Prepared for:

FDOT District 5
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SR 40 PD&E Study

From Breakaway Trail to Williamson Boulevard

Final Pond Siting Report

November 2012

Volusia County, Florida
Financial Project No: 428947-1-22-01

Professional Engineer Certificate

I hereby certify that I am a registered professional engineer in the State of Florida practicing with Inwood Consulting Engineers, Inc., a corporation authorized to operate as an engineering business, FEID No. 59-3216593, by the State of Florida, Department of Professional Regulation, and Board of Professional Engineers. I have reviewed or approved the evaluation, findings, opinions and conclusions as reported in this Pond Siting Report.

The Pond Siting Report includes a summary of data collection efforts and design analysis for SR 40 PD&E Study from Breakaway Trail to Williamson Boulevard. I acknowledge that the procedures and references used to develop the results contained in this report are standard to the professional practice of civil engineering as applied through design standards and criteria set forth by the federal, state, and local regulatory agencies as well as professional judgment and experience.

RENATO E. CHUW
LICENSE
No 56050
11/16/12
STATE OF FLORIDA
PROFESSIONAL ENGINEER

Signature:

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EXECUTIVE SUMMARY

The Florida Department of Transportation (FDOT), District Five, is conducting a Project Development and Environment (PD&E) Study to evaluate alternative roadway concepts for the four lane to six lane widening of the segment of State Road (SR) 40 from Breakaway Trail to Williamson Boulevard, a distance of approximately two (2) miles. The study is being conducted as a State Environmental Impact Report (SEIR), as no federal funds are being sought for the improvements to this section of the corridor.

The need for the project is based on accommodating future traffic demand within the corridor, partly involving planned development. The study will develop and evaluate concepts that address traffic operations, intersection improvements, safety and provisions for bicycles and pedestrians. The study will also evaluate the anticipated impacts and costs for each concept. This project has been identified in the City of Ormond Beach, City of Daytona Beach, and Volusia County Comprehensive Plans, and is also part of the Volusia Transportation Planning Organization's 2035 Long Range Transportation Plan (LRTP).

State Road 40 is a regionally significant, east-west arterial that originates on the west coast of Florida and terminates in Ormond Beach, a distance of over 90 miles. This section of SR 40 is part of the Florida Scenic Highway network as well as a designated hurricane evacuation route. This two (2) mile segment is composed of residential land use (west of I-95) transitioning to commercial land use (east of I-95). Improvements to the corridor will address the implementation of bicycle/pedestrian features, widening of the bridge over the Tomoka River, configuration of medians and utilization of existing right of way.

The overall purpose of this study is to begin developing a transportation improvement project that satisfies the project purpose and need, minimizes social, economic and environmental impacts, incorporates community input and obtains and maintains project consensus from agency partners and stakeholders.

The purpose of this Pond Siting Report is to discuss the stormwater management plan for the project. This report identifies alternative pond locations, discusses right-of-way requirements, and documents right-of-way acquisition and possible mitigation costs associated with the alternative pond sites. In addition, this report makes recommendations for the preferred alternative pond sites.

Existing Drainage Conditions

The project is located within the Little Tomoka River and Tomoka River watersheds located within the St. Johns River Water Management District (SJRWMD). SR 40 is further divided into five (5) local drainage sub-basins for stormwater management. These basins ultimately discharge to the Little Tomoka River and Tomoka River which are considered Outstanding Florida Waters (OFW) and are also on the Florida Department of Environmental Protection (FDEP) 303(d) list of Impaired Water Bodies.

Basins 1 and 2 are within Water Body Identification Number (WBID) 2646: Little Tomoka River, which is impaired for dissolved oxygen; however there is no causative pollutant for the impairment. Basins 3, 4, and 5 are within WBID 2634: Tomoka River, which was placed on the planning list for impairment for dissolved oxygen on September 21, 2007. Currently there is no causative pollutant identified for this WBID, but it will remain on the planning list until one is identified. During final design, a review of FDEP's 303(d) List of Impaired Water Bodies should be reviewed, as additional information regarding Total Maximum Daily Loads (TMDL) may become available.

The existing land use within the two (2) mile stretch of SR 40 is predominantly residential west of I-95 and transitions to commercial east of I-95. It is anticipated that the proposed roadway widening will result in minimal wetland impacts. Pond alternative recommendations will be based on avoidance of wetland impacts whenever possible. The topography surrounding the project vicinity is relatively flat; however, ground elevations along SR 40 rise to around 27 feet and drop as low as 16 feet within the study limits. Portions of the project are located within the Tomoka River recharge area.

There are four (4) existing permitted stormwater treatment ponds to treat and attenuate the runoff from SR 40 between Breakaway Trail and Williamson Boulevard. Currently, the stormwater runoff from SR 40 is collected by roadside swale systems that flow to the existing stormwater ponds and discharge to the Little Tomoka River in Basin 1 or the Tomoka River in Basins 3, 4, and 5. Basin 2, which lies between cross drain CD-1, at approximately station 1320+45, and Tymber Creek Road at station 1346+50, is collected in a roadside swale system which discharges directly to CD-1 and the Little Tomoka River. At the time when SR 40 was widened from two (2) to four (4) lanes, Basin 2 was permitted to flow untreated to the Little Tomoka River. The untreated runoff was compensated for by treating the two (2) existing lanes of SR 40 in Basin 1. There are two (2) cross drains and one (1) bridge that convey stormwater runoff under SR 40 and, with the exception of CD-2, serve as outfall locations for the roadway. Please refer to **Appendix 11 – Preferred Alternative Roadway Plans** for existing stormwater treatment ponds, stationing, cross drains locations and bridge location.

The Federal Emergency Management Agency (FEMA) has developed a Flood Insurance Rate Map (FIRM) for Volusia County. SR 40 primarily traverses Zone X of the FEMA designated floodplain, which are areas determined to be outside the 500-year floodplain. However, areas designated as Zone AE, areas in which the base flood elevations have been determined, are located along the roadway in two (2) locations. The first location is at CD-1 and is associated with a tributary to the Little Tomoka River. The base flood elevation was determined to be at elevation 13.00 feet NGVD 29 on the north side of the roadway. The south side of SR 40 at this location is designated as Zone A, which are areas where no base flood elevations are determined. The second location is associated with the Tomoka River, where the base flood elevation was determined to be at elevation 10.00 feet NGVD 29. The Tomoka River is a federally designated floodway. **Table 1** shows a **Summary of Existing Cross Drains and Bridge**.

Table 1 – Summary of Existing Cross Drains and Bridge

Cross Drain	Approximate Location	Description	Outfall
CD – 1	1320+45	(2) – 6' X 6' CBC	Little Tomoka River
Bridge – 1	1365+00	360' wide Bridge	Tomoka River
CD-2	1381+00	(2) – 24" RCP	Roadway Swale

Future Drainage Conditions

The existing drainage boundaries and local drainage basins will be maintained in the proposed condition. The stormwater runoff from SR 40 will be collected by a roadside swale system or a curb & gutter system which will convey stormwater to curb inlets and pipes, depending on the preferred typical section, which will flow to stormwater management ponds. The water quality treatment will be achieved through the utilization of both proposed and existing stormwater ponds.

This project will have no adverse impact to the area's water quality. Stormwater runoff of the project area will be treated as required by the rules set forth by the St. Johns River Water Management District (SJRWMD) (Chapter 40C-42 F.A.C, Section 40C-42.026, Specific Design and Performance Criteria), and the Florida Department of Transportation (FDOT).

<u>The required treatment volume for a wet detention system is the greater of:</u>

Two and a half (2.5) inches of runoff from the impervious area

Or

One (1) inch of runoff from the basin area

<u>The required treatment volume for an offline dry retention system is the greater of:</u>

One and a quarter (1.25) inches of runoff from the impervious area

Or

One half (0.5) inch of runoff from the basin area

<u>The required treatment volume for an online dry retention system is the greater of:</u>

One and a quarter (1.25) inches of runoff from the impervious area

Or

One half (0.5) inch of runoff from the basin area

Plus

An additional one half (0.5) inch of runoff from the basin area.

Portions of the project are located within the Tomoka River Most Effective Recharge Area which states that portions of projects, in the recharge areas must retain three (3) inches of runoff from the directly connected impervious area. Most effective recharge areas are more accurately defined as areas with Type "A" Hydrologic Soil Group (HSG) soils. For the SR 40 project, the required treatment volume for a dry retention system is the greater of the presumptive criteria described above or the Tomoka Recharge criterion.

The SJRWMD requires that the post development discharge generated by the 25-year/24-hour storm event be equal to or less than the pre-development discharge. Ponds were designed to attenuate the difference in post development runoff volume and pre development runoff volume.

Much of the area surrounding SR 40 is either developed and provides its own stormwater management, or flows north away from the roadway to the Little Tomoka River and east or west to the Tomoka River. In instances where offsite runoff flows toward the roadway, proper conveyance of the runoff across SR 40 towards its historical path can be provided in the onsite drainage conveyance systems.

A 2.46 acre offsite area drains to the roadway in Basin 2 located on the southeast corner of Old Tomoka Road and SR 40 between station 1335+00 and station 1340+70. The existing land use appears to be woods that are in good condition and are protected from grazing. This area has low runoff potential and it is expected that the proposed pond sites can accommodate it.

The limits of the proposed basins begin and end at the same locations as the existing condition in order to maintain existing drainage patterns. CD-1 and the bridge over Tomoka River serve as the project outfall locations. The locations of the outfalls in the proposed condition are the same as the existing condition.

Based on the available information, only the hydraulically feasible and environmentally permissible alternative pond sites are considered. Alternative pond sites are analyzed and evaluated for the following parameters:

- hydrologic and hydraulic factors such as existing ground elevation, soil types, seasonal high water table (SHWT), stormwater conveyance feasibility, allowable hydraulic grade line (HGL), and basin outfalls;
- cultural resource impacts;
- environmental resource impacts including wetlands and threatened or endangered species;
- potential for hazardous materials and contamination;
- floodplain impacts;
- major utility conflict potential; and
- Pond right of way and construction costs

Summary

As an alternative to siting new ponds within Basins 1, 4, and 5, in which existing stormwater ponds currently provide treatment and attenuation of the existing four-lane runoff of SR 40, this report analyzes the required right of way necessary to accommodate the additional runoff generated by the widening of the roadway. However, alternative pond sites have been identified within Basin 2. Prior to the four-laning of SR 40, no water quality treatment was provided for the roadway. During the design for the four-lane section, the runoff from Basin 2 was allowed discharge directly to CD-1. The untreated runoff from Basin 2 was compensated for by treating the existing lanes in Basin 1. Now, with the additional impervious area in both Basin 1 and Basin 2, the runoff from Basin 2 cannot be discharged directly to CD-1 because there is no additional existing impervious area in Basin 1 to compensate for it.

The analysis for this basin estimates the right-of-way needs using a volumetric analysis, which accounts for water quality treatment and water quantity for runoff attenuation. A more detailed analysis using the Interconnected Channel and Pond Routing modeling software (ICPR v.3.10) for wet ponds and the PONDS Routing modeling software (PONDS v.3.3) for dry ponds is provided for Basins 1 and 4 respectively, where the use of the existing pond site or an expansion of the existing pond site is proposed. This is to ensure that these options are a feasible and cost effective alternative in lieu of new pond sites. In Basin 5, it was found that recovery modeling of the treatment and retention volumes was not necessary since the measured basin areas were less than the permitted basin areas to drain to the pond. Please see **Section 7.3.5 Basin 5** for more details.

The right-of-way cost estimate found in this report is a budget tool used by the Department to estimate total acquisition costs associated with each pond site and to budget the appropriate funds for acquisition. Right-of-way cost estimates are not real estate appraisals and do not reflect market value. In addition, FDOT uses appraisals that comply with the Uniform Standards of Professional Appraisal Practice (USPAP) for acquisition purposes.

Please note that the recommendations were based on pond sizes and locations determined from preliminary data calculations, reasonable engineering judgment, environmental analysis, and assumptions. This is a preliminary conceptual document which pond sizes and locations may change during final design as more detailed information on SHWT, wetland hydrologic information, final roadway profile, and final TMDL's become available. **Table 2** below shows a summary of the preferred pond alternatives.

Table 2 – Summary of Pond Recommendations

Basin	Preferred Pond Alternative	Right of Way Area (ac.)	Cost ($)
1	Pond 1	5.69	$1,256,504
2	2B-1 and 2B-2	4.41 and 1.59	$3,266,407
3	Pond 3A and 3B	0.96 and 1.17	$401,895
4	Pond 4	0.90	$0
5	Pond 5	3.56	$0

SECTION 1 INTRODUCTION

The Florida Department of Transportation (FDOT), District Five, is conducting a Project Development and Environment (PD&E) Study to evaluate alternative roadway concepts for the four lane to six lane widening of the segment of State Road (SR) 40 from Breakaway Trail to Williamson Boulevard, a distance of approximately two (2) miles. The study is being conducted as a State Environmental Impact Report (SEIR), as no federal funds are being sought for the improvements to this section of the corridor.

The need for the project is based on accommodating future traffic demand within the corridor, partly involving planned development. The study will develop and evaluate concepts that address traffic operations, intersection improvements, safety and provisions for bicycles and pedestrians. The study will also evaluate the anticipated impacts and costs for each concept. This project has been identified in the City of Ormond Beach, City of Daytona Beach, and Volusia County Comprehensive Plans, and is also part of the Volusia Transportation Planning Organization's 2035 Long Range Transportation Plan (LRTP).

State Road 40 is a regionally significant, east-west arterial that originates on the west coast of Florida and terminates in Ormond Beach, a distance of over 90 miles. This section of SR 40 is part of the Florida Scenic Highway network as well as a designated hurricane evacuation route. This two (2) mile segment is composed of residential land use (west of I-95) transitioning to commercial land use (east of I-95). Improvements to the corridor will address the implementation of bicycle/pedestrian features, widening of the bridge over the Tomoka River, configuration of medians and utilization of existing right of way.

The overall purpose of this study is to begin developing a transportation improvement project that satisfies the project purpose and need, minimizes social, economic and environmental impacts, incorporates community input and obtains and maintains project consensus from agency partners and stakeholders.

The project is within Sections 25, 26, and 35 of Township 14 South, Range 31 East and Section 30 of Township 14 South, Range 32 East. Refer to the **USGS Quadrangle Map** in **Figure 2**, **Appendix 1.**

The purpose of this pond siting report is to discuss the stormwater management plan for the project. This report identifies alternative pond locations, discusses right-of-way requirements, and documents right-of-way acquisition and possible mitigation costs associated with the alternative pond sites. In addition, this report makes recommendations for the preferred alternative pond sites.

The pond siting analysis documentation for the conceptual pond sites is found in **Section 7** of this report. All figures for this report are included in **Appendix 1**. For the ease of review, **Drainage Criteria Matrix**, **Pond Design Calculations**, **Estimated Pond Construction Costs**, and **Alternative Evaluations Matrix** are included in **Appendices 2, 3, 4,** and **5**. Other supporting information and data is included in the remaining appendices. The datum used for all calculations is NAVD 88 unless otherwise specified.

1.1 PROJECT NEED

The need for the project is based on accommodating future traffic demand within the corridor, partly involving planned development. The study will develop and evaluate concepts that address traffic operations, intersection improvements, safety and provisions for bicycles and pedestrians. The study will also evaluate the anticipated impacts and costs for each concept. This project has been identified in the City of Ormond Beach, City of Daytona Beach, and Volusia County Comprehensive Plans, and is also part of the Volusia Transportation Planning Organization's 2035 Long Range Transportation Plan (LRTP).

SECTION 2 PROJECT DESCRIPTION

The existing roadway typical section for SR 40 consists of four 12-foot wide travel lanes (two lanes in each direction), separated by a 40-foot wide grassed median with paved shoulders adjacent to the outside travel lanes. An 8-foot wide concrete sidewalk runs on the north side of SR 40 between Breakaway Trail and Tymber Creek Road. Proposed typical sections for the widening of SR 40 from 4 to 6 lanes were presented for public comment at the Public Kick-off Meeting in July 2011. The study area was broken into two segments for the PD&E Study; from Breakaway Trail to Tymber Creek Road, and from Tymber Creek Road to I-95. Three typical sections were presented for each segment. For the segment from Breakaway Trail to Tymber Creek Road the alternatives included a rural (maintain existing 60 mph design speed, to be posted at 50 mph), suburban (50 mph), and high-speed urban (50 mph) typical sections. For the segment of SR 40 between Tymber Creek Road and I-95, the alternatives included a suburban (50 mph), high-speed urban (50 mph), and urban (45 mph). The segment of SR 40 between I-95 and Williamson Road was developed as an independent alternative to fit within the constraints of the existing roadway, I-95 overpass bridge, and right-of-way. These typical sections were evaluated to determine the comparative costs, constructability, safety, and fit with the surrounding land use context. Based on this evaluation, the suburban typical section was eliminated from further study.

The future land uses, desired design speed and pedestrian and bicycle mobility are important factors in addition to vehicle capacity and mobility in the selection of a proposed 6-lane roadway typical section. The remaining two typical sections for each study segment have been applied to the roadway alignment in order to assess the right-of-way and environmental impacts of each typical section. Based on the different combinations of typical sections possible for the corridor, the following roadway design alternatives were developed in **Table 3**:

Table 3 – Typical Sections Developed within the Project Corridor

Alternative	Typical Section		
	Breakaway Trail to Tymber Creek Road	Tymber Creek Road to I-95	I-95 to Williamson Boulevard
A	Rural (60 mph design, 50 mph Posted)	High-Speed Urban (30-ft median) (50 mph)	Same for Alternatives A, B, C, D. Includes sidewalk adjacent to Roadway both sides of SR 40
B	Rural (60 mph design, 50 mph Posted)	Urban (45 mph)	
C	High-Speed Urban (40-ft median) (50 mph)	High-Speed Urban (30-ft median) (50 mph)	
D	High-Speed Urban (40-ft median) (50 mph)	Urban (45 mph)	
E	N/A (only applies to Williamson Blvd)		Sidewalk on north side of SR 40 set back behind utility poles

The roadway typical section alternatives outlined above are currently being evaluated to determine how each addresses the purpose and need of the project. Important factors in this evaluation include compatibility and consistency within the corridor, design speed, right-of-way impacts, utility impacts, environmental impacts, pedestrian and bicycle considerations, drainage needs, and construction cost estimates. Of the alternatives outlined above, Alternative B is the preferred alternative; graphics can be found in **Appendix 11 – Preferred Alternative Roadway Plans**.

SECTION 3 DESIGN CRITERIA

The design of the stormwater management facilities for the project is governed by the rules set forth by the SJRWMD and FDOT. Water quality treatment and water quantity attenuation requirements will comply with the guidelines as defined in SJRWMD Chapter 40C-4 of the Florida Administration Code (F.A.C) Environmental Resource Permit (ERP) manual. During final design a critical duration analysis should be performed to comply with FDOT Rule Chapter 14-86 F.A.C. Please refer to **Appendix 2** for the **Drainage Criteria Matrix** compiled from both SJRWMD and FDOT criterion and used for this project.

Wet detention and dry retention ponds will provide for water quality improvements as well as water quantity attenuation for the project runoff. Please refer to the summary below for the water quality, water quantity, FDOT critical duration, and retention pond facilities configuration criterion used for the project:

- **Water Quality** – For wet detention ponds the treatment will be provided for the greater of one inch (1") of stormwater runoff over the drainage area or two and a half inches (2.5") of runoff from the impervious area (excluding water bodies). An orifice should be set at the Seasonal High Water Level (SHWL) elevation and sized to drawdown one-half of the required treatment volume within 24 to 30 hours but no more than one half of this volume will be discharged within the first 24 hours. For offline dry retention ponds the treatment will be provided for the greater of one half inch (0.5") of stormwater runoff over the drainage area or one and a quarter inches (1.25") of runoff from the impervious area (excluding water bodies). For online dry retention ponds the treatment will be provided for the greater of that which is specified for offline systems, plus an additional one half inch (0.5") of stormwater runoff over the drainage area. The pond bottom, for dry retention, shall be set no less than one foot (1') above the SHWL in order to provide recovery of the required treatment volume through the soil. The required treatment volume is required to be fully recovered within 72 hours of the storm event. Portions of the project are located within the Tomoka River recharge area which states that portions of projects, in the most effective recharge areas must retain three (3) inches of runoff from the directly connected impervious area. Most effective recharge areas are more accurately defined as areas with Type "A" Hydrologic Soil Group (HSG) soils. For this project, the required treatment volume for a dry retention system is the greater of the presumptive criteria described above or the Tomoka Recharge criterion.

- **Water Quantity** – For open basins, SJRWMD requires that the post-development peak discharges shall be at or below pre-development peak discharges for the 25-year/24-hour storm event. FDOT requires that the post-development peak discharge cannot exceed pre-development discharge for all frequencies and durations from the 2-year/1-hour storm through the 100-year/72-hour storm event and all those in between.

- **Critical Duration** – For open basins, FDOT critical duration analysis for 1-hour through 3-day storm events shall be analyzed to ensure that the post developed peak runoff volume do not exceed the pre-developed peak runoff volume.

- **Detention Pond Facilities Configuration** – The proposed pond will include a 20-foot maintenance berm (15' minimum), maximum 1:4 (Vertical:Horizontal) for pond side slopes (to a depth of 2-feet below the control elevation, then 1:2 to the pond bottom) and tie up/down slopes to existing ground and a minimum 1-foot freeboard from the inside maintenance berm to the Design High Water (DHW). Please refer to FDOT District 5 checklist for more detailed information about pond configurations.

- **Retention Pond Facilities Configuration** – The proposed pond will include a 20-foot maintenance berm (15' minimum), maximum 1:4 (Vertical:Horizontal) for pond side slopes (to a depth of 1-foot above the SHWL) and tie up/down slopes to existing ground and a minimum 1-foot freeboard from the inside maintenance berm to the Design High Water (DHW). Please refer to FDOT District 5 checklist for more detailed information about pond configurations.

The stormwater runoff for the roadway will be collected by a roadside system and conveyed to the proposed wet detention ponds. The SCS method has been used to determine the required pond size for the basin. In addition, Basin 1 and Basin 1-2 also used ICPR to model the existing pond expansion in more detail. It should be noted that for contingency purposes, the alternative pond sites for Basin 2 have been upsized by twenty percent (20%).

SECTION 4 DATA COLLECTION

The study team collected and reviewed data from the following sources:

- FDOT Drainage Manual, March 2012.
- FDOT Drainage Handbook: "Stormwater Management Facility", January 2004
- FDOT Project Development and Environment Manual (PD&E), Part 2, Chapter 24 "Floodplains," January 2008
- SJRWMD Applicant's Handbook: "Management and Storage of Surface Waters", December 2010
- SJRWMD Chapter 40C-42, F.A.C., Environmental Resource Permit (ERP), "Regulation of Stormwater Management Systems", December 2010
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for Volusia County. Panel # 12127CO194H, 12127CO200H, 12127CO213H, 12127CO350G, 12127CO351G.
- Volusia County Soils maps 2009.

- FDEP 303(d) list of Impaired Water Bodies
- United States Geological Survey (USGS) Quad maps
- Site Visit (March 13, 2012)
- Volusia County Tax maps
- Topographic Survey (1-foot LIDAR Contours)
- Natural Environment Report, Inwood Consulting Engineers, July 2012
- Preliminary Soil Survey Report, Antillian Engineering Associates, July 2012
- Contamination Screening Evaluation Report, Nodarse & Associates (A Terracon Company), January 2012
- Cultural Resource Assessment Survey
- SR 40 Straight Line Diagrams
- SJRWMD Permit #'s 4-127-23005-2, 4-127-23036-5, 4-127-67904-1

SECTION 5 EXISTING SITE CONDITIONS

5.1 TOPOGRAPHY & HYDROLOGIC FEATURES

There are two (2) cross drains and one (1) bridge that convey stormwater runoff under SR 40 and, with the exception of CD-2, serve as outfall locations for the roadway runoff. Stormwater runoff is currently treated in existing stormwater ponds except for the portion of SR 40 between CD-1 and Tymber Creek Road. For Basin 2, runoff is currently untreated and discharged to CD-1 and to the Little Tomoka River. **Table 4** shows a **Summary of Existing Cross Drains and Bridge**.

Table 4 – Summary of Existing Cross Drains and Bridge

Cross Drain	Approximate Location	Description	Outfall
CD – 1	1320+45	(2) – 6' X 6' CBC	Little Tomoka River
Bridge – 1	1365+00	360' wide Bridge	Tomoka River
CD-2	1381+00	(2) – 24" RCP	Roadway Swale

5.2 SOILS DATA & GEOTECHNICAL INVESTIGATIONS

The Soil Survey of Volusia County, Florida, published by Volusia County (dated 2009) has been reviewed for the project vicinity. The soil survey map for the project vicinity is illustrated in **Figure 4– NRCS Soils Map**, in **Appendix 1**.

Thirty-one (31) types of soils were encountered along the project limits because of the limited project coverage. The soil types vary and range from Hydrologic Soil Group (HSG) 'A' to HSG 'D'. Type 'A' soils are very well drained soils with low water tables and Type 'D' soils are very poorly or poorly drained soils with high water tables. **Table 5 – NRCS Soil Survey Information** summarizes and lists the soil types and relevant information.

Table 5 – NRCS Soil Survey Information

Soil No.	Volusia County USDA Soil Name	Seasonal High Ground Water				HSG	Soil Classification		
		Duration (months)		Depth* (feet)			Depth (inches)	Unified	AASHTO
		BEG	END	HIGH	LOW				
1	Apopka	---	---	>6.0	---	A	0-62	SP, SP-SM	A-3
							62-80	SM-SC, SC	A-2-4, A-2-6, A-4,A-6
3	Arents	---	---	>6.0	---	A	0-95	SP, SP-SM	A-3
4	Astatula	---	---	> 6.0	---	A	0-95	SP, SP-SM	A-3
8	Basinger	JUN	FEB	+2	1.0	A/D	0-90	SP, SP-SM	A-3, A-2-4
13	Cassia	JUL	JAN	1.5	3.5	C	0-28	SP, SP-SM	A-3
							28-36	SP-SM, SM	A-3, A-2-4
							36-80	SP, SP-SM	A-3
17	Daytona	JUL	NOV	3.5	5.0	B	0-36	SP, SP-SM	A-3
							36-47	SP, SP-SM	A-3
							47-80	SP, SP-SM, SM	A-3, A-2-4
19	Deland	---	---	> 6.0	---	A	0-4	SP, SP-SM	A-3
							4-55	SP, SP-SM	A-3
							55-67	SP-SM, SM	A-3, A-2-4
							67-94	SP-SM, SM	A-3, A-2-4
22	Electra	JUL	OCT	2.0	3.5	C	0-35	SP, SP-SM	A-3
							35-52	SP-SM, SM	A-3, A-2-4
							52-57	SP-SM	A-3, A-2-4
							57-70	SC, SC-SM	A-2, A-4, A-6
23	Farmton	JUN	OCT	0	1.0	D	0-7	SP, SP-SM	A-3
							7-34	SP, SP-SM	A-3
							34-50	SP-SM, SM	A-3, A-2-4
							50-80	SM,, SM-SC, SC	A-2-4
24	Fluvaquents	---	---	---	---	D	---	---	---
30	Immokalee	JUN	SEP	+2.0	1.0	A/D	0-8	SP, SP-SM	A-3
							8-36	SP, SP-SM	A-3
							36-50	SP-SM, SM	A-3, A-2-4
							50-80	SP, SP-SM	A-3
31	Malabar	JUN	SEP	0	1.0	B/D	0-15	SP, SP-SM	A-3
							15-32	SP, SP-SM	A-3, A-2-4
							32-42	SP, SP-SM	A-3
							42-80	SC, SM-SC	A-2, A-4, A-6
32	Myakka	JUN	FEB	0	1.0	A/D	0-27	SP, SP-SM	A-3
							27-43	SM, SP-SM	A-3, A-2-4
							43-78	SP, SP-SM	A-3
34	Myakka	JUN	FEB	+2.0	1.0	A/D	0-27	SP, SP-SM	A-3
							27-43	SM, SP-SM	A-3, A-2-4
							43-78	SP, SP-SM	A-3
37	Orsino	JUN	DEC	3.5	5.0	A	0-30	SP	A-3
							30-80	SP, SP-SM	A-3
40	Palm Beach	---	---	>6.0	---	A	0-80	SP, SW	A-3

Continued on next page.

Soil No.	Volusia County USDA Soil Name	Seasonal High Ground Water				HSG	Soil Classification		
		Duration (months)		Depth* (feet)			Depth (inches)	Unified	AASHTO
		BEG	END	HIGH	LOW				
45	Pineda	JUN	NOV	0	1.0	B/D	0-40	SP, SP-SM	A-3
							40-96	SC, SM-SC	A-2-4, A-2-6
47	Pits	---	---	---	---	---	---	---	---
49	Pomona	JUL	SEP	0	1.0	B/D	0-5	SP, SP-SM	A-3, A-2-4
							5-18	SP, SP-SM	A-3, A-2-4
							18-45	SP, SP-SM	A-3, A-2-4
							45-50	SP, SP-SM	A-3, A-2-4
							50-60	SC, SM-SC	A-2, A-4, A-6
50	Pomona	JUL	SEP	+2.0	1.0	B/D	0-7	SP, SP-SM	A-3, A-2-4
							7-14	SP, SP-SM	A-3, A-2-4
							14-33	SP-SM, SM	A-3, A-2-4
							33-53	SP, SP-SM	A-3, A-2-4
							53-70	SC-SM-SC	A-2, A-4, A-6
51	Pomona	JUL	SEP	+2.0	1.0	B/D	0-7	SP, SP-SM	A-3, A-2-4
							7-14	SP, SP-SM	A-3, A-2-4
							14-33	SP-SM, SM	A-3, A-2-4
							33-53	SP, SP-SM	A-3, A-2-4
							53-70	SC, SM-SC	A-2, A-4, A-6
52	Pompano	JUN	NOV	0	1.0	A/D	0-80	SP, SP-SM	A-3, A-2-4
53	Pompano	JUN	NOV	+2.0	1.0	A/D	0-80	SP, SP-SM	A-3, A-2-4
54	Quartzipsamments	---	---	---	---	A	---	---	---
58	Satellite	JUN	NOV	1.0	3.5	C	0-80	SP	A-3
59	Scoggin	JUN	FEB	+1.0	1.0	D	4-0	Pt	A-8
							0-7	SP-SM, SM	A-3, A-2-4
							7-36	SP, SP-SM	A-3, A-2-4
							36-49	SC, SM-SC	A-2-4, A-2-6
							49-54	SC, SM-SC	A-2-4
63	Tavares	JUN	DEC	3.5	6.0	A	0-80	SP, SP-SM	A-3
65	Terra Ceia	JUN	APR	+1.0	1.0	A/D	0-64	Pt	---
75	Wauchula	JUN	FEB	0	1.0	B/D	0-7	SP-SM	A-3, A-2-4
							7-20	SP-SM	A-3, A-2-4
							20-29	SP-SM, SM	A-3, A-2-4
							29-34	SP-SM, SM	A-3, A-2-4
							34-80	SM, SM-SC, SC	A-2-4, A-2-6, A-4, A-6
76	Wauchula	JUN	SEP	+1.0	1.0	D	0-7	SP-SM	A-3, A-2-4
							7-22	SP-SM	A-3, A-2-4
							22-31	SP-SM, SM	A-3, A-2-4
							31-37	SP-SM, SM	A-3, A-2-4
							37-60	SM, SM-SC, SC	A-2-4, A-2-6, A-4, A-6
99	Water	---	---	---	---	---	---	---	---

* Depth is referenced below existing grade.

5.3 ENVIRONMENTAL CHARACTERISTICS

5.3.1 Land Use Data

Existing land use is predominantly residential to the west of I-95 and transitions into commercial to the east of I-95. The future land uses in the project area will not be altered. Please see **Figure 5**, **Existing Land Use Map**, and **Figure 6, Future Land Map**, in **Appendix 1**.

5.3.2 Cultural Features & Cultural Resources

Cultural features preserve and enhance the cultural nature of a community and include parks, schools, churches and other religious institutions. Also included are historic sites, archaeologically significant sites and neighborhood gathering places. Community services include facilities that provide necessary services such as fire stations, police stations, public and private schools, hospitals, cemeteries, public buildings, and civic facilities. The following is a list of sites in or near the project area:

- Riverbend Community Church
- Faith Lutheran Church
- Calvary Christian Center
- Oasis Church on Tymber Creek Road south of 7/11
- Coquina Presbyterian Church, across SR 40 from Riverbend

Cultural Resources are the collective evidence of past activities and accomplishments of people. Buildings, objects, locations, and structures with scientific, historic and cultural value are all examples of Cultural Resources. These are finite and non-renewable resources that once destroyed cannot be returned to their original state.

Cultural resources include prehistoric and historic archeological sites, historic standing structures, bridges, cemeteries, and monuments, among others. Impacts to resources eligible for the National Register of Historic Places (NRHP) must be mitigated through excavation, avoidance, or preservation. All Federal and most State agencies are required to identify and protect cultural resources on the lands they manage. Industries, whose projects are licensed by federal and or state agencies, must identify and mitigate impacts to cultural resources in project areas before construction activities. Additional information regarding archaeological and historic resources can be found in **Appendix 6 – Cultural Resource Assessment Report**.

5.3.3 Natural and Biological Features

The project corridor was evaluated for the presence of potentially-occurring species. Due to the fact that the project is located within a developed corridor, much of the quality of the habitat has been reduced or otherwise diminished due to its proximity to surrounding development.

There are two (2) federally-protected plant species with the potential to occur in Volusia County. In addition to species receiving federal protection, there are 22 plant species listed as either threatened or endangered by the State of Florida that have the potential to occur in Volusia County. No State or Federally listed plant species were observed within the proposed project corridor.

The proposed project has potential to involve several State and/or Federally listed wildlife species. Those species and their anticipated involvement are identified in the **SR 40 PD&E Study Natural Environment Report**.

Nine (9) wetlands were identified within the 'Build' alternative limits based on project area topography, soils, land use and habitat types, and site verification. A list of wetlands, along with the U.S. Fish and Wildlife Service and Florida Land Use, Cover and Forms Classification System classifications, and a habitat description, is included in **SR 40 PD&E Study Natural Environment Report**. It is likely that this project will impact wetlands regulated by the State and Federal Governments. Pond alternative recommendations will be based on avoidance of wetland impacts, whenever possible.

The project corridor traverses the Tomoka River, which is listed as an Outstanding Florida Water by the Florida Department of Environmental Protection, and is designated as Essential Fish Habitat by the National Marine Fisheries Service. Additionally, the entire project corridor falls within the Tomoka River Mitigation Basin (as defined by the St. Johns River Water Management District, Chapter 40C-41 F.A.C.), within which, wetlands and uplands abutting the Tomoka River are afforded additional protection through the Riparian Wildlife Habitat Standard. The potential effects of the project on the Tomoka River, and wetland habitats are detailed in **SR 40 PD&E Study Natural Environment Report**.

5.4 EXISTING DRAINAGE CONDITIONS

The project is located within the Little Tomoka River and Tomoka River watersheds of the Northern Coastal Basin as defined by the St. Johns River Water Management District (SJRWMD). SR 40 is further divided into five (5) local drainage sub-basins for stormwater management. These basins ultimately discharge to the Little Tomoka River and Tomoka River which are considered Outstanding Florida Waters (OFW) and are also on the Florida Department of Environmental Protection (FDEP) 303(d) list of Impaired Water Bodies. The limits of the basins are shown in **Table 6** for **Summary of Existing and Proposed Drainage Basins**.

Table 6 – Summary of Existing and Proposed Drainage Basins

Basin Name	From	To	Outfall Location	Preferred Pond Alternative
1	1282+00	1320+50	CD-1: Little Tomoka River Tributary	Pond 1
2	1320+50	1347+00	CD-1: Little Tomoka River Tributary	2B-1 and 2B-2
3	1347+00	1365+20	Tomoka River	Pond 3A and 3B
4	1365+20	1375+00	Tomoka River	Pond 4
5	1375+00	1398+13	Tomoka River	Pond 5

Basins 1 and 2 are within WBID 2646: Little Tomoka River, which is impaired for dissolved oxygen; however there is no causative pollutant for the impairment. Basins 3, 4, and 5 are within WBID 2634: Tomoka River, which was placed on the planning list for impairment for dissolved oxygen on September 21, 2007. Currently there is no causative pollutant identified for this WBID, but it will remain on the planning list until one is identified. During final design, a review of FDEP's 303(d) List of Impaired Water Bodies should be reviewed, as additional information regarding TMDL's may become available.

There are four (4) existing permitted stormwater ponds to treat and attenuate the runoff from SR 40 between Breakaway Trail and Williamson Boulevard. Currently, the stormwater runoff from SR 40 is collected by roadside swale systems that flow to the existing stormwater ponds and discharged to the Little Tomoka River in Basin 1 or the Tomoka River in Basins 3, 4, and 5. Basin 2, which lies between cross drain CD-1, at approximately station 1320+50, and Tymber Creek Road at station 1347+00, is collected in a roadside swale system which discharges directly to CD-1 and the Little Tomoka River. At the time when SR 40 was widened from two (2) to four (4) lanes, Basin 2 was permitted to flow untreated to the Little Tomoka River. The untreated runoff was compensated for by treating the two (2) existing lanes of SR 40 in Basin 1. There are two (2) cross drains and one (1) bridge that convey stormwater runoff under SR 40 and, with the exception of CD-2, serve as outfall locations for the roadway.

5.4.1 Basin 1

Basin 1 begins west of the intersection of SR 40 and Breakaway Trail at station 1282+00 and continues east just past CD-1 at station 1320+50. The stormwater runoff from the roadway is collected in roadside swales that flow to the permitted existing wet detention pond at station 1315+00. A copy of the permit calculations for this pond site can be found in **Appendix 9 – Existing Permit Calculations**. Between station 1317+00 and station 1320+50 stormwater runoff goes untreated and discharges to both the upstream and downstream ends of CD-1. The outfall control structure for the pond discharges back into the south roadside swale at approximately station 1317+70; continues east to the upstream (south) end of CD-1. CD-1 is a double 6' X 6' concrete box culvert (CBC) which allows a tributary to the Little Tomoka River to flow north underneath SR 40.

A residential area exists on the north side of SR 40 for the entirety of this basin. The south side of SR 40 consists of open pasture land intermixed with pine forested areas and small depressions. Wetlands exist on both sides of the roadway at CD-1 and are associated with the tributary to the Little Tomoka River. The north side of CD-1 is designated as Zone AE of the FEMA designated floodplain at elevation 13.00 feet NGVD 29. The south side of CD-1 is designated as Zone A of the FEMA designated floodplain, where no base flood elevation has been determined.

Basin 1 currently compensates for the untreated discharge of the portion of SR 40 within Basin 2 of this study.

5.4.2 Basin 2

Basin 2 begins just past CD-1 at station 1320+50 and continues east to Tymber Creek Road at station 1347+00. The stormwater runoff from the roadway is collected in roadside swales that flow west and eventually to CD-1 at station 1320+50. The stormwater runoff within this basin is not currently treated before being discharged at CD-1.

Between station 1320+50 and station 1334+00 the north side of SR 40 consists of residential areas while the south side of SR 40 is the Riverbend Community Church. Both sites provide their own required water quality treatment and discharge to the tributary of the Little Tomoka River. Woodlands exist on both sides of the roadway between station 1334+00 and 1341+00, and continues on the north side until station 1343+50. Commercial areas exist on both sides of the roadway for the remainder of the basin ending at station 1347+00.

A 2.46 acre offsite area drains to the roadway from the southeast corner of Old Tomoka Road and SR 40 between station 1335+00 and station 1340+70. The existing land use appears to be woods that are in good condition and are protected from grazing. This offsite area flows into the southern roadside swale where it is conveyed west to CD-1.

5.4.3 Basin 3

Basin 3 begins at station 1347+00 and continues east to a high point in the bridge over Tomoka River at station 1365+20. The area of SR 40 between station 1345+00 and 1347+00 is proposed to be collected by the Tymber Creek Road widening project pond located approximately 900 feet north of SR 40 on the west side of Tymber Creek Road. The stormwater runoff from the roadway is collected in roadside swales that flow to the existing dry retention pond at approximately station 1359+00. Between station 1359+00 and 1363+50, the roadway is collected in valley gutters which flow to inlets and directed to the dry retention pond. The dry retention pond recovers the water quality volume through a system of underdrains set at elevation 9.75 feet NGVD, and outfalls to the Tomoka River. Water quantity attenuation is accomplished in the roadside swales. According to the existing permitted information (Permit #4-127-23005-2), the average ground water table (GWT) is at elevation 3.7 feet NGVD, the average seasonal high water table (SHWT) is at elevation 16.7 feet NGVD and the average conductivity rate (k) of the soils is 1.15 in/hr (2.3 ft/day). A copy of the permit calculations for this pond site can be found in **Appendix 9 – Existing Permit Calculations**.

The north side of SR 40 is primarily residential while the south side is a mixture of commercial and residential. The end of the basin passes over the Tomoka River which is a federally defined floodway. This area is designated as Zone AE of the FEMA designated floodplain with a base flood elevation of 10.00 feet NGVD.

5.4.4 Basin 4

Basin 4 begins at station 1365+20 and continues east to station 1375+00. The stormwater runoff from the roadway is collected in roadside swales that flow west to the existing dry retention pond at approximately station 1370+00. Between station 1367+50 and 1370+00, the roadway is collected in valley gutters which flow to inlets and directed to the dry retention pond. The pond recovers the water quality volume naturally through the soils. Water quantity attenuation is accomplished in the roadside swales and a control structure is located at the beginning of the system inside the south side ditch, which outfalls to the Tomoka River. A copy of the permit calculations for this pond site can be found in **Appendix 9 – Existing Permit Calculations**.

The north side of SR 40 is primarily undeveloped woodlands while the south side is a mixture of commercial and undeveloped woodlands. The beginning of the basin passes over the Tomoka River which is a federally defined floodway. This area is designated as Zone AE of the FEMA designated floodplain with a base flood elevation of 10.00 feet NGVD.

5.4.5 Basin 5

Basin 5 begins at station 1375+00 at Booth Road and continues east to just west of Williamson Boulevard at station 1398+13, which is consistent with the permitted basin limit (SJRWMD Permit #4-127-23036-5). A copy of the permit calculations for this pond site can be found in **Appendix 9 – Existing Permit Calculations**. The stormwater runoff from the north side of the roadway between station 1375+00 and 1380+60 is collected in roadside swales that flow to CD-2 at station 1381+00. CD-2 consists of a double (2) 24" pipes which allow stormwater runoff to cross south underneath SR 40 where it continues east. On the south side of SR 40 the stormwater runoff is collected in roadside swales and flows east to station 1387+50. The north side of SR 40 between station 1383+60 and station 1387+50 is collected is a series of ditch bottom inlets which flow east to station 1387+50. At station 1387+50 all stormwater runoff is directed north via storm sewer systems along the west side I-95 exit ramp for approximately 1190 feet where it discharges to an existing FDOT dry retention pond behind the Calvary Christian Center.

Between Station 1387+50 and 1398+13, SR 40 is collected in curb and gutters and directed to storm sewer inlets which flow to approximately station 1392+50 where the stormwater runoff is directed north via storm sewer systems along the east side of I-95 entrance ramp for approximately 1160 feet. It then crosses I-95 to the west and discharges to an existing FDOT dry retention pond behind the Calvary Christian Center. The existing FDOT dry retention pond currently treats Basin 5 of SR 40 and portions of the I-95 ramp/interchange. The pond is currently designed to treat and attenuate the six (6) lanes improvements of SR 40. The basin limits on I-95 extend from the high point in the Bridge over SR 40 to the south end of the dual bridges over the Tomoka River.

The entire basin along SR 40 is surrounded by commercial areas on both sides of the roadway.

5.5 FLOODPLAINS/FLOODWAYS

The Federal Emergency Management Agency (FEMA) has developed a Flood Insurance Rate Map (FIRM) for Volusia County. SR 40 primarily traverses Zone X of the FEMA designated floodplain, which are areas determined to be outside the 500-year floodplain. However, areas designated as Zone AE, which are areas in which the base flood elevations have been determined, are located along the roadway in two (2) locations. The first location is at cross drain CD-1 and is associated with a tributary to the Little Tomoka River. The base flood elevation was determined to be at elevation 13.00 feet NGVD 29 (11.89 feet NAVD) on the north side of the roadway. The south side of SR 40 at this location is designated as Zone A, which are areas where no base flood elevations are determined. The second location is associated with the Tomoka River, where the base flood elevation was determined to be at elevation 10.00 feet NGVD 29 (8.89 feet NAVD). The Tomoka River is a federally designated floodway. If the effective base flood elevations (BFE) are proposed to be modified by determination of hydraulic and hydrologic analysis, the designer should proceed with the Letter of Map Revision (LOMR) process with FEMA. A Conditional Letter of Map Revision (CLOMR) may be appropriate as well. For regulated floodway areas where there will be no change proposed to effective base flood elevations (BFE), a No-Rise Certification will be required for work in FEMA Floodways.

Please see the **FEMA Flood Insurance Rate Maps in Appendix 1, Figure 7**. Minor impacts to the 100-year floodplain are expected to occur with the SR 40 widening. For more information regarding Floodplain Impacts please refer to the **SR 40 PD&E Study Location Hydraulics Report.**

SECTION 6 PROPOSED DRAINAGE CONDITIONS

The stormwater runoff from SR 40 will be collected by roadside swales or curb and gutter, depending on the preferred typical section, which will flow to offsite wet detention and dry retention ponds because of the rural typical section proposed. The water quality treatment will be achieved through the utilization of both proposed and existing stormwater ponds. The existing drainage patterns will be maintained in the future condition. The project will have no adverse impacts to the area's water quality. Water quality treatment will be provided as required by the rules set forth by the SJRWMD and FDOT.

SECTION 7 PROPOSED PONDS

7.1 OVERVIEW

7.1.1 Stormwater Ponds

Within the project limits there are currently five (5) drainage sub-basins. For the sub-basins that currently have required water quality treatment sites (Basins 1, 3, 4, and 5), a more detailed volumetric analysis and/or ICPR pond routing simulation was conducted, in lieu of locating alternative pond sites, to determine feasibility of the existing treatment sites in accommodating the additional runoff from the newly proposed impervious areas. However, for the sub-basin which did not have required water quality treatment (Basin 2), three (3) alternative pond scenarios have been analyzed. Also, for contingency purposes, the pond alternative scenarios for Basin 2 were upsized by twenty percent (20%). The limits of the proposed basins begin and end at the same locations as the existing condition. The location of the outfall in the proposed condition is the same as the existing condition. Please refer to **Pond Design Calculations** in **Appendix 3** for the pond locations.

7.2 METHODOLOGY OF POND DETERMINATION

Based on the available information, only the hydraulically feasible and environmentally permissible alternative pond sites are considered. Alternative pond sites are analyzed and evaluated for the following parameters:

- Hydrologic and hydraulic factors such as existing ground elevation, soil types, estimated Seasonal High Water Table (SHWT) established by a review of the USDA NRCS soils and geotechnical investigations, stormwater conveyance feasibility, allowable hydraulic grade line (HGL), and basin outfalls;

- Environmental resource impacts including wetlands and threatened or endangered species;
- Floodplain impacts;
- Major utility conflict potential;
- Estimated right-of-way acquisition;
- Impacts to cultural resources; and
- Hazardous materials and contamination

Please note that the information for environmental impacts can be found in the SR 40 PD&E Study Natural Environment Report. Hazardous materials and contamination impacts, estimated SHWT, and cultural resources impacts are included in **Appendices 6** through **8**. All the information was gathered and incorporated into the **Alternatives Evaluation Matrices** in **Appendix 5**.

7.3 STORMWATER POND ALTERNATIVES

7.3.1 Basin 1

There are two (2) alternatives being considered for Basin 1. Both of the alternatives are offsite wet detention ponds. The particulars of the alternatives are discussed in the following sections. All calculations and parameters for each alternative are located in the **Pond Design Calculations** in **Appendix 3**. The preferred alternative for this basin is **Pond 1 (Alternative B** in the **Alternatives Evaluation Matrix** in **Appendix 5)**.

7.3.1.1 Pond 1

Pond 1 is located south of SR 40 at approximately station 1315+00. This pond alternative is an expansion of the existing SJRWMD permit (#4-127-67904-1) FDOT wet detention pond to treat and attenuate the additional impervious area from the newly proposed travel lanes on SR 40 in Basin 1. Through a review of the existing permit and as-built plans for this portion of SR 40, an ICPR model was created to determine the feasibility of the proposed pond expansion.

Pond 1 is designed as a wet detention pond with a control elevation set at 16.00 feet NGVD. This control elevation is lower than the previously permitted elevation of 17.00 NGVD, and is necessary in order to provide hydraulic grade line clearance from the low point of the roadway. In order to avoid impacting the hydroperiod of the adjacent wetland by drawing down the water table, an impervious liner was factored into the cost of this pond alternative. A control structure at the north east side of the pond provides the required treatment and attenuation for Basin 1. The outfall structure will discharge directly to CD-1, the tributary to the Little Tomoka River. The tailwater condition for the outfall structure as well as the boundary elevation for the routing model were set at the upstream end of CD-1 at elevation 15.60 feet NGVD, which was determined from the existing drainage maps.

24-30 hours). Pond 1 has a peak stage of 17.97 feet NGVD for the 25-year/24-hour storm event, providing 2 feet of freeboard to the inside berm of 20.00 feet NGVD. The post development peak rate of discharge is 10.72 cfs, which is less than the pre-development peak rate of discharge of 13.27 cfs.

Basin 1 is within WBID 2646: Little Tomoka River, which is impaired for dissolved oxygen, however, no causative pollutant has been identified. A pollutant loading analysis is not required for discharges to impaired waters where no causative pollutant has been identified. During final design, if nutrients have been identified as the causative pollutant, a pollutant loading analysis must be performed in order to ensure that the pollutant loading rates are not increased in the post development condition.

Preliminary pond sizing calculations indicates that this pond requires approximately 5.69 acres.

7.3.1.2 Pond 1-2

Pond 1-2 is located south of SR 40 at approximately station 1315+00. This pond alternative is an expansion of the existing SJRWMD permit (#4-127-67904-1) FDOT wet detention pond to treat and attenuate the additional impervious area from the newly proposed travel lanes on SR 40 for Basin 1 and Basin 2. It is anticipated that the runoff from the east side of CD-1 (Basin 2) can be conveyed via storm sewer underneath the cross drain. The cross drain invert is at elevation 8.3 feet NGVD, according to the permitted plans. A storm sewer pipe can cross underneath the box culvert, assuming a 30" pipe, the flow line would be approximately elevation 3.8 feet NGVD, allowing for 1 foot of clearance between the bottom of the box culvert and the top of the pipe. Since Pond 1-2 is a wet detention pond, it can be excavated to a depth which would allow the pipe to discharge into the pond. A copy of the permit calculations for this existing pond site can be found in **Appendix 9 – Existing Permit Calculations**. Through a review of the existing permit and as-built plans for this portion of SR 40, an ICPR model was created to determine the feasibility of the proposed pond expansion.

Pond 1-2 is designed as a wet detention pond with a control elevation set at 16.30 feet NGVD. This control elevation is lower than the previously permitted elevation of 17.00 feet NGVD, and is necessary in order to provide hydraulic grade line clearance from the low point of the roadway. In order to avoid impacting the hydroperiod of the adjacent wetland by drawing down the water table, an impervious liner was factored into the cost of this pond alternative. A control structure at the northeast side of the pond provides the required treatment and attenuation for Basin 1 and Basin 2. The outfall structure will discharge directly to CD-1, the tributary to the Little Tomoka River. The tailwater condition for the outfall structure as well as the boundary elevation for the routing model were set at the upstream end of CD-1 at elevation 15.60 feet NGVD, which was determined from the existing drainage maps.

Recovery analysis was not performed on this pond as it was assumed that a 6-inch orifice would provide the required recovery time as set forth by the SJRWMD (½ the treatment volume within 24-30 hours). Pond 1-2 has a peak stage of 18.12 feet NGVD for the 25-year/24-hour storm event, providing 1.88 feet of freeboard to the inside berm of 20.00 feet NGVD. The post development peak rate of discharge is 13.54 cfs, which is less than the pre-development peak rate of discharge of 31.23 cfs.

Basin 1-2 is within WBID 2646: Little Tomoka River, which is impaired for dissolved oxygen, however, no causative pollutant has been identified. A pollutant loading analysis is not required for discharges to impaired waters where no causative pollutant has been identified. During final design, if nutrients have been identified as the causative pollutant, a pollutant loading analysis must be performed in order to ensure that the pollutant loading rates are not increased in the post development condition.

Preliminary pond sizing calculations indicates that this pond requires approximately 10.44 acres.

7.3.2 Basin 2

There are three (3) alternatives being considered for Basin 2, one of which was described above in Section 7.3.1.2 Pond 1-2. All of the alternatives are offsite wet detention ponds. The particulars of the remaining alternatives are discussed in the following sections. All calculations and parameters for each alternative are located in the **Pond Design Calculations** in **Appendix 3**. The preferred alternative for this basin is the combination of **POND 2B-1 and Pond 2B-2 (Alternative B** in the **Alternatives Evaluation Matrix** in **Appendix 5)**.

7.3.2.1 Pond 2A

Pond 2A is located on the south side of SR 40 at approximately station 1321+00 and is designed to treat and attenuate stormwater runoff for Basin 2. This pond site sits upon a portion of one (1) parcel. According to the Volusia County Soil Survey, Pond 2A consists of Apopka (HSG A) soils and Farmton (HSG D) soils. The soil survey defines the seasonal high water depth in these soils to be >6.0 feet and 0 to 1.0 feet below existing ground, respectively. According to LIDAR data obtained for this pond site, the existing ground elevation at the perimeter of the pond is at approximately 22.00 feet NAVD. Geotechnical investigations revealed a seasonal high water table elevation at elevation 22.00 feet NAVD. This boring was taken in the portion of the pond which sits upon Farmton soils at elevation 24.00 feet NAVD. With the data compiled it was determined that Pond 2A will be a wet pond with the normal water level/control elevation set at elevation 16.60 feet, which is lower than the estimated SHWT in the area, but is necessary to maintain hydraulic grade line clearance from the low point in the roadway. In order to avoid impacting the hydroperiod of the adjacent wetland by drawing down the water table, an impervious liner was factored into the cost of this pond alternative. Preliminary pond sizing calculations indicates that this pond requires approximately 8.18 acres of area. This pond will outfall to the tributary to the little Tomoka River upstream of CD-1.

7.3.2.2 Pond 2B-1

Pond 2B-1 is located on the south side of SR 40 at approximately station 1321+00 and is designed to treat and attenuate a portion of Basin 2 between station 1320+50 and station 1345+00. This pond site sits upon a portion of one (1) parcel. According to LIDAR data obtained for this pond site, the existing ground elevation at the perimeter of the pond is at approximately 22.00 feet NAVD. Geotechnical investigations revealed a seasonal high water table elevation at elevation 20.00 feet NAVD. This boring was taken in the portion of the pond which sits upon Farmton soils at elevation 22.00 feet NAVD. With the data compiled it was determined that Pond 2B-1 will be a wet pond with the normal water level/control elevation set at elevation 16.60 feet, which is lower than the estimated SHWT in the area, but is necessary to maintain hydraulic grade line clearance from the low point in the roadway. In order to avoid impacting the hydroperiod of the adjacent wetland by drawing down the water table, an impervious liner was factored into the cost of this pond alternative.

This pond alternative is to be used in conjunction with either pond 2B-2 (**Alternative B** per the **Alternatives Evaluation Matrix** in **Appendix 5**) or pond 2B-3 (**Alternative C** per the **Alternatives Evaluation Matrix** in **Appendix 5**). Preliminary pond sizing calculations indicates that this pond requires 4.41 acres of area. This pond will outfall to the tributary to the little Tomoka River upstream of CD-1.

7.3.2.3 Pond 2B-2

Pond 2B-2 is located on the north side of SR 40 at approximately station 1335+00 and is designed to treat and attenuate a portion of Basin 2 between station 1335+00 and 1345+00. This pond is proposed to be used in conjunction with Pond 2B-1 (**Alternative B** per the **Alternatives Evaluation Matrix** in **Appendix 5**). This pond site sits upon one (1) parcel. According to the Volusia County Soil Survey, Pond 2B-2 consists of Basinger (HSG D) soils and Farmton (HSG D) soils. The soil survey defines the seasonal high water depth in these soils to be +2.0 to 1.0 and 0 to 1.0 feet below existing ground respectively. However, a geotechnical boring in this pond site indicates that the SHWT is approximately 5 feet below existing grade. The boring was taken at approximately elevation 17.00 feet NAVD, with the seasonal high water table at elevation 12.00 feet NAVD. According to LIDAR data obtained for this pond site, the existing ground elevation at the perimeter of the pond is at approximately 18.50 feet NAVD. With the data compiled it was determined that Pond 2B-2 will conservatively be a wet pond with the normal water level/control elevation set at elevation 12.00 feet. Preliminary pond sizing calculations indicates that this pond requires approximately 1.59 acres of area. This pond will outfall to the downstream end of CD-1.

7.3.2.4 Pond 2B-3

Pond 2B-3 is located north of SR 40 at approximately station 1335+00 and is designed to treat and attenuate a portion of Basin 2 between station 1335+00 and 1345+00. This pond is proposed to be used in conjunction with Pond 2B-1 (**Alternative C** per the **Alternatives Evaluation Matrix** in **Appendix 5**). This pond site sits upon one (1) parcel. According to the Volusia County Soil Survey, Pond 2B-3 consists of Farmton (HSG D) soils. The soil survey defines the seasonal high water depth in these soils to be 0 to 1.0 feet below existing ground. However, a geotechnical boring in this pond site indicates that the SHWT is approximately 5 feet below existing grade. The boring was taken at approximately elevation 18.00 feet NAVD, with the seasonal high water table at elevation 13.00 feet NAVD. According to LIDAR data obtained for this pond site, the existing ground at the perimeter of the pond is at approximately 17.50 feet NAVD. With the data compiled it was determined that Pond 2B-3 will be a wet pond with the normal water level/control elevation set at elevation 13.00 feet. Preliminary pond sizing calculations indicates that this pond requires approximately 1.79 acres of area. This pond will outfall to the downstream end of CD-1.

7.3.3 Basin 3

There are two (2) alternatives being considered for Basin 3. The particulars of each alternative are discussed in the following sections. All calculations and parameters for each alternative are located in the **Pond Design Calculations** in **Appendix 3**. The preferred alternative for this basin is a combination of **Ponds 3A and 3B**. It should be noted that an option of using an offline system with an exfiltration trench to attenuate the runoff was explored. However, based on the available information at the time (SHWT, existing ground elevation, and required storage capacity) this option was deemed to be unfeasible because in order to maintain base clearance with the roadway the required trench size would be in the SHWT. During final design, once more accurate information about the SHWT in the area is obtained; this option should be explored as an option in order to reduce right-of-way acquisition costs.

7.3.3.1 Pond 3 (Online System)

Pond 3 is located south of SR 40 at approximately station 1353+00. It consists of the existing pond which is proposed to be expanded into the adjacent parcel to the west. This pond alternative is an expansion of the existing permitted (#4-127-23005-2) FDOT dry retention pond. The existing pond site is approximately 0.96 acres in size; the pond berm is set at elevation 21.00 feet NGVD while the bottom is set at elevation 13.00 feet NGVD and has an existing underdain system at elevation 9.75 feet NGVD which is used to draw down the water table to provide sufficient clearance between it and the pond bottom. This pond expansion is proposed to be an online dry retention system designed to treat the runoff from Basin 3 and attenuate the difference of pre vs. post runoff volume from the existing permitted condition as well as the newly proposed impervious travel lanes and sidewalks. Preliminary pond sizing calculations indicates that this pond requires approximately 1.74 acres of area. This equates to an approximately 0.78 acre expansion of the pond site. According to geotechnical boring conducted on the site, the SHWT at this location is expected to be approximately 6.5 below existing grade. The base of aquifer, due to a clayey confining layer, is at 7 feet below existing grade. The horizontal (k_h) and vertical (k_v) permeability rates were each determined to be at approximately 40 ft/day, with a fillable porosity of 25%.

7.3.3.2 Pond 3A and 3B (Offline System)

Pond 3A and 3B is a proposed offline dry retention system where treatment will occur in the existing FDOT Pond 3A and attenuation will occur in a new site, Pond 3B. Pond 3A is the existing footprint of the FDOT pond already located on the south side of SR 40 at approximately station 1359+00. Pond 3B is a proposed pond located on the north side of SR 40 at approximately station 1361+00. In the original permit (#4-127-23005-2), attenuation was accomplished in the roadside swales for this basin, and required approximately 0.50 ac-ft of attenuation volume. With the additional impervious area proposed in this basin, another 0.62 ac-ft of attenuation volume is required. In total, 1.12 ac-ft of attenuation volume is required.

According to the Volusia County NRCS Soils Survey, Pond 3B consists of Apopka (HSG A) soils, Quartzipsamments (HSG A) soils, and Tavares (HSG A) soils. The soil survey defines the seasonal high water depth in these soils to be between 3.5 and >6.0 feet below existing ground. According to LiDAR data obtained for this pond site, the existing ground slopes drastically from Bayberry Drive toward the Tomoka River. At Bayberry Drive, the existing ground is at elevation 13.00 feet and drops to elevation 4.00 feet as it approaches the Tomoka

River. Soil boring performed at this pond site by Antillian Engineering Associates, Inc. indicate that groundwater was encountered approximately nine (9) feet below existing grade in boring 3B-PB1 and four (4) feet in 3B-PB2. The average SHWT elevation is at approximately elevation 5 feet. This pond site would require approximately 1.17 acres of right-of-way.

7.3.4 Basin 4

There is one (1) alternative being considered for Basin 4. This alternative is the existing offsite FDOT dry retention pond. The particulars of the alternative are discussed in the following sections. All calculations and parameters for the alternative are located in the **Pond Design Calculations** in **Appendix 3**. The preferred alternative for this basin is **Pond 4**.

7.3.4.1 Pond 4

Pond 4 is an existing dry retention pond located on the south side of SR 40 at approximately station 1370+00. This pond site will require re-grading and expansion within the existing right-of-way to accomplish the stormwater treatment and attenuation. Since Pond 4 is the only alternative within Basin 4 for stormwater treatment and attenuation, a review of the existing permit and as-built plans for this portion of SR 40 was performed so that a PONDS model could be created to determine the feasibility of the proposed pond re-grading and expansion within the right-of-way.

Pond 4 was designed as an online dry retention pond with the bottom elevation set at 13.50 feet NGVD. An emergency overflow structure at the northwest side of the pond will provide emergency relief for extreme storm events. The emergency overflow structure will discharge directly to the Tomoka River. Geotechnical investigations performed on this pond site provided the recovery rates used in the PONDS model. Preliminary soil properties for this pond site show the estimated seasonal high ground water level at a depth of 9.5 feet below existing grade due to a confining clayey layer at 10 feet below existing grade. Horizontal (k_h) and Vertical (k_v) permeability rates were each determined to be 40 feet/day, with a fillable porosity of 25%.

Recovery of the treatment and attenuation volume was performed using the aforementioned soil properties and governed by the rules set forth by SJRWMD. In the original permit (#4-127-23005-2), attenuation was accomplished in the roadside swales for this basin, and required approximately 0.64 ac-ft of attenuation volume. With the additional impervious area proposed in this basin, another 0.53 ac-ft of attenuation volume is required. In total, 1.17 ac-ft of attenuation volume is required to be recovered within 14 days. The PONDS recovery model indicates that Pond 4 can recover the entire attenuation volume within 60 hours.

This basin is located within the Tomoka Recharge Area as defined by SJRWMD, which requires the treatment of the greater of the first 3 inches of runoff from the DCIA over the most effective recharge area (type A soils), the first 1.25 inches of runoff from the impervious area or, the first 0.50 inches of runoff from the total basin area. The Tomoka River is also considered an Outstanding Florida Waterbody, which requires an additional 50% treatment volume. SJRWMD requires that the pond recover this volume within 72 hours. The required treatment volume for this basin is controlled by the Tomoka Recharge criteria. This basin requires 0.97 ac-ft of treatment volume. The PONDS recovery model indicates that Pond 4 can recover the entire treatment volume within 36 hours (factor of safety of 2).

PONDS routing analysis was not performed on this pond as it was assumed that the additional volume provided in the pond could accommodate the additional runoff. Volumetrically, this pond site requires 2.15 ac-ft of treatment and attenuation volume, but provides 2.64 ac-ft of treatment and attenuation volume.

7.3.5 Basin 5

There is one (1) alternative being considered for Basin 5. The alternative is an existing offsite FDOT dry retention pond which has previously been designed for the six laning of SR 40. The particulars of the alternatives are discussed in the following sections. All calculations and parameters for this alternative are located in the **Pond Design Calculations** in **Appendix 3**. The preferred alternative for this basin is **POND 5**.

7.3.5.1 Pond 5

Pond 5 is an existing dry retention pond located approximately 1100 feet north of SR 40 behind the Calvary Christian Center and east of Interstate 95. This pond treats and attenuates for I-95 and the proposed six laning of SR 40 from Booth Road to Williamson Boulevard. The basin limits on I-95 extend from the high point of the bridge over SR 40 to the south end of the dual bridges over the Tomoka River, a distance of approximately 1923 feet and includes the ramps from the reconstructed SR 40 interchange. The existing pond site is approximately 1.77 acres at the bottom (EL. 14.76 feet NGVD) and outfalls to the Tomoka River via the existing roadside swale along I-95. This pond was previously permitted (#4-127-23036-5) in the Interstate 95/SR 9 – US 92 to Airport Boulevard Overpass project and is referred to as Pond 7 for that project.

The permitted calculations showed no breakdown of area between the proposed six lane section of I-95 and the future six lane section of SR 40. The only items provided were the ultimate basin area (Basin 1000A: 42.23 ac), Pavement area (23.841 ac) and grassed area (18.389 ac), along with a drainage basin map. The approach taken was to replicate the basin area delineation in Microstation, and compare it to the permitted ultimate condition area. The area delineated in Microstation was computed to be 36.95 acres; 5.28 acres less than the permitted ultimate condition. The proposed impervious area along SR 40 was also measured in Microstation and resulted in 19.58 acres of total impervious area, which included offsite areas, I-95, and SR 40 impervious areas. Since the measured areas in Microstation were less than the permitted areas, the standards to which the permit was issued should remain.

This pond site was originally much larger and extended further north toward the Tomoka River. This caused the pond to encroach into the Riparian Habitat Protection Zone (RHPZ). According to a memorandum dated January 18, 2001 about a meeting between Ginger Sinn PWS, and Glenn Lowe and Mike Register (both with SJRWMD), the pond size was reduced to minimize the impacts to the RHPZ but that it could no longer meet the criteria set forth for water quality treatment (Tomoka Recharge Criteria). To which Mr. Lowe pointed out that “in some instances impacting sensitive environments in order to meet water quality criteria does not make sense.” From the permitted calculations, it appears that the Tomoka Recharge criteria were waived for this pond site and normal offline dry retention criteria was used. However, an extra 50% treatment volume was still applied since the Tomoka River is an Outstanding Florida Waterbody. A copy of this memorandum can be found in **Appendix 12 – Correspondence**.

The permitted calculations and pre-post drainage maps are provided in **Appendix 3** along with the delineated basin area showing the Microstation measured basin area, impervious area and pervious area.

SECTION 8 CONCLUSION

Alternative pond sites have been identified along the project limits. The analysis estimates right-of-way needs using a volumetric analysis and/or pond routing simulations, which accounts for water quality treatment and water quantity for runoff attenuation. The right-of-way cost estimate found in this report is a budget tool used by the Department to estimate total acquisition costs associated with each pond site and to budget the appropriate funds for acquisition. Right-of-way cost estimates are not real estate appraisals and do not reflect market value. In addition, FDOT uses appraisals that comply with the Uniform Standards of Professional Appraisal Practice (USPAP) for acquisition purposes.

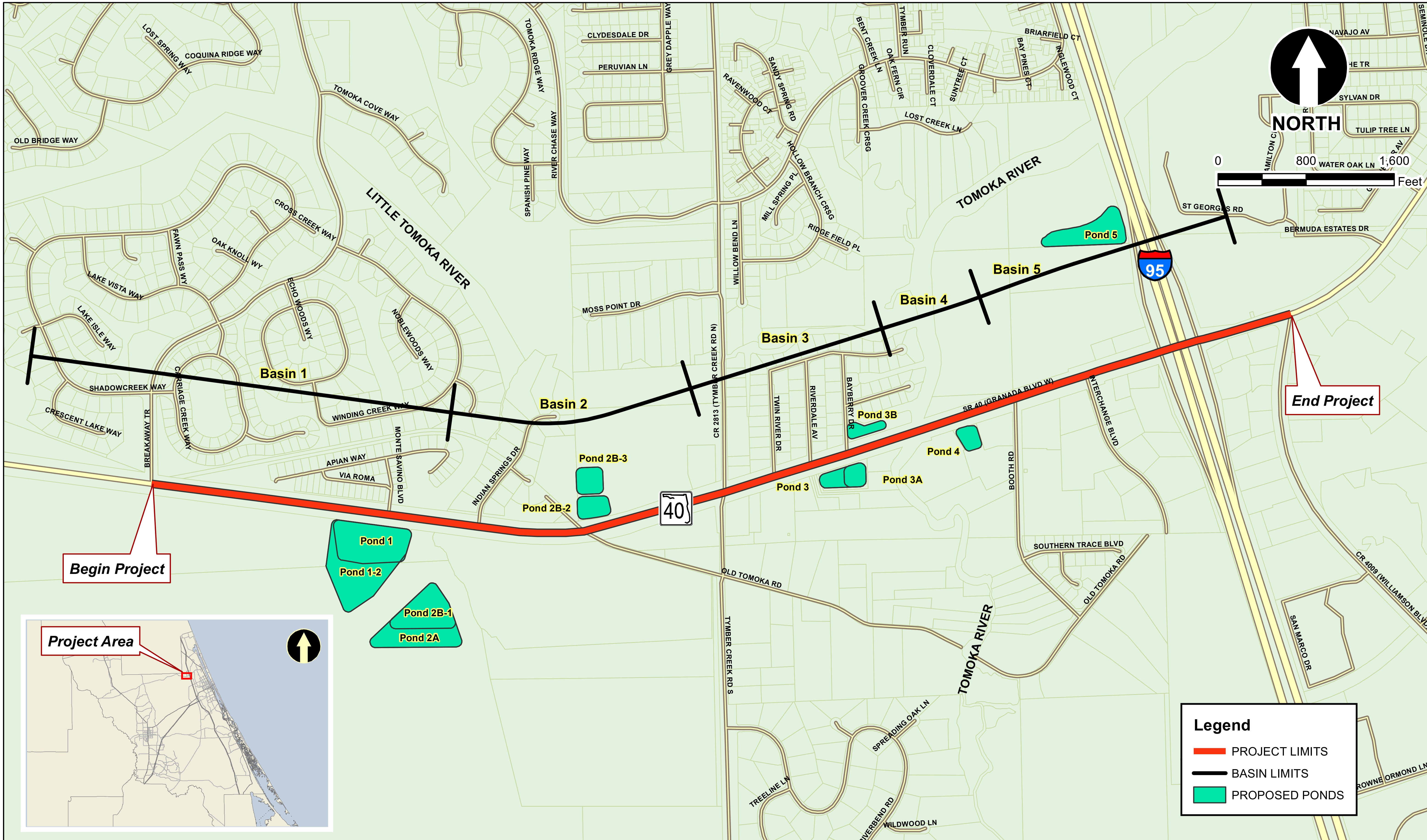
Pond sizing calculations as well as graphics showing the roadway alignment and associated pond site alternatives are included in **Appendices 3** to **5** of this Pond Siting Report. Please note that the recommendations were based on pond sizes and locations determined from preliminary data calculations, reasonable engineering judgment, and assumptions. Pond sizes and locations may change during final design as more detailed information on SHWT, wetland normal pool elevation, final roadway profile design; TMDL requirements, etc. become available. Please see **Table 7** for a **Summary of Pond Recommendations**.

Table 7 – Summary of Pond Recommendations

Basin	Preferred Pond Alternative	Right of Way Area (ac.)	Cost ($)
1	Pond 1	5.69	$1,256,504
2	2B-1 and 2B-2	4.41 and 1.59	$3,266,407
3	Pond 3A and 3B	0.96 and 1.17	$401,895
4	Pond 4	0.90	$0
5	Pond 5	3.56	$0

APPENDIX 1

Figures



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from Breakaway Trail to Williamson Blvd

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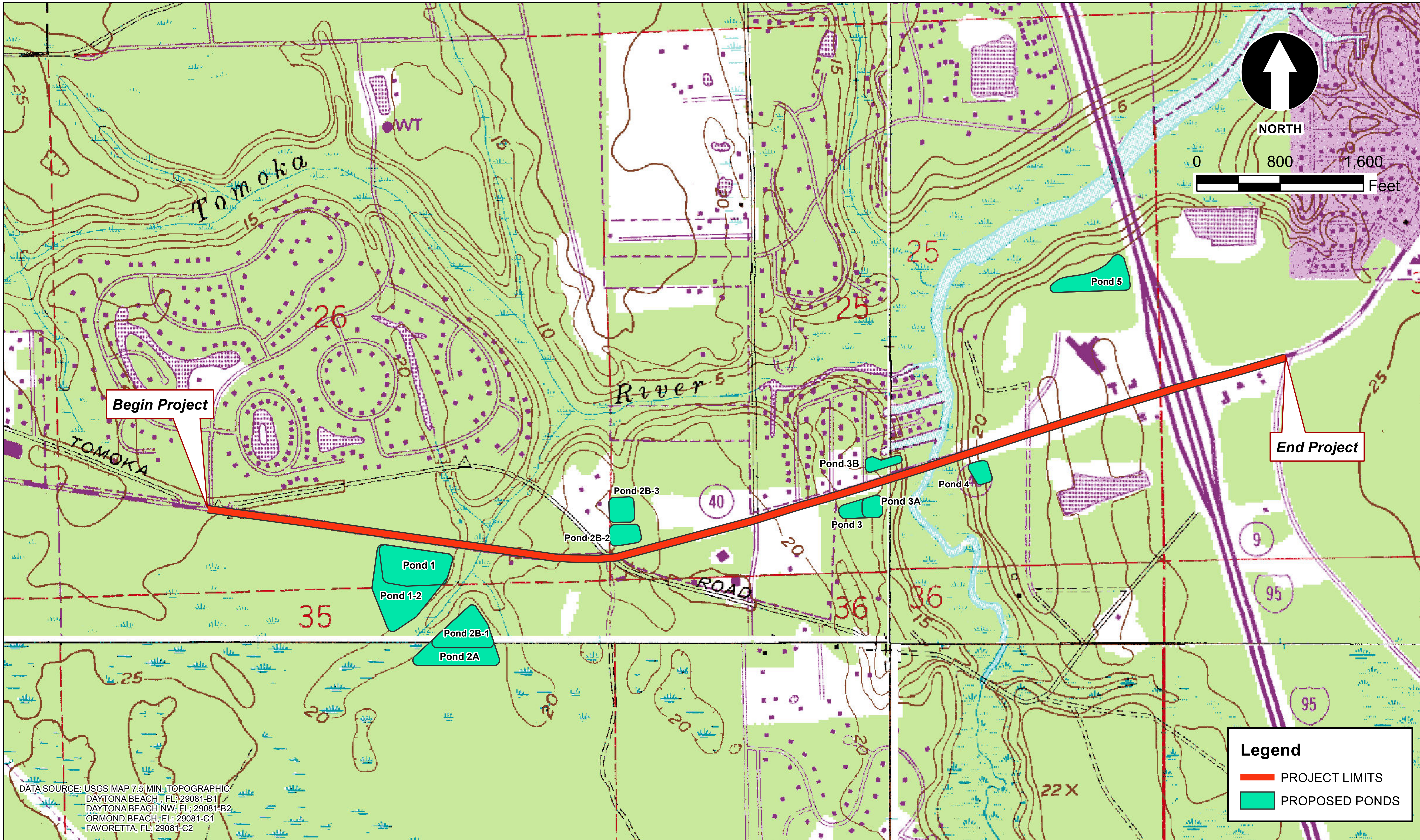
PROJECT LOCATION MAP

FIGURE 1



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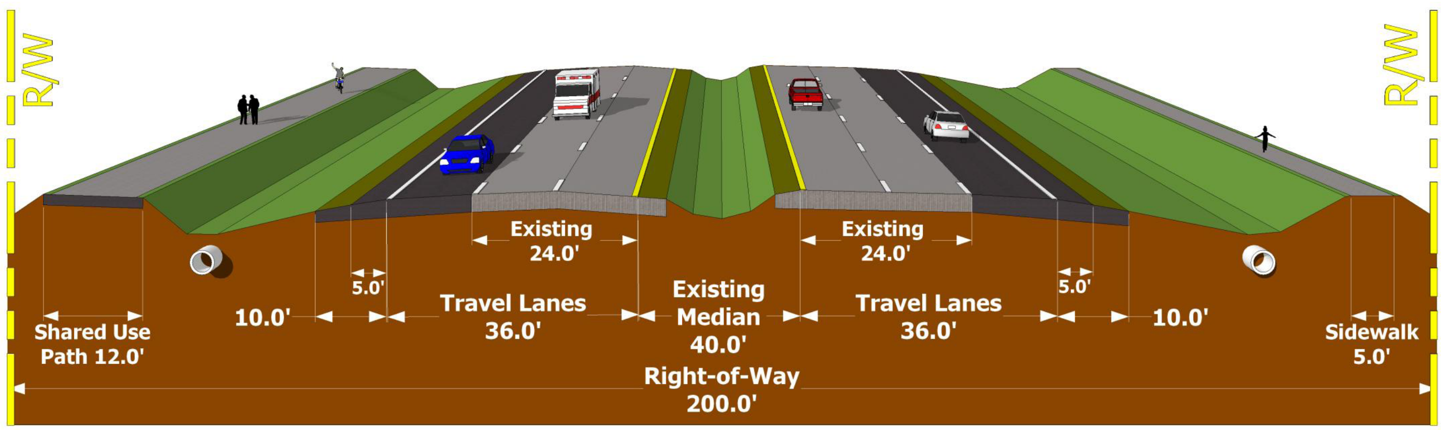
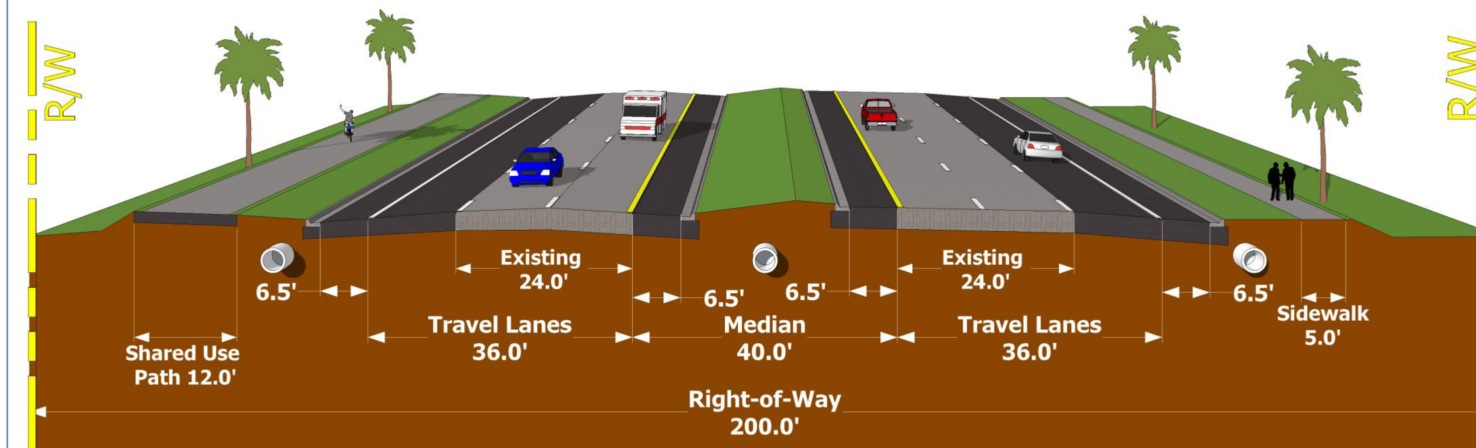
USGS QUAD MAP

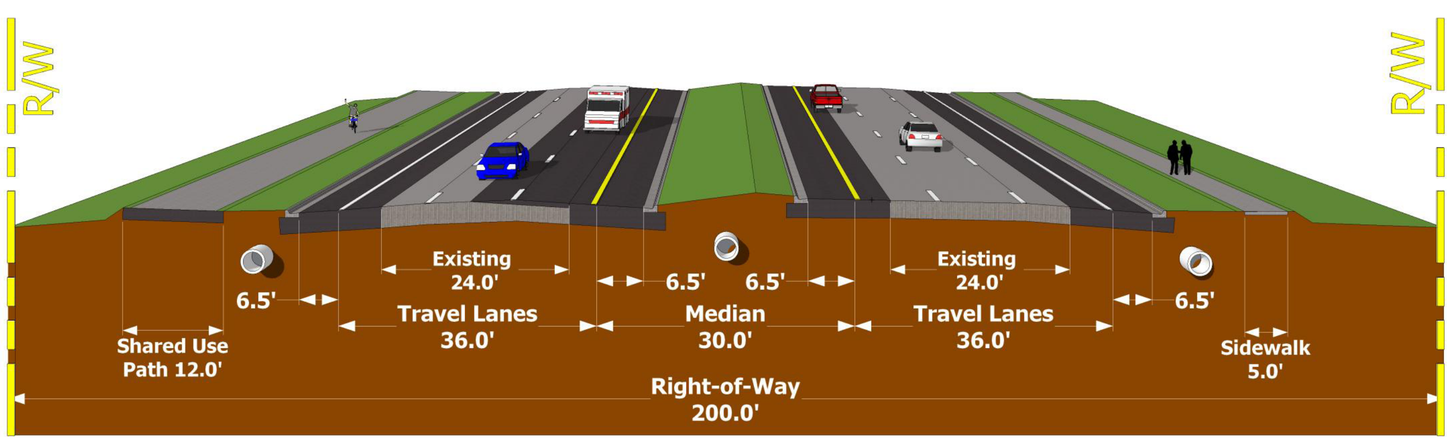
FIGURE 2



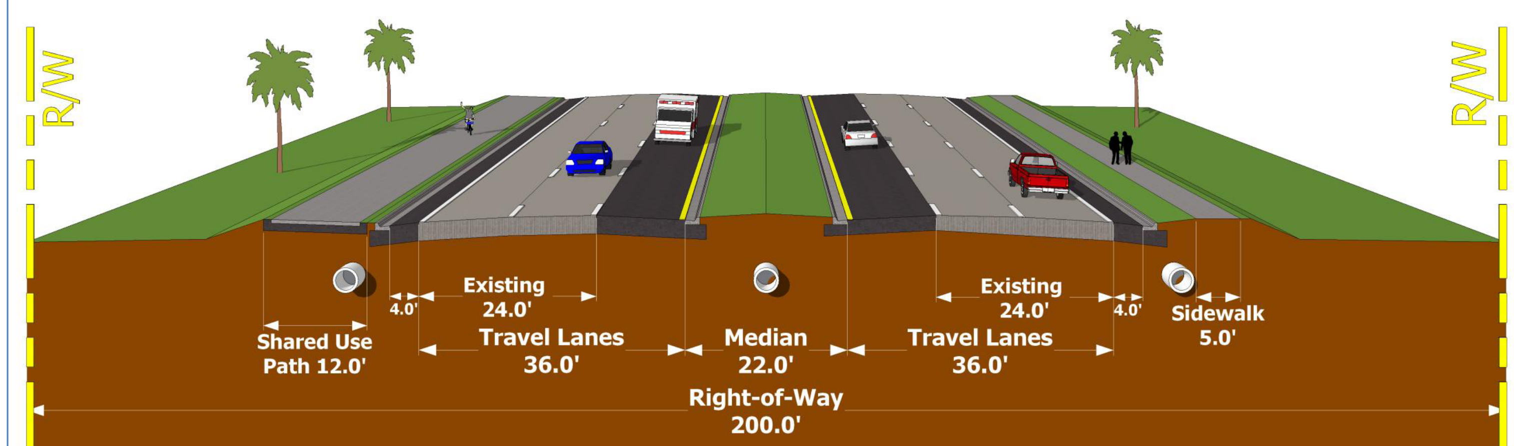
Breakaway Trail to Tymber Creek Road
Typical Section 1 – Rural with Wide Median



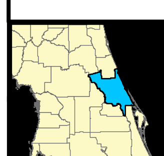
Breakaway Trail to Tymber Creek Road
Typical Section 3A – High Speed Urban w/ 40' Median
(50mph Design Speed)



Tymber Creek Road to Interchange Boulevard
Typical Section 3B – High Speed Urban w/ 30' Median
(50mph Design Speed)



Tymber Creek Road to Interchange Boulevard
Typical Section 4 – Urban
(45mph Design Speed)



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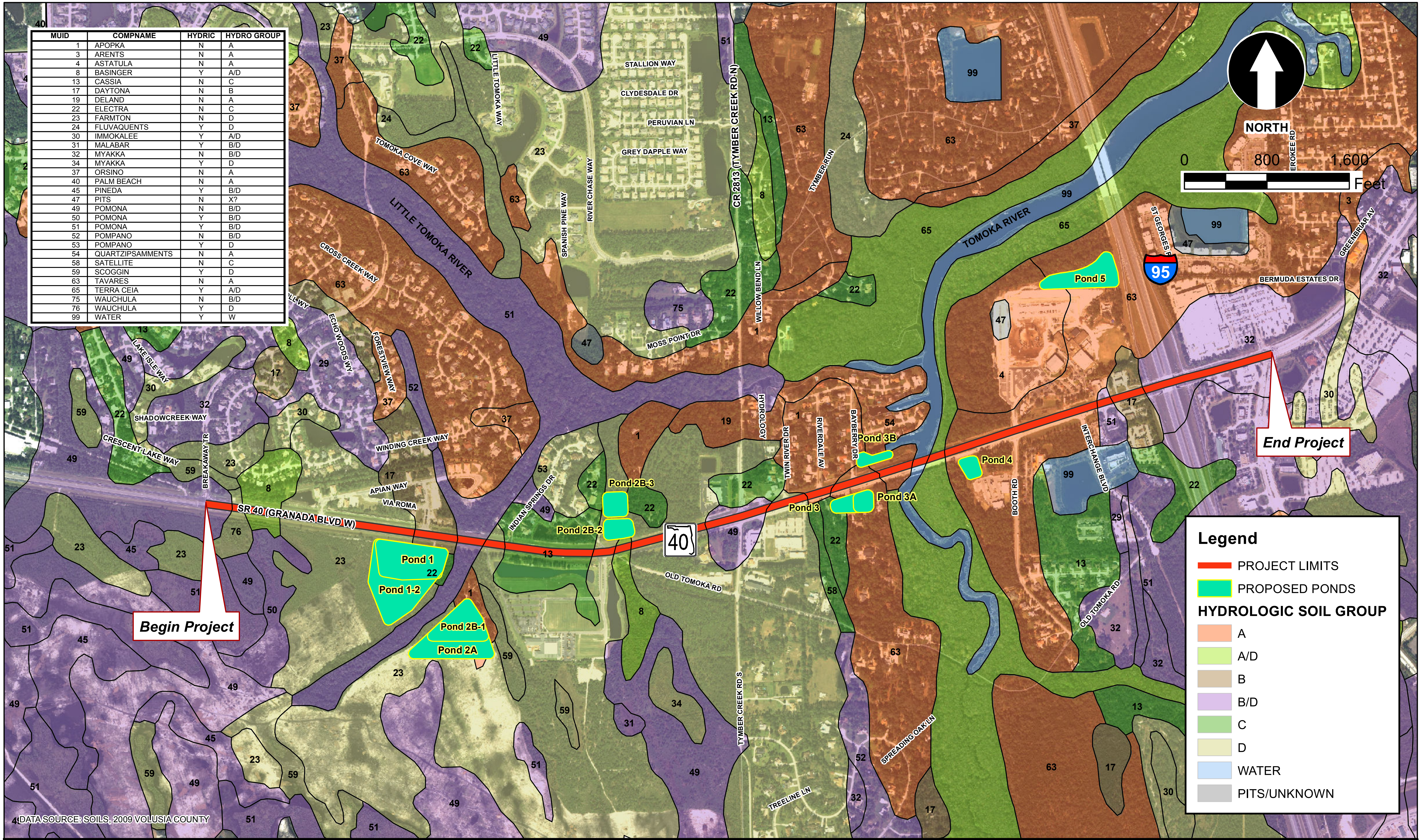
PROPOSED TYPICAL SECTION

FIGURE
3



MUID	COMPNAME	HYDRIC	HYDRO GROUP
1	APOPKA	N	A
3	ARENTS	N	A
4	ASTATULA	N	A
8	BASINGER	Y	A/D
13	CASSIA	N	C
17	DAYTONA	N	B
19	DELAND	N	A
22	ELECTRA	N	C
23	FARMTON	N	D
24	FLUVAQUENTS	Y	D
30	IMMOKALEE	Y	A/D
31	MALABAR	Y	B/D
32	MYAKKA	N	B/D
34	MYAKKA	Y	D
37	ORSINO	N	A
40	PALM BEACH	N	A
45	PINEDA	Y	B/D
47	PITS	N	X?
49	POMONA	N	B/D
50	POMONA	Y	B/D
51	POMONA	Y	B/D
52	POMPANO	N	B/D
53	POMPANO	Y	D
54	QUARTZIPSAMMENTS	N	A
58	SATELLITE	N	C
59	SCOGGIN	Y	D
63	TAVARES	N	A
65	TERRA CEIA	Y	A/D
75	WAUCHULA	N	B/D
76	WAUCHULA	Y	D
99	WATER	Y	W

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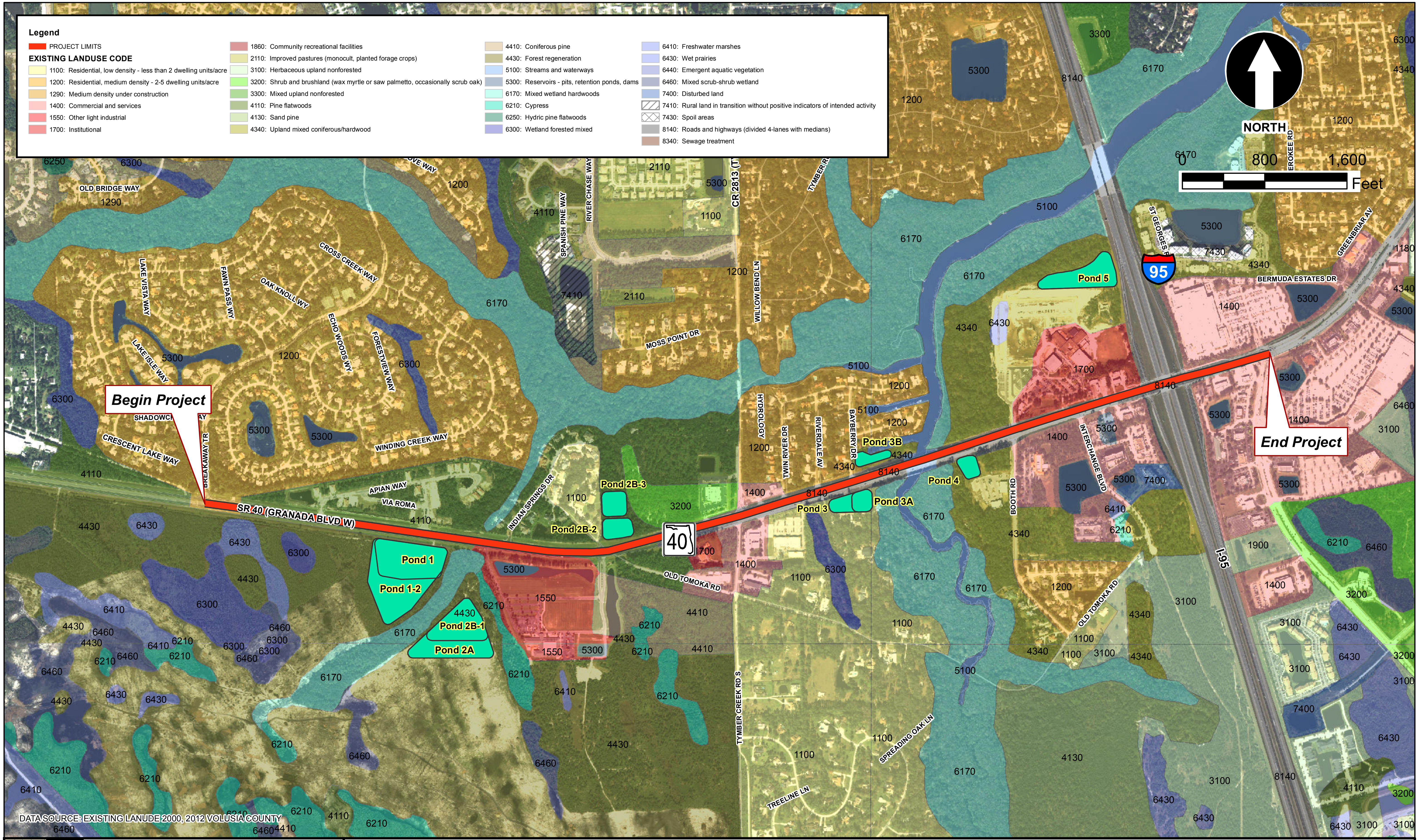
NRCS SOILS MAP

FIGURE 4



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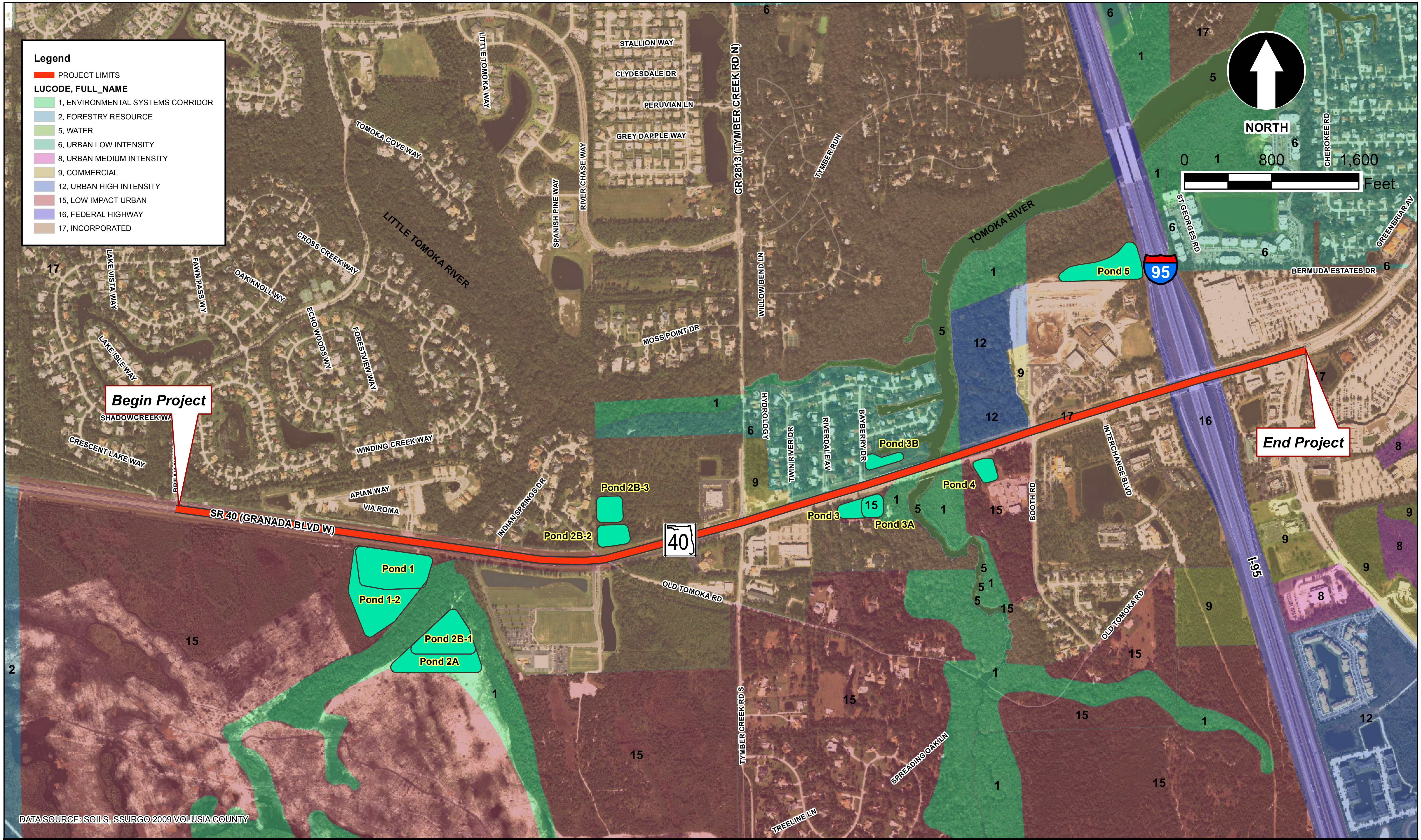
EXISTING LAND USE MAP

FIGURE 5



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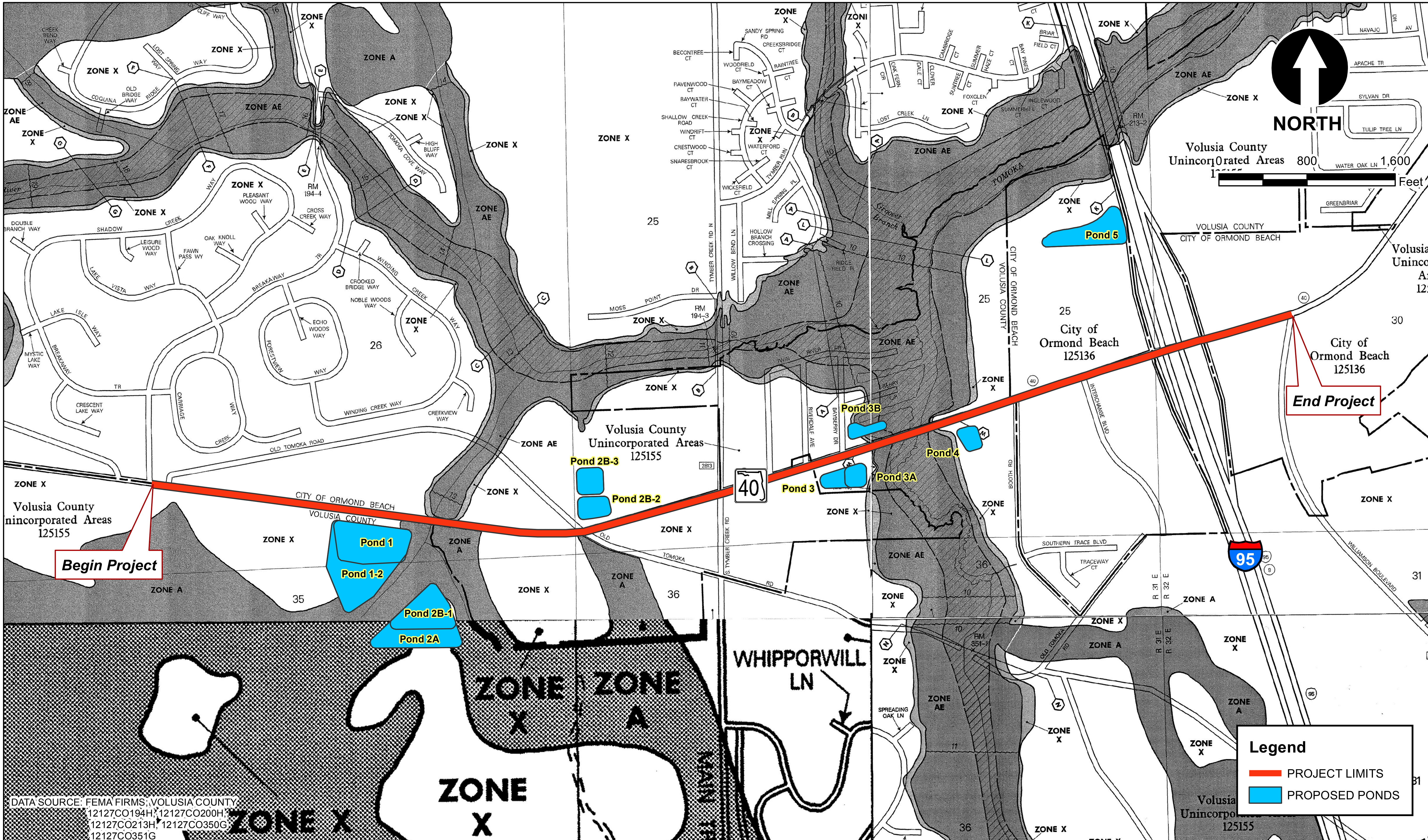
FUTURE LAND USE MAP

FIGURE 6



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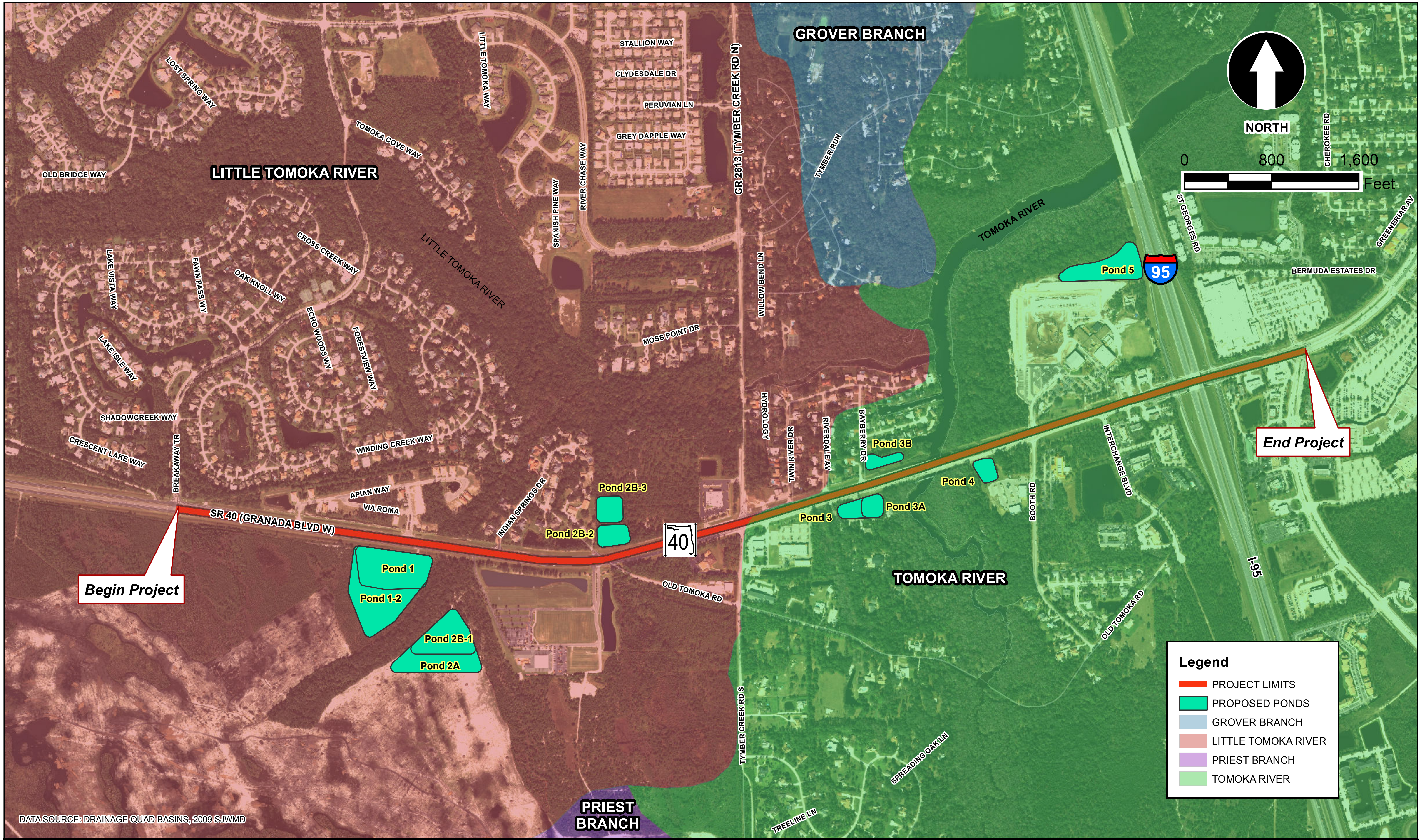
FEMA FIRM MAP

FIGURE 7



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SJRWMD WATERSHED MAP

FIGURE 8

APPENDIX 2

Drainage Criteria Matrix

Drainage Design Criteria Matrix
SR 40 PD&E Study
From Breakaway Trail to Williamson Boulevard

Volusia County, Florida
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Design Parameter		SJRMWD Criteria	FDOT Criteria	Drainage Criteria to be Used
Storm Sewer	Design Frequency and Analysis for Pipe Hydraulics	N/A	Rational Method required. General design = 3-year/24-hour (P=5.5 in) Composite C-value - Impervious=0.95, Pervious=0.20	FDOT
	Spread	N/A	Analyze with 4 in./hr. rainfall intensity. Based on design speed, 1/2 of lane shall remain clear (45mph or less). Keep 8' of lane clear (between 45 mph to 55 mph). With shoulder gutter, 10-year freq. storm shall not exceed 1'-3" outside gutter toward front slope.	FDOT
	Inlet Types	N/A	FDOT Inlets (Design Standards 2008)	FDOT
	Inlet Placement	N/A	Inlets shall be placed at all low points in the gutter grade. For curb inlets on a continuous grade, a maximum spacing of 300 feet shall be used unless spread calculations indicate a greater spacing is acceptable. Curb inlets shall be placed at the critical section prior to the level section in superelevated transitions. Refer to the FDOT Drainage Manual Section 3.7.1.1	FDOT
	System Velocity	N/A	Min. velocity = 2.5 fps when flowing full	FDOT
	Pipe Lengths	N/A	18" Pipe - max. 300 ft. 24" to 36" - max 400 ft. 42" and larger - max. 500 ft.	FDOT
	Hydraulic Grade Line	N/A	Friction and energy losses due to pollution control and utility conflict structures shall be considered for the storm sewer design event (3-year/24-hour). If minor losses are not considered in addition to the above losses, the HGL for the design storm shall be at least 1 ft. below the theoretical gutter elevation. If all minor losses are considered, the HGL elevation can reach the gutter elevation. This criteria does not apply to DBI's or structures where temporary ponding is not objectionable.	FDOT (minor losses will be considered in the storm sewer design)

Drainage Design Criteria Matrix
SR 40 PD&E Study
From Breakaway Trail to Williamson Boulevard

Design Parameter		SJRMWD Criteria	FDOT Criteria	Drainage Criteria to be Used
Storm Sewer	Design Tailwater	N/A	When discharging to stormwater ponds, the tailwater shall be the elevation of the pond at the peak inflow into the pond for the storm sewer design event (3-year/24-hour). The tailwater shall be computed assuming the pond control orifice plugged and starting initial pond elevation at the weir. For free flowing ditches - normal depth in the ditch at the storm drain outlet for storm drain design event (may differ from ditch design event). For ditches with downstream control - the higher of either the stage due to free flow conditions or the maximum stage at the storm drain outlet due to backwater from the downstream control using flows from the storm drain design event. When discharging to existing storm drain systems - the tailwater shall be the elevation of the HGL of the existing system at the location of the connection for the storm drain design storm event.	FDOT
	Pipe Clearance	N/A	When flexible pavement is used, the minimum distance between the bottom of the roadway base material and the top of the pipe (outside edge) is 7" for concrete pipe and at least 12" for other pipe materials as specified in the FDOT Standard Index 205. Utilities - If utility has been accurately located, clearance between the outside of the storm drain pipe and the utility shall not be less than 6 in. If the location of the utility has been estimated, the clearance should not be less than 1ft.	FDOT
	Pipe Material	N/A	Optional Material Analysis shall be performed for this project.	FDOT
	Pipe Size	N/A	Trunk line and lateral, min. = 18". Does not apply to discharge systems from Stormwater Mgmt. Facilities	FDOT

Drainage Design Criteria Matrix
SR 40 PD&E Study
From Breakaway Trail to Williamson Boulevard

Design Parameter		SJRMWD Criteria	FDOT Criteria	Drainage Criteria to be Used
Culvert Design	Minimum Size and Length	N/A	Crossdrain = 18"; Median Drain = 15"/18"; Side Drain = 15"/18"; Box Culvert = 3' x 3' (Precast) 4' x 4' (Cast in Place). Pipe lengths shall follow the criteria for storm sewers. Max. Length for box culverts=500 feet.	FDOT
	Design Procedure	N/A	Refer to the FDOT Drainage Manual Chapter 4 and the FDOT Drainage Handbook Culvert Design.	FDOT
Hydrologic and Hydraulic Calculations for all other Drainage Features	Peak Discharge and Runoff Volume	Use one of the following methods: 1.) SCS Curve Number and Unit Hydrograph Method, 2.) Santa Barbara Urban Hydrograph Method, or 3.) USACOE HEC-1 Programs 4.) Other hydrographs methods approved by the District	For Open Channels and Crossdrains- Use gauge data when available. If not available, use regional or local regression equations (USGS) or use the rational equation for drainage areas up to 600 acres. For Stormwater Management Facilities, one of the following is acceptable: (1) for basins with a tc of 15 minutes or less, the modified rational method shall be used OR (2) the SCS Unit Hydrograph method shall be used.	SJRWMD - SCS Curve Number and Unit Hydrograph Method
	Design Frequency	Mean-annual storm and 25-year storm for Stormwater Mgmt Facilities	Roadside Ditches-10-yr.; Outfall Ditches and Canals-25-yr.; Off-site crossdrains-50-yr (High use or essential).; Stormwater Management Facilities-Critical Duration Analysis (Chapter 14-86)	SJRWMD and FDOT Critical Duration (if applicable)
	Time of Concentration (tc)	TR-55 (Overland flow, storm sewer flow, channel flow). Minimum Tc=10 minutes.	Velocity Method (Overland flow using Kinematic Wave equation, Shallow Channel Flow using V=kS^0.5, main channel flow using Manning's equation). Minimum Tc=10 minutes. TR-55 methodology acceptable.	TR-55 methodology (SJRWMD and FDOT accepted)
	Design Storm Duration	24-hour storm duration for stormwater mgmt facilities	24-hour storm duration for closed drainage systems and roadside ditches. Chapter 14-86 - Critical Duration Analysis (1-hour through 10-day duration)	SJRWMD and FDOT Critical Duration (if applicable)
	Rainfall Distributions	Modified NRCS Type II Florida Distribution (SJRWMD - Open Basins), SJRWMD96 Distribution (SJRWMD - Closed Basins)	FDOT Rainfall Distributions	SJRWMD and FDOT Critical Duration (if applicable)

Drainage Design Criteria Matrix
SR 40 PD&E Study
From Breakaway Trail to Williamson Boulevard

Design Parameter		SJRMWD Criteria	FDOT Criteria	Drainage Criteria to be Used
Hydrologic and Hydraulic Calculations for all Other Drainage Features	Water Quality/Treatment (Wet Detention/Dry Retention)	Required treatment volume = 1" over entire developed area or 2.5" over the impervious area, whichever is greater (Wet Detention Systems). Off-line Retention = 1.25" over the impervious area or 0.5" over entire developed area, whichever is greater. On-line Retention = 0.5" over entire developed area plus volume specified in Off-Line Retention. Pre - Post Pollutant Loading Calculations for Impaired Water Body (Lake Jesup) will be required.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Water Quantity/Attenuation	**Open Basins:** Post-development peak discharges shall be at or below pre-development peak discharges for the Mean Annual Storm (2.3 year/24-hour) and the 25-year/24-hour storm events. **Closed basins:** retain the runoff volume difference between the pre and post development for the 25-year/96-hour storm event.	Post-development peak discharge cannot exceed pre-development peak discharge for all frequencies and durations from the 2-year/1-hour storm event to the 100-year/10-day storm event and those in between (Critical Duration Analysis)	SJRWMD and FDOT Critical Duration (if applicable)
	Off-site Flows	N/A	When possible, offsite discharges should be separated from the FDOT facilities.	FDOT
Retention and Detention Facilities	Pond Configuration - Wet Ponds (for additional info, see Open Drainage Facilities)	Requires a maximum pond depth of 12 ft. and a mean depth (pond volume divided by pond area at the control elevation) between 2 and 8 ft. A max. length:width of 2:1.	Pond Depth specified by Regulatory Agency (SJRWMD).	SJRWMD
	Residence Time (Wet Detention)	Shall be designed to provide at least a 14-day residence time during the wet season. Additional volume may be required for systems discharging to Class I, II, or II or OFW waterways.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD

Design Parameter		SJRMWD Criteria	FDOT Criteria	Drainage Criteria to be Used
Retention and Detention Facilities	Littoral Zone (Wet Detention)	Shall be sloped 1:6 or flatter and contain at least 30% of the pond surface area at the control elevation. The treatment volume should not cause the pond level to rise more than 18" above the control elevation unless the applicant can demonstrate that the littoral shelf vegetation can survive depths greater than 18". Within 24 months of completion of the system, 80% coverage of the littoral zone by suitable aquatic plants is required. Construction of a littoral zone can be avoided only if one of the following criteria is met: 1.) An additional 50% of the appropriate permanent pool volume is provided; or 2.) Pre-treatment of the stormwater prior to entering the stormwater treatment pond as required in Section 14-11 of the SJRWMD Applicant's Handbook.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Water Quality/Quantity Volume Recovery Rate (Wet Detention/Dry Retention)	**Wet Detention:** The outfall control structure shall be designed to drawdown 1/2 the required treatment volume within 24 and 30 hours following a storm event, but no more than 1/2 of this volume will be discharged within the first 24 hours. **Retention Systems:** drawdown the required treatment volume within 72 hours following a storm event. Closed Basins: Drawdown runoff volume difference between the pre and post for the 25-year/96-hour storm within 14 days.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD

Drainage Design Criteria Matrix
SR 40 PD&E Study
From Breakaway Trail to Williamson Boulevard

Design Parameter		SJRMWD Criteria	FDOT Criteria	Drainage Criteria to be Used
Retention and Detention Facilities	Orifice/Bleeder Devices (Wet Detention)	Drawdown devices smaller than 6 square inches of cross-section area that is 2 inches wide or less than 20º for "V" notches shall include a device to eliminate clogging.	Specified by the Regulatory Agency (SJRWMD)	SJRWMD
	Skimmer	Systems which receive stormwater from areas with greater than 50% impervious area (excluding water bodies) or which are a potential source of oil and grease, must include a baffle, skimmer, grease trap or other mechanism suitable for preventing oil and grease from leaving the stormwater system in concentrations that would cause a violation of water quality standards.	Oil skimmer is required and should be designed to function from an elevation 6 in. below the elevation of inflow to the outfall control structure to an elevation 6 in. above the DHW of the pond. It should also cover all directions of inflow to the outfall control structure.	FDOT
	Erosion Control Measures	N/A	Sod from the Pond Berm up to 2' below the Control Elevation (NWL)	FDOT

Drainage Design Criteria Matrix
SR 40 PD&E Study
From Breakaway Trail to Williamson Boulevard

Design Parameter		SJRMWD Criteria	FDOT Criteria	Drainage Criteria to be Used
Open Drainage Facilities (Ponds, Ditches, Canals)	Minimum Requirement for Maintenance Berms on Ditches/Canals (based on top width)	N/A	N/A	N/A
	Minimum Requirement for Maintenance Berms around Perimeter of Ponds		Ponds - 20 ft. clearance between top edge of normal pool elevation and R/W line. At least 15 ft. of berm adjacent to the pond shall be at a 1:8 slope or flatter. For wet ponds, keep the lowest point of the maintenance berm at least 1 foot above the top of the treatment volume to minimize saturation of the maintenance berm. 1 ft. of freeboard is required above the maximum DHW. Inside edge of the berm shall have a minimum 35 ft. radius to accommodate the largest maintenance equipment.	FDOT
	Maximum Side Slopes for Ditches/Canals	For permanently wet ponds or ditches, side slopes can be no steeper than 1:3 (average pond side slope) out to a depth of 2-feet below the control elevation.	Based on FDOT Clear Zone Criteria	FDOT
	Maximum Side Slopes for Ponds		Use a 1:4 side slope for ease with maintenance. Side slopes steeper than 1:3 require special equipment for mowing.	FDOT

Drainage Design Criteria Matrix
SR 40 PD&E Study
From Breakaway Trail to Williamson Boulevard

Design Parameter		SJRMWD Criteria	FDOT Criteria	Drainage Criteria to be Used
Open Drainage Facilities (Ponds, Ditches, Canals)	Minimum Longitudinal Slope	N/A	0.0005 ft./ft.	FDOT
	Minimum Bottom Width	N/A	V-bottom allowed on ditches.	FDOT
	Tailwater Conditions for Ponds	Must follow one of the following conditions: 1.)Max. stage in receiving water for the mean annual 24-hour storm. (Figure 9-2, SJRWMD Applicant's Handbook). Lower stages may be utilized if the applicant can demonstrate that the flow from the pond will reach the receiving water prior to the maximum stage of the receiving water. or 2.)Mean annual seasonal high water table elevation determined by water lines on vegetation or structures, historical data, adventitious roots or other hydrological or biological indicators.	Free flowing ditches - normal depth in the ditch at the storm drain outlet for storm drain design event (may differ from ditch design event). For ditches with downstream control - the higher of the stage due to free flow conditions or the maximum stage at the storm drain outlet due to backwater from the downstream control using flows from the storm drain design event. When discharging to existing storm drain systems - the tailwater shall be the elevation of the HGL of the existing system at the location of the connection for the storm drain design storm event.	SJRWMD and FDOT
	Erosion Control Measures (by max. velocity)	N/A	Grass with Mulch - Bare Soil, Sod - 4 fps max vel., Riprap (rubble) ditch lining - 6 fps max vel. (refer to FDOT Drainage Manual, Table 2.4)	FDOT

Drainage Design Criteria Matrix
SR 40 PD&E Study
From Breakaway Trail to Williamson Boulevard

Design Parameter		SJRMWD Criteria	FDOT Criteria	Drainage Criteria to be Used
Open Drainage Facilities (Ponds, Ditches, Canals)	Minimum Freeboard	N/A	1 ft. above DHW elevation. Less freeboard is acceptable when a permanent containment, such as concrete, is provided.	FDOT
	Swales	Treatment volume: Systems discharging to Class III receiving water bodies, percolate 80% of the runoff from the 3-year, 1-hour storm. The remaining 20% of the runoff from the 3-year, 1-hour storm may be discharged offsite by the swale system. Percolate all of the runoff if discharging to Class I, Class II or OFW's. Recovery of the treatment volume within 72 hours following the storm event. Top width to depth ratio of the cross section equal to or greater than 6:1 or side slopes equal to or greater than 3:1 (horizontal to vertical).	Swale drainage only permitted in Type A Soils conditions	SJRWMD and FDOT

Criteria Sources:

1. SJRWMD - Applicant's Handbook: Management and Storage of Surface Waters (12/03/2006)

2. FDOT - Drainage Manual (01/2006), Drainage Handbook Culvert Design (01/2004), Drainage Handbook Hydrology (01/2004), Drainage Handbook Erosion and Sediment Control (02/2002), Drainage Handbook Storm Drains (01/2004), Drainage Handbook Stormwater Mgmt. Facility (01/2004), Drainage Handbook Temporary Drainage Design (10/2001)

APPENDIX 3

Pond Design Calculations

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

Inwood consulting engineers

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

BASIN 1 MAP

SHEET NO.

Inwood consulting engineers
3000 Dovera Drive, Oviedo, FL 32765
(407) 971-8850 (phone)
(407) 971-8955 (fax)

Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1**
POND NAME : **Pond 1**

Station Limits:

From: 1282+00 — Roadway Length = 3500 ft
To: 1317+00 — R/W Width = 200 ft

EXISTING CONDITION

Roadway Area (Draining to Pond 1):

Impervious Roadway Area:	5.58 ac	<------- From Existing SJRWMD Permit # 4-127-67904-1
Pervious Roadway Area:	10.51 ac	<------- From Existing SJRWMD Permit # 67904
Total Roadway Area:	16.09 ac	(SubBasin #10 - WDA 8)

Roadway Area (Draining to CD-1):

Impervious Roadway Area:	0.97 ac	
Pervious Roadway Area:	0.64 ac	
Total Roadway Area:	1.61 ac	<------- Area between sta. 1317+00 and sta. 1320+50

Pond Area:

Pervious Pond Area =	1.20 ac	<------- From Existing Permit # 67904
Water Surface Area:	2.66 ac	<------- From Existing Permit # 67904
Pervious Pond Expansion Area =	1.83 ac	
Total Pond Area:	5.69 ac	

Total Area:

Impervious Area:	**9.21 ac**	(including pond water surface area)
Pervious Area:	**14.18 ac**	
Total Area:	**23.39 ac**	

Curve Number:

WDA 8 (Pond 1) from Permit # 67904-1				
Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	5.58 ac	546.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	11.71 ac	714.3
Existing Lakes (Water surface)	B	100	2.66 ac	266.0
Woods; Good condition (Woods are protected from grazing and covered with forest litter and brush)	B	55	1.83 ac	100.7
		Total:	21.78 ac	1627.8

CN = Total CN*Area / Total Area = **74.7**

Additional area within Basin 1 Draining to CD-1				
Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	0.97 ac	95.1
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	0.64 ac	39.0
		Total:	1.61 ac	134.1

CN = Total CN*Area / Total Area = **83.3**
Composite CN = Total CN*Area / Total Area = **75.3**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10$ = **3.28 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/8hr	FDOT 100yr/72hr	Storm Sewer 10yr/24hr
Precipitation (P) =	9.00 in	7.80 in	14.00 in	8.00 in
Runoff (Q) =	**5.99 in**	**4.90 in**	**10.71 in**	**5.08 in**

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Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1**
POND NAME : **Pond 1**

Station Limits:

From: 1282+00 | Roadway Length = 3850 ft
To: 1320+50 | R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 9.89 ac
Pervious Roadway Area: 7.81 ac
Total Roadway Area: 17.70 ac

Pond Area:

Pervious Pond Area : 1.82 ac
Water Surface Area: 3.87 ac Wet Pond
Total Pond Area: 5.69 ac

Total Area:

Impervious Area: **9.89 ac**
Pervious Area: **9.63 ac**
Water Surface Area: **3.87 ac**
Total Area: **23.39 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	9.89 ac	969.2
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	9.63 ac	587.2
Proposed Ponds (Water Surface)	B	100	3.87 ac	387.0
		Total:	23.39 ac	1943.5

CN = Total CN*Area / Total Area = **83.1**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ 2.03 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/8hr	FDOT 100yr/72hr	Storm Sewer 10yr/24hr
Precipitation (P) =	9.00 in	7.80 in	14.00 in	8.00 in
Runoff (Q) =	**6.95 in**	**5.80 in**	**11.82 in**	**5.99 in**

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Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1**
POND NAME : **Pond 1**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Wet Detention**
Online/Offline	**Online**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Wet Detention	**2.50 in**	x Impervious Areas =	2.06 ac-ft
	1.00 in	x Total Basin Area =	1.95 ac-ft

Treatment V_{req} = Largest of Trt. Vol. = **2.06 ac-ft**

Impaired Waters Requirement, provide 50% more TV = **3.09 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer Design
Q_{pre} =	11.68 ac-ft	9.55 ac-ft	20.89 ac-ft	9.90 ac-ft
Q_{post} =	13.54 ac-ft	11.30 ac-ft	23.04 ac-ft	11.67 ac-ft
ΔQ =	**1.86 ac-ft**	**1.75 ac-ft**	**2.16 ac-ft**	**1.77 ac-ft**

Attenuation V_{req} = **2.16 ac-ft** (use largest value)

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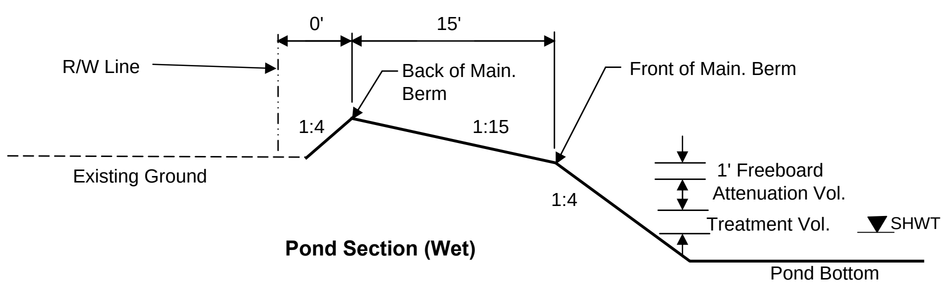
DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1**
POND NAME : **Pond 1**

Maintenance Area Width =	15.0 ft	@ 1:15	Existing Ground Elevation =	21.00
Pond Tie-In Width =	0.0 ft	@ 1:4	Normal Water Elevation =	16.00
Maximum Storage Depth (**SD**) =	3.00 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	17.85

Hydraulic Grade Line (HGL) check

HGL Slope =	0.030%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	400 ft	
Estimated Energy Losses =	0.1 ft	
HGL Clearance =	0.0 ft	
Allowable Storm Sewer Tailwater EL =	17.73 ft	



Pond Section (Wet)

Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	Average Area (ac)	Delta D (ft)	Delta Storage (ac-ft)	Sum Storage (ac-ft)
21.00	Pond R/W	5.69 ac				21.62
			5.43	0.00	0.00	
21.00	Back of Main. Berm	5.16 ac				21.62
			5.00	0.50	2.50	
20.50		4.84 ac				19.12
			4.68	0.50	2.34	
20.00	Front of Main. Berm	4.52 ac				16.78
			4.44	1.00	4.44	
19.00	Provided Treat.Vol.+Att.Vol	4.36 ac				12.34
			4.22	1.68	7.09	
17.32	Req'd Treat.Vol+Att. Vol	4.08 ac				5.25
			4.08	0.09	0.39	
17.23	Estimated Storm Sewer TW	4.07 ac				4.86
			4.03	0.44	1.77	
16.79	Top of Treatment Vol.	4.00 ac				3.09
			3.93	0.79	3.09	
16.00	Normal Water Level	3.87 ac				0.00
14.50		3.64 ac				
12.00	Pond Bottom	3.25 ac				

Required Treatment+Attenuation Vol.= 5.25 ac-ft
Required Treatment+Attenuation Stage= 17.32 ft

Provided Treatment+Attenuation Vol.= 12.34 ac-ft
Provided Treatment+Attenuation Stage= 19.00 ft

Estimated Storm Sewer Att.= 4.86 ac-ft
Estimated Storm Sewer TW EL.= 17.23 ft

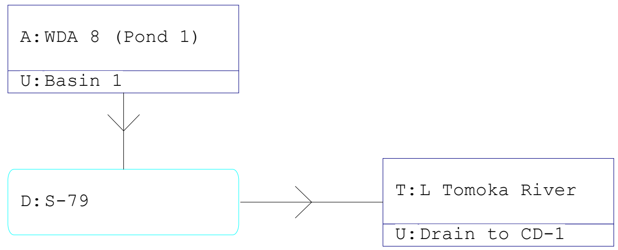
HGL requirements met

SR 40 PD&E Study from Breakaway Trail to Williamson Boulevard
FPID:428947-1-22-01
Basin 1 Existing Condition (From existing SJRWMD permt #4-127-67904-1)
Network Diagram

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



```
==========================================================================================
==== Basins ==============================================================================
==========================================================================================

         Name: Basin 1                 Node: WDA 8 (Pond 1)         Status: Onsite
        Group: BASE                    Type: SCS Unit Hydrograph CN

        Unit Hydrograph: Uh323                 Peaking Factor: 323.0
          Rainfall File: Flmod             Storm Duration(hrs): 24.00
    Rainfall Amount(in): 9.000               Time of Conc(min): 68.80
               Area(ac): 21.780                Time Shift(hrs): 0.00
           Curve Number: 74.70           Max Allowable Q(cfs): 999999.000
                DCIA(%): 0.00


----------------------------------------------------------------------------------------------------
         Name: Drain to CD-1           Node: L Tomoka River         Status: Onsite
        Group: BASE                    Type: SCS Unit Hydrograph CN

        Unit Hydrograph: Uh323                 Peaking Factor: 323.0
          Rainfall File: Flmod             Storm Duration(hrs): 24.00
    Rainfall Amount(in): 9.000               Time of Conc(min): 10.00
               Area(ac): 1.610                 Time Shift(hrs): 0.00
           Curve Number: 83.30           Max Allowable Q(cfs): 999999.000
                DCIA(%): 0.00


==========================================================================================
==== Nodes ===============================================================================
==========================================================================================

      Name: L Tomoka River      Base Flow(cfs): 0.000         Init Stage(ft): 15.600
     Group: BASE                                              Warn Stage(ft): 15.800
      Type: Time/Stage


      Time(hrs)       Stage(ft)
--------------- ---------------
           0.00          15.600
         999.00          15.600

------------------------------------------------------------------------------------------
      Name: WDA 8 (Pond 1)      Base Flow(cfs): 0.168         Init Stage(ft): 17.000
     Group: BASE                                              Warn Stage(ft): 19.000
      Type: Stage/Area


      Stage(ft)        Area(ac)
--------------- ---------------
         17.000          2.6600
         18.000          2.8000
         20.000          3.0700

==========================================================================================
==== Drop Structures =====================================================================
==========================================================================================

         Name: S-79               From Node: WDA 8 (Pond 1)     Length(ft): 52.00
        Group: BASE                 To Node: L Tomoka River          Count: 1

               UPSTREAM       DOWNSTREAM                 Friction Equation: Automatic
     Geometry: Circular       Circular                  Solution Algorithm: Most Restrictive
     Span(in): 24.00          24.00                                   Flow: Both
     Rise(in): 24.00          24.00                     Entrance Loss Coef: 0.000
   Invert(ft): 15.700         15.600                        Exit Loss Coef: 1.000
  Manning's N: 0.012000       0.012000                    Outlet Ctrl Spec: Use dc or tw
 Top Clip(in): 0.000          0.000                        Inlet Ctrl Spec: Use dc
 Bot Clip(in): 0.000          0.000                          Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall


*** Weir 1 of 5 for Drop Structure S-79 ***
                                                                                 TABLE
                  Count: 1                       Bottom Clip(in): 0.000
```

```
                Type: Vertical: Mavis            Top Clip(in): 0.000
                Flow: Both                     Weir Disc Coef: 3.200
            Geometry: Rectangular           Orifice Disc Coef: 0.600

            Span(in): 24.00                       Invert(ft): 18.000
            Rise(in): 10.20                 Control Elev(ft): 18.000

*** Weir 2 of 5 for Drop Structure S-79 ***
                                                                            TABLE
               Count: 1                       Bottom Clip(in): 0.000
                Type: Vertical: Mavis            Top Clip(in): 0.000
                Flow: Both                     Weir Disc Coef: 3.200
            Geometry: Rectangular           Orifice Disc Coef: 0.600

            Span(in): 24.00                       Invert(ft): 18.000
            Rise(in): 18.00                 Control Elev(ft): 18.000

*** Weir 3 of 5 for Drop Structure S-79 ***
                                                                            TABLE
               Count: 1                       Bottom Clip(in): 0.000
                Type: Vertical: Mavis            Top Clip(in): 0.000
                Flow: Both                     Weir Disc Coef: 3.200
            Geometry: Rectangular           Orifice Disc Coef: 0.600

            Span(in): 48.00                       Invert(ft): 18.850
            Rise(in): 7.80                  Control Elev(ft): 18.850

*** Weir 4 of 5 for Drop Structure S-79 ***
                                                                            TABLE
               Count: 1                       Bottom Clip(in): 0.000
                Type: Vertical: Mavis            Top Clip(in): 0.000
                Flow: Both                     Weir Disc Coef: 3.200
            Geometry: Circular              Orifice Disc Coef: 0.600

            Span(in): 6.00                        Invert(ft): 16.500
            Rise(in): 6.00                  Control Elev(ft): 17.000

*** Weir 5 of 5 for Drop Structure S-79 ***
                                                                            TABLE
               Count: 1                       Bottom Clip(in): 0.000
                Type: Horizontal                 Top Clip(in): 0.000
                Flow: Both                     Weir Disc Coef: 3.200
            Geometry: Rectangular           Orifice Disc Coef: 0.600

            Span(in): 24.00                       Invert(ft): 19.500
            Rise(in): 37.00                 Control Elev(ft): 19.500


==========================================================================================
==== Hydrology Simulations ===============================================================
==========================================================================================

         Name: 010yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Pre Development\010yr_024hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Fdot-24
    Rainfall Amount(in): 8.00

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 025yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Pre Development\025yr_024hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Flmod
    Rainfall Amount(in): 9.00

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 100yr_008hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Pre Development\100yr_008hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 8.00
          Rainfall File: Fdot-8
    Rainfall Amount(in): 7.80
```

```
Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 100yr_072hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Pre Development\100yr_072hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 72.00
          Rainfall File: Fdot-72
    Rainfall Amount(in): 14.00

Time(hrs)       Print Inc(min)
--------------- ---------------
80.000          5.00

==========================================================================================
==== Routing Simulations =================================================================
==========================================================================================

         Name: 010yr_024hr         Hydrology Sim: 010yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Pre Development\010yr_024hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


----------------------------------------------------------------------------------------------------
         Name: 025yr_024hr         Hydrology Sim: 025yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Pre Development\025yr_024hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


----------------------------------------------------------------------------------------------------
         Name: 100yr_008hr         Hydrology Sim: 100yr_008hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Pre Development\100yr_008hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 10.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
```

```
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


----------------------------------------------------------------------------------------------------
         Name: 100yr_072hr         Hydrology Sim: 100yr_072hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Pre Development\100yr_072hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 80.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes
```

SR 40 PD&E Study from Breakaway Trail to Williamson Boulevard
FPID:428947-1-22-01
Basin 1 Existing Condition (From existing SJRWMD permt #4-127-67904-1)
Results

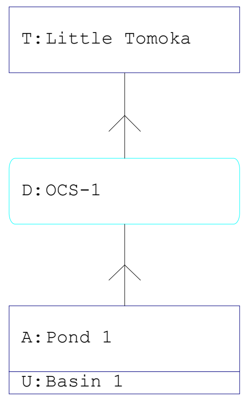
Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
L Tomoka River	BASE	010yr_024hr	0.00	15.60	15.80	0.0000	0	17.75	7.31	0.00	0.00
L Tomoka River	BASE	025yr_024hr	0.00	15.60	15.80	0.0000	0	14.98	13.42	0.00	0.00
L Tomoka River	BASE	100yr_008hr	0.00	15.60	15.80	0.0000	0	7.01	13.27	0.00	0.00
L Tomoka River	BASE	100yr_072hr	0.00	15.60	15.80	0.0000	0	61.15	12.03	0.00	0.00
WDA 8 (Pond 1)	BASE	010yr_024hr	17.73	18.58	19.00	0.0050	125403	12.50	10.96	17.73	6.82
WDA 8 (Pond 1)	BASE	025yr_024hr	14.99	18.95	19.00	0.0050	127534	12.67	39.24	14.99	12.97
WDA 8 (Pond 1)	BASE	100yr_008hr	7.17	18.93	19.00	0.0050	127463	4.50	32.56	7.17	12.71
WDA 8 (Pond 1)	BASE	100yr_072hr	61.15	18.87	19.00	0.0029	127089	60.08	14.12	61.15	11.40

SR 40 PD&E Study from Breakaway Trail to Williamson Boulevard
FPID:428947-1-22-01
Post Development Condition
Network Diagram

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



```
==========================================================================================
==== Basins ==============================================================================
==========================================================================================

         Name: Basin 1                 Node: Pond 1                 Status: Onsite
        Group: BASE                    Type: SCS Unit Hydrograph CN

        Unit Hydrograph: Uh323                  Peaking Factor: 323.0
          Rainfall File: Flmod             Storm Duration(hrs): 24.00
    Rainfall Amount(in): 9.000               Time of Conc(min): 68.80
               Area(ac): 23.390                Time Shift(hrs): 0.00
           Curve Number: 83.10            Max Allowable Q(cfs): 999999.000
                DCIA(%): 0.00



==========================================================================================
==== Nodes ===============================================================================
==========================================================================================

      Name: Little Tomoka       Base Flow(cfs): 0.000         Init Stage(ft): 15.600
     Group: BASE                                              Warn Stage(ft): 15.800
      Type: Time/Stage



      Time(hrs)       Stage(ft)
--------------- ---------------
           0.00          15.600
         999.00          15.600

------------------------------------------------------------------------------------------
      Name: Pond 1              Base Flow(cfs): 0.000         Init Stage(ft): 16.000
     Group: BASE                                              Warn Stage(ft): 19.000
      Type: Stage/Area



      Stage(ft)        Area(ac)
--------------- ---------------
         16.000          3.8700
         19.000          4.3600
         20.000          4.5200
         21.000          5.1600

==========================================================================================
==== Drop Structures =====================================================================
==========================================================================================

         Name: OCS-1              From Node: Pond 1            Length(ft): 52.00
        Group: BASE                 To Node: Little Tomoka          Count: 1

               UPSTREAM       DOWNSTREAM                 Friction Equation: Automatic
     Geometry: Circular       Circular                  Solution Algorithm: Most Restrictive
     Span(in): 24.00          24.00                                   Flow: Both
     Rise(in): 24.00          24.00                     Entrance Loss Coef: 0.000
   Invert(ft): 15.700         15.600                        Exit Loss Coef: 1.000
  Manning's N: 0.012000       0.012000                    Outlet Ctrl Spec: Use dc or tw
 Top Clip(in): 0.000          0.000                        Inlet Ctrl Spec: Use dc
 Bot Clip(in): 0.000          0.000                          Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall



*** Weir 1 of 5 for Drop Structure OCS-1 ***
                                                                                     TABLE
                  Count: 1                       Bottom Clip(in): 0.000
                   Type: Vertical: Mavis            Top Clip(in): 0.000
                   Flow: Both                     Weir Disc Coef: 3.200
               Geometry: Circular              Orifice Disc Coef: 0.600

               Span(in): 6.00                        Invert(ft): 15.500
               Rise(in): 6.00                  Control Elev(ft): 16.000

*** Weir 2 of 5 for Drop Structure OCS-1 ***
                                                                                     TABLE
                  Count: 2                       Bottom Clip(in): 0.000
                   Type: Vertical: Mavis            Top Clip(in): 0.000
                   Flow: Both                     Weir Disc Coef: 3.200
```

```
               Geometry: Rectangular          Orifice Disc Coef: 0.600

               Span(in): 11.00                       Invert(ft): 16.800
               Rise(in): 12.00                 Control Elev(ft): 16.800

*** Weir 3 of 5 for Drop Structure OCS-1 ***
                                                                                 TABLE
                  Count: 2                      Bottom Clip(in): 0.000
                   Type: Vertical: Mavis           Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Rectangular          Orifice Disc Coef: 0.600

               Span(in): 24.00                       Invert(ft): 17.800
               Rise(in): 20.40                 Control Elev(ft): 17.800

*** Weir 4 of 5 for Drop Structure OCS-1 ***
                                                                                 TABLE
                  Count: 1                      Bottom Clip(in): 0.000
                   Type: Horizontal                Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Rectangular          Orifice Disc Coef: 0.600

               Span(in): 24.00                       Invert(ft): 19.500
               Rise(in): 37.00                 Control Elev(ft): 19.500

*** Weir 5 of 5 for Drop Structure OCS-1 ***
                                                                                 TABLE
                  Count: 1                      Bottom Clip(in): 0.000
                   Type: Vertical: Mavis           Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Rectangular          Orifice Disc Coef: 0.600

               Span(in): 24.00                       Invert(ft): 16.800
               Rise(in): 32.40                 Control Elev(ft): 16.800


==========================================================================================
==== Hydrology Simulations ===============================================================
==========================================================================================

         Name: 010yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Post Development\010yr_024hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Fdot-24
    Rainfall Amount(in): 8.00

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 025yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Post Development\025yr_024hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Flmod
    Rainfall Amount(in): 9.00

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 100yr_008hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Post Development\100yr_008hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 8.00
          Rainfall File: Fdot-8
    Rainfall Amount(in): 7.80

Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 100yr_072hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Post Development\100yr_072hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 72.00
          Rainfall File: Fdot-72
```

```
    Rainfall Amount(in): 14.00

Time(hrs)       Print Inc(min)
--------------- ---------------
80.000          5.00

==============================================================================================
==== Routing Simulations =====================================================================
==============================================================================================

         Name: 010yr_024hr         Hydrology Sim: 010yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Post Development\010yr_024hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes

----------------------------------------------------------------------------------------------------
         Name: 025yr_024hr         Hydrology Sim: 025yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Post Development\025yr_024hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes

----------------------------------------------------------------------------------------------------
         Name: 100yr_008hr         Hydrology Sim: 100yr_008hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Post Development\100yr_008hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 10.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes

----------------------------------------------------------------------------------------------------
         Name: 100yr_072hr         Hydrology Sim: 100yr_072hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1\Post Development\100yr_072hr.I32
```

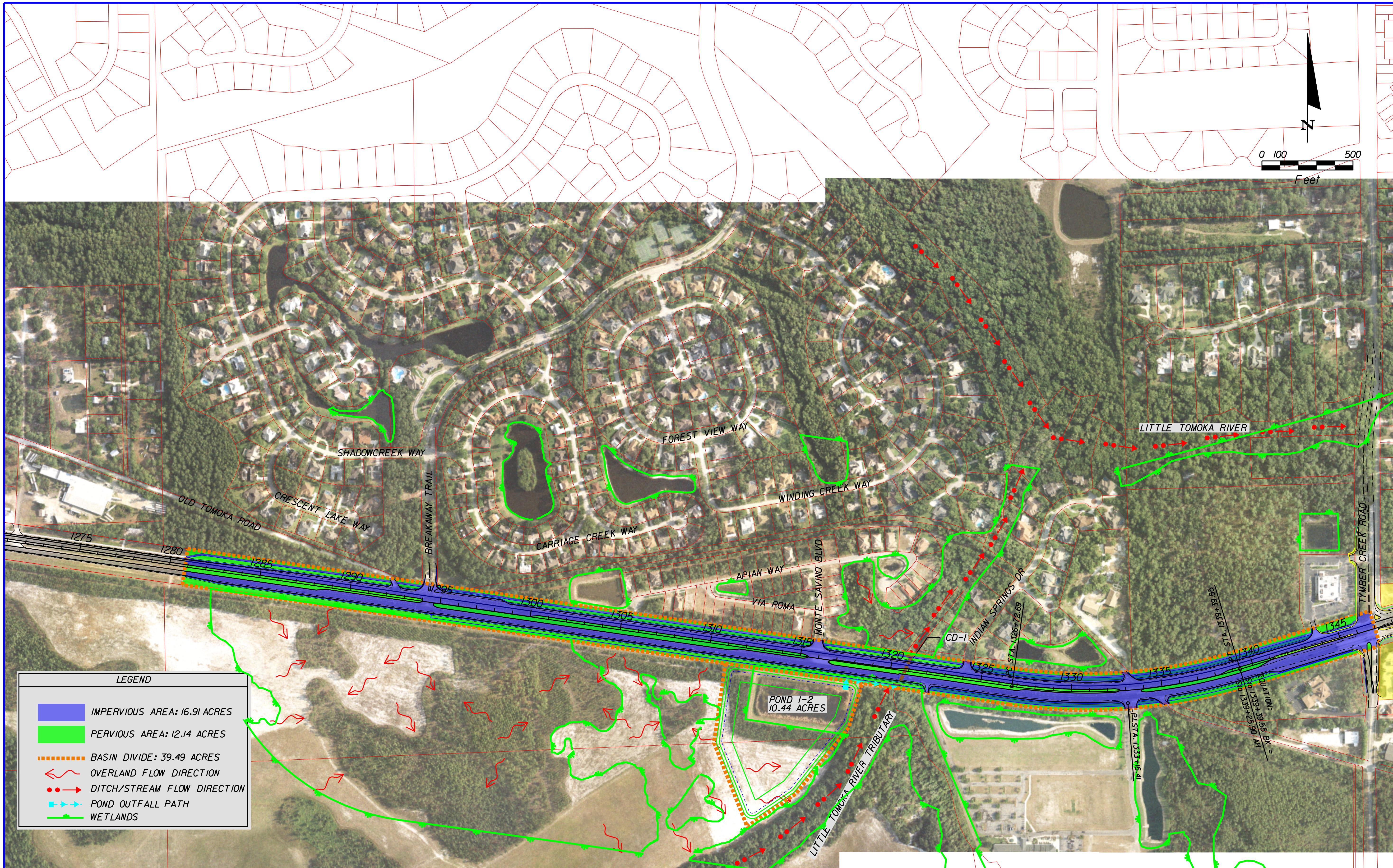
```
      Execute: Yes         Restart: No           Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 80.00
     Min Calc Time(sec): 0.5000              Max Calc Time(sec): 60.0000
        Boundary Stages:                         Boundary Flows:
```

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

SR 40 PD&E Study from Breakaway Trail to Williamson Boulevard
FPID:428947-1-22-01
Basin 1 Post Development Condition
Results

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
Little Tomoka	BASE	010yr_024hr	0.00	15.60	15.80	0.0000	0	19.57	6.96	0.00	0.00
Little Tomoka	BASE	025yr_024hr	0.00	15.60	15.80	0.0000	0	15.83	10.72	0.00	0.00
Little Tomoka	BASE	100yr_008hr	0.00	15.60	15.80	0.0000	0	7.90	10.76	0.00	0.00
Little Tomoka	BASE	100yr_072hr	0.00	15.60	15.80	0.0000	0	63.58	9.53	0.00	0.00
Pond 1	BASE	010yr_024hr	19.57	17.55	19.00	0.0044	179638	12.42	13.79	19.57	6.96
Pond 1	BASE	025yr_024hr	15.83	17.97	19.00	0.0050	182568	12.67	48.89	15.83	10.72
Pond 1	BASE	100yr_008hr	7.90	17.97	19.00	0.0050	182599	4.50	41.80	7.90	10.76
Pond 1	BASE	100yr_072hr	63.43	17.85	19.00	0.0028	181721	60.08	15.57	63.58	9.53



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

Inwood consulting engineers

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

BASIN 1-2 MAP

SHEET NO.

scarrigan 9/21/2012 5:13:17 PM F:\Projects\KIT-004-01\drainage\DRMPRD02_BASIN 1-2.DGN

Inwood consulting engineers
3000 Dovera Drive, Oviedo, FL 32765
(407) 971-8850 (phone)
(407) 971-8955 (fax)

Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1-2**
POND NAME : **Pond 1-2**

Station Limits:
From: 1282+00 Roadway Length = 3500 ft
To: 1317+00 R/W Width = 200 ft

EXISTING CONDITION

Roadway Area (Draining to Pond 1):

Impervious Roadway Area: 5.58 ac <------- From Existing SJRWMD Permit # 4-127-67904-1
Pervious Roadway Area: 10.51 ac <------- From Existing SJRWMD Permit # 67904
Total Roadway Area: 16.09 ac (SubBasin #10 - WDA 8)

Roadway Area: (Draining to CD-1 - Existing Basin 2)

Impervious Roadway Area: 4.29 ac <------- From Existing SJRWMD Permit # 67904
Pervious Roadway Area: 8.67 ac <------- From Existing SJRWMD Permit # 67904
Total Roadway Area: 12.96 ac (SubBasin #10 - WDA 8)

Pond Area:

Pervious Pond Area = 1.20 ac <------- From Existing SJRWMD Permit # 67904
Water Surface Area: 2.66 ac <------- From Existing SJRWMD Permit # 67904
Pervious Pond Expansion Area = 6.58 ac (SubBasin #10 - WDA 8)
Total Pond Area: 10.44 ac

Total Area:

Impervious Area: **12.53 ac** (including pond water surface area)
Pervious Area: **26.96 ac**
Total Area: **39.49 ac**

Curve Number:

Basin 1				
Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	5.58 ac	546.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	11.71 ac	714.3
Existing Lakes (Water surface)	B	100	2.66 ac	266.0
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	4.50 ac	274.5
Woods; Good condition (Woods are protected from grazing and covered with forest litter and brush)	B	55	2.08 ac	114.4
		Total:	26.53 ac	1916.0

CN = Total CN*Area / Total Area = **72.2**

Basin 2				
Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	4.29 ac	420.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	8.67 ac	528.9
		Total:	12.96 ac	949.3

CN = Total CN*Area / Total Area = **73.2**
Composite CN = Total CN*Area / Total Area = **72.6**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10$ = **3.78 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**5.65 in**	**7.48 in**	**10.30 in**	**2.84 in**

Inwood consulting engineers
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Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1-2**
POND NAME : **Pond 1-2**

Station Limits:

From: 1282+00 Roadway Length = 6300 ft
To: 1345+00 R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 16.91 ac
Pervious Roadway Area: 12.14 ac
Total Roadway Area: 29.05 ac

Pond Area:

Pervious Pond Area : 2.34 ac
Water Surface Area: 8.10 ac Wet Pond
Total Pond Area: 10.44 ac

Total Area:

Impervious Area: **16.91 ac**
Pervious Area: **14.48 ac**
Water Surface Area: **8.10 ac**
Total Area: **39.49 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	16.91 ac	1657.2
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	14.48 ac	883.0
Existing Lakes (Water surface)	B	100	8.10 ac	810.0
				0.0
		Total:	39.49 ac	3350.2

CN = Total CN*Area / Total Area = **84.8**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10$ = 1.79 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**7.16 in**	**9.11 in**	**12.06 in**	**4.05 in**

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Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1-2**
POND NAME : **Pond 1-2**

PROPOSED CONDITION

POND SIZING

Required Treatment Volume (TV)

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Wet Detention**
Online/Offline	**Online**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Wet Detention	**2.50 in**	x Impervious Areas =	3.52 ac-ft
	1.00 in	x Total Basin Area =	3.29 ac-ft

Treatment V_{req} = Largest of Trt. Vol. = **3.52 ac-ft**

Impaired Waters Requirement, provide 50% more TV = **5.28 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer Design
Q_{pre} =	18.60 ac-ft	24.62 ac-ft	33.90 ac-ft	9.35 ac-ft
Q_{post} =	23.57 ac-ft	29.99 ac-ft	39.69 ac-ft	13.33 ac-ft
ΔQ =	**4.97 ac-ft**	**5.37 ac-ft**	**5.79 ac-ft**	**3.98 ac-ft**

Attenuation V_{req} = **5.79 ac-ft** (use largest value)

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Made by: SVC
Checked by: REC

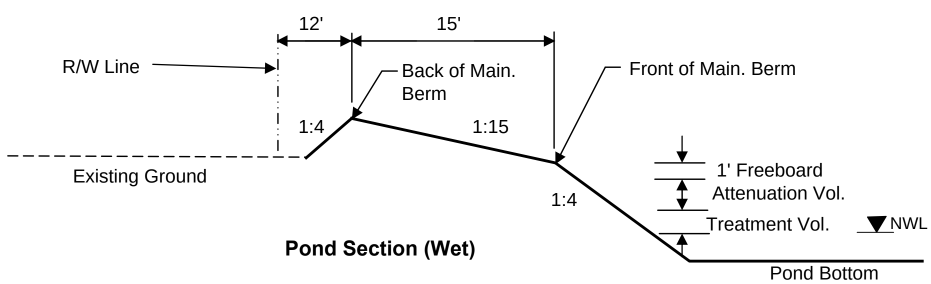
DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1-2**
POND NAME : **Pond 1-2**

Maintenance Area Width =	15.0 ft	@ 1:15	Existing Ground Elevation =	24.00
Pond Tie-In Width =	12.0 ft	@ 1:4	Normal Water Elevation =	16.30
Maximum Storage Depth (**SD**) =	2.70 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	17.85

Hydraulic Grade Line (HGL) check

HGL Slope =	0.030%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	400 ft	
Estimated Energy Losses =	0.1 ft	
HGL Clearance =	0.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	17.73 ft	



Pond Section (Wet)

Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	Average Area (ac)	Delta D (ft)	Delta Storage (ac-ft)	Sum Storage (ac-ft)
24.00	Pond R/W	10.44 ac				71.19
			10.12	3.00	30.35	
21.00	Back of Main. Berm	9.79 ac				40.84
			9.57	0.50	4.79	
20.50		9.36 ac				36.06
			9.14	0.50	4.57	
20.00	Front of Main. Berm	8.92 ac				31.49
			8.81	1.00	8.81	
19.00	Provided Treat.Vol.+Att.Vol	8.70 ac				22.68
			8.55	1.36	11.60	
17.64	Req'd Treat.Vol+Att. Vol	8.40 ac				11.08
			8.37	0.22	1.82	
17.43	Estimated Storm Sewer TW	8.35 ac				9.26
			8.30	0.48	3.98	
16.95	Top of Treatment Vol.	8.24 ac				5.28
			8.17	0.65	5.28	
16.30	Normal Water Level	8.10 ac				0.00
14.50		7.73 ac				
12.00	Existing Pond Bottom El.	6.97 ac				
3.00	Proposed Pond Bottom El.	5.40 ac				

Required Treatment+Attenuation Vol.= 11.08 ac-ft
Required Treatment+Attenuation Stage= 17.64 ft

Provided Treatment+Attenuation Vol.= 22.68 ac-ft
Provided Treatment+Attenuation Stage= 19.00 ft

Estimated Storm Sewer Att.= 9.26 ac-ft
Estimated Storm Sewer TW EL.= 17.43 ft

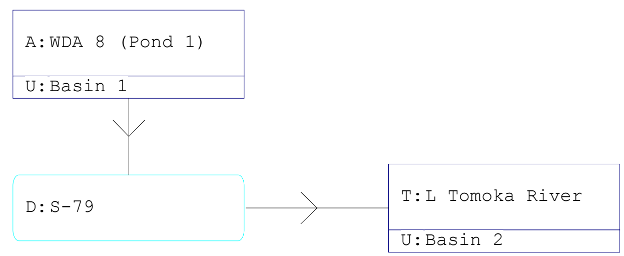
HGL requirements met

SR 40 PD&E Study from Breakaway Trail to WIlliamson Boulevard
FPID: 428947-1-22-01
Basin 1-2 Predevelopment Condition
Network Diagram

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



```
==========================================================================================
==== Basins ==============================================================================
==========================================================================================

         Name: Basin 1                  Node: WDA 8 (Pond 1)         Status: Onsite
        Group: BASE                     Type: SCS Unit Hydrograph CN

        Unit Hydrograph: Uh323                   Peaking Factor: 323.0
          Rainfall File: Flmod              Storm Duration(hrs): 24.00
    Rainfall Amount(in): 9.000                Time of Conc(min): 68.80
               Area(ac): 26.530                 Time Shift(hrs): 0.00
           Curve Number: 72.20             Max Allowable Q(cfs): 999999.000
                DCIA(%): 0.00

----------------------------------------------------------------------------------------------------
         Name: Basin 2                  Node: L Tomoka River         Status: Onsite
        Group: BASE                     Type: SCS Unit Hydrograph CN

        Unit Hydrograph: Uh323                   Peaking Factor: 323.0
          Rainfall File: Flmod              Storm Duration(hrs): 24.00
    Rainfall Amount(in): 9.000                Time of Conc(min): 41.70
               Area(ac): 12.960                 Time Shift(hrs): 0.00
           Curve Number: 73.20             Max Allowable Q(cfs): 999999.000
                DCIA(%): 0.00

==========================================================================================
==== Nodes ===============================================================================
==========================================================================================

      Name: L Tomoka River      Base Flow(cfs): 0.000         Init Stage(ft): 15.600
     Group: BASE                                              Warn Stage(ft): 15.800
      Type: Time/Stage

      Time(hrs)       Stage(ft)
--------------- ---------------
           0.00          15.600
         999.00          15.600

------------------------------------------------------------------------------------------
      Name: WDA 8 (Pond 1)      Base Flow(cfs): 0.168         Init Stage(ft): 17.000
     Group: BASE                                              Warn Stage(ft): 19.000
      Type: Stage/Area

      Stage(ft)        Area(ac)
--------------- ---------------
         17.000          2.6600
         18.000          2.8000
         20.000          3.0700

==========================================================================================
==== Drop Structures =====================================================================
==========================================================================================

         Name: S-79                From Node: WDA 8 (Pond 1)     Length(ft): 52.00
        Group: BASE                  To Node: L Tomoka River          Count: 1

               UPSTREAM       DOWNSTREAM                 Friction Equation: Automatic
     Geometry: Circular       Circular                  Solution Algorithm: Most Restrictive
     Span(in): 24.00          24.00                                   Flow: Both
     Rise(in): 24.00          24.00                     Entrance Loss Coef: 0.000
   Invert(ft): 15.700         15.600                        Exit Loss Coef: 1.000
  Manning's N: 0.012000       0.012000                  Outlet Ctrl Spec: Use dc or tw
 Top Clip(in): 0.000          0.000                      Inlet Ctrl Spec: Use dc
 Bot Clip(in): 0.000          0.000                        Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

*** Weir 1 of 5 for Drop Structure S-79 ***
                                                                            TABLE
                 Count: 1                      Bottom Clip(in): 0.000
```

```
                   Type: Vertical: Mavis          Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Rectangular          Orifice Disc Coef: 0.600

               Span(in): 24.00                      Invert(ft): 18.000
               Rise(in): 10.20                Control Elev(ft): 18.000

*** Weir 2 of 5 for Drop Structure S-79 ***
                                                                                  TABLE
                  Count: 1                     Bottom Clip(in): 0.000
                   Type: Vertical: Mavis          Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Rectangular          Orifice Disc Coef: 0.600

               Span(in): 24.00                      Invert(ft): 18.000
               Rise(in): 18.00                Control Elev(ft): 18.000

*** Weir 3 of 5 for Drop Structure S-79 ***
                                                                                  TABLE
                  Count: 1                     Bottom Clip(in): 0.000
                   Type: Vertical: Mavis          Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Rectangular          Orifice Disc Coef: 0.600

               Span(in): 48.00                      Invert(ft): 18.850
               Rise(in): 7.80                 Control Elev(ft): 18.850

*** Weir 4 of 5 for Drop Structure S-79 ***
                                                                                  TABLE
                  Count: 1                     Bottom Clip(in): 0.000
                   Type: Vertical: Mavis          Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Circular             Orifice Disc Coef: 0.600

               Span(in): 6.00                       Invert(ft): 16.500
               Rise(in): 6.00                 Control Elev(ft): 17.000

*** Weir 5 of 5 for Drop Structure S-79 ***
                                                                                  TABLE
                  Count: 1                     Bottom Clip(in): 0.000
                   Type: Horizontal               Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Rectangular          Orifice Disc Coef: 0.600

               Span(in): 24.00                      Invert(ft): 19.500
               Rise(in): 37.00                Control Elev(ft): 19.500


==========================================================================================
==== Hydrology Simulations ===============================================================
==========================================================================================

         Name: 010yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\PreDevelopment\010yr_024hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Fdot-24
    Rainfall Amount(in): 8.00

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 025yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\PreDevelopment\025yr_024hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Flmod
    Rainfall Amount(in): 9.00

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 100yr_008hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\PreDevelopment\100yr_008hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 8.00
          Rainfall File: Fdot-8
    Rainfall Amount(in): 7.80
```

```
Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 100yr_072hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\PreDevelopment\100yr_072hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 72.00
          Rainfall File: Fdot-72
    Rainfall Amount(in): 14.00

Time(hrs)       Print Inc(min)
--------------- ---------------
80.000          5.00

==========================================================================================
==== Routing Simulations =================================================================
==========================================================================================

         Name: 010yr_024hr         Hydrology Sim: 010yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\PreDevelopment\010yr_024hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


----------------------------------------------------------------------------------------------------
         Name: 025yr_024hr         Hydrology Sim: 025yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\PreDevelopment\025yr_024hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


----------------------------------------------------------------------------------------------------
         Name: 100yr_008hr         Hydrology Sim: 100yr_008hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\PreDevelopment\100yr_008hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 10.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
```

```
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


----------------------------------------------------------------------------------------------------
         Name: 100yr_072hr         Hydrology Sim: 100yr_072hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\PreDevelopment\100yr_072hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 80.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes
```

SR 40 PD&E Study from Breakaway Trail to WIlliamson Boulevard
FPID: 428947-1-22-01
Basin 1-2 Existing Condition (from Existing SJRWMD Permit #4-127-67904-1)
Results

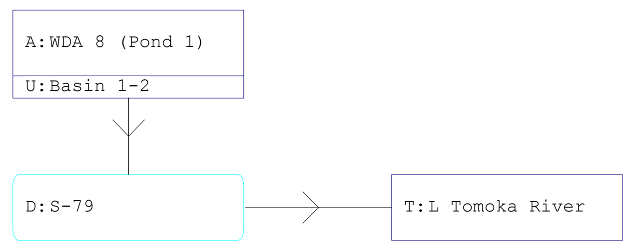
Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
L Tomoka River	BASE	010yr_024hr	0.00	15.60	15.80	0.0000	0	16.25	12.40	0.00	0.00
L Tomoka River	BASE	025yr_024hr	0.00	15.60	15.80	0.0000	0	12.41	31.23	0.00	0.00
L Tomoka River	BASE	100yr_008hr	0.00	15.60	15.80	0.0000	0	4.25	24.39	0.00	0.00
L Tomoka River	BASE	100yr_072hr	0.00	15.60	15.80	0.0000	0	60.25	21.42	0.00	0.00
WDA 8 (Pond 1)	BASE	010yr_024hr	17.30	18.68	19.00	0.0050	125991	12.50	12.51	17.30	8.31
WDA 8 (Pond 1)	BASE	025yr_024hr	14.82	19.10	19.00	0.0050	128455	12.75	45.25	14.82	16.23
WDA 8 (Pond 1)	BASE	100yr_008hr	6.97	19.08	19.00	0.0050	128342	4.50	37.17	6.97	15.85
WDA 8 (Pond 1)	BASE	100yr_072hr	61.02	19.00	19.00	0.0034	127846	60.08	16.90	61.02	14.12

SR 40 PD&E Study from Breakaway Trail to WIlliamson Boulevard
FPID: 428947-1-22-01
Basin 1-2 Postdevelopment Condition
Network Diagram

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



```
==========================================================================================
==== Basins ==============================================================================
==========================================================================================

         Name: Basin 1-2                Node: WDA 8 (Pond 1)        Status: Onsite
        Group: BASE                     Type: SCS Unit Hydrograph CN

        Unit Hydrograph: Uh323                    Peaking Factor: 323.0
          Rainfall File: Flmod               Storm Duration(hrs): 24.00
    Rainfall Amount(in): 9.000                 Time of Conc(min): 68.80
               Area(ac): 39.490                  Time Shift(hrs): 0.00
           Curve Number: 84.80              Max Allowable Q(cfs): 999999.000
                DCIA(%): 0.00


==========================================================================================
==== Nodes ===============================================================================
==========================================================================================

      Name: L Tomoka River      Base Flow(cfs): 0.000         Init Stage(ft): 15.600
     Group: BASE                                              Warn Stage(ft): 15.800
      Type: Time/Stage


      Time(hrs)       Stage(ft)
--------------- ---------------
          0.00          15.600
        999.00          15.600

------------------------------------------------------------------------------------------
      Name: WDA 8 (Pond 1)      Base Flow(cfs): 0.000         Init Stage(ft): 16.300
     Group: BASE                                              Warn Stage(ft): 19.000
      Type: Stage/Area


      Stage(ft)        Area(ac)
--------------- ---------------
        16.300          8.1000
        19.000          8.7000
        20.000          8.9200
        21.000          9.7900

==========================================================================================
==== Drop Structures =====================================================================
==========================================================================================

         Name: S-79                From Node: WDA 8 (Pond 1)     Length(ft): 52.00
        Group: BASE                  To Node: L Tomoka River          Count: 1

               UPSTREAM       DOWNSTREAM                 Friction Equation: Automatic
     Geometry: Circular       Circular                  Solution Algorithm: Most Restrictive
     Span(in): 24.00          24.00                                   Flow: Both
     Rise(in): 24.00          24.00                     Entrance Loss Coef: 0.000
   Invert(ft): 15.700         15.600                        Exit Loss Coef: 1.000
  Manning's N: 0.012000       0.012000                  Outlet Ctrl Spec: Use dc or tw
 Top Clip(in): 0.000          0.000                      Inlet Ctrl Spec: Use dc
 Bot Clip(in): 0.000          0.000                        Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall


*** Weir 1 of 4 for Drop Structure S-79 ***
                                                                                   TABLE
                  Count: 1                         Bottom Clip(in): 0.000
                   Type: Vertical: Mavis              Top Clip(in): 0.000
                   Flow: Both                       Weir Disc Coef: 3.200
               Geometry: Rectangular              Orifice Disc Coef: 0.600

               Span(in): 42.00                         Invert(ft): 17.000
               Rise(in): 30.00                   Control Elev(ft): 17.000

*** Weir 2 of 4 for Drop Structure S-79 ***
                                                                                   TABLE
                  Count: 1                         Bottom Clip(in): 0.000
                   Type: Vertical: Mavis              Top Clip(in): 0.000
                   Flow: Both                       Weir Disc Coef: 3.200
```

```
              Geometry: Circular             Orifice Disc Coef: 0.600

              Span(in): 6.00                        Invert(ft): 15.800
              Rise(in): 6.00                  Control Elev(ft): 16.300

*** Weir 3 of 4 for Drop Structure S-79 ***
                                                                                  TABLE
                 Count: 1                      Bottom Clip(in): 0.000
                  Type: Horizontal                Top Clip(in): 0.000
                  Flow: Both                    Weir Disc Coef: 3.200
              Geometry: Rectangular          Orifice Disc Coef: 0.600

              Span(in): 24.00                       Invert(ft): 19.500
              Rise(in): 37.00                 Control Elev(ft): 19.500

*** Weir 4 of 4 for Drop Structure S-79 ***
                                                                                  TABLE
                 Count: 2                      Bottom Clip(in): 0.000
                  Type: Vertical: Mavis           Top Clip(in): 0.000
                  Flow: Both                    Weir Disc Coef: 3.200
              Geometry: Rectangular          Orifice Disc Coef: 0.600

              Span(in): 36.00                       Invert(ft): 17.000
              Rise(in): 30.00                 Control Elev(ft): 17.000


==========================================================================================
==== Hydrology Simulations ===============================================================
==========================================================================================

         Name: 010yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\Post Development\010yr_024hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Fdot-24
    Rainfall Amount(in): 8.00

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 025yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\Post Development\025yr_024hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Flmod
    Rainfall Amount(in): 9.00

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 100yr_008hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\Post Development\100yr_008hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 8.00
          Rainfall File: Fdot-8
    Rainfall Amount(in): 7.80

Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          5.00

----------------------------------------------------------------------------------------------------
         Name: 100yr_072hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\Post Development\100yr_072hr.R32

      Override Defaults: Yes
    Storm Duration(hrs): 72.00
          Rainfall File: Fdot-72
    Rainfall Amount(in): 14.00

Time(hrs)       Print Inc(min)
--------------- ---------------
80.000          5.00

==========================================================================================
==== Routing Simulations =================================================================
==========================================================================================
```

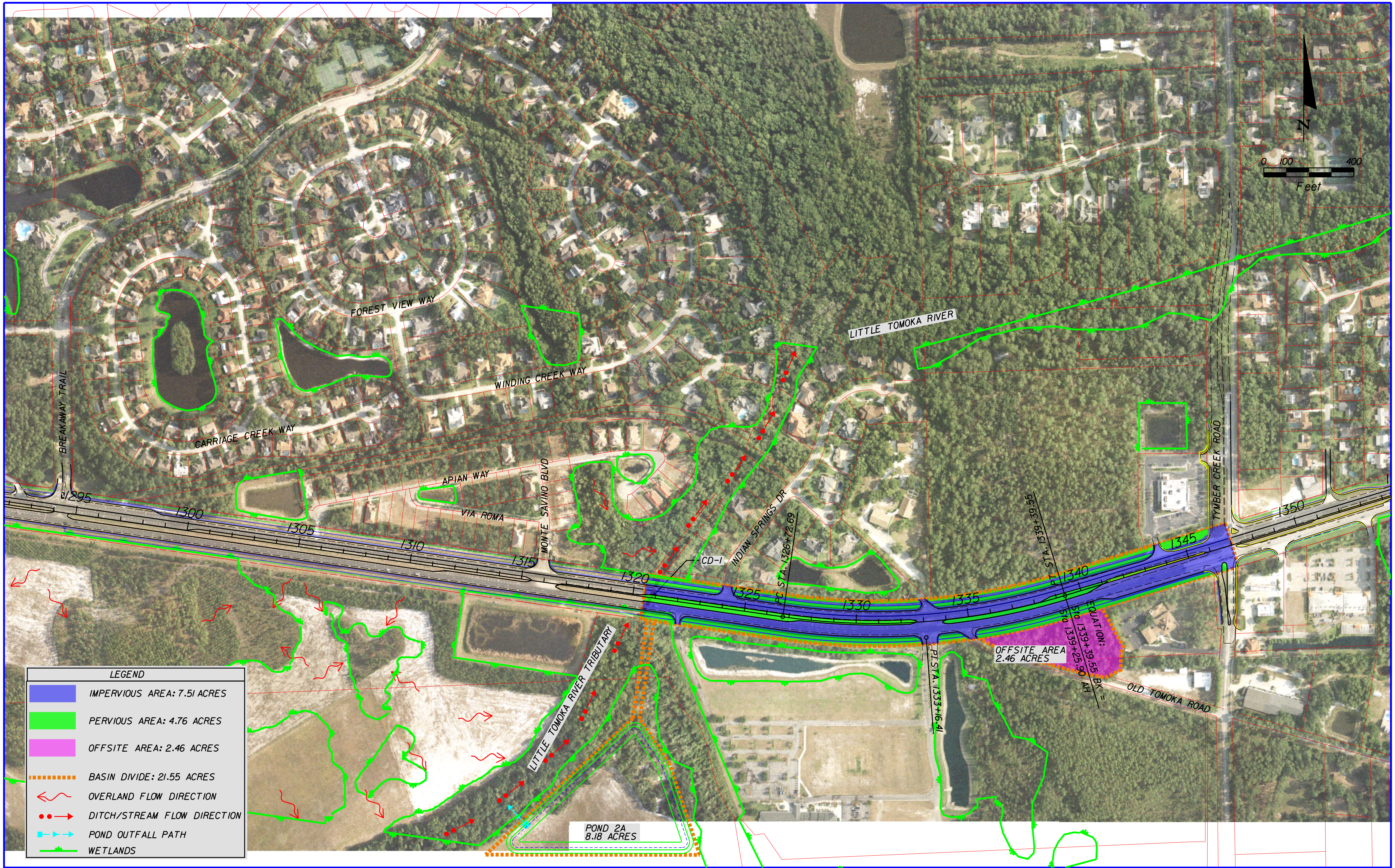
```
         Name: 010yr_024hr         Hydrology Sim: 010yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\Post Development\010yr_024hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes

----------------------------------------------------------------------------------------------------
         Name: 025yr_024hr         Hydrology Sim: 025yr_024hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\Post Development\025yr_024hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes

----------------------------------------------------------------------------------------------------
         Name: 100yr_008hr         Hydrology Sim: 100yr_008hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\Post Development\100yr_008hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 10.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes

----------------------------------------------------------------------------------------------------
         Name: 100yr_072hr         Hydrology Sim: 100yr_072hr
     Filename: F:\Projects\KIT-004-01\drainage\eng_data\ICPR\Basin 1-2\Post Development\100yr_072hr.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                     Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                     End Time(hrs): 80.00
     Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
        Boundary Stages:                          Boundary Flows:
```

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

SR 40 PD&E Study from Breakaway Trail to WIlliamson Boulevard
FPID: 428947-1-22-01
Basin 1-2 Postdevelopment Condition
Results

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
L Tomoka River	BASE	010yr_024hr	0.00	15.60	15.80	0.0000	0	20.62	10.17	0.00	0.00
L Tomoka River	BASE	025yr_024hr	0.00	15.60	15.80	0.0000	0	16.58	13.54	0.00	0.00
L Tomoka River	BASE	100yr_008hr	0.00	15.60	15.80	0.0000	0	8.47	13.51	0.00	0.00
L Tomoka River	BASE	100yr_072hr	0.00	15.60	15.80	0.0000	0	64.72	13.14	0.00	0.00
WDA 8 (Pond 1)	BASE	010yr_024hr	20.62	17.75	19.00	0.0037	366871	12.42	23.96	20.62	10.17
WDA 8 (Pond 1)	BASE	025yr_024hr	16.58	18.12	19.00	0.0050	370487	12.67	84.64	16.58	13.54
WDA 8 (Pond 1)	BASE	100yr_008hr	8.47	18.12	19.00	0.0050	370462	4.50	72.84	8.47	13.51
WDA 8 (Pond 1)	BASE	100yr_072hr	64.72	18.08	19.00	0.0026	370089	60.08	26.44	64.72	13.14



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

Inwood consulting engineers

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

BASIN 2A MAP

SHEET NO.

scarrigan 9/21/2012 5:13:34 PM F:\Projects\KIT-004-01\drainage\DRMPRD02_BASIN 2.DGN

Inwood consulting engineers
3000 Dovera Drive, Oviedo, FL 32765
(407) 971-8850 (phone)
(407) 971-8955 (fax)

Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2A**

Station Limits:
From: 1320+50 — Roadway Length = 2450 ft
To: 1345+00 — R/W Width = 200 ft

EXISTING CONDITION

Roadway Area:

Impervious Roadway Area: 3.32 ac <------- From Existing SJRWMD Permit # 4-127-67904-1
Pervious Roadway Area: 8.03 ac <------- From Existing Permit # 67904
Total Roadway Area: 11.35 ac

Offsite Area:

Impervious Roadway Area: 0.00 ac
Pervious Roadway Area: 2.46 ac
Total Roadway Area: 2.46 ac

Pond Area: Pervious Pond Area = 6.82 ac

Impervious Area: **3.32 ac**
Pervious Area: **17.31 ac**
Total Area: **20.63 ac**

Onsite Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	3.32 ac	325.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	8.03 ac	489.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	6.82 ac	415.9
		Total:	18.17 ac	1231.1

CN = Total CN*Area / Total Area = **67.8**

Offsite Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Woods; Good condition (Woods are protected from grazing and covered with forest litter and brush)	D	77	2.46 ac	189.4
		Total:	2.46 ac	189.4

CN = Total CN*Area / Total Area = **77.0**

Runoff:

Soil Capacity (S_{on}) = (1000/CN) - 10 = **4.76 in**
Soil Capacity (S_{off}) = (1000/CN) - 10 = **2.99 in**
Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Onsite Runoff (Q) =	**5.06 in**	**6.82 in**	**9.56 in**	**2.41 in**
Offsite Runoff (Q) =	**6.20 in**	**8.08 in**	**10.96 in**	**3.26 in**

Inwood consulting engineers
3000 Dovera Drive, Oviedo, FL 32765
(407) 971-8850 (phone)
(407) 971-8955 (fax)

Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2A**

Station Limits:
From: 1320+50
To: 1347+00

Roadway Length = 2650 ft
R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 7.51 ac
Pervious Roadway Area: 4.76 ac
Total Roadway Area: 12.27 ac

Offsite Area:

Impervious Roadway Area: 0.00 ac
Pervious Roadway Area: 2.46 ac
Total Roadway Area: 2.46 ac

Pond Area:

Pervious Pond Area : 1.06 ac
Water Surface Area: 5.76 ac Wet Pond
Total Pond Area: 6.82 ac

Total Area:

Impervious Area: **7.51 ac**
Pervious Area: **8.27 ac**
Water Surface Area: **5.76 ac**
Total Area: **21.55 ac**

Onsite Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	7.51 ac	736.0
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	5.81 ac	354.6
Proposed Ponds (Water Surface)	B	100	5.76 ac	576.2
		Total:	19.09 ac	1666.8

CN = Total CN*Area / Total Area = **87.3**

Offsite Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Woods; Good condition (Woods are protected from grazing and covered with forest litter and brush)	D	77	2.46 ac	189.4
		Total:	2.46 ac	189.4

CN = Total CN*Area / Total Area = **77.0**

Runoff:

Soil Capacity (S_{on}) = (1000/CN) - 10 = **1.45 in**
Soil Capacity (S_{off}) = (1000/CN) - 10 = **2.99 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Onsite Runoff (Q) =	**7.47 in**	**9.43 in**	**12.40 in**	**4.31 in**
Offsite Runoff (Q) =	**6.20 in**	**8.08 in**	**10.96 in**	**3.26 in**

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DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2A**

PROPOSED CONDITION

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Wet Detention**
Online/Offline	**Online**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Wet Detention	**2.50 in**	x Impervious Areas =	1.56 ac-ft
	1.00 in	x Total Basin Area =	1.80 ac-ft

Treatment V_{req} = Largest of Trt. Vol. = **1.80 ac-ft**
Impaired Waters Requirement, provide 50% more TV = **2.69 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	**FDOT 100yr/24hr**	**FDOT 100yr/72hr**	**Storm Sewer**
Q_{pre} =	7.66 ac-ft	10.32 ac-ft	14.48 ac-ft	3.65 ac-ft
Q_{post} =	11.88 ac-ft	15.00 ac-ft	19.72 ac-ft	6.86 ac-ft
ΔQ =	**4.22 ac-ft**	**4.68 ac-ft**	**5.24 ac-ft**	**3.21 ac-ft**

Attenuation V_{req} = 5.24 ac-ft (use largest value)

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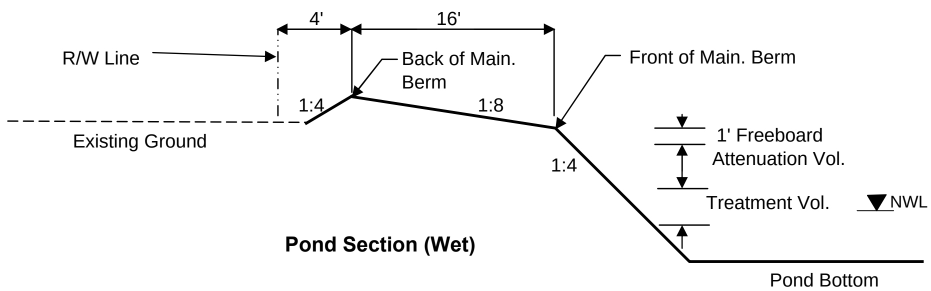
PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2A**

Maintenance Area Width =	16.0 ft	@ 1:8	Existing Ground Elevation =	22.00
Pond Tie-In Width =	4.0 ft	@ 1:4	Normal Water Elevation =	16.50
Maximum Storage Depth (**SD**) =	1.50 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	17.85

Hydraulic Grade Line (HGL) check

HGL Slope =	0.030%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	1000 ft	
Estimated Energy Losses =	0.3 ft	
HGL Clearance =	0.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	17.55 ft	



Pond Section (Wet)

Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
22.00	Pond R/W	6.82 ac	545.0 ft	545.0 ft	
21.00	Back of Main. Berm	6.62 ac	537.0 ft	537.0 ft	27.65 ac-ft
20.00		6.23 ac	521.0 ft	521.0 ft	21.22 ac-ft
19.00	Front of Main. Berm	6.23 ac	521.0 ft	521.0 ft	14.99 ac-ft
18.00	Provided Treat.Vol.+Att.Vol	6.04 ac	513.0 ft	513.0 ft	8.85 ac-ft
17.85	Req'd Treat.Vol+Att. Vol	6.01 ac	511.8 ft	511.8 ft	7.94 ac-ft
17.51	Estimated Storm Sewer TW	5.95 ac	509.1 ft	509.1 ft	5.91 ac-ft
16.96	Top of Treatment Vol.	5.85 ac	504.7 ft	504.7 ft	2.69 ac-ft
16.50	Normal Water Level	5.76 ac	501.0 ft	501.0 ft	0.00 ac-ft
13.50		5.22 ac	477.0 ft	477.0 ft	
10.50	Pond Bottom	4.71 ac	453.0 ft	453.0 ft	

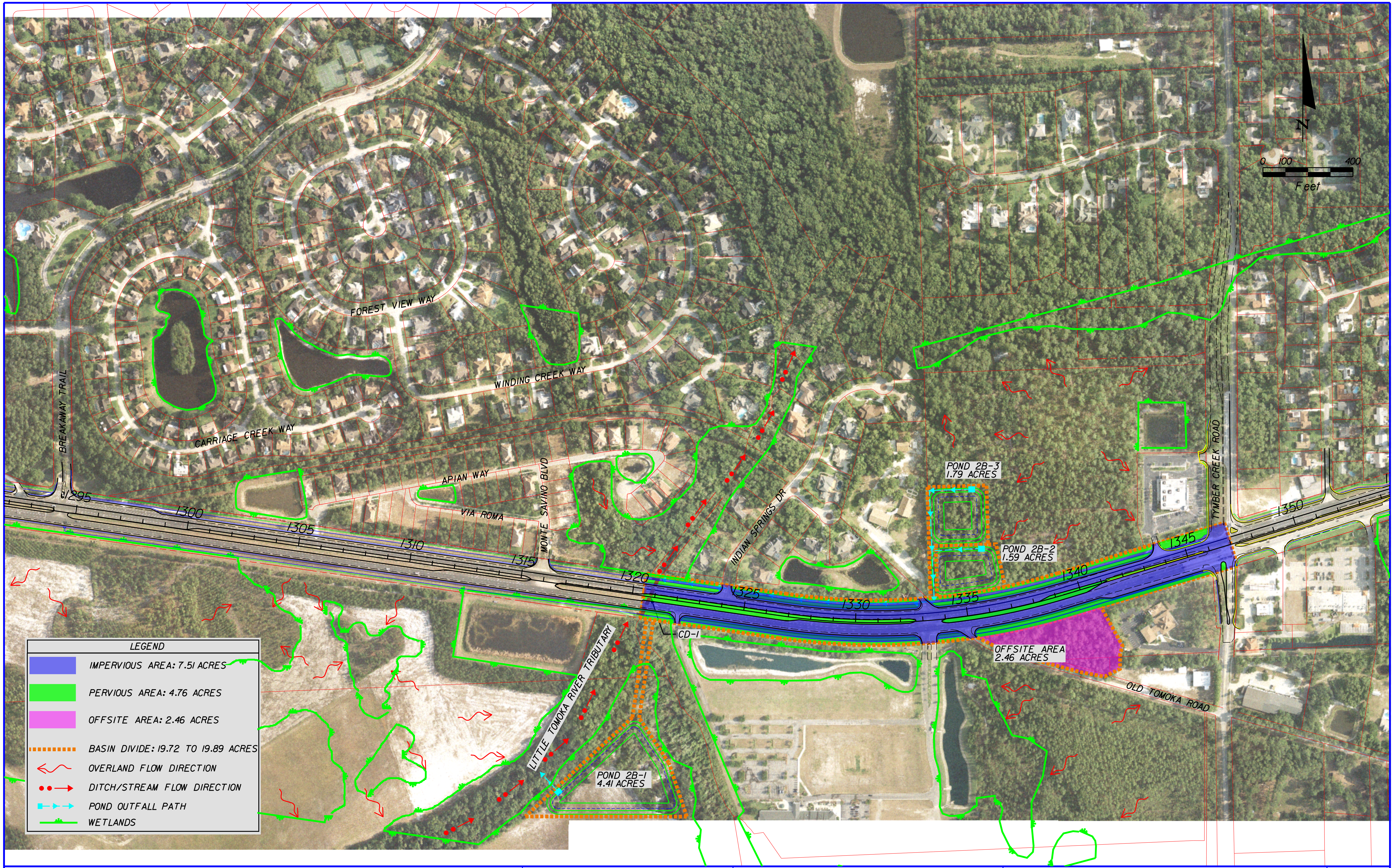
Required Treatment+Attenuation Vol.= 7.94 ac-ft
Required Treatment+Attenuation Stage= 17.85 ft

Provided Treatment+Attenuation Vol.= 8.85 ac-ft
Provided Treatment+Attenuation Stage= 18.00 ft

Estimated Storm Sewer Att.= 5.91 ac-ft
Estimated Storm Sewer TW EL.= 17.51 ft

HGL requirements met

Additional 20% = 8.18 ac



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

BASIN 2B MAP

SHEET NO.

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B1** **Split Basin**

Station Limits:
From: 1320+50 Roadway Length = 1450 ft
To: 1335+00 R/W Width = 200 ft

EXISTING CONDITION

Roadway Area:

Impervious Roadway Area: 1.42 ac <------- From Existing SJRWMD Permit # 4-127-67904-1
Pervious Roadway Area: 5.29 ac <------- From Existing Permit # 67904
Total Roadway Area: 6.71 ac

Pond Area: Pervious Pond Area = 3.67 ac

Impervious Area: **1.42 ac**
Pervious Area: **8.96 ac**
Total Area: **10.38 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	1.42 ac	139.2
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	5.29 ac	322.5
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	3.67 ac	224.1
		Total:	10.38 ac	685.8

CN = Total CN*Area / Total Area = **66.1**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **5.14 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**4.85 in**	**6.58 in**	**9.29 in**	**2.26 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B1** **Split Basin**

Station Limits:

From: 1320+50 Roadway Length = 1450 ft
To: 1335+00 R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area:	4.11 ac
Pervious Roadway Area:	2.60 ac
Total Roadway Area:	6.71 ac

Pond Area:

Pervious Pond Area :	0.76 ac	
Water Surface Area:	2.91 ac	Wet Pond
Total Pond Area:	3.67 ac	

Total Area:

Impervious Area:	**4.11 ac**
Pervious Area:	**3.36 ac**
Water Surface Area:	**2.91 ac**
Total Area:	**10.38 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	4.11 ac	402.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	3.36 ac	205.0
Proposed Ponds (Water Surface)	B	100	2.91 ac	290.9
		Total:	10.38 ac	898.8

CN = Total CN*Area / Total Area = **86.6**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ 1.55 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**7.37 in**	**9.34 in**	**12.30 in**	**4.23 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B1 Split Basin**

PROPOSED CONDITION

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Wet Detention**
Online/Offline	**Online**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Wet Detention	**2.50 in**	x Impervious Areas =	0.86 ac-ft
	1.00 in	x Total Basin Area =	0.87 ac-ft

Treatment V_{req} = Largest of Trt. Vol. = **0.87 ac-ft**
Impaired Waters Requirement, provide 50% more TV = **1.30 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Q_{pre} =	4.19 ac-ft	5.69 ac-ft	8.04 ac-ft	1.96 ac-ft
Q_{post} =	6.38 ac-ft	8.08 ac-ft	10.64 ac-ft	3.66 ac-ft
ΔQ =	**2.19 ac-ft**	**2.38 ac-ft**	**2.60 ac-ft**	**1.71 ac-ft**

Attenuation V_{req} = **2.60 ac-ft** (use largest value)

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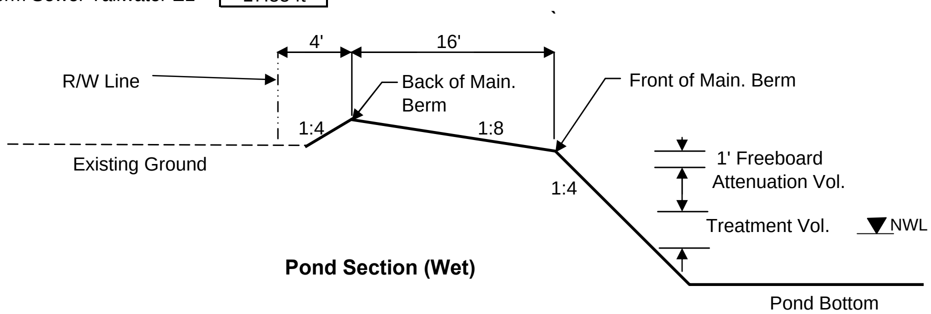
PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B1 Split Basin**

Maintenance Area Width =	16.0 ft	@ 1:8	Existing Ground Elevation =	22.00
Pond Tie-In Width =	4.0 ft	@ 1:4	Normal Water Elevation =	16.50
Maximum Storage Depth (**SD**) =	1.50 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	17.85

Hydraulic Grade Line (HGL) check

HGL Slope =	0.030%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	1000 ft	
Estimated Energy Losses =	0.3 ft	
HGL Clearance =	0.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	17.55 ft	



Pond Section (Wet)

Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
22.00	Pond R/W	3.67 ac	400.0 ft	400.0 ft	
21.00	Back of Main. Berm	3.53 ac	392.0 ft	392.0 ft	14.33 ac-ft
20.00		3.25 ac	376.0 ft	376.0 ft	10.94 ac-ft
19.00	Front of Main. Berm	3.25 ac	376.0 ft	376.0 ft	7.69 ac-ft
18.00	Provided Treat.Vol.+Att.Vol	3.11 ac	368.0 ft	368.0 ft	4.51 ac-ft
17.80	Req'd Treat.Vol+Att. Vol	3.08 ac	366.4 ft	366.4 ft	3.90 ac-ft
17.51	Estimated Storm Sewer TW	3.04 ac	364.1 ft	364.1 ft	3.00 ac-ft
16.94	Top of Treatment Vol.	2.97 ac	359.5 ft	359.5 ft	1.30 ac-ft
16.50	Normal Water Level	2.91 ac	356.0 ft	356.0 ft	0.00 ac-ft
13.50		2.53 ac	332.0 ft	332.0 ft	
10.50	Pond Bottom	2.18 ac	308.0 ft	308.0 ft	

Required Treatment+Attenuation Vol.= 3.90 ac-ft
Required Treatment+Attenuation Stage= 17.80 ft

Provided Treatment+Attenuation Vol.= 4.51 ac-ft
Provided Treatment+Attenuation Stage= 18.00 ft

Estimated Storm Sewer Att.= 3.00 ac-ft
Estimated Storm Sewer TW EL.= 17.51 ft HGL requirements met

Additional 20% = 4.41 ac

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B2 Split Basin**

Station Limits: From: 1335+00 To: 1345+00
Roadway Length = 1000 ft
R/W Width = 200 ft

EXISTING CONDITION

Roadway Area:

Impervious Roadway Area: 1.90 ac <------- From Existing SJRWMD Permit # 4-127-67904-1
Pervious Roadway Area: 2.74 ac <------- From Existing Permit # 67904
Total Roadway Area: 4.64 ac

Offsite Area:

Impervious Roadway Area: 0.00 ac
Pervious Roadway Area: 2.46 ac
Total Roadway Area: 2.46 ac

Pond Area: Pervious Pond Area = 1.32 ac

Impervious Area: **1.90 ac**
Pervious Area: **6.52 ac**
Total Area: **8.42 ac**

Onsite Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	1.90 ac	186.2
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	2.74 ac	167.2
Woods; Good condition (Woods are protected from	B	55	1.32 ac	72.7
		Total:	5.96 ac	426.2

CN = Total CN*Area / Total Area = **71.5**

Offsite Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Woods; Good condition (Woods are protected from grazing and covered with forest litter and brush)	D	77	2.46 ac	189.4
		Total:	2.46 ac	189.4

CN = Total CN*Area / Total Area = **77.0**

Runoff:

Soil Capacity (S_{on}) = (1000/CN) - 10 = **3.99 in**
Soil Capacity (S_{off}) = (1000/CN) - 10 = **2.99 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Onsite Runoff (Q) =	**5.52 in**	**7.33 in**	**10.13 in**	**2.74 in**
Offsite Runoff (Q) =	**6.20 in**	**8.08 in**	**10.96 in**	**3.26 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B2 Split Basin**

Station Limits:

From: 1335+00 Roadway Length = 1200 ft
To: 1347+00 R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area: 3.40 ac
Pervious Roadway Area: 2.16 ac
Total Roadway Area: 5.56 ac

Offsite Area:

Impervious Roadway Area: 0.00 ac
Pervious Roadway Area: 2.46 ac
Total Roadway Area: 2.46 ac

Pond Area:

Pervious Pond Area : 0.58 ac
Water Surface Area: 0.74 ac Wet Pond
Total Pond Area: 1.32 ac

Total Area:

Impervious Area: **3.40 ac**
Pervious Area: **5.20 ac**
Water Surface Area: **0.74 ac**
Total Area: **9.34 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	3.40 ac	333.2
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	2.74 ac	167.0
Proposed Ponds (Water Surface)	B	100	0.74 ac	74.4
		Total:	6.88 ac	574.6

CN = Total CN*Area / Total Area = **83.5**

Offsite Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Woods; Good condition (Woods are protected from grazing and covered with forest litter and brush)	D	77	2.46 ac	189.4
		Total:	2.46 ac	189.4

CN = Total CN*Area / Total Area = **77.0**

Runoff:

Soil Capacity (S_{on}) = (1000/CN) - 10 = **1.98 in**
Soil Capacity (S_{off}) = (1000/CN) - 10 = **2.99 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Onsite Runoff (Q) =	**7.00 in**	**8.94 in**	**11.88 in**	**3.91 in**
Offsite Runoff (Q) =	**6.20 in**	**8.08 in**	**10.96 in**	**3.26 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B2 Split Basin**

PROPOSED CONDITION

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Wet Detention**
Online/Offline	**Online**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Wet Detention	**2.50 in**	x Impervious Areas =	0.71 ac-ft
	1.00 in	x Total Basin Area =	0.78 ac-ft

Treatment V_{req} = Largest of Trt. Vol. = **0.78 ac-ft**
Impaired Waters Requirement, provide 50% more TV = **1.17 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Q_{pre} =	3.87 ac-ft	5.15 ac-ft	7.11 ac-ft	1.92 ac-ft
Q_{post} =	5.45 ac-ft	6.96 ac-ft	9.25 ac-ft	3.04 ac-ft
ΔQ =	**1.58 ac-ft**	**1.81 ac-ft**	**2.13 ac-ft**	**1.12 ac-ft**

Attenuation V_{req} = **2.13 ac-ft** (use largest value)

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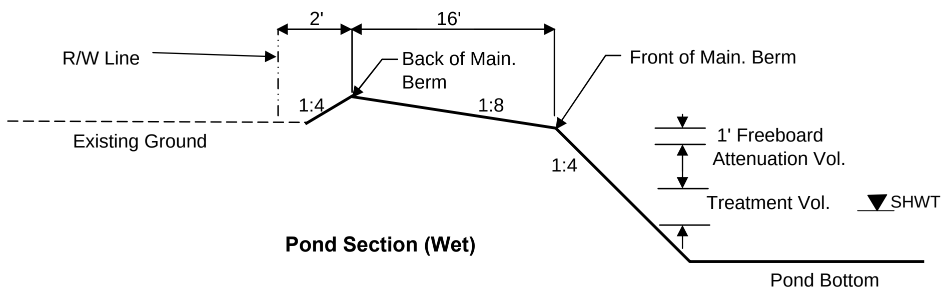
PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B2 Split Basin**

Maintenance Area Width =	16.0 ft	@ 1:8	Existing Ground Elevation =	18.50
Pond Tie-In Width =	2.0 ft	@ 1:4	Normal Water Elevation =	12.00
Maximum Storage Depth (**SD**) =	3.00 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	18.00

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	400 ft	
Estimated Energy Losses =	0.2 ft	
HGL Clearance =	0.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	17.80 ft	



Pond Section (Wet)

Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
18.50	Pond R/W	1.32 ac	240.0 ft	240.0 ft	
19.00	Back of Main. Berm	1.28 ac	236.0 ft	236.0 ft	6.94 ac-ft
18.00		1.11 ac	220.0 ft	220.0 ft	5.75 ac-ft
17.00	Front of Main. Berm	1.11 ac	220.0 ft	220.0 ft	4.64 ac-ft
16.00	Provided Treat.Vol.+Att.Vol	1.03 ac	212.0 ft	212.0 ft	3.55 ac-ft
15.76	Req'd Treat.Vol+Att. Vol	1.01 ac	210.1 ft	210.1 ft	3.30 ac-ft
14.73	Estimated Storm Sewer TW	0.94 ac	201.8 ft	201.8 ft	2.29 ac-ft
13.47	Top of Treatment Vol.	0.84 ac	191.8 ft	191.8 ft	1.17 ac-ft
12.00	Normal Water Level	0.74 ac	180.0 ft	180.0 ft	0.00 ac-ft
9.00		0.56 ac	156.0 ft	156.0 ft	
6.00	Pond Bottom	0.40 ac	132.0 ft	132.0 ft	

Required Treatment+Attenuation Vol.= 3.30 ac-ft
Required Treatment+Attenuation Stage= 15.76 ft

Provided Treatment+Attenuation Vol.= 3.55 ac-ft
Provided Treatment+Attenuation Stage= 16.00 ft

Estimated Storm Sewer Att.= 2.29 ac-ft
Estimated Storm Sewer TW EL.= 14.73 ft

HGL requirements met

Additional 20% = 1.59 ac

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B3** **Split Basin**

Station Limits: From: 1335+00 To: 1345+00
Roadway Length = 1000 ft
R/W Width = 200 ft

EXISTING CONDITION

Roadway Area:

Impervious Roadway Area: 1.90 ac <------- From Existing SJRWMD Permit # 4-127-67904-1
Pervious Roadway Area: 2.74 ac <------- From Existing Permit # 67904
Total Roadway Area: 4.64 ac

Offsite Area:

Impervious Roadway Area: 0.00 ac
Pervious Roadway Area: 2.46 ac
Total Roadway Area: 2.46 ac

Pond Area: Pervious Pond Area = 1.49 ac

Impervious Area: **1.90 ac**
Pervious Area: **6.69 ac**
Total Area: **8.59 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	1.90 ac	186.2
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	2.74 ac	167.2
Woods; Good condition (Woods are protected from	B	55	1.49 ac	82.1
		Total:	6.13 ac	435.5

CN = Total CN*Area / Total Area = **71.0**

Offsite Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Woods; Good condition (Woods are protected from grazing and covered with forest litter and brush)	D	77	2.46 ac	189.4
		Total:	2.46 ac	189.4

CN = Total CN*Area / Total Area = **77.0**

Runoff:

Soil Capacity (S_{on}) = (1000/CN) - 10 = **4.08 in**
Soil Capacity (S_{off}) = (1000/CN) - 10 = **2.99 in**

$$\text{Runoff (Q)} = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Onsite Runoff (Q) =	**5.46 in**	**7.27 in**	**10.06 in**	**2.70 in**
Offsite Runoff (Q) =	**6.20 in**	**8.08 in**	**10.96 in**	**3.26 in**

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DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B3** **Split Basin**

Station Limits:

From: 1335+00 Roadway Length = 1200 ft
To: 1347+00 R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area:	3.40 ac
Pervious Roadway Area:	2.16 ac
Total Roadway Area:	5.56 ac

Offsite Area:

Impervious Roadway Area:	0.00 ac
Pervious Roadway Area:	2.46 ac
Total Roadway Area:	2.46 ac

Pond Area:

Pervious Pond Area :	0.76 ac	
Water Surface Area:	0.74 ac	Wet Pond
Total Pond Area:	1.49 ac	

Total Area:

Impervious Area:	**3.40 ac**
Pervious Area:	**5.38 ac**
Water Surface Area:	**0.74 ac**
Total Area:	**9.51 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	B	98	3.40 ac	333.2
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	B	61	2.92 ac	177.9
Proposed Ponds (Water Surface)	B	100	0.74 ac	73.6
		Total:	7.05 ac	584.7

CN = Total CN*Area / Total Area = **82.9**

Offsite Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Woods; Good condition (Woods are protected from grazing and covered with forest litter and brush)	D	77	2.46 ac	189.4
		Total:	2.46 ac	189.4

CN = Total CN*Area / Total Area = **77.0**

Runoff:

Soil Capacity (S_{on}) = (1000/CN) - 10 = **2.06 in**

Soil Capacity (S_{off}) = (1000/CN) - 10 = **2.99 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Onsite Runoff (Q) =	**6.92 in**	**8.86 in**	**11.80 in**	**3.85 in**
Offsite Runoff (Q) =	**6.20 in**	**8.08 in**	**10.96 in**	**3.26 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B3 Split Basin**

PROPOSED CONDITION

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Wet Detention**
Online/Offline	**Online**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Wet Detention	**2.50 in**	x Impervious Areas =	0.71 ac-ft
	1.00 in	x Total Basin Area =	0.79 ac-ft

Treatment V_{req} = Largest of Trt. Vol. = **0.79 ac-ft**
Impaired Waters Requirement, provide 50% more TV = **1.19 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Q_{pre} =	3.91 ac-ft	5.21 ac-ft	7.21 ac-ft	1.93 ac-ft
Q_{post} =	5.49 ac-ft	7.02 ac-ft	9.35 ac-ft	3.05 ac-ft
ΔQ =	**1.58 ac-ft**	**1.82 ac-ft**	**2.14 ac-ft**	**1.12 ac-ft**

Attenuation V_{req} = **2.14 ac-ft** (use largest value)

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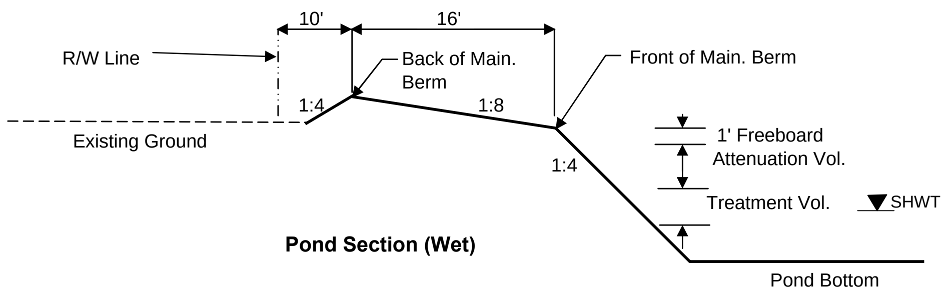
PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B3 Split Basin**

Maintenance Area Width =	16.0 ft	@ 1:8	Existing Ground Elevation =	17.50
Pond Tie-In Width =	10.0 ft	@ 1:4	Normal Water Elevation =	13.00
Maximum Storage Depth (**SD**) =	3.00 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	18.00

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	600 ft	
Estimated Energy Losses =	0.3 ft	
HGL Clearance =	0.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	17.70 ft	



Pond Section (Wet)

Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	DIMENSIONS		STORAGE
			LENGTH	WIDTH	
17.50	Pond R/W	1.49 ac	255.0 ft	255.0 ft	
20.00	Back of Main. Berm	1.27 ac	235.0 ft	235.0 ft	6.88 ac-ft
19.00		1.10 ac	219.0 ft	219.0 ft	5.69 ac-ft
18.00	Front of Main. Berm	1.10 ac	219.0 ft	219.0 ft	4.59 ac-ft
17.00	Provided Treat.Vol.+Att.Vol	1.02 ac	211.0 ft	211.0 ft	3.52 ac-ft
16.82	Req'd Treat.Vol+Att. Vol	1.01 ac	209.6 ft	209.6 ft	3.33 ac-ft
15.78	Estimated Storm Sewer TW	0.93 ac	201.2 ft	201.2 ft	2.31 ac-ft
14.51	Top of Treatment Vol.	0.84 ac	191.1 ft	191.1 ft	1.19 ac-ft
13.00	Normal Water Level	0.74 ac	179.0 ft	179.0 ft	0.00 ac-ft
10.00		0.55 ac	155.0 ft	155.0 ft	
7.00	Pond Bottom	0.39 ac	131.0 ft	131.0 ft	

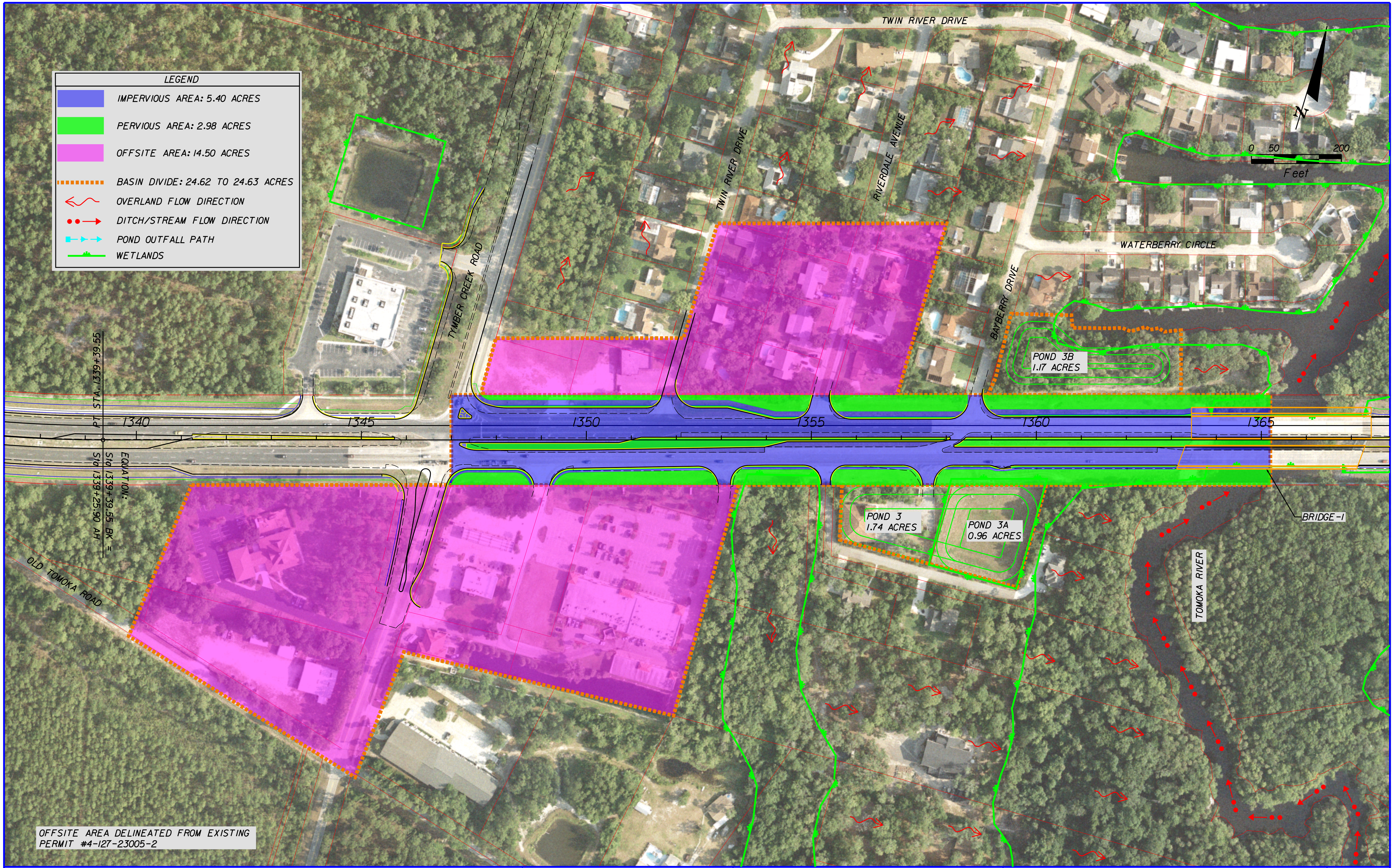
Required Treatment+Attenuation Vol.= 3.33 ac-ft
Required Treatment+Attenuation Stage= 16.82 ft

Provided Treatment+Attenuation Vol.= 3.52 ac-ft
Provided Treatment+Attenuation Stage= 17.00 ft

Estimated Storm Sewer Att.= 2.31 ac-ft
Estimated Storm Sewer TW EL.= 15.78 ft

HGL requirements met

Additional 20% = 1.79 ac



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

BASIN 3 MAP

SHEET NO.

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3**

Station Limits: From: 1347+00 To: 1365+20

Roadway Length = 1820 ft
R/W Width = 200 ft

EXISTING CONDITION

Roadway Area:

Impervious Roadway Area:	3.12 ac	<------- From Existing Permit # 23005
Pervious Roadway Area:	5.26 ac	<------- From Existing Permit # 23005
Total Roadway Area:	8.36 ac	

tymber creek rd.

Impervious Roadway Area:	0.30 ac	<------- From Existing Permit # 23005
Pervious Roadway Area:	0.30 ac	<------- From Existing Permit # 23005
Total Roadway Area:	0.60 ac	

Offsite Area: Total Area: 13.90 ac <------- From Existing Permit # 23005

Pond Area:

Proposed Expansion =	0.78 ac	<------- Commercial building to the west
Pervious Pond Area =	0.96 ac	<------- From Existing Permit # 23005
Water Surface Area:	0.00 ac	<------- From Existing Permit # 23005
Total Pond Area:	1.74 ac	

Impervious Area:	**3.42 ac**
Pervious Area:	**7.30 ac**
Offsite Area:	**13.90 ac**
Total Area:	**24.62 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
PROJECT AREA				
Impervious areas; Streets & roads	D	98	1.08 ac	105.8
Impervious areas; Streets & roads	A	98	2.04 ac	199.9
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	0.57 ac	47.9
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	4.69 ac	229.8
OFFSITE AREA				
Land Use Description	Soil Group	CN	Area	CN*Area
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	7.30 ac	613.2
Commercial & business (85% impervious)	C	94	1.50 ac	141.0
Residential Areas (1/2 acre, 25% Impervious)	A	54	4.30 ac	232.2
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	0.30 ac	23.7
Impervious areas; Streets & roads	A	98	1.10 ac	107.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	0.96 ac	47.0
Commercial & business (85% impervious)	A	89	0.78 ac	69.4
		Total:	24.62 ac	1817.8

CN = Total CN*Area / Total Area = **73.8**

Pond Areas Highlighted in yellow

Runoff:

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**5.81 in**	**7.66 in**	**10.49 in**	**2.96 in**

Soil Capacity (S) = $\frac{1000}{CN} - 10$ = **3.54 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3**

Station Limits: From: 1347+00 To: 1365+20

Roadway Length = 1820 ft
R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area:	5.40 ac
Pervious Roadway Area:	2.98 ac
Total Roadway Area:	8.36 ac

tymber creek rd.

Impervious Roadway Area:	0.30 ac	<------- From Existing Permit #
Pervious Roadway Area:	0.30 ac	<------- From Existing Permit #
Total Roadway Area:	0.60 ac	

Offsite Area: Total Area: 13.90 ac <------- From Existing Permit # 23005

Pond Area:

Pervious Pond Area :	0.65 ac	Dry Pond
Water Surface Area:	1.09 ac	<-- Area @ DHW
Total Pond Area:	1.74 ac	

Total Area:

Impervious Area:	**5.70 ac**
Pervious Area:	**3.93 ac**
Water Surface Area:	**1.09 ac**
Offsite Area:	**13.90 ac**
Total Area:	**24.62 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Within Tomoka River Recharge Area				
Impervious areas; Streets & roads	A	98	3.01 ac	295.0
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	0.74 ac	36.3
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	2.98 ac	146.0
Residential Areas (1/2 acre, 25% Impervious)	A	54	4.30 ac	232.2
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	A	36	1.10 ac	39.6
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	A	39	0.65 ac	25.4
Proposed Ponds (Water Surface)	A	100	1.09 ac	108.9
Outside Tomoka River Recharge Area				
Impervious areas; Streets & roads	D	98	2.69 ac	263.6
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	0.30 ac	23.7
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	6.26 ac	525.8
Commercial & business (85% impervious)	C	94	1.50 ac	141.0
		Total:	24.62 ac	1837.5

CN = Total CN*Area / Total Area = **74.6**

Pond Areas Highlighted in yellow

Runoff:

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in

Soil Capacity (S) = $\frac{1000}{CN} - 10$ = **3.40 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3**

$$\text{Runoff (Q)} = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

Runoff (Q) =				
	5.91 in	**7.76 in**	**10.61 in**	**3.04 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3**

PROPOSED CONDITION

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Dry Retention**
Online/Offline	**Online**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Tomoka River Recharge Criteria	**3.00 in**	x DCIA from Most Effective Recharge Area (Type A soils) =	0.75 ac-ft	
	1.25 in	x Impervious Area =	0.59 ac-ft	
	0.50 in	x Total Basin Area =	1.03 ac-ft	

Online System Criteria	
0.50 in x Total Basin Area + Greatest volume specified for Offline Systems =	2.05 in

Treatment V_{req} = Largest of Trt. Vol. = **2.05 ac-ft**
Impaired Waters Requirement, provide 50% more TV = **3.08 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Q_{pre} =	11.92 ac-ft	15.71 ac-ft	21.53 ac-ft	6.07 ac-ft
Q_{post} =	12.12 ac-ft	15.93 ac-ft	21.77 ac-ft	6.23 ac-ft
ΔQ =	**0.20 ac-ft**	**0.22 ac-ft**	**0.24 ac-ft**	**0.15 ac-ft**

Attenuation V_{req} = **0.24 ac-ft** (use largest value)
Existing Permit No. 23005 Attenuation V_{req} = **0.50 ac-ft**
Total Attenuation V_{req} = **0.74 ac-ft**

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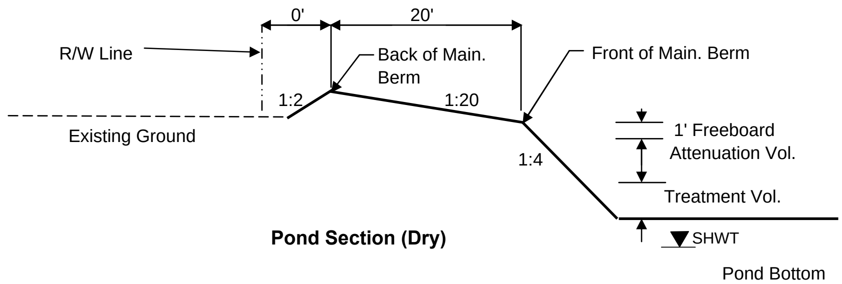
PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3**

Maintenance Area Width =	20.0 ft	@ 1:20	Existing Ground Elevation =	21.00
Pond Tie-In Width =	0.0 ft	@ 1:2	Pond Bottom Elevation =	13.00
Maximum Storage Depth (**SD**) =	7.00 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	19.90

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	150 ft	
Estimated Energy Losses =	0.1 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	18.83 ft	



Pond Section (Dry)

Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	Average Area (ac)	Delta D (ft)	Delta Storage (ac-ft)	Sum Storage (ac-ft)
21.00	Pond R/W	1.74 ac				6.76
			1.69	0.00	0.00	
21.00	Back of Main. Berm	1.65 ac				6.76
			1.53	0.00	0.00	
21.00		1.41 ac				6.76
			1.29	0.00	0.00	
21.00	Front of Main. Berm	1.17 ac				6.76
			1.13	1.00	1.13	
20.00	Provided Treat.Vol.+Att.Vol	1.09 ac				5.63
			1.02	1.78	1.81	
18.22	Req'd Treat.Vol+Att. Vol	0.94 ac				3.82
			0.94	0.10	0.09	
18.12	Estimated Storm Sewer TW	0.94 ac				3.73
			0.91	0.71	0.64	
17.41	Top of Treatment Vol.	0.88 ac				3.08
			0.70	4.41	3.08	
13.00	Pond Bottom	0.52 ac				0.00

Required Treatment+Attenuation Vol.= 3.82 ac-ft
Required Treatment+Attenuation Stage= 18.22 ft

Provided Treatment+Attenuation Vol.= 5.63 ac-ft
Provided Treatment+Attenuation Stage= 20.00 ft

Estimated Storm Sewer Att.= 3.73 ac-ft
Estimated Storm Sewer TW EL.= 18.12 ft

HGL requirements met

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3A and 3B**

Station Limits:

From: 1347+00 Roadway Length = 1820 ft
To: 1365+20 R/W Width = 200 ft

EXISTING CONDITION

Roadway Area:

Impervious Roadway Area:	3.12 ac	<------- From Existing SJRWMD Permit #4-127-23005-2
Pervious Roadway Area:	5.26 ac	<------- From Existing Permit # 23005
Total Roadway Area:	8.36 ac	

tymber creek rd.

Impervious Roadway Area:	0.30 ac	<------- From Existing Permit # 23005
Pervious Roadway Area:	0.30 ac	<------- From Existing Permit # 23005
Total Roadway Area:	0.60 ac	

Offsite Area: Total Area: 13.90 ac <------- From Existing Permit # 23005

Atten. Pond Area:

Pervious Pond Area =	0.79 ac	
Water Surface Area:	0.00 ac	
Total Pond Area:	0.79 ac	

Treat. Pond Area:

Pervious Pond Area =	0.36 ac	<------- From Existing Permit # 23005
Water Surface Area:	0.60 ac	<------- From Existing Permit # 23005
Total Pond Area:	0.96 ac	

Total Area:

Impervious Area:	**4.02 ac**
Pervious Area:	**6.71 ac**
Offsite Area:	**13.90 ac**
Total Area:	**24.63 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
PROJECT AREA				
Impervious areas; Streets & roads	D	98	1.08 ac	105.8
Impervious areas; Streets & roads	A	98	2.04 ac	199.9
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	0.57 ac	47.9
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	4.69 ac	229.8
OFFSITE AREA				
Land Use Description	Soil Group	CN	Area	CN*Area
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	7.30 ac	613.2
Commercial & business (85% impervious)	C	94	1.50 ac	141.0
Residential Areas (1/2 acre, 25% Impervious)	A	54	4.30 ac	232.2
Impervious areas; Streets & roads	D	98	0.30 ac	29.4
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	A	36	1.10 ac	39.6
Brush-weed-grass mixture; Poor condition (< 50% ground cover)	A	48	0.79 ac	38.1
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	0.36 ac	17.6
Existing Lakes (Water surface)	A	100	0.60 ac	60.0
		Total:	24.63 ac	1754.6

CN = Total CN*Area / Total Area = **71.2**

Pond Areas Highlighted in yellow

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **4.04 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**5.49 in**	**7.30 in**	**10.10 in**	**2.72 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3A and 3B**

Station Limits: From: 1347+00 To: 1365+20

Roadway Length = 1820 ft
R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area:	5.40 ac
Pervious Roadway Area:	2.98 ac
Total Roadway Area:	8.36 ac

tymber creek rd.

Impervious Roadway Area:	0.30 ac	<------- From Existing Permit #
Pervious Roadway Area:	0.30 ac	<------- From Existing Permit #
Total Roadway Area:	0.60 ac	

Offsite Area: Total Area: 13.90 ac <------- From Existing Permit # 23005

Atten. Pond Area:

Pervious Pond Area :	0.79 ac	Dry Pond
Water Surface Area:	0.00 ac	
Total Pond Area:	0.79 ac	

Treat. Pond Area:

Pervious Pond Area :	0.43 ac	Dry Pond
Water Surface Area:	0.53 ac	<-- Area @ DHW
Total Pond Area:	0.96 ac	

Total Area:

Impervious Area:	**5.70 ac**
Pervious Area:	**4.50 ac**
Water Surface Area:	**0.53 ac**
Offsite Area:	**13.90 ac**
Total Area:	**24.63 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Within Tomoka River Recharge Area				
Impervious areas; Streets & roads	A	98	3.01 ac	295.0
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	0.74 ac	36.3
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	2.98 ac	146.0
Residential Areas (1/2 acre, 25% Impervious)	A	54	4.30 ac	232.2
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	A	36	1.10 ac	39.6
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	A	39	0.43 ac	16.7
Proposed Ponds (Water Surface)	A	100	0.53 ac	53.1
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	A	39	0.79 ac	31.0
Outside Tomoka River Recharge Area				
Impervious areas; Streets & roads	D	98	2.69 ac	263.6
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	D	79	0.30 ac	23.7
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	6.26 ac	525.8
Commercial & business (85% impervious)	C	94	1.50 ac	141.0
		Total:	24.63 ac	1804.0

CN = Total CN*Area / Total Area = **73.2**

Pond Areas Highlighted in yellow

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10$ = 3.66 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**5.73 in**	**7.57 in**	**10.40 in**	**2.90 in**

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Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3A and 3B**

PROPOSED CONDITION

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Dry Retention**
Online/Offline	**Offline**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Tomoka River Recharge Criteria	**3.00 in**	x DCIA from Most Effective Recharge = Area (Type A soils)	0.75 ac-ft
	0.50 in	x Total Basin Area =	1.03 ac-ft

Treatment V_{req} = Largest of Trt. Vol. = **1.03 ac-ft**
Impaired Waters Requirement, provide 50% more TV = **1.54 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Q_{pre} =	11.26 ac-ft	14.98 ac-ft	20.73 ac-ft	5.58 ac-ft
Q_{post} =	11.77 ac-ft	15.55 ac-ft	21.36 ac-ft	5.96 ac-ft
ΔQ =	**0.51 ac-ft**	**0.56 ac-ft**	**0.62 ac-ft**	**0.38 ac-ft**

Attenuation V_{req} = 0.62 ac-ft (use largest value)

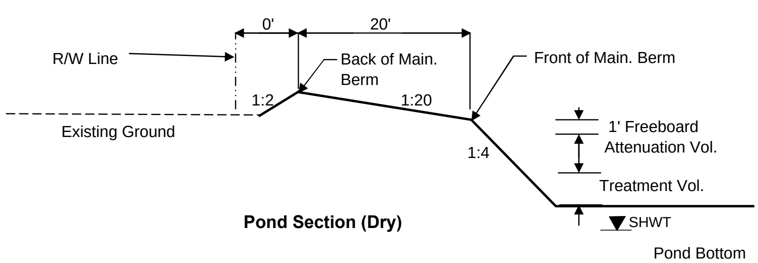
Existing Permit No. 23005 Attenuation V_{req} = 0.50 ac-ft

Total Attenuation V_{req} = 1.12 ac-ft

Maintenance Area Width =	20.0 ft	@ 1:20	Existing Ground Elevation =	21.00
Pond Tie-In Width =	0.0 ft	@ 1:2	Pond Bottom Elevation =	13.00
Maximum Storage Depth (**SD**) =	7.00 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	19.90

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	150 ft	
Estimated Energy Losses =	0.1 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	18.83 ft	



Pond Section (Dry)

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Made by: SVC
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DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3A and 3B**

Pond 3A: Treatment Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	Average Area (ac)	Delta D (ft)	Delta Storage (ac-ft)	Sum Storage (ac-ft)
21.00	Pond R/W	0.96 ac				3.18
			0.92	0.00	0.00	
21.00	Back of Main. Berm	0.87 ac				3.18
			0.80	0.00	0.00	
21.00		0.72 ac				3.18
			0.65	0.00	0.00	
21.00	Front of Main. Berm	0.58 ac				3.18
			0.55	1.00	0.55	
20.00	Provided Treatment Vol	0.53 ac				2.62
			0.48	2.25	1.08	
17.75	Req'd Treatment Vol	0.43 ac				1.54
			0.41	0.75	0.31	
17.00		0.40 ac				1.23
			0.37	1.00	0.37	
16.00		0.35 ac				0.86
			0.29	3.00	0.86	
13.00	Pond Bottom	0.22 ac				0.00

Required Treatment Volume= 1.54 ac-ft
Required Treatment Stage= 17.75 ft

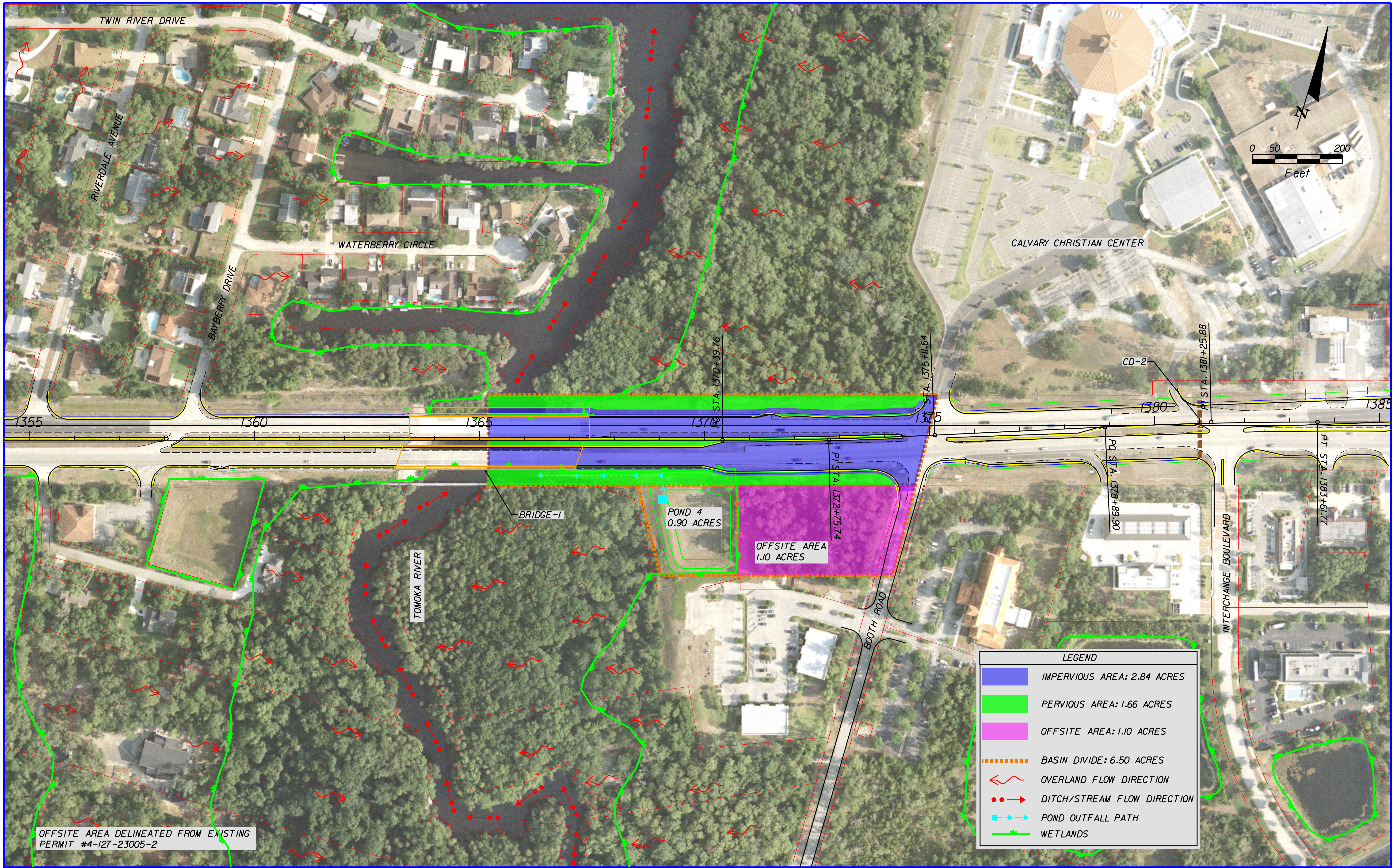
Provided Treatment Volume= 2.62 ac-ft
Provided Treatment Stage= 20.00 ft

Pond 3B: Attenuation Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	Average Area (ac)	Delta D (ft)	Delta Storage (ac-	Sum Storage (ac-
13.00	Pond R/W	1.17 ac				7.60
			0.98	6.00	5.89	
7.00	Back of Main. Berm	0.79 ac				1.71
			0.72	0.00	0.00	
7.00		0.65 ac				1.71
			0.58	0.00	0.00	
7.00	Front of Main. Berm	0.51 ac				1.71
			0.48	1.00	0.48	
6.00	Provided Attenuation Vol	0.44 ac				1.23
			0.43	0.25	0.11	
5.75	Req'd Attenuation Vol	0.43 ac				1.12
			0.37	1.75	0.64	
4.00		0.31 ac				0.48
			0.27	1.00	0.27	
3.00		0.24 ac				0.21
			0.21	1.00	0.21	
2.00	Pond Bottom	0.17 ac				0.00

Required Attenuation Volume= 1.12 ft
Required Attenuation Stage= 5.75 ft

Provided Attenuation Vol.= 1.23 ac-ft
Provided Attenuation Stage= 6.00 ft



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

Inwood consulting engineers

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

BASIN 4 MAP

SHEET NO.

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DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 4**
POND NAME : **Pond 4**

Station Limits:

From: 1365+20 Roadway Length = 980 ft
To: 1375+00 R/W Width = 200 ft

EXISTING CONDITION

Roadway Area:

Impervious Roadway Area:	1.79 ac	<-------	From Existing SJRWMD Permit #4-127-23005-2
Pervious Roadway Area:	2.71 ac	<-------	From Existing Permit # 23005
Total Roadway Area:	4.50 ac		

1/2 Booth Rd. Drwy

Impervious Roadway Area:	0.10 ac	<-------	From Existing Permit # 23005
Pervious Roadway Area:	0.40 ac	<-------	From Existing Permit # 23005
Total Roadway Area:	0.50 ac		

Offsite Area:

Impervious Area:	0.00 ac	<-------	From Existing Permit # 23005
Pervious Area:	0.60 ac	<-------	From Existing Permit # 23005
Total Roadway Area:	0.60 ac		

Pond Area:

Pervious Pond Area =	0.90 ac	<-------	From Existing Permit # 23005
Water Surface Area:	0.00 ac	<-------	From Existing Permit # 23005
Total Pond Area:	0.90 ac		

Impervious Area:	**1.89 ac**
Pervious Area:	**4.61 ac**
Total Area:	**6.50 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	A	98	1.71 ac	167.6
Impervious areas; Streets & roads	D	98	0.18 ac	17.6
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	2.72 ac	133.3
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	0.39 ac	32.8
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	A	36	1.05 ac	37.8
Existing Lakes (Water surface)	A	100	0.45 ac	45.0
		Total:	6.50 ac	434.1

CN = Total CN*Area / Total Area = **66.8**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ **4.97 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**4.94 in**	**6.68 in**	**9.41 in**	**2.32 in**

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DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 4**
POND NAME : **Pond 4**

Station Limits: From: 1365+20 To: 1375+00
Roadway Length = 980 ft
R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area:

Impervious Roadway Area:	2.84 ac
Pervious Roadway Area:	1.66 ac
Total Roadway Area:	4.50 ac

1/2 Booth Rd. Drwy

Impervious Roadway Area:	0.10 ac	<------- From Existing Permit #
Pervious Roadway Area:	0.40 ac	<------- From Existing Permit #
Total Roadway Area:	0.50 ac	

Offsite Area:

Impervious Area:	0.00 ac	<------- From Existing Permit # 23005
Pervious Area:	0.60 ac	<------- From Existing Permit # 23005
Total Roadway Area:	0.60 ac	

Pond Area:

Pervious Pond Area :	0.90 ac	Dry Pond
Water Surface Area:	0.00 ac	
Total Pond Area:	0.90 ac	

Total Area:

Impervious Area:	**2.94 ac**
Pervious Area:	**3.56 ac**
Water Surface Area:	**0.00 ac**
Total Area:	**6.50 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Within Tomoka River Recharge Area				
Impervious areas; Streets & roads	A	98	2.59 ac	253.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	49	1.43 ac	70.1
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	A	36	1.01 ac	36.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Good condition (grass cover > 75%)	A	39	0.45 ac	17.6
Proposed Ponds (Water Surface)	A	100	0.45 ac	45.0
Outside Tomoka River Recharge Area				
Impervious areas; Streets & roads	D	98	0.35 ac	34.3
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	D	84	0.22 ac	18.5
		Total:	6.50 ac	475.6

CN = Total CN*Area / Total Area = **73.2**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10$ = 3.67 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**5.73 in**	**7.56 in**	**10.39 in**	**2.90 in**

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DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 4**
POND NAME : **Pond 4**

PROPOSED CONDITION

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Dry Retention**
Online/Offline	**Online**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Tomoka River Recharge Criteria	**3.00 in**	xEffective Recharge = DCIA from Most Area (Type A soils)	0.65 ac-ft
	1.25 in	x Impervious Area =	0.31 ac-ft
	0.50 in	x Total Basin Area =	0.27 ac-ft

Online System Criteria	
0.50 in x Total Basin Area + Greatest volume specified for Offline Systems =	0.58 in

Treatment V_{req} = Largest of Trt. Vol. = **0.65 ac-ft**
Impaired Waters Requirement, provide 50% more TV = **0.97 ac-ft**

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	**FDOT 100yr/24hr**	**FDOT 100yr/72hr**	**Storm Sewer**
Q_{pre} =	2.67 ac-ft	3.62 ac-ft	5.10 ac-ft	1.26 ac-ft
Q_{post} =	3.10 ac-ft	4.10 ac-ft	5.63 ac-ft	1.57 ac-ft
ΔQ =	**0.43 ac-ft**	**0.48 ac-ft**	**0.53 ac-ft**	**0.31 ac-ft**

Attenuation V_{req} = **0.53 ac-ft** (use largest value)
Permit # 23005 Attenuation V_{req} = **0.64 ac-ft**
Total Attenuation V_{req} = **1.17 ac-ft**

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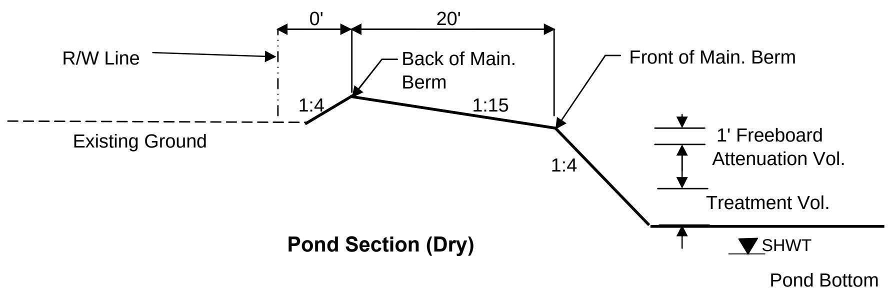
DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 4**
POND NAME : **Pond 4**

Maintenance Area Width =	20.0 ft	@ 1:15	Existing Ground Elevation =	20.00
Pond Tie-In Width =	0.0 ft	@ 1:4	Pond Bottom Elevation =	13.50
Maximum Storage Depth (**SD**) =	5.50 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	19.90

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	90 ft	
Estimated Energy Losses =	0.0 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	18.86 ft	



Pond Section (Dry)

Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	Average Area (ac)	Delta D (ft)	Delta Storage (ac-ft)	Sum Storage (ac-ft)
20.00	Pond R/W	0.90 ac				
20.00	Back of Main. Berm	0.86 ac				3.25
			0.80	0.00	0.00	
20.00		0.75 ac				3.25
			0.69	0.00	0.00	
20.00	Front of Main. Berm	0.63 ac				3.25
			0.61	1.00	0.61	
19.00	Provided Treat.Vol.+Att.Vol	0.59 ac				2.64
			0.57	0.90	0.52	
18.10	Req'd Treat.Vol+Att. Vol	0.55 ac				2.13
			0.52	1.62	0.85	
16.48	Estimated Storm Sewer TW	0.49 ac				1.28
			0.48	0.65	0.31	
15.83	Top of Treatment Vol.	0.46 ac				0.97
			0.42	2.33	0.97	
13.50	Pond Bottom	0.37 ac				0.00

Required Treatment+Attenuation Vol.= 2.15 ac-ft
Required Treatment+Attenuation Stage= 18.10 ft

Provided Treatment+Attenuation Vol.= 2.64 ac-ft
Provided Treatment+Attenuation Stage= 19.00 ft

Estimated Storm Sewer Att.= 1.28 ac-ft
Estimated Storm Sewer TW EL.= 16.48 ft

HGL requirements met

PONDS Version 3.3.0229
Retention Pond Recovery - Refined Method

Devo Seereeram, Ph.D., P.E.

Project Data

Project Name:	SR 40 PD&E Study from Breakaway Trail to Williamson Blvd.
Simulation Description:	Pond 4
Project Number:	428947-1-22-01
Engineer :	SVC
Supervising Engineer:	REC
Date:	06-21-2012

Aquifer Data

Base Of Aquifer Elevation, [B] (ft datum):	9.00
Water Table Elevation, [WT] (ft datum):	9.50
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day):	40.00
Fillable Porosity, [n] (%):	25.00
Unsaturated Vertical Infiltration Rate, [Iv] (ft/day):	33.0
Maximum Area For Unsaturated Infiltration, [Av] (ft^2):	16160.8

Geometry Data

Equivalent Pond Length, [L] (ft):	224.0
Equivalent Pond Width, [W] (ft):	174.0

Ground water mound is expected to intersect the pond bottom

Stage vs Area Data

Stage (ft datum)	Area (ft^2)
13.50	16160.8
15.83	20204.9
19.00	25707.1
20.00	27442.8

Scenario Input Data

Scenario 1 :: Treatment Volume - 42307.65 ft³ slug load

Hydrograph Type: Slug Load
Modflow Routing: Routed with infiltration

Treatment Volume (ft³) 42307.65

Initial ground water level (ft datum) default, 9.50

Time After Storm Event (days)	Time After Storm Event (days)
0.100	2.000
0.250	2.500
0.500	3.000
1.000	3.500
1.500	4.000

Scenario 2 :: Retention Volume - 50383.7 ft³ slug load

Hydrograph Type: Slug Load
Modflow Routing: Routed with infiltration

Treatment Volume (ft³) 50383.7

Initial ground water level (ft datum) default, 9.50

Time After Storm Event (days)	Time After Storm Event (days)	Time After Storm Event (days)	Time After Storm Event (days)	Time After Storm Event (days)
0.100	2.500	5.500	8.500	11.500
0.250	3.000	6.000	9.000	12.000
0.500	3.500	6.500	9.500	12.500
1.000	4.000	7.000	10.000	13.000
1.500	4.500	7.500	10.500	13.500
2.000	5.000	8.000	11.000	14.000

PONDS Version 3.3.0229
Retention Pond Recovery - Refined Method
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Detailed Results *:: Scenario 1 :: Treatment Volume - 42307.65 ft³ slug load*

Elapsed Time (hours)	Inflow Rate (ft³/s)	Outside Recharge (ft/day)	Stage Elevation (ft datum)	Infiltration Rate (ft³/s)	Overflow Discharge (ft³/s)	Cumulative Inflow Volume (ft³)	Cumulative Infiltration Volume (ft³)	Cumulative Discharge Volume (ft³)	Flow Type
0.000	7051.2750	0.0000	9.500	0.00000	0.00000	0.0	0.0	0.0	N.A.
0.002	7051.2750	0.0000	15.825	6.17016	0.00000	42307.7	37.0	0.0	U/P
2.400	0.0000	0.0000	14.566	1.81931	0.00000	42307.7	24098.9	0.0	U/S
6.000	0.0000	0.0000	14.298	0.30986	0.00000	42307.7	28854.6	0.0	S
12.000	0.0000	0.0000	14.030	0.18634	0.00000	42307.7	33492.1	0.0	S
24.000	0.0000	0.0000	13.697	0.10203	0.00000	42307.7	39091.6	0.0	S
36.000	0.0000	0.0000	13.432	0.03722	0.00000	42307.7	42307.7	0.0	S
48.000	0.0000	0.0000	13.157	0.00000	0.00000	42307.7	42307.7	0.0	S
60.000	0.0000	0.0000	12.946	0.00000	0.00000	42307.7	42307.7	0.0	S
72.000	0.0000	0.0000	12.774	0.00000	0.00000	42307.7	42307.7	0.0	S
84.000	0.0000	0.0000	12.631	0.00000	0.00000	42307.7	42307.7	0.0	S
96.000	0.0000	0.0000	12.508	----	----	42307.7	42307.7	0.0	N.A.

Summary of Results *:: Scenario 1 :: Treatment Volume - 42307.65 ft³ slug load*

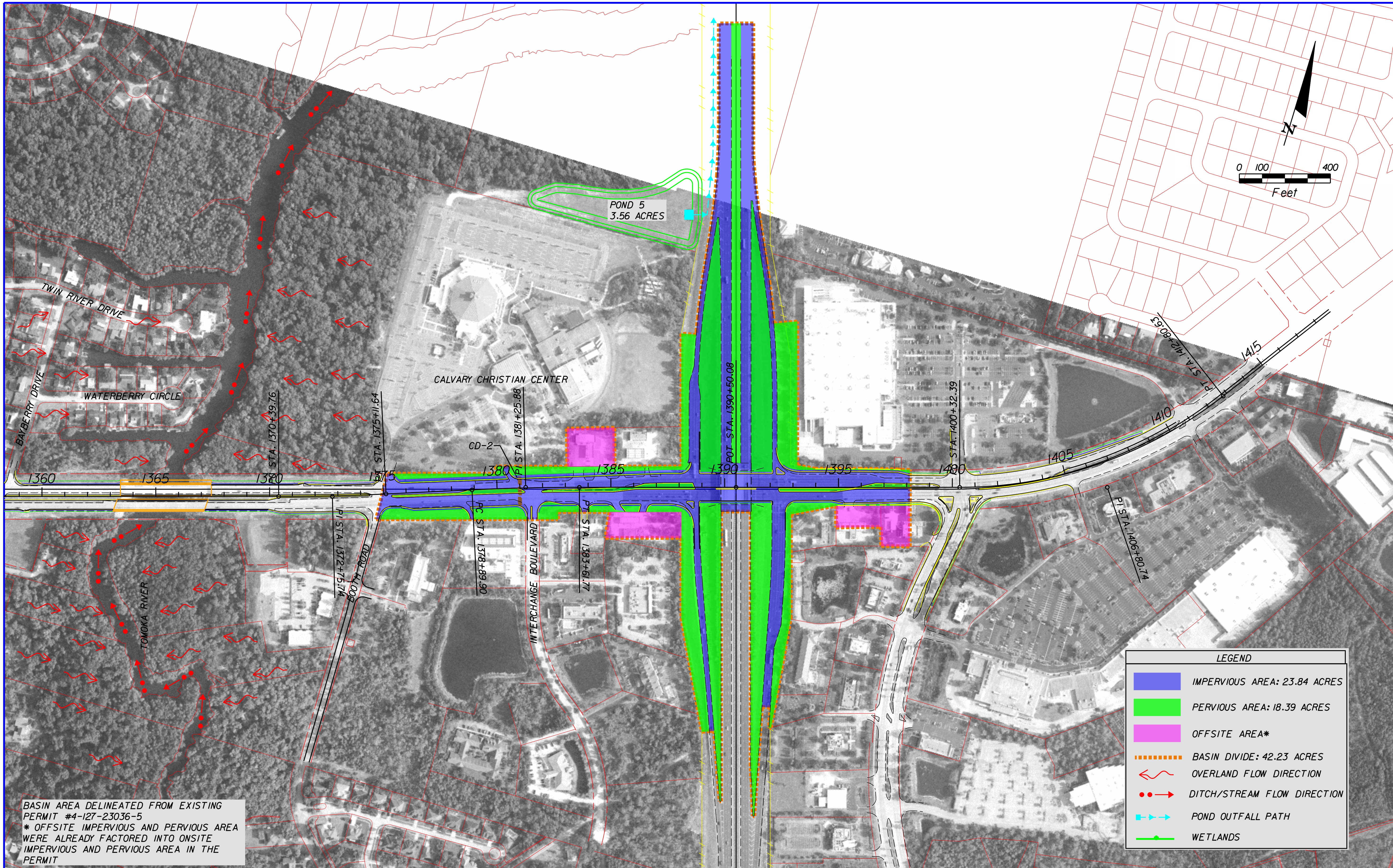
	Time (hours)	Stage (ft datum)	Rate (ft³/s)	Volume (ft³)
Stage				
Minimum	0.000	9.50		
Maximum	0.002	15.83		
Inflow				
Rate - Maximum - Positive	0.002		7051.2750	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	0.002			42307.7
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	96.000			42307.7
Infiltration				
Rate - Maximum - Positive	0.002		6.1702	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	36.000			42307.7
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	96.000			42307.7
Combined Discharge				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	96.000			0.0
Discharge Structure 1 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Discharge Structure 2 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Discharge Structure 3 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Pollution Abatement:				
36 Hour Stage and Infiltration Volume	36.000	13.43		42307.7
72 Hour Stage and Infiltration Volume	72.000	12.77		42307.7

Detailed Results *:: Scenario 2 :: Retention Volume - 50383.7 ft³ slug load*

Elapsed Time (hours)	Inflow Rate (ft^3/s)	Outside Recharge (ft/day)	Stage Elevation (ft datum)	Infiltration Rate (ft^3/s)	Overflow Discharge (ft^3/s)	Cumulative Inflow Volume (ft^3)	Cumulative Infiltration Volume (ft^3)	Cumulative Discharge Volume (ft^3)	Flow Type
0.000	8397.2830	0.0000	9.500	0.00000	0.00000	0.0	0.0	0.0	N.A.
0.002	8397.2830	0.0000	16.219	6.17024	0.00000	50383.7	37.0	0.0	U/P
2.400	0.0000	0.0000	14.956	1.89911	0.00000	50383.7	25007.8	0.0	U/S
6.000	0.0000	0.0000	14.669	0.34504	0.00000	50383.7	30302.2	0.0	S
12.000	0.0000	0.0000	14.381	0.20765	0.00000	50383.7	35469.4	0.0	S
24.000	0.0000	0.0000	14.022	0.12345	0.00000	50383.7	41711.7	0.0	S
36.000	0.0000	0.0000	13.759	0.09065	0.00000	50383.7	46135.1	0.0	S
48.000	0.0000	0.0000	13.552	0.04917	0.00000	50383.7	49543.9	0.0	S
60.000	0.0000	0.0000	13.326	0.00972	0.00000	50383.7	50383.7	0.0	S
72.000	0.0000	0.0000	13.123	0.00000	0.00000	50383.7	50383.7	0.0	S
84.000	0.0000	0.0000	12.956	0.00000	0.00000	50383.7	50383.7	0.0	S
96.000	0.0000	0.0000	12.814	0.00000	0.00000	50383.7	50383.7	0.0	S
108.000	0.0000	0.0000	12.691	0.00000	0.00000	50383.7	50383.7	0.0	S
120.000	0.0000	0.0000	12.583	0.00000	0.00000	50383.7	50383.7	0.0	S
132.000	0.0000	0.0000	12.486	0.00000	0.00000	50383.7	50383.7	0.0	S
144.000	0.0000	0.0000	12.399	0.00000	0.00000	50383.7	50383.7	0.0	S
156.000	0.0000	0.0000	12.320	0.00000	0.00000	50383.7	50383.7	0.0	S
168.000	0.0000	0.0000	12.248	0.00000	0.00000	50383.7	50383.7	0.0	S
180.000	0.0000	0.0000	12.182	0.00000	0.00000	50383.7	50383.7	0.0	S
192.000	0.0000	0.0000	12.120	0.00000	0.00000	50383.7	50383.7	0.0	S
204.000	0.0000	0.0000	12.063	0.00000	0.00000	50383.7	50383.7	0.0	S
216.000	0.0000	0.0000	12.010	0.00000	0.00000	50383.7	50383.7	0.0	S
228.000	0.0000	0.0000	11.960	0.00000	0.00000	50383.7	50383.7	0.0	S
240.000	0.0000	0.0000	11.914	0.00000	0.00000	50383.7	50383.7	0.0	S
252.000	0.0000	0.0000	11.870	0.00000	0.00000	50383.7	50383.7	0.0	S
264.000	0.0000	0.0000	11.828	0.00000	0.00000	50383.7	50383.7	0.0	S
276.000	0.0000	0.0000	11.789	0.00000	0.00000	50383.7	50383.7	0.0	S
288.000	0.0000	0.0000	11.751	0.00000	0.00000	50383.7	50383.7	0.0	S
300.000	0.0000	0.0000	11.716	0.00000	0.00000	50383.7	50383.7	0.0	S
312.000	0.0000	0.0000	11.682	0.00000	0.00000	50383.7	50383.7	0.0	S
324.000	0.0000	0.0000	11.650	0.00000	0.00000	50383.7	50383.7	0.0	S
336.000	0.0000	0.0000	11.619	----	----	50383.7	50383.7	0.0	N.A.

Summary of Results :: *Scenario 2 :: Retention Volume - 50383.7 ft³ slug load*

	Time (hours)	Stage (ft datum)	Rate (ft³/s)	Volume (ft³)
Stage				
Minimum	0.000	9.50		
Maximum	0.002	16.22		
Inflow				
Rate - Maximum - Positive	0.002		8397.2830	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	0.002			50383.7
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	336.000			50383.7
Infiltration				
Rate - Maximum - Positive	0.002		6.1702	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	60.000			50383.7
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	336.000			50383.7
Combined Discharge				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	336.000			0.0
Discharge Structure 1 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Discharge Structure 2 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Discharge Structure 3 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Pollution Abatement:				
36 Hour Stage and Infiltration Volume	36.000	13.76		46135.1
72 Hour Stage and Infiltration Volume	72.000	13.12		50383.7



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

Inwood consulting engineers

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

BASIN 5 MAP

SHEET NO.

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Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 5**
POND NAME : **Pond 5**

Station Limits:

From: 1375+00 — Roadway Length = 4133 ft
To: 1416+33 — R/W Width = 200 ft

EXISTING CONDITION

Roadway Area: (Including I-95)

Impervious Roadway Area:	15.12 ac	<-------	From Existing SJRWMDPermit #4-127-23036-5
Pervious Roadway Area:	25.82 ac	<-------	From Existing Permit # 23036
Total Roadway Area:	40.94 ac		

Pond Area:

Pervious Pond Area =	0.00 ac	<-------	From Existing Permit # 23036
Water Surface Area:	0.00 ac	<-------	From Existing Permit # 23036
Total Pond Area:	0.00 ac		

Impervious Area:	**15.12 ac**
Pervious Area:	**25.82 ac**
Total Area:	**40.94 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	A	98	15.12 ac	1481.8
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	69	19.43 ac	1340.7
Woods; Fair condition (Woods grazed but not burned, and with some forest litter)	A	36	6.39 ac	230.0
		Total:	40.94 ac	3052.5

CN = Total CN*Area / Total Area = **74.6**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10$ = **3.41 in**

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**5.90 in**	**7.75 in**	**10.60 in**	**3.03 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 5**
POND NAME : **Pond 5**

Station Limits: From: 1375+00 To: 1416+33

Roadway Length = 4133 ft
R/W Width = 200 ft

PROPOSED CONDITION

Roadway Area: (Including I-95)

Impervious Roadway Area:	23.84 ac	<------- From Existing Permit # 23036
Pervious Roadway Area:	18.39 ac	<------- From Existing Permit # 23036
Total Roadway Area:	42.23 ac	

Pond Area:

Pervious Pond Area :	3.56 ac	Dry Pond
Water Surface Area:	0.00 ac	
Total Pond Area:	3.56 ac	

Total Area:

Impervious Area:	**23.84 ac**
Pervious Area:	**18.39 ac**
Water Surface Area:	**0.00 ac**
Total Area:	**42.23 ac**

Curve Number:

Land Use Description	Soil Group	CN	Area	CN*Area
Impervious areas; Streets & roads	A	98	23.84 ac	2336.4
Open Space (lawns, parks, golf courses, cemeteries, etc.) Fair condition (grass cover 50% to 75%)	A	69	18.39 ac	1268.8
		Total:	42.23 ac	3605.3

CN = Total CN*Area / Total Area = **85.4**

Runoff:

Soil Capacity (S) = $\frac{1000}{CN} - 10 =$ 1.71 in

Runoff (Q) = $\frac{(P - 0.2S)^2}{(P + 0.8S)}$

	SJRWMD 25yr/24hr	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer 3yr/24hr
Precipitation (P) =	9.00 in	11.00 in	14.00 in	5.75 in
Runoff (Q) =	**7.23 in**	**9.18 in**	**12.13 in**	**4.11 in**

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PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 5**
POND NAME : **Pond 5**

PROPOSED CONDITION

Selection criteria

Permitting Agency	**SJRWMD**
StormW.Mgmt.	**Dry Retention**
Online/Offline	**Offline**
OFW/Impaired	**Yes**
Open/Closed Basin	**Open**

Dry Retention	**1.25 in**	x Impervious Areas =	2.48 ac-ft
	0.50 in	x Total Basin Area =	1.76 ac-ft

Treatment V_{req} = Largest of Trt. Vol. = 2.48 ac-ft
Impaired Waters Requirement, provide 50% more TV = 3.73 ac-ft

Required Attenuation Volume:

Total Runoff (ac-ft)

	SJRWMD	FDOT 100yr/24hr	FDOT 100yr/72hr	Storm Sewer
Q_{pre} =	20.12 ac-ft	26.45 ac-ft	36.17 ac-ft	10.33 ac-ft
Q_{post} =	25.43 ac-ft	32.31 ac-ft	42.70 ac-ft	14.45 ac-ft
ΔQ =	**5.31 ac-ft**	**5.86 ac-ft**	**6.54 ac-ft**	**4.12 ac-ft**

Attenuation V_{req} = 6.54 ac-ft (use largest value)

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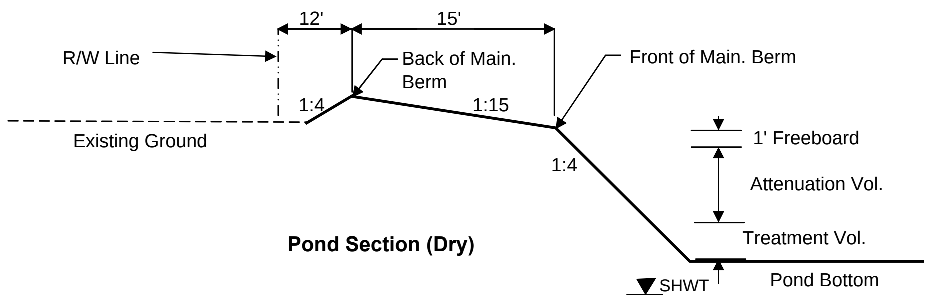
PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 5**
POND NAME : **Pond 5**

Maintenance Area Width =	15.0 ft	@ 1:15	Existing Ground Elevation =	20.00
Pond Tie-In Width =	11.9 ft	@ 1:4	Pond Bottom Elevation =	14.76
Maximum Storage Depth (**SD**) =	7.21 ft	with 1.0 ft freeboard	Lowest EOP Elevation =	20.82

Hydraulic Grade Line (HGL) check

HGL Slope =	0.050%	Use 0.05% for very flat terrain to 0.1% for flat terrain
Distance from Pond to Lowest EOP =	1000 ft	
Estimated Energy Losses =	0.5 ft	
HGL Clearance =	1.0 ft	Use 1.0 foot as a standard HGL clearance (no junction losses)
Allowable Storm Sewer Tailwater EL =	19.32 ft	



Pond Section (Dry)

Pond Stage / Storage Calculations

ELEVATION	DESCRIPTION	AREA	Average Area (ac)	Delta D (ft)	Delta Storage (ac-ft)	Sum Storage (ac-ft)
20.00	Pond R/W	3.56 ac				9.71
			3.54	-2.97	-10.51	
22.97	Back of Main. Berm	3.52 ac				20.23
			3.34	0.82	2.75	
22.15		3.17 ac				17.48
			2.99	0.82	2.46	
21.33	Front of Main. Berm	2.81 ac				15.02
			2.73	1.00	2.73	
20.33	Provided Treat.Vol.+Att.Vol	2.65 ac				12.29
			2.57	1.00	2.56	
19.33	Req'd Treat.Vol+Att. Vol	2.49 ac				9.73
			2.46	0.39	0.96	
18.94	Estimated Storm Sewer TW	2.43 ac				8.77
			2.25	2.24	5.04	
16.71	Top of Treatment Vol.	2.08 ac				3.73
			1.92	1.94	3.73	
14.76	Pond Bottom	1.77 ac				0.00

Required Treatment+Attenuation Vol.= 10.26 ac-ft
Required Treatment+Attenuation Stage= 19.33 ft

Provided Treatment+Attenuation Vol.= 12.29 ac-ft
Provided Treatment+Attenuation Stage= 20.33 ft

Estimated Storm Sewer Att.= 7.84 ac-ft
Estimated Storm Sewer TW EL.= 18.94 ft

HGL requirements met

APPENDIX 4

Estimated Pond Construction Costs

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Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1**
POND NAME : **Pond 1**

CONSTRUCTION COSTS

Existing Elevation Above Back of Main Berm

x

	ELEVATION	AREA	FILL HEIGHT	FILL VOLUME	EXCAVATION HEIGHT	EXCAVATION VOLUME
POND SLOPE BOTTOM*	12.00 ft	1.22 ac				
			0.00 ft	0 cy	8.00 ft	17230 cy
FRONT OF POND BERM*	20.00 ft	1.45 ac				
			0.00 ft	0 cy	1.00 ft	2420 cy
BACK OF POND BERM*	21.00 ft	1.55 ac				
			0.00 ft	0 cy	0.00 ft	0 cy
EXISTING GROUND	21.00 ft	5.69 ac				
			TOTAL:	0 cy	**TOTAL:**	19650 cy

EARTHWORK

	VOLUME	UNIT COST
POND FILL :	0 cy	$10.50
POND EXCAVATION:	19650 cy	$5.50
TOTAL COST:		**$108,077.20**

CLEARING AND GRUBBING*

POND R/W AREA :	1.83 ac
COST PER ACRE :	$3,268.42
TOTAL COST :	**$5,981.21**

POND SOD QUANTITIES

POND R/W AREA :	5.69 ac
POND WATER AREA :	3.87 ac
TOTAL POND SOD AREA :	1.82 ac
COST PER SY :	$1.66
TOTAL COST :	**$14,622.61**

POND FENCE QUANTITIES

POND R/W PERIMETER :	2110
COST PER FT :	$10.76
20-FT STANDARD GATE :	1
COST PER EA :	$1,392.26
TOTAL COST :	**$24,095.86**

PIPE QUANTITIES (includes both inflow and outfall pipes)

Length		
Inflow	**Outfall**	**Total**
3850 ft	100 ft	3950 ft
UNIT COST - PIPE (30") (RCP):		$42.70
TOTAL COST:		**$168,665.00**

IMPERMEABLE LINER QUANTITY

POND LINED AREA (AC) :	0.19 ac
POND LINED AREA (SY) :	916.25 sy
COST PER SY:	$9.89
TOTAL COST:	**$9,061.67**

TOTAL CONSTRUCTION COST: $330,503.55

*Expansion of existing pond; Clearing and Grubbing and excavation quantities take the existing pond into consideration.

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DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 1-2**
POND NAME : **Pond 1-2**

CONSTRUCTION COSTS

Existing Elevation Above Back of Main Berm

x

	ELEVATION	AREA	FILL HEIGHT	FILL VOLUME	EXCAVATION HEIGHT	EXCAVATION VOLUME
PROPOSED BOTTOM	3.00 ft	5.40 ac				
			0.00 ft	0 cy	9.00 ft	89806 cy
EXISTING BOTTOM *	12.00 ft	6.97 ac				
			0.00 ft	0 cy	0.00 ft	0 cy
POND SLOPE BOTTOM*	12.00 ft	4.94 ac				
			0.00 ft	0 cy	8.00 ft	69631 cy
FRONT OF POND BERM*	20.00 ft	5.85 ac				
			0.00 ft	0 cy	1.00 ft	9704 cy
BACK OF POND BERM*	21.00 ft	6.18 ac				
			0.00 ft	0 cy	0.00 ft	0 cy
BACK OF POND BERM	21.00 ft	9.79 ac				
			0.00 ft	0 cy	3.00 ft	23692 cy
EXISTING GROUND	24.00 ft	10.44 ac				
			TOTAL:	0 cy	TOTAL:	192834 cy

EARTHWORK

	VOLUME	UNIT COST
POND FILL :	0 cy	$10.50
POND EXCAVATION:	192834 cy	$5.50
TOTAL COST:		**$1,060,585.17**

CLEARING AND GRUBBING

POND R/W AREA :	6.58 ac
COST PER ACRE :	$3,268.42
TOTAL COST :	**$21,506.20**

POND SOD QUANTITIES

POND R/W AREA :	10.44 ac
POND WATER AREA :	8.10 ac
TOTAL POND SOD AREA :	2.34 ac
COST PER SY :	$1.66
TOTAL COST :	**$18,800.50**

POND FENCE QUANTITIES

POND R/W PERIMETER :	2750
COST PER FT :	$10.76
20-FT STANDARD GATE :	1
COST PER EA :	$1,392.26
TOTAL COST :	**$30,982.26**

PIPE QUANTITIES (includes both inflow and outfall pipes)

Length		
Inflow	Outfall	Total
6300 ft	100 ft	6400 ft
UNIT COST - PIPE (30") (RCP):		$42.70
TOTAL COST:		**$273,280.00**

IMPERMEABLE LINER QUANTITY

POND LINED AREA (AC) :	1.45 ac
POND LINED AREA (SY) :	7009.28 sy
COST PER SY:	$9.89
TOTAL COST:	**$69,321.77**

TOTAL CONSTRUCTION COST: $1,474,475.90

*Expansion of existing pond; Clearing and Grubbing and excavation quantities take the existing pond into consideration.

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DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2A**

CONSTRUCTION COSTS

Existing Elevation Above Back of Main Berm

x

	ELEVATION	AREA	FILL		EXCAVATION	
			HEIGHT	VOLUME	HEIGHT	VOLUME
POND SLOPE BOTTOM	10.50 ft	4.71 ac				
			0.00 ft	0 cy	8.50 ft	75028 cy
FRONT OF POND BERM	19.00 ft	6.23 ac				
			0.00 ft	0 cy	2.00 ft	20734 cy
BACK OF POND BERM	21.00 ft	6.62 ac				
			0.00 ft	0 cy	1.00 ft	10841 cy
EXISTING GROUND	22.00 ft	6.82 ac				
			TOTAL:	0 cy	**TOTAL:**	106603 cy

EARTHWORK

	VOLUME	UNIT COST
POND FILL :	0 cy	$10.50
POND EXCAVATION:	106603 cy	$5.50
TOTAL COST:		**$586,314.16**

CLEARING AND GRUBBING

POND R/W AREA :	6.82 ac
COST PER ACRE :	$3,268.42
TOTAL COST :	**$22,286.56**

POND SOD QUANTITIES

POND R/W AREA :	6.82 ac
POND WATER AREA :	0.74 ac
TOTAL POND SOD AREA :	6.08 ac
COST PER SY :	$1.66
TOTAL COST :	**$48,874.83**

POND FENCE QUANTITIES

POND R/W PERIMETER :	1020
COST PER FT :	$10.76
20-FT STANDARD GATE :	1
COST PER EA :	$1,392.26
TOTAL COST :	**$12,367.46**

PIPE QUANTITIES (includes both inflow and outfall pipes)

Length		
Inflow	**Outfall**	**Total**
2650 ft	1500 ft	4150 ft
UNIT COST - PIPE (30") (RCP):		$42.70
TOTAL COST:		**$177,205.00**

IMPERMEABLE LINER QUANTITY

POND LINED AREA (AC) :	1.21 ac
POND LINED AREA (SY) :	5841.07 sy
COST PER SY:	$9.89
TOTAL COST:	**$57,768.15**

TOTAL CONSTRUCTION COST: $904,816.15

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Made by: SVC
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DATE: September 24, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B-1**

CONSTRUCTION COSTS

Existing Elevation Above Back of Main Berm

	ELEVATION	AREA	FILL HEIGHT	FILL VOLUME	EXCAVATION HEIGHT	EXCAVATION VOLUME
POND SLOPE BOTTOM	10.50 ft	2.18 ac				
			0.00 ft	0 cy	8.50 ft	37186 cy
FRONT OF POND BERM	19.00 ft	3.25 ac				
			0.00 ft	0 cy	2.00 ft	10927 cy
BACK OF POND BERM	21.00 ft	3.53 ac				
			0.00 ft	0 cy	1.00 ft	5809 cy
EXISTING GROUND	22.00 ft	3.67 ac				
			TOTAL:	0 cy	**TOTAL:**	53922 cy

EARTHWORK

	VOLUME	UNIT COST
POND FILL :	0 cy	$10.50
POND EXCAVATION:	53922 cy	$5.50
TOTAL COST:		**$296,570.59**

CLEARING AND GRUBBING

POND R/W AREA :	3.67 ac
COST PER ACRE :	$3,268.42
TOTAL COST :	**$12,005.22**

POND SOD QUANTITIES

POND R/W AREA :	3.67 ac
POND WATER AREA :	0.00 ac
TOTAL POND SOD AREA :	3.67 ac
COST PER SY :	$1.66
TOTAL COST :	**$29,511.11**

POND FENCE QUANTITIES

POND R/W PERIMETER :	1600
COST PER FT :	$10.76
20-FT STANDARD GATE :	1
COST PER EA :	$1,392.26
TOTAL COST :	**$18,608.26**

PIPE QUANTITIES (includes both inflow and outfall pipes)

Length		
Inflow	**Outfall**	**Total**
1450 ft	1200 ft	2650 ft
UNIT COST - PIPE (30") (RCP):		$42.70
TOTAL COST:		**$113,155.00**

IMPERMEABLE LINER QUANTITY

POND LINED AREA (AC) :	0.80 ac
POND LINED AREA (SY) :	3894.04 sy
COST PER SY:	$9.89
TOTAL COST:	**$38,512.10**

TOTAL CONSTRUCTION COST: $508,362.28

Inwood consulting engineers
3000 Dovera Drive, Suite 200
Oviedo, Florida 32765
p 407.971.8850 f 407.971.8955

Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B-2**

CONSTRUCTION COSTS

Existing Elevation Above Front of Main Berm, Below Back of Main Berm

	ELEVATION	AREA	FILL		EXCAVATION	
			HEIGHT	VOLUME	HEIGHT	VOLUME
POND SLOPE BOTTOM	6.00 ft	0.40 ac				
			0.00 ft	0 cy	11.00 ft	13409 cy
FRONT OF POND BERM	17.00 ft	1.11 ac				
			0.00 ft	0 cy	1.50 ft	2738 cy
EXISTING GROUND	18.50 ft	1.32 ac				
			0.50 ft	42 cy	0.00 ft	0 cy
BACK OF POND BERM	19.00 ft	1.28 ac				
			TOTAL:	42 cy	**TOTAL:**	16147 cy

EARTHWORK

	VOLUME	UNIT COST
POND FILL :	42 cy	$10.50
POND EXCAVATION:	16147 cy	$5.50
TOTAL COST:		**$89,252.76**

CLEARING AND GRUBBING

POND R/W AREA :	1.32 ac
COST PER ACRE :	$3,268.42
TOTAL COST :	**$4,321.88**

POND SOD QUANTITIES

POND R/W AREA :	1.32 ac
POND WATER AREA :	0.74 ac
TOTAL POND SOD AREA :	0.58 ac
COST PER SY :	$1.66
TOTAL COST :	**$4,648.00**

POND FENCE QUANTITIES

POND R/W PERIMETER :	960
COST PER FT :	$10.76
20-FT STANDARD GATE :	1
COST PER EA :	$1,392.26
TOTAL COST :	**$11,721.86**

PIPE QUANTITIES (includes both inflow and outfall pipes)

Length		
Inflow	**Outfall**	**Total**
1200 ft	1800 ft	3000 ft
UNIT COST - PIPE (30") (RCP):		$42.70
TOTAL COST:		**$128,100.00**

TOTAL CONSTRUCTION COST: $238,044.50

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3000 Dovera Drive, Suite 200
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Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 2**
POND NAME : **Pond 2B-3**

CONSTRUCTION COSTS

Existing Elevation Below Front of Main Berm

x

	ELEVATION	AREA	FILL HEIGHT	FILL VOLUME	EXCAVATION HEIGHT	EXCAVATION VOLUME
POND SLOPE BOTTOM	7.00 ft	0.39 ac				
			0.00 ft	0 cy	10.50 ft	3299 cy
EXISTING GROUND	17.50 ft	1.49 ac				
			0.50 ft	752 cy	0.00 ft	0 cy
FRONT OF POND BERM	18.00 ft	1.10 ac				
			2.00 ft	594 cy	0.00 ft	0 cy
BACK OF POND BERM	20.00 ft	1.27 ac				
			TOTAL:	1347 cy	**TOTAL:**	3299 cy

EARTHWORK

	VOLUME	UNIT COST
POND FILL :	1347 cy	$10.50
POND EXCAVATION:	3299 cy	$5.50
TOTAL COST:		**$32,286.07**

CLEARING AND GRUBBING

POND R/W AREA :	1.49 ac
COST PER ACRE :	$3,268.42
TOTAL COST :	**$4,878.99**

POND SOD QUANTITIES

POND R/W AREA :	1.49 ac
POND WATER AREA :	0.74 ac
TOTAL POND SOD AREA :	0.76 ac
COST PER SY :	$1.66
TOTAL COST :	**$6,083.72**

POND FENCE QUANTITIES

POND R/W PERIMETER :	1020
COST PER FT :	$10.76
20-FT STANDARD GATE :	1
COST PER EA :	$1,392.26
TOTAL COST :	**$12,367.46**

PIPE QUANTITIES (includes both inflow and outfall pipes)

Length		
Inflow	**Outfall**	**Total**
1200 ft	2100 ft	3300 ft
UNIT COST - PIPE (30") (RCP):		$42.70
TOTAL COST:		**$140,910.00**

TOTAL CONSTRUCTION COST: $196,526.24

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Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : SR 40 PD&E Study - From Breakaway Trail to Williamson Road
BASIN NAME : Basin 3
POND NAME : Pond 3

CONSTRUCTION COSTS

Existing Elevation Above Back of Main Berm

	ELEVATION	AREA	FILL HEIGHT	FILL VOLUME	EXCAVATION HEIGHT	EXCAVATION VOLUME
POND SLOPE BOTTOM	13.00 ft	0.52 ac				
			0.00 ft	0 cy	8.00 ft	10906 cy
FRONT OF POND BERM	21.00 ft	1.17 ac				
			0.00 ft	0 cy	0.00 ft	0 cy
BACK OF POND BERM	21.00 ft	1.65 ac				
			0.00 ft	0 cy	0.00 ft	0 cy
EXISTING GROUND	21.00 ft	1.74 ac				
			TOTAL:	0 cy	TOTAL:	10906 cy

EARTHWORK

	VOLUME	UNIT COST
POND FILL :	0 cy	$10.50
POND EXCAVATION:*	10906 cy	$5.50
TOTAL COST:		$59,983.73

CLEARING AND GRUBBING

POND R/W AREA :*	0.87 ac
COST PER ACRE :	$3,268.42
TOTAL COST :	$2,843.53

POND SOD QUANTITIES

POND R/W AREA :	0.87 ac
POND WATER AREA :	0.00 ac
TOTAL POND SOD AREA :	0.52 ac
COST PER SY :	$1.66
TOTAL COST :	$4,177.89

POND FENCE QUANTITIES

POND R/W PERIMETER :	575
COST PER FT :	$10.76
20-FT STANDARD GATE :	0
COST PER EA :	$1,392.26
TOTAL COST :	$6,187.00

PIPE QUANTITIES (includes both inflow and outfall pipes)

Length: Inflow	Outfall	Total
1820 ft	0 ft	1820 ft
UNIT COST - PIPE (30") (RCP):		$42.70
TOTAL COST:		$77,714.00

TOTAL CONSTRUCTION COST: $150,906.15

* Expansion of the existing pond, therefore, only half the pond needs to be excavated and cleared and grubbed.

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Made by: SVC
Checked by: REC

DATE: September 21, 2012
Job Number: KIT-004-01

PROJECT : **SR 40 PD&E Study - From Breakaway Trail to Williamson Road**
BASIN NAME : **Basin 3**
POND NAME : **Pond 3B**

CONSTRUCTION COSTS

Existing Elevation Above Back of Main Berm

	ELEVATION	AREA	FILL HEIGHT	FILL VOLUME	EXCAVATION HEIGHT	EXCAVATION VOLUME
POND SLOPE BOTTOM	2.00 ft	0.17 ac				
			0.00 ft	0 cy	5.00 ft	2755 cy
FRONT OF POND BERM	7.00 ft	0.51 ac				
			0.00 ft	0 cy	0.00 ft	0 cy
BACK OF POND BERM	7.00 ft	0.79 ac				
			0.00 ft	0 cy	6.00 ft	9507 cy
EXISTING GROUND	13.00 ft	1.17 ac				
			TOTAL:	0 cy	TOTAL:	12262 cy

EARTHWORK

	VOLUME	UNIT COST
POND FILL :	0 cy	$10.50
POND EXCAVATION:	12262 cy	$5.50
TOTAL COST:		$67,440.88

CLEARING AND GRUBBING

POND R/W AREA :	1.17 ac
COST PER ACRE :	$3,268.42
TOTAL COST :	$3,824.05

POND SOD QUANTITIES

POND R/W AREA :	1.17 ac
POND WATER AREA :	0.00 ac
TOTAL POND SOD AREA :	1.00 ac
COST PER SY :	$1.66
TOTAL COST :	$8,010.30

POND FENCE QUANTITIES

POND R/W PERIMETER :	1145
COST PER FT :	$10.76
20-FT STANDARD GATE :	1
COST PER EA :	$1,392.26
TOTAL COST :	$13,712.46

PIPE QUANTITIES (includes both inflow and outfall pipes)

Length - Inflow	Length - Outfall	Length - Total
1820 ft	0 ft	1820 ft
UNIT COST - PIPE (30") (RCP):		$42.70
TOTAL COST:		$77,714.00

TOTAL CONSTRUCTION COST: $170,701.69

APPENDIX 5

Alternatives Evaluation Matrix

Inwood consulting engineers
3000 Dovera Drive, Suite 200, Oviedo Fl 32765
(407)971-8850 - (407) 971-8955 (fax)

SR 40 PD&E Study - From Breakway Trail to Williamson Boulevard

BASIN 1 & BASIN 2 ALTERNATIVE POND SITES

ENGINEERING DATA & ANALYSIS

Alternatives	Location	Existing Ground Elevation (ft)	Soil Names & Hydrologic Groups	Estimated SHWT Elevation (ft)	Lowest Edge of Existing Roadway (ft)	Distance From Lowest Edge of Proposed Roadway (ft)	Estimated Allowable $DHW_{25yr/72hr}$ (ft)	Estimated Allowable Treatment & Attenuation Depth (ft)	Outfall Location	Roadway Drainage Area (ac)	Required Treatment & Attenuation Volume (ac-ft)	Required Pond Area Including Access (ac)
Pond 1	1317+00	21.00	Daytona (B), Electra ©, Farmton (D)	16.00	17.85	400	19.00	3.00	CD-1	23.39	5.25	5.69
Pond 1-2	1317+00	24.00	Daytona (B), Electra ©, Farmton (D)	16.30	17.85	400	19.00	2.70	CD-1	39.49	11.08	10.44
2A	1321+00	22.00	Apopka (A), Farmton (D)	16.50	17.85	1000	18.00	1.50	CD-1	21.55	7.94	8.18
2B-1	1321+00	22.00	Apopka (A), Farmton (D)	16.50	17.85	1000	18.00	1.50	CD-1	10.38	3.90	4.41
2B-2	1335+00	18.50	Farmton (D), Basinger (D)	12.00	18.00	400	16.00	3.00	CD-1	9.34	3.30	1.59
2B-3	1335+00	17.50	Farmton (D), Basinger (D), Electra (C)	13.00	18.00	600	17.00	3.00	CD-1	9.51	3.33	1.79

IMPACT & COST ANALYSIS

Alternatives	Roadway Floodplain Impacts (ac-ft)	Pond Floodplain Impacts (ac-ft)	Total Floodplain Impacts (ac-ft)	Arch. / Historical Impact Potential	Wetland Impacts (ac)	Wetland Impact Cost	Threatened or Endangered Species Impacts	Hazardous Materials & Contamination Potential	Major Utility Conflict Potential (Y/N)	Existing Land Use	Total Parcel Area (ac)	Estimated Construction Cost	Estimated Right-of-Way Acquisition Cost	Total Pond Costs
Pond 1	0.02	0.00	0.02	None	0	$0	None	None	N	Pond, Pasture	610	$330,504	$926,000	$1,256,504
Pond 1-2	0.02	0.00	0.02	None	0	$0	None	None	N	Pond, Pasture	610	$1,474,476	$3,263,000	$4,737,476
2A	0	0	0	None	0	$0	None	None	N	Pasture	610	$904,816	$2,438,000	$3,342,816
2B-1	0	0	0	None	0	$0	None	None	N	Pasture	610	$508,362	$1,450,000	$1,958,362
2B-2	0	0	0	None	0	$0	None	None	N	Woods	24	$238,044	$1,070,000	$1,308,044
2B-3	0	0	0	None	0	$0	None	None	N	Woods	24	$196,526	$1,455,000	$1,651,526

Note: Wetland impact costs were determined conservatively based on a UMAM score of 1 credit per 1 acre of wetland impact at a cost of $95,000 per credit/acre.

Alternative	Ponds	Total Cost	Rankings
A	Pond 1 & Pond 2A	$4,599,320	2
B	Pond 1, Pond 2B-1 & Pond 2B-2	$4,522,910	1
C	Pond 1, Pond 2B-1 & Pond 2B-3	$4,866,392	3
D	Pond 1-2	$4,737,476	4

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SR 40 PD&E Study - From Breakway Trail to Williamson Boulevard

BASIN 3 ALTERNATIVE POND SITES

ENGINEERING DATA & ANALYSIS

Alternatives	Location	Existing Ground Elevation (ft)	Soil Names & Hydrologic Groups	Estimated SHWT Elevation (ft)	Lowest Edge of Existing Roadway (ft)	Distance From Lowest Edge of Proposed Roadway (ft)	Estimated Allowable $DHW_{25yr/72hr}$ (ft)	Estimated Allowable Treatment & Attenuation Depth (ft)	Outfall Location	Roadway Drainage Area (ac)	Required Treatment & Attenuation Volume (ac-ft)	Required Pond Area Including Access (ac)
Pond 3	1358+00	21.00	Tavares (A), Electra (c)	13.00	19.90	150	20.00	7.00	Tomoka River	24.62	4.14	1.74
Pond 3A	1359+00	21.00	Tavares (A)	13.00	19.90	150	20.00	7.00	Tomoka River	24.63	2.66	0.96
Pond 3B	1362+00	13.00	Quartzipsamments (A), Tavares (A)	1.00			6.00	4.00	Tomoka River			1.17

IMPACT & COST ANALYSIS

Alternatives	Roadway Floodplain Impacts (ac-ft)	Pond Floodplain Impacts (ac-ft)	Total Floodplain Impacts (ac-ft)	Arch. / Historical Impact Potential	Wetland Impacts (ac)	Wetland Impact Cost	Threatened or Endangered Species Impacts	Hazardous Materials & Contamination Potential	Major Utility Conflict Potential (Y/N)	Existing Land Use	Total Parcel Area (ac)	Estimated Construction Cost	Estimated Right-of-Way Acquisition Cost	Total Pond Costs	Rankings
Pond 3	0.20	0.00	0.20	None	0	$0	None	None	N	Pond, Commercial	1.74	$130,039	$1,444,500	$1,574,539	2
Pond 3A	0.20	0.00	0.20	None	0	$0	None	None	N	Pond	0.96	$0	$0	$401,895	1
Pond 3B	0.20	0.17	0.37	None	0.04	$4,193	None	None	N	Woods	1.95	$170,702	$227,000		

APPENDIX 6

Cultural Resource Assessment Report

CULTURAL RESOURCE ASSESSMENT SURVEY OF STATE ROAD 40 FROM BREAKAWAY TRAIL TO WILLIAMSON BOULEVARD VOLUSIA COUNTY, FLORIDA

FINANCIAL MANAGEMENT # 428947-1-22-01

SEARCH PROJECT # 2657-11053

PREPARED FOR

KITTLESON & ASSOCIATES, INC.

BY

SOUTHEASTERN ARCHAEOLOGICAL RESEARCH, INC.

JULY 2012

Cultural Resource Assessment Survey of State Road 40 From Breakaway Trail to Williamson Boulevard Volusia County, Florida

Financial Management # 428947-1-22-01

Search Project # 2657-11053

Prepared for

Kittleson & Associates, Inc.

Prepared by

Southeastern Archaeological Research, Inc.
Elizabeth Chambless, Edward Salo, Ryan VanDyke, and Elizabeth Murphy

DRAFT

____

Elizabeth J. Chambless, MS, RPA
Principal Investigator

www.searchinc.com

July 2012

EXECUTIVE SUMMARY

This report presents the results of a Cultural Resource Assessment Survey (CRAS) conducted in support of the widening of State Road (SR) 40 from Breakaway Trail to Williamson Boulevard in Volusia County, Florida. The Florida Department of Transportation (FDOT), District 5, is conducting a Project Development and Environment (PD&E) Study to widen SR 40 (currently a divided four-lane roadway) to a six-lane facility from west of Breakaway Trail to east of Williamson Boulevard, a distance of approximately 2.4 miles. The CRAS for the project included the project roadway corridor in addition to 10 pond alternatives associated with the project.

The Area of Potential Effect (APE) was developed to consider visual, audible, and atmospheric effects that the project may have to historic properties. For this project, the APE was defined to include the existing and proposed right-of-way along SR 40 and was extended to the back or side property lines of parcels adjacent to the corridor or a distance of 100 meters (330 feet) from the right-of-way. The APE for the pond locations was defined as the proposed pond footprint. Archaeological testing was conducted within the existing and proposed right-of-way along SR 40 and within the pond footprints; the architectural survey included the entire APE.

The archaeological survey included the excavation of 67 shovel tests within the SR 40 right-of-way and associated ponds. None of the shovel tests recovered any artifacts or cultural material, and no archaeological sites or occurrences were identified within the SR 40 APE.

The architectural survey resulted in the identification and evaluation of three newly recorded historic resources (8VO09384–8VO09386). All three resources lack the architectural distinction or significant historical associations necessary to be considered for listing in the National Register of Historic Places (NRHP) and are recommended ineligible. Furthermore, no potential NRHP districts were identified due to the lack of concentration of historical structures.

In the opinion of the Principal Investigator, the proposed widening project will have no effect on cultural resources listed or eligible for listing in the NRHP. No further work is recommended for the SR 40 from Breakaway Trail to Williamson Boulevard project APE.

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INTRODUCTION

This report presents the results of a Cultural Resource Assessment Survey (CRAS) conducted in support of the widening of State Road (SR) 40 from Breakaway Trail to Williamson Boulevard in Volusia County, Florida (**Figure 1**). The Florida Department of Transportation (FDOT), District 5, is conducting a Project Development and Environment (PD&E) Study to widen SR 40 (currently a divided four-lane roadway) to a six-lane facility from west of Breakaway Trail to east of Williamson Boulevard, a distance of approximately 2.4 miles. Ten pond alternatives associated with the project were also included in the CRAS.

The Area of Potential Effect (APE) was developed to consider visual, audible, and atmospheric effects that the project may have to historic properties. For this project, the APE was defined to include the existing and proposed right-of-way along SR 40 between Breakaway Trail and Williamson Boulevard and was extended to the back or side property lines of parcels adjacent to the corridor or a distance of 100 meters (330 feet) from the right-of-way (**Figure 2**). The APE for the pond locations was defined as the proposed pond footprint. Archaeological testing was conducted within the existing and proposed right-of-way along SR 40 and within the pond footprints; the architectural survey included the entire APE.

This study was conducted to comply with Chapter 267 of the Florida Statutes and Rule Chapter 1A-46, Florida Administrative Code. All work was performed in accordance with Part 2, Chapter 12 of the FDOT PD&E Manual (revised January 1999) and the Cultural Resource Management Handbook (revised November 2004), as well as the Florida Division of Historical Resources (FDHR) recommendations for such projects as stipulated in the FDHR's *Cultural Resource Management Standards & Operations Manual, Module Three: Guidelines for Use by Historic Preservation Professionals*. The Principal Investigator for this project meets the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-42). This study also complies with Section 106 of the National Historic Preservation Act (as amended) and its implementing regulation 36 CFR Part 800 (*Protection of Historic Properties*).

Elizabeth J. Chambless, MS, RPA, served as the Principal Investigator for this project; Edward G. Salo, PhD, served as Architectural Historian. The report was written by Ms. Chambless, Dr. Salo, Ryan VanDyke, MA, and Elizabeth Murphy, BA. The archaeological fieldwork was conducted by Keith Pickles and Spencer Prentice. The architectural survey was done by Dr. Salo and Ms. VanDyke. Lisabeth A. Carlson, PhD, RPA, conducted the quality-control review, and Jennifer Salo, MA, edited and produced the document.

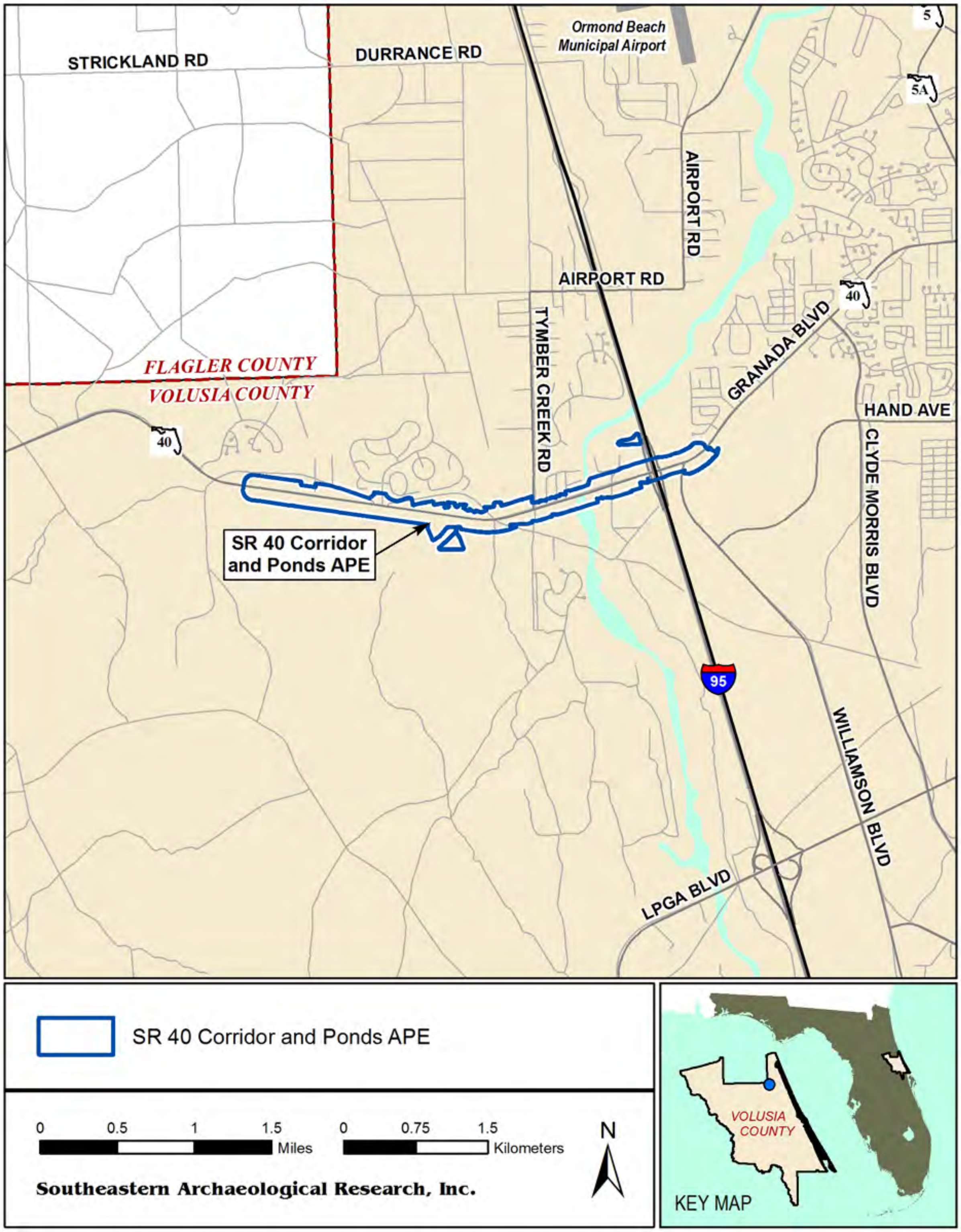

Figure 1. Location of the SR 40 project in Volusia County, Florida.

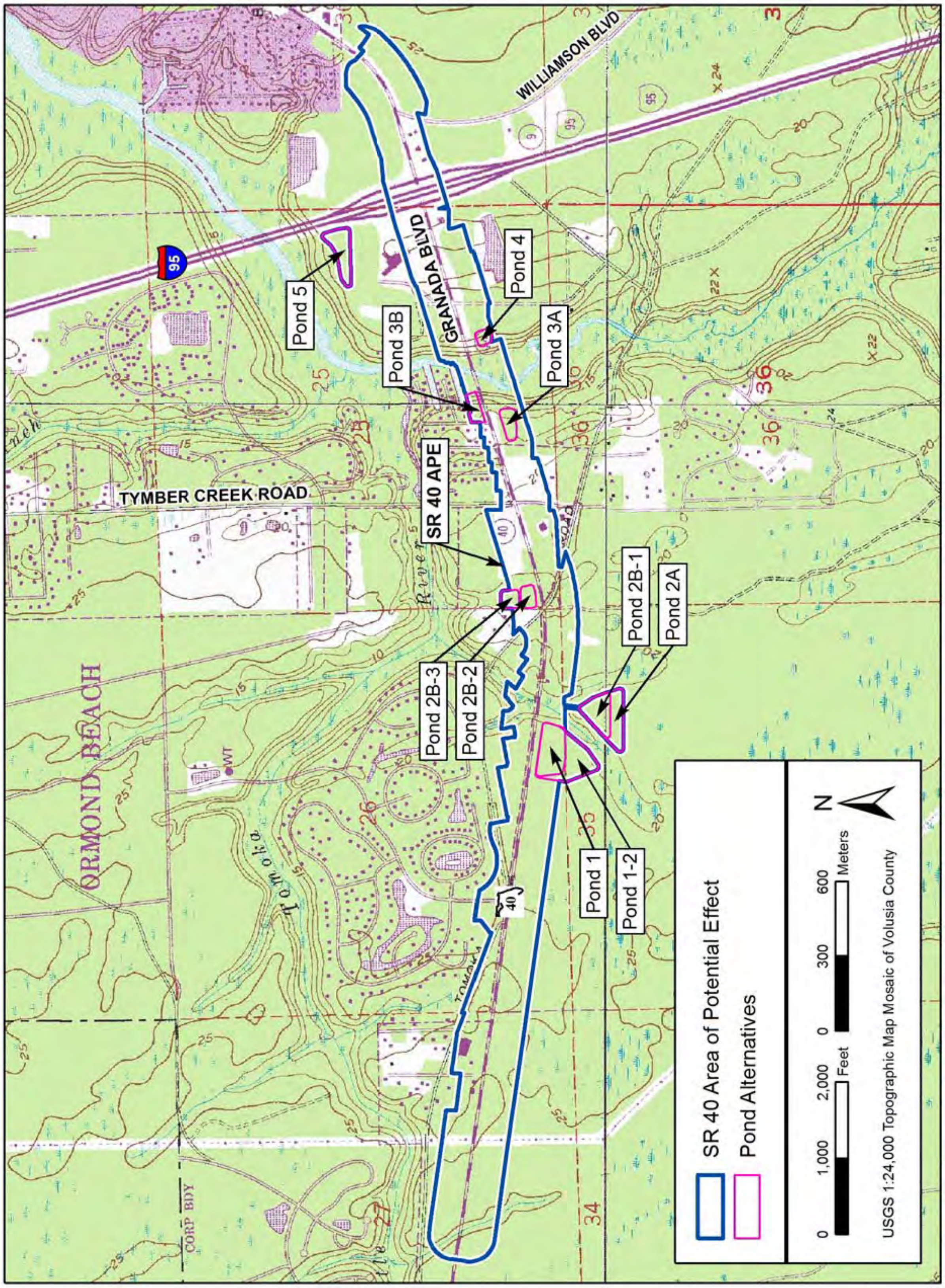

Figure 2. SR 40 Area of Potential Effect, Volusia County, Florida.

PROJECT LOCATION AND ENVIRONMENT

LOCATION AND MODERN CONDITIONS

The SR 40 APE is located in the City of Ormond Beach in northeastern Volusia County, Florida. The APE lies within Sections 25, 26, 35, and 36 of Township 14 South, Range 31 East, and Section 30 of Township 14 South, Range 32 East. Interstate 95 (I-95) is located near the eastern end of the project. Development in the vicinity of the APE is most dense near the I-95 interchange with SR 40; the remainder of the APE consists of residential neighborhoods and undeveloped parcels. The Tomoka River crosses SR 40 approximately 0.5 miles west of I-95, and an unnamed branch of the Little Tomoka River crosses SR 40 approximately 0.5 miles east of Old Tomoka Road. Elevations within the project APE are generally level at 20 feet above mean sea level (amsl), sloping down to 5 feet amsl near the Tomoka River crossing.

The project APE is located within the Eastern Flatwoods physiographic district (Brooks 1981). Flatwoods communities generally occur along level terrain, as the name implies. Soils, including those within the APE, are generally poorly to somewhat poorly drained (**Figure 3**). Pine flatwoods are typically a pyric or fire-dependent community, characterized by a mixture of longleaf pine (*Pinus palustris*), typical slash pine (*Pinus elliottii* var. *elliottii*), south Florida slash pine (*Pinus elliottii* var. *densa*), and pond pine (*Pinus serotina*). Fire restrains hardwood growth while promoting pine regeneration (USDA 1998). Minor tree species include live oak (*Quercus virginiana*), water oak (*Quercus nigra*), sweet gum (*Liquidambar styraciflua*), and red maple (*Acer rubrum*). Common shrubs include saw palmetto (*Serens repens*), gallberry (*Ilex glabra*), dwarf huckleberry (*Gaylussacia dumosa*), and dwarf live oak (*Quercus minima*).

PALEOENVIRONMENT

Between 18,000 and 12,000 years before present (BP), Florida was a much cooler and drier place than it is today. Melting of the continental ice sheets led to a major global rise in sea level (summarized for long time scales by Rohling et al. 1998) that started from a low stand of -120 meters at 18,000 BP. The rise was slow while glacial conditions prevailed at high latitudes but became very rapid in the latest Pleistocene and earliest Holocene. It became warmer and wetter rather rapidly during the next three millennia. By about 9000 BP, a warmer and drier climate began to prevail. These changes were more drastic in northern Florida and southern Georgia than in southern Florida, where the "peninsular effect" and a more tropically influenced climate tempered the effects of the continental glaciers that were melting far to the north (Watts 1969, 1971, 1975, 1980). Lake Okeechobee and the Everglades did not exist at this time. Sea levels, though higher, were still much lower than at present; surface water was limited; and extensive grasslands probably existed, which may have attracted mammoth, bison, and other large grazing mammals. By 6000–5000 BP the climate had changed to one of increased precipitation and surface water flow. By the late Holocene, ca. 4000 BP, the climate,

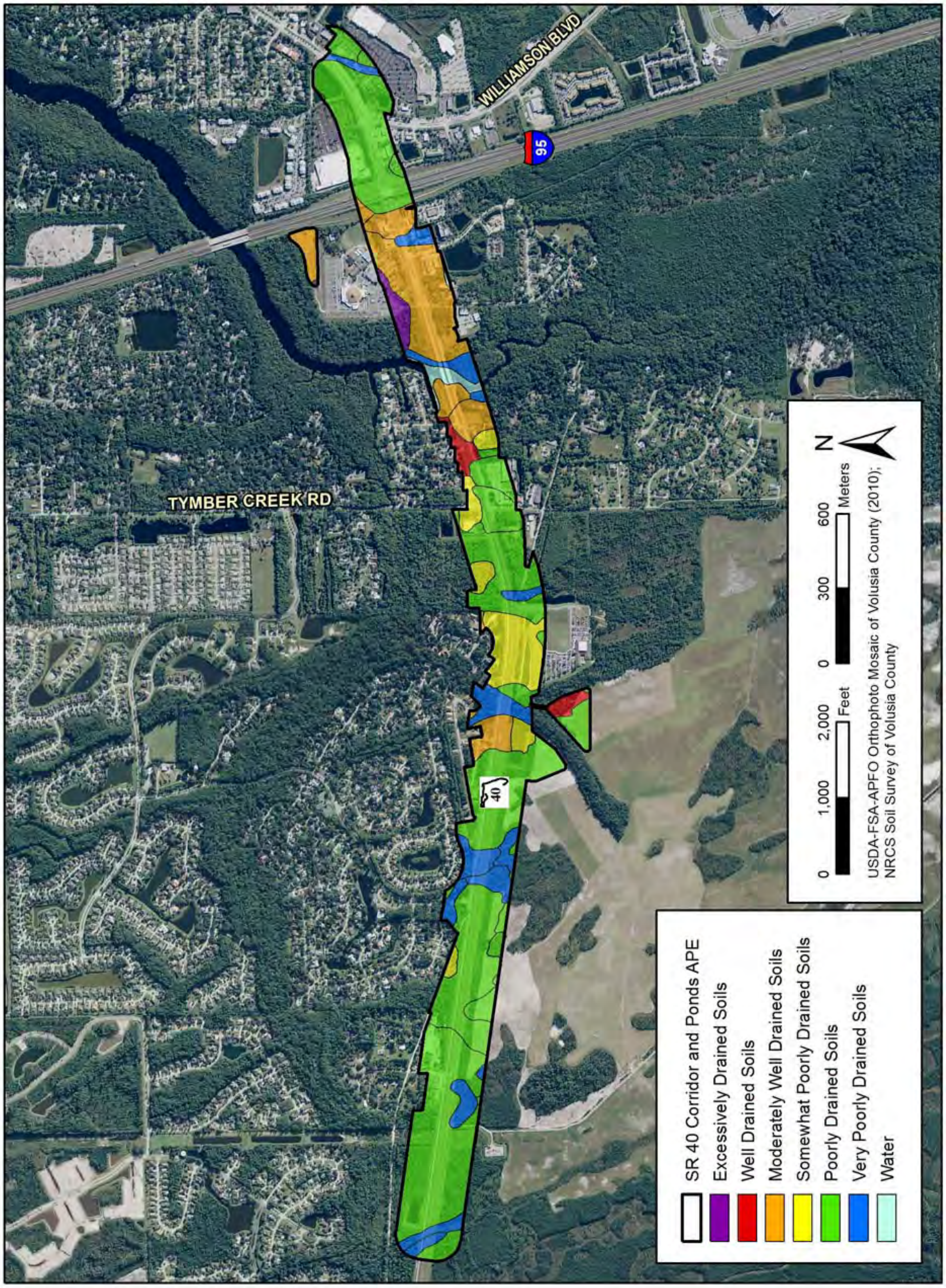

Figure 3. Soil drainage within the SR 40 APE.

water levels, and plant communities of Florida attained essentially modern conditions. These have been relatively stable with only minor fluctuations over the past 4,000 years.

HISTORIC OVERVIEW

NATIVE AMERICAN CULTURE HISTORY

The following overview of the history of precontact Florida consists of a four-part chronology, with each period defined by distinct cultural and technological characteristics recognized by archaeologists. From oldest to most recent, the four temporal periods are Paleoindian, Archaic, Woodland, and Mississippian.

Paleoindian Period

Current evidence indicates that the first inhabitants of Florida entered the area approximately 12,000 years ago (Clausen et al. 1979; Dunbar 2006; Hemmings 2004). Sea level was much lower than today, and the Florida peninsula was wider and drier, particularly in the central interior. Most of the known Paleoindian sites are located in north and west-central Florida, where karst springs and chert were readily available.

Florida's earliest Native Americans were probably nomadic hunter-gatherers who relied on now-extinct mammals (mammoth, mastodon, camel, horse, dire wolf) and wild plant foods for their subsistence (Milanich 1994). By the late Paleoindian period, however, it appears that people were spending part of each year in large habitation sites located near freshwater springs and lithic raw material sources (Daniel and Wisenbaker 1987). Purdy (1981) has suggested that the Paleoindian populations followed rivers through north and central Florida, exploiting the resources of the Florida Highlands and the Gulf Coast. The Paleoindian tool assemblage contains lanceolate-shaped projectile points, blades, end scrapers, thumbnail scrapers, gouges, and Edgefield scrapers, reflecting a reliance on hunting and butchering of animals as well as the use of well-made scraping tools for woodworking, hide scraping, and other tasks. Lanceolate-shaped Suwannee and Simpson projectile points are commonly found on sites in the karst regions of north and central Florida, although they are sometimes found in south Florida as well. There are only two Paleoindian sites recorded in Volusia County: the Samuel Butts site (8VO05266) and the Dean Sligh site (8VO00451). Both of these were identified through the discovery of lanceolate-shaped Suwannee points.

Archaic Period

Around 8000 BC the environment and physiology of Florida underwent some pronounced changes. These changes were interconnected and included a gradual warming trend, a rise in sea levels, a reduction in the width of peninsular Florida, and the spread of oak-dominated forests and hammocks throughout much of the state (Milanich 1994; Smith 1986). Concomitant with these environmental changes were alterations in native subsistence strategies, which became more diverse due to the emergence of new plant, animal, and aquatic species. Also occurring at this time was a significant increase in population numbers and density, with native groups developing regional habitat-specific adaptations and material assemblages (Milanich 1994; Smith 1986:10). Along the coasts, settled communities began to develop, while in the interior a more mobile lifestyle appears to have been practiced. A variety of site types reflect these different regional adaptations: residential base camps, short-term settlements, specialized procurement camps, quarries, and cemeteries (Milanich 1994:75–85).

The Early Archaic period (8000–5000 BC) was arid and warm and characterized by the spread of oak hardwood forests (Watts and Hansen 1988). Early Archaic campsites and habitation sites tend to be located in the same places that earlier Paleoindian sites are located, primarily around springs and spring-fed rivers. In Volusia County there are only two recorded Early Archaic sites: the JD site (8VO00627) and the Fort Florida Midden site (8VO00048). Both sites are located in close proximity to high-volume waterways. The JD site is located near the coast on the north side of Strickland Bay, which is between present-day Daytona Beach and New Smyrna Beach. The Fort Florida Midden site is located in southwestern Volusia County near the confluence of the St. Johns River and the Wekiva River.

The Middle Archaic period (5000–3000 BC) coincided with the climatic episode known as the Altithermal, a period in which temperatures peaked and rainfall diminished, while the Late Archaic saw an increase in precipitation and the intrusion of mixed pine and oak into the hardwood forests. As conditions became wetter, riparian and lacustrine adaptations became increasingly common, particularly along the coasts where relatively sedentary habitations occur (Russo 1991; Ste. Claire 1990). By contrast, the interior Archaic hunter-gatherers remained fairly mobile (Austin 1996; Chance 1983). By the Late Archaic period (3000–1000 BC), there was a trend toward more sedentary occupations and more circumscribed territories as conditions became increasingly similar to the modern environment.

A major technological innovation of the Late Archaic was the development of fired-clay pottery around 2000 BC. Referred to as Orange pottery by archaeologists, this early ceramic ware was tempered with vegetal fibers, either thin strands of palmetto or Spanish moss (Bullen 1972; Griffin 1945). Bullen (1972) divided this period into four subperiods (Orange 1–4) that dated from 2000 to about 500 BC. However, research conducted by Sassaman (2003) in the middle St. Johns River region has resulted in the refinement of the Orange period, with radiometric analysis illustrating that the phase spanned a much shorter interval from about 2000 to 1500 BC. With regard to vessel form, early pots were hand-molded and tended to be thick-walled, whereas some of the later vessels were thinner and formed by coiling. Horticulture preceded the early fiber-tempered pottery, which appeared simultaneously in three areas of the southeastern United States (Sassaman 1993).

The Middle and Late Archaic periods saw an increase in human activity within Volusia County. This increased activity was particularly intensive around the St. Johns River, although Middle and Late Archaic sites also are common in the eastern portion of the county, along rivers and creeks that empty into the Intracoastal Waterway. Along the lower portion of the Tomoka River, between present-day Tomoka State Park and the Ormond Beach Municipal Airport, are two sites that date to the latter portion of the Archaic period: the Tomoka River site (8VO02568) and Alissa's Site (8VO07495). Both sites consist of moderately dense artifact scatters, with Orange-series pottery present at both. Many Late Archaic fiber-tempered sites have been documented in New Smyrna Beach, mostly along the modern Indian River.

Some Archaic-period peoples in central and south Florida practiced a unique mortuary custom of interring their dead in wetland cemeteries. One of the most famous is located at the Windover site in Titusville (Doran 2002). Other wetland cemeteries have been documented in Hardee, Sarasota, and Collier Counties. Evidence of Middle Archaic burials in east Florida includes the Harris Creek site (8VO00024) at Tick Island, where burials were interred in specially prepared terrestrial locations, including a low sand mound (Aten 1999).

Woodland and Mississippian Periods

Following the Archaic period there began a gradual development of more complex forms of political, social, and religious community life throughout much of Florida, including Volusia County. This was accompanied by the establishment of more formal, settled communities and increased regional diversity. This regional diversity, due primarily to local adaptation to varied ecological conditions within the state, has traditionally been described in terms of cultural periods based on variations in ceramic types.

The post-Archaic culture on the northeast coast is referred to as St. Johns. This native culture began around 500 BC or earlier (e.g., Sassaman 2003) and lasted until after historic settlement occurred in St. Augustine in AD 1565 (Milanich 1994:246–248). The St. Johns culture arose out of the preceding Late Archaic, Orange-period cultures of the region. Clear continuities in incised design motifs exist between the Orange fiber-tempered ceramics and the chalky and incised wares of the early St. Johns periods (Bullen 1972; Rouse 1951). Many early St. Johns-culture sites occupy the same locations as the preceding Orange-period cultures, further supporting this developmental relationship (Milanich 1994:254–255). The common ceramic type on the northeast Atlantic Coast was a soft paste ware containing sponge spicules and referred to as St. Johns. This pottery was sometimes decorated with incised lines, and after AD 750, paddle stamping became a common decoration. Pre-AD 750 assemblages are commonly assigned to the St. Johns I period, and those postdating AD 750 are assigned to the St. Johns II period. The period of time after AD 1565 is referred to as the Spanish Mission period. The main archeological indicators of the Spanish Mission period are the presence of artifacts of European manufacture and the introduction of Old World flora and fauna.

St. Johns I sites in Volusia County are concentrated along the St. Johns River and the eastern coastal boundary. However, during the St. Johns II period, native populations began to increasingly move deeper into the interior of the county. For example, sites such as the Campbell Oaks site (8VO01973) and the Muck Lake site (8VO03463), both located east of the present city of DeLand, suggest an increasing trend of St. Johns II groups moving farther away from the high-subsistence-resource riverine and coastal zones. This movement away from these environments may represent an alteration in subsistence strategies, with a greater reliance on horticulture and agriculture.

The St. Johns I period is divided into three subperiods (I, Ia, and Ib) on the basis of observable changes in material culture, most notably ceramics (Goggin 1952:40; Milanich 1994:247). People of the St. Johns I culture (500 BC–AD 100) were foragers who relied primarily on hunting, fishing, and wild-plant collecting. During this time, the resources found near freshwater wetlands, swamps, and the coastal zones were typically the most heavily exploited. St. Johns I sites are typically shell middens in coastal zones that contain St. Johns Plain and St. Johns Incised pottery.

At St. Johns Ia sites (AD 100–500), St. Johns Plain and Incised pottery continued to be produced, and a red-painted St. Johns variant called Dunns Creek Red also was made. Exotic Hopewellian artifacts also occur in burial mounds. Weeden Island pottery (a primarily Gulf Coast ware) has been recovered from late St. Johns Ia sites, and was apparently acquired through trade. The St. Johns Ib period (AD 500–750) is similar to the Ia period, with the carryover of St. Johns Plain and Incised wares and Dunns Creek Red, but Weeden Island pottery becomes more common, particularly in burial mounds. However, the majority of everyday ceramics are plain. As the St. Johns culture progressed, sand mounds continued to be constructed and became larger through time.

The St. Johns II period is divided into three subperiods (IIa, IIb, and IIc). As populations grew, the number and size of mounds and villages increased. The emergence of check stamping marks the beginning of the St. Johns II period around AD 750 and, along with plain pottery, dominates the assemblages throughout the period. During St. Johns IIa (AD 750–1050), incised and punctated wares, possibly a reflection of Gulf Coast influences, occur with some frequency in mounds and middens. Late Weeden Island pottery continued to be traded into the St. Johns region and is recovered in sand burial mounds.

The St. Johns II culture reached its apex in terms of social, political, and ceremonial complexity during the St. Johns IIb period (AD 1050–1513). Classic Mississippian traits such as the construction of large truncated mounds and the presence of Southern Cult burial paraphernalia in association with perceived elite burials are evident (Milanich 1994; Smith 1986), indicating influence from northwest Florida. Some sand burial mounds were quite large and ceremonially complex, including truncated pyramidal mounds with ramps or causeways leading up to their summits (Milanich 1994:269–270). The rise in the number of St. Johns village and mound sites implies greater cultural complexity compared to that of the earlier St. Johns I period (Milanich 1994:267-274; Miller 1998). Shell and bone ornaments, worked copper, and other exotic materials and artifacts occur with some frequency in burial mounds (Goggin 1952; Milanich 1994).

In addition to the exploitation of aquatic resources for subsistence, it has been suggested that there was an increased dependence on horticulture during St. Johns II times (Goggin 1952; Milanich 1994:263–264). However, no direct evidence of corn agriculture in prehistoric St. Johns-period sites has been recovered, although indirect evidence is provided by corncob impressions on ceramic pots and clay effigies of corncobs, squash, and gourds (Milanich 1994:264–265). Corncobs and kernels have been recovered at Hontoon Island (Newsom 1987:74–75) and at the Riverbend site (8VO02567) on the Tomoka River in Volusia County (Russo et al. 1989), but in archaeological deposits that date to the historic Spanish Mission period.

POST-CONTACT HISTORY

Early Spanish Exploration and Colonization, 1513–1763

The earliest attempts to colonize Florida by Europeans occurred during the early sixteenth century with the entradas of Ponce de León (1513, 1521), Pánfilo de Narváez (1528), and Hernando de Soto (1539–1540). These early efforts were largely unsuccessful and were followed by a similarly unsuccessful attempt in Pensacola by Tristán de Luna (1559–1561). These failures to colonize Florida caused King Philip II to abandon the effort. He changed his mind, however, when he learned that the French were building settlements and military fortifications on Florida's east coast (Lyon 1983).

One of these, Fort Caroline, was established near the mouth of the St. Johns River near present-day Jacksonville in 1564. The French settlement not only undermined Spanish claims to Florida, it threatened Spanish fleets loaded with gold that sailed through the Straits of Florida. Consequently, King Philip sent Pedro Menéndez de Avilés to Florida with orders to expel the French. Menéndez arrived in Florida in 1565, quickly dispatched the French, and established St. Augustine. Chosen for its strategic location, St. Augustine existed as a military outpost and as a base for missionaries, who were sent to convert the native peoples to Catholicism (Deagan 1983).

Although the French occupation of Florida lasted only 15 months, they had many opportunities to interact with native groups in the region (**Figure 4**). After the fall of Fort Caroline and the establishment of St. Augustine, the Saturiwa (a Timucuan chiefdom centered near the mouth of the St. Johns River) and their allies, who were hostile to the Spanish, mounted a series of raids on the Spanish garrisons in the area. Governor Menéndez, upset by these constant attacks, decided that it was time to deal with the Indian problem. Menéndez's plan was to immobilize the Saturiwa by traveling south and forging alliances with other tribes in the area. At the end of August 1566, he proceeded in three small vessels with 100 men up the St. Johns River (Lyon 1983:168). He was ambushed by the Mayaca tribe at a narrows in the river south of Lake George and had to retreat.

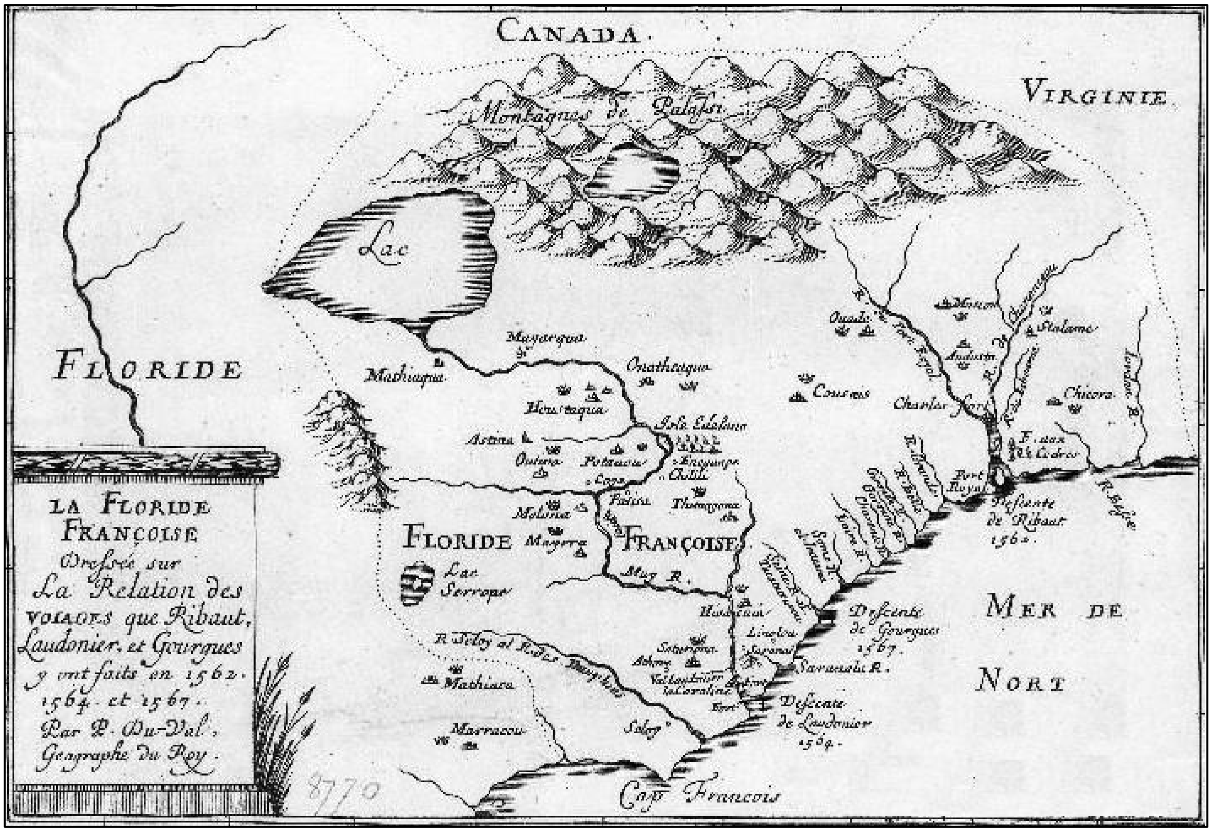

Figure 4. *Floride française* ("French Florida"), by Pierre du Val, seventeenth century. Source: explorethenationalparks.com.

Tensions between the Spanish and the Indians continued to escalate. In the summer of 1567, the Mayaca joined forces with the Saturiwa, the Nocoroco (whose village was on the Tomoka River), and the Potano (located within modern Alachua County) to wage war on the Utina, another northeast Florida Timucuan group, who were allied with the Spanish (Lyon 1983:198). In 1568, the Saturiwa allied themselves with the French in attacking and burning several Spanish forts including the fort at San Mateo at the mouth of the St. Johns River (Lyon 1983:199–201). San Mateo was eventually abandoned in 1569 (Milanich 1995:162), heralding the end of Spanish interest in much of modern-day Florida until the seventeenth century. Instead, the Spanish shifted their focus toward the area of the Atlantic coast north of St. Augustine. The Spanish also introduced the mission system in Florida in the late 1500s. By the 1630s, the Franciscans had established missions from St. Augustine to the Apalachicola River. The system was used to create political allies for the Spanish as well as indoctrinate the natives into Catholicism. In the 1700s, the English, as part of Queen Anne's War, destroyed much of the Spanish missions in Florida (McEwan 1993).

British Period, 1763–1784

In 1763, as part of the Treaty of Paris marking the end of the Seven Years' War, Spain ceded Florida to Great Britain. Florida was then divided at the Apalachicola River into East and West

Florida. The area of modern-day Volusia County was part of East Florida, and St. Augustine served as the capitol of East Florida (Fabel 1996). The British extended huge grants of land to investors who promised to develop the interior of the territory. Richard Oswald, a Scotsman of renown in British governmental circles, received two tracts of 20,000 acres each. One was located along the Halifax and Tomoka Rivers at present-day Tomoka State Park and was known as Mount Oswald. An absentee landowner, Oswald relied on local representatives to run his operation, which cultivated rice and indigo on several plantations. Without slave labor, these efforts would not have been successful. Another grant recipient, John Moultrie of South Carolina, also chose land on the Tomoka River. He called his plantation Rosetta (Griffin 1999).

Figure 5. Ruins of Turnbull's coquina plantation warehouse, New Smyrna Beach, Florida, ca. 1935. Source: Florida Memory Collection, Image #PR07597.

One of the largest English efforts to establish a colony in Florida was at Smyrnea in modern New Smyrna Beach. In 1768 Dr. Andrew Turnbull, a Scottish physician, established a plantation on his 20,000-acre land grant and raised indigo, rice, and other crops (**Figure 5**). Turnbull brought over 1,200 indentured servants, primarily Minorcans, from Europe to work his land and established a settlement for his workers along the Indian River (Griffin 1999).

Several years of drought eventually brought Turnbull's effort to ruin, and by 1777 the colony was completely abandoned after the colonists revolted and relocated to St. Augustine. The impact of the Turnbull plantation, however, would last much longer than the colony itself. By the time of their departure from the settlement, Turnbull's workers had cleared over 3,000 acres of land and covered the country with an intricate and extensive canal system, and even today the remains of building foundations from the settlement are present (Grange and Moore 2003; Griffin 1999:63). Additionally, its importance to British settlement efforts is made apparent by the British government financing the construction of the Kings Road, the southern portion of which went from St. Augustine to Turnbull's settlement.

Completed in 1775 during the British period of Florida history, the Kings Road stretched from New Smyrna in Volusia County to the St. Marys River in Nassau County. The road connected St. Augustine with points northward and southward, providing a land alternative to sea travel. From both a commercial and military standpoint, the 150-mile road was vital. When the Spanish returned to Florida in 1784, they maintained the road, which continued to serve as a major corridor in the region into the early American period, when it became known alternatively as the "Road to Jacksonville" or the "Road to St. Augustine." The Kings Road dwindled in importance as the nineteenth century drew to a close (Adams et al. 1997; Coomes 1975).

Second Spanish Period, 1784–1821

In 1783, the Treaty of Paris that ended the American Revolutionary War returned Florida to the Spanish. However, English-speaking settlers continued to reside in the countryside. The combination of former British subjects, Spanish soldiers and returning families, their slaves, white and black immigrants from the United States and the Caribbean, and Seminole Indians made East Florida, including present-day Volusia County, a culturally and racially heterogeneous area (Coker and Parker 1996:158–159).

Foreign, particularly American, settlement of East Florida was encouraged by a royal order issued by the King of Spain to Governor Quesada of Florida on October 20, 1790. The order authorized Quesada to grant lands to foreigners under certain conditions. Under the order, 100 acres could be allotted to each head of a family and 50 acres to other members. Quesada added his own terms to the royal order, requiring 10 years of continued residence or an oath of allegiance to the Spanish king before full title was granted. Enrique White, Quesada's successor, revised the terms for issuing grants on October 12, 1803, reducing the amount of land that could be granted to 50 acres for the head of a family, 25 acres for each child or servant over age 16, and 15 acres for each child or servant between the ages of eight and 15 (Hoffman 2002).

The revised terms also required that cultivation of the granted lands must begin within one month or forfeiture would occur. Some modification to White's terms was made by Governor Kindelan in 1815 whereby land titles were delivered upon proof that the grantees had cleared the land and made certain improvements. Kindelan's terms continued until 1817, when four years of residence on the land was required to establish ownership (Gold 1929:34). One of the most notable of these land grants was a 3,000-acre plot along the Halifax River awarded to Samuel Williams in 1804. The Williams plot makes up the bulk of what is now Daytona Beach (Cardwell and Cardwell 2004:7).

Title to much of the land in present-day Volusia County rests on these old Spanish land grant concessions. The eighth article of the Adams-Onís Treaty by which Spain ceded Florida to the United States in 1821 provided "that all grants of land made before the 24th of January 1818, by Spain, shall be ratified and confirmed to the same extent that the same grants would be valid if the territories had remained under the dominion of Spain" (Gold 1929:34–35).

Spanish control over Florida during the period from 1784 to 1821 remained tenuous. The influx of foreign nationals into north Florida, combined with the growing sentiment that the United States should control the territory, eventually led to the deterioration of Spanish dominance in the area. Spanish authority in Florida slowly waned until 1819, when the United States purchased the territory for $5 million. The United States officially took over Florida in 1821, with Andrew Jackson serving as the first territorial governor (Coker and Parker 1996).

Early American Settlement and the Seminole Wars, 1821–1861

With the establishment of Florida as a territory of the United States, two large counties divided along the Suwannee River were created: Escambia County to the west of the river and St. Johns County to the east. On December 29, 1824, St. Johns County was divided, with portions of it becoming Alachua, Nassau, Monroe, and Mosquito (also spelled Musquito) Counties. Mosquito County encompassed an area south of St. Johns County that was 190 miles long and 60 miles wide. New Smyrna eventually emerged as the county seat of Mosquito County on January 29, 1835 (Morris 1998) (**Figure 6**).

Disputes between the Seminole Indians and white settlers led to three successive wars, the first taking place between 1817 and 1818, predominantly in the northern part of Florida. In 1823 the Treaty of Moultrie Creek formed an Indian reservation in the interior of Florida (Mahon 1985). The treaty restricted the Seminoles to just over 4 million acres of land and isolated them from the coast of Florida (Mahon 1985:50). This treaty, as well as subsequent treaties (the Treaty of Payne's Landing [1832] and the Treaty of Fort Gibson [1833]) were unpopular with the Seminoles. This dissatisfaction led to years of conflict with white settlers and the US military, culminating in the Second Seminole War (1835–1842). A major source of tension between whites and Seminoles was slavery. For decades, runaway slaves had sought and found refuge among the Seminoles, who incorporated them as members of their frontier communities. This comradeship between blacks and Seminoles served as a beacon to slaves living on plantations in Florida and neighboring states. Therefore, pro-slavery forces were adamant about the removal of the Seminoles from Florida (Landers 1996; Mahon 1985).

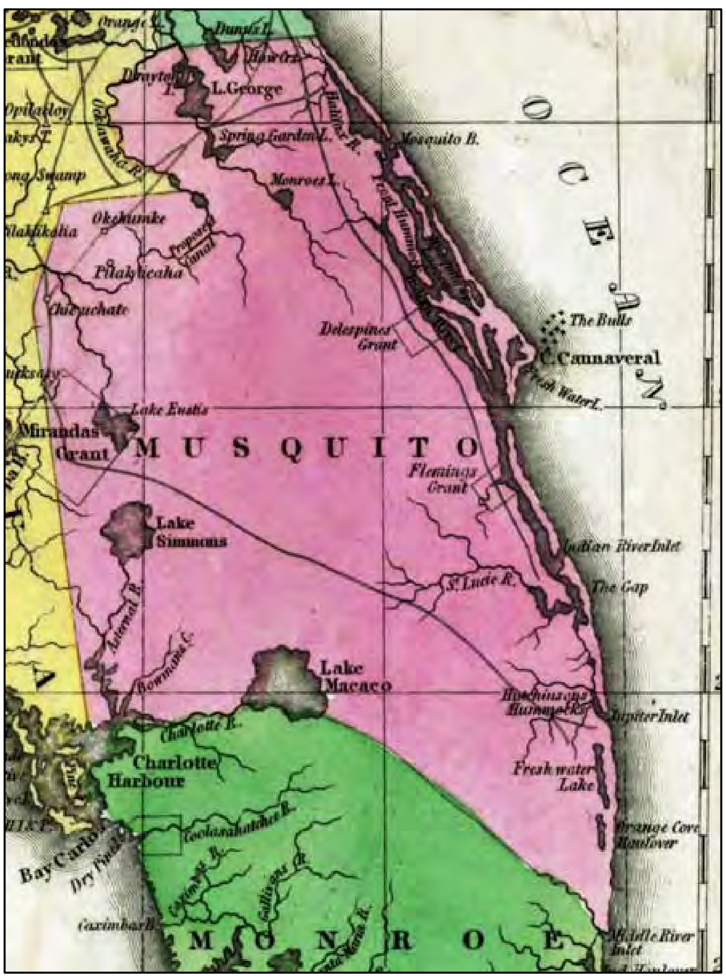

Figure 6. Portion of a 1827 map of Florida showing Mosquito County. Source: Exploring Florida Maps.

At the start of the Second Seminole War, several large and prosperous plantations that had been developed in previous decades within the boundaries of present-day Volusia County were destroyed. In response to requests from settlers, the United States established a chain of forts as a protective measure, including one in New Smyrna in 1837. After pursuing the Seminoles to the Everglades, the US government ended the war in 1842, and reservation boundaries were established farther south (Mahon 1985).

Following the war, the US government attempted to encourage settlement in Florida by passing the Armed Occupation Act in 1842. The act made available for homesteading 200,000 acres south of Gainesville to the Peace River. Homesteads of 160 acres were given to any head of a family or single man, 18 years of age or older, who would agree to cultivate at least five acres, build a dwelling, and live on the land for five years (Tebeau 1971:149). The Homestead Acts of 1866 and 1876 provided further incentives to settlers (Tebeau 1971:266, 294).

As the war with the Seminoles drew to a close, Enterprise emerged as the focus of new settlement in what would later become Volusia County. Settlement of the locale began in 1841, when Major Cornelius Taylor, along with a group of other settlers, established homesteads in the vicinity of Green Spring. Settlement increased as traffic along the St. Johns River expanded and people from coastal areas moved inland to relocate along the shores of Lake Monroe. Among these new settlers was James Brock, who in 1852 built a hotel on a shell bluff above Lake Monroe, about a mile from the old site of Enterprise. The hotel served as a catalyst for the new town site of Enterprise (Nance 1962:224).

Volusia County was established from a portion of Mosquito County in 1854 and named for a landing called Volusia near Lake George on the St. Johns River (Morris 1998:147). The origin of the name is unknown but may be from a Frenchman or Belgian named Veluche.

By the 1850s, remaining Seminoles led by Billy Bowlegs saw the ever-expanding reach of white civilization as a threat. Conflict continued, eventually resulting in the Third Seminole War or Billy Bowlegs War (1855–1858). Unlike the previous war, much of the action was set in south Florida. Three years later, the war ended, and Billy Bowlegs and his followers were sent to lands in the west. Left behind were an estimated 200 Seminoles, whose descendants live in south Florida today (Tebeau 1971:50).

The Civil War and the Late Nineteenth Century, 1861–1900

On January 10, 1861, Florida seceded from the United States as a slave state, becoming the third state to join the Confederacy. Volusia County's delegate to the Secession Convention was the Reverend James H. Chandler, who at the time was the county judge. During the war, Union soldiers raided the western part of the county three times in search of cattle and horses, while destroying the town of DeLeon Springs and plantations in the area. In eastern Volusia County, federal gunboats bombarded New Smyrna and burned stockpiles of oak timber abandoned by loggers at the beginning of the war. The gunboats were also after blockade runners at Mosquito Inlet, which was an important shipping point in the area (Hebel 1955:4).

Farmers with cattle did particularly well during the war. In fact, the war was a major turning point in the establishment of the cattle industry in Volusia County. During the Civil War, cattlemen were exempt from military service due to the large demand for beef from the Confederate Army. Cattlemen in Volusia County contributed to the war effort by sending tons of beef to Confederate troops (Hebel 1955:26). Beef became such a valuable commodity during the war that the Confederacy organized a “Cow Cavalry” to protect herds of cattle from Union raiders (Schene 1976).

With the end of the Civil War in 1865, an influx of new settlers came to Florida; some were Southerners looking for new homes, others were former slaves in search of a new beginning, and still others were Northerners looking for new economic opportunities. Among these economic opportunists were cattlemen in search of a milder climate, longer pasture-growing season, and an extensive territory of grassland for their herds. Many of these cattlemen settled in Volusia County, where they established large cattle ranches (Hebel 1955:26).

Prior to the establishment of railroads through the area, Volusia County cattlemen drove their herds to market along established cattle trails. Ranchers separated the animals intended for market from the common herd and generally began the cattle drive in September. The closest cattle market was at Jacksonville, but prior to construction of the railroad, ranchers would also drive their cattle as far north as Savannah, Georgia, or Charleston, South Carolina. For these longer cattle drives, cattlemen crossed the St. Johns River at Cowford (present-day Jacksonville) or Palatka. The trip to Savannah generally took four to five weeks, with cattlemen moving the herds slowly to prevent loss of weight (Hebel 1955:27). **Figure 7** provides a view of a typical cattle operation in Volusia County.

J. M. Hawks, a physician and a veteran of the Union Army, purchased several hundred acres of land in Volusia County in 1865 with the intention of starting a colony. Five years later he settled the land and began attracting other settlers to his new community, which he called Hawks Park. In later years, it would become Edgewater (Sikes 1993). Mathias Day Jr., an entrepreneur from Ohio, moved to eastern Volusia County in 1870 to establish a settlement. Day purchased 2,145 acres of the Samuel Williams grant from Williams’ daughter, Christina Reft, and laid out the town of Daytona. By 1873 there were 20 homes, a mercantile business, and a post office in Day’s settlement, in addition to the Palmetto House and a sawmill. In July 1876, the settlement was incorporated and named Daytona in honor of Day (Cardwell and Cardwell 2004). Also during this period, the Bostrom family settled in what would become Ormond Beach.

The rebuilding and expansion of rail lines through Volusia County greatly reduced the time required to transport livestock to market while spurring further growth of the cattle industry in the vicinity around Osteen. Cattle shipping centers such as Osteen and Haw Creek subsequently emerged to facilitate the transport of cattle to northern markets (Hebel 1955:26). In Volusia County, the Florida East Coast (FEC) Railway and one of its predecessor lines, the Jacksonville, Tampa, and Key West (JT&KW) Railroad, provided the catalyst for much of the development in the county. The completion of the JT&KW branch line in December 1885

Figure 7. Dairy cows grazing in a pasture, Volusia County, Florida, ca. 1929.
Source: Florida Memory Collection, Image #N048301.

encouraged growth in the community of Osteen and provided cattle ranchers in the area with a new means of transportation. It also spurred the establishment of new trackside communities such as Kalamazoo. Located three miles east of Osteen, Kalamazoo was a small rural cattle community along the JT&KW corridor, with about 100 people living in the area by 1905. Many of the residents worked at nearby stockyards or assisted local ranchers in bringing their cattle to the Kalamazoo depot (Schene 1976:121).

During the 1880s, citrus groves were an important source of income for Volusia County residents (Webb 1885:109). For example, the Town of New Smyrna was incorporated in 1887 with a population of 150, and served as a transportation node for the citrus industry. Development continued with the extension of Henry Flagler's East Coast Railway along the eastern coast of the county in the 1890s. The arrival of the railroad brought further changes to the community. The railroad hastened development in the area by encouraging tourism and opening up new markets for citrus growers and commercial fisherman (Fitzgerald 1993). Hurt by the Great Freeze of the mid-1890s, citrus industry nevertheless recovered as the twentieth century began (Strickland 1980).

Twentieth Century to Recent Times, 1900–Present

Shortly after the turn of the century, automobiles came to Daytona, and it was not long before it was realized that the hard, compacted sand of the Daytona beaches was an ideal surface for a racecourse (**Figure 8**). Beginning in 1903, men from around the world brought their cars to Daytona to break world speed records. Publicity for these events earned Daytona the nicknames "World's Most Famous Beach" and the "Birthplace of Speed" (Atwell 1998:8). Races continued on the beach until 1959, when the Daytona International Speedway opened.

Figure 8. Auto speed racers at Dayton Beach, no date.
Source: Florida Memory Collection, Image #PC0740.

In the 1930s, Volusia County boosters marketed their land as "the most productive in Florida" and invited outsiders, particularly Northerners, to tourist centers of Daytona Beach, DeLand, and New Smyrna. The diversity of soil types won the county the nickname of "Versatile Volusia." Many varieties of fruits and vegetables were grown and approximately 1.5 million boxes of citrus were produced in the county annually. At least three orange varieties were born here—the Enterprise, the Hamlin, and the Lue Gim Gong. Cattle raising remained important, as did commercial fishing. On the St. Johns, Indian, and Halifax Rivers, freight steamers could still be seen. Daytona Beach offered year-round entertainment alongside "the world's finest beach" (Florida Chamber of Commerce 1935:278). In addition, New Smyrna attracted historical interest as one of the oldest settlements in Florida, and DeLand, the county seat, was home to Stetson University. The lure was unmistakable: by 1935 the population of Volusia County had grown to 50,591 as compared to 42,725 in 1930 (Florida Chamber of Commerce 1935) (**Table 1**).

Table 1. Volusia County Population, 1860–2000.

Year	Population
1860	1,158
1870	1,723
1880	3,294
1890	8,467
1900	10,003
1910	16,510
1920	23,374
1930	42,757
1940	53,710
1950	74,229
1960	125,319
1970	169,487
1980	258,762
1990	370,712
2000	443,343

Source: US Bureau of the Census.

The federal government's efforts to relieve the Great Depression could be seen across Volusia County in the 1930s and particularly at Daytona. The Works Progress Administration (WPA) provided hundreds of the area's men with jobs. Some of Daytona's most interesting architectural resources are the result of projects completed by the WPA, including the band shell, the boardwalk, and the armory (Atwell 1998). By 1939, the economy was back on the upswing in Daytona. The US entry into World War II provided a boost to the economy through military contracts awarded to the Daytona Beach Works for the construction of boats for the Navy (Atwell 1998:8). In addition to these contracts, Daytona Beach saw the addition of a US Navy air base and was host to a Women's Army Corps (WAC) training center and a US Convalescent Hospital (Atwell 1998). Indeed, World War II (1941–1945) was very evident in Volusia County as numerous servicemen and -women trained here and the coast was active with German submarine patrols (Strickland 1980).

World War II precipitated another cattle boom in Volusia County. Thousands of acres were cleared for permanent pastures. In 1952, land suitable for pasture sold for $27 per acre. Inquiries for pastureland became so great that the Agricultural Extension Service began providing information on available properties to interested buyers. The Soil Conservation Service was another valuable resource for ranchers buying land, since it furnished seed and planting materials for new pastures (Hebel 1955:29). By the mid-1950s, there were nearly 12,000 acres of improved pasture in grasses and clovers in the county, while the number of cattle increased from approximately 10,000 in 1940 to approximately 25,000 in 1954 (Hebel 1955:29).

In the late 1950s, the Miami-based Mackle Brothers purchased 12,000 acres in the Enterprise area of southwestern Volusia County for the development of a new city called Deltona. Patterned on other Mackle developments in Florida such as Port Charlotte and Port St. Lucie, the community was notable at the time because it was to be a self-contained community with its own utilities, water, sewer, churches, schools, recreation, shopping center, and industrial area. Model houses were built at the site in 1962, and a nationwide advertising campaign was begun (*Daytona Beach Morning Journal*, 21 September 1962).

Long known for its beaches and racetrack, Daytona Beach was losing attention to the newly developed Disney World at the start of the 1970s. An advertising campaign successfully reversed the situation, luring college students away from Fort Lauderdale to Daytona's 27 miles of beaches and generating millions in new revenue for the city (Mormino 2005).

In the present, tourism is vital to Volusia County's economy, but the picture is fairly diversified. Major employers in recent years are the Volusia County School Board (8,998 employees), Halifax Staffing (6,330 employees), and Publix Supermarkets (2,798 employees) (Enterprise Florida 2010). DeLand is the county seat. Deltona is the largest city, followed by Daytona Beach and Port Orange. There are three airports in the county. The opportunities for post-secondary education in Volusia County have expanded in the twentieth century. Embry-Riddle Aeronautical University, Stetson University, Bethune-Cookman University, and the University of Central Florida (Daytona campus) as well as several junior colleges and vocational/technical schools are well established (Enterprise Florida 2010).

BACKGROUND RESEARCH

FLORIDA MASTER SITE FILE REVIEW

A review of the Florida Master Site File (FMSF) database updated in April 2012 indicates that 13 previous cultural resource surveys have been conducted within one mile of the SR 40 project APE (**Figure 9; Table 2**). While FMSF Survey Nos. 1436 and 1892 both included portions of the current project corridor, both surveys were primarily windshield surveys. The report for Survey No. 1436 indicates that limited shovel testing was done within the SR 40 right-of-way but does not describe the methods used. Both surveys included minimal reporting that does not detail the scope and methods of the fieldwork; as such, these previous surveys do not meet current FDOT and FDHR standards and thus were largely disregarded during the present study.

The FMSF review indicates that three archaeological sites and one historic structure have been recorded within one mile of the SR 40 project APE (**Table 3**; see **Figure 9**). None of the previously recorded historic resources are located within the current project APE.

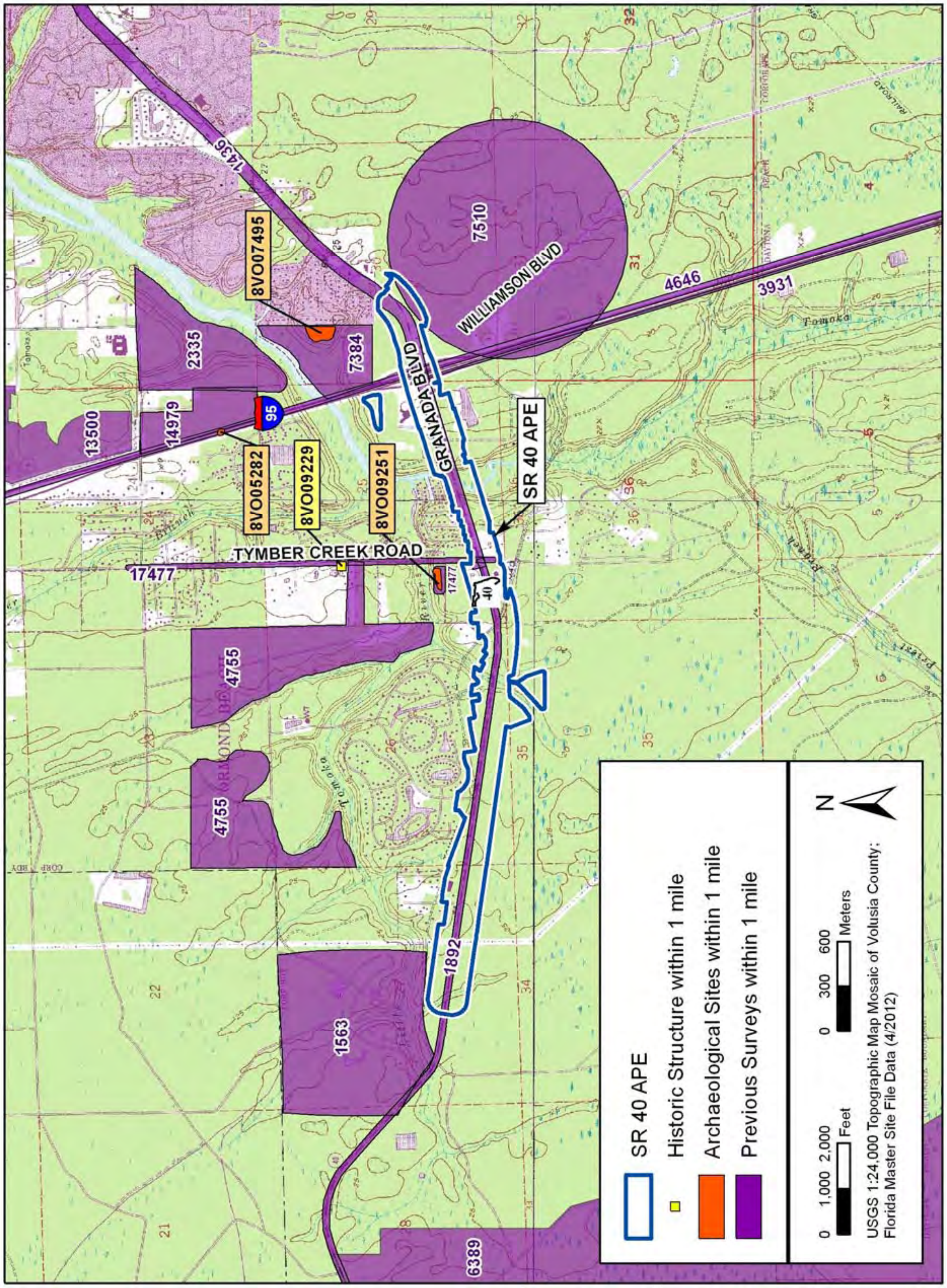

Figure 9. Previously recorded cultural resources and surveys within one mile of the SR 40 APE.

Table 2. Cultural Resource Surveys Conducted within One Mile of the SR 40 APE.

FMSF No.	Title	Date	Author
1436	Proposed Addition of Two Lanes to the Existing Two Lanes of SR 40 from 1000' West of Timber Creek Road to SR 5A in Volusia County, Florida	1987	FDOT
1563	An Archaeological Survey of the Shadow Crossing Area	1988	Historic Property Associates, Inc.
1892	Proposed Widening of SR 40 from Tymber Creek Road to US 19	1989	FDOT
2335	Cultural Resource Assessment Survey of the Proposed Broadwater Subdivision Development Site, Volusia County, Florida.	1990	Piper Archaeological Research, Inc.
3931	An Intensive Cultural Resource Assessment Survey of the I-95 Widening 11th Street to SR 40, Volusia County, Florida	1994	Environmental Services, Inc.
4646	A Cultural Resources Survey of Interstate 95 from a Point 0.32 km North of US 92 in Volusia County to a Point 0.64 km North of the St. Johns County Line in Flagler County, Florida	1995	Florida Archeological Services
4755	Cultural Resource Assessment Survey of the Breakaway Trails Development Phase III, Volusia County, Florida	1995	Dana Ste. Claire
6389	Cultural Resource Assessment and Survey within the Tiger Bay State Forest, Volusia County, Florida	2001	Bureau of Archaeological Research
7384	Cultural Resources Survey and Assessment, Bermuda Estates, Ormond Beach, Volusia County, Florida	2003	SouthArc, Inc.
7510	An Archaeological and Historical Survey of the Proposed Hand Avenue Tower Location in Volusia County, Florida	2001	Panamerican Consultants, Inc.
13500	A Cultural Resource Reconnaissance Survey of the Pineland Tract, Volusia County, Florida	2006	Environmental Services, Inc.
14979	A Cultural Resource Reconnaissance Survey of the River Oaks Tract, Volusia County, Florida	2008	Environmental Services, Inc.
17477	A Cultural Resource Assessment Survey of Tymber Creek Road, Volusia County, Florida USACE Permit # SAJ-2009-02925 (SP-JCP)	2010	SEARCH

Table 3. Previously Recorded Cultural Resources within One Mile of the SR 40 APE.

Historic Structures				
FMSF No.	**Address**	**Year Built**	**Surveyor Evaluation**	**SHPO Evaluation**
8VO09229	118 N. Tymber Creek Rd.	1936	Ineligible	Ineligible

Archaeological Sites				
FMSF No.	**Name**	**Time Period**	**Surveyor Evaluation**	**SHPO Evaluation**
8VO05282	Christien	Prehistoric	Ineligible	Ineligible
8VO07495	Alissa’s	Middle Archaic and Orange	Ineligible	Ineligible
8VO09251	Tymber Creek 1	Aceramic prehistoric; 18th and 19th century American	Ineligible	Ineligible

HISTORIC MAP AND AERIAL PHOTOGRAPH REVIEW

Historic maps and aerial photographs were examined in order to identify past land use in the vicinity of the current project APE. The earliest available maps of detail are the General Land Office (GLO) survey maps created by US government land surveyors in the first half of the nineteenth century. These maps characteristically show landscape features such as vegetation, bodies of water, roads, and Spanish land grants. The level of detail in GLO maps varies, with some also depicting structures, Indian villages, railroads, and agricultural fields.

GLO survey maps of this area of Volusia County were first created in 1837 and were updated over the subsequent decades; no cultural features are illustrated in the vicinity of the project on any of these maps (GLO 1837, 1845, 1850). The earliest indication of cultural activities is illustrated on a GLO map of Township 14 South, Range 31 East created in 1853. This map shows the “Road from N. Smyrna to St. Augustine” to the immediate south of the project area (**Figure 10**). The road runs in a general north–south direction, with an arrow indicating a continuation northward to an unmarked dotted line to the north of the project corridor (GLO 1853). Field notes from the original 1835 GLO survey indicate the presence of an earlier road crossing into Section 25 from Section 26; however, the notes do not mention a road crossing from Section 25 into Section 24 (which would include the current project corridor) (Washington 1835). Historically, the Road from New Smyrna to St. Augustine functioned as an alternate name for the Kings Road, an important transportation corridor in Florida that was established during the British period. Further research regarding the historic path of the Kings Road, however, suggests that the road depicted in the 1853 GLO is not the actual Kings Road. In their intensive study of the route of the old Kings Road, Adams et al. (1997) approximated the location of the Kings Road to be several miles east of the current project corridor.

A 1936 General Highway Map of Volusia County shows no sign of the road mentioned above; in fact, it shows very little development in the vicinity of the project corridor. Present-day SR 40 is shown following a west–east path that crosses the Tomoka River south of its current position. On this map, SR 40 stops before reaching Little Tomoka Creek (FDOT 1936) (**Figure 11**).

Beginning in the 1930s the US Department of Agriculture (USDA) took aerial photographs of the state of Florida. Photographs of this area of Volusia County were first taken in 1943, and much like the 1936 General Highway Map, they show virtually no development in the vicinity of the project area. SR 40 is visible crossing through the project area, and a small bridge is visible at the Tomoka River crossing 500 meters south of the project area (USDA 1943). There appear to be structures on the west shore where the current APE crosses the Tomoka River.

These structures are still visible on the 1958 USDA aerial photograph. Present-day Tymber Creek Road has been constructed and is visible intersecting SR 40 approximately 200 meters south of the current intersection. A few scattered agricultural fields are also visible in the general vicinity of the project corridor; however, the landscape still appears largely rural (USDA 1958). The 1970 aerial photograph reveals a substantial increase in development and shows

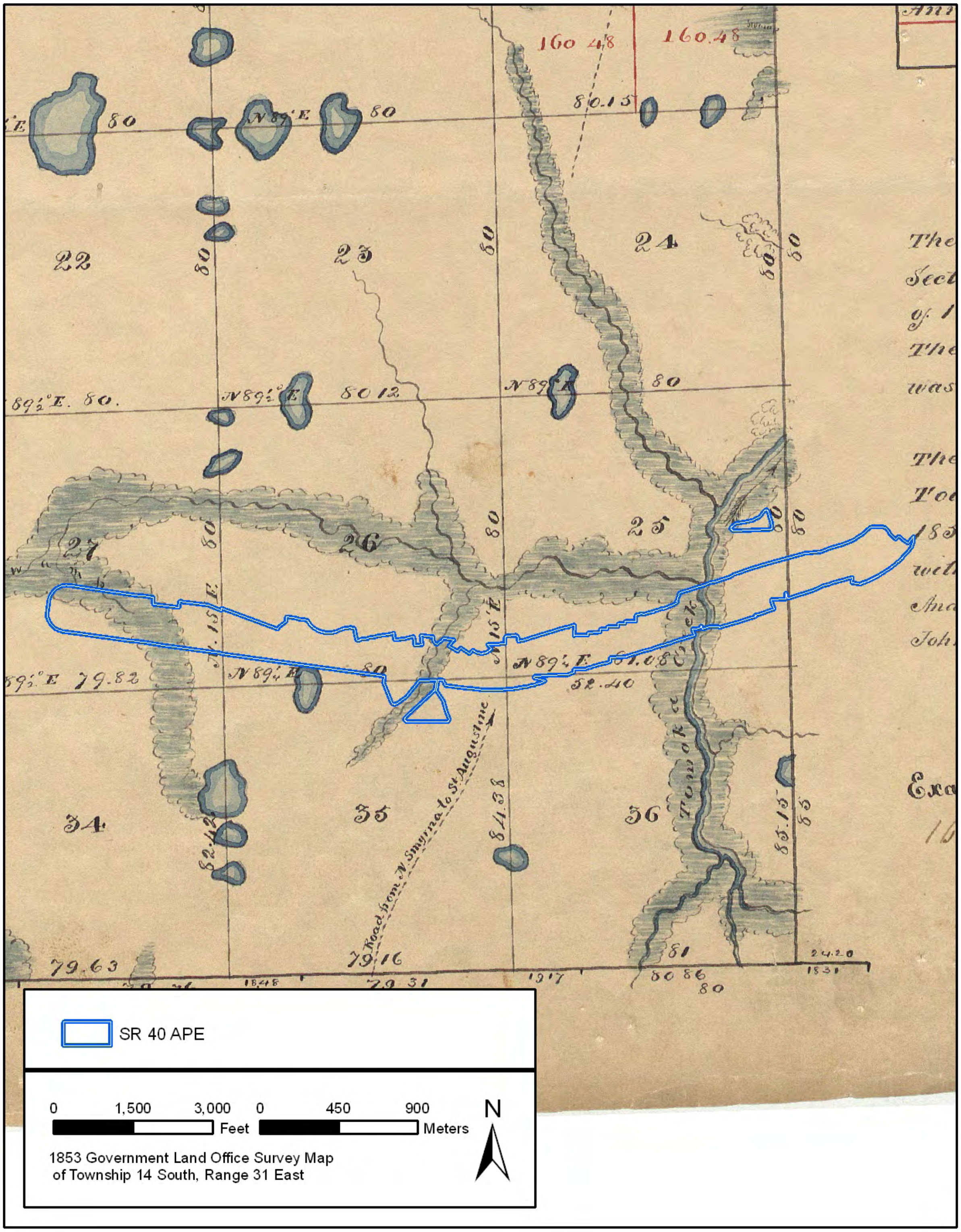

Figure 10. 1853 GLO map showing the current location of the SR 40 APE in blue.

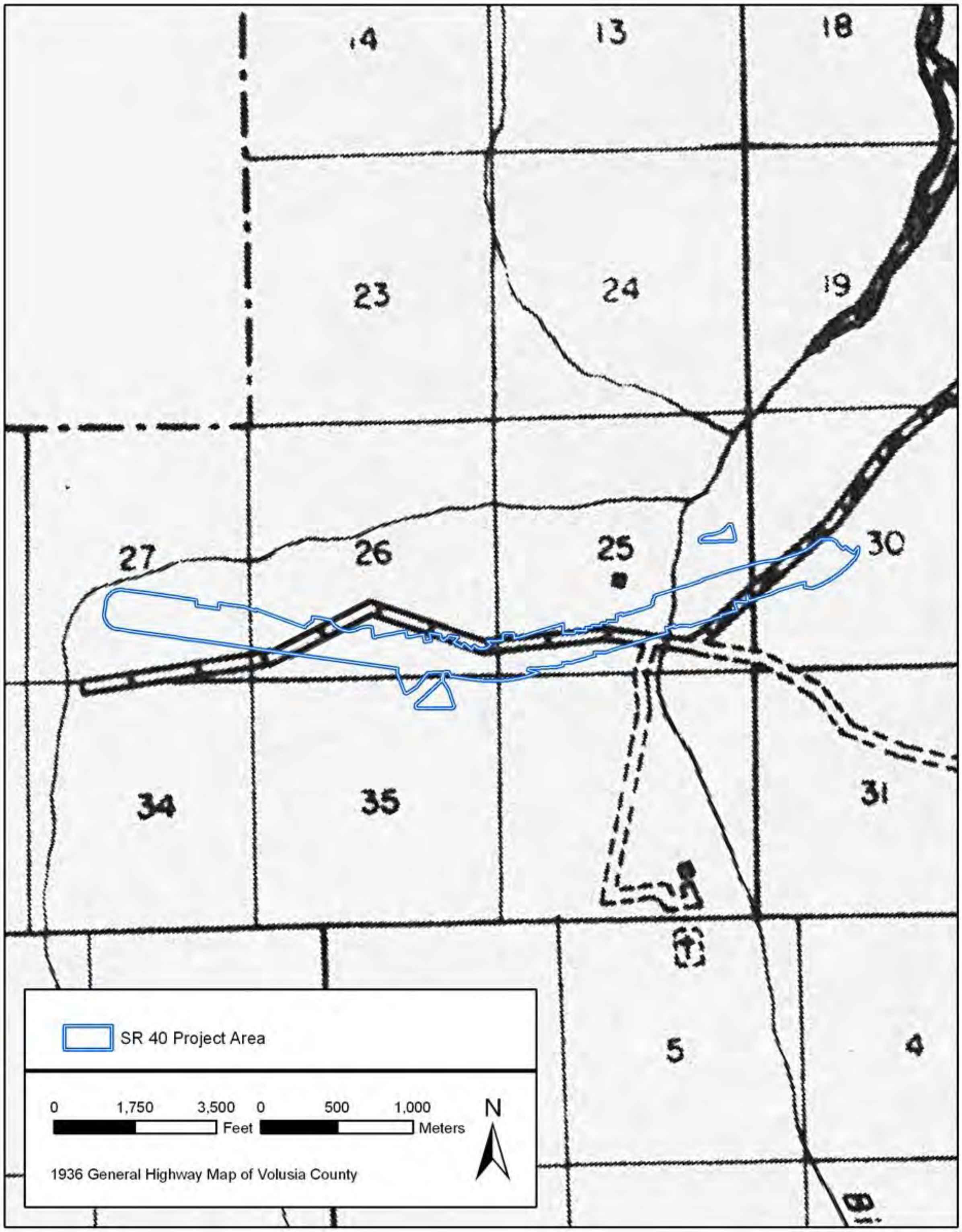

Figure 11. 1936 General Highway Map showing the current location of the SR 40 APE in blue.

SR 40 with its current alignment. The I-95 corridor had been constructed through the eastern end of the project corridor by this time as well, facilitating development near the eastern end of the APE (USDA 1970) (**Figure 12**). Since 1970, large residential subdivisions have been constructed along either side of SR 40 within the APE.

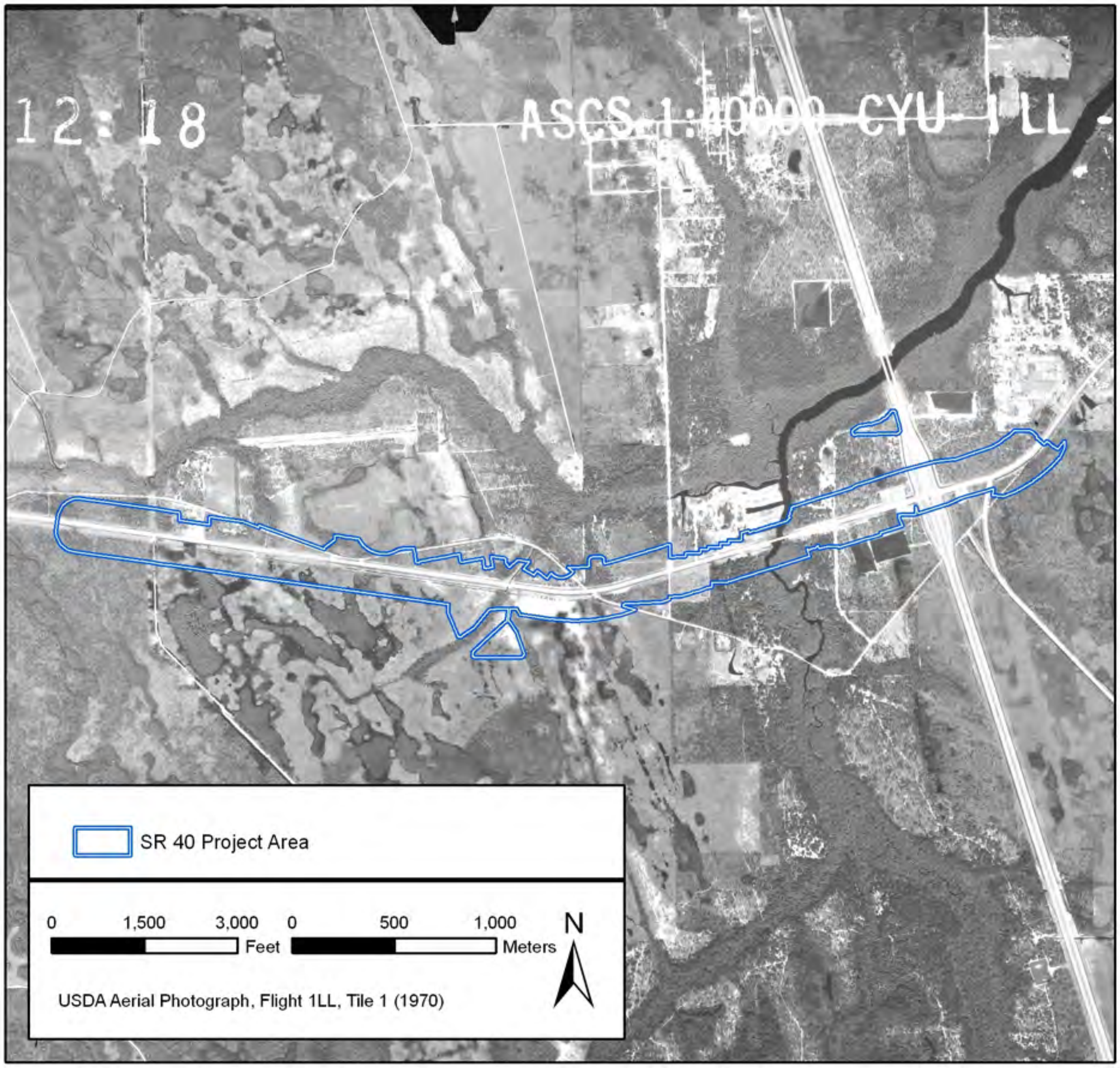

Figure 12. 1970 USDA aerial photograph showing the current location of the SR 40 APE in blue.

RESEARCH DESIGN

PROJECT GOALS

A research design is a plan to coordinate the cultural resource investigation from inception to the completion of the project. This plan should minimally account for three things: (1) it should make explicit the goals and intentions of the research, (2) it should define the sequence of events to be undertaken in pursuit of the research goals, and (3) it should provide a basis for evaluating the findings and conclusions drawn from the investigation.

The goal of this survey was to locate and document evidence of historic or prehistoric occupation or use within the APE (archaeological or historic sites, historic structures, or archaeological occurrences [isolated artifact finds]), and to evaluate these for their potential eligibility for listing in the NRHP. The research strategy was composed of background investigation, a historic document search, and field survey. The background investigation involved a perusal of relevant archaeological literature, producing a summary of previous archaeological work undertaken near the project area. The FMSF was checked for previously recorded sites within the project corridor, which provided an indication of prehistoric settlement and land-use patterns for the region. Current soil surveys, vegetation maps, and relevant literature were consulted to provide a description of the physiographic and geological region of which the project area is a part. These data were used in combination to develop expectations regarding the types of archaeological sites that may be present and their likely locations (site probability areas).

The historical document search involved a review of both primary and secondary historic sources as well as a review of the FMSF for any previously recorded historic structures. The original township plat maps, early aerial photographs, and other relevant sources were checked for information pertaining to the existence of historic structures, sites of historic events, and historically occupied or noted aboriginal settlements within the project limits.

CULTURAL RESOURCE POTENTIAL

Based on an examination of environmental variables (soil drainage, relative elevation, nearness to water or wetland resources), as well as the results of previously conducted surveys, the potential for prehistoric archaeological sites to be present within the project APE was considered moderate to either side of the two creek crossings and low elsewhere along the corridor. The historic map/aerial review indicated a moderate potential to identify historic-period archaeological remains on the west side of the Tomoka River where structures are shown on the 1943 aerial photograph; the historic archaeological potential was considered low elsewhere within the project APE.

SURVEY METHODS

ARCHAEOLOGICAL FIELD METHODS

The Phase I field survey consisted of systematic subsurface shovel testing according to the potential for containing buried archaeological sites. Shovel tests were excavated at 50-meter intervals within the moderate probability areas to either side of the Tomoka River and at 100-meter intervals elsewhere along the right-of-way. Three of the ponds (Ponds 3A, 4, and 5) associated with the SR 40 project are existing drainage ponds; the northern portion of Pond 1 is also an existing pond. The remainder of Pond 1-2 was considered to have low archaeological potential. The eastern-central portion of Pond 2A/2B-1 is composed of well-drained soils adjacent to a small creek and was thus considered to have moderate archaeological potential; the remainder of Pond 2A/2B-1 was considered low probability. Ponds 2B-2 and 2B-3 were both considered low probability as well. Pond 3B is an undeveloped parcel composed of moderately well-drained soils located in close proximity to the Tomoka River; as such, Pond 3B was considered to have moderate to high archaeological probability.

The entire project corridor and all 10 pond locations were investigated except for areas with buried utilities or pavement. The existing and proposed right-of-way along SR 40 in addition to the proposed ponds was visually examined via pedestrian survey for the presence of exposed artifacts and aboveground features (chert outcrops, sand mounds). Shovel tests measured approximately 50 centimeters in diameter and were excavated to a minimum depth of 100 centimeters below surface (cmbs), subsurface conditions permitting. All excavated sediments were screened through 1/4-inch-mesh hardware cloth. The location of each shovel test was marked on aerial photographs and recorded on WAAS-enabled handheld GPS units. The cultural content, soil strata, and environmental setting of each shovel test were recorded in field notebooks.

ARCHITECTURAL FIELD METHODS

The architectural field investigation employed several methods to identify historic resources in the study area. In addition to a search of the FMSF for previously recorded historic structures within the project area, past US Geological Survey (USGS) quadrangle maps and historic aerial photos were reviewed for structures that were constructed prior to 1967. Each historic resource was plotted with a GPS unit on USGS quadrangle maps and on project aerials. All identified historic resources were photographed with a digital camera, and all pertinent information regarding the architectural style, distinguishing characteristics, and condition was recorded on FMSF structure forms. Upon completion of fieldwork, forms and photographs were returned to the SEARCH offices for analysis. Date of construction, design, architectural features, condition, and integrity of the structure, as well as how the resources relate to the surrounding landscape, were carefully considered. The resources were categorized according to their significance for listing in the NRHP and then recommended eligible, potentially eligible, or not eligible. FMSF resource forms were completed for all extant resources documented during the field survey.

LABORATORY METHODS

No artifacts were recovered as a result of this survey, and therefore no laboratory analysis was required.

CURATION

The original maps and field notes are presently housed at the Newberry office of SEARCH. The original maps and field notes will be turned over to FDOT District 5 upon project completion; copies will be retained by SEARCH.

PROCEDURES TO DEAL WITH UNEXPECTED DISCOVERIES

Every reasonable effort has been made during this investigation to identify and evaluate possible locations of prehistoric and historic archaeological sites; however, the possibility exists that evidence of cultural resources may yet be encountered within the project limits. Should any evidence of unrecorded cultural resources be discovered during construction activities, all work in that portion of the project area must stop. Evidence of cultural resources includes aboriginal or historic pottery, prehistoric stone tools, bone or shell tools, historic trash pits, and historic building foundations. Should questionable materials be uncovered during the excavation of the project area, representatives of FDOT District 5 will assist in the identification and preliminary assessment of the materials. If such evidence is found, the FDHR will be notified within two working days.

In the unlikely event that human skeletal remains or associated burial artifacts are uncovered within the project area, all work in that area must stop. The FDOT District 5 Cultural Resources Coordinator must be contacted. The discovery must be reported to local law enforcement, who will in turn contact the medical examiner. The medical examiner will determine whether or not the State Archaeologist should be contacted per the requirements of Chapter 872.05, Florida Statutes.

Appendix A provides more detailed information on actions to take should any unanticipated discoveries be found subsequent to this report.

NRHP CRITERIA

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

A. that are associated with events or activities that have made a significant contribution to the broad patterns of our history; or
B. that are associated with the lives of persons significant in our past; or
C. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
D. that have yielded, or may be likely to yield, information important in prehistory or history.

NRHP-eligible districts must possess a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development. NRHP-eligible districts and buildings must also possess historical significance, historical integrity, and historical context.

SURVEY RESULTS

ARCHAEOLOGICAL SURVEY

In May 2012, two SEARCH archaeologists surveyed the SR 40 project APE. Sixty-seven shovel tests were excavated within the SR 40 APE, including 46 within the road right-of-way and 21 within the proposed pond locations (**Figure 13**). No shovel tests were dug within Ponds 3A, 4, 5, or the northern portion of Pond 1 due to existing drainage ponds in these areas. None of the 67 shovel tests recovered any artifacts or cultural material.

Shovel tests were placed judgmentally between Bermuda Estates Drive and Booth Road at the eastern end of the project due to dense development along SR 40 in the vicinity of Williamson Boulevard and I-95. A typical shovel test in this area revealed light gray-brown sand with fill material from 0 to 16 cmbs (0–6 inches), mottled light gray-brown and brown sand with fill material from 16 to 55 cmbs (6–22 inches), and light gray-brown sand from 55 to 100 cmbs (22–39 inches).

West from Booth Road to Bayberry Drive, shovel tests were placed at 50-meter intervals on both sides of SR 40, encompassing the moderately well-drained soil on either side of the Tomoka River. Testing on the south side of SR 40 in this area was impeded by large pipes and

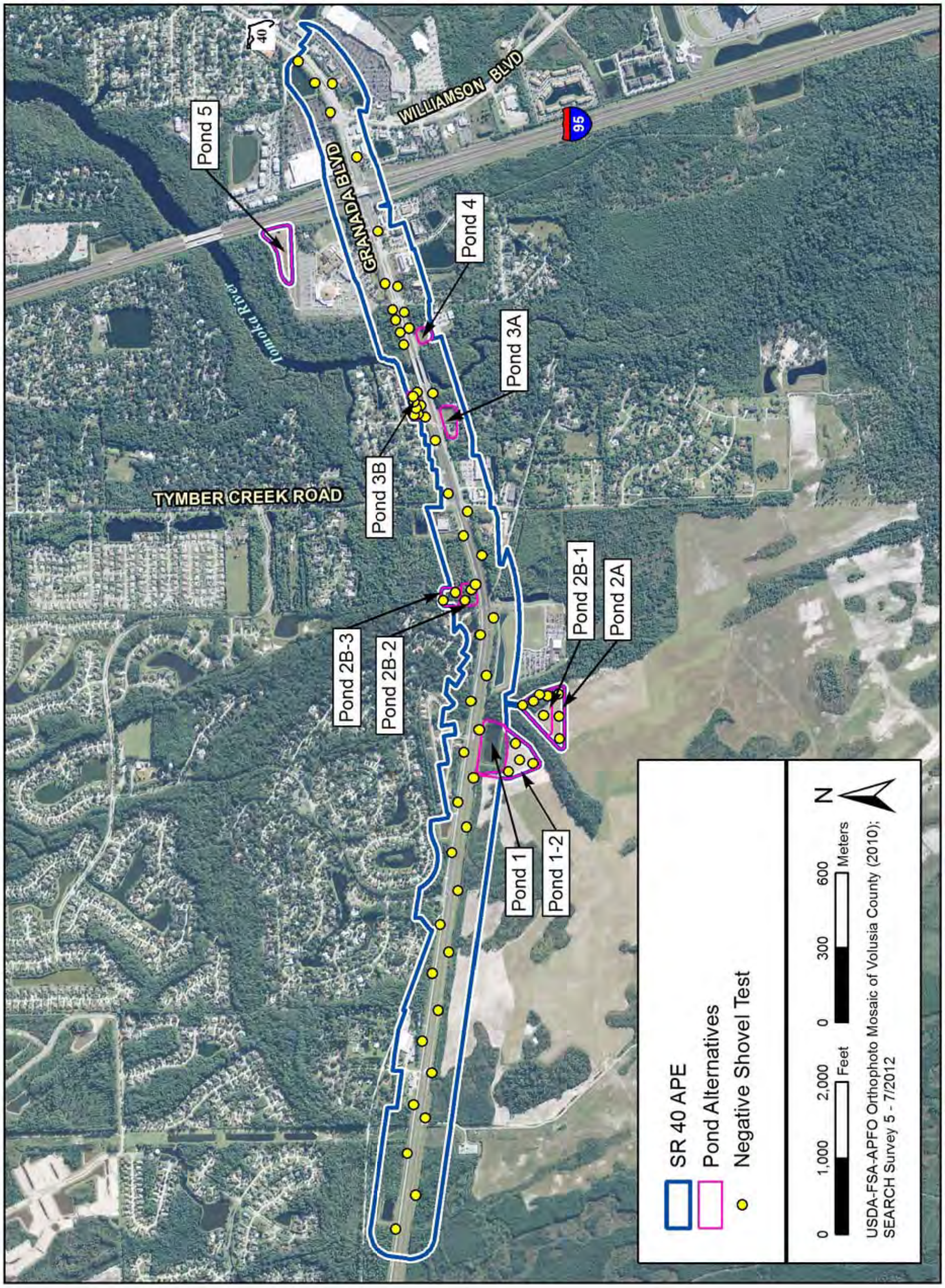

Figure 13. Shovel test locations within the SR 40 APE.

other buried utilities within the right-of-way. A typical shovel test on the north side of SR 40 in this area revealed gray or light yellow-brown sand with fill from 0 to 35 cmbs (0–14 inches), light gray sand from 35 to 45 cmbs (14–18 inches), and light yellow-brown sand from 45 to 100 cmbs (18–39 inches).

The remainder of the project was tested at 100- to 200-meter intervals, depending on the level of disturbance encountered; intervals were increased to 200 meters in areas where shovel tests indicated extensive subsurface disturbance. West of the Tomoka River, shovel tests frequently encountered limestone fill material in the upper 30 centimeters (12 inches), with gray or gray-brown sand beneath.

None of the shovel tests recovered any artifacts or cultural material. No archaeological sites or occurrences were identified within the SR 40 APE. The FMSF survey log sheet is attached as **Appendix B**.

ARCHITECTURAL SURVEY

The architectural survey resulted in the identification and evaluation of three newly recorded historic resources: 8VO09384–8VO09386 (**Table 4; Figure 14**). All of these resources lack the architectural distinction or significant historical associations necessary to be considered for listing in the NRHP and are recommended ineligible. Furthermore, no potential NRHP districts were identified due to the lack of concentration of historical structures. FMSF forms were completed for the three resources, and these are attached as **Appendix C**.

Table 4. Historic Resources Recorded within the SR 40 APE.

FMSF No.	Name/Address	Style	Year Built	NRHP Status
8VO09384	2639 West Granada Boulevard	Masonry Vernacular	ca. 1967	Not eligible
8VO09385	1705 West Granada Boulevard	Frame Vernacular	ca. 1946	Not eligible
8VO09386	1641 West Granada Boulevard	Masonry Vernacular	ca. 1967	Not eligible

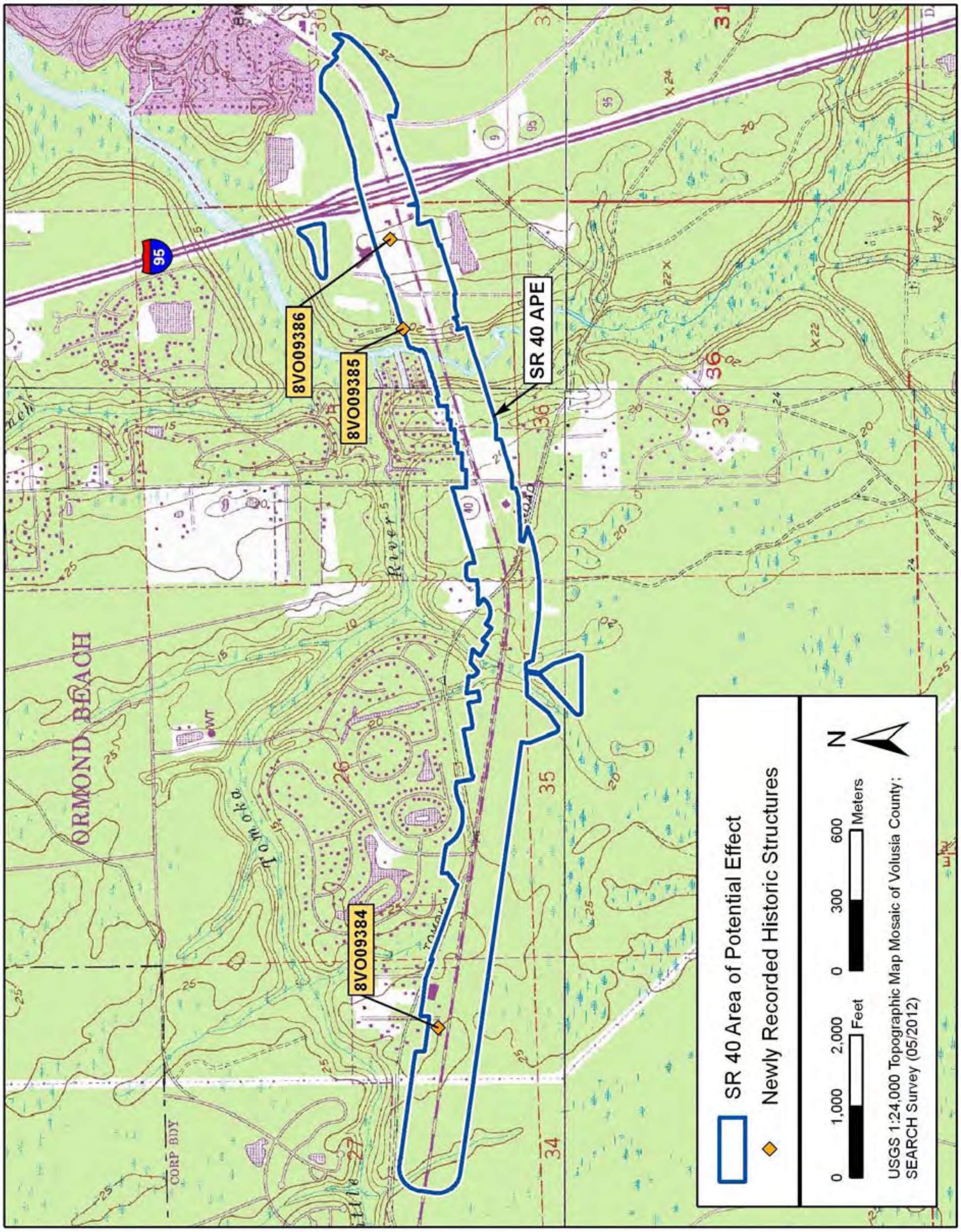

Figure 14. Historic resources identified within the SR 40 APE.

NRHP Evaluations

8VO09384, 2369 West Granada Boulevard

Figure 15. Resource 8VO09384, facing north.

This newly recorded, one-story Masonry Vernacular building at 2369 West Granada Boulevard is located in Section 27 of Township 14 South, Range 31 East, as shown on the *Favoretta, Fla.* USGS quadrangle map (see **Figure 14**). Constructed ca. 1967, Resource 8VO09384 currently functions as a restaurant. The 4,319-square-foot concrete-block building with a rectangular footprint sits on a poured-concrete slab foundation (**Figure 15**). The exterior of the building is covered with stucco and has decorative quoins at the corners and along the entrances. The building has a built-up flat roof with a parapet and a modern canvas awning that wraps around the exterior of the building on the south, east, and west elevations, and a small gable roof in the southwest corner. Fenestration consists of fixed commercial windows, both rectangular and circular, and metal awning windows on the rear (north) elevation. The main entrance on the south facade features a set of double glass-and-metal commercial doors sheltered beneath a front-facing canvas awning supported by thin metal poles. Two flat-roof, wood-clad additions are attached to the north elevation, and a small flat-roof, metal-clad addition has been attached to the northeast corner of one of those additions. Finally, a small ca. 1967 flat-roof outbuilding with stucco exterior is located to the east, and a gable-covered outdoor cooking area with a concrete slab floor is located to the north of the restaurant.

Resource 8VO09384 is a simple Masonry Vernacular commercial building that represents a highly prevalent approach to commercial design in Florida, as well as the United States in general. Based on the historical context, the building is not significant under NRHP Criterion A because it is not indicative of a particular era and is not associated with any significant period. Also, it is not eligible under Criterion B because it lacks association with any person(s) significant in history, and it is not eligible under Criterion C because of its lack of architectural distinction. Finally, the building is not significant under Criterion D because it lacks the potential to yield further information of historical importance. In conclusion, it is the opinion of the Principal Investigator that 8VO09384 does not meet the minimum criteria for listing in the NRHP, either individually or as a contributing resource within a potential or existing historic district.

8VO09385, 1705 West Granada Boulevard

Figure 16. Resource 8VO09385, facing north.

This newly recorded, two-story Frame Vernacular building at 1705 West Granada Boulevard is located in Section 25 of Township 14 South, Range 31 East, as shown on the *Ormond Beach, Fla.* USGS quadrangle map (see **Figure 14**). Constructed ca. 1946, Resource 8VO09385 was previously a private residence and is currently vacant (**Figure 16**). The split-level, wood-frame structure is clad with board-and-batten siding and weatherboard. The intersecting-gable-roof building rests on a concrete-block pier foundation. The gable roof is covered with asphalt shingles and features exposed rafter tails and louvered, rectangular-gable end vents. The main entrance on the east facade features a paneled wood door recessed beneath an incised porch supported by square wood posts and brackets. Single-hung wood-sash windows in a three-over-one configuration remain on the south and west elevations, and two-over-two single-hung metal windows are on the two-story addition; however, the majority of windows are boarded over. A shed-roof enclosed rear porch is attached to the west elevation of the one-story portion. A small wood-clad shed is located to the southeast of the residence.

Resource 8VO09385 is a simple Frame Vernacular residence that represents a highly prevalent approach to residential design in Florida, as well as the United States in general. Based on the historical context, the building is not significant under NRHP Criterion A because it is not indicative of a particular era and is not associated with any significant period. Additionally, it is not eligible under Criterion B because it lacks association with any person(s) significant in history, and it is not eligible under Criterion C because of its lack of architectural distinction. Finally, the building is not significant under Criterion D because it lacks the potential to yield further information of historical importance. In conclusion, it is the opinion of the Principal Investigator that 8VO09385 does not meet the minimum criteria for listing in the NRHP, either individually or as a contributing resource within a potential or existing historic district.

8VO09386, 1641 West Granada Boulevard

Figure 17. Resource 8VO09386, facing north.

This newly recorded, one-story Masonry Vernacular building at 1641 West Granada Boulevard is located in Section 25 of Township 14 South, Range 31 East, as shown on the *Ormond Beach, Fla.* USGS quadrangle map (see **Figure 14**). Constructed ca. 1967, Resource 8VO09386 currently functions as a gas station, auto-repair business, and restaurant. The 2,378-square-foot, concrete-block-frame structure has a rectangular footprint and rests on a poured-concrete slab foundation (**Figure 17**). The exterior of the building is stucco with decorative quoins at the corners. The building has a front-gable roof with nonhistoric boxed, aluminum eaves. Fenestration consists of fixed, rectangular commercial windows. The main entrance on the south facade is offset to the east and features a glass-and-metal commercial door sheltered beneath the extended boxed gable eave. Two auto bays with metal rollup doors pierce the south facade and are offset to the west. A flat-roof canopy shelters the gas pumps to the south of the building, and a small metal shed is located to the west.

Resource 8VO09386 is a simple Masonry Vernacular commercial building that represents a highly prevalent approach to commercial design in Florida, as well as the United States in general. Based on historical research, the building is not significant under NRHP Criterion A because it is not indicative of a particular era and is not associated with any significant period. It is not eligible under Criterion B because it lacks association with any person(s) significant in history, and it is not eligible under Criterion C because of its lack of architectural distinction. Finally, the building is not significant under Criterion D because it lacks the potential to yield further information of historical importance. In conclusion, it is the opinion of the Principal Investigator that 8VO09386 does not meet the minimum criteria for listing in the NRHP, either individually or as a contributing resource within a potential or existing historic district.

CONCLUSION AND RECOMMENDATIONS

This report presents the results of a CRAS conducted in support of the widening of SR 40 from Breakaway Trail to Williamson Boulevard in Volusia County, Florida. FDOT District 5 is proposing to widen SR 40 (currently a divided four-lane roadway) to a six-lane facility from west of Breakaway Trail to east of Williamson Boulevard, a distance of approximately 2.4 miles. The CRAS for the project included the project roadway corridor in addition to 10 pond alternatives associated with the project.

The archaeological survey included the excavation of 67 shovel tests within the SR 40 right-of-way and associated ponds. None of the shovel tests recovered any artifacts or cultural material; no archaeological sites or occurrences were identified within the SR 40 APE.

The architectural survey resulted in the identification and evaluation of three newly recorded historic resources: 8VO09384–8VO09386. All three resources lack the architectural distinction or significant historical associations necessary to be considered for listing in the NRHP and are recommended ineligible.

No further work is recommended for the SR 40 from Breakaway Trail to Williamson Boulevard project APE.

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APPENDIX A.

UNANTICIPATED DISCOVERIES STATEMENT

UNANTICIPATED DISCOVERIES
OF ARCHAEOLOGICAL AND HISTORIC SITES
INCLUDING HUMAN REMAINS

Although a project area may receive a complete cultural resource assessment survey, it is impossible to ensure that all cultural resources will be discovered. Even at sites that have been previously identified and assessed, there is a potential for the discovery of previously unidentified archaeological components, features, or human remains that may require investigation and assessment. Therefore, a procedure has been developed for the treatment of any unexpected discoveries that may occur during site development.

If unexpected cultural resources are discovered the following steps should be taken:

1) Initially, all work in the immediate area of the discovery should cease and reasonable efforts should be made to avoid or minimize impacts to the cultural resources.
2) A qualified Professional Archaeologist should be contacted immediately and should evaluate the nature of the discovery.
3) The Archaeologist should then contact the State Historic Preservation Officer (SHPO) and if necessary, the State Archaeologist.
4) As much information as possible concerning the cultural resource, such as resource type, location, and size, as well as any information on its significance, should be provided to the SHPO.
5) Consultation with the SHPO should occur in order to obtain technical advice and guidance for the evaluation of the discovered cultural resource.
6) If necessary, a mitigation plan should be prepared for the discovered cultural resource. This plan should be sent to the SHPO for review and comment. The SHPO should be expected to respond with preliminary comments within two working days, with final comments to follow as quickly as possible.
7) If a formal data recovery mitigation plan is required, development activities in the near vicinity of the cultural resource should be avoided to ensure that no adverse impact to the resource occurs until the mitigation plan can be executed.

If human remains are encountered during site development, the stipulations of Chapter 872.05 (Offenses Concerning Dead Bodies and Graves) should be followed. All work in the near vicinity of the human remains should cease and reasonable efforts should be made to avoid and protect the remains from additional impact. In cases of inclement weather, the human remains should be protected with tarpaulins. A qualified Professional Archaeologist should be retained to investigate the reported discovery, inventory the remains and any associated artifacts, and assist in coordinating with state and local officials.

1) The County Medical Examiner should be immediately notified as to the findings. If the remains are found to be other than human, any construction will be cleared to proceed. If the remains are human, and are less than 75 years old, the Medical Examiner and local law enforcement officials will assume jurisdiction. If the remains are found to be human and older than 75 years, the State Archaeologist should be notified and may assume jurisdiction of the remains.
2) If jurisdiction is assumed by the State Archaeologist, he will a) determine whether the human remains represent a significant archaeological resource, and b) make a reasonable effort to identify and locate persons who can establish direct kinship, tribal community, or ethnic relationship with the remains. If such a relationship cannot be established, then the State Archaeologist may consult with a committee of four to determine the proper disposition of the remains. This committee shall consist of a human skeletal analyst, two Native American members of current state tribes recommended by the Governor's Council on Indian Affairs, and "an individual who has special knowledge or expertise regarding the particular type of the unmarked human burial."
3) A plan for the avoidance of any further impact to the human remains and/or mitigative excavation, reinterment, or a combination of these treatments will be developed in consultation with the State Archaeologist, the SHPO, and if applicable, appropriate Indian tribes or closest lineal descendents. All parties will be expected to respond with advice and guidance in an efficient time frame. Once the plan is agreed to by all parties, the plan will be implemented.

The points of contact for Florida are:

Robert Bendus, Director and State Historic Preservation Officer
Florida Division of Historical Resources
R.A. Gray Building
500 S. Bronough St.
Tallahassee, FL 32399-0250
PH: 850-245-6333

Mary Glowacki, PhD, Chief and State Archaeologist
Bureau of Archaeological Research
B. Calvin Jones Center for Archaeology at the Governor Martin House
1001 de Soto Park Drive
Tallahassee, FL 32301
PH: 850-245-6301

APPENDIX B.

FDHR SURVEY LOG

Ent D (FMSF only) ____________

Survey Log Sheet

Florida Master Site File
Version 4.1 1/07

Survey # (FMSF only) ____________

Consult *Guide to the Survey Log Sheet* for detailed instructions.

Identification and Bibliographic Information

Survey Project (name and project phase) Cultural Resource Assessment Survey of State Road 40 from Breakaway Trail to Williamson Boulevard

Report Title (exactly as on title page) Cultural Resource Assessment Survey of State Road 40 from Breakaway Trail to Williamson Boulevard, Volusia County, Florida

Report Authors (as on title page, last names first)
1. Chambless, Elizabeth
2. Salo, Edward
3. VanDyke, Ryan
4. Murphy, Elizabeth

Publication Date (year) 2012 **Total Number of Pages in Report** (count text, figures, tables, not site forms) 44

Publication Information (Give series, number in series, publisher and city. For article or chapter, cite page numbers. Use the style of *American Antiquity*.)
On file at FL DHR and SEARCH, Newberry, FL.

Supervisors of Fieldwork (even if same as author) Names Chambless, Elizabeth

Affiliation of Fieldworkers: Organization Southeastern Archaeological Research City Pensacola

Key Words/Phrases (Don't use county name, or common words like *archaeology*, *structure*, *survey*, *architecture, etc.*)
1. Phase I
2. DOT
3.
4.
5.
6.
7.
8.

Survey Sponsors (corporation, government unit, organization or person directly funding fieldwork)
Name ____________ Organization Florida Dept of Transportation - District 5
Address/Phone/E-mail DeLand, Florida

Recorder of Log Sheet Chambless, Elizabeth **Date Log Sheet Completed** 6-19-2012

Is this survey or project a continuation of a previous project? ☒ No ☐ Yes: **Previous survey #s (FMSF only)** ____________

Mapping

Counties (List each one in which field survey was done; attach additional sheet if necessary)
1. Volusia
2.
3.
4.
5.
6.

USGS 1:24,000 Map Names/Year of Latest Revision (attach additional sheet if necessary)

	Name	Year
1.	DAYTONA BEACH NW	1993
2.	FAVORETTA	1993
3.	ORMOND BEACH	1993
4.		
5.		
6.		

Description of Survey Area

Dates for Fieldwork: Start 5-1-2012 End 5-11-2012 **Total Area Surveyed** (fill in one) ______ hectares 304 acres

Number of Distinct Tracts or Areas Surveyed 1

If Corridor (fill in one for each) **Width:** 250 meters ______ feet **Length:** 5.00 kilometers ______ miles

Survey Log Sheet

Survey # __________

Research and Field Methods

Types of Survey (check all that apply): ☒archaeological ☒architectural ☐historical/archival ☐underwater ☐damage assessment ☐monitoring report ☐other(describe): __________

Scope/Intensity/Procedures 67 shovel tests were excavated; all were negative for cultural material. Architectural survey identified 3 newly recorded historic resources.

Preliminary Methods (check as many as apply to the project as a whole)

☐Florida Archives (Gray Building)
☐Florida Photo Archives (Gray Building)
☒Site File property search
☒Site File survey search
☐library research- *local public*
☐library-special collection - *nonlocal*
☐Public Lands Survey (maps at DEP)
☐local informant(s)
☒local property or tax records
☒newspaper files
☐literature search
☐Sanborn Insurance maps
☒other historic maps
☒soils maps or data
☐windshield survey
☒aerial photography
☐other (describe): __________

Archaeological Methods (check as many as apply to the project as a whole)

☐Check here if **NO** archaeological methods were used.

☐surface collection, controlled
☐surface collection, uncontrolled
☒shovel test-1/4"screen
☐shovel test-1/8" screen
☐shovel test 1/16"screen
☐shovel test-unscreened
☐shovel test-other screen size
☐water screen
☐posthole tests
☐auger tests
☐coring
☐test excavation (at least 1x2 m)
☐block excavation (at least 2x2 m)
☐soil resistivity
☐magnetometer
☐side scan sonar
☒pedestrian survey
☐unknown
☐other (describe): __________

Historical/Architectural Methods (check as many as apply to the project as a whole)

☐Check here if **NO** historical/architectural methods were used.

☐building permits
☐commercial permits
☐interior documentation
☐demolition permits
☒exposed ground inspected
☒local property records
☐neighbor interview
☐occupant interview
☐occupation permits
☐subdivision maps
☒tax records
☐unknown
☐other (describe): __________

Survey Results (cultural resources recorded)

Site Significance Evaluated? ☒Yes ☐No

Count of Previously Recorded Sites 0 **Count of Newly Recorded Sites** 3

Previously Recorded Site #'s with Site File Update Forms (List site #'s without "8". Attach additional pages if necessary.) N/A

Newly Recorded Site #'s (Are all originals and not updates? List site #'s without "8". Attach additional pages if necessary.) VO09384-VO09386

Site Forms Used: ☐Site File Paper Form ☒Site File Electronic Recording Form

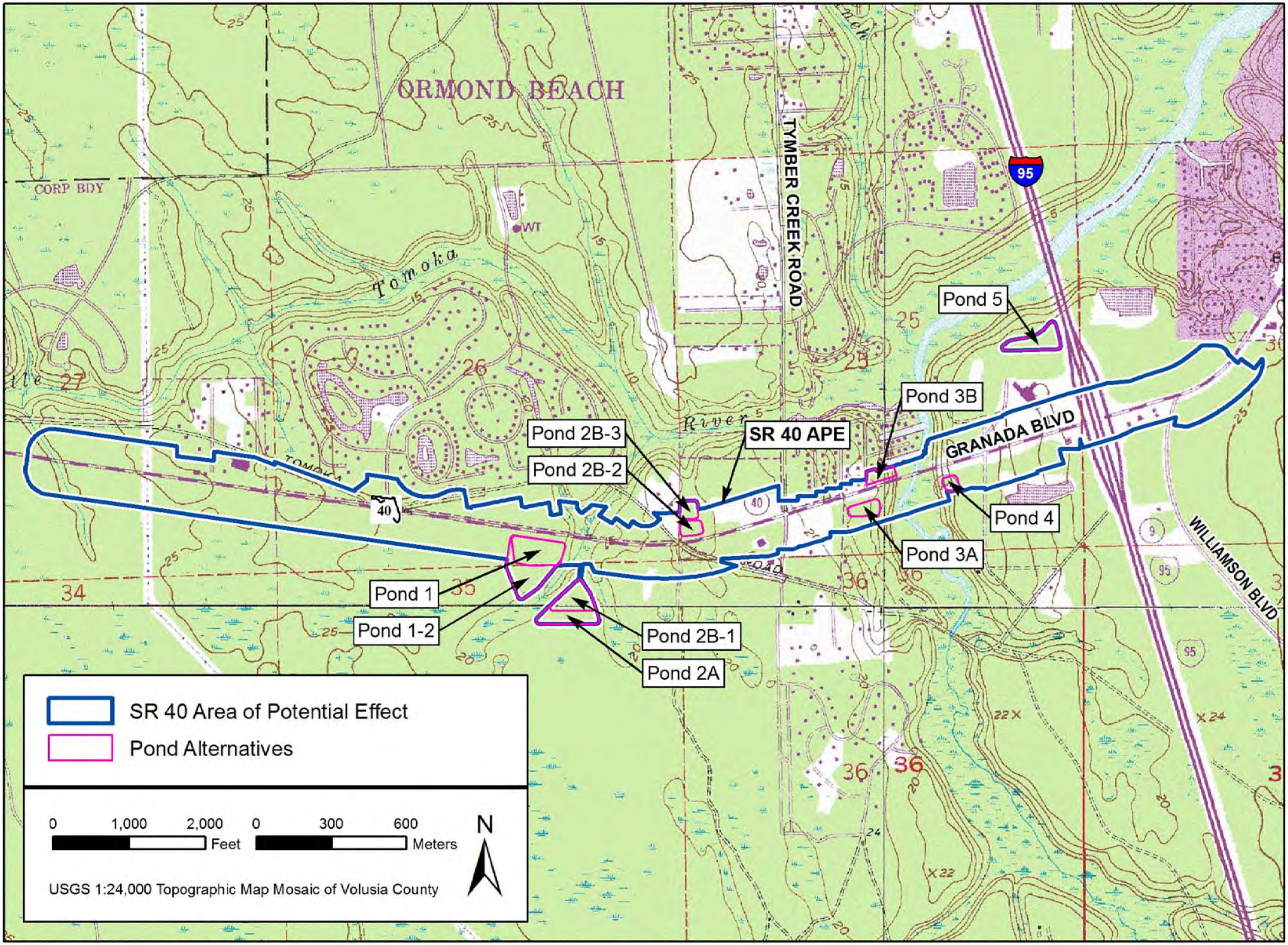
*****REQUIRED: ATTACH PLOT OF SURVEY AREA ON PHOTOCOPY OF USGS 1:24,000 MAP(S)*****

SHPO USE ONLY SHPO USE ONLY SHPO USE ONLY

Origin of Report: ☐872 ☐CARL ☐UW ☐1A32 # __________ ☐Academic ☐Contract ☐Avocational ☐Grant Project # __________ ☐Compliance Review: CRAT # __________

Type of Document: ☐Archaeological Survey ☐Historical/Architectural Survey ☐Marine Survey ☐Cell Tower CRAS ☐Monitoring Report ☐Overview ☐Excavation Report ☐Multi-Site Excavation Report ☐Structure Detailed Report ☐Library, Hist. or Archival Doc ☐MPS ☐MRA ☐TG ☐Other: __________

Document Destination: __________ **Plotability:** __________


ORMOND BEACH
CORP BDY
Tomoka
River
TYMBER CREEK ROAD
SR 40 APE
GRANADA BLVD
WILLIAMSON BLVD
95
Pond 1
Pond 1-2
Pond 2A
Pond 2B-1
Pond 2B-2
Pond 2B-3
Pond 3A
Pond 3B
Pond 4
Pond 5
SR 40 Area of Potential Effect
Pond Alternatives
0
1,000
2,000
Feet
0
300
600
Meters
N
USGS 1:24,000 Topographic Map Mosaic of Volusia County

APPENDIX C.

FMSF RESOURCE FORMS

Page 1

[X] Original
[ ] Update

HISTORICAL STRUCTURE FORM
FLORIDA MASTER SITE FILE
Version 4.0 1/07

Site #8 VO09384
Field Date 5-12-2012
Form Date 5-31-2012
Recorder #

Shaded Fields represent the minimum acceptable level of documentation.
Consult the *Guide to Historical Structure Forms* for detailed instructions.

Site Name(s) (address if none) 2369 W. Granada Blvd. Multiple Listing (DHR only) ____
Survey Project Name CRAS SR 40 from Breakaway Trail to Williamson Rd Survey # (DHR only) ____
National Register Category (please check one) [X] building [ ] structure [ ] district [ ] site [ ] object
Ownership: [X] private-profit [ ] private-nonprofit [ ] private-individual [ ] private-nonspecific [ ] city [ ] county [ ] state [ ] federal [ ] Native American [ ] foreign [ ] unknown

LOCATION & MAPPING

	Street Number	Direction	Street Name	Street Type	Suffix Direction
Address:	2369	W	Granada	Boulevard	

Cross Streets (nearest / between) Old Tomoka Rd/SR 40 (W. Granada Blvd)
USGS 7.5 Map Name FAVORETTA USGS Date 1993 Plat or Other Map ____
City / Town (within 3 miles) Ormond Beach In City Limits? [ ] yes [X] no [ ] unknown County Volusia
Township 14S Range 31E Section 27 ¼ section: [ ] NW [ ] SW [X] SE [ ] NE Irregular-name: ____
Tax Parcel # 27-14-31-00-00-003A Landgrant ____
Subdivision Name ____ Block ____ Lot ____
UTM Coordinates: Zone [ ] 16 [ ] 17 Easting ____ Northing ____
Other Coordinates: X: ____ Y: ____ Coordinate System & Datum ____
Name of Public Tract (e.g., park) ____

HISTORY

Construction Year: 1967 [X] approximately [ ] year listed or earlier [ ] year listed or later
Original Use Commercial From (year): 1967 To (year): unk
Current Use Restaurant From (year): unk To (year): 2012
Other Use ____ From (year): ____ To (year): ____
Moves: [ ] yes [X] no [ ] unknown Date: ____ Original address ____
Alterations: [X] yes [ ] no [ ] unknown Date: ____ Nature canvas awning, window replacement
Additions: [X] yes [ ] no [ ] unknown Date: ____ Nature flat roof addns to north elevation
Architect (last name first): unknown Builder (last name first): unknown
Ownership History (especially original owner, dates, profession, etc.) ____

Is the Resource Affected by a Local Preservation Ordinance? [ ] yes [ ] no [X] unknown Describe ____

DESCRIPTION

Style Masonry Vernacular Exterior Plan Rectangular Number of Stories 1
Exterior Fabric(s) 1. Stucco 2. ____ 3. ____
Roof Type(s) 1. Flat 2. Gable 3. ____
Roof Material(s) 1. Built-up 2. ____ 3. ____
Roof secondary strucs. (dormers etc.) 1. Other 2. Parapet
Windows (types, materials, etc.) fixed, rectangular and circular commercial windows and metal awning windows

Distinguishing Architectural Features (exterior or interior ornaments) decorative quoins at corners and entries, canvas awning

Ancillary Features / Outbuildings (record outbuildings, major landscape features; use continuation sheet if needed.) ca. 1967 flat roof outbuilding to east and gable-covered outdoor cooking area north of restaurant

DHR USE ONLY — OFFICIAL EVALUATION — DHR USE ONLY

NR List Date ____
[ ] Owner Objection

SHPO – Appears to meet criteria for NR listing: [ ] yes [ ] no [ ] insufficient info Date ____ Init. ____
KEEPER – Determined eligible: [ ] yes [ ] no Date ____
NR Criteria for Evaluation: [ ] a [ ] b [ ] c [ ] d (see *National Register Bulletin 15*, p. 2)

HISTORICAL STRUCTURE FORM

Site #8 VO09384

DESCRIPTION (continued)

Chimney: No. 0 Chimney Material(s): 1. ______ 2. ______
Structural System(s): 1. Concrete block 2. ______ 3. ______
Foundation Type(s): 1. Slab 2. ______
Foundation Material(s): 1. Poured Concrete Footing 2. ______
Main Entrance (stylistic details) Main entry on south features set of double glass & metal commercial doors sheltered beneath front facing canvas awning.
Porch Descriptions (types, locations, roof types, etc.) ______

Condition (overall resource condition): ☐excellent ☒good ☐fair ☐deteriorated ☐ruinous
Narrative Description of Resource ______

Archaeological Remains ______ ☐Check if Archaeological Form Completed

RESEARCH METHODS (check all that apply)

☒FMSF record search (sites/surveys) ☒library research ☐building permits ☐Sanborn maps
☐FL State Archives/photo collection ☐city directory ☐occupant/owner interview ☐plat maps
☒property appraiser / tax records ☐newspaper files ☒neighbor interview ☐Public Lands Survey (DEP)
☒cultural resource survey (CRAS) ☒historic photos ☐interior inspection ☐HABS/HAER record search
☒other methods (describe) pedestrian survey
Bibliographic References (give FMSF manuscript # if relevant, use continuation sheet if needed) ______

OPINION OF RESOURCE SIGNIFICANCE

Appears to meet the criteria for National Register listing individually? ☐yes ☒no ☐insufficient information
Appears to meet the criteria for National Register listing as part of a district? ☐yes ☒no ☐insufficient information
Explanation of Evaluation (**required**, whether significant or not; use separate sheet if needed) Due to lack of sufficient historical and architectural significance, 8VO09384 is ineligible for listing in the NRHP, either individually or as a contributing resource within a potential or existing historic district.
Area(s) of Historical Significance (see *National Register Bulletin 15*, p. 8 for categories: e.g. "architecture", "ethnic heritage", "community planning & development", etc.)
1. ______ 3. ______ 5. ______
2. ______ 4. ______ 6. ______

DOCUMENTATION

Accessible Documentation Not Filed with the Site File - including field notes, analysis notes, photos, plans and other important documents

1) Document type All materials at one location Maintaining organization Southeastern Archaeological Research
Document description photos, maps, field notes, aerials File or accession #'s 2657-11053T

2) Document type ______ Maintaining organization ______
Document description ______ File or accession #'s ______

RECORDER INFORMATION

Recorder Name VanDyke, Ryan Affiliation Southeastern Archaeological Research
Recorder Contact Information 315 NW 138th Terr, Newberry, FL 32669/352-333-0049/352-333-0069/ryan@searchinc.com
(address / phone / fax / e-mail)

Required Attachments

❶ **USGS 7.5' MAP WITH STRUCTURE LOCATION PINPOINTED IN RED**
❷ **LARGE SCALE STREET, PLAT OR PARCEL MAP** (available from most property appraiser web sites)
❸ **PHOTO OF MAIN FACADE, ARCHIVAL B&W PRINT OR DIGITAL IMAGE FILE**
If submitting an image file, it must be included on disk or CD AND in hard copy format (plain paper is acceptable).
Digital image must be at least 1600 x 1200 pixels, 24-bit color, jpeg or tiff.

8VO09384_a Facing North

8VO09384_b Facing Northwest

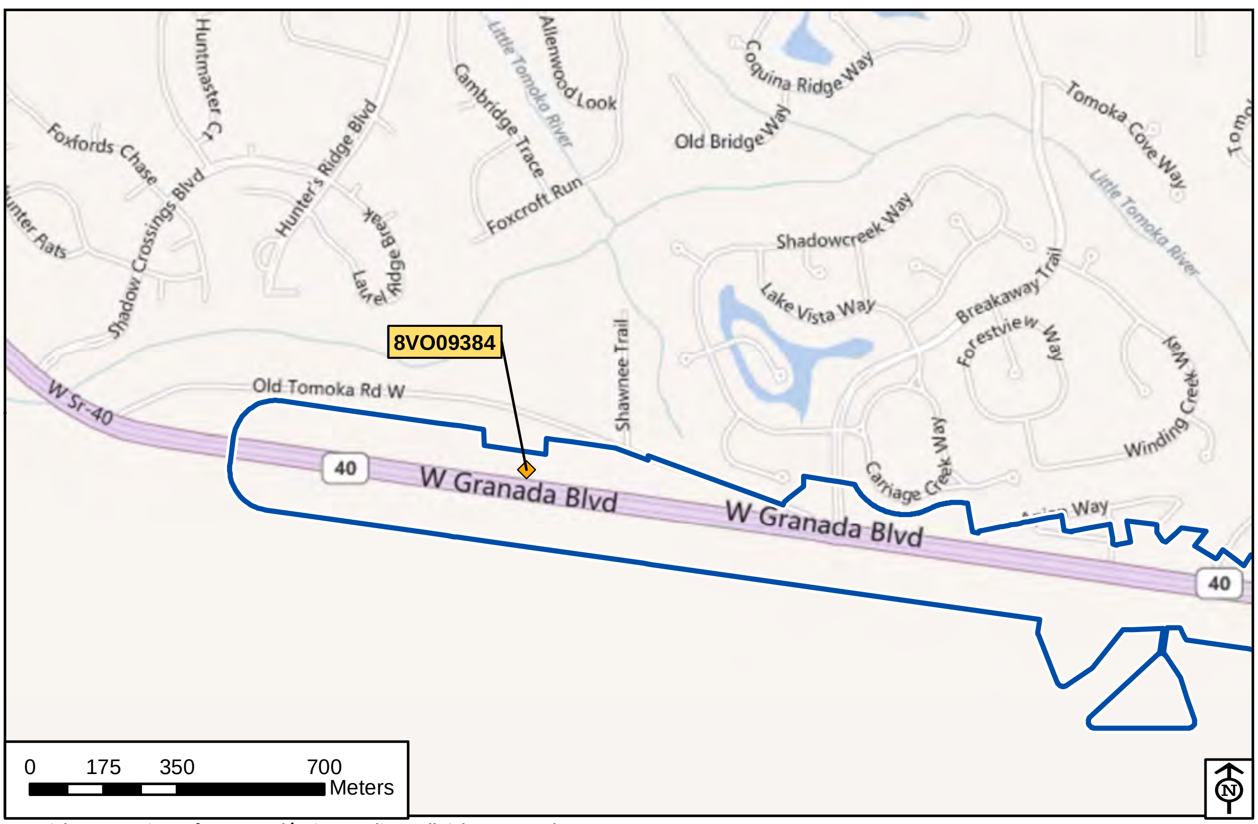
8VO09384_c Facing Southwest

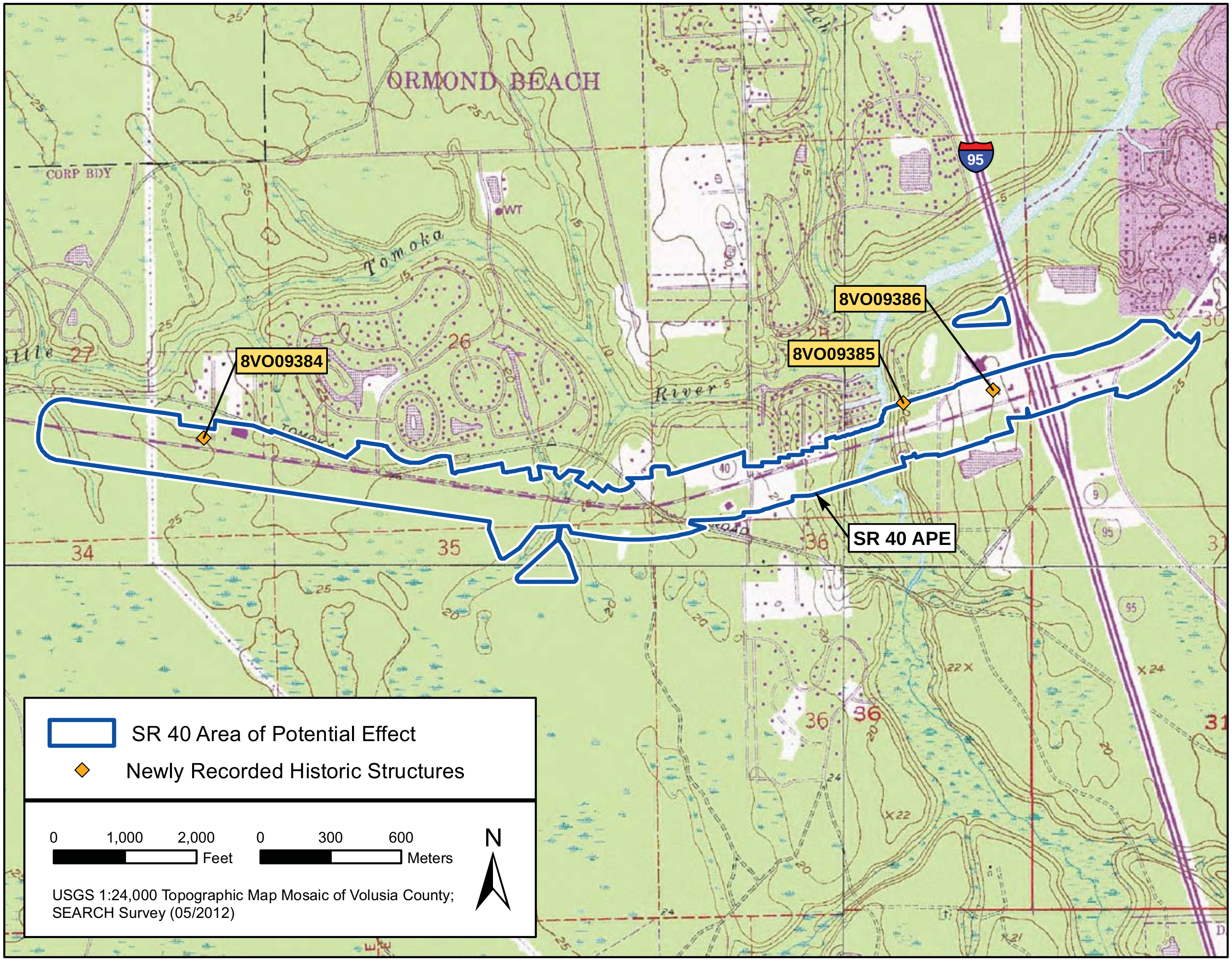
8VO09384_d Facing SSE

8VO09384_e Sign Facing Northwest

8VO09384_f Outbuilding Facing Northwest

8VO09384
at 2639 W. Granada Bvd.





ORMOND BEACH
CORP BDY
Tomoka
River
8VO09384
8VO09385
8VO09386
SR 40 APE
95
SR 40 Area of Potential Effect
Newly Recorded Historic Structures
0 1,000 2,000 Feet
0 300 600 Meters
N
USGS 1:24,000 Topographic Map Mosaic of Volusia County;
SEARCH Survey (05/2012)

☒ Original
☐ Update

HISTORICAL STRUCTURE FORM
FLORIDA MASTER SITE FILE
Version 4.0 1/07

Site #8 VO09385
Field Date 5-12-2012
Form Date 5-31-2012
Recorder #

Shaded Fields represent the minimum acceptable level of documentation.
Consult the *Guide to Historical Structure Forms* for detailed instructions.

Site Name(s) (address if none) 1705 W. Granada Blvd.
Multiple Listing (DHR only)
Survey Project Name CRAS SR 40 from Breakaway Trail to Williamson Rd
Survey # (DHR only)
National Register Category (please check one) ☒building ☐structure ☐district ☐site ☐object
Ownership: ☒private-profit ☐private-nonprofit ☐private-individual ☐private-nonspecific ☐city ☐county ☐state ☐federal ☐Native American ☐foreign ☐unknown

LOCATION & MAPPING

	Street Number	Direction	Street Name	Street Type	Suffix Direction
Address:	1705	W	Granada	Boulevard	

Cross Streets (nearest / between) Booth Rd/SR 40 (W. Granada Blvd)
USGS 7.5 Map Name ORMOND BEACH USGS Date 1993 Plat or Other Map
City / Town (within 3 miles) Ormond Beach In City Limits? ☐yes ☒no ☐unknown County Volusia
Township 14S Range 31E Section 25 ¼ section: ☐NW ☐SW ☒SE ☐NE Irregular-name:
Tax Parcel # 25-14-31-00-00-0160 Landgrant
Subdivision Name Block Lot
UTM Coordinates: Zone ☐16 ☐17 Easting Northing
Other Coordinates: X: Y: Coordinate System & Datum
Name of Public Tract (e.g., park)

HISTORY

Construction Year: 1946 ☒approximately ☐year listed or earlier ☐year listed or later
Original Use Private residence From (year): 1946 To (year): unk
Current Use Vacant From (year): unk To (year): 2012
Other Use From (year): To (year):
Moves: ☐yes ☐no ☐unknown Date: Original address
Alterations: ☒yes ☐no ☐unknown Date: Nature windows boarded over, siding removed
Additions: ☒yes ☐no ☐unknown Date: Nature 2-story gable roof addn to north elev
Architect (last name first): unknown Builder (last name first): unknown
Ownership History (especially original owner, dates, profession, etc.)

Is the Resource Affected by a Local Preservation Ordinance? ☐yes ☐no ☒unknown Describe

DESCRIPTION

Style Frame Vernacular Exterior Plan Rectangular Number of Stories 2
Exterior Fabric(s) 1. Weatherboard 2. Board and batten 3.
Roof Type(s) 1. Gable 2. 3.
Roof Material(s) 1. Asphalt/Composition shingles 2. 3.
Roof secondary strucs. (dormers etc.) 1. 2.
Windows (types, materials, etc.) 3/1 SHS wood windows, boarded over windows, and 2/2 SHS metal windows on 2-story addition
Distinguishing Architectural Features (exterior or interior ornaments) exposed rafter tails

Ancillary Features / Outbuildings (record outbuildings, major landscape features; use continuation sheet if needed.) historic wood clad shed located to southeast of residence

DHR USE ONLY — OFFICIAL EVALUATION — DHR USE ONLY

NR List Date
☐Owner Objection

SHPO – Appears to meet criteria for NR listing: ☐yes ☐no ☐insufficient info Date Init.
KEEPER – Determined eligible: ☐yes ☐no Date
NR Criteria for Evaluation: ☐a ☐b ☐c ☐d (see *National Register Bulletin 15*, p. 2)

HISTORICAL STRUCTURE FORM

Site #8 VO09385

DESCRIPTION (continued)

Chimney: No. 1 Chimney Material(s): 1. Brick 2.
Structural System(s): 1. Wood frame 2. 3.
Foundation Type(s): 1. Piers 2.
Foundation Material(s): 1. Concrete Block 2.
Main Entrance (stylistic details) Main entry on east features paneled wood door recessed beneath incised porch.

Porch Descriptions (types, locations, roof types, etc.) incised, E/entry/square wood posts/E,N, gable roof of one story; closed, W/rear/boarded over/W, shed

Condition (overall resource condition): ☐excellent ☐good ☐fair ☒deteriorated ☐ruinous
Narrative Description of Resource

Archaeological Remains ☐Check if Archaeological Form Completed

RESEARCH METHODS (check all that apply)

☒FMSF record search (sites/surveys)
☐FL State Archives/photo collection
☒property appraiser / tax records
☒cultural resource survey (CRAS)
☒library research
☐city directory
☐newspaper files
☒historic photos
☐building permits
☐occupant/owner interview
☒neighbor interview
☐interior inspection
☐Sanborn maps
☐plat maps
☐Public Lands Survey (DEP)
☐HABS/HAER record search
☒other methods (describe) pedestrian survey
Bibliographic References (give FMSF manuscript # if relevant, use continuation sheet if needed)

OPINION OF RESOURCE SIGNIFICANCE

Appears to meet the criteria for National Register listing individually? ☐yes ☒no ☐insufficient information
Appears to meet the criteria for National Register listing as part of a district? ☐yes ☒no ☐insufficient information
Explanation of Evaluation (**required**, whether significant or not; use separate sheet if needed) Due to lack of sufficient historical and architectural significance, 8VO09385 is ineligible for listing in the NRHP, either individually or as a contributing resource within a potential or existing historic district.
Area(s) of Historical Significance (see *National Register Bulletin 15*, p. 8 for categories: e.g. "architecture", "ethnic heritage", "community planning & development", etc.)
1. 3. 5.
2. 4. 6.

DOCUMENTATION

Accessible Documentation Not Filed with the Site File - including field notes, analysis notes, photos, plans and other important documents

1) Document type All materials at one location — Maintaining organization Southeastern Archaeological Research
Document description photos, maps, field notes, aerials — File or accession #'s 2657-11053T

2) Document type — Maintaining organization
Document description — File or accession #'s

RECORDER INFORMATION

Recorder Name VanDyke, Ryan Affiliation Southeastern Archaeological Research
Recorder Contact Information 315 NW 138th Terr, Newberry, FL 32669/352-333-0049/352-333-0069/ryan@searchinc.com
(address / phone / fax / e-mail)

Required Attachments

❶ **USGS 7.5' MAP WITH STRUCTURE LOCATION PINPOINTED IN RED**
❷ **LARGE SCALE STREET, PLAT OR PARCEL MAP** (available from most property appraiser web sites)
❸ **PHOTO OF MAIN FACADE, ARCHIVAL B&W PRINT OR DIGITAL IMAGE FILE**
If submitting an image file, it must be included on disk or CD AND in hard copy format (plain paper is acceptable).
Digital image must be at least 1600 x 1200 pixels, 24-bit color, jpeg or tiff.

8VO09385_a Facing NNW

8VO09385_b Facing West

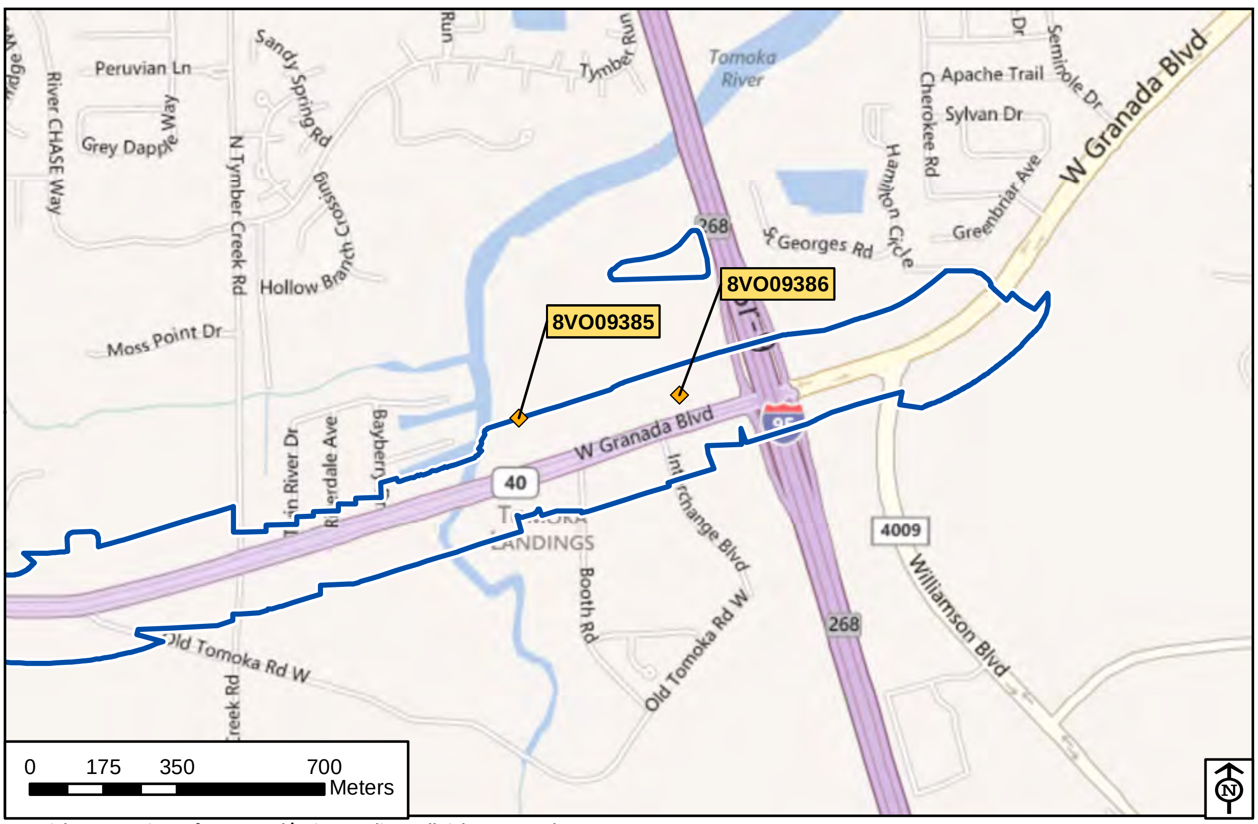
8VO09385_c Facing Southwest

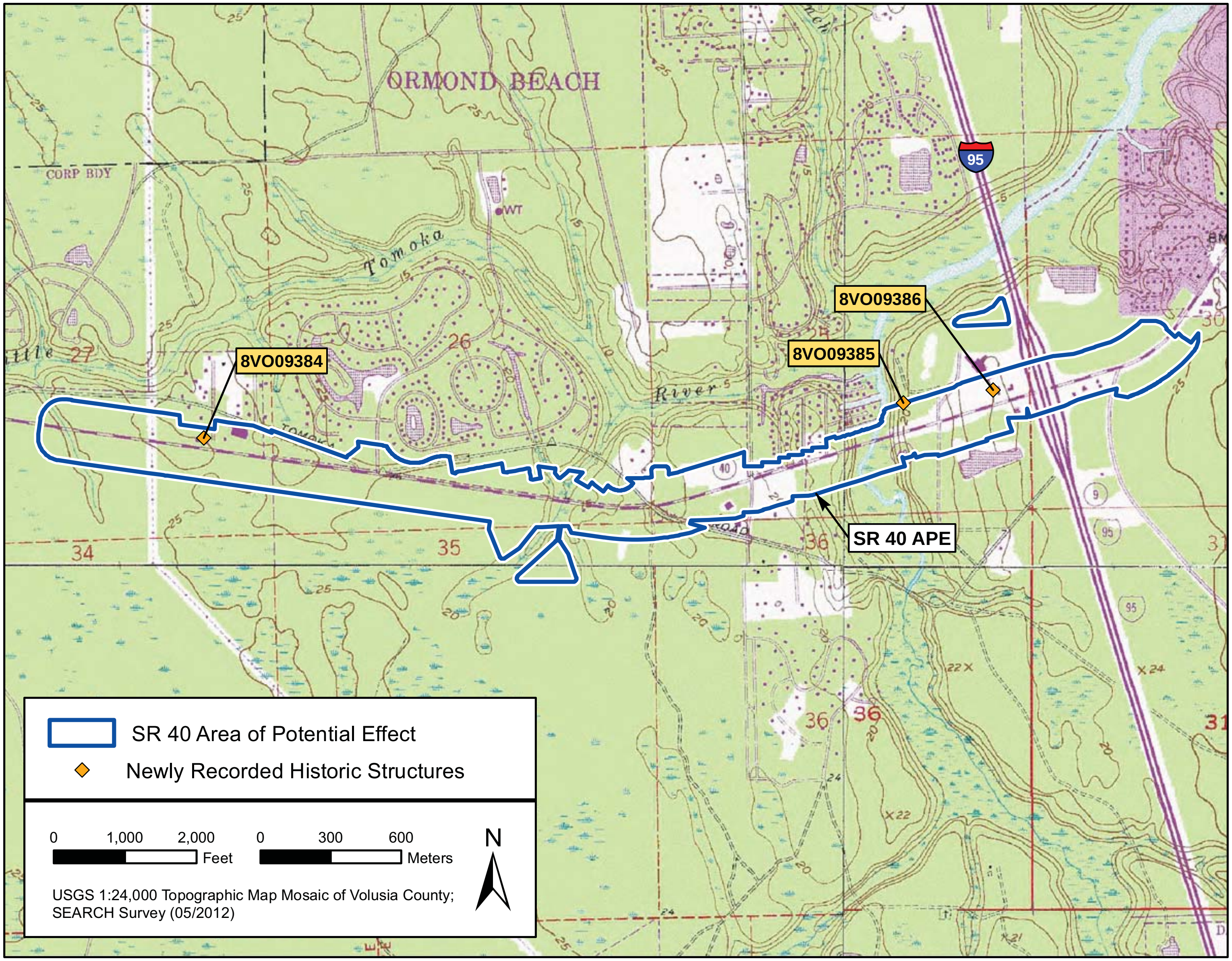
8VO09385_d Facing East

8VO09385_e Facing North

8VO09385_f Outbuilding Facing West

8VO09385
at 1705 W. Granada Bvd.




ORMOND BEACH
CORP BDY
Tomoka
River
95
8VO09384
8VO09385
8VO09386
SR 40 APE
SR 40 Area of Potential Effect
Newly Recorded Historic Structures
0
1,000
2,000
Feet
0
300
600
Meters
N
USGS 1:24,000 Topographic Map Mosaic of Volusia County;
SEARCH Survey (05/2012)

☒ Original
☐ Update

HISTORICAL STRUCTURE FORM

FLORIDA MASTER SITE FILE

Version 4.0 1/07

Site #8 VO09386
Field Date 5-12-2012
Form Date 5-31-2012
Recorder #

Shaded Fields represent the minimum acceptable level of documentation.
Consult the *Guide to Historical Structure Forms* for detailed instructions.

Site Name(s) (address if none) 1641 W. Granada Blvd.
Multiple Listing (DHR only)
Survey Project Name CRAS SR 40 from Breakaway Trail to Williamson Rd
Survey # (DHR only)
National Register Category (please check one) ☒ building ☐ structure ☐ district ☐ site ☐ object
Ownership: ☒ private-profit ☐ private-nonprofit ☐ private-individual ☐ private-nonspecific ☐ city ☐ county ☐ state ☐ federal ☐ Native American ☐ foreign ☐ unknown

LOCATION & MAPPING

	Street Number	Direction	Street Name	Street Type	Suffix Direction
Address:	1641	W	Granada	Boulevard	

Cross Streets (nearest / between) Interchange Blvd/SR 40 (W. Granada Blvd)
USGS 7.5 Map Name ORMOND BEACH
USGS Date 1993
Plat or Other Map
City / Town (within 3 miles) Ormond Beach
In City Limits? ☐ yes ☒ no ☐ unknown
County Volusia
Township 14S Range 31E Section 25 ¼ section: ☐ NW ☐ SW ☒ SE ☐ NE Irregular-name:
Tax Parcel # 25-14-31-00-00-0085
Landgrant
Subdivision Name
Block
Lot
UTM Coordinates: Zone ☐ 16 ☐ 17 Easting Northing
Other Coordinates: X: Y: Coordinate System & Datum
Name of Public Tract (e.g., park)

HISTORY

Construction Year: 1967 ☒ approximately ☐ year listed or earlier ☐ year listed or later
Original Use Commercial From (year): 1967 To (year): unk
Current Use Gas station From (year): unk To (year): 2012
Other Use Auto repair shop From (year): unk To (year): 2012
Moves: ☐ yes ☐ no ☐ unknown Date: Original address
Alterations: ☒ yes ☐ no ☐ unknown Date: Nature nonhistoric boxed, aluminum eaves
Additions: ☐ yes ☒ no ☐ unknown Date: Nature
Architect (last name first): unknown
Builder (last name first): unknown
Ownership History (especially original owner, dates, profession, etc.)

Is the Resource Affected by a Local Preservation Ordinance? ☐ yes ☐ no ☒ unknown Describe

DESCRIPTION

Style Masonry Vernacular
Exterior Plan Rectangular
Number of Stories 1
Exterior Fabric(s) 1. Stucco 2. 3.
Roof Type(s) 1. Gable 2. 3.
Roof Material(s) 1. Unspecified 2. 3.
Roof secondary strucs. (dormers etc.) 1. 2.
Windows (types, materials, etc.) fixed rectangular commercial windows

Distinguishing Architectural Features (exterior or interior ornaments) nonhistoric boxed, aluminum eaves, quoins on corners

Ancillary Features / Outbuildings (record outbuildings, major landscape features; use continuation sheet if needed.) flat roof canopy and gas pumps to south and small metal shed to west

DHR USE ONLY **OFFICIAL EVALUATION** **DHR USE ONLY**

NR List Date

☐ Owner Objection

SHPO – Appears to meet criteria for NR listing: ☐ yes ☐ no ☐ insufficient info Date Init.
KEEPER – Determined eligible: ☐ yes ☐ no Date
NR Criteria for Evaluation: ☐ a ☐ b ☐ c ☐ d (see *National Register Bulletin 15*, p. 2)

HISTORICAL STRUCTURE FORM

Site #8 VO09386

DESCRIPTION (continued)

Chimney: No. 0 Chimney Material(s): 1. ______ 2. ______
Structural System(s): 1. Concrete block 2. ______ 3. ______
Foundation Type(s): 1. Slab 2. ______
Foundation Material(s): 1. Poured Concrete Footing 2. ______
Main Entrance (stylistic details) Main entry on south features glass and metal commercial door sheltered beneath the extended boxed gable eave.
Porch Descriptions (types, locations, roof types, etc.) ______

Condition (overall resource condition): ☐excellent ☒good ☐fair ☐deteriorated ☐ruinous
Narrative Description of Resource Two auto bays with metal, roll-up door pierce the south façade and are offset to the west.

Archaeological Remains ______ ☐Check if Archaeological Form Completed

RESEARCH METHODS (check all that apply)

☒FMSF record search (sites/surveys)
☐FL State Archives/photo collection
☒property appraiser / tax records
☒cultural resource survey (CRAS)
☒library research
☐city directory
☐newspaper files
☒historic photos
☐building permits
☐occupant/owner interview
☒neighbor interview
☐interior inspection
☐Sanborn maps
☐plat maps
☐Public Lands Survey (DEP)
☐HABS/HAER record search
☒other methods (describe) pedestrian survey

Bibliographic References (give FMSF manuscript # if relevant, use continuation sheet if needed) ______

OPINION OF RESOURCE SIGNIFICANCE

Appears to meet the criteria for National Register listing individually? ☐yes ☒no ☐insufficient information
Appears to meet the criteria for National Register listing as part of a district? ☐yes ☒no ☐insufficient information
Explanation of Evaluation (**required**, whether significant or not; use separate sheet if needed) Due to lack of sufficient historical and architectural significance, 8VO09386 is ineligible for listing in the NRHP, either individually or as a contributing resource within a potential or existing historic district.
Area(s) of Historical Significance (see *National Register Bulletin 15*, p. 8 for categories: e.g. "architecture", "ethnic heritage", "community planning & development", etc.)
1. ______ 3. ______ 5. ______
2. ______ 4. ______ 6. ______

DOCUMENTATION

Accessible Documentation Not Filed with the Site File - including field notes, analysis notes, photos, plans and other important documents

1) Document type All materials at one location Maintaining organization Southeastern Archaeological Research
Document description photos, maps, field notes, aerials File or accession #'s 2657-11053T

2) Document type ______ Maintaining organization ______
Document description ______ File or accession #'s ______

RECORDER INFORMATION

Recorder Name VanDyke, Ryan Affiliation Southeastern Archaeological Research
Recorder Contact Information 315 NW 138th Terr, Newberry, FL 32669/352-333-0049/352-333-0069/ryan@searchinc.com
(address / phone / fax / e-mail)

Required Attachments

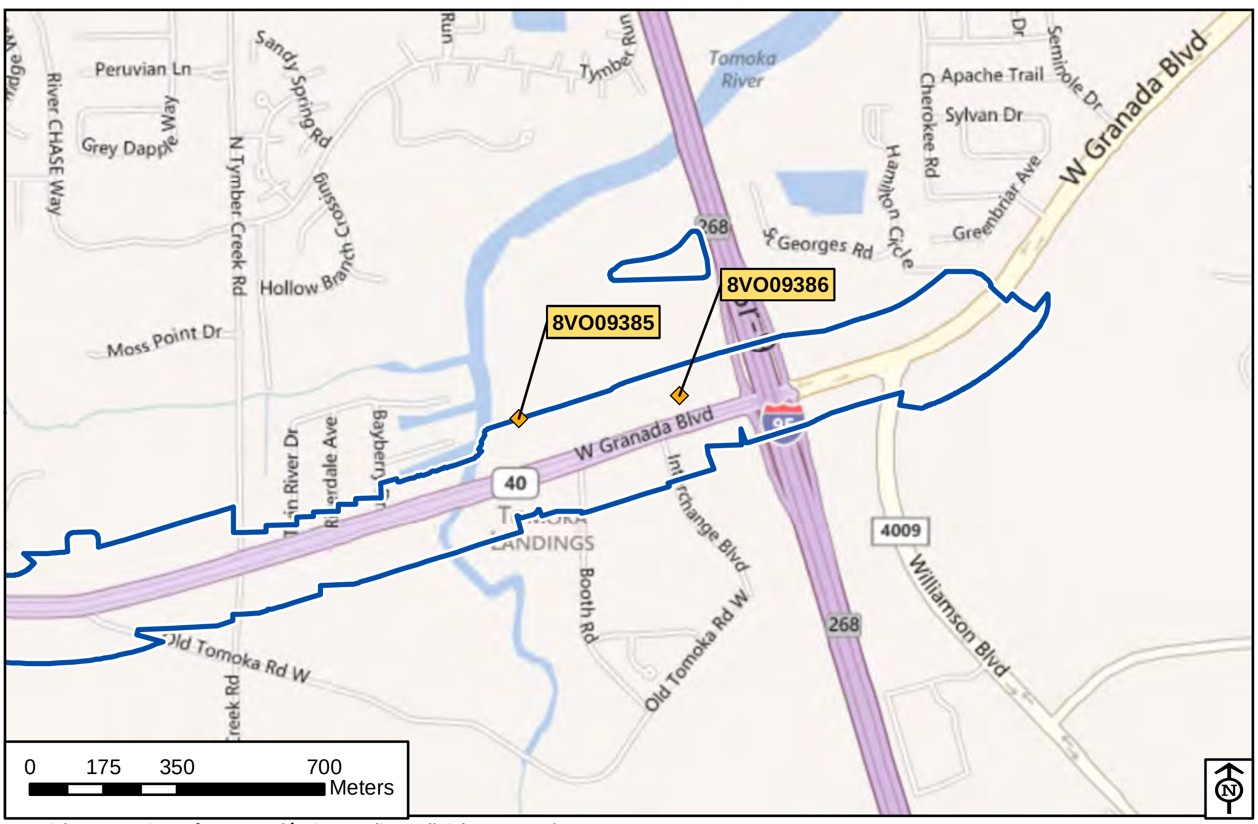
❶ USGS 7.5' MAP WITH STRUCTURE LOCATION PINPOINTED IN RED
❷ LARGE SCALE STREET, PLAT OR PARCEL MAP (available from most property appraiser web sites)
❸ PHOTO OF MAIN FACADE, ARCHIVAL B&W PRINT OR DIGITAL IMAGE FILE
If submitting an image file, it must be included on disk or CD AND in hard copy format (plain paper is acceptable).
Digital image must be at least 1600 x 1200 pixels, 24-bit color, jpeg or tiff.

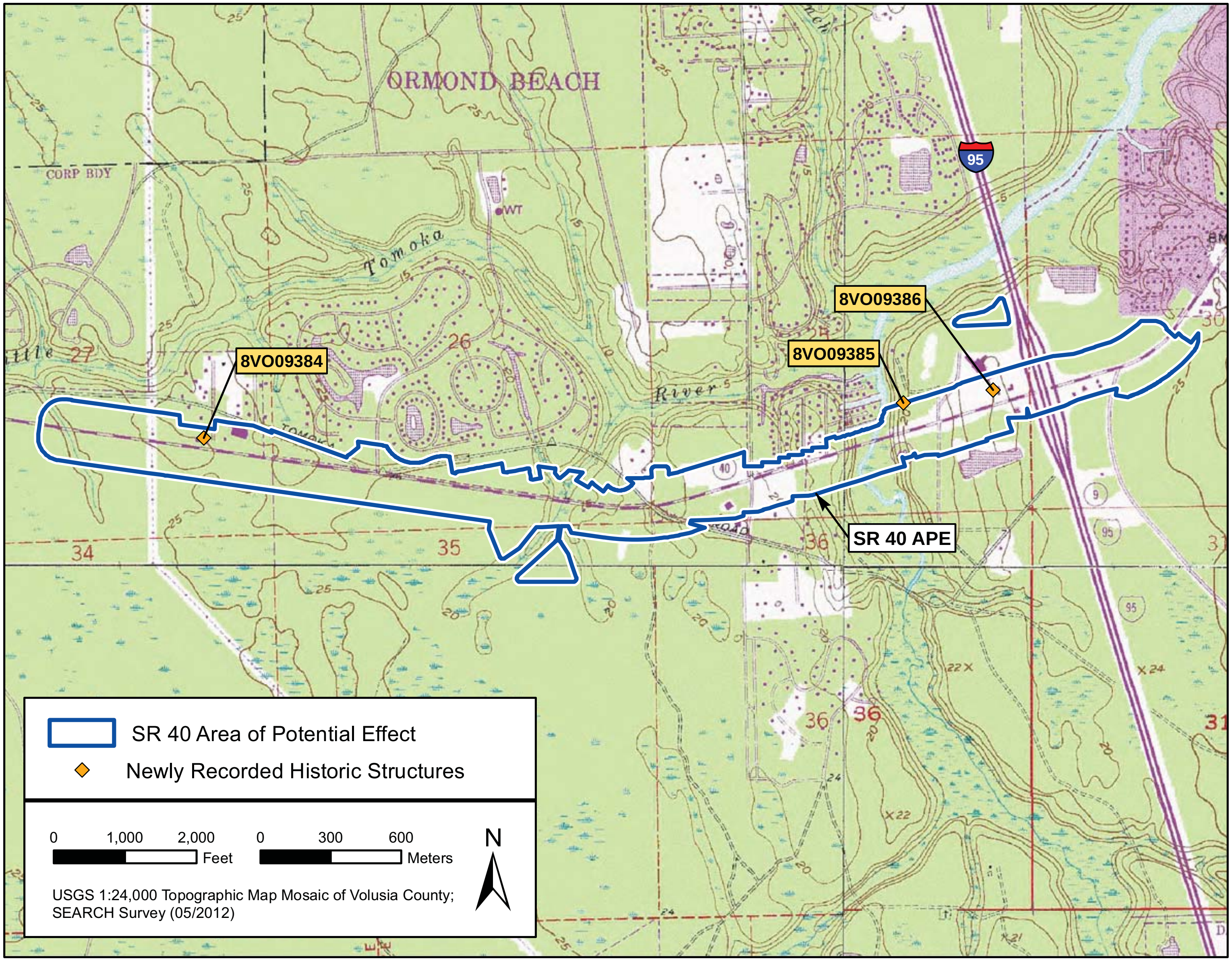
8VO09386_a Facing Northwest

8VO09386_b Facing North

8VO09386_c Facing Northeast

8VO09386
at 1641 W. Granada Bvd.





ORMOND BEACH
CORP BDY
Tomoka
River
95
8VO09384
8VO09385
8VO09386
SR 40 APE
SR 40 Area of Potential Effect
Newly Recorded Historic Structures
0
1,000
2,000
Feet
0
300
600
Meters
N
USGS 1:24,000 Topographic Map Mosaic of Volusia County;
SEARCH Survey (05/2012)

APPENDIX 7

Contamination Screening Evaluation Report

LEVEL 1 CONTAMINATION SCREENING EVALUATION REPORT
STATE ROAD 40 PD&E STUDY
BREAKAWAY TRAIL TO WILLIAMSON BOULEVARD
VOLUSIA COUNTY, FLORIDA

FM: 428947-1-22-01
January 6, 2012

Prepared for:
Kittelson & Associates, Inc.
225 East Robinson Street, Suite 450
Orlando, Florida 32801

Prepared by:
Nodarse & Associates, Inc., A Terracon Company
1675 Lee Road
Winter Park, Florida 32799

Nodarse/Terracon Project No. H1117355

NODARSE
A Terracon COMPANY

January 6, 2012

Kittelson & Associates, Inc.
225 East Robinson Street, Suite 450
Orlando, Florida 32801

Attention: Mr. John R. Freeman, Jr., P.E., PTOE

Telephone: (407) 540-0555

Re: Level 1 Contamination Screening Evaluation Report
State Road 40 PD&E Study from Breakaway Trail to Williamson Boulevard
Volusia County, Florida
FM: 428947-1-22-01
Nodarse/Terracon Project No. H1117355

Dear Mr. Freeman:

We are pleased to submit the enclosed Level 1 Contamination Screening Evaluation Report (CSER) for the above-referenced site. This assessment was performed in accordance with our Standard Subcontract Agreement dated May, 25, 2011, executed June 18, 2011.

We appreciate the opportunity to perform these services for you. Please contact our office at (407) 740-6110 if you have questions regarding this information or if we can provide any other services.

Sincerely,

Nodarse & Associates, A Terracon Company

Laura Sebastian for
Senior Environmental Scientist

Eric R. Krebill, P.G.
Senior Project Manager

N:\Projects\2011\H1117355\Working Files\DRAFTS (Proposal-Reports-Communications)\CSER H1117355, SR 40.doc

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APPENDICES

Level 1 Contamination Screening Evaluation Report
SR 40 PD&E Study from Breakaway Trail to Williamson Boulevard
Volusia County, Florida

FM: 428947-1-22-01
Nodarse/Terracon Project No. H1117355
January 6, 2012

1.0 INTRODUCTION

Nodarse & Associates, Inc., A Terracon Company (Nodarse/Terracon), has been retained by Kittelson & Associates, Inc., on behalf of the Florida Department of Transportation (FDOT), to provide a Level 1 Contamination Screening Evaluation Report (CSER) for the proposed road widening evaluation associated with the State Road 40 (SR 40 – Granada Boulevard) corridor from Breakaway Trail to Williamson Boulevard (County Road 4009) in the Ormond Beach area of Volusia County, Florida. The purpose of this report is to present the findings of a contamination screening evaluation of the corridor for the proposed widening of SR 40 from four to six lanes. This report identifies and evaluates known or potential contamination problems, presents recommendations concerning these problems, and discusses possible impacts to the proposed project. The approximate location of the site is shown on the Project Location Map presented as Figure 1 and Aerial Photograph – Land Use Map provided as Figure 2.

This study was performed in general accordance with the Level 1 Assessment portion of the methodology described in Chapter 22 of the FDOT Project Development and Environment (PD&E) guidelines dated January 17, 2008.

Nodarse/Terracon performed this CSER study in accordance with the terms of the Standard Professional Services Agreement, FDOT Contract C9225. This CSER was performed in accordance with generally accepted practices of this profession undertaken in similar studies at the same time and in the same geographical area. We have endeavored to meet this standard of care but may be limited by conditions encountered during performance, a client-driven scope of services, or inability to review information not received by the report date.

Contamination Screening Evaluations, such as the one performed at this site, are of limited scope, are noninvasive and cannot eliminate the potential that hazardous, toxic or petroleum substances are present or have been released at the site beyond what is identified by the limited scope of this CSER. No contamination screening evaluation can wholly eliminate uncertainty regarding the potential for recognized environmental conditions in connection with a property. Performance of this practice is intended to reduce, but not eliminate, uncertainty regarding the potential for recognized environmental conditions. No warranties, express or implied, are intended or made. The limitations herein must be considered when the user of this report formulates opinions as to risks associated with the site or otherwise uses the report for any other purpose.

2.0 PROJECT DESCRIPTION

The intent of this CSER is to evaluate potential for contaminant impacts in the areas of proposed widening of the SR 40 (Granada Boulevard) roadway corridor from Breakaway Trail to Williamson Boulevard in the Ormond Beach area of Volusia County, Florida. The CSER corridor is located in Sections 25 and 26, Township 14 South, Range 31 East and Section 30, Township 14 South, Range 32 East shown on a portion of a United States Geological Survey (USGS) topographic quadrangle map presented as Figure 1. A 2009 aerial photograph including the CSER corridor is provided as Figure 2.

3.0 LAND USES

Developed land within the project limits fronting SR 40 is primarily residential at the west portion with commercial land use increasing eastward. Commercial property use is concentrated at the SR 40 intersections with Tymber Creek Road, Booth Road, Interstate I-95 and Williamson Boulevard. An Aerial Photograph - Land Use Map is provided as Figure 2. Portions of a zoning map obtained from the City of Ormond Beach website, and city boundary, land use, wetland areas and stormwater Environmental Resource Permit maps obtained from the St. Johns River Water Management District (SJRWMD) website are provided in Appendix A.

4.0 HYDROLOGIC FEATURES

4.1 Geology/Hydrology

The Geologic Map of Florida, compiled in *Open-File Report 80* by the Florida Geological Survey in 2001, indicates Pleistocene/Holocene age beach ridge and dune sediments are exposed at the project area. The siliciclastics are light gray, tan, brown to black, unconsolidated to poorly consolidated, clean to clayey, silty, unfossiliferous, variably organic-bearing sands to blue green to olive green, poorly to moderately consolidated, sandy, silty clays. Organics occur as plant debris, roots, disseminated organic matrix and beds of peat. The site and surrounding area are located within an area of low to no recharge to the underlying Floridian aquifer system, based on a review of a geologic document prepared by the U.S. Geological Survey entitled *Areas of Natural Recharge to the Floridian Aquifer in Florida* dated 1980.

The Tomoka River flowing northeast and a tributary of the Little Tomoka River flowing generally east both cross the project area as indicated on Figure 1.

4.2 Surficial Soils

According to the U.S. Soil Conservation Service (USCS) Soil Map - Volusia County, surficial soil at the CSER corridor includes approximately 17 named soil types, which include sands, sandy loams, and muck, some of which are occasionally to frequently flooded. Approximately 60 percent of the SR 40 alignment is mapped with soils that have a seasonal high groundwater levels within 10 inches of or above natural ground surface. Deep organic soils are mapped adjacent to the Tomoka River crossing. A copy for the USCS soils map is included in Appendix A.

4.3 USGS Quadrangle Map Review

The Favoretta and Ormond Beach, Florida USGS topographic quadrangle maps dated 1956, photorevised 1993, provided as Figure 1, indicate that the project area is located at an elevation which ranges from approximately 5 to 25 feet above sea level. The predominant topographic slopes in the corridor are toward the Tomoka River and a tributary of the Little Tomoka River crossing the roadway corridor. Groundwater flow at the project area, based on the quadrangle map, is predominantly north.

4.4 Previous Assessment Groundwater Depth and Flow Information

Review of assessment information conducted at petroleum cleanup facilities in the CSER corridor identified measurements of groundwater less than 10 feet below ground surface (bgs). Shallow groundwater flow was measured toward the northeast at petroleum cleanup facilities located west of the Tomoka River. Shallow groundwater flow was measured toward the northwest at petroleum cleanup facilities located east of the Tomoka River.

5.0 METHODOLOGY

Nodarse/Terracon performed a preliminary evaluation of the SR 40 corridor from Breakaway Trail to the Williamson Boulevard to determine potential contamination problems existing in the area of proposed widening of SR 40. An aerial photograph showing the CSER corridor is contained in Appendix A. The evaluation consisted of the following tasks:

- Review of current and historical land use within the corridor:
    - Historical aerial photographs – Publication of Archived Library and Museum Materials website (1943, 1958, 1970, 1980), FDOT website (1984) and Google Earth website (1995, 1999, 2007, 2010) contained in Appendix A.
    - Historical city directories – Ormond Beach Public Library (1985-no area coverage, 1991, 1995, 2000, 2005, 2010).

- Review of a federal and state regulatory database report obtained from Environmental Data Resources, Inc. (EDR) contained in Appendix B.

- A search for historical Sanborn map conducted at the Ormond Beach Public Library and State University System of Florida - Publication of Archival Library and Museum Materials website did not identify Sanborn maps available for the corridor area.

- Review of the Florida Department of Environmental Protection (FDEP) Map Direct website. Review of regulatory information for identified facilities available at the FDEP's OCULUS website and U.S. Environmental Protection Agency (EPA) Enforcement & Compliance website. Current regulatory information is summarized on Table 1 and select information is contained in Appendix C.
- Interview with representatives of the Ormond Beach Planning, Ormond Beach Engineering, Volusia County Planning & Development Services Engineering Division, Volusia County Environmental Management, and FDEP Central District Hazardous Waste Section.
- Conduct reconnaissance of the corridor, photographs of High Risk Facilities are contained in Appendix D.
- Determine the contamination potential risk level (no, low, medium, high) for properties identified in the corridor, summarized on Table 1.
- Consider potential impacts along the proposed road widening corridor, summarized on Table 1 and Site Evaluation Checklist in Appendix E.

6.0 ALIGNMENT ALTERNATIVES

No alternative alignments are considered herein.

7.0 PROJECT IMPACTS

Potential sources of contamination and contamination risk at the roadway widening area associated with contaminants originating at 26 commercial facilities identified in the corridor area are summarized on Table 1. The identified facilities appear to present no or low risk of contaminant impacts, except for the following:

Medium Risk Facilities
- NE Cleaners – 1634/1640 West Granada Boulevard (Facility 15 on Figure 3C)
- Texaco Station – 1629 West Granada Boulevard (Facility 18 on Figure 3C)
- Ormond Beach Cleaners – 1482 West Granada Boulevard (Facility 23 on Figure 3C)

High Risk Facilities

- BP Station – 1628 West Granada Boulevard (Facility 16 on Figure 3C)
- Former Shell Station – 1546 West Granada Boulevard (Facility 20 on Figure 3C)
- Chevron Station – 1520 West Granada Boulevard (Facility 21 on Figure 3C)

8.0 REGULATORY STATUS OF SITES

Nodarse/Terracon identified activities at the High Risk Facilities that a regulatory agency is, has, or may take an action where potential contamination could have an impact on the project at this time. A summary of recommendations concerning the High Risk Facilities is provided on Table 1, an in the following section.

9.0 RECOMMENDATIONS

Nodarse/Terracon recommends conducting additional evaluation of the following High Risk Facilities:

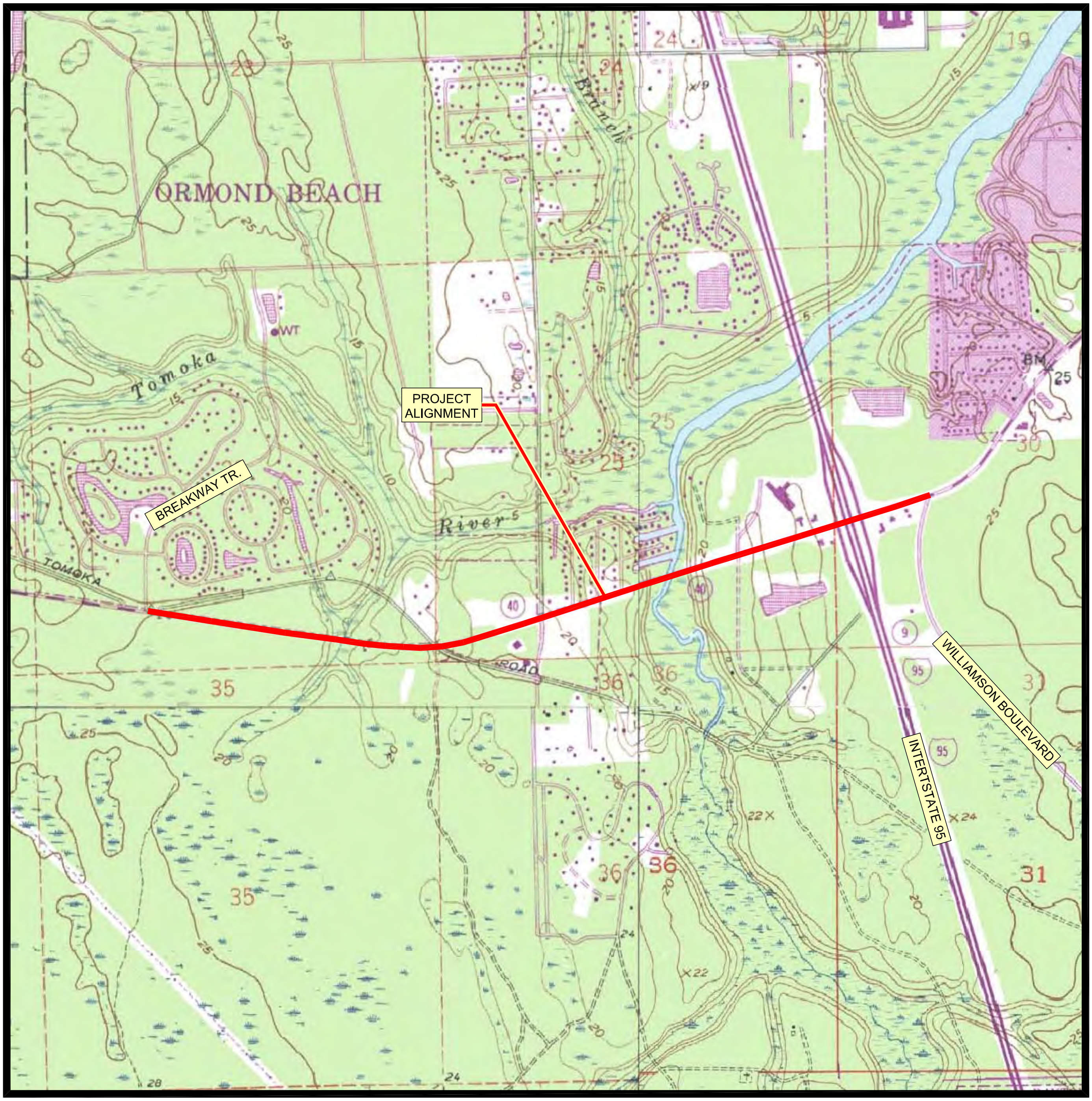
- **1628 West Granada Boulevard (BP Station, fka: Sunshine Food Mart #204, Amoco #761), Facility 16 on Figure 3C, Table 1 and Appendix C and D:** Evaluate whether existing monitor wells in ROW areas and proposed remedial equipment in south ROW will interfere with proposed road widening. Figures in Appendix C identified as Facility 16 (Sunshine Food Mart No. 204) obtained from a *Remedial Action Plan Modification Addendum* dated November 29, 2011 show the location of existing monitor wells in the ROW areas, area of petroleum contamination in soil and groundwater, and proposed air sparge wells, multiphase extraction wells and piping in the south ROW area. Construction of the proposed air sparge wells, multiphase extraction wells and associated piping in the ROW is proposed in 2012. The Volusia County Growth and Resource Management Department, Environmental Management (VCEM) is the regulatory agency managing the petroleum cleanup. The VCEM project manager should contacted to discuss timing of the proposed roadway widening and remedial equipment construction to evaluate whether placement of the proposed well heads may be redesigned now to allow access outside the proposed road widening. Alternatively, the well head access vaults could be moved during the roadway widening by trenching and replacing the well head structures at locations agreeable to VCEM and FDOT. The existing monitoring wells in the ROW may require replacement at locations agreeable to VCEM and FDOT.

- **1546 West Granada Boulevard (Vacant, fka: Shell First Coast Energy #1099/2517, Tomoka Food Mart, A+S Food Mart, BP 24475), Facility 20 on Figure 3C and Table**

1: Evaluate whether existing monitor wells in ROW areas and median, and proposed remedial equipment in south ROW will interfere with proposed road widening. Figures in Appendix C identified as Facility 20 (Former BP 24475) obtained from a *Level 1 Remedial Action Plan* dated December 20, 2010 show the location of existing monitor wells in the median and ROW areas, petroleum contaminant concentrations at sampling locations in soil and groundwater, and proposed air sparge points, soil vapor extraction wells and trenching in the road and south ROW. The VCEM is the regulatory agency managing the petroleum cleanup. The VCEM project manager should contacted to discuss timing of the proposed roadway widening and remedial equipment construction to evaluate whether placement of the proposed well heads may be redesigned now to allow access outside the proposed road widening. Alternatively, the well head access vaults could be moved during the roadway widening by trenching and replacing the well head structures at locations agreeable to VCEM and FDOT. The existing monitoring wells in the ROW may require replacement at locations agreeable to VCEM and FDOT.

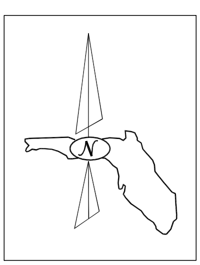
- **1520 West Granada Boulevard (Chevron/Kangaroo Express, fka: Handy Way No. 2574, The Pantry No. 2574), Facility 21 on Figure 3C and Table 1:** Conduct Level II assessment - soil sampling and analysis to determine the potential presence of petroleum contamination in soil in the area of identified petroleum contaminants in groundwater at the south ROW in advance of widening so that worker health and safety and proper management of impacted soils may be considered. Evaluate whether existing monitor wells in ROW areas and median, and existing remedial equipment in south ROW will interfere with proposed road widening. Figures in Appendix C identified as Facility 21 (Handy Way No. 2574) obtained from a *Supplemental Site Assessment Report* dated July 25, 2011 in Appendix C show the location of existing monitor wells in the median and ROW areas, area of groundwater contamination approaching the south ROW where Level II soil sampling is recommended, and existing air sparge points, soil vapor extraction wells and trenching located in the south ROW. The VCEM is the regulatory agency managing the petroleum cleanup. The VCEM project manager should be contacted to discuss timing of the proposed roadway widening to evaluate whether movement of air sparge points and soil vapor extraction well heads and trenching to locations agreeable to VCEM and FDOT should be conducted before or during the widening. The existing monitoring wells in the ROW may require replacement at locations agreeable to VCEM and FDOT.

FIGURES



REFERENCE: U.S.G.S. "FAVORETTA, FLORIDA" QUADRANGLE MAP ISSUED: 1956 REVISED: 1993
U.S.G.S. "ORMOND BEACH, FLORIDA" QUADRANGLE MAP ISSUED: 1956 REVISED: 1993

SECTIONS:	25, 26	30
TOWNSHIP:	14 SOUTH	14 SOUTH
RANGES:	31 EAST	32 EAST
SCALE:	1" = 2000'	



PROJECT LOCATION MAP
CONTAMINATION SCREENING EVALUATION REPORT
SR 40
FROM BREAKAWAY TRAIL TO WILLIAMSON BOULVARD
VOLUSIA COUNTY, FLORIDA

DRAWN: MG
CHKD: EK
SCALE: 1"=2000'
DATE: 12-12-11
PROJ. NO: H1117355
FIGURE: 1

NODARSE
A Terracon COMPANY

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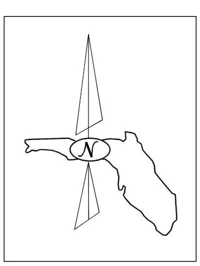

AERIAL PHOTOGRAPH – LAND USE MAP
CONTAMINATION SCREENING EVALUATION REPORT
SR 40
FROM BREAKAWAY TRAIL TO WILLIAMSON BOULVARD
VOLUSIA COUNTY, FLORIDA

DRAWN: MG	NODARSE A Terracon COMPANY	
CHKD: EK		
SCALE: 1"=2000'		
DATE: 12-12-11	PROJ. NO: H1117355	FIGURE: 2

1	Riverbend Community Church	2080 West Granada Boulevard/SR 40
2	Coquina Presbyterian Church	2085 West Granada Boulevard/SR 40
3	Faith Lutheran Church	2010 West Granada Boulevard/SR 40
4	Walgreens	2001 West Granada Boulevard/SR 40
5	7–11 Food Store #32198	1950 West Granada Boulevard/SR 40
6	Tymber Creek Plaza (Tymber Creek Cleaners	1930–1940 West Granada Boulevard/SR 40
7	Vacant Lot – Former Herman's Jiffy Food Store #1894	1999 West Granada Boulevard/SR 40
8	J. Ishram & Sons, Inc. Professional office Building	1951 West Granada Boulevard/SR 40
9	Former Holland Financial building (vacant)	1870 West Granada Boulevard/SR 40
10	Tomoka Business Park	200, 204, 208 West Granada Boulevard/SR 40
11	Halifax Medical Center	1688 West Granada Boulevard/SR 40
12	Calvary Christian Church	1687–1691 West Granada Boulevard/SR 40
13	Racetrac #332	1670 West Granada Boulevard/SR 40
14	McDonalds Restaurant	105 Interchange Boulevard
15	NE Cleaners	1634 West Granada Boulevard/SR 40
16	BP Gas Station (Former Sunshine Food Mart #204)	1628 West Granada Boulevard/SR 40
17	Mobil Gas Station and Collazo & Son Auto Repair (Former Sunrise Food Mart #20)	1641 West Granada Boulevard/SR 40
18	Texaco Gas Station (Former Sunrise Food Mart #57)	1629 West Granada Boulevard/SR 40
19	Former Calypso Tan & Hair/Island Therapy Massage (Vacant Storefronts)	1566, 1568, 1572 West Granada Boulevard/SR 40
20	Vacant Gas Station (Former Shell First Coast energy #1099/2517)	1546 West Granada Boulevard/SR 40
21	Chevron Gas Station/Kangaroo Express #2574 (The Pantry # 2574)	1520 West Granada Boulevard/SR 40
22	Wal–Mart	1521 West Granada Boulevard/SR 40
23	Ormond Beach Cleaners	1482 West Granada Boulevard/SR 40, Suite 610
24	Publix	1482 West Granada Boulevard/SR 40
25	SunTrust Bank	1470 West Granada Boulevard/SR 40
26	chik–Fil–A	1464 West Granada Boulevard/SR 40

SITE RISK RATING

25 HIGH 25 MEDIUM 25 LOW 25 NO RISK

POTENTIAL CONTAMINATION SITE LOCATION MAP
CONTAMINATION SCREENING EVALUATION REPORT
SR 40
FROM BREAKAWAY TRAIL TO WILLIAMSON BOULVARD
VOLUSIA COUNTY, FLORIDA

DRAWN: MG
CHKD: HF
SCALE: NOTED
DATE: 8–1–11

NODARSE
A Terracon COMPANY

PROJ. NO: H1117355
FIGURE: 3A

1	Riverbend Community Church	2080 West Granada Boulevard/SR 40
2	Coquina Presbyterian Church	2085 West Granada Boulevard/SR 40
3	Faith Lutheran Church	2010 West Granada Boulevard/SR 40
4	Walgreens	2001 West Granada Boulevard/SR 40
5	7-11 Food Store #32198	1950 West Granada Boulevard/SR 40
6	Tymber Creek Plaza (Tymber Creek Cleaners	1930-1940 West Granada Boulevard/SR 40
7	Vacant Lot – Former Herman's Jiffy Food Store #1894	1999 West Granada Boulevard/SR 40
8	J. Ishram & Sons, Inc. Professional office Building	1951 West Granada Boulevard/SR 40
9	Former Holland Financial building (vacant)	1870 West Granada Boulevard/SR 40
10	Tomoka Business Park	200, 204, 208 West Granada Boulevard/SR 40
11	Halifax Medical Center	1688 West Granada Boulevard/SR 40
12	Calvary Christian Church	1687-1691 West Granada Boulevard/SR 40
13	Racetrac #332	1670 West Granada Boulevard/SR 40
14	McDonalds Restaurant	105 Interchange Boulevard
15	NE Cleaners	1634 West Granada Boulevard/SR 40
16	BP Gas Station (Former Sunshine Food Mart #204)	1628 West Granada Boulevard/SR 40
17	Mobil Gas Station and Collazo & Son Auto Repair (Former Sunrise Food Mart #20)	1641 West Granada Boulevard/SR 40
18	Texaco Gas Station (Former Sunrise Food Mart #57)	1629 West Granada Boulevard/SR 40
19	Former Calypso Tan & Hair/Island Therapy Massage (Vacant Storefronts)	1566, 1568, 1572 West Granada Boulevard/SR 40
20	Vacant Gas Station (Former Shell First Coast energy #1099/2517)	1546 West Granada Boulevard/SR 40
21	Chevron Gas Station/Kangaroo Express #2574 (The Pantry # 2574)	1520 West Granada Boulevard/SR 40
22	Wal-Mart	1521 West Granada Boulevard/SR 40
23	Ormond Beach Cleaners	1482 West Granada Boulevard/SR 40, Suite 610
24	Publix	1482 West Granada Boulevard/SR 40
25	SunTrust Bank	1470 West Granada Boulevard/SR 40
26	chik-Fil-A	1464 West Granada Boulevard/SR 40

SITE RISK RATING

25 HIGH 25 MEDIUM 25 LOW 25 NO RISK

POTENTIAL CONTAMINATION SITE LOCATION MAP
CONTAMINATION SCREENING EVALUATION REPORT
SR 40
FROM BREAKAWAY TRAIL TO WILLIAMSON BOULVARD
VOLUSIA COUNTY, FLORIDA

DRAWN: MG
CHKD: HF
SCALE: NOTED
DATE: 8-1-11

NODARSE
A Terracon COMPANY

PROJ. NO: H1117355
FIGURE: 3B

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1	Riverbend Community Church	2080 West Granada Boulevard/SR 40
2	Coquina Presbyterian Church	2085 West Granada Boulevard/SR 40
3	Faith Lutheran Church	2010 West Granada Boulevard/SR 40
4	Walgreens	2001 West Granada Boulevard/SR 40
5	7–11 Food Store #32198	1950 West Granada Boulevard/SR 40
6	Tymber Creek Plaza (Tymber Creek Cleaners	1930–1940 West Granada Boulevard/SR 40
7	Vacant Lot – Former Herman's Jiffy Food Store #1894	1999 West Granada Boulevard/SR 40
8	J. Ishram & Sons, Inc. Professional office Building	1951 West Granada Boulevard/SR 40
9	Former Holland Financial building (vacant)	1870 West Granada Boulevard/SR 40
10	Tomoka Business Park	200, 204, 208 West Granada Boulevard/SR 40
11	Halifax Medical Center	1688 West Granada Boulevard/SR 40
12	Calvary Christian Church	1687–1691 West Granada Boulevard/SR 40
13	Racetrac #332	1670 West Granada Boulevard/SR 40
14	McDonalds Restaurant	105 Interchange Boulevard
15	NE Cleaners	1634 West Granada Boulevard/SR 40
16	BP Gas Station (Former Sunshine Food Mart #204)	1628 West Granada Boulevard/SR 40
17	Mobil Gas Station and Collazo & Son Auto Repair (Former Sunrise Food Mart #20)	1641 West Granada Boulevard/SR 40
18	Texaco Gas Station (Former Sunrise Food Mart #57)	1629 West Granada Boulevard/SR 40
19	Former Calypso Tan & Hair/Island Therapy Massage (Vacant Storefronts)	1566, 1568, 1572 West Granada Boulevard/SR 40
20	Vacant Gas Station (Former Shell First Coast energy #1099/2517)	1546 West Granada Boulevard/SR 40
21	Chevron Gas Station/Kangaroo Express #2574 (The Pantry # 2574)	1520 West Granada Boulevard/SR 40
22	Wal–Mart	1521 West Granada Boulevard/SR 40
23	Ormond Beach Cleaners	1482 West Granada Boulevard/SR 40, Suite 610
24	Publix	1482 West Granada Boulevard/SR 40
25	SunTrust Bank	1470 West Granada Boulevard/SR 40
26	chik–Fil–A	1464 West Granada Boulevard/SR 40

SITE RISK RATING

25 HIGH 25 MEDIUM 25 LOW 25 NO RISK

POTENTIAL CONTAMINATION SITE LOCATION MAP
CONTAMINATION SCREENING EVALUATION REPORT
SR 40
FROM BREAKAWAY TRAIL TO WILLIAMSON BOULVARD
VOLUSIA COUNTY, FLORIDA

DRAWN: MG	NODARSE A Terracon COMPANY	
CHKD: HF		
SCALE: NOTED		
DATE: 8-1-11	PROJ. NO: H1117355	FIGURE: 3C

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TABLES

TABLE 1
Contamination Risk Potential Summary
SR 40 (West Granada Blvd) From Breakaway Trail to Williamson Blvd
Ormond Beach, Volusia County, Florida
December 2011

No.	Facility Name	Site Address	Approximate Distance from ROW, feet	Database Listings	Facilility Regulatory Information Summary	Evaluation of Recognized Environmental Concerns	Contamination Evaluation Rating	Recommendations
1	Riverbend Community Church, Academy	2080 West Granada Boulevard/SR 40	Adjoining	County-SQG	FDEP records indicate facility is not a hazardous waste generator.	No indications of contaminants identified.	**No**	None at this time
2	Coquina Presbyterian Church	2085 West Granada Boulevard/SR 40	300	None	No hazardous material generator or registered petroleum storage tanks.	No indications of contaminants identified.	**No**	None at this time
3	Faith Lutheran Church	2010 West Granada Boulevard/SR 40	Adjoining	None	No hazardous material generator or registered petroleum storage tanks.	No indications of contaminants identified.	**No**	None at this time
4	Walgreens	2001 West Granada Boulevard/SR 40	Adjoining	County-SQG	Generator status not determined.	No indications of contaminants identified.	**No**	None at this time
5	7-Eleven Food Store #32198	1950 West Granada Boulevard/SR 40	Adjoining	FDEP LUST, UST, Spills	This operating filling station (FDEP Facility ID No. 9700500) reported a petroleum discharge in October 2006. A *Supplemental Site Assessment Report* dated January 7, 2008 indicated groundwater was measured approximately 3 to 4 feet below ground surface and petroleum constituent concentrations soil & groundwater did not exceed cleanup target levels. The FDEP issue a SRCO on 3/13/2008. A FDEP *Storage Tank Facility Annual Compliance Site Inspection Report* dated 10/6/2011 indicates the facility was operating in compliance.	SRCO granted by FDEP in March 2008. No indications of subsequent discharges identified.	**Low**	None at this time
6	Tymber Creek Plaza (Tymber Creek Cleaners)	1930-1940 West Granada Boulevard/SR 40	Adjoining	None	No hazardous material generator or registered petroleum storage tanks. Dry cleaning not conducted at facility, clothes drop-off location.	No indications of contaminants identified.	**No**	None at this time
7	Vacant Lot - Former Herman's Jiffy Food Store #1894	1999 West Granada Boulevard/SR 40	Adjoining	FDEP LUST, UST, Spills	This former filling station (FDEP Facility ID No. 8517451) is currently a vacant lot. A petroleum discharge was reported 4/13/1999. A *Post Active Remediation Monitoring Report* dated 6/3/2003 indicates groundwater was measured approximately 2 to 3 feet below ground surface, groundwater flow was meaured toward the northeast and petroleum contaminant concentrations in groundwater did not exceed cleanup target levels. The facility received a SRCO on 10/23/2003.	SRCO granted by FDEP in October 2003. No subsequent gasoline storage or dispensing activities documented.	**Low**	None at this time
8	J. Ishram & Sons, Inc. Professional office Building	1951 West Granada Boulevard/SR 40	Adjoining	None	No hazardous material generator or registered petroleum storage tanks.	No indications of contaminants identified.	**No**	None at this time
9	Former Holland Financial building (vacant)	1870-1910 West Granada Boulevard/SR 40	Adjoining	None	No hazardous material generator or registered petroleum storage tanks. The drycleaner ships the clothes offsite for processing.	No indications of contaminants identified.	**No**	None at this time
10	Tomoka Business Park	200, 204, 208 Booth Road	100	None	No hazardous material generator or registered petroleum storage tanks	No indications of contaminants identified.	**No**	None at this time
11	Halifax Medical Center, Childrens Medical Center, Twlight Pediatrics	1688 West Granada Boulevard/SR 40	Adjoining	County-SQG	Childrens Medical Center: CESQG, Twilght Pediatrics: Generator status not determined.	No indications of contaminants identified.	**No**	None at this time
12	Calvery Christian Church	1687-1691 West Granada Boulevard/SR 40	Adjoining	County-SQG	Conditionally-Exempt Small Quantity Generator	No indications of contaminants identified.	**No**	None at this time
13	Racetrac #332	1670 West Granada Boulevard/SR 40	Adjoining	UST	This filling station is currently operating (FDEP Facility ID No. 9812188). The tanks were installed in June 2010. A FDEP *Storage Tank Facility Installation Site Inspection Report* dated 6/10/2010 indicates the facility was operating in complinace. No discharges, leaks or spills identified.	USTs and piping constructed with secondary containment, no compliance violations or discharges identified.	**Low**	None at this time
14	McDonalds Restaurant	105 Interchange Boulevard	Adjoining	None	No hazardous material generator or registered petroleum storage tanks.	No indications of contaminants identified.	**Low**	None at this time
15	NE Cleaners	1634/1640 West Granada Boulevard/SR 40	Adjoining	Drycleaner, RCRA-SQG	Active dry cleaner facility (FDEP Facility #9811233, FLR000094045). No discharges or compliance documention identified.	Low potential for impact to soils within SR 40 ROW, based on distance of drycleaner machine.	**Medium**	None at this time

TABLE 1
Contamination Risk Potential Summary
SR 40 (West Granada Blvd) From Breakaway Trail to Williamson Blvd
Ormond Beach, Volusia County, Florida
December 2011

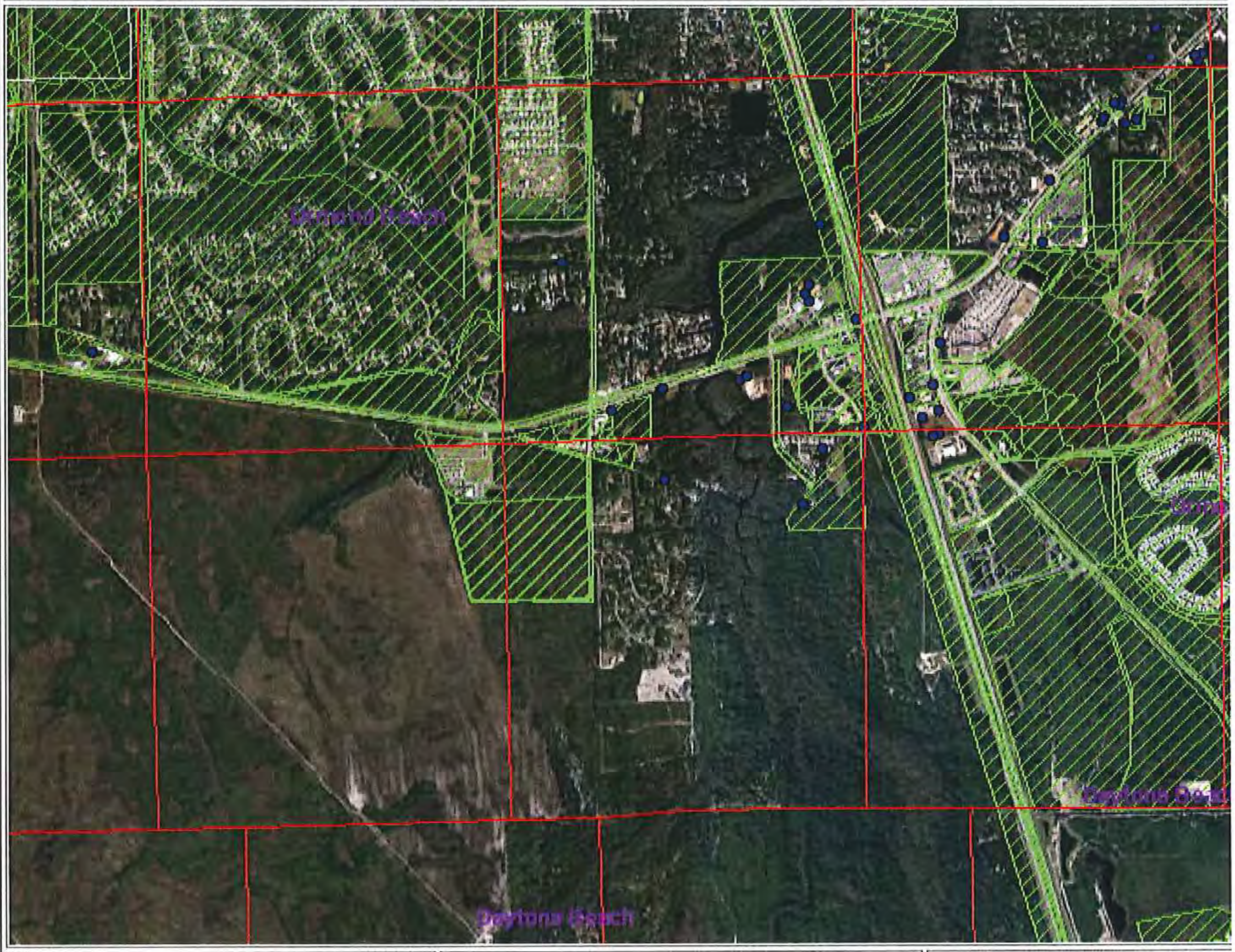
No.	Facility Name	Site Address	Approximate Distance from ROW, feet	Database Listings	Facillity Regulatory Information Summary	Evaluation of Recognized Environmental Concerns	Contamination Evaluation Rating	Recommendations
16	BP Station (Former Sunshine Food Mart #204, Amoco #761)	1628 West Granada Boulevard/SR 40	Adjoining	UST, LUST, SPILLS	This operating filling station (FDEP Facility ID No. 8517258) reported a petroleum discharge on 12/5/1988, which was found eligible for the FDEP's Petroleum Cleanup Program and assigned a cleanup priority score of 76. Monitoring wells were observed at in the SR 40 ROW during site reconnaissance. A revised *Supplemental Site Assessment Report* dated January 2009 indicates groundwater was measured approximately 3 to 5 feet below ground surface with flow toward the northwest. An *Offsite Notice* was issued for this facility to Mr. Randy Stafford of the FDOT District 5 regarding GW Contamination in the Granada Blvd ROW on 10/22/10. Figures obtained from a *Remedial Action Plan Modification Addendum* dated 11/29/11 are contained in Appendix D, which indicate the extent of soil contamination is defined within the facility boundary; however, petroleum contaminant concentrations exceeding cleanup target levels extend below Granada Blvd and installation of remedial equipment in the south ROW area is proposed.	Petroleum contamination groundwater plume is under SR 40.	**High**	Evaluate whether proposed remedial equipment in south ROW will interfere with proposed road widening, see Facility #16 figures in Appendix D.
17	Mobil Station and Collazo & Son Auto Repair (Former Sunrise Food Mart #20, Tiny's Auto Repair, Disalvo Auto Repair)	1641 West Granada Boulevard/SR 40	Adjoining	UST, LUST, SPILLS, County-SQG	This operating filling station (FDEP Facility ID No. 8622825) reported a petroleum discharge on 11/16/1995. A Year 1, Annual Post Active Remediation Monitoring Report dated 8/27/2009 indicated groundwater was measured approximately 4 to 10 feet below ground surface, flow was toward the northwest and petroleum concentrations in groundwater did not exceed gleanup target levels. The FDEP issued a SRCO on 1/14/2010. A FDEP *Storage Tank Facility Annual Compliance Site Inspection Repor* t dated 9/21/2011 indicates the facility was operating in "major out of compliance"; however, no indications of a discharge were noted. During the site reconnaissance, several drums were observed in secondary containment outside with no cover.	The discharge at this facility received an SRCO on 1/14/2010. Groundwater flow away from roadway.	**Low**	None at this time
18	Texaco Station (Former Sunrise Food Mart #57, Hess, Chevron)	1629 West Granada Boulevard/SR 40	Adjoining	UST, LUST, SPILLS, County-SQG	This operating filling station (FDEP Facility ID No. 8517543) reported a petroleum discharge on 12/21/1988, which was found eligible for the FDEP's Petroleum Cleanup Program and assigned a cleanup priority score of 72. An *L3-LSRAP* dated 8/19/2011 indicates groundwater was measured approximately 3 to 10 feet below ground surface with flow toward the northwest and the extent of petroleum contamination was defined within the facility boundaries. Monitoring wells were observed druing reconnaissance along the grassy shoulder of the north ROW.	Petroleum contaminants defined within facility boundary. Groundwater flow away from roadway.	**Medium**	None at this time
19	Former Calypso Tan & Hair/Island Therapy Massage (Vacant Storefronts)	1566, 1568, 1572 West Granada Boulevard/SR 40	Adjoining	None	No hazardous material generator or registered petroleum storage tanks. Monitoring wells were observed in the northeastern portion of this property adjacent to the former Shell station to the east at 1546 W. Granada Blvd.	Monitor wells associated with east-adjoining former Shell station petroleum contamination plume extending below SR 40.	**None**	None at this time, other than recommended for the following former Shell station.
20	Vacant Filling Station (Former Shell First Coast Energy #1099/2517, BP 24475, Tomoka BP, A+S Food Mart)	1546 West Granada Boulevard/SR 40	Adjoining	UST, LUST, SPILLS	This closed fillig station (FDEP Facility ID No. 8517248) reported petroleum discharge 7/2/1992, which was fould eligible for the FDEP's Petroleum Cleanup Program and assigned a cleanup priority score of 73. An Offsite Notice was issued for this site to Mr. Randy Stafford of the FDOT District 5 regarding GW Contamination in the Granada Blvd ROW on 10/22/10. A *Level 1 RAP* dated 12/20/2010 indicates groundwater was measured approximately 5 to 7 feet below ground surface with flow to the northwest. Figures obtained from the report are contained in Appendix D, which indicate the extent of soil contamination was defined within the facility boundary; however, petroleum contaminant concentrations exceeding cleanup target levels may extend below Granada Blvd and installation of remedial equipment in the south ROW area is proposed. Monitoring wells were observed at this facility in the SR 40 ROW along the grassy shoulder and median of the roadway.	Petroleum contamination groundwater plume is under SR 40.	**High**	Evaluate whether proposed remedial equipment in south ROW will interfere with proposed road widening. See Facility #20 figures in Appendix D.

TABLE 1
Contamination Risk Potential Summary
SR 40 (West Granada Blvd) From Breakaway Trail to Williamson Blvd
Ormond Beach, Volusia County, Florida
December 2011

No.	Facility Name	Site Address	Approximate Distance from ROW, feet	Database Listings	Facillity Regulatory Information Summary	Evaluation of Recognized Environmental Concerns	Contamination Evaluation Rating	Recommendations
21	Chevron/Kangaroo Express #2574 (The Pantry # 2574, aka Handyway)	1520 West Granada Boulevard/SR 40	Adjoining	UST, LUST, SPILLS	This operating filling station (FDEP Facility ID No. 8517430) is a reported LUST facility found eligible for the FDEP's Petroleum Cleanup Program with a current cleanup priority score of 73. A *Supplemental Site Assessment Report* dated July 25, 2011 indicates groundwater was measured approximately 5 to 10 feet bgs with flow to the northwest toward SR 40. Petroleum contaminants in groundwater appear to have migrated below the SR 40 south ROW. Soil assessment activities conducted north of the sidewalk did not identify indications of petroleum contaminant in soils above the water table; however, no soil assessment appears to have been conducted in the ROW in the area where petroleum contaminants were indicated in groundwater. Figures obtained from the report are contained in Appendix D, The Volusia County Environmental Management report review letter dated December 30, 2011 indicates remediation iin progress. Monitoring wells associated with this facility were observed in the SR 40 ROW median and ROW.	No soil assessment appears to have been conducted in the ROW in the area where petroleum contaminants were indicated in groundwater	**High**	Level II assessment: soil sampling and analysis to determine the condition of environmental contamination in the ROW in the area of identified petroleum contaminants in groundwater. Evaluate whether existing remedial equipment in south ROW will interfere with proposed road widening. See Facility #21 figures in Appendix D.
22	Wal-Mart	1521 West Granada Boulevard/SR 40	Adjoining	AST, County-SQG	Not a hazardous waste generator. This emergency generator AST (FDEP Facility ID No. 9805752) was in compliance on the most recent FDEP inspection dated 12/8/2010. No discharges have been reported for this site.	No discharges have been reported and the facility is in compliance.	**Low**	None at this time
23	Ormond Beach Cleaners	1482 West Granada Boulevard/SR 40, Suite 610	400	UST, Waste Cleanup, Dry Cleaner	This drycleaner facility is in the FDEP Drycleaning Solvent Cleanup Program. It has a current priority cleanup score of 99. However, this is below the minimum score required for active cleanup. No recent assessment data were available in Oculus.	Low potential for impact to soils within SR 40 ROW, based on distance of facility	**Medium**	None at this time
24	Publix	1482 West Granada Boulevard/SR 40	400	AST	This emergency generator AST (FDEP Facility ID No. 9808247) was in compliance on the most recent FDEP inspection dated 12/8/2010. No discharges have been reported .	No discharges have been reported and the facility is in compliance.	**Low**	None at this time
25	SunTrust Bank	1470 West Granada Boulevard/SR 40	200	None	No hazardous material generator or registered petroleum storage tanks.	No indications of contaminants identified.	**No**	None at this time
26	Chik-Fil-A	1464 West Granada Boulevard/SR 40	300	None	No hazardous material generator or registered petroleum storage tanks.	No indications of contaminants identified.	**No**	None at this time

Red - High Risk Facilities
Blue - Medium Risk Facilities
Yellow - Low Risk Facilities
White - No Risk Facilities

Environmental Resource Permit



Legend

ERP Boundaries

Section/Township/Range

County Boundaries

SJRWMD Boundary

Dislaimer: The St. Johns River
Management District prepares a
Information for its own purpose
information may not be suitable
purposes. This information is pr
Further documentation of this d
obtained by contacting: St. Johr
Management District, Geograph
Systems,Program Management,
4049 Reid Street Palatka, Florid
Tel: (386) 329-4176.

1984

Title: Aerial photographs of Volusia County - Flight 3V (1958)

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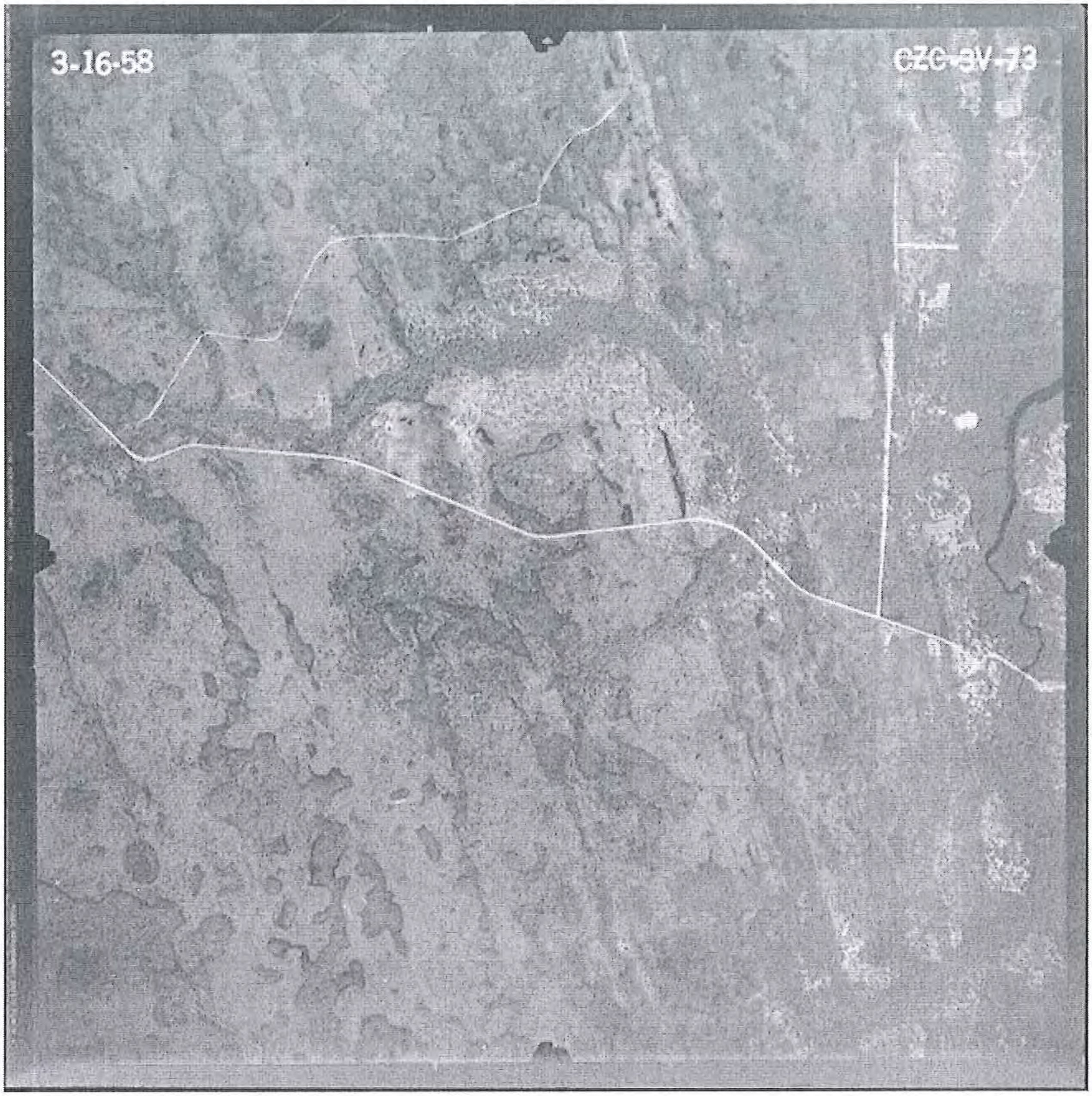
Site: University of Florida Digital Collections



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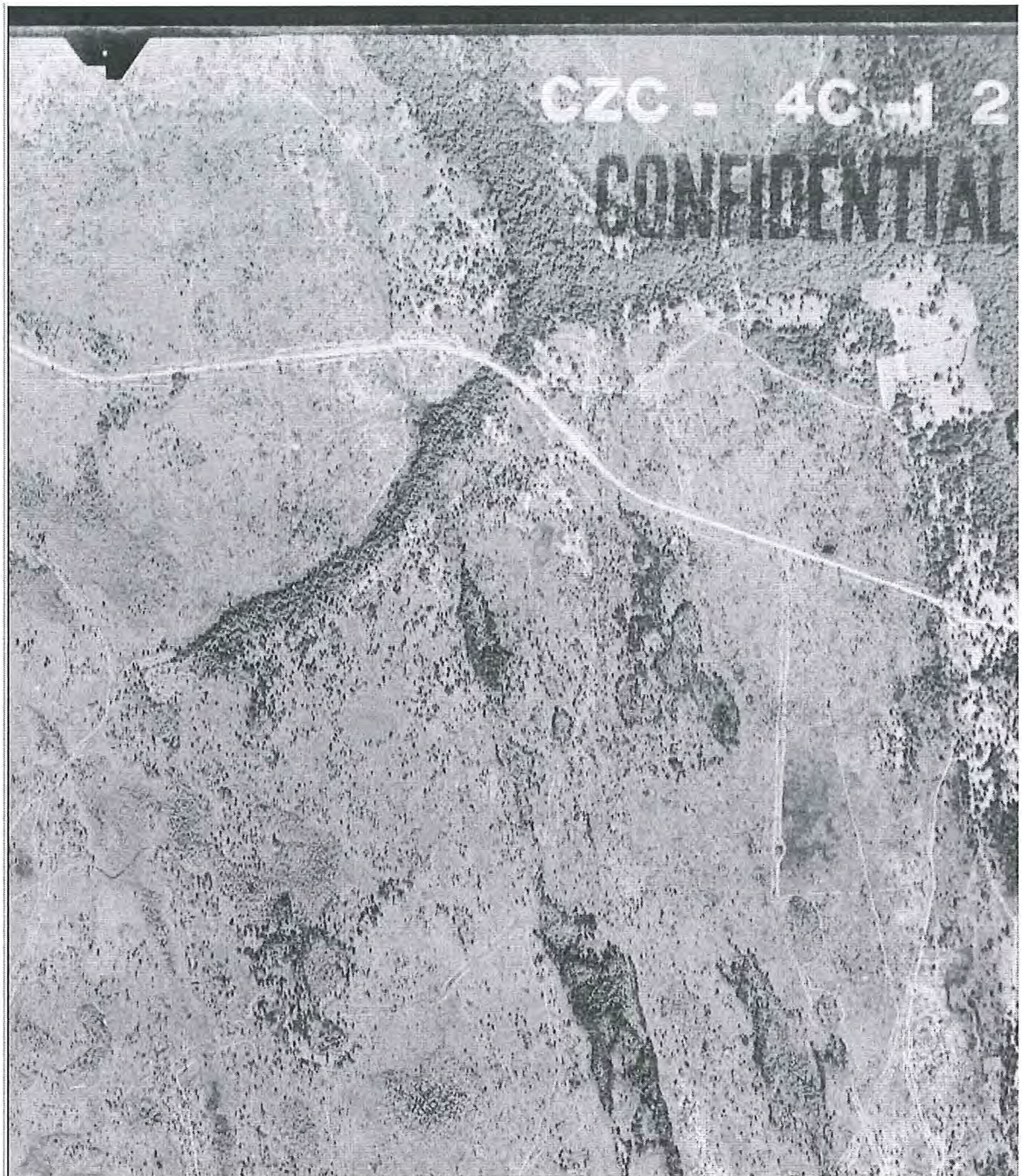
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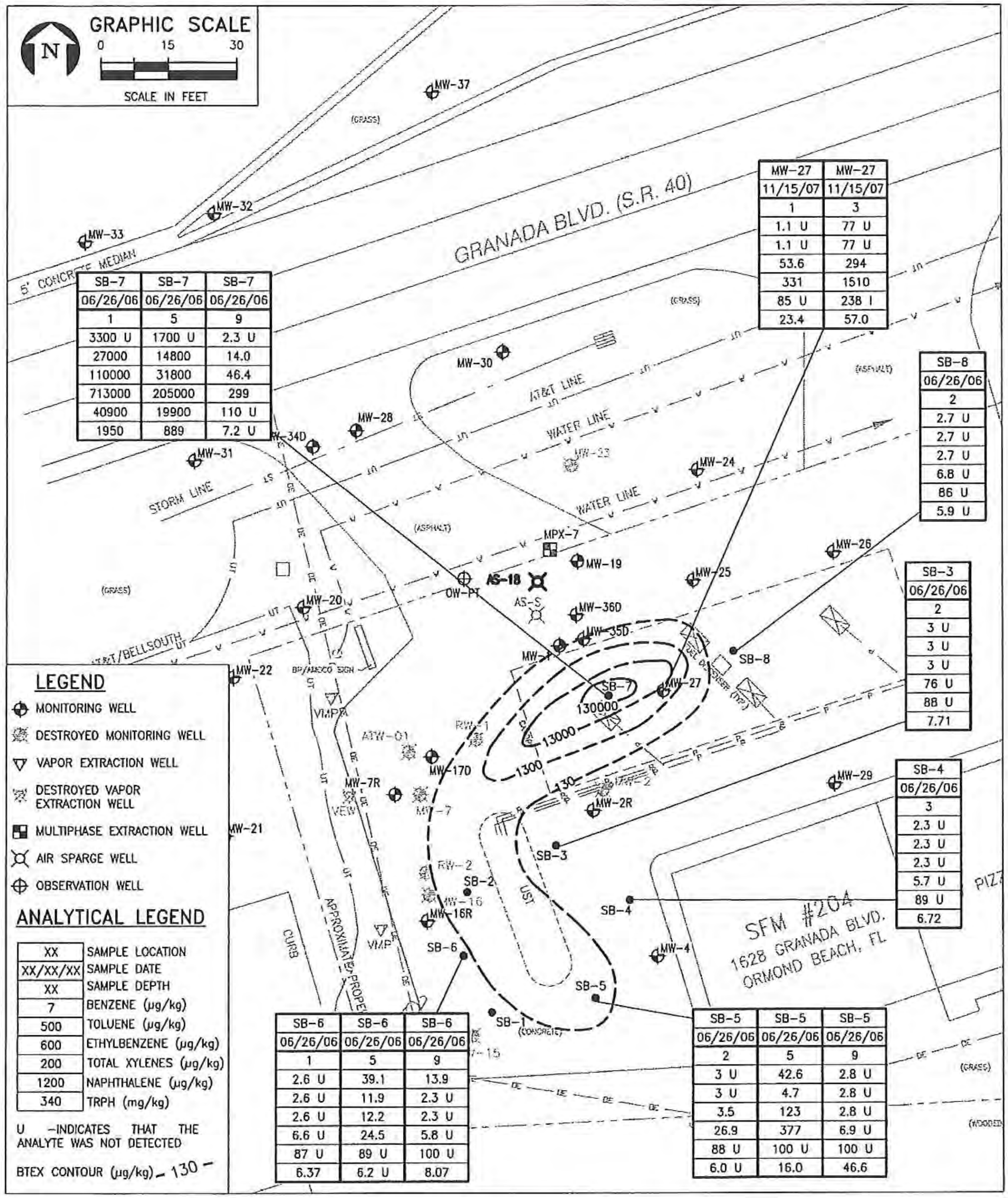

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110000	31800	46.4
713000	205000	299
40900	19900	110 U
1950	889	7.2 U

MW-27	MW-27
11/15/07	11/15/07
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1.1 U	77 U
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331	1510
85 U	238 I
23.4	57.0

SB-8
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2.7 U
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SB-3
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SB-5	SB-5	SB-5
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3.5	123	2.8 U
26.9	377	6.9 U
88 U	100 U	100 U
6.0 U	16.0	46.6

FIGURE 1

SOIL ANALYTICAL SUMMARY

SUNSHINE FOOD MART No. 204

Sources: Metcalf & Eddy, 2003; ECT, 2011

ECT

Environmental Consulting & Technology, Inc.

Facility #16

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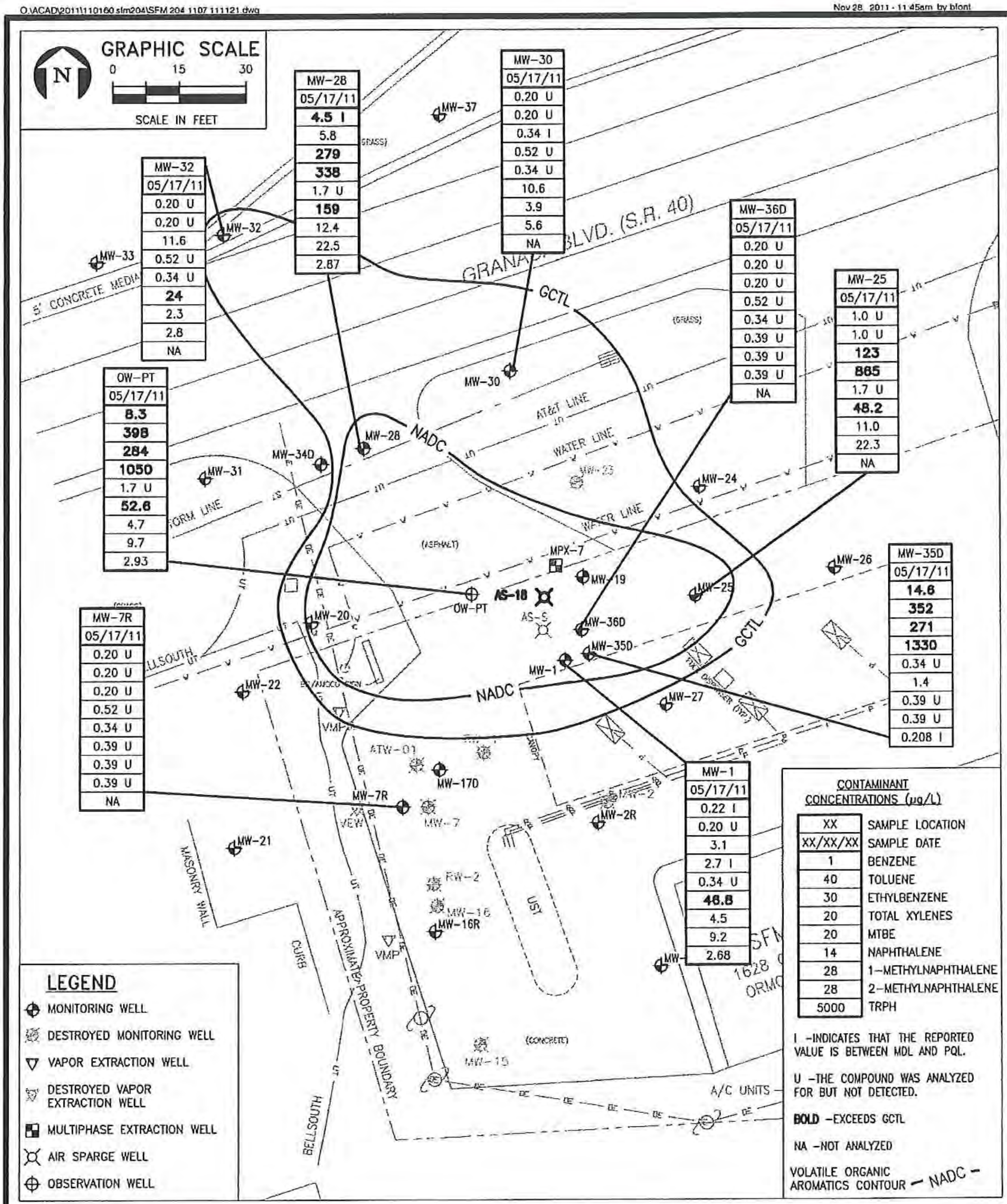

FIGURE 2

GROUNDWATER ANALYTICAL SUMMARY - MAY 17, 2011

SUNSHINE FOOD MART No. 204

Sources: Metcalf & Eddy, 2003; ECT, 2011

ECT

Environmental Consulting & Technology, Inc.

Facility #16

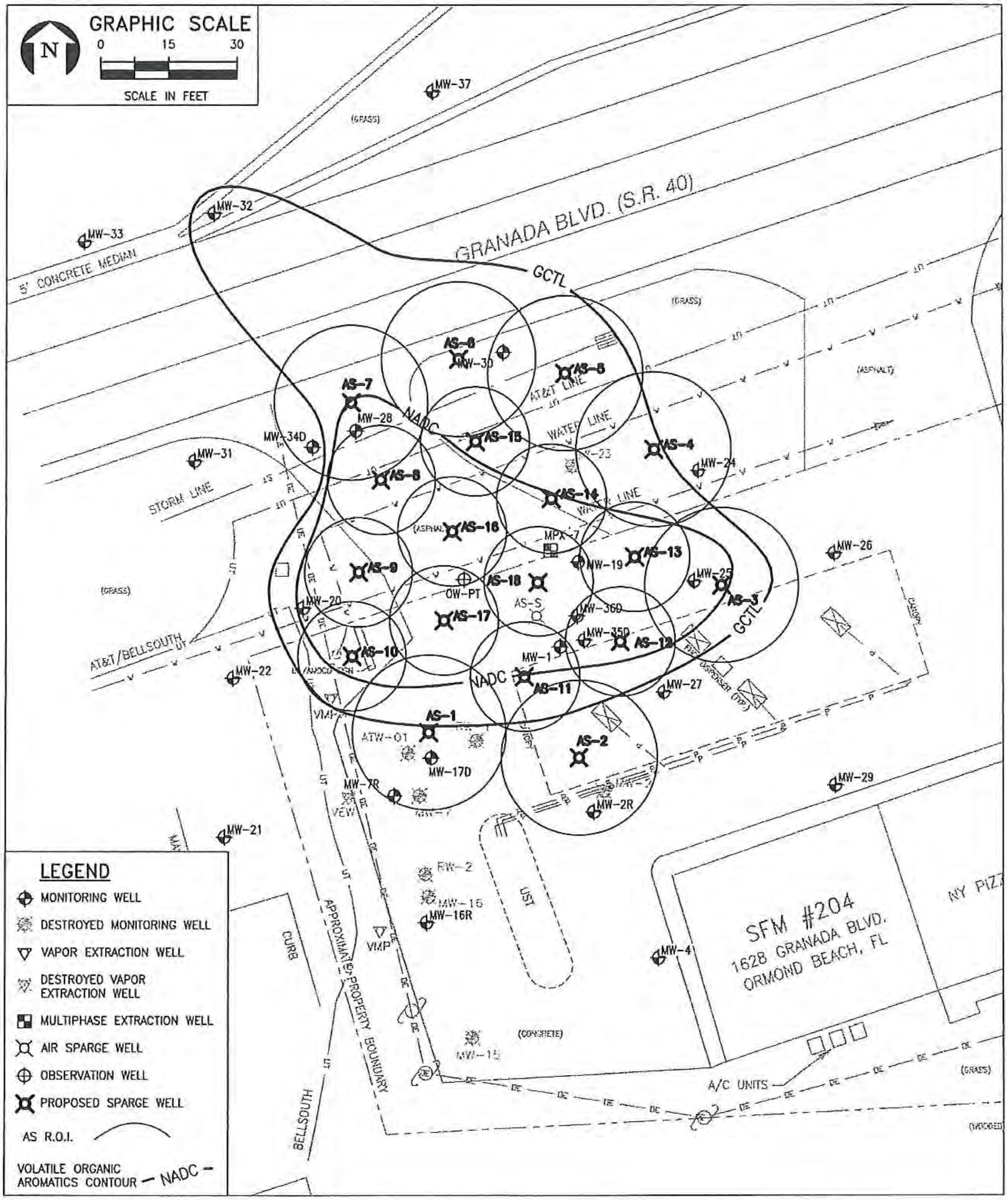

FIGURE 3
AIR SPARGE WELL LAYOUT
SUNSHINE FOOD MART No. 204

Sources: Metcalf & Eddy, 2003; ECT, 2011

ECT
Environmental Consulting & Technology, Inc.

Facility #16

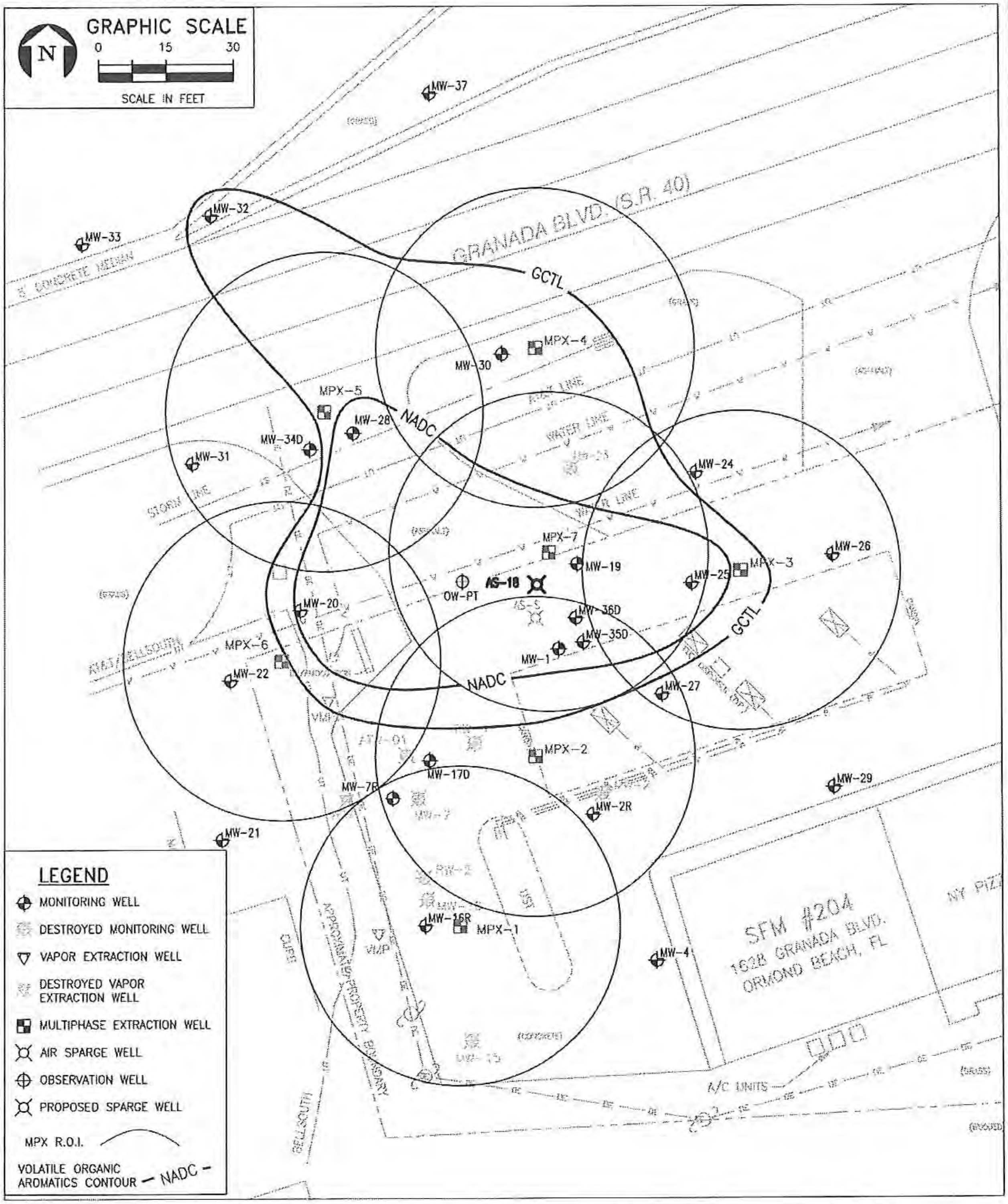

FIGURE 4

MULTI-PHASE EXTRACTION WELL LAYOUT

SUNSHINE FOOD MART No. 204

Sources: Metcalf & Eddy, 2003; ECT, 2011

ECT

Environmental Consulting & Technology, Inc.

Facility #14

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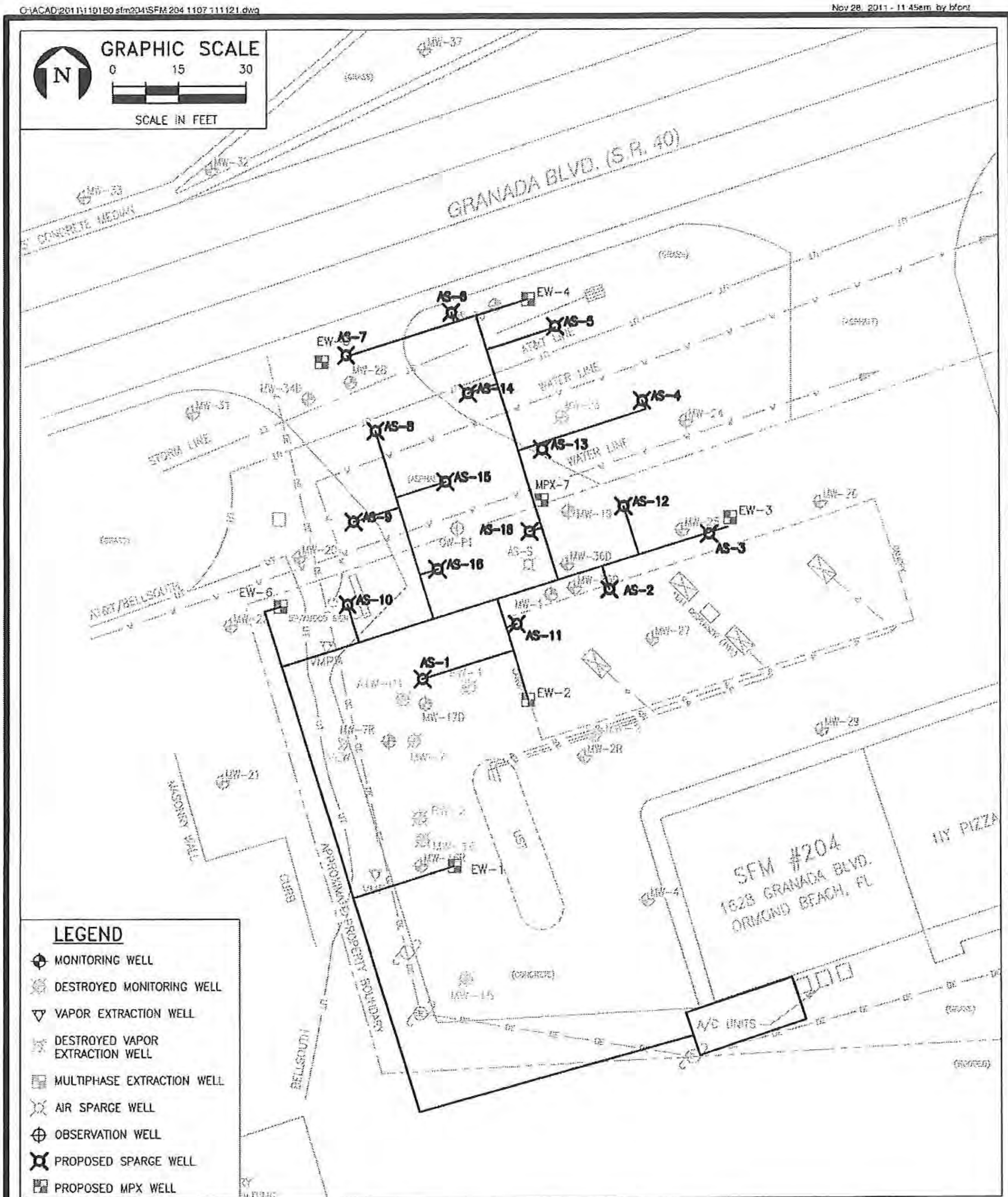


FIGURE 5

AIR SPARGE & MULTI-PHASE EXTRACTION STSTEM TRENCH LAYOUT

SUNSHINE FOOD MART No. 204

Sources: Metcolf & Eddy, 2003; ECT, 2011

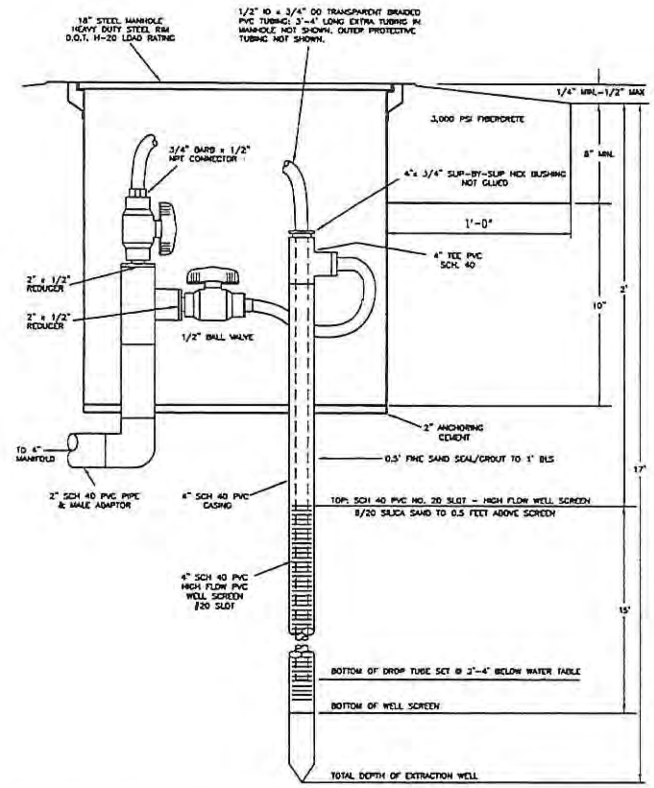
ECT

Environmental Consulting & Technology, Inc.

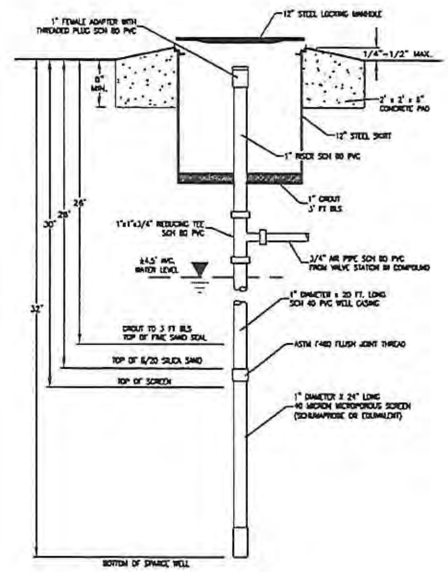
Facility #14

O:\ACAD\2011\110180 sfm204\SFM 204 1107 111121.dwg

Nov 28, 2011 - 11:45am by blont



MULTIPHASE EXTRACTION WELL



AIR SPARGING WELL

NOTES:

WELL DRILLING CONTRACTOR TO INSTALL AIR SPARGE & MULTIPHASE EXTRACTION WELLS

CONSTRUCTION CONTRACTOR TO INSTALL ALL PIPING & MANHOLES

AIR SPARGING & VACUUM EXTRACTION WELLS LOCATED IN PAIRS WILL BE HOUSED IN A COMMON 2FT. x 2FT. MANHOLE

FIGURE 6

WELL CONSTRUCTION DETAILS

SUNSHINE FOOD MART No. 204

Sources: ECT, 2011

ECT

Environmental Consulting & Technology, Inc.

Facility #16

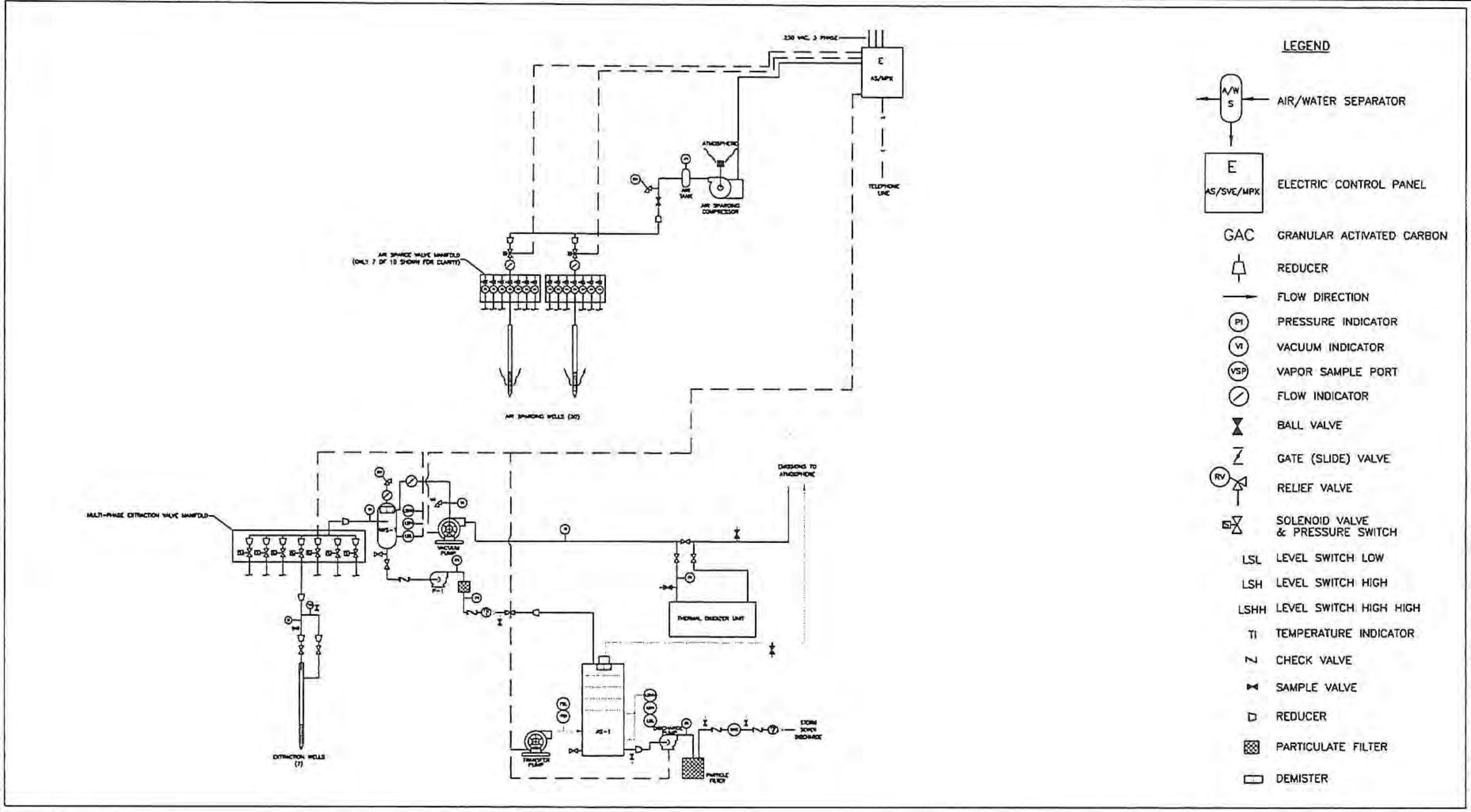
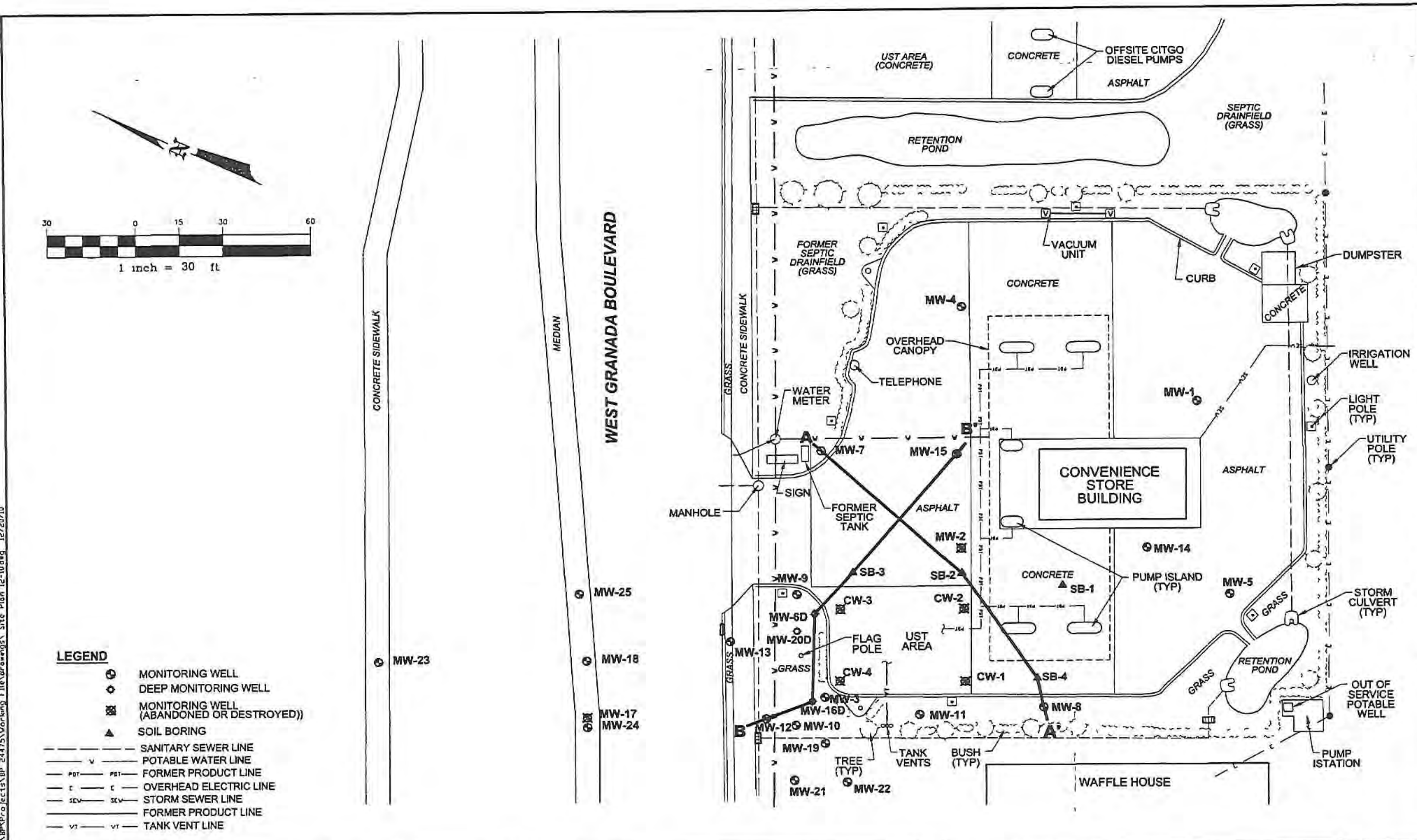


FIGURE 7
PROCESS & INSTRUMENTATION DIAGRAM
SUNSHINE FOOD MART No. 204
Sources: Metcalf & Eddy, 2003; ECT, 2011

ECT
Environmental Consulting & Technology, Inc.

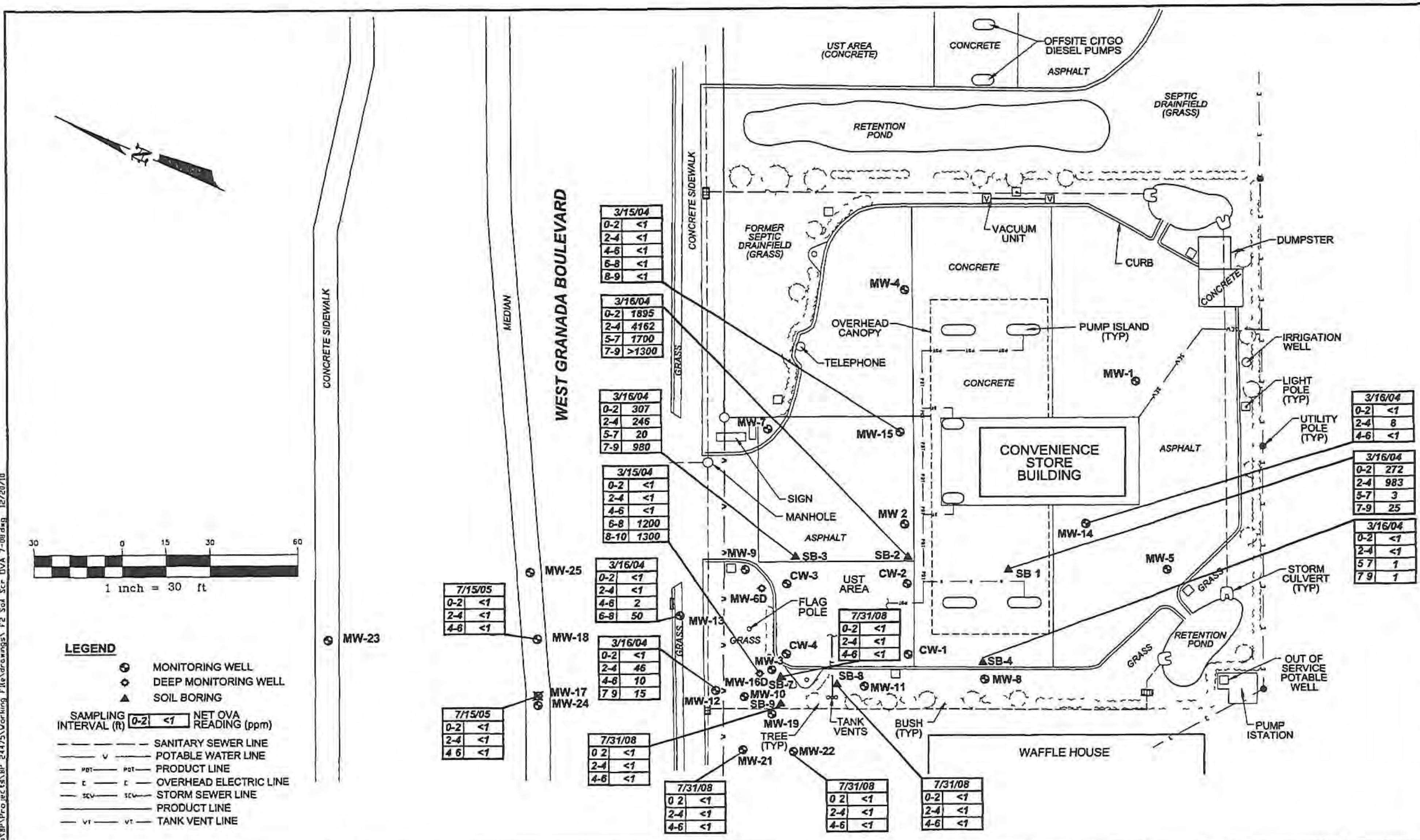
Facility #16



DRAWN BY RC/DS CHECKED BY LG DATE NOV 07	URS 7800 CONGRESS AVENUE SUITE 200 BOCA RATON FLORIDA 33487 PHONE (561) 994-6500 FAX (561) 994-6524	FORMER BP 24475 (FCE 2517) 1546 WEST GRANADA BOULEVARD ORMOND BEACH, VOLUSIA COUNTY, FLORIDA Job No 38427527 Date DECEMBER 2010	SITE PLAN	Figure 1

R:\Petroleum Group\BP\Projects\BP 24475\Working File\drawings\ Site Plan 12-10.dwg 12/20/10

Facility # 20



DRAWN BY RC/DS
CHECKED BY LG
DATE DEC 10

URS
7800 CONGRESS AVENUE SUITE 200
BOCA RATON FLORIDA 33487
PHONE (561) 994-6500
FAX (561) 994-6524

Job No 38427527

FORMER BP 24475 (FCE 2517)
1546 WEST GRANADA BOULEVARD
ORMOND BEACH VOLUSIA COUNTY FLORIDA

Date DECEMBER 2010

SOIL SCREENING MAP

Figure 2

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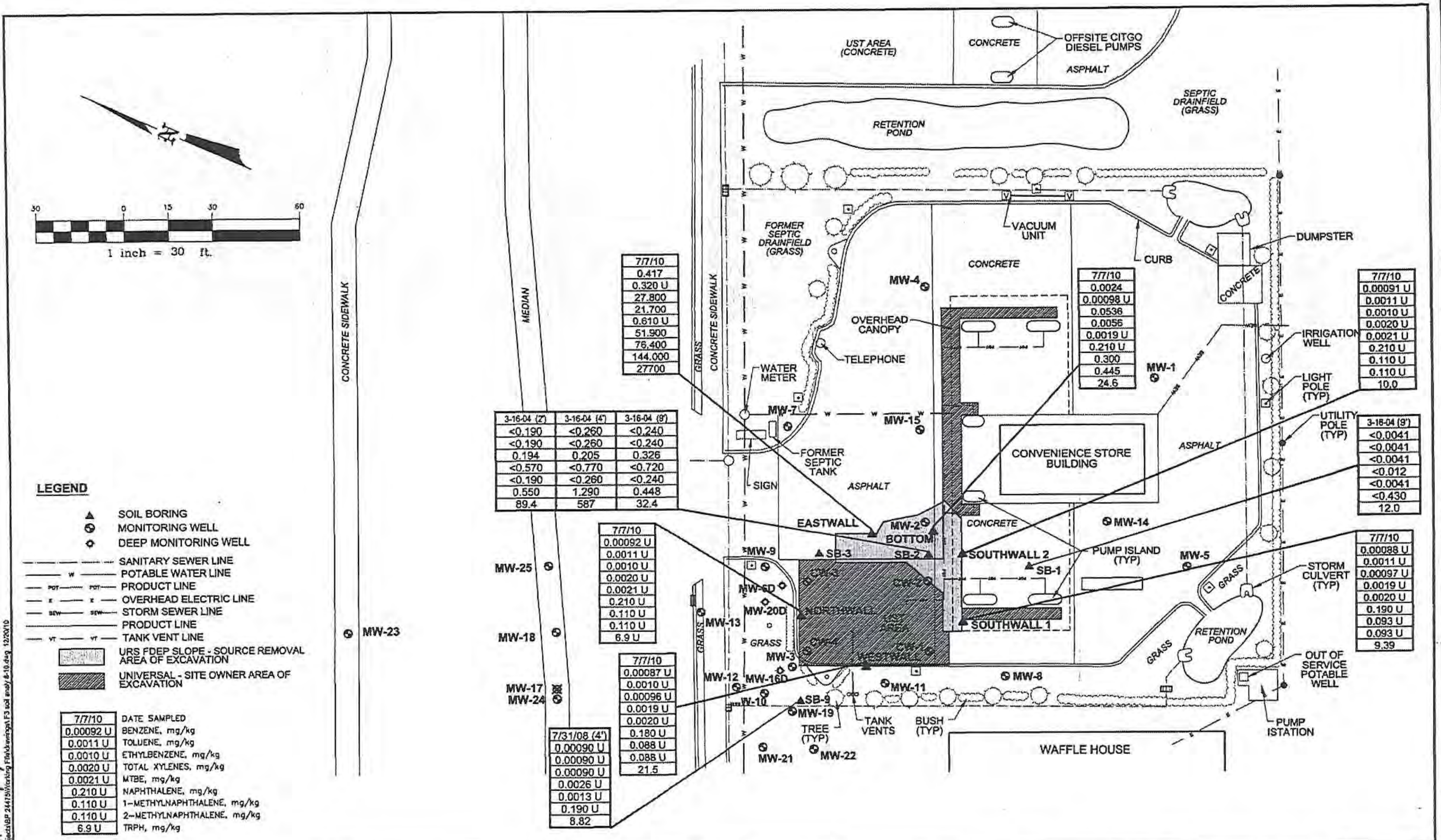
Facility #20



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DRAWN BY: RC/DS
CHECKED BY: LG
DATE: DEC 10

URS
7800 CONGRESS AVENUE, SUITE 200
BOCA RATON, FLORIDA 33487
PHONE: (561) 994-6500
FAX: (561) 994-6524

Job No.: 38427527

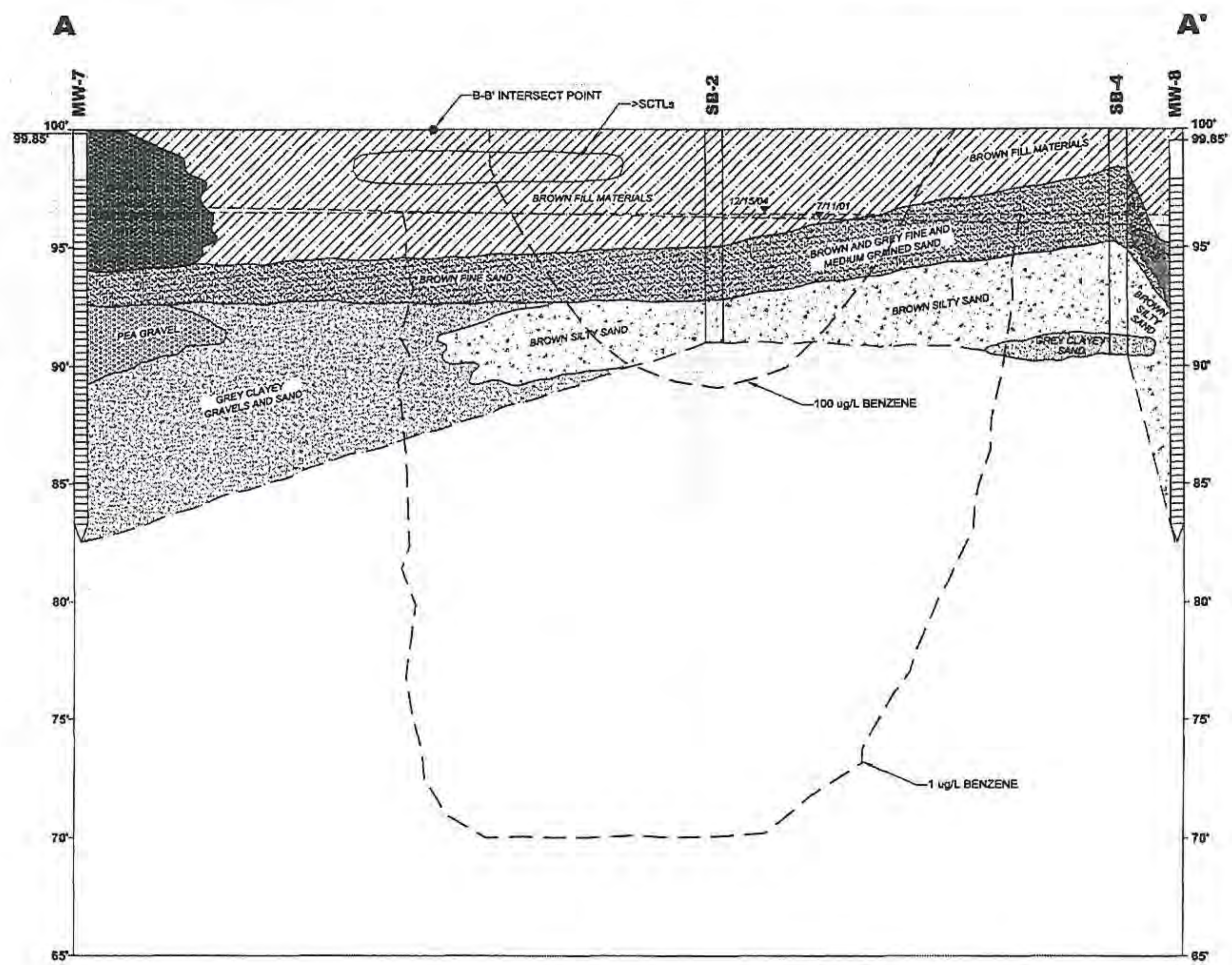
FORMER BP 24475 (FCE 2517)
1546 WEST GRANADA BOULEVARD
ORMOND BEACH, VOLUSIA COUNTY, FLORIDA

Date: DECEMBER 2010

SOIL ANALYTICAL DATA

Figure: 3

Facility #20



VERTICAL SCALE: 1" = 5'
HORIZONTAL SCALE: 1" = 12'

- - ▼ - - WATER TABLE
SCTLs SOIL CLEANUP TARGET LEVELS

LITHOLOGY DESCRIPTIONS FOR MW-7 AND MW-8 ARE INCLUDED IN THE SOIL BORING LOGS FROM THE CAR REPORT SUBMITTED IN 4/94'

DRAWN BY: RC/DS CHECKED BY: LC DATE: JUL 08	URS 7800 CONGRESS AVENUE, SUITE 200 BOCA RATON, FLORIDA 33487 PHONE: (561) 994-6500 FAX: (561) 994-6524	FORMER BP 24475 (FCE 2517) 1546 WEST GRANADA BOULEVARD ORMOND BEACH, VOLUSIA COUNTY, FLORIDA Job No.: 38427527 Date: DECEMBER 2010	GEOLOGICAL CROSS SECTION A-A'	Figure: 4a

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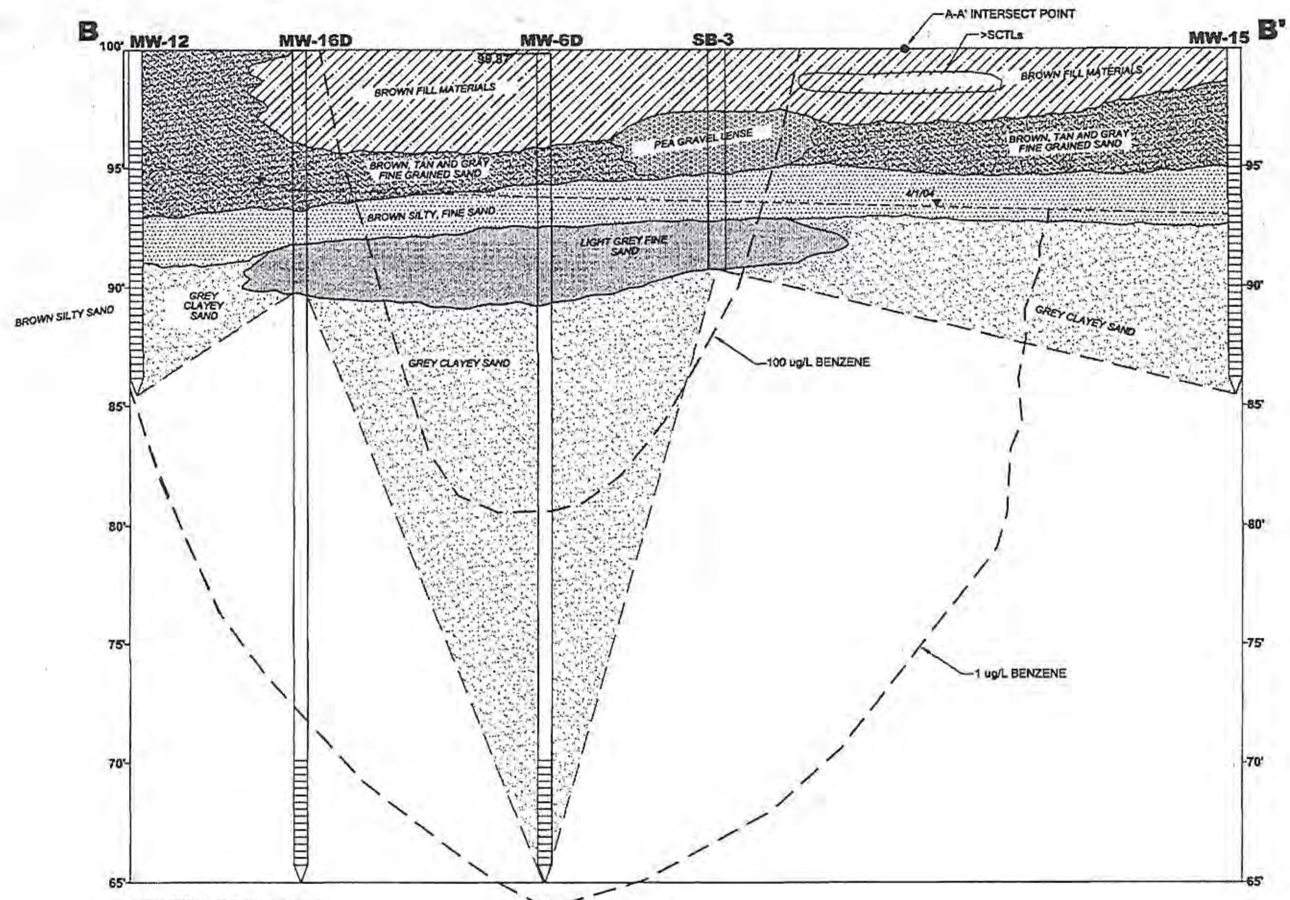
Facility # 20

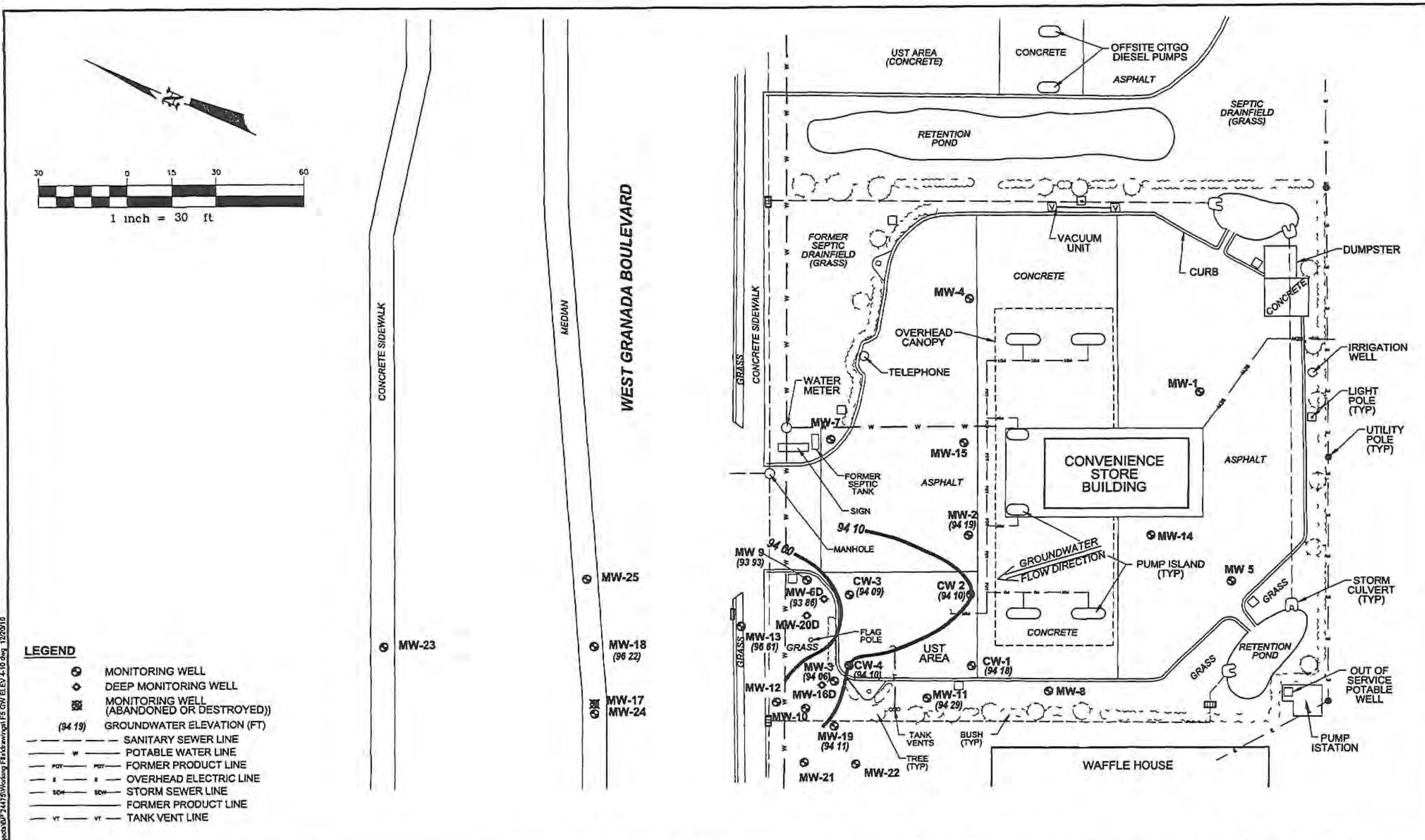


VERTICAL SCALE: 1" = 5'
HORIZONTAL SCALE: 1" = 12'

WATER TABLE
SCTLs SOIL CLEANUP TARGET LEVELS

DRAWN BY: RC/DS CHECKED BY: LG DATE: DEC 10	URS 7650 CONGRESS AVENUE, SUITE 200 BOCA RATON, FLORIDA 33487 PHONE: (561) 994-6500 FAX: (561) 994-6524	FORMER BP 24475 (FCE 2517) 1546 WEST GRANADA BOULEVARD ORMOND BEACH, VOLUSIA COUNTY, FLORIDA Job No.: 38427527 Date: DECEMBER 2010	GEOLOGICAL CROSS SECTION B-B'	Figure: 4b

Facility #20



DRAWN BY DS/RC CHECKED BY LG DATE DEC 10	URS 7800 CONGRESS AVENUE SUITE 200 BOCA RATON FLORIDA 33487 PHONE (561) 994-6500 FAX (561) 994-6524

FORMER BP 24475 (FCE 2517)
1546 WEST GRANADA BOULEVARD
ORMOND BEACH VOLUSIA COUNTY FLORIDA

Job No 38427527

Date DECEMBER 2010

GROUNDWATER ELEVATION MAP
APRIL 6, 2010

Figure 5

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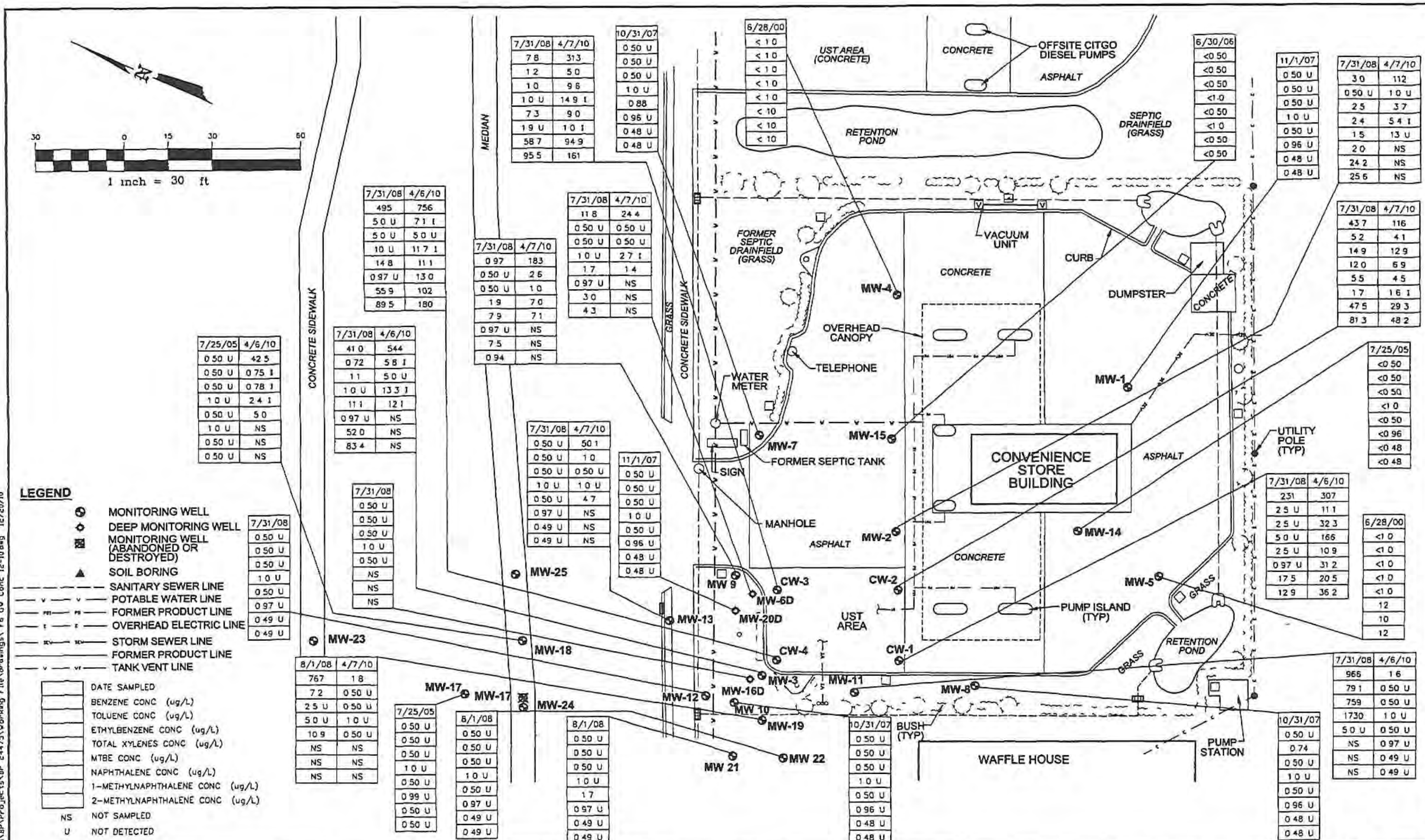
Facility # 20



DRAWN BY RC/DS
CHECKED BY LG
DATE DEC 10

URS
7800 CONGRESS AVENUE SUITE 200
BOCA RATON FLORIDA 33487
PHONE (561) 994-6500
FAX (561) 994-6524

FORMER BP #24475 (FCE 2517)
1546 WEST GRANADA BOULEVARD
ORMOND BEACH VOLUSIA COUNTY FLORIDA

Job No 38427527 Date DECEMBER 2010

GROUNDWATER CONTAMINANT CONCENTRATION MAP

Figure 6

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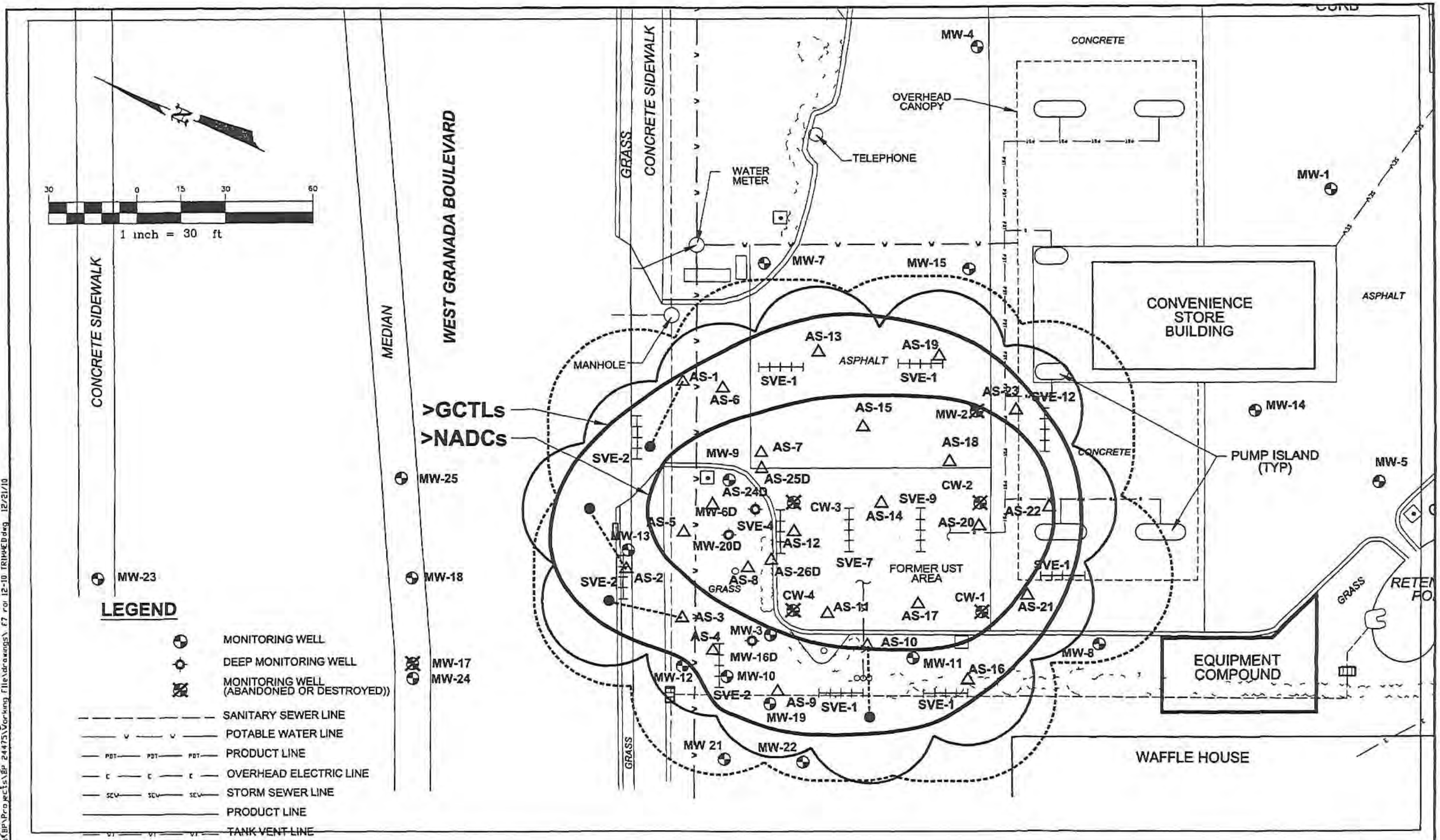
Facility #20



DRAWN BY RC/DS	URS 7800 CONGRESS AVENUE SUITE 200 BOCA RATON FLORIDA 33487 PHONE (561) 994-6500 FAX (561) 994-6524	FORMER BP 24475 (FCE 2517) 1546 WEST GRANADA BOULEVARD ORMOND BEACH VOLUSIA COUNTY FLORIDA	AS / SVE WELL RADIUS OF INFLUENCE MAP	Figure 7
CHECKED BY LG		Job No 38427527	Date DECEMBER 2010	
DATE NOV 07				

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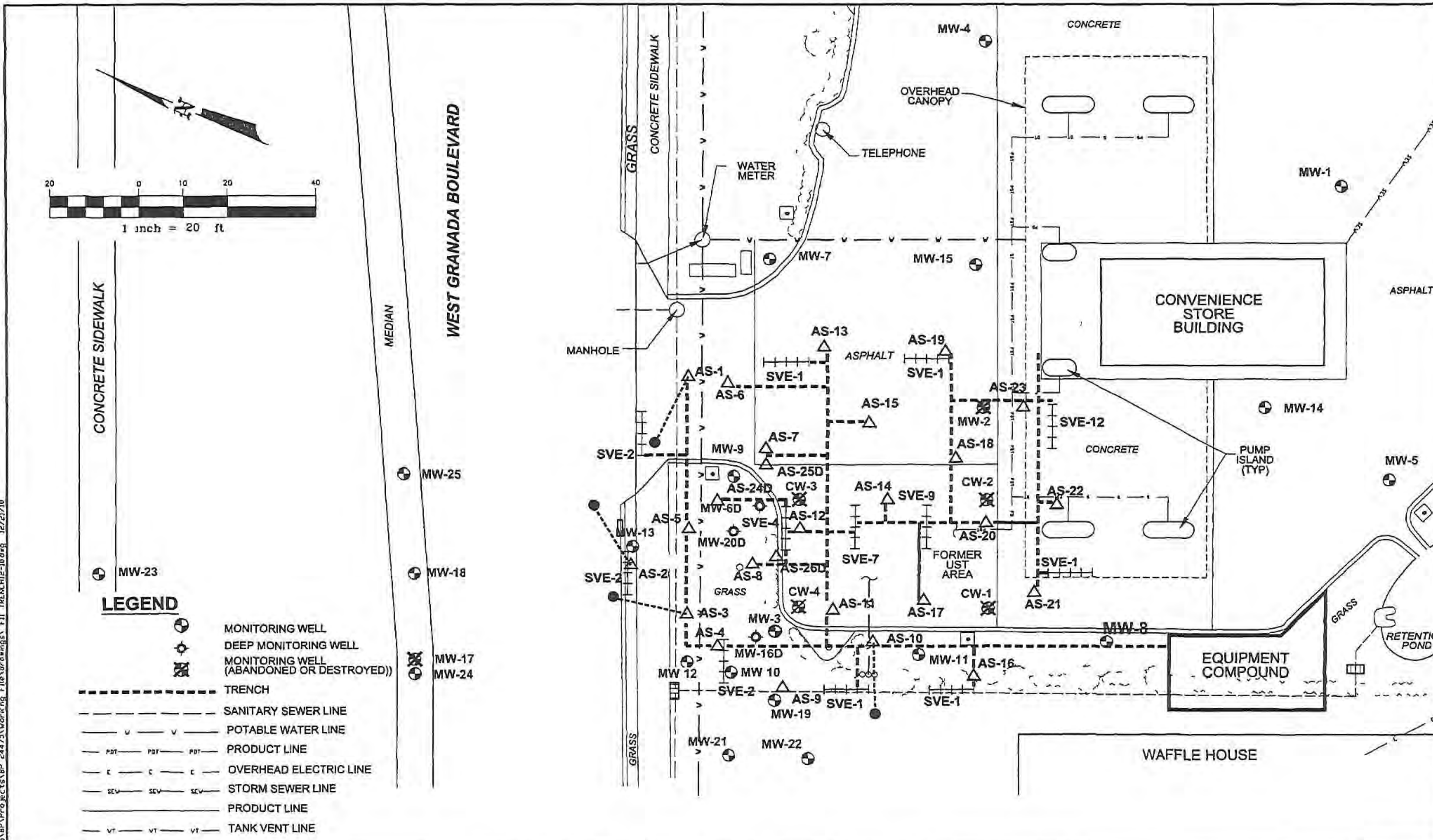
Facility #20



DRAWN BY RC/DS CHECKED BY LC DATE NOV 07	URS 7800 CONGRESS AVENUE SUITE 200 BOCA RATON FLORIDA 33487 PHONE (561) 994-6500 FAX (561) 994-6524	FORMER BP 24475 (FCE 2517) 1546 WEST GRANADA BOULEVARD ORMOND BEACH VOLUSIA COUNTY FLORIDA Job No 38427527 Date DECEMBER 2010	REMEDIATION SYSTEM LAYOUT	Figure 11

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Facility # 20

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DRAWN BY: MEB
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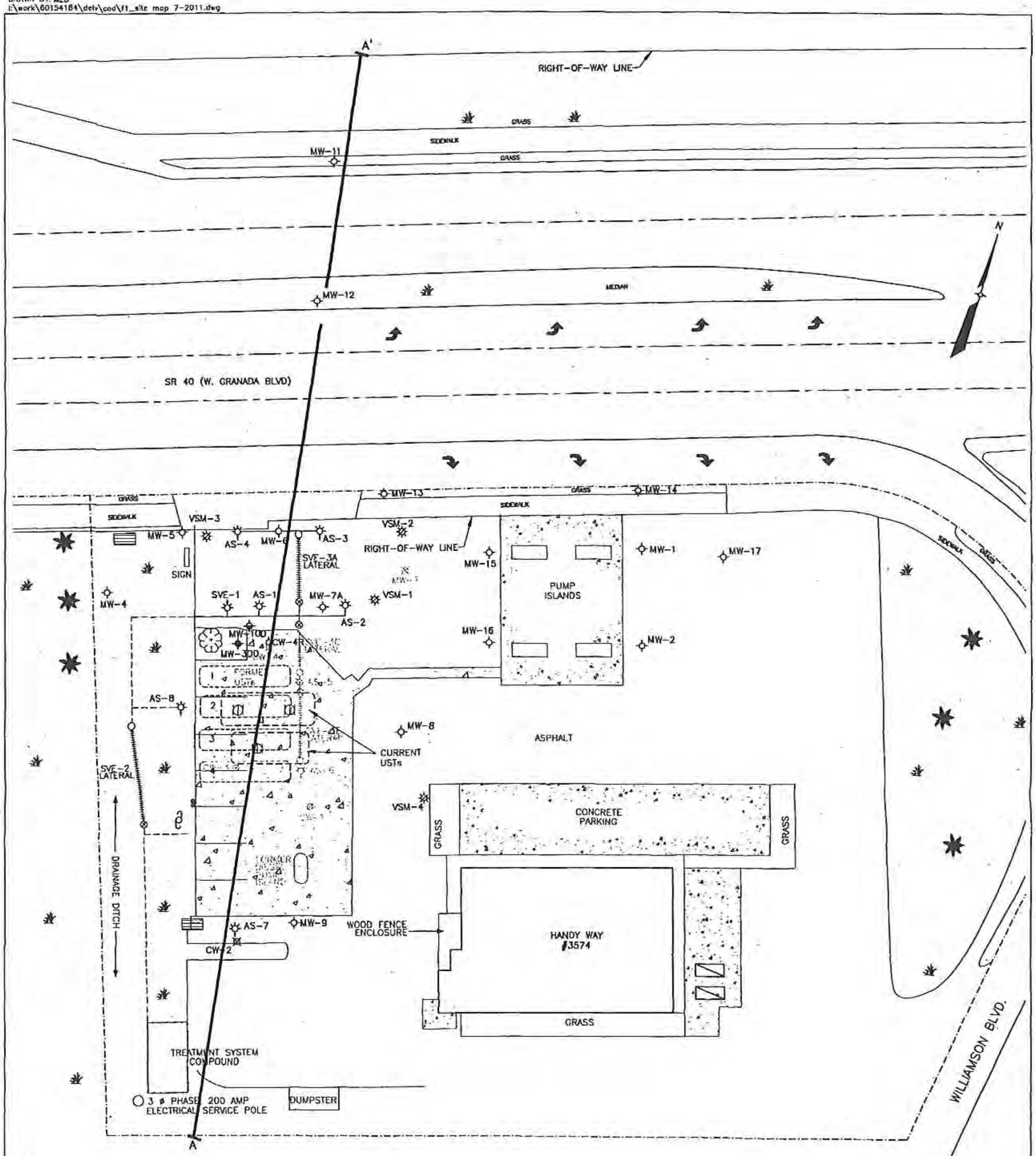

LEGEND:

- COMPLIANCE WELL
- SHALLOW MONITOR WELL
- INTERMEDIATE MONITOR WELL
- DEEP MONITOR WELL
- VACUUM STRESS MONITOR WELL
- AIR SPARGE WELL
- SOIL VAPOR EXTRACTION WELL
- DESTROYED MONITOR/COMPLIANCE WELL
- DESTROYED AIR SPARGE WELL
- DESTROYED SVE LATERAL
- FORMER DIESEL UST
- FORMER UNLEADED PLUS UST
- FORMER PREMIUM UNLEADED UST
- FORMER REGULAR UNLEADED UST
- RIGHT OF WAY CROSS SECTION
- 12" VAULT FOR SVE LATERAL RISER
- 12" VAULT FOR SVE LATERAL RISER AND POINT OF EXTRACTION
- STORMWATER GRATE
- SINGLE POST SIGN
- LIGHT POLE
- UST VENT
- UST FILL PORT

0' 15' 30' 60'
SCALE

AECOM

FIGURE 1
SITE MAP

HANDY WAY NO. 2574
ORMOND BEACH, VOLUSIA COUNTY, FLORIDA
FDEP FACILITY ID NO.: 648517430

7/18/2011

60154184

Facility #21

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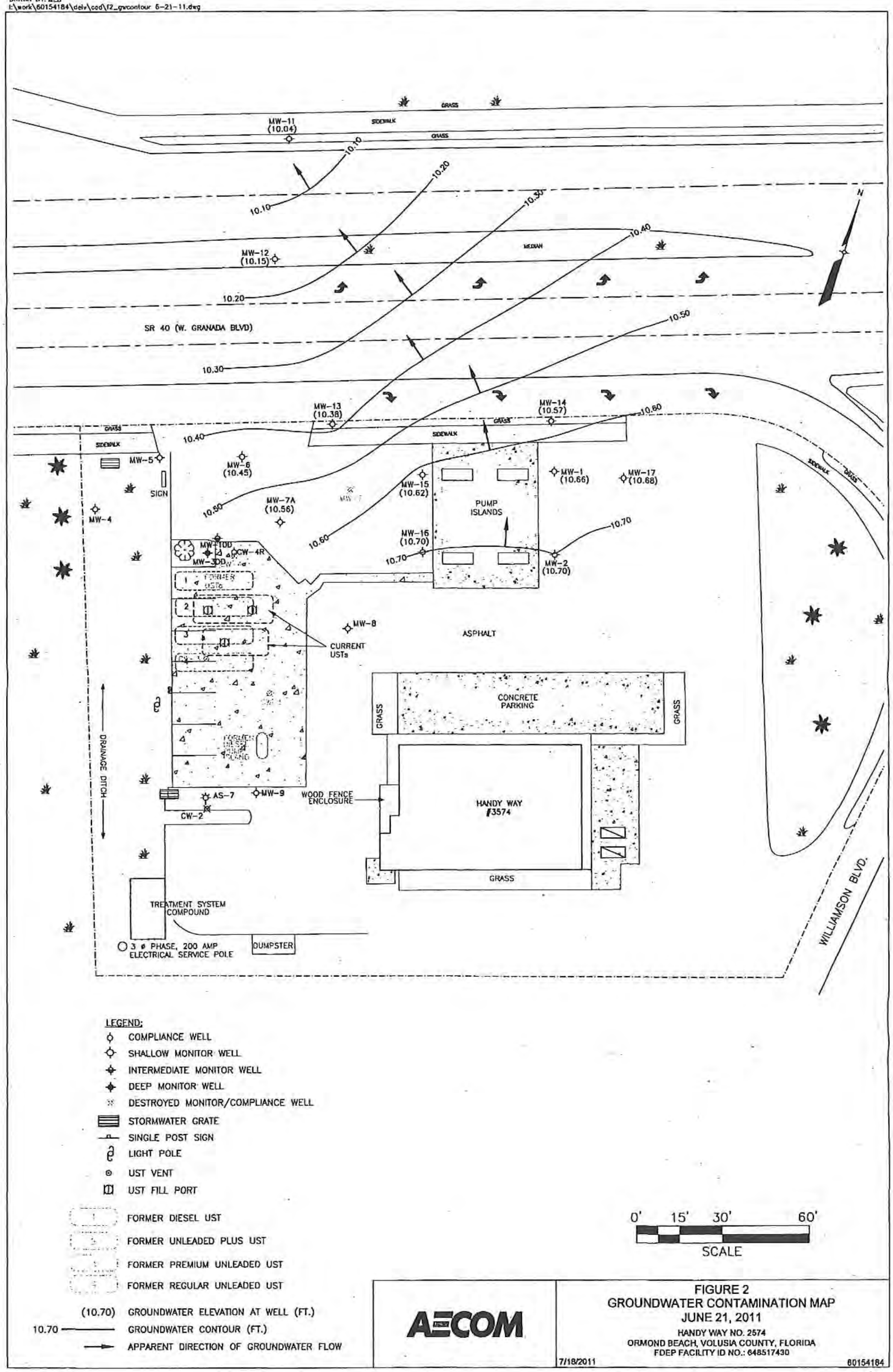

FIGURE 2
GROUNDWATER CONTAMINATION MAP
JUNE 21, 2011
HANDY WAY NO. 2574
ORMOND BEACH, VOLUSIA COUNTY, FLORIDA
FDEP FACILITY ID NO.: 648517430

Facility #21

REVISED BY: MEB
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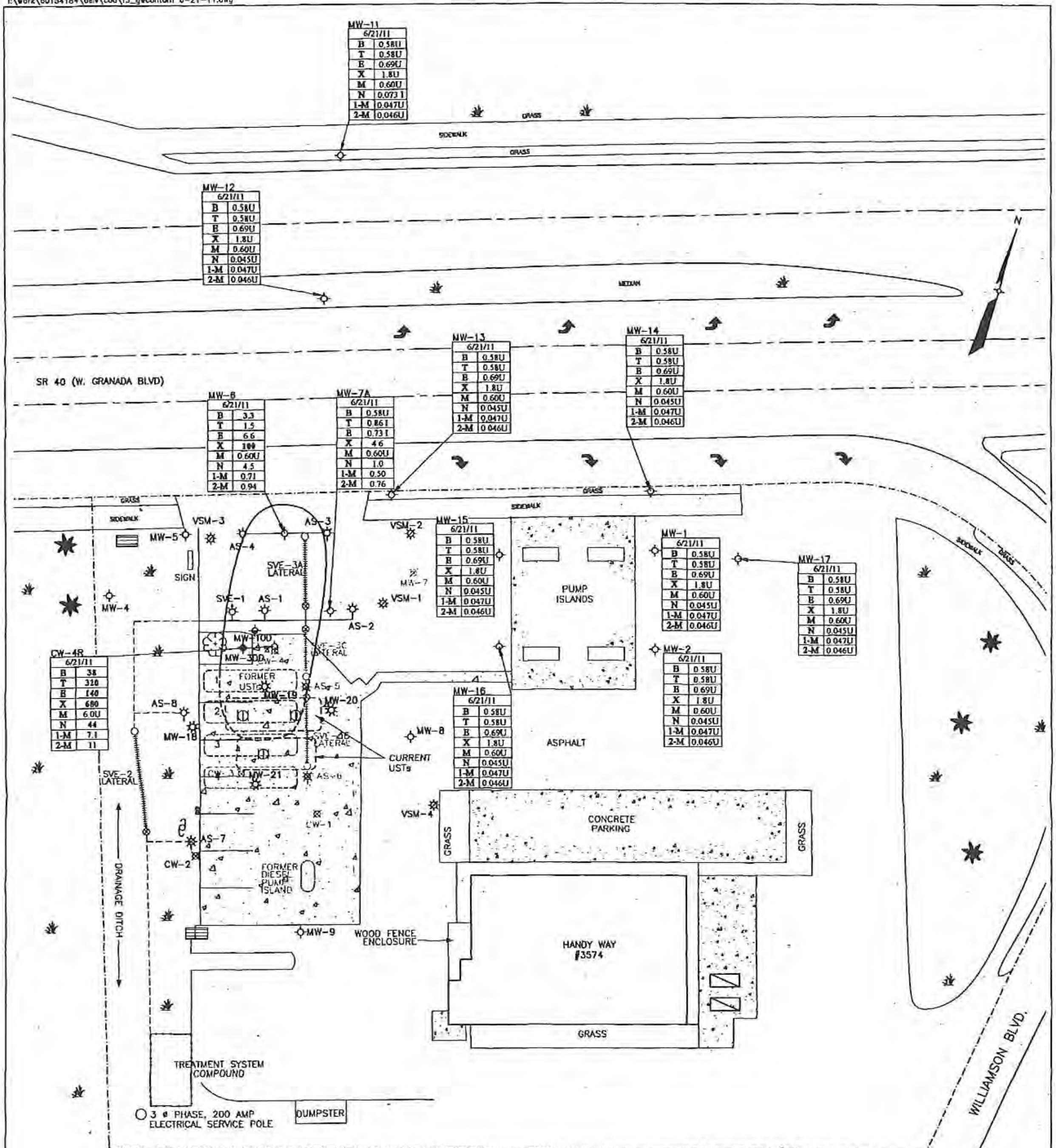


	MW-11	MW-12	MW-13	MW-14	MW-6	MW-7A	MW-15	MW-1	MW-17	MW-2	MW-16	CW-4R
	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11	6/21/11
B	0.58U	0.58U	0.58U	0.58U	3.3	0.58U	0.58U	0.58U	0.58U	0.58U	0.58U	38
T	0.58U	0.58U	0.58U	0.58U	1.5	0.86 I	0.58U	0.58U	0.58U	0.58U	0.58U	320
E	0.69U	0.69U	0.69U	0.69U	6.6	0.73 I	0.69U	0.69U	0.69U	0.69U	0.69U	140
X	1.8U	1.8U	1.8U	1.8U	109	46	1.8U	1.8U	1.8U	1.8U	1.8U	680
M	0.60U	0.60U	0.60U	0.60U	0.60U	0.60U	0.60U	0.60U	0.60U	0.60U	0.60U	6.0U
N	0.073 I	0.045U	0.045U	0.045U	4.5	1.0	0.045U	0.045U	0.045U	0.045U	0.045U	44
1-M	0.047U	0.047U	0.047U	0.047U	0.71	0.50	0.047U	0.047U	0.047U	0.047U	0.047U	7.1
2-M	0.046U	0.046U	0.046U	0.046U	0.94	0.76	0.046U	0.046U	0.046U	0.046U	0.046U	11

LEGEND:

- PROPOSED MONITOR WELL LOCATION
- COMPLIANCE WELL
- SHALLOW MONITOR WELL
- INTERMEDIATE MONITOR WELL
- DEEP MONITOR WELL
- VACUUM STRESS MONITOR WELL
- AIR SPARGE WELL
- SOIL VAPOR EXTRACTION WELL
- DESTROYED MONITOR/COMPLIANCE WELL
- DESTROYED AIR SPARGE WELL
- DESTROYED SVE LATERAL
- 1 FORMER DIESEL UST
- 2 FORMER UNLEADED PLUS UST
- 3 FORMER PREMIUM UNLEADED UST
- 4 FORMER REGULAR UNLEADED UST
- 12" VAULT FOR SVE LATERAL RISER
- 12" VAULT FOR SVE LATERAL RISER AND POINT OF EXTRACTION
- STORMWATER GRATE
- LIGHT POLE
- UST VENT
- UST FILL PORT

5/4/10		SAMPLE DATE
B	36	BENZENE CONCENTRATION IN µg/L
T	5.5	TOLUENE CONCENTRATION IN µg/L
E	0.5U	ETHYLBENZENE CONCENTRATION IN µg/L
X	2.11	TOTAL XYLENES CONCENTRATION IN µg/L
M	1.0U	MTBE CONCENTRATION IN µg/L
N	0.10U	NAPHTHALENE CONCENTRATION IN µg/L
1-M	0.10U	1-METHYLNAPHTHALENE CONCENTRATION IN µg/L
2-M	0.10U	2-METHYLNAPHTHALENE CONCENTRATION IN µg/L

APPROXIMATE EXTENT OF GROUNDWATER CONTAMINATION ABOVE GCTLs (DASHED WHERE INFERRED)

NOTE:
U = ANALYTE INCLUDED IN THE ANALYSIS, BUT NOT DETECTED
I = DETECTED BUT BELOW THE REPORTING LIMIT; THEREFORE, THE RESULT IS AN ESTIMATED VALUE

0' 15' 30' 60'
SCALE

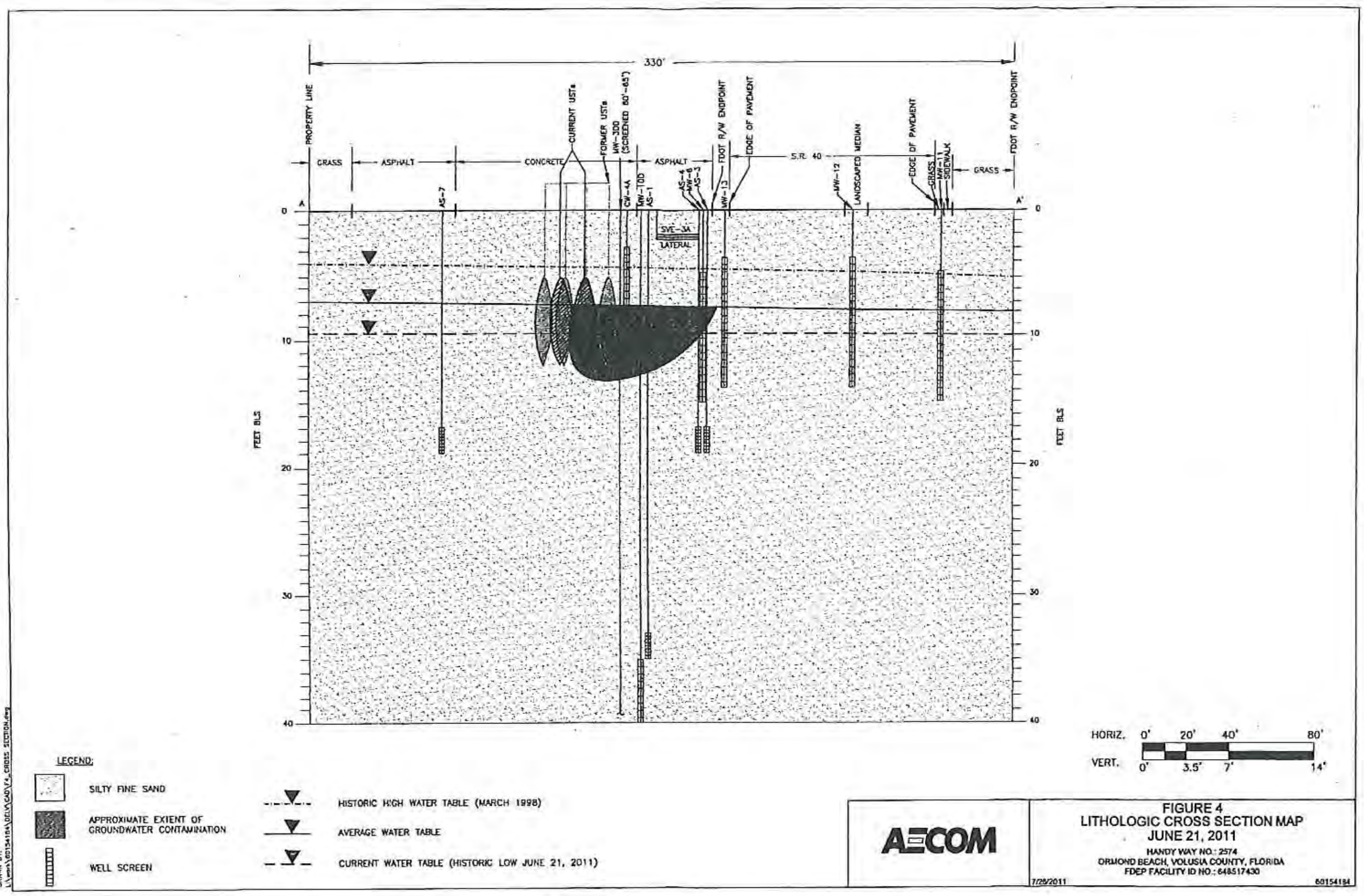
AECOM

FIGURE 3
GROUNDWATER CONTAMINATION MAP
JUNE 21, 2011
HANDY WAY NO. 2574
ORMOND BEACH, VOLUSIA COUNTY, FLORIDA
FDEP FACILITY ID NO.: 648517430

7/22/2011

60154184

Facility #21


330'
PROPERTY LINE
GRASS
ASPHALT
CONCRETE
CURRENT USTs
FORMER USTs
MW-300 (SCREENED 60'-65')
ASPHALT
FDOT R/W ENDPOINT
EDGE OF PAVEMENT
S.R. 40
LANDSCAPED MEDIAN
EDGE OF PAVEMENT
GRASS
SIDEWALK
FDOT R/W ENDPOINT
A
A'
AS-7
CW-4A
MW-TOD
AS-1
AS-4
MW-6
AS-3
MW-13
MW-12
MW-11
SVE-3A LATERAL
FEET BLS
0
10
20
30
40
HORIZ. 0' 20' 40' 80'
VERT. 0' 3.5' 7' 14'
LEGEND:
SILTY FINE SAND
APPROXIMATE EXTENT OF GROUNDWATER CONTAMINATION
WELL SCREEN
HISTORIC HIGH WATER TABLE (MARCH 1998)
AVERAGE WATER TABLE
CURRENT WATER TABLE (HISTORIC LOW JUNE 21, 2011)
AECOM
FIGURE 4
LITHOLOGIC CROSS SECTION MAP
JUNE 21, 2011
HANDY WAY NO.: 2574
ORMOND BEACH, VOLUSIA COUNTY, FLORIDA
FDEP FACILITY ID NO.: 648517430
7/29/2011
60154184

Facility #21

APPENDIX D

Site Photographs

Terracon Project No. H1117355
Site Name: SR 40, Breakaway Trail to Williamson Blvd, Volusia Co. FL
Date Photos Taken: December 23, 2011

Photo #1 NE Cleaners, 1634 W Granada, Facility#15

Photo #2 BP Station, 1628 W Granada, Facility #16

Photo #3 Texaco Station, 1629 W Granada, Facility #18

Photo #4 Vacant vehicle fueling station, 1546 W Granada, Facility #20

Photo #5 Chevron Station, 1520 W Granada, Facility #21

Photo #6 Ormond Beach Cleaners, 1482 W Granada, Facility # 23

APPENDIX E
Site Evaluation Checklist

APPENDIX E

SITE EVALUATION CHECKLIST

The following check list is intended to be a suggested format for compilation of data collected. There is no intent to limit the amount of investigation the evaluator should pursue. If this check list does not meet the needs of the District, a locally generated check list should be used on all projects.

CHECK LIST

Property Location: **SR 40**
Address: **SR 40 from Breakaway Trail to Williamson Boulevard, Ormond Beach, Volusia County, Florida**
Owner: **FDOT**
Current user: **Roadway/ROW**
Past uses: **Undeveloped**

Enforcement Agencies

Past, present or future actions pending: **None identified**
Hazardous classification: **N/A**
EPA / State Permit / Facility No.: **N/A**
Existing Stationary Tanks: **No**
- Contents: **N/A**
- Year installed: **N/A**

Former Stationary Tanks (AST, UST): **None identified**
- Size: **N/A**
- Contents: **N/A**
- Year removed: **N/A**

Site Summary List (DEP) known leaks / spills: **None identified**

Aerial Photo Interpretation

No. of years available: **9 aerials were available covering 68 years (1943-2010)**
No. of years used: **9 aerials were used (1943-2009)**
Apparent land use changes: **1**
- From: **Undeveloped wooded land (1943-1958+)**
- To: **SR 40 roadway (prior to 1970-present)**
- To: **N/A**

Landfills: **No**
Lagoons: **No**
Storage areas: **No**
- For what: **N/A**

Drums: **No**
Tanks: **No**
Landscaping: **No**
Ground staining: **De minimis**
Fuel Dispenser / Canopies: **No**
Other: **N/A**

Local Officials

City / County Planning & Development Services: **Ormond Beach & Volusia**
Fire Dept. / HazMat responder: **Volusia County**
Water management district: **SJRWMD**
Utility Company: **N/A**
Telephone Company: **N/A**
Cable Company: **N/A**
Waste Management Company: **N/A**
Regulatory Agency Staff: **FDEP Central District & Volusia County Environmental Management**

Site Assessment

Who was met at the site: **None**
Type of business activities: **Roadway**
Was entire site viewed: **Yes**
- Lands: **Roadway**
- Buildings: **N/A**

Landscaping? Why?: **N/A**
Ground Staining: **De minimis**
Standing Liquids: **None observed**
Odors: **None observed**
Sink Holes: **None observed**
Drums? Labeled? **None observed**
Containers? Labeled? **None observed**
Ventilation pipes? To what?: **None observed**
Does building look like an old gasoline station?: **N/A**
Transformers: **None observed**
Monitoring wells: **Yes, in ROW**
Water wells: **None observed**
Septic tanks: **None observed**
Underground (buried) lines, etc.: **Utilities**
Anything unusual (i.e., pavement patches, etc.): **None observed**
Photographs taken of the site and specific areas of concern: **Yes**

Contamination Screening Evaluation

***High*—Petroleum contamination identified in groundwater below roadway corridor associated with vehicle fueling stations adjoining roadway, additional assessment is recommended.**

APPENDIX 8

Preliminary Roadway Soil Survey

PRELIMINARY SOIL SURVEY REPORT
SR 40 PD&E STUDY
BREAKAWAY TRAIL to WILLIAMSON BLVD.
VOLUSIA COUNTY, FLORIDA
FDOT Financial Project ID No. 428947-1-22-01
AEA PROJECT No. 201106

Antillian Engineering Associates, Inc.
3331 Bartlett Boulevard
Orlando, Florida 32811
(407) 422-1441

ANTILLIAN
ENGINEERING ASSOCIATES, INC.

July 13, 2012

Kittelson and Associates, Inc.
225 East Robinson Street, Suite 450
Orlando, Florida 32801

Attention: John R. Freeman, Jr., P.E.

Reference: Preliminary Soil Survey Report
SR 40 PD&E Study
Breakaway Trail to Williamson Boulevard
Volusia County, Florida
FDOT Financial Project No. 428947-1-22-01
AEA Project No. 201106

Dear Mr. Freeman:

Antillian Engineering Associates, Inc. has completed a preliminary soils survey to support the Preliminary Engineering (Conceptual Design) and Environmental Study for the proposed widening of SR 40 from Breakaway Trail to Williamson Boulevard in Volusia County, Florida. The investigation was conducted in accordance with the scope of services negotiated with the Florida Department of Transportation for this project on April 12, 2011. This report contains the results of our investigation, a preliminary assessment of the soils at the designated pond sites as they relate to drainage design and other concerns as appropriate.

It has been our pleasure to serve Kittelson and Associates and the District Five office of the Florida Department of Transportation on this project. Please call if you have any questions or if you need additional information.

Very truly yours,
ANTILLIAN ENGINEERING ASSOCIATES, INC.
Certificate of Authorization No. EB6685

PETER GREGORY SUAH
LICENSE
No 46910
STATE OF FLORIDA
PROFESSIONAL ENGINEER

07.20.2012

Peter G. Suah, P.E.
Florida Registration No. 46910
Principal Engineer

Attachments: Figures
Appendix A: Field and Laboratory Investigations
Appendix B: Important Information About Your Geotechnical Engineering Report
Appendix C: Constraints and Restrictions

PROJECT DESCRIPTION

The Florida Department of Transportation (FDOT) is planning to widen State Road 40 in Volusia County from Breakaway Trail to Williamson Boulevard. Most of the project is west of Interstate Highway 95 (I-95). Its approximate location is shown on Figure 1. The FDOT District Five office selected a team headed by the Orlando, Florida office of Kittelson and Associates, Inc. (Kittelson) to conduct the Preliminary Engineering (Conceptual Design) and Environmental (PD&E) Study for the project. This firm conducted the preliminary soil survey of the pond sites. The original concept for the proposed widening project included four new wet stormwater ponds and reconfiguration of two existing dry ponds. During this study, a conflict developed at one pond site which prompted the design team to move to a substitute site on the opposite side of the road.

AVAILABLE INFORMATION

The United States Geological Survey (USGS) quadrangle topographic map for the area, the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey of Volusia County, Florida and The Potentiometric Surface Map of the Upper Floridan Aquifer for February 2012 published online by the St. Johns River Water Management District (SJRWMD) were reviewed to obtain general information about the project area. Kittelson provided preliminary right-of-way plans superimposed on public-domain digital aerial images for site- and project-specific information.

The USGS map showed the project area as a broad, nearly level to level area on either side of the Tomoka River. This broad plain was separated into a number of smaller areas by low, irregularly shaped knolls and shallow, intermittent natural drainage courses leading to the river. The area south of SR 40 generally exhibited less variation in relief that the area north of the roadway, and the drainage courses were narrower and shallower. Although residential development was apparent, land use was mapped as mostly rural-agricultural. SR 40, Breakaway Trail, I-95 and Williamson Boulevard were shown, as well as most of the local streets and roads. The ground surface in the area was mapped between the Elevation 15 feet NGVD (El. 15) and El. 20 contours. Knolls on opposite banks of the Tomoka River and a low knoll near the middle of the alignment were mapped above the El. 20 contour, while the river floodplain was mapped below the El. 5 contour. Wetlands or swamps were mapped in several places on the broad plain south of SR 40.

The NRCS Soil Survey reported Farmton fine sand as the predominant soil unit on the broad, nearly level to level plains shown on the USGS map. Electra fine sand and Cassia fine sand were mapped at slightly higher elevations on the plains. Apopka fine sand and Tavares fine sand was mapped on the knolls near the Tomoka River. Farmton fine sand was reported to be a level, poorly drained soil with seasonal high groundwater level within a foot of the natural ground surface. Small areas of other soils with similar characteristics such as Eau Gallie, Immokalee, Myakka and Basinger fine sand are often included in this map unit. Electra fine sand and Cassia fine sand were reported as somewhat poorly drained soils with seasonal high groundwater between two feet and four feet below the natural ground surface. Apopka fine sand and Tavares fine sand were reported to be gently sloping, well drained to moderately well drained soils with seasonal high groundwater level between three feet and more than six feet below the natural ground surface. Permeability in Tavares fine sand was reported to exceed 40 feet per day (ft/day), while permeability in Apopka fine sand was reported to range from 12 ft/day to 40 ft/day in the uppermost five feet and from 1 ft/day to 4 ft/day from five feet to about seven feet. Permeability values were not reported below that depth. The NRCS Soil Survey sheet is shown in Figure 2.

The potentiometric surface of the Upper Floridan Aquifer is the approximate level to which its water surface would rise were it not confined by the low-permeability materials above. The SJRWMD Potentiometric Surface Map for February 2012 showed the water surface between the Elevation 0 and Elevation 30 contours in the general area of the project. Based on the proximity of the site to the coastline and the mapped distance from the coast to the Elevation 30 contour, the elevation of the potentiometric surface in the project area was estimated to be below the Elevation 10 contour.

The preliminary right-of-way sheets showed seven parcels of land designated as possible pond sites. Those sites were designated from west to east as Ponds 1-2, 2A, 2B-1, 2B-2, 2B-3, 3 and 4. It is our understanding that an existing pond on the northwestern corner of the I-95/SR 40 interchange is also included in the project but it was reportedly already designed for the final widened section so further enhancements are not needed. The substitute site for Pond 3 (designated "Pond 3B") was on the opposite (north) side of SR 40 from Pond 3. It was not shown on the Kittelson preliminary right-of-way plans, which are reproduced as Figures 3 through 6.

FIELD INVESTIGATION

Boring locations were selected in collaboration with the design team based on defined project needs. A field visit was conducted on May 10, 2012 to examine the existing site conditions and prepare for the drilling program. Boring locations were established in the field using dimensions and existing features on the preliminary right-of-way plans provided by Kittelson. The locations were staked and marked for underground utility location as required by Florida Statutes.

Eight test borings were drilled using continuous augers powered by a rotary drill rig to examine the subsurface conditions as they relate to suitability for ponds. Each boring was designated by its pond site and relative position east to west on that site, i.e., in the direction of increasing roadway stationing. For example "1-2-PB1" was the western boring (lower stationing) on the Pond 1-2 site. Two borings, designated "AB-1"and "AB-2" were drilled by hand using a bucket auger to check groundwater levels on the inside of the superelevated curve near the middle of the project. These ten borings were drilled on May 24 and June 5, 2012. Two more borings, designated "3B-PB1" and "3B-PB1" were drilled on the Pond 3B site on July 4, 2012. Because of poor access, a small, track-mounted rig was used to drill by continuous split-spoon sampling and mud-rotary drilling. The Standard Penetration Test (SPT) was conducted with the sampling in accordance with ASTM D 1586. Approximate boring locations are summarized in Table 1 on the following page. They are also shown on Figures 3 through 6.

TABLE 1
SUMMARY OF FIELD INVESTIGATION PROGRAM

POND	BORING	APPROX. STATION (SR 40)	APPROX. OFFSET (feet)	APPROX. ELEVATION (feet)	DEPTH (feet)
Pond 1-2	1-2-PB1	1311+50	530	24	20
	1-2-PB2	1315+00	730	23	20
Pond 2A	2A-PB-1	1317+70	1110	24	20
Pond 2B-1	2B1-PB1	1320+00	825	22	20
Pond 2B-2	2B2-PB1	1335+20	-180	17	20
Pond 2B-3	2B3-PB1	1335+40	-530	18	20
Pond 3	3-PB1	1360+30	100	19	20
Pond 3B	3B-PB1	1359+50	-220	19	20
	3B-PB2	1362+00	-130	14	20
Pond 4	4-PB1	1370+60	120	4	20
Roadway	AB-1	1331+00	-110	20	10
Roadway	AB-2	1336+00	-100	18	10

The soils encountered during drilling were logged by the field crew. Representative samples were sealed in clean, airtight containers for transportation to our Orlando office. The depth to groundwater encountered at each boring location was measured and recorded on the field logs. Field permeability tests were conducted in borings 3-PB1, 3-PB2 and 3B-PB1. At the completion of the field program, the borings were backfilled with soil. The boring locations were not surveyed but the approximate location information shown for each boring should be sufficient for the intent of this investigation.

LABORATORY TESTING

The recovered soil samples were examined in our office by a geotechnical engineer who confirmed the descriptions on the field logs, classified the soils visually and developed a representation of the soil stratigraphy at each boring location. Representative samples were selected for laboratory testing, which consisted of 25 soil gradation analyses, one Atterberg limits test series and three natural moisture content tests. Results are presented on the Report of Tests sheet, on the Summary of Laboratory Test Results sheets and on the graphs in Appendix A.

SURFACE CONDITIONS

As expected from the review of the available information, the natural ground surface in the project area was mostly level to nearly level. Slightly higher terrain was observed in the locations corresponding to the low knolls on the USGS map, i.e., on the banks of the Tomoka River and in the middle of the alignment near the intersection with Old Tomoka Road. Pond sites 1-2, 2A and 2B-1 were on cleared, nearly level, apparently agricultural land on the southern side of State Road 40 west of Old Tomoka Road. Pond sites 2B-2 and 2B-3 were in a wooded, slightly elevated area on the north side of SR 40 just east of Old Tomoka Road. The Pond 3 site was on the southern side of SR 40 just west of the Tomoka River bridge beside an existing dry pond. That pond was on the upper portion of the western riverbank. Its eastern end was impounded by a low earth embankment with a crest that appeared to be level with the natural ground on the western side. The Pond 3B site was directly opposite on the northern side of SR40. That site was wooded, and extended down the western bank of the river onto its floodplain, which was estimated to be less than three feet above the river surface. The Pond 4 site was on the southern side of SR 40 on the eastern bank of the river. Like the Pond 3 site, it was next to an existing dry pond on the slope of the riverbank and like Pond 3, the end of Pond 4 closest to the river was impounded by a low earth embankment with a crest that appeared to be near the natural ground surface level on the side away from the river.

PRELIMINARY SUBSURFACE CONDITIONS

Based on the common characteristics observed in the ten test borings originally planned for this investigation, the encountered subsurface conditions were separated into two primary sections using Tymber Creek Road as the dividing line. The reader is cautioned that Tymber Creek Road was selected **simply and arbitrarily for ease of reference for this preliminary investigation only**. The actual subsurface conditions at any location in either section may not necessarily correspond to the general characterizations presented below for that section (see roadway borings AB-1 and AB-2 as an example). The subsequent investigations on the Pond 3B site revealed subsurface conditions that were sufficiently different from the other two sections to warrant designation of a third section, i.e., the Pond 3B site.

West of Tymber Creek Road

The uppermost material encountered in borings 1-2-PB1, 1-2-PB2, 2A-PB1, 2B1-PB1, 2B2-PB1 and 2B3-PB1was light brownish gray, grayish brown, pale yellow and occasionally very dark brown fine sand that appeared to contain very small amounts of silt or clay. Encountered thicknesses ranged from three feet to about 11 feet. Gradation analysis of three samples indicated fines contents (fraction passing the U.S. Standard No. 200 sieve) that ranged from 1 percent to 7 percent. They were classified as "A-3" material using the American Association of State Highway and Transportation Officials (AASHTO) Designation M-145 and were designated "Stratum 1".

Beneath the Stratum 1 soils was mostly grayish brown and occasionally dark gray, brown and yellowish brown fine sands containing some clay. These soils typically had a non-plastic texture. Encountered thicknesses ranged from nine feet to about 13 feet. Actual thicknesses could not be confirmed as the borings were terminated in this soil without penetrating it completely. Gradation analysis of eight samples indicated fines contents that ranged from 12 percent to 18 percent. The samples were classified as "A-2-4" soils using AASHTO Designation M-145 and were designated "Stratum 2".

A thin layer (less than four feet thick) of gray sand containing more clay was encountered at a depth of about 14 feet within the clayey Stratum 2 soils in boring 2B-3-PB1. Analysis of a sample indicated a fines content of 53 percent, Plastic Limit of 14, Liquid Limit of 31 and natural moisture content of 28 percent. Based on those results, the sample was classified as sandy clay ("A-6") material using AASHTO Designation M-145. It was designated "Stratum 3".

Groundwater was encountered in the borings at depths between six feet and nine feet below the existing ground surface. Details of the subsurface characteristics encountered at each boring location are shown on the Report of Pond Boring sheets and on the Summary of Laboratory Tests sheets and charts in Appendix A.

East of Tymber Creek Road

The uppermost soils in borings 3-PB1 and 4-PB1 exhibited similar composition to the Stratum 1 soils encountered in roadway borings AB-1, AB-2 and the other pond sites, but their coloration varied more with depth at each location. As noted earlier in this report, both pond banks were also partially impounded by fill. As a result, the uppermost soils in both pond borings were designated "possible fill" in which case soil color should not be used as an aid to estimating seasonal high groundwater levels. Gradation analysis of three samples indicated fines contents that ranged from 4 percent to 5 percent, resulting in classification as "A-3" material using AASHTO Designation M-145. Constant-head field permeability tests in borings 3-PB1 and 4-PB1 yielded permeability in the horizontal direction (k_h) exceeding 40 ft/day. The soils were designated "Stratum 4".

Beneath the Stratum 4 soils in borings 3-PB1 and 4-PB1 and the Stratum 1 soils in borings AB-1 and AB-2 was light olive brown and grayish brown to brown and strong brown fine sand that appeared to contain more clay than the Stratum 2 soils encountered elsewhere on the project. The encountered thickness of these soils ranged from about two feet to about seven feet. Actual thicknesses could not be confirmed in AB-1 and AB-2 both of which were terminated in this soil without penetrating it completely. Gradation analysis of four samples indicated fines contents that ranged from 19 percent to 28 percent. The samples were classified as "A-2-4" soils using AASHTO Designation M-145 and were designated "Stratum 5".

Beneath the Stratum 5 soils in 3-PB1 and 4-PB1 was grayish brown sand that appeared to contain less clay. Encountered thicknesses were between three feet and seven feet. Actual thicknesses could not be confirmed as both borings were terminated in this soil without penetrating it completely. Gradation analysis of two samples indicated fines contents of 13 percent and 15 percent, so the samples were classified as "A-2-4" soils using AASHTO Designation M-145. The gradation results were consistent with the "Stratum 2" soils encountered west of Tymber Creek Road.

Groundwater was encountered in the borings at depths between eight feet and 18 feet below the existing ground surface. Details of the subsurface characteristics encountered at each boring location are shown on the boring logs and on the Summary of Laboratory Tests sheets in Appendix A.

Pond 3B Site

Although their coloration differed, the uppermost soils in boring 3B-PB2 (on the floodplain of the river) exhibited similar composition to the Stratum 1 and Stratum 2 soils encountered on the broad, nearly level plains west of Tymber Creek Road. Those soils extended to a depth of about four feet.

The underlying soils in 3B-PB2 were dark grayish brown, grayish brown and dark gray fine sand that appeared to contain a little silt. The uppermost soils in boring 3B-PB1 appeared to be similar but were pale brown and light grayish brown in color. The encountered thickness was about 13 feet in both borings. SPT N-values ranged from 4 blows per foot (bpf) to 31 bpf with most higher than 11 bpf, indicating generally medium dense to dense consistency. Gradation analysis of three samples indicated fines contents that ranged from 4 percent to 9 percent, which resulted in classification "A-3" like the Stratum 1 soils. However, the particle size distributions of the three samples revealed that they were generally finer than Stratum 1 soils. Constant-head field permeability tests in boring 3B-PB1 yielded permeability in the horizontal direction (k_h) of about 3 ft/day. As a result, these soils were designated "Stratum 6".

Beneath the Stratum 6 soils in both borings was light olive brown and grayish brown to brown fine to medium sand that appeared to contain a little silt. The encountered thickness was three feet and seven feet. Actual thicknesses could not be confirmed as both borings were terminated in this soil without penetrating it completely. SPT N-values ranged from 9 bpf to 11 bpf, indicating generally loose consistency. Gradation analysis of a sample from 3B-PB1 indicated a fines content of 6 percent, but the particle size distribution revealed that it was coarser than the Stratum 1 and Stratum 6 soils. Despite its "A-3" classification, this soil was designated "Stratum 7".

Groundwater was encountered at a depth of about nine feet in boring 3B-PB1 and about four feet in 3B-PB2. The difference in depth largely can be attributed to the observed difference in ground surface elevation between the two locations, even though they were not surveyed. Details of the subsurface characteristics encountered at each boring location are shown on the boring logs and on the Summary of Laboratory Tests sheets in Appendix A.

GENERAL COMMENTS ON RECOMMENDATIONS

The following preliminary recommendations are based upon a review of the available information, the limited field and laboratory test results discussed in this report and our experience with similar projects and subsurface conditions. Because soils are natural materials, variations in composition and other physical characteristics are normal and should be expected. It is anticipated that further subsurface explorations will be conducted during the design stage of this project and it is likely that the conditions encountered during those investigations may differ from those discussed in this report. As a result, the preliminary assessments discussed in the following sections may have to be changed as needed to reflect the additional information that becomes available. The information compiled for this report should be considered when developing final geotechnical recommendations for pond design and construction.

GENERAL PRELIMINARY ASSESSMENT OF ENCOUNTERED SOILS

In general, the soils encountered during this investigation should not adversely affect the design and construction of the ponds. As discussed earlier in this report, the uppermost soils were mostly fine sands containing small amounts of silt that were classified as "A-3"soil. If these soils are excavated to create new ponds or expand existing ponds, they may be reused as select fill in accordance with FDOT Standard Index 505 Embankment Utilization, provided they are not mixed with other, less-desirable materials.

The low fines contents of the "A-3" soils in Stratum 1, Stratum 4, Stratum 6 and Stratum 7 suggested that they should be permeable and drain well. However, the low permeability obtained in the medium dense to dense Stratum 6 soils indicated that assumption is reasonable only as long as those soils are not naturally medium dense to dense nor cemented, nor excessively compacted during construction. We recommend drilling SPT borings in the dry pond sites during the design phase of this project to check for medium dense to dense or cemented soils ("hardpan") which can have low permeability despite low and apparently favorable fines contents.

Clayey sands designated "A-2-4" and clay "A-6" soils were encountered beneath the surficial sands. If excavated during construction, they should only be reused as allowed by FDOT Standard Index 505 Embankment Utilization. These soils should be expected to have limited drainage capability and should be considered as the confining layer defining the "aquifer bottom" for stormwater pond recovery analyses. Clayey soils should not be reused in load-bearing situations, in the shoulders of any water-impounding embankment or in any impoundment through which seepage will be used to dispose of stormwater runoff. However, they may be used for non-load-bearing purposes such as low permeability liner or as a seepage barrier ("clay core") within a water-impounding embankment. If used for that purpose, these soils should be compacted at a moisture content several points wet of optimum to ensure that they do not dry out and crack to produce an unintended seepage path.

ESTIMATED SEASONAL HIGH GROUNDWATER LEVEL

During the rainy season in Florida, groundwater levels are generally higher than those observed at other times of the year. The extent of that variation depends on several factors, including the terrain, the intensity and duration of rainfall, the hydrogeologic properties of the soils and the presence and proximity of artificial drainage facilities. Because of the time of year of this investigation, we expect higher groundwater levels under the normal, cyclic influence of seasonal rainfall. However, the groundwater was encountered at significant depths below the ground surface in sloping to strongly sloping terrain. In addition, only a limited number of borings was drilled and ground surface elevations at the boring locations were not surveyed. As a result, only preliminary estimates of seasonal high groundwater level could be developed at this stage. Those estimates are shown on the Report of Borings sheets.

The seasonal high groundwater level was set conservatively at two feet above the top of the clayey "Stratum 5" soils encountered in roadway borings AB-1 and AB-2. Those depths were at least three feet below the bottom of pavement base shown on the cross-sections. The cross-sections showed open swales with bottoms at least two feet below the bottom of the pavement base. Underdrains were shown beneath the eastbound lanes of SR 40, but their age and current condition are unknown. Underdrains can also become ineffective if not properly maintained. As a result, we recommend not using the depicted underdrains as a reference for setting pavement base elevation.

Until more information becomes available, we recommend a preliminary estimate of the seasonal high groundwater level at two to three feet above the encountered groundwater level, zero to one foot above the top of the clayey sand horizons (to model perched conditions) or two feet above the bottom of the pond boring, whichever is highest. Seasonal high groundwater levels may be set at other depths as needed to model specific conditions for preliminary design purposes. Seasonal high groundwater levels should be estimated with caution on the river floodplain of the river, where stream hydraulics can easily overwhelm the slow, cyclic variation in groundwater level caused by seasonal rainfall. As the project design progresses and more information becomes available, estimates of seasonal high groundwater level can be refined.

POTENTIAL FOR ARTESIAN CONDITIONS

As discussed earlier in this report, the ground surface in the project area was mapped between the Elevation 15 feet NGVD (El. 15) and El. 20 contours, while the potentiometric surface of the Upper Floridan aquifer was mapped between the Elevation 0 and Elevation 10 contours. Those conditions suggest that artesian flow conditions should not be expected in the conventional sense. However, excavations may encounter groundwater seepage from adjacent soils at higher elevations. This is especially true after periods of rainfall in soils where low-permeability horizons at shallow depth promote short-term, perched groundwater conditions.

If excavation activity encounters unexpected seepage, work should be halted immediately and the excavation backfilled quickly to suppress further seepage. Dewatering should be initiated right away outside the excavation to control the seepage and depress the groundwater to a level for safe working conditions. Even modest volumes of uncontrolled seepage can erode banks, displace surprisingly large quantities of soil and adversely affect the stability of excavation side slopes.

PRELIMINARY POND RECOVERY ANALYSES

It is our understanding that preliminary pond recovery analyses are likely to be conducted at this stage to assess the general suitability of each site for the proposed ponds. Preliminary properties for that purpose are presented below in Table 2.

TABLE 2
PRELIMINARY SOIL PROPERTIES
FOR STORMWATER POND RECOVERY ANALYSES

POND	APPROXIMATE DEPTH (feet)		PERMEABILITY (feet/day)		FILLABLE POROSITY (%)
	ESHGWL	AQUIFER	k_h	k_v	
Pond 3	6½	7	40	26 to 40	25
Pond 3B	6	20	3	2	25
Pond 4	9½	10	40	26 to 40	25

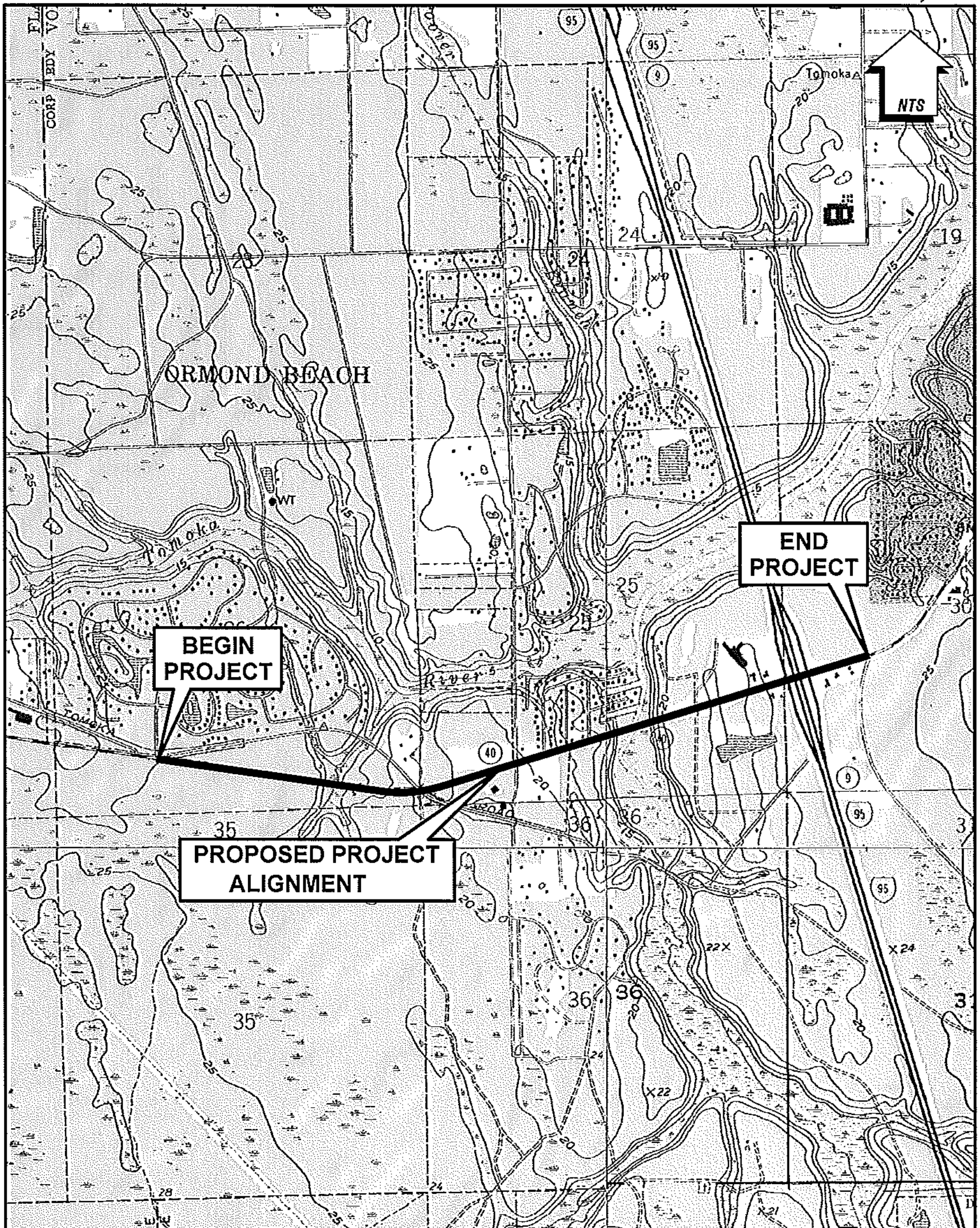
LIMITATIONS

This report presents an evaluation of the subsurface conditions at the indicated locations on the basis of accepted geotechnical procedures for site characterization. The recovered soil samples were not examined or tested in any way for chemical composition or environmental hazards.

The investigation was confined to the zone of soil that was most likely to be affected by the proposed construction. It did not address the potential of surface expression of deep geologic activity such as sinkholes, which requires more extensive services than those performed for this study.

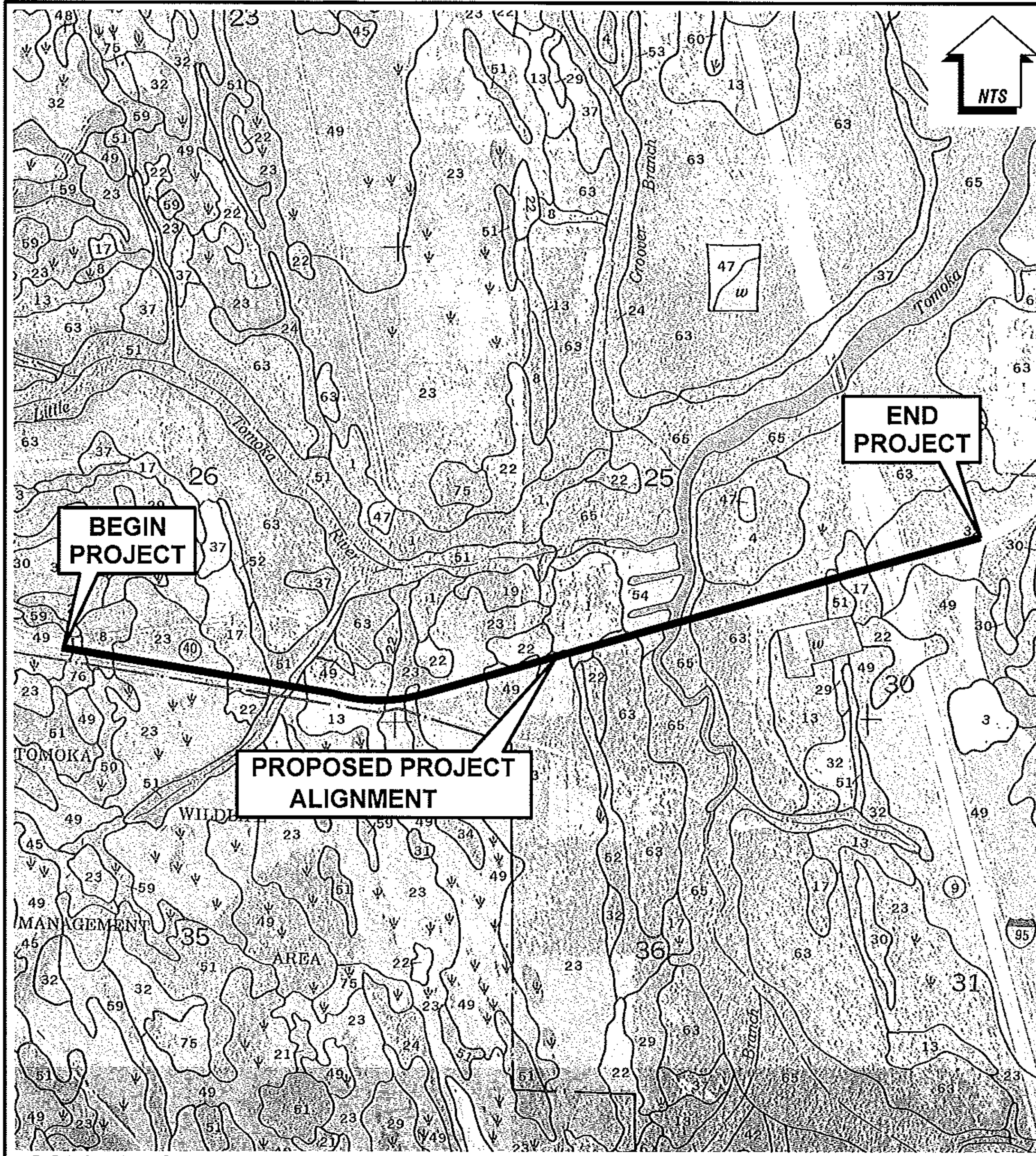
Because of the natural limitations inherent in working below the ground surface, a geotechnical engineer cannot predict and address all possible problems and on most construction projects, ground-related issues not addressed in this report may arise. "Important Information About Your Geotechnical Engineering Report," a bulletin published by the Association of Engineering Firms Practicing in the Geosciences (ASFE) is provided in Appendix B to help explain the nature of geotechnical engineering issues. Additional narrative is presented in Appendix C to bring to your attention the potential concerns and the basic limitations of a typical geotechnical engineering report.

FIGURES



SITE LOCATION PLAN		
201106	SR 40 PD&E STUDY	FIG. 1

ANTILLIAN ENGINEERING ASSOCIATES, INC.



SOIL LEGEND

1 – APOPKA FINE SAND, 0 TO 5 PERCENT SLOPES
8 – BASINGER FINE SAND, DEPRESSIONAL
13 – CASSIA FINE SAND
17 – DAYTONA SAND, 0 TO 5 PERCENT SLOPES
22 – ELECTRA FINE SAND, 0 TO 5 PERCENT SLOPES
23 – FARMTON FINE SAND
32 – MYAKKA FINE SAND
49 – POMONA FINE SAND
51 – POMONA-ST. JOHNS COMPLEX
54 – QUARTZIPSAMMENTS, GENTLY SLOPING 1/
63 – TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES
65 – TERRA CEIA MUCK
76 – WACHULA FINE SAND, DEPRESSIONAL

Figure developed from USDA SCS Soil Survey of Volusia County, Florida, issued 1980

USDA SCS SOIL SURVEY MAP		
201106	SR 40 PD&E STUDY	FIG. 2

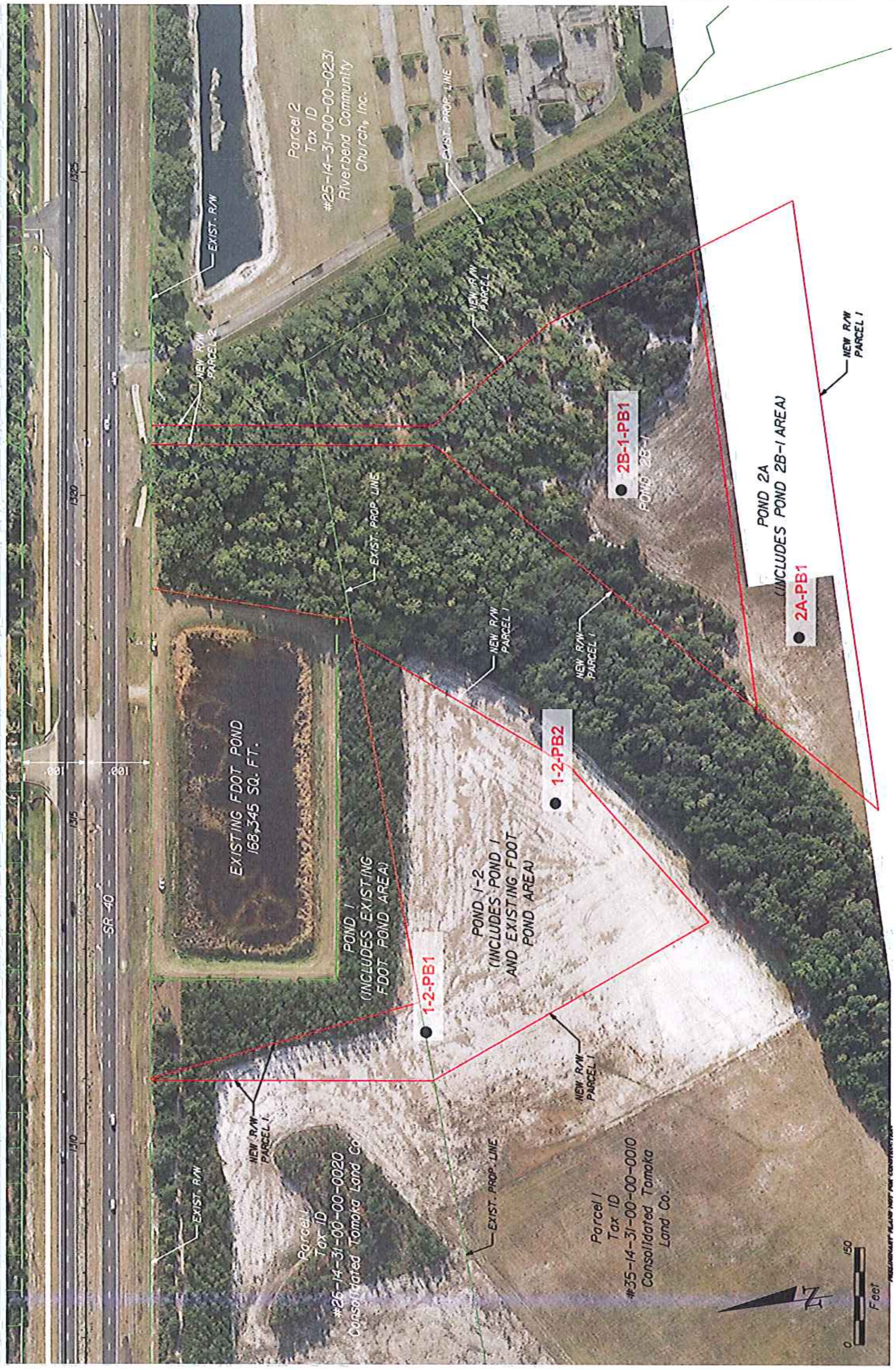


Figure developed from image furnished by Client

LEGEND

● APPROXIMATE LOCATION OF BORING

	BORING LOCATION PLAN	
201106	**SR 40 PD&E STUDY**	**FIG. 3**

S:\Current Projects\SR 40 PD&E Study\EA Drawings\SR 40 PDE Master.dwg, Figure 3, 7/12/2012 11:41:05 AM

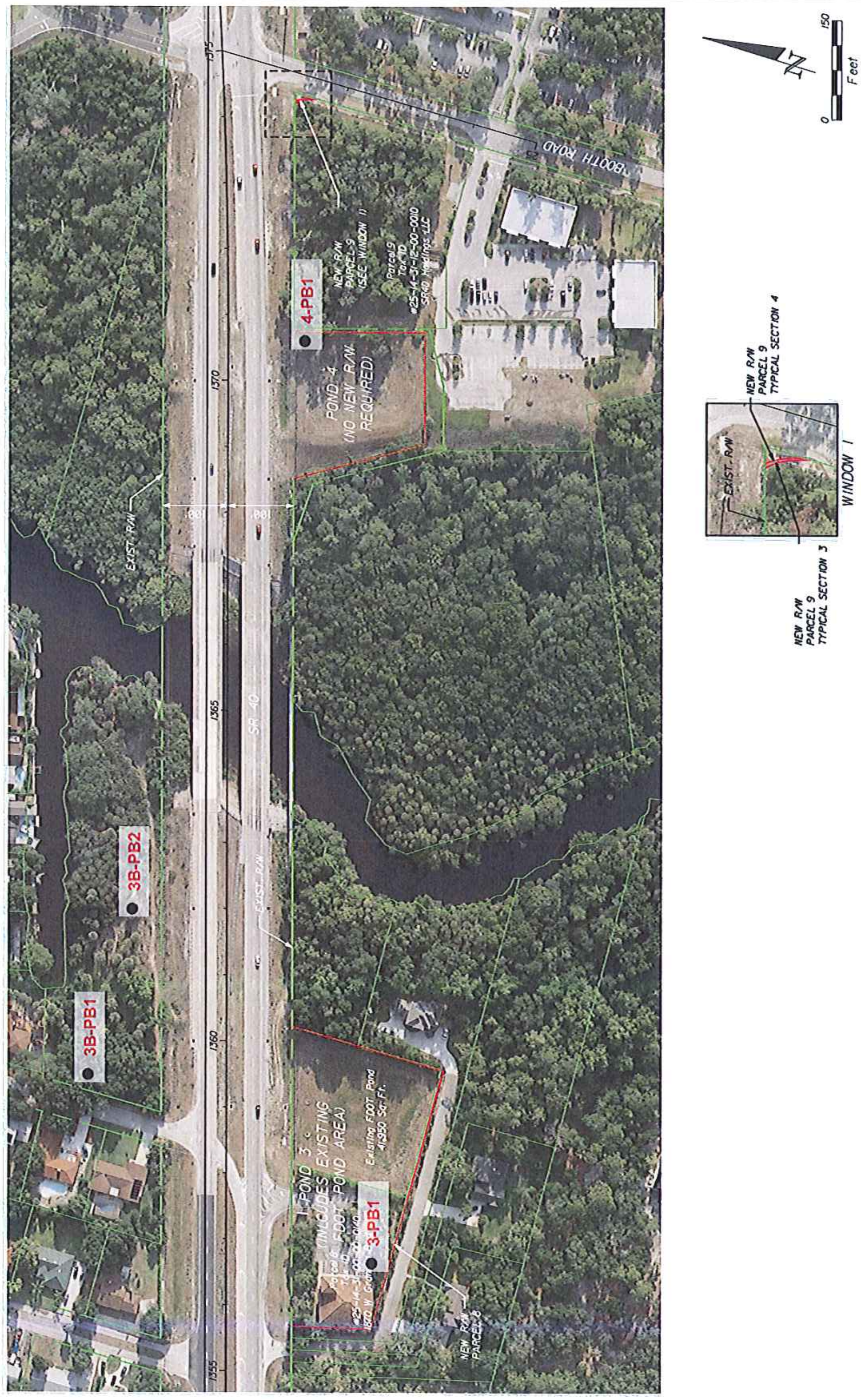
Figure developed from image furnished by Client

LEGEND

● APPROXIMATE LOCATION OF BORING

BORING LOCATION PLAN		
201106	**SR 40 PD&E STUDY**	**FIG. 4**

ANTILLIAN ENGINEERING ASSOCIATES, INC.



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LEGEND

● APPROXIMATE LOCATION OF BORING

BORING LOCATION PLAN

201106	SR 40 PD&E STUDY	FIG. 5

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Figure developed from image furnished by Client

LEGEND

● APPROXIMATE LOCATION OF BORING

BORING LOCATION PLAN		
201106	SR 40 PD&E STUDY	FIG. 6

APPENDIX A

ANTILLIAN ENGINEERING ASSOCIATES, INC.
3331 Bartlett Boulevard Orlando, Florida 32811
Tel (407) 422-1441 Fax (407) 422-2226

KEY TO BORING LOGS

SYMBOLS

10	SPT N-Value (number of blows a 140-lb weight falling 30 inches required to drive a Standard Split-Spoon sampler one foot into otherwise undisturbed soil)
WR	Penetration of sampler under weight of drill rods
WH	Penetration of sampler under weight of drill rods and hammer
SS	Split Spoon sample
ST	Undisturbed thin-walled Shelby Tube sample
	Observed change in soil type
	Unobserved change in soil type
∇	Estimated seasonal high groundwater level
▼	Encountered groundwater level

SOIL CONSISTENCY

(Based on empirical correlation with SPT N-Value)

GRANULAR SOILS

Very Loose - Less Than 4 blows/ft.
Loose - 4 to 10 blows/ft.
Medium Dense - 10 to 30 blows/ft.
Dense - 30 to 50 blows/ft.
Very Dense - More Than 50 blows/ft.

FINE-GRAINED SOILS

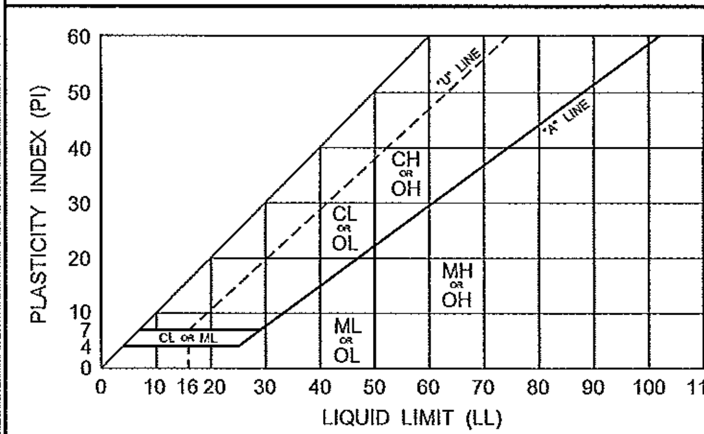
Very Soft - Less Than 2 blows/ft.
Soft - 2 to 4 blows/ft.
Firm - 4 to 8 blows/ft.
Stiff - 8 to 15 blows/ft.
Very Stiff - 15 to 30 blows/ft.
Hard - More Than 30 blows/ft.

UNIFIED SOILS CLASSIFICATION SYSTEM ASTM D 2487

(Based on material passing the 3-inch (75-mm) sieve)

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS More than 50% passing No. 200 sieve	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			Pt	Peat, muck and other highly organic soils

PLASTICITY CHART



ROADWAY SOILS SURVEY
REPORT OF TESTS

TOWNSHIP: 14 SOUTH
RANGE: 31 EAST
SECTION: 25, 26

PROJECT NO.: 428947-1-22-01
ROAD NO.: SR 40 PD&E STUDY BREAKAWAY TRAIL TO WILLIAMSON BLVD.
SUBMITTED BY: ANTILLIAN ENGINEERING ASSOCIATES, INC.

DATE OF SURVEY: 05/24/12 TO 06/05/12
SURVEYED BY: ANTILLIAN ENGINEERING ASSOCIATES, INC.
SURVEY BEGINS STA. NO.: MP 24.5
SURVEY ENDS STA. NO.: MP 26.5
DATE REPORTED: 06/15/2012

		ORGANIC CONTENT			SIEVE ANALYSIS RESULTS (% PASSING)						ATTERBERG LIMITS (%)					CORROSION TEST RESULTS				ENVIRONMENTAL CLASSIFICATION (SUBSTRUCTURE)	
STRATUM NO.	LBR VALUE	NO. OF TESTS	% ORGANIC	MOISTURE CONTENT %	NO. OF TESTS	#10 MESH	#40 MESH	#60 MESH	#100 MESH	#200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTICITY INDEX	AASHTO GROUP	DESCRIPTION	RESISTIVITY ohm-cm	CHLORIDES ppm	SULFATES ppm	pH	CONCRETE	STEEL
1	--	--	--	--	3	100	92-95	73-76	21-27	1-7	--	--	--	A-3	LIGHT BROWNISH GRAY, GRAYISH BROWN AND OCCASIONALLY VERY DARK BROWN FINE SAND	--	--	--		--	--
2	--	--	--	--	11	98-100	88-97	49-82	19-38	12-18	--	--	--	A-2-4	GRAYISH BROWN, OCCASIONALLY DARK GRAY, BROWN AND YELLOWISH BROWN CLAYEY OR SILTY FINE SAND	--	--	--		--	--
3	--	--	--	--	1	100	98	93	73	53	1	33	19	A-6	GRAY SANDY CLAY	--	--	--		--	--
4	--	--	--	--	2	100	95-97	82-87	28-33	4-5	--	--	--	A-3	LIGHT BROWNISH GRAY AND PALE YELLOW FINE SAND (POSSIBLE FILL)	--	--	--		--	--
5	--	--	--	--	4	100	93-98	74-86	32-49	19-28	--	--	--	A-2-4	LIGHT OLIVE BROWN AND GRAYISH BROWN TO BROWN AND STRONG BROWN CLAYEY FINE SAND	--	--	--		--	--
6	--	--	--	--	3	100	94-98	70-86	31-42	4-9	--	--	--	A-3	LIGHT GRAY AND BROWN TO DARK GRAYISH BROWN AND DARK GRAY FINE SAND	--	--	--		--	--
7	--	--	--	--	1	100	66	20	8	6	--	--	--	A-3	BROWN FINE TO MEDIUM SAND	--	--	--		--	--

NOTES

1. THE SYMBOL "--", IF PRESENT, REPRESENTS UNMEASURED SOIL PARAMETERS.
2. STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH BORING LOCATION ONLY. ANY STRATA CONNECTION LINES SHOWN ARE FOR ESTIMATING EARTH WORK ONLY AND DO NOT INDICATE ACTUAL STRATUM LIMITS. SURFACE VARIATION BETWEEN BORINGS SHOULD BE ANTICIPATED.
3. ▼ – ENCOUNTERED GROUNDWATER LEVEL
4. ▽ – PRELIMINARY ESTIMATED SEASONAL HIGH GROUNDWATER LEVEL (LEVELS SHOWN MAY CHANGE AS MORE INFORMATION BECOMES AVAILABLE)

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ANTILLIAN ENGINEERING ASSOCIATES, INC.
GEOTECHNICAL ENGINEERS
CERTIFICATE OF AUTHORIZATION E86685
3331 BARTLETT BOULEVARD ORLANDO, FLORIDA 32811
PHONE: 407-422-1441 FAX: 407-422-2226
ENGINEER OF RECORD: PETER O. SUAH, P.E. LICENSE NO. 48910

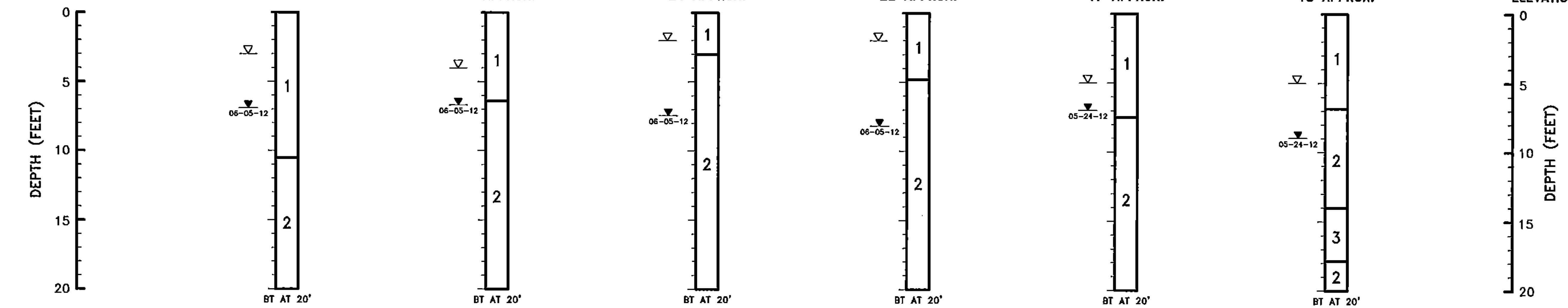
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 40	VOLUSIA	428947-1-22-01

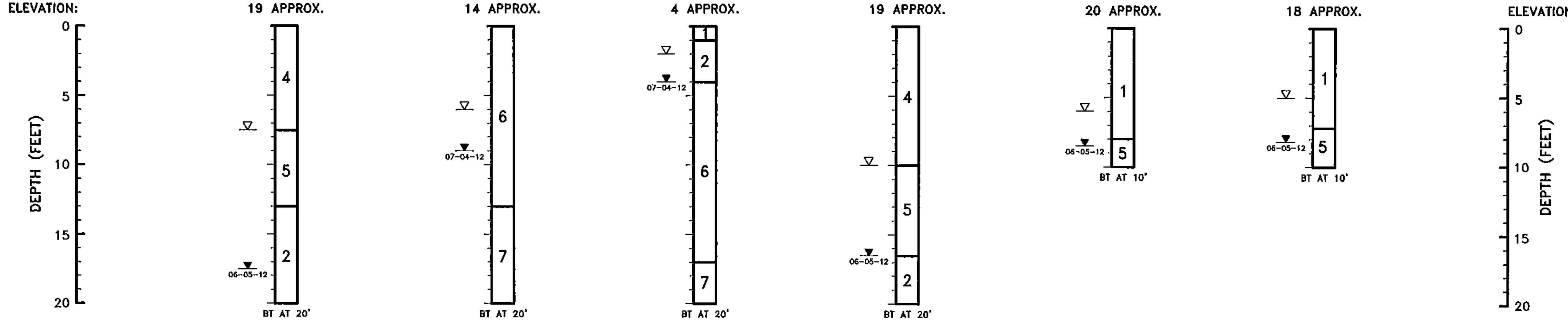
REPORT OF TESTS

SHEET NO.

BORING:	POND 1-2 (CENTER) 1-2-PB1	1-2-PB2	POND 2A 2A-PB1	POND 2B-1 2B-1-PB1	POND 2B-2 2B-2-PB1	POND 2B-3 2B-3-PB1
STATION:	1311+50	1315+00	1317+70	1320+00	1335+20	1335+40
OFFSET:	530' RT.	730' RT.	1110' RT.	825' RT.	180' LT.	530' LT.
ELEVATION:	24 APPROX.	23 APPROX.	24 APPROX.	22 APPROX.	17 APPROX.	18 APPROX.



BORING:	POND 3 3-PB1	POND 3B (CENTER) 3B-PB1	3B-PB2	POND 4 4-PB1	SR 40 ROADWAY (CENTER) AB-1	AB-2
STATION:	1360+30	1359+50	1362+00	1370+60	1331+00	1336+00
OFFSET:	100' RT.	220' LT.	130' LT.	120' RT.	110' LT.	100' LT.
ELEVATION:	19 APPROX.	14 APPROX.	4 APPROX.	19 APPROX.	20 APPROX.	18 APPROX.



STRATUM NO.	AASHTO SOIL CLASSIFICATION SYMBOL	DESCRIPTION
1	A-3	LIGHT BROWNISH GRAY, GRAYISH BROWN AND OCCASIONALLY VERY DARK BROWN FINE SAND
2	A-2-4	GRAYISH BROWN, OCCASIONALLY DARK GRAY, BROWN AND YELLOWISH BROWN CLAYEY FINE SAND
3	A-6	GRAY SANDY CLAY
4	A-3	LIGHT BROWNISH GRAY AND PALE YELLOW FINE SAND (POSSIBLE FILL)
5	A-2-4	LIGHT OLIVE BROWN AND GRAYISH BROWN TO BROWN AND STRONG BROWN CLAYEY FINE SAND
6	A-3	LIGHT GRAY AND BROWN TO DARK GRAYISH BROWN AND DARK GRAY FINE SAND
7	A-3	BROWN FINE TO MEDIUM SAND

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ANTILLIAN ENGINEERING ASSOCIATES, INC.
GEOTECHNICAL ENGINEERS
CERTIFICATE OF AUTHORIZATION EB6685
3331 BARTLETT BOULEVARD ORLANDO, FLORIDA 32811
PHONE: 407-422-1441 FAX: 407-422-2226
ENGINEER OF RECORD: PETER G. SUAH, P.E. LICENSE NO. 46910

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 40	VOLUSIA	428947-1-22-01

REPORT OF POND BORINGS

SHEET NO.

Project: SR 40 PD&E Study | Job Number: 201106 | Sheet 1 of 2

Manager: ______ | Client: Kittelson | Project Description: ______

Location: ______

Boring	Depth	Sample Description	#4	#10	#40	#60	#100	Fines #200	Water Content	LL	PI	Organic Content	k (ft/day)		AASHTO	USCS
1-2-PB1	1.5	Grayish brown fine sand		100.0	92.6	73.1	24.0	3.9							A-3	
1-2-PB2	6.5	Brown clayey fine sand		100.0	92.5	74.6	33.5	17.6							A-2-4	
1-2-PB2	10.5	Grayish brown clayey fine sand		100.0	88.7	67.3	19.9	12.4							A-2-4	
2A-PB1	4.0	Dark yellowish brown clayey fine sand		100.0	93.4	77.5	34.7	17.5							A-2-4	
2A-PB1	7.0	Grayish brown clayey fine sand		100.0	90.0	69.8	24.1	12.8							A-2-4	
2A-PB1	13.0	Dark gray clayey fine sand		99.9	92.7	75.3	37.5	17.5							A-2-4	
2B-1-PB1	3.0	Very dark brown fine sand with silt		100.0	93.3	75.3	26.9	6.9							A-3	
2B-1-PB1	17.0	Very dark gray clayey fine sand		100.0	89.5	69.6	24.2	17.6							A-2-4	
2B-2-PB1	1.0	Light brownish gray fine sand		100.0	94.4	75.7	21.0	1.4							A-3	
2B-2-PB1	7.5	Grayish brown clayey fine sand		100.0	95.1	78.5	35.0	14.9	19.7						A-2-4	
2B-2-PB1	10.0	Grayish brown clayey fine sand		100.0	93.0	75.5	29.4	15.3	22.4						A-2-4	
2B-3-PB1	14.0	Gray sandy clay		100.0	98.2	92.9	72.5	53.4	28.1	33.1	18.9				A-6	
3B-PB1	4.0	Light gray and brown mixed fine sand		100.0	94.9	75.5	35.0	4.2							A-3	
3B-PB1	13.5	Brown fine to medium sand with silt		100.0	66.0	19.6	8.1	6.3							A,3	
3B-PB2	2.0	Very dark gray silty fine sand with roots	100.0	98.9	91.1	70.4	31.6	14.1							A-2-4	
3B-PB2	4.0	Dark grayish brown fine sand with silt		100.0	96.9	84.4	42.2	7.7							A-3	
3B-PB2	8.5	Dark gray fine sand with silt	100.0	99.3	97.2	85.9	34.9	8.8							A-3	
3-PB-1	2.0	Light brownish gray fine sand		100.0	95.6	82.0	27.9	4.6							A-3	
3-PB-1	8.0	Light olive bn. and strong bn. clayey fine sand	100.0	100.0	95.3	83.7	42.9	27.4							A-2-4	

Summary Of Laboratory Test Results

ANTILLIAN ENGINEERING ASSOCIATES, INC

Project: **SR 40 PD&E Study** Job Number: **201106**

Manager:

Client: **Kittelson**

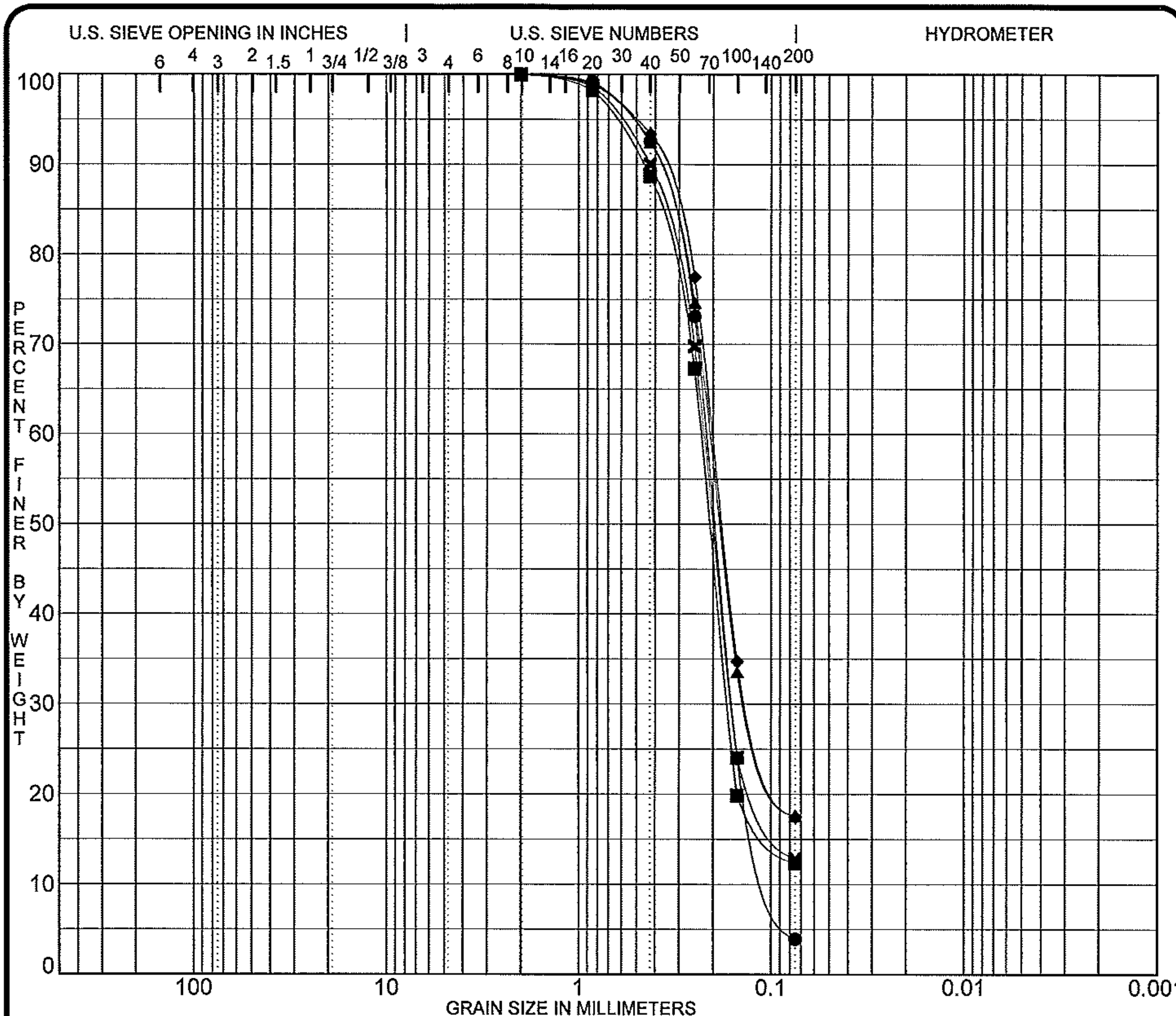
Project Description:

Location:

Boring	Depth	Sample Description	#4	#10	#40	#60	#100	Fines #200	Water Content	LL	PI	Organic Content	k (ft/day)		AASHTO	USCS
3-PB-1	17.0	Brownish yellow clayey fine sand	100.0	100.0	88.1	49.1	23.8	15.0							A-2-4	
4-PB-1	7.0	Pale yellow fine sand		100.0	97.0	86.7	32.3	4.4							A-3	
4-PB-1	13.0	Strong brown clayey fine sand		100.0	97.8	86.0	48.7	24.7							A-2-4	
4-PB-1	17.0	Yellowish brown clayey fine sand		100.0	97.0	81.7	25.2	12.9							A-2-4	
AB-1	8.0	Brown clayey fine sand		100.0	93.5	74.0	32.8	19.0							A-2-4	
AB-2	8.0	Grayish brown clayey fine sand	100.0	100.0	94.8	77.2	37.5	21.9							A-2-4	

Summary Of Laboratory Test Results

ANTILLIAN ENGINEERING ASSOCIATES, INC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	MC%	LL	PL	PI	Cc	Cu
●	1-2-PB1	1.5	Grayish brown fine sand					1.26	2.4
▲	1-2-PB2	6.5	Brown clayey fine sand						
■	1-2-PB2	10.5	Grayish brown clayey fine sand					2.01	3.8
◆	2A-PB1	4.0	Dark yellowish brown clayey fine sand						
✖	2A-PB1	7.0	Grayish brown clayey fine sand						

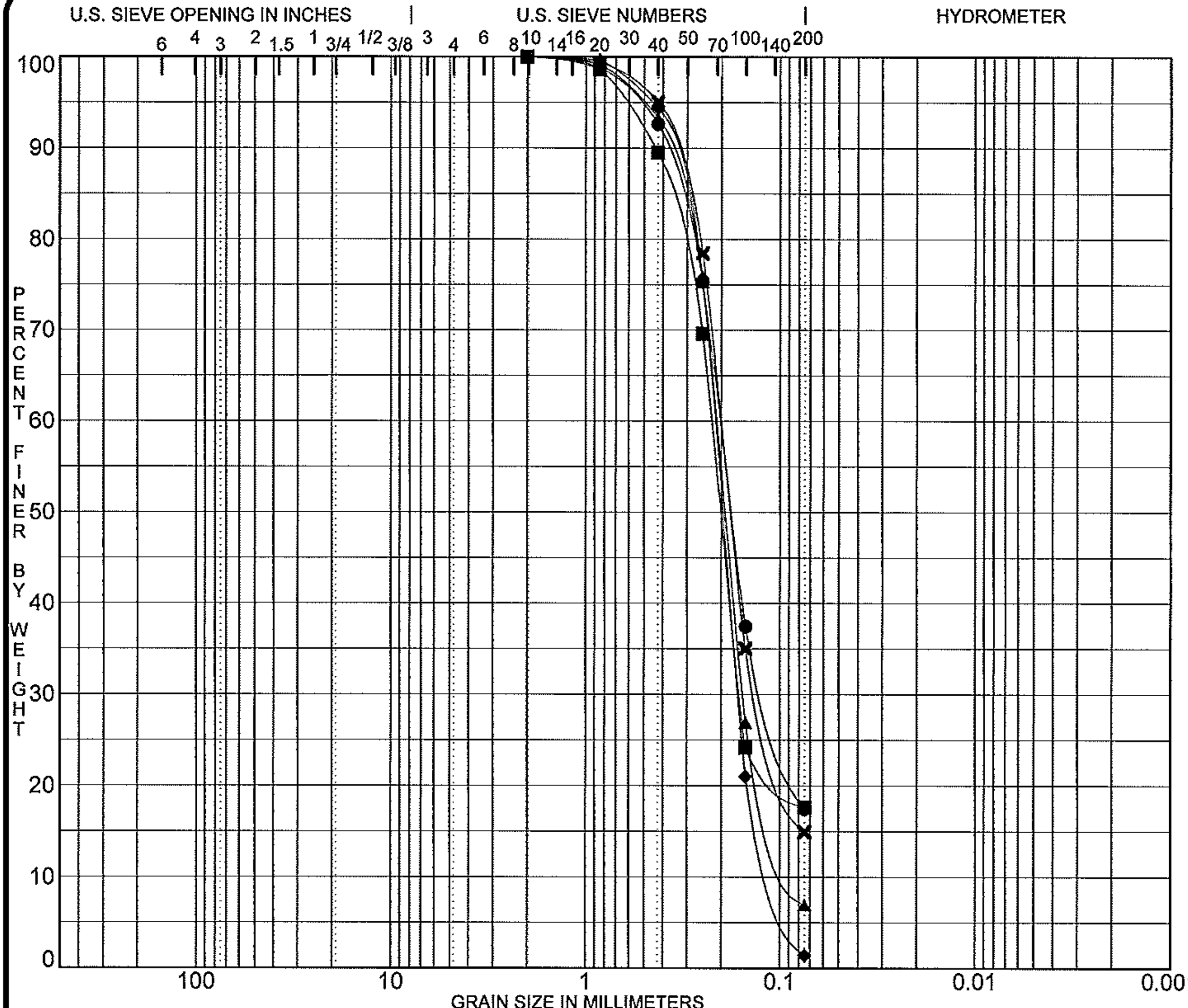
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	1-2-PB1	1.5	2.00	0.22	0.160	0.0925	0.0	96.1	3.9	
▲	1-2-PB2	6.5	2.00	0.21	0.129		0.0	82.4	17.6	
■	1-2-PB2	10.5	2.00	0.23	0.167		0.0	87.6	12.4	
◆	2A-PB1	4.0	2.00	0.20	0.124		0.0	82.5	17.5	
✖	2A-PB1	7.0	2.00	0.22	0.160		0.0	87.2	12.8	

PROJECT **SR 40 PD&E Study**

JOB NO. **201106**
DATE **07/12/12**

GRADATION CURVES

ANTILLIAN ENGINEERING ASSOCIATES, INC.
Orlando, Florida, USA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	MC%	LL	PL	PI	Cc	Cu
●	2A-PB1	13.0	Dark gray clayey fine sand	19.7					
▲	2B-1-PB1	3.0	Very dark brown fine sand with silt	19.7				1.35	2.6
■	2B-1-PB1	17.0	Very dark gray clayey fine sand	19.7					
◆	2B-2-PB1	1.0	Light brownish gray fine sand	19.7				1.21	2.1
✖	2B-2-PB1	7.5	Grayish brown clayey fine sand	19.7					

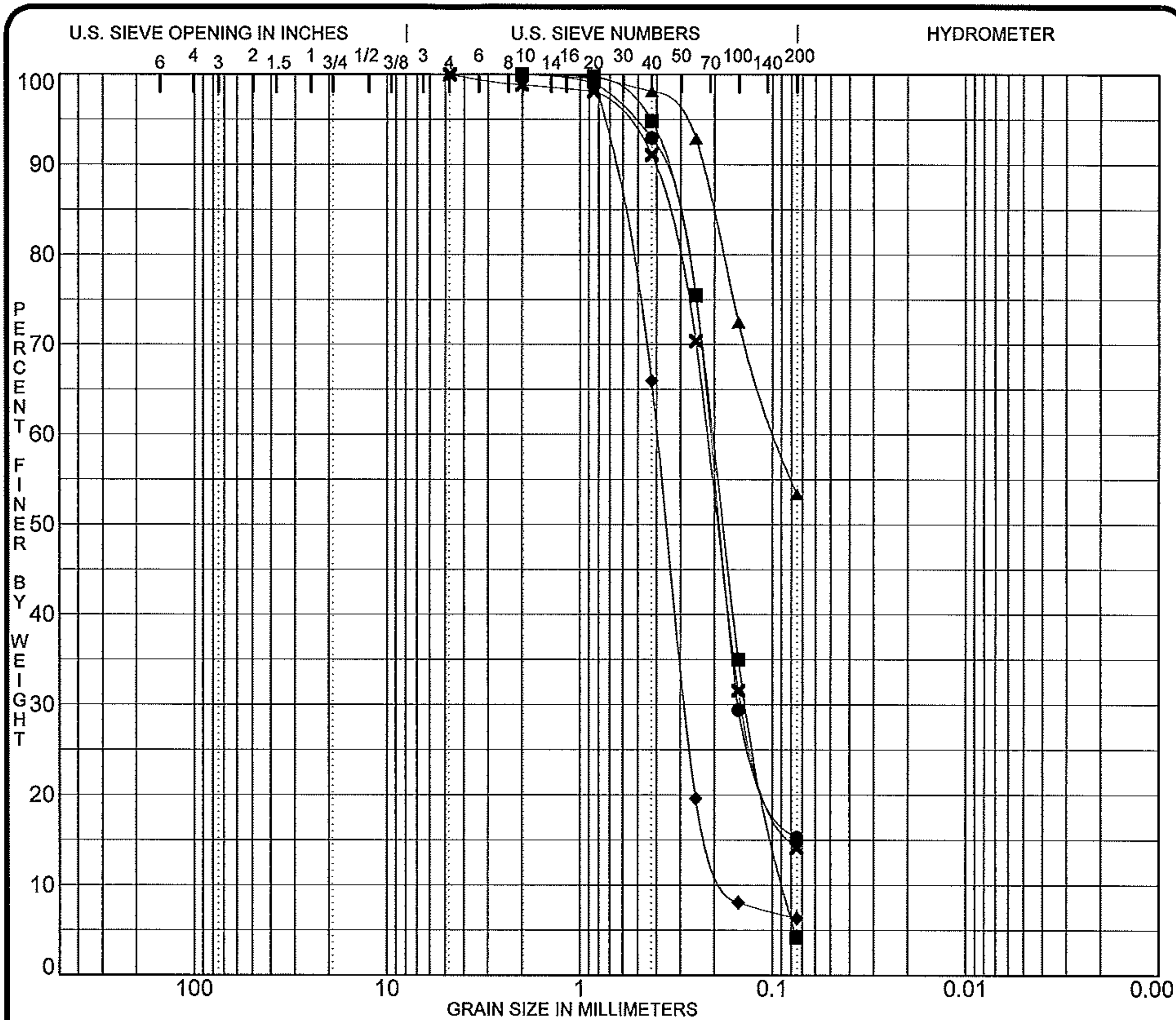
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	2A-PB1	13.0	2.00	0.20	0.116		0.0	82.5	17.5	
▲	2B-1-PB1	3.0	2.00	0.21	0.155	0.0834	0.0	93.1	6.9	
■	2B-1-PB1	17.0	2.00	0.22	0.160		0.0	82.3	17.6	
◆	2B-2-PB1	1.0	2.00	0.22	0.163	0.1016	0.0	98.6	1.4	
✖	2B-2-PB1	7.5	2.00	0.20	0.126		0.0	85.1	14.9	

PROJECT SR 40 PD&E Study

JOB NO. 201106
DATE 07/12/12

GRADATION CURVES

ANTILLIAN ENGINEERING ASSOCIATES, INC.
Orlando, Florida, USA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
● 2B-2-PB1	10.0	Grayish brown clayey fine sand						
▲ 2B-3-PB1	14.0	Gray sandy clay		33	14	19		
■ 3B-PB1	4.0	Light gray and brown mixed fine sand					1.02	2.4
◆ 3B-PB1	13.5	Brown fine to medium sand with silt					1.22	2.4
✖ 3B-PB2	2.0	Very dark gray silty fine sand with roots						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2B-2-PB1	10.0	2.00	0.21	0.151		0.0	84.7	15.3	
▲ 2B-3-PB1	14.0	2.00	0.10			0.0	46.6	53.4	
■ 3B-PB1	4.0	2.00	0.21	0.134	0.0854	0.0	95.8	4.2	
◆ 3B-PB1	13.5	2.00	0.40	0.282	0.1633	0.0	93.7	6.3	
✖ 3B-PB2	2.0	4.75	0.22	0.141		0.0	85.9	14.1	

PROJECT SR 40 PD&E Study

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GRADATION CURVES

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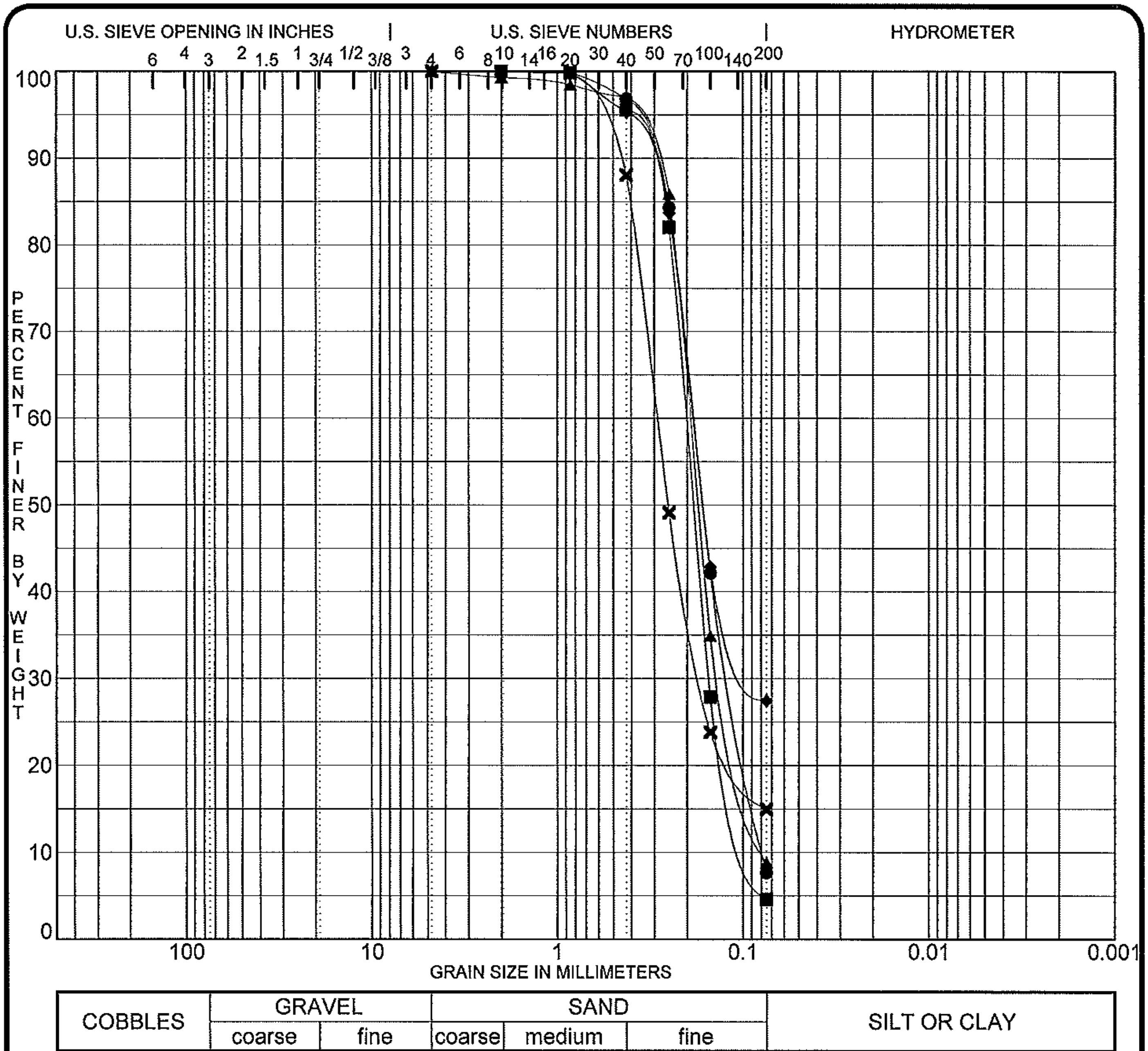
Orlando, Florida, USA



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**3B-PB2**	**4.0**	**Dark grayish brown fine sand with silt**					**0.94**	**2.4**
▲	**3B-PB2**	**8.5**	**Dark gray fine sand with silt**					**1.16**	**2.5**
■	**3-PB-1**	**2.0**	**Light brownish gray fine sand**					**1.31**	**2.3**
◆	**3-PB-1**	**8.0**	**Light olive bn. and strong bn. clayey fine sand**						
✖	**3-PB-1**	**17.0**	**Brownish yellow clayey fine sand**						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**3B-PB2**	**4.0**	**2.00**	**0.19**	**0.117**	**0.0786**	**0.0**	**92.3**	**7.7**	
▲	**3B-PB2**	**8.5**	**4.75**	**0.19**	**0.132**	**0.0773**	**0.0**	**91.2**	**8.8**	
■	**3-PB-1**	**2.0**	**2.00**	**0.20**	**0.153**	**0.0881**	**0.0**	**95.4**	**4.6**	
◆	**3-PB-1**	**8.0**	**4.75**	**0.19**	**0.084**		**0.0**	**72.6**	**27.4**	
✖	**3-PB-1**	**17.0**	**4.75**	**0.29**	**0.170**		**0.0**	**85.0**	**15.0**	

PROJECT **SR 40 PD&E Study**

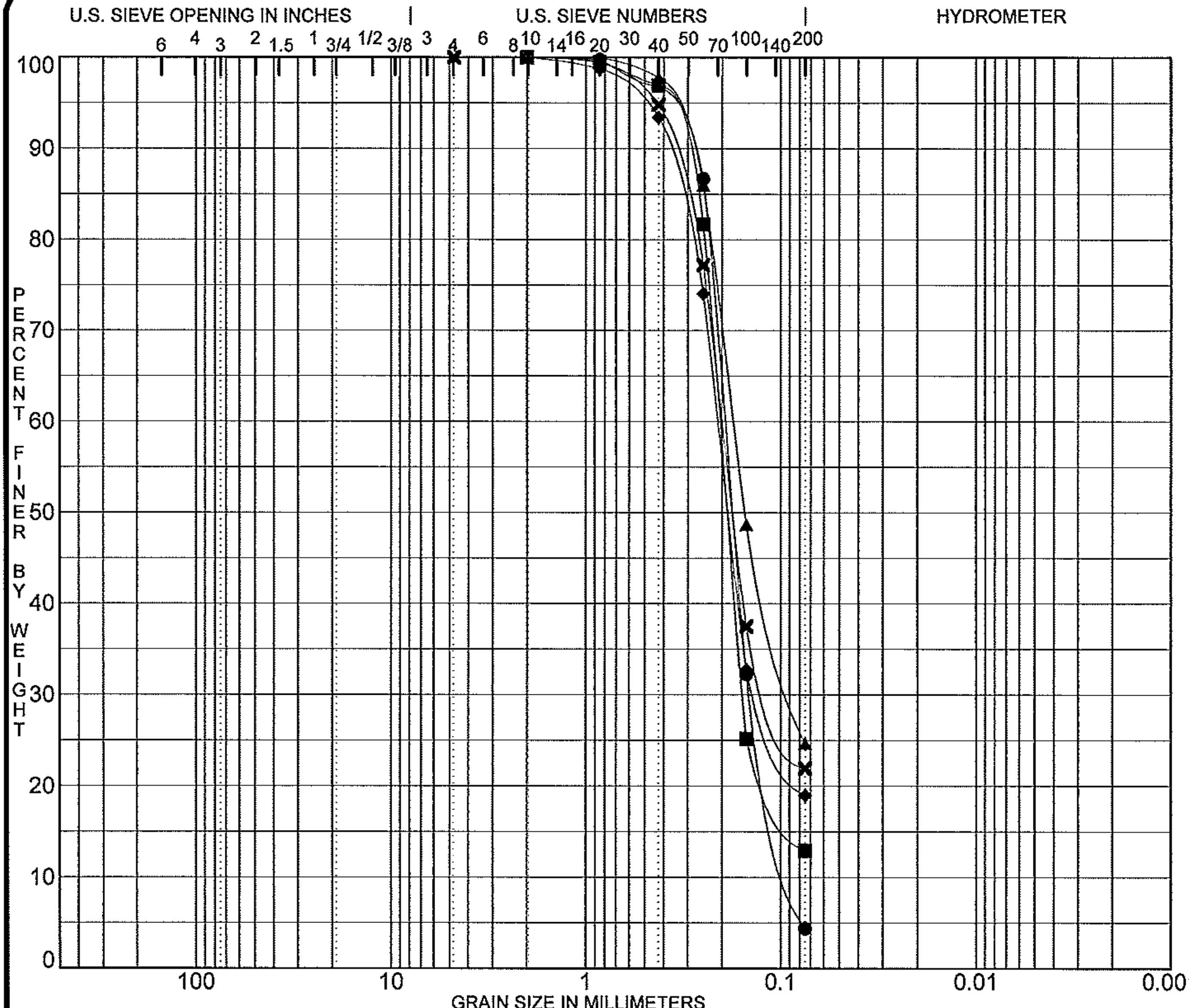
JOB NO. **201106**

DATE **07/12/12**

GRADATION CURVES

ANTILLIAN ENGINEERING ASSOCIATES, INC.

Orlando, Florida, USA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	MC%	LL	PL	PI	Cc	Cu
●	4-PB-1	7.0	Pale yellow fine sand					1.20	2.3
▲	4-PB-1	13.0	Strong brown clayey fine sand						
■	4-PB-1	17.0	Yellowish brown clayey fine sand						
◆	AB-1	8.0	Brown clayey fine sand						
✖	AB-2	8.0	Grayish brown clayey fine sand						

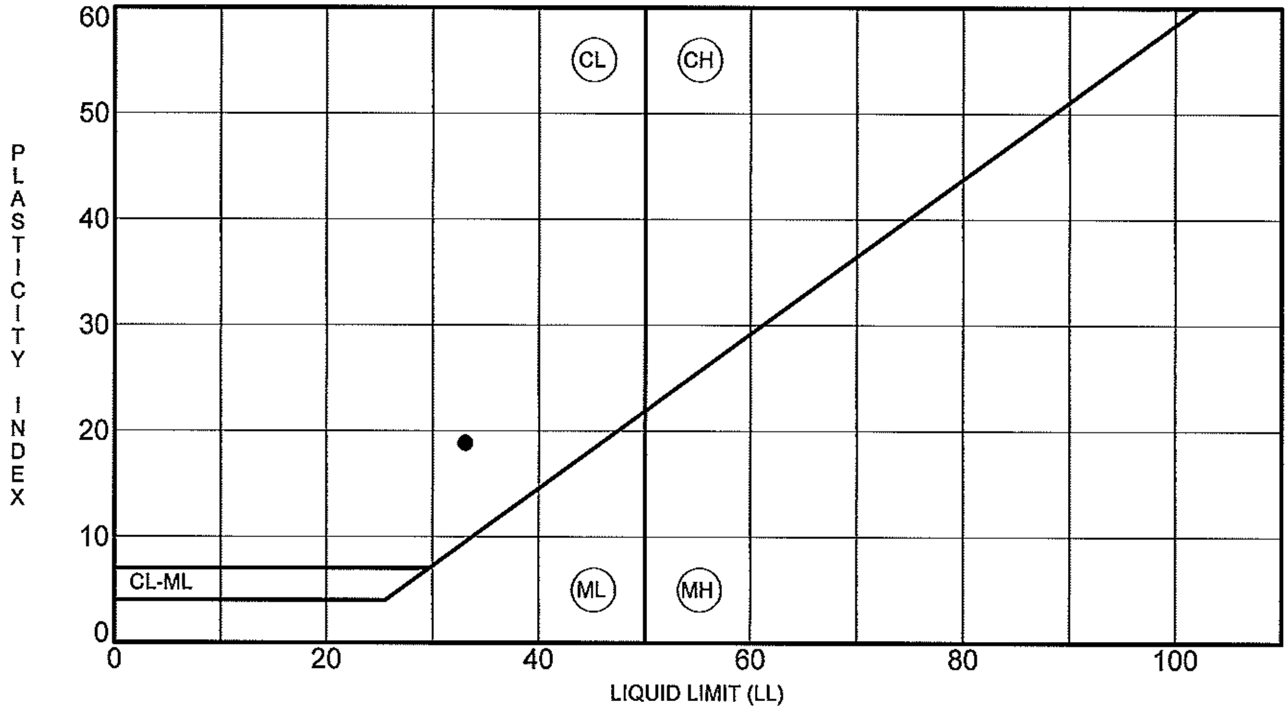
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4-PB-1	7.0	2.00	0.19	0.142	0.0862	0.0	95.6	4.4	
▲	4-PB-1	13.0	2.00	0.18	0.088		0.0	75.3	24.7	
■	4-PB-1	17.0	2.00	0.21	0.157		0.0	87.1	12.9	
◆	AB-1	8.0	2.00	0.21	0.131		0.0	81.0	19.0	
✖	AB-2	8.0	4.75	0.20	0.107		0.0	78.1	21.9	

PROJECT **SR 40 PD&E Study**

JOB NO. **201106**
DATE **07/12/12**

GRADATION CURVES

ANTILLIAN ENGINEERING ASSOCIATES, INC.
Orlando, Florida, USA



	Specimen Identification		LL	PL	PI	Fines	Classification
●	2B-3-PB1	14.0	33	14	19	53.4	

CDM NO.

PROJECT **SR 40 PD&E Study**

JOB NO. **201106**

DATE **07/12/12**

ATTERBERG LIMITS

ANTILLIAN ENGINEERING ASSOCIATES, INC.

Orlando, Florida, USA

APPENDIX B

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage*, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

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APPENDIX C

ANTILLIAN ENGINEERING ASSOCIATES, INC.
CONSTRAINTS AND RESTRICTIONS

WARRANTY

Antillian Engineering Associates, Inc. has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

UNANTICIPATED SOIL CONDITIONS

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Antillian Engineering Associates, Inc., as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Antillian Engineering Associates, Inc. of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Antillian Engineering Associates, Inc. to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

MISINTERPRETATION OF SOIL ENGINEERING REPORT

Antillian Engineering Associates, Inc. is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Antillian Engineering Associates, Inc..

CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Antillian Engineering Associates, Inc..

USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other investigations to determine those conditions that may affect construction operations. Antillian Engineering Associates, Inc. cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Antillian Engineering Associates, Inc. to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Antillian Engineering Associates, Inc. to locate any such buried objects. Antillian Engineering Associates, Inc. cannot be responsible for any buried man-made objects which are subsequently encountered during construction that are not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of investigation. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.

APPENDIX 9

Existing Permit Calculations

State Road 40
Drainage Calculations
S.J.R.W.M.D. Permit Application Re-Submittal

Application No. 4-127-67904-1
Financial Project ID 241009-1-52-01

67904-1

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Florida Department of Transportation
District 5

Prepared by Bessent, Hammack, & Ruckman, Inc.
February 2001

Subbasin 10– Post-Development – W.D.A. 8

The portion of State Road 40 draining to subbasin 10 begins at Sta. 1282+00 and extends to Sta. 1345+00. The W.D.A. is located at Station 1315+00 RT. The runoff will be collected by roadside ditches. The roadway runoff that is to be treated will be diverted to W.D.A. 8 which outfalls to a roadway ditch that drains to the existing box culvert at Sta. 1320+75. The untreated runoff will be diverted directly to the existing cross drain.

The post development area has been divided into the area draining to W.D.A. 8 and system 1 (untreated area). The area draining to W.D.A. 8 includes all area within the R/W (Sta. 1282+00 to Sta. 1317+00). System 1 includes all area within the R/W (Sta. 1317+00 to Sta. 1345+00). These proposed areas are unable to be treated due to the location of the pond in relation to the outfall. The pre and post development flows will be compared at the outfall.

See the following pages for an explanation of the time of concentration, drainage area quantities and curve numbers.

STATE ROAD 40 - SUBBASIN #10
POST- DEVELOPMENT
DRAINAGE BASIN ASSESSMENT

WDA 8

DRAINAGE AREA DESCRIPTION	ROADWAY AREA (R/W) TOTAL AREA (ACRES)	PERV. AREA (ACRES)	PERV. SCS CN	IMPERV. AREA (ACRES)	IMPERV. SCS CN	POND AREA POND AREA (ACRES)	POND SCS CN	COMP. CN
	16.09	10.51	61	5.58	98	0.00	100	73.8
Pond	3.86	1.20	61	.0.00	98	2.66	100	87.9
Totals	19.95	11.71	61	5.58	98	2.66	100	76.5

TIME OF CONCENTRATION = 68.8 MIN

SYSTEM 1 (AREA NOT TREATED)

DRAINAGE AREA DESCRIPTION	ROADWAY AREA (R/W) TOTAL AREA (ACRES)	PERV. AREA (ACRES)	PERV. SCS CN	IMPERV. AREA (ACRES)	IMPERV. SCS CN	POND AREA POND AREA (ACRES)	POND SCS CN	COMP. CN
	12.96	8.67	61	4.29	98	0.00	100	73.2
Totals	12.96	8.67	61	4.29	98	0.00	100	73.2

TIME OF CONCENTRATION = 41.7 MIN

SOURCES: SCS SOIL SURVEY OF VOLUSIA COUNTY FLORIDA, SCS TR 55, URBAN HYDROLOGY FOR SMALL WATERSHEDS

TREATMENT VOLUME CALCULATIONS - WDA 8

DRAINAGE AREA (DA)	19.95
IMPERVIOUS NON-LAKE AREA (IMP. DA)	5.58

TREATMENT VOLUME
REQUIRED:

		(AC-FT)	
1"	1" X (1'/12") X DA X 1.5	$\boxed{2.49}$	GOVERNS
2.5"	2.5" X (1'/12") X IMP. DA X 1.5	1.74	

TREATMENT VOLUME
PROVIDED:

POND	EL. (FEET)	AREA (ACRES)	TREATMENT VOLUME (AC-FT)
TOB	20.00	3.07	
WEIR	18.00	2.80	$\boxed{2.73}$
NWL	17.00	2.66	
BOT	12.00	2.03	

EQUIVALENT RUNOFF COEFFICIENT
FOR 25 YEAR RETURN PERIOD

CNcomp	77
	C 25 yr = 1 - (S/Pt) * (1.2 - (S / (Pt + .8*S)))
P 25 YEAR (inches)	8.64 ZONE 7
S = 1000/CN -10 MAX SOIL STORAGE (inches)	3.06
C EQUIVALENT RUNOFF COEFFICIENT 25 YEAR RETURN	0.67

PERMANENT POOL CALCULATIONS

DRAINAGE AREA (ACRES)	19.95	
COMPOSITE CN	77	
C EQUIVALENT RUNOFF COEFFICIENT 25 YEAR RETURN	0.67	
POOL REQUIRED FOR 31.5 DAY RESIDENCY	(31.5 DAYS/153 DAYS)*(29"/12")*DA*C	
POOL REQUIRED CALCULATED (AC-FT)	6.67	(AC-FT)

POND	EL. (FEET)	AREA (ACRES)
NWL	17.00	2.66
BOT	12.00	2.03

POOL PROVIDED: (AC-FT) $\boxed{11.73}$ (AC-FT)

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SIZING BLEED-DOWN ORIFICE FOR RESIDENCY TIME

DATA:

TREATMENT VOLUME (AC-FT): TV	2.49
RECOVERY TIME (HRS): t	27.00
CONVERSION FACTOR (SEC/HR): CF	3,600.00
TREATMENT HEAD (FEET): h1	1.00
HALF OF TREATMENT HEAD (FEET): h2	0.50

CALCULATIONS:

Q = TV / (2*t*CF) + Q(base flow)	0.727 (cfs)
h = (h1 + h2)/2	0.750 (FEET)
Ao = Q / (C(2*g*h)^0.5)	0.174 (FT^2)
D^2 =	0.222 (FT^2)
D =	0.471 (FT)
D =	5.654 (in)

ADJUST FOR FLOW LINE ELEVATION:

NWL + D/2 =	17.24	CHECK:	FOR RESIDENCY
TREATMENT HEAD (FEET): h1	0.76	TRY DIAM (in)	6.00
HALF OF TREATMENT HEAD (FEET): h2	0.38	(FT)	0.500
Q = TV / (2*t*CF) + Q(base flow)	0.727 (cfs)	Ac =	28.260 (in^2)
h = (h1 + h2)/2	0.573 (FEET)	Ac =	0.196 (FT^2)
Ao = Q / (C(2*g*h)^0.5)	0.199 (FT^2)	NWL + D/2 =	17.25
		h1 =	0.75
D^2 =	0.254 (FT^2)	h2 =	0.38
D =	0.504 (FT)	h =	0.563
		Qavg =	0.709 (cfs)
D =	6.046 (in)		
		RES = TIME	$\boxed{27.89}$ (hrs.)
FLOW LINE ELEVATION = NWL + D/2 =	17.25		

INSTALL A:	**6.00 INCH ORIFICE**

GROUNDWATER INFLOW - WDA 8

SHWL (FT) =	19.0
NWL (FT) =	17.0
Draw Down (FT): h	2

ASSUME RADIUS OF INFLUENCE (L) EXTENDS 20' FOR EVERY FOOT OF DRAWDOWN

L = 20 x h	40 (FT)	
i = h / L	0.05	
PERIMETER @ NWL : Pnwl	1385 (FT)	
PERIMETER @ RADIUS OF INFLUENCE : Pri	1636 (FT)	
Pa = (Pnwl + Pri) / 2	1510.5 (FT)	
A = h x Pa	3021 (FT^2)	
K (FT / HR) =	2.0	(TYPE B SOILS, TABLE 33.1 SJRWMD HANDBOOK) FS = 2
Q = 2 x K i A	0.1678 (CFS)	

BASE FLOW - WDA 8

CALCULATE BASE FLOW INFLUENCE ON NORMAL WATER LEVEL WITH 6.00" ORIFICE

Q = CA(2gh)^0.5

Q =	0.1678 (CFS)
C =	0.6
A =	0.196 (FT^2)
g =	32.2 (FT/S^2)
SOLVE FOR h: h = (Q/CA)^2 / 2g =	0.0315 (FT)
BASE FLOW NWL =	17.03

CHECK TREATMENT VOLUME:

	EL. (FEET)	AREA (ACRES)	TREATMENT VOLUME (AC-FT)
WEIR	18.00	2.80	$\boxed{2.65}$
BASE FLOW NWL	17.03	2.664	
NWL	17.00	2.66	

REQUIRED TREATMENT VOLUME = 2.49 < 2.65 PROVIDED

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Subbasin 10 – Pre vs. Post

Now that all of the treatment requirements have been met, as set forth by the St. Johns River Water Management District, it must be sized for the attenuation of certain design storms. Attenuation of runoff will be accomplished by sizing the rectangular weir such that the peak outflow from the pond is less than the peak pre-development outflow for the same storm. This must be done without leaving less than one foot of freeboard between the peak stage and the pond's top of bank. The weir length used for W.D.A. 8 is 4 feet. It will be placed inside a modified ditch bottom inlet. An outfall pipe attached to the modified inlet will convey the outflow to the existing cross drain – the same place the pre-development runoff outfalled to.

Software Information

Two different computer software application programs were used in the hydraulic analysis of W.D.A. 8. The first program applied was Hydraulic Systems Software's BRN 3.1. BRN was used to make a detailed model of the attenuation and outfall system. The model was created to see the affect of the SCS 25 year storm on the pond system. This system includes the pond, the control structure, and the outfall pipes.

The second program applied was Supra3. The information required by Supra is a bit less detailed. Input data includes basin areas, curve numbers, and time of concentration, as well as the pond area, control structure type, and configuration. Supra3 was used to calculate the critical duration storm.

BRN Analysis

The required input parameters for the pre-development hydrographs were determined in the pre-development conditions portion of this section. These parameters are the Time of Concentration, Tc, drainage area, and Curve Number. The storm model used for the hydrographs is the SCS Type II Modified. Lastly, from the FDOT's IDF curves for Rainfall Zone 7, the total rainfall is 8.64 in. There is a small area beyond Sta. 1345+00 that drains to subbasin 10, but these areas are not modeled since they do not change from pre-development to post-development. All of this data culminates in a peak runoff of 46.69 cfs at the outfall.

The first step in modeling the post-development system is to determine the peak runoff with a hydrograph. The same parameters as were used in the pre-development are used here, but reflect post-development conditions. These quantities are the Tc, drainage area, and curve number. The storm model used for the hydrograph is the SCS Type II Modified. The total rainfall is also 8.64 inches. All of this data culminates in a peak runoff of 29.66 cfs at the outfall.

The SCS Type II Modified storm results in a peak post-development runoff rate of 29.66 cfs, which is less than the pre-development peak of 46.69 cfs. The maximum stage in the pond for the storm is 18.86'. Top of bank for the pond is 20.00', which leaves more than the necessary 1 foot of freeboard. A printout of the output from this analysis can be found on the following pages.

Supra Analysis

The input and output derived from the Supra3 analysis can be found at the end of this section.

The critical storm as determined by Supra3 is the 8 hr - 100 year storm. The pre-development peak flow is 44.62 cfs and the post development for this storm is 15.23 cfs. The maximum stage in W.D.A. 8 is 18.84'. This will not exceed the capacity of the pond.

Unit Hydrograph File..	SCS_323
Drainage Area.........	19.95 Acres
SCS Curve Number......	76.50
Initial Abstraction K.	0.200
Time of Concentration.	1.138 Hours

SCS Excess, User Tc, UHG Method (NONE)

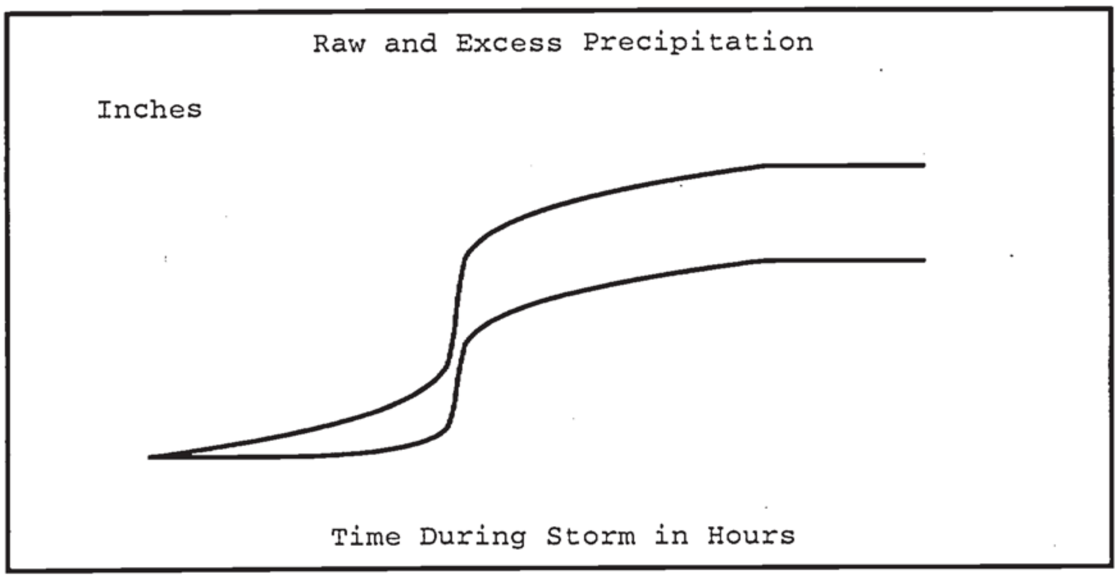
Storm File	SCS_IIM	Site Tc	68.30 Minutes
Rainfall	8.64 In	Peak Rate	35.85 CFS
Excess	5.80 In	Volume	9.66 AcFt

POST-DEVELOPMENT SUBBASIN 10-WDA8

UNIT HYDROGRAPH FILE.........	SCS_323
TOTAL DRAINAGE AREA, ACRES...	19.95
WEIGHTED SCS CURVE NUMBER....	76.5
INITIAL ABSTRACTION FACTOR...	0.2
TIME OF CONCENTRATION, HOURS.	1.138333

FILE....	SB10-WD8
INPUT ID	101102166
TYPE....	RNF002
RUN, HRS	30.1
DT, HRS.	0.1
DATA PTS	302
STORM...	SCS_IIM
DURATION	24.0
RAINFALL	8.64
EXCESS..	5.8040547
ACREAGE.	19.95
TC, HRS.	1.138333
TP, HRS.	12.8
PEAK CFS	35.851868
ACFT VOL	9.6616762
READY...	YES
CFS TOL.	0.01
HRS TOL.	0.01

Raw and Excess Precipitation



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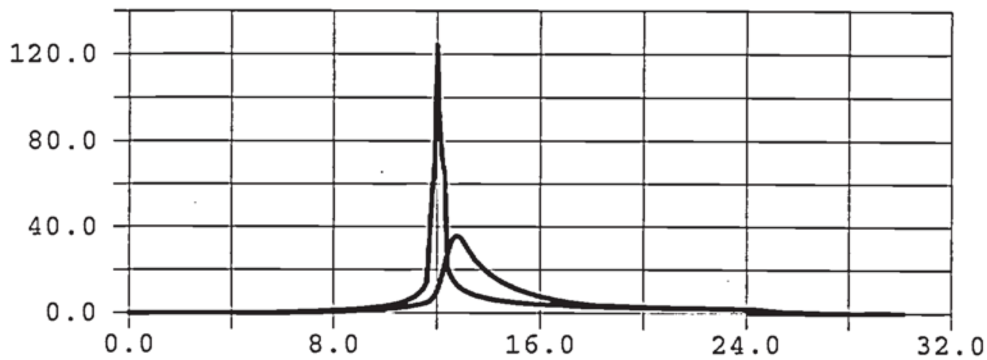
Instantanious and Routed Runoff

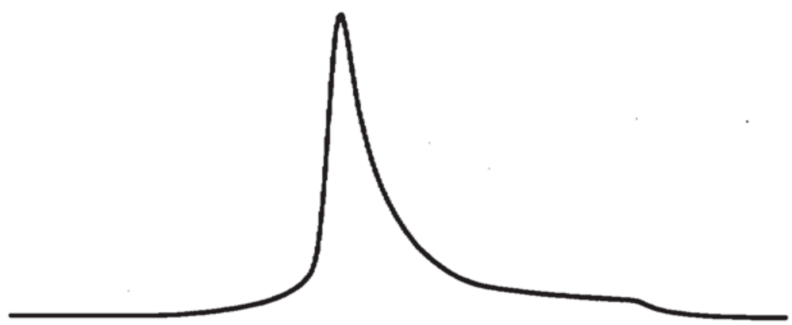
Rate CFS



Time During Storm in Hours

Runoff Hydrograph

Runoff



Time During Storm in Hours

Data Pt #	Time Hours	Rainfall In	Excess In	Raw CFS Load	Final CFS Runoff
0	0.000	0.0000	0.0000	0.000	0.0000
10	1.000	0.1041	0.0000	0.000	0.0000
20	2.000	0.2154	0.0000	0.000	0.0000
30	3.000	0.3349	0.0000	0.000	0.0000
40	4.000	0.4645	0.0000	0.000	0.0000
50	5.000	0.6064	0.0000	0.000	0.0000
60	6.000	0.7637	0.0069	0.286	0.0448
70	7.000	0.9414	0.0315	0.677	0.2531
80	8.000	1.1470	0.0787	1.198	0.5899
90	9.000	1.3941	0.1578	1.965	1.0733
100	10.000	1.7109	0.2884	3.299	1.8086
101	10.100	1.7485	0.3058	3.496	1.9050
102	10.200	1.7876	0.3242	3.709	2.0072

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Data Pt #	Time Hours	Rainfall In	Excess In	Raw CFS Load	Final CFS Runoff
103	10.300	1.8283	0.3439	3.943	2.1160
104	10.400	1.8709	0.3648	4.202	2.2321
105	10.500	1.9154	0.3871	4.490	2.3564
106	10.600	1.9621	0.4110	4.810	2.4900
107	10.700	2.0114	0.4367	5.174	2.6342
108	10.800	2.0635	0.4645	5.586	2.7905
109	10.900	2.1190	0.4947	6.062	2.9609
110	11.000	2.1782	0.5276	6.617	3.1476
111	11.100	2.2420	0.5637	7.274	3.3538
112	11.200	2.3113	0.6038	8.067	3.5834
113	11.300	2.3874	0.6488	9.048	3.8413
114	11.400	2.4720	0.7000	10.296	4.1348
115	11.500	2.5680	0.7595	11.948	4.4735
116	11.600	2.6798	0.8304	14.262	4.8724
117	11.700	2.9266	0.9930	32.703	5.4736
118	11.800	3.3209	1.2677	55.240	6.4280
119	11.900	3.7810	1.6074	68.302	7.8152
120	12.000	4.5682	2.2251	124.229	10.2598
121	12.100	5.0959	2.6589	87.232	13.4862
122	12.200	5.5169	3.0140	71.413	17.4169
123	12.300	5.8911	3.3351	64.576	22.4346
124	12.400	6.0134	3.4411	21.320	27.0002
125	12.500	6.1166	3.5309	18.049	31.1401
126	12.600	6.2065	3.6094	15.779	34.1436
127	12.700	6.2865	3.6795	14.097	35.5322
128	12.800	6.3590	3.7431	12.793	35.8519
129	12.900	6.4254	3.8015	11.747	34.8624
130	13.000	6.4869	3.8556	10.889	33.4095
131	13.100	6.5442	3.9062	10.166	31.6326
132	13.200	6.5979	3.9537	9.551	29.6008
133	13.300	6.6485	3.9985	9.018	27.8094
134	13.400	6.6965	4.0411	8.554	26.0365
135	13.500	6.7421	4.0816	8.143	24.3679
136	13.600	6.7856	4.1202	7.776	22.9688
137	13.700	6.8272	4.1573	7.447	21.6356
138	13.800	6.8671	4.1928	7.151	20.4227
139	13.900	6.9055	4.2270	6.881	19.3842
140	14.000	6.9424	4.2600	6.634	18.3793
141	14.100	6.9781	4.2919	6.409	17.4663
142	14.200	7.0126	4.3227	6.200	16.6593
143	14.300	7.0459	4.3526	6.010	15.8709
144	14.400	7.0783	4.3816	5.829	15.1489
145	14.500	7.1097	4.4098	5.664	14.4942
146	14.600	7.1402	4.4372	5.508	13.8472
147	14.700	7.1699	4.4638	5.363	13.2485
148	14.800	7.1989	4.4898	5.227	12.6995
149	14.900	7.2271	4.5152	5.099	12.1528
150	15.000	7.2546	4.5399	4.979	11.6479
151	15.100	7.2815	4.5641	4.863	11.1802

Data Pt #	Time Hours	Rainfall In	Excess In	Raw CFS Load	Final CFS Runoff
152	15.200	7.3077	4.5878	4.756	10.7106
153	15.300	7.3334	4.6109	4.654	10.2786
154	15.400	7.3585	4.6336	4.556	9.8724
155	15.500	7.3831	4.6558	4.465	9.4587
156	15.600	7.4072	4.6775	4.376	9.0777
157	15.700	7.4309	4.6989	4.292	8.7186
158	15.800	7.4540	4.7198	4.213	8.3539
159	15.900	7.4768	4.7404	4.135	8.0298
160	16.000	7.4991	4.7606	4.063	7.7262
161	16.100	7.5210	4.7805	3.992	7.4179
162	16.200	7.5426	4.8000	3.925	7.1422
163	16.300	7.5638	4.8192	3.861	6.8783
164	16.400	7.5846	4.8381	3.799	6.6101
165	16.500	7.6051	4.8567	3.738	6.3717
166	16.600	7.6253	4.8750	3.681	6.1442
167	16.700	7.6452	4.8930	3.626	5.9162
168	16.800	7.6648	4.9108	3.572	5.7088
169	16.900	7.6841	4.9283	3.521	5.5067
170	17.000	7.7031	4.9455	3.471	5.3035
171	17.100	7.7218	4.9625	3.423	5.1181
172	17.200	7.7403	4.9793	3.377	4.9398
173	17.300	7.7585	4.9959	3.331	4.7659
174	17.400	7.7764	5.0122	3.288	4.6112
175	17.500	7.7942	5.0284	3.246	4.4648
176	17.600	7.8117	5.0443	3.205	4.3274
177	17.700	7.8290	5.0601	3.164	4.2043
178	17.800	7.8460	5.0756	3.128	4.0888
179	17.900	7.8629	5.0910	3.089	3.9821
180	18.000	7.8795	5.1062	3.052	3.8890
181	18.100	7.8960	5.1212	3.018	3.8061
182	18.200	7.9123	5.1360	2.983	3.7319
183	18.300	7.9283	5.1507	2.950	3.6660
184	18.400	7.9442	5.1652	2.918	3.6048
185	18.500	7.9600	5.1795	2.885	3.5466
186	18.600	7.9755	5.1937	2.854	3.4913
187	18.700	7.9909	5.2078	2.825	3.4383
188	18.800	8.0061	5.2217	2.794	3.3876
189	18.900	8.0211	5.2354	2.768	3.3390
190	19.000	8.0360	5.2490	2.738	3.2923
191	19.100	8.0508	5.2625	2.712	3.2473
192	19.200	8.0654	5.2759	2.684	3.2039
193	19.300	8.0798	5.2891	2.659	3.1621
194	19.400	8.0941	5.3022	2.633	3.1217
195	19.500	8.1083	5.3152	2.610	3.0827
196	19.600	8.1224	5.3280	2.585	3.0449
197	19.700	8.1363	5.3407	2.560	3.0082
198	19.800	8.1500	5.3534	2.539	2.9728
199	19.900	8.1637	5.3659	2.515	2.9384
200	20.000	8.1772	5.3783	2.493	2.9050

Data Pt #	Time Hours	Rainfall In	Excess In	Raw CFS Load	Final CFS Runoff
210	21.000	8.3063	5.4967	2.295	2.6171
220	22.000	8.4254	5.6062	2.131	2.3918
230	23.000	8.5362	5.7083	1.994	2.2093
240	24.000	8.6400	5.8041	1.874	2.0578
250	25.000	8.6400	5.8041	0.000	1.1138
260	26.000	8.6400	5.8041	0.000	0.4526
270	27.000	8.6400	5.8041	0.000	0.1821
280	28.000	8.6400	5.8041	0.000	0.0585
290	29.000	8.6400	5.8041	0.000	0.0000
300	30.000	8.6400	5.8041	0.000	0.0000
301	30.100	8.6400	5.8041	0.000	0.0000

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Created.: Thu Dec 16 17:07:57 1999
Revised.: Wed Jan 16 17:25:29 2002
Executed: Wed Jan 16 17:31:02 2002

Project Run Converged.

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Project Contains 6 Paths.
Project Contains 7 Nodes.
Project Contains 0 Sgnls.

Path	Up Stream Node Name	Down Stream Node Name	Path Type
0	R/W1	WDA8	DIRECT
1	WDA8	S-1	RECT WEIR
2	S-1	S-2	PIPE
3	S-2	S-3	DITCH
4	R/W2	OUTFALL	DIRECT
5	S-3	OUTFALL	DITCH

Node	Name	Node Type
0	OUTFALL	STAGING
1	S-1	JUNCTION
2	R/W1	SUBAREA
3	WDA8	POND
4	S-2	JUNCTION
5	R/W2	SUBAREA
6	S-3	JUNCTION

Node	Name	Node Type	Min El.	at Hr.	Max El.	at Hr.
0	OUTFALL	STAGING	12.5	0.00	12.5	0.00
1	S-1	JUNCTION	15.6	0.00	17.1	15.30
2	R/W1	SUBAREA	20.0	0.00	20.0	0.00
3	WDA8	POND	17.0	5.60	18.9	15.30
4	S-2	JUNCTION	15.5	0.00	16.2	15.30

Elevations in Feet, Nodes marked with an '*' have Flooded.

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Node	Name	Node Type	Min El.	at Hr.	Max El.	at Hr.
5	R/W2	SUBAREA	20.0	0.00	20.0	0.00
6	S-3	JUNCTION	13.8	0.00	14.3	15.30

Elevations in Feet, Nodes marked with an '*' have Flooded.

Node	Name	Maximum CFS Inflow	Maximum CFS Outflow
0	OUTFALL	29.66 @ 12.50 Hours	0.00 @ 0.00 Hours
1	S-1	10.31 @ 15.30 Hours	10.30 @ 15.30 Hours
2	R/W1	35.85 @ 12.80 Hours	35.85 @ 12.80 Hours
3	WDA8	35.85 @ 12.80 Hours	10.31 @ 15.30 Hours
4	S-2	10.30 @ 15.30 Hours	10.29 @ 15.30 Hours
5	R/W2	29.66 @ 12.50 Hours	29.66 @ 12.50 Hours
6	S-3	10.29 @ 15.30 Hours	10.21 @ 15.30 Hours

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Created.: Thu Dec 16 17:07:57 1999
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Project Run Converged.

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,

ACCUMULATED MASS BALANCE ERROR..........	0.0728 Acre Feet
ERROR AS A PERCENT OF OUTFLOW...........	0.2706 Percent

Project Contains 6 Paths.
Path 000 from Node 002 (R/W1) to Node 003 (WDA8)

Path 000 ID 945094589 Type DIRECT US Std	
00	DIRECT..----------
01	
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
12	
13	
14	
15	HW PE/KE NO
16	TW PE/KE YES
17	Max HW.. 20.000 Ft
18	Max TW.. 20.000 Ft

Path 000 Output Data Type DIRECT US Std			
00	Input ID 945094589		
01	Flow T0.	0.000	CFS
02	Vol T0..	0	CF
03	Max In..	35.852	CFS
04	Min In..	0.000	CFS
05	Max Out.	35.852	CFS
06	Min Out.	0.000	CFS
07			
08			
09			
10			
11			
12			
13			
14			
15	Fwd K...	0.000	
16	Rev K...	0.000	
17	Fwd X...	0.000	
18	Rev X...	0.000	

Path 001 from Node 003 (WDA8) to Node 001 (S-1)

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Path 001 ID 945696677	Type RECT WEIR US Std
00	Crest El 18.000 Ft
01	Width... 4.000 Ft
02	Weir C.. 3.200
03	Num Ends 0
04	
05	Breadth. Ft
06	
07	
08	
09	
10	
11	
12	
13	
14	
15	HW PE/KE YES
16	TW PE/KE NO
17	Max HW.. 20.000 Ft
18	Max TW.. 20.000 Ft

Path 001 Output Data	Type RECT WEIR US Std
00	Input ID 945696677
01	Flow T0. 0.000 CFS
02	Vol T0.. 0 CF
03	Max In.. 10.311 CFS
04	Min In.. 0.000 CFS
05	Max Out. 10.311 CFS
06	Min Out. 0.000 CFS
07	
08	
09	
10	
11	
12	
13	
14	
15	Fwd K... 0.000
16	Rev K... 0.000
17	Fwd X... 0.000
18	Rev X... 0.000

Path 002 from Node 001 (S-1) to Node 004 (S-2)

Path 002 ID 1011025088	Type PIPE US Std
00	Length.. 52.0 Ft
01	Mann N.. 0.012
02	Rise.... 2.000 Ft
03	Span.... 2.000 Ft
04	Inlet
05	Invert.. 15.600 Ft
06	Ent Ke.. 0.200
07	Outlet
08	Invert.. 15.500 Ft
09	Ent Ke.. 0.200
10	
11	BW Steps 10
12	
13	
14	
15	HW PE/KE NO
16	TW PE/KE NO
17	Max HW.. 20.000 Ft
18	Max TW.. 18.000 Ft

Path 002 Output Data	Type PIPE US Std
00	Input ID 1011025088
01	Flow T0. 0.000 CFS
02	Vol T0.. 0 CF
03	Max In.. 10.303 CFS
04	Min In.. 0.000 CFS
05	Max Out. 10.303 CFS
06	Min Out. 0.000 CFS
07	
08	
09	
10	
11	
12	
13	
14	
15	Fwd K... 0.000
16	Rev K... 0.000
17	Fwd X... 0.000
18	Rev X... 0.000

Path 003 from Node 004 (S-2) to Node 006 (S-3)

Path 003 ID 1011219854 Type DITCH	US Std
00 Length..	180.0 Ft
01 Mann N..	0.035
02 Lf Bank.	4.000 H:V
03 Rt Bank.	4.000 H:V
04 Inlet	
05 Invert..	15.550 Ft
06 Bottom..	5.000 Ft
07 Ent Ke..	0.050
08 Outlet	
09 Invert..	13.820 Ft
10 Bottom..	5.000 Ft
11 Ent Ke..	0.050
12	
13 BW Steps	10
14	
15 HW PE/KE NO	
16 TW PE/KE NO	
17 Max HW..	18.000 Ft
18 Max TW..	18.000 Ft

Path 003 Output Data Type DITCH	US Std
00 Input ID 1011219854	
01 Flow T0.	0.000 CFS
02 Vol T0..	0 CF
03 Max In..	10.294 CFS
04 Min In..	0.000 CFS
05 Max Out.	10.294 CFS
06 Min Out.	0.000 CFS
07	
08	
09	
10	
11	
12	
13	
14	
15 Fwd K...	0.000
16 Rev K...	0.000
17 Fwd X...	0.000
18 Rev X...	0.000

Path 004 from Node 005 (R/W2) to Node 000 (OUTFALL)

Path 004 ID 945448800 Type DIRECT	US Std
00 DIRECT..----------	
01	
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
12	
13	
14	
15 HW PE/KE NO	
16 TW PE/KE NO	
17 Max HW..	20.000 Ft
18 Max TW..	18.000 Ft

Path 004 Output Data Type DIRECT	US Std
00 Input ID 945448800	
01 Flow T0.	0.000 CFS
02 Vol T0..	0 CF
03 Max In..	29.662 CFS
04 Min In..	0.000 CFS
05 Max Out.	29.662 CFS
06 Min Out.	0.000 CFS
07	
08	
09	
10	
11	
12	
13	
14	
15 Fwd K...	0.000
16 Rev K...	0.000
17 Fwd X...	0.000
18 Rev X...	0.000

Path 005 from Node 006 (S-3) to Node 000 (OUTFALL)

Path 005 ID 1011219903
Type DITCH US Std

00	Length..	102.0	Ft
01	Mann N..	0.035	
02	Lf Bank.	4.000	H:V
03	Rt Bank.	4.000	H:V
04	Inlet		
05	Invert..	13.820	Ft
06	Bottom..	5.000	Ft
07	Ent Ke..	0.050	
08	Outlet		
09	Invert..	8.500	Ft
10	Bottom..	5.000	Ft
11	Ent Ke..	0.050	
12			
13	BW Steps	10	
14			
15	HW PE/KE	NO	
16	TW PE/KE	NO	
17	Max HW..	18.000	Ft
18	Max TW..	18.000	Ft

Path 005 Output Data
Type DITCH US Std

00	Input ID	1011219903	
01	Flow T0.	0.000	CFS
02	Vol T0..	0	CF
03	Max In..	10.210	CFS
04	Min In..	0.000	CFS
05	Max Out.	10.210	CFS
06	Min Out.	0.000	CFS
07			
08			
09			
10			
11			
12			
13			
14			
15	Fwd K...	0.000	
16	Rev K...	0.000	
17	Fwd X...	0.000	
18	Rev X...	0.000	

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Project Run Converged.

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ACCUMULATED MASS BALANCE ERROR..........	0.0728 Acre Feet
ERROR AS A PERCENT OF OUTFLOW...........	0.2706 Percent

Project Contains 7 Nodes.

Node 000 Name OUTFALL						Input# 945465799
Type STAGING						US Std
00	Flood El.	18.000	Ft	PE to KE. NO		
01						
02	Time.....		Hrs	Stage El.		Ft
03	Time.....		Hrs	Stage El.		Ft
04	Time.....		Hrs	Stage El.		Ft
05	Time.....		Hrs	Stage El.		Ft
06	Time.....		Hrs	Stage El.		Ft
07	Time.....		Hrs	Stage El.		Ft
08	Time.....		Hrs	Stage El.		Ft
09	Time.....		Hrs	Stage El.		Ft
10	Time.....		Hrs	Stage El.		Ft
11	Time.....		Hrs	Stage El.		Ft
12	Time.....		Hrs	Stage El.		Ft
13						
14						
15						
16						
17	Base Flow		CFS	Stage T0.	12.500	Ft
18	X Coord..		Ft	Y Coord..		Ft

Node 000 Name OUTFALL — Output Data
Type STAGING — US Std

00	Input ID......................	945465799
01	Flood Elevation Reached.......	NO
02	Initial Stage Elevation.......	12.500 Feet
03	Initial Storage...............	0 CF
04	Maximum Stage Reached.........	12.500 Feet
05	Minimum Stage Reached.........	12.500 Feet
06	Maximum Gross Storage.........	0 CF
07	Maximum Detention Storage.....	0 CF
08	Final Stage Elevation.........	12.500 Feet
09	Time of Maximum Stage.........	0.000 Hours
10	Time of Minimum Stage.........	0.000 Hours
11		
12		
13	Peak Nodal Intake.............	29.662 CFS
14	Time of Peak Intake...........	12.500 Hours
15	Peak Nodal Output.............	0.000 CFS
16	Time of Peak Output...........	0.000 Hours
17	Points Out of Tolerance.......	0
18	Maximum Stage Error...........	0.000 Feet

Node 001 Name S-1 — Input# 945448440
Type JUNCTION — US Std

00	Flood El. 20.000 Ft	
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
13		
14		
15		
16		
17	Base Flow 0.00 CFS	Stage T0. Ft
18	X Coord.. Ft	Y Coord.. Ft

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Node 001 Name S-1		Output Data
Type JUNCTION		US Std
00	Input ID......................	945448440
01	Flood Elevation Reached.......	NO
02	Initial Stage Elevation.......	15.600 Feet
03	Initial Storage...............	0 CF
04	Maximum Stage Reached.........	17.074 Feet
05	Minimum Stage Reached.........	15.600 Feet
06	Maximum Gross Storage.........	0 CF
07	Maximum Detention Storage.....	0 CF
08	Final Stage Elevation.........	16.314 Feet
09	Time of Maximum Stage.........	15.300 Hours
10	Time of Minimum Stage.........	0.000 Hours
11		
12		
13	Peak Nodal Intake.............	10.311 CFS
14	Time of Peak Intake...........	15.300 Hours
15	Peak Nodal Output.............	10.303 CFS
16	Time of Peak Output...........	15.300 Hours
17	Points Out of Tolerance.......	0
18	Maximum Stage Error...........	0.000 Feet

Node 002 Name R/W1				Input# 1011025135
Type SUBAREA				US Std
00	Subarea..	SB10-WD8	File	Flood El. 20.00 Ft
01	File ID#.	1011021666		
02	Alt Type.	RNF002		
03	Run Time.	30.100	Hrs	
04	Delta T..	0.100	Hrs	
05	NumData..	302	Pts	
06	Storm....	SCS_IIM	File	
07	Duration.	24.000	Hrs	
08	Rainfall.	8.640	In	
09	Excess...	5.804	In	
10	Area.....	19.950	Ac	
11	TC.......	1.138	Hrs	
12	TP.......	12.800	Hrs	
13	Peak Flow	35.852	CFS	
14	Volume...	9.662	AcFt	
15	Executed.	YES		
16				
17	Base Flow	0.00	CFS	Stage T0. Ft
18	X Coord..		Ft	Y Coord.. Ft

Node 002 Name R/W1 — Output Data
Type SUBAREA — US Std

00	Input ID......................	1011025135
01	Flood Elevation Reached.......	NO
02	Initial Stage Elevation.......	20.000 Feet
03	Initial Storage...............	0 CF
04	Maximum Stage Reached.........	20.000 Feet
05	Minimum Stage Reached.........	20.000 Feet
06	Maximum Gross Storage.........	0 CF
07	Maximum Detention Storage.....	0 CF
08	Final Stage Elevation.........	20.000 Feet
09	Time of Maximum Stage.........	0.000 Hours
10	Time of Minimum Stage.........	0.000 Hours
11		
12		
13	Peak Nodal Intake.............	35.852 CFS
14	Time of Peak Intake...........	12.800 Hours
15	Peak Nodal Output.............	35.852 CFS
16	Time of Peak Output...........	12.800 Hours
17	Points Out of Tolerance.......	0
18	Maximum Stage Error...........	0.000 Feet

Node 003 Name WDA8 — Input# 1011025193
Type POND — US Std

00	Top El...	20.000	Ft	Top Area.	3.070	Ac
01	El.......	18.000	Ft	Area.....	2.800	Ac
02	El.......	17.000	Ft	Area.....	2.660	Ac
03	El.......		Ft	Area.....		Ac
04	El.......		Ft	Area.....		Ac
05	El.......		Ft	Area.....		Ac
06	El.......		Ft	Area.....		Ac
07	El.......		Ft	Area.....		Ac
08	El.......		Ft	Area.....		Ac
09	El.......		Ft	Area.....		Ac
10	Bot El...	12.000	Ft	Bot Area.	2.030	Ac
11						
12	Top Perim		Ft	Side %Per		Pct
13	Mid Perim		Ft	Base %Per		Pct
14	Bot Perim		Ft			
15						
16						
17	Base Flow	0.00	CFS	Stage T0.	17.000	Ft
18	X Coord..		Ft	Y Coord..		Ft

Node 003 Name WDA8 Type POND		Output Data US Std
00	Input ID	1011025193
01	Flood Elevation Reached	NO
02	Initial Stage Elevation	17.000 Feet
03	Initial Storage	510741 CF
04	Maximum Stage Reached	18.864 Feet
05	Minimum Stage Reached	16.999 Feet
06	Maximum Gross Storage	740178 CF
07	Maximum Detention Storage	229437 CF
08	Final Stage Elevation	18.374 Feet
09	Time of Maximum Stage	15.300 Hours
10	Time of Minimum Stage	5.600 Hours
11		
12		
13	Peak Nodal Intake	35.852 CFS
14	Time of Peak Intake	12.800 Hours
15	Peak Nodal Output	10.311 CFS
16	Time of Peak Output	15.300 Hours
17	Points Out of Tolerance	0
18	Maximum Stage Error	0.000 Feet

Node 004 Name S-2 Type JUNCTION		Input# 945449645 US Std
00	Flood El. 18.000 Ft	
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
13		
14		
15		
16		
17	Base Flow 0.00 CFS	Stage T0. Ft
18	X Coord.. Ft	Y Coord.. Ft

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Node 004 Name S-2 Type JUNCTION		Output Data US Std
00	Input ID......................	945449645
01	Flood Elevation Reached.......	NO
02	Initial Stage Elevation.......	15.500 Feet
03	Initial Storage...............	0 CF
04	Maximum Stage Reached.........	16.162 Feet
05	Minimum Stage Reached.........	15.500 Feet
06	Maximum Gross Storage.........	0 CF
07	Maximum Detention Storage.....	0 CF
08	Final Stage Elevation.........	15.841 Feet
09	Time of Maximum Stage.........	15.300 Hours
10	Time of Minimum Stage.........	0.000 Hours
11		
12		
13	Peak Nodal Intake.............	10.303 CFS
14	Time of Peak Intake...........	15.300 Hours
15	Peak Nodal Output.............	10.294 CFS
16	Time of Peak Output...........	15.300 Hours
17	Points Out of Tolerance.......	0
18	Maximum Stage Error...........	0.000 Feet

Node 005 Name R/W2 Type SUBAREA				Input# 945466861 US Std
00	Subarea..	SB10-SY1	File	Flood El. 20.00 Ft
01	File ID#.	945381905		
02	Alt Type.	RNF002		
03	Run Time.	27.800	Hrs	
04	Delta T..	0.100	Hrs	
05	NumData..	279	Pts	
06	Storm....	SCS_IIM	File	
07	Duration.	24.000	Hrs	
08	Rainfall.	8.640	In	
09	Excess...	5.405	In	
10	Area.....	12.960	Ac	
11	TC.......	0.695	Hrs	
12	TP.......	12.500	Hrs	
13	Peak Flow	29.662	CFS	
14	Volume...	5.845	AcFt	
15	Executed.	YES		
16				
17	Base Flow	0.00	CFS	Stage T0. Ft
18	X Coord..		Ft	Y Coord.. Ft

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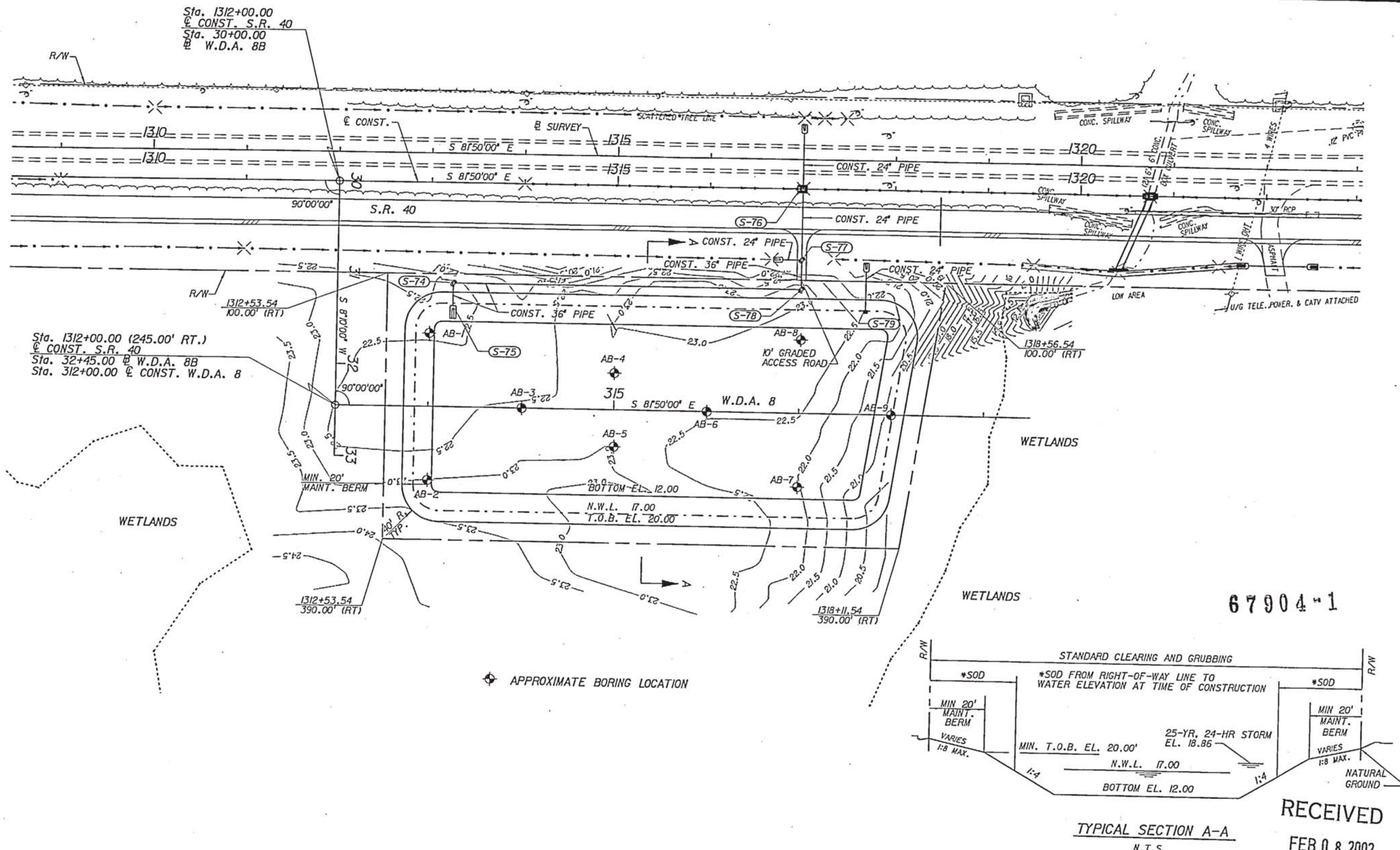
Node 005 Name R/W2 Type SUBAREA		Output Data US Std
00	Input ID......................	945466861
01	Flood Elevation Reached.......	NO
02	Initial Stage Elevation.......	20.000 Feet
03	Initial Storage...............	0 CF
04	Maximum Stage Reached.........	20.000 Feet
05	Minimum Stage Reached.........	20.000 Feet
06	Maximum Gross Storage.........	0 CF
07	Maximum Detention Storage.....	0 CF
08	Final Stage Elevation.........	20.000 Feet
09	Time of Maximum Stage.........	0.000 Hours
10	Time of Minimum Stage.........	0.000 Hours
11		
12		
13	Peak Nodal Intake.............	29.662 CFS
14	Time of Peak Intake...........	12.500 Hours
15	Peak Nodal Output.............	29.662 CFS
16	Time of Peak Output...........	12.500 Hours
17	Points Out of Tolerance.......	0
18	Maximum Stage Error...........	0.000 Feet

Node 006 Name S-3 Type JUNCTION		Input# 1011219929 US Std
00	Flood El. 18.000 Ft	
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
13		
14		
15		
16		
17	Base Flow 0.00 CFS	Stage T0. Ft
18	X Coord.. Ft	Y Coord.. Ft

Node 006 Name S-3 Type JUNCTION		Output Data US Std
00	Input ID......................	1011219929
01	Flood Elevation Reached.......	NO
02	Initial Stage Elevation.......	13.820 Feet
03	Initial Storage...............	0 CF
04	Maximum Stage Reached.........	14.259 Feet
05	Minimum Stage Reached.........	13.820 Feet
06	Maximum Gross Storage.........	0 CF
07	Maximum Detention Storage.....	0 CF
08	Final Stage Elevation.........	13.999 Feet
09	Time of Maximum Stage.........	15.300 Hours
10	Time of Minimum Stage.........	0.000 Hours
11		
12		
13	Peak Nodal Intake.............	10.294 CFS
14	Time of Peak Intake...........	15.300 Hours
15	Peak Nodal Output.............	10.210 CFS
16	Time of Peak Output...........	15.300 Hours
17	Points Out of Tolerance.......	0
18	Maximum Stage Error...........	0.000 Feet

FINANCIAL PROJ. ID.	SHEET NO.
241009-1-52-01	107



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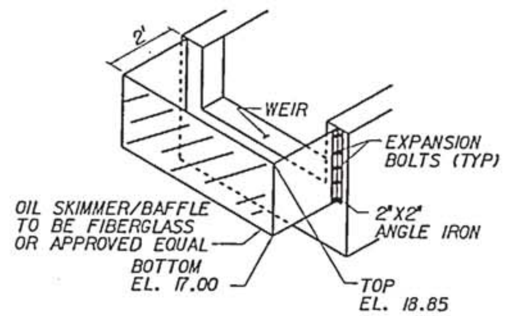
1900 CORPORATE SQUARE BLVD.
JACKSONVILLE, FLORIDA 32216

WDA NO. 8

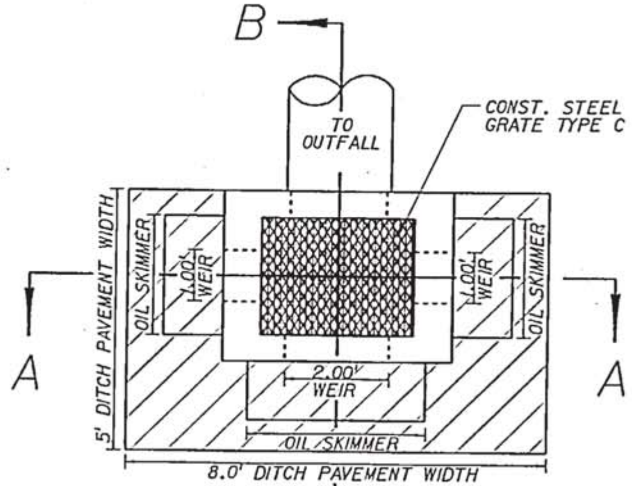
31-JAN-2002
K:\98017 SR 40\drdtrd08.dgn

FINANCIAL PROJ. ID.	SHEET NO.
241009-1-52-01	112

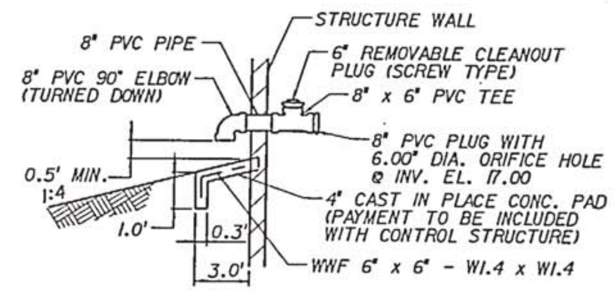
* NOTE: THE COST OF DITCH PAVEMENT IS INCLUDED IN THE COST OF CONTROL STRUCTURE.



OIL SKIMMER/ BAFFLE DETAIL

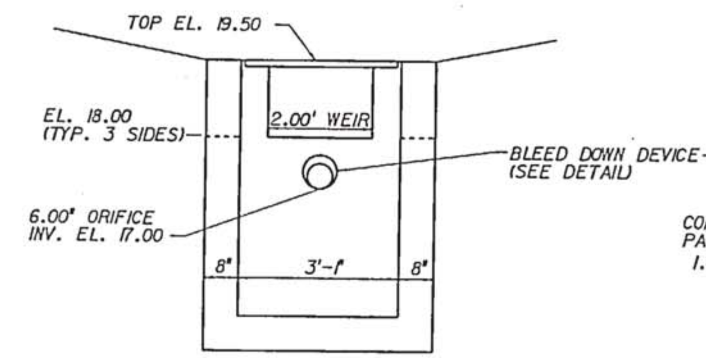


TOP VIEW

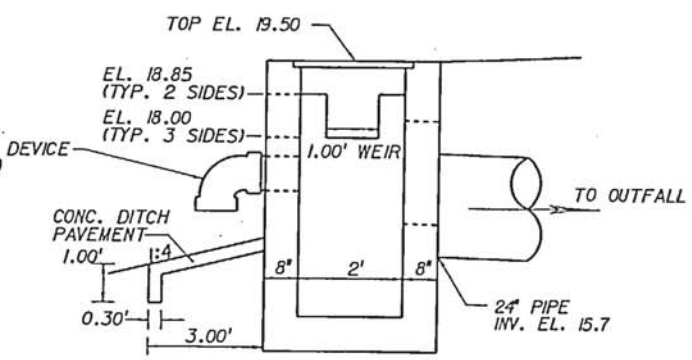


BLEED DOWN DEVICE DETAIL

NTS



SECTION A-A



SECTION B-B

W.D.A. NO. 8 CONTROL STRUCTURE - S-79

INLET TYPE C (SPECIAL)

67904-1

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ALTAMONTE SVC. CTR.

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REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

BHR
1500 CORPORATE SQUARE BLVD. JACKSONVILLE, FLORIDA

DRAINAGE DETAILS
CONTROL STRUCTURE

SR 40

TYMBER CREEK ROAD TO I-95

DRAINAGE CALCULATIONS

ADDENDUM
JULY 1994

STATE PROJECT NO. 79100-3523
WORK PROGRAM ITEM NO. 5119223
VOLUSIA COUNTY

PREPARED BY:

FARSHAD FARAHBAKHSH

SUPERVISED BY:

ANTHONY J. BRYAN, P.E.
DISTRICT 5 DRAINAGE ENGINEER
P.E. LICENSE NO. 36759

NOVEMBER 1993

Subject: SR 40	Sheet 1 of 47	WPI No. 5119223
System II	Project No. 79100-3523	
Pre-Dev.	Prepared by F.F.	Date 9,30,92
	Checked by	Date

From Sta 1347+00 To Sta 1365+20 $L = 1,820'$

Drainage Area 23.86 AC $= .0373\ mile^2$

Project Area 8.36 AC

Pre-Dev.

Project. IMP. $1820' \times 36.4' = 1.52\ Ac \Rightarrow CN = 98$

Per. Soil, D, $650' \times 163.6' = 2.44\ Ac$, grass, Fair $CN = 84$

Soil A, $1170' \times 163.6' = 4.4\ Ac$, grass, Fair $CN = 49$

offsite

Comm. Soil, C 1.5 AC $CN = 94$

Resid. 1/2 Ac Soil, A 4.3 Ac $CN = 54$

Tymber Creek Rd IMP. 0.3 AC. $CN = 98$

Per. Soil D 0.3 Ac $CN = 84$

grass land, Fair, 7.0 Ac. Soil D $CN = 84$

woods, Fair, Soil A, 2.1 AC $CN = 36$

$P_{25yr-24hr} = 9''$

$P_{2yr-24hr} = 5''$

$$WCN = \frac{(1.52+.3)98+(2.44+.3+7)84+(4.4)49+(4.3)54+(1.5)94+(2.1)36}{23.86} = 69.6 \Rightarrow 70$$

$Q_{25} = 5.33''$, $I_a = .857$, $I_a/P = .1$

Tc; Ave slope from bank of ditch @ Sta 1348+00 To R/W $\frac{22.2-21.8}{73'} = .0055'/ft$

from 435' Rt of R/W @ Sta 1348+00

Ave $S = .0055'/ft \Rightarrow$ $V = 1.2'/s$ (overland)

$$T_t = \frac{.007(.15 \times 300)^{.8}}{\sqrt{5}\ (.0055)} = .53\ hr = 31.8\ min$$

$$T_t = \frac{135'}{1.2 \times 60} = 1.9\ min, \quad \frac{73'}{1.2 \times 60} = 1.0\ min$$

elev. at Sta 1360+00, 15.1

Ave $S = \frac{19-15.1}{1200} = .0033'/ft$ using $V = .9'/s$ (max

$$T_t = \frac{1200}{.9 \times 60} = 22.2\ min$$

Total $TC = 31.8 + 1.9 + 1 + 22.2 = 56.9\ min = .95\ hrs$

$q_{u\ SCS\ III} = 300\ csm/in$

$Q_{Pre} = .0373 \times 300 \times 5.33 = 59.6\ CFS$

$V_r = 23.86 \times \frac{5.33''}{12} = 10.6\ Ac\text{-}ft$

RECYCLED PAPER 621-466

FORM 625-020-01-a
STRUCTURES - 02/91

	Subject: SR 40	Sheet 3 of	WPI No. 5119223
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		Project No. 79100-3523	
	System II	Prepared by F.F.	Date 10, 2, 92
	Post-Dev.	Checked by	Date

From Sta 1347+00 To Sta 1365+20. $L = 1820'$

Drainage Area 23.86 Ac = .0373 $mile^2$

Project Area 8.36 Ac

Post-Dev.

Project: IMP. 1820' x 60' = 3.12 Ac => CN = 98

Per. Soil, D, 650' 0.57 Ac => CN = 84

Soil, A, 1170' 4.67 Ac => CN = 49

Pond: water 0.6 Ac, CN = 98

Berm 0.4 Ac Soil A grass good Cond. CN = 36

Offsite: Comm. Soil, C, 1.5 Ac CN = 94

Resid. 1/2 Ac lot Soil A, 4.3 Ac CN = 54

Tymbe Creek Rd IMP. 0.3 Ac CN = 98

Per. 0.3 Ac, Soil D CN = 84

Clear land, Fair 7.0 Ac, Soil D CN = 84

Woods, Fair, Soil A 1.1 Ac CN = 36

$$WCN = \frac{(3.12+.6+.3)98+(0.57+.3+7)84+(4.67)49+(1.5)94+(4.3)54+(.4+1.1)36}{23.86} = 71.7 = 72$$

$Q = 5.58''$, $I_a = .778$, $I_a/p = .086 \Rightarrow 0.1$

TC: To ditch at sta 1348+00 From Pre-Dev. C/C. 33.7 min

elev. at ditch sta 1348+00, 18.8 => Ave S = .002 ft/ft

elev. at ditch sta 1359+50, 16.0 Use max V = 4'/s

$t_t = \frac{1150}{4 \times 60} = 4.8$ min Total TC = 33.7 + 4.7 = 38.5 min = .64

From sh#8 use .9 ft/s velocity ∴ $33.7 + \frac{1150}{.9 \times 60} = 55$ min

$q_{u\,SCS\,III}$ = 310 CSM/in

$Q_{Post} = .0373 \times 310 \times 5.58 = 64.5$ CFS

$\frac{Q_{Pre}}{Q_{Post}} = \frac{59.6}{64.5} = 0.92$ use 0.8 ∴ $\frac{V_S}{V_r} = .175$

$V_r = 53.33 \times 5.58 \times .0373 = 11.1$ ac-ft ∴ $V_S = .175 \times 11.1 = 1.94$ ac-ft

wet line, Retention, Underdrain (OFW) W.Q = $23.86 \times \frac{.75''}{12} = \boxed{1.49 \text{ Ac-ft}}$

Total volume = 1.94 + 1.49 = $\boxed{3.43 \text{ ac-ft}}$

25yr-24hr Pre-Post runoff volume = $23.86\,\frac{(5.58 - 5.33'')}{12} = 0.5$ Ac-ft

RECYCLED PAPER 621-466

FORM 625-020-01-a
STRUCTURES - 02/91

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	Subject: SR 40 System III Pre Dev.	Sheet 1 of 37	WPI No. 5119223
		Project No. 79100-3523	
		Prepared by F.F.	Date 10/15/92
		Checked by	Date

Basin 100: Sta 1365+20 - Sta 1375+00   L = 980'

R/W 980' x 200' = 4.5 Ac

Woods (0.9+0.6) = 1.5 Ac

1/2 Booth Rd & Drwy (.4+.1) = 0.5 Ac

Total Drainage Area 6.50 Ac = 0.0102 $mile^2$

R/W IMP. (.88+.09) = 0.97 Ac ⇒ CN = 98

Per. Soil B, 150' x 166' = 0.57 Ac ⇒ CN = 84

Soil A, 2.96 Ac ⇒ CN = 49

Woods 1.5 Ac ⇒ CN = 36

Booth Rd & Drwy IMP. 0.1 Ac ⇒ CN = 98

Per. 0.4 Ac ⇒ CN = 49

$$WCN = \frac{(.97+.1)98 + (.57)84 + (2.96+.4)49 + (1.5)36}{6.5} = 57.1 \Rightarrow 57$$

$Q = 3.73''$, $I_a = 1.509$, $I_a/p = 0.17$, $q_{u\,SCS\,III} = 440$ csm/in

TC: From 235' Rt of ditch @ Sta 1374+00

Ave slope from x-sec. ⇒ Ave $S = \frac{23-21.9}{90} = .015'/ft$

$$T_t = \frac{.007(.15 \times 235)^{.8}}{\sqrt{5}\ (.015)^{.4}} = 0.29\ hr = 17.4\ min$$

Using V = 1.3'/s for Existing Ditch from Sh No. 10

From 1374+00 To Sta 1371+00 (Proposed x-Drain/interance to Pond)

$t_t = \frac{300'}{1.3 \times 60} = 3.8\ min$ Total Tc = 17.4 + 3.8 = $\boxed{21.2\ min}$

$Q_{Pre} = .0102 \times 440 \times 3.73 = 16.7$

$V_r = 6.50 \times \frac{3.73''}{12} = 2.02$ Ac-ft

RECYCLED PAPER 621-466

Subject: SR 40 System III POST-DeV.	Sheet 4 of	WPI No. 5119223
	Project No. 79100-3523	
	Prepared by F.F.	Date 10,12,92
	Checked by	Date

Sta 1365+20 - Sta 1375+00 => L = 980'

R/W 980 x 200' = 4.5 Ac

Pond 280' x 140' = 0.90 Ac

Woods 0.60 Ac

1/2 Booth Rd Drwy (.40 + .1) 0.50 Ac

Total Drainage Area 6.5 Ac = .0102 mile^2

R/W Imp From Sh No. 3 = 1.79 Ac CN = 98

Per. Soil D, 150 x 114 = 0.39 Ac CN = 84

Soil A, 2.32 Ac CN = 49

Pond Soil A, 0.45 Ac CN = 36

Water 0.45 Ac CN = 98

Woods 0.6 Ac CN = 36

Booth Rd & Drwy Imp. 450 x 10 = 0.10 Ac CN = 98

Per 0.40 Ac CN = 49

$$WCN = \frac{(1.79+.45+.10)98+(.39)84+(2.32+.40)49+(.45+.6)36}{6.50} = 66.6$$

$Q = 4.92''$, $I_a = 0.985$, $I_a/p = 0.11$

TC: From 170' Rt of Prop. ditch at Sta 1374+00 → $T_t = \frac{.007(.15 \times 170)^{.8}}{\sqrt{5}\,(.015)^{.4}} = 0.22 = 13.4\,min$

use V from Sh No. 9 for 25yr V = 0.6'/s

$13.4 + T_t \frac{300}{.6 \times 60} = \boxed{21.7\,min}$

q_u SCS III = 460 csm/in

$Q_{Post} = .0102 \times 460 \times 4.92 = 23.1$ CFS

$\frac{Q_{Pre}}{Q_{Post}} = \frac{16.7}{23.1} = 0.72 \Rightarrow \frac{V_s}{V_r} = 0.2$

$V_r = 53.33 \times 4.92'' \times .0102 = 2.68$ ac-ft ∴ $V_s = 0.54$ Ac-ft

off line (OFW) W.Q. $6.5 \times \frac{.75''}{12} = 0.41$ Ac-ft or $\frac{1.88''}{12} \times 1.79 = 0.28$ Ac-ft => $\boxed{0.41\ Ac\text{-}ft}$

Total Storage 0.54 + 0.41 = 0.95 ac-ft

-25yr-24hr Pre-Post runoff Volume : $6.5\left(\frac{4.92'' - 3.73''}{12}\right) = 0.64$ Ac-ft

Provided storage volume below weir is 0.94 Ac-ft > 0.64 Ac-ft ∴ ok

Supplemental information to Addendum to the DRAINAGE CALCULATIONS BOOK

TO SUPPORT THE
ST. JOHN'S RIVER WATER MANAGEMENT DISTRICT
REQUEST FOR ADDITIONAL INFORMATION
FOR

SJRWMD PERMIT APPLICATION NUMBER:
4-127-0238AGM4-ERP

INTERSTATE 95/SR 9
FDOT FINANCIAL PROJECT NUMBER:
242695-1-52-01
U.S. 92 to Airport Boulevard Overpass
Volusia County, Florida

93036-5

PREPARED FOR:
FLORIDA DEPARTMENT OF TRANSPORTATION
DISTRICT 5
719 S. WOODLAND BLVD.
DELAND, FL 32720

PREPARED BY:.
METRIC ENGINEERING, INC.
2269 LEE ROAD, SUITE 200
WINTER PARK, FL 32789

Joseph Yand
3/12/01

APRIL 2001

The post development drainage basin for Basin 900 is delineated on Figures IV-8, IV-9, IV-10, and IV-11. Figure IV-25 shows the post nodal diagram, and Figure IV-26 shows the proposed pond typical section.

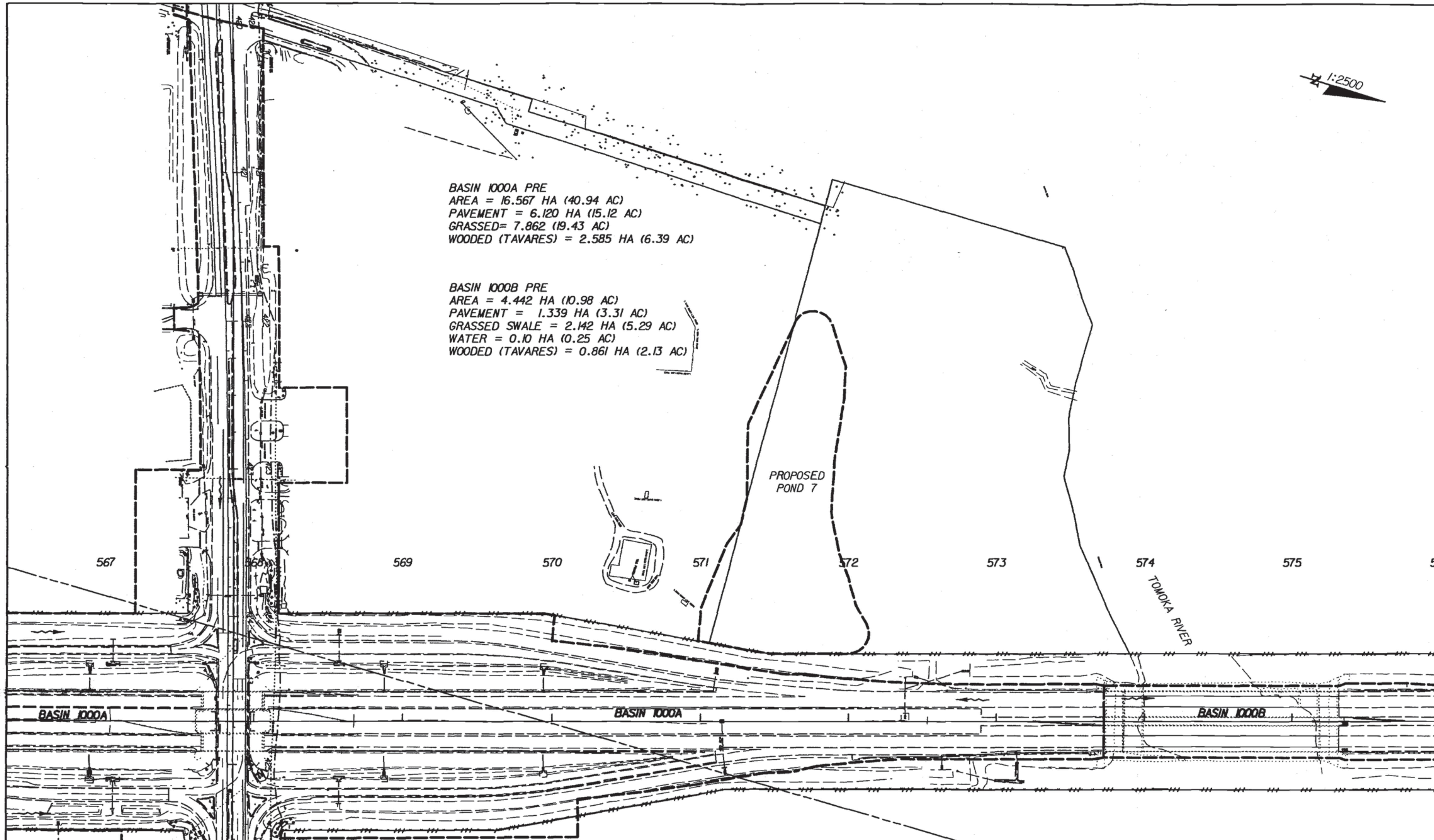
Basin 1000

Basin 1000 is located between Station 567+86, the high point of the proposed bridge over SR 40 to Station 587+50, the Airport Boulevard bridge over Interstate 95. This basin is divided into two sub-basins, 1000A and 1000B.

Basin 1000A spans from Station 567+86 to Station 573+72.077, the north end of the dual bridges over the Tomoka River. This basin is 17.93 Ha (44.31 Ac) of which 8.648 Ha (23.84 Ac) are impervious. Water quality and increased runoff attenuation from this basin, which includes the ramps from the reconstructed SR 40 interchange and additional impervious from the future six laning of SR 40, will be handled in the proposed Pond 7, located west of the interstate, south of the Tomoka River, between Station 571+15 and Station 572+25. This pond is proposed to be a dry pond, 1.286 Ha (3.178 ac) at the bottom, with outfall to the Tomoka River via the existing roadside swale along Interstate 95. The post developed maximum discharge and maximum stage for Pond 7 for the 25 year/24 hour storm event is 3.96 m^3/s (139.85 cfs) and 5.40 m, respectively, as shown on Table IV-1 which summarizes Basin 1000A/Pond 7 post development conditions. The post development drainage basin for Basin 1000A is delineated on Figures IV-11, IV-11A, IV-11B, and IV-12. Figure IV-27 shows the post nodal diagram, and Figure IV-28 shows the proposed pond typical section.

Basin 1000B spans from Station 573+72.077 to Station 587+50, the Airport Boulevard bridge over Interstate 95. This basin is 4.60 Ha (11.37 Ac) of which 2.954 Ha (7.30 Ac) are impervious. Water quality and increased runoff attenuation from this basin will be handled in the proposed Pond 8, located east of the interstate, north of the Tomoka River, between Station 577+00 and Station 579+00. This pond is proposed to be a wet pond, 0.654 Ha (1.617 ac) at the normal control, with outfall to the Tomoka River via existing roadside swales along Interstate 95. The post developed maximum discharge and maximum stage for Pond 8 for the 25 year/24 hour storm event is 0.90 m^3/s (31.8 cfs) and 4.53 m, respectively, as shown on Table IV-1 which summarizes Basin 1000B/Pond 8 post development conditions. The post development drainage basin for Basin 1000B is delineated on Figures IV-11A, IV-12, and IV-13. Figure IV-29 shows the post nodal diagram, and Figure IV-30 shows the proposed pond typical section.

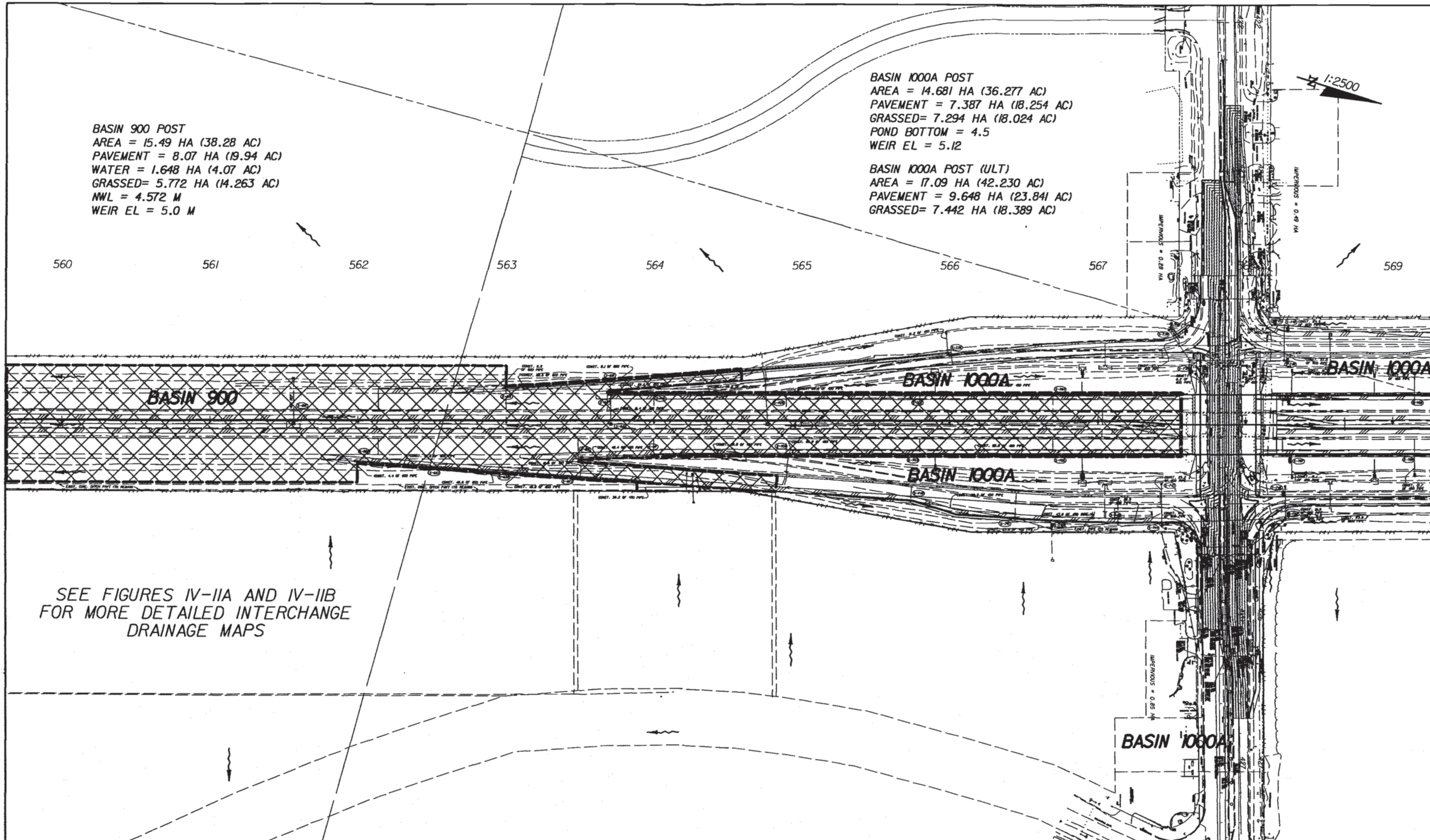
The following Table IV-1 shows the post developed conditions summary for the basins located within the project boundaries.



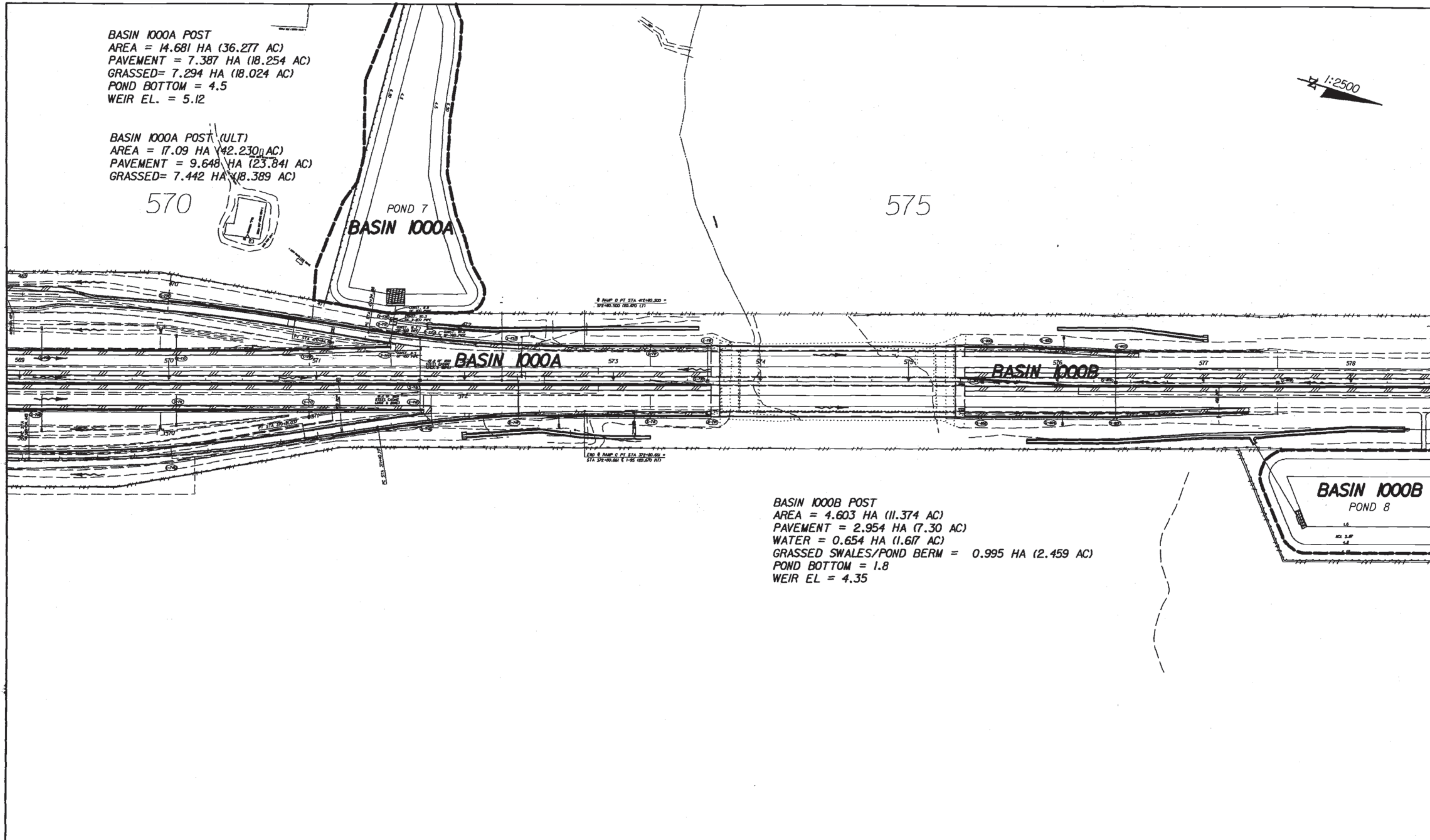
INTERSTATE 95 - SIX LANING
DRAINAGE REPORT

PRE-DEVELOPMENT BASIN
BASIN 1000A

FIG.
III-12



INTERSTATE 95 - SIX LANING DRAINAGE REPORT	POST-DEVELOPMENT BASIN BASIN 900	FIG. IV-11



INTERSTATE 95 - SIX LANING DRAINAGE REPORT	POST DEVELOPMENT BASIN BASIN 1000B	FIG. IV-12

CURVE NUMBER CALCULATION

METRIC ENGINEERING INC.

PROJECT TITLE:	I-95 SIX LANING			
PROJECT NUMBER:	4.1283			
FILE NAME:	BSN1000.123			
BASIN NAME:	BASIN 1000A	**MADE BY:**	CSD	06-Apr-01
BASIN ANALYSIS (PRE/POST):	POST	**CHECKED BY:**	JY	06-Apr-01

LAND-USE DESCRIPTION	SOIL NAME	SOIL GROUP	CN	AREA (HA)	PRODUCT
GRASSED SWALE/POND BERM	TAVARES	A	69	7.44	513.36
ROADWAY	TAVARES	A	98	9.65	945.50
			TOTALS	**17.09**	**1458.86**

COMPOSITE CN	**85.37**

METRIC ENGINEERING, INC. ENGINEERS, PLANNERS, SURVEYORS	JOB #: 4.1315 SHEET ___ OF ___ PROJECT NAME: I-95 SUBJECT: POND 7 CALCULATED BY: CSD DATE: REV.12/29/00 CHECKED BY: JY DATE: 1/4/01

POND 7 (BASIN 1000A)

1) WATER QUALITY CALCULATIONS

INTERIM CONDITIONS

- TOTAL BASIN AREA = 14.681 HA
- PAVED AREA = 7.387 HA

(For Offline Retention Systems)

A) 12.7 mm (1/2") over total basin area + 50% (OFW*)
= 1.5 x [14.681 ha x 12.7 mm x (10,000 m^2/1 ha) x (1 m/1000 mm)]
= 2796.7 m^3

B) 31.75 mm (1.25") over impervious area (For Dry Retention Ponds) + 50% (OFW*)
= 1.5 x [7.387 ha x 31.75 mm x (10,000 m^2/1 ha) x (1 m/1000 mm)]
= 3518.0 m^3 ← GOVERNS

∴ *INTERIM TREATMENT VOLUME REQUIRED = 3518.0 M^3 = 2.852 AC-FT*

* Outstanding Florida Waters

ULTIMATE CONDITIONS *(includes Six Laning SR40)*

- TOTAL BASIN AREA = 17.09 HA
- PAVED AREA = 9.648 HA

A) 12.7 mm (1/2") over total basin area + 50% (OFW*)
= 1.5 x [17.09 ha x 12.7 mm x (10,000 m^2/1 ha) x (1 m/1000 mm)]
= 3255.65 m^3

B) 31.75 mm (1.25") over impervious area (For Dry Retention Ponds) + 50% (OFW*)
= 1.5 x [9.648 ha x 31.75 mm x (10,000 m^2/1 ha) x (1 m/1000 mm)]
= 4594.9 m^3 ← GOVERNS
= 3.73 ac-ft REQUIRED

∴ *ULTIMATE TREATMENT VOLUME REQUIRED = 4594.9 M^3 = 3.73 AC-FT*

* Outstanding Florida Waters

2) TREATMENT VOLUME PROVIDED

Per enclosed stage-storage computer output (FDOT program DTBSINGR.EXE):

∴ *TREATMENT VOLUME PROVIDED = 3.73 – 0.0 = 3.73 AC-FT (4600.9 m^3)*

2) TREATMENT RECOVERY

For a dry retention system, the treatment volume must be recovered within 72 hours following the storm event assuming average antecedent moisture conditions. Per MODRET output data in Appendix B, this criteria has been satisfied for Pond 7 (just over 31.58 hours).

ELEVATION - STORAGE VALUES

Prgm : DTBSIN6R.VOL

DETENTION BASIN DESIGN

04-05-2001

Name of Storage Basin : POND7_REV040501

ELEVATION TOP STORAGE BASIN-FT ==> 21.3255

ELEVATION BOT STORAGE BASIN - FT ==> 14.7638

INCREMENTAL STAGE DEPTH - FT ==> 0.1

STORAGE BASIN AREA - ACRES AT TOP OF BASIN ==> 2.8121

STORAGE BASIN PERIMETER @ TOP OF BASIN ==> 1819.3570

AVERAGE SIDE SLOPE RATIO ==> 4

POND BOTTOM 14.7638 FT (4.5M)

0.0896 AC-F

STAGE EL.	AREA-ACRES	STORAGE-AC FT
0.00	0.000	0.00
14.83	1.730	0.09
14.93	1.740	0.26
15.03	1.760	0.43
15.13	1.780	0.61
15.23	1.790	0.79
15.33	1.810	0.97
15.43	1.830	1.15
15.53	1.840	1.34
15.63	1.860	1.52
15.73	1.880	1.71
15.83	1.890	1.90
15.93	1.910	2.09
16.03	1.930	2.28
16.13	1.940	2.47
16.23	1.960	2.67
16.33	1.980	2.86
16.43	1.990	3.06
16.53	2.010	3.26
16.63	2.030	3.46
16.73	2.040	3.67
16.83	2.060	3.87
16.93	2.080	4.08
17.03	2.090	4.29
17.13	2.110	4.50
17.23	2.130	4.71
17.33	2.140	4.92
17.43	2.160	5.14
17.53	2.180	5.36
17.63	2.190	5.57
17.73	2.210	5.79
17.83	2.230	6.02
17.93	2.240	6.24
18.03	2.260	6.47

TREATMENT VOLUME PROVIDED = 3.73 AC-FT (4600.9 M³)

3.8196 AC-

WEIR ELEVATION 16.805 FT (5.12 M)

ELEVATION - STORAGE VALUES

Prgm : DTBSIN6R.VOL

DETENTION BASIN DESIGN

04-05-2001

Name of Storage Basin : POND7_REV040501

ELEVATION TOP STORAGE BASIN-FT ==> 21.3255

ELEVATION BOT STORAGE BASIN - FT ==> 14.7638

INCREMENTAL STAGE DEPTH - FT ==> 0.1

STORAGE BASIN AREA - ACRES AT TOP OF BASIN ==> 2.8121

STORAGE BASIN PERIMETER @ TOP OF BASIN ==> 1819.3570

AVERAGE SIDE SLOPE RATIO ==> 4

STAGE EL.	AREA-ACRES	STORAGE-AC FT
18.13	2.280	6.69
18.23	2.290	6.92
18.33	2.310	7.15
18.43	2.330	7.38
18.53	2.340	7.62
18.63	2.360	7.85
18.73	2.380	8.09
18.83	2.390	8.33
18.93	2.410	8.57
19.03	2.430	8.81
19.13	2.440	9.05
19.23	2.460	9.30
19.33	2.480	9.55
19.43	2.490	9.79
19.53	2.510	10.04
19.63	2.530	10.30
19.73	2.540	10.55
19.83	2.560	10.81
19.93	2.580	11.06
20.03	2.590	11.32
20.13	2.610	11.58
20.23	2.630	11.84
20.33	2.650	12.11
20.43	2.660	12.37
20.53	2.680	12.64
20.63	2.700	12.91
20.73	2.710	13.18
20.83	2.730	13.45
20.93	2.750	13.72
21.03	2.760	14.00
21.13	2.780	14.28
21.23	2.800	14.56

*** End of This Calculation ***

APPENDIX 10

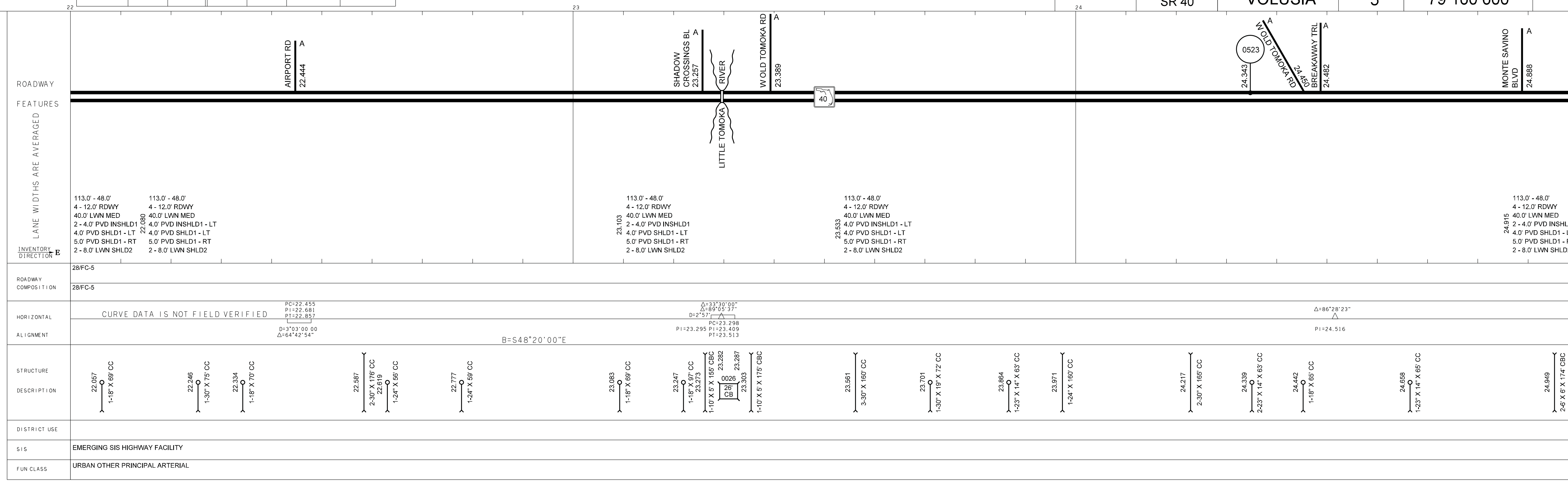
Straight Line Diagram

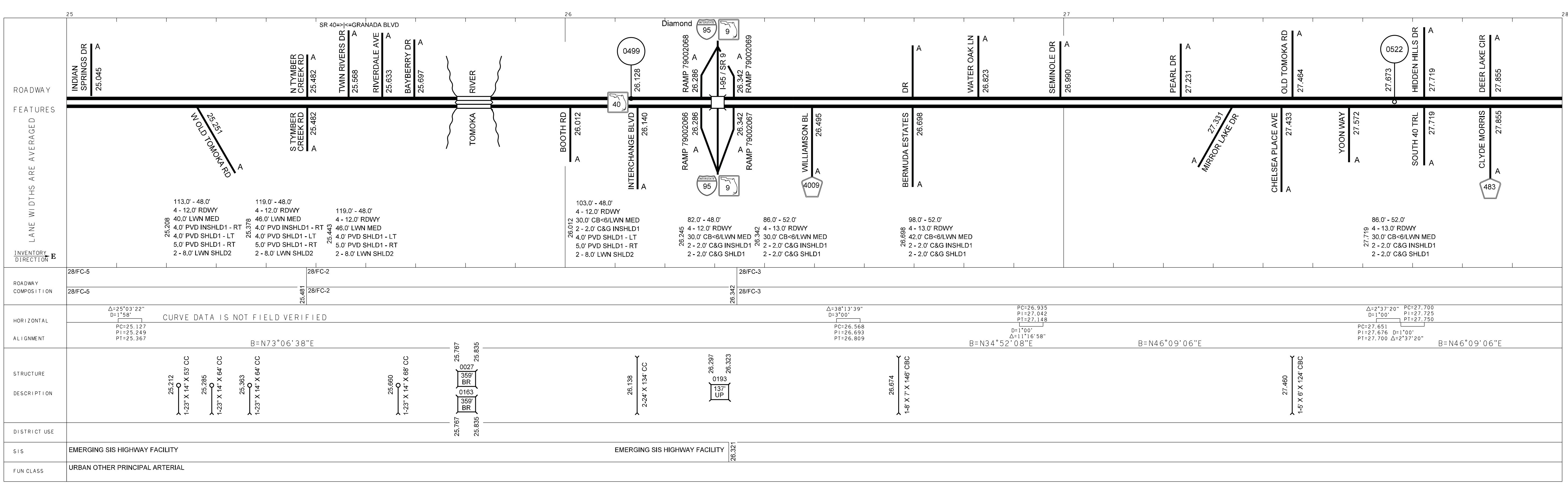
STRAIGHT LINE DIAGRAM OF ROAD INVENTORY

FLORIDA DEPARTMENT OF TRANSPORTATION

	5 YR INV	SLD REV	INTERIM REVISIONS BMP	EMP	INV	SLD REV
DATE	05/07/12	05/31/12				
BY	DP	MR				

INT. or US ROUTE NO	STATE ROAD NO.	COUNTY	DISTRICT	ROADWAY ID	SHEET NO.:
	SR 40	VOLUSIA	5	79 100 000	4 OF 5





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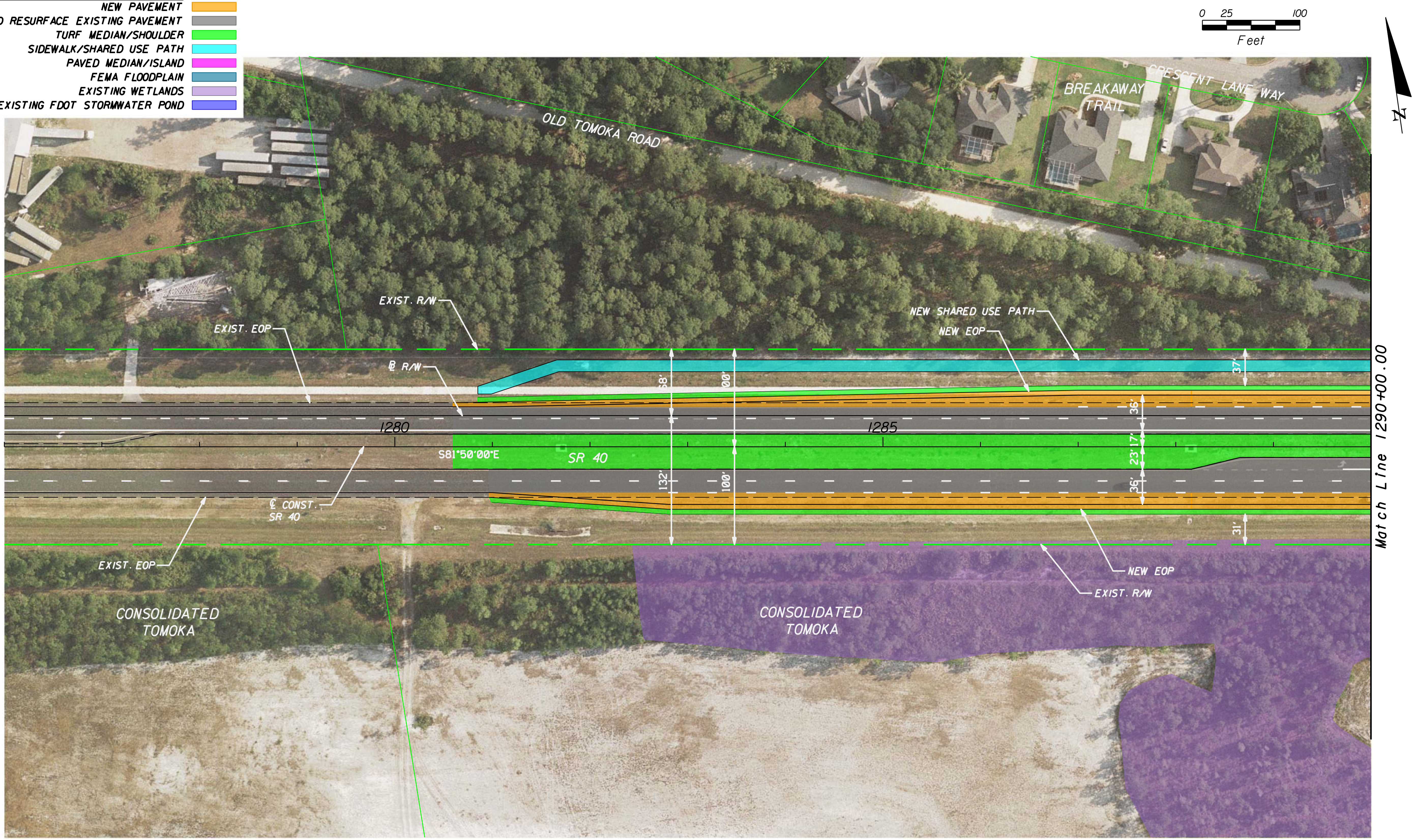
APPENDIX 11

Preferred Alternative Roadway Plans

LEGEND

NEW PAVEMENT	
MILL AND RESURFACE EXISTING PAVEMENT	
TURF MEDIAN/SHOULDER	
SIDEWALK/SHARED USE PATH	
PAVED MEDIAN/ISLAND	
FEMA FLOODPLAIN	
EXISTING WETLANDS	
EXISTING FDOT STORMWATER POND	



ALTERNATIVE B
TYPICAL SECTION 1 (WEST)
TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

Engineer of Record: JOHN R. FREEMAN, JR., P.E., PTOE
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CERTIFICATE OF AUTHORIZATION NO. 007524

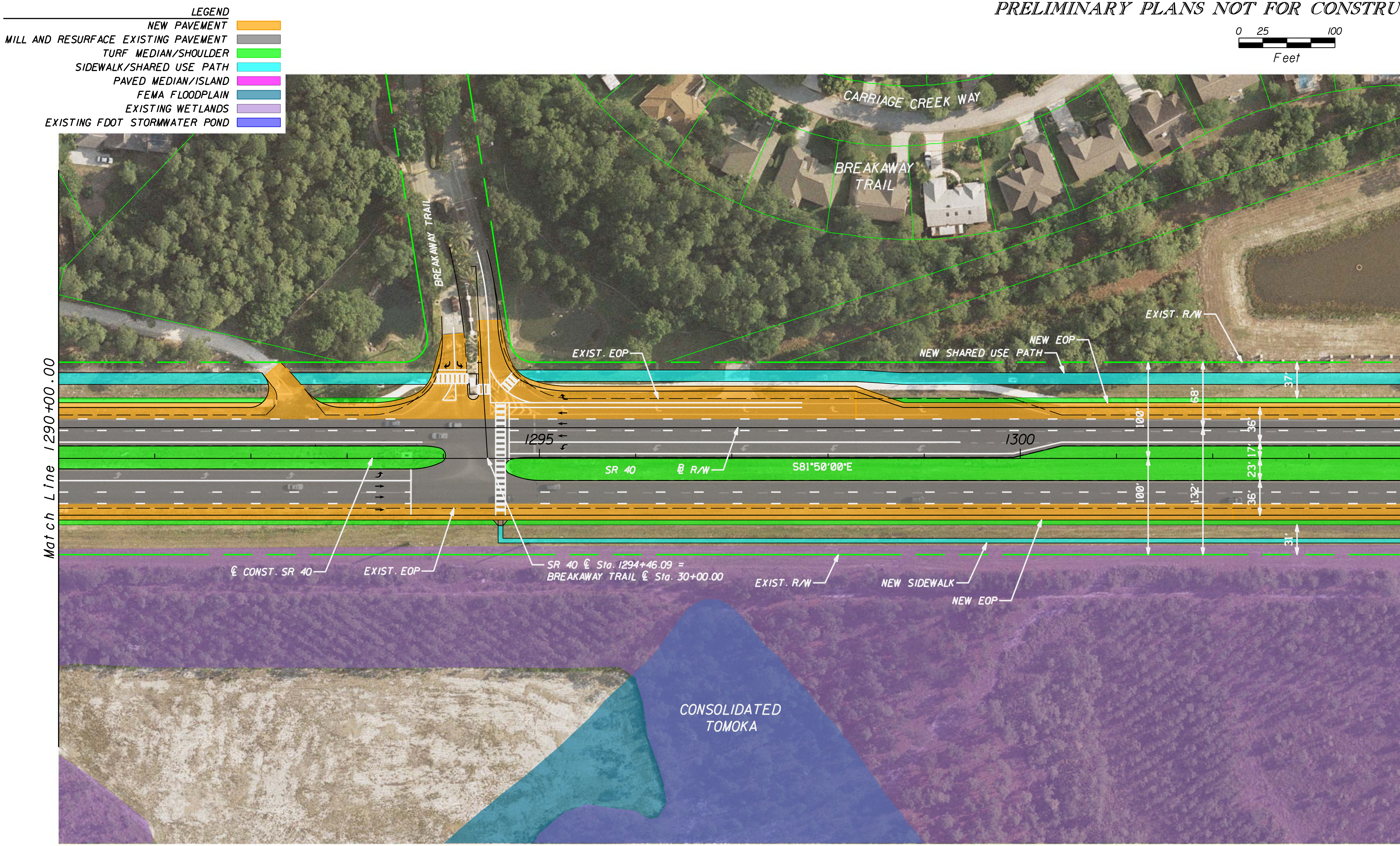
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1276+00 to Sta 1290+00

SHEET NO.
1

PRELIMINARY PLANS NOT FOR CONSTRUCTION



ALTERNATIVE B
TYPICAL SECTION 1 (WEST)
TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1290+00 to Sta 1304+00

SHEET NO.
2

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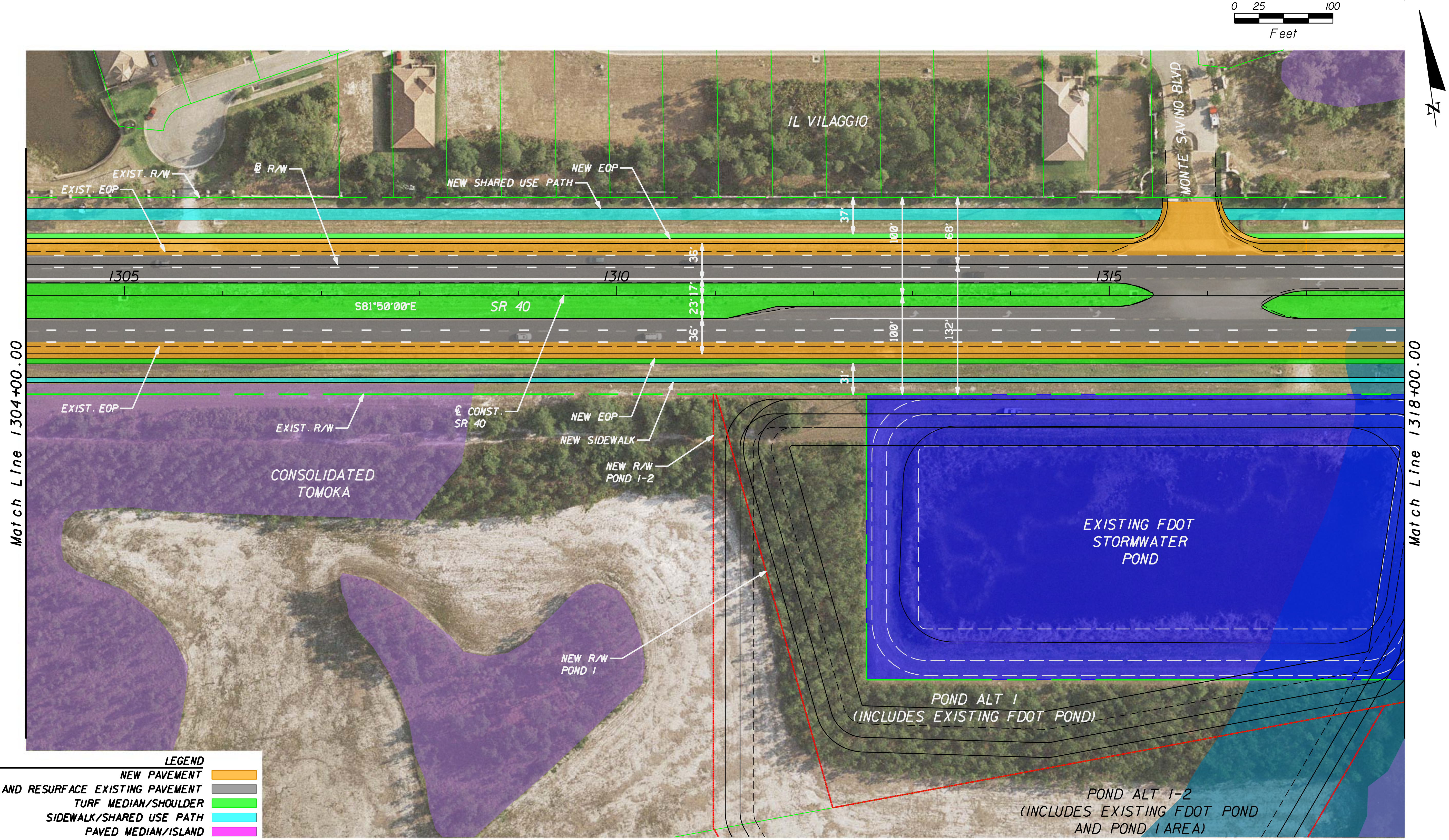

LEGEND

- NEW PAVEMENT
- MILL AND RESURFACE EXISTING PAVEMENT
- TURF MEDIAN/SHOULDER
- SIDEWALK/SHARED USE PATH
- PAVED MEDIAN/ISLAND
- FEMA FLOODPLAIN
- EXISTING WETLANDS
- EXISTING FDOT STORMWATER POND

ALTERNATIVE B
TYPICAL SECTION 1 (WEST) TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

REVISIONS			
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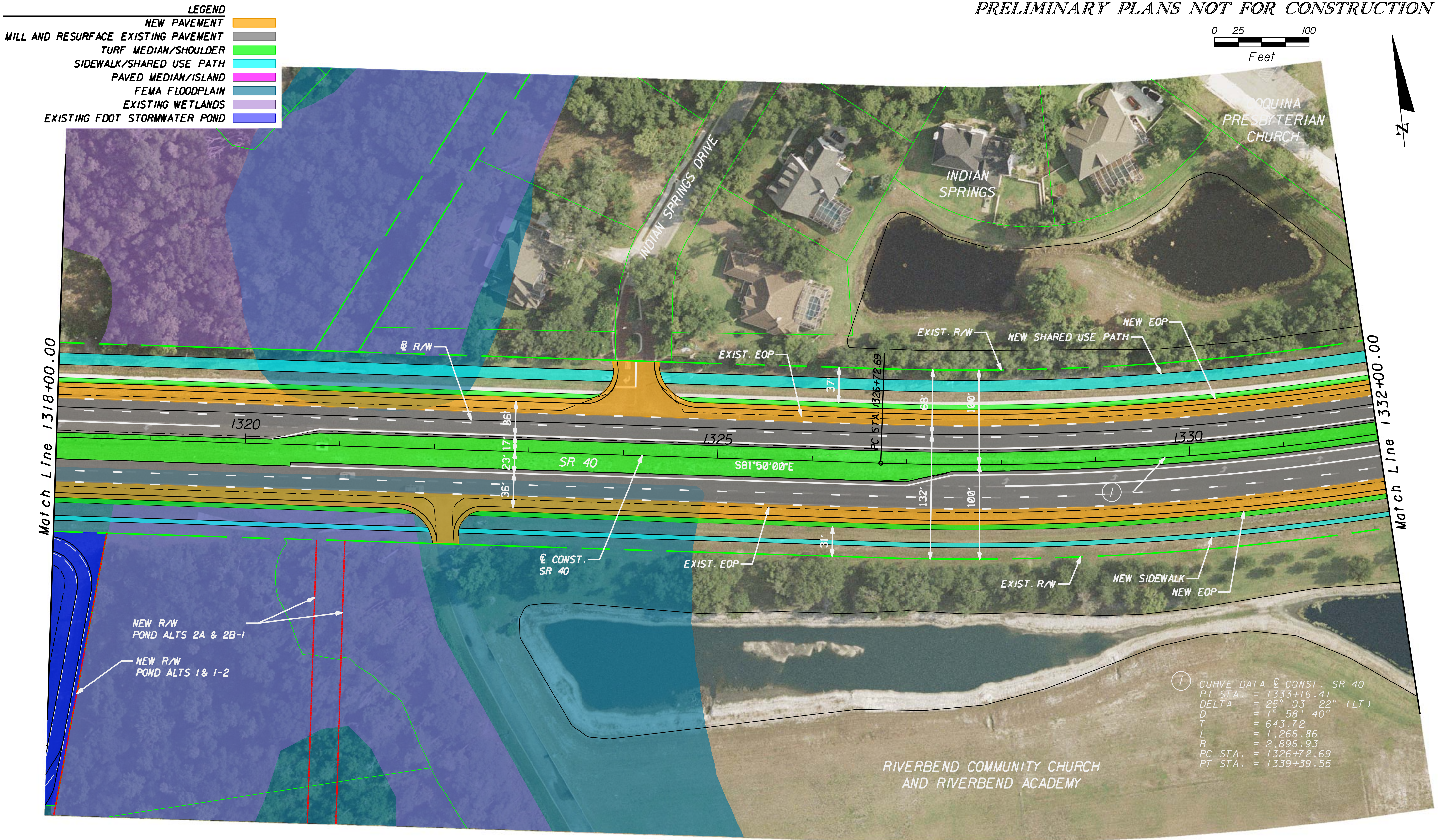
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1304+00 to Sta 1318+00

SHEET NO. 3

PRELIMINARY PLANS NOT FOR CONSTRUCTION



ALTERNATIVE B
TYPICAL SECTION 1 (WEST)
TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1318+00 to Sta 1332+00

SHEET NO.
4

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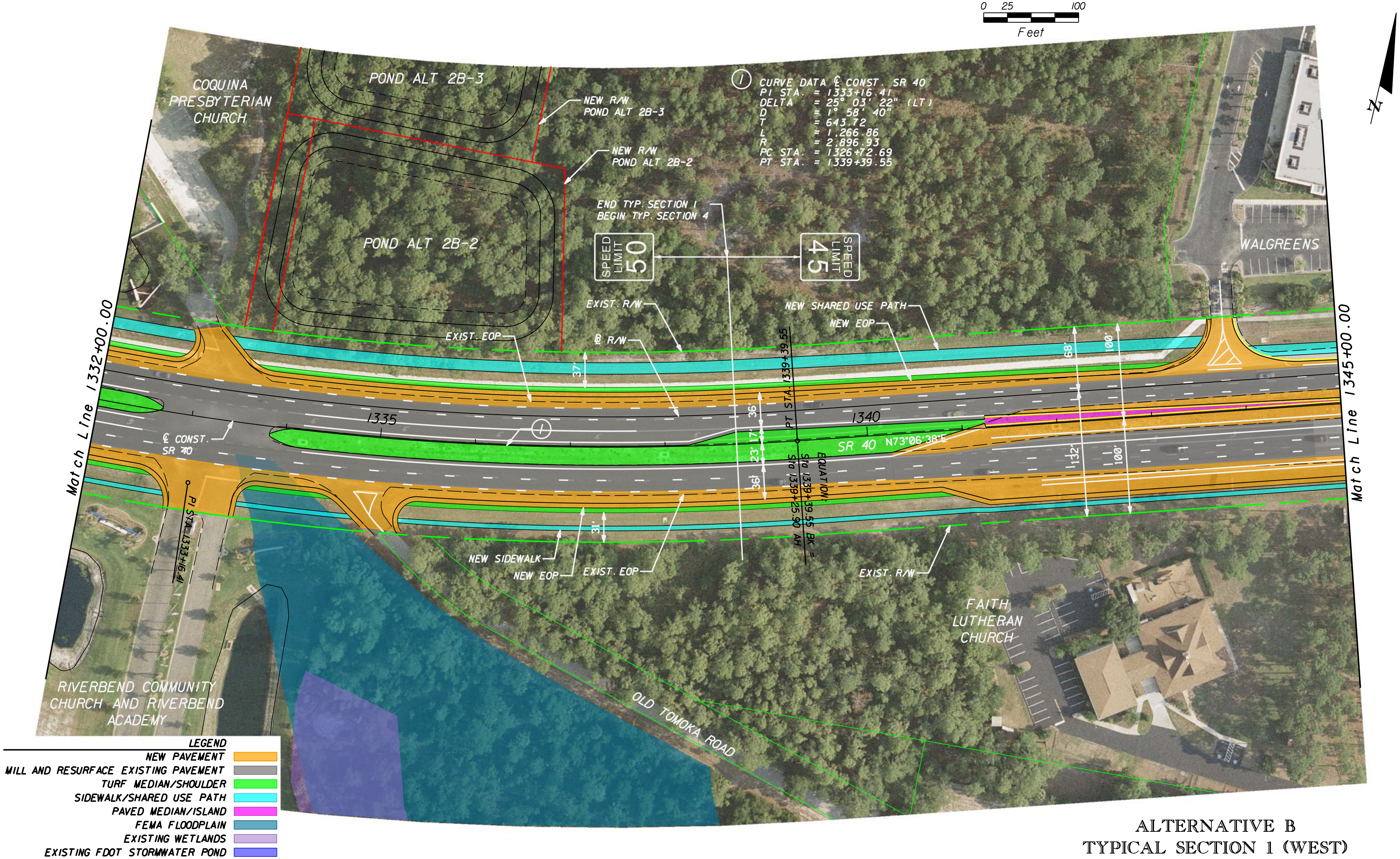
PRELIMINARY PLANS NOT FOR CONSTRUCTION



PRELIMINARY PLANS NOT FOR CONSTRUCTION

ALTERNATIVE B
TYPICAL SECTION 1 (WEST)
TO TYPICAL SECTION 4 (EAST)

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1332+00 to Sta 1345+00

SHEET NO.
5

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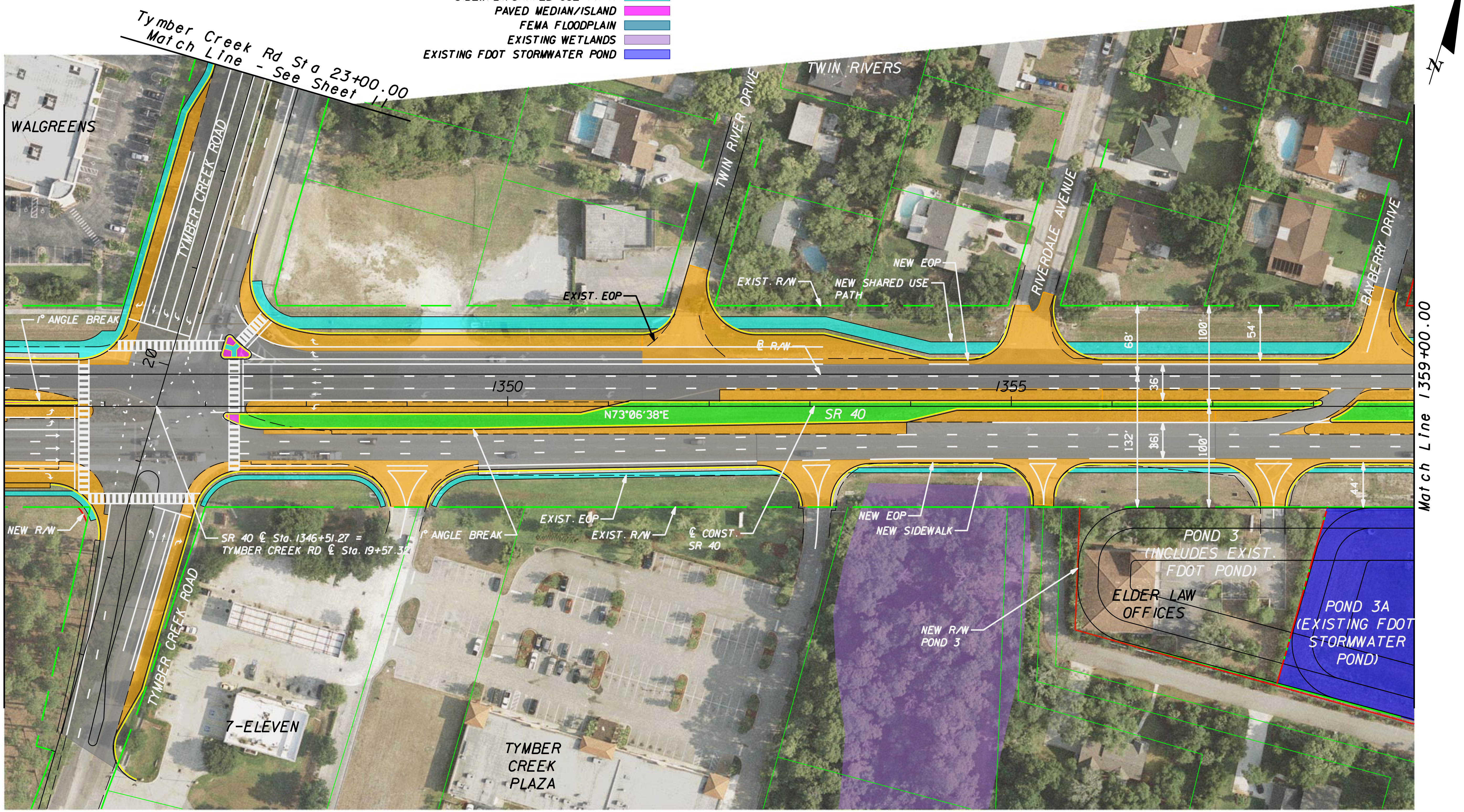
PRELIMINARY PLANS NOT FOR CONSTRUCTION

LEGEND

NEW PAVEMENT	orange
MILL AND RESURFACE EXISTING PAVEMENT	gray
TURF MEDIAN/SHOULDER	green
SIDEWALK/SHARED USE PATH	cyan
PAVED MEDIAN/ISLAND	magenta
FEMA FLOODPLAIN	teal
EXISTING WETLANDS	lavender
EXISTING FDOT STORMWATER POND	blue



ALTERNATIVE B
TYPICAL SECTION 1 (WEST)
TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1345+00 to Sta 1359+00

SHEET NO.
6

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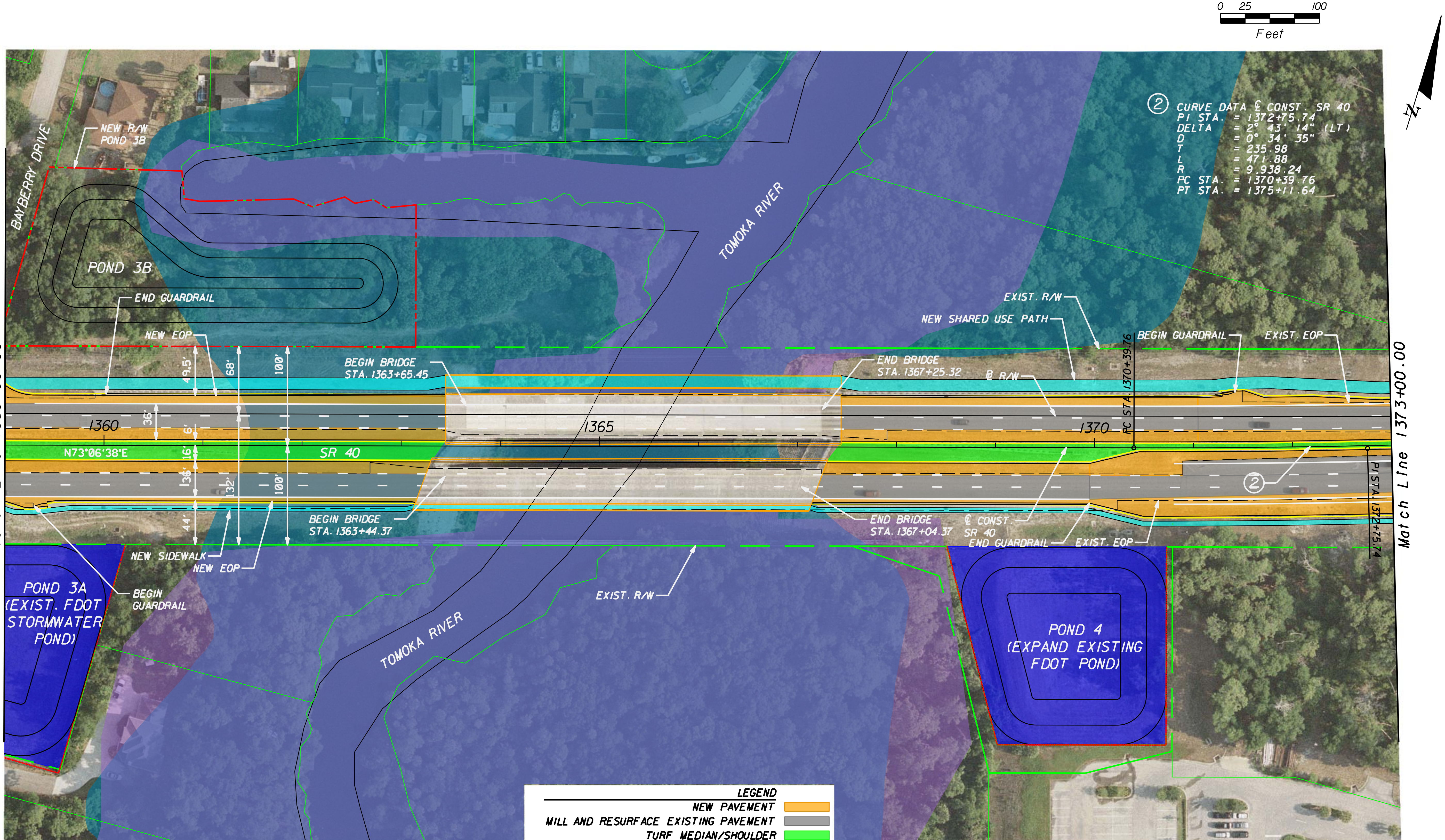

ALTERNATIVE B
TYPICAL SECTION 1 (WEST) TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

REVISIONS

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40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1359+00 to Sta 1373+00

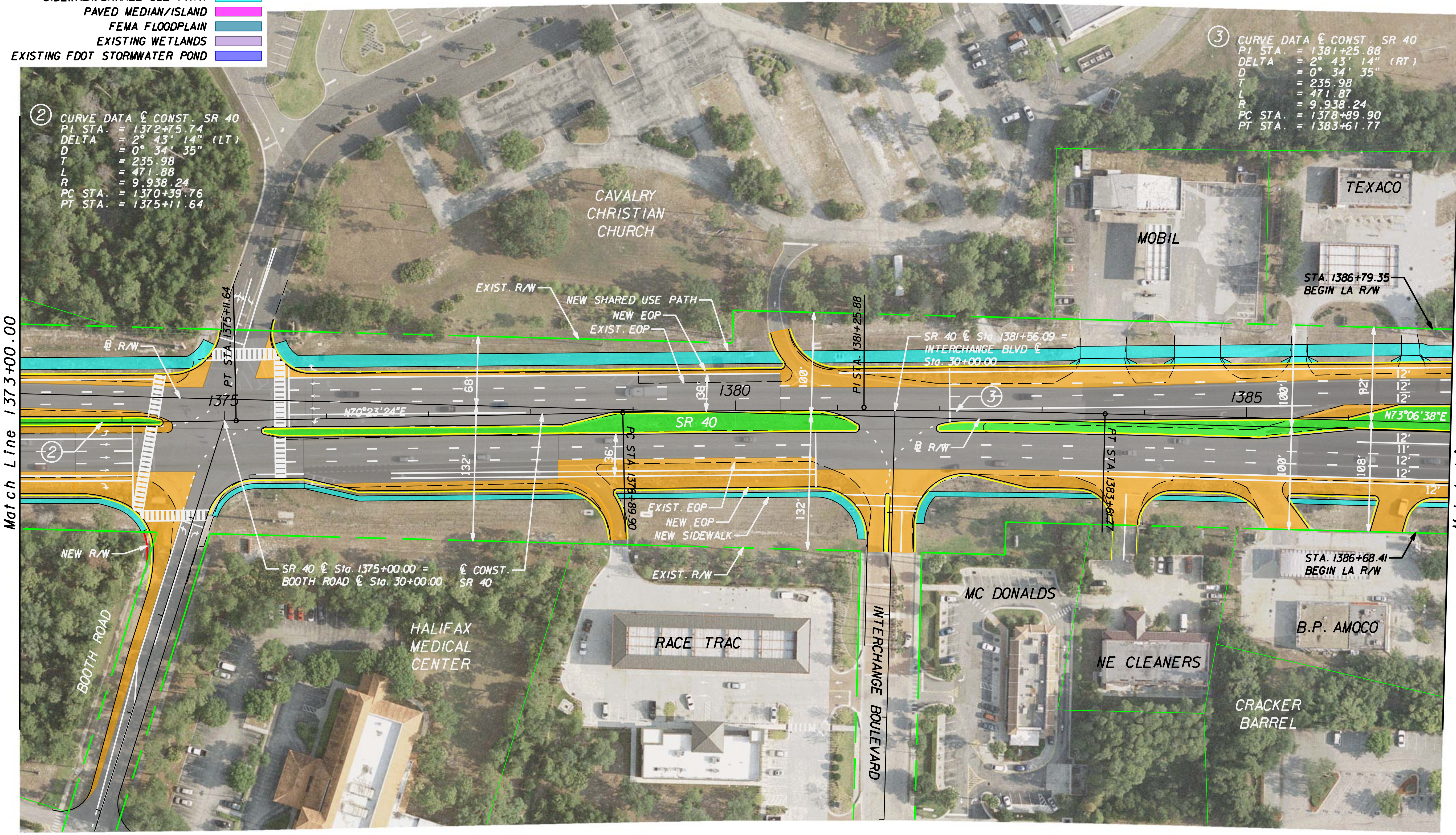
SHEET NO.
7

PRELIMINARY PLANS NOT FOR CONSTRUCTION

LEGEND

NEW PAVEMENT	
MILL AND RESURFACE EXISTING PAVEMENT	
TURF MEDIAN/SHOULDER	
SIDEWALK/SHARED USE PATH	
PAVED MEDIAN/ISLAND	
FEMA FLOODPLAIN	
EXISTING WETLANDS	
EXISTING FDOT STORMWATER POND	

0 25 100
Feet



ALTERNATIVE B
TYPICAL SECTION 1 (WEST)
TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

REVISIONS

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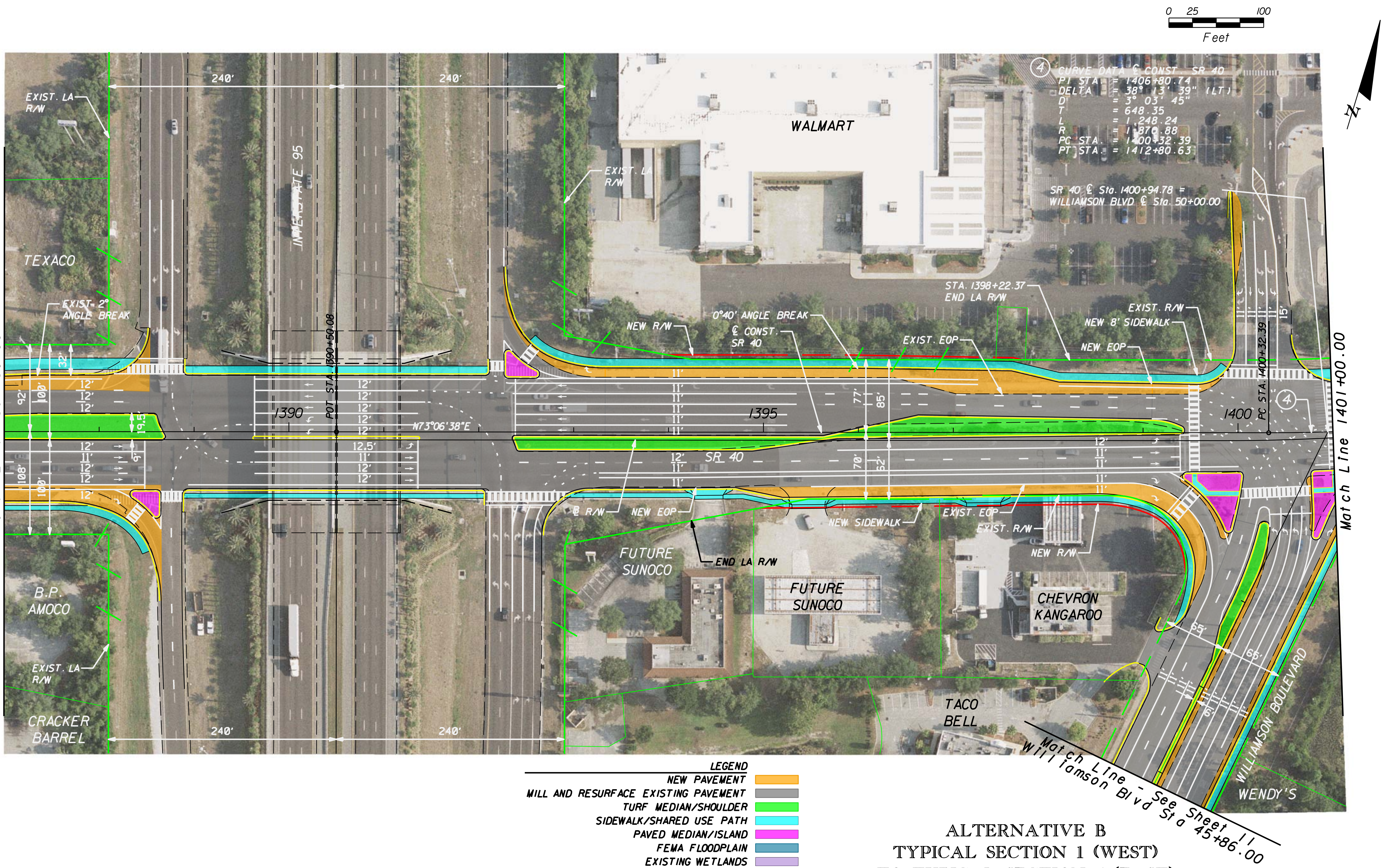
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1373+00 to Sta 1387+00

SHEET NO.
8



LEGEND

- NEW PAVEMENT
- MILL AND RESURFACE EXISTING PAVEMENT
- TURF MEDIAN/SHOULDER
- SIDEWALK/SHARED USE PATH
- PAVED MEDIAN/ISLAND
- FEMA FLOODPLAIN
- EXISTING WETLANDS
- EXISTING FDOT STORMWATER POND

ALTERNATIVE B
TYPICAL SECTION 1 (WEST) TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

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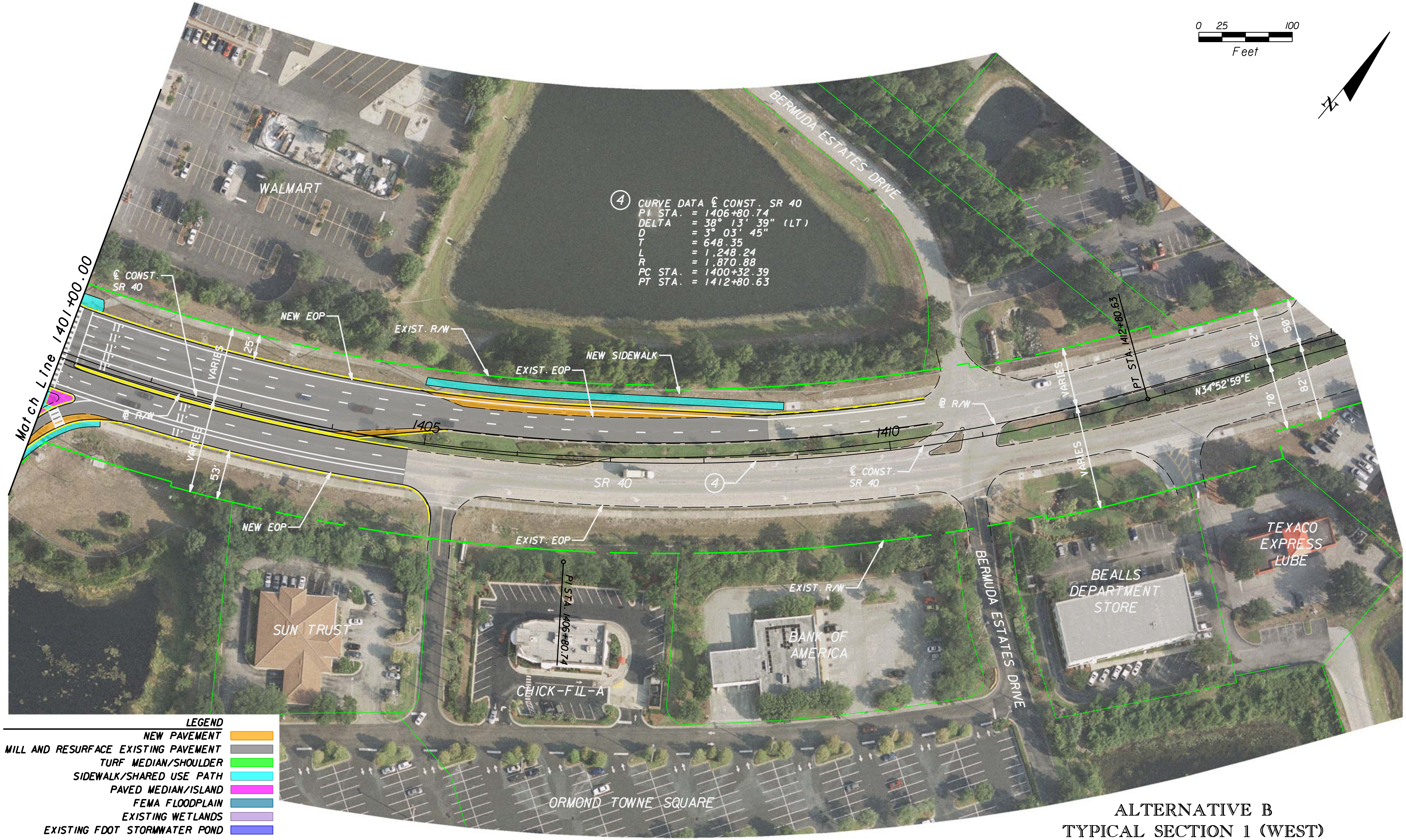
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1387+00 to Sta 1401+00

SHEET NO. 9

PRELIMINARY PLANS NOT FOR CONSTRUCTION



LEGEND

NEW PAVEMENT	(orange)
MILL AND RESURFACE EXISTING PAVEMENT	(gray)
TURF MEDIAN/SHOULDER	(green)
SIDEWALK/SHARED USE PATH	(cyan)
PAVED MEDIAN/ISLAND	(magenta)
FEMA FLOODPLAIN	(blue-gray)
EXISTING WETLANDS	(lavender)
EXISTING FDOT STORMWATER POND	(blue)

ALTERNATIVE B
TYPICAL SECTION 1 (WEST)
TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

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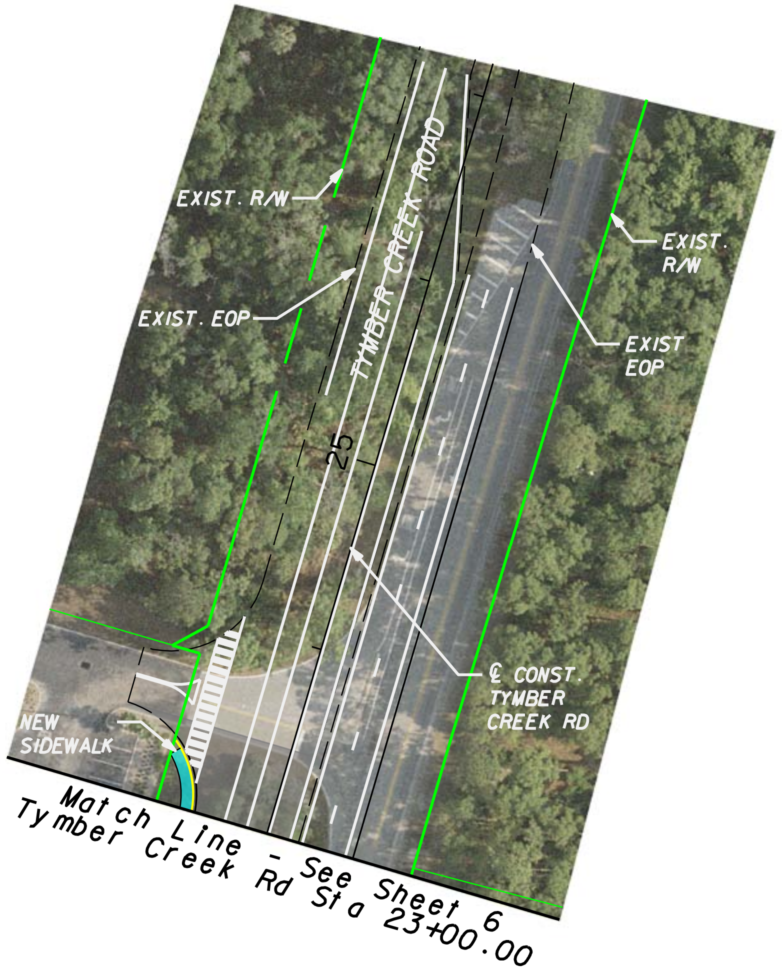
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

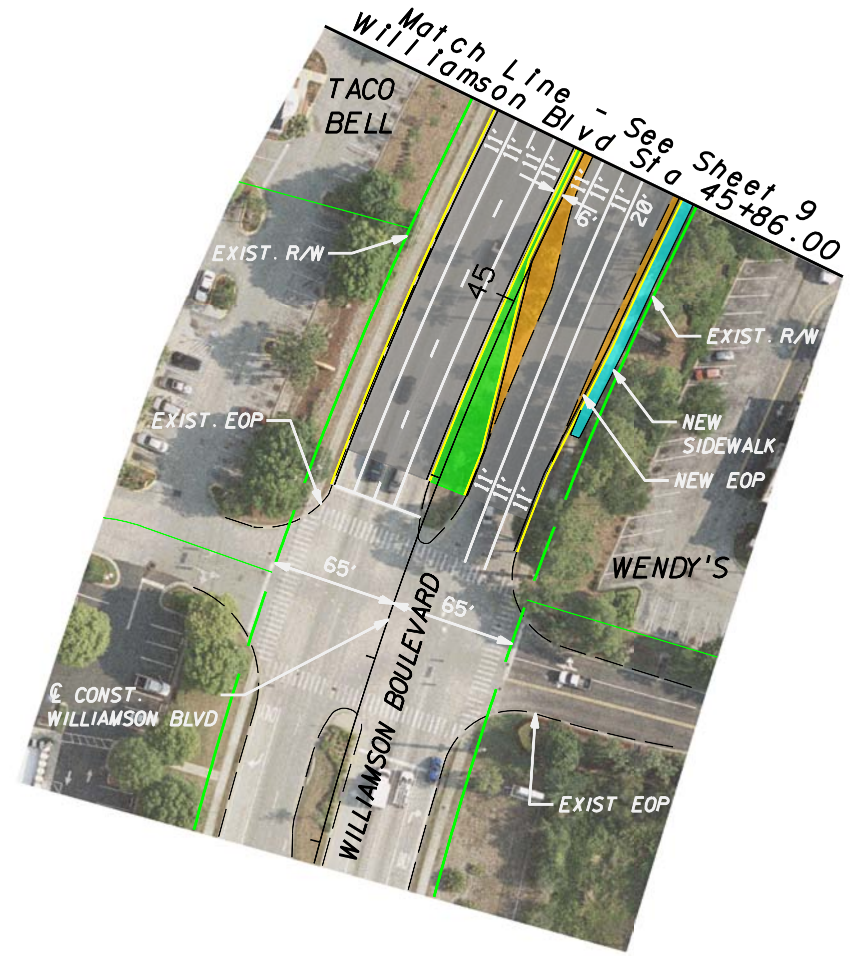
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1401+00 to Sta 1415+00

SHEET NO.
10

0 25 100
Feet





LEGEND	
NEW PAVEMENT	
MILL AND RESURFACE EXISTING PAVEMENT	
TURF MEDIAN/SHOULDER	
SIDEWALK/SHARED USE PATH	
PAVED MEDIAN/ISLAND	
FEMA FLOODPLAIN	
EXISTING WETLANDS	
EXISTING FDOT STORMWATER POND	

ALTERNATIVE B
TYPICAL SECTION 1 (WEST) TO TYPICAL SECTION 4 (EAST)

PRELIMINARY PLANS NOT FOR CONSTRUCTION

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ROAD NO.	COUNTY	FINANCIAL PROJECT ID
40	VOLUSIA	428947-1-22-01

SR 40 PD&E Study
Sta 1387+00 to Sta 1401+00

SHEET NO. 11

APPENDIX 12

Correspondence

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TRANSPORTATION ENGINEERING / PLANNING
225 E Robinson Street, Suite 450, Orlando, FL 32801 P 407.540.0555 F 407.540.0550

Meeting Notes

Design Concept Review Meeting

SR 40, from Breakaway Trail to Williamson Boulevard, PD&E Study

Financial Project No. 428947-1-22-01

Meeting Date:	March 2, 2012	Project #: 11508
Location:	FDOT District 5; Manatee Conference Room	
Time:	10:00 a.m.	

Attendees:

George Borchik – FDOT Design Office

Chris Cairns – FDOT Traffic Operations Office

Mary McGehee – FDOT Environment Management Office

Chris Rizzolo – URS/FDOT

Jack Freeman – Kittelson & Associates, Inc.

Discussion Items

Mr. Freeman provided all attendees the following information:

- Typical sections being considered
- Bridge typical sections at Tomoka River
- 2035 design traffic – turning movement projections and lane requirements
- 1″=100′ design concepts for:
    - Typical Section #1 (west) to Typical Section #3 (east)
    - Typical Section #1 (west) to Typical Section #4 (east)
    - Typical Section #3 (west) to Typical Section #3 (east)
    - Typical Section #3 (west) to Typical Section #4 (east)

Typical Sections

As a project update, Mr. Freeman stated that the analysis of the alternative typical sections selected three different typicals to be evaluated in two segments of SR 40 with Tymber Creek Road being the dividing point. These are:

Breakaway Trail to Tymber Creek Road

- Rural with outside widening (Typical Section #1)
- High Speed Urban with outside widening (Typical Section #3)

Tymber Creek Road to I-95

- High Speed Urban with outside widening (Typical Section #3)
- Urban with inside widening (Typical Section #4)

Comments provided regarding the typical sections were as follows:

- Typical #1 – The typical section shows the existing median to vary in width between 40′ and 46′. Please confirm that the median varies from 40′ between Breakaway Trail and Tymber Creek Road.
- Typical #3 – The typical section shows the proposed median to be 40′. This is to match the 40′ median between Breakaway Trail and Tymber Creek Road. The high speed typical generally has a 30′ median. East of Tymber Creek Road, consider narrowing the median to 30′ to avoid right-of-way takings.
- Typical #4 – The typical section shows inside widening with the lanes sloped to the median. This would cause a center drainage system. Consider sloping the lanes to the outside to avoid the cost of this drainage system.

Design Concepts

The initial review of design concepts was for Typical Section #1 (west) to Typical Section #3 (east). The following comments were provided:

Sheet #1 – Change the callout of New Sidewalk on north side of SR 40 to be Multi-use Path. This is though-out the plans.

Sheet #2 – Consider stopping the sidewalk on the south side of SR 40 at the Breakaway Trail intersection. A pedestrian crossing of SR 40 can be provided as part of the signalized intersection.

Sheet # 5 – Do not provide the right turn lane into the Walgreens on the north side near Sta. 1344. Also, if the same median width is provided between Typical Section #1 (west) and #3 (east), why are there angle breaks near Sta. 1341 and 1342? If Typical Section #3 (east) has the median reduced to 30′, then the angle breaks would likely increase or change to horizontal curves.

Sheet #6 – Provide 5′ of set back from the back of curb to the multi-use path. Improve the graphics to show the Volusia County improvement to the Tymber Creek Road intersection better so that any further enhancement from this project can be easily seen. Show a stop bar at the dual right turn lanes for the WB to NB movement as this movement will need to be under signal control. This will also aid with patrons of the multi-use path crossing the two lanes. The office in the northwest corner of the Twin River Drive and SR 40 should be labeled.

Sheet #7 – It was discussed that the property in the northwest side of the Tomoka River bridge is currently used for a canoe launch. During project meetings, questions have been asked whether a park can be provided at this location for public access to the river. This property is shown on the Volusia County Property Appraiser's website to be privately owned.

Sheet #8 – We had extensive discussion of the SR 40 and Interchange Boulevard intersection. This intersection is currently being evaluated by FDOT Traffic Operations to be modified from full access to WB directional access. FDOT has received a public inquiry to Secretary Prasad about the intersection modifications. The discussion at the meeting was to keep the directional access but increase the length of the WB left turn lane for additional storage should the intersection become signalized in the future. The design should also be modified to delete the concrete traffic separator and place the left turn lane adjacent to the thru lane. It was also noted that the left turn radius should be checked to accommodate a WB-67 truck for Race Trac. Following the meeting and review of the e-mail exchange from the inquiry to Secretary Prasad, a request has been sent to FDOT to show full intersection access at this location for upcoming public meetings. It also requested that the plans identify where the existing posted speed limit changes from 45 mph to the east to 50 mph to the west. The EB right turn lane to the I-95 SB entrance ramp should be shortened to begin just after the southeast radius return at Interchange Boulevard.

Sheet #9 – It was noted that this plan sheet is the same for both alternatives since there are six lanes on SR 40 under I-95 and there is limited right-of-way between I-95 and Williamson Boulevard. The input received was to show a pedestrian crosswalk for the multi-use path across the WB right turn lane to I-95 NB entrance ramp. We also discussed the potential for modifying the recommended intersection lane geometry at the SR 40 and Williamson Boulevard intersection to have the third NB left turn lane be a shared left turn and thru movement. We have requested additional traffic analysis at this intersection to see if this is possible as it can avoid expensive right-of-way in the southeast intersection quadrant if possible.

Sheet #10 – It was noted that in the ongoing 3R project east of Williamson Road, the lanes will be 11' and a 4' bike lane will be provided.

In the review of design concept for Typical Section #3 (west) to Typical Section #4 (east). The following comments were provided:

Sheet #2 – There are existing access points on the north side near Sta. 1293 and 1297 with no access provided. The access at Sta. 1293 is a frequently used and right-in/right-out access will be added. The access at Sta. 1297 would be across a right turn lane and appears to be into private property. This will be field checked to see what is served by the driveway.

Sheet #5 – Note on plans where the transition from one typical section to the other begins and ends. Also, the plans should include the location where the 45 mph speed limit associated with Typical Section #4 ends and the 50 mph speed limit begins.

Sheets #6 thru #10 – Same comments as previously stated.

Due to time limitations, there was no review of the other two plan sets. It was noted that the only difference from previously reviewed plans were the transitions between typical sections at Tymber Creek Road.

This memorandum provides Jack Freeman's understanding of the discussions during this meeting. Any comments, corrections or additions should be addressed to him at 407-373-1103 or by e-mail at jfreeman@kittelson.com.

Copies to:
All attendees
Joey Bansen – KAI
Ralph Bove – DRMP
Amanda Woods – DRMP
Jason Houck – Inwood
Renato Chew - Inwood
File 11508