SR 9/I-95 AT LANTANA ROAD

Palm Beach County, Florida

FPID No.: 413258-1-22-02 | ETDM# 14338

PD&E Study

Drainage Analysis Report

FDOT

July 2020

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

TECHNICAL REPORT COVERSHEET

650-050-38
ENVIRONMENTAL
MANAGEMENT
06/17

DRAINAGE ANALYSIS REPORT

Florida Department of Transportation

District Four

SR 9/I-95 at Lantana Road Interchange PD&E Study

Limits of Project: From North of Hypoluxo Road to South of 6th Avenue S (MP 18.420 to MP 19.158)

Palm Beach County, Florida

Financial Management Number: 413258-1-22-02

ETDM Number: 14338

July 12, 2020

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

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1.0 INTRODUCTION

The Florida Department of Transportation (FDOT), District Four, is conducting a Project Development and Environment (PD&E) Study that proposes improvements to SR 9/I-95 at Lantana Road Interchange from High Ridge Road to Andrew Redding Road.

The objective of this Alternative Drainage Analysis Report is to evaluate the three (3) proposed alternatives as part of the PD&E Study to identify suitable stormwater management systems for each alternative to mitigate the additional runoff volume from new impervious areas and mitigate the loss of storage due to the proposed improvements at SR9/I-95 Lantana Road Interchange. A volumetric compensation analysis was performed to evaluate the post-development alternatives conditions. Due to the lack of topography and detailed information, a detailed hydrologic/hydraulic model analysis could not be performed at this phase of the study.

1.1 PROJECT BACKGROUND

SR 9/I-95 is the main Interstate Highway on the East Coast of the United States serving areas from Florida to Maine. Within the State of Florida, SR 9/ I-95 is a major state transportation resource critical in the facilitation of statewide travel, and is included in the Strategic Intermodal System (SIS) established by the Florida Legislature in 2003, for its role in supporting the State's economy and mobility.

SR 9/I-95 has experienced increasing traffic volumes since its completion in Palm Beach County in 1980: fueled largely by population and economic growth within the County. The FDOT has responded to this increased transportation demand with various interventions to improve operations and safety along the SR 9/I-95 mainline including, adding a High Occupancy Vehicle (HOV) lane and auxiliary lanes from south of Linton Boulevard to north of PGA Boulevard in the 1990s and 2000s, and minor interchange improvements at eight interchange locations within this segment of SR 9/I-95.

In December 2015, the FDOT completed the SR 9/I-95 Interchange Master Plan for Palm Beach County to identify short-term and long-term needs at the interchange locations within the County through the 2040 design year horizon. This Master Plan included design concepts to address traffic spillback onto SR 9/1-95, improve interchange operations, reduce congestion, and increase safety at 17 interchanges from Linton Boulevard to Northlake Boulevard. SR 9/I-95 at Lantana Road Interchange was one of the interchange locations evaluated as part of the I-95 Interchange Master Plan.

A Concept Development Report (CDR) was completed for this interchange as part of the I-95 Interchange Master Plan Study for Palm Beach County. The CDR identified several preliminary short-term and long-term improvements at the SR 9/I-95 at Lantana Road Interchange including:

- Dual right-turn lanes for the SR 9/I-95 southbound off-ramp
- Dual eastbound left-turn lanes from Lantana Road to the SR 9/I-95 northbound on-ramp
- Additional westbound through lane between the SR 9/I-95 southbound off-ramp and High Ridge Road
- Additional eastbound through lane between the SR 9/I-95 northbound off-ramp and Andrew Redding Road
- Improvements at various intersections along Lantana Road including High Ridge Road, Andrew Redding Road, Sunset Road and Shopping Center Drive

Within Palm Beach County, the Transportation Planning Agency (TPA) adopted a vision to transform the County into a place where bicycling is a safe and convenient transportation option and an attractive form of recreation for residents and visitors alike by 2035. In keeping with this vision, Palm Beach County adopted the Master Comprehensive Bicycle Transportation Plan (MCBTP) with recommendations to include/improve bicycle facilities throughout Palm Beach County. Lantana Road from Jog Road to Dixie Highway was identified as one of the corridors for inclusion in the Priority Bicycle Network.

This PD&E Study is being conducted to evaluate concepts that improve interchange operations and safety, accommodate future transportation demand at the Lantana Road Interchange, and provide bicycle accommodations along Lantana Road within the project limits.

1.2 PROJECT DESCRIPTION

The SR 9/I-95 at Lantana Road interchange is located within the Town of Lantana in Palm Beach County, Florida, between the 6th Avenue South (1.54 miles to the north) and the Hypoluxo Road (1.04 miles to the south) interchanges. The interchange provides access to the Palm Beach County Park/Lantana Airport, Hypoluxo Island, Lantana Scrub Natural Area, and the Lantana Lake Worth Health Center. The study interchange is a typical diamond interchange and the limits along Lantana Road extend from High Ridge Road to Andrew Redding Road. The South Florida Rail Corridor (SFRC)/CSX Railroad runs parallel along the west side of SR 9/I-95 in this area and crosses below an elevated section of Lantana Road.

SR 9/I-95 near the Lantana Road interchange is a ten-lane divided urban interstate, providing four general purpose lanes and one High Occupancy Vehicle (HOV) lane in each direction. Auxiliary lanes are provided in both the northbound and southbound direction within the study area. At the Lantana Road interchange, SR 9/I-95 crosses below an elevated section of Lantana Road. SR 9/I-95 is a SIS designated highway as well as an emergency evacuation route.

Within the project limits, Lantana Road is primarily a four-lane urban principal arterial under the jurisdiction of Palm Beach County, with two through lanes in each direction. At the interchange location, Lantana Road is elevated over SR 9/I-95 and the SFRC/CSX Railroad. There is one dedicated left-turn lane in each direction to access the SR 9/I-95 on-ramps and two through lanes in each direction. A single free-flow right-turn lane is also provided in both eastbound and westbound directions along Lantana Road to serve the SR 9/I-95 on-ramps. Sidewalks are provided along both sides of Lantana Road; however, bicycle lanes do not exist. The segment of Lantana Road from SR 9/I-95 to SR 5/US-1 is designated as an emergency evacuation route.

Land use adjacent to the interchange is predominantly commercial with some industrial, institutional and residential uses. The adjacent signalized intersections within the project limits are: High Ridge Road west of SR 9/I-95 southbound ramps, and Shopping Center Drive and Andrew Redding Road east of SR 9/I-95 northbound ramps.

The proposed improvements will include operational and safety improvements to the Interchange including capacity improvements along Lantana Road, additional turning lanes at the SR 5/I-95 ramp terminal intersections and signal improvements. The project will also include improvements to sidewalks, ADA ramps, guide signs, and designated bicycle lanes. The project location map is shown in Error! Reference source not found.

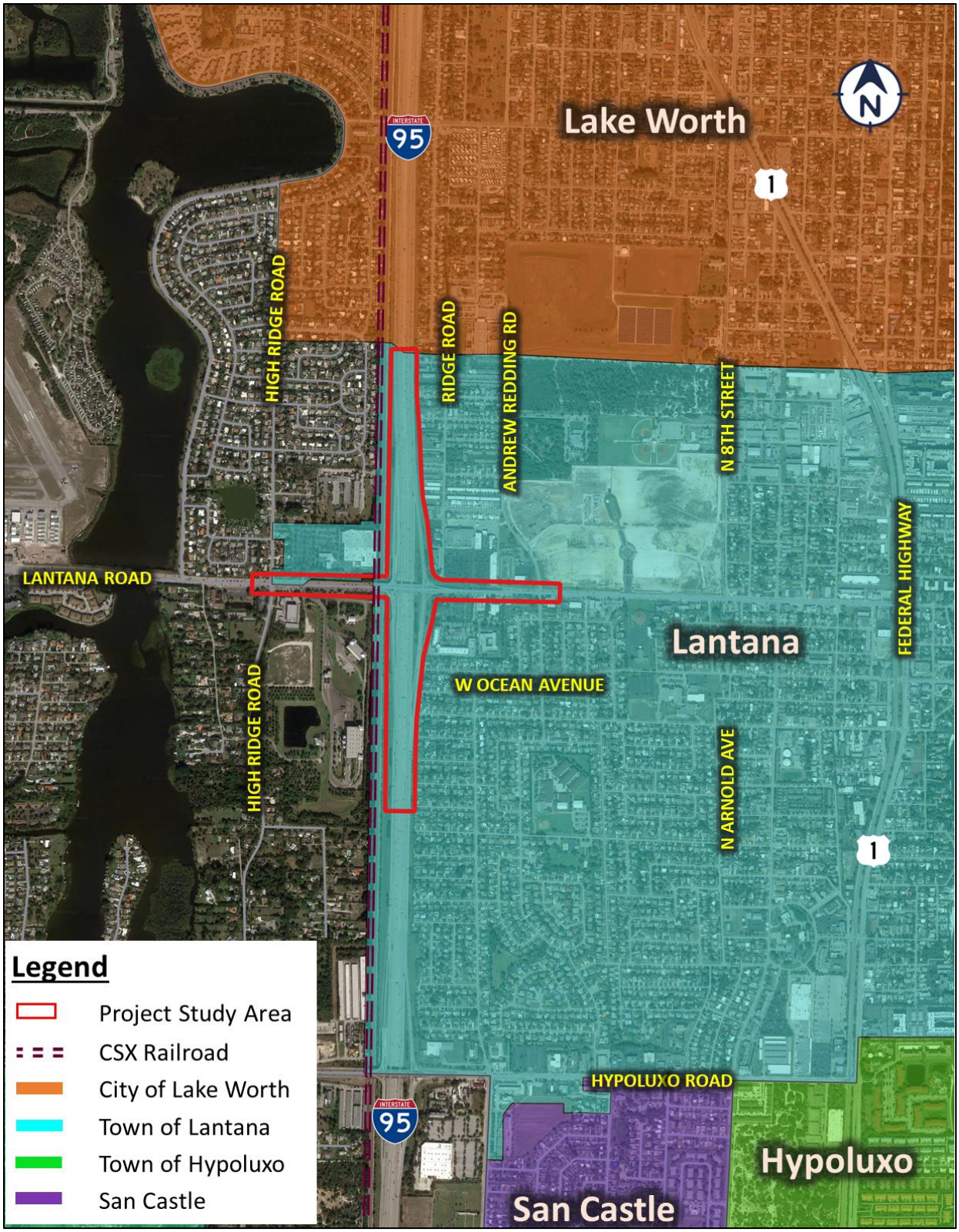


Figure 1-1 Project Location Map

1.3 PURPOSE AND NEED

The primary purpose of this interchange project is to improve the local and regional transportation network while also providing enhanced multimodal interrelationships at the SR 9/I-95/Lantana Road interchange. Additional features that will be improved include capacity and transportation demand, safety, and emergency evacuation. The study will evaluate alternatives that eliminate traffic spillback onto SR 9/I-95, enhance interchange operations and safety, reduce congestion, while providing for multimodal accommodations at this interchange location. The study will also consider accommodation for potential extension of I-95 Managed Lanes through Palm Beach County. The needs for this project are further described in the following sections:

1.3.1 Transportation Network

Lantana Road is a county roadway (CR 812) that provides access to the Town of Lantana and Hypoluxo Island via East Ocean Avenue (Lantana) Bridge. To the west, Lantana Road provides access to the Palm Beach County Park/Lantana Airport and the City of Atlantis. Although Lantana Road is not a designated road in the state's SIS, SR 9/I-95 is a part of the SIS system. The SIS includes Florida's important transportation facilities that support the State's economy and mobility. Improved interchange operations at Lantana Road will help to reduce traffic spillback onto I-95 thereby enhancing connectivity among the local and regional network.

1.3.2 Multimodal Interrelationships

The SR 9/I-95 at Lantana Road interchange accommodates east-west sidewalks on the north and south sides of Lantana Road, from High Ridge Road to Shopping Center Drive, extending beyond both intersections. Bicycle lanes are not provided in both directions along Lantana Road within the project limits. The Palm Beach County Transportation Planning Agency (TPA) Master Comprehensive Bicycle Transportation Plan (MCBTP) includes recommendations to improve bicycle facilities throughout Palm Beach County. The MCBTP recommends a "Detailed Corridor Study" along Lantana Road. Additionally, the MCBTP designates segments of High Ridge Road as "Bike Level of Service (LOS) Threshold Met" and "Shoulder Candidate." As part of the study, provision of bike lanes would be evaluated along Lantana Road.

Four schools are located within approximately one mile of the interchange: Barton Elementary School, Lantana Elementary School, Lantana Middle School, and Palm Beach Maritime Academy. There are no Palm Tran transit bus stops within the project limits. However, bus stops are located on Lantana Road west of High Ridge Road and east of Andrew Redding Road. Adding

improvements to bicycle and pedestrian facilities at the intersections within the study area will enhance the safety of the local community pedestrian users traveling the corridor.

1.3.3 Capacity and Transportation Demand

The SR 9/I-95 southbound ramps within the study area currently operate at an overall LOS E during the A.M. peak hours, while the northbound ramps operate at a LOS C. During the P.M. peak hours, the southbound ramps operate at LOS D, and the northbound ramps operate at LOS C. If no improvements are made to the SR 9/I-95 at Lantana Road interchange, it is forecasted that by 2045, both the southbound and northbound ramps will operate at LOS F for both the A.M. and P.M. peak hours.

Due to the current need to increase capacity, the proposed interchange improvements are included in the Palm Beach County TPA 2040 Long Range Transportation Plan (LRTP) as part of the 2020-2040 Desires Plan. Funding for Design (Preliminary Engineering and PD&E) are planned to be available in 2026-2030 and Construction in 2031-2040. The interchange improvements are also included in the SIS Cost Feasible Plan 2024-2040. The interchange is also included in the I-95 Interchange Master Plan.

1.3.4 Safety

Crash data from 2014 to 2018 for SR 9/I-95 (Roadway ID: 93220000) from south of Lantana Road to the north of Lantana Road, SR 9/I-95 Ramps at Lantana Road (Roadway ID: 93220037, 93220038, 93220039, and 93220040), and Lantana Road (Roadway ID: 93530000) from High Ridge Road to Andrew Redding Road (MP 2.80 to MP 3.50) was obtained from the FDOT State Safety Office GIS (SSOGis) Query Tool on the Traffic Safety Web Portal. Based on the crash analysis, 313 crashes occurred on the SR 9/I-95 mainline, 157 crashes occurred on the SR 9/I-95 ramps at Lantana Road interchange and 172 crashes occurred on Lantana Road within the study area from 2014 to 2018. The predominant crash types that occurred within the study area were rear-end collisions, sideswipe collisions, and angled collisions. Crashes of these types are typically attributed to congested conditions along the arterials and interchange ramps and terminals. As such, providing capacity improvements for different modes of transportation within the study area will help to improve safety by alleviating congestion.

1.3.5 Emergency Evacuation

Based on Palm Beach County's Evacuation Routes and Zones Map, Lantana Road is classified as an evacuation route from SR 5/US-1 to SR 9/I-95. Therefore, improvements to the interchange of I-95 and Lantana Road, along with improvements to nearby intersections, will decrease evacuation times by increasing connectivity between eastern and western towns/cities and SR 9/I-95. Additionally, emergency response times will be decreased by the proposed improvements.

1.4 PLANNED AND ONGOING ADJACENT PROJECTS

Transportation plans from the state, county, city and municipal level were reviewed to identify projects that impact the SR 9/I-95 at Lantana Road PD&E Study Area. Transportation plans that were reviewed as part of this study include: FDOT District 4 Five Year Work Program, Palm Beach County TPA 2040 LRTP, Palm Beach County Transportation Improvement Program (TIP) and Palm Beach County MCBTP. A number of planned or ongoing projects were identified within the influence area of the SR 9/I-95 at Lantana Road PD&E Study. **Table 1-1** below provides a summary of these projects.

Table 1-1 Ongoing and Adjacent Projects

Project #	Project Name	Work Mix	Fiscal Year
427516-2	SR 9/I-95 From Gateway Boulevard to Lantana Road	Resurfacing	2020
444202-1	I-95 Managed Lanes from Linton Blvd. to 6th Ave	PD&E Study	2024
413257-1	SR 9/I-95 at Hypoluxo Road	PD&E	2020
436963-1	SR 9/I-95 at 6th Avenue South	PD&E / P.E.	2020
444340-1	SR 9 @ 6th Avenue South	Landscaping	2022
20230001	Lantana Road from Hagen Ranch to SR 9/I-95	Resurfacing	2023
N/A	Water Town Commons Development	Mixed-Use Development	Ongoing

Lantana Road is also included as a priority corridor in the Palm Beach County adopted MCBTP), with recommendations for bicycle lanes along Lantana Road from Jog Road to Dixie Highway.

2.0 ALTERNATIVES CONSIDERED

The alternatives considered as part of the SR 9/I-95 at Lantana Road PD&E Study include a No-Action Alternative, Transportation System Management & Operations (TSM&O) Alternative, and three Build Alternatives. The Alternatives are described below:

2.1 NO-ACTION ALTERNATIVE

The No-Action Alternative assumes no proposed improvements to the study interchange and serves as a baseline for comparison against the Build Alternatives. The No-Action Alternative includes consideration for the Water Tower Commons Development located in the northeast quadrant of Lantana Road and Andrew Redding Road Intersection. This is a 73-acre mixed-use development with 1,100 residential units and 209,000 square feet of commercial space for offices, retail stores and restaurants.

2.2 TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS

The TSM&O Alternative considers minor improvements to enhance operations and safety without the addition of through lanes. TSM&O includes low-cost improvements such as adding turn lanes at intersections, adjusting signal phasing and timings, and considering opportunities to enhance alternative travel modes. It also includes implementation of intelligent transportation systems (ITS) technologies. The Build Alternatives developed for this IMR also incorporate TSM&O improvements. The proposed TSM&O improvements to be incorporated as part of the Build Alternatives include:

- Incident Management CCTV Cameras
- Wrong Way Detection Technology
- Vehicle Detection System
- Dynamic Message Signs on Lantana Road east and west of SR 9/I-95

TSM&O improvements will only alleviate some operational, geometric and safety deficiencies along some portions of the study area. Their implementation alone does not meet the purpose and need for this project. TSM&O improvements are only viable in combination with the Build Alternatives that are discussed in the next section of this report.

2.3 BUILD ALTERNATIVE 1

Build Alternative 1 considered for this Study is generally based on the preliminary conceptual design recommended as part of the I-95 Interchange Master Plan Study and described in Section 1.1. This Alternative maintains the existing Tight Urban Diamond Interchange (TUDI) configuration; however, additional improvements were incorporated into the original concept from the I-95 Interchange Master Plan Study to better accommodate the design year traffic demand. The following improvements are proposed under Build Alternative 1 (See **Figure 2-1**):

- Widen Lantana Road to provide 3 lanes in each direction from High Ridge Road to Andrew Redding Road.
- Widen the existing Lantana Road bridge over I-95 and the two ramp bridges.
- Provide triple right-turn lanes and dual left-turn lanes for the SR 9/I-95 northbound and southbound off-ramps.
- Provide dual eastbound and westbound right-turn lanes onto I-95 southbound and northbound on-ramps, respectively.
- Provide dual eastbound and westbound left-turn lanes from Lantana Road to the I-95 southbound and northbound on-ramps, respectively.
- Eliminate eastbound left-turn movement and provide directional median opening at the Sunset Road intersection.
- Provide exclusive southbound and northbound right-turn lane along High Ridge Road and extend the EB left urn storage from 200 ft to 300 ft.
- Widen right-turn lane at Sunset Road to accommodate WB62FL Design Vehicles.
- Provide 7 ft buffered bicycle lanes and 6 ft sidewalks along Lantana Road in both directions.

These improvements are necessary to enhance the operations of the intersections within the interchange influence area. The proposed improvements under this alternative will also require right of way impacts to 9 commercial properties along Lantana Road.

2.4 BUILD ALTERNATIVE 2

Build Alternative 2 reconfigures the existing Tight Urban Diamond Interchange into a Diverging Diamond Interchange (DDI) configuration (See **Figure 2-2**). The diverging diamond concept requires drivers to briefly cross to the left, or opposite side of the road at carefully designed crossover intersections. Drivers travel for a short distance, then cross back to the traditional or right side of the road. This unconventional design allows movements for the left and right-turns

to and from the I-95 ramps onto Lantana Road without crossing the path of opposing traffic. The crossover is made at the signal where the opposing traffic flows split the signal green time. The major advantage of this type of interchange is that the left-turning vehicles do not require a signal phase which makes this a two-phased signal system with more green time for the opposing traffic. In addition, the DDI has fewer conflict points (i.e. 14 for DDI, 26 for TUDI) resulting in significant safety and operational improvement at the interchange. The following improvements are proposed to accommodate the design year traffic demand under Build Alternative 2:

- Widen Lantana Road to provide 3 lanes in each direction between High Ridge Road and Andrew Redding Road.
- Replace the existing single Lantana Road bridge over I-95 and SFRC/CSX Railroad with two separate bridges over SR 9/I-95 and SFRC/CSX Railroad.
- Replace the existing ramp bridges for the southbound on and off ramps with embankment and MSE walls.
- Provide dual right-turn lanes and dual left-turn lanes for the SR 9/I-95 northbound and southbound off-ramps.
- Provide dual eastbound and westbound right-turn lanes from Lantana Road onto I-95 southbound and northbound on-ramps, respectively.
- Provide dual eastbound and westbound left-turn lanes from Lantana Road onto the I-95 northbound and southbound on-ramps.
- Eliminate the eastbound left-turn, northbound left-turn and thru movements and provide a directional median opening at the Sunset Road intersection with an underpass access road.
- Provide exclusive southbound and northbound right-turn lane along High Ridge Road.
- Widen westbound right-turn lane at Sunset Road to accommodate WB62FL Design Vehicles.
- Provide 7 ft buffered bicycle lanes and 6 ft sidewalks along Lantana Road in both directions.

These improvements are necessary to enhance the operations of the intersections within the interchange influence area. The proposed improvements under this alternative will also require right of way impacts to 6 commercial properties along Lantana Road.

2.5 BUILD ALTERNATIVE 3

Build Alternative 3 reconfigures the existing Tight Urban Diamond Interchange into a Single Point Urban Interchange (SPUI) configuration (See **Figure 2-3**). The SPUI concept consolidates the two intersections of a TUDI into one single intersection. This allows left-turning traffic from both directions of the intersecting roadways to turn simultaneously without crossing the path of the opposing left-turns. Since traffic passing through the SPUI is controlled by a single signal, vehicles can clear the intersection much more quickly compared to a TUDI. The major advantages of SPUI are improved operational efficiency and safety. This can be attributed to the single, three-phase traffic signal and less conflict points compared to the TUDI. In addition, the SPUI also allows for wider turns, easing movement for heavy trucks. The following improvements are proposed to accommodate the design year traffic demand under Build Alternative 3:

- Widen Lantana Road to provide 3 lanes in each direction from High Ridge Road to Andrew Redding Road
- Replace the existing Lantana Road bridge over I-95 and the two ramp bridges
- Provide triple right-turn lanes and dual left-turn lanes for the SR 9/I-95 northbound and southbound off-ramps.
- Provide dual eastbound and westbound right-turn lanes onto I-95 southbound and northbound on-ramps, respectively.
- Provide dual eastbound and westbound left-turn lanes from Lantana Road to the I-95 southbound and northbound on-ramps, respectively.
- Provide dual eastbound and westbound left-turn lanes from Lantana Road to the I-95 southbound and northbound on-ramps, respectively.
- Eliminate the eastbound left-turn, northbound left-turn and thru movements and provide a directional median opening at the Sunset Road intersection with an underpass access road.
- Provide exclusive southbound and northbound right-turn lane along High Ridge Road
- Widen right-turn lane at Sunset Road to accommodate WB62FL Design Vehicles
- Provide 7 ft buffered bicycle lanes and 6 ft sidewalks along Lantana Road in both directions.

These improvements are necessary to enhance the operations of the intersections within the interchange influence area. The proposed improvements under this alternative will also require right of way impacts to 9 commercial properties along Lantana Road.

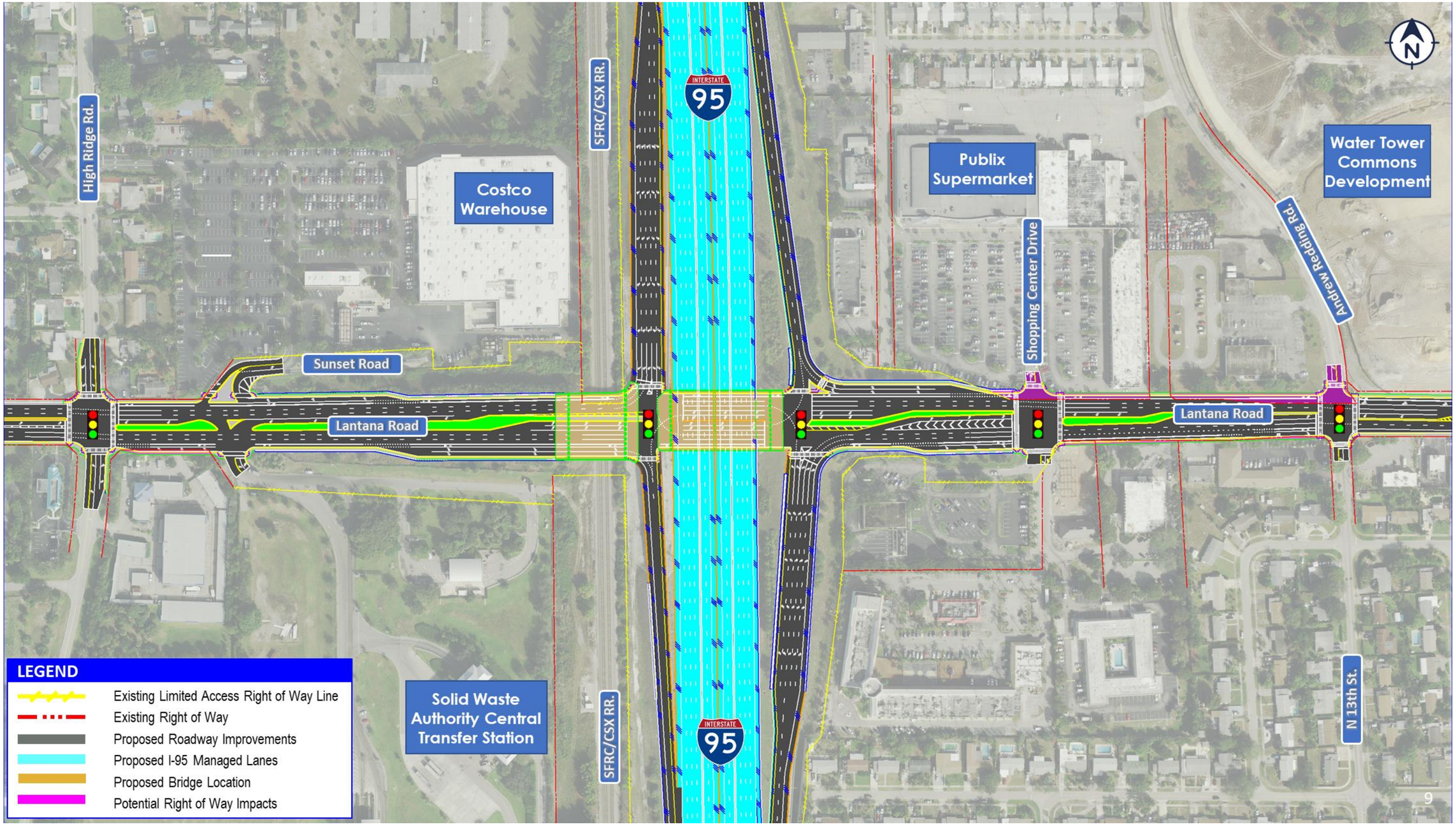


Figure 2-1 Build Alternative 1: Tight Urban Diamond Interchange (TUDI)

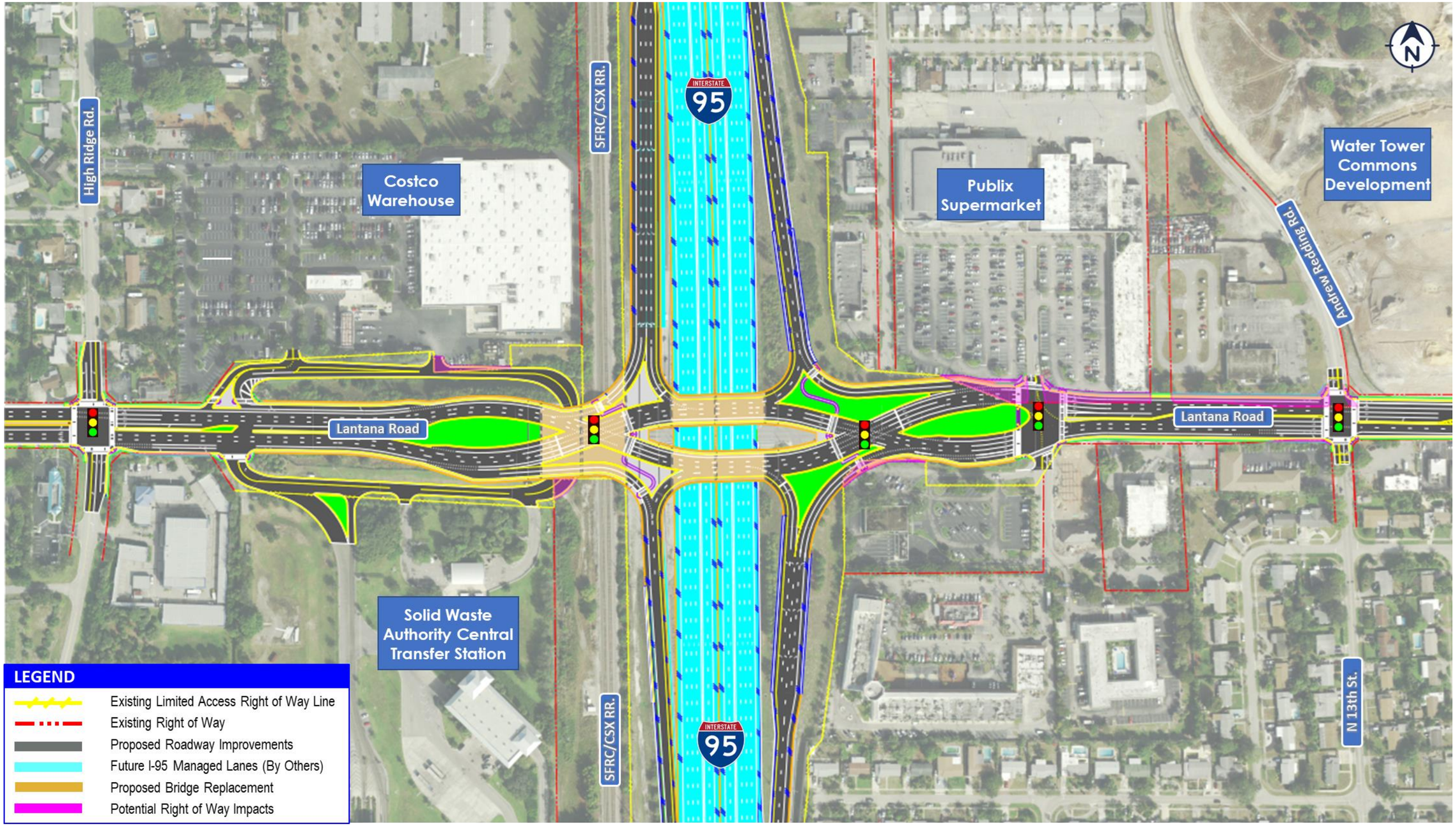


Figure 2-2 Build Alternative 2: Diverging Diamond Interchange (DDI)

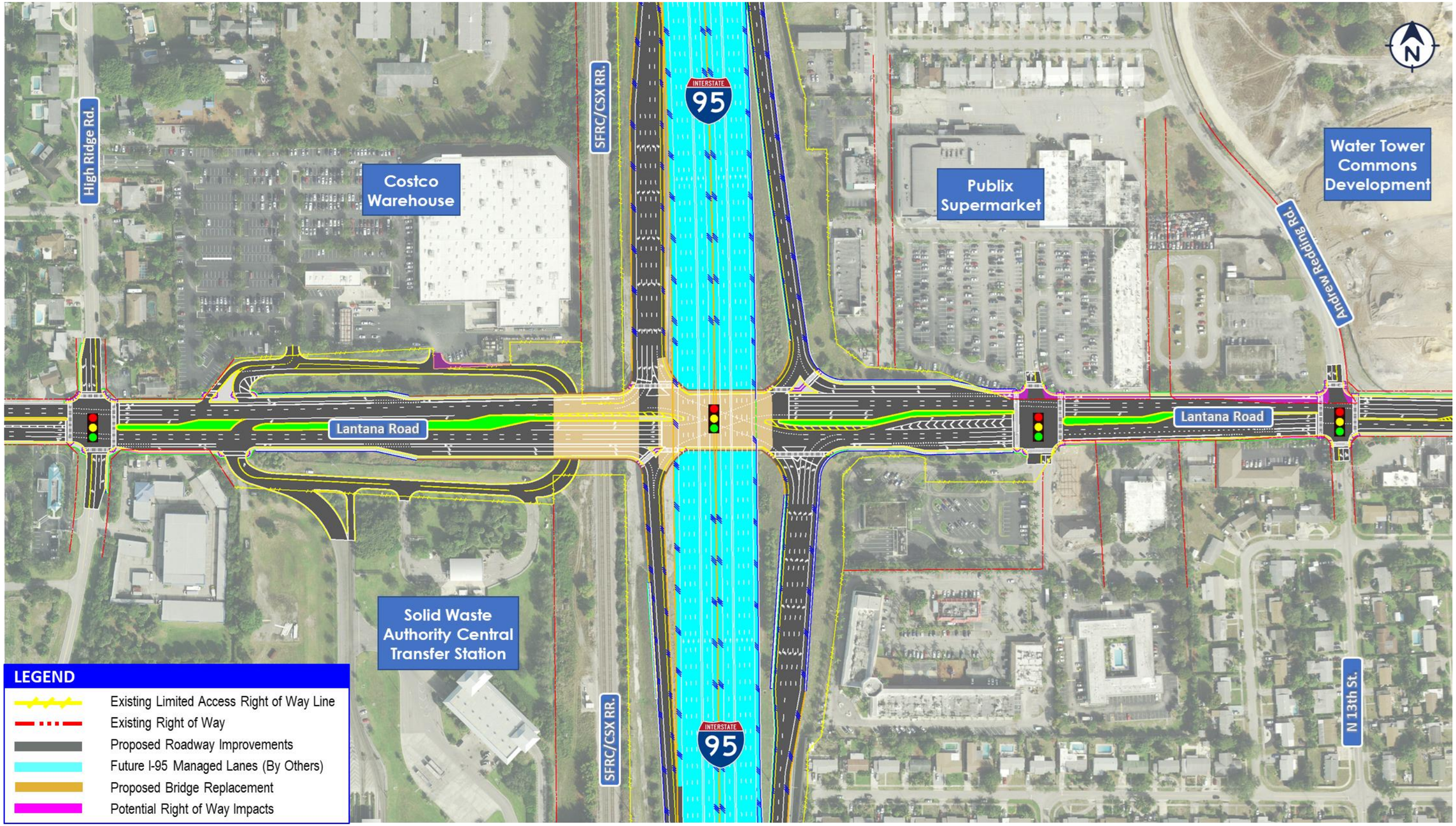


Figure 2-3 Build Alternative 3: Single Point Urban Interchange (SPUI)

3.0 EXISTING CONDITIONS PRE-DEVELOPMENT

3.1 DATA COLLECTION AND EVALUATION

3.1.1 Existing Permits

The project limits are within the South Florida Water Management District (SFWMD) C-16 Basin and within the Lake Worth Drainage District (LWDD) jurisdiction. A permit searched was performed in the SFWMD ePermitting web portal, and there are several Environmental Resources Permit (ERP) and ERP modifications that have taken place within the project study limits. **Figure 3-1** shows the permits located within the project location.

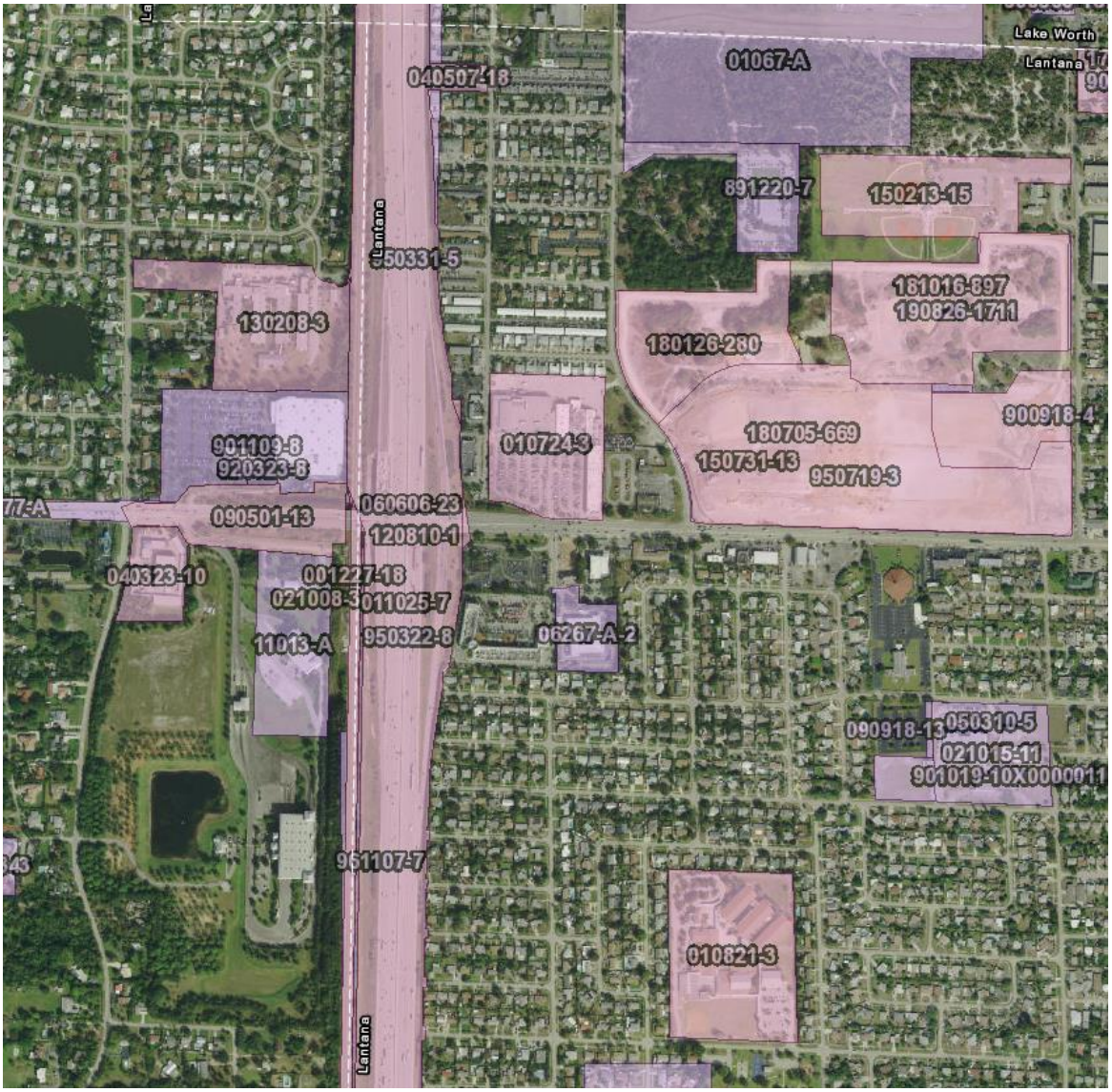


Figure 3-1 Permits Within Project Limits

Some of the key ERPs are summarized below:

1. ERP No. 50-03485-S: Project limits are covered under this ERP, and the ERP includes Lantana Road and I-95 Interchange Improvements and SR 9/I-95 from South of Gateway Boulevard to South of 6th Ave.
2. ERP No. 50-09127-P: Includes the portion of Lantana Rd. west of I-95. Lantana Road (High Ridge Road to Southbound I-95) Widening
3. ERP No. 50-03570-S: Includes Lantana Rd. and the portion east of I-95 with a trunkline of 24" heading west, which is connected with curb inlets on both sides of the road.
4. ERP No. 50-06540-P: Includes a private property (Simmers and White) located on the southeast corner of Lantana Rd. and High Ridge Rd. This property has a French drain system with an overflow connection to the FDOT drainage system via a control structure and a 24" pipe.

3.1.2 Available Data Collected

The following is a summary list of other available data and data obtained from the existing permits:

1. SR 9/I-95 At Lantana Road PD&E Study – Cultural Resource Assessment Survey Research Design
2. Lantana Road and I-95 Interchange Improvements (ERP 50-03485-S)
3. SR 9/I-95 from South of Gateway Boulevard to South of 6th Ave (ERP 50-03485-S)
4. Keeper's Self-Storage Development (ERP 50-06510-P) design high water (8.5 feet relative to the National Geodetic Vertical Datum of 1929 (ft-NGVD) and percolation rate (4.91x10-4 CFS/ft2 – ft Head) for corner property between High Ridge Road and Lantana Road
5. Lantana Road (High Ridge Road to Southbound I-95) Widening design plans (ERP 50-09127-P), design high water (10 ft-NGVD) and percolation rate (2.46x10-4 CFS/ft2 – ft Head)
6. Lantana Shopping Center (ERP 50-05114-P) design highwater elevation (9.0 ft-NGVD) and percolation rate (1.18x10-4 CFS/ft2 – ft Head)
7. Water Tower Commons (ERP 05-03570-S) Seasonal High Water (9.0 ft-NGVD) and percolation rate (4.5x10-4 CFS/ft2 – ft Head)
8. Percolation Test provided by AREHNA Engineering, Inc., performed in October 2019. The results are included in **APPENDIX 1**
9. Environmental Resource Permit Applicant's Handbook Volume II – Isohyetal Maps – 25-year, 3-day rainfall distribution (13-in)

3.1.3 Project Datum

The vertical datum used in this report is the National Geodetic Vertical Datum of 1929 (NGVD29). However, plans will use the North American Vertical Datum of 1988 (NAVD88). Elevations can be converted from NGVD29 to NAVD88 with a conversion factor of 1.6 feet (NGVD29 – 1.6 = NAVD88).

3.2 EXISTING DRAINAGE SYSTEM

The exiting drainage patterns include conveyance of stormwater runoff via overland flow, swales, inlets, and pipes to the existing stormwater systems and ultimately discharged to the LWDD E-4 Canal via several control structures. There are four main drainage basins in the vicinity of the I-95 and Lantana Road Interchange. **Figure 3-2** shows the existing drainage basin map.

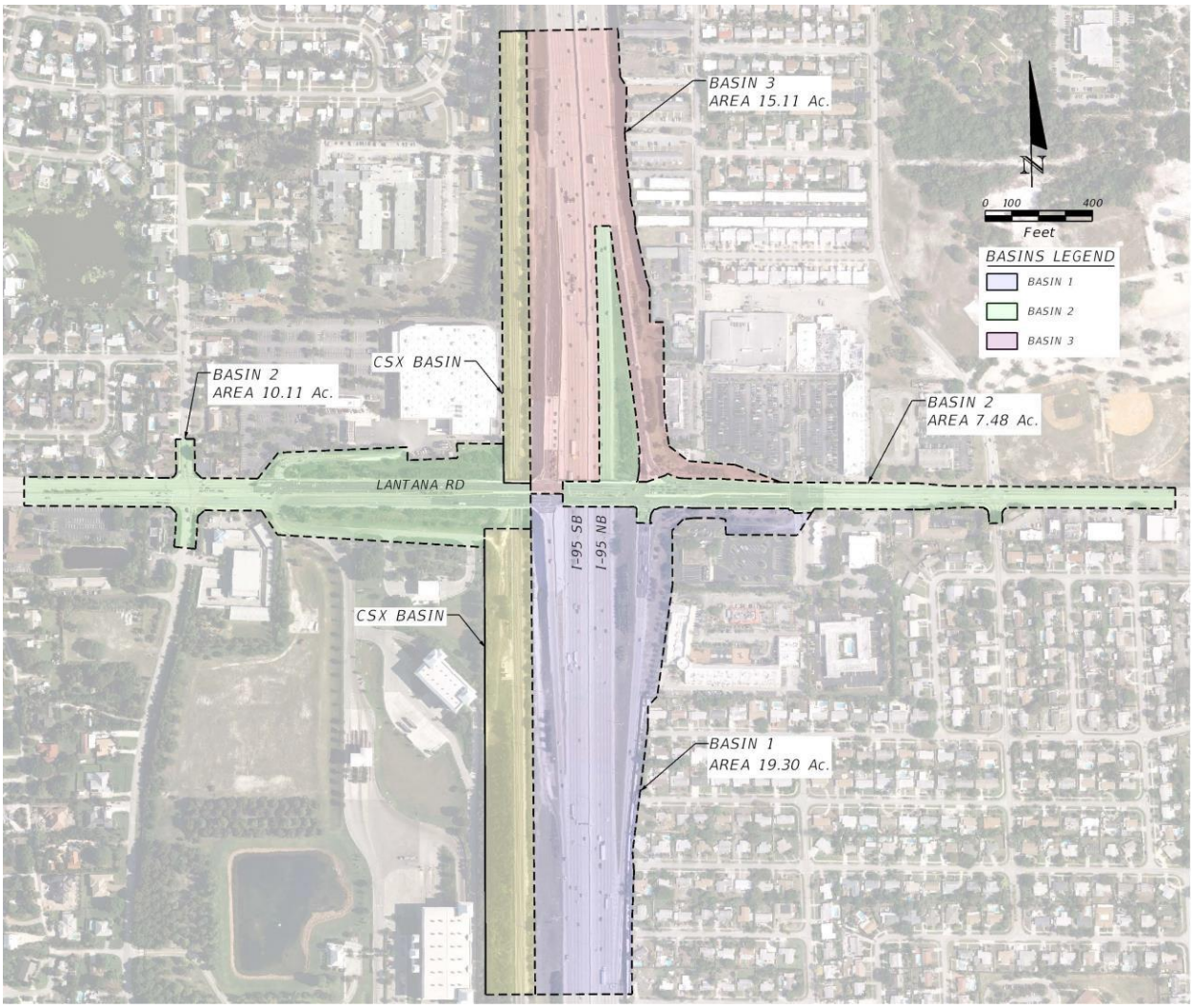


Figure 3-2 Existing Drainage Basin Map

3.2.1 Basin 1:

This basin extends from north of Hypoluxo Road to just south of Lantana Road overpass, including the I-95 eastbound off-ramp. The basin also includes some adjacent areas south of Lantana Rd. from I-95 to approximately 350-ft to the east.

The system is comprised of a dry swale/ditch (on both the east and west sides) that runs parallel to I-95 towards the south. Also, there is a French drain trunkline along the median that collects all stormwater runoff on the median (per ERP 50-03485-S). This French drain is connected with a dry detention pond at Hypoluxo Road on the westbound off-ramp, which ultimately discharges via a 60" pipe LWDD E-4 Canal. There is a control structure that maintains the water quality storage and controls the discharge from this system. The SHGWT elevation for this structure is set to 11.0-ft NGVD.

3.2.2 Basin 2:

This basin includes the segment of Lantana Rd. east and west of I-95 and the NE quadrant of I-95/Lantana Rd. Interchange. This basin captures the runoff on the NE quadrant of the Lantana Interchange through curb inlets and connects to an existing 48" pipe that runs west and ultimately discharges into Lake Osborne/LWDD E-4 Canal. Currently, no water quality treatment is being provided from this quadrant/system within this basin, but water quality is compensated within Basins 1 and 3. The existing drainage system along Lantana Rd. consists of a series of curb inlets on both sides of the road, collecting the stormwater runoff and connecting to a trunkline (located on the median along Lantana Rd.), which is connected to a 48" pipe that discharges into Lake Osborne.

3.2.3 Basin 3:

This basin extends from the North of the Lantana Rd. overpass to the North, beyond the limits of the project study. There is a dry detention pond underneath the Lantana Rd. overpass and the west side of I-95 on/off ramps. This pond has a detention control structure (S-255A) that connects and discharges into a northern swale on the west side of I-95 with an ultimate discharge to the Lake Osborne through an existing 60" pipe underneath 12th Avenue. Detention Control Structure S-255A is a ditch bottom inlet with a SHGWT elevation set to 15.75 ft-NGVD with a 3" circular bleeder orifice at elevation 14.16 ft-NGVD. This basin also has a French drain trunkline collection system along the median of I-95, which is connected to swales on both sides of I-95.

3.2.4 CSX Basin:

This basin is contiguous to drainage detention swales west of I-95. However, there is a berm between the two swales along the west side of I-95. Therefore, there is no runoff being contributed by the CSX Basin. **Table 3.1** provides a summary of the existing drainage basins with their respective impervious and pervious areas.

Table 3-1 Existing Drainage Basin Areas

Basins	Existing Basin Areas (acres)		
	Impervious	Pervious	Total
1	11.24	8.06	19.30
2	12.83	4.75	17.58
3	9.58	5.53	15.11

4.0 DRAINAGE DESIGN CRITERIA

Table 4-1 Design Criteria for Drainage		
Design Element	**Criteria**	**Source**
Cross Drains	50-Year design frequency	D.M. Section 4.3.1
Design Tailwater		
All Conditions	Conditions vary with outfall	D.M. Section 3.4
Time of Concentration (TOC)	Minimum T.O.C. of 10 Minutes	D.M. Section 3.5.1
	Other T.O.C calculations to follow NRCS TR-55	
Pipe Slopes		
Minimum	Min. slope to produce v=2.5-ft./sec flowing full	D.M. Section 3.6.1
Manning's "n" Coefficient		
Pipes	0.012 (smooth pipes) 0.024 (corrugated pipe)	D.M. Section 3.6.4
Asphalt (rough texture)	0.016 Asphalt Pavement	D.D.G. Table B-2
Grades		
Longitudinal Gutter Grade	minimum gutter grade is 0.3%	D.M. Section 3.8.1
Spread Standards		
Design Speed < 45	Keep ½ travel lane clear	D.M. Section 3.9
45 < Design Speed <55	Keep 8-ft. of travel lane clear	
Design Speed >55	No encroachment	
Pipe Size and Length		
Trunk Line	18-in Minimum Diameter.	D.M. Section 3.10.1
Length Between Structure	18 in. Pipe=300-ft., 24 in. - 36 in.=400-ft., >42 in.=500-ft.	D.M. Section 3.10.1
Ground Water Clearance		
Dry-retention	Pond bottom minimum 1-ft. above SHGWT	B.M.P. Section VIII
Freeboard		
Storm Drain	Minimum 1-ft. Below Theoretical Gutter Elevation	D.D.G. Section 6.5
Ponds	Minimum 1-ft. above peak design stage	D.M. Section 5.4.4.2
Roadside Swale	Minimum of 0.5-ft. freeboard	D.M. Section 5.4.4.2
Stormwater Management System		
Water Quality	Water quality standards, as set forth in Chapter 62-302, Florida Administrative Code.	ERP II 4.1.1
Discharge Limitations	Historic Discharges, Post <= Pre	ERP II 3.2

5.0 POST DEVELOPMENT DRAINAGE ANALYSIS

The proposed Alternatives consider in this analysis include the widening of Lantana Road at the SR 9/I-95 Interchange and the on/off ramps to/from I-95. The proposed improvements will result in additional runoff volume due to the new impervious areas for each basin and loss of storage of the existing dry detention pond in Basin 3. This study does not include any additional runoff volume due to new impervious areas from the proposed widening of I-95.

5.1 SEASONAL HIGH GROUNDWATER TABLE ELEVATION

A representative Seasonal High Groundwater Table (SHGWT) for each basin was determined based on previous ERPs (50-03485-S, 50-03514-S, 50-05114-P, ERP 05-03570-S) within the project limits and adjacent areas. After the analysis and evaluation of adjacent projects, the SHGWT elevation was estimated at 9.0 ft-NGVD for Basin 1, 2, and 3.

5.2 ALTERNATIVE 1 – TIGHT UBRAN DIAMOND INTERCHANGE (TUDI)

Alternative 1 consists of the widening along Lantana Road and the on/off ramps to/from I-95. The on/off ramps bridge structures on the west side of I-95 will be maintained. Widening of I-95 is not being considered at the time of this analysis for Alternative 1.

Under this proposed alternative, no impacts to the dry detention pond are expected. Consequently, no reduction in storage volume is anticipated. Only additional runoff volume due to new impervious areas would need to be mitigated. The existing control structure S-255A located at the pond, conveying water to the north FDOT swale from Basin 3, does not appear to be impacted by this change. **Table 4.1** provides a comparison of the pre-development and post-development drainage basin areas for Alternative 1 with the change in impervious and pervious areas.

Table 5-1 Pre- and Post- Development Basin Area Comparison for Alternative 1							
		Pre-development (acres)			Post-development (acres)		
Design Alternative	Basins	Impervious	Pervious	Total	Impervious	Pervious	Total
1	1	11.24	8.06	19.30	11.74	7.56	19.30
	2	12.83	4.75	17.58	13.63	3.95	17.58
	3	9.58	5.53	15.11	10.03	5.08	15.11

5.3 ALTERNATIVE 2 – DIVERGING DIAMOND INTERCHANGE (DDI)

Alternative 2 consists of the widening along Lantana Road and the on/off ramps to/from I-95. The on/off ramps bridge structures on the west side of I-95 will be converted to MSE walls. Widening of I-95 is not being considered at the time of this analysis for Alternative 2. Under this proposed alternative, the existing dry detention pond will be impacted, and storage volume will be reduced by 76%. Regrading and deepening of the pond at the same location will not be possible due to limited space. To account for volume loss and provide additional storage due to new impervious areas the pond will need to be relocated north of the existing location along the FDOT swale. The existing control structure S-255A will need to be removed. **Table 4.2** provides a comparison of the pre-development and post-development drainage basin areas for alternative 2 with the change in impervious and pervious areas.

Table 5-2 Pre- and Post- Development Basin Area Comparison for Alternative 2

Design Alternative	Basins	Pre-development (acres)			Post-development (acres)		
		Impervious	Pervious	Total	Impervious	Pervious	Total
2	1	11.24	8.06	19.30	13.84	4.62	18.46
	2	12.83	4.75	17.58	15.85	3.28	19.13
	3	9.58	5.53	15.11	11.08	4.03	15.11

5.4 ALTERNATIVE 3 – SINGLE POINT URBAN INTERCHANGE (SPUI)

Alternative 3, like Alternative 1, consists of the widening along Lantana Road and the on/off ramps to/from I-95. The on/off ramps bridge structures on the west side of I-95 will be converted to MSE walls. Widening of I-95 is not being considered at the time of this analysis for Alternative 3. Under this proposed alternative, the existing dry detention pond will be impacted, and storage volume will be reduced by 82%. Regrading and deepening of the pond at the same location will not be possible due to limited space. To account for volume loss and provide additional storage due to new impervious areas the pond will need to be relocated north of the existing location along the FDOT swale. The existing control structure S-255A will need to be removed. **Table 4.3** provides a comparison of the pre-development and post-development drainage basin areas for alternative 3 with the change in impervious and pervious areas.

Table 5-3 Pre- and Post- Development Basin Area Comparison for Alternative 3							
Design Alternative	Basins	Pre-development (acres)			Post-development (acres)		
		Impervious	Pervious	Total	Impervious	Pervious	Total
3	1	11.24	8.06	19.30	11.84	7.46	19.30
	2	12.83	4.75	17.58	13.78	3.80	17.58
	3	9.58	5.53	15.11	10.23	4.88	15.11

For the purpose of this study, drainage patterns were maintained, and pre- and post-development basins were kept constant within the project limits to prevent any increases in discharge from each basin to the outfall.

As outlined in Section 4, the loss of any storage volume and additional runoff volume due to new impervious areas will be mitigated by compensating these volumes via new French drains and compensating dry detention areas. The detention volumes will be provided below the SHGWT elevation of each basin, prior to discharging offsite.

The attenuation requirements for the project are not to exceed the pre-development peak stages for the 25-year, 72-hour design storm event. The rainfall depth for this design event is 13.0 inches based on the SFWMD ERP Applicant's Handbook Volume II. **Table 4.4** provides a summary of the additional volume that will need to be mitigated within each basin for each alternative.

Table 5-4 Post-Development Additional Volume to be Mitigated by Alternative					
DESIGN ALTERNATIVE	BASINS	Volume Reduced (ac-ft)	Additional Impervious (ac)	Additional Runoff Volume (ac-ft)	Total Volume to Mitigate (ac-ft)
1	1	0.00	0.50	0.54	0.54
	2	0.00	0.80	0.87	0.87
	3	0.00	0.45	0.49	0.49
2	1	0.00	2.60	2.82	2.82
	2	0.00	3.02	3.28	3.28
	3	0.35	1.50	1.63	1.98
3	1	0.00	0.60	0.65	0.65
	2	0.00	0.95	1.03	1.03
	3	0.38	0.65	0.70	1.09

6.0 POST DEVELOPMENT STORMWATER MANAGEMENT SYSTEMS

The drainage analyses performed as part of this study include evaluating the three (3) proposed alternatives to mitigate the loss of storage volume within each basin and the additional runoff volume due to new impervious areas. These volumes will be compensated via new French drains and dry detention/retention areas. The detention/retention volumes will be provided below the SHGWT elevation of each basin, prior to discharging offsite, to maintain the currently permitting peak allowable discharges and water quality volumes.

The primary permitting agencies are the South Florida Water Management District (SFWMD) and the Lake Worth Drainage District. The quality of stormwater discharge to receiving waters is presumed to meet the surface water standards in Chapters 62-4 62-302, F.A.C. To assure that these criteria are met, the project must meet the volumetric retention/detention requirements, as described in the SFWMD Environmental Resource Manual. For water quality purposes, the additional treatment volume shall be the amount of additional impervious area multiplied by 2.5 inches. For the post-development conditions, the post-development discharge during the 25-yr, 3-day storm event shall be the same or less than the pre-development discharge.

The analysis performed determined the additional impervious surface generated by the improvements and based on this additional impervious, the water quality and quantity impacts were then estimated. These impacts were determined in terms of required treatment and attenuation volumes. It is assumed that if the detention/retention areas can be modified to store the total of the additional runoff volume, then the pre vs. post criteria will be met.

The detention/retention volumes provided for each basin were determined for the 25-year, 72-hour design storm event with a 13.0-inch rainfall depth for the project location. Three percolation tests were requested and performed by AREHNA Engineering, Inc., on October 21, 2019. See **APPENDIX 1** for the percolation test report. An average of the three tests was calculated, and an average hydraulic conductivity of 4.95 x 10-4 CFS/ft2 – ft Head was used for estimating the volume of exfiltration needed to mitigate additional runoff. The French drain maximum capacity used for retention volume was limited to 3.28 inches or runoff, as required by the SFWMD. French drain calculations are provided in **APPENDIX 2**.

The following subsections outlined the recommended stormwater management systems for each alternative and basin to mitigate the volumes summarized in **Table 4.4**.

6.1 ALTERNATIVE 1 - TIGHT URBAN DIAMOND INTERCHANGE (TUDI)

Alternative 1 consists of the widening along Lantana Road and the on/off ramps to/from I-95. The on/off ramps bridge structures on the west side of I-95 will be maintained. The proposed stormwater management improvements for Alternative 1 are summarized in the following subsection and **Table 5.1**.

The proposed French drains and dry detention/retention areas will need to take into consideration their location in reference to contamination sites as referenced in the "413258-1 PD&E Study – Contamination Screening Evaluation Report." A level II testing must be performed for the proposed French drain locations to ensure there are no contamination sites within the French drain limits for the following locations:

- Proposed dry retention pond with 32 L.F. French drain west side of I-95 and south of Lantana Rd. West of Contamination sites #8 – Solid Waste Authority of PBC and #9 CSX Railroad
- Proposed dry retention pond with 42 L.F. French drain south of west Lantana Rd. North of Contamination site #8 and south of #3 Costco Gas station

6.1.1 Basin 1:

The existing system is composed of a dry swale/ditch (on both east and west sides) that runs parallel to I-95 towards the south. Also, there is a French drain trunkline along the median that collects all stormwater runoff on the median. This French drain is connected with a dry detention pond at Hypoluxo Road on the westbound of the ramp, which ultimately discharges via a 60" pipe into Lake Worth Drainage District (LWDD) E-4 Canal.

The proposed improvements will maintain the existing system as no volume reduction on the basin is expected. The improvements will add 0.50 acres of additional impervious areas. Treatment and attenuation for the additional 0.54 ac-ft of runoff volume will be provided with 32 linear feet of French drain and a proposed 0.30-acre dry retention pond referred to as SMP.B1.1. The dry retention pond will be located in the swale west of I-95 between the proposed MSE wall for the I-95 southbound ON ramp and the basin boundary. The runoff will be directed to the dry retention pond through the structure (S-174A) located on the NL2 swale. The pond bottom elevation will be at 14.5 ft-NGVD and will have an overflow at the south end of the pond at 16 ft-NGVD. The runoff will be conveyed south and will be retained by a ditch berm set to SHGWT elevation 15.75 ft-NGVD. When the peak elevation exceeds 15.75 ft-NGVD, the additional

runoff will be discharged to the south without increasing the pre-development peak discharges. Basin 1 stormwater improvements are shown in **APPENDIX 3A.**

6.1.2 Basin 2:

The existing system includes the segment of Lantana Rd., east and west of I-95, and the NE quadrant of I-95/Lantana Rd., Interchange. This basin captures the runoff on the NE quadrant of the Lantana Interchange through curb inlets and connects to an existing 48" RCP pipe that runs west on the north side of Lantana Road and ultimately discharges into Lake Osborne/LWDD E-4 Canal.

The proposed improvements will maintain the existing system as no volume reduction on the basin is expected. The improvements will add 0.80 acres of additional impervious area. Treatment and attenuation for the additional 0.87 ac-ft of runoff volume will be provided with 42 linear feet of French drain and a proposed 0.45-acre dry retention pond referred to as SMP.B2.1. The dry retention pond will be located between the proposed MSE wall on the south side of Lantana road and the edge of the pavement of the road below. The pond bottom elevation will be at 13.5 ft-NGVD. The additional dry retention volume will be provided below elevation 14.5 ft-NGVD. Runoff from the east and west side of Lantana Rd. will be capture through proposed control Structure S1.B2.1 and directed to the dry retention pond through bubble up Structure S1.B2.2, which will cross under the existing 48-in RCP pipe and proposed MSE walls. When the peak elevation exceeds 14.5 ft-NGVD, the additional runoff will be discharged to the west without increasing the pre-development peak discharges. Basin 2 stormwater improvements are shown in **APPENDIX 3B**.

6.1.3 Basin 3:

The existing system extends from the North of the Lantana Rd., overpass to the North, beyond the limits of the project study. There is a dry detention pond underneath the Lantana Rd., overpass, and the I-95 on/off ramps. This pond has a detention control Structure S-255A that connects and discharges into a northern swale on the west side of I-95 with an ultimate discharge to the Lake Osborne through an existing 60" pipe underneath 12th Avenue. This basin also has a French drain trunkline collection system along the median of I-95, which is connected to swales on both sides of I-95.

The proposed improvements will maintain the existing system as no volume reduction on the basin is expected. The improvements will add 0.45 acres of additional impervious area. Treatment and attenuation for the additional 0.49 ac-ft of runoff volume will be provided by regrading the exiting pond referred to as SMP.B3.1. The pond bottom elevation will be modified from 15.5 ft-NGVD to 15 ft-NGVD. The additional dry detention volume will be provided below the basin SHGWT elevation (15.75 ft-NGVD). The existing control Structure S-255A located at the pond, conveying water to the north FDOT swale from Basin 3, will not be impacted by this change. Basin 3 stormwater improvements are shown in **APPENDIX 3C**.

Table 6-1 Post-Development Stormwater Improvements – Alternative 1

Design Aternative	BASINS	Total Volume (ac-ft)	Volume Provided w French Drain (ac-ft)	Trench Required (ft)	Volume Remaining to be Mitigated (ac-ft)	New Pond Volume (ac-ft)	New Pond Area (ac)	PPond Depth (ft)
1	1	0.54	0.14	32	0.40	0.45	0.30	1.5
	2	0.87	0.22	42	0.65	0.68	0.45	1.5
	3	0.49	0.00	0	0.49	0.93	1.86	0.5

6.2 ALTERNATIVE 2 – DIVERGING DIAMOND INTERCHANGE (DDI)

Alternative 2 consists of the widening along Lantana Road and the on/off ramps to/from I-95. The on/off ramps bridge structures on the west side of I-95 will be converted to MSE walls. The proposed stormwater management improvements for Alternative 2 are summarized in **Table 5.2**.

The proposed French drains and dry detention/retention areas will need to take into consideration their location in reference to contamination sites as referenced in the "413258-1 PD&E Study – Contamination Screening Evaluation Report." A level II testing must be performed for the proposed French drain locations to ensure there are no contamination sites within the French drain limits for the following locations:

- Proposed dry retention pond with 1,145 L.F. French drain west side of I-95 and south of Lantana Rd. West of Contamination sites #8 – Solid Waste Authority of PBC and #9 CSX Railroad

- Proposed dry retention pond with 965 L.F. French drain east side of I-95 and north of Lantana Rd. East of Contamination site #2 Publix (AST) and near #4 a petroleum spill in the median of northbound I95.
- Proposed 655 L.F. French drain west side of I-95 and north of Lantana Rd. West of Contamination site #9 CSX Railroad

6.2.1 Basin 1:

The existing system is composed of a dry swale/ditch (on both east and west sides) that runs parallel to I-95 towards the south. Also, there is a French drain trunkline along the median that collects all stormwater runoff on the median. This French drain is connected with a dry retention pond at Hypoluxo Road on the westbound of the ramp, which ultimately discharges via a 60" pipe into Lake Worth Drainage District (LWDD) E-4 Canal.

The proposed improvements will maintain the existing system as no volume reduction on the basin is expected. The improvements will add 2.60 acres of additional impervious area. Treatment and attenuation for the additional 2.82 ac-ft of runoff volume will be provided with 1,145 linear feet of French drain and a proposed 0.61-acre dry retention pond referred to as SMP.B1.2. The dry retention pond will be located in the swale west of I-95 southbound between the proposed MSE wall for the ON ramp and the basin boundary. The runoff will be directed to the dry retention pond through the structure (S-174A) located on the NL2 swale. The pond bottom elevation will be at 10.0 ft-NGVD and will have an overflow at the south end at 16 ft-NGVD. The runoff will be conveyed south and will be retained by ditch berm set to SHGWT elevation 15.75 ft-NGVD. When the peak elevation exceeds 15.75 ft-NGVD, the additional runoff will be discharged to the south without increasing the pre-development peak discharges. Basin 1 stormwater improvements are shown in **APPENDIX 4A**.

6.2.2 Basin 2:

The existing system includes the segment of Lantana Rd., east and west of I-95, and the NE quadrant of I-95/Lantana Rd., Interchange. This basin captures the runoff on the NE quadrant of the Lantana Interchange through curb inlets and connects to an existing 48" pipe that runs west and ultimately discharges into Lake Osborne/LWDD E-4 Canal.

The proposed improvements will maintain the existing system as no volume reduction on the basin is expected. The improvements will add 3.02 acres of additional impervious area. Treatment and attenuation for the additional 3.28 ac-ft of runoff volume will be provided with 965 linear feet of French drain and a proposed 0.60-acre dry retention pond referred to as SMP.B2.2. The dry retention pond will be located in the NE Infield between the proposed MSE wall on the I-95 northbound ON ramp and east of I-95. The pond bottom elevation will be at 10.0 ft-NGVD. The additional dry retention volume will be provided below the elevation 18.0 ft-NGVD. Proposed manhole (MH-B2.1) and inlet at the bottom of the dry retention pond will convey runoff to the proposed dry retention pond, from east and west of Lantana Rd, through the existing 48-in RCP pipe. A containment berm is proposed with a containing elevation of 17.5 ft-NGVD to avoid discharges to the north into private properties. This containment berm will be located south of the right-way-line and north of the proposed Lantana Rd. MSE wall. The proposed control Structure S1.B2.2 will have a SHGWT elevation of 17.0 ft-NGVD to convey water back to the 48-in RCP pipe and outfall through the proposed Manhole connection MH-B2.2. When the peak elevation exceeds 17.0 ft-NGVD, the additional runoff will be discharged to the west without increasing the pre-development peak discharges. Basin 2 stormwater improvements are shown in **APPENDIX 4B**.

6.2.3 Basin 3:

The existing system extends from the North of the Lantana Rd., overpass to the North, beyond the limits of the project study. There is a dry detention pond underneath the Lantana Rd., overpass, and the I-95 on/off ramps. This pond has a detention control Structure S-255A that connects and discharges into a northern swale on the west side of I-95 with an ultimate discharge to the Lake Osborne through an existing 60" pipe underneath 12th Avenue. This basin also has a French drain trunkline collection system along the median of I-95, which is connected to swales on both sides of I-95.

The proposed improvements will impact the dry detention pond, and the detention volume will be reduced by 76%. The improvements will add 1.50 acres of additional impervious area. Treatment and attenuation for the additional 1.98 ac-ft of runoff volume will be provided with 655 linear feet of French drain and a proposed 0.46-acre dry retention pond referred to as SMP.B3.2. The existing pond will be removed and pond SMP.B3.2 will be located north of the existing location along the FDOT swale between the proposed MSE wall and basin boundary. The runoff will be directed to the dry retention pond through the existing cross-drain structure

located on the L11 swale. The pond bottom elevation will be at 10.0 ft-NGVD and will have an overflow at the south end at 14 ft-NGVD. The runoff will be conveyed south and will be retained by a proposed ditch berm set to SHGWT elevation 15.75 ft-NGVD. When the peak elevation exceeds

15.75 ft-NGVD, the additional runoff will be discharged to the north without increasing the pre-development peak discharges. Basin 3 stormwater improvements are shown in **APPENDIX 4C**.

Table 6-2 Post-Development Stormwater Improvements Alternative 2

Design Aternative	BASINS	Total Volume (ac-ft)	Volume Provided w French Drain (ac-ft)	Trench Required (ft)	Volume Remaining to be Mitigated (ac-ft)	New Pond Volume (ac-ft)	New Pond Area (ac)	PPond Depth (ft)
2	1	2.82	0.71	1,145	2.11	2.22	0.61	6.5
	2	3.28	0.60	965	2.68	2.88	0.60	8.0
	3	1.98	0.40	655	1.57	1.68	0.46	4.5

6.3 Alternative 3 – Single Point Urban Interchange (SPUI)

Alternative 3, like Alternative 1, consists of the widening along Lantana Road and the on/off ramps to/from I-95. The on/off ramps bridge structures on the west side of I-95 will be converted to MSE walls. The proposed stormwater management improvements for Alternative 3 are summarized in **Table 5.3**.

The proposed French drains and dry detention/retention areas will need to take into consideration their location in reference to contamination sites as referenced in the "413258-1 PD&E Study – Contamination Screening Evaluation Report." A level II testing must be performed for the proposed French drain locations to ensure there are no contamination sites within the French drain limits for the following:

- Proposed dry retention pond with 37 L.F. French drain west side of I-95 and south of Lantana Rd. West of Contamination sites #8 – Solid Waste Authority of PBC and #9 CSX Railroad
- Proposed dry retention pond with 50 L.F. French drain south of west Lantana Rd. North of Contamination site #8 and south of #3 Costco Gas station

- Proposed 37 L.F. French drain west side of I-95 and north of Lantana Rd. West of Contamination site #9 CSX Railroad

6.3.1 Basin 1:

The existing system is composed of a dry swale/ditch (on both east and west sides) that runs parallel to I-95 towards the south. Also, there is a French drain trunkline along the median that collects all stormwater runoff on the median. This French drain is connected with a dry retention pond at Hypoluxo Road on the westbound of the ramp, which ultimately discharges via a 60" pipe into Lake Worth Drainage District (LWDD) E-4 Canal.

The proposed improvements will maintain the existing system as no volume reduction on the basin is expected. The improvements will add 0.60 acres of additional impervious area. Treatment and attenuation for the additional 0.65 ac-ft of runoff volume will be provided with 37 linear feet of French drain and a proposed 0.35-acre dry retention pond referred to as SMP.B1.3. The dry retention pond will be located in the swale west of I-95 southbound between the proposed MSE wall for the ON ramp and the basin boundary. The runoff will be directed to the dry retention pond through Structure (S-174A) located on the NL2 swale. The pond bottom elevation will be at 13.0 ft-NGVD and will have an overflow at the south end of the pond at 16 ft- NGVD. The runoff will be conveyed south and will be retained by a ditch berm set to SHGWT elevation 15.75 ft-NGVD. When the peak elevation exceeds 15.75 ft-NGVD, the additional runoff will be discharged to the south without increasing the pre-development peak discharges. Basin 1 stormwater improvements are shown in **APPENDIX 5A**.

6.3.2 Basin 2:

The existing system includes the segment of Lantana Rd., east and west of I-95, and the NE quadrant of I-95/Lantana Rd., Interchange. This basin captures the runoff on the NE quadrant of the Lantana Interchange through curb inlets and connects to an existing 48" pipe that runs west and ultimately discharges into Lake Osborne/LWDD E-4 Canal.

The proposed improvements will maintain the existing system as no volume reduction on the basin is expected. The improvements will add 0.95 acres of additional impervious area. Treatment and attenuation for the additional 1.03 ac-ft of runoff volume will be provided with 50 linear feet of French drain and a proposed 0.55-acre dry retention pond referred to as SMP.B2.3. The dry retention pond will be located between the proposed MSE wall on the south

side of Lantana road and the edge of the pavement of the road below. The pond bottom elevation will be at 13.5 ft-NGVD. The additional dry retention volume will be provided below elevation of 14.5 ft-NGVD. Runoff from the east and west side of Lantana Rd. will be capture through proposed control Structure S1.B2.1 and directed to the dry retention pond through bubble up Structure S1.B2.2, which will cross under the existing 48-in RCP pipe and proposed MSE walls. When the peak elevation exceeds 14.5 ft-NGVD, the additional runoff will be discharged to the west without increasing the pre-development peak discharges. Basin 2 stormwater improvements are shown in **APPENDIX 5B**.

6.3.3 Basin 3:

The existing system extends from the North of the Lantana Rd., overpass to the North, beyond the limits of the project study. There is a dry detention pond underneath the Lantana Rd., overpass, and the I-95 on/off ramps. This pond has a detention control Structure S-255A that connects and discharges into a northern swale on the west side of I-95 with an ultimate discharge to the Lake Osborne through an existing 60" pipe underneath 12th Avenue. This basin also has a French drain trunkline collection system along the median of I-95, which is connected to swales on both sides of I-95.

The proposed improvements will impact the dry detention pond, and the detention volume will be reduced by 82%. The improvements will add 0.65 acres of additional impervious area. Treatment and attenuation for the additional 1.09 ac-ft of runoff volume will be provided with 37 linear feet of French drain and a proposed 0.33-acre dry retention pond referred to as SMP.B3.3. The existing pond will be removed and pond SMP.B3.3 will be located north of the existing location along the FDOT swale between the proposed MSE wall and basin boundary. The runoff will be directed to the dry retention pond through the existing cross-drain structure located on the L11 swale. The pond bottom elevation will be at 11.5 ft-NGVD and will have an overflow at the south end at 14 ft-NGVD. The runoff will be conveyed south and will be retained by a proposed ditch berm set to SHGWT elevation 15.75 ft-NGVD. When the peak elevation exceeds 15.75 ft-NGVD, the additional runoff will be discharged to the north without increasing the pre-development peak discharges. Basin 3 stormwater improvements are shown in **APPENDIX 5C**.

Table 6-3 Post-Development Stormwater Improvements Alternative 3								
Design Aternative	BASINS	Total Volume (ac-ft)	Volume Provided w French Drain (ac-ft)	Trench Required (ft)	Volume Remaining to be Mitigated (ac-ft)	New Pond Volume (ac-ft)	New Pond Area (ac)	PPond Depth (ft)
3	1	0.60	0.16	37	0.49	0.53	0.35	1.5
	2	0.95	0.26	50	0.77	0.83	0.55	1.5
	3	0.65	0.18	37	0.91	0.99	0.33	3.0

7.0 CONCLUSIONS AND RECOMMENDATIONS

The proposed three (3) alternatives improvements as part of the PD&E Study were evaluated to identify mitigation strategies for the additional runoff volume from the new impervious areas and loss of storage due to the proposed improvements. A volumetric compensation analysis was performed to evaluate the post-development alternatives conditions. It was determined that additional volumes could be retained with a combination of French drains and dry detention/retention areas. The proposed stormwater management improvements for all alternatives are summarized in **Table 6.1**.

Table 7-1 Post-Development Stormwater Improvements for each Alternative								
Design Aternative	BASINS	Total Volume (ac-ft)	Volume Provided w French Drain (ac-ft)	Trench Required (ft)	Volume Remaining to be Mitigated (ac-ft)	New Pond Volume (ac-ft)	New Pond Area (ac)	Pond Depth (ft)
1	1	0.54	0.14	32	0.40	0.45	0.30	1.5
	2	0.87	0.22	42	0.65	0.68	0.45	1.5
	3	0.49	0.0	0.0	0.49	0.93	1.86	0.5
2	1	2.82	0.71	1,145	2.11	2.22	0.61	6.5
	2	3.28	0.60	965	2.68	2.88	0.60	8.0
	3	1.98	0.40	655	1.57	1.68	0.46	4.5
3	1	0.65	0.16	37	0.49	0.53	0.35	1.5
	2	1.03	0.26	50	0.77	0.83	0.55	1.5
	3	1.09	0.18	37	0.91	0.99	0.33	3.0

With the proposed stormwater management improvements, no additional off-site pond sites are required for all three alternatives. However, dry pond retention/detention areas required steep slopes and guardrail in some instances to maximize the existing area and avoid the need for off-site pond sites and/or right-of-way acquisition. If we include a 15-ft berm on each side slopes of 1:4 on the ponds the required additional volume cannot be compensated within the Basins and off-site areas would be needed.

These improvements, however, do not include the future widening of I-95. Future widening of I-95 may require a Pond Siting Report to identify additional offsite stormwater detention/retention areas.

The proposed conceptual stormwater management systems were analyzed based on a compensating volumetric analysis method. The ultimate stormwater management systems will need to be evaluated with a hydrodynamic hydrologic/hydraulic model to ensure that the resulting hydraulic grade lines meet the required flood protection criteria for the roadway and adjacent properties.

Appendix 1
Percolation Test Results

0 50 200
Feet

N

LEGEND

- APPROXIMATE SPT BORING LOCATION
- APPROXIMATE PERCOLATION TEST LOCATION

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ANGELA L. ALBA, P.E.
P.E. LICENSE NUMBER 58538
AREHNA ENGINEERING, INC.
12296 WILES ROAD
CORAL SPRINGS, FLORIDA 33076
CERTIFICATE OF AUTHORIZATION 28410

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	PALM BEACH	413258-1-22-02

BORING LOCATION PLAN

SHEET NO.

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

SUMMARY OF PERCOLATION TEST RESULTS
USUAL CONDITION TEST CONSTANT HEAD
Project Name: I-95 at Lantana Road

AREHNA PROJECT NO. B-18-078 Date Performed 10/12/2019 and 10/21/19

Test No.	Depth to Grd. Water (ft)	Depth to Water during testing (ft)	(H2) (ft)	Borehole Depth (ft)	Casing/ Borehole Diameter (inches)	Rate of Flow (gpm)	Rate of Flow (cfs)	k, Hydraulic Conductivity (cfs/ft^2-ft. Head):
PT-01	7.0	0.0	7.0	10	5.0	6.12	0.01364	**2.3E-04**
PT-02	10.0	0.0	10.0	10	5.0	11.45	0.02551	**3.8E-04**
PT-03	10.0	0.0	10.0	10	5.0	18.35	0.04089	**6.1E-04**

Note: Screen depth -
from 0.0 ft
to 10.0 ft below existing ground surface.

SFWMD PERCOLATION TEST – CONSTANT HEAD

Percolation Test No. PT-01

Date: 10/12/19	Project Name: I-95 at Lantana Road
Project No.: B-18-078	FPID No.: 413258-1-22-01
Driller: C. Molinares	Prepared by/ Date: AT – 10/14/19 Checked by/ Date: ALA – 10/28/19

BOREHOLE GEOMETRY

Borehole Diameter: 5 (inches) Casing Diameter: 3 (inches) Borehole Depth: 10 (feet)	Solid Casing Depth: - (feet) to - (feet) Perforated Casing Depth: 0 (feet) to 10 (feet) Groundwater Depth: 7 (feet) (measured from ground surface)

PERCOLATION TEST DATA

Flushing Period: 10 minutes	Groundwater Depth during testing: 0 (feet) (measured from ground surface)

TEST RESULTS

Time (minutes)	Meter Reading		Time (minutes)	Meter Reading	
	Meter Reading (Gallons)	Gallons (Accumulated)		Meter Reading (Gallons)	Gallons (Accumulated)
Initial Reading	0	0	8	6.3	48.2
1	5.2	5.2	9	6.6	54.8
2	5.8	11.0	10	6.4	61.2
3	6.1	17.1	11		
4	6.6	23.7	12		
5	6.4	30.1	13		
6	6.1	36.2	14		
7	5.7	41.9	15		

BORING INFORMATION

Sample No.	Depth (feet)		Soil/Rock Description
	From	To	
1	0	4	Light Gray Fine Sand (SP)
2	4	6	Dark Brown Fine Sand (SP)
3	6	15	Yellow-Brown Fine Sand (SP)
4	15	20	Brown Fine Sand (SP)

SFWMD PERCOLATION TEST – CONSTANT HEAD

Percolation Test No. PT-02

Date: 10/12/19	Project Name: I-95 at Lantana Road
Project No.: B-18-078	FPID No.: 413258-1-22-01
Driller: C. Molinares	Prepared by/ Date: AT – 10/14/19 Checked by/ Date: ALA – 10/28/19

BOREHOLE GEOMETRY

Borehole Diameter: 5 (inches) Casing Diameter: 3 (inches) Borehole Depth: 10 (feet)	Solid Casing Depth: - (feet) to - (feet) Perforated Casing Depth: 0 (feet) to 10 (feet) Groundwater Depth: GNE (i.e., > 10' (feet) (measured from ground surface)

PERCOLATION TEST DATA

Flushing Period: 10 minutes	Groundwater Depth during testing: 0 (feet) (measured from ground surface)

TEST RESULTS

Time (minutes)	Meter Reading		Time (minutes)	Meter Reading	
	Meter Reading (Gallons)	Gallons (Accumulated)		Meter Reading (Gallons)	Gallons (Accumulated)
Initial Reading	0	0	8	11.5	92.5
1	12	12	9	11	103.5
2	12	24	10	11	114.5
3	12	36	11		
4	11.5	47.5	12		
5	11.5	59	13		
6	11	70	14		
7	11	81	15		

BORING INFORMATION

Sample No.	Depth (feet)		Soil/Rock Description
	From	To	
1	0	2	Light Brown Fine Sand with Little Limerock Fragments (SP)
2	0	20	Dark Brown to Brown Fine Sand (SP)
3			
4			

SFWMD PERCOLATION TEST – CONSTANT HEAD

Percolation Test No. PT-03

Date: 10/21/19	Project Name: I-95 at Lantana Road
Project No.: B-18-078	FPID No.: 413258-1-22-01
Driller: J. Medina	Prepared by/ Date: AT – 10/14/19 Checked by/ Date: ALA – 10/28/19

BOREHOLE GEOMETRY

Borehole Diameter: 5 (inches) Casing Diameter: 3 (inches) Borehole Depth: 10 (feet)	Solid Casing Depth: - (feet) to - (feet) Perforated Casing Depth: 0 (feet) to 10 (feet) Groundwater Depth: 12 (feet) (measured from ground surface)

PERCOLATION TEST DATA

Flushing Period: 10 minutes	Groundwater Depth during testing: 0 (feet) (measured from ground surface)

TEST RESULTS

Time (minutes)	Meter Reading		Time (minutes)	Meter Reading	
	Meter Reading (Gallons)	Gallons (Accumulated)		Meter Reading (Gallons)	Gallons (Accumulated)
Initial Reading	0	0	8	16.5	152
1	20	20	9	16.5	168.5
2	20	40	10	15	183.5
3	20	60	11		
4	20	80	12		
5	19	99	13		
6	18.5	117.5	14		
7	18	135.5	15		

BORING INFORMATION

Sample No.	Depth (feet)		Soil/Rock Description
	From	To	
1	0	20	Light Brown to Light Gray Fine Sand (SP)
2			
3			
4			

Appendix 2
SFWMD Self Contained French Drain Calculations

Alternative 1

bcc engineering

SHEET NO.	1 of 2
DATE	10/30/2019
PROJECT No.:	
Designed By:	VV
Checked By:	AV

Project Name: SR 9/I-95 Lantana Road
ALTERNATIVE 1 - BASIN 1

Catch Basin ID.

Project Location

DRAINAGE AREAS

		SQ. FT.	ACRES
Impervious Area	(A_I)	21,780	0.50
Pervious Area	(A_P)	0	0.00
Total Drainage Area	(A_T)	21,780	0.50

SFWMD RETENTION REQUIREMENTS

Percent Impervious = 100.0%

1" of Runoff = 0.50 (ac-in)
2.5 inches X Percent Impervious = 1.25 (ac-in)

Volume of WQ Treatment Volume required (V_{wq}) = 1.64 (ac-in)
3.28 (inches)

Additional WQ Volume (V_{add}) = 0.00 (ac-in)
0.00 (inches)

Total Volume Treated by Trench = V_{wq} + V_{add} = 3.28 (inches)
(Max allowed 3.28 inches)

Safety Factor (SF) = 2.0 (Minimum 2.0)

Percent Water Quality Reduction (%WQ) = 50%
(50% for wet or dry retention)

SFWMD EXFILTRATION TRENCH EQUATIONS AND TRENCH LENGTH

If $D_u > D_S$ or $W < 2(D_u + D_s)$ then Eq 1 Applies. If not, Eq 2 Applies.

$$Equation1: \quad L_1 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(H_2 W + 2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 1 = L_1 30.8 (feet)

$$Equation\ 2: \quad L_2 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 2 = L_2 42.7 (feet)

Trench Length Required = L_{REQ} 30.8 (feet)

Trench Length Provided = L_{PRO} 32.0 (feet)

Safety Factor Provided = SF_{PRO} 2.07

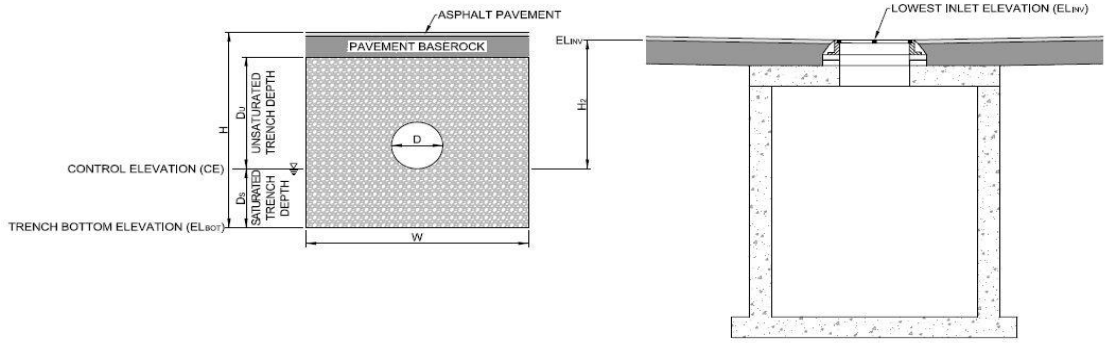
TRENCH DATA - SELFCONTAINED SYSTEM

Trench Width	W	5.0	(feet)	
Hydraulic Conductivity	K	4.92E-04	(cfs/ft2-ft head)	
Control Elevation	CE	9.00	(ft-NGVD)	
Invert Elevation of Lowest Inlet	EL_{inv}	15.00	(ft-NGVD)	Lowest Inlet Elevation
Top Elevation of Trench	EL_{top}	14.00	(ft-NGVD)	Average El
Bottom Elevation of Trench	EL_{bot}	6.00	(ft-NGVD)	Average Bottom El
Pipe Diameter	D	24	(inches)	
Pipe Invert	P_{inv}	11.00	(ft-NGVD)	
Head on Saturated Surface = EI_{inv} - CE =	H_2	6.00	(feet)	
Unsaturated Trench Depth = EL_{top} - CE =	D_u	5.00	(feet)	
Saturated Trench Depth = CE - EL_{bot} =	D_S	3.00	(feet)	

Is Du > Ds YES
Is W < 2*(Du + Ds) YES

NOTES: Gray Cells is where data is required, and blue Cells is where data is calculated.

SELF CONTAINED EXFILTRATION TRENCH



TRENCH SECTION

LOWEST INLET

bcc engineering

SHEET NO.	1 of 2
DATE	10/30/2019
PROJECT No.:	
Designed By:	VV
Checked By:	AV

Project Name: SR 9/I-95 Lantana Road
ALTERNATIVE 1 - BASIN 2

Catch Basin ID.

Project Location

DRAINAGE AREAS

		SQ. FT.	ACRES
Impervious Area	(A_I)	34,848	0.80
Pervious Area	(A_P)	0	0.00
Total Drainage Area	(A_T)	34,848	0.80

SFWMD RETENTION REQUIREMENTS

Percent Impervious = 100.0%

1" of Runoff = 0.80 (ac-in)
2.5 inches X Percent Impervious = 2.00 (ac-in)

Volume of WQ Treatment Volume required (V_{wq}) = 2.60 (ac-in)
3.25 (inches)

Additional WQ Volume (V_{add}) = 0.00 (ac-in)
0.00 (inches)

Total Volume Treated by Trench = V_{wq} + V_{add} = 3.28 (inches)
(Max allowed 3.28 inches)

Safety Factor (SF) = 2.0 (Minimum 2.0)

Percent Water Quality Reduction (%WQ) = 50%
(50% for wet or dry retention)

SFWMD EXFILTRATION TRENCH EQUATIONS AND TRENCH LENGTH

If $D_u > D_S$ or $W < 2(D_u + D_s)$ then Eq 1 Applies. If not, Eq 2 Applies.

$$Equation1: \quad L_1 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(H_2 W + 2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 1 = L_1 41.9 (feet)

$$Equation\ 2: \quad L_2 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 2 = L_2 60.1 (feet)

Trench Length Required = L_{REQ} 41.9 (feet)

Trench Length Provided = L_{PRO} 42.0 (feet)

Safety Factor Provided = SF_{PRO} 2.01

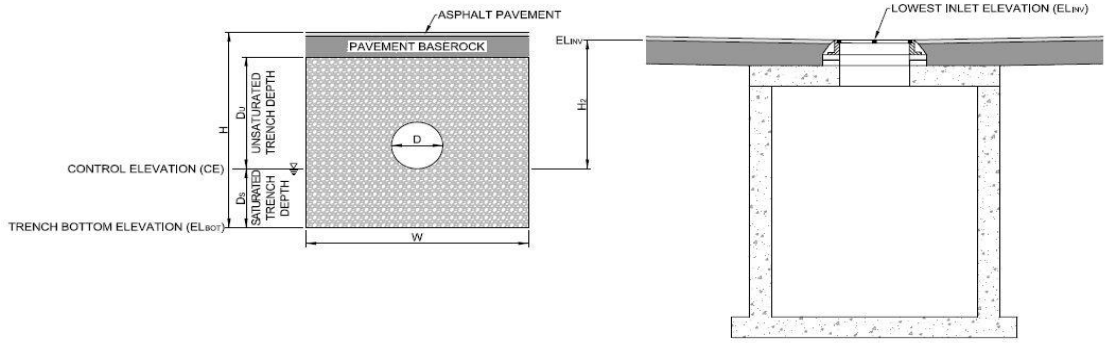
TRENCH DATA - SELFCONTAINED SYSTEM

Trench Width	W	5.0	(feet)	
Hydraulic Conductivity	K	4.95E-04	(cfs/ft2-ft head)	
Control Elevation	CE	9.00	(ft-NGVD)	
Invert Elevation of Lowest Inlet	EL_{inv}	16.62	(ft-NGVD)	Lowest Inlet Elevation
Top Elevation of Trench	EL_{top}	15.62	(ft-NGVD)	Average El
Bottom Elevation of Trench	EL_{bot}	7.62	(ft-NGVD)	Average Bottom El
Pipe Diameter	D	24	(inches)	
Pipe Invert	P_{inv}	11.00	(ft-NGVD)	
Head on Saturated Surface = EI_{inv} - CE =	H_2	7.62	(feet)	
Unsaturated Trench Depth = EL_{top} - CE =	D_u	6.62	(feet)	
Saturated Trench Depth = CE - EL_{bot} =	D_S	1.38	(feet)	

Is Du > Ds YES
Is W < 2*(Du + Ds) YES

NOTES: Gray Cells is where data is required, and blue Cells is where data is calculated.

SELF CONTAINED EXFILTRATION TRENCH



TRENCH SECTION

LOWEST INLET

bcc engineering

SHEET NO.	1 of 2
DATE	10/30/2019
PROJECT No.:	
Designed By:	VV
Checked By:	AV

Project Name: SR 9/I-95 Lantana Road
ALTERNATIVE 1 - BASIN 3

Catch Basin ID.

Project Location

DRAINAGE AREAS

		SQ. FT.	ACRES
Impervious Area	(A_I)	19,602	0.45
Pervious Area	(A_P)	0	0.00
Total Drainage Area	(A_T)	19,602	0.45

SFWMD RETENTION REQUIREMENTS

Percent Impervious = 100.0%

1" of Runoff = 0.45 (ac-in)
2.5 inches X Percent Impervious = 1.13 (ac-in)

Volume of WQ Treatment Volume required (V_{wq}) = 1.45 (ac-in)
3.22 (inches)

Additional WQ Volume (V_{add}) = 0.00 (ac-in)
0.00 (inches)

Total Volume Treated by Trench = V_{wq} + V_{add} = 3.28 (inches)
(Max allowed 3.28 inches)

Safety Factor (SF) = 2.0 (Minimum 2.0)

Percent Water Quality Reduction (%WQ) = 50%
(50% for wet or dry retention)

SFWMD EXFILTRATION TRENCH EQUATIONS AND TRENCH LENGTH

If $D_u > D_S$ or $W < 2(D_u + D_s)$ then Eq 1 Applies. If not, Eq 2 Applies.

$$Equation1: \quad L_1 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(H_2 W + 2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 1 = L_1 25.1 (feet)

$$Equation\ 2: \quad L_2 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 2 = L_2 35.3 (feet)

Trench Length Required = L_{REQ} 25.1 (feet)

Trench Length Provided = L_{PRO} 0.0 (feet)

Safety Factor Provided = SF_{PRO} 0.00

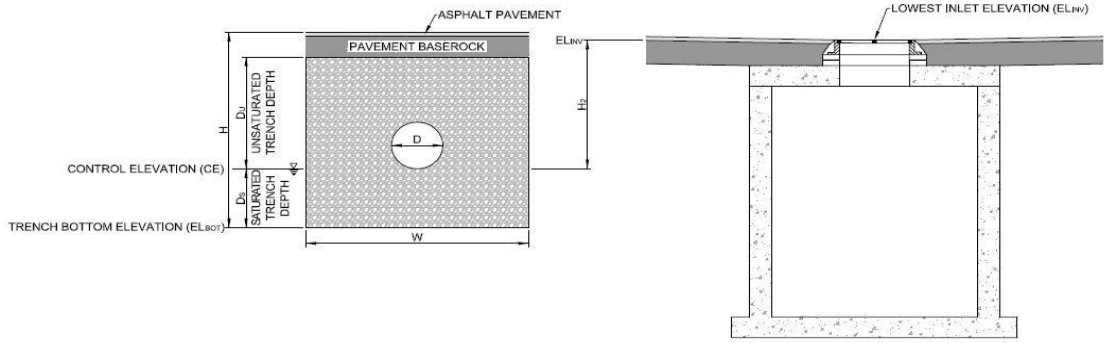
TRENCH DATA - SELFCONTAINED SYSTEM

Trench Width	W	5.0	(feet)	
Hydraulic Conductivity	K	4.95E-04	(cfs/ft2-ft head)	
Control Elevation	CE	9.00	(ft-NGVD)	
Invert Elevation of Lowest Inlet	EL_{inv}	15.75	(ft-NGVD)	Lowest Inlet Elevation
Top Elevation of Trench	EL_{top}	14.75	(ft-NGVD)	Average El
Bottom Elevation of Trench	EL_{bot}	6.75	(ft-NGVD)	Average Bottom El
Pipe Diameter	D	24	(inches)	
Pipe Invert	P_{inv}	11.00	(ft-NGVD)	
Head on Saturated Surface = EI_{inv} - CE =	H_2	6.75	(feet)	
Unsaturated Trench Depth = EL_{top} - CE =	D_u	5.75	(feet)	
Saturated Trench Depth = CE - EL_{bot} =	D_S	2.25	(feet)	

Is Du > Ds YES
Is W < 2*(Du + Ds) YES

NOTES: Gray Cells is where data is required, and blue Cells is where data is calculated.

SELF CONTAINED EXFILTRATION TRENCH



TRENCH SECTION

LOWEST INLET

Alternative 2

bcc engineering

SHEET NO.	1 of 2
DATE	10/30/2019
PROJECT No.:	
Designed By:	VV
Checked By:	AV

Project Name: SR 9/I-95 Lantana Road
ALTERNATIVE 2 - BASIN 1

Catch Basin ID.

Project Location

DRAINAGE AREAS

		SQ. FT.	ACRES
Impervious Area	(A_I)	113,256	2.60
Pervious Area	(A_P)	0	0.00
Total Drainage Area	(A_T)	113,256	2.60

SFWMD RETENTION REQUIREMENTS

Percent Impervious = 100.0%

1" of Runoff = 2.60 (ac-in)
2.5 inches X Percent Impervious = 6.50 (ac-in)

Volume of WQ Treatment Volume required (V_{wq}) = 8.50 (ac-in)
3.27 (inches)

Additional WQ Volume (V_{add}) = 0.00 (ac-in)
0.00 (inches)

Total Volume Treated by Trench = V_{wq} + V_{add} = 3.28 (inches)
(Max allowed 3.28 inches)

Safety Factor (SF) = 2.0 (Minimum 2.0)

Percent Water Quality Reduction (%WQ) = 50%
(50% for wet or dry retention)

SFWMD EXFILTRATION TRENCH EQUATIONS AND TRENCH LENGTH

If $D_u > D_S$ or $W < 2(D_u + D_s)$ then Eq 1 Applies. If not, Eq 2 Applies.

$$Equation1: \quad L_1 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(H_2 W + 2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 1 = L_1 1,144.8 (feet)

$$Equation\ 2: \quad L_2 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 2 = L_2 1,717.2 (feet)

Trench Length Required = L_{REQ} 1,144.8 (feet)

Trench Length Provided = L_{PRO} 1,145.0 (feet)

Safety Factor Provided = SF_{PRO} 2.00

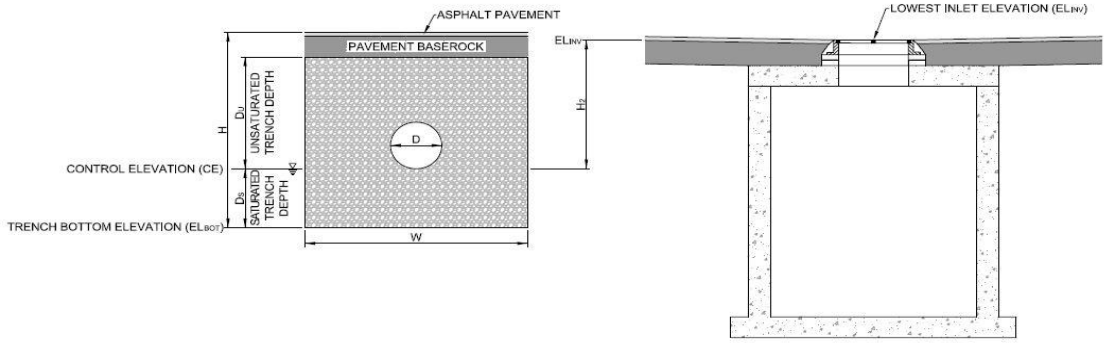
TRENCH DATA - SELFCONTAINED SYSTEM

Trench Width	W	5.0	(feet)	
Hydraulic Conductivity	K	4.95E-04	(cfs/ft2-ft head)	
SHGWT	CE	9.00	(ft-NGVD)	
Invert Elevation of Lowest Inlet	EL_{inv}	10.00	(ft-NGVD)	Lowest Inlet Elevation
Top Elevation of Trench	EL_{top}	9.00	(ft-NGVD)	Average El
Bottom Elevation of Trench	EL_{bot}	4.00	(ft-NGVD)	Average Bottom El
Pipe Diameter	D	24	(inches)	
Pipe Invert	P_{inv}	6.00	(ft-NGVD)	
Head on Saturated Surface = EI_{inv} - CE =	H_2	1.00	(feet)	
Unsaturated Trench Depth = EL_{top} - CE =	D_u	0.00	(feet)	
Saturated Trench Depth = CE - EL_{bot} =	D_S	5.00	(feet)	

Is Du > Ds NO
Is W < 2*(Du + Ds) YES

NOTES: Gray Cells is where data is required, and blue Cells is where data is calculated.

SELF CONTAINED EXFILTRATION TRENCH



TRENCH SECTION

LOWEST INLET

bcc engineering

SHEET NO.	1 of 2
DATE	10/30/2019
PROJECT No.:	
Designed By:	VV
Checked By:	AV

Project Name: SR 9/I-95 Lantana Road
ALTERNATIVE 2 - BASIN 2

Catch Basin ID.

Project Location

DRAINAGE AREAS

		SQ. FT.	ACRES
Impervious Area	(A_I)	95,832	2.20
Pervious Area	(A_P)	0	0.00
Total Drainage Area	(A_t)	95,832	2.20

SFWMD RETENTION REQUIREMENTS

Percent Impervious = 100.0%

1" of Runoff = 2.20 (ac-in)
2.5 inches X Percent Impervious = 5.50 (ac-in)

Volume of WQ Treatment Volume required (V_{wq}) = 7.15 (ac-in)
3.25 (inches)

Additional WQ Volume (V_{add}) = 0.00 (ac-in)
0.00 (inches)

Total Volume Treated by Trench = V_{wq} + V_{add} = 3.28 (inches)
(Max allowed 3.28 inches)

Safety Factor (SF) = 2.0 (Minimum 2.0)

Percent Water Quality Reduction (%WQ) = 50%
(50% for wet or dry retention)

SFWMD EXFILTRATION TRENCH EQUATIONS AND TRENCH LENGTH

If $D_u > D_S$ or $W < 2(D_u + D_s)$ then Eq 1 Applies. If not, Eq 2 Applies.

$$Equation1: \quad L_1 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(H_2 W + 2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 1 = L_1 963.0 (feet)

$$Equation\ 2: \quad L_2 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 2 = L_2 1,444.4 (feet)

Trench Length Required = L_{REQ} 963.0 (feet)

Trench Length Provided = L_{PRO} 965.0 (feet)

Safety Factor Provided = SF_{PRO} 2.00

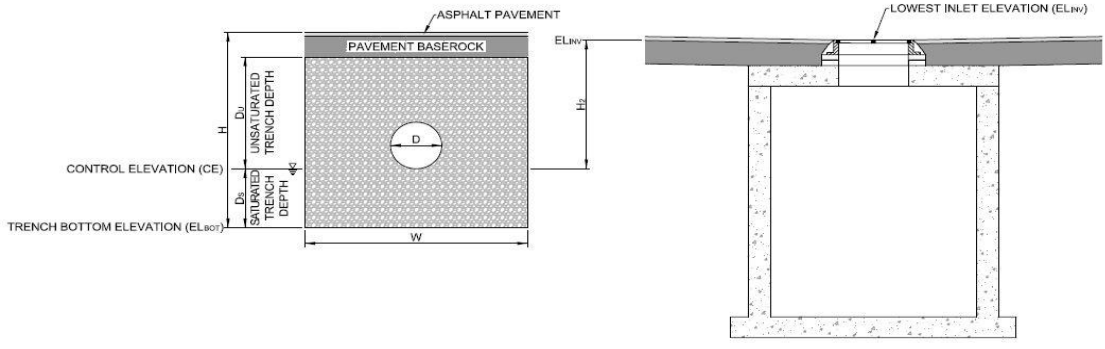
TRENCH DATA - SELFCONTAINED SYSTEM

Trench Width	W	5.0	(feet)	
Hydraulic Conductivity	K	4.95E-04	(cfs/ft2-ft head)	
SHGWT	CE	9.00	(ft-NGVD)	
Invert Elevation of Lowest Inlet	EL_{inv}	10.00	(ft-NGVD)	Lowest Inlet Elevation
Top Elevation of Trench	EL_{top}	9.00	(ft-NGVD)	Average El
Bottom Elevation of Trench	EL_{bot}	4.00	(ft-NGVD)	Average Bottom El
Pipe Diameter	D	24	(inches)	
Pipe Invert	P_{inv}	6.00	(ft-NGVD)	
Head on Saturated Surface = EI_{inv} - CE =	H_2	1.00	(feet)	
Unsaturated Trench Depth = EL_{top} - CE =	D_u	0.00	(feet)	
Saturated Trench Depth = CE - EL_{bot} =	D_S	5.00	(feet)	

Is Du > Ds NO
Is W < 2*(Du + Ds) YES

NOTES: Gray Cells is where data is required, and blue Cells is where data is calculated.

SELF CONTAINED EXFILTRATION TRENCH



TRENCH SECTION

LOWEST INLET

bcc engineering

SHEET NO.	1 of 2
DATE	11/25/2019
PROJECT No.:	
Designed By:	VV
Checked By:	AV

Project Name: SR 9/I-95 Lantana Road
ALTERNATIVE 2 - BASIN 3

Catch Basin ID.

Project Location

DRAINAGE AREAS

		SQ. FT.	ACRES
Impervious Area	(A_I)	65,340	1.50
Pervious Area	(A_P)	0	0.00
Total Drainage Area	(A_t)	65,340	1.50

SFWMD RETENTION REQUIREMENTS

Percent Impervious = 100.0%

1" of Runoff = 1.50 (ac-in)
2.5 inches X Percent Impervious = 3.75 (ac-in)

Volume of WQ Treatment Volume required (V_{wq}) = 4.85 (ac-in)
3.23 (inches)

Additional WQ Volume (V_{add}) = 0.00 (ac-in)
0.00 (inches)

Total Volume Treated by Trench = V_{wq} + V_{add} = 3.28 (inches)
(Max allowed 3.28 inches)

Safety Factor (SF) = 2.0 (Minimum 2.0)

Percent Water Quality Reduction (%WQ) = 50%
(50% for wet or dry retention)

SFWMD EXFILTRATION TRENCH EQUATIONS AND TRENCH LENGTH

If $D_u > D_S$ or $W < 2(D_u + D_s)$ then Eq 1 Applies. If not, Eq 2 Applies.

$$Equation1: \quad L_1 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(H_2 W + 2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 1 = L_1 653.2 (feet)

$$Equation\ 2: \quad L_2 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 2 = L_2 979.8 (feet)

Trench Length Required = L_{REQ} 653.2 (feet)

Trench Length Provided = L_{PRO} 655.0 (feet)

Safety Factor Provided = SF_{PRO} 2.01

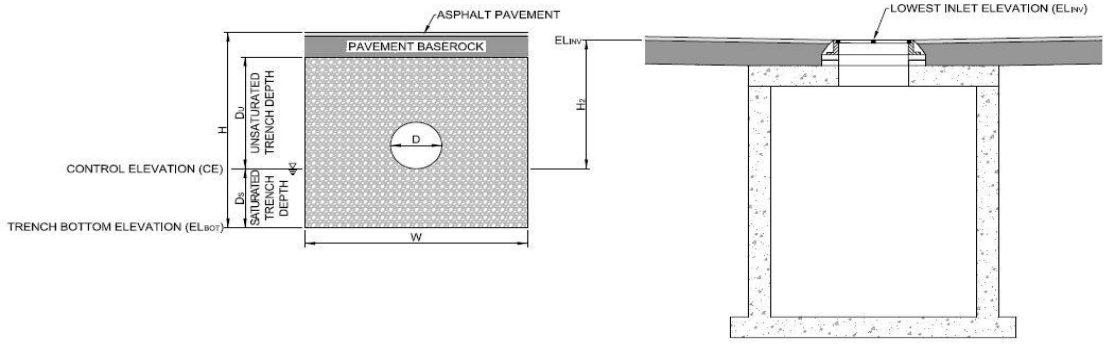
TRENCH DATA - SELFCONTAINED SYSTEM

Trench Width	W	5.0	(feet)	
Hydraulic Conductivity	K	4.95E-04	(cfs/ft2-ft head)	
SHGWT	CE	9.00	(ft-NGVD)	
Invert Elevation of Lowest Inlet	EL_{inv}	10.00	(ft-NGVD)	Lowest Inlet Elevation
Top Elevation of Trench	EL_{top}	9.00	(ft-NGVD)	Average El
Bottom Elevation of Trench	EL_{bot}	4.00	(ft-NGVD)	Average Bottom El
Pipe Diameter	D	24	(inches)	
Pipe Invert	P_{inv}	6.00	(ft-NGVD)	
Head on Saturated Surface = EI_{inv} - CE =	H_2	1.00	(feet)	
Unsaturated Trench Depth = EL_{top} - CE =	D_u	0.00	(feet)	
Saturated Trench Depth = CE - EL_{bot} =	D_S	5.00	(feet)	

Is Du > Ds NO
Is W < 2*(Du + Ds) YES

NOTES: Gray Cells is where data is required, and blue Cells is where data is calculated.

SELF CONTAINED EXFILTRATION TRENCH



TRENCH SECTION LOWEST INLET

Alternative 3

bcc engineering

SHEET NO.	1 of 2
DATE	10/30/2019
PROJECT No.:	
Designed By:	VV
Checked By:	AV

Project Name: SR 9/I-95 Lantana Road
ALTERNATIVE 3 - BASIN 1

Catch Basin ID.

Project Location

DRAINAGE AREAS

		SQ. FT.	ACRES
Impervious Area	(A_I)	26,136	0.60
Pervious Area	(A_P)	0	0.00
Total Drainage Area	(A_T)	26,136	0.60

SFWMD RETENTION REQUIREMENTS

Percent Impervious = 100.0%

1" of Runoff = 0.60 (ac-in)
2.5 inches X Percent Impervious = 1.50 (ac-in)

Volume of WQ Treatment Volume required (V_{wq}) = 1.95 (ac-in)
3.25 (inches)

Additional WQ Volume (V_{add}) = 0.00 (ac-in)
0.00 (inches)

Total Volume Treated by Trench = V_{wq} + V_{add} = 3.28 (inches)
(Max allowed 3.28 inches)

Safety Factor (SF) = 2.0 (Minimum 2.0)

Percent Water Quality Reduction (%WQ) = 50%
(50% for wet or dry retention)

SFWMD EXFILTRATION TRENCH EQUATIONS AND TRENCH LENGTH

If $D_u > D_S$ or $W < 2(D_u + D_s)$ then Eq 1 Applies. If not, Eq 2 Applies.

$$Equation1: \quad L_1 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(H_2 W + 2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 1 = L_1 36.5 (feet)

$$Equation\ 2: \quad L_2 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 2 = L_2 50.5 (feet)

Trench Length Required = L_{REQ} 36.5 (feet)

Trench Length Provided = L_{PRO} 37.0 (feet)

Safety Factor Provided = SF_{PRO} 2.03

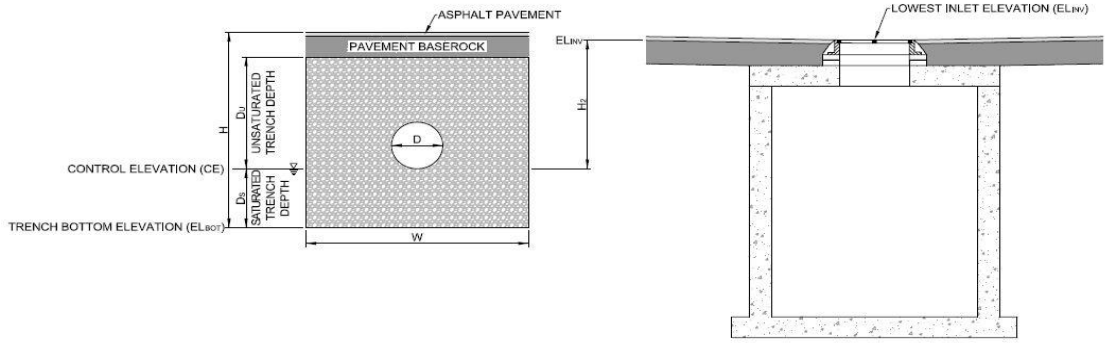
TRENCH DATA - SELFCONTAINED SYSTEM

Trench Width	W	5.0	(feet)	
Hydraulic Conductivity	K	4.95E-04	(cfs/ft2-ft head)	
Control Elevation	CE	9.00	(ft-NGVD)	
Invert Elevation of Lowest Inlet	EL_{inv}	15.00	(ft-NGVD)	Lowest Inlet Elevation
Top Elevation of Trench	EL_{top}	14.00	(ft-NGVD)	Average El
Bottom Elevation of Trench	EL_{bot}	6.00	(ft-NGVD)	Average Bottom El
Pipe Diameter	D	24	(inches)	
Pipe Invert	P_{inv}	11.00	(ft-NGVD)	
Head on Saturated Surface = EI_{inv} - CE =	H_2	6.00	(feet)	
Unsaturated Trench Depth = EL_{top} - CE =	D_u	5.00	(feet)	
Saturated Trench Depth = CE - EL_{bot} =	D_S	3.00	(feet)	

Is Du > Ds YES
Is W < 2*(Du + Ds) YES

NOTES: Gray Cells is where data is required, and blue Cells is where data is calculated.

SELF CONTAINED EXFILTRATION TRENCH



TRENCH SECTION

LOWEST INLET

bcc engineering

SHEET NO.	1 of 2
DATE	10/30/2019
PROJECT No.:	
Designed By:	VV
Checked By:	AV

Project Name: SR 9/I-95 Lantana Road
ALTERNATIVE 3 - BASIN 2

Catch Basin ID.

Project Location

DRAINAGE AREAS

		SQ. FT.	ACRES
Impervious Area	(A_I)	41,382	0.95
Pervious Area	(A_P)	0	0.00
Total Drainage Area	(A_T)	41,382	0.95

SFWMD RETENTION REQUIREMENTS

Percent Impervious = 100.0%

1" of Runoff = 0.95 (ac-in)
2.5 inches X Percent Impervious = 2.38 (ac-in)

Volume of WQ Treatment Volume required (V_{wq}) = 3.10 (ac-in)
3.26 (inches)

Additional WQ Volume (V_{add}) = 0.00 (ac-in)
0.00 (inches)

Total Volume Treated by Trench = V_{wq} + V_{add} = 3.28 (inches)
(Max allowed 3.28 inches)

Safety Factor (SF) = 2.0 (Minimum 2.0)

Percent Water Quality Reduction (%WQ) = 50%
(50% for wet or dry retention)

SFWMD EXFILTRATION TRENCH EQUATIONS AND TRENCH LENGTH

If $D_u > D_S$ or $W < 2(D_u + D_s)$ then Eq 1 Applies. If not, Eq 2 Applies.

$$Equation1: \quad L_1 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(H_2 W + 2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 1 = L_1 49.9 (feet)

$$Equation\ 2: \quad L_2 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 2 = L_2 71.7 (feet)

Trench Length Required = L_{REQ} 49.9 (feet)

Trench Length Provided = L_{PRO} 50.0 (feet)

Safety Factor Provided = SF_{PRO} 2.00

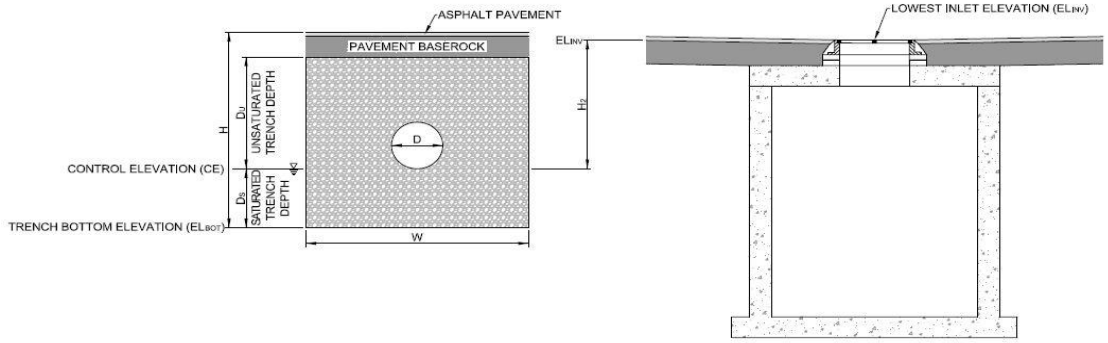
TRENCH DATA - SELFCONTAINED SYSTEM

Trench Width	W	5.0	(feet)	
Hydraulic Conductivity	K	4.95E-04	(cfs/ft2-ft head)	
Control Elevation	CE	9.00	(ft-NGVD)	
Invert Elevation of Lowest Inlet	EL_{inv}	16.62	(ft-NGVD)	Lowest Inlet Elevation
Top Elevation of Trench	EL_{top}	15.62	(ft-NGVD)	Average El
Bottom Elevation of Trench	EL_{bot}	7.62	(ft-NGVD)	Average Bottom El
Pipe Diameter	D	24	(inches)	
Pipe Invert	P_{inv}	11.00	(ft-NGVD)	
Head on Saturated Surface = EI_{inv} - CE =	H_2	7.62	(feet)	
Unsaturated Trench Depth = EL_{top} - CE =	D_u	6.62	(feet)	
Saturated Trench Depth = CE - EL_{bot} =	D_S	1.38	(feet)	

Is Du > Ds YES
Is W < 2*(Du + Ds) YES

NOTES: Gray Cells is where data is required, and blue Cells is where data is calculated.

SELF CONTAINED EXFILTRATION TRENCH



TRENCH SECTION

LOWEST INLET

bcc engineering

SHEET NO.	1 of 2
DATE	11/25/2019
PROJECT No.:	
Designed By:	VV
Checked By:	AV

Project Name: SR 9/I-95 Lantana Road
ALTERNATIVE 3 - BASIN 3

Catch Basin ID.

Project Location

DRAINAGE AREAS

		SQ. FT.	ACRES
Impervious Area	(A_I)	28,314	0.65
Pervious Area	(A_P)	0	0.00
Total Drainage Area	(A_T)	28,314	0.65

SFWMD RETENTION REQUIREMENTS

Percent Impervious = 100.0%

1" of Runoff = 0.65 (ac-in)
2.5 inches X Percent Impervious = 1.63 (ac-in)

Volume of WQ Treatment Volume required (V_{wq}) = 2.10 (ac-in)
3.23 (inches)

Additional WQ Volume (V_{add}) = 0.00 (ac-in)
0.00 (inches)

Total Volume Treated by Trench = V_{wq} + V_{add} = 3.28 (inches)
(Max allowed 3.28 inches)

Safety Factor (SF) = 2.0 (Minimum 2.0)

Percent Water Quality Reduction (%WQ) = 50%
(50% for wet or dry retention)

SFWMD EXFILTRATION TRENCH EQUATIONS AND TRENCH LENGTH

If $D_u > D_S$ or $W < 2(D_u + D_s)$ then Eq 1 Applies. If not, Eq 2 Applies.

$$Equation1: \quad L_1 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(H_2 W + 2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 1 = L_1 36.3 (feet)

$$Equation\ 2: \quad L_2 = \frac{FS\left[(\%WQ)(V_{wq}) + V_{add}\right]}{K\left(2H_2 D_u - D_u^2 + 2H_2 D_s\right) + (1.39E-04) W D_u}$$

Trench Length Required for Eq 2 = L_2 51.1 (feet)

Trench Length Required = L_{REQ} 36.3 (feet)

Trench Length Provided = L_{PRO} 37.0 (feet)

Safety Factor Provided = SF_{PRO} 2.04

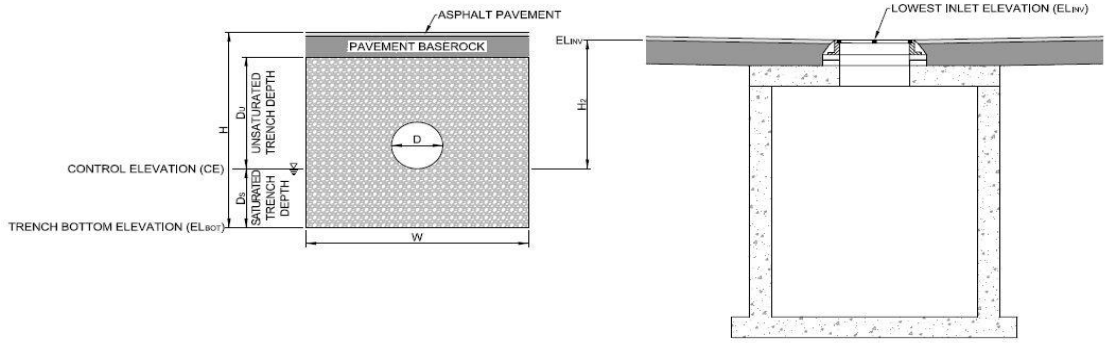
TRENCH DATA - SELFCONTAINED SYSTEM

Trench Width	W	5.0	(feet)	
Hydraulic Conductivity	K	4.95E-04	(cfs/ft2-ft head)	
Control Elevation	CE	9.00	(ft-NGVD)	
Invert Elevation of Lowest Inlet	EL_{inv}	15.75	(ft-NGVD)	Lowest Inlet Elevation
Top Elevation of Trench	EL_{top}	14.75	(ft-NGVD)	Average El
Bottom Elevation of Trench	EL_{bot}	6.75	(ft-NGVD)	Average Bottom El
Pipe Diameter	D	24	(inches)	
Pipe Invert	P_{inv}	11.00	(ft-NGVD)	
Head on Saturated Surface = EI_{inv} - CE =	H_2	6.75	(feet)	
Unsaturated Trench Depth = EL_{top} - CE =	D_u	5.75	(feet)	
Saturated Trench Depth = CE - EL_{bot} =	D_S	2.25	(feet)	

Is Du > Ds YES
Is W < 2*(Du + Ds) YES

NOTES: Gray Cells is where data is required, and blue Cells is where data is calculated.

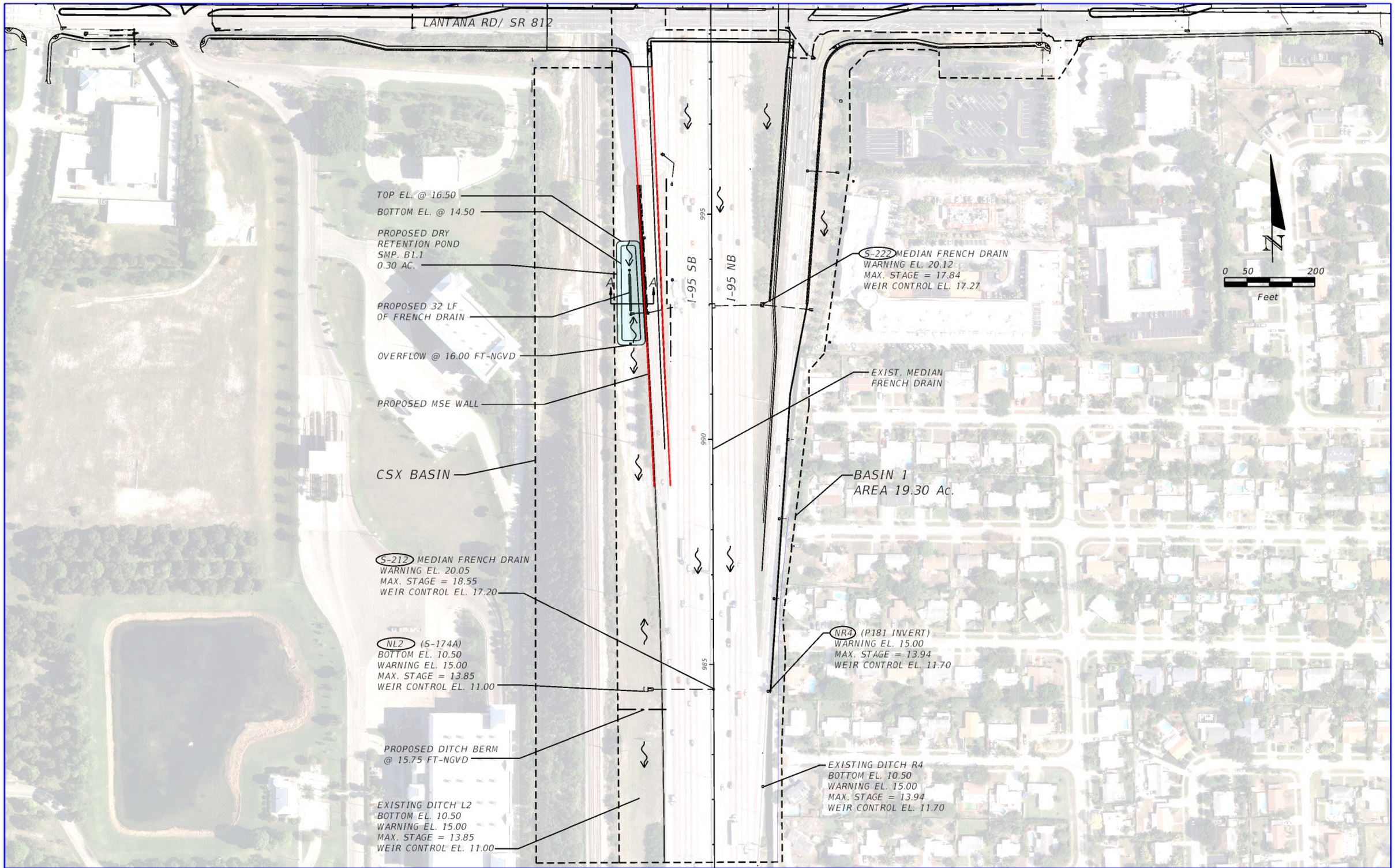
SELF CONTAINED EXFILTRATION TRENCH



TRENCH SECTION

LOWEST INLET

Appendix 3A
Alternative 1 Basin 1



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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

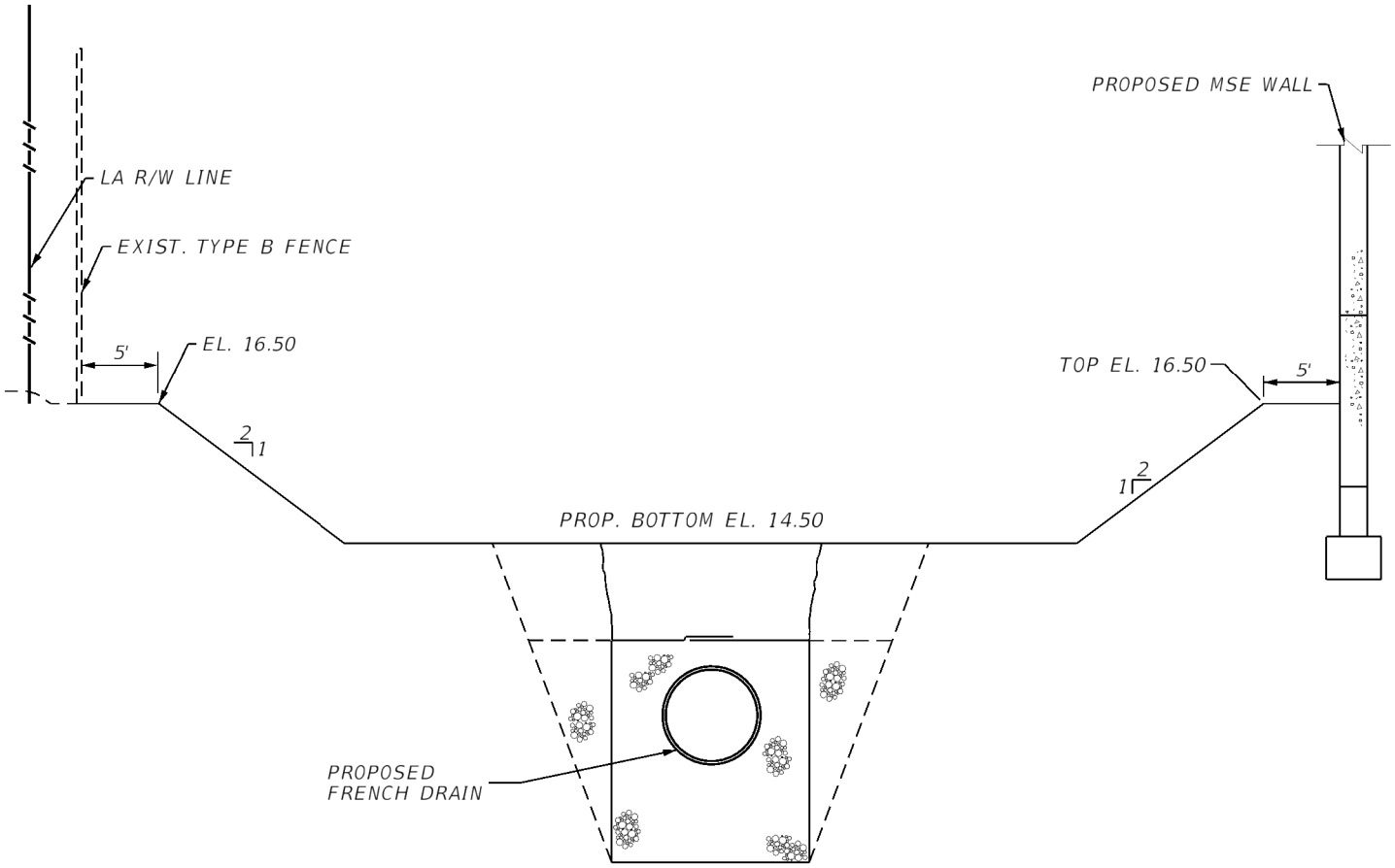
BCC ENGINEERING, INC.
ALEX VAZQUEZ, P.E. No. 42108
6401 SW 87th Ave, Suite 200,
Miami, Florida 33173.
P: (305) 670-2350 F: (305) 670-2351
Certificate of Authorization No. 7184

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
812	PALM BEACH	000000-0-00-00

I-95 AND LANTANA RD
ALTERNATIVE 1 BASIN 1

SHEET NO.
FG-2

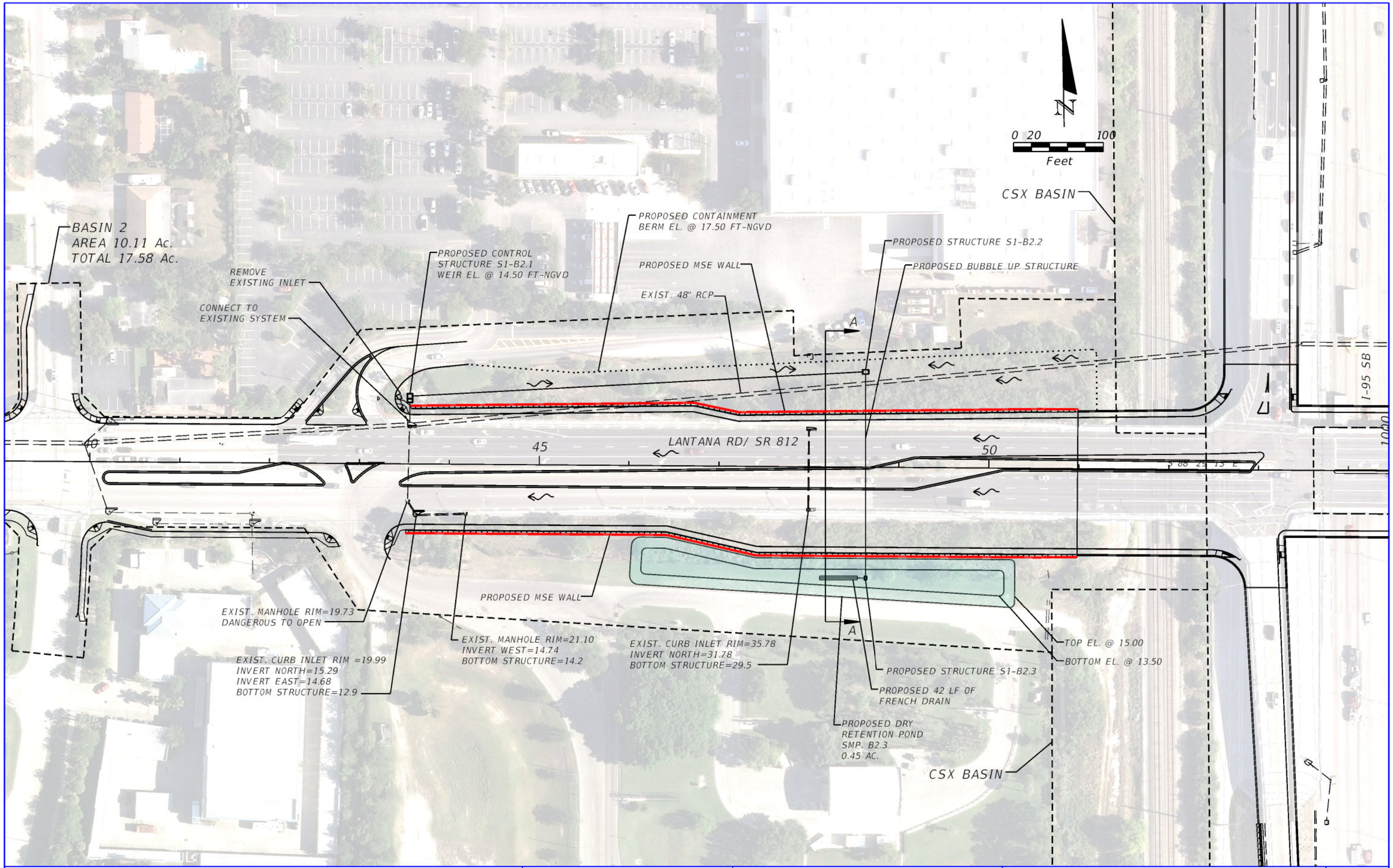


SECTION A-A

NOT TO SCALE

BASIN 1 - ALTERNATIVE 1

Appendix 3B
Alternative 1 Basin 2



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

BCC ENGINEERING, INC.
ALEX VAZQUEZ, P.E. No. 42108
6401 SW 87th Ave, Suite 200,
Miami, Florida 33173.
P: (305) 670-2350 F: (305) 670-2351
Certificate of Authorization No. 7184

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
812	PALM BEACH	000000-0-00-00

I-95 AND LANTANA RD
ALTRENATIVE 1 BASIN 2

SHEET NO.
FG-2

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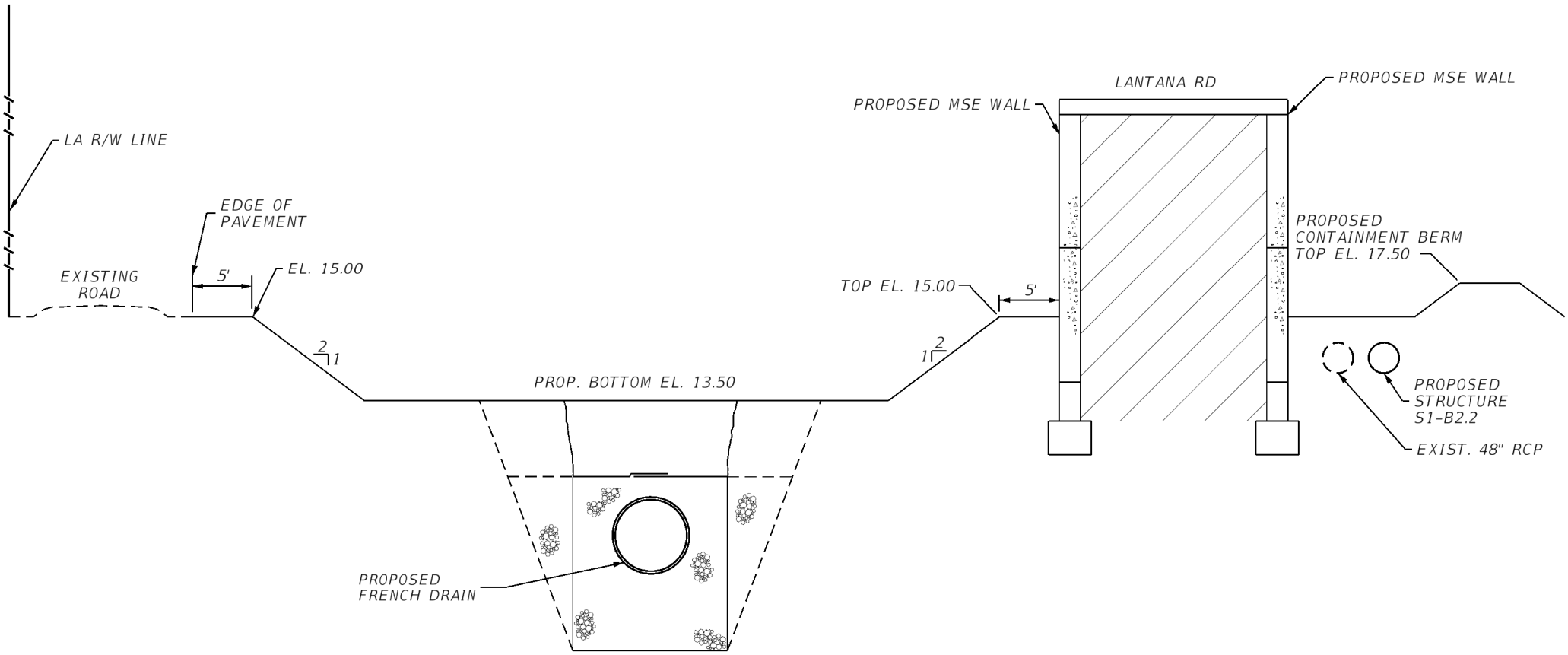
mramirez 11/26/2019 5:45:47 PM H:\CADD\PD&E I-95 at Lantana\drainage\DRMPRD05_PROP-B2-1.DGN



SECTION A-A

NOT TO SCALE

BASIN 2 - ALTERNATIVE 1

Appendix 3C
Alternative 1 Basin 3

S-297 EXIST. DITCH L11
BOTTOM EL. 10.50
WARNING EL. 15.00
MAX. STAGE = 13.38
WEIR CONTROL EL. 11.60

EXIST. CATCH BASIN RIM=18.65
INVERT SOUTH=12.99
INVERT WEST=12.95
BOTTOM STRUCTURE=12.8

CSX BASIN

EXIST. MANHOLE RIM=19.27
INVERT NORTH=13.27
INVERT WEST=13.33
BOTTOM STRUCTURE=13.2

S-255A EXIST. DETENTION
CONTROL STRUCTURE
WARNING EL. 18.50
MAX. STAGE = 16.93
WEIR CONTROL EL. 15.75
BLEEDER =14.50

EXISTING DRY
DETENTION POND 2
BOTTOM @ EL. 15.50
MODIFY EXISTING POND
BOTTOM @ EL. 15.00
BLEEDER @ EL. 14.00
SMP. B3.1
1.86 AC.

BASIN 3
AREA 15.11 Ac.

EXIST. MEDIAN FRENCH DRAIN
WARNING EL. 18.69
MAX. STAGE = 16.69
WEIR CONTROL EL. 11.60

S-297 EXIST. DITCH R11
BOTTOM EL. 11.00
WARNING EL. 15.00
MAX. STAGE = 15.14
WEIR CONTROL EL. 11.60

S-233A NE INFIELD OF
INTERCHANGE (BASIN 2)
BOTTOM EL. 16.50
WARNING EL. 19.50
MAX. STAGE = 18.62
WEIR CONTROL EL. 17.80

I-95 SB

I-95 NB

LANTANA RD/ SR 812

CSX BASIN

A A

N

0 50 200
Feet

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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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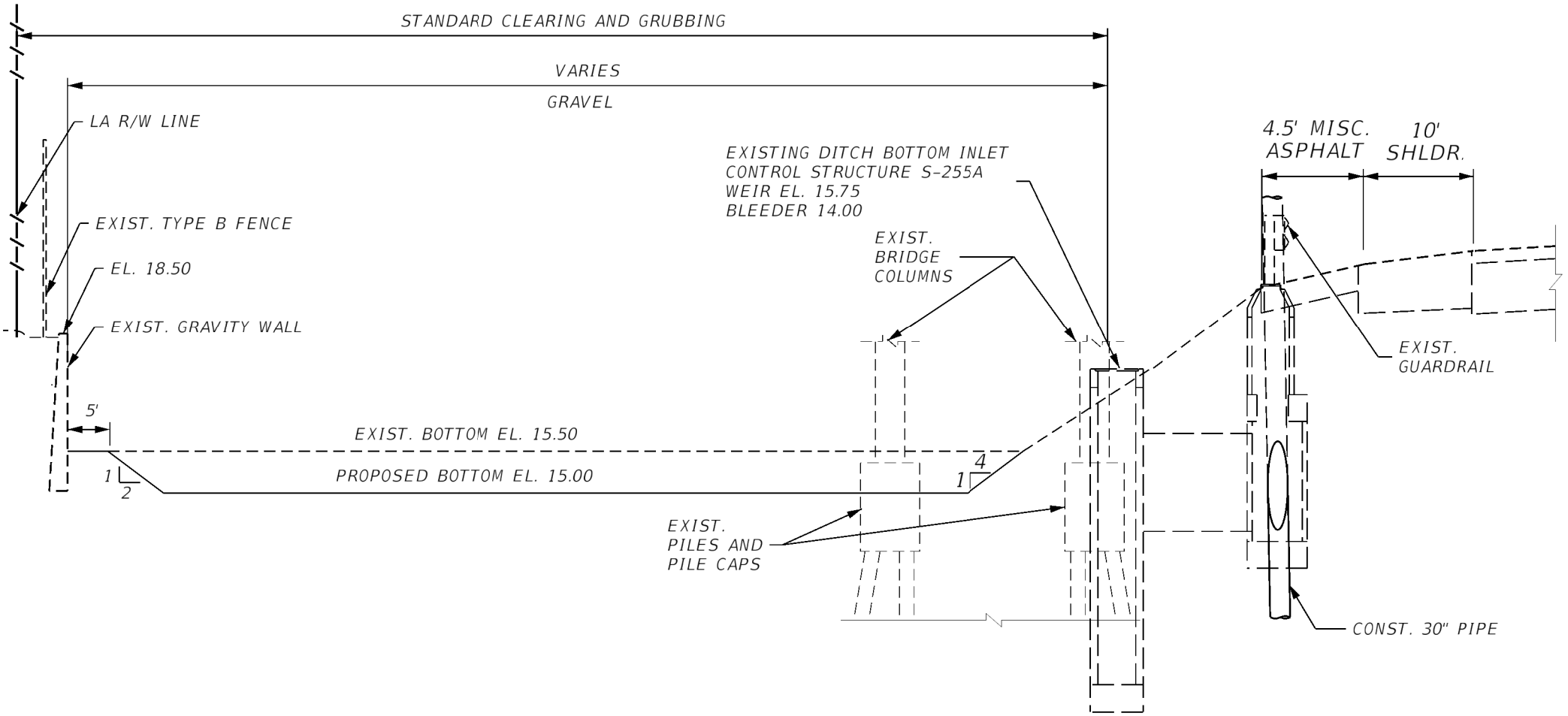
Certificate of Authorization No. 7184

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
812	PALM BEACH	000000-0-00-00

I-95 AND LANTANA RD
ALTRENATIVE 1 BASIN 3

SHEET NO.
FG-4



SECTION A-A

NOT TO SCALE

BASIN 3 - ALTERNATIVE 1

Appendix 4A
Alternative 2 Basin 1

LANTANA RD/ SR 812

PROPOSED MSE WALL

TOP EL. @ 16.50

BOTTOM EL. @ 12.00

PROPOSED DRY
RETENTION POND
SMP. B1.2
0.61 AC.

PROPOSED 1,145 LF
OF FRENCH DRAIN

A

A

CSX BASIN

OVERFLOW @ 16.00 FT-NGVD

S-212 MEDIAN FRENCH DRAIN
WARNING EL. 20.05
MAX. STAGE = 18.55
WEIR CONTROL EL. 17.20

NL2 (S-174A)
BOTTOM EL. 10.50
WARNING EL. 15.00
MAX. STAGE = 13.85
WEIR CONTROL EL. 11.00

PROPOSED DITCH BERM
@ 15.75 FT-NGVD

EXISTING DITCH L2
BOTTOM EL. 10.50
WARNING EL. 15.00
MAX. STAGE = 13.85
WEIR CONTROL EL. 11.00

I-95 SB

I-95 NB

995

990

985

S-222 MEDIAN FRENCH DRAIN
WARNING EL. 20.12
MAX. STAGE = 17.84
WEIR CONTROL EL. 17.27

EXIST. MEDIAN
FRENCH DRAIN

BASIN 1
AREA 18.46 Ac.

NR4 (P181 INVERT)
WARNING EL. 15.00
MAX. STAGE = 13.94
WEIR CONTROL EL. 11.70

EXISTING DITCH R4
BOTTOM EL. 10.50
WARNING EL. 15.00
MAX. STAGE = 13.94
WEIR CONTROL EL. 11.70

N

0 50 200

Feet

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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

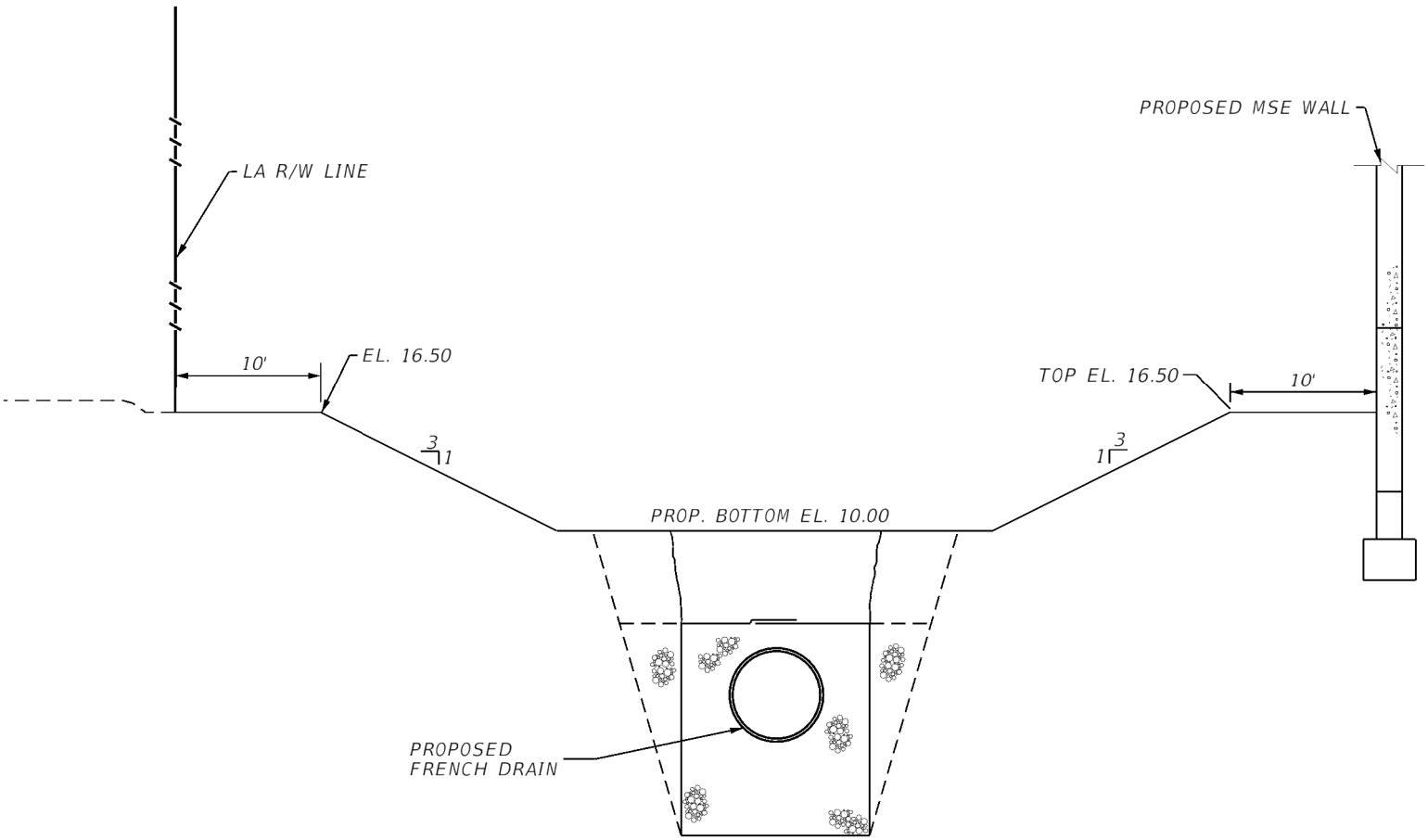
BCC ENGINEERING, INC.
ALEX VAZQUEZ, P.E. No. 42108
6401 SW 87th Ave, Suite 200,
Miami, Florida 33173.
P: (305) 670-2350 F: (305) 670-2351
Certificate of Authorization No. 7184

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
812	PALM BEACH	000000-0-00-00

I-95 AND LANTANA RD
ALTERNATIVE 2 BASIN 1

SHEET NO.
FG-2



SECTION A-A

NOT TO SCALE

BASIN 1 - ALTERNATIVE 2

Appendix 4B
Alternative 2 Basin 2

PROPOSED FRENCH DRAIN

1010

MATCH LINE A-A

PROPOSED MH-B2.3

PROPOSED MH-B2.2

REMOVE EXIST. INLET

PROPOSED CONTROL STRUCTURE S1-B2.2 @ WEIR EL 17.0 FT-NGVD

PROPOSED CONTAINMENT BERM EL. 17.50 FT-NGVD

EXIST. 48" RCP

PROPOSED MH-B2.4

BASIN 2
AREA 10.11 Ac.
TOTAL AREA 19.13 Ac.

CSX BASIN

PROPOSED MSE WALL

A

A

LANTANA RD/SR 812

45

50

55

S 88° 29' 13" E

EXIST. MANHOLE RIM=21.10'
INVERT WEST=14.74'
BOTTOM STRUCTURE=14.2'

EXIST. CURB INLET RIM =19.99'
INVERT NORTH=15.29'
INVERT EAST=14.68'
BOTTOM STRUCTURE=12.9'

EXIST. MANHOLE RIM=19.73'

PROPOSED MSE WALL

EXIST. CURB INLET RIM=35.78'
INVERT NORTH=31.78'
BOTTOM STRUCTURE=29.5'

EXIST. CATCH BASIN RIM=37.85'
INVERT NORTHEAST=30.38'
INVERT SOUTH=30.38'
BOTTOM STRUCTURE=30.4'

0 20 100
Feet

MATCH LINE A-A

PROPOSED MSE WALL

TOP EL. @ 18.00

BOTTOM EL. @ 14.50

PROPOSED DRY RETENTION POND SMP. B2.2 0.60 AC.

PROPOSED 965 LF OF FRENCH DRAIN

B

B

PROPOSED CB2.1 @ EL. 14.50

PROPOSED MH-B2.1

I-95 SB
1005

I-95 NB

EXIST. 48" RCP

EXIST. CATCH BASIN RIM=34.10'
INVERT NORTHWEST=29.71'
INVERT SOUTHEAST=30.02'
BOTTOM STRUCTURE=29.7'

1000

EXIST. CATCH BASIN RIM=38.00'
INVERT NORTH=30.61'
INVERT SOUTHEAST=30.61'
BOTTOM STRUCTURE=30.6'

EXIST. CATCH BASIN RIM=34.26'
INVERT NORTHWEST=31.43'
BOTTOM STRUCTURE=31.4'

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

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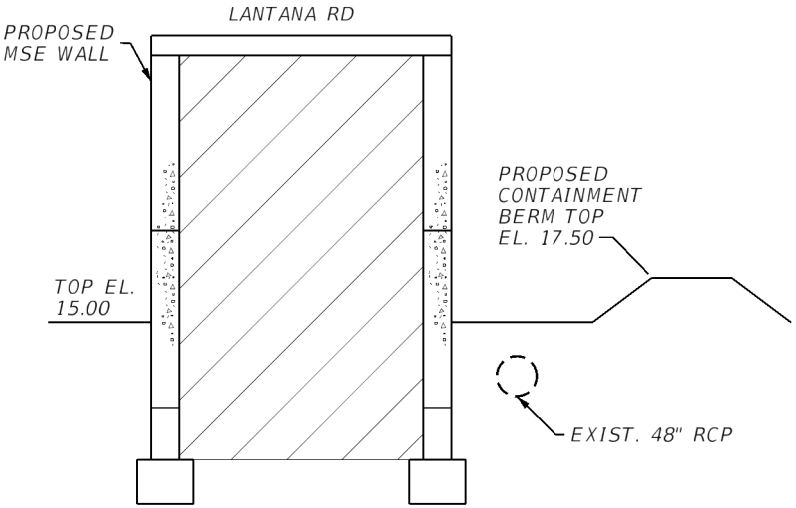
812	PALM BEACH	000000-0-00-00

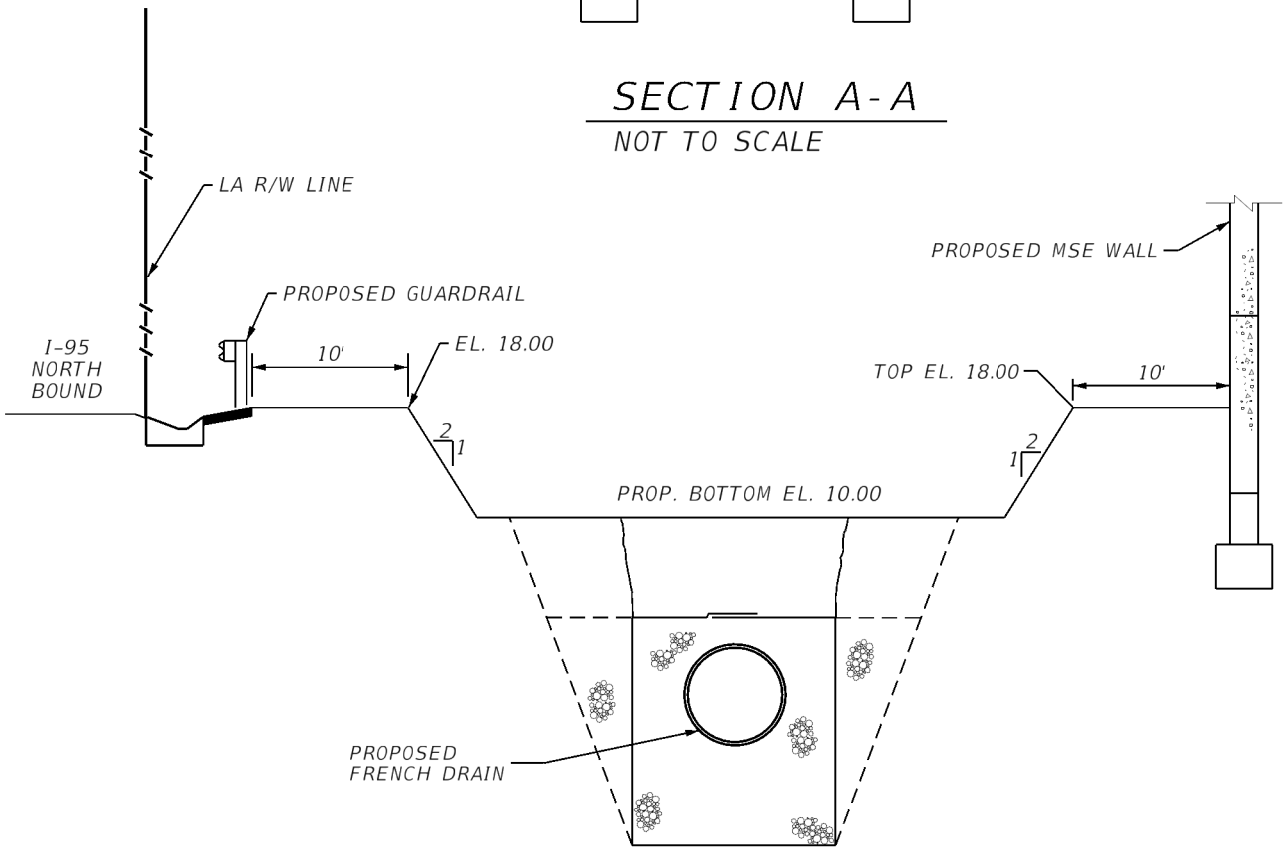
I-95 AND LANTANA RD
ALTERNATIVE 2 BASIN 2

SHEET NO.
FG-3



SECTION A-A

NOT TO SCALE



SECTION B-B

NOT TO SCALE

BASIN 2 - ALTERNATIVE 2

Appendix 4C
Alternative 2 Basin 3

PROPOSED DITCH BERM
@ 15.75 FT-NGVD

OVERFLOW @ 14.00 FT-NGVD

TOP EL. @ 14.50

BOTTOM EL. @ 11.00

PROPOSED 655 LF OF
FRENCH DRAIN

S-297 EXIST. DITCH L11
BOTTOM EL. 10.50
WARNING EL. 15.00
MAX. STAGE = 13.38
WEIR CONTROL EL. 11.60

EXIST. CATCH BASIN RIM=18.65
INVERT SOUTH=12.99
INVERT WEST=12.95
BOTTOM STRUCTURE=12.8

CSX BASIN

PROPOSED MSE WALL

EXIST. MANHOLE RIM=19.27
INVERT NORTH=13.27
INVERT WEST=13.33
BOTTOM STRUCTURE=13.2

REMOVE S-255A EXIST. DETENTION
CONTROL STRUCTURE
WARNING EL. 18.50
MAX. STAGE = 16.93
WEIR CONTROL EL. 15.75
BLEEDER =14.50

REMOVE EXISTING DRY
DETENTION POND 2

PROPOSED DRY
RETENTION POND
SMP. B3.2
0.46 AC.

S-297 EXIST. DITCH R11
BOTTOM EL. 11.00
WARNING EL. 15.00
MAX. STAGE = 15.14
WEIR CONTROL EL. 11.60

BASIN 3
AREA 15.11 Ac.

EXIST. MEDIAN FRENCH DRAIN
WARNING EL. 18.69
MAX. STAGE = 16.69
WEIR CONTROL EL. 11.60

S-233A NE INFIELD OF
INTERCHANGE (BASIN 2)
BOTTOM EL. 16.50
WARNING EL. 19.50
MAX. STAGE = 18.62
WEIR CONTROL EL. 17.80

A A

1015

1010

1005

1000

I-95 SB

I-95 NB

LANTANA RD/ SR 812

S 88° 21' 13" E

40 45 50 55 60 65

N

0 50 200
Feet

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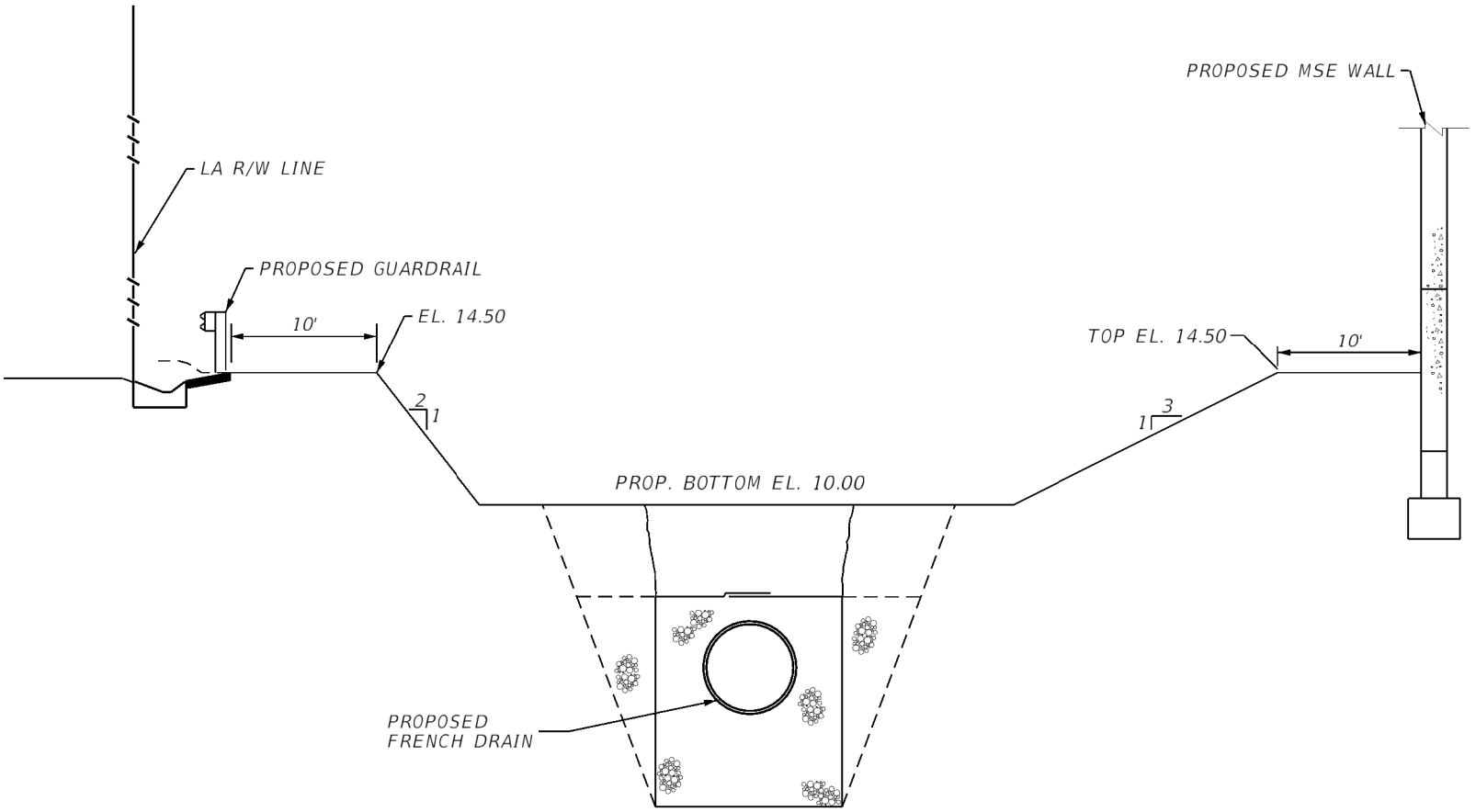
812	PALM BEACH	000000-0-00-00

I-95 AND LANTANA RD
ALTRENATIVE 2 BASIN 3

SHEET NO.
FG-4

mramirez 7/7/2020 5:55:19 PM H:\CADD\PD&E I-95 at Lantana\drainage\DRMPRD09_PROP-B3-2.DGN



SECTION A-A

NOT TO SCALE

BASIN 3 - ALTERNATIVE 2

Appendix 5A
Alternative 3 Basin 1

LANTANA RD/ SR 812

PROPOSED MSE WALL

I-95 SB

I-95 NB

995

990

985

TOP EL. @ 16.50
BOTTOM EL. @ 13.00
PROPOSED DRY
RETENTION POND
SMP. B1.3
0.35 AC.

A

A

PROPOSED 37 LF
OF FRENCH DRAIN

CSX BASIN

OVERFLOW @ 16.00 FT-NGVD

S-212 MEDIAN FRENCH DRAIN
WARNING EL. 20.05
MAX. STAGE = 18.55
WEIR CONTROL EL. 17.20

NL2 (S-174A)
BOTTOM EL. 10.50
WARNING EL. 15.00
MAX. STAGE = 13.85'
WEIR CONTROL EL. 11.00

PROPOSED DITCH BERM
@ 15.75 FT-NGVD

EXISTING DITCH L2
BOTTOM EL. 10.50
WARNING EL. 15.00
MAX. STAGE = 13.85'
WEIR CONTROL EL. 11.00

S-222 MEDIAN FRENCH DRAIN
WARNING EL. 20.12
MAX. STAGE = 17.84
WEIR CONTROL EL. 17.27

EXIST. MEDIAN
FRENCH DRAIN

BASIN 1
AREA 19.30 Ac.

NR4 (P181 INVERT)
WARNING EL. 15.00
MAX. STAGE = 13.94
WEIR CONTROL EL. 11.70

EXISTING DITCH R4
BOTTOM EL. 10.50
WARNING EL. 15.00
MAX. STAGE = 13.94'
WEIR CONTROL EL. 11.70

N

0 50 200
Feet

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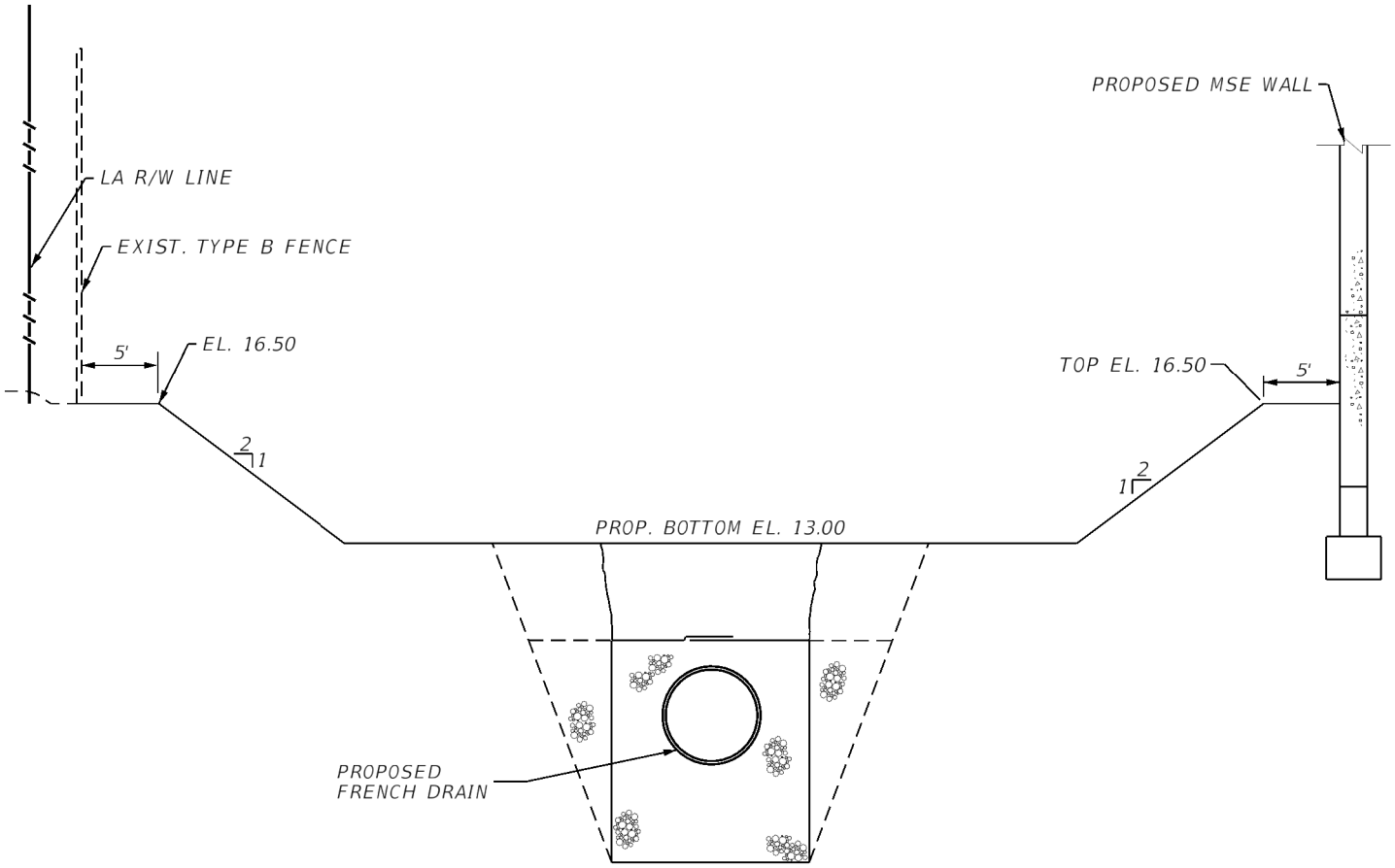
812	PALM BEACH	000000-0-00-00

I-95 AND LANTANA RD
ALTERNATIVE 3 BASIN 1

SHEET NO.
FG-2

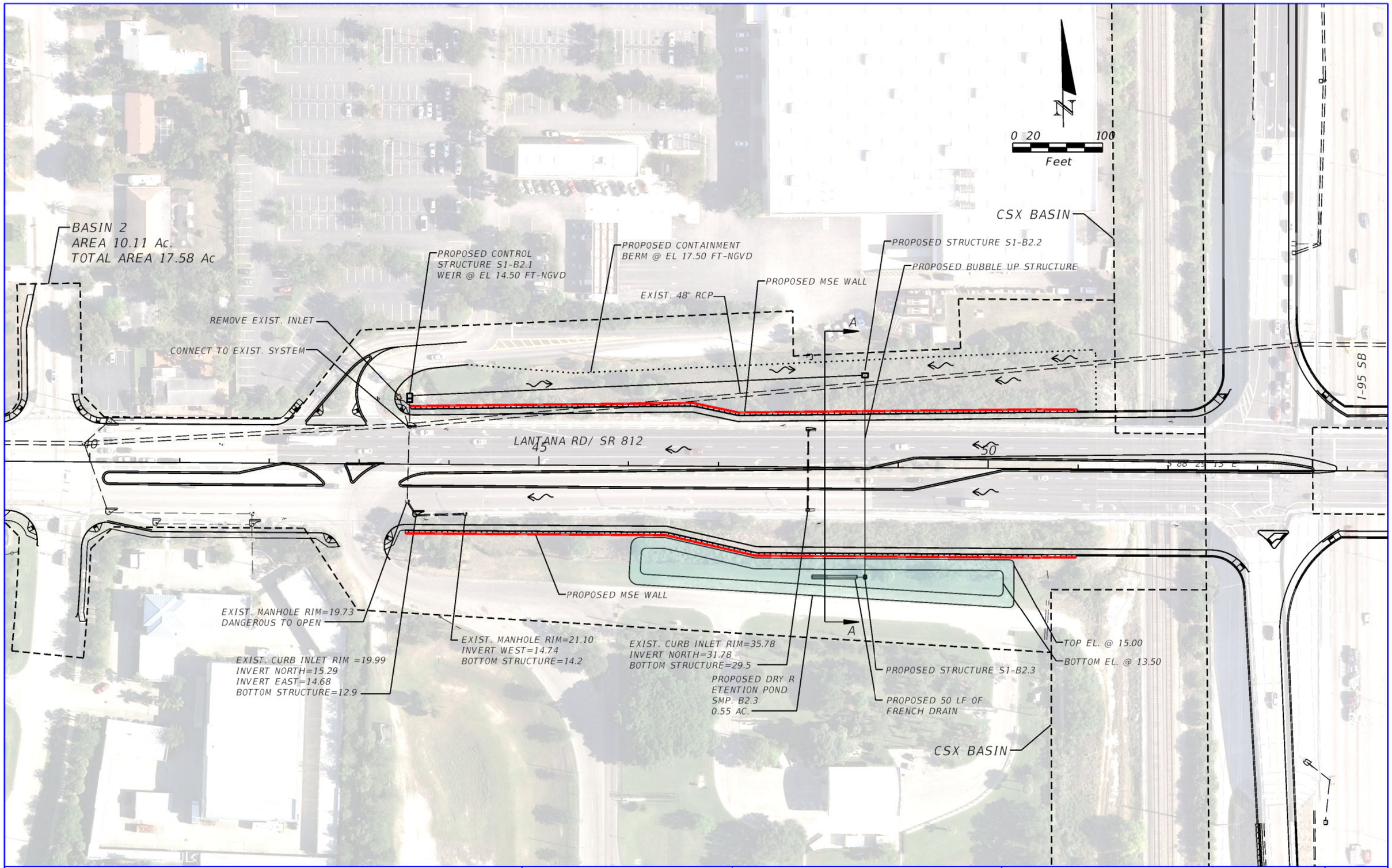


SECTION A-A

NOT TO SCALE

BASIN 1 - ALTERNATIVE 3

Appendix 5B
Alternative 3 Basin 2



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812	PALM BEACH	000000-0-00-00

I-95 AND LANTANA RD
ALTRENATIVE 3 BASIN 2

SHEET NO.
FG-2

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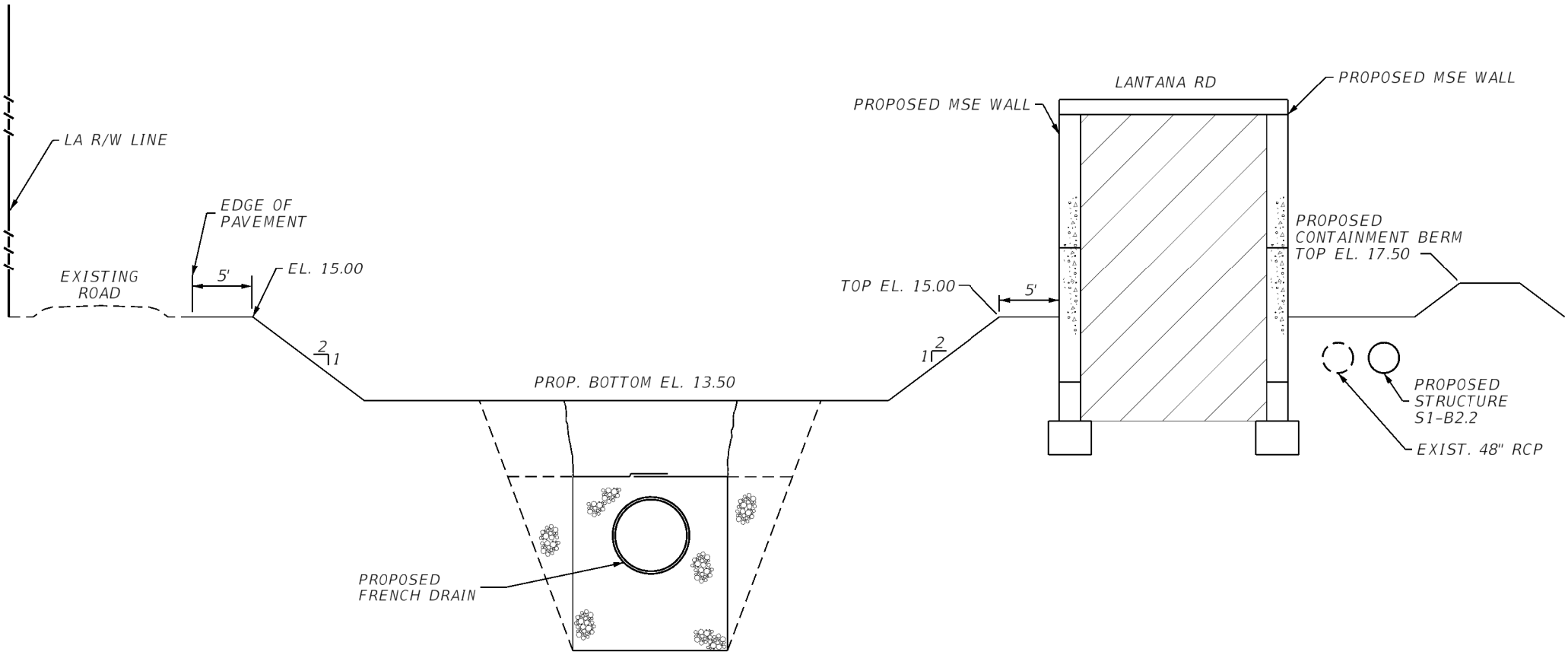
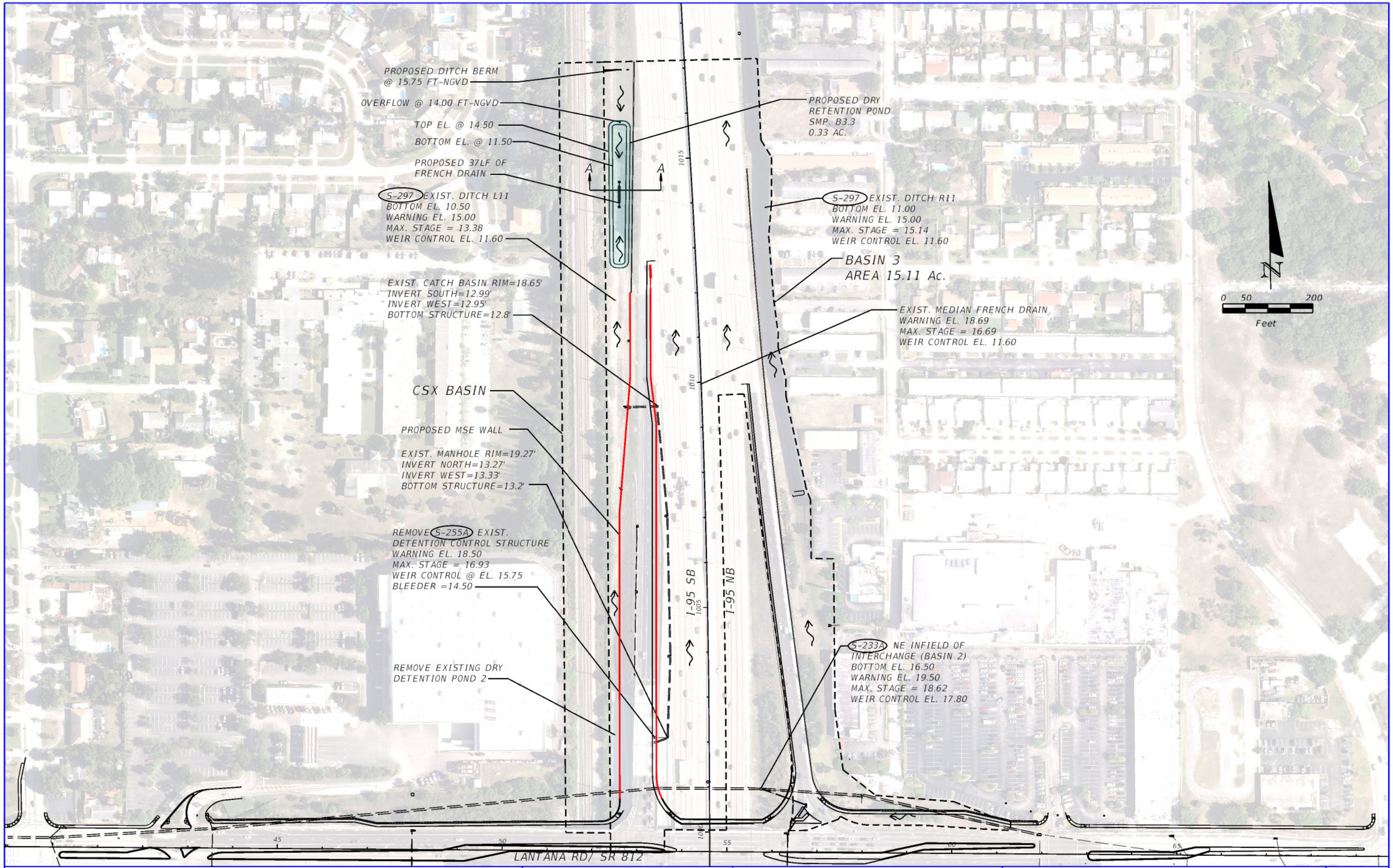


SECTION A-A

NOT TO SCALE

BASIN 2 - ALTERNATIVE 3

Appendix 5C
Alternative 3 Basin 3



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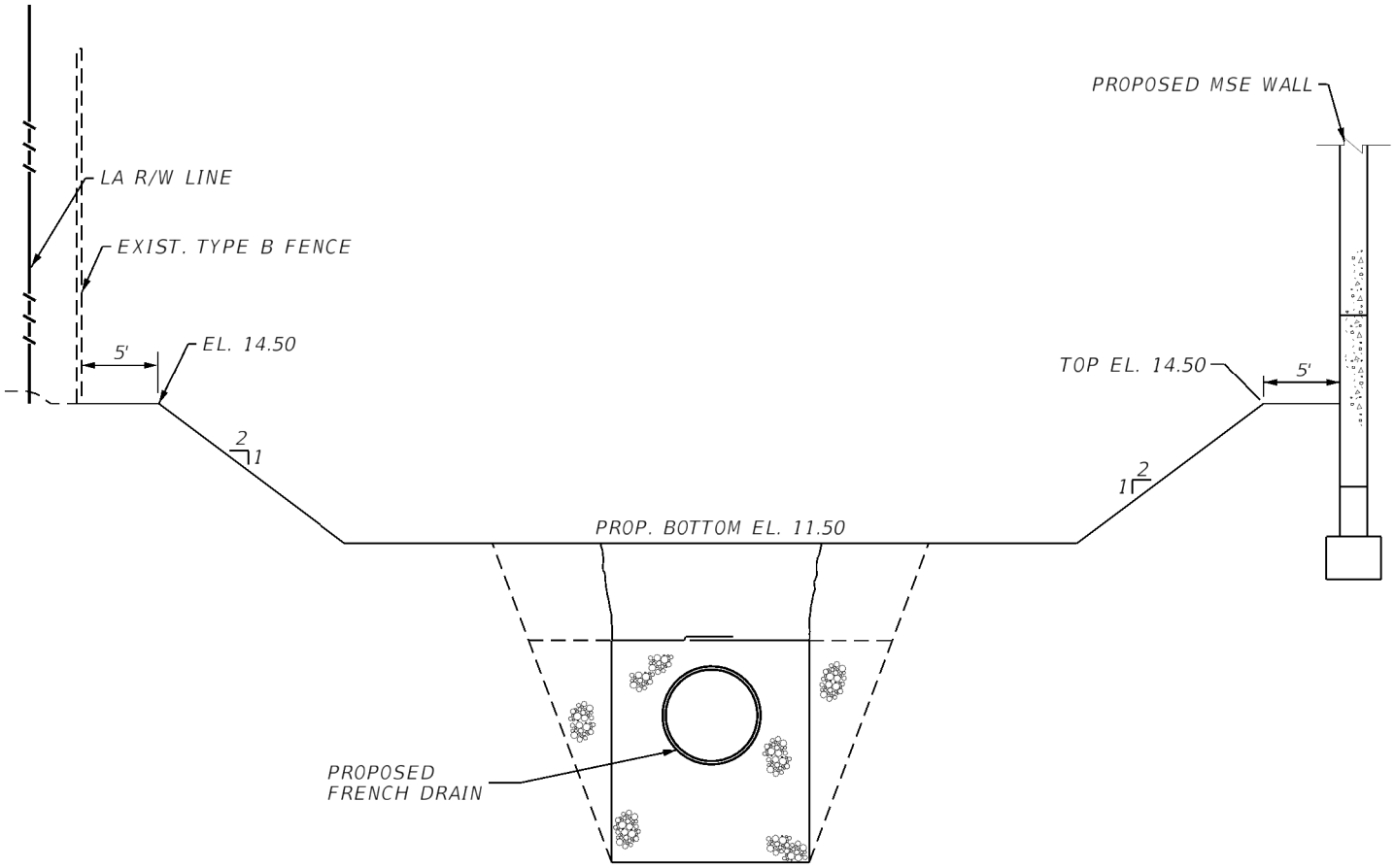
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
812	PALM BEACH	000000-0-00-00

I-95 AND LANTANA RD
ALTRENATIVE 3 BASIN 3

SHEET NO. FG-4

mramirez 11/26/2019 6:26:03 PM H:\CADD\PD&E I-95 at Lantana\drainage\DRMPRD10_PROP-B3-3.DGN



SECTION A-A

NOT TO SCALE

BASIN 3 - ALTERNATIVE 3