LOCATION HYDRAULICS REPORT

Florida Department of Transportation
District Five

I-75 (S.R.93)
from South of S.R. 44 to S.R. 200
Sumter County, Florida

Financial Management Number: 452074-2

ETDM Number: 14541

April 2024

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 USC § 327 and a Memorandum of Understanding dated May 26, 2022, and executed by the Federal Highway Administration and FDOT.

I-75

S.R. 44 TO S.R. 200

Location Hydraulics Report

Marion and Sumter Counties

April 2024

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FDOT

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I am a registered professional engineer in the State of Florida practicing engineering with Burgess & Niple, Inc. and that I have supervised the preparation of and approve the analysis, findings, opinions, conclusions, and technical advice hereby reported for:

PROJECT: Interstate 75 (I-75) from South of State Road (S.R.) 44 to S.R. 200

ETDM Number: 14541

Financial Project ID: 452074-2

Federal Aid Project Number: N/A

PROJECT DOCUMENT: Location Hydraulics Report

This location hydraulics report contains engineering information that fulfills the purpose and need for the I-75 Project Development & Environment Study for the Southern Section of I-75 beginning South of S.R. 44 and extending north to S.R. 200. I acknowledge that the procedures and references used to develop the results contained in this report are standard to the professional practice of transportation engineering as applied through professional judgment and experience.

I hereby certify that I am a registered professional engineer in the State of Florida practicing with Burgess & Niple, Inc., and that I have prepared or approved the evaluation, findings, opinions, conclusions, or technical advice for this project.

This item has been digitally signed and sealed by Carlton D. Spirio, Jr., P.E. on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed.

Burgess & Niple, Inc.
1511 North Westshore Boulevard, Suite 500
Tampa, Florida 33607
Carlton D. Spirio, Jr.
PE No. 47649

Table of Contents

1.0 Introduction

The purpose for this Location Hydraulics Report (LHR), which is required by **23 CFR Part 650A**, is to support all of the PD&E Study efforts being developed to analyze the proposed roadway improvements for I-75 between S.R. 44 and S.R. 200. Similarly, this report is intended to document the evaluation and identification all of floodplain involvement within and adjacent to this portion of I-75 in compliance with the Part 2, Chapter 13 Floodplains, of the Project Development and Environmental Manual. Overall, this report will summarize the parameters used to assess the level of analysis in determining the significance of the involvement produced by the proposed roadway improvements to the existing designated floodplains throughout the project limits.

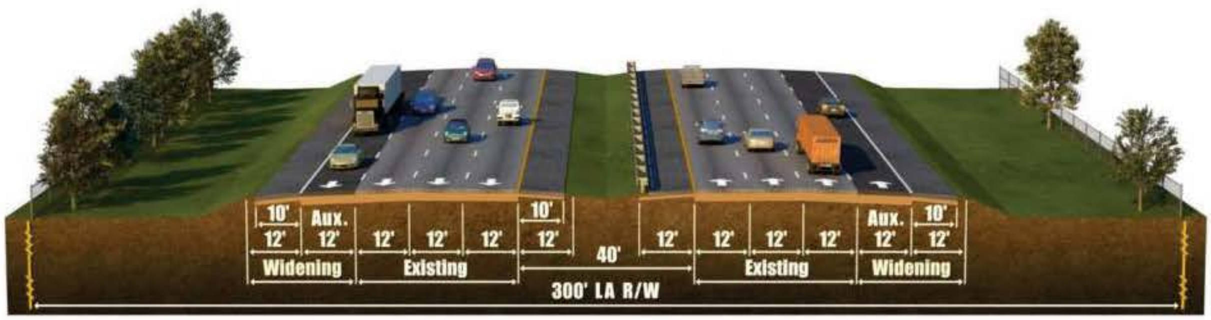
This project area has been divided into 33 drainage basins based on the overland topography and other features that influence the drainage patterns throughout this portion of I-75. The project corridor crosses the jurisdictional limits for both the St. Johns River and Southwest Florida Water Management Districts. The southern drainage basins, Basins 0 through 8, are within Sumter County, which is part of the jurisdictional limits for the Southwest Florida Water Management District (SWFWMD). The remainder of the drainage basins, Basins 9 through 33, are in Marion County. The I-75 corridor in Marion County serves as the boundary between the jurisdictional limits for both the St. John River Water Management District (SJRWMD) and the Southwest Florida Water Management District (SWFWMD). There are no Impaired Water Bodies nor Outstanding Florida Waters (OFWs) directly associated with the waterbodies that cross through this portion of I-75; however, Lake Panasoffkee is a designated OFW downstream of the I-75 Turnpike interchange area.

2.0 Existing Roadway Conditions

The existing I-75 corridor roadway typical section consists of a six (6) lane divided high speed roadway with three (3) travel lanes in both the northbound and southbound directions. Much of the stormwater runoff is collected within grassed swales/ditches outside of the travel lanes and within the median. These swales/ditches collect and convey roadway and offsite drainage to the numerous cross drains and outfall locations throughout the project limits. Similarly, there are intermittent piped drainage systems that are associated with both shoulder gutter roadway sections and within sections of the median that do not meet minimum width criteria. Several sections of the outside roadway swales/ditches are permitted linear stormwater management facilities to address water quality for previous roadway improvements. The proposed roadway improvements will impact these facilities and will be mitigated for in the proposed stormwater management facilities that are further addressed in the Pond Siting Report that accompanies the other reports and studies that have been developed as part of the NEPA documentation for this Interstate project.

3.0 Proposed Roadway Improvements

The proposed roadway improvements to I-75 will require new stormwater management controls to mitigate for the existing permitted systems and to address the roadway widening for the interim and ultimate roadway configurations.



As noted in the Figure above, the interim design approach is to construct new Auxiliary lanes that will begin at the interchange on-ramps and extend to the next interchange, where these lanes will become the off-ramp lanes. The ultimate roadway typical section for I-75 consists of 12-lanes, four (4) General Use lanes and two (2) Express Lanes in each direction. Stormwater runoff from the proposed roadway improvements will be collected and conveyed in both open and closed storm drain systems and routed to stormwater management facilities located throughout the I-75 corridor for treatment and attenuation. Offsite drainage patterns will remain unchanged and runoff that currently drains towards the FDOT right of way will be collected and conveyed by diversion ditches that preserve the existing drainage patterns and discharge to the existing receiving waterbodies, where feasible, otherwise, the offsite flow will be incorporated into the stormwater management system for the specific subbasin. Overall, both the stormwater management and offsite conveyance systems will be designed to preserve the historic drainage patterns throughout the project limits for the proposed improvements to I-75.

4.0 Existing Drainage Characteristics

The existing drainage for SR 93 (I-75) from south of SR 44 to SR 200 was assessed by conducting field reviews throughout the corridor and reviewing existing as-built plans and other available construction plans, Straight Line Diagrams (SLDs), Geographic Information System (GIS) maps, and Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs). Additionally, existing permit information was obtained from the Florida Department of Environmental Protection (FDEP), the St. John’s River Florida Water Management District (SJRWMD) and the Southwest Florida Water Management District (SWFWMD).

The project limits exist within two Florida counties, Sumter and Marion. Both counties are adjacent to and naturally drain into the Gulf of Mexico to the west. The topography within the project area ranges from relatively flat in Sumter County to rolling hills in Marion County. Elevations range from 45' to 65' within Sumter County and from 65' to 113' in Marion County. All elevations are referenced to North American Vertical Datum (NAVD88).

Drainage conveyance within the project limits is typically accomplished via open swales, both within the roadside areas and in the median. Stormwater runoff within the swales is conveyed downstream to historic receiving basins including cross drain locations and natural depressions. There are many cross drains, side drains and small closed storm drain systems that convey and discharge runoff into numerous outfalls. Some subbasins have multiple isolated depressions and outfalls within the primary basin. Therefore, runoff is stored locally until it percolates into the ground or stages high enough to pop-off into an adjacent sub-basin.

The roadside areas are also utilized for management of stormwater in accordance with water quality and water quantity requirements of the Water Management Districts and the Florida Department of Transportation. These stormwater management facilities were designed and permitted when the corridor was last widened from 4 to 6 lanes. Offsite stormwater facilities were also constructed whenever roadside areas were not physically capable of meeting minimum stormwater management requirements associated with the widening. A majority of the stormwater management facilities are designed to be dry retention facilities due to the well-drained soil conditions and the high number of closed drainage basins.

The land use within the southern project is primarily agriculture with some rural residential, industrial, commercial, mixed use, wooded and conservation. While the northern segment is mostly rural land on the east side of I-75 within significant portions of medium residential on the west side with scattered low residential, public and municipal, and some preservation lands.

4.1 Watersheds and Springsheds

Two primary watersheds exist within the limits of the project; the Withlacoochee River Watershed – which is regulated and managed by the Southwest Florida Water Management District (SWFWMD), and the Ocklawaha River Watershed – which is regulated and managed by the St. Johns River Water Management District (SJRWMD).

Withlacoochee River Watershed: From south of the Florida Turnpike Interchange, I-75 traverses through three of the Withlacoochee River Watershed's sub basins, also referred to as Water Basin ID's (WBID's). Those sub-basins include WBID #1344 – Little Johns Creek, WBID #1346 – Little Johns Creek and WBID #1324 – Big Jones Creek. These basins have no adopted Total Maximum Daily Loads (TMDLs) or verified impairments involving nutrients such as Total Nitrogen (TN) or Total Phosphorus (TP) and are, therefore, not designated as "impaired".

One water body in the vicinity of the project is classified as Outstanding Florida Waters (OFW); Lake Panasoffkee. The Lake Panasoffkee is located west of the I-75 / Florida Turnpike Interchange and south of SR 44; and is the receiving water body for the Little Jones Creek, which passes through the interchange.

Ocklawaha River Watershed: Beginning approximately 1000 feet south of the I-75 Rest Areas, the project enters the Ocklawaha River Watershed. From this point to the project end, north of the SR 200 interchange, I-75 is part of WBID #2772B – Silver River Drain. Similar to the WBID's to the south, the Silver River Drain is not designated as impaired, or is it an OFW.

Two major springsheds also exist within the project limits.

Silver Springs Springshed: Beginning north of SR 44, on the east side of I-75, is the southern limit of the Silver Springs Springshed. This designation continues north on the east side of I-75 to the project end. Silver Springs is listed as an Outstanding Florida Spring (OFS).

Rainbow Springs & Rainbow River Springshed: The Rainbow Springs & Rainbow River Springshed is identified on the west side of I-75. Its southern limits include the northern half of the project's Marion County segment. Rainbow Springs is a designated OFS.

Effective in June 2018, the Florida Department of Environmental Protection (FDEP) issued a final order establishing the Silver Springs, Rainbow Springs and Rainbow River as part of the "Silver and Rainbow Springs Best Management Action Plan" (BMAP). This BMAP establishes nutrient TMDLs for the impaired water basins, as authorized under the Florida Watershed Restoration Act and the Florida Springs and Aquifer Protection Act. Surface waters covered in the BMAP are Class III waters which are defined as suitable for recreational use and for the propagation and well-being of fish and wildlife.

5.0 Proposed Drainage

Efficient Transportation Decision Making: Both SWFWMD and SJRWMD participated in the Efficient Transportation Decision Making (ETDM) review process. Highlights of their review and evaluation of this project are summarized below.

Issue	SWFWMD	SJRWMD
Water Quality & Quantity	Recommend participating in BMAP activities	Anticipate interagency agreement
Floodplain	Recommend use of flood studies	No adverse impacts to floodplain
Special Designations	Lake Panasoffkee Wildlife Area OFW	Sensitive Karst Area

Design Criteria: Stormwater management design criteria required by both Agencies are uniquely different in regard to water quality treatment and water quantity attenuation. Their criteria are itemized below.

Design Element	SWFWMD	SJRWMD
Water Quality	Dry Retention: ½" over new impervious, 72-hour recovery Wet Detention: 1" over the new impervious	Dry Retention: 1" or 1.75" over impervious, 72-hour recovery Wet Detention: 1" or 2.5" over impervious
Water Quantity	Open Basin: 25-yr/24-hr peak discharge Closed Basin: 100-yr/24-hr retention vol	Open Basin: 25-yr/24-hr peak discharge Closed Basin: 25-yr/96-hr retention vol, 14-day recovery

5.1 Cross Drains

There are total of 36 cross drains within the proposed project limits. A List of these structures can be found in Appendix B, along with a Table showing the preliminary hydraulic analysis for these structures.

The following Table provides a general description of the 33 subbasins that have been delineated throughout the project limits. This Table also provides the watershed name, County and approximate stationing for each of the subbasin and cross drains.

Basin and Outfall Information

Basin No.	Basin Limits		Watershed	WMD	County	Outfall	
	From Station	To Station				Type	Station
0	1157+00	1189+65	Little Jones Creek	SWF	Sumter	36” CD	1158+50
1	1189+65	1217+80	Little Jones Creek	SWF	Sumter	18” CD	1202+00
2	1217+80	1253+50	Little Jones Creek	SWF	Sumter	24” CD	1234+00
3	1253+50	1307+80	Nicholas Pond	SWF	Sumter	24” CD	1290+02
4	1307+80	1342+00	Nicholas Pond	SWF	Sumter	24” CD	1316+10
5	1342+00	1371+00	Nicholas Pond	SWF	Sumter	(2) 24” CD	1352+27
6	1371+00	1416+00	Nicholas Pond	SWF	Sumter	24” CD	1385+53
7	1416+00	1472+80	Nicholas Pond	SWF	Sumter	(3) 24” CD	1460+51
8	1472+80	1512+00	Nicholas Pond	SWF	Sumter	30” CD	1488+23
9	1512+00	1464+00	Nicholas Pond	SJR	Marion	36” CD	1438+80
10	1464+00	1505+50	Nicholas Pond	SJR	Marion	24” CD	1473+00
11	1505+50	1545+00	Nicholas Pond	SJR	Marion	30” CD	1539+00
12	1545+00	1596+50	Nicholas Pond	SJR	Marion	30” CD	1588+00
13	1596+50	1642+50	Nicholas Pond	SJR	Marion	Ditch	1595+50
14	1642+50	1669+80	Gum Swamp	SJR	Marion	30” CD	1655+90
15	1669+80	1684+80	Gum Swamp	SJR	Marion	Wetland	1669+80
16	1684+80	1722+00	Gum Swamp	SJR	Marion	30” CD	1695+95
17	1722+00	1768+00	Gum Swamp	SJR	Marion	30” CD	1756+80
18	1768+00	1792+00	Gum Swamp	SJR	Marion	Wetland	1789+00
19	1792+00	1821+50	Cotton Plant	SJR	Marion	24” CD	1802+90
20	1821+50	1835+00	Cotton Plant	SJR	Marion	24” CD LP	1825+90
21	1835+00	1857+00	Cotton Plant	SJR	Marion	Unknown	1849+20
22	1857+00	1889+00	Cotton Plant	SJR	Marion	30” CD	1865+50
23	1889+00	1905+00	Cotton Plant	SJR	Marion	2-24” CD	1898+90
24	1905+00	1925+00	Cotton Plant	SJR	Marion	30” CD	1910+90
25	1925+00	1940+80	Cotton Plant	SJR	Marion	30” CD	1937+00
26	1940+80	1963+60	SR 200	SJR	Marion	Ditch	1954+95
27	1963+60	1993+00	SR 200	SJR	Marion	30” CD	1976+90
28	1993+00	2016+20	SR 200	SJR	Marion	24” CD	2001+50
29	2016+20	2043+00	SR 200	SJR	Marion	24” CD	2029+00
30	2043+00	2091+00	West Ocala	SJR	Marion	Depressional	2091+00
31	2091+00	2126+80	West Ocala	SJR	Marion	36” CD	2106+80
32	2126+80	2159+00	West Ocala	SJR	Marion	24” CD	2145+80

6.0 Floodplain Evaluation

The Federal Emergency Management Agency (FEMA) has designated locations of the 100-year base flood elevations (BFE's) within the project corridor. These floodplains are associated with the contributing drainage basins and surface water tributaries to the Withlacoochee River and to the Ocklawaha River. There are no regulatory floodways within the project limits. FEMA has approved Flood Insurance Studies (FIS's) and has authorized the issuance of Flood Insurance Rate Maps (FIRM's) for Sumter and Marion Counties. The FIRM's are listed below by Panel Number and issue date. Digital representation of the FIRM's published by FEMA are provided in Appendix C.

County	**Map No.**	**Effective Date**
Sumter	12119C0127D	9/26/2013
Sumter	12119C0064D	9/26/2013
Sumter	12119C0063D	9/26/2013
Sumter	12119C0061D	9/26/2013
Sumter	12119C0053D	9/26/2013
Marion	12083C0880D	8/28/2008
Marion	12083C0860D	8/28/2008
Marion	12083C0720D	8/28/2008
Marion	12083C0716E	4/19/2017
Marion	12083C0708E	4/19/2017
Marion	12083C0706E	4/19/2017
Marion	12083C0518E	4/19/2017

FEMA designates locations of floodplains by zones and are defined as follows.

Zone A: Special Flood Hazard Area without BFE

Zone AE: Special Flood Hazard Area with BFE

Zone C: Areas of Minimal Flood Hazard

Zone X: 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas less than one square mile

For the Interim Auxiliary Lane roadway typical section, all floodplain impacts will be mitigated for within the existing right-of-way through compensatory volume provided within the roadway ditches throughout the I-75 project corridor. Whereas the ultimate roadway typical section is expected to impact all designated floodplain areas identified within the I-75 right-of-way. The floodplain compensation will be sized to provide equivalent flood volumes in a "cup to cup" manner to ensure the existing impacts maintain the historic stages that exist throughout the corridor. All floodplain compensation will be accomplished within the preferred pond site alternatives associated with each encroachment. The anticipated floodplain impacts were estimated using the FEMA floodplain GIS layers and 2' contour maps, and volumes will be replaced by balancing cut/fill either within the R/W, or by the addition of equivalent compensatory volume within the proposed stormwater management facilities. The floodplain impacts are identified with “Cross Hatching” on the FEMA Floodplain/Soils Maps in Appendix C and summarized in the following table.

Estimated Floodplain Encroachments

Basin No.	Floodplain within R/W	Flood Zone	Base Flood Elevation (ft)	Floodplain Encroachment Area (ac)
0	No			
1	No			
2	Yes	A	56.0	0.02
3	Yes	A	58.0	0.13
4	No			
5	Yes	A	59.0	0.93
6	Yes	A	54.0	1.07
7	No			
8	Yes	A	57.0	0.86
9	No			
10	No			
11	No			
12	No			
13	No			
14	No			
15	No			
16	No			
17	Yes	A	54.0	0.63
18	Yes	A	54.0	0.53
19	No			
20	No			
21	Yes	AE	83.8	0.80
22	Yes	AE	81.3	0.18
23	Yes	AE	82.0	0.23
24	No			
25	Yes	AE	82.8	0.78
26	No			
27	No			
28	Yes	AE	67.5	1.05
29	No			
30	Yes	AE	76.8	1.16
31	Yes	AE	70.7	
32	Yes	AE	69.7	1.38

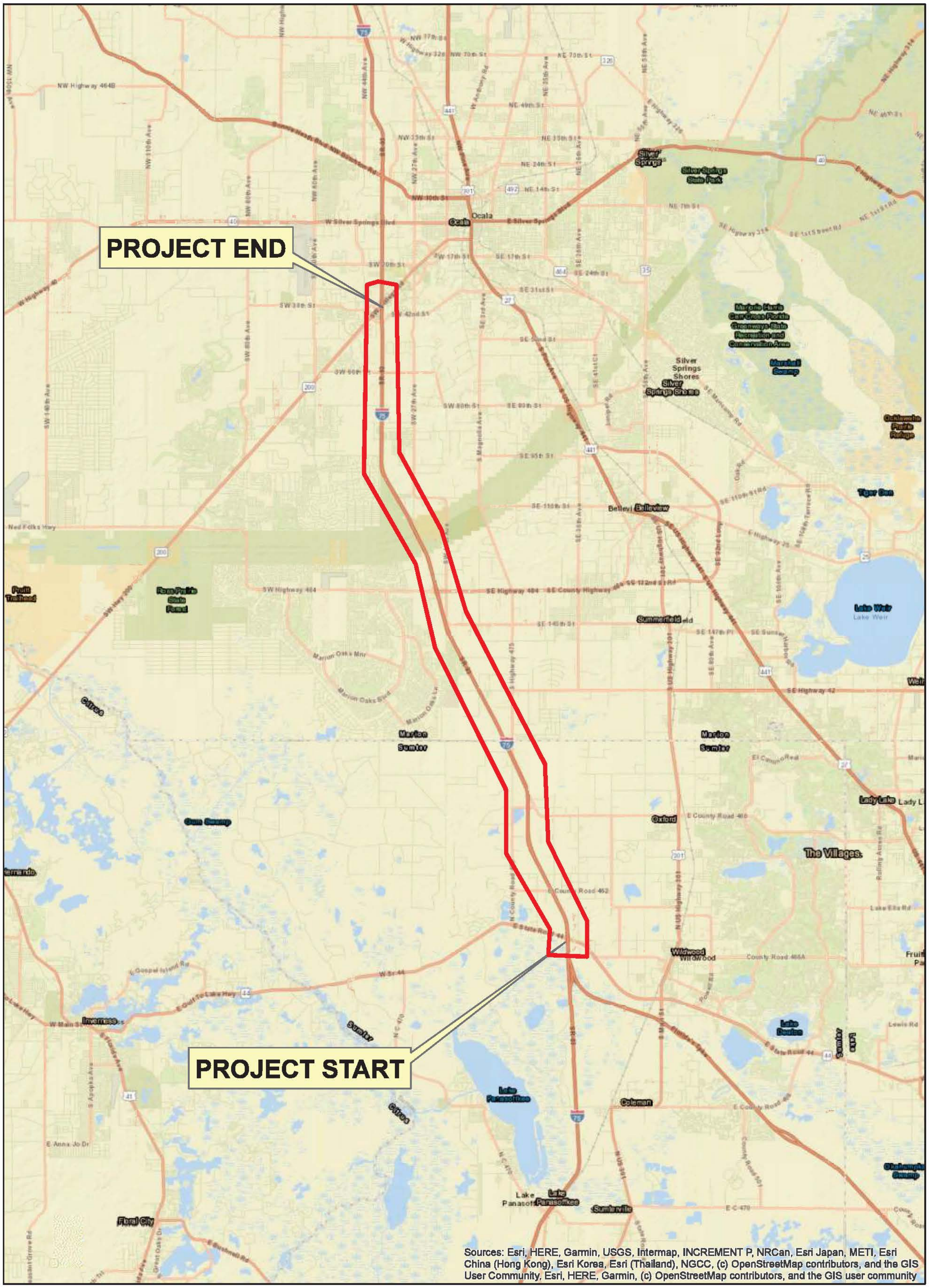
- Zone A base flood elevations are estimated based on GIS and topographic data.

Based on the preliminary floodplain analysis, there is one transverse crossing of the FEMA defined floodplain through the I-75 corridor between Stations 1485+00 and 1490+00. This crossing is associated with Cross Drain Structure #12, which is a 30-inch culvert located at Station 1486+20. This floodplain area is listed as a Zone A designation; however, there is no Base Flood Elevation attributed to this location. Based on our preliminary analysis, the modeled Base Floodplain Elevation appears to be approximately elevation 57.0-feet, NAVD. The designated floodplain limits published on the FEMA FIRM suggests that this designated floodplain encroaches onto the Interstate at elevation 60.7-feet, NAVD. The floodplain limits do not follow the existing contours within and adjacent to this area; therefore, the Flood Zone limits appear to be incorrectly represented for this transverse crossing. Similarly, we contacted the FDOT Maintenance Offices to inquire about flooding in and along this portion of I-75, and there were no overtopping records for any historic flooding associated with this cross drain. Additional watershed modeling of this crossing will be performed during the upcoming design phase to ensure the existing culvert size is adequate for the anticipated peak discharge rates for the 50-year, 100-year and 500-year design events.

7.0 Conclusions

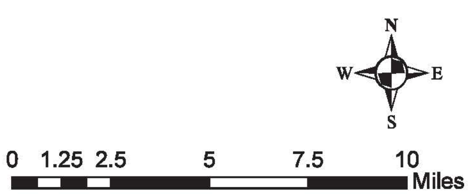
The proposed roadway improvements will impact several floodplains that extend within the existing I-75 right-of-way. Much of these impacts will be offset by the new roadway swales/ditches, new stormwater management ponds and floodplain compensation sites. The proposed roadway design will be developed to avoid and minimize the potential for impacts to the FEM designated floodplain that extend into the I-75 roadway right-of-way. Likewise, there are no regulatory floodways associated with this portion of I-75.

Modifications to existing drainage structures such as extending cross drains and median drains included in this project will result in an insignificant change in their capacity to convey stormwater runoff through the Interstate corridor during extreme weather events. All of the proposed modifications to the existing cross drains will cause minimal, if any, increases in flood heights and flood limits to these depressional areas. The proposed roadway and drainage improvements will be developed to prevent adverse impacts on the natural and beneficial floodplain values noted for the land uses adjacent to I-75. There will be no significant change in the potential for interruption or termination of emergency services or evacuations as the result of modifications to existing drainage structures. Finally, the proposed design approach for the roadway and drainage improvements to this portion of I-75 will not cause or create any significant changes to the flood risks, potential for overtopping nor changes to the existing flood stages on either side of I-75. Therefore, it has been determined that the anticipated encroachments onto the existing floodplain limits noted throughout this project are minimal and will not damage or pose a significant threat to the beneficial function provided by these systems.



I-75 FROM FLORIDA TURNPIKE TO SR 200

LOCATION MAP



APPENDIX

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Appendix A - Drainage Maps with Cross Drains

LEGEND

- PROPERTY LINE
- EXISTING BASIN DIVIDE
- EXISTING CROSS DRAIN
- WATERSHED BOUNDARY
- FLOW ARROW
- FEMA FLOOD PLAIN

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 93	SUMTER MARION	443623-1-22-01

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EXISTING CONDITIONS DRAINAGE MAP (1)

SHEET NO. 1

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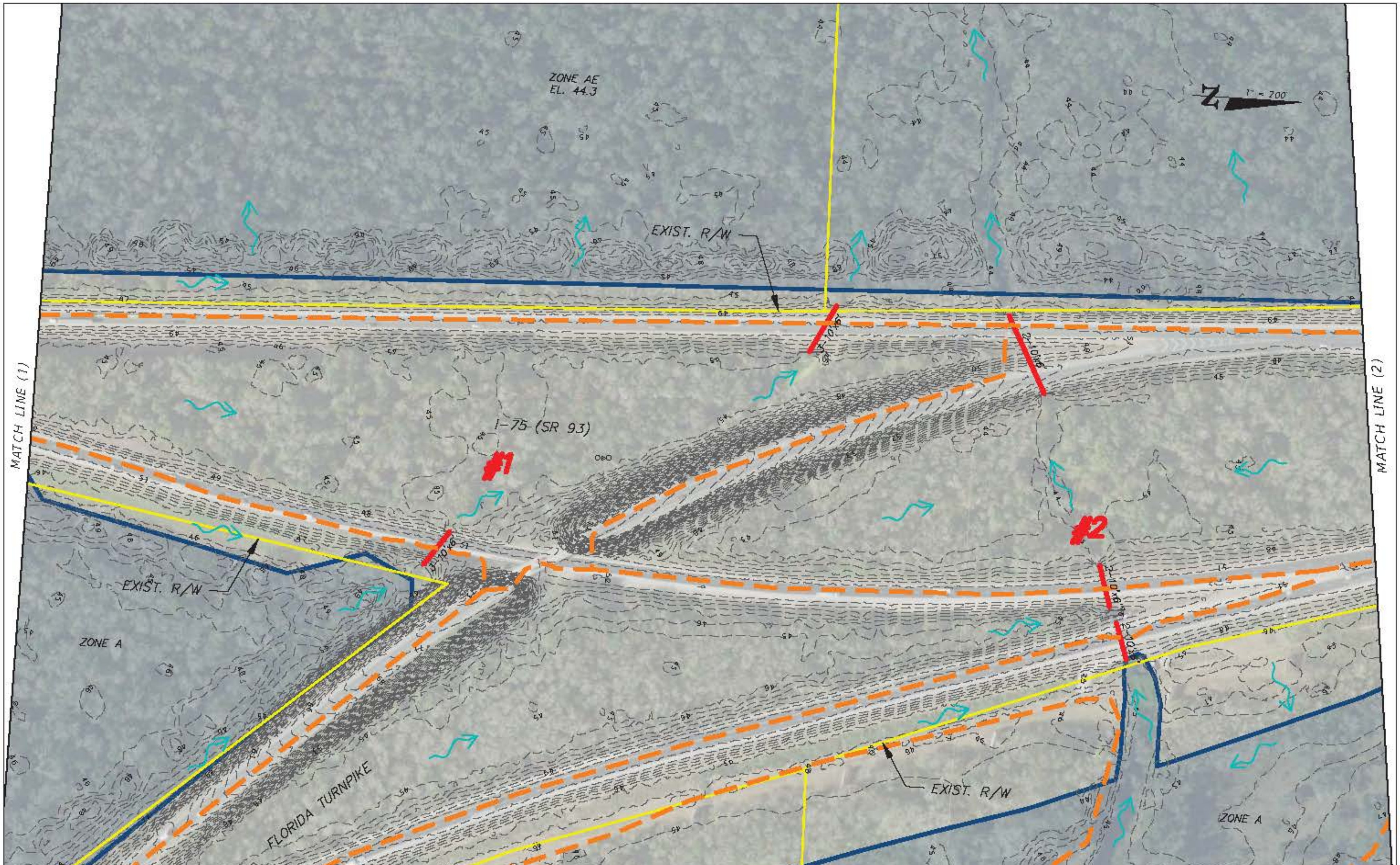

LEGEND		
PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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EXISTING CONDITIONS DRAINAGE MAP (2)

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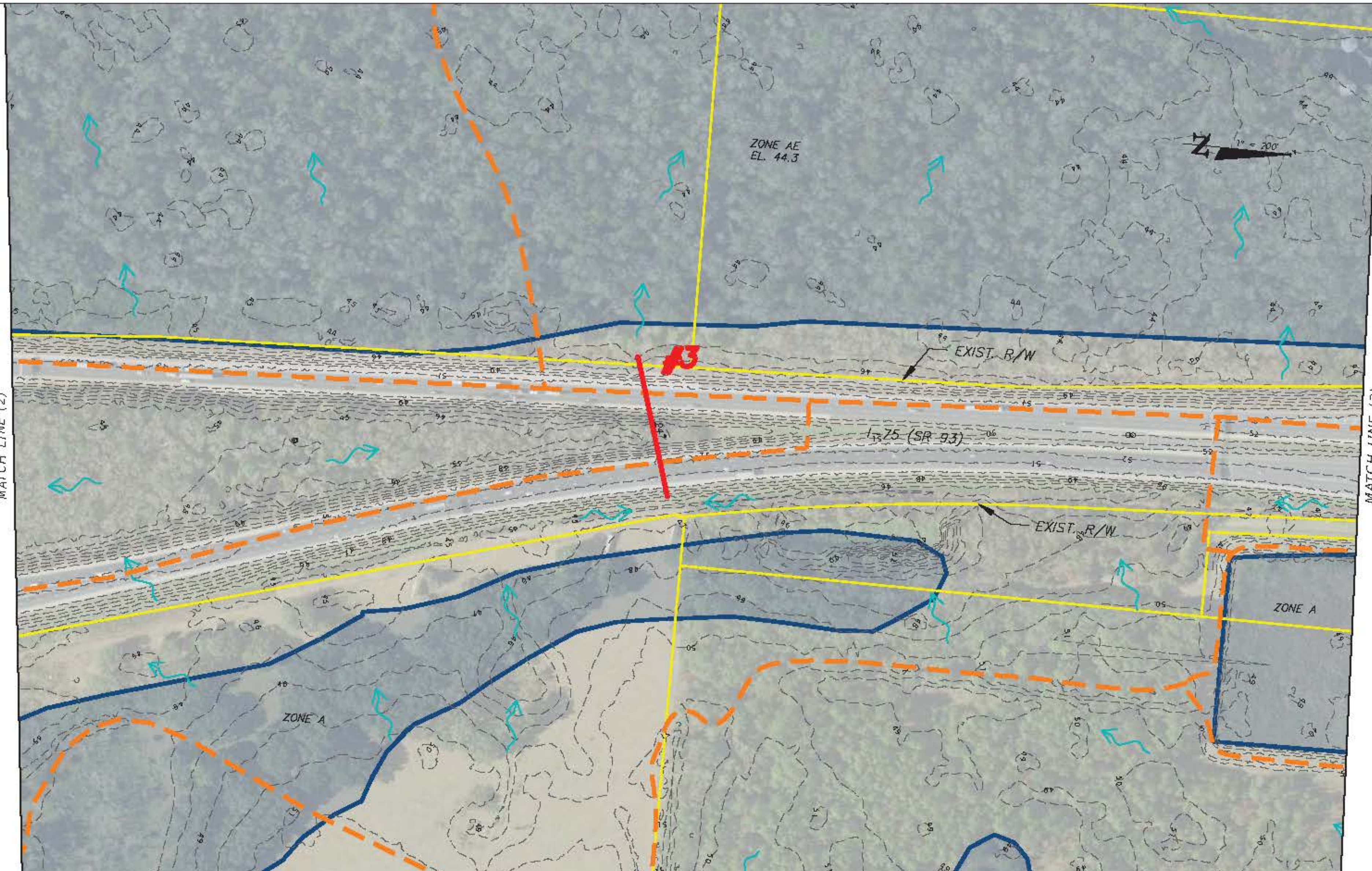

LEGEND

PROPERTY LINE
EXISTING BASIN DIVIDE
EXISTING CROSS DRAIN
WATERSHED BOUNDARY
FLOW ARROW
FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (3)

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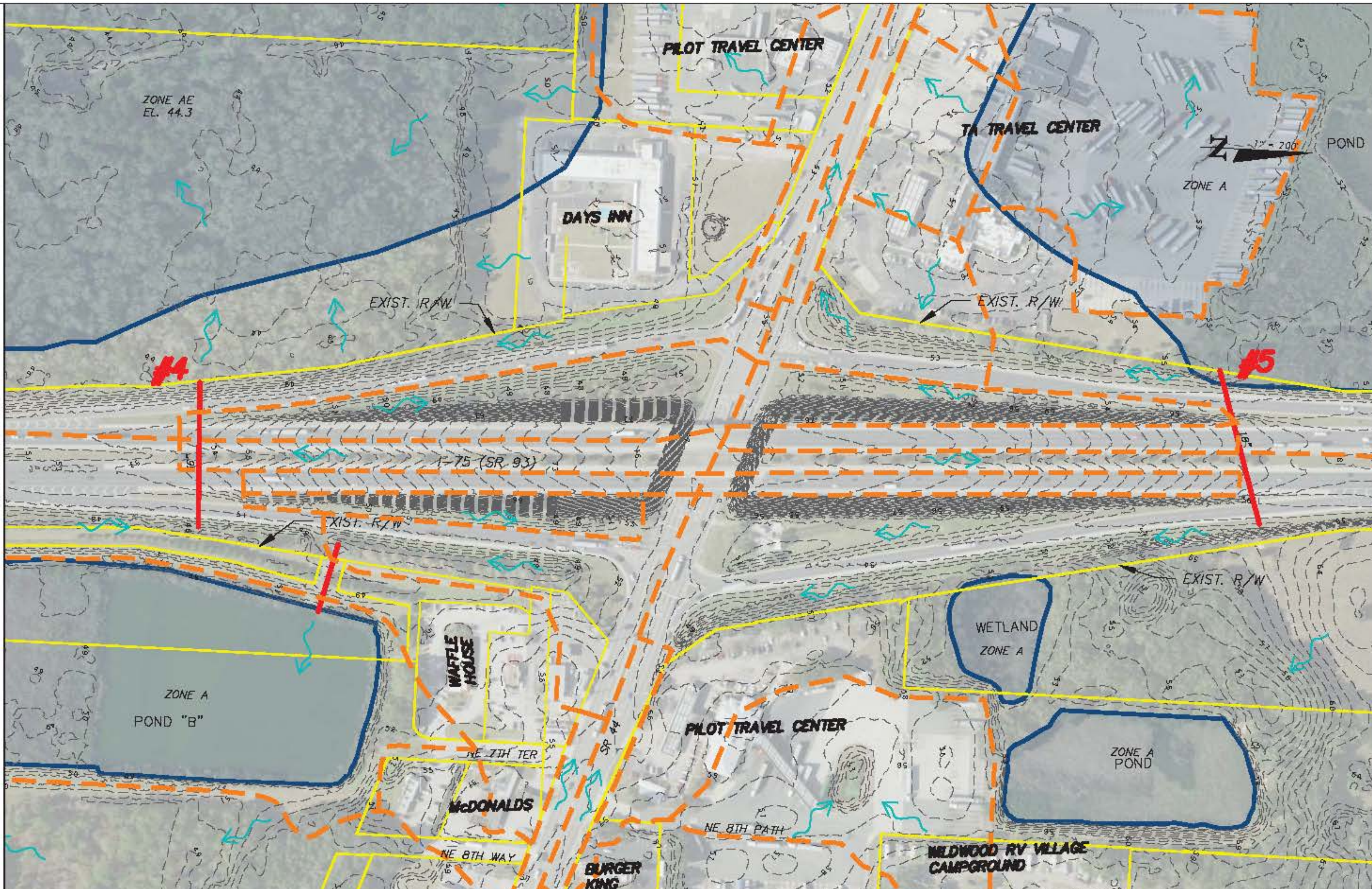

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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EXISTING CONDITIONS DRAINAGE MAP (4)

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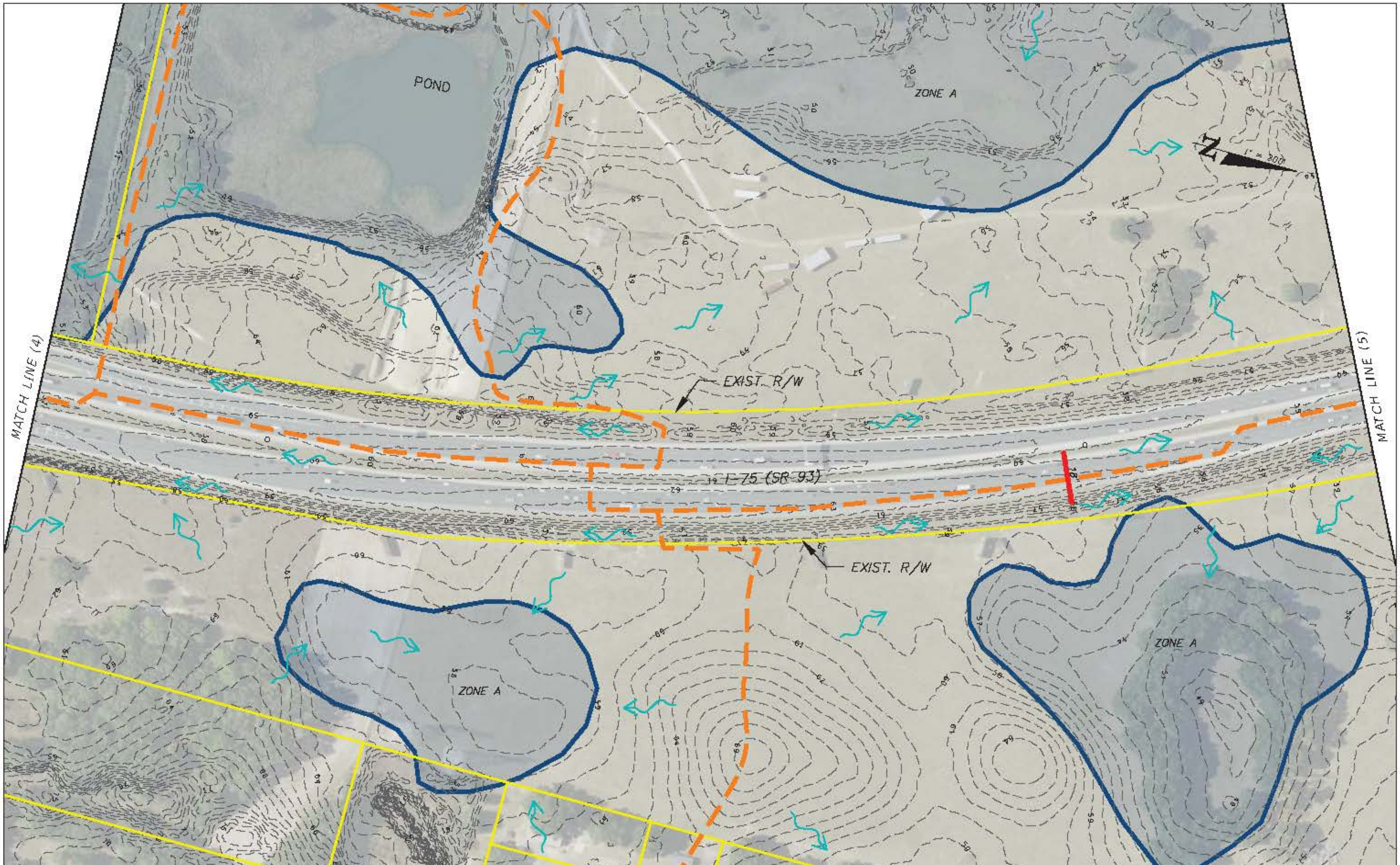

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW	
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN	
EXISTING CROSS DRAIN			

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SR 93	SUMTER MARION	443623-1-22-01

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EXISTING CONDITIONS DRAINAGE MAP (6)

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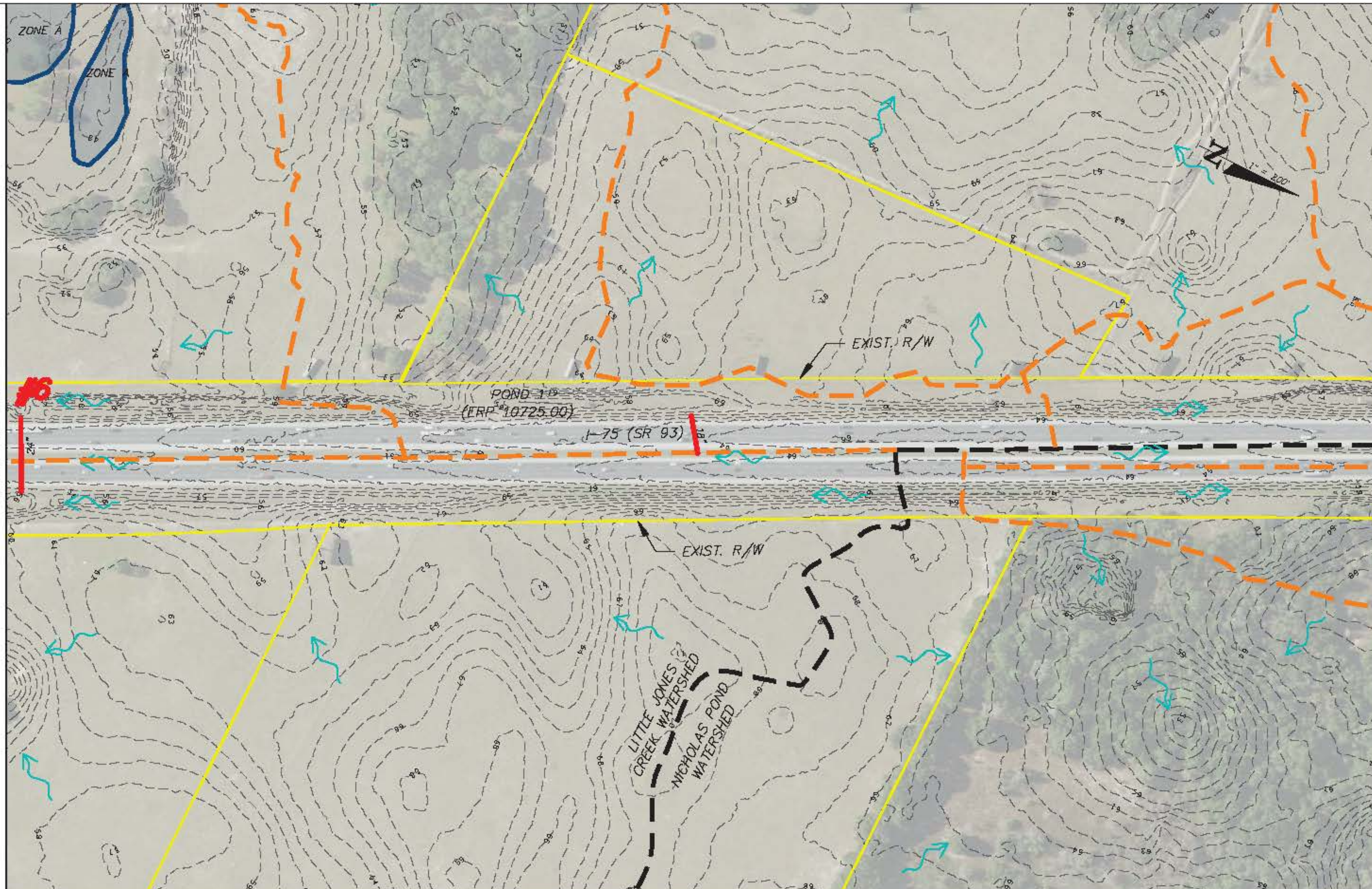

LEGEND

PROPERTY LINE		WATERSHED BOUNDARY		FLOW ARROW	
EXISTING BASIN DIVIDE				FEMA FLOOD PLAIN	
EXISTING CROSS DRAIN					

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EXISTING CONDITIONS DRAINAGE MAP (6)

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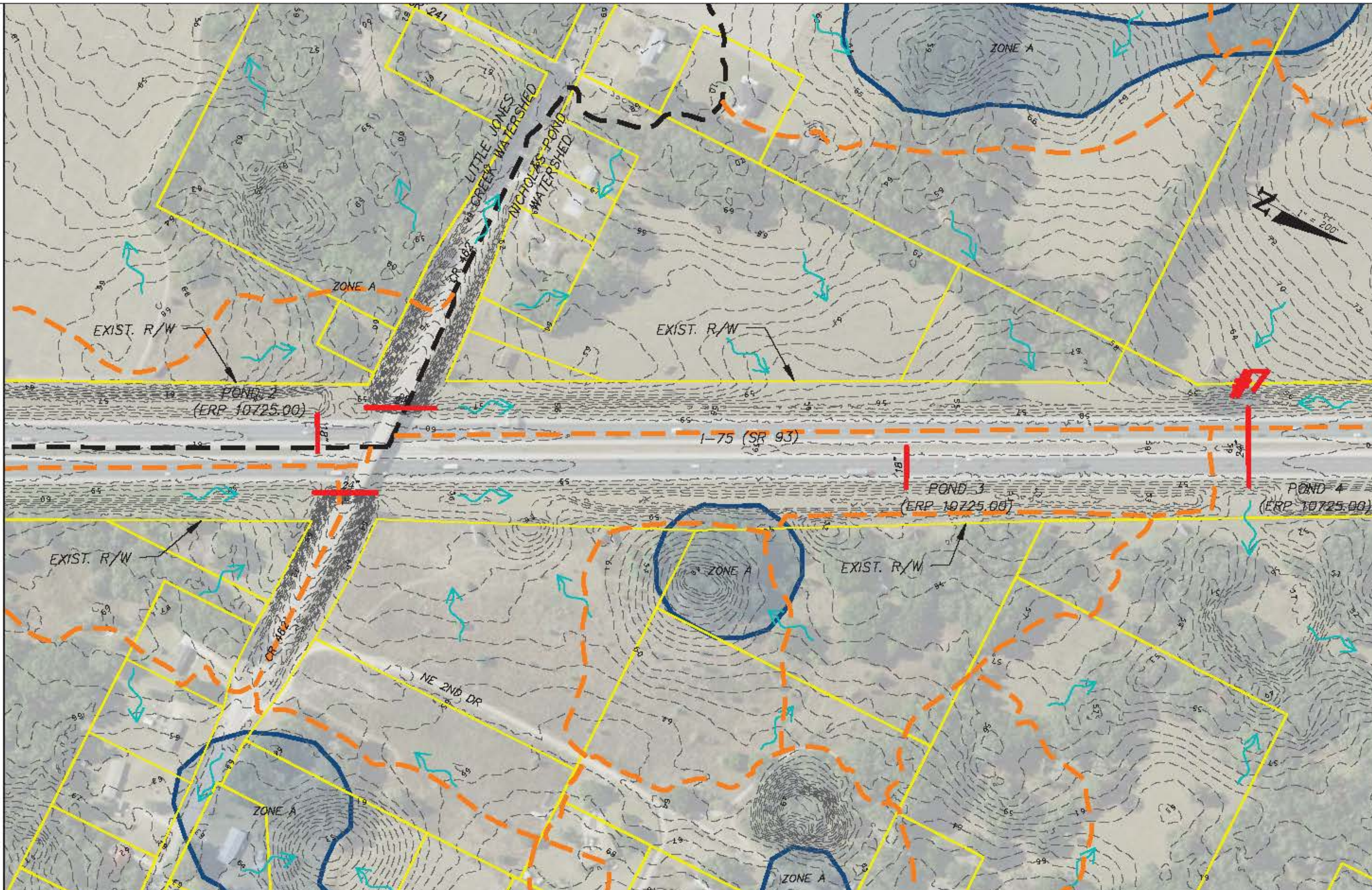

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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EXISTING CONDITIONS DRAINAGE MAP (7)

SHEET NO. 7

John Hutchison 6/16/2020 9:54:13 AM

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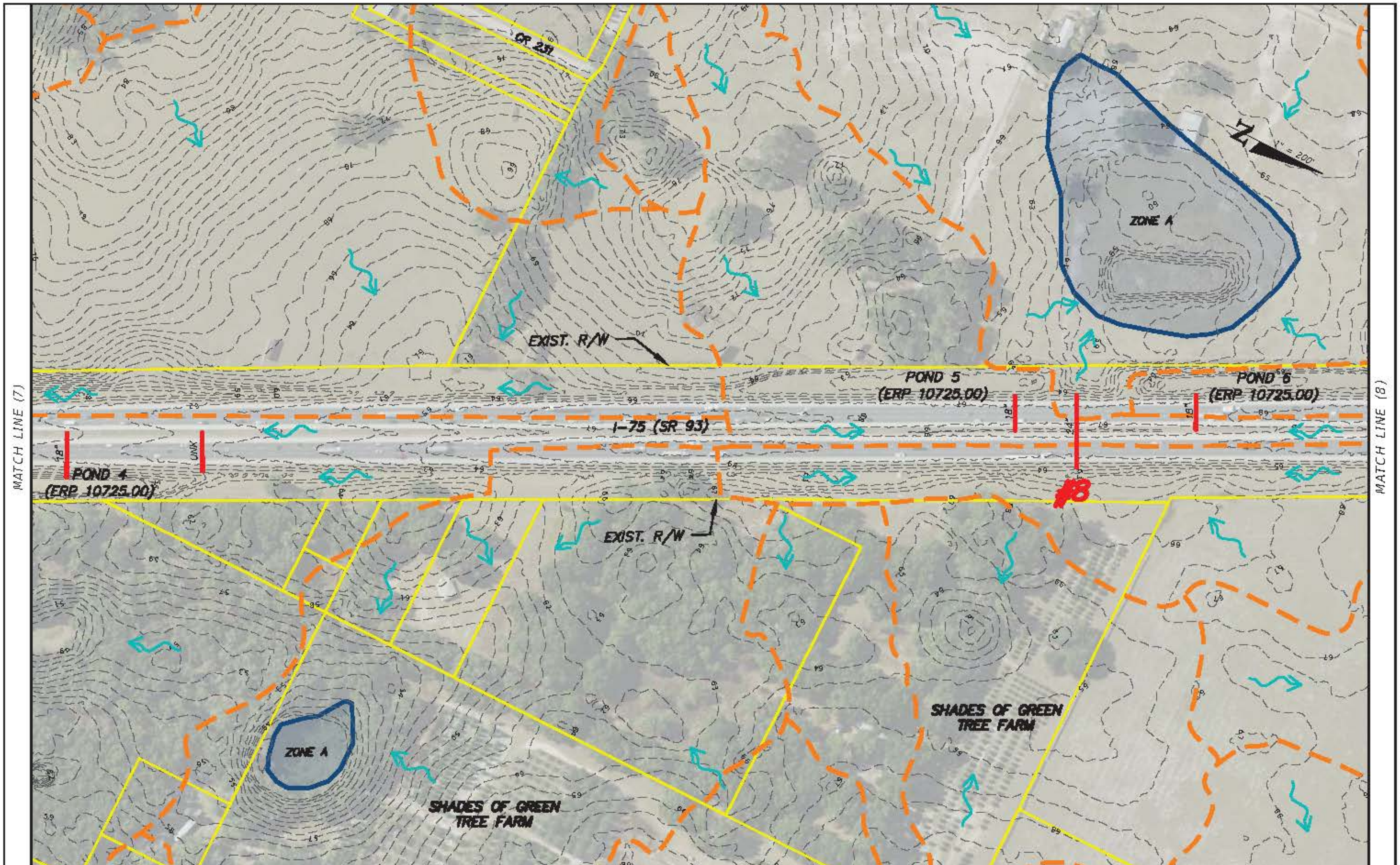

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW	
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN	
EXISTING CROSS DRAIN			

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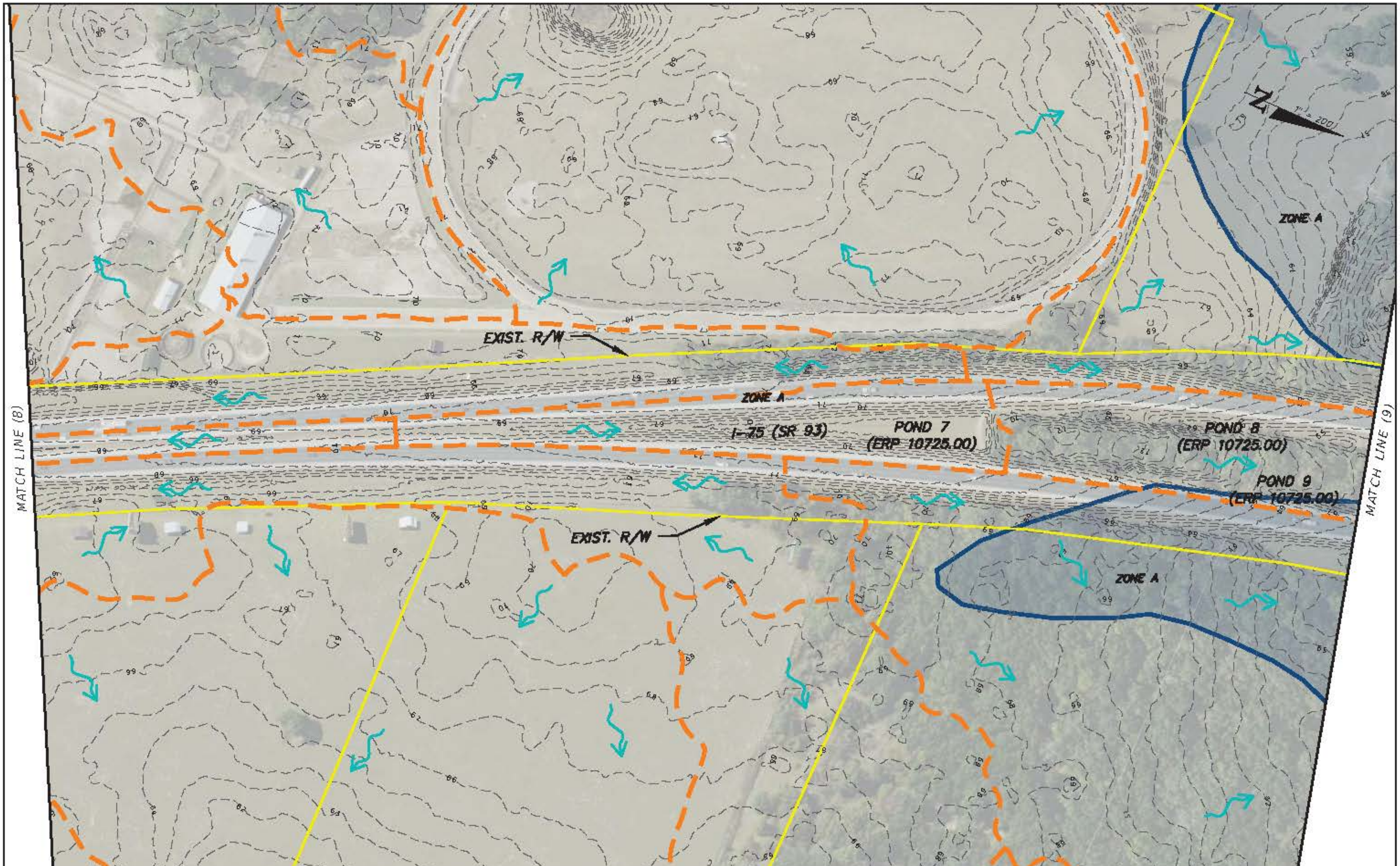
EXISTING CONDITIONS DRAINAGE MAP (8)

SHEET NO. 8

John Hutchison 6/18/2020 9:55:15 AM F:\Projects\44362312201_I-75_PD&E\Drainage\CAD\Maps.dwg



LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW	
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN	
EXISTING CROSS DRAIN			

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EXISTING CONDITIONS DRAINAGE MAP (9)

SHEET NO. 9

John Hutchison 6/16/2020 10:05:02 AM

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LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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	ROAD NO.	COUNTY	FINANCIAL PROJECT ID	
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EXISTING CONDITIONS DRAINAGE MAP (10)

SHEET NO. 10

John Hutchison 6/16/2020 10:06:14 AM

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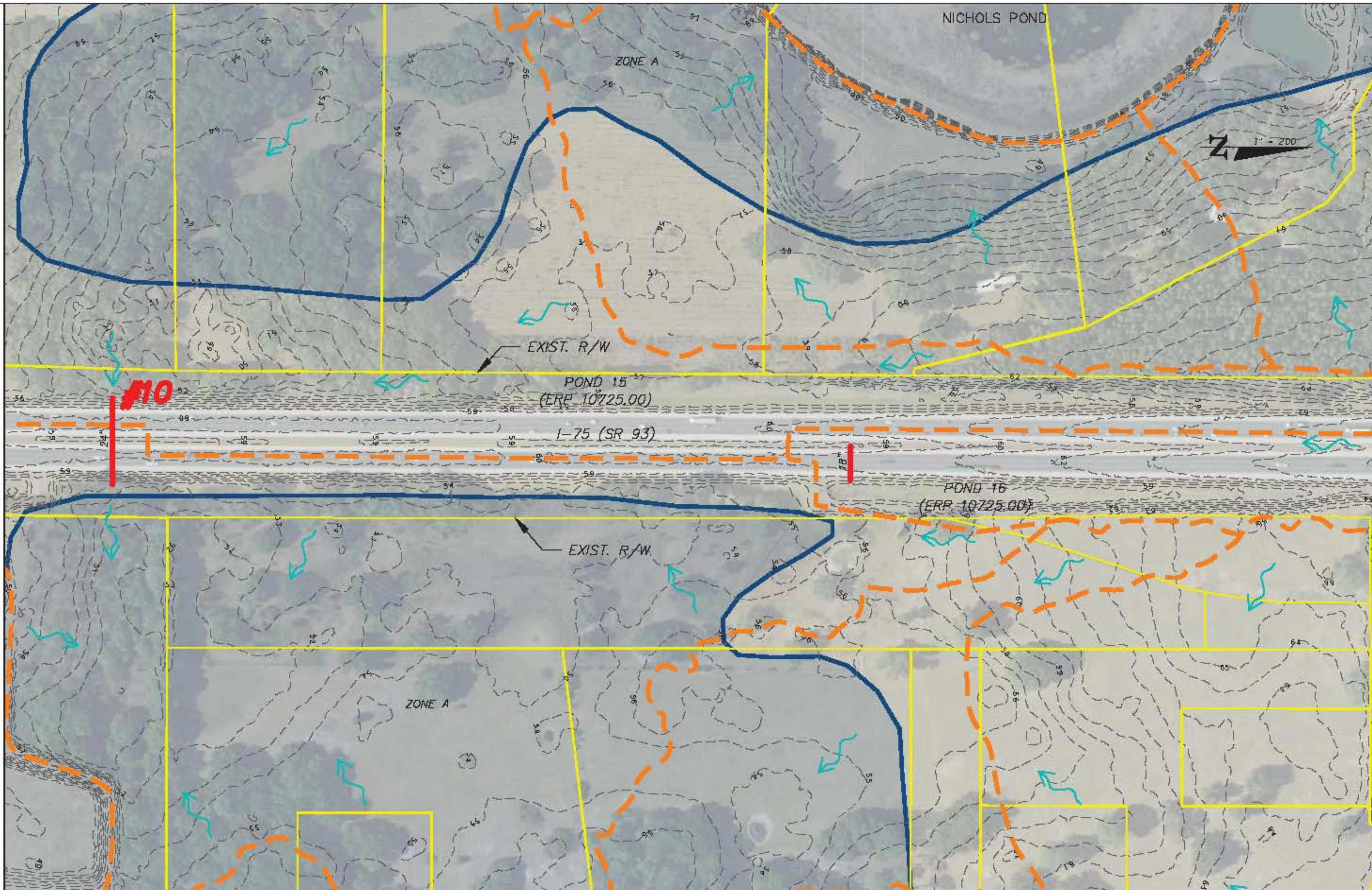

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (11)

SHEET NO. 11

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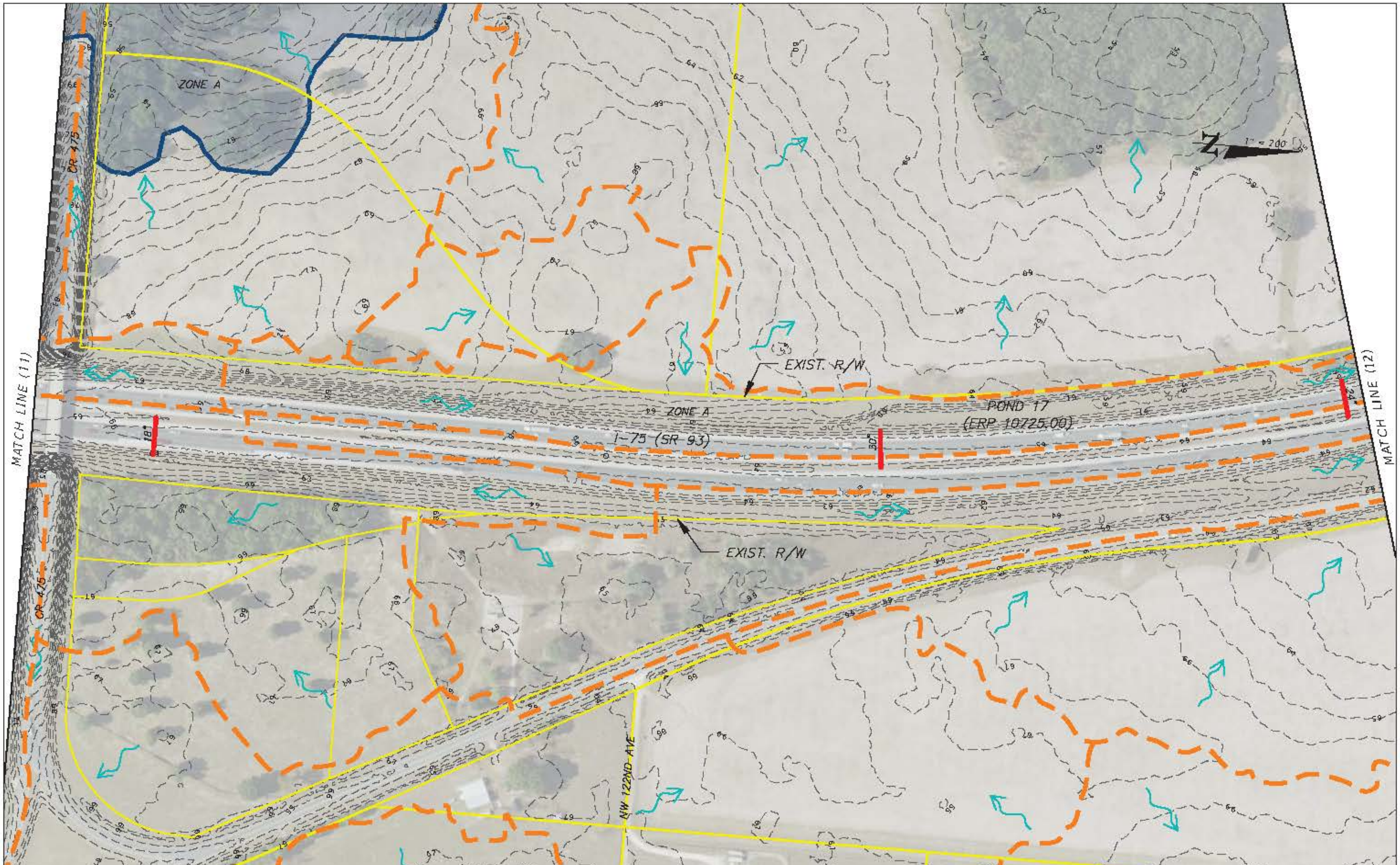

LEGEND

PROPERTY LINE
EXISTING BASIN DIVIDE
EXISTING CROSS DRAIN
WATERSHED BOUNDARY
FLOW ARROW
FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (12)

SHEET NO. 12

John Hutchison 6/16/2020 10:12:53 AM

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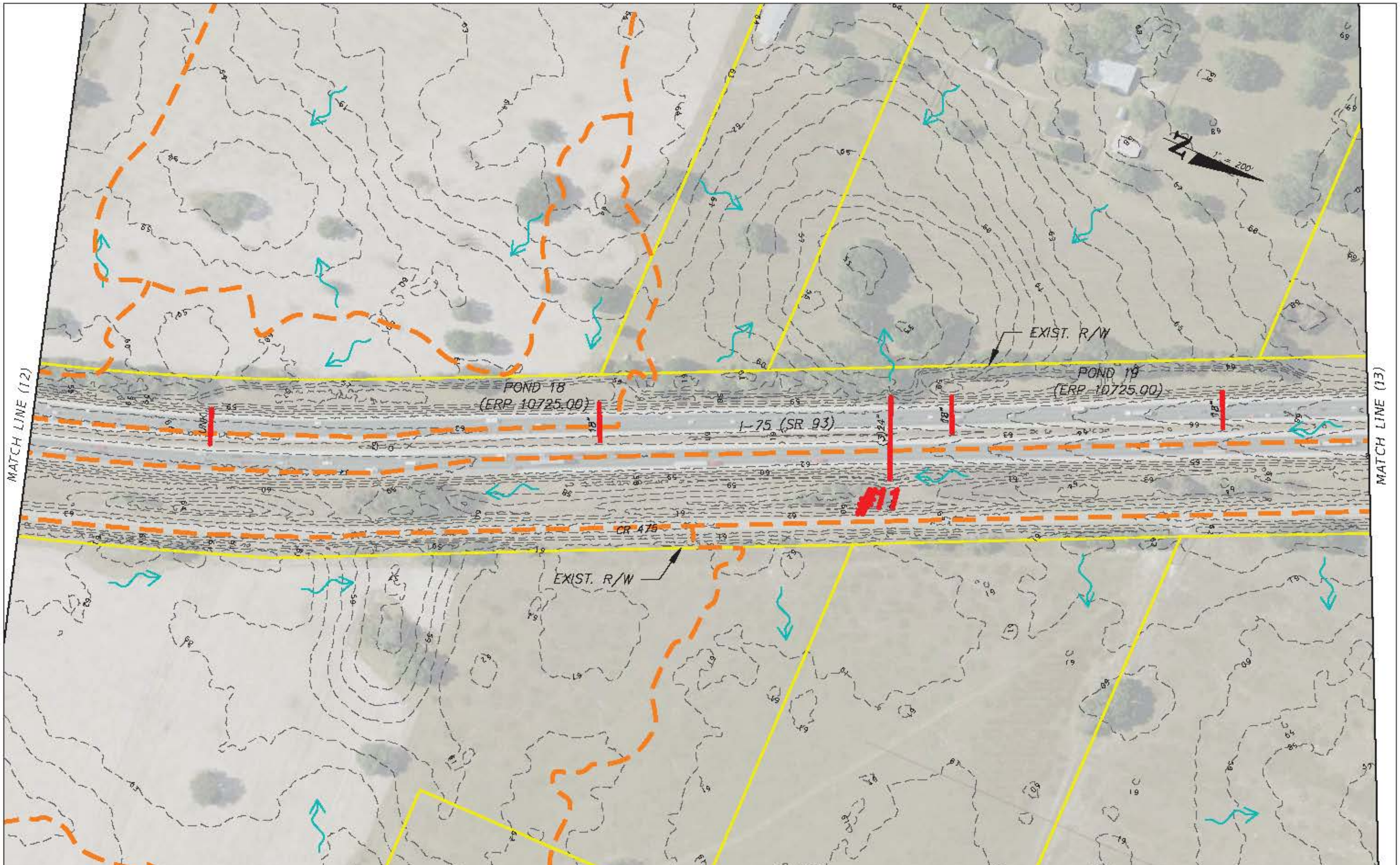

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (13)

SHEET NO. 13

John Hutchison 6/16/2020 10:13:53 AM

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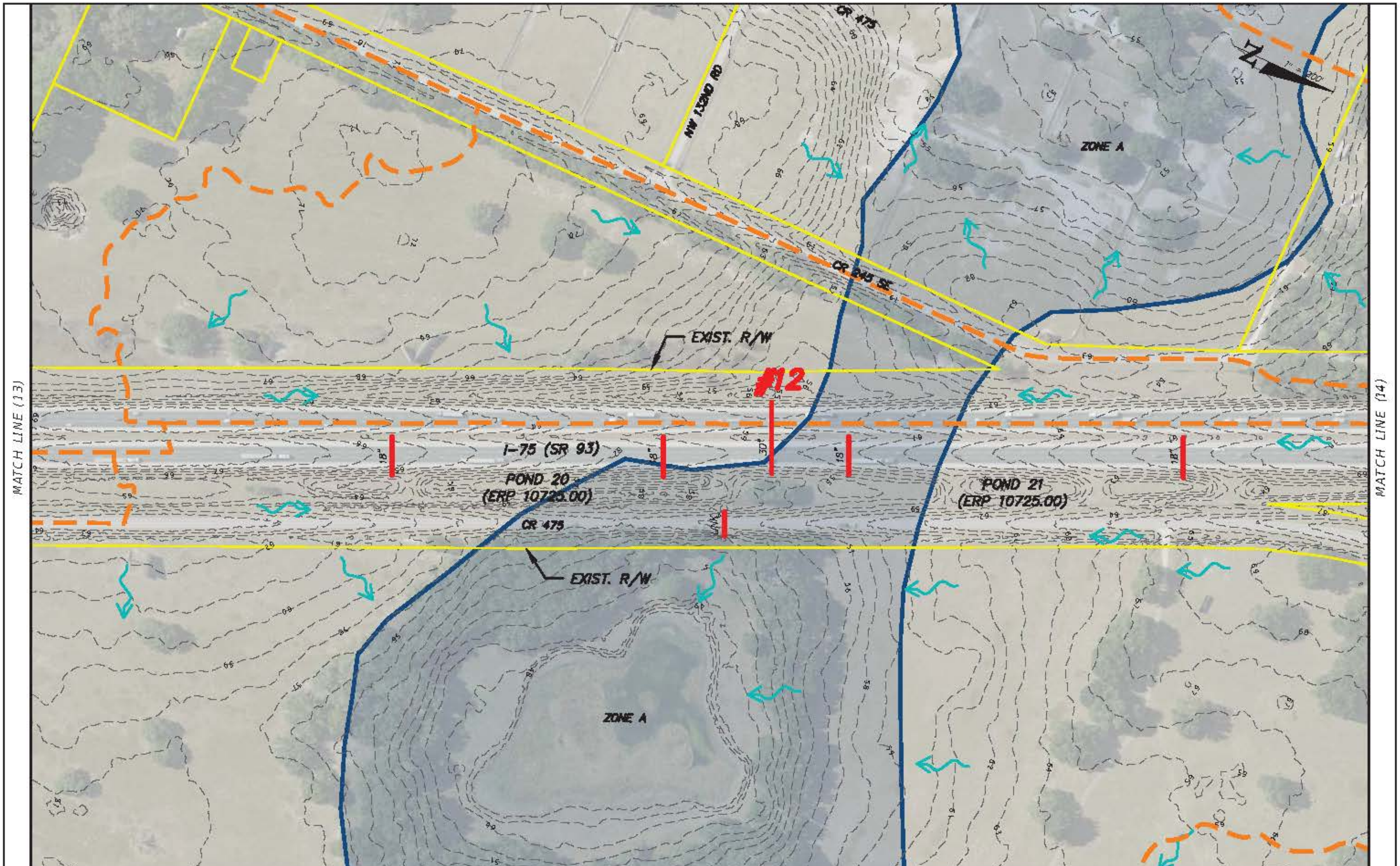
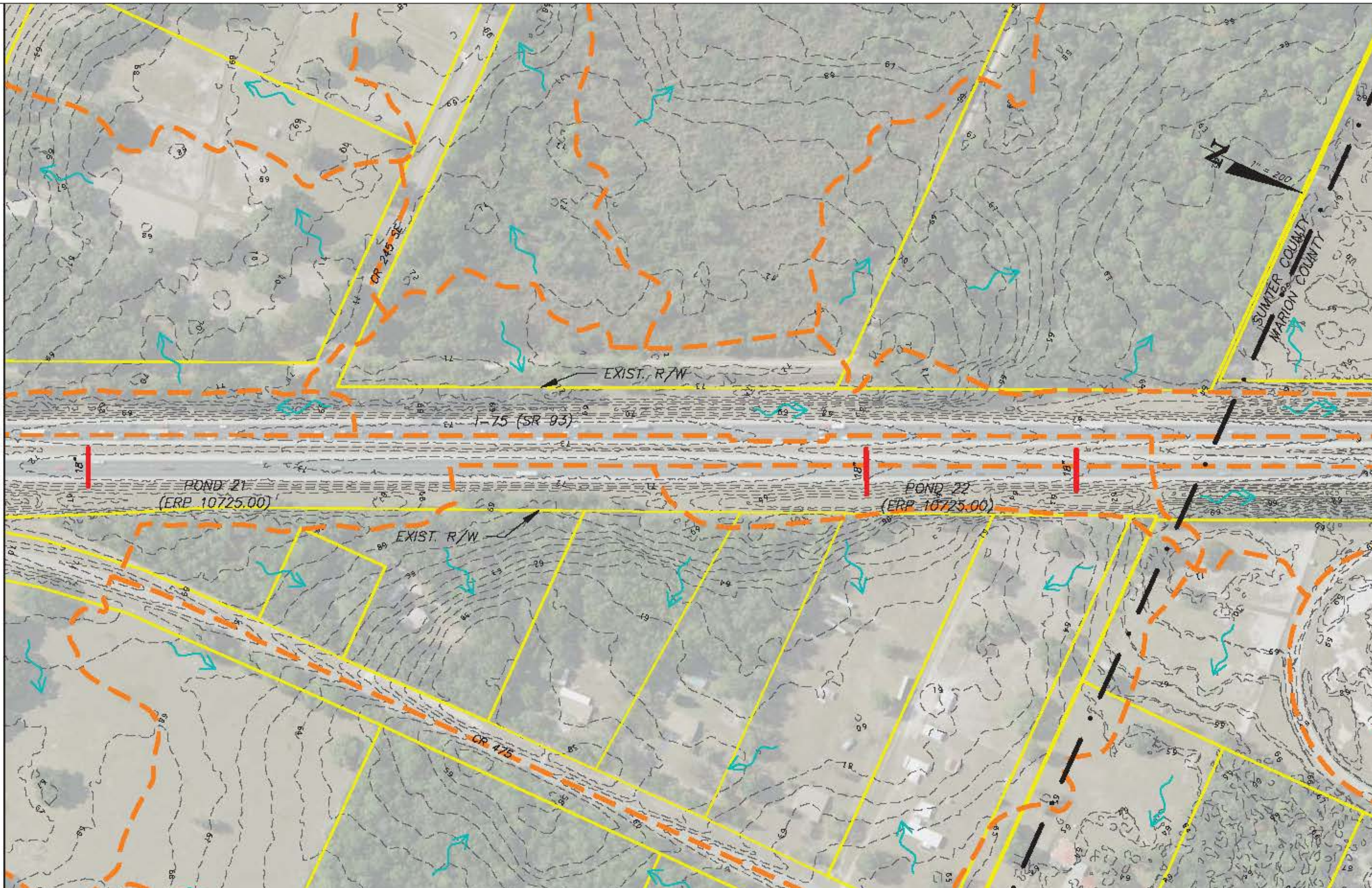


LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

BURGESS & NIPLE 10006 N. DALE MABRY HWY SUITE 201 TAMPA, FL. 33618 (813) 962-8689	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			EXISTING CONDITIONS DRAINAGE MAP (14)	SHEET NO.
	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
	SR 93	SUMTER MARION	443623-1-22-01		14

John Hutchison 8/18/2020 10:14:58 AM F:\Projects\44362312201_I-75_PD&E\Drainage\CAD\Maps.dwg



LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (15)

SHEET NO. 15

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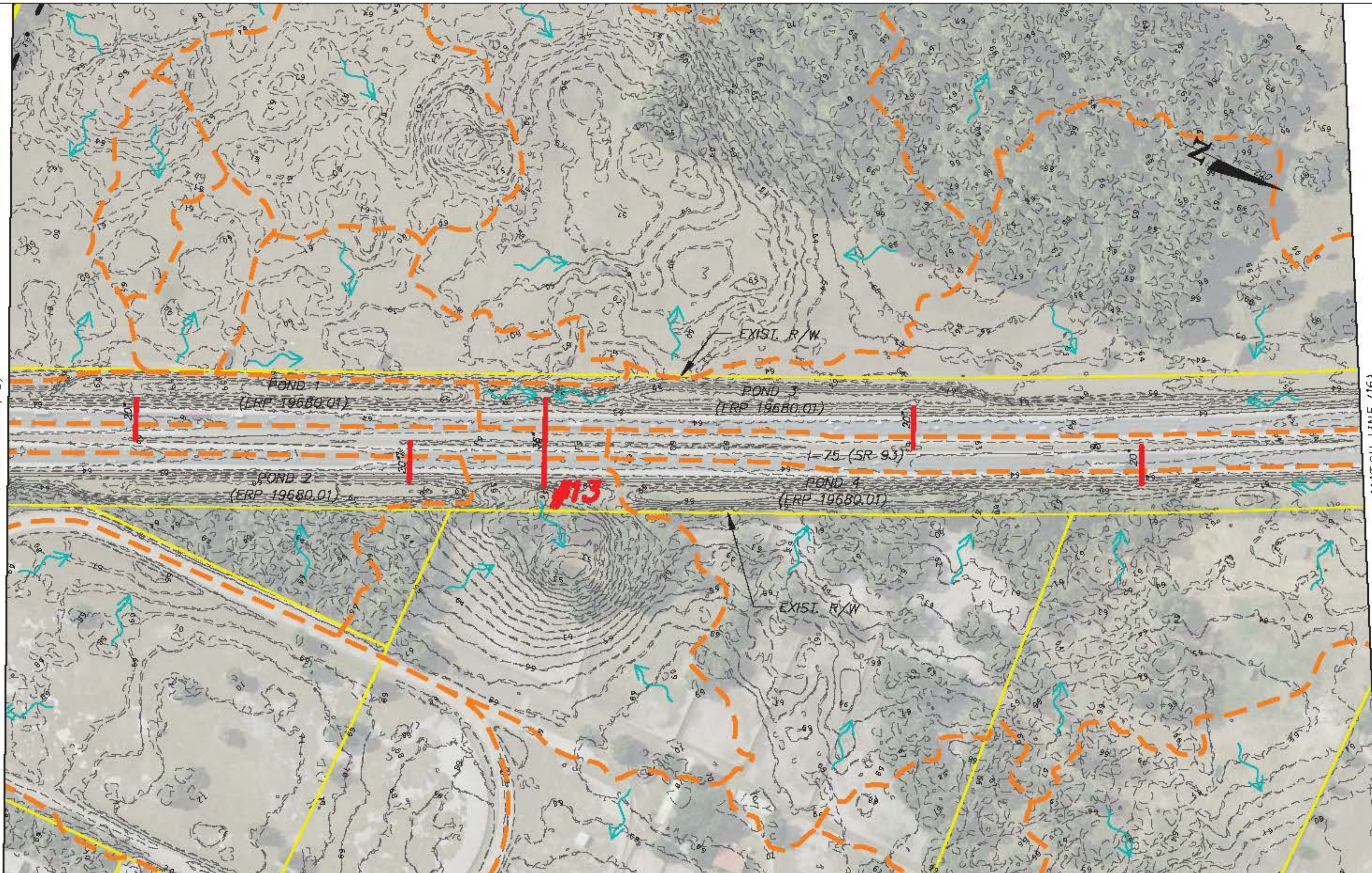

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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EXISTING CONDITIONS DRAINAGE MAP (16)

SHEET NO. 16

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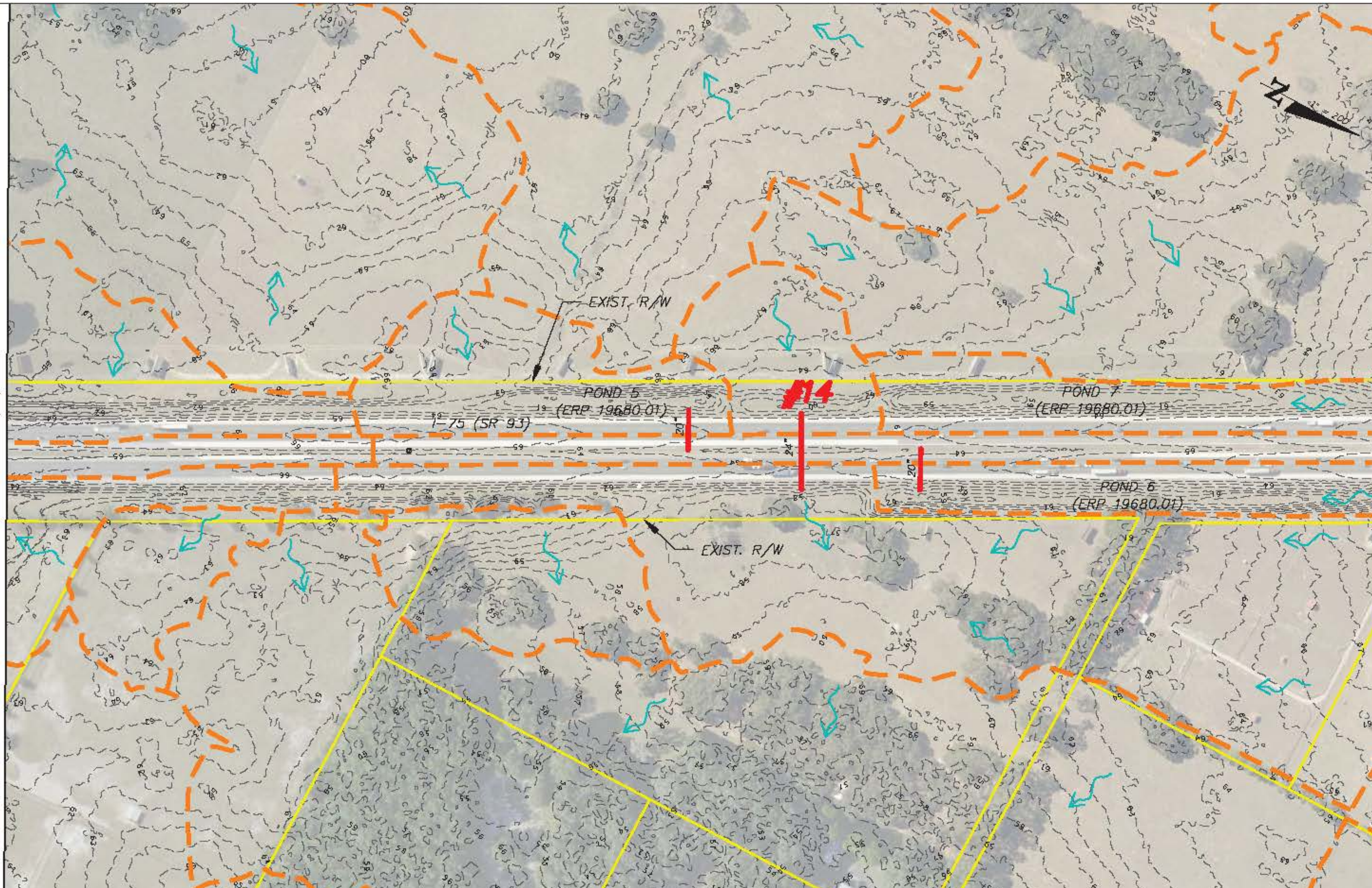

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (17)

SHEET NO. 17

John Hutchison 6/16/2020 10:22:02 AM

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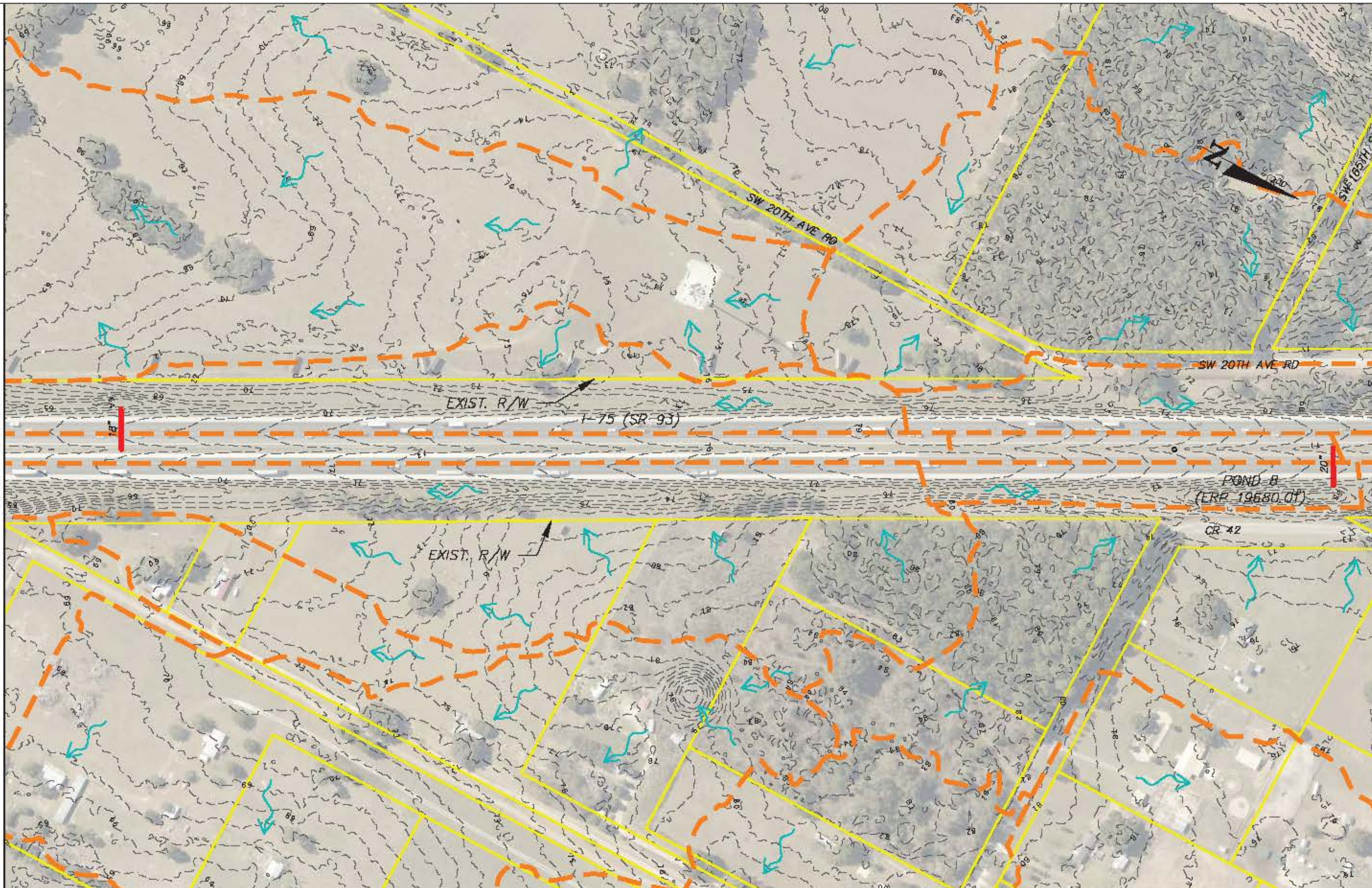

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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EXISTING CONDITIONS DRAINAGE MAP (18)

SHEET NO. 18

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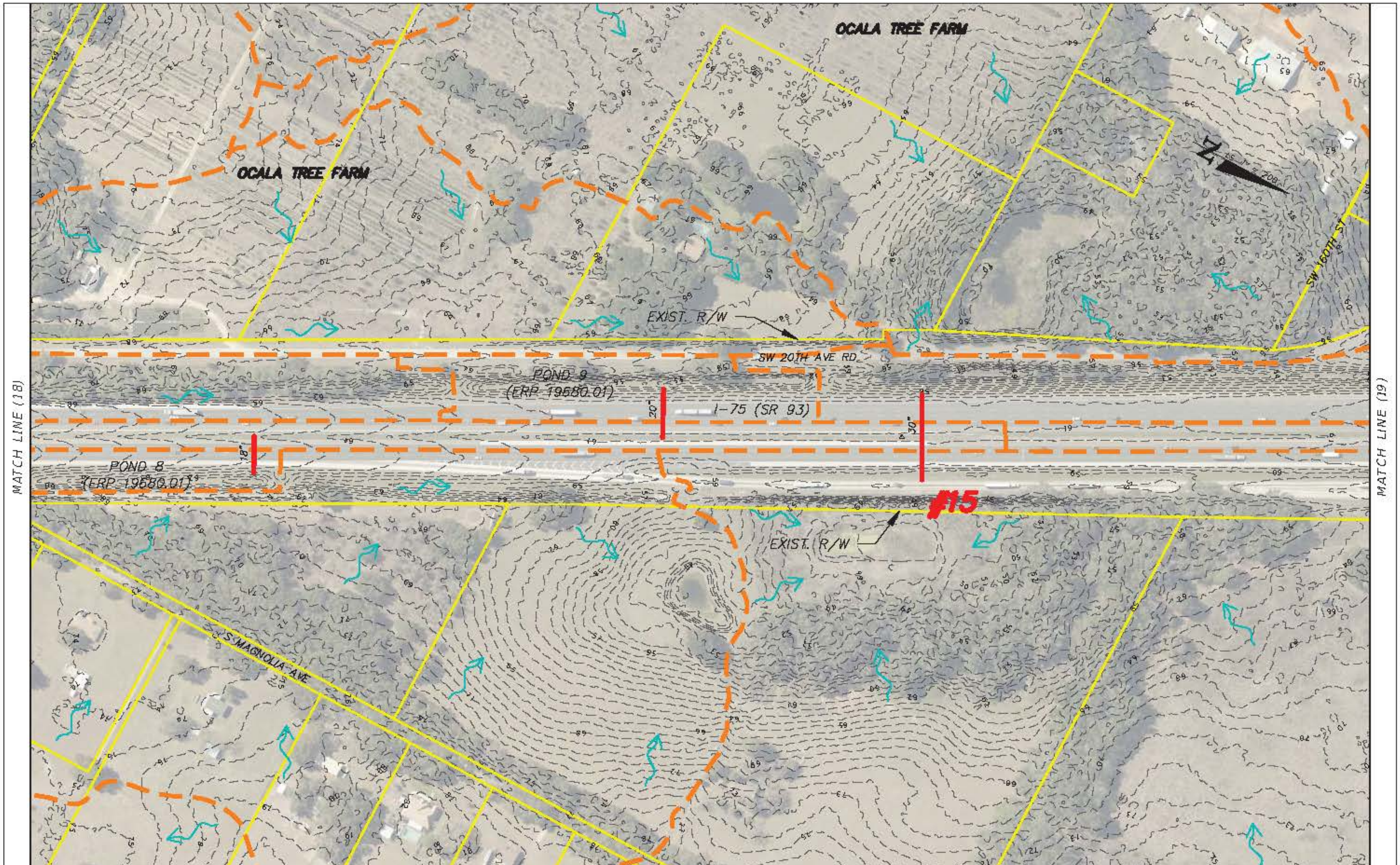

LEGEND		
PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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EXISTING CONDITIONS DRAINAGE MAP (19)

SHEET NO. 19

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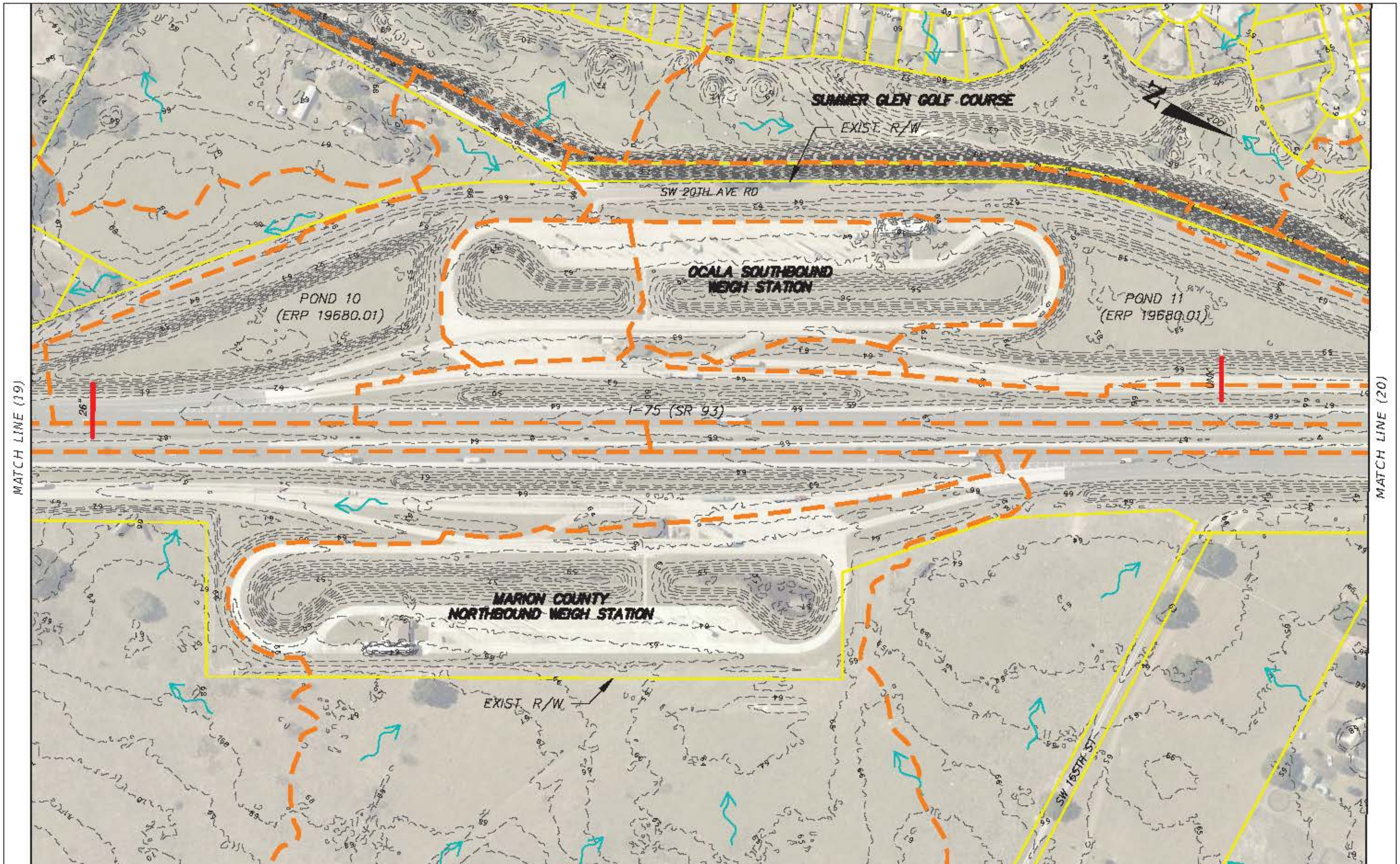

LEGEND

- PROPERTY LINE
- EXISTING BASIN DIVIDE
- EXISTING CROSS DRAIN
- WATERSHED BOUNDARY
- FLOW ARROW
- FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (20)

SHEET NO. 20

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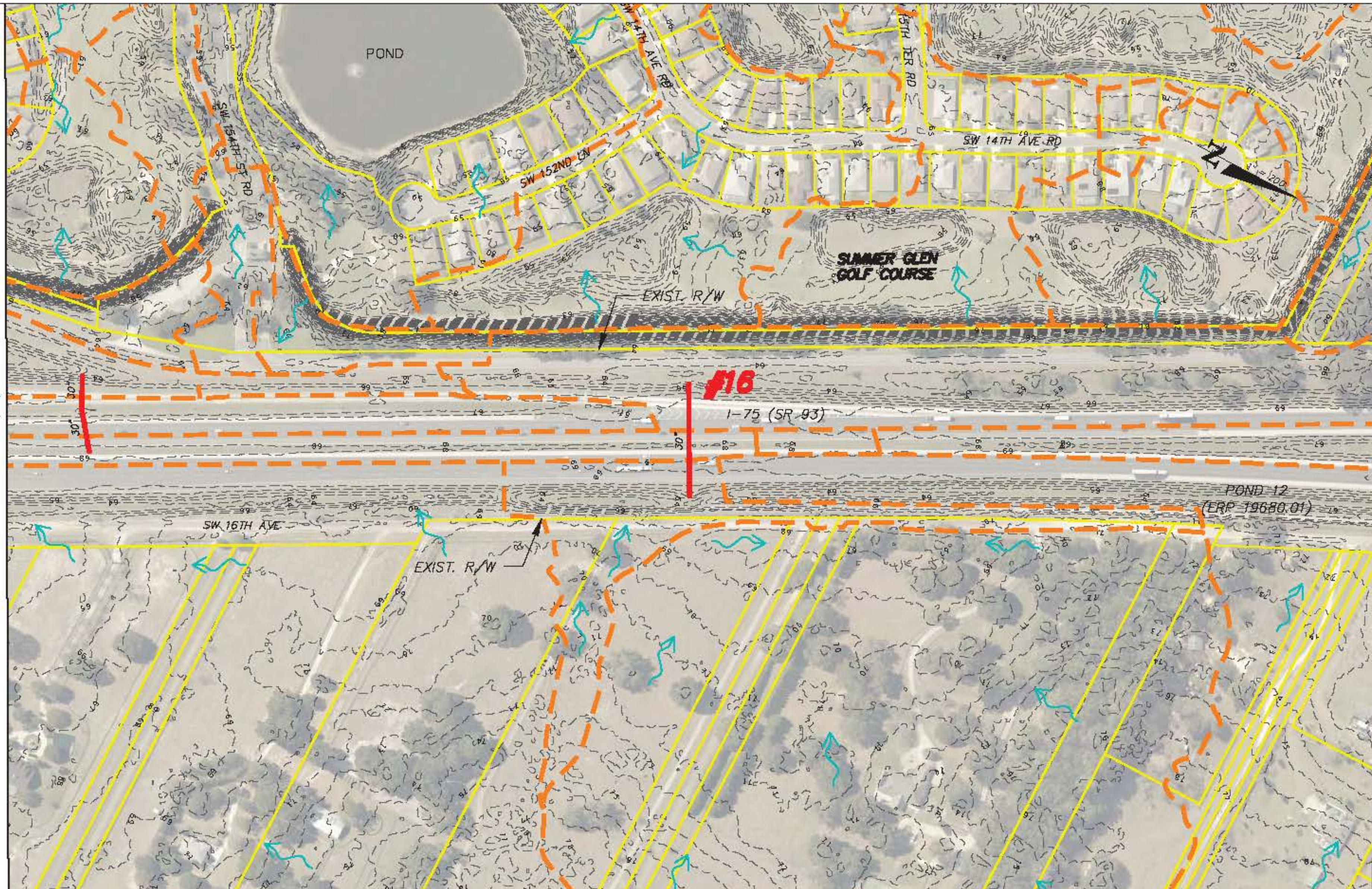

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (21)

SHEET NO. 21

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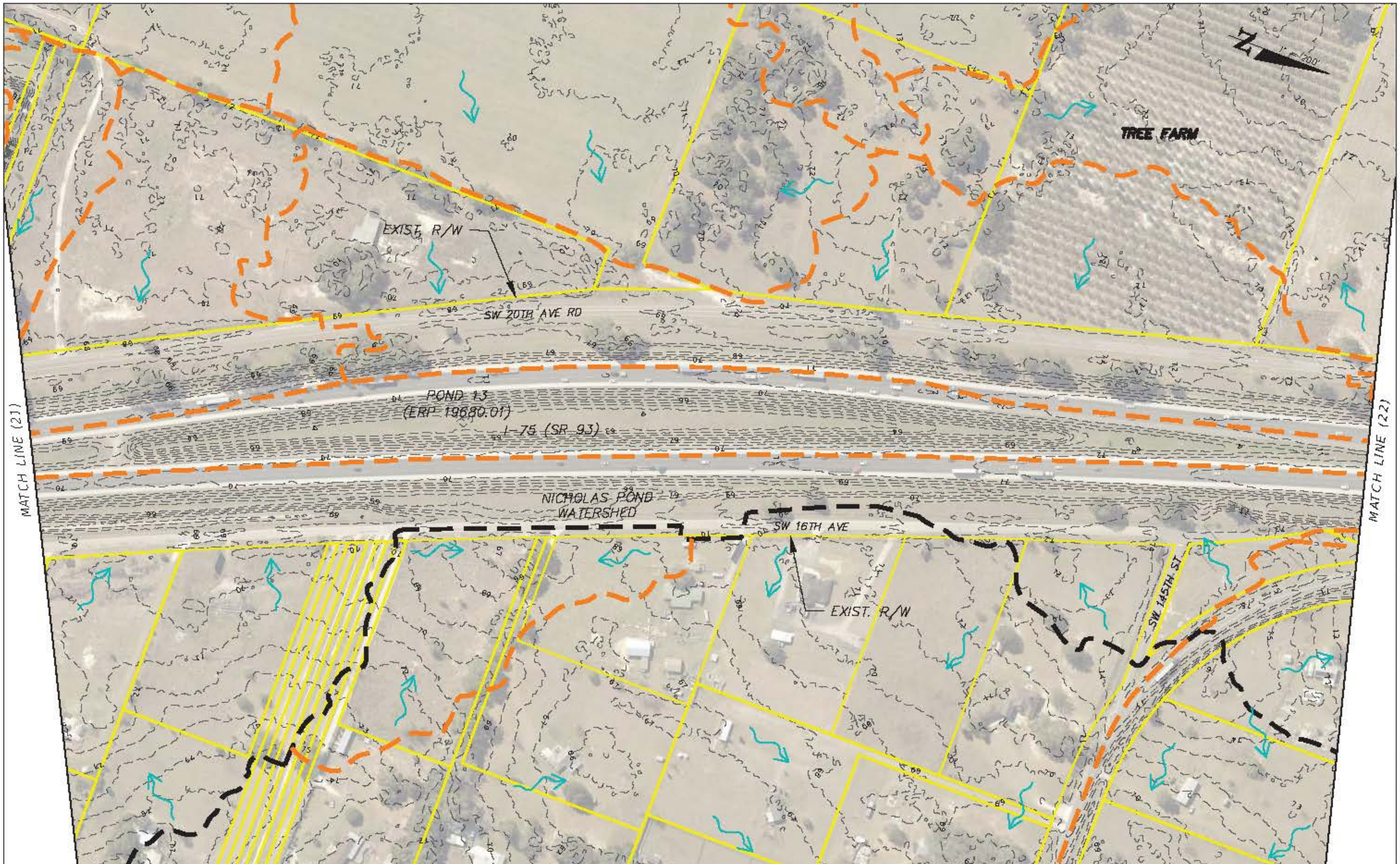

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (22)

SHEET NO. 22

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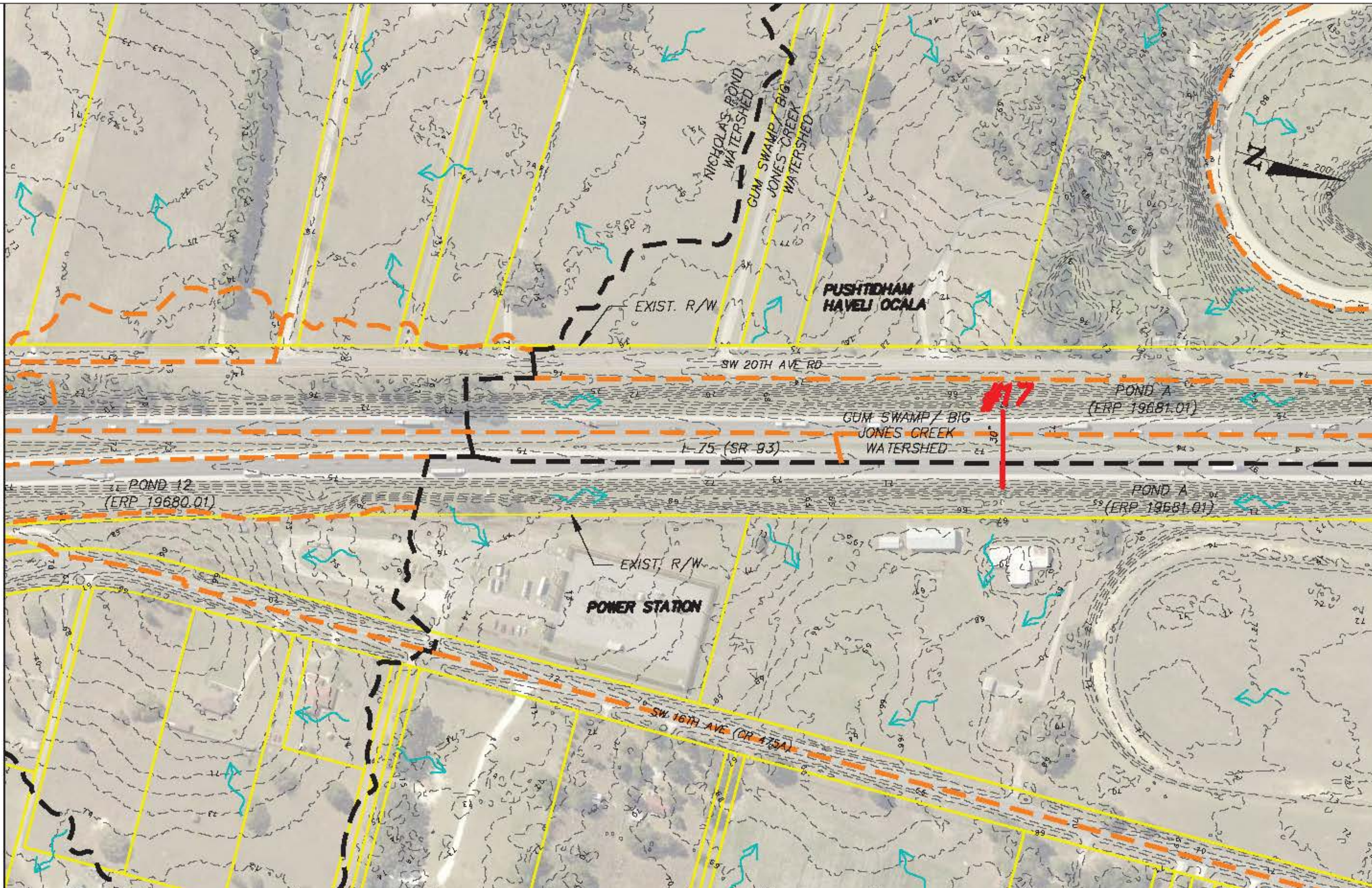

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW	
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN	
EXISTING CROSS DRAIN			

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EXISTING CONDITIONS DRAINAGE MAP (23)

SHEET NO. 23

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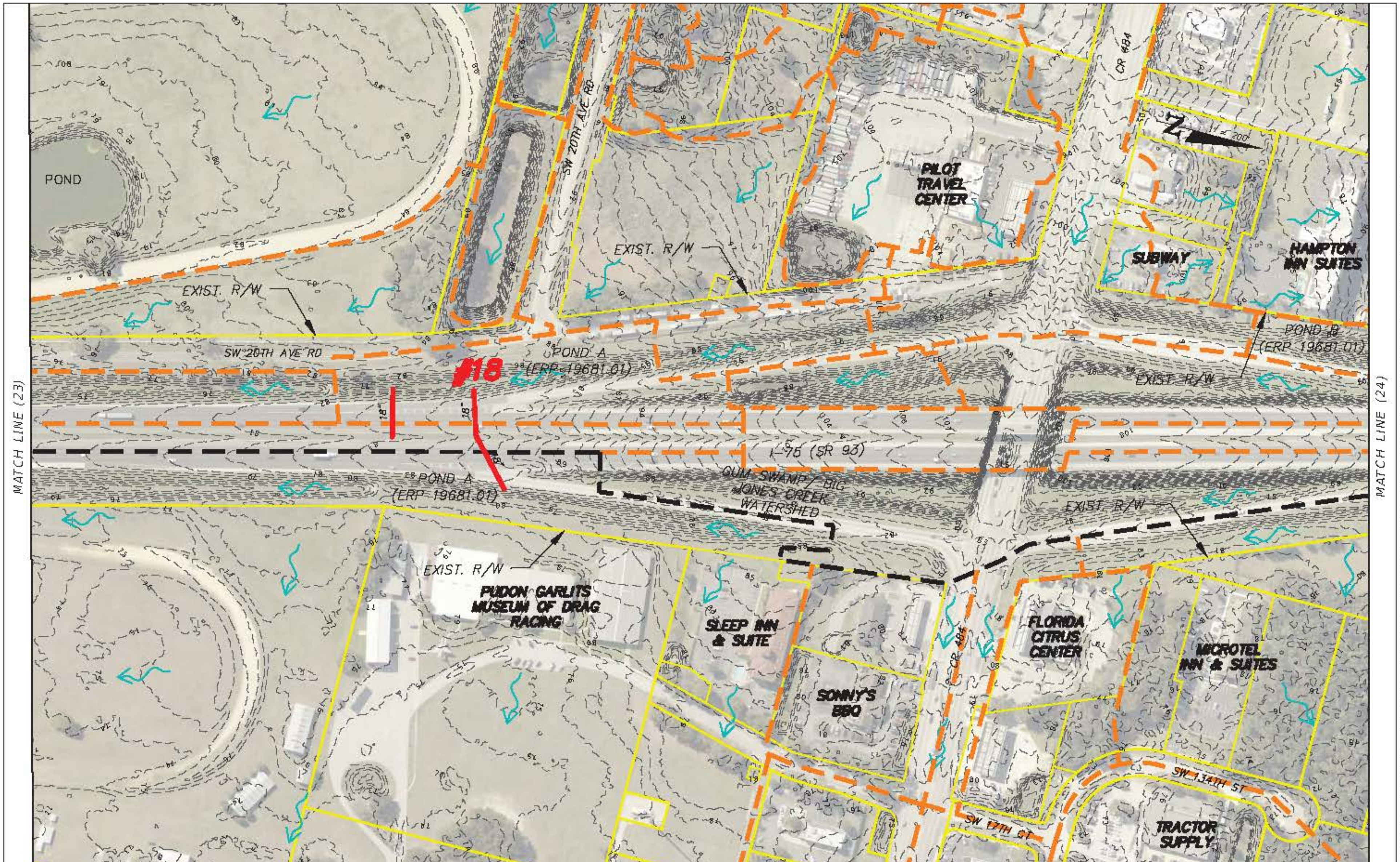

LEGEND

PROPERTY LINE
EXISTING BASIN DIVIDE
EXISTING CROSS DRAIN
WATERSHED BOUNDARY
FLOW ARROW
FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (24)

SHEET NO. 24

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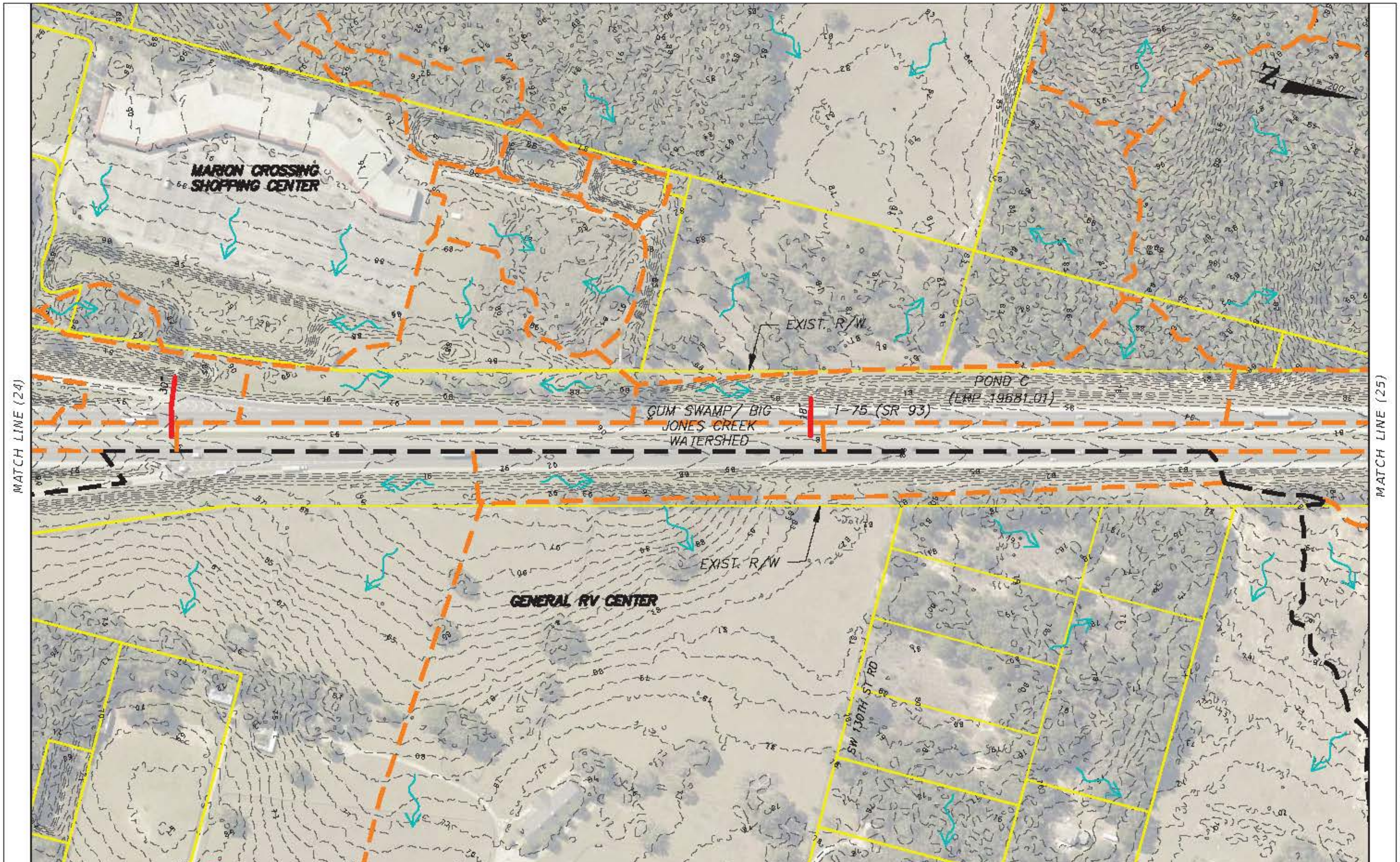

LEGEND			
PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW	
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN	
EXISTING CROSS DRAIN			

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EXISTING CONDITIONS DRAINAGE MAP (25)

SHEET NO. 25

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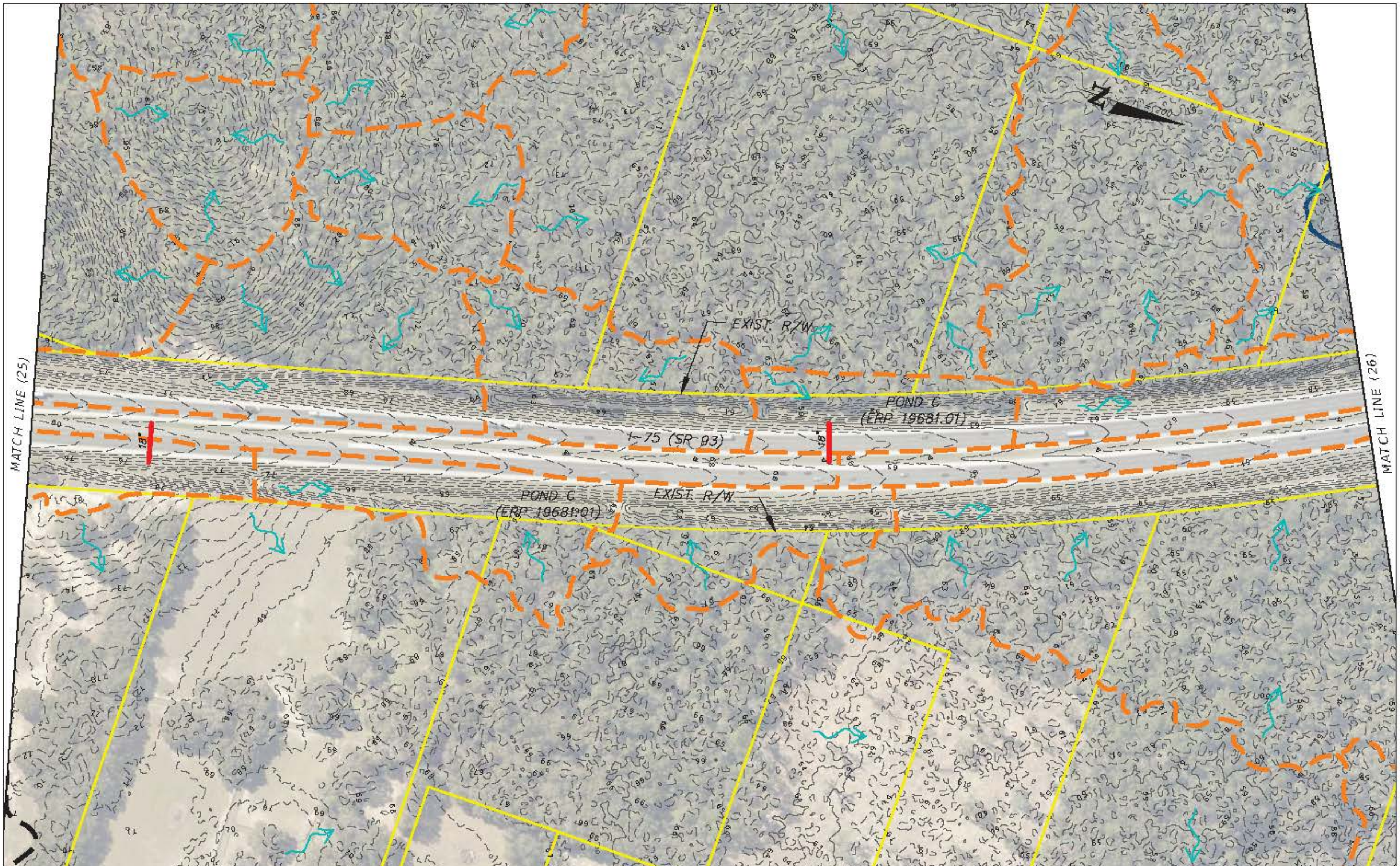

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EXISTING CONDITIONS DRAINAGE MAP (26)

SHEET NO. 26

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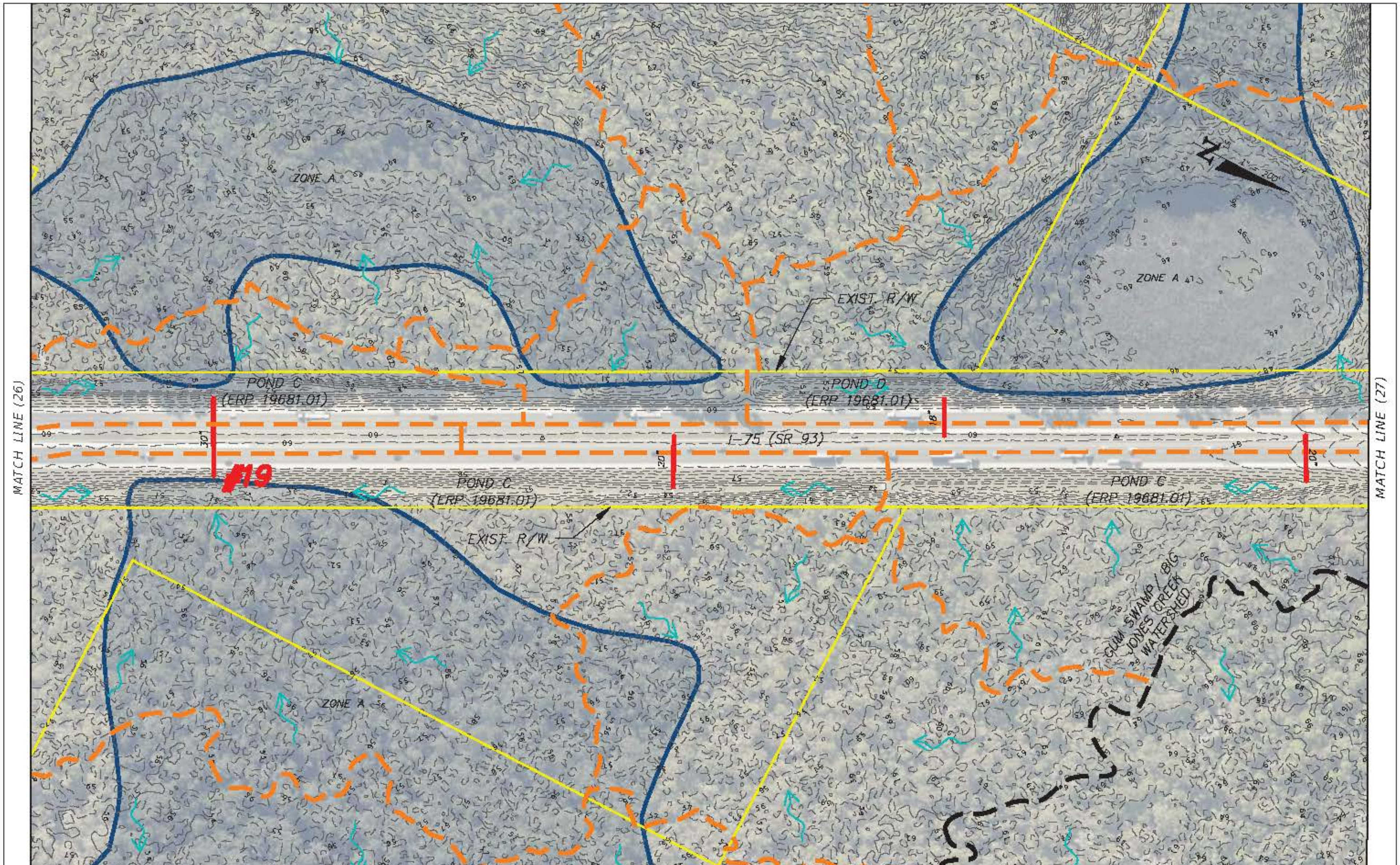

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (27)

SHEET NO. 27

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EXISTING CONDITIONS DRAINAGE MAP (28)

SHEET NO. 28

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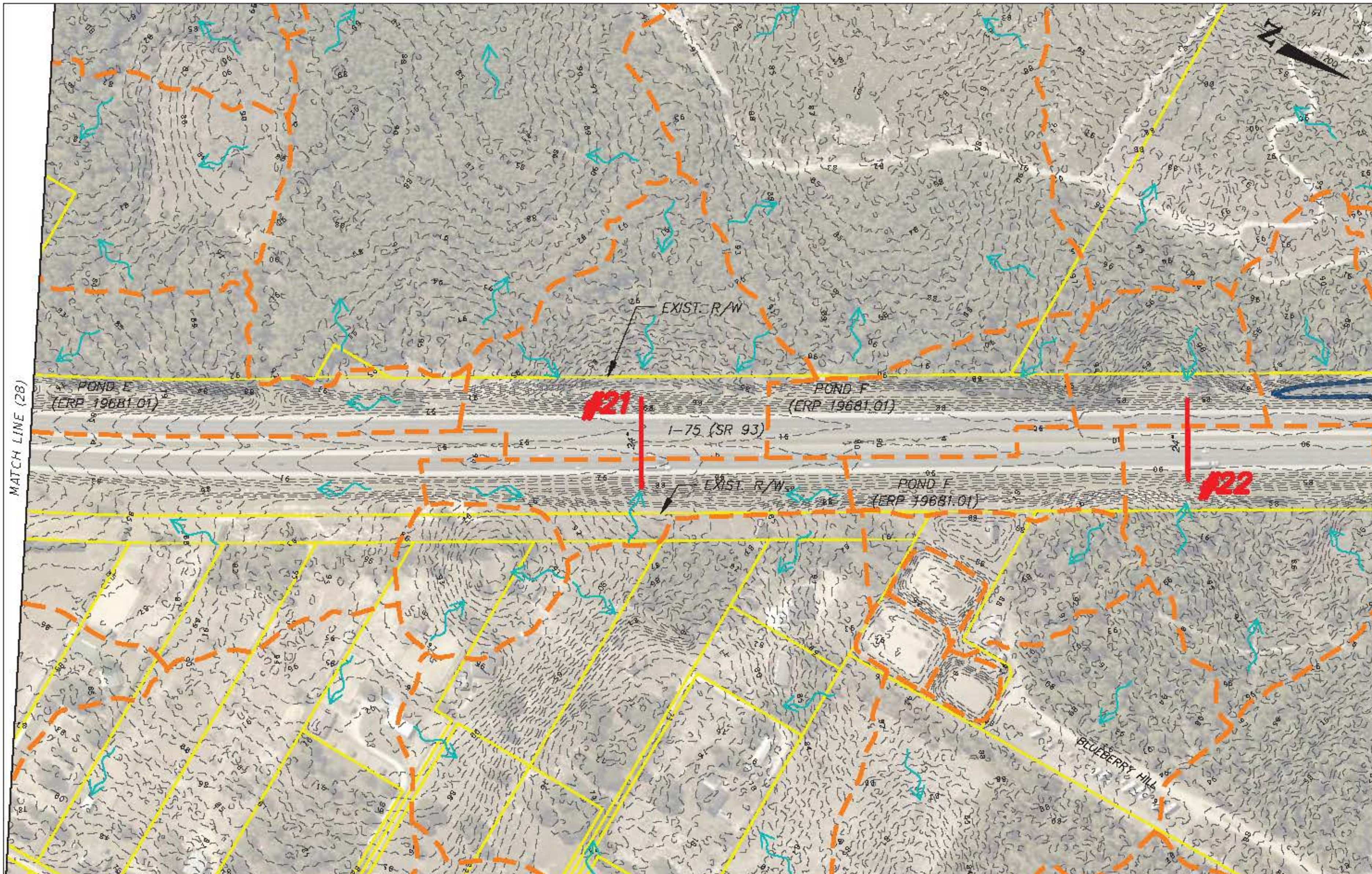

LEGEND

PROPERTY LINE
EXISTING BASIN DIVIDE
EXISTING CROSS DRAIN
WATERSHED BOUNDARY
FLOW ARROW
FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (29)

SHEET NO. 29

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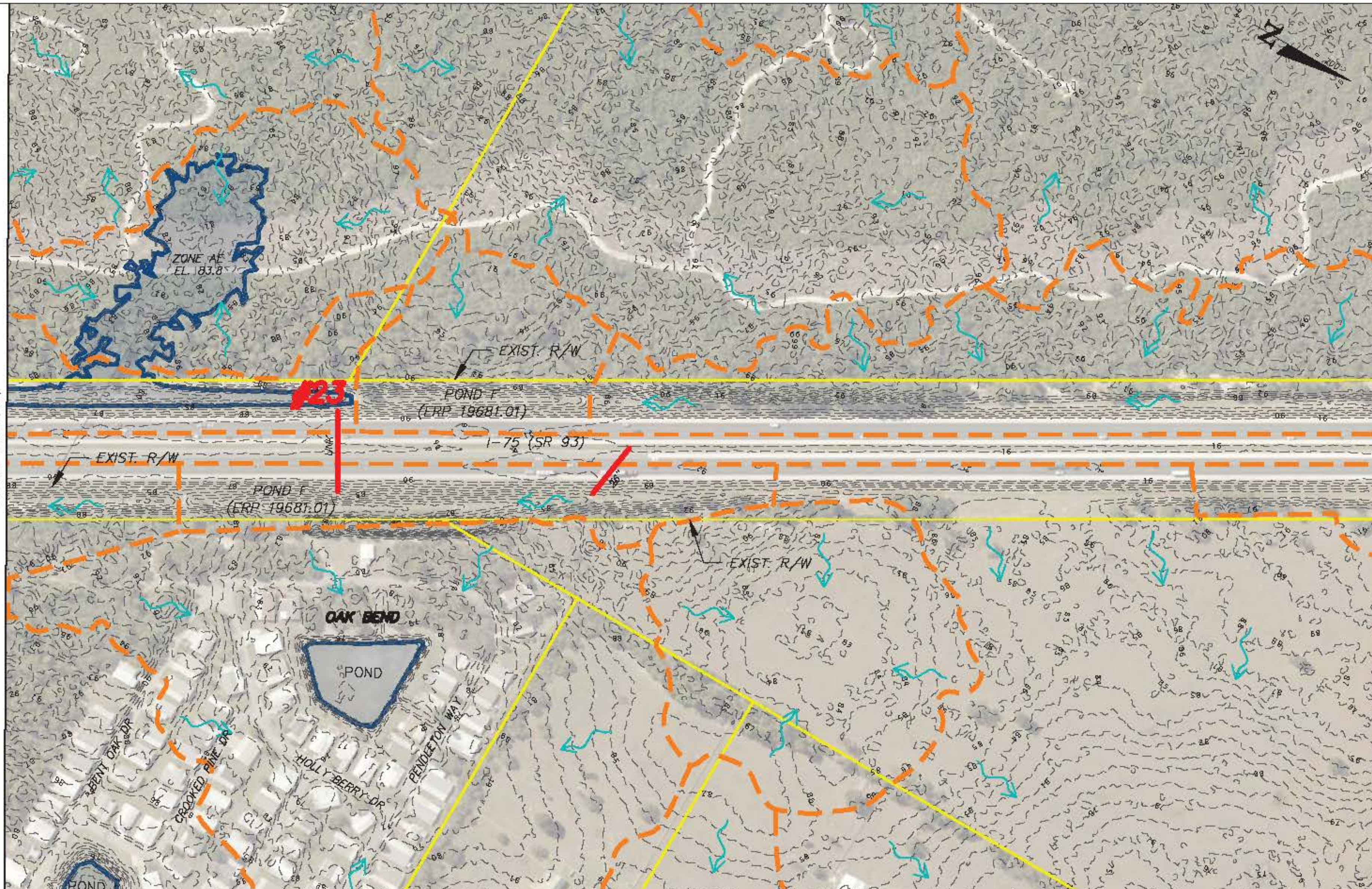

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (30)

SHEET NO. 30

John Hutchison 6/16/2020 10:46:20 AM

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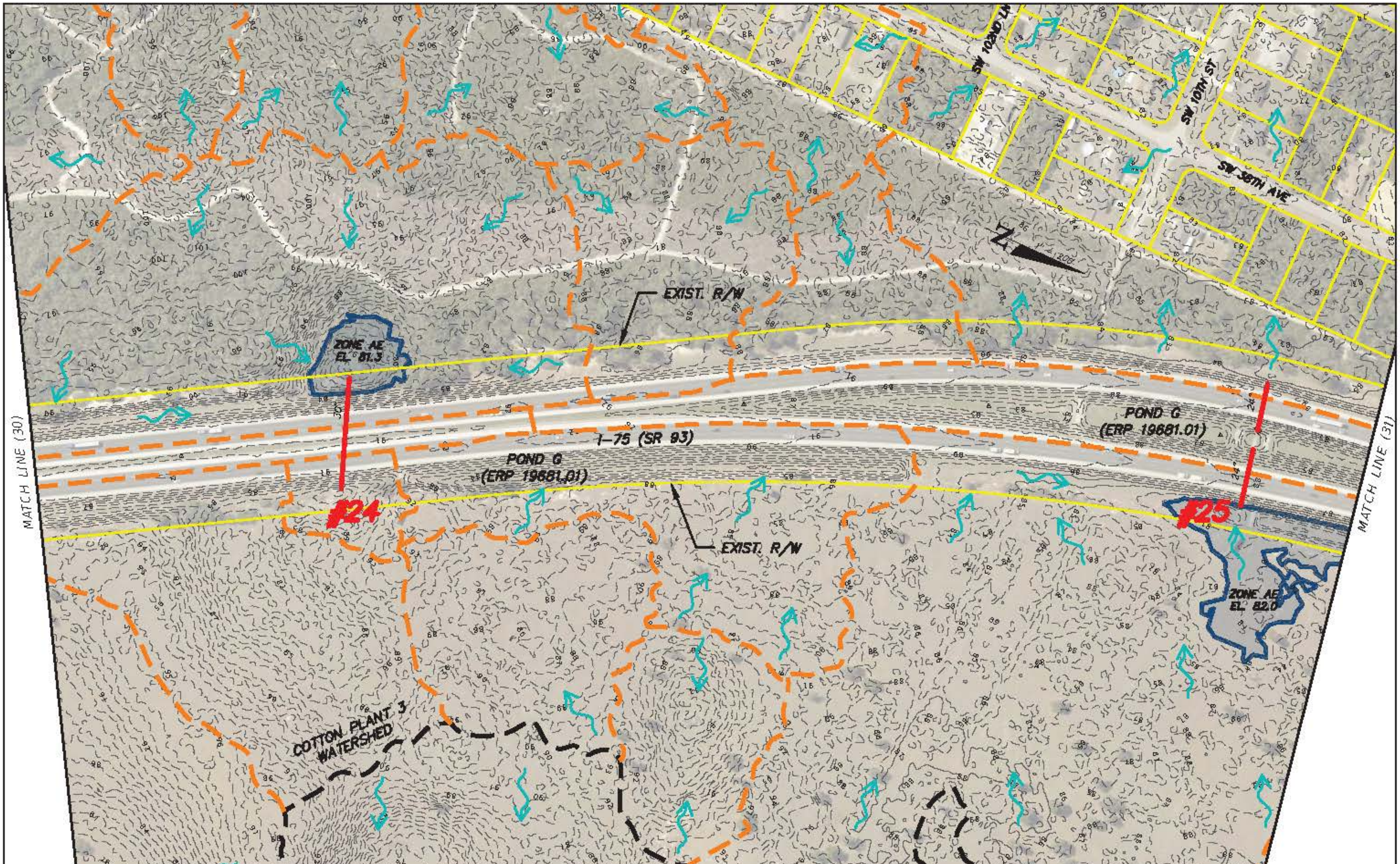

LEGEND

PROPERTY LINE
EXISTING BASIN DIVIDE
EXISTING CROSS DRAIN
WATERSHED BOUNDARY
FLOW ARROW
FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (31)

SHEET NO. 31

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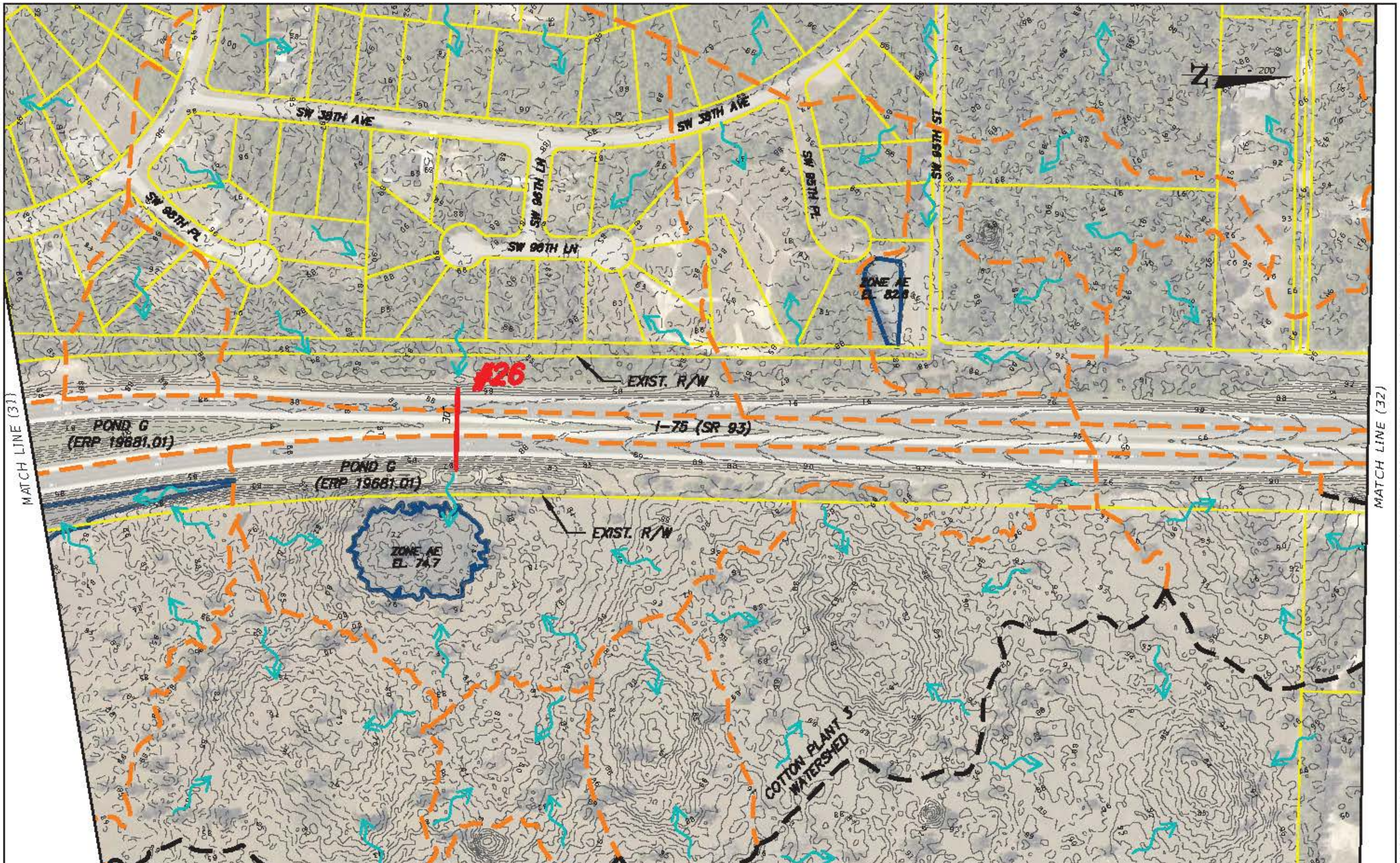

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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EXISTING CONDITIONS DRAINAGE MAP (32)

SHEET NO. 32

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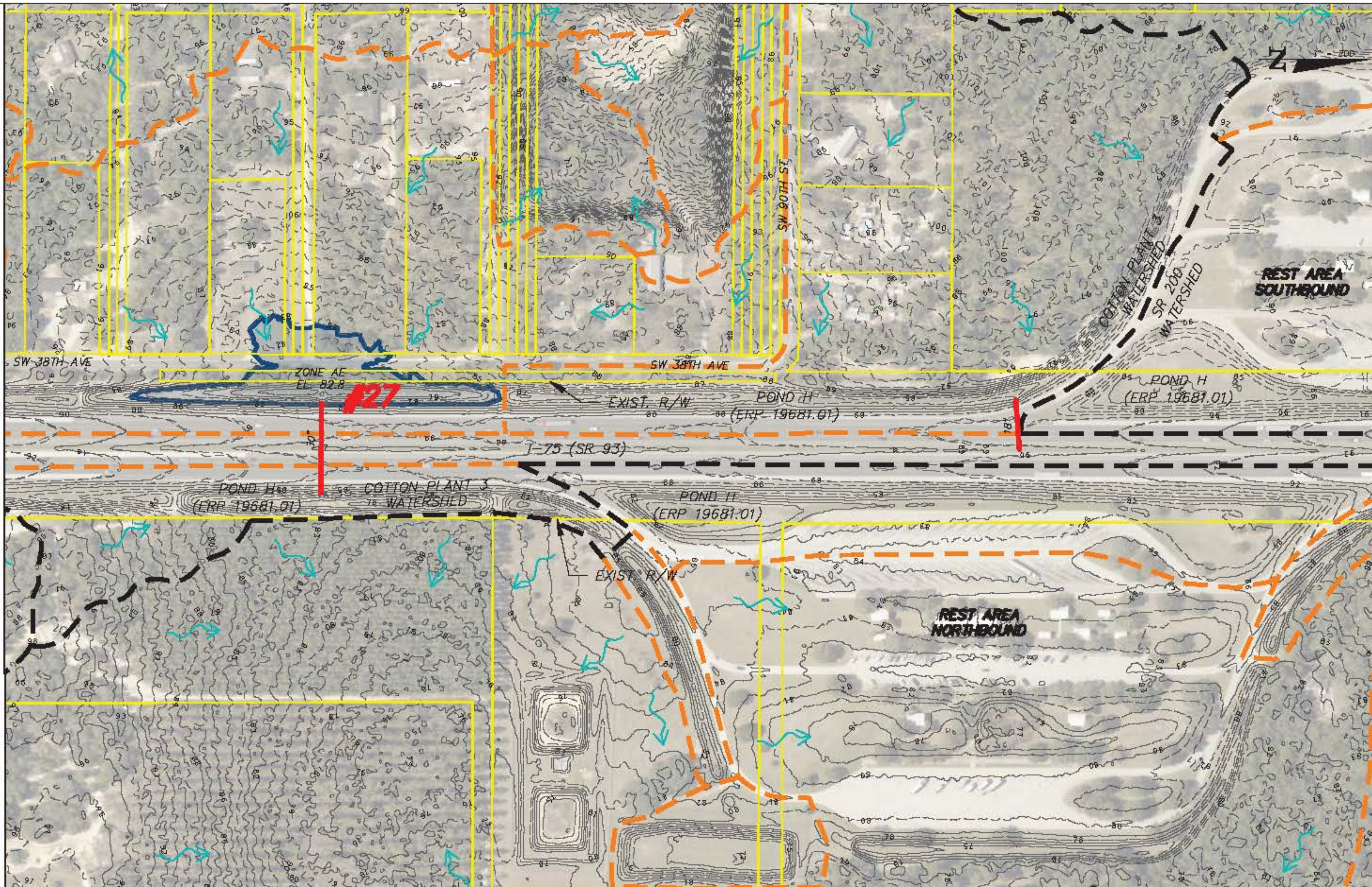

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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SR 93	SUMTER MARION	443623-1-22-01

EXISTING CONDITIONS DRAINAGE MAP (33)

SHEET NO. 33

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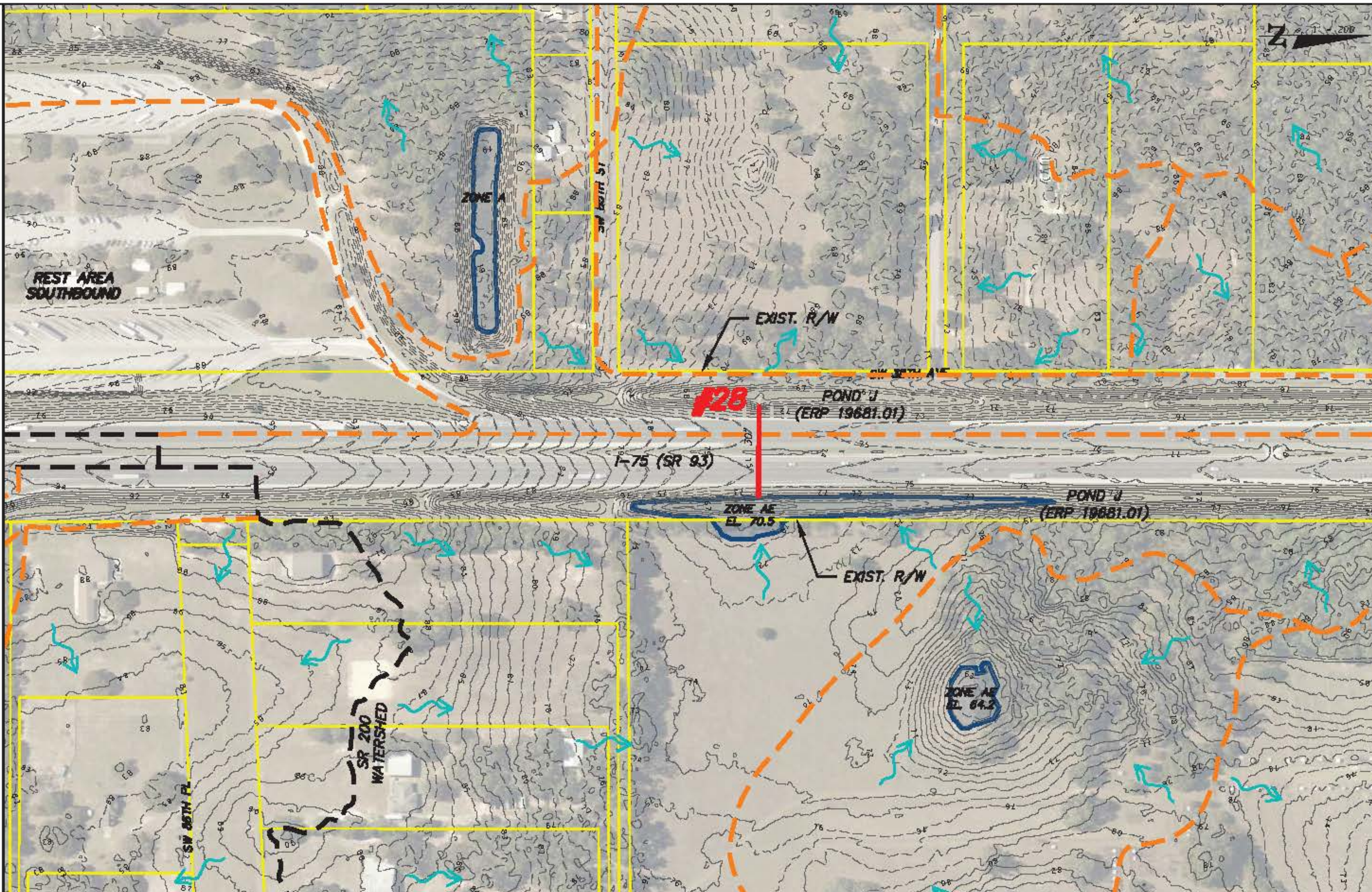

LEGEND

PROPERTY LINE	
EXISTING BASIN DIVIDE	
EXISTING CROSS DRAIN	
WATERSHED BOUNDARY	
FLOW ARROW	
FEMA FLOOD PLAIN	

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EXISTING CONDITIONS DRAINAGE MAP (34)

SHEET NO. 34

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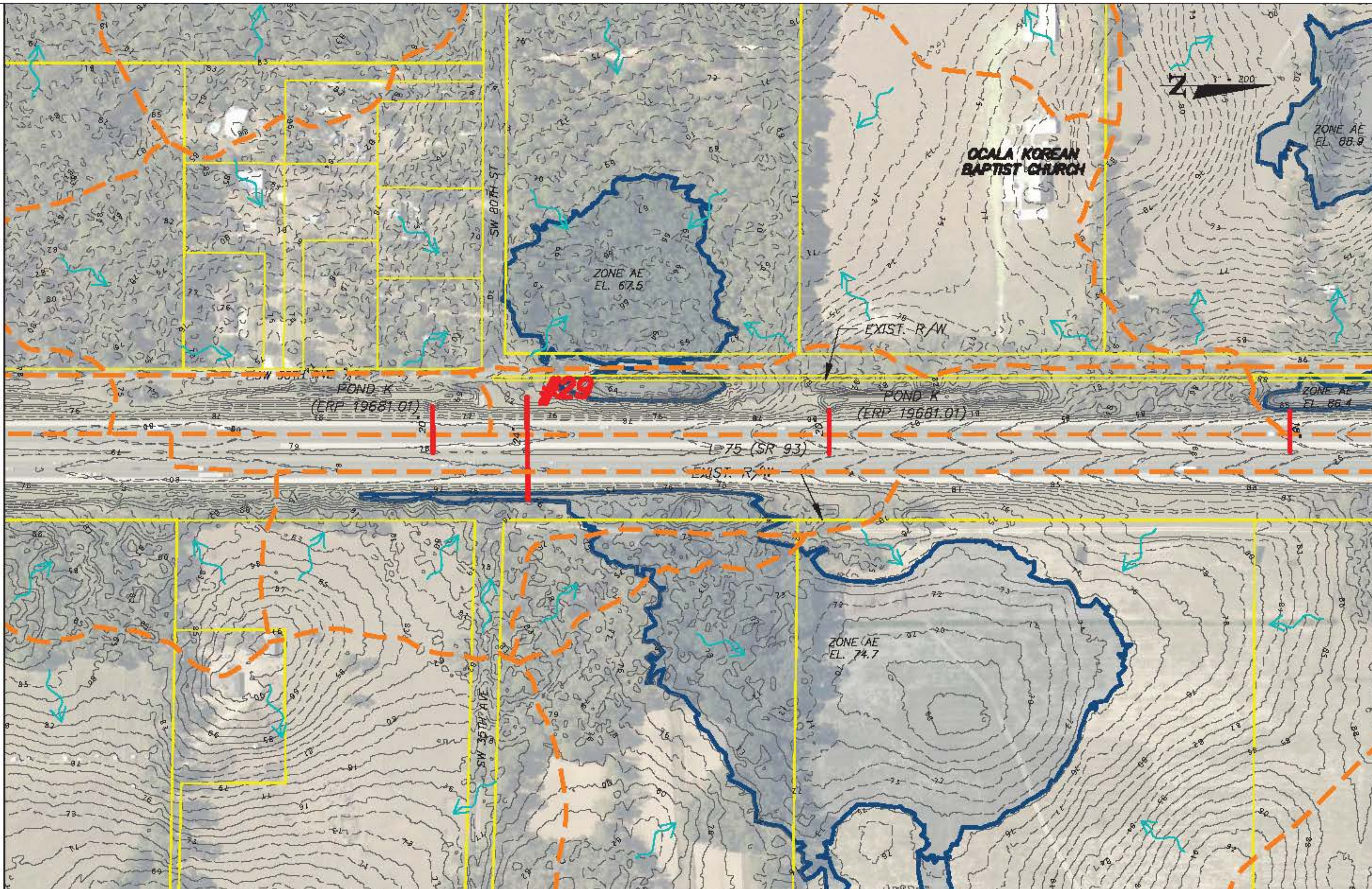

LEGEND	
PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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John Hutchison 6/16/2020 10:53:23 AM

EXISTING CONDITIONS DRAINAGE MAP (35)

SHEET NO. 35

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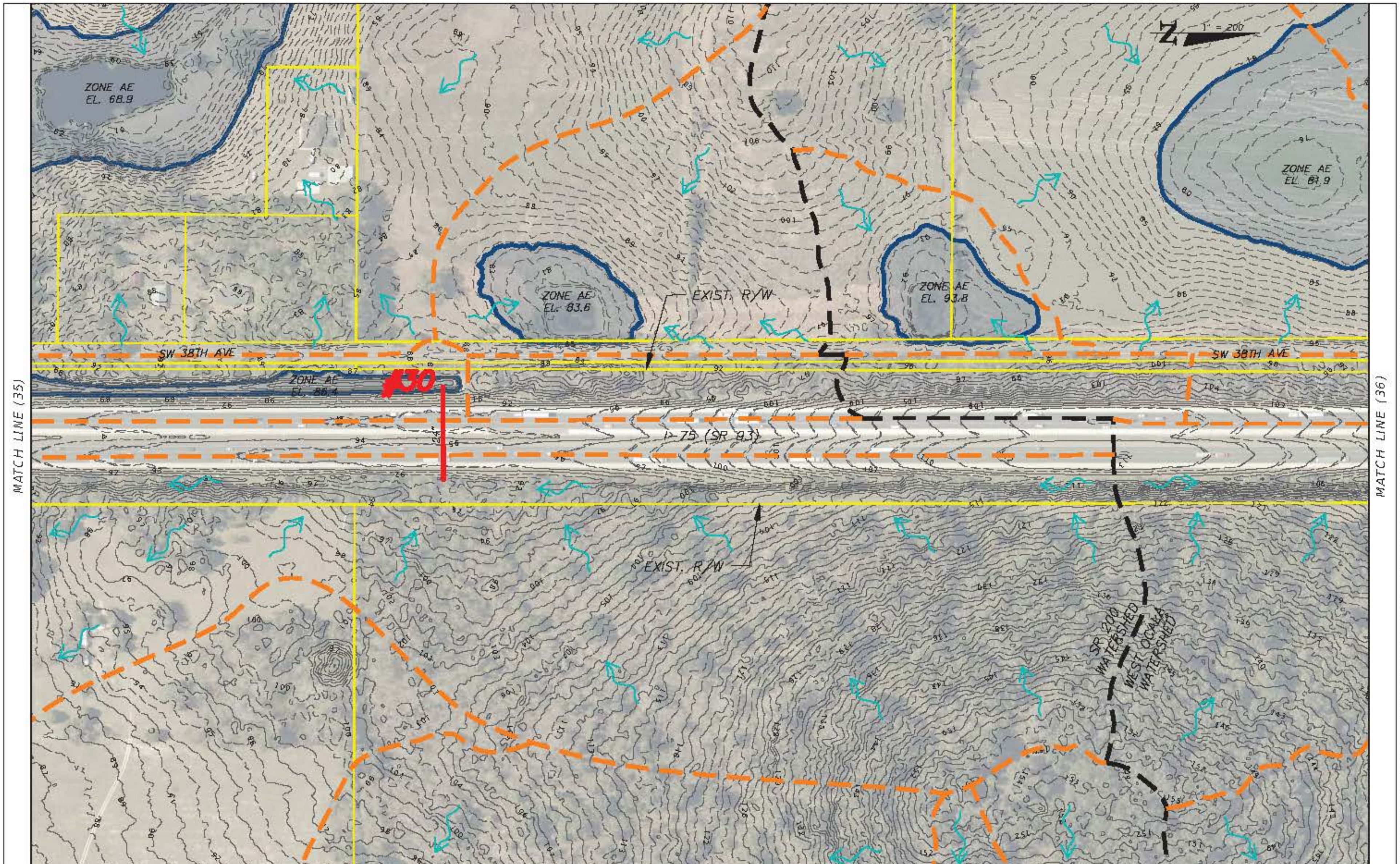

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (36)

SHEET NO. 36

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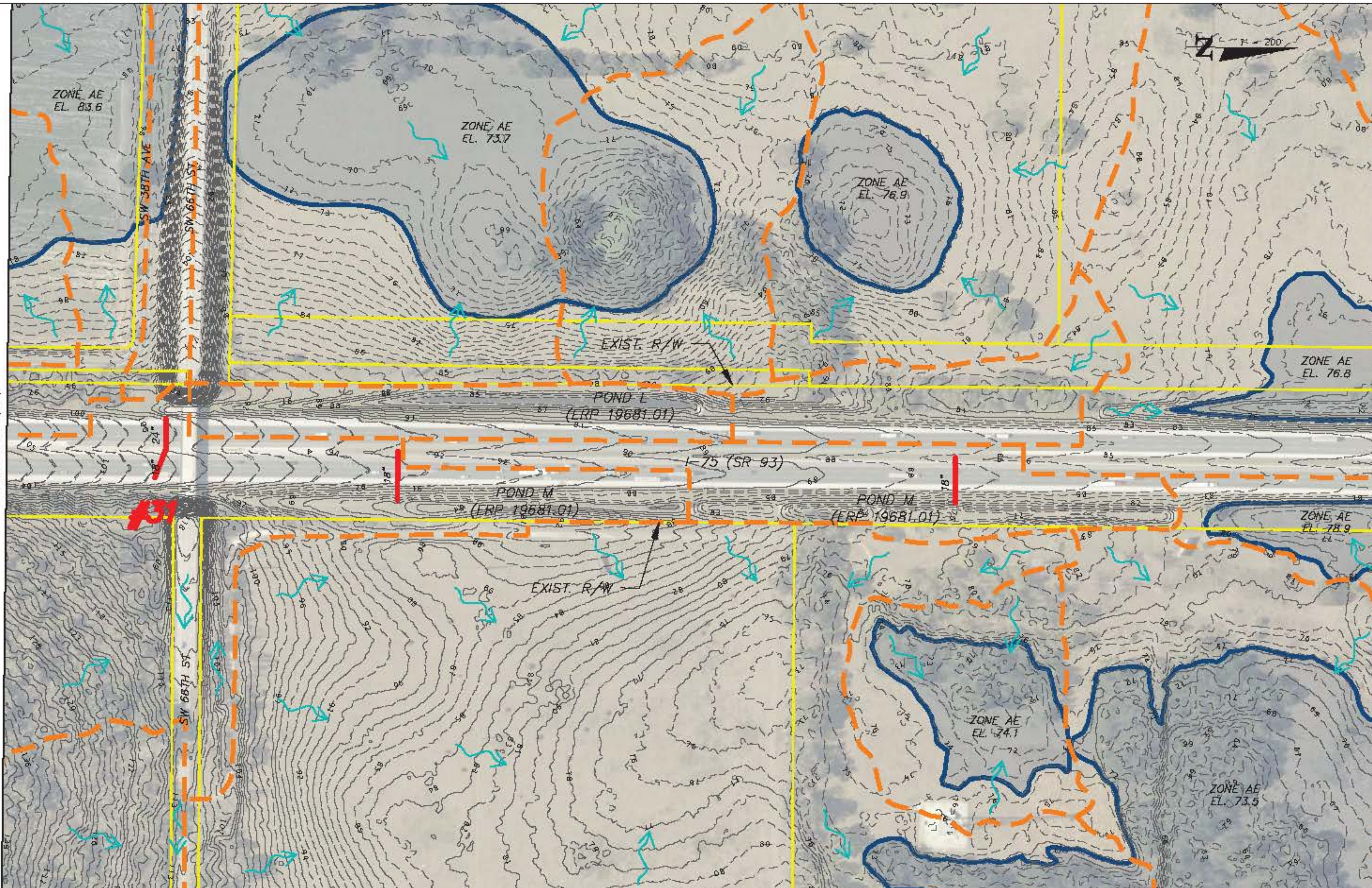

LEGEND			
PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW	
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN	
EXISTING CROSS DRAIN			

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EXISTING CONDITIONS DRAINAGE MAP (37)

SHEET NO. 37

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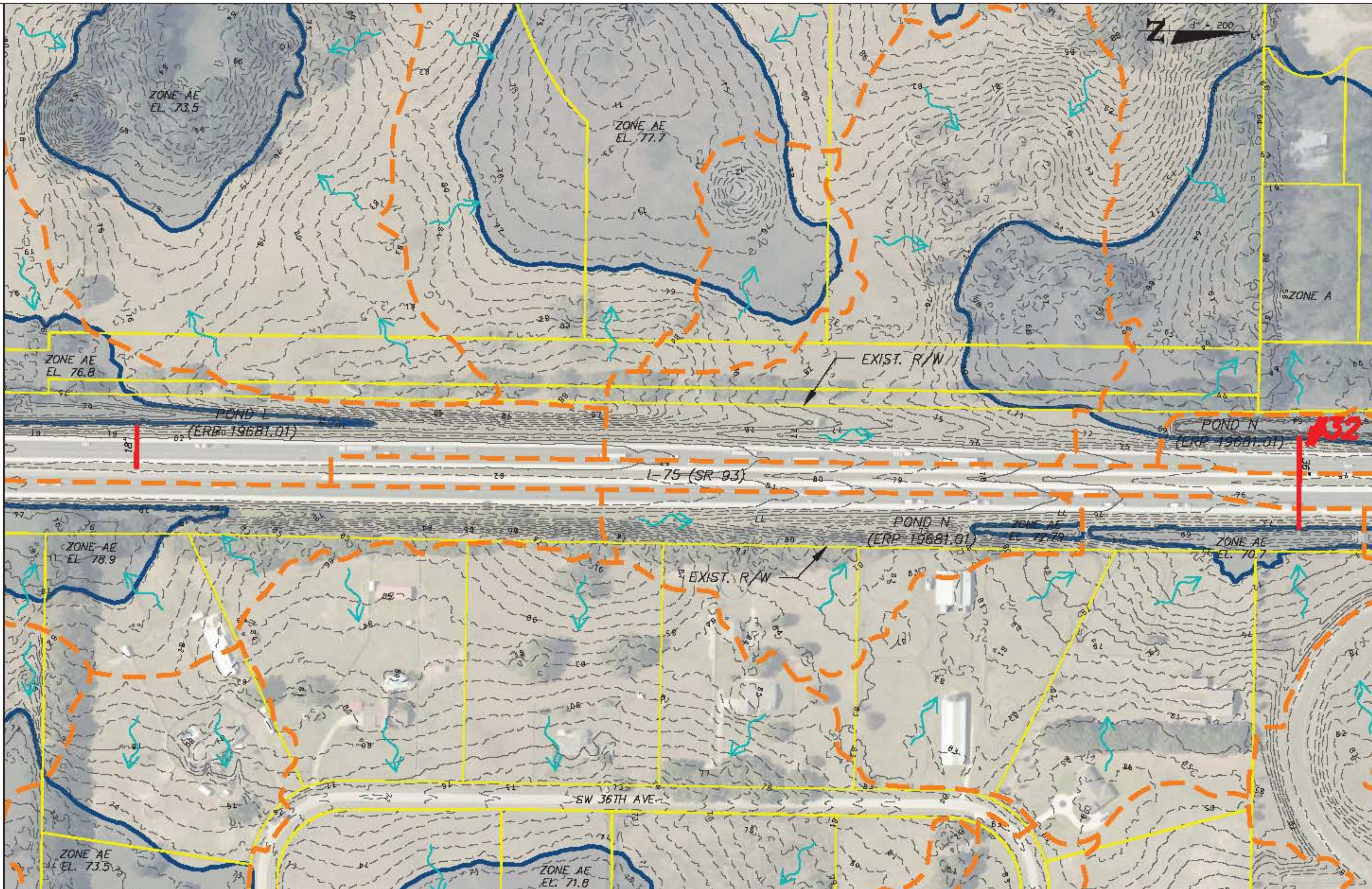

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN
EXISTING CROSS DRAIN		

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EXISTING CONDITIONS DRAINAGE MAP (38)

SHEET NO. 38

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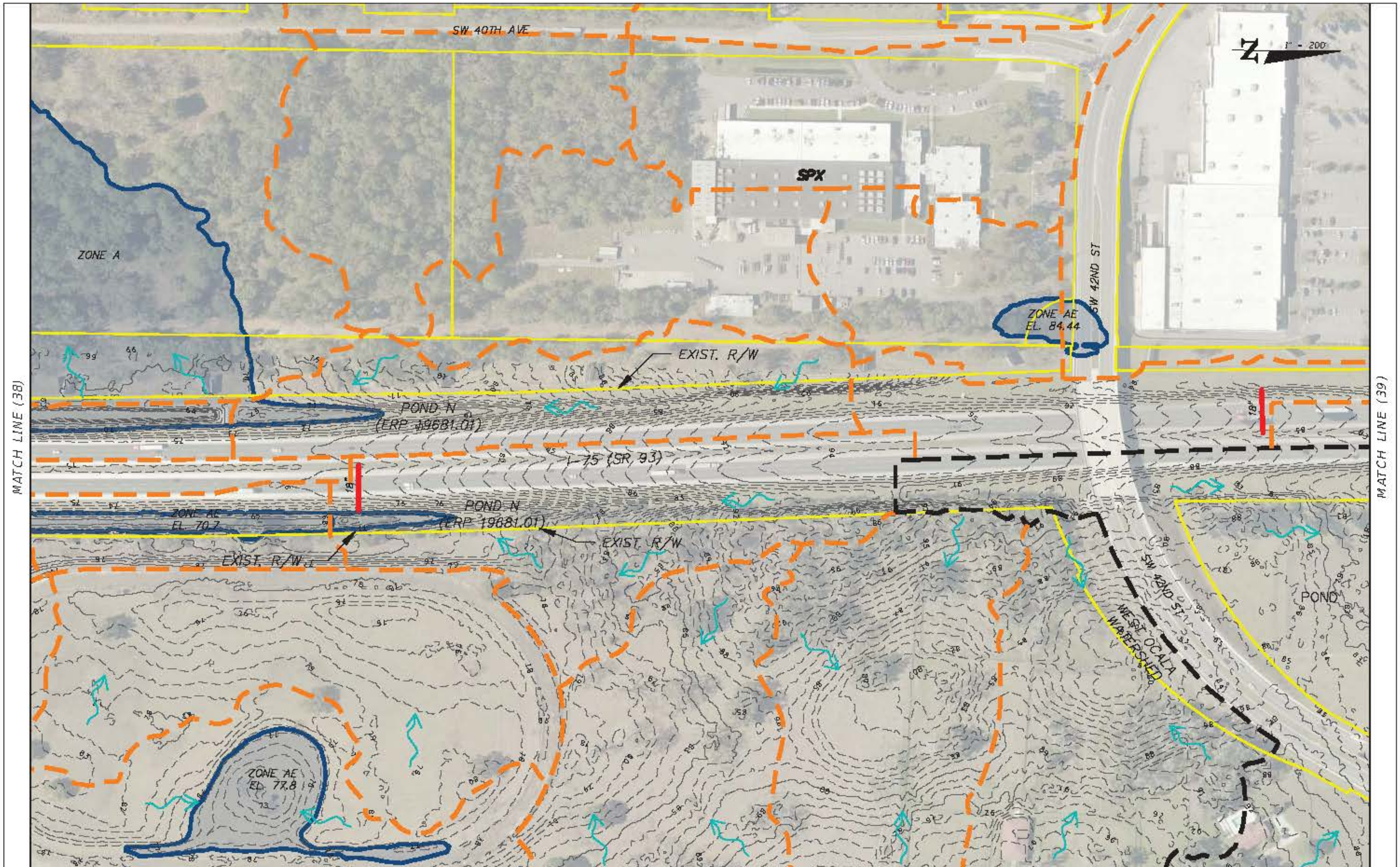

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY	FLOW ARROW	
EXISTING BASIN DIVIDE		FEMA FLOOD PLAIN	
EXISTING CROSS DRAIN			

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EXISTING CONDITIONS DRAINAGE MAP (39)

SHEET NO. 39

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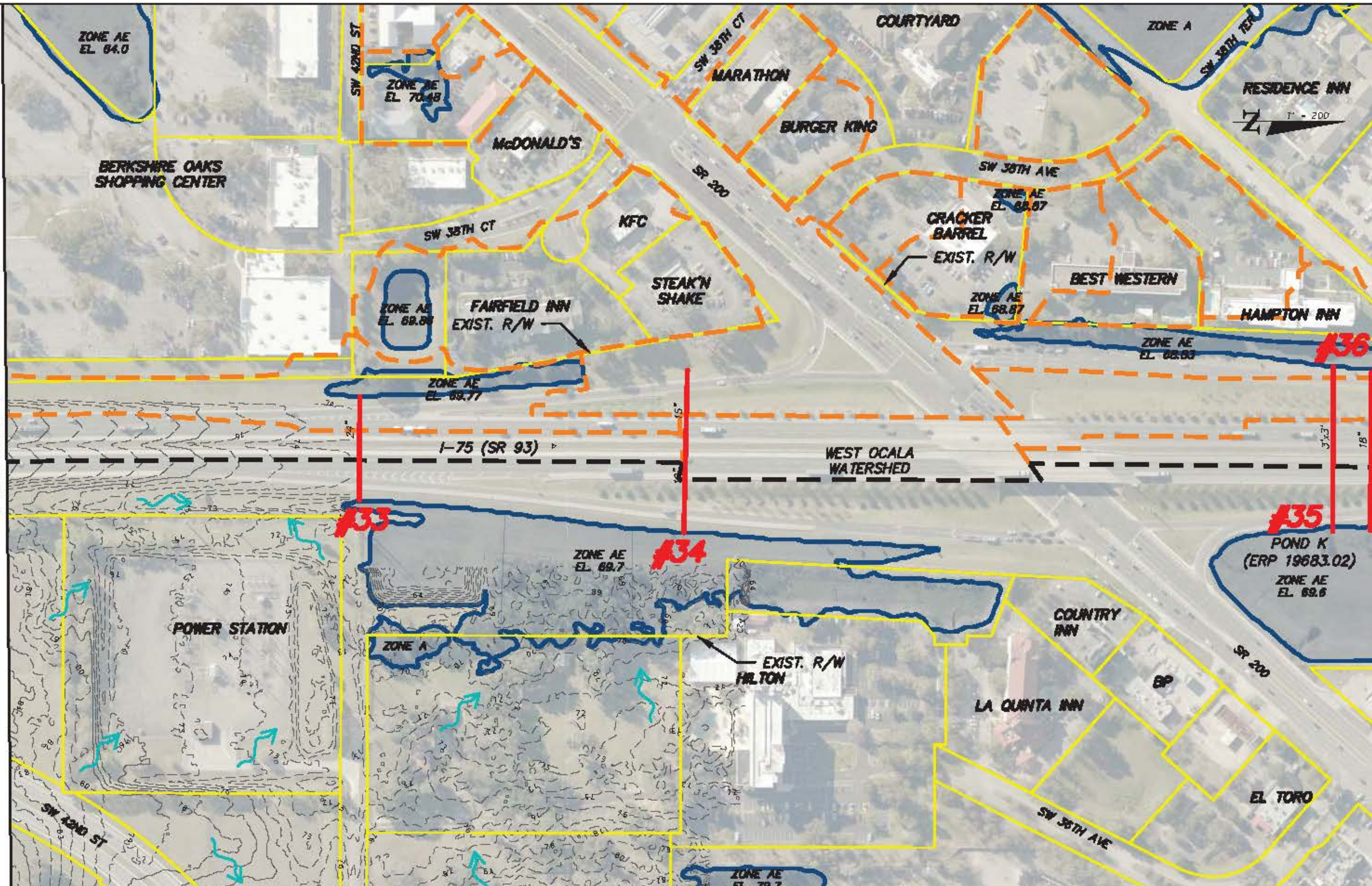

LEGEND

PROPERTY LINE	WATERSHED BOUNDARY
EXISTING BASIN DIVIDE	FLOW ARROW
EXISTING CROSS DRAIN	FEMA FLOOD PLAIN

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EXISTING CONDITIONS DRAINAGE MAP (40)

SHEET NO. 40

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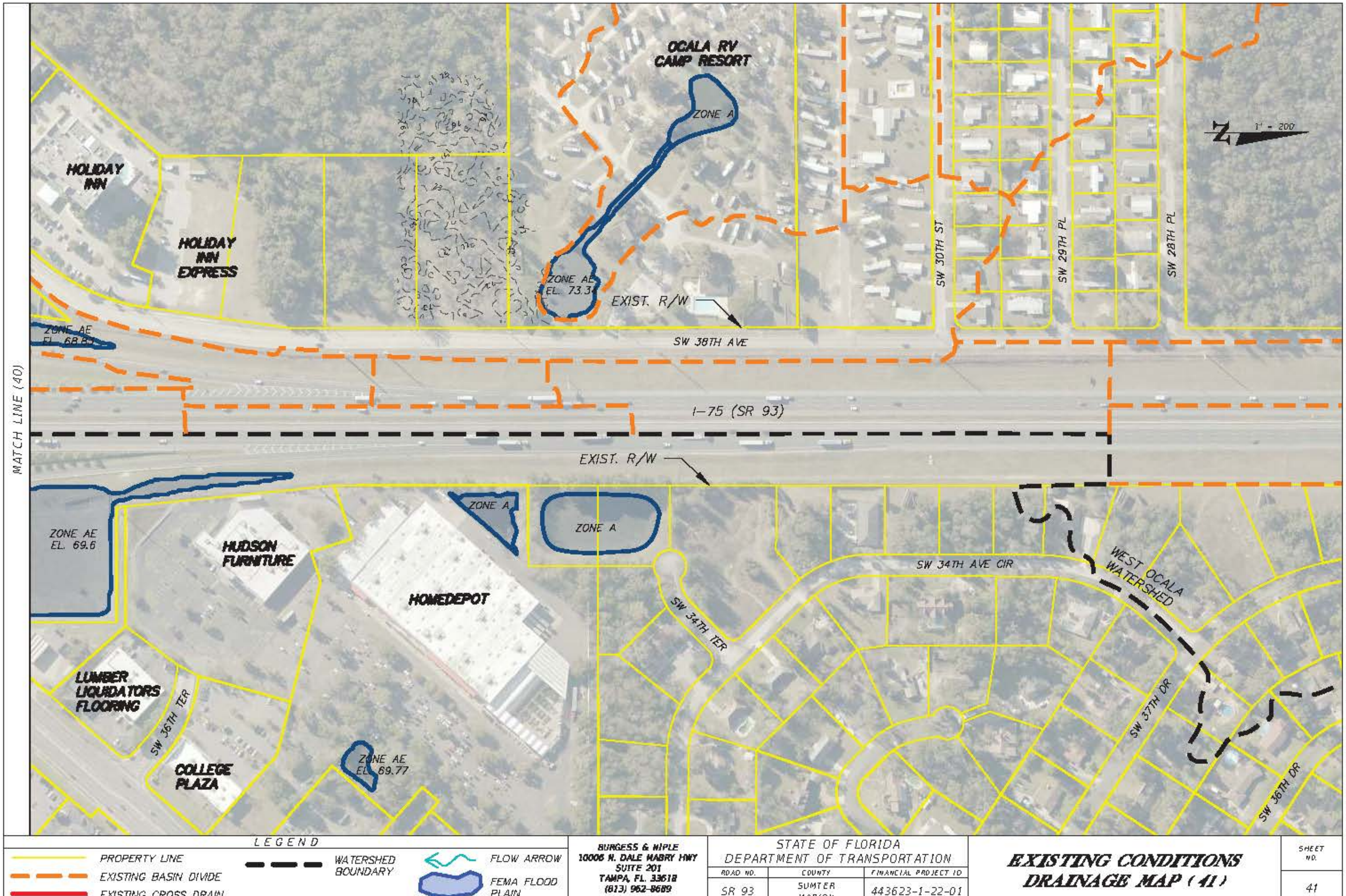

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EXISTING CONDITIONS DRAINAGE MAP (41)

SHEET NO. 41

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Appendix B - Appendix B-1 - Summary Table

Existing Condition Summary Table

Structure	S# on Map	County	Milepost	Lane	Size	Slope	Length (ft)	Invert West	Invert East	Q50	Q100	50-yr Stage	100-yr Stage	EOP Elev.	Floodplain Elev.
1A	1	Sumter	21.552	SB	3-10'x6'	-0.0009	116	39.9	40.0	432	504	47.5	47.7	51	45.2
1B	1	Sumter	21.552	NB	3-10'x6'	-0.0003	94	40.1	40.2	432	504	47.7	47.9	51	45.2
2A	2	Sumter	21.641	SB	2-10'x6'	0.0009	189	40.0	39.8	432	504	47.5	47.7	51	45.2
2B	2	Sumter	22.641	NB	2-10'x6'	-0.0006	100	40.5	40.6	432	504	48.1	48.3	50	45.2
2C	2	Sumter	21.641	NB TP	2-10'x6'	-0.0015	99	40.3	40.4	432	504	47.9	48.1	52	45.2
3	3	Sumter	22.038	SB	24"	-0.0045	65	43.3	43.6	23	26	47.9	48.6	51	45.2
4	4	Sumter	22.442	Both	36"	-0.0048	310	42.1	43.6	51	59	48.6	49.4	50	45.2
5	5	Sumter	23.466	Both	24"	-0.0019	158	54.4	54.7	23	26	59.0	59.7	62	N/A
6	6	Sumter	24.529	Both	24"	0.0036	167	53.2	52.6	23	26	57.5	58.2	62	N/A
7	7	Sumter	25.023	Both	24"	-0.0013	159	61.3	61.5	23	26	65.8	66.5	66	N/A
9A	9	Sumter	25.766	SB	24"	-0.0021	95	54.2	54.4	23	26	58.7	59.4	67	N/A
9B	9	Sumter	25.766	NB	24"	0.0030	101	54.7	54.4	23	26	59.0	59.7	67	N/A
10	10	Sumter	26.338	Both	24"	0.0000	186	50.3	50.3	23	26	54.6	55.3	60	N/A
11	11	Sumter	27.758	Both	3-24"	0.0000	180	56.6	56.6	23	26	60.9	61.6	63.5	N/A
12	12	Sumter	28.283	Both	30"	0.0000	157	53.8	53.8	35	41	58.5	59.1	61.3	N/A
13	13	Marion	0.266	Both	36"	0.0074	190	57.4	56.0	51	59	62.4	63.2	63	N/A
14	14	Marion	0.95	Both	24"	0.0012	163	58.1	57.9	23	26	62.4	63.1	65.4	N/A
15	15	Marion	2.142	Both	30"	0.0021	189	56.9	56.5	35	41	61.6	62.2	62.8	N/A
16	16	Marion	3.14	Both	30"	-0.0008	241	62.7	62.9	35	41	67.6	68.2	70	N/A
17	17	Marion	4.4	Both	30"	0.0086	163	66.9	65.5	35	41	71.6	72.2	73.5	N/A
19	19	Marion	6.304	Both	30"	-0.0012	169	53.2	53.4	35	41	58.2	58.8	73	N/A
20	20	Marion	7.175	Both	24"	0.0012	166	67.8	67.6	23	26	72.2	72.9	85	N/A
21	21	Marion	7.61	Both	24"	-0.0078	193	81.8	83.3	23	26	87.7	88.4	93.5	N/A
22	22	Marion	7.83	Both	24"	0.0012	173	83.7	83.5	23	26	88.1	88.8	91.5	N/A
23	23	Marion	8.045	Both	24"	0.0116	173	84.8	82.8	23	26	89.2	89.9	92	84.8
24	24	Marion	8.601	Both	30"	-0.0198	243	76.1	80.9	35	41	85.7	86.3	90	82.3
25A	25	Marion	9.011	NB	24"	0.0029	123	79.8	79.4	23	26	84.2	84.9	90	83.0
25B	25	Marion	10.011	SB	24"	0.0170	100	81.8	80.1	23	26	86.2	86.9	91	N/A
26	26	Marion	9.22	Both	30"	0.0195	174	81.2	77.8	35	41	86.0	86.6	91	75.7
27	27	Marion	9.714	Both	30"	-0.0005	192	80.7	80.8	35	41	85.6	86.2	87	83.8
28	28	Marion	10.452	Both	30"	-0.0010	191	67.7	67.9	35	41	72.7	73.3	87	71.5
29	29	Marion	10.98	Both	24"	-0.0362	221	61.6	69.6	23	26	74.0	74.7	88	75.7
31	31	Marion	11.461	Both	24"/18"	-0.0085	205	87.2	89.0	23	26	91.1	91.8	99	71.5
32	32	Marion	12.92	Both	36"	-0.0084	193	66.1	67.7	51	59	72.9	73.6	79	71.7
33	33	Marion	13.658	Both	24"	0.0027	223	66.7	66.1	23	26	71.1	71.8	95	70.7
34	34	Marion	14.085	Both	15"	0.0154	355	68.2	62.8	65	76	73.1	73.9	87.5	69.8

Proposed Condition Summary Table

Structure	S# on Map	County	Milepost	Lane	Size	Slope	Length (ft)	Invert West	Invert East	Q50	Q100	50-yr Stage	100-yr Stage	EOP Elev.	Floodplain Elev.
1A	1	Sumter	21.552	SB	3-10'x6'	-0.0009	300	39.8	40.0	432	504	45.7	45.9	51	45.2
1B	1	Sumter	21.552	NB	3-10'x6'	-0.0003	300	40.1	40.2	432	504	45.9	46.1	51	45.2
2A	2	Sumter	21.641	SB	2-10'x6'	0.0009	300	40.0	39.7	432	504	45.7	45.9	51	45.2
2B	2	Sumter	22.641	NB	2-10'x6'	-0.0006	300	40.4	40.6	432	504	46.3	46.5	50	45.2
2C	2	Sumter	21.641	NB TP	2-10'x6'	-0.0015	300	40.1	40.5	432	504	46.2	46.4	52	45.2
3	3	Sumter	22.038	SB	24"	-0.0045	300	42.7	44.0	23	26	46.5	47.2	51	45.2
4	4	Sumter	22.442	Both	36"	-0.0048	310	42.1	43.6	51	59	47.7	48.5	50	45.2
5	5	Sumter	23.466	Both	24"	-0.0019	300	54.2	54.8	23	26	58.2	58.9	62	N/A
6	6	Sumter	24.529	Both	24"	0.0036	300	53.4	52.3	23	26	56.8	57.5	62	N/A
7	7	Sumter	25.023	Both	24"	-0.0013	300	61.2	61.5	23	26	64.3	64.7	66	N/A
9A	9	Sumter	25.766	SB	24"	-0.0021	300	53.9	54.6	23	26	58.0	58.7	67	N/A
9B	9	Sumter	25.766	NB	24"	0.0030	300	54.9	54.1	23	26	58.3	59.0	67	N/A
10	10	Sumter	26.338	Both	24"	0.0000	300	50.3	50.3	23	26	53.7	54.4	60	N/A
11	11	Sumter	27.758	Both	3-24"	0.0000	300	56.6	56.6	23	26	60.0	60.7	63.5	N/A
12	12	Sumter	28.283	Both	30"	0.0000	300	53.8	53.8	35	41	57.6	58.2	61.3	N/A
13	13	Marion	0.266	Both	36"	0.0074	300	57.8	55.5	51	59			63	N/A
14	14	Marion	0.95	Both	24"	0.0012	300	58.1	57.8	23	26	61.5	62.2	65.4	N/A
15	15	Marion	2.142	Both	30"	0.0021	300	57.0	56.3	35	41	60.8	61.4	62.8	N/A
16	16	Marion	3.14	Both	30"	-0.0008	300	62.6	62.9	35	41	66.7	67.3	70	N/A
17	17	Marion	4.4	Both	30"	0.0086	300	67.4	64.9	35	41	71.2	71.8	73.5	N/A
19	19	Marion	6.304	Both	30"	-0.0012	300	53.2	53.4	35	41	57.2	57.8	73	N/A
20	20	Marion	7.175	Both	24"	0.0012	300	67.8	67.5	23	26	71.2	71.9	85	N/A
21	21	Marion	7.61	Both	24"	-0.0078	300	81.3	83.7	23	26	86.7	87.4	93.5	N/A
22	22	Marion	7.83	Both	24"	0.0012	300	83.7	83.4	23	26	87.1	87.8	91.5	N/A
23	23	Marion	8.045	Both	24"	0.0116	300	85.5	82.0	23	26	88.2	88.9	92	84.8
24	24	Marion	8.601	Both	30"	-0.0198	300	75.5	81.4	35	41	84.7	85.3	90	82.3
25A	25	Marion	9.011	NB	24"	0.0029	300	79.9	79.1	23	26	83.2	83.9	90	83.0
25B	25	Marion	10.011	SB	24"	0.0170	300	83.5	78.4	23	26	85.2	85.9	91	N/A
26	26	Marion	9.22	Both	30"	0.0195	300	82.4	76.5	35	41	85.0	85.6	91	75.7
27	27	Marion	9.714	Both	30"	-0.0005	300	80.6	80.8	35	41	84.6	85.2	87	83.8
28	28	Marion	10.452	Both	30"	-0.0010	300	67.6	67.9	35	41	71.7	72.3	87	71.5
29	29	Marion	10.98	Both	24"	-0.0362	300	60.1	71.0	23	26	73.0	73.7	88	75.7
31	31	Marion	11.461	Both	24"/18"	-0.0085	300	86.7	89.3	23	26	90.1	90.8	99	71.5
32	32	Marion	12.92	Both	36"	-0.0084	300	65.6	68.1	51	59	71.9	72.6	79	71.7
33	33	Marion	13.658	Both	24"	0.0027	300	66.8	65.9	23	26	70.1	70.8	95	70.7
34	34	Marion	14.085	Both	15"	0.0154	355	70.2	62.7	65	76	72.1	72.9	87.5	69.8

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Appendix B-2 - Cross Drain Analysis

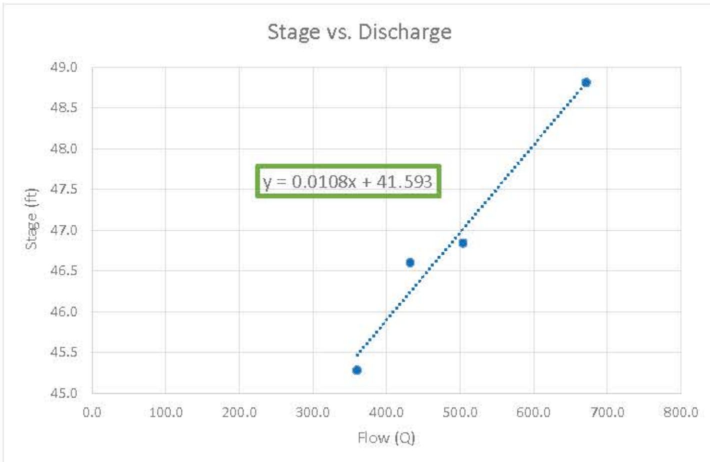
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

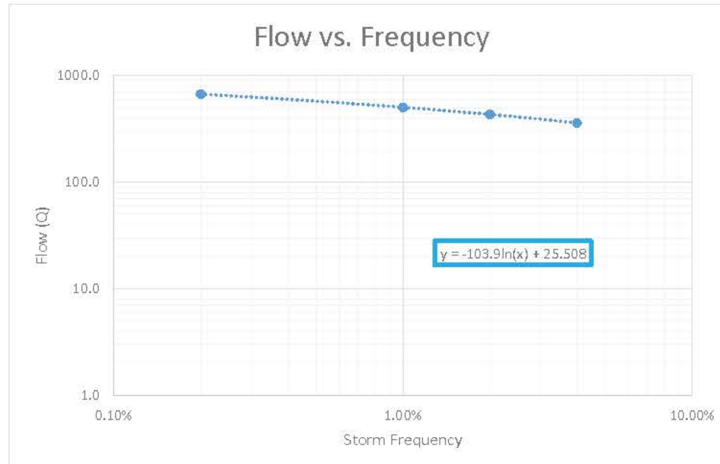
CD-1A

	Storm	Frequency	Flow	Stage
	25	4.00%	360.0	45.3
Design Flood	50	2.00%	432.1	46.6
Base Flood	100	1.00%	504.0	46.8
Greatest	500	0.20%	671.3	48.8

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	40	Upstream invert
FL (DS) =	39.8	Downstream invert
EOP =	51	(Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-1A	1	10'x6'	60.00	6	360.0	504.0

Height (D)	6
With (B)	10

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
Q/B	36.0	43.21	50.4	
HW/D	0.88	1.10	1.14	Found using Chart 8B, FHWA HDS 5 (see attached)
HW	5.3	6.6	6.8	HW = (HW/D) * Diameter
HW Elev.	45.3	46.6	46.8	HW Elev. = HW + FL (US)

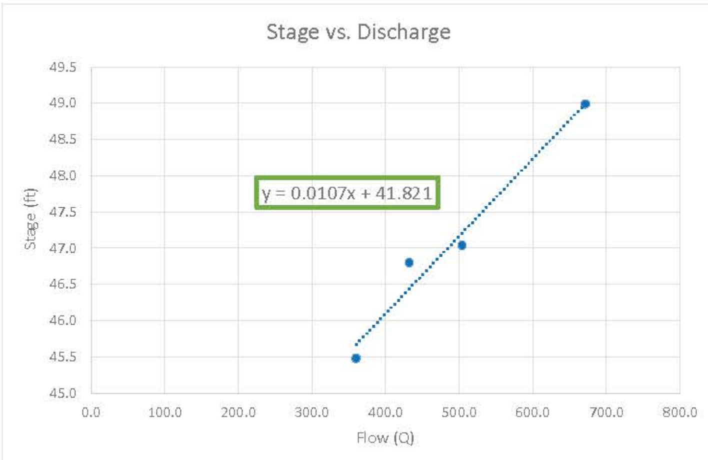
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

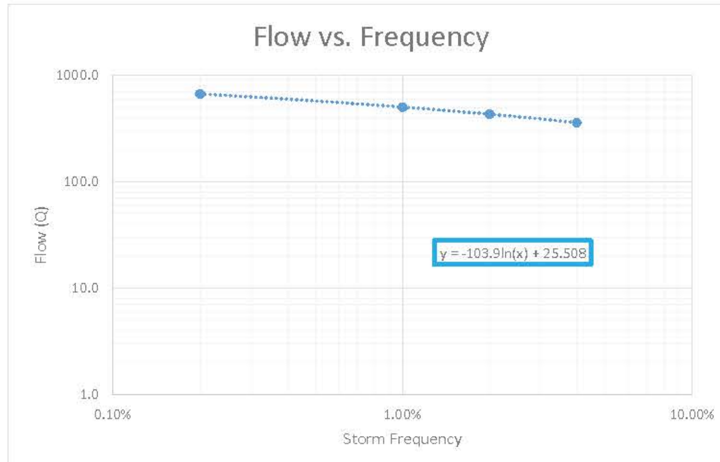
CD-1B

	Storm	Frequency	Flow	Stage
	25	4.00%	360.0	45.5
Design Flood	50	2.00%	432.1	46.8
Base Flood	100	1.00%	504.0	47.0
Greatest	500	0.20%	671.3	49.0

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 40.2 Upstream invert
FL (DS) = 40.1 Downstream invert
EOP = 51 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-1B	1	10'x6'	60.00	6	360.0	504.0

Height (D) 6
With (B) 10

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
Q/B	36.0	43.21	50.4	
HW/D	0.88	1.10	1.14	Found using Chart 8B, FHWA HDS 5 (see attached)
HW	5.3	6.6	6.8	HW = (HW/D) * Diameter
HW Elev.	45.5	46.8	47.0	HW Elev. = HW + FL (US)

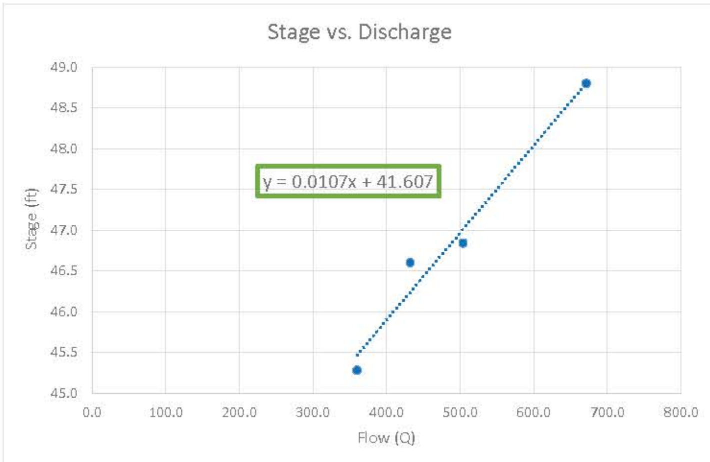
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

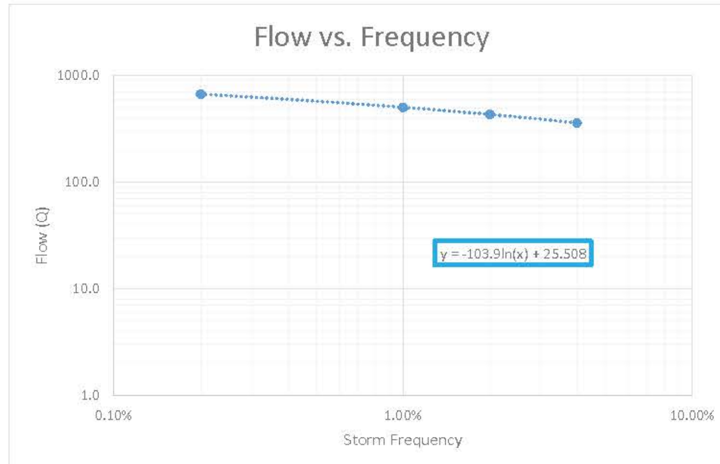
CD-2A

	Storm	Frequency	Flow	Stage
	25	4.00%	360.0	45.3
Design Flood	50	2.00%	432.1	46.6
Base Flood	100	1.00%	504.0	46.8
Greatest	500	0.20%	671.3	48.8

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 40 Upstream invert
FL (DS) = 39.7 Downstream invert
EOP = 51 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-2A	1	10'x6'	60.00	6	360.0	504.0

Height (D) 6
With (B) 10

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
Q/B	36.0	43.21	50.4	
HW/D	0.88	1.10	1.14	Found using Chart 8B, FHWA HDS 5 (see attached)
HW	5.3	6.6	6.8	HW = (HW/D) * Diameter
HW Elev.	45.3	46.6	46.8	HW Elev. = HW + FL (US)

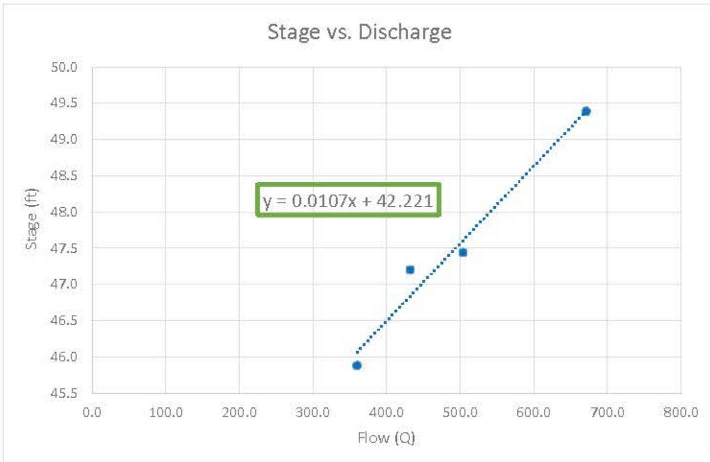
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

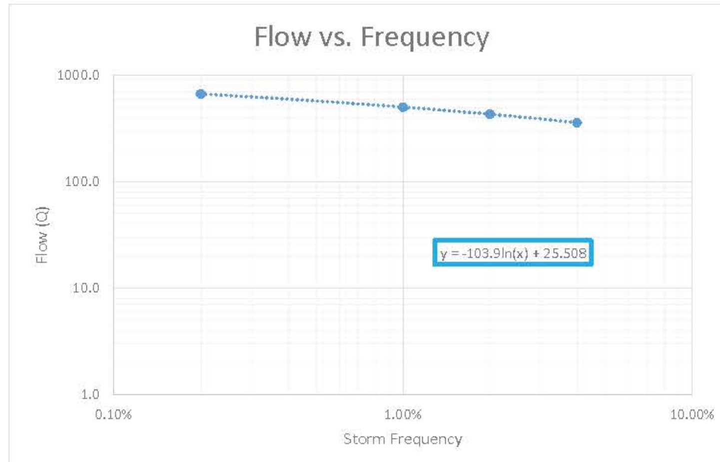
CD-2B

	Storm	Frequency	Flow	Stage
	25	4.00%	360.0	45.9
Design Flood	50	2.00%	432.1	47.2
Base Flood	100	1.00%	504.0	47.4
Greatest	500	0.20%	671.3	49.4

Notes
25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	40.6	Upstream invert
FL (DS) =	40.4	Downstream invert
EOP =	50	(Upstream)

A. Calculate Discharge
Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-2B	1	10'x6'	60.00	6	360.0	504.0

Height (D)	6
With (B)	10

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
Q/B	36.0	43.21	50.4	
HW/D	0.88	1.10	1.14	Found using Chart 8B, FHWA HDS 5 (see attached)
HW	5.3	6.6	6.8	HW = (HW/D) * Diameter
HW Elev.	45.9	47.2	47.4	HW Elev. = HW + FL (US)

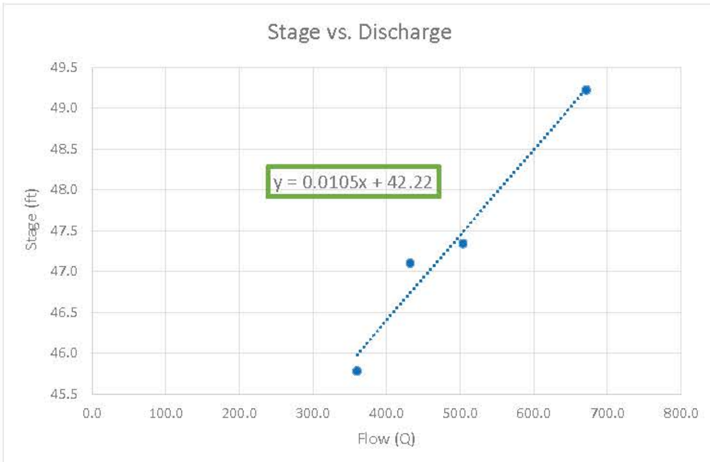
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

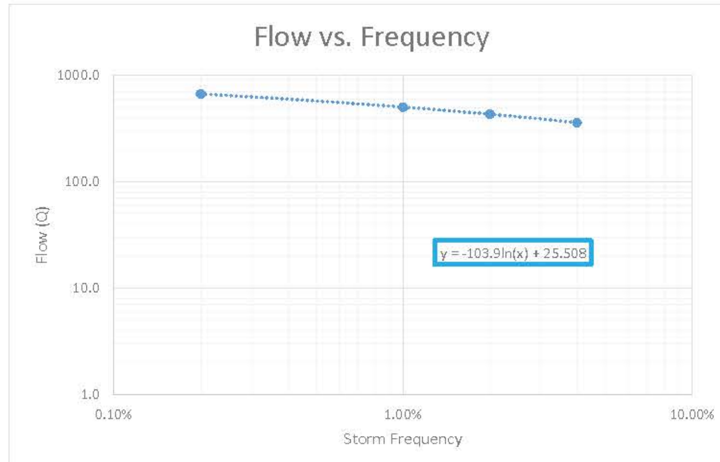
CD-2C

	Storm	Frequency	Flow	Stage
	25	4.00%	360.0	45.8
Design Flood	50	2.00%	432.1	47.1
Base Flood	100	1.00%	504.0	47.3
Greatest	500	0.20%	671.3	49.2

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	40.5	Upstream invert
FL (DS) =	40.1	Downstream invert
EOP =	52	(Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-2C	1	10'x6'	60.00	6	360.0	504.0

Height (D)	6
With (B)	10

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
Q/B	36.0	43.21	50.4	
HW/D	0.88	1.10	1.14	Found using Chart 8B, FHWA HDS 5 (see attached)
HW	5.3	6.6	6.8	HW = (HW/D) * Diameter
HW Elev.	45.8	47.1	47.3	HW Elev. = HW + FL (US)

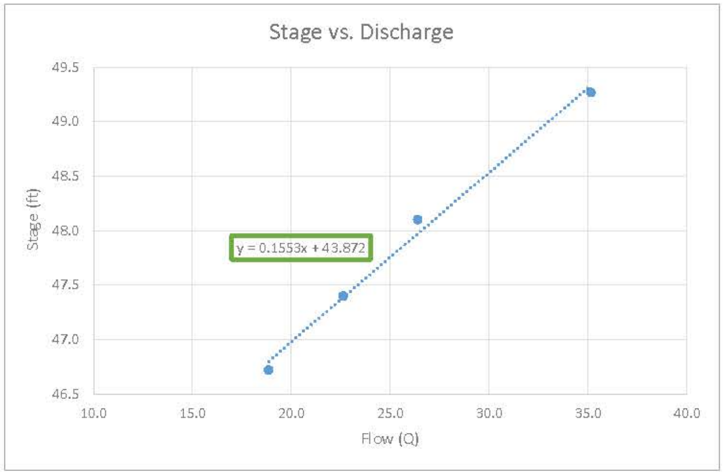
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

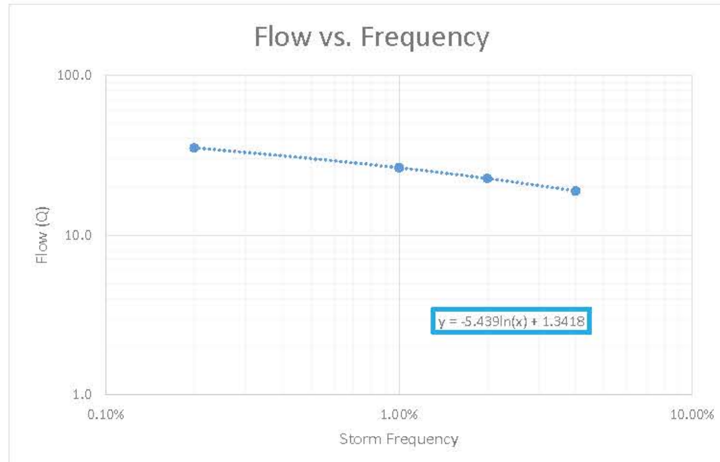
CD-3

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	46.7
Design Flood	50	2.00%	22.6	47.4
Base Flood	100	1.00%	26.4	48.1
Greatest	500	0.20%	35.1	49.3

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	44	Upstream invert
FL (DS) =	42.7	*Downstream invert
EOP =	51	(Upstream)

*approximate

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-3	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	46.7	47.4	48.1	HW Elev. = HW + FL (US)

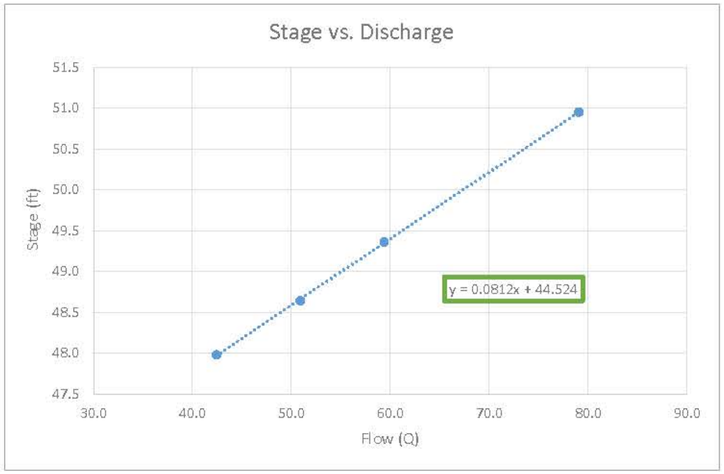
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

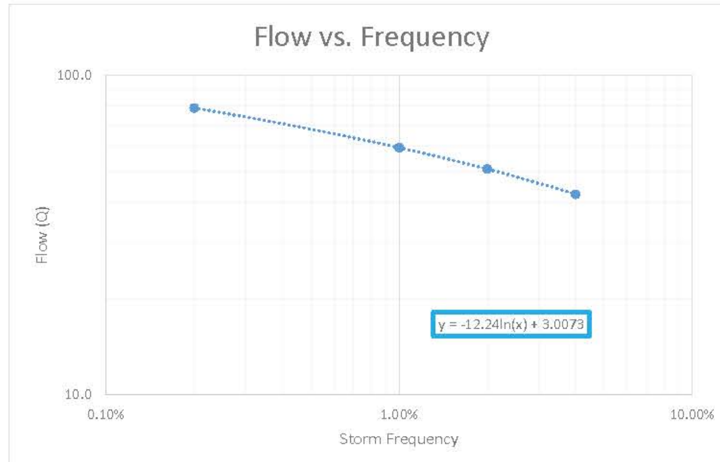
CD-4

	Storm	Frequency	Flow	Stage
	25	4.00%	42.4	48.0
Design Flood	50	2.00%	50.9	48.6
Base Flood	100	1.00%	59.4	49.4
Greatest	500	0.20%	79.1	50.9

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 44.5 Upstream invert
FL (DS) = 43 Downstream invert
EOP = 50 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-4	1	36	7.07	6	42.4	59.4

B. Compute stages using FHWA HDS 5

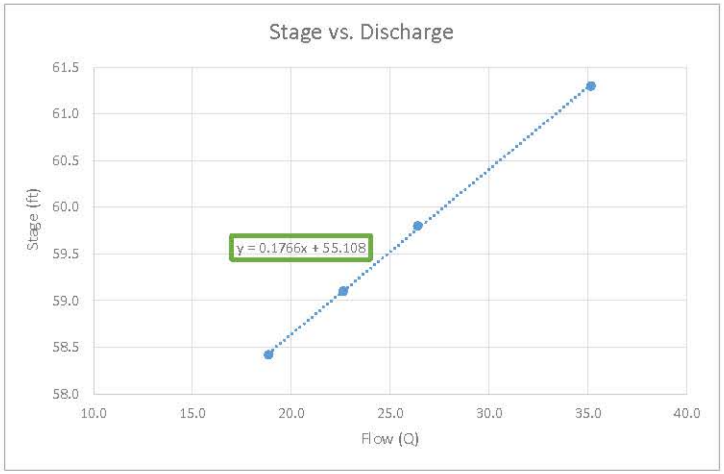
	25-yr	50-yr	100-yr	Notes
HW/D	1.16	1.38	1.62	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.5	4.1	4.9	HW = (HW/D) * Diameter
HW Elev.	48.0	48.6	49.4	HW Elev. = HW + FL (US)

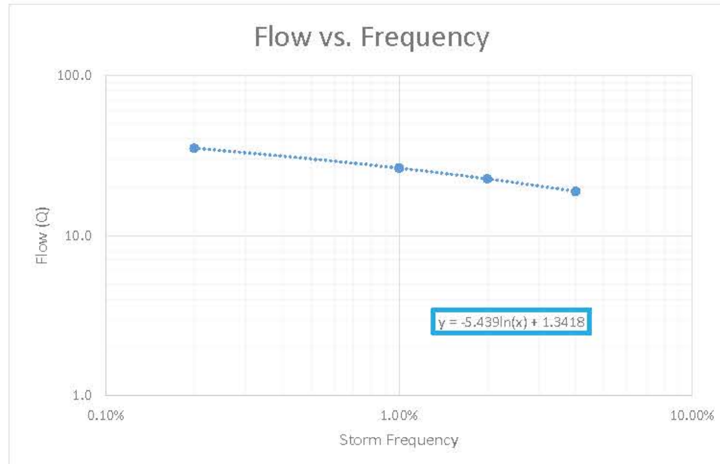
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

CD-5

	Storm	Frequency	Flow	Stage	Notes
	25	4.00%	18.8	58.4	25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
Design Flood	50	2.00%	22.6	59.1	50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
Base Flood	100	1.00%	26.4	59.8	25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
Greatest	500	0.20%	35.1	61.3	500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 55.7 Upstream invert
FL (DS) = 55.1 Downstream invert
EOP = 62 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-5	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	58.4	59.1	59.8	HW Elev. = HW + FL (US)

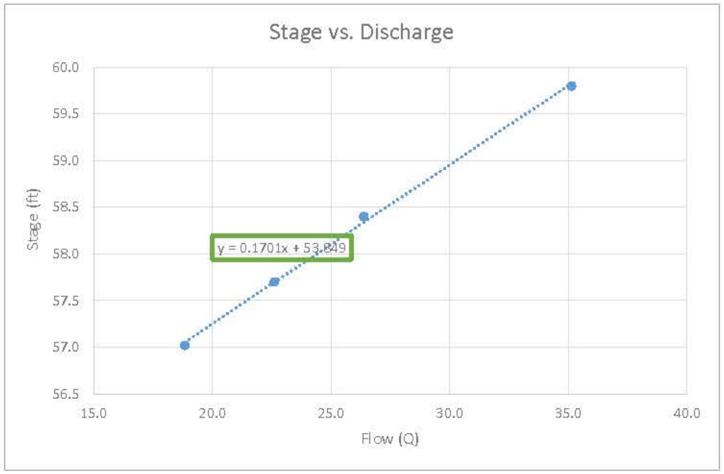
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

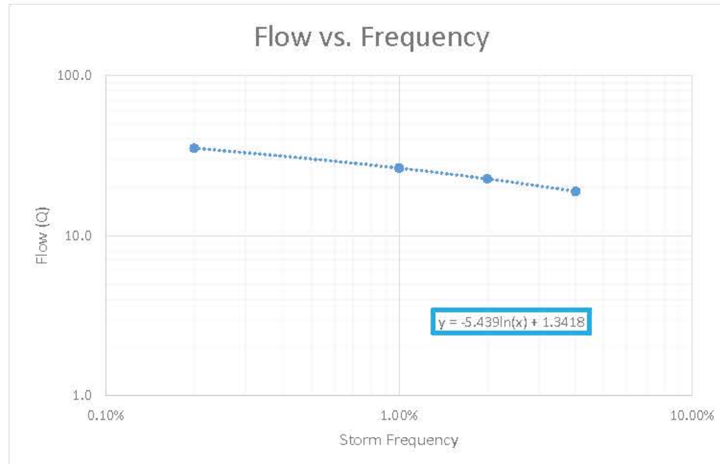
CD-6

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	57.0
Design Flood	50	2.00%	22.6	57.7
Base Flood	100	1.00%	26.4	58.4
Greatest	500	0.20%	35.1	59.8

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 54.3 Upstream invert
FL (DS) = 53.2 Downstream invert
EOP = 62 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-6	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	57.0	57.7	58.4	HW Elev. = HW + FL (US)

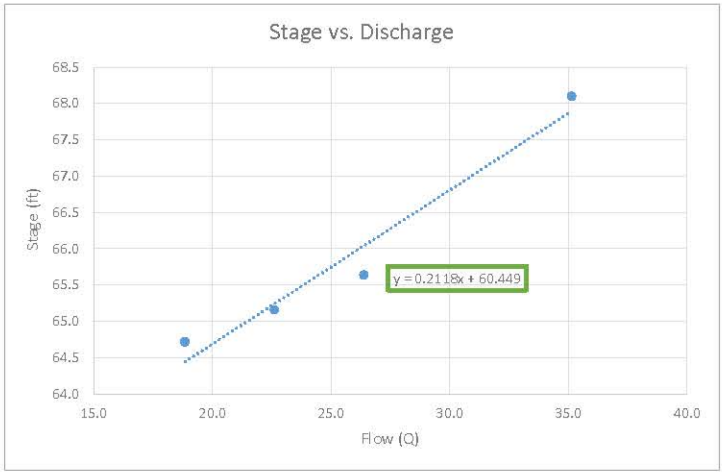
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

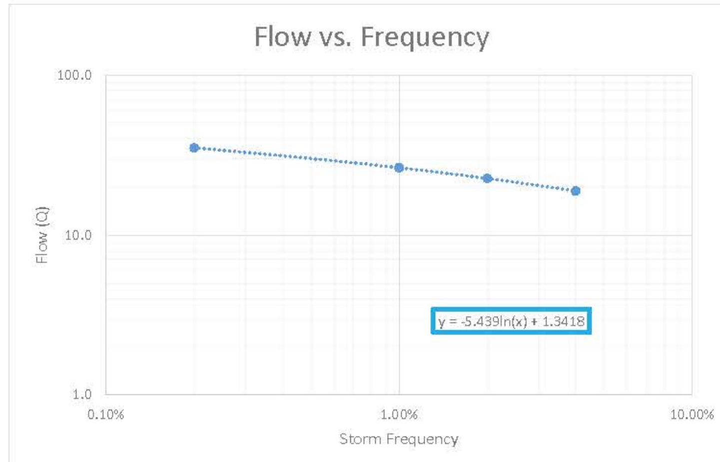
CD-7

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	64.7
Design Flood	50	2.00%	22.6	65.2
Base Flood	100	1.00%	26.4	65.6
Greatest	500	0.20%	35.1	68.1

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 62.4 Upstream invert
FL (DS) = 62.1 Downstream invert
EOP = 66 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-7	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.16	1.38	1.62	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.3	2.8	3.2	HW = (HW/D) * Diameter
HW Elev.	64.7	65.2	65.6	HW Elev. = HW + FL (US)

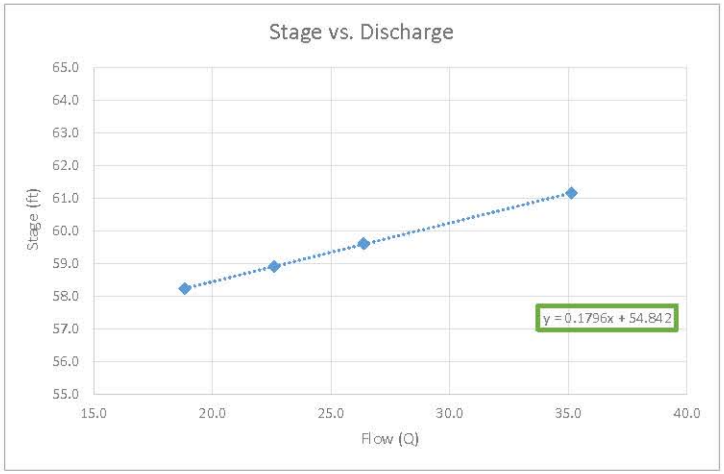
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

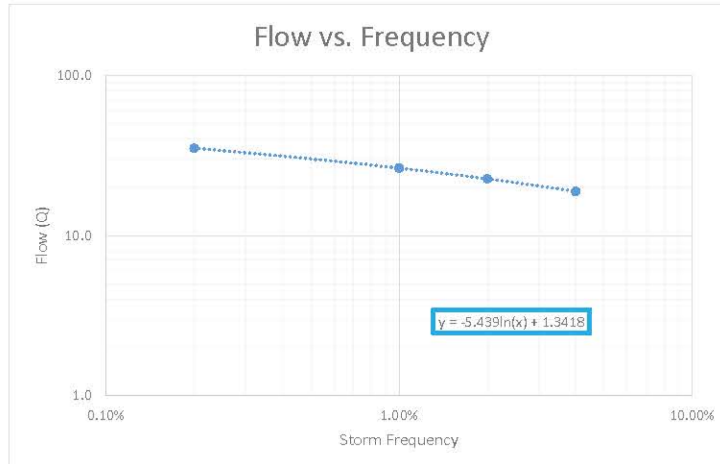
CD-9A

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	58.2
Design Flood	50	2.00%	22.6	58.9
Base Flood	100	1.00%	26.4	59.6
Greatest	500	0.20%	35.1	61.1

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 55.5 Upstream invert
FL (DS) = 54.8 Downstream invert
EOP = 67 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-9A	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	58.2	58.9	59.6	HW Elev. = HW + FL (US)

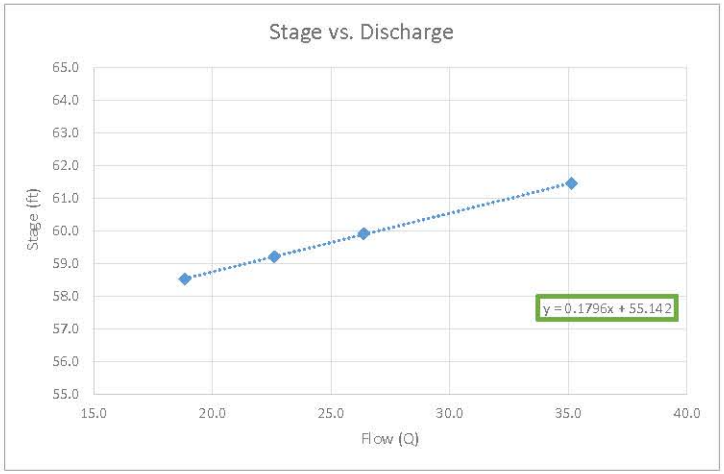
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

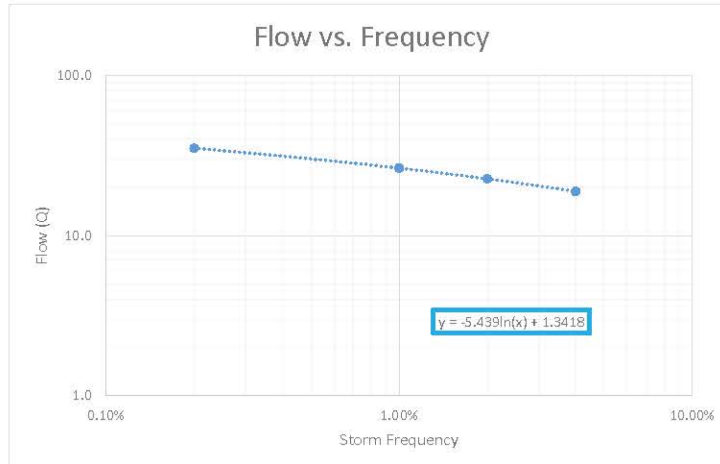
CD-9B

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	58.5
Design Flood	50	2.00%	22.6	59.2
Base Flood	100	1.00%	26.4	59.9
Greatest	500	0.20%	35.1	61.4

Notes
25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations
FL (US) = 55.8 Upstream invert
FL (DS) = 55 Downstream invert
EOP = 67 (Upstream)

A. Calculate Discharge
Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-9B	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	58.5	59.2	59.9	HW Elev. = HW + FL (US)

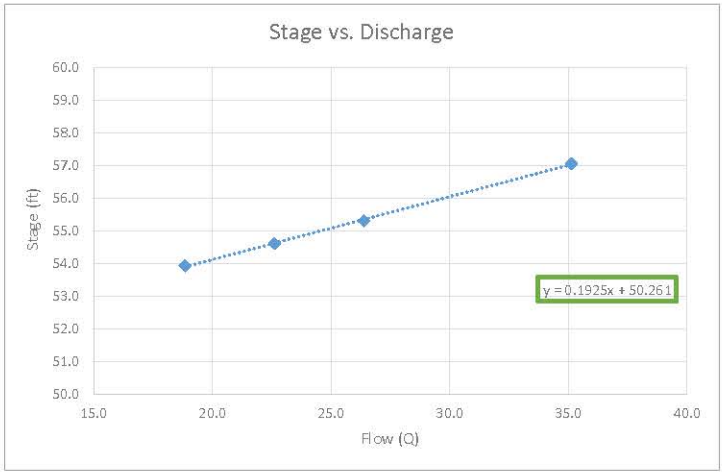
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

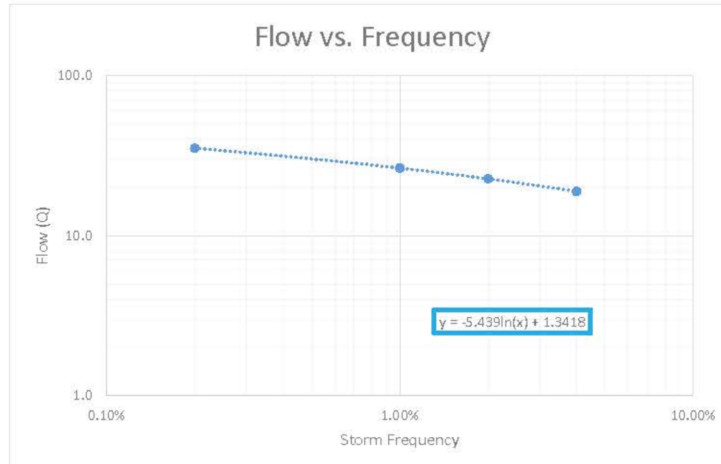
CD-10

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	53.9
Design Flood	50	2.00%	22.6	54.6
Base Flood	100	1.00%	26.4	55.3
Greatest	500	0.20%	35.1	57.0

Notes
25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 51.2 Upstream invert
FL (DS) = 51.2 Downstream invert
EOP = 60 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-10	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	53.9	54.6	55.3	HW Elev. = HW + FL (US)

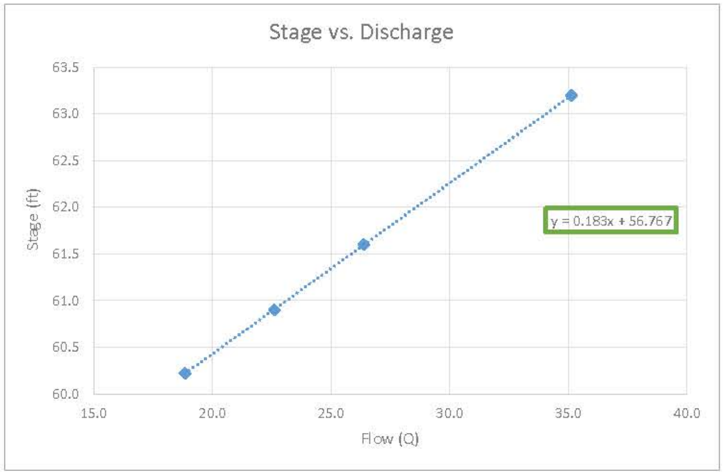
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

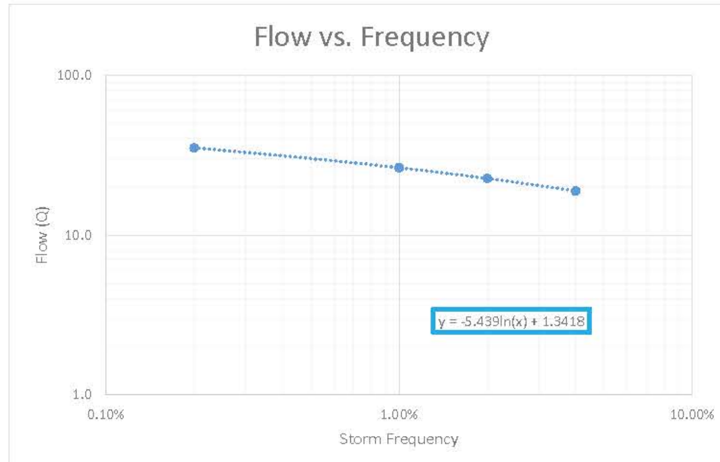
CD-11

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	60.2
Design Flood	50	2.00%	22.6	60.9
Base Flood	100	1.00%	26.4	61.6
Greatest	500	0.20%	35.1	63.2

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 57.5 Upstream invert
FL (DS) = 57.5 Downstream invert
EOP = 63.5 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-11	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	60.2	60.9	61.6	HW Elev. = HW + FL (US)

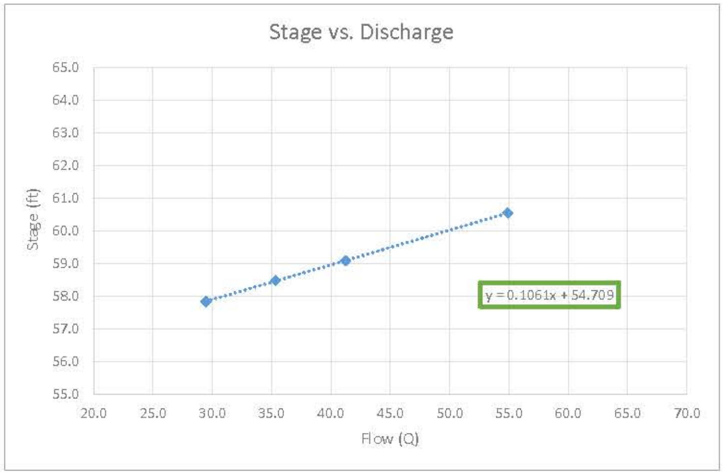
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

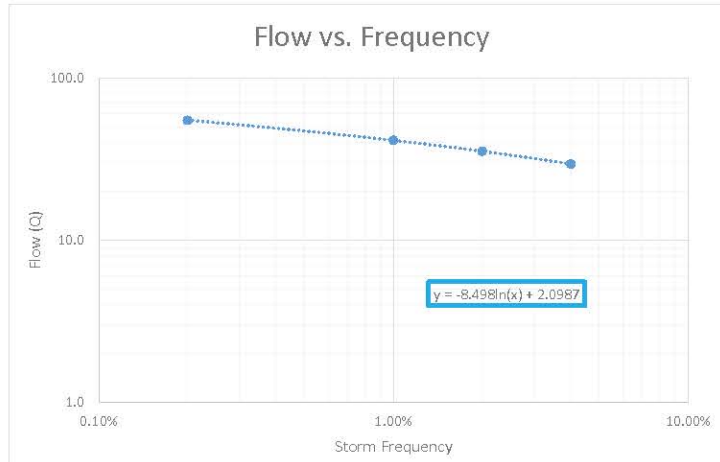
CD-12

	Storm	Frequency	Flow	Stage
	25	4.00%	29.5	57.8
Design Flood	50	2.00%	35.3	58.5
Base Flood	100	1.00%	41.2	59.1
Greatest	500	0.20%	54.9	60.5

Notes
25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 54.7 Upstream invert
FL (DS) = 54.7 Downstream invert
EOP = 61.26 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-12	1	30	4.91	6	29.5	41.2

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.25	1.51	1.75	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.1	3.8	4.4	HW = (HW/D) * Diameter
HW Elev.	57.8	58.5	59.1	HW Elev. = HW + FL (US)

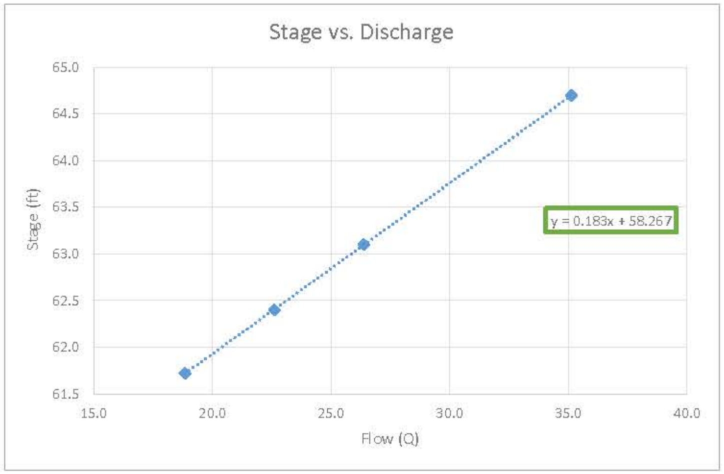
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

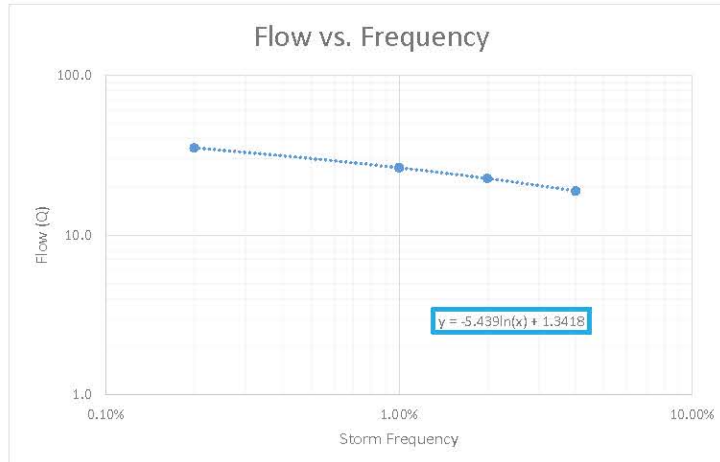
CD-14

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	61.7
Design Flood	50	2.00%	22.6	62.4
Base Flood	100	1.00%	26.4	63.1
Greatest	500	0.20%	35.1	64.7

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 59 Upstream invert
FL (DS) = 58.7 Downstream invert
EOP = 65.4 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-14	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	61.7	62.4	63.1	HW Elev. = HW + FL (US)

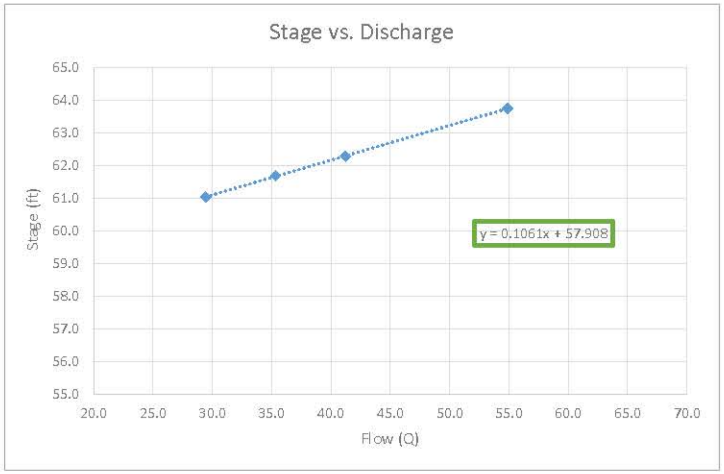
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

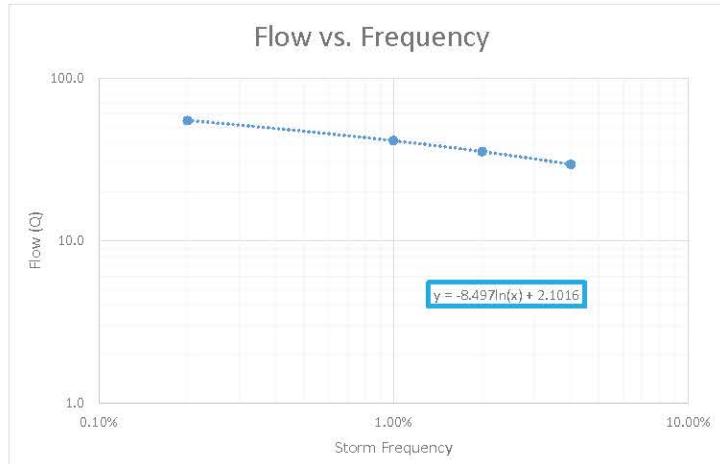
CD-15

	Storm	Frequency	Flow	Stage
	25	4.00%	29.5	61.0
Design Flood	50	2.00%	35.3	61.7
Base Flood	100	1.00%	41.2	62.3
Greatest	500	0.20%	54.9	63.7

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 57.9 Upstream invert
FL (DS) = 57.2 Downstream invert
EOP = 62.8 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-15	1	30	4.91	6	29.5	41.2

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.25	1.51	1.75	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.1	3.8	4.4	HW = (HW/D) * Diameter
HW Elev.	61.0	61.7	62.3	HW Elev. = HW + FL (US)

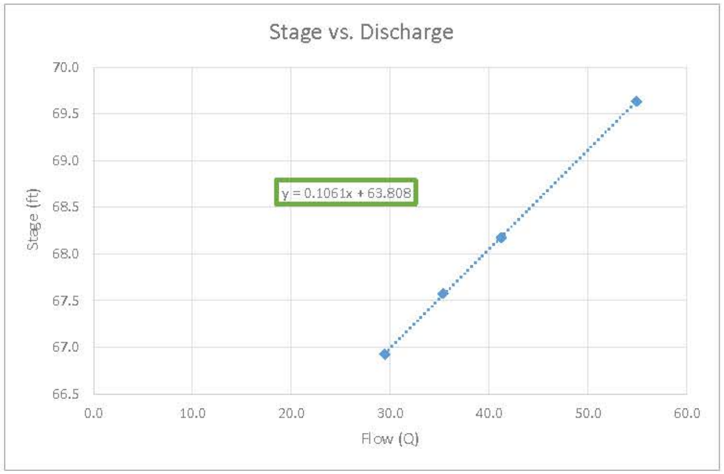
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

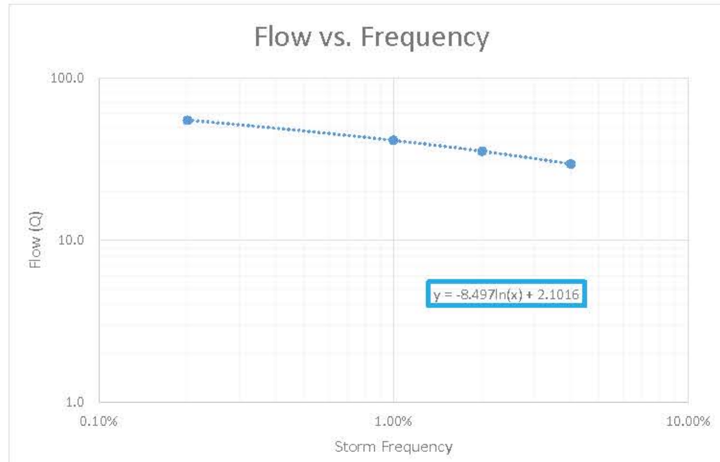
CD-16

	Storm	Frequency	Flow	Stage
	25	4.00%	29.5	66.9
Design Flood	50	2.00%	35.3	67.6
Base Flood	100	1.00%	41.2	68.2
Greatest	500	0.20%	54.9	69.6

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	63.8	Upstream invert
FL (DS) =	63.5	Downstream invert
EOP =	70	(Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)

Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1

Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-16	1	30	4.91	6	29.5	41.2

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.25	1.51	1.75	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.1	3.8	4.4	HW = (HW/D) * Diameter
HW Elev.	66.9	67.6	68.2	HW Elev. = HW + FL (US)

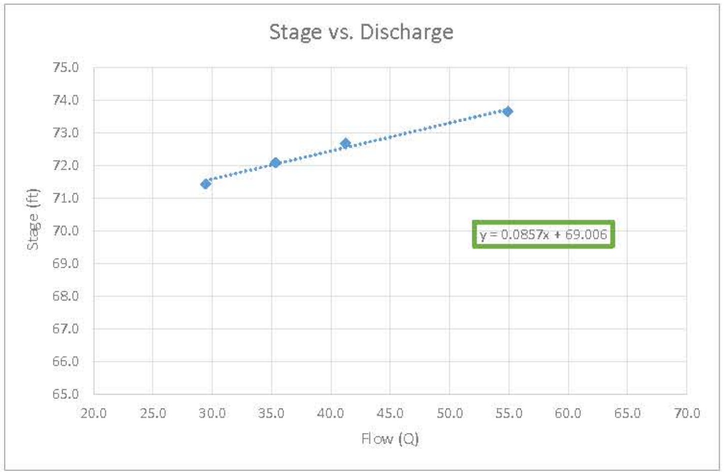
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

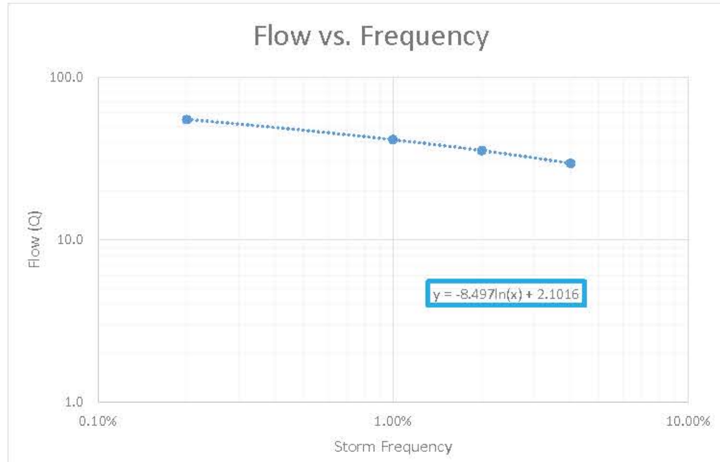
CD-17

	Storm	Frequency	Flow	Stage
	25	4.00%	29.5	71.4
Design Flood	50	2.00%	35.3	72.1
Base Flood	100	1.00%	41.2	72.7
Greatest	500	0.20%	54.9	73.6

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 68.3 Upstream invert
FL (DS) = 65.8 Downstream invert
EOP = 73.5 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-17	1	30	4.91	6	29.5	41.2

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.25	1.51	1.75	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.1	3.8	4.4	HW = (HW/D) * Diameter
HW Elev.	71.4	72.1	72.7	HW Elev. = HW + FL (US)

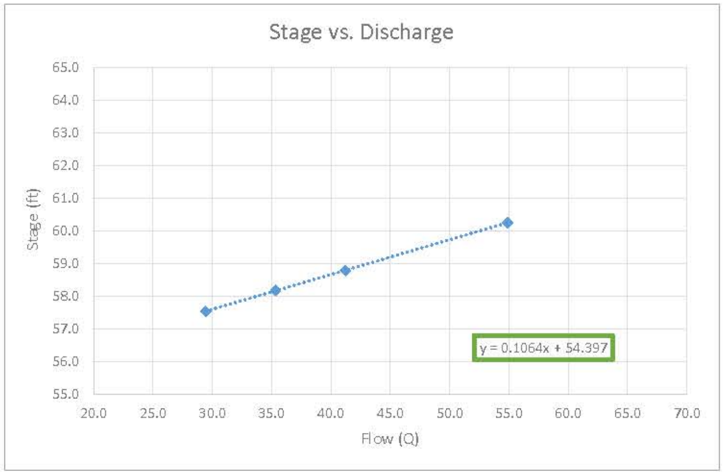
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

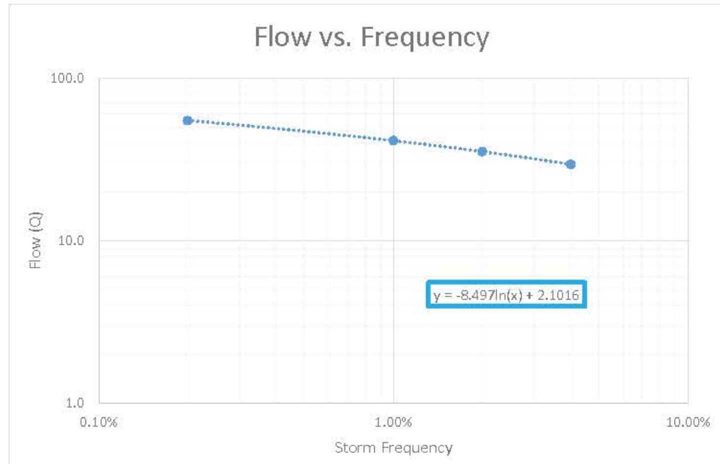
CD-19

	Storm	Frequency	Flow	Stage
	25	4.00%	29.5	57.5
Design Flood	50	2.00%	35.3	58.2
Base Flood	100	1.00%	41.2	58.8
Greatest	500	0.20%	54.9	60.2

Notes
25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 54.4 Upstream invert
FL (DS) = 54.1 Downstream invert
EOP = 73 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-19	1	30	4.91	6	29.5	41.2

B. Compute stages using FHWA HDS 5

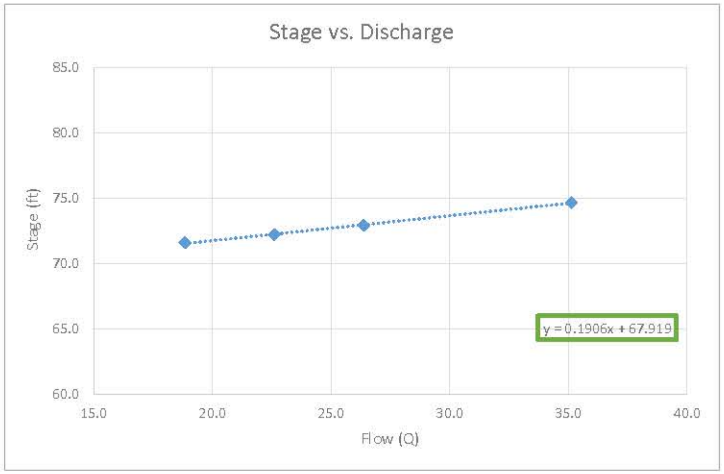
	25-yr	50-yr	100-yr	Notes
HW/D	1.25	1.51	1.75	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.1	3.8	4.4	HW = (HW/D) * Diameter
HW Elev.	57.5	58.2	58.8	HW Elev. = HW + FL (US)

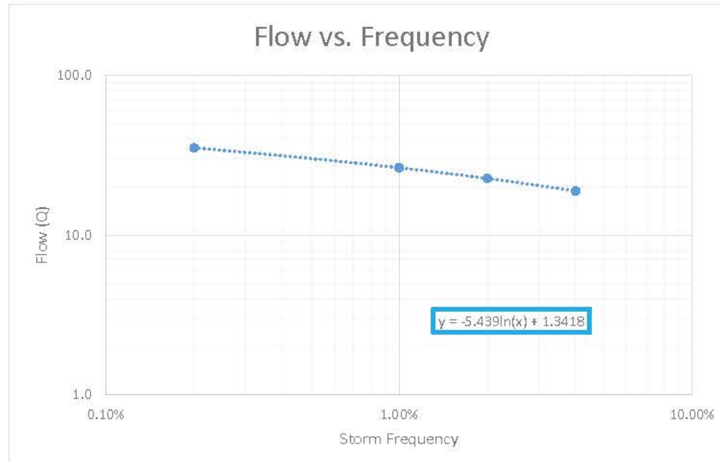
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

CD-20

	Storm	Frequency	Flow	Stage	Notes
	25	4.00%	18.8	71.6	25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
Design Flood	50	2.00%	22.6	72.2	50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
Base Flood	100	1.00%	26.4	72.9	25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
Greatest	500	0.20%	35.1	74.6	500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 68.8 Upstream invert
FL (DS) = 68.5 Downstream invert
EOP = 85 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-20	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.38	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.8	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	71.6	72.2	72.9	HW Elev. = HW + FL (US)

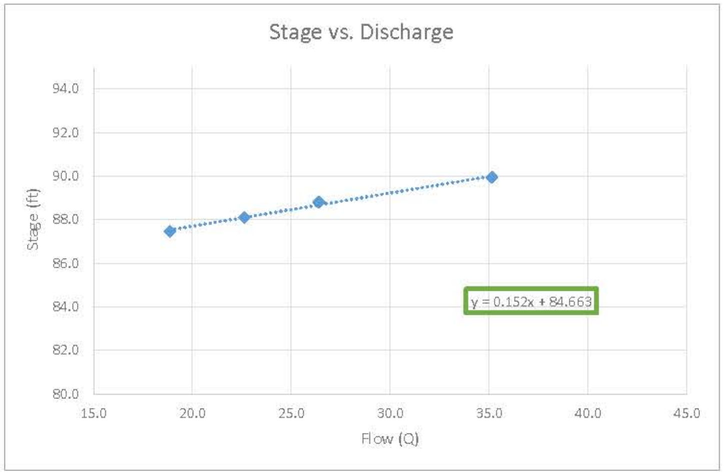
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

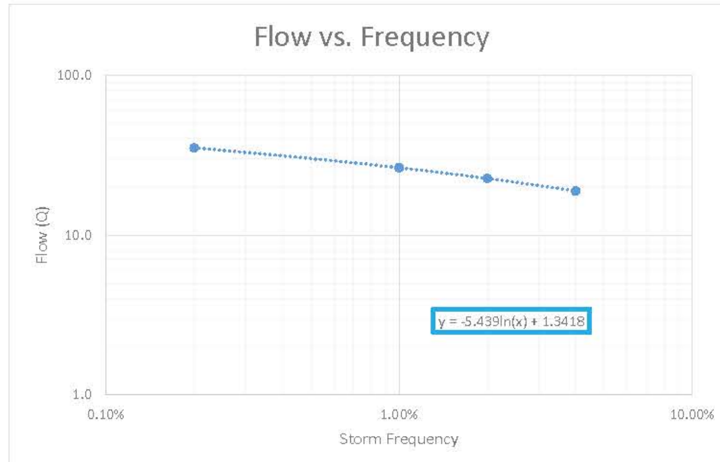
CD-21

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	87.5
Design Flood	50	2.00%	22.6	88.1
Base Flood	100	1.00%	26.4	88.8
Greatest	500	0.20%	35.1	89.9

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 84.7 Upstream invert
FL (DS) = 82.3 Downstream invert
EOP = 93.5 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-21	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.38	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.8	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	87.5	88.1	88.8	HW Elev. = HW + FL (US)

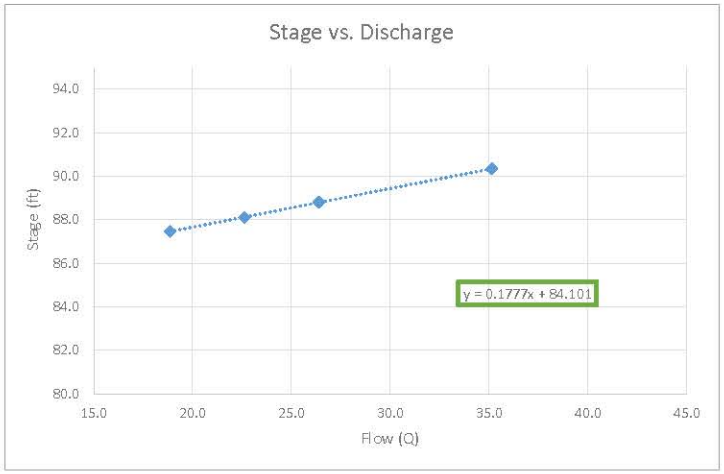
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

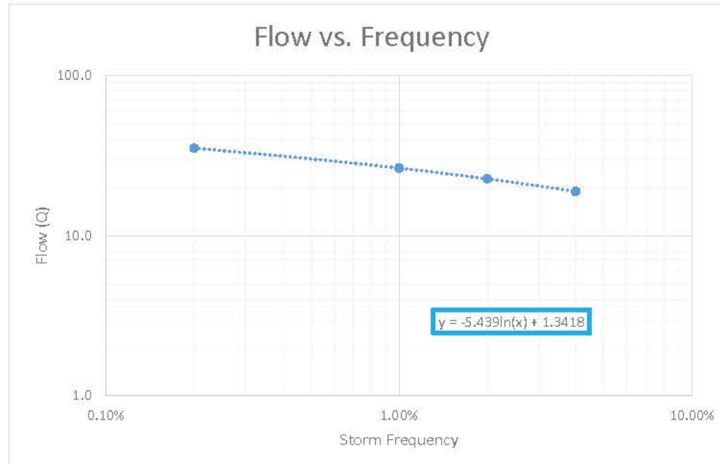
CD-22

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	87.5
Design Flood	50	2.00%	22.6	88.1
Base Flood	100	1.00%	26.4	88.8
Greatest	500	0.20%	35.1	90.3

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 84.7 Upstream invert
FL (DS) = 84.4 Downstream invert
EOP = 91.5 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-22	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.38	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.8	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	87.5	88.1	88.8	HW Elev. = HW + FL (US)

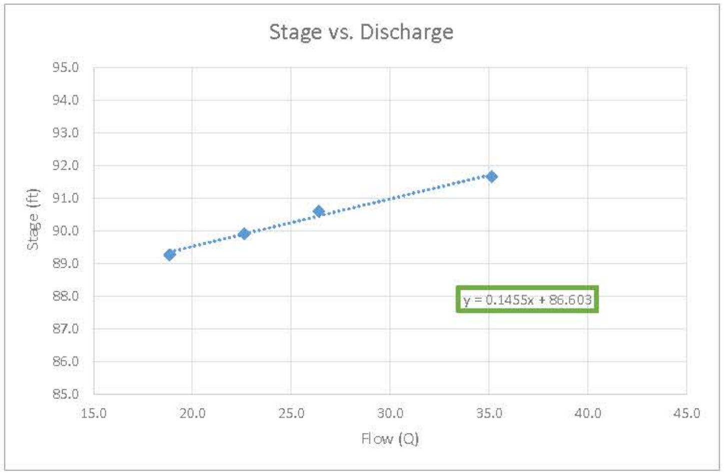
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

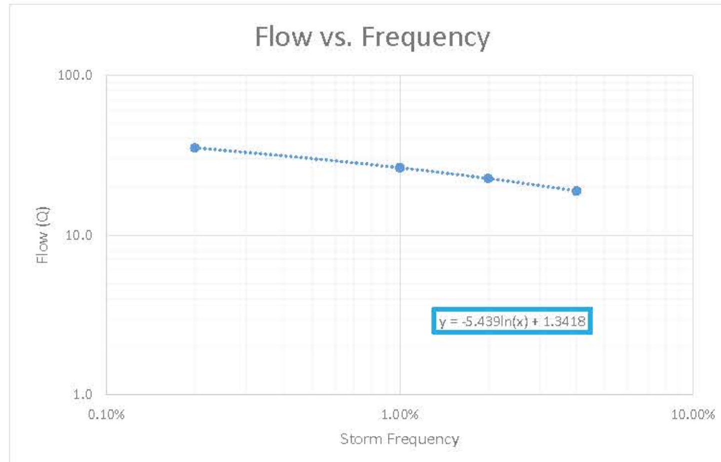
CD-23

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	89.3
Design Flood	50	2.00%	22.6	89.9
Base Flood	100	1.00%	26.4	90.6
Greatest	500	0.20%	35.1	91.6

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	86.5	Upstream invert
FL (DS) =	83	Downstream invert
EOP =	92	(Upstream)

A. Calculate Discharge
Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-23	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.38	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.8	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	89.3	89.9	90.6	HW Elev. = HW + FL (US)

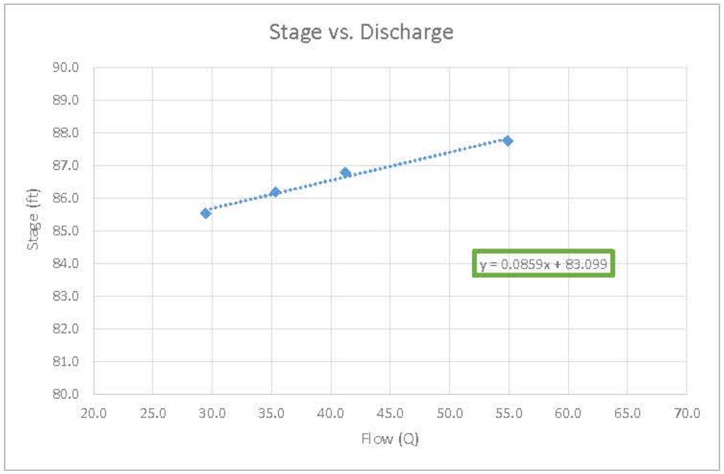
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

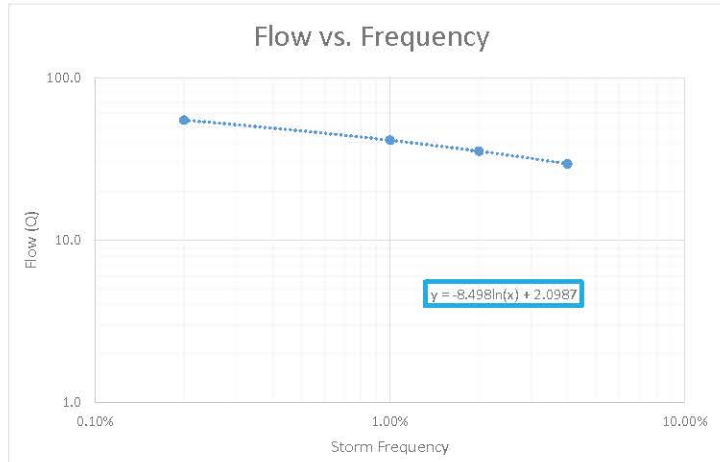
CD-24

	Storm	Frequency	Flow	Stage
	25	4.00%	29.5	85.5
Design Flood	50	2.00%	35.3	86.2
Base Flood	100	1.00%	41.2	86.8
Greatest	500	0.20%	54.9	87.7

Notes
25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	82.4	Upstream invert
FL (DS) =	76.5	Downstream invert
EOP =	90	(Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)

Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1

Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-24	1	30	4.91	6	29.5	41.2

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.25	1.51	1.75	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.1	3.8	4.4	HW = (HW/D) * Diameter
HW Elev.	85.5	86.2	86.8	HW Elev. = HW + FL (US)

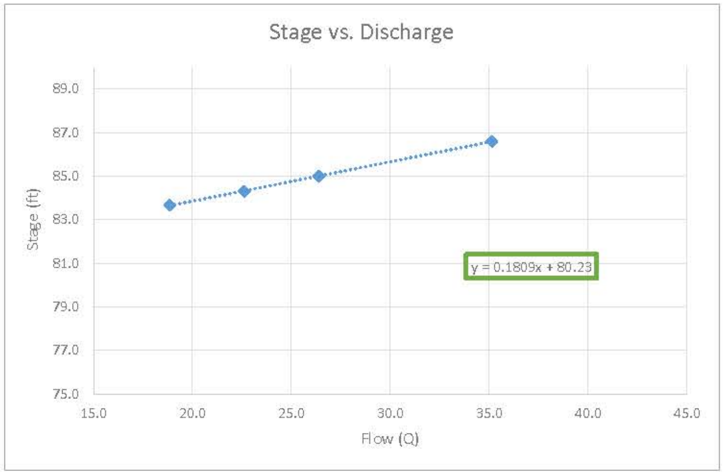
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

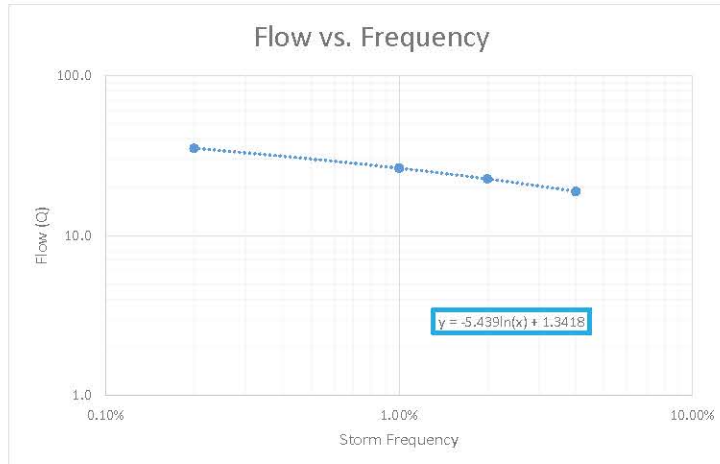
CD-25A

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	83.7
Design Flood	50	2.00%	22.6	84.3
Base Flood	100	1.00%	26.4	85.0
Greatest	500	0.20%	35.1	86.6

Notes
25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations
FL (US) = 80.9 Upstream invert
FL (DS) = 80.1 Downstream invert
EOP = 90 (Upstream)

A. Calculate Discharge
Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-25A	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.38	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.8	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	83.7	84.3	85.0	HW Elev. = HW + FL (US)

I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

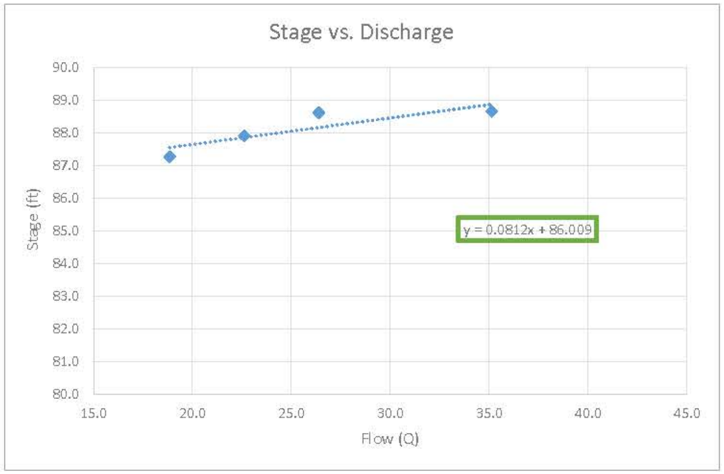
CD-25B

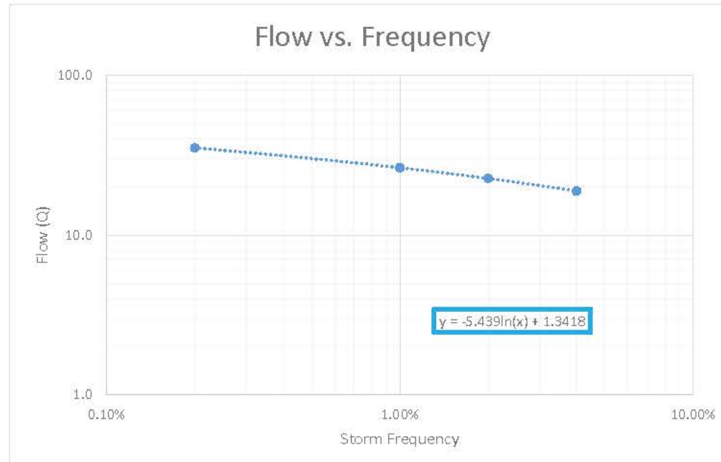
	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	87.3
Design Flood	50	2.00%	22.6	87.9
Base Flood	100	1.00%	26.4	88.6
Greatest	500	0.20%	35.1	88.6

Notes

- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	84.5	Upstream invert
FL (DS) =	79.4	Downstream invert
EOP =	91	(Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-25B	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.38	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.8	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	87.3	87.9	88.6	HW Elev. = HW + FL (US)

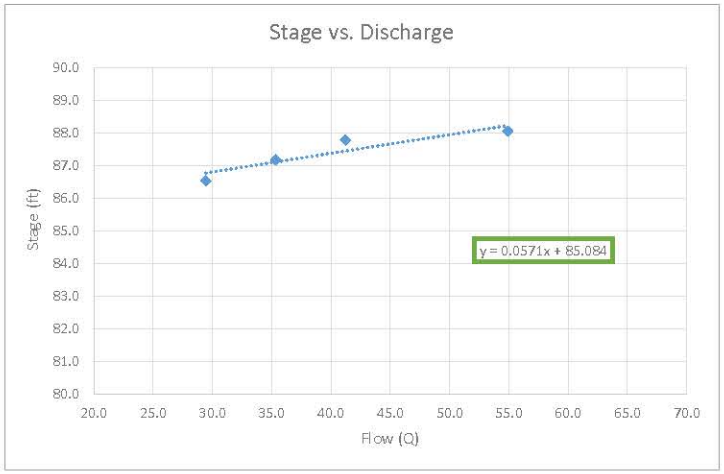
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

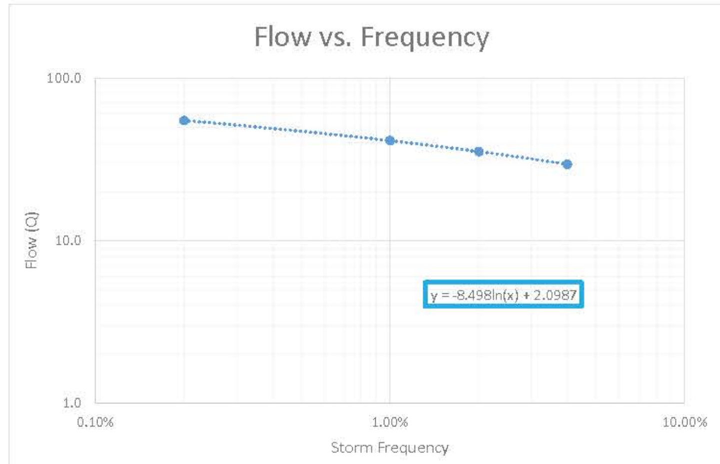
CD-26

	Storm	Frequency	Flow	Stage
	25	4.00%	29.5	86.5
Design Flood	50	2.00%	35.3	87.2
Base Flood	100	1.00%	41.2	87.8
Greatest	500	0.20%	54.9	88.0

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 83.4 Upstream invert
FL (DS) = 77.5 Downstream invert
EOP = 91 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-26	1	30	4.91	6	29.5	41.2

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.25	1.51	1.75	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.1	3.8	4.4	HW = (HW/D) * Diameter
HW Elev.	86.5	87.2	87.8	HW Elev. = HW + FL (US)

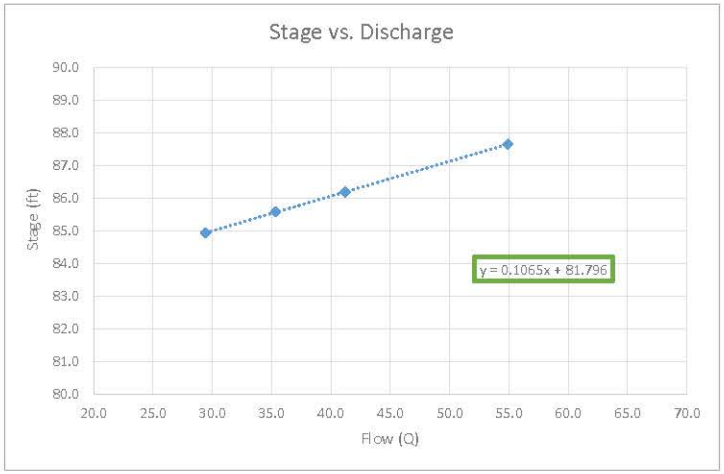
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

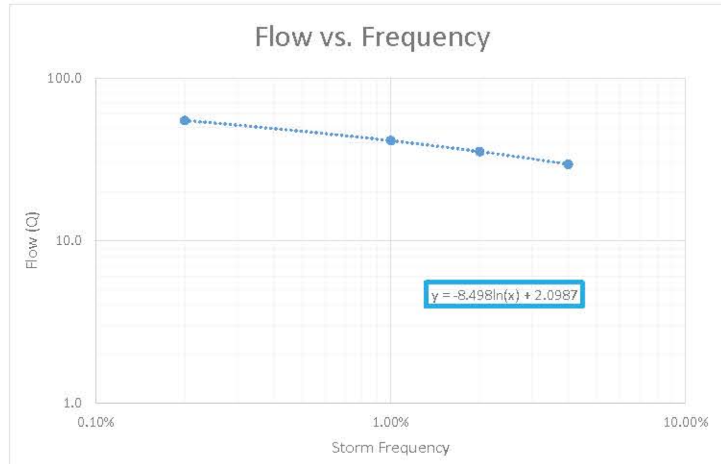
CD-27

	Storm	Frequency	Flow	Stage
	25	4.00%	29.5	84.9
Design Flood	50	2.00%	35.3	85.6
Base Flood	100	1.00%	41.2	86.2
Greatest	500	0.20%	54.9	87.6

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 81.8 Upstream invert
FL (DS) = 81.6 Downstream invert
EOP = 87 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-27	1	30	4.91	6	29.5	41.2

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.25	1.51	1.75	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.1	3.8	4.4	HW = (HW/D) * Diameter
HW Elev.	84.9	85.6	86.2	HW Elev. = HW + FL (US)

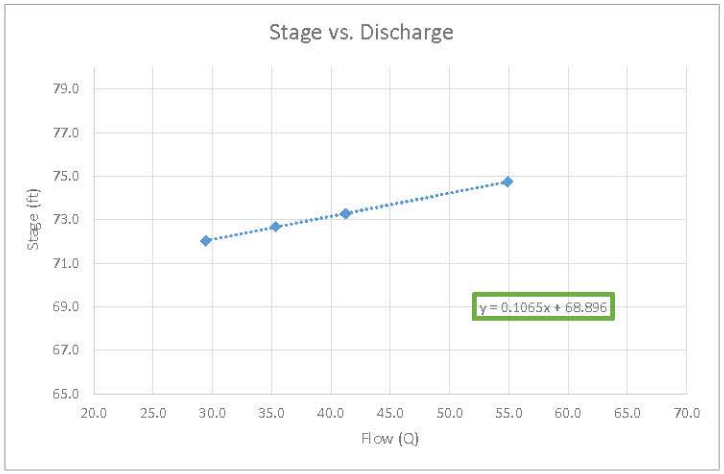
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

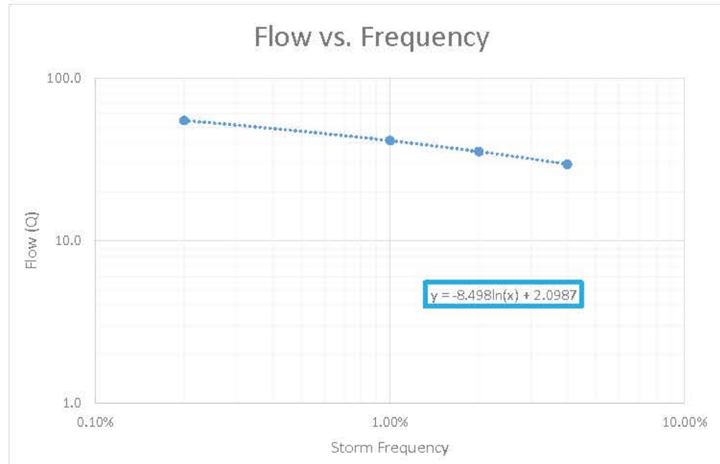
CD-28

	Storm	Frequency	Flow	Stage
	25	4.00%	29.5	72.0
Design Flood	50	2.00%	35.3	72.7
Base Flood	100	1.00%	41.2	73.3
Greatest	500	0.20%	54.9	74.7

Notes
25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 68.9 Upstream invert
FL (DS) = 68.6 Downstream invert
EOP = 87 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-28	1	30	4.91	6	29.5	41.2

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.25	1.51	1.75	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.1	3.8	4.4	HW = (HW/D) * Diameter
HW Elev.	72.0	72.7	73.3	HW Elev. = HW + FL (US)

I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

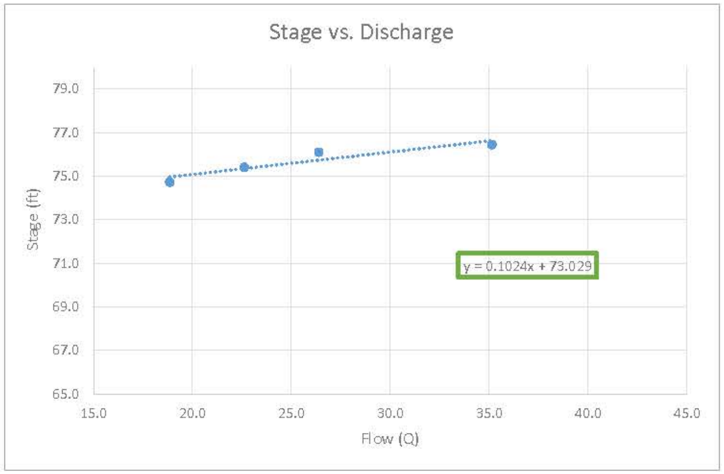
CD-29

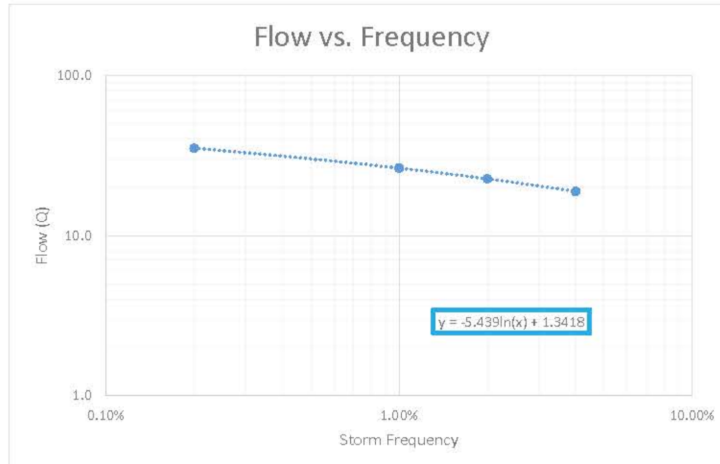
	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	74.7
Design Flood	50	2.00%	22.6	75.4
Base Flood	100	1.00%	26.4	76.1
Greatest	500	0.20%	35.1	76.4

Notes

- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	72	Upstream invert
FL (DS) =	61.1	Downstream invert
EOP =	88	(Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-29	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	74.7	75.4	76.1	HW Elev. = HW + FL (US)

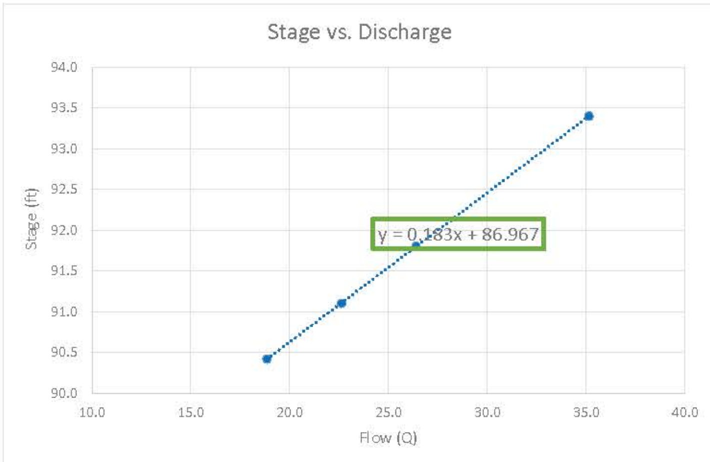
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

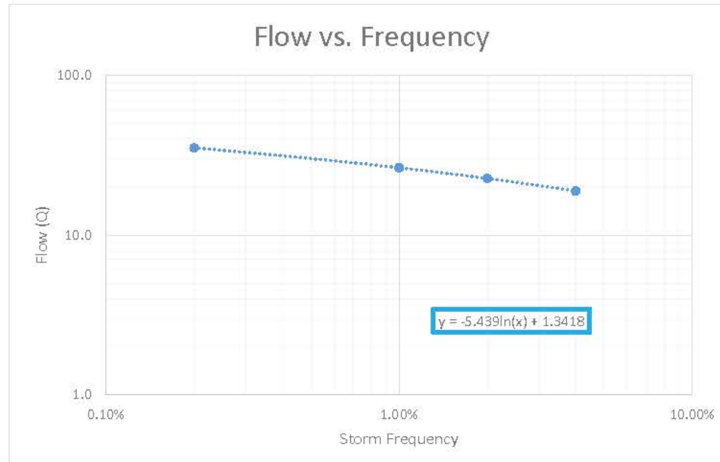
CD-31

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	90.4
Design Flood	50	2.00%	22.6	91.1
Base Flood	100	1.00%	26.4	91.8
Greatest	500	0.20%	35.1	93.4

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	87.7	Upstream invert	87.7
FL (DS) =	90.3	Downstream invert	90.3
EOP =	99	(Upstream)	99

A. Calculate Discharge
Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-31	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 8B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	90.4	91.1	91.8	HW Elev. = HW + FL (US)

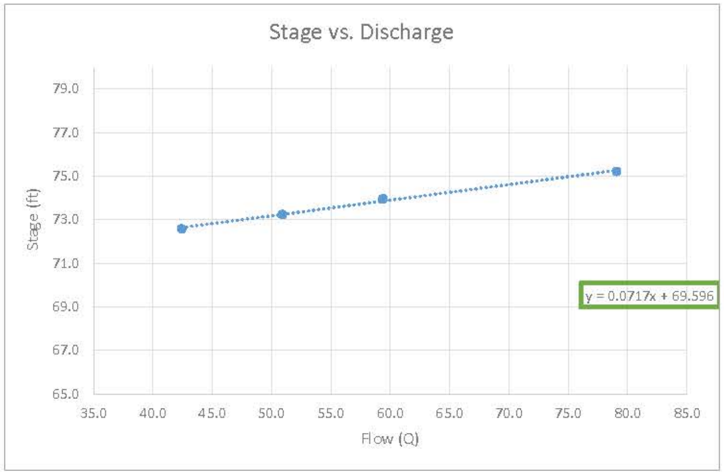
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

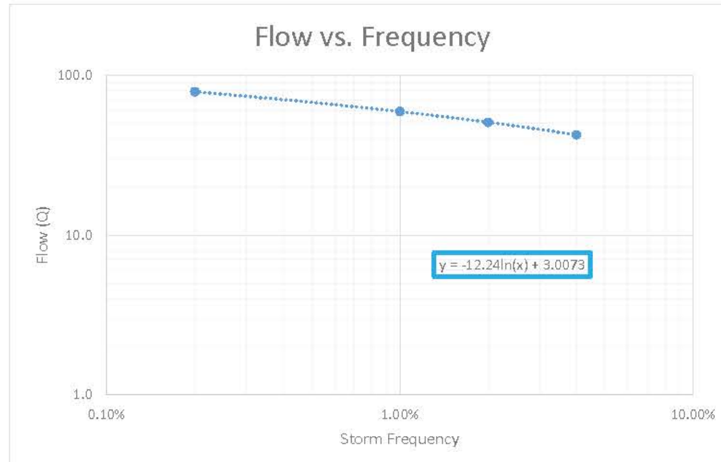
CD-32

	Storm	Frequency	Flow	Stage
	25	4.00%	42.4	72.6
Design Flood	50	2.00%	50.9	73.2
Base Flood	100	1.00%	59.4	74.0
Greatest	500	0.20%	79.1	75.2

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 69.1 Upstream invert
FL (DS) = 66.6 Downstream invert
EOP = 79 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-32	1	36	7.07	6	42.4	59.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.16	1.38	1.62	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	3.5	4.1	4.9	HW = (HW/D) * Diameter
HW Elev.	72.6	73.2	74.0	HW Elev. = HW + FL (US)

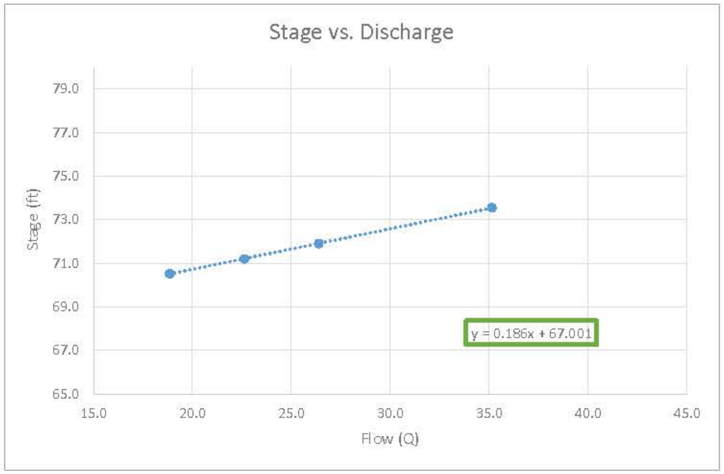
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

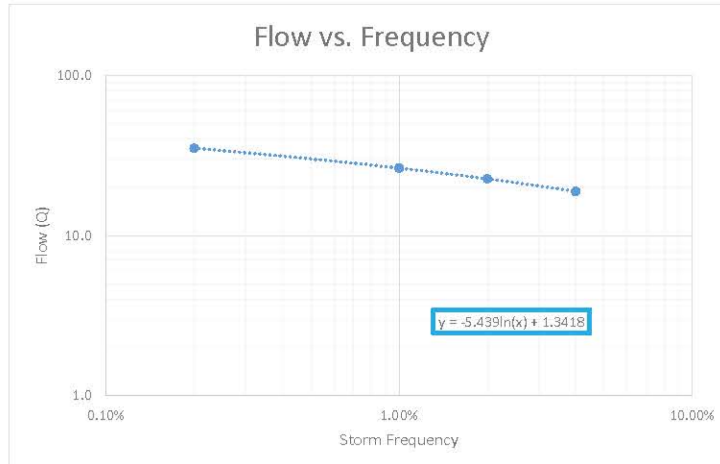
CD-33

	Storm	Frequency	Flow	Stage
	25	4.00%	18.8	70.5
Design Flood	50	2.00%	22.6	71.2
Base Flood	100	1.00%	26.4	71.9
Greatest	500	0.20%	35.1	73.5

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) =	67.8	Upstream invert
FL (DS) =	66.9	Downstream invert
EOP =	95	(Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)

Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1

Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-33	1	24	3.14	6	18.8	26.4

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
HW/D	1.36	1.70	2.05	Found using Chart 1B, FHWA HDS 5 (see attached)
HW	2.7	3.4	4.1	HW = (HW/D) * Diameter
HW Elev.	70.5	71.2	71.9	HW Elev. = HW + FL (US)

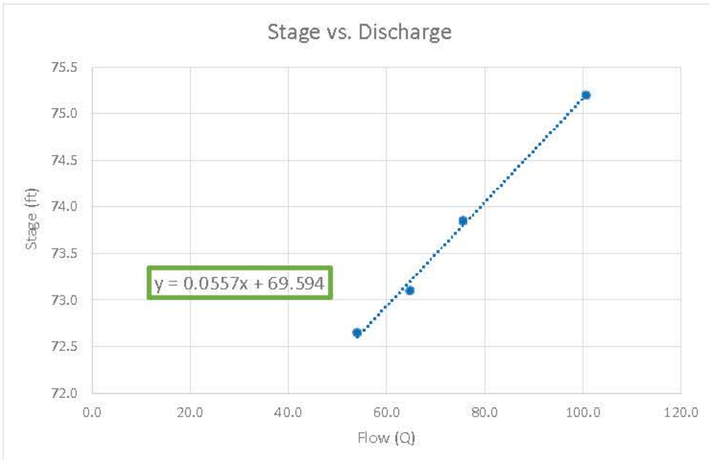
I-75 LHR
FPID 443623-1-22-01
Cross Drain Flow/Stage Calculations

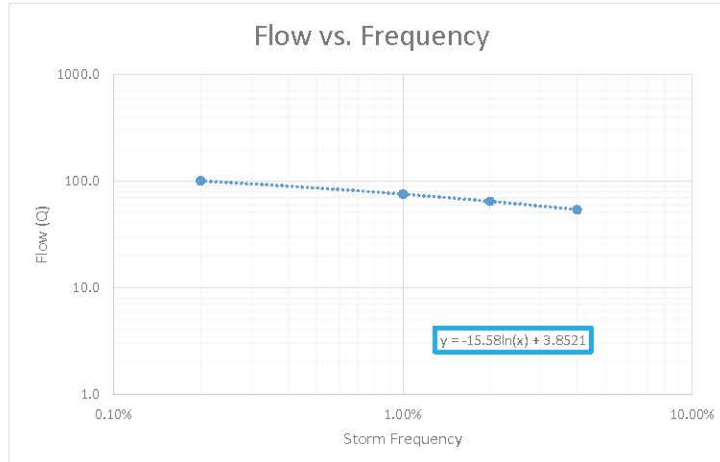
CD-34

	Storm	Frequency	Flow	Stage
	25	4.00%	54.0	72.7
Design Flood	50	2.00%	64.8	73.1
Base Flood	100	1.00%	75.6	73.9
Greatest	500	0.20%	100.7	75.2

Notes
- 25-yr and 100-yr flow rates calculated per Drainage Design Guide (see below, Section A.)
- 50-yr & 500 yr flow rates calculated using Flow vs. Frequency equation (obtained from graphing 25-yr and 100-yr rates)
- 25-yr, 50-yr and 100-yr stages found using Chart 1B, FHWA HDS 5 (see below, Section B.)
- 500-yr stage calculated using Stage vs. Discharge equation (obtained from graphing 25-yr to 100-yr stages)

Note: 25 and 100 year flows calculated per Drainage Design Guide, see below





Given Elevations

FL (US) = 69.2 Upstream invert
FL (DS) = 63.7 Downstream invert
EOP = 87.5 (Upstream)

A. Calculate Discharge

Q25= (Velocity) x (Area)
Velocity = 6 ft/sec per Per Drainage Design Guide, Chapter 4, Method 1
Q100 = Q25*1.4

CD Name	Barrels	Pipe Size	Pipe Area (sq. ft)	Velocity (ft/s)	Flow (25 yr) (cfs)	Flow (100 yr) (cfs)
CD-34	1	3' x 3'	9.00	6	54.0	75.6

Height (D) 3
With (B) 3

B. Compute stages using FHWA HDS 5

	25-yr	50-yr	100-yr	Notes
Q/B	18.0	21.60	25.2	
HW/D	1.15	1.30	1.55	Found using Chart 8B, FHWA HDS 5 (see attached)
HW	3.5	3.9	4.7	HW = (HW/D) * Diameter
HW Elev.	72.7	73.1	73.9	HW Elev. = HW + FL (US)

BURGESS & NIPLE
Engineers ■ Planners

Appendix C - I-75 Floodzone Impact Area Estimate

Legend

- OFW Aquatic Preserves
- Other OFWs
- Special OFWs

Flood Hazard Zones

Zone Type

- 1% Annual Chance Flood Hazard
- Regulatory Floodway
- Special Floodway
- Area of Undetermined Flood Hazard
- 0.2% Annual Chance Flood Hazard
- Future Conditions 1% Annual Chance Flood Hazard
- Floodplain Encroachment
- Hydraulic Soil Group
- Area with Reduced Risk Due to Levee
- Area with Risk Due to Levee

WETLANDS

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
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- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
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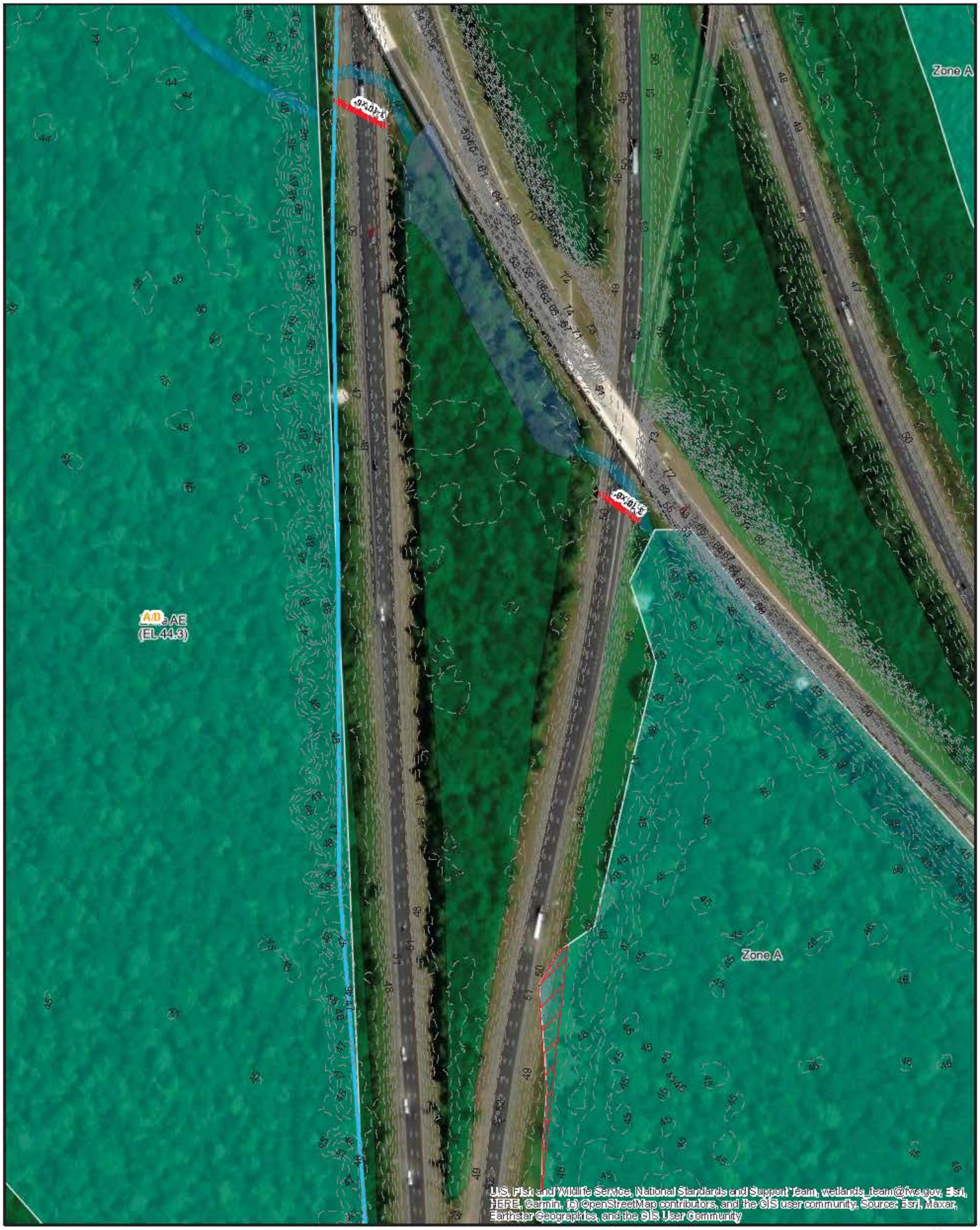

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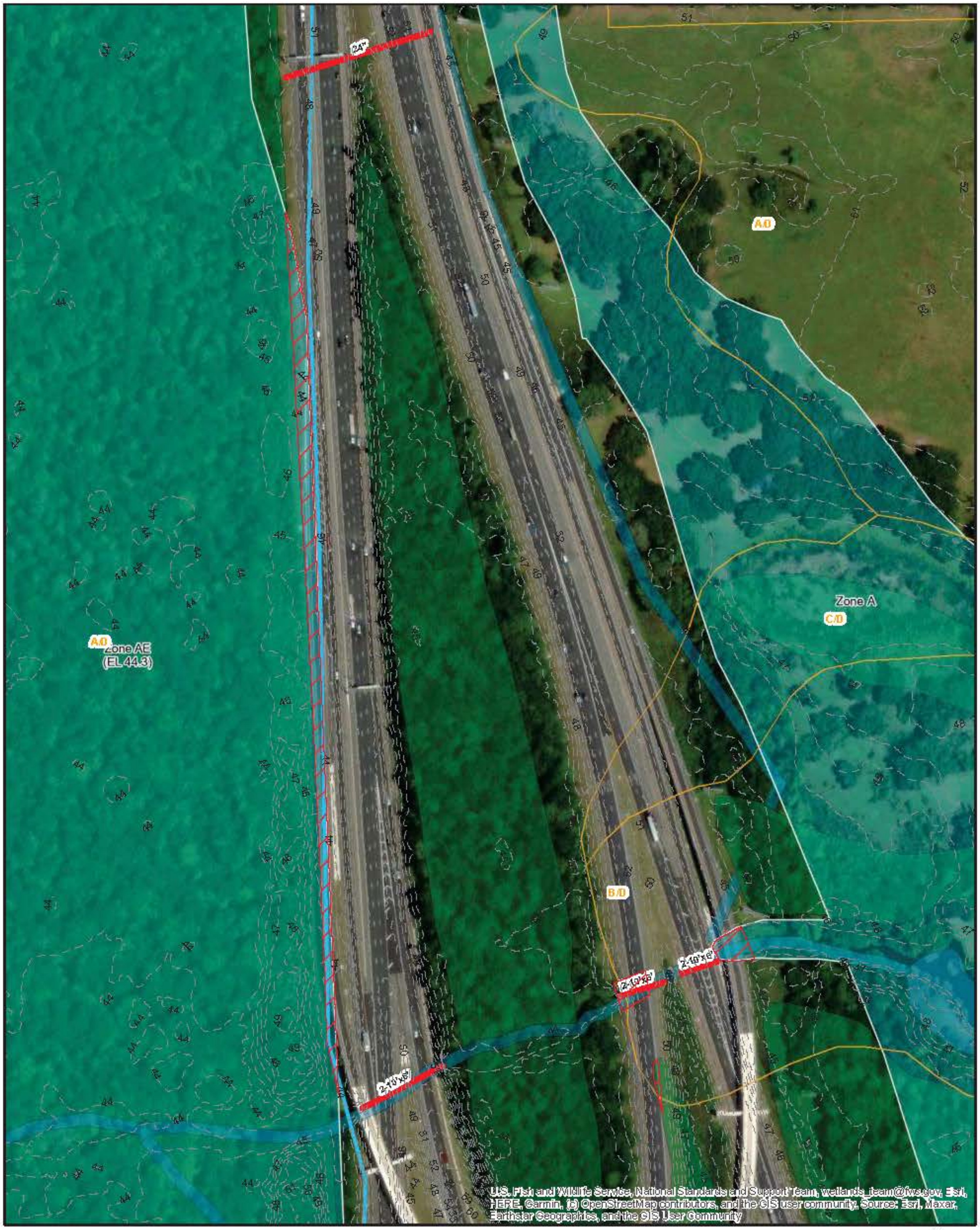

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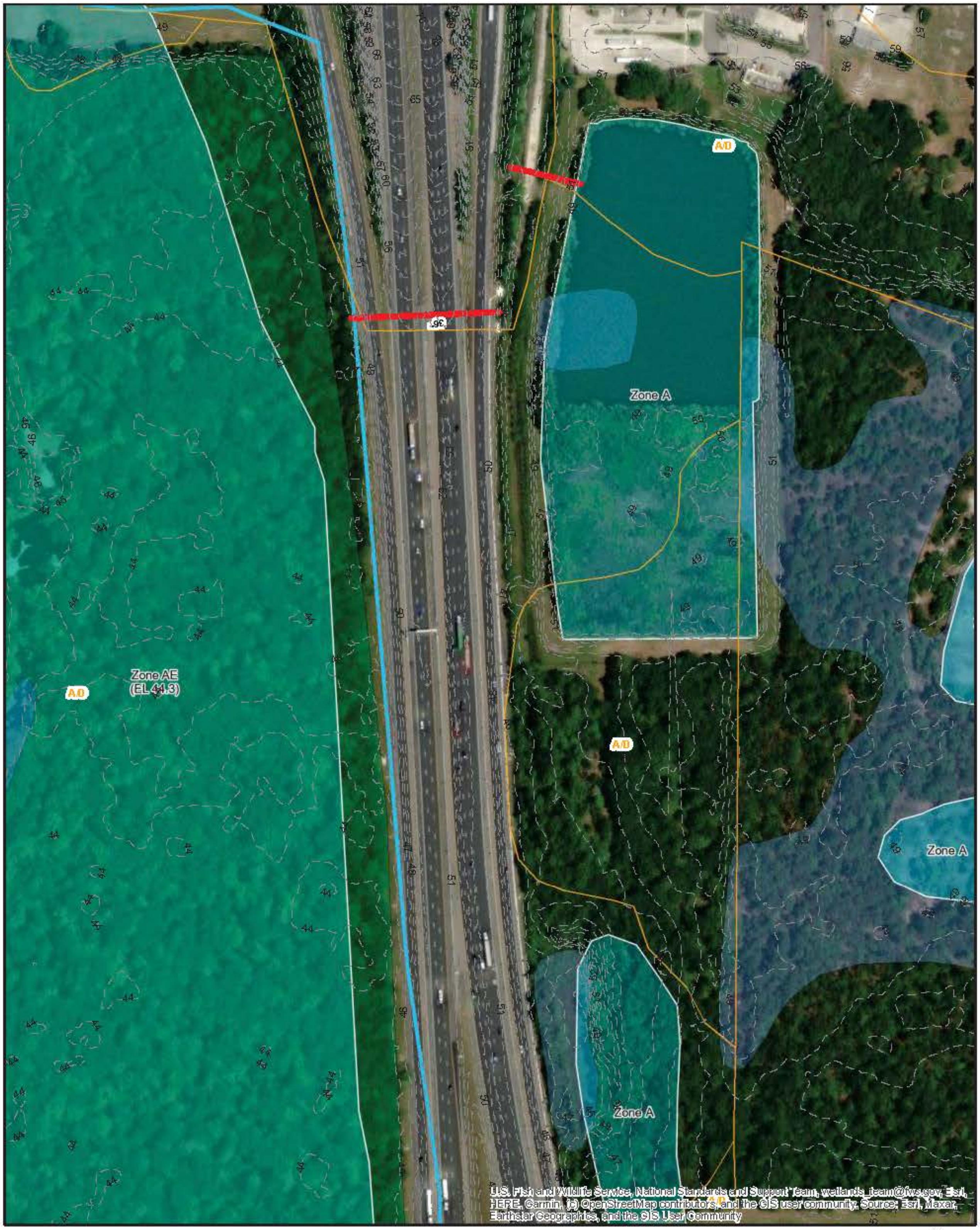

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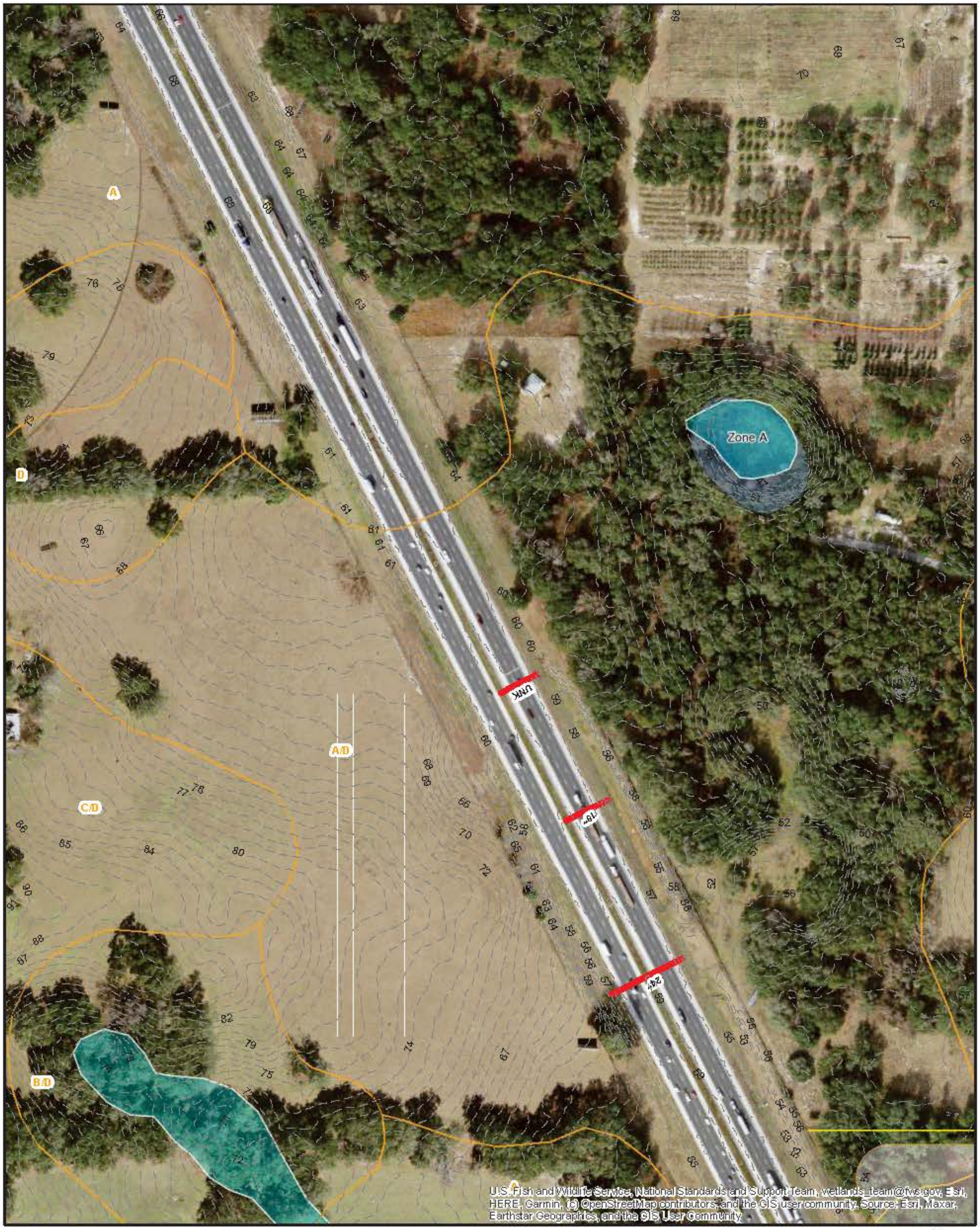

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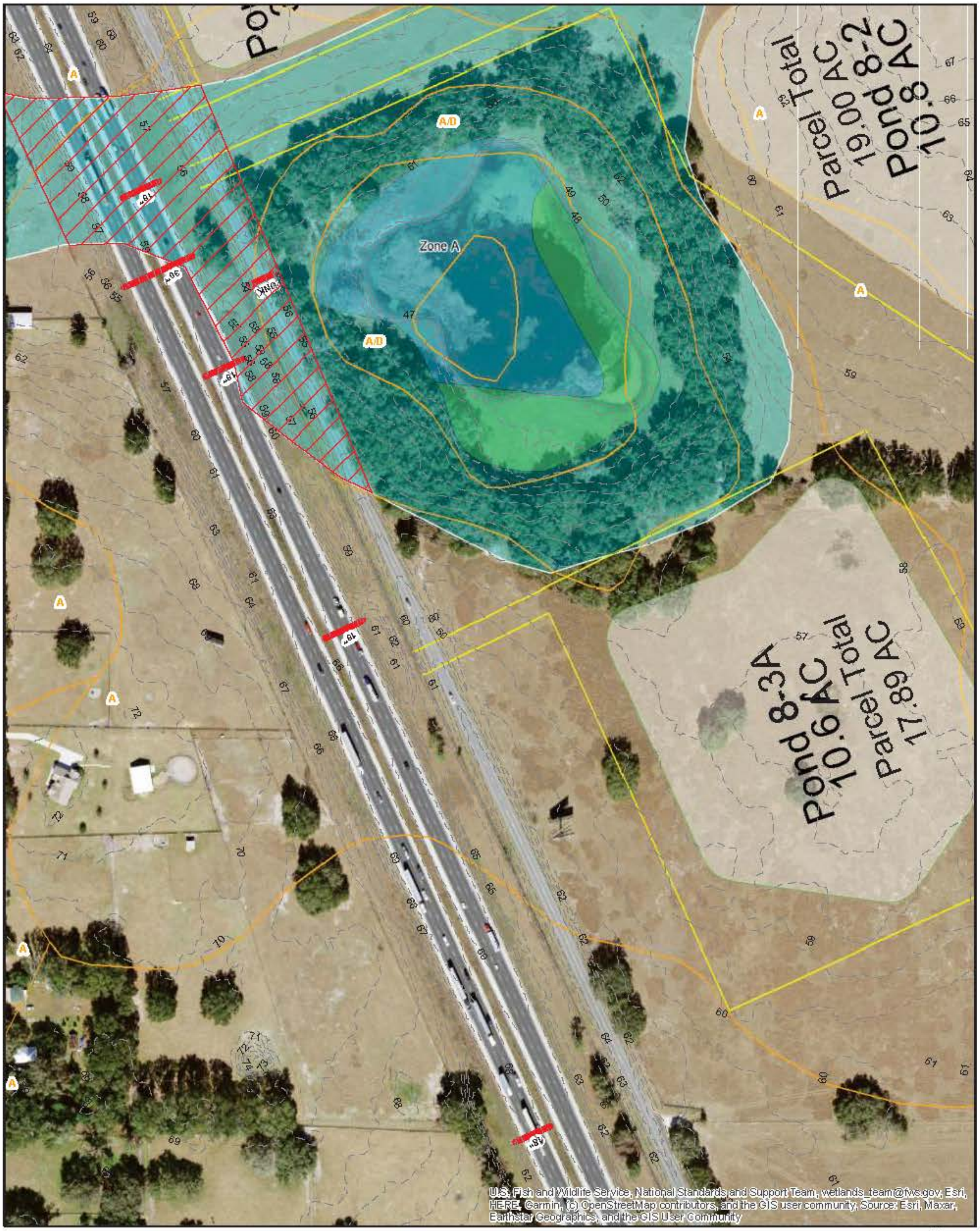

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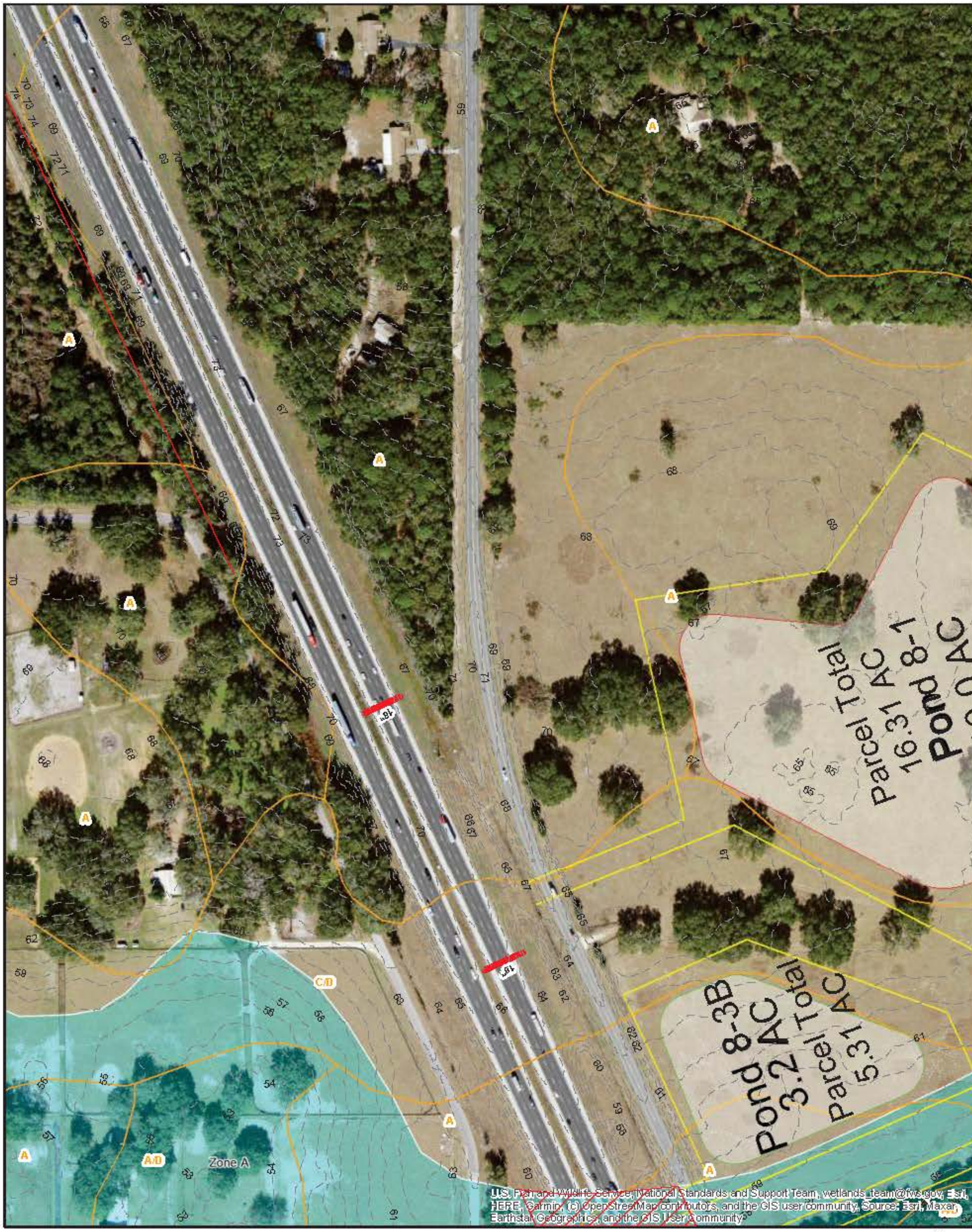

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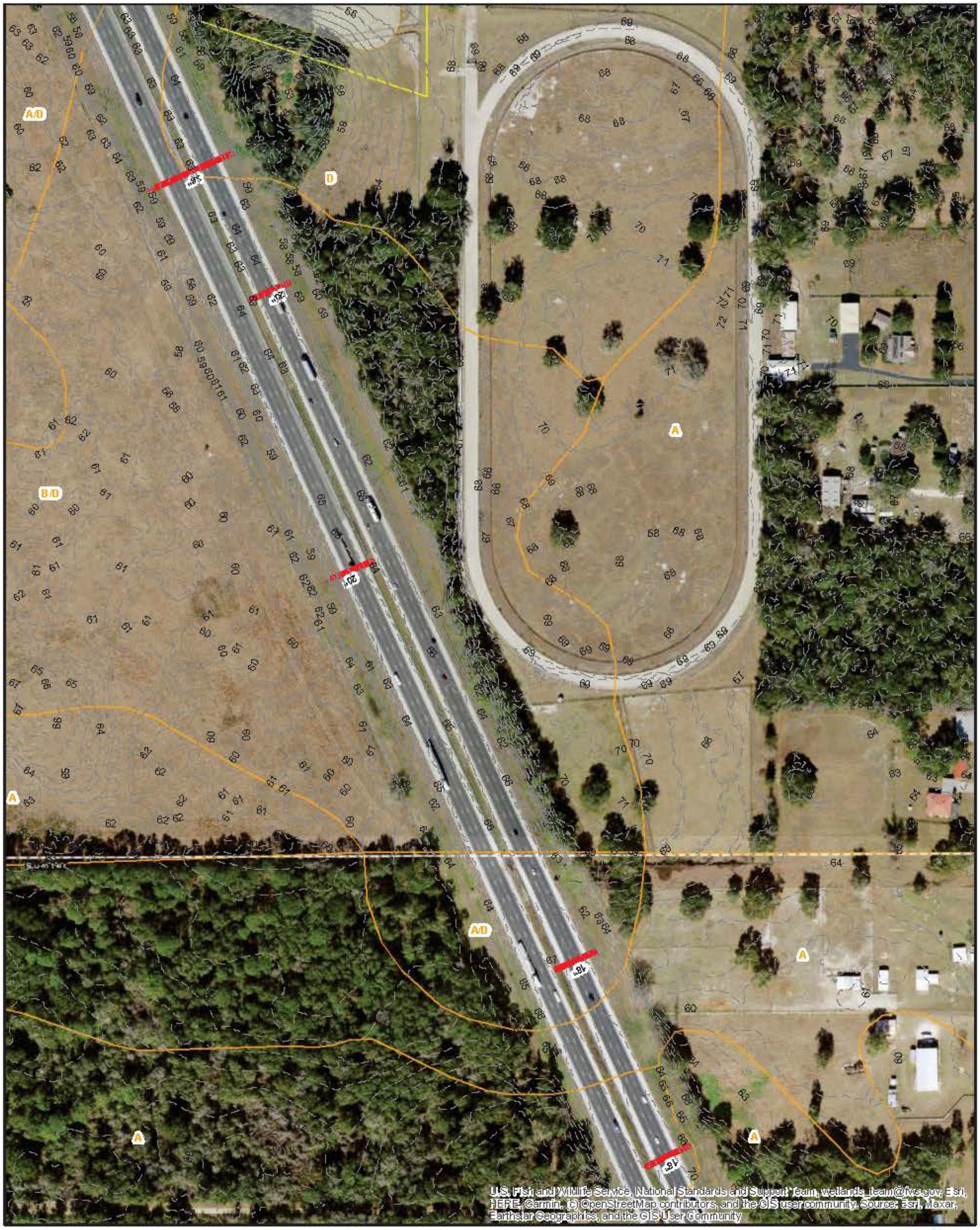

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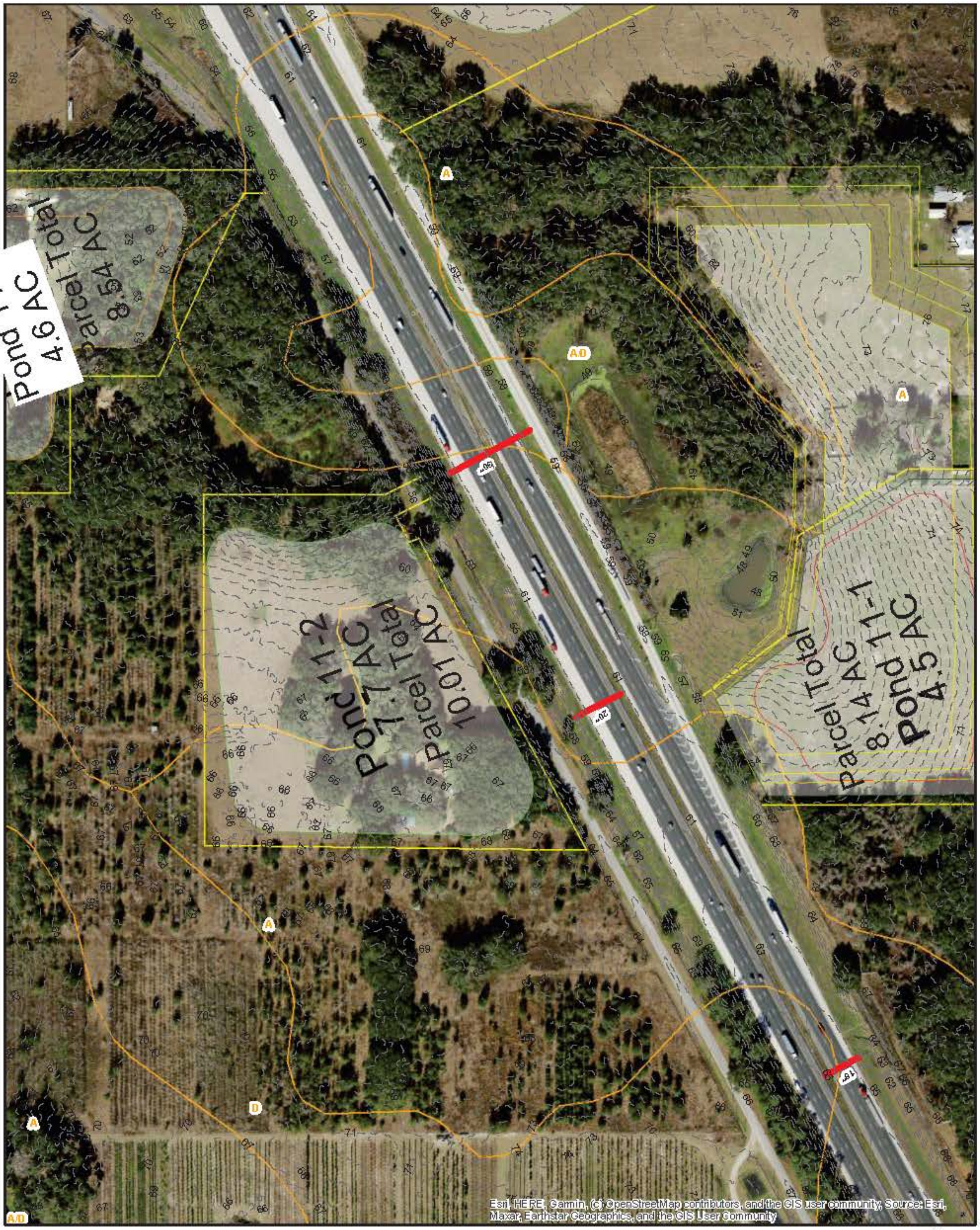

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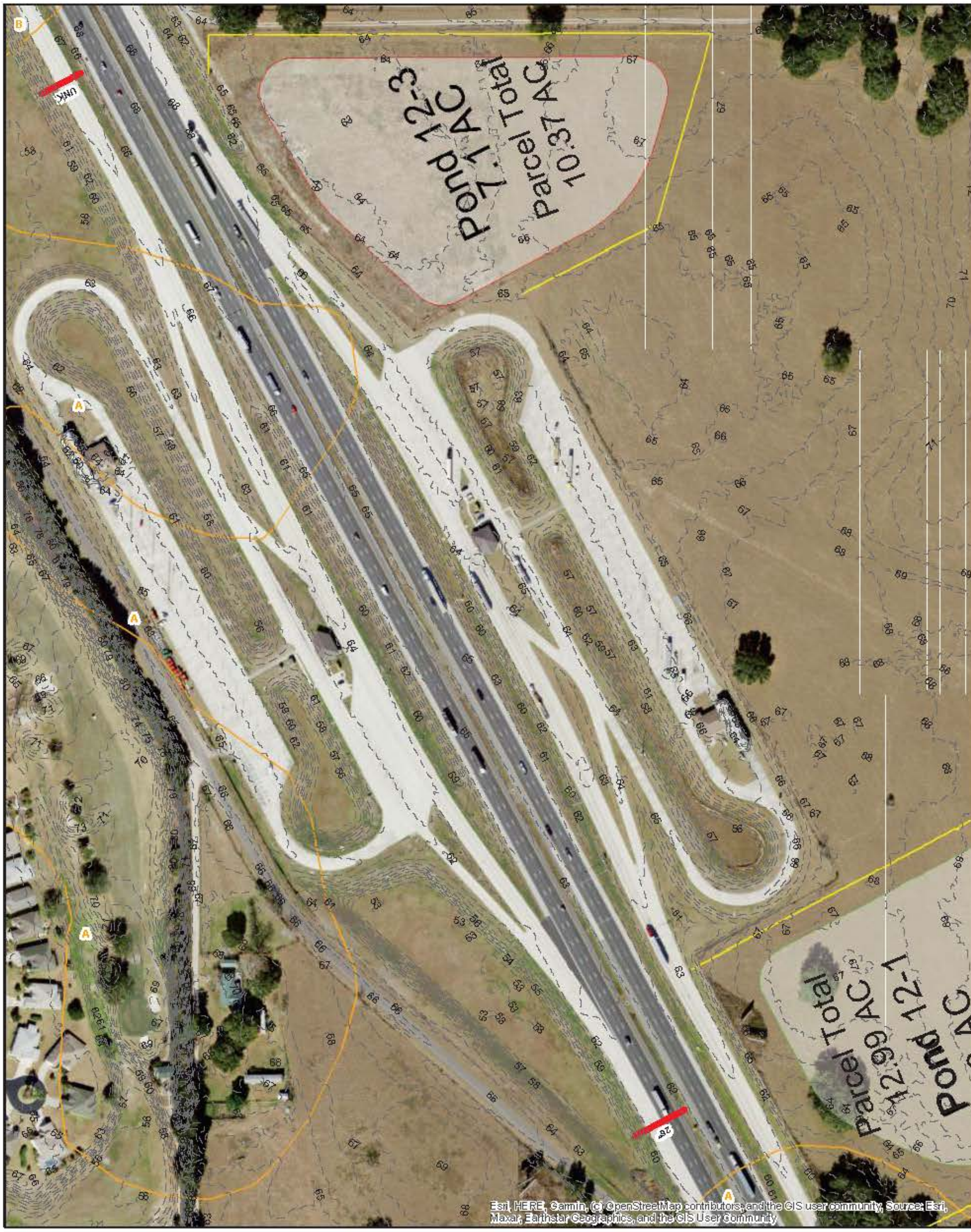

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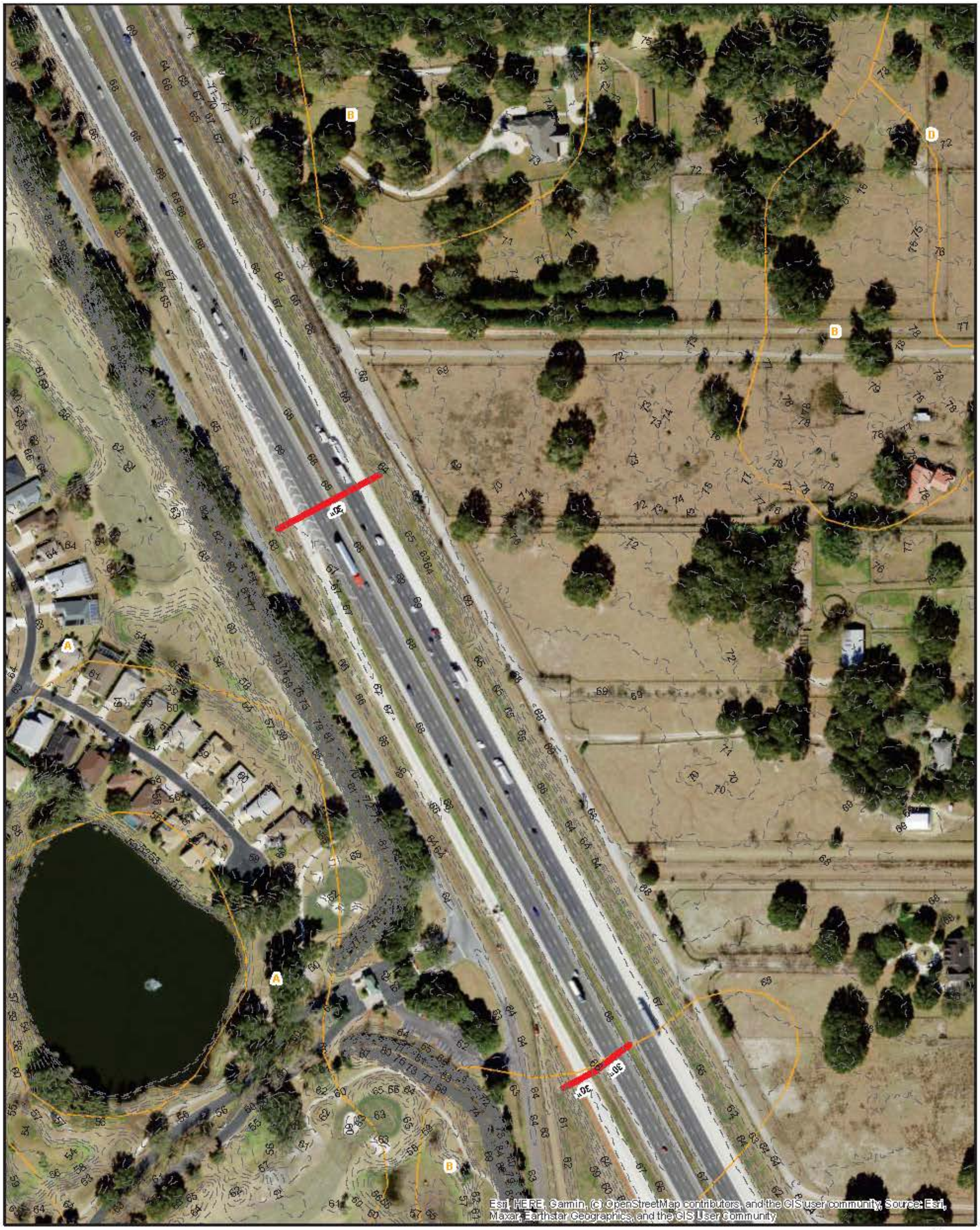

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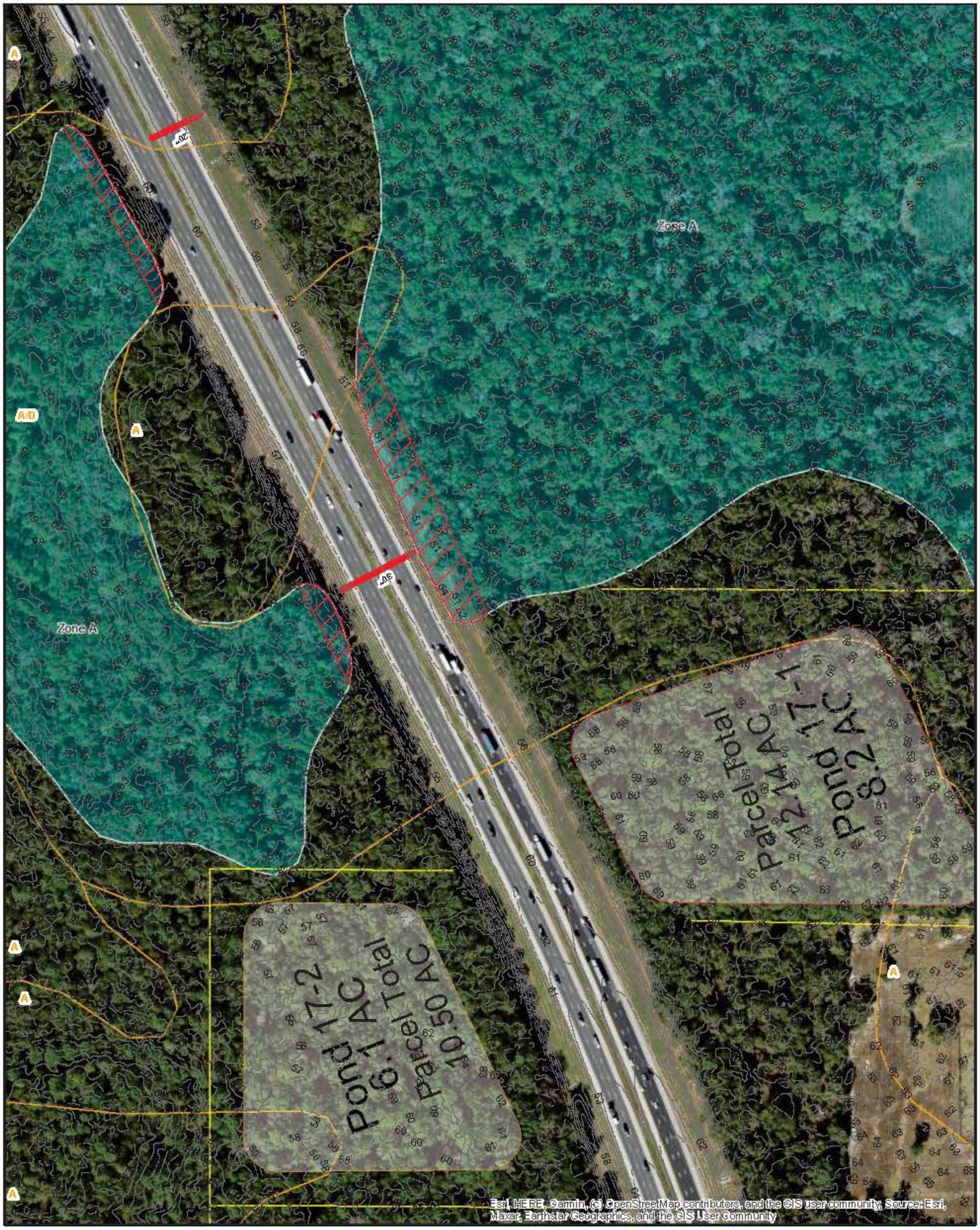

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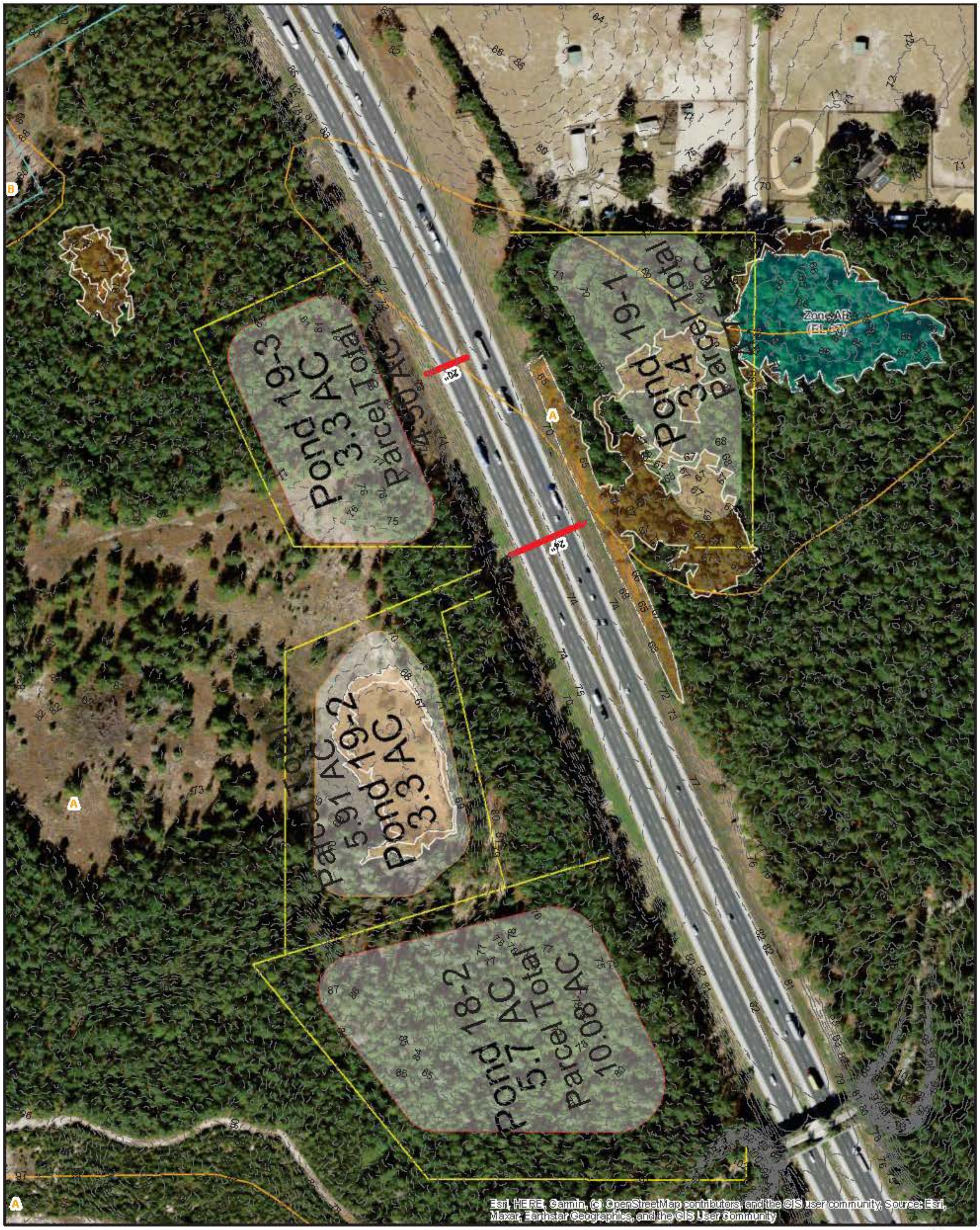

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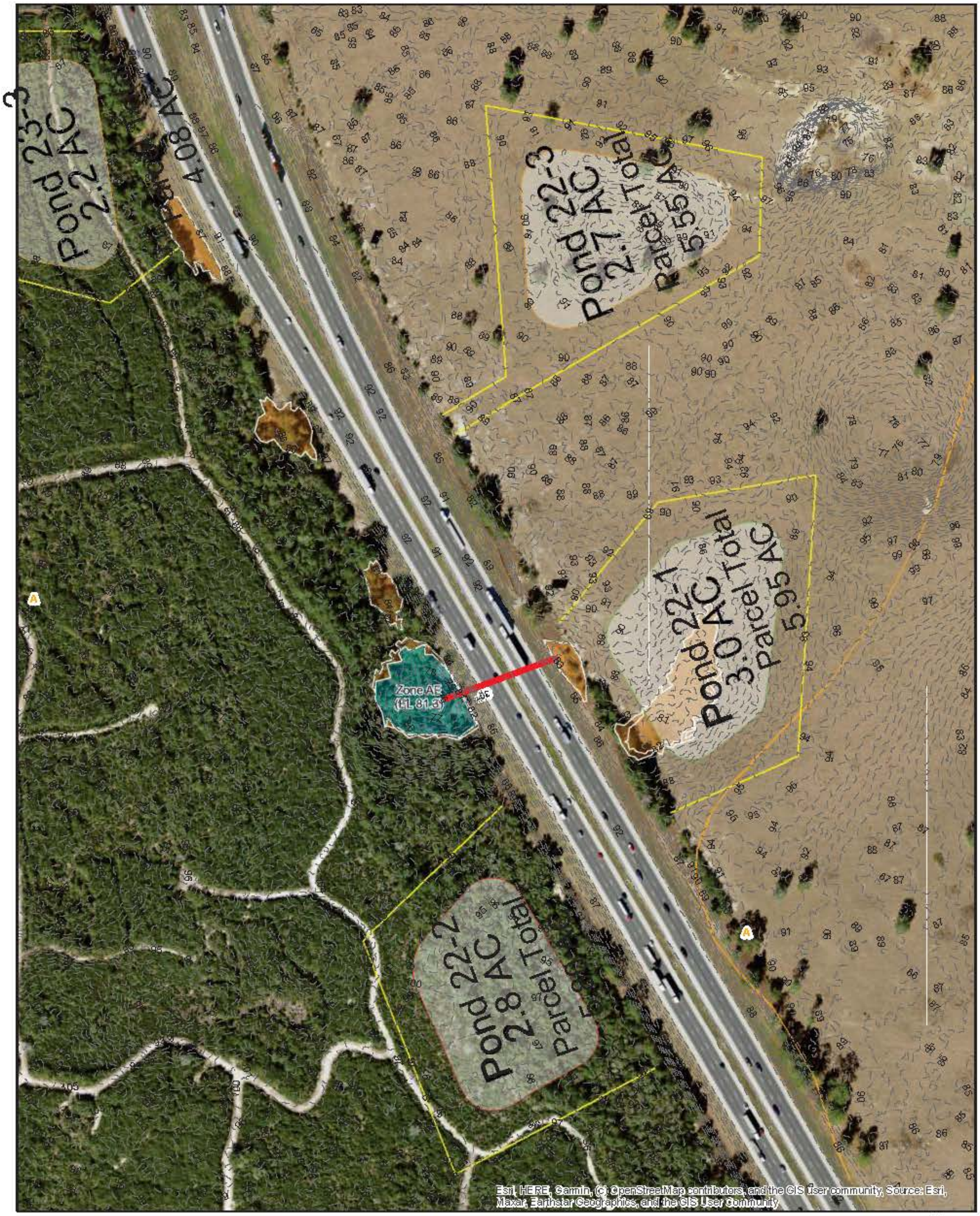

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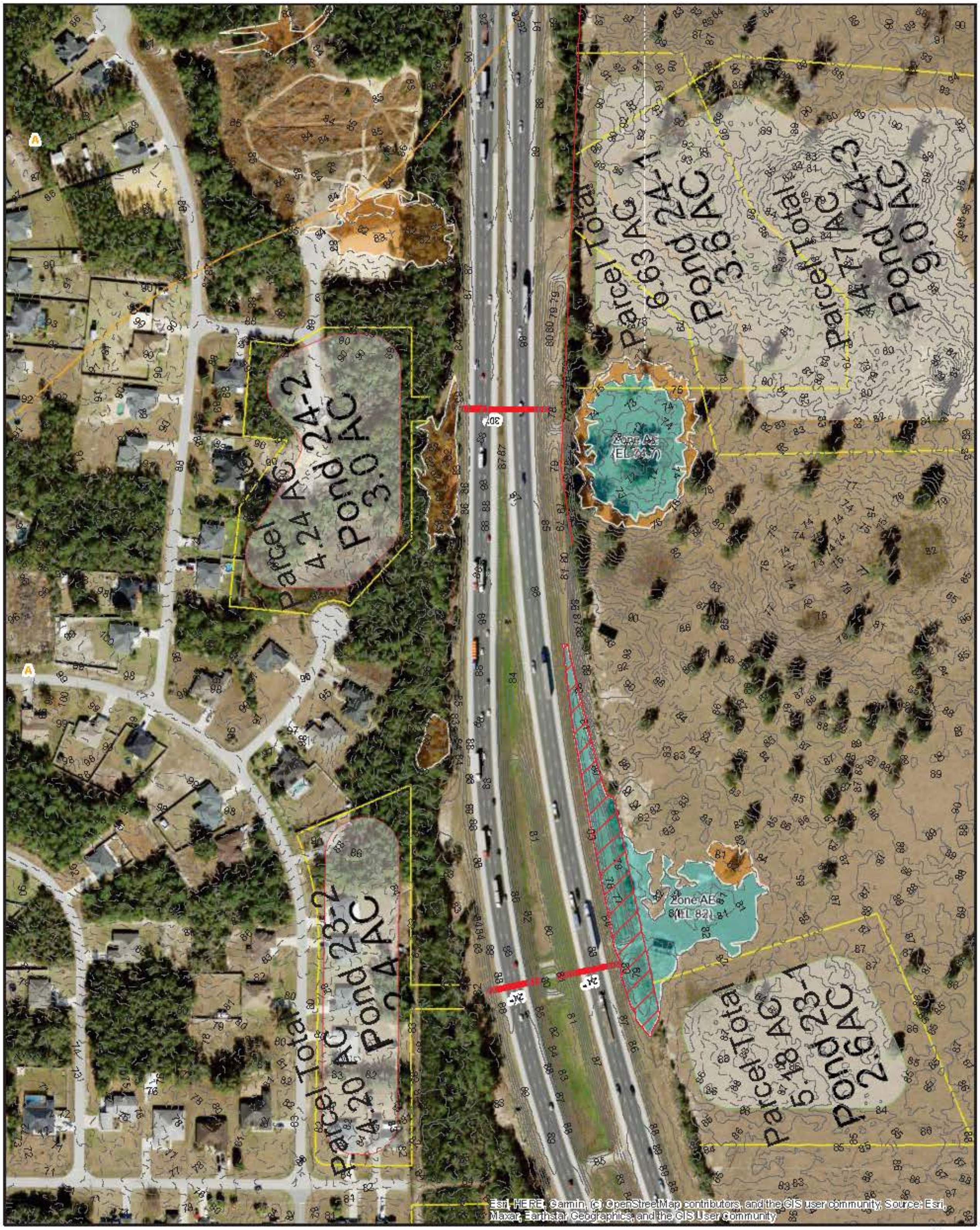

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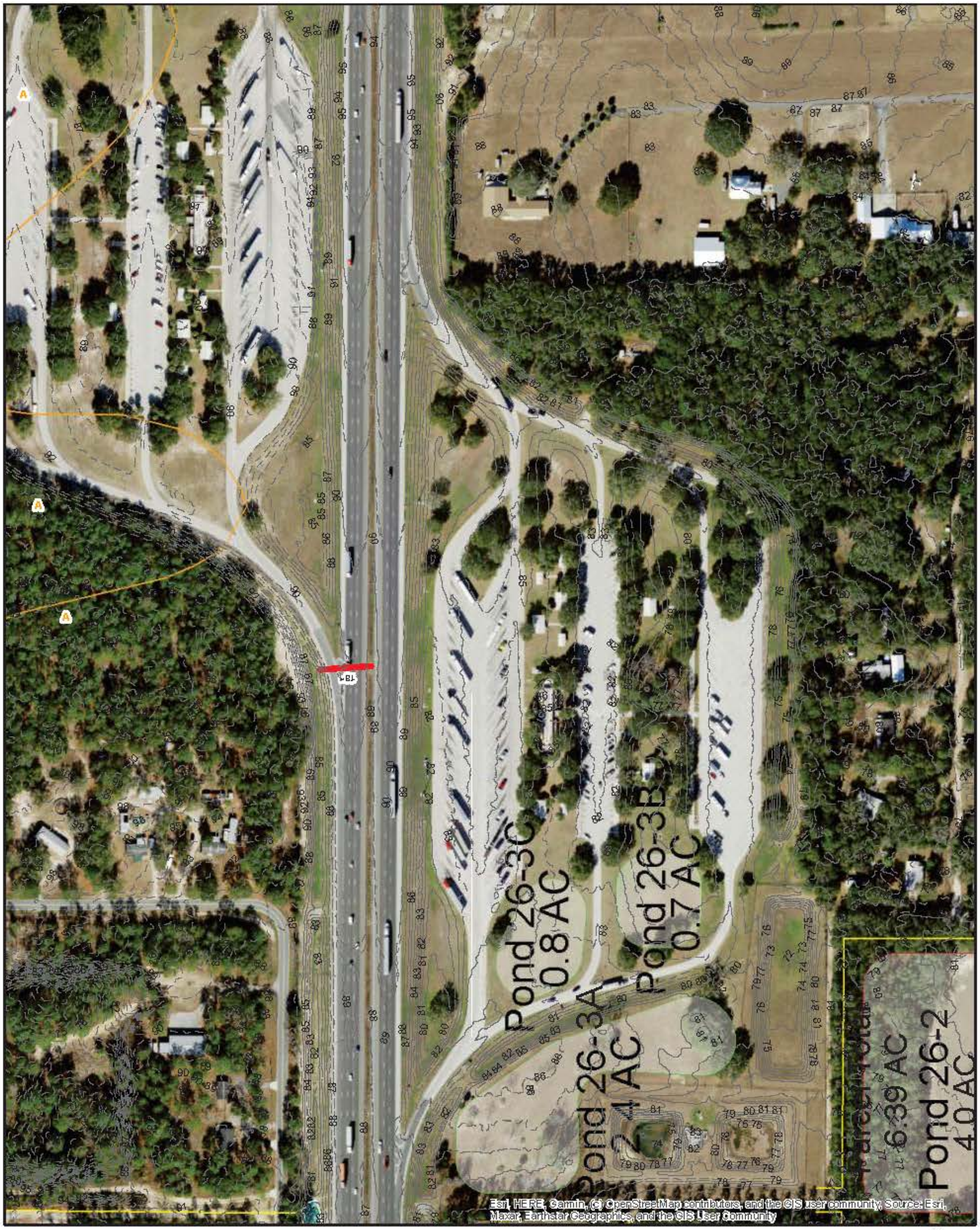

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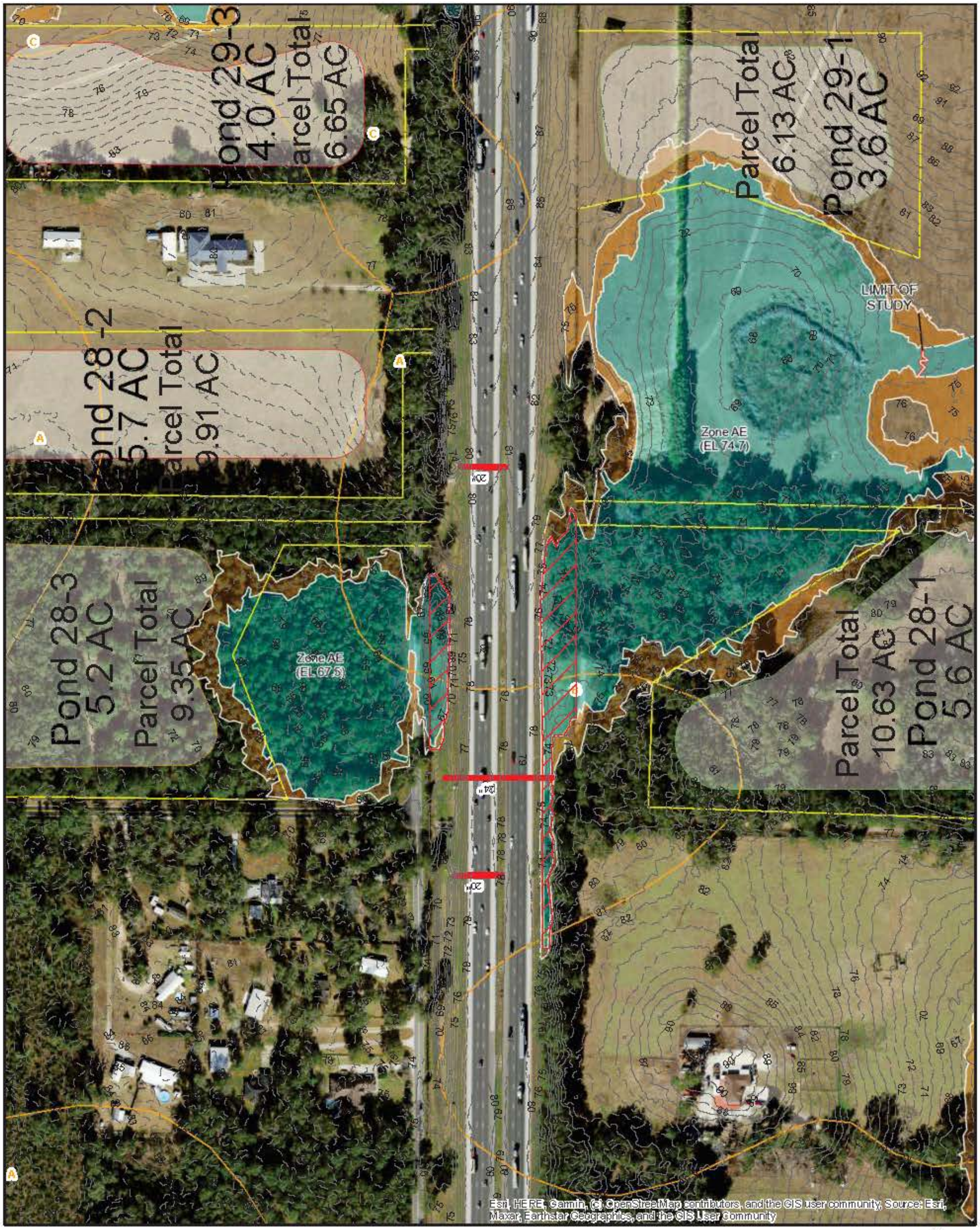

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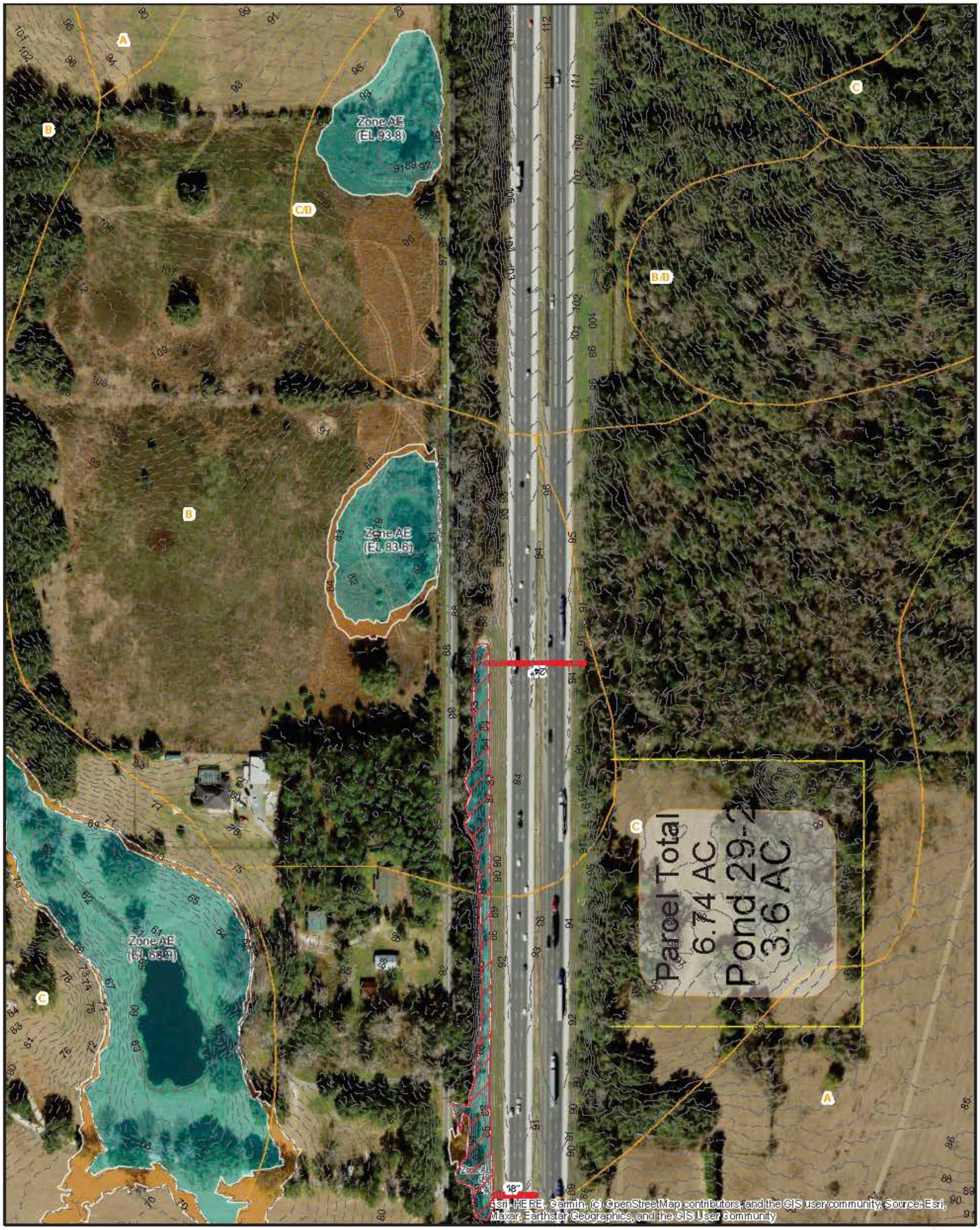

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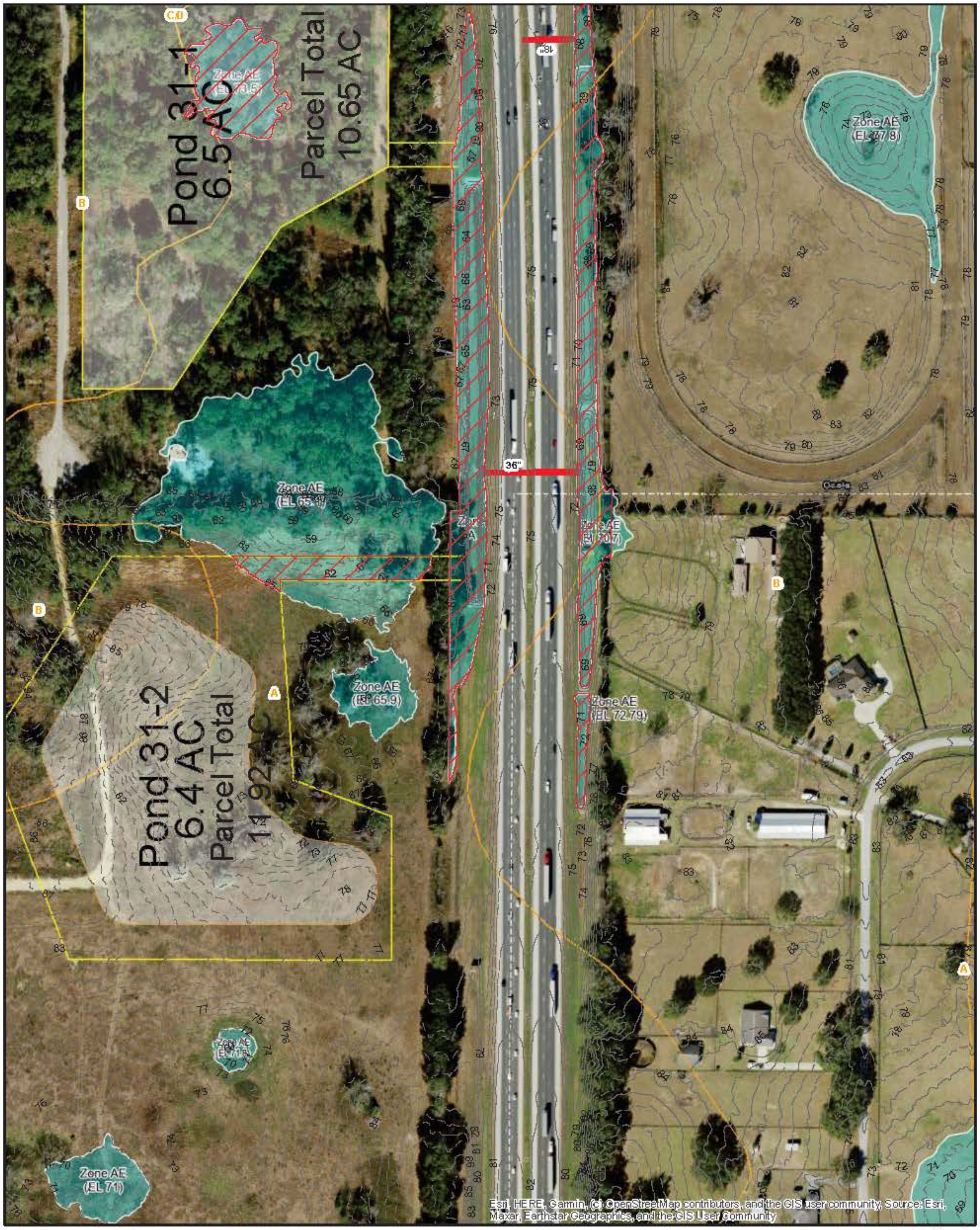

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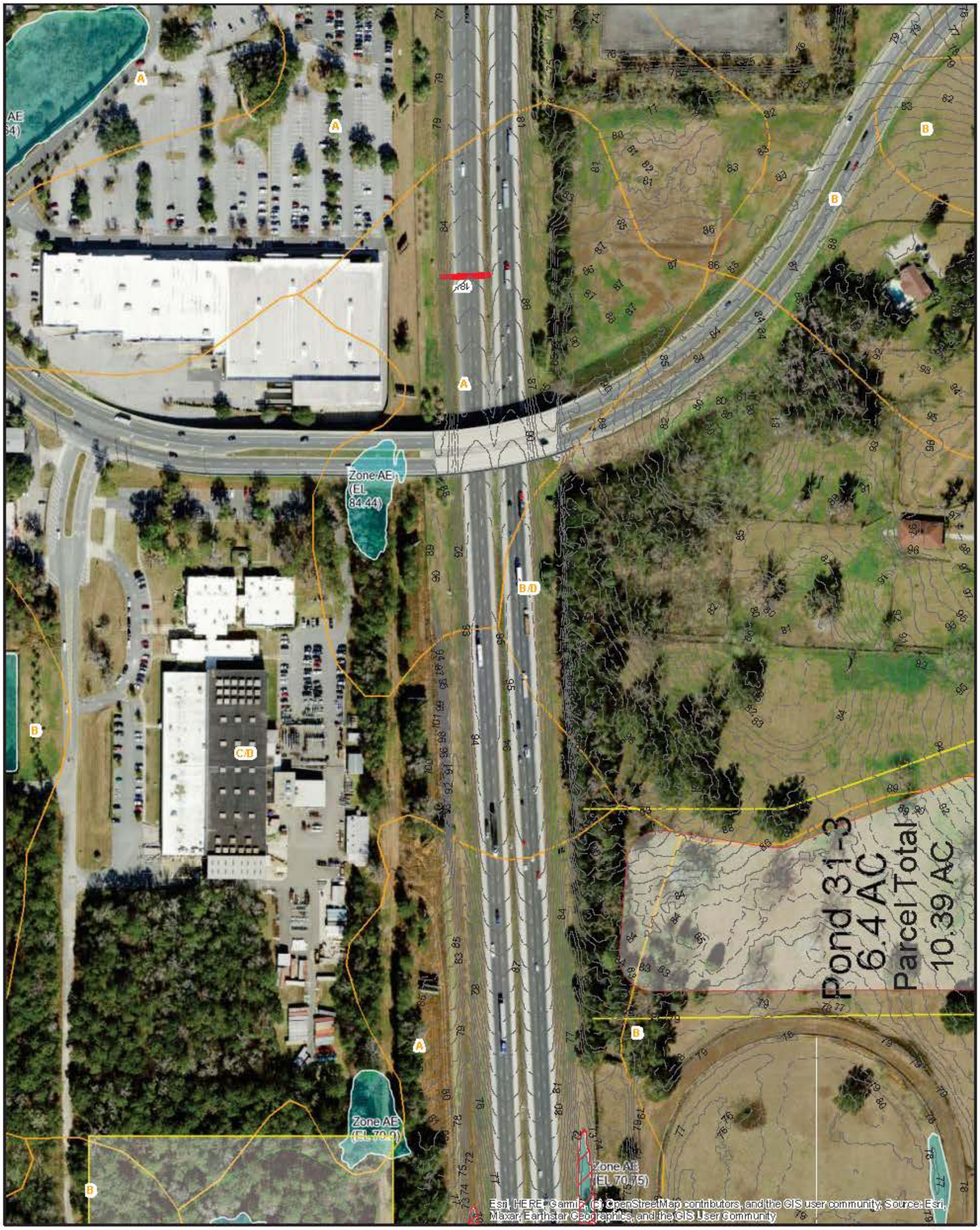

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