Location Hydraulics Memorandum

State Road 869 / SW 10th Street Connector

Project Development and Environment (PD&E) Study

SW 10th Street from Florida's Turnpike / Sawgrass Expressway to I-95 (SR 869/Sawgrass Expressway MP 21.077 to MP 21.835 and SW 10th Street MP 0.00 to 1.427)

ETDM No.: 14291 / FAP No.: TBD

Financial Project ID No. 439891-1-22-02

Broward County, Florida

Prepared for:
FDOT District Four
3400 W. Commercial Blvd.
Ft. Lauderdale, FL 33309

January 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 the Florida Department of Transportation (FDOT) pursuant to 23 U.S.C. §327 and a Memorandum of Understanding dated December 14, 2016 and executed by the Federal Highway Administration and FDOT.

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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 SW 10th Street Connector 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.

PROJECT OVERVIEW

The SW 10th Street Connector PD&E Study is located in the City of Deerfield Beach, Florida, and the limits extend from west of SR 845/Powerline Road to west of Military Trail within the existing SW 10th Street right-of-way, approximately from milepost 21.077 to milepost 21.835 (Roadway ID 86472000) and from milepost 0.000 to milepost 1.400 (Roadway ID 86012000). The project falls within Sections 2, 3, 4, 9, 10 and 11 of Township 48 South and Range 42 East. For the limits of this PD&E study, please refer to **Appendix A – Project Location Map**.

The existing typical section along SW 10th Street consists of a four-lane divided suburban roadway with raised curbed median, 12-foot travel lanes, 5-foot paved shoulders, and sidewalk along the south side. The existing typical section widens to a six-lane divided roadway at the eastern and western limits of the project, adjacent to connections with Powerline Road and Military Trail.

The proposed typical section for SR 869/SW 10th Street within the PD&E study limits provides a four-lane divided urban principal arterial for the general purpose lanes, with raised curbed median, 11-foot travel lanes, 5-foot paved shoulders, and sidewalk along the south side. In the eastbound direction, 7-foot bicycle lanes are proposed from Waterways Boulevard to the end project limits. In the westbound direction, the bicycle lanes are shared-use with the outside shoulder from Powerline Road to the end project limits. The proposed typical section widens to a six-lane divided urban roadway at the eastern and western study limits,

adjacent to connections with Powerline Road and Military Trail as in the existing condition. The proposed managed lanes provide 100.5 feet of new impervious width, consisting of four 12-foot lanes, two 12-foot inside shoulders, two 12-foot outside shoulders, a two-foot median concrete barrier wall, and two 1.25-foot barrier walls on the outside.

The project lies within the jurisdiction of the South Florida Water Management District (SFWMD) and the Broward County Environmental Protection and Growth Management Department (BCEPGMD). The project lies within the SFWMD Hillsboro Canal Drainage Basin and the Broward County Water Control District (BCWCD #2) C-2 and C-3 Canal Basins. The receiving waterbody between the Florida's Turnpike/Sawgrass Expressway and Powerline Road is the C-3 Canal which crosses SW 10th Street via culverts. The C-3 Canal receives runoff from the watershed area bounded by the Hillsboro Canal to the north, Florida's Turnpike to the west, SR-834/Sample Road to the south and Powerline Road to the east. The receiving waterbody between Powerline Road and east of Military Trail is the C-2 Canal which crosses SW 10th Street via culverts. The C-2 Canal receives runoff from the watershed area bounded by the Hillsboro Canal to the north, Military Trail to the east, SR-834/Sample Road to the south and Powerline Road to the west.

The existing drainage within the PD&E study corridor limits consists primarily of an open swale system that collects and retains roadway runoff, with minimal overflow discharge to the BCWCD #2 C-2 and C-3 Canals. The existing drainage within the project limits can be divided into two distinct systems, which are then subdivided into several sub-basins based on existing collection and conveyance systems, interconnected stormwater management facilities, and outfalls. Between the Florida Turnpike/Sawgrass Expressway and Powerline Road, roadway runoff from SW 10th Street eastbound is primarily retained within grassed swales and conveyed to the grassed swales along the westbound corridor, while runoff from SW 10th Street westbound is accommodated in wide grassed swales before overtopping into the C-3 Canal. Between Powerline Road and Military Trail, roadway runoff from SW 10th Street eastbound is primarily retained within wide grassed swales, while runoff from SW 10th Street westbound is accommodated in narrow grassed swales before overtopping into adjacent Century Village parking lots during larger storm events. There is no history of flooding within the existing facilities and the additional runoff from the proposed roadway improvements will be attenuated with additional compensation volume within the proposed stormwater facilities.

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. FIRM Community Panel Numbers 12011C0166H and 12011C0167H, indicate that much of the project limits are within the 100-year flood zone, Zone AH (EL. 13.00 ft.-NAVD and EL. 14.00 ft.-NAVD) and the encroachment due to the roadway improvements will be longitudinal since the flood zone is within the existing right-of-way and parallel with the existing alignment. Zone AH is a special flood hazard area, subject to inundation by the 100-year flood that experiences flood depths of one to three feet (which are usually areas of ponding) with determined

based flood elevations. Please refer to **Appendix B – FEMA Firmettes** and **Appendix C – Floodplain Location Map**.

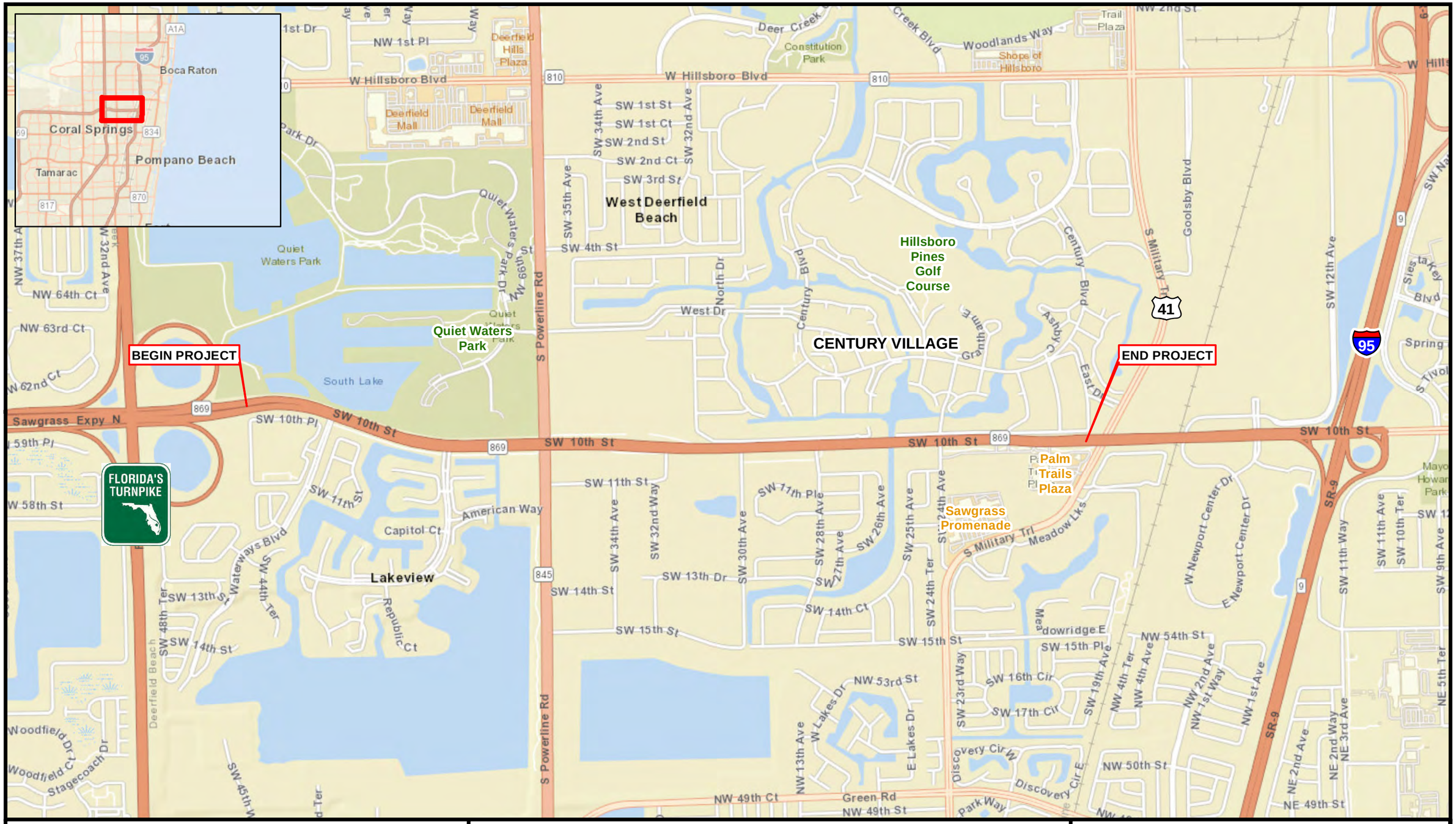
There are no regulatory floodways within the PD&E Study project limits and therefore no impacts to regulatory floodways are anticipated as a result of this project.

RISK ASSESSMENT

The project will result only in minimal encroachments to floodplains. These encroachments will be constrained to the limits described above and as shown on **Appendix 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 **Appendix 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.

APPENDIX A
Project Location Map



Florida Department of Transportation
SW 10th Street Connector PD&E Study
from West of Powerline Road to West of Military Trail
FM # 439891-1-22-02
Broward County, Florida

0 500 1,000 2,000 Feet

Figure 1
Project Location Map

APPENDIX 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 bouncaries. 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, NINGS12
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.

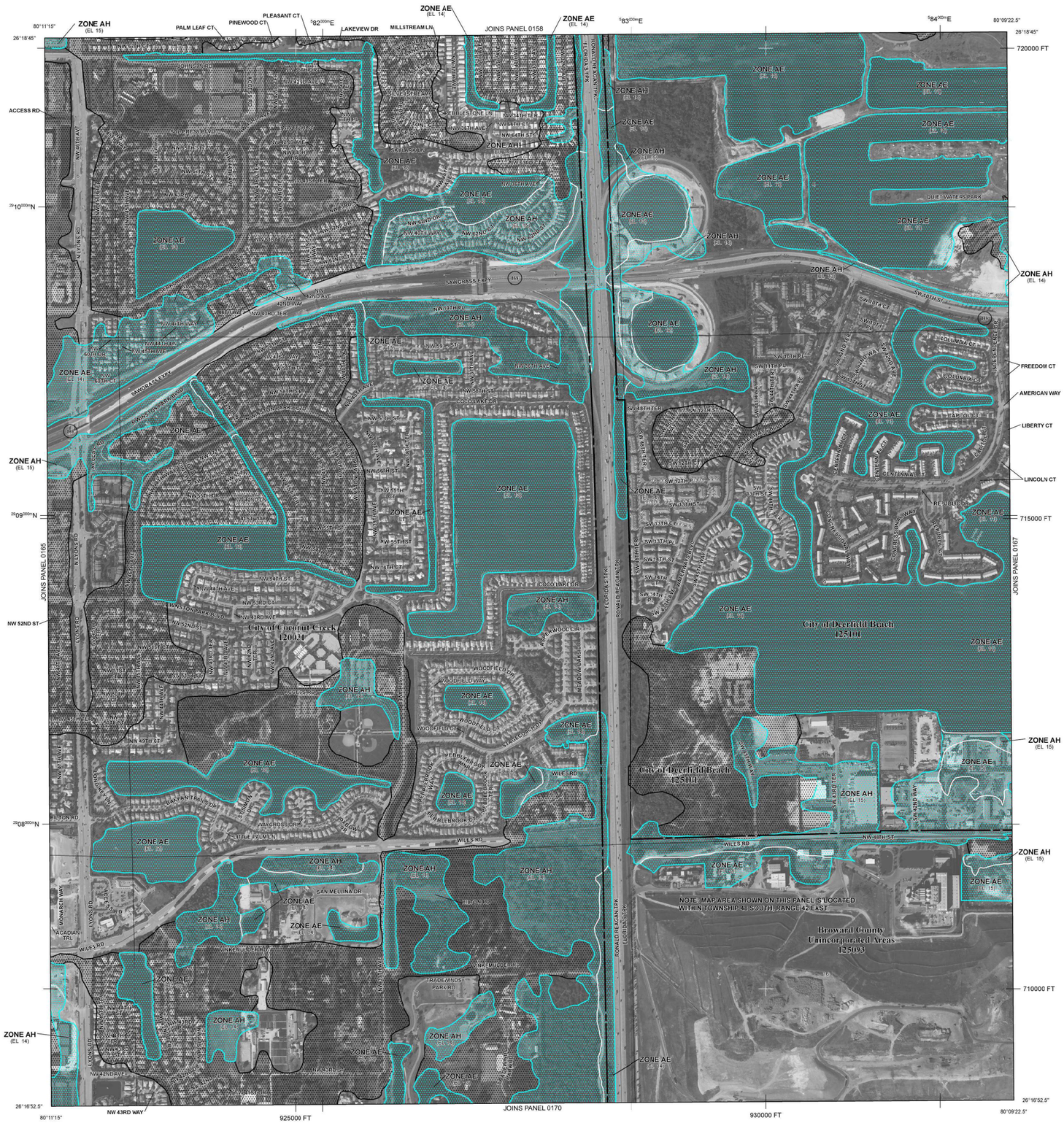
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, 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
513 — 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
A — A — Cross section line
23 — 23 — Transect line
97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
4°75'000"E — 1000-meter Universal Transverse Mercator grid ticks, zone 17
6000000 FT — 5000-foot grid values: Florida State Plane coordinate system, East Zone (FIPSZONE = 0901), Transverse Mercator projection
DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 — River Mile

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

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MAP SCALE 1" = 500'

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

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0166H

FIRM

FLOOD INSURANCE RATE MAP
BROWARD COUNTY, FLORIDA
AND INCORPORATED AREAS

PANEL 166 OF 751
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BROWARD COUNTY	125093	0166	H
COCONUT CREEK, CITY OF	120031	0166	H
DEERFIELD BEACH, CITY OF	125101	0166	H

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MAP NUMBER
12011C0166H

EFFECTIVE DATE
AUGUST 18, 2014

Federal Emergency Management Agency

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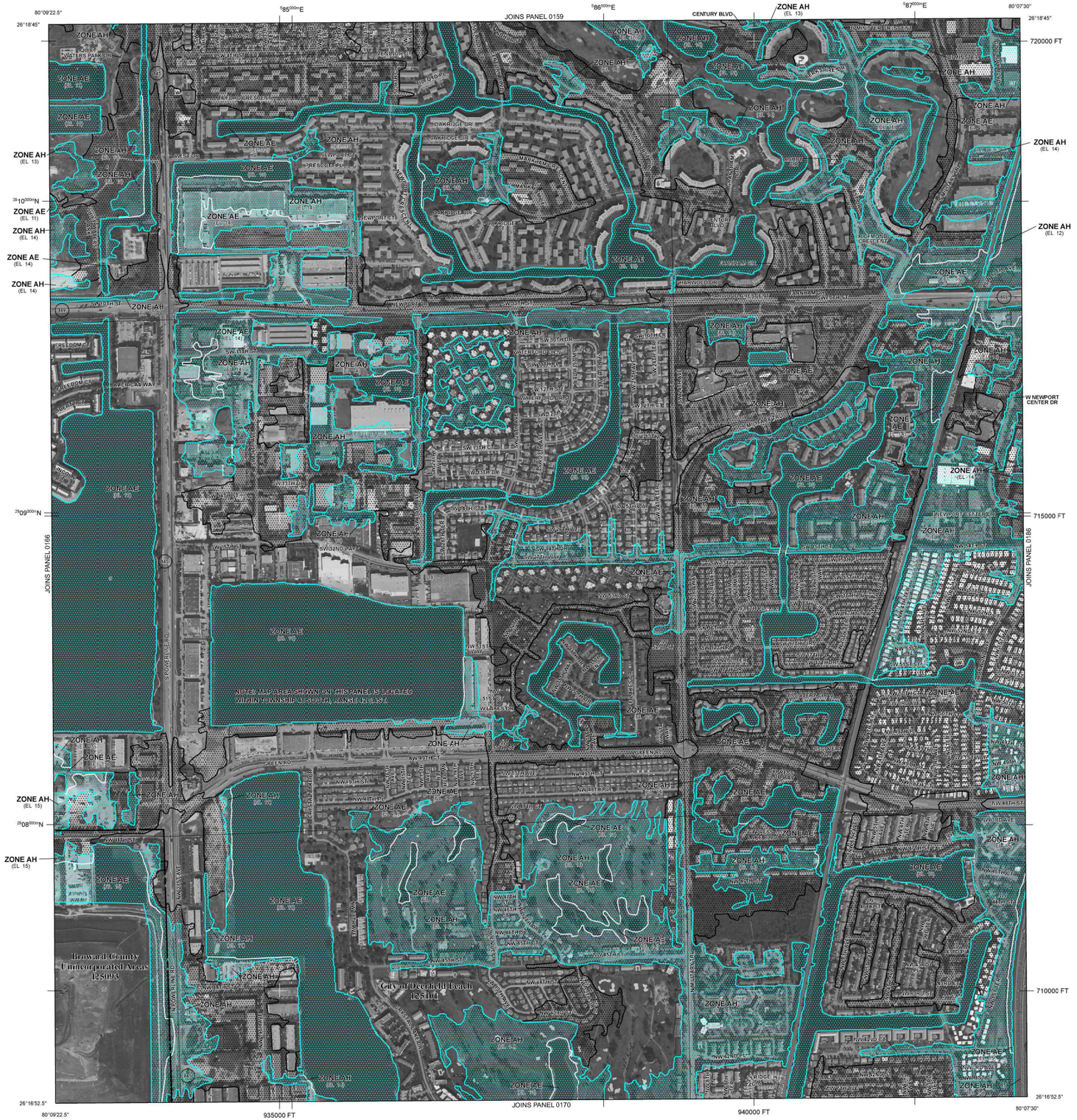

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	CBRS and OPA boundary
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M1.5	River Mile

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

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

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

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0167H

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

PANEL 167 OF 751
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BROWARD COUNTY	125093	0167	H
DEERFIELD BEACH, CITY OF	125101	0167	H

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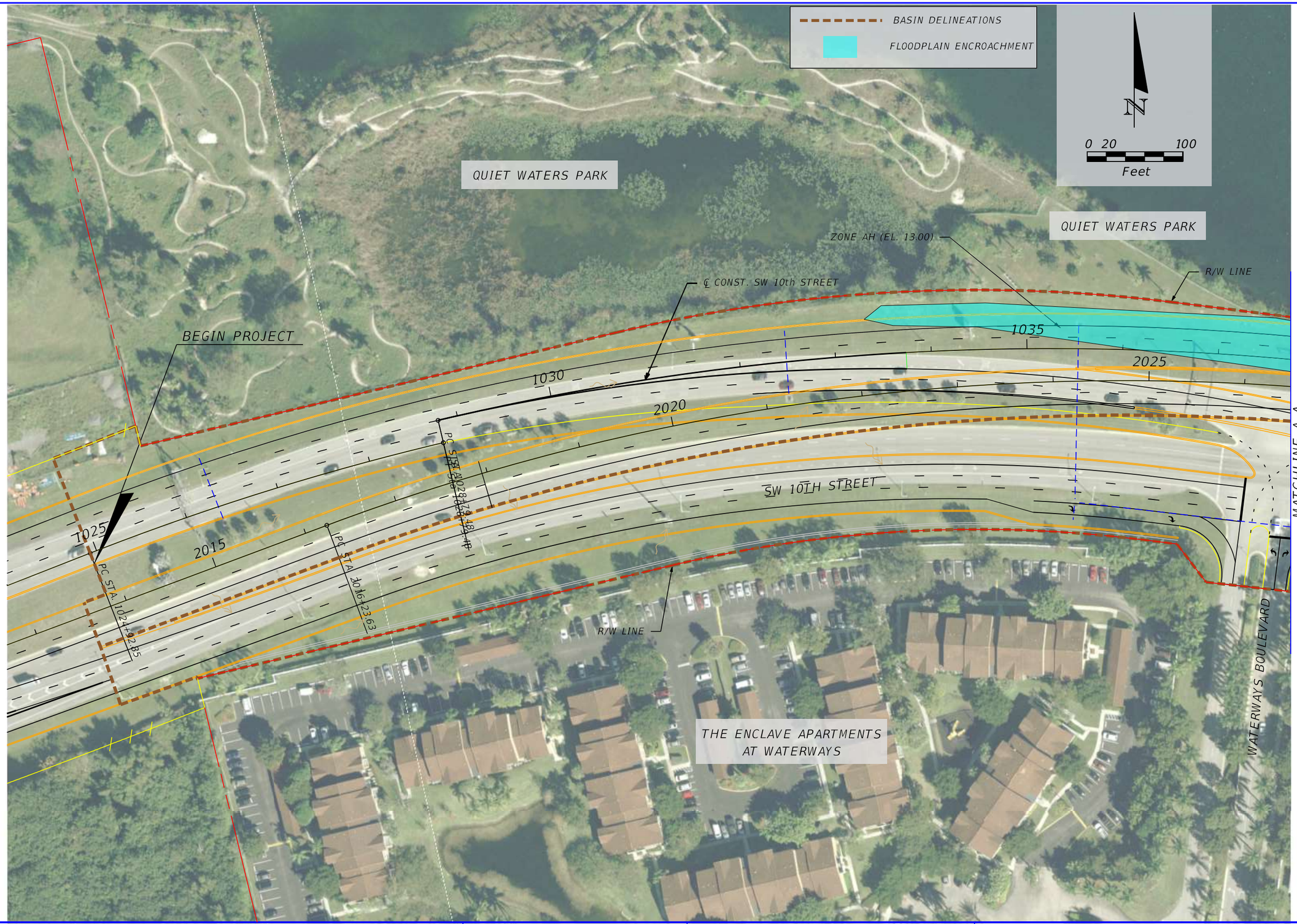
MAP NUMBER
12011C0167H

EFFECTIVE DATE
AUGUST 18, 2014

Federal Emergency Management Agency

APPENDIX C
FEMA Floodplain Encroachment Map



THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

RS&H, Inc.
3125 W. Commercial Blvd. - Suite 130
Fort Lauderdale, Florida 33309-3446
954-474-3005
FL Cert. No. EB0005620
Christian B. Jackson, P.E. No. 61898

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
869	BROWARD	439891-1-52-01

FEMA FLOODPLAIN ENCROACHMENT MAPS

SHEET NO. 1

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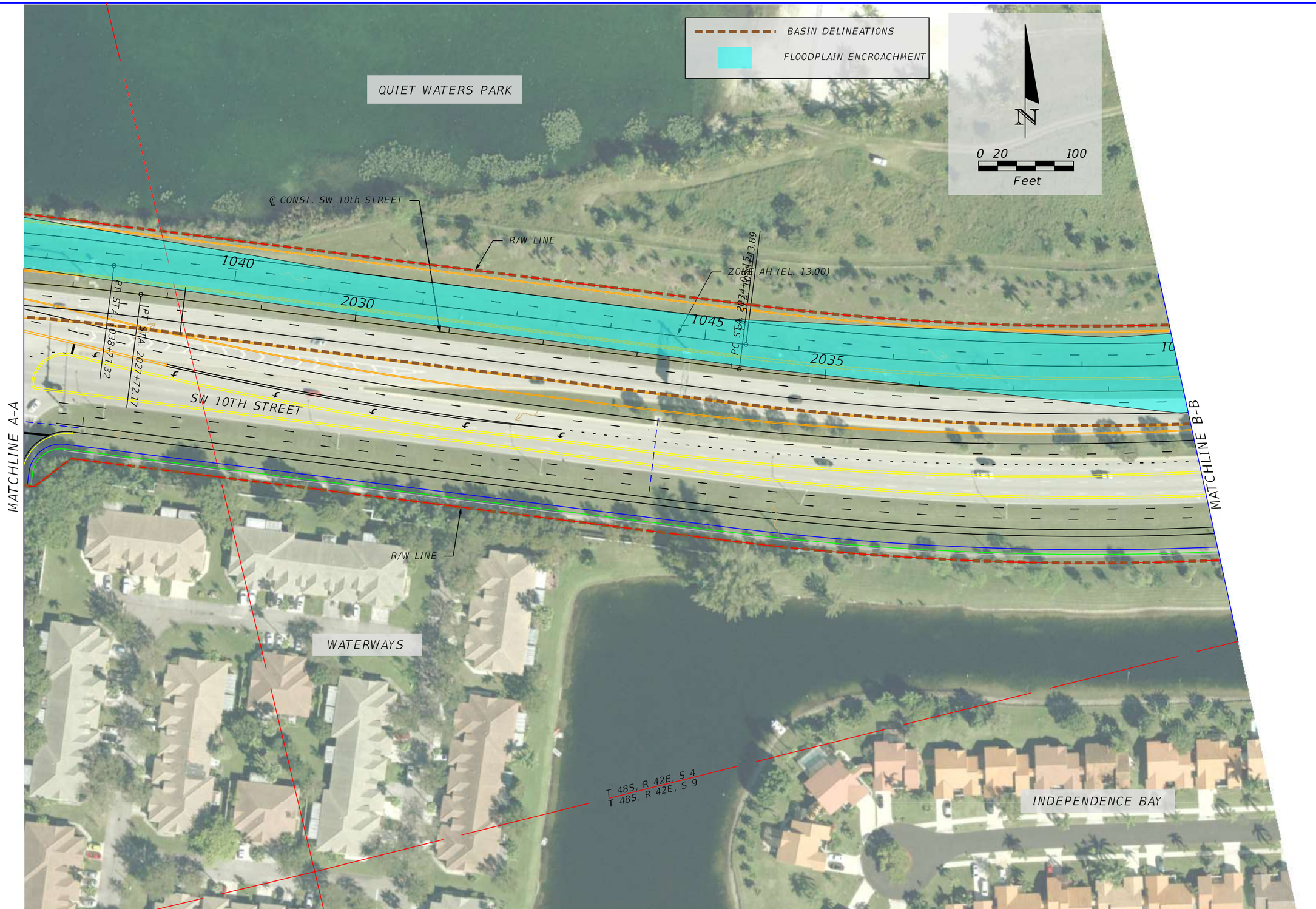

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954-474-3005
FL Cert. No. EB0005620
Christian B. Jackson, P.E. No. 61898

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
869	BROWARD	439891-1-52-01

FEMA FLOODPLAIN ENCROACHMENT MAPS

SHEET NO. 2

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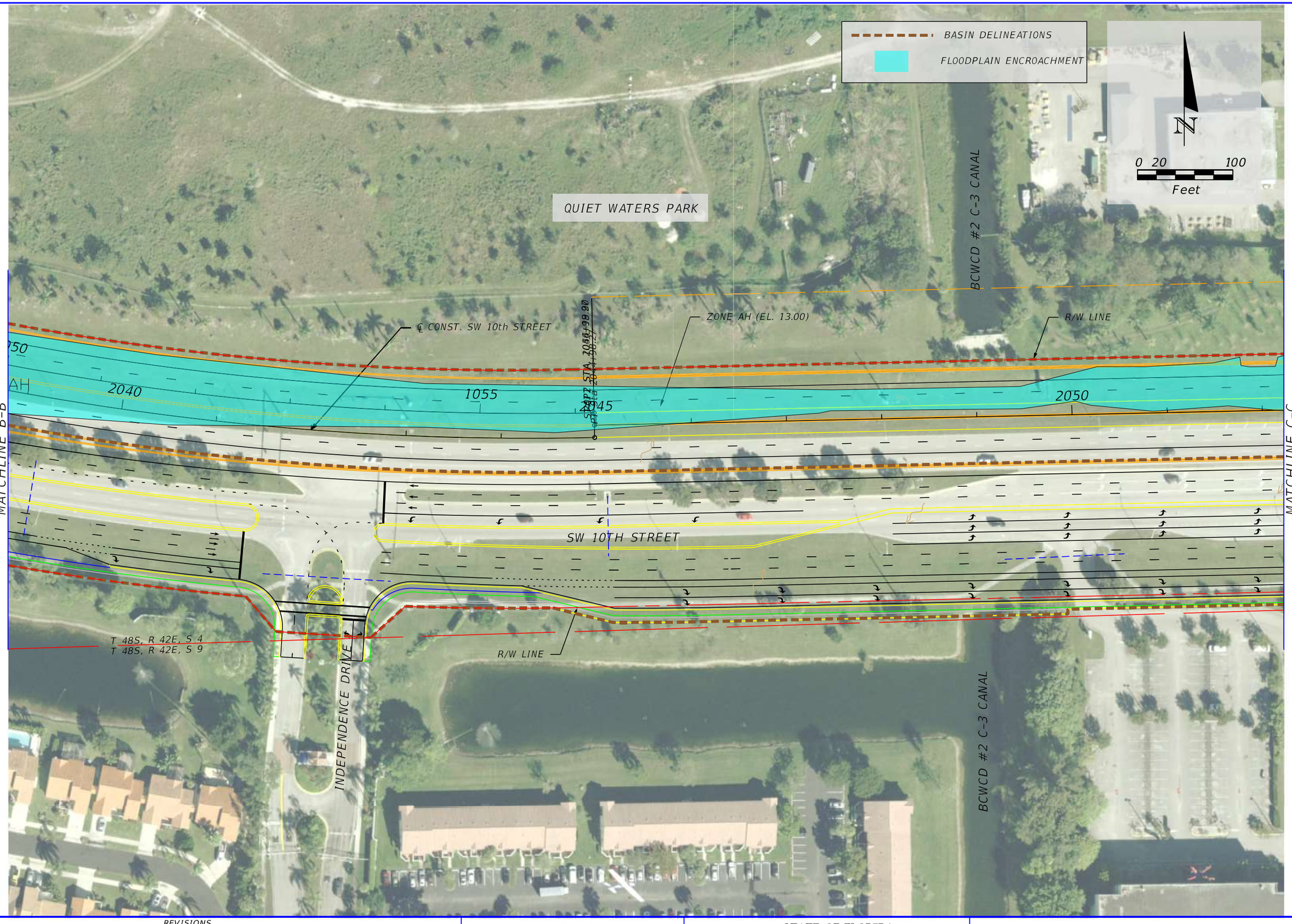

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DEPARTMENT OF TRANSPORTATION

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869	BROWARD	439891-1-52-01

FEMA FLOODPLAIN ENCROACHMENT MAPS

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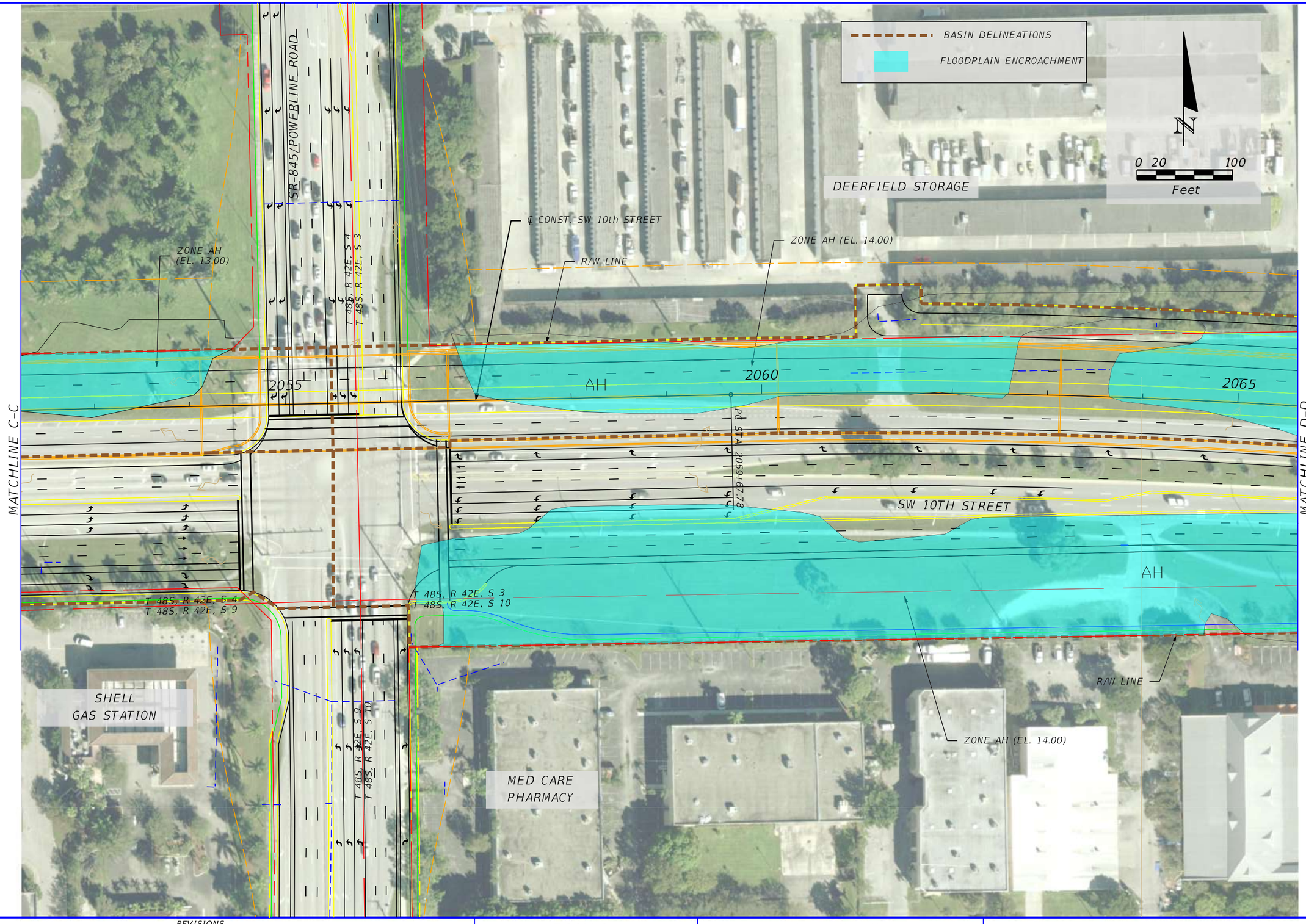

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FEMA FLOODPLAIN ENCROACHMENT MAPS

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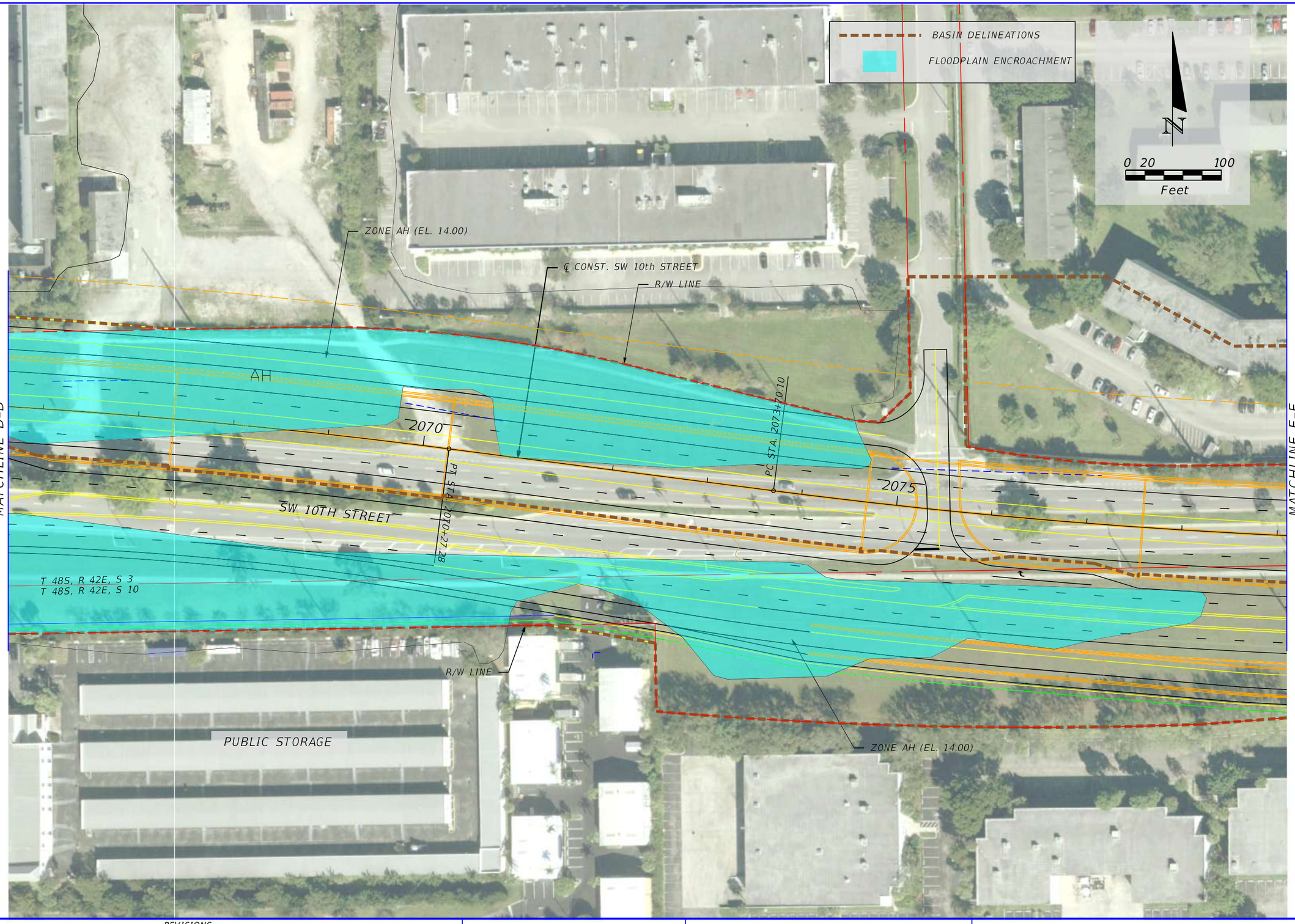

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FEMA FLOODPLAIN ENCROACHMENT MAPS

SHEET NO. 5

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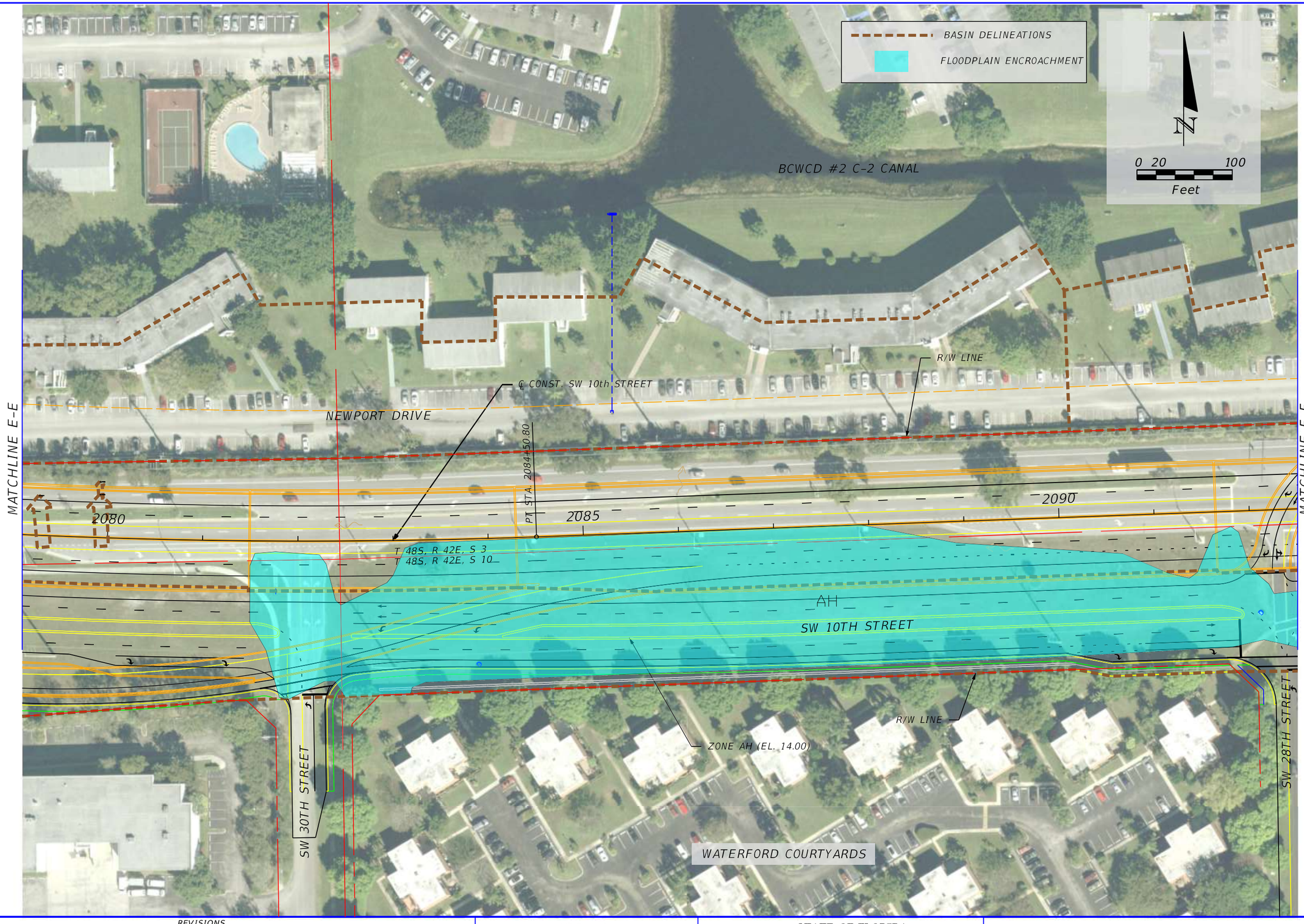

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FEMA FLOODPLAIN ENCROACHMENT MAPS

SHEET NO. 6

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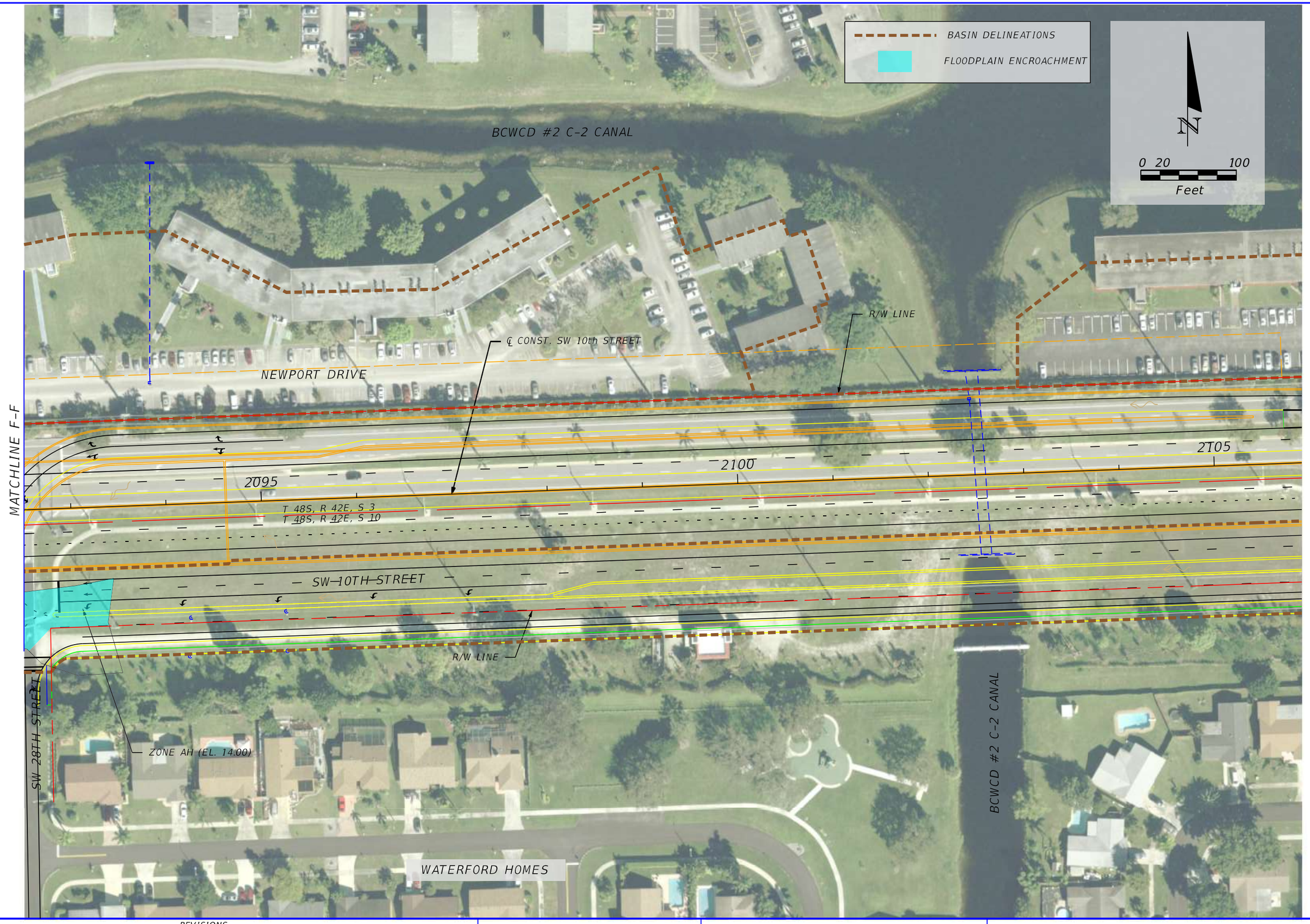

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DEPARTMENT OF TRANSPORTATION

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FEMA FLOODPLAIN ENCROACHMENT MAPS

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APPENDIX D
Floodplain Calculations

SR 869/SW 10th Street Connector PD&E Study Drainage Calculations

Floodplain Calculations

Zone 1 - Turnpike/Sawgrass Expressway to Powerline Road			
Floodplain Zone AH - Floodplain Elevation =	**13.00**	ft. NAVD	
Existing Average Ground Elevation =	**12.00**	ft. NAVD	
Average Depth (FT)	**Depth (YD)**	**Encroachment Area (SY)**	**Encroachment Volume (CY)**
1.00	0.33	17,182.00	**5,727.33**

Proposed Pond				
Compensation Volume (Ponds)		**Compensation Volume (French Drain)**		**Total Compensation Volume**
Ac-ft	**CY**	**Ac-ft**	**CY**	**CY**
27.79	**44,834.53**	-	**-**	**44,834.53**

Zone 2 - Powerline Road to SW 30th Street			
Floodplain Zone AH - Floodplain Elevation =	**14.00**	ft. NAVD	
Existing Average Ground Elevation =	**12.50**	ft. NAVD	
Average Depth (FT)	**Depth (YD)**	**Encroachment Area (SY)**	**Encroachment Volume (CY)**
1.50	0.50	39,107.20	**19,553.60**

Proposed Pond				
Compensation Volume (Ponds)		**Compensation Volume (French Drain)**		**Total Compensation Volume**
Ac-ft	**CY**	**Ac-ft**	**CY**	**CY**
62.46	**100,768.80**	-	**-**	**100,768.80**

Zone 3 - SW 30th Street to Military Trail			
Floodplain Zone AH - Floodplain Elevation =	**14.00**	ft. NAVD	
Existing Average Ground Elevation =	**12.50**	ft. NAVD	
Average Depth (FT)	**Depth (YD)**	**Encroachment Area (SY)**	**Encroachment Volume (CY)**
1.50	0.50	15,972.00	**7,986.00**

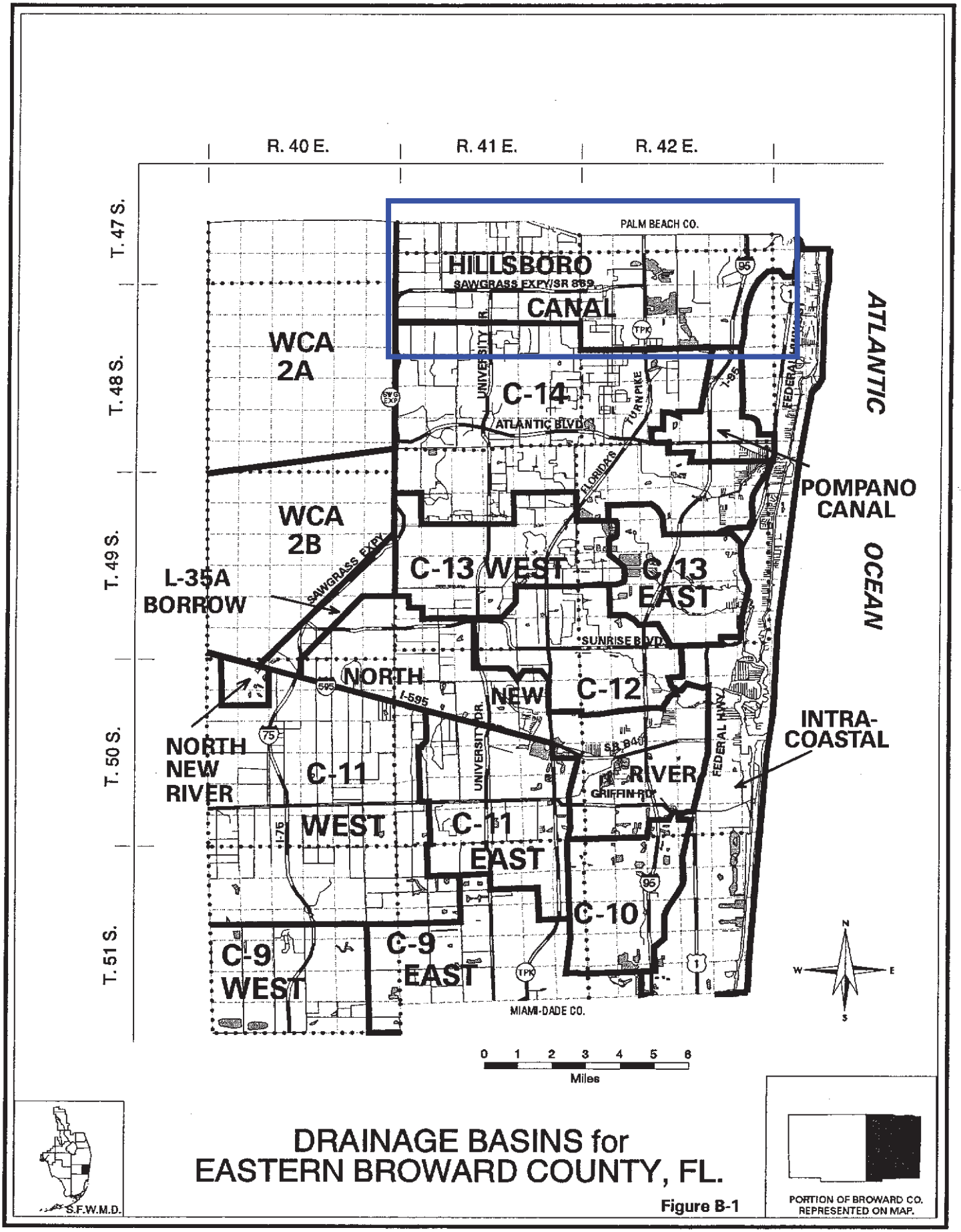
Total Encroachment Volume (CY) - Floodplain Zone AH =	**33,267**

Total Compensation Volume (CY) - Ponds =	**145,603**

* Refer to Appendix C - FEMA Floodplain Encroachment Map in the Location Hydraulics Memorandum

Compensation > Encroachment	=	**yes**
Surplus Compensation (CY)	=	**112,336**

APPENDIX E
SFWMD Drainage Basin Map



DRAINAGE BASINS for EASTERN BROWARD COUNTY, FL.

Figure B-1