



Location Hydraulics Memorandum

**SR-9/I-95 @ SR 842/Broward Boulevard (Broward
Boulevard from West of SW 24th Avenue to East of
NW/SW 18th Avenue)
Project Development & Environment (PD&E) Study**

Efficient Transportation Decision Making (ETDM) No.: 14226

**Broward County, Florida
Financial Project ID Number: 435513-1-22-02**

**Prepared for:
Florida Department of Transportation, District Four
3400 West Commercial Boulevard
Fort Lauderdale, FL 33309**

February 2019

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by FDOT pursuant to 23 U.S.C. §327 and a Memorandum of Understanding dated December 14, 2016 and executed by FHWA and FDOT.

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Abbreviations

ETDM	Efficient Transportation Decision Making
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
PD&E	Project Development and Environment Study

1.0 Purpose and Overview

Protection of floodplains and floodways is required by Executive Order 11988, “Floodplain Management”, USDOT Order 5650.2, “Floodplain Management and Protection”, and Federal-Aid Policy Guide 23 CFR 650A. Per Chapter 13 (Floodplains) of the FDOT PD&E Manual (2017), “the intent of these regulations is to avoid or minimize highway encroachments within the 100 year (base) floodplain, where practicable, and to avoid supporting land use development which is incompatible with floodplain values. Where encroachment is unavoidable, the regulations require the Department to take appropriate measures to minimize impacts”. Location hydraulic studies are required by the Federal-Aid Policy Guide 23 CFR 650A Sec. 650.111. The magnitude of the study reflects the level of significance for floodplain encroachment as determined in the Class of Action Determination from the ETDM Programming Screen. For the SR 9/I-95 at SR 842/Broward Boulevard Interchange PD&E Study, the level of significance for floodplain encroachments is “minimal encroachments”, reflective of projects with floodplain involvement but the impacts on human life, transportation facilities, and natural and beneficial floodplain values are not significant and can be resolved with minimal efforts. Normally, these minimal efforts to address the impacts will consist of applying the Department’s drainage design standards and following the Water Management’s District’s procedures to achieve results that will not increase or significantly change the flood elevations and/or limits. For projects where the level of significance for the floodplain encroachment is “minimal encroachment”, the findings of the review of the alternatives may consist of documentation in the project file. This Location Hydraulics Memorandum serves such purpose. For the limits of this PD&E Study, please refer to **Attachment A – Project Location Map**.

2.0 Base Floodplain

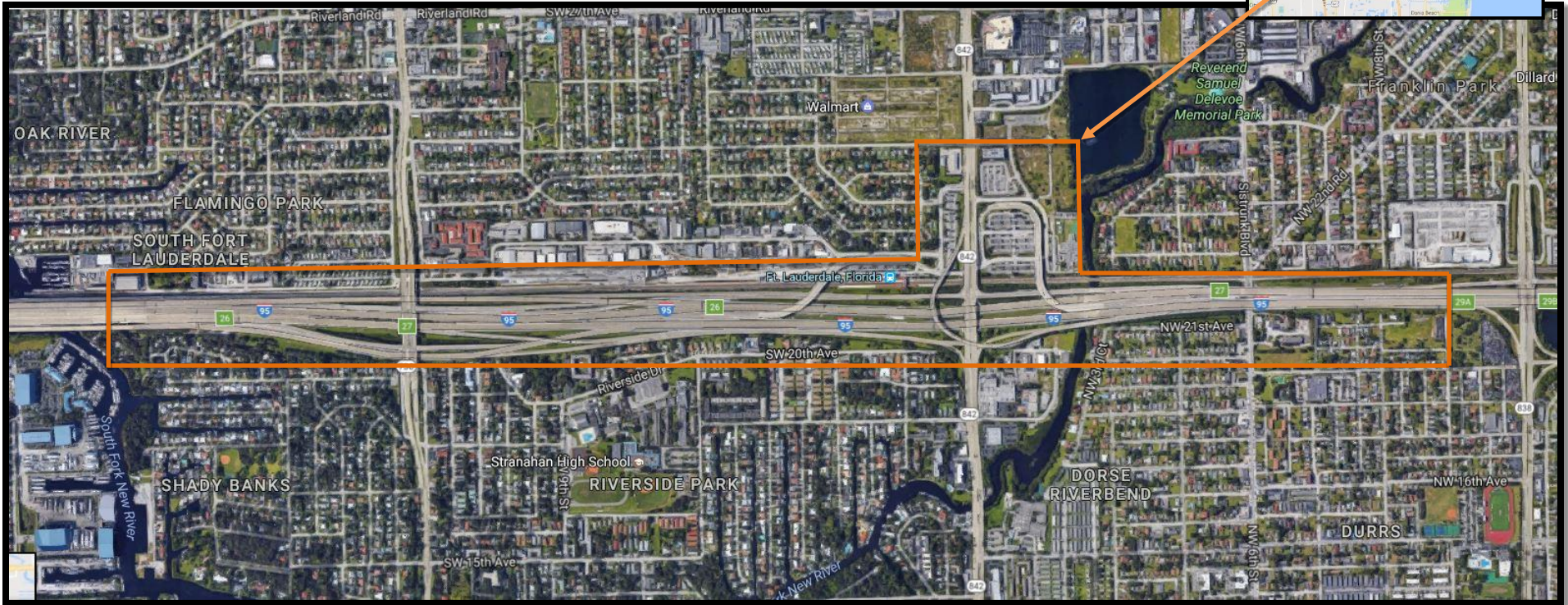
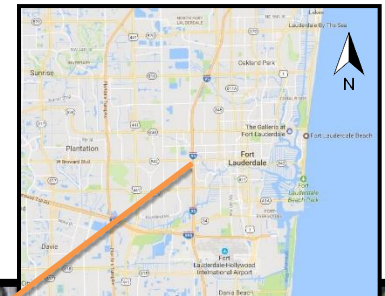
Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) were obtained to evaluate the floodplains located within or adjacent to the PD&E Study limits. Please refer to **Attachment B – FEMA Floodplain Map** and **Attachment C – FEMA Floodplain Encroachment Map**. FIRM Community Panel Number(s) 12011C00556H, and 12011C0368H indicate that the project limits are within 100-year flood zones, including Zone AE and Zone AH with flood elevations that vary between 7.00 ft.-NAVD and 8.00 ft.-NAVD. Base floodplain encroachments are mostly located east, west and, and within the I-95 median mainline as well as Broward Boulevard.

3.0 Risk Assessment

The project will result only in minimal encroachments to floodplains. These encroachments will be constrained to the limits described above and shown on **Attachment C**. Encroachments resulting from the construction of the preferred alternative will be fully compensated within the proposed drainage systems to ensure there will be no increase or significant change to flood elevations and/or limits. Please refer to **Attachment D – Floodplain Calculations**.

The proposed drainage system will perform hydraulically in a manner equal to or greater than the existing system, and floodplain surface elevations are not expected to increase. Thus, there will be no significant adverse impacts on natural and beneficial floodplain values. There will be no significant change in flood risk, and there will not be a significant change in the potential for interruption or termination of emergency service or emergency evacuation routes.” Therefore, it has been determined that this encroachment is not significant.

ATTACHMENT A
Project Location Map



I-95 at Broward Boulevard
PD&E Study

Project Location Map

ATTACHMENT B
FEMA Floodplain Map

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded tenth-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations (BFEs) shown on this map apply only landward of 0.0 North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The projection used in preparation of this map was Transverse Mercator State Plane Florida East FIPS 0901. The horizontal datum was NAD83 HARN, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NNGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for bench marks shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was provided in digital format by Broward County. The original orthophotographic base imagery was provided in color with a one-foot pixel resolution at a scale of 1" = 300' from photography flown in 2008.

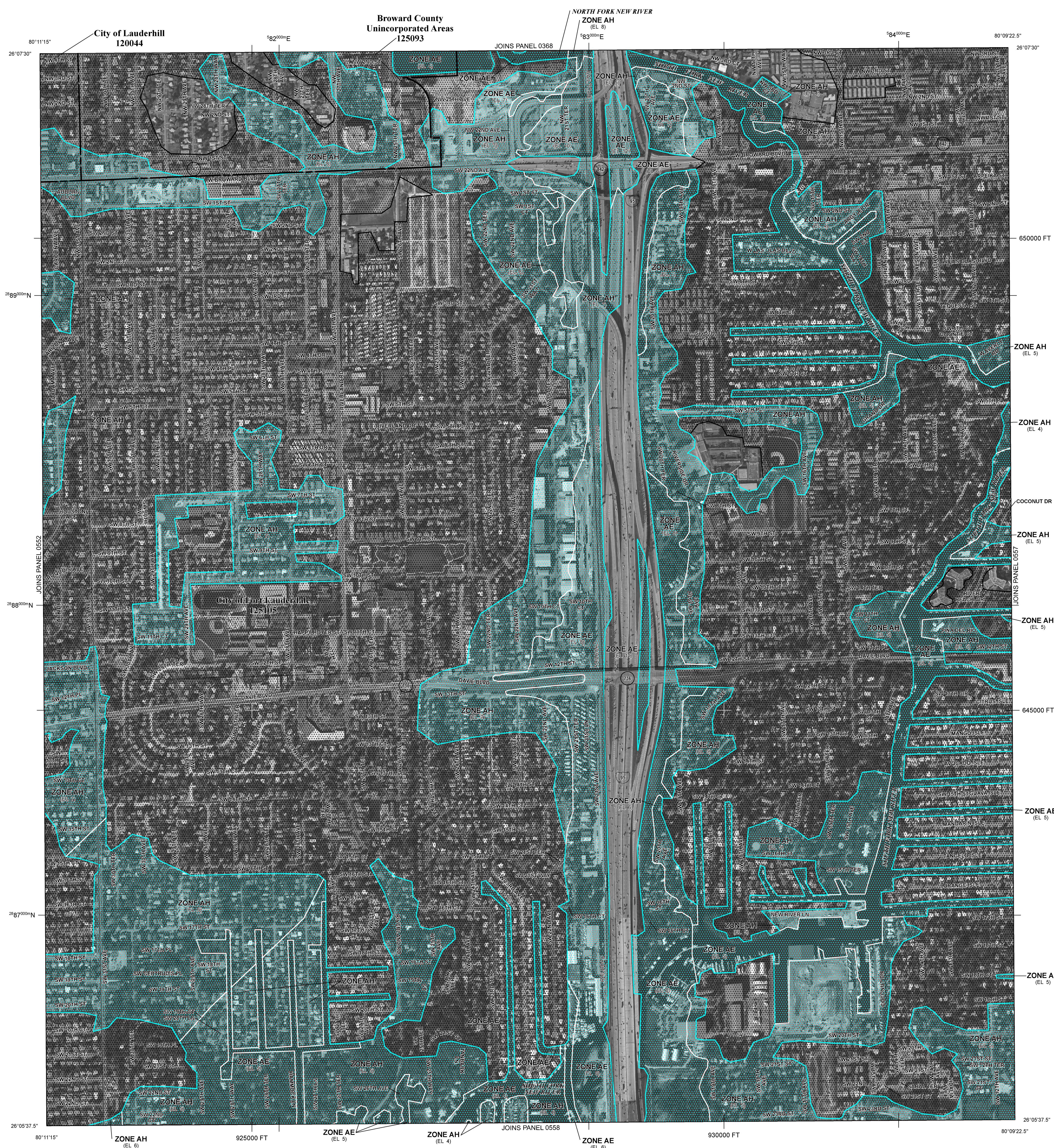
This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

The "profile base lines" depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the profile base line, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities
- Base Flood Elevation line and value; elevation in feet* (EL 987)
- Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

MAP REPOSITORIES
Refer to Map Repositories List on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
August 18, 2014

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 250 500 750 1,000 FEET
150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0556H

FIRM
FLOOD INSURANCE RATE MAP
BROWARD COUNTY, FLORIDA
AND INCORPORATED AREAS

PANEL 556 OF 751
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BROWARD COUNTY	125093	0556	H
FORT LAUDERDALE, CITY OF	125105	0556	H
LAUDERHILL, CITY OF	120044	0556	H

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER 12011C0556H
EFFECTIVE DATE AUGUST 18, 2014

Federal Emergency Management Agency

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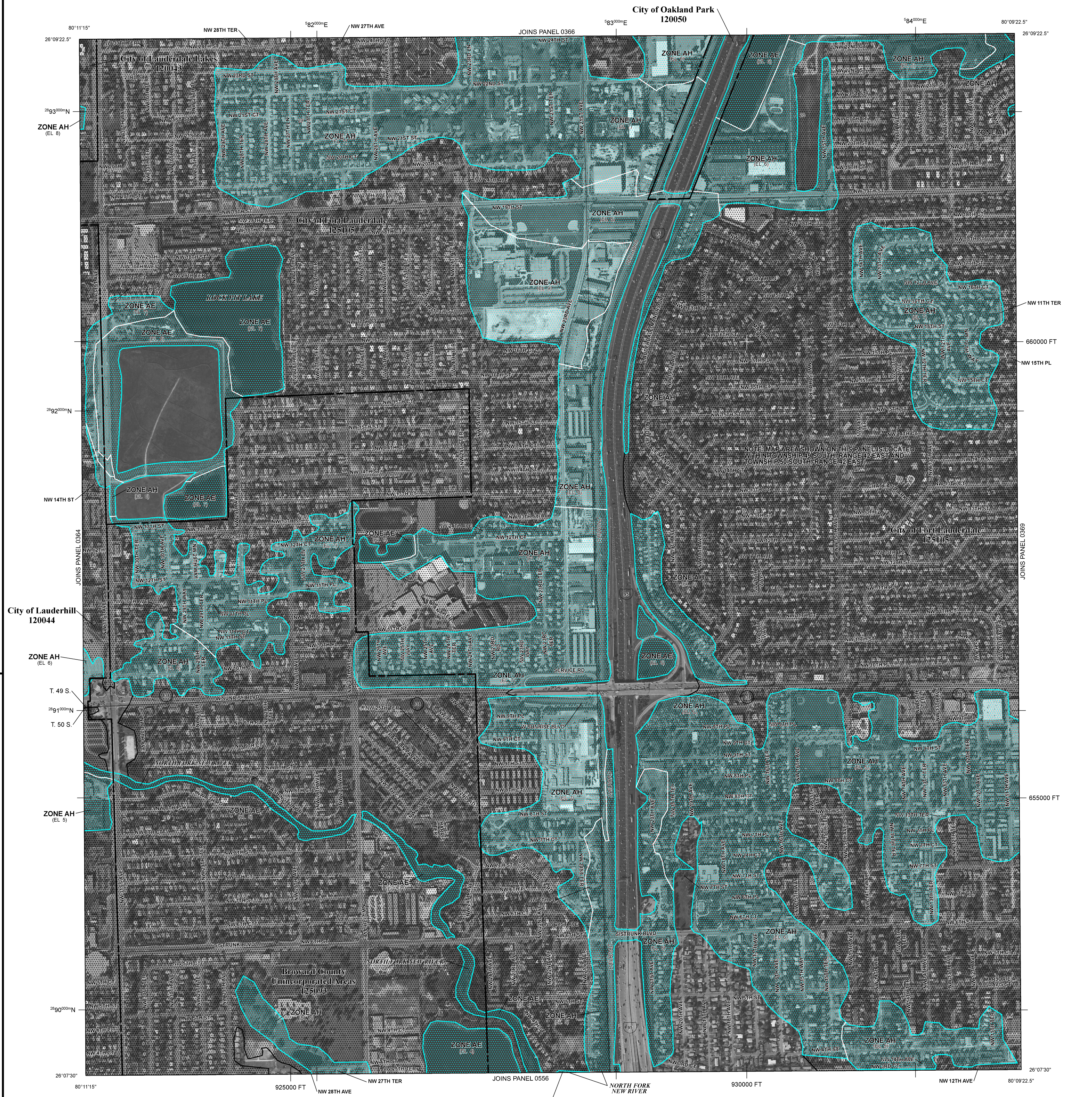
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**City of Oakland Park
120050**



LEGEND

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FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

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0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities
Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

Cross section line
Transect line
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
1000-meter Universal Transverse Mercator grid ticks, zone 17
5000-foot grid values: Florida State Plane coordinate system, East Zone (FIPSZONE = 0901), Transverse Mercator projection
Bench mark (see explanation in Notes to Users section of this FIRM panel)
River Mile

MAP REPOSITORIES
Refer to Map Repositories List on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
August 18, 2014

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0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0368H

FIRM
FLOOD INSURANCE RATE MAP
BROWARD COUNTY,
FLORIDA
AND INCORPORATED AREAS

PANEL 368 OF 751
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
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FORT LAUDERDALE, CITY OF	125105	0368	H
LAUDERDALE LAKES, CITY OF	120043	0368	H
LAUDERHILL, CITY OF	120044	0368	H
OAKLAND PARK, CITY OF	120050	0368	H

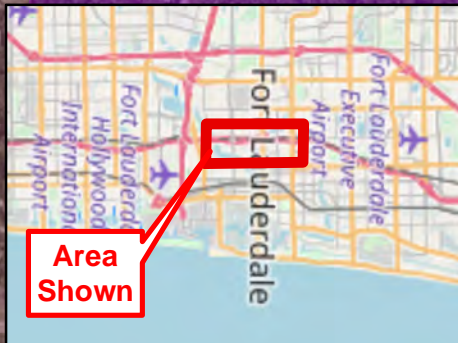
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MAP NUMBER
12011C0368H

EFFECTIVE DATE
AUGUST 18, 2014

Federal Emergency Management Agency

ATTACHMENT C
FEMA Floodplain Encroachment Map



BEGIN PROJECT

Legend

Project Limits

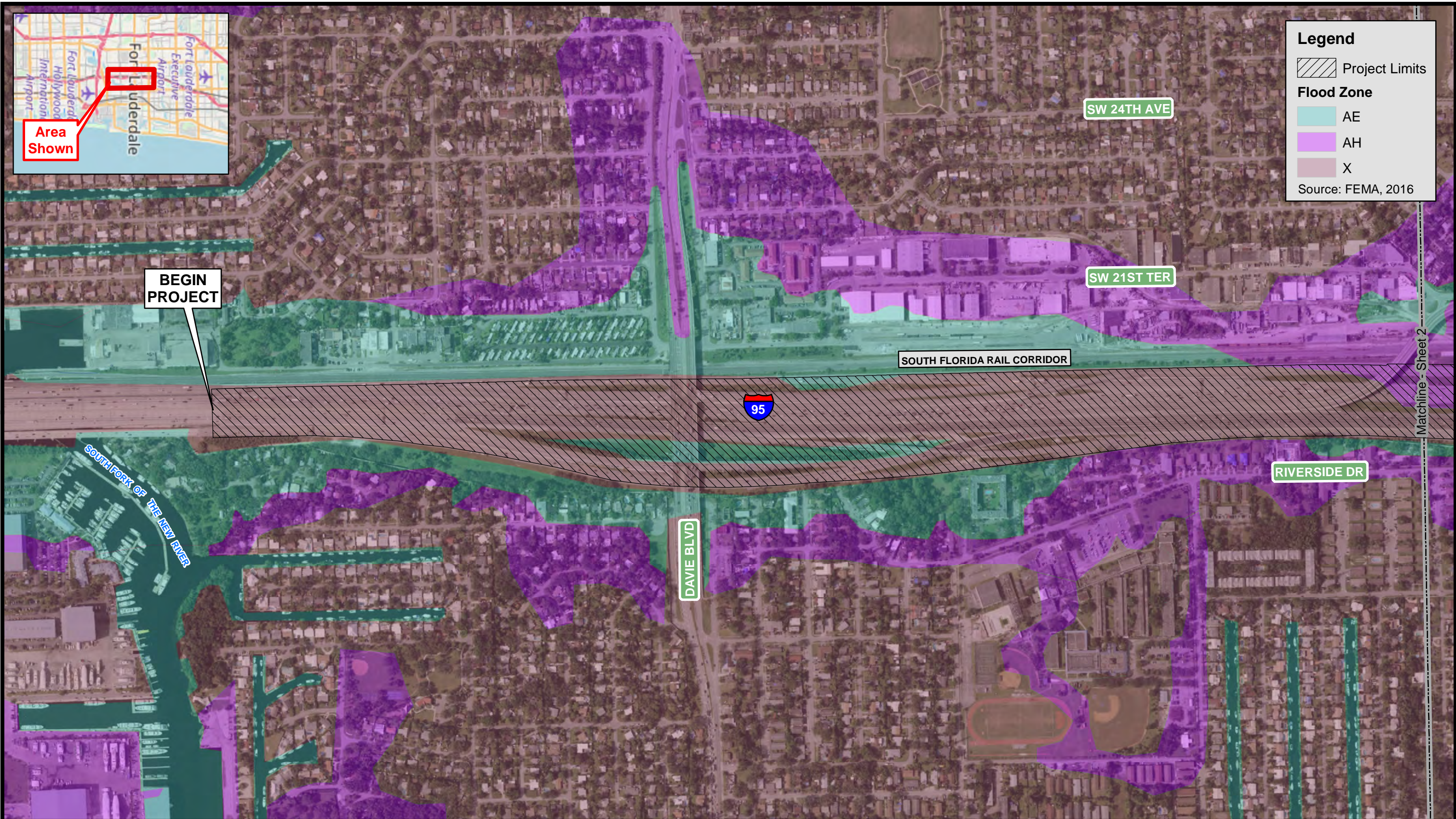
Flood Zone

AE

AH

X

Source: FEMA, 2016



Matchline - Sheet 2



Florida Department of Transportation
 I-95 at Broward Blvd PD&E Study
 ETDM # 14226
 FM # 435513-1-22-02
 Broward County, Florida

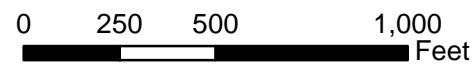
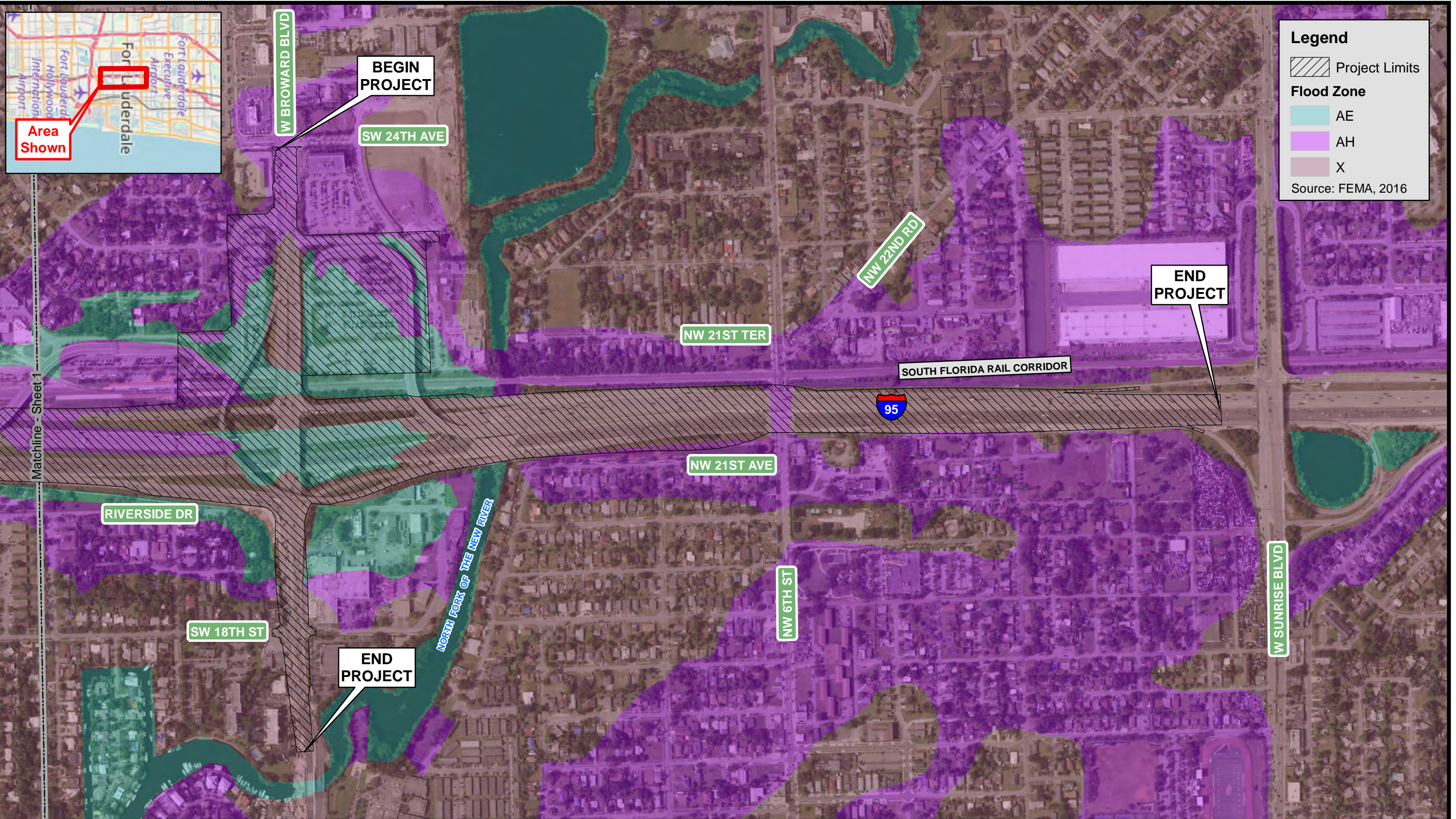


Figure 7
 Flood Zone Location Map



Florida Department of Transportation
 I-95 at Broward Blvd PD&E Study
 ETDM # 14226
 FM # 435513-1-22-02
 Broward County, Florida

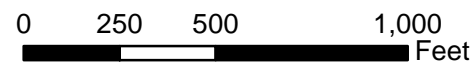


Figure 7
 Flood Zone Location Map

ATTACHMENT D
Floodplain Calculations

I-95 at Broward Boulevard Interchange PD&E Study DRAINAGE CALCULATIONS

Floodplain Calculations

Area A1			
Floodplain Zone AE - Floodplain Elevation =		12.00	ft. NAVD
Average Ground Elevation =		9.00	ft. NAVD
Average Depth (FT)	Depth (YD)	Encroachment Area (SY)	Encroachment Volume (CY)
3.00	1.00	2889.48	2889.48

Area A2			
Floodplain Zone AE - Floodplain Elevation =		10.00	ft. NAVD
Average Ground Elevation =		8.50	ft. NAVD
Average Depth (FT)	Depth (YD)	Encroachment Area (SY)	Encroachment Volume (CY)
1.50	0.50	1539.12	769.56

Area A3			
Floodplain Zone AH - Floodplain Elevation =		7.00	ft. NAVD
Average Ground Elevation =		6.50	ft. NAVD
Average Depth (FT)	Depth (YD)	Encroachment Area (SY)	Encroachment Volume (CY)
0.50	0.17	2783.00	463.83

Area A4			
Floodplain Zone AE - Floodplain Elevation =		11.00	ft. NAVD
Average Ground Elevation =		6.00	ft. NAVD
Average Depth (FT)	Depth (YD)	Encroachment Area (SY)	Encroachment Volume (CY)
5.00	1.67	4772.24	7953.73

Area A5			
Floodplain Zone AH - Floodplain Elevation =		8.00	ft. NAVD
Average Ground Elevation =		6.00	ft. NAVD
Average Depth (FT)	Depth (YD)	Encroachment Area (SY)	Encroachment Volume (CY)
2.00	0.67	6534.00	4356.00

Total Encroachment Volume (CY) - Floodplain Zone AE =	11612.77
Total Encroachment Volume (CY) - Floodplain Zone AH =	4819.83
Total Encroachment Volume (CY) =	16432.61

System 16A				
Compensation Volume (Ponds)		Compensation Volume (French Drain)		Total Compensation Volume
Ac-ft	CY	Ac-ft	CY	CY
9.19	14826.53	-	-	14826.53

System 16B				
Compensation Volume (Ponds)		Compensation Volume (French Drain)		Total Compensation Volume
Ac-ft	CY	Ac-ft	CY	CY
4.64	7485.87	0.29	467.87	7953.73

System 17				
Compensation Volume (Ponds)		Compensation Volume (French Drain)		Total Compensation Volume
Ac-ft	CY	Ac-ft	CY	CY
4.34	7001.87	-	-	7001.87

Broward Blvd and Park and Ride				
Compensation Volume (Ponds)		Compensation Volume (French Drain)		Total Compensation Volume
Ac-ft	CY	Ac-ft	CY	CY
0.98	1581.07	3.35	5404.67	6985.73

Total Compensation Volume (CY) - Ponds =	30895.33
Total Compensation Volume (CY) - French Drain =	5872.53
Total Compensation Volume (CY) =	36767.87

* Refer to Figure 7 - Flood Zone Map in the Drainage Report