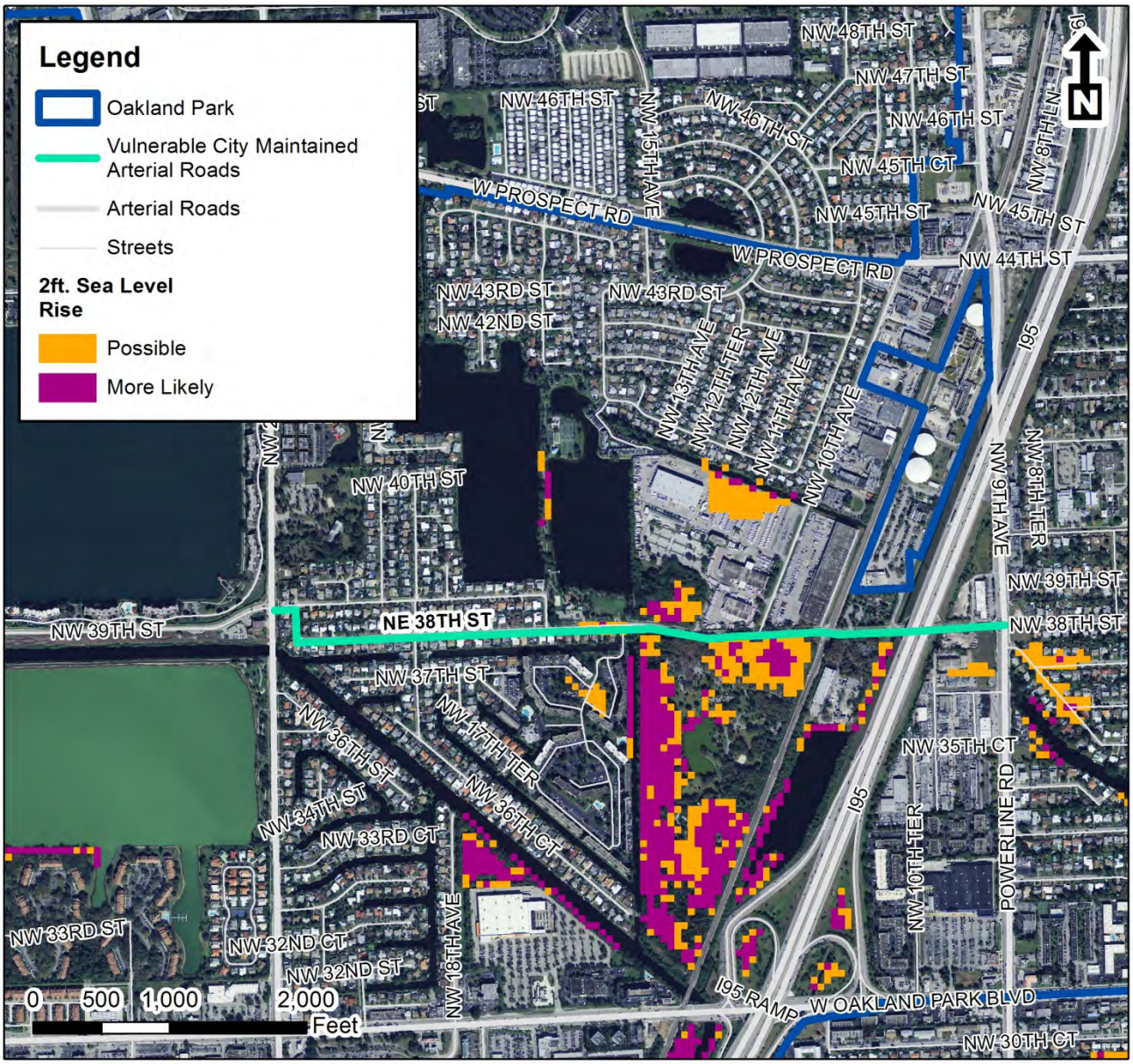
The following table lists the two vulnerable segments of arterial roads maintained by the City of Oakland Park. For each segment, the table provides the miles of vulnerable roadway and the total length with vulnerability expressed in percent for both the one and two foot sea level rise scenarios.

NE 38TH ST, from NW 21 Ave to Powerline Rd			Total Miles
			1.06
SLR Scenario	Possible	More Likely	Percent Total
1 Foot	0.00	0.00	0%
2 Foot	0.08	0.00	8%
NE 16TH AVE, from North Fork Middle River to Floranada Rd			Total Miles
			1.36
SLR Scenario	Possible	More Likely	Percent Total
1 Foot	0.00	0.00	0%
2 Foot	0.09	0.00	6%

Northeast 38th Street

From NW 21 Ave. to Powerline Rd.

Two Foot Sea Level Rise Scenario



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Prepared By: H. Ziegler
Environmental Protection and Growth Management Department
Natural Resources Planning and Management Division

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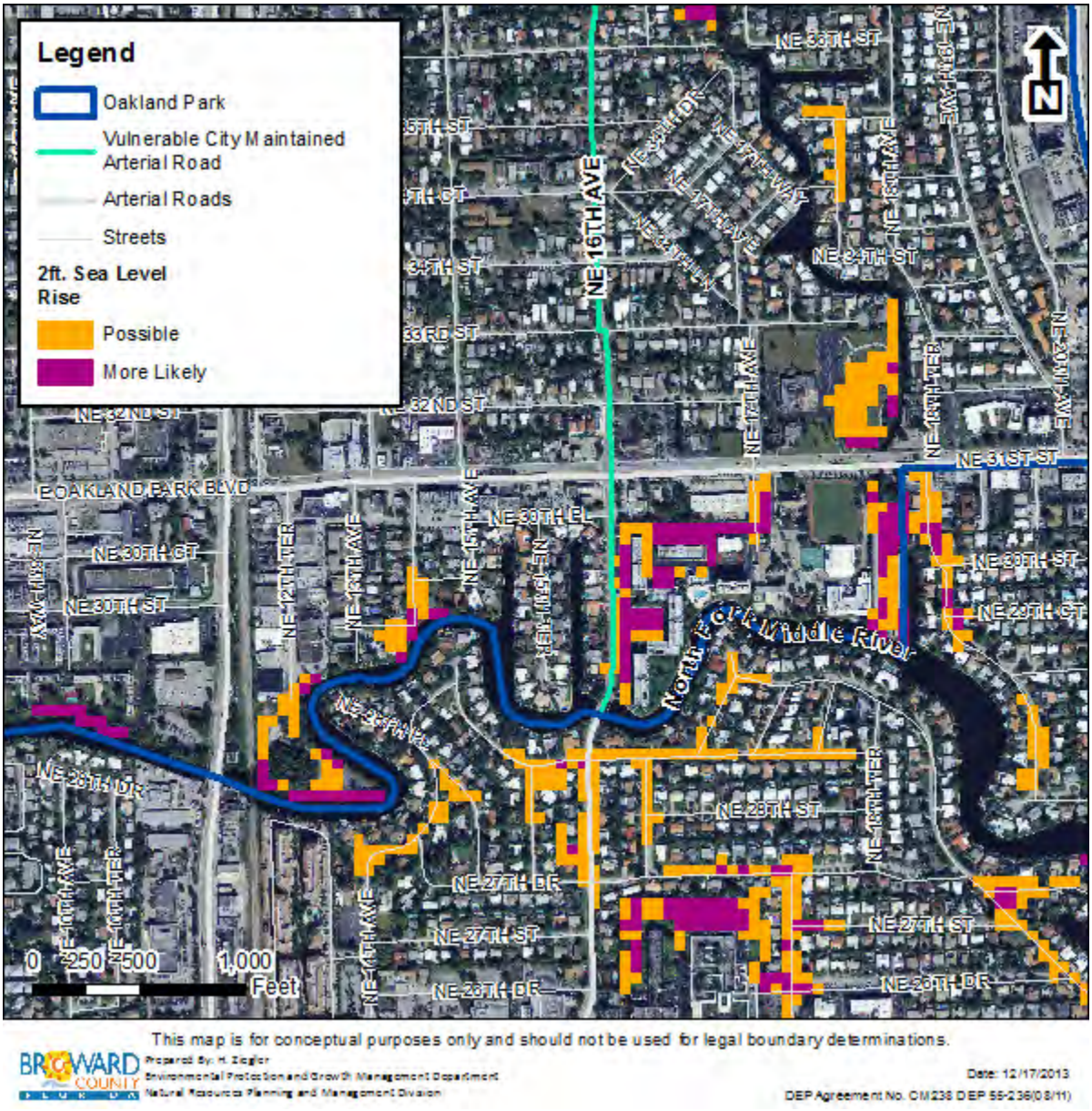
DEP Agreement No. CM238 DEP 55-236(08/11)

This Map provides a view of NE 38th St, which runs 1.06 miles from NW 21 Ave to Powerline Rd. The roadway lies adjacent to John D. Easterlin Park, which has a large area located at or below projected sea levels. Up to 8% of the roadway may have areas at or below projected sea levels during a two foot sea level rise scenario. The road is not affected during a one foot scenario.

Northeast 16th Avenue

From North Fork Middle River to Floranada Rd.

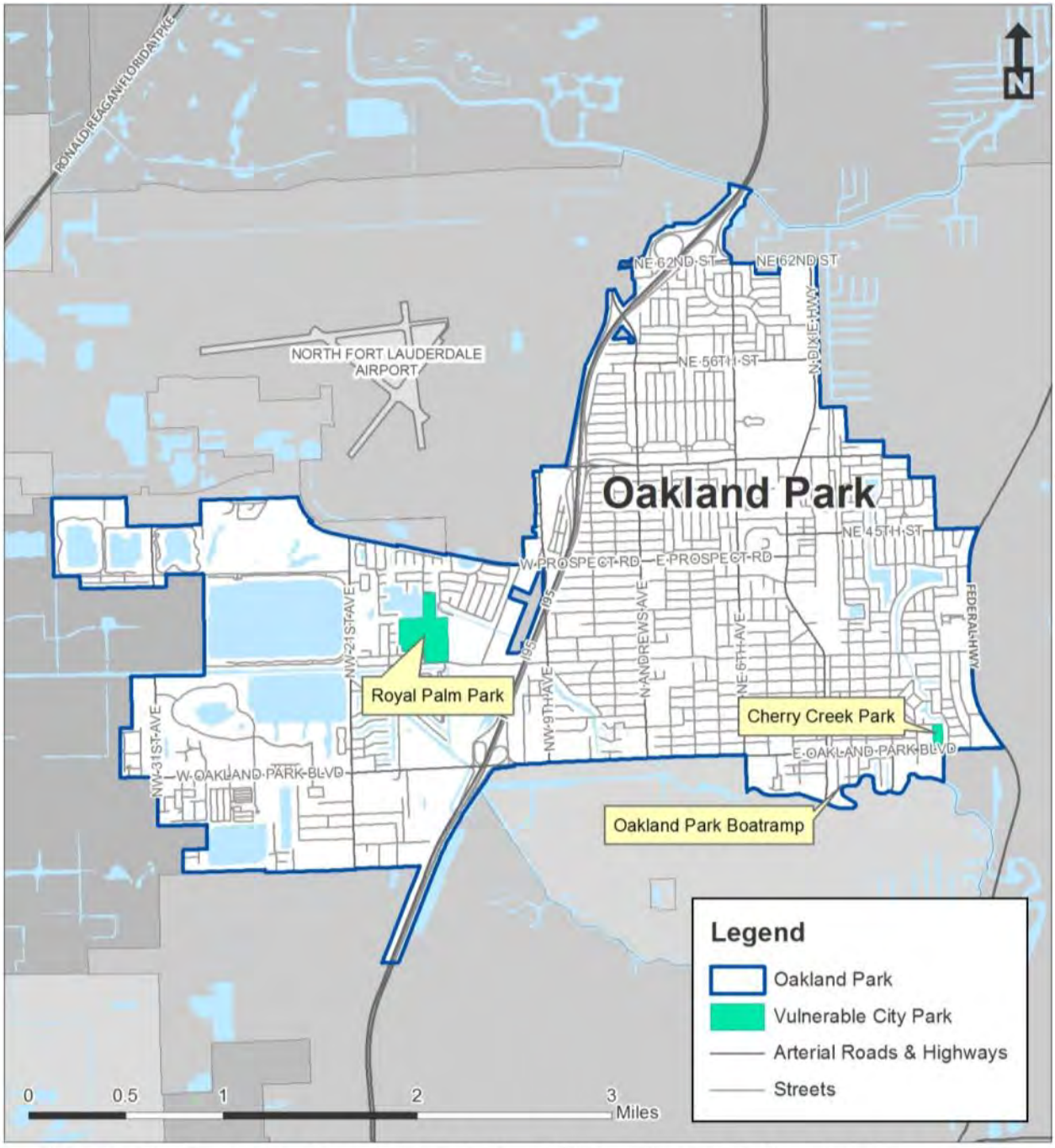
Two Foot Sea Level Rise Scenario



This Map provides a view of NE 16th Ave., which has a 1.36 mile stretch within the City of Oakland Park. The vulnerable area is near the tidally influenced North Fork Middle River, which defines a part of the southern municipal border of Oakland Park. Up to 6% of the roadway (from North Fork Middle River to Floranada Rd.) may have areas below projected sea levels during a two foot sea level rise scenario. The road is not affected during a one foot scenario.

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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Environmental Protection and Growth Management Department
Natural Resources Planning and Management Division

Date: 12/16/2013
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Table of Vulnerable City Parks

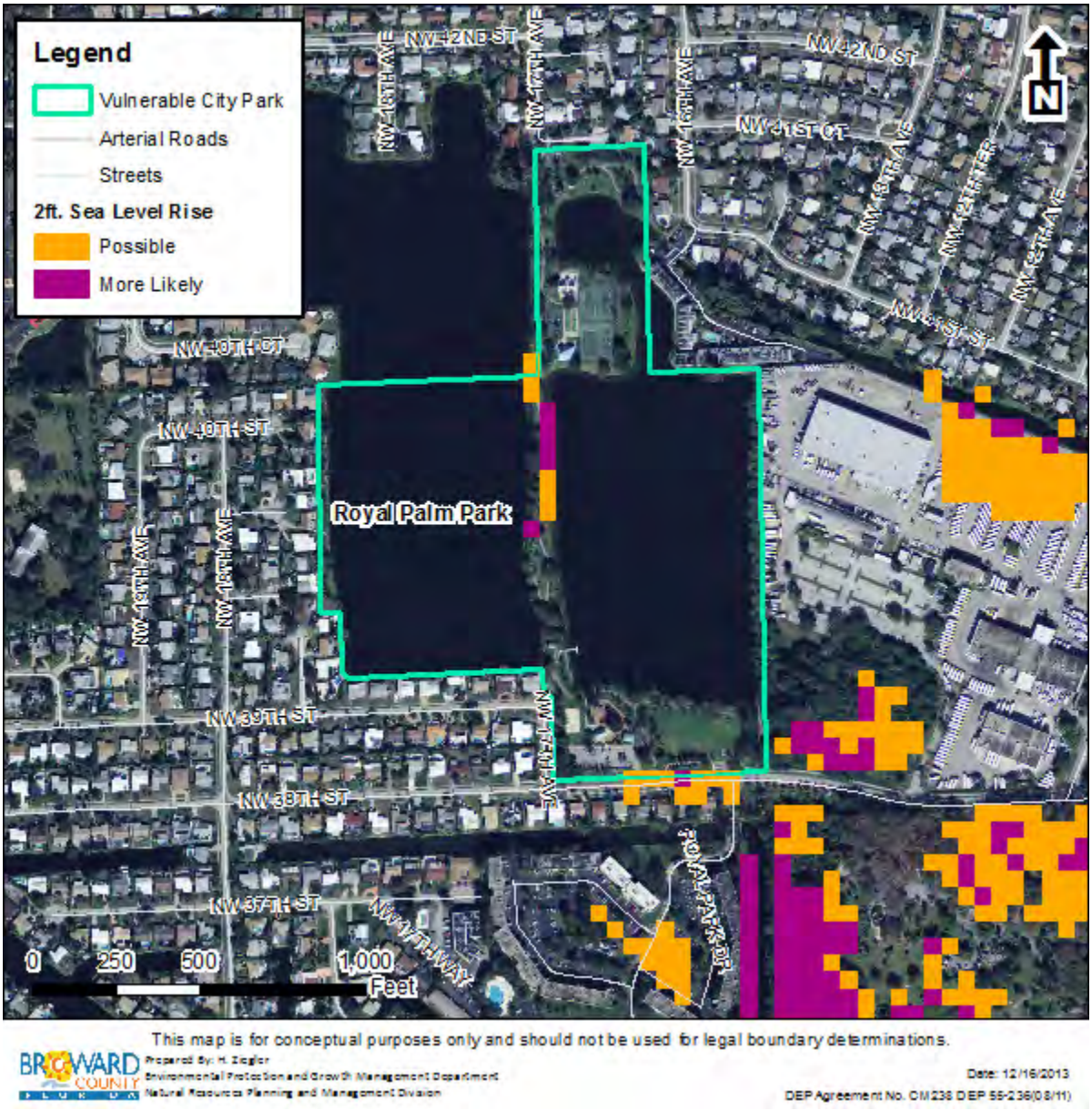
The following table lists the three city-owned parks with vulnerabilities. Each park was assessed for the one and two foot sea level rise scenarios. Parks do not appear to be vulnerable during a one foot scenario. Three parks were vulnerable during a two foot scenario. For each park the table provides 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 the inundation grid and do not subtract existent water bodies within the park to determine the percent value.

Royal Palm Park, 1701 NW 38th St.			Total Acres
			36.41
SLR Scenario	Possible	More Likely	Percent Total
1 Foot	0.00	0.00	0%
2 Foot	0.34	0.30	2%
Cherry Creek Park, 1701 E Oakland Park Blvd.			Total Acres
			3.55
SLR Scenario	Possible	More Likely	Percent Total
1 Foot	0.00	0.00	0%
2 Foot	1.73	0.34	58%
Oakland Park Boatramp, 3000 NE 12th Ter.			Total Acres
			0.15
SLR Scenario	Possible	More Likely	Percent Total
1 Foot	0.00	0.00	0%
2 Foot	0.05	0.08	86%

Royal Palm Park

1701 NW 38th St

Two Foot Sea Level Rise Scenario



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BROWARD COUNTY PLUE UA
Prepared By: H. Ziegler
Environmental Protection and Growth Management Department
Natural Resource Planning and Management Division

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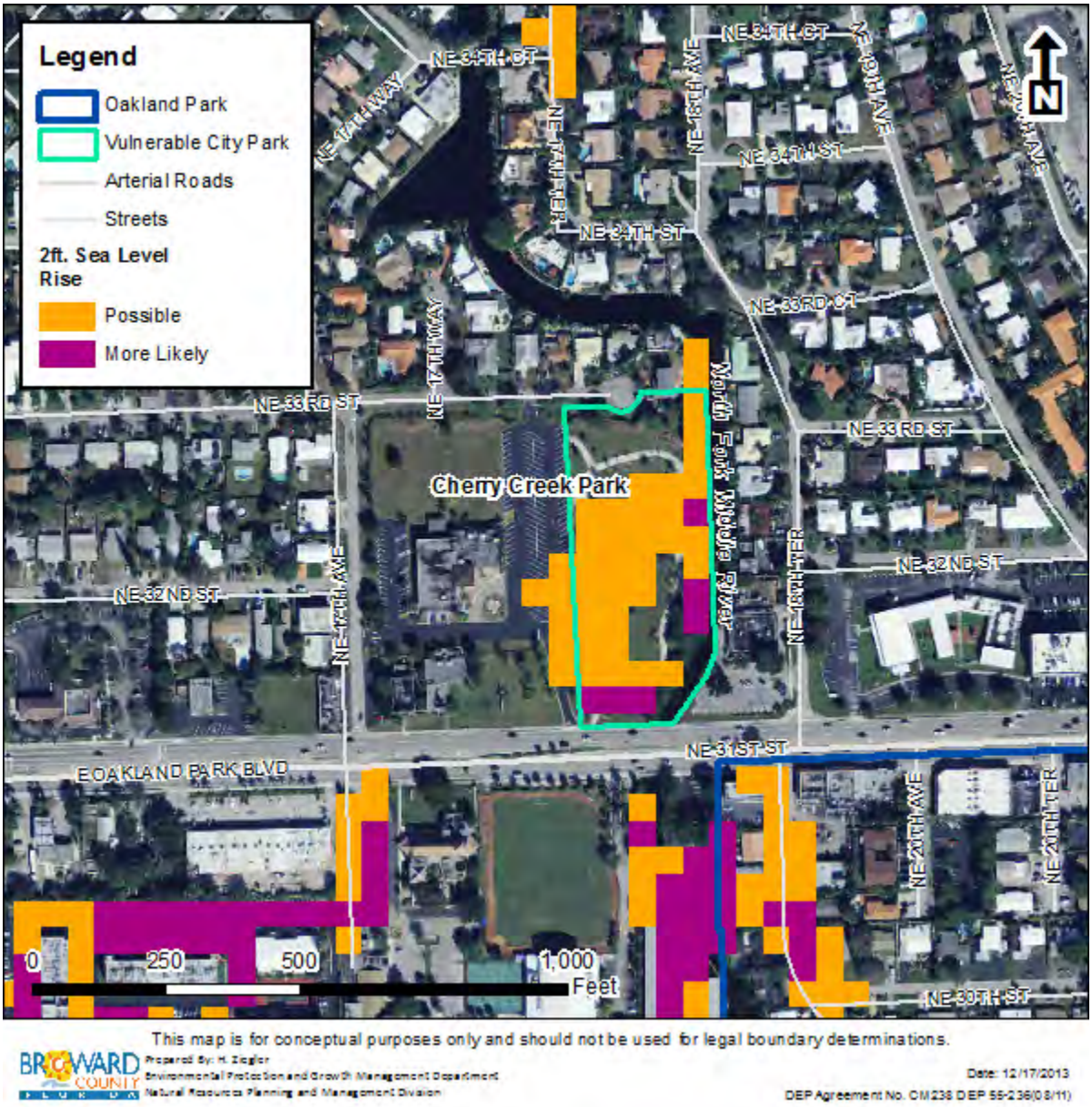
This Map provides a view of Royal Palm Park during a two foot sea level rise scenario. The park has an area of 36.41 Acres and may have up to 2% of that area located at or below projected sea levels during the two foot scenario. Note that these estimates are based on the area of the entire park and do not subtract the area of water bodies within the park to determine the percent value. The park is not affected during the one foot scenario.

Cherry Creek Park

1701 E Oakland Park Blvd.

Two Foot Sea Level Rise Scenario

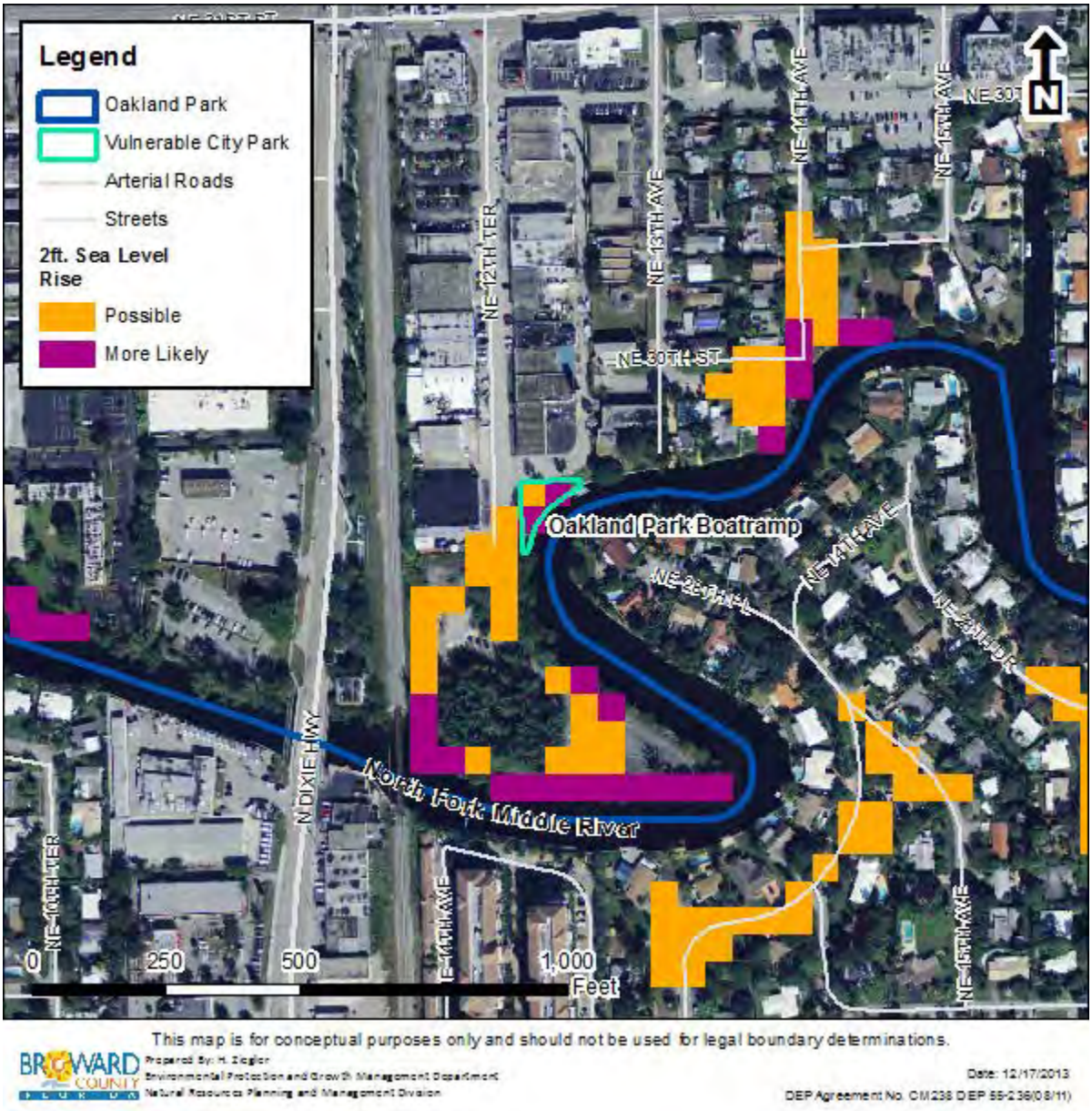


This Map provides a view of Cherry Creek Park during the two foot sea level rise scenario. Cherry Creek Park may have up to 58% of area located at or below projected sea levels during the two foot scenario. It is situated adjacent to the tidally influenced North Fork Middle River. The park is not affected during the one foot scenario.

Oakland Park Boatramp

3000 NE 12th Ter.

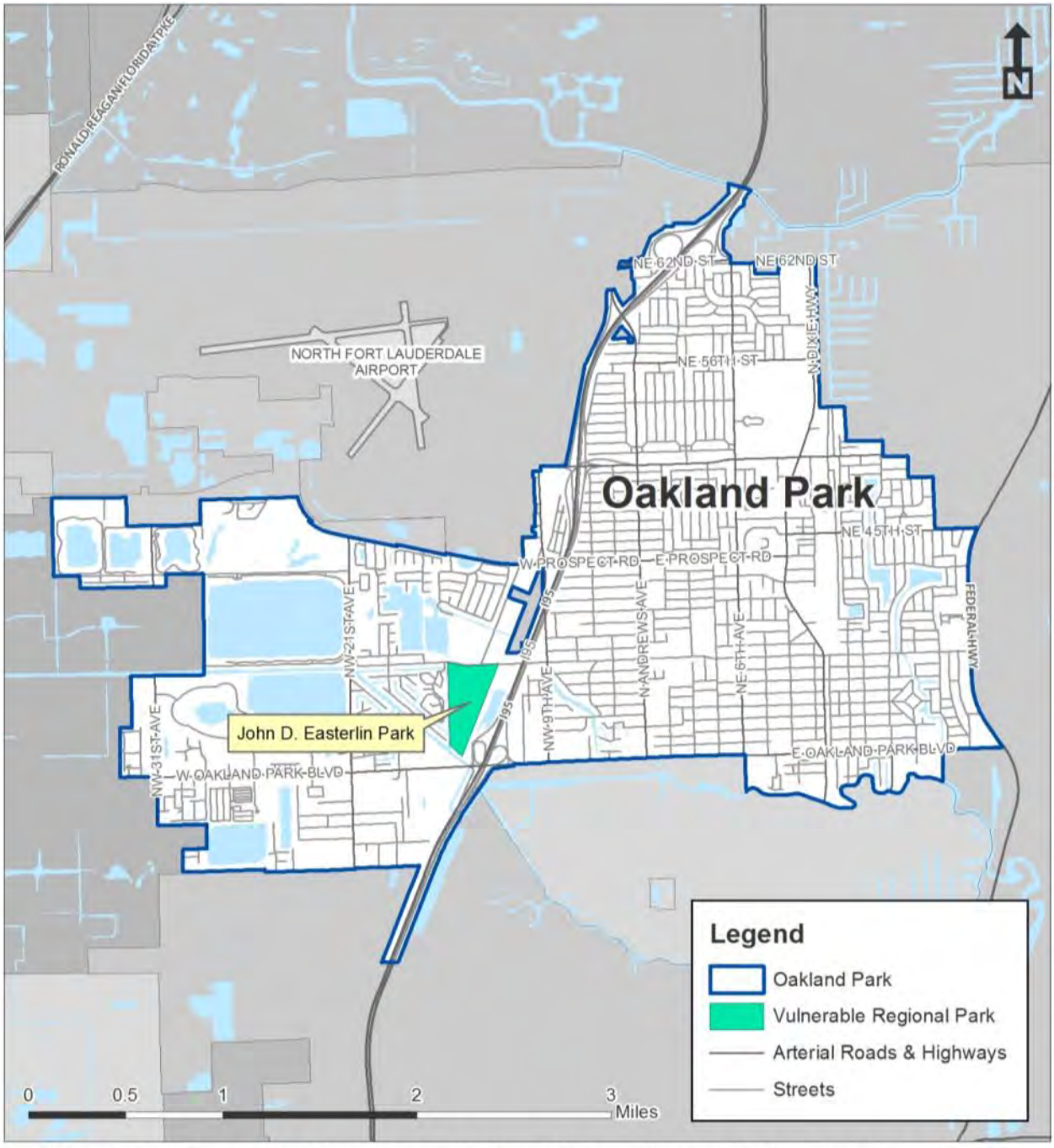
Two Foot Sea Level Rise Scenario



This Map provides a view of Oakland Park Boatramp during the two foot sea level rise scenario. The Oakland Park Boatramp may have up to 86% of area located at or below projected sea levels during the two foot scenario. It is situated adjacent to the tidally influenced North Fork Middle River. The park is not vulnerable during the one foot 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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Table of Vulnerable Regional Parks

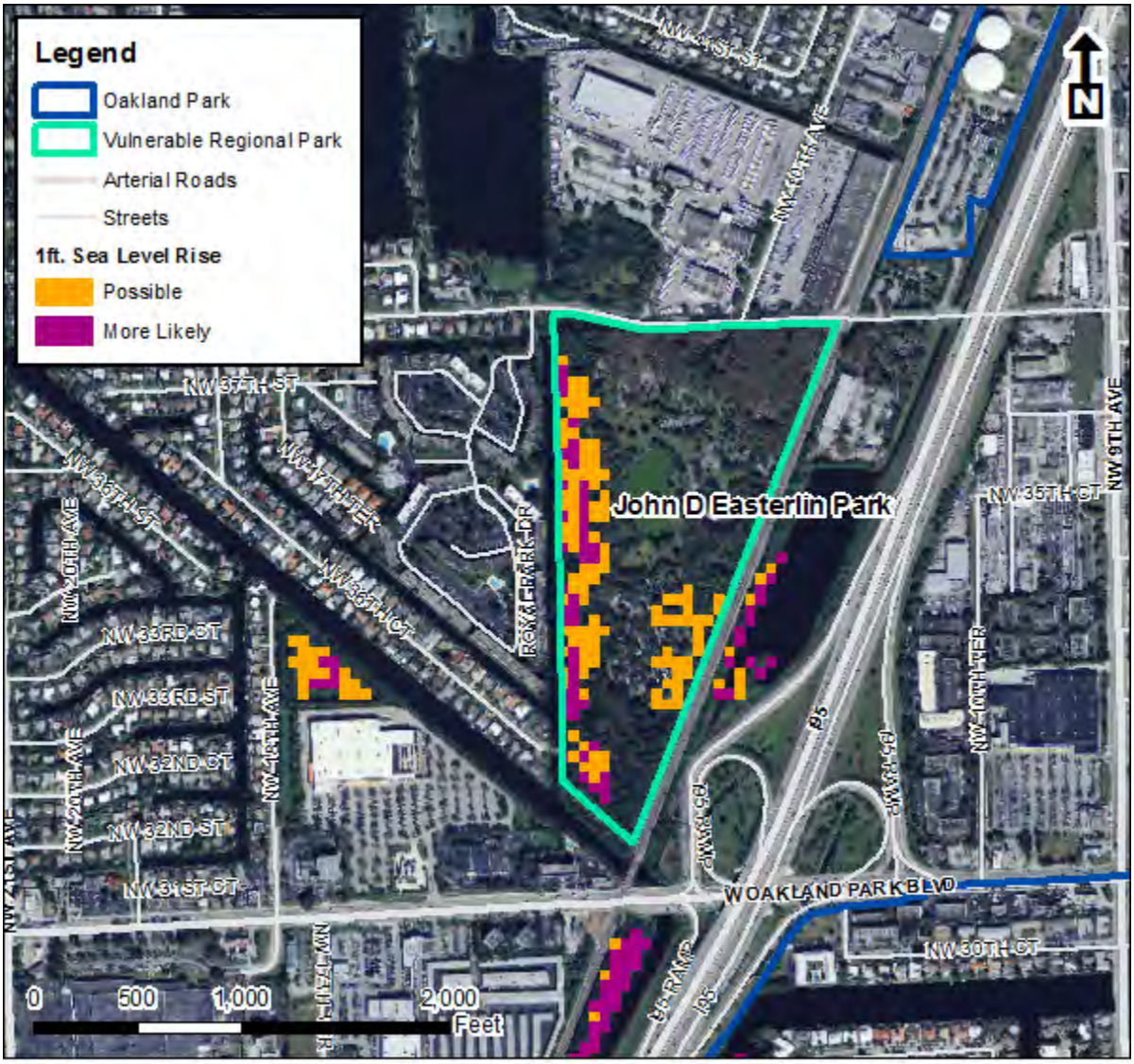
The following table lists vulnerable regional parks in the City of Oakland Park. John D. Easterlin Park has areas that lie at or below projected sea levels during both the one and two foot scenarios. During a two foot sea level rise scenario, as much as 55% of the park may be inundated. These estimates are based on the area of the entire park and the inundation grid and do not subtract the area of water bodies within the park to determine the percent value.

John D. Easterlin Park, 1000 NW 38th St.			Total Acres
			47.20
SLR Scenario	Possible	More Likely	Percent Total
1 Foot	6.56	2.58	19%
2 Foot	9.97	15.88	55%

John D. Easterlin Park

1000 NW 38th St.

One Foot Sea Level Rise Scenario

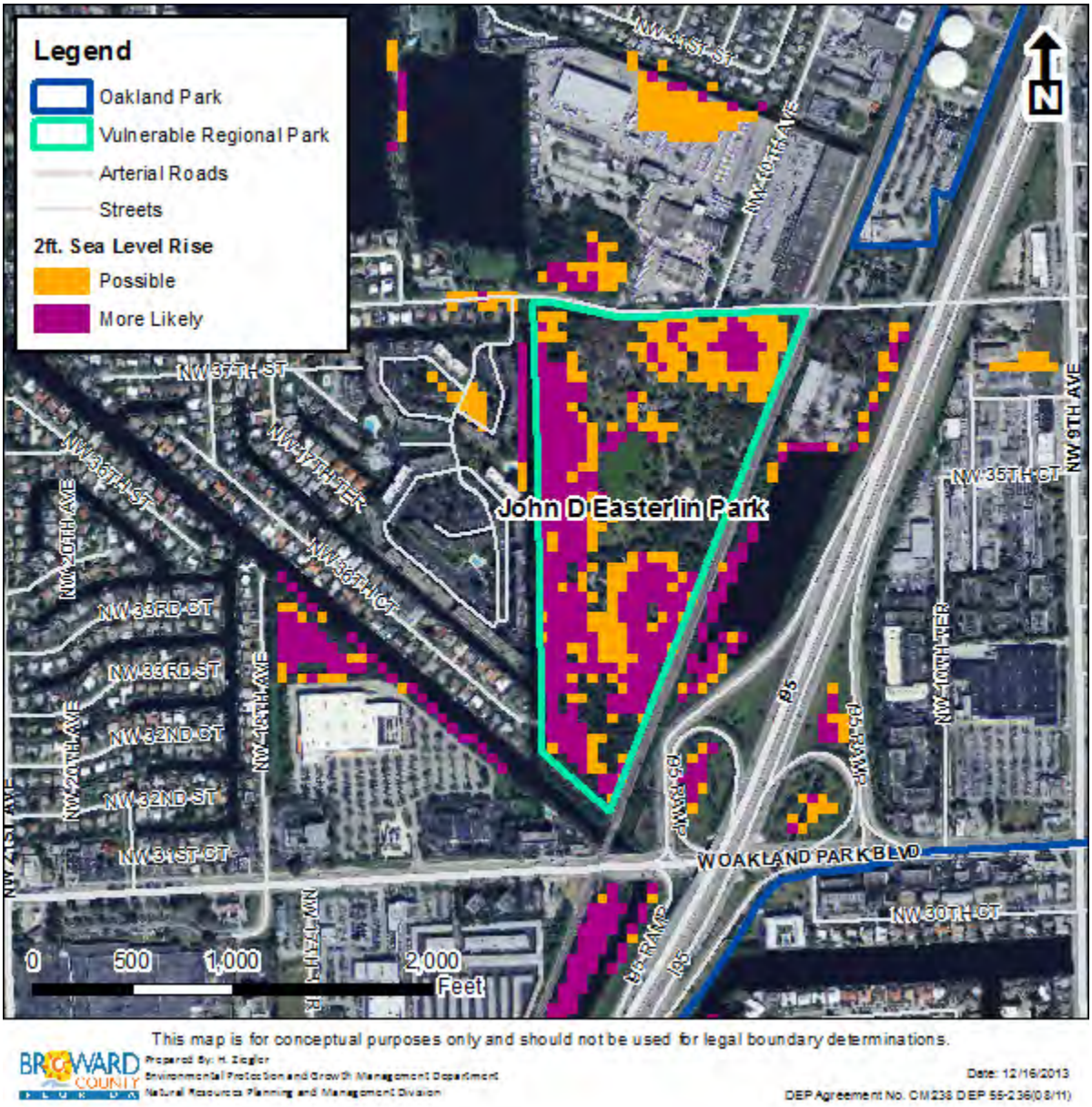


This Map provides a view of John D. Easterlin Park during the one foot sea level rise scenario. In this scenario, the park may have as much as 19% of area located at or below projected sea levels.

John D. Easterlin Park

1000 NW 38th St.

Two Foot Sea Level Rise Scenario



This Map provides a view of John D. Easterlin Park during a two foot sea level rise scenario. In this scenario, the park may have as much as 55% of area located at or below projected sea leves.

Community Redevelopment Areas (CRA)

Vulnerability Assessment

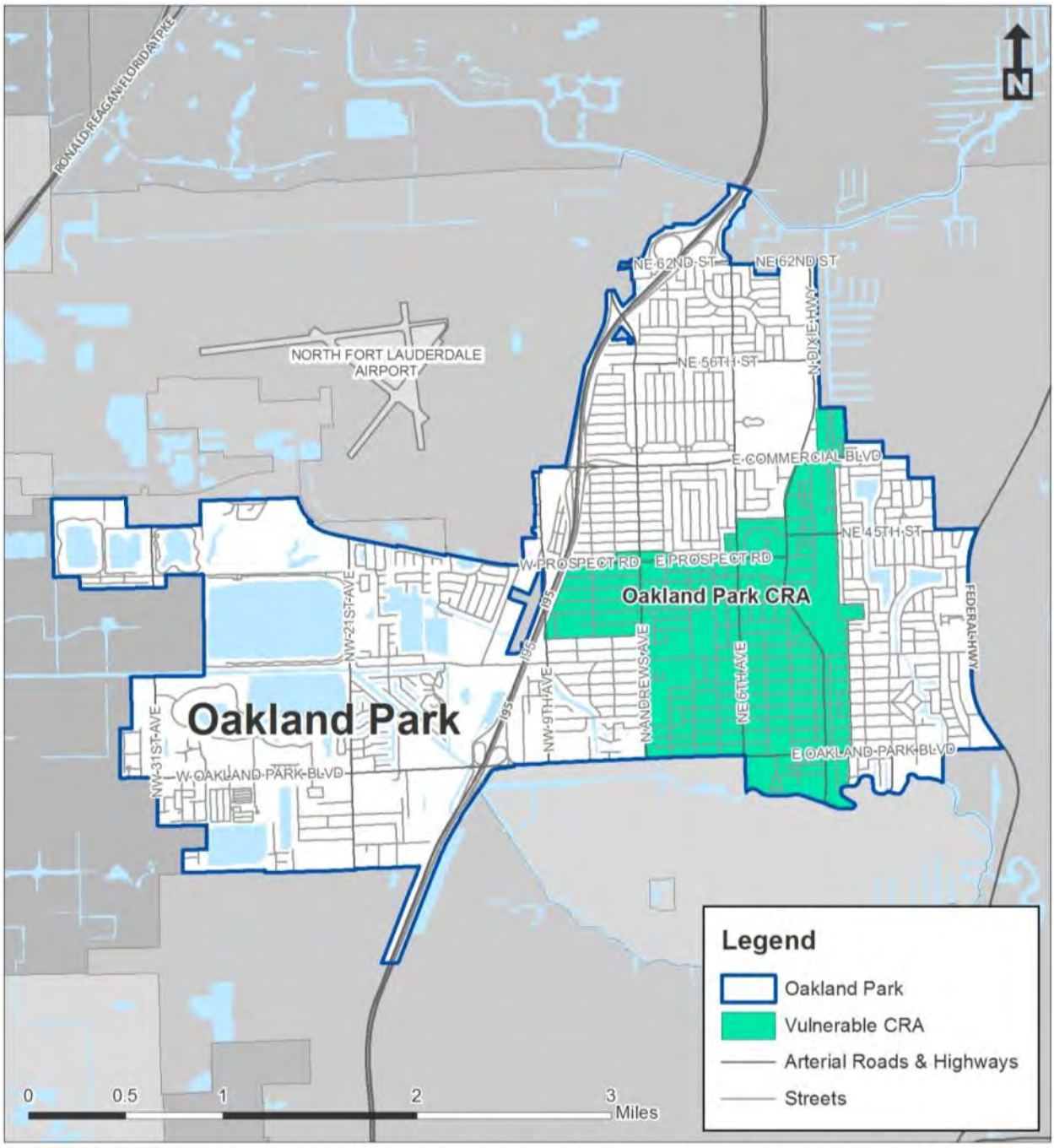


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Table of Vulnerable Community Redevelopment Areas (CRA)

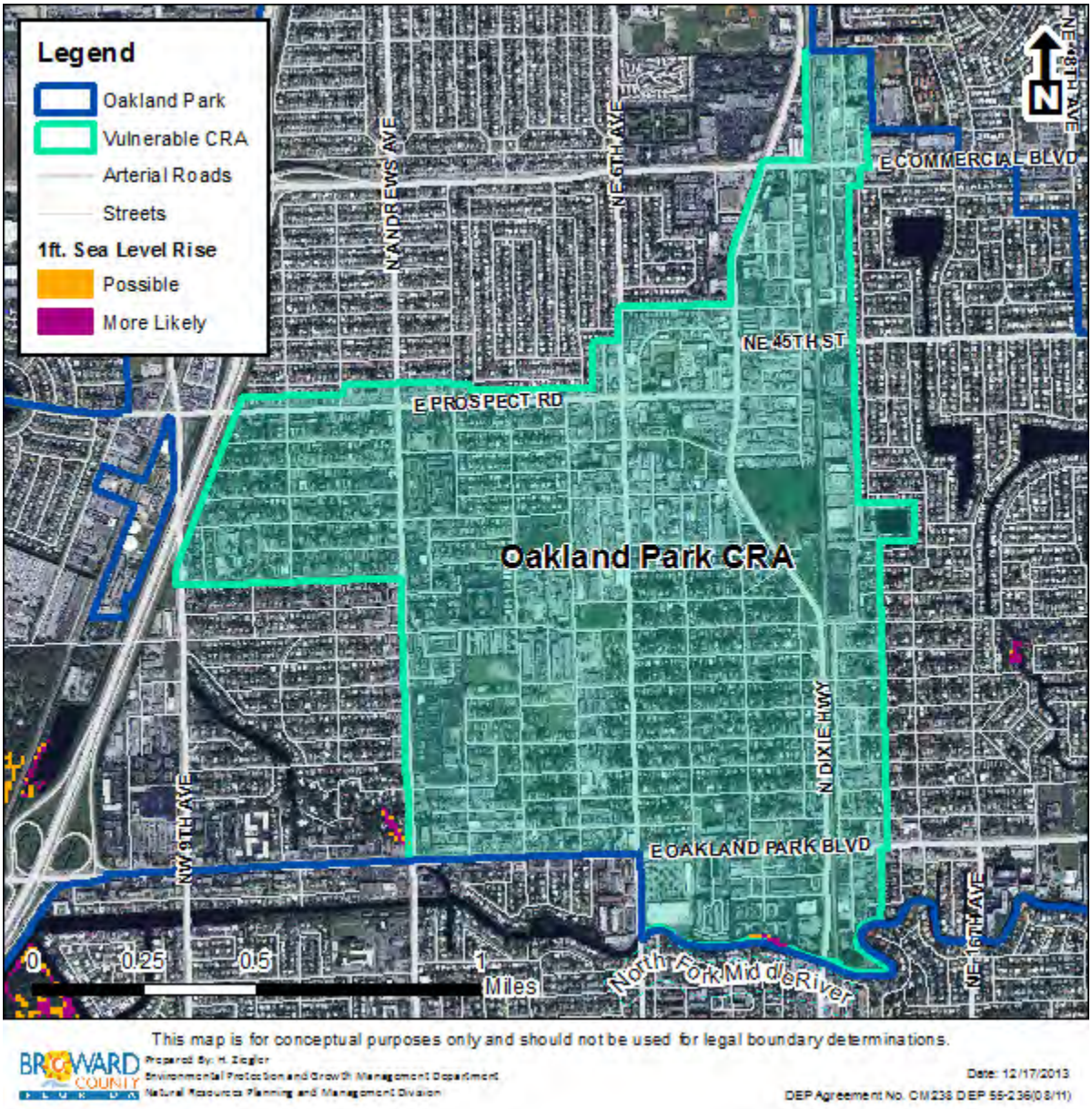
The following table lists CRAs within the City of Oakland Park that have areas located at or below projected sea levels during the one or two foot scenarios. There is only one CRA in the City of Oakland Park, the Oakland Park CRA, and it is vulnerable during both the one and two foot scenarios.

Vulnerable Community Redevelopment Areas City of Oakland Park		
CRA	One Foot Scenario(Y/N)	Two Foot Scenario (Y/N)
Oakland Park CRA	**Y**	**Y**

Key: For Y/N, Y = Yes, N = No

Oakland Park Community Redevelopment Area (CRA)

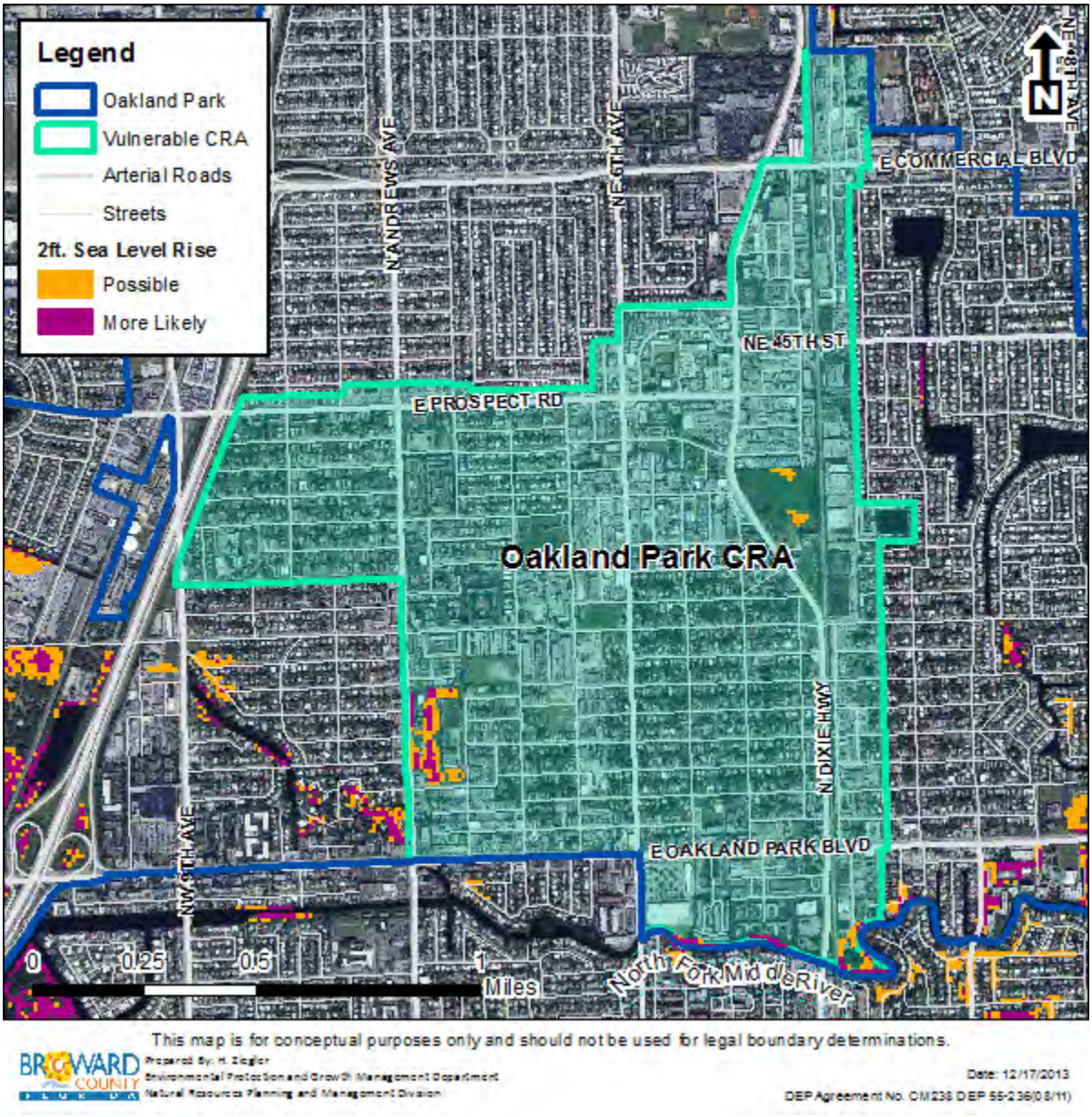
One Foot Sea Level Rise Scenario



This map shows the Oakland Park Community Redevelopment Area (CRA) overlaid by the one foot sea level rise scenario. A relatively small area of the CRA, along the North Fork Middle River, is located at or below projected sea level during the one foot scenario.

Oakland Park Community Redevelopment Area (CRA)

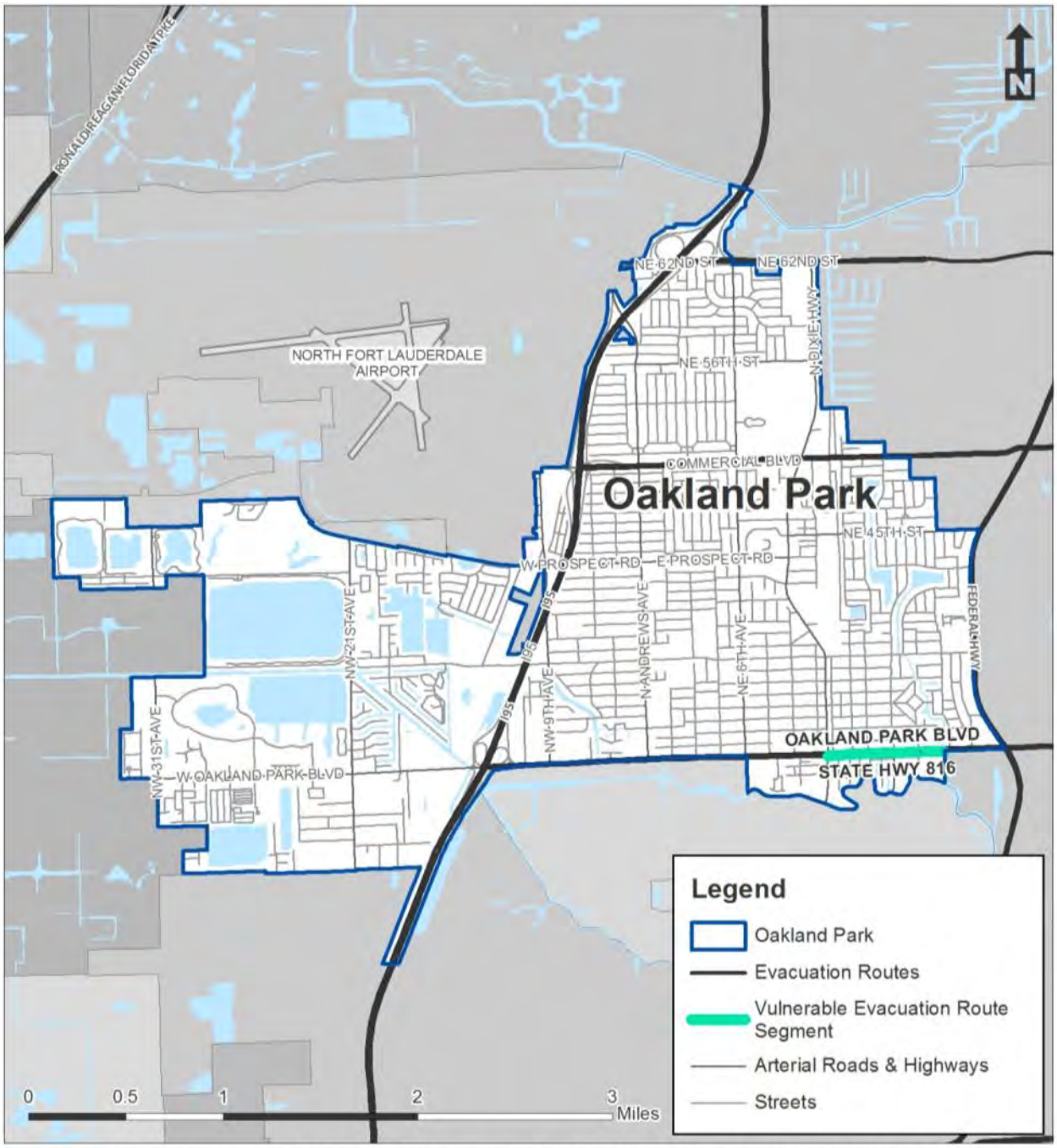
Two Foot Sea Level Rise Scenario



This map shows the Oakland Park Community Redevelopment Area (CRA) overlaid by the two foot sea level rise scenario. An increasingly larger area along the North Fork Middle River is located at or below sea levels during the two foot scenario. The large area of low elevation on the Western border of the CRA belongs to the Oakland Park Festival Shopping Center. The Oakland Park Festival Shopping Center parking lot is located at or below projected sea levels during the two foot scenario.

Evacuation Routes

Vulnerability Assessment



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DEP Agreement No. CM238 DEP 55-236(08/11)

Table of Vulnerable Evacuation Routes

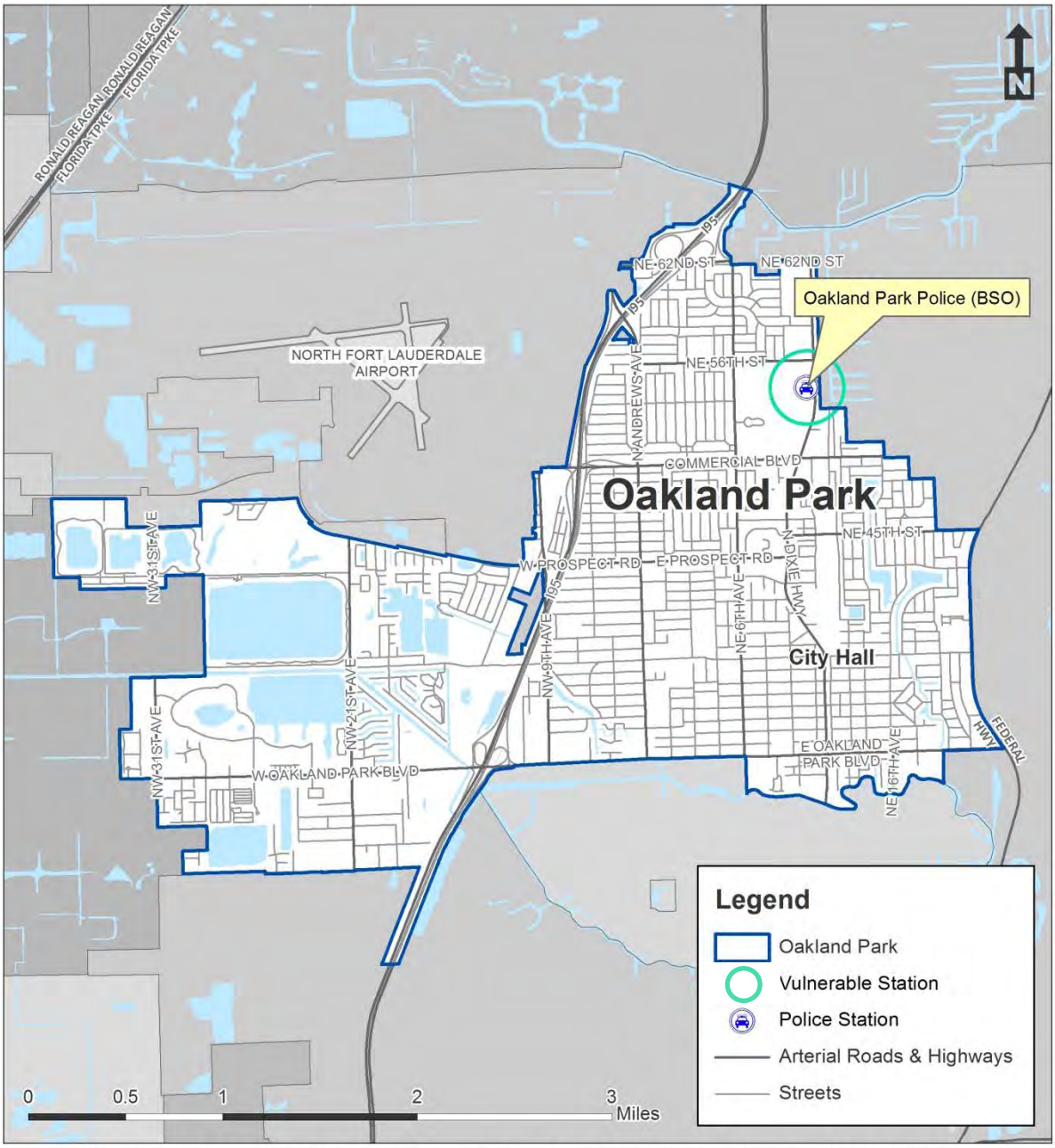
The following table lists all evacuation routes within the City of Oakland Park that have areas located at or below projected sea levels during the one or two foot scenarios. One evacuation route, State Highway 816 (Oakland Park Blvd.) is vulnerable. For each scenario, vulnerable routes receive a Y for yes, or an N for no.

Vulnerable Evacuation RoutesCity of Oakland Park		
Roadway	One Foot Scenario(Y/N)	Two Foot Scenario (Y/N)
State Hwy. 816 (Oakland Park Blvd)	**N**	**Y**

Key: For Y/N, Y = Yes, N = No

Law Enforcement Assets

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.

Prepared By: Hannes Ziegler
Environmental Protection and Growth Management Department
Natural Resources Planning and Management Division

Date: 5/23/2014
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Table of Vulnerable Law Enforcement Assets

Law Enforcement Assets and streets within a 1000-foot radius of aforementioned assets were analyzed for potential vulnerability to one and two foot scenarios of sea level rise. The following table lists the identified vulnerable law enforcement assets. One asset, Oakland Park Police (Broward Sherriff's Office), is vulnerable. For each scenario, vulnerable assets receive a Y for yes, or an N for no.

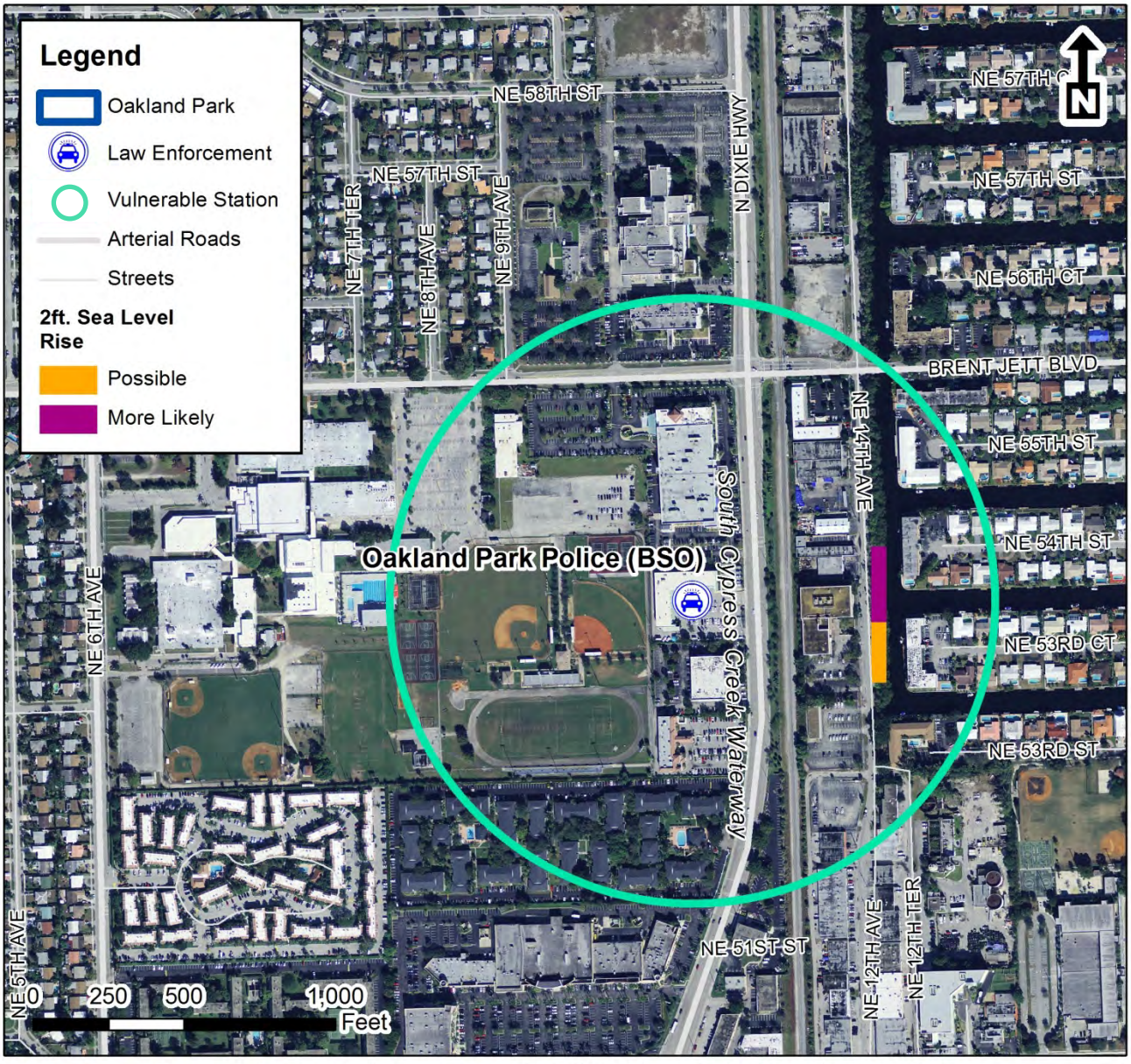
Vulnerable Law Enforcement Assets City of Oakland Park		
Law Enforcement Asset	One Foot Scenario(Y/N)	Two Foot Scenario (Y/N)
Oakland Park Police (BSO)	**N**	**Y**

Key: For Y/N, Y = Yes, N = No

Oakland Park Police

5399 N. Dixie Highway

Two Foot Sea Level Rise Scenario



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Prepared By: H. Ziegler
Environmental Protection and Growth Management Department
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This map shows areas within a 1000-foot radius of the Oakland Park Police Station overlaid by the two foot sea level rise scenario. There is a marginal strip of land along South Fork Cypress Creek Waterway - immediately adjacent to NW 14th Ave - that is located at or below sea level during a two foot scenario. The area was not vulnerable during a one foot scenario.