Preliminary Roadway Soil Survey
PD&E Study for SR 46
From SR 415 to CR 426
Seminole County, Florida

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Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

June 19, 2012
File No. 11-6445

URS
315 E. Robinson Street
Suite 245
Orlando, Florida 32801-1949

Attention: Ms. Jan Everett, P.E.

Subject: Preliminary Roadway Soil Survey
PD&E Study for SR 46
From SR 415 to CR 426
Seminole County, Florida
FPID 240216-4-28-01

Dear Ms. Everett:

As requested and authorized, we have completed a preliminary roadway soil survey for the SR 46 PD&E project. The purpose of performing this exploration was to preliminarily evaluate the general subsurface conditions within the proposed retention pond and swale areas relative to the preliminary design and engineering phase of the project. This report documents our findings.

This report has been prepared in accordance with generally accepted geotechnical engineering practices for specific application to the project area indicated in this report. No other warranty, expressed or implied, is made. The soils information and preliminary recommendations submitted herein are based on the data obtained from the soil borings presented on Figures 4 and 5. This report does not reflect any variations which may occur adjacent to or between the borings. The nature and extent of the variations adjacent to or between the borings may not become evident until during further exploration and/or construction.

It is a pleasure assisting you with this phase of the project. If you have any questions, or when we may be of further assistance to you, please do not hesitate to contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.
Certificate of Authorization No. 5950

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1.0 INTRODUCTION

1.1 Site Location

The project is located in Seminole County, Florida (Sections 1, 2, and 3, Township 20 South, Range 31 East and Sections 6, 7, 8, 16, 17, 21 and 22, Township 20 South, Range 32 East). The total length of construction will be approximately 7.3 miles.

The general site location is shown superimposed on a composite of the Osteen, Oviedo and Geneva, Florida, U.S.G.S. quadrangle maps presented on Figure 1.

1.2 Project Considerations

It is our understanding that the proposed development will include widening the existing 2-lane road to 4 lanes. The project is approximately 7.3 miles in length bounded to the west by SR 415 and bounded to the east by CR 426.

We also understand that eight new retention ponds, two treatment swales and two flood plain compensation areas, are being considered. In addition, two existing ponds may be expanded. The locations and approximate sizes of the ponds are as follows:

Pond	Approximate Location	Approximate Size (acres)	Type of Pond
A	45+00 Left	36.7	Wet
B	170+00 Left	30.2	Wet
C	237+00 Left	17.8	Wet
D	279+00 Left	4.1	Wet
E	301+50 Right	4.4	Dry
F	316+50 Right	4.3	Dry
G	329+50 Right	11.9	Dry
H	900' Southeast of CR 426	11.1	Dry
FP 1	18+00 Left	80.0	Flood Plain Compensation
FP 2	150+00 Left	150.3	Flood Plain Compensation
Pond 1	86+00 Left	1.7	Wet (Existing)
Pond 2	142+00 Left	12.5	Wet (Existing)

1.3 Purpose and Scope of Exploration

The purposes of this exploration were to explore shallow subsurface conditions within the proposed swale and pond areas and to provide a preliminary geotechnical engineering evaluation of the conditions encountered. Our services included:

1. Conducting auger borings and measuring groundwater levels within the proposed pond and swale areas.

2. Observing recovered soil samples in our laboratory and performing tests on selected samples to aid in classification.

3. Analyzing and interpreting the field and laboratory data.

4. Performing engineering analyses to develop recommendations for site preparation.

5. Conducting falling head field permeability tests within the proposed dry retention pond areas.

6. Conducting double ring infiltration tests within the proposed swale areas.

1.4 **Review of Available Data**

1.4.1 Soil Survey Maps

Based on the 1990 Soil Survey for Seminole County, Florida, as prepared by the U.S. Department of Agriculture Soil Conservation Service, various soil types exist within the proposed roadway, pond and swale areas. The individual soil types and their characteristics are summarized and presented on Table 1. The type and location of the individual soils are also shown on the Boring Location Plans presented as Figures 2A through 2F.

1.4.2 U.S.G.S. Quadrangle Maps

Based on our review of the Osteen, Oviedo and Geneva, Florida, U.S.G.S. quadrangle maps, the existing ground surface elevation along the project alignment varies approximately from +5 to +75 feet NGVD.

1.4.3 Potentiometric Maps

Based on review of the "Potentiometric Surface of the Upper Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida" (dated May, 2009) published by the United States Geological Survey, the potentiometric elevation within the project area is approximately +15 feet NGVD, or generally below the prevailing ground surface elevation. As an exception, the portion of the alignment in the vicinity of Lake Jessup has a ground surface elevation lower than the potentiometric elevation indicating that artesian conditions are possible.

1.4.4 Regional Geology

Geomorphic features of Central Florida including Seminole County are delineated by ridges scattered within the broad uplands and plains of the region. These ridges are characterized by subparallel orientation relative to the present coastline and by mature karst development. The stratigraphy is a typical sedimentary sequence of thick carbonate rocks resulting primarily from sea level fluctuations. The strata were deposited in horizontal layers with little subsequent distortion.

The regional surficial and bedrock geology comprise a stratigraphy of several tens of feet of surficial soils overlying several hundreds of feet of limestone and dolomite. Specifically, according to Lichtler, (1968) and Scott, (1988, 1989), the geological sequence from oldest to youngest for the upper 1500 feet of sediments consists of: Eocene age Avon Park Formation, and Ocala Group Limestones, Miocene age Hawthorn Group and post-Miocene age Plio-Pleistocene undifferentiated surficial deposits.

The oldest (middle Eocene) formation penetrated by water wells in Seminole County is the Avon Park Formation. The lower part of this formation was formerly called the Lake City Limestone and the upper part the Avon Park Limestone. Current nomenclature has merged the Lake City and Avon Park Limestones to form the Avon Park Formation. The Avon Park Formation consists of interbedded limestone and dolomite. The limestones are cream to brown, soft to hard, chalky and fossiliferous while the dolomites are light brown to dark brown, hard, porous to dense, crystalline and fossiliferous. In some areas, part of this Formation is composed principally of sand-size cone-shaped foraminifera. The Avon Park Formation is more than 1,000 feet thick in the study area.

The Ocala Group limestones of upper Eocene age unconformable overly the Avon Park Formation. The Ocala Group carbonates consist of white to light gray, soft to very hard, fine - to very coarse-grained, porous, fossiliferous, partly dolomitic limestone. The thickness ranges from about 125 feet thick in the northeast portion of the county to absent in the south-central part.

The Miocene age Hawthorn Group unconformably overlies the Ocala Group where present and the Avon Park Formation where the Ocala Group is absent. The Hawthorn Group consists of siliciclastic clayey quartz sands, impure limestone and phosphatic sand and gravel. The lower part of the formation is primarily a carbonate unit containing much phosphorite and quartz sand with interbedded siliciclastic beds. The upper portion of the formation consists of a siliciclastic mixture of quartz sand, clay and phosphate. The contact between the Hawthorn Group and the underlying Eocene limestone is usually quite distinct; however, the contact with the overlying deposits is gradational. The top of the Hawthorn in Seminole County is usually placed at the first occurrence of appreciable quantities of phosphorite, or where a distinct and persistent greenish color appears. A generalized statewide isopach map of the Hawthorn Group (Scott, 1988) shows that the thickness of the Hawthorn Group in Seminole County ranges from 150 feet thick in the southwest portion to absent in the northeast.

The post-Miocene age Plio-Pleistocene undifferentiated surficial deposits overlying the Hawthorn Group are composed of loose, unsorted, fine to coarse-grained quartz sand with varying amounts of organic matter and clay. The undifferentiated sediments extend to land surface and vary in thickness from less than 50 feet to greater than 100 feet.

Groundwater in Seminole County occurs within three aquifer systems; the surficial aquifer system, the intermediate aquifer system, and the Floridan aquifer system.

2.0 FIELD EXPLORATION PROGRAM

2.1 Auger Borings

The field exploration program consisted of performing 24 auger borings within the proposed swales and pond locations. The auger borings were conducted using a 4-inch diameter continuous-flight auger advanced to a depth of 20 feet below the ground surface. All of the borings were backfilled with soil upon completion of the field exploration program. A summary of the auger boring procedure is included in the Appendix. Soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory in sealed sample jars for further classification and laboratory testing.

The approximate locations of the borings are schematically illustrated on Boring Location Plans shown on Figures 2A through 2F. These locations were determined in the field using a hand-held GPS unit, and should be considered accurate only to the degree implied by the method of measurement used. The borings have been referenced to the SR 46 baseline.

2.2 Groundwater Level

The groundwater level was measured in the boreholes after stabilization of the downhole water level. The measured groundwater levels are shown on Figures 4 and 5 adjacent to the soil profiles. Fluctuations in groundwater levels should be anticipated throughout the year primarily due to seasonal variations in rainfall and other factors that may vary from the time the borings were conducted.

2.3 Field Permeability Tests

Field permeability tests were conducted within the proposed dry stormwater pond areas adjacent to Borings PB-9, PB-10, PB-11 and PB-12. For each of the tests, a 4-inch diameter solid-walled, open-ended PVC pipe was installed to varying depths. Approximately 1 foot of gravel was packed at the bottom of the pipe and the pipe was then raised approximately 1 foot. Falling head permeability tests were conducted by filling the PVC pipe with water to the top of the pipe and measuring the time rate of fall of the water level. A continuous reading of the falling water level in the PVC pipe versus time was recorded. A stabilization period of 15 minutes was used for each test.

2.4 Double Ring Infiltration Tests

A total of 12 double-ring infiltration (DRI) tests were conducted within the proposed drainage swales adjacent to Borings SW-1 through SW-12. The double-ring infiltration tests were conducted in general accordance with ASTM D-3385 procedure, “Infiltration Rate of Soils in Field Using Double-Ring Infiltrometers”.

The double-ring infiltration test consisted of driving two open cylinders, one inside the other, into the ground at each test location in an excavation approximately 0.5 to 1 foot below the existing ground surface. Organic topsoil and roots in the area of the test were removed prior to seating the rings. The rings were partially filled with water until a constant water level was achieved. A measurement of time versus water volumes added to the rings to maintain a constant water level was then recorded.

3.0 LABORATORY TESTING PROGRAM

3.1 Visual Examination and Classification Testing

Representative soil samples obtained during our field sampling operation were packaged and transferred to our laboratory for further visual examination and classification to obtain more accurate descriptions of the existing soil strata. The soil samples were visually classified in general accordance with the AASHTO Soil Classification System (ASTM D-3282).

In addition, sieve analyses, organic content, Atterberg limits and natural moisture content tests were conducted on representative soil samples to aid in classification. The resulting soil descriptions and the results of our tests are shown on Table 2 and summarized on the Soil Survey sheet presented as Figure 3.

4.0 CONCLUSIONS AND PRELIMINARY RECOMMENDATIONS

4.1 General Soil Stratigraphy

The results of the field exploration and laboratory testing programs are graphically summarized on the Soil Survey sheet (Figure 3) and the soil boring profiles (Figures 4 and 5). The stratification of the boring profiles represents our interpretation of the field boring logs and the results of the laboratory examination of the recovered samples. The stratification lines represent the approximate boundary between soil types. The actual transitions may be more gradual than implied.

The results of our test borings indicate the following general soil types:

Strata No.	Description	Classification	
		AASHTO	FDOT Index 505
1	Light brown to dark brown, gray brown and orange brown fine sand to fine sand with silt, with occasional roots.	A-3	S
2	Light brown to dark brown, orange brown and green brown silty fine sand, occasional organics.	A-2-4	S
3	Brown and gray fine sand with clay to clayey fine sand.	A-2-4	S
4	Green gray clayey fine sand to sandy clay.	A-7-6	P
5	Dark brown mucky fine sand to organic muck (2-11%)	A-8	M
6	Debris typically consisting of household trash	--	--

The results of our exploration indicate that the soil conditions encountered in the borings presented on Figures 4 and 5 are acceptable for construction of the proposed roadway, in accordance with standard FDOT design and construction practices, except where plastic and organic soils (Strata 4 and 5) were encountered.

Organic muck (Stratum 5) was encountered in several of the borings. Results of organic content tests conducted on retrieved samples indicated organic contents ranging between 3 and 11 percent.

Strata 1, 2 and 3 soils encountered in the roadway borings are considered Select (reference Index 505 of FDOT Design Standards) for use as fill for roadway construction. Stratum 4 soils are considered plastic and should not be used in the subgrade portion of the road.

We note that buried trash and debris (Stratum 6) was encountered in Boring PB-10 between approximate depths of 6 and 12 feet below the existing ground surface. Strata 5 and 6 materials are not suitable for use as foundation materials for the proposed roadway.

4.2 Measured Coefficients of Permeability

The results of the soil field permeability tests are presented on Table 3.

For the type of soils encountered at the test locations, a transformation ratio of 1 is considered appropriate. Therefore, the horizontal and vertical permeabilities are approximately equal.

It is noted that the silty fine sand and fine sand with clay and clayey fine sand (Strata 2, 3 and 4) underlying the relatively free-draining soils encountered in the stormwater ponds are anticipated to be much less permeable than the fine sand and fine sand with silt soils (Stratum 1) as encountered in the borings.

4.3 **Measured Infiltration Rates**

The double-ring infiltration testing results are presented on Table 4 in terms of the average infiltration velocity in feet per day (ft/day) after the infiltration rate became relatively stable during the test.

Results of each test presenting the infiltration velocity versus elapsed time in minutes are presented in Appendix II.

4.4 **Groundwater Control**

The groundwater level was measured in the boreholes on the day drilled after stabilization of the downhole water level. As shown on Figures 4 and 5, groundwater was encountered at depths that ranged between 3.5 and 15 feet below the existing ground surface. The absence of groundwater data at some of the boring locations indicates that groundwater was not encountered within the vertical reach of the boring on the date drilled. However, this does not necessarily mean that groundwater would not be encountered at some other time. Fluctuations in groundwater levels should be anticipated throughout the year primarily due to seasonal variations in rainfall and other factors that may vary from the time the borings were conducted.

If the control of the groundwater is required during construction, the actual method(s) of dewatering should be determined by the contractor. However, regardless of the method(s) used, we suggest drawing down the water table sufficiently, say 2 to 3 feet, below the bottom of any excavation or compaction surface to preclude "pumping" and/or compaction-related problems with the foundation soils.

Dewatering should be accomplished with the knowledge that the permeability of soil tends to decrease with an increasing silt and clay content. Therefore, a silty fine sand is typically less permeable than a fine sand. The Stratum 1 and some Stratum 2 type soils can usually be dewatered by well pointing or ditch/sump methods.

4.5 **Seasonal High Water Table**

The typical seasonal high water table each year is the level in the August-September period at the end of the rainy season during an average rainfall year. The water table elevations associated with a flood level would be much higher than the seasonal high water table elevations. The normal high water levels would more approximate the seasonal high water table elevations.

The seasonal high water table is affected by a number of factors. The drainage characteristics of the soils, the land surface elevation, relief points such as lakes, rivers, swamp areas, etc., and distance to relief points are some of the more important factors influencing the seasonal high water table elevation.

Based on our interpretation of the site conditions using our boring log data, we have estimated the seasonal high water table at the boring locations. Our estimates of the normal seasonal high groundwater level are presented on the boring profiles presented on Figures 4 and 5.

TABLE 1

Review of USDA Soil Survey Maps
PD&E Study for SR 46
From SR 415 to CR 426
Seminole County, Florida

Soil type	Description	Permeability		Approximate Depth to Normal Seasonal High Groundwater Level
		Depth (feet)	inch/hour	
4 - Astatula fine sand, 0 to 5 % slopes	Level to gently sloping and excessively drained soil found on the hillsides and ridges on the uplands	0-80	> 20	Greater than 80 inches
5 - Astatula fine sand, 5 to 8 % slopes	Sloping and excessively drained soil found on the hillsides on the uplands	0-80	> 20	Greater than 80 inches
6 - Astatula-Apopka fine sands, 0 to 5 % slopes	Nearly level to gently sloping and well to excessively drained soil found on hillsides and ridges on the uplands	0-64 64-80	6-20 0.6-2	Greater than 80 inches
7 - Astatula-Apopka fine sands, 5 to 8 % slopes	Sloping and well to excessively drained soil found on hillsides on the uplands	0-65 65-80	6-20 0.6-2	Greater than 80 inches
8 - Astatula-Apopka fine sands, 8 to 12 % slopes	Strongly sloping and well to excessively drained soil found on hillsides on the uplands	0-65 65-80	6-20 0.6-2	Greater than 80 inches
9 - Basinger and Delray fine sand	Nearly level and very poorly to poorly drained soils in sloughs and poorly defined drainageways	0-50 50-80	6-20 0.6-6	Less than 12 inches
10 - Basinger, Samsula, and Hontoon soils, depressional	Nearly level and very poorly drained soil found in swamps and depressions	0-80	6-20	Ponded for 6 to 9 months or more
11 - Basinger and Smyrna fine sands, depressional	Nearly level and very poorly drained soil found in depressions	0-15 15-25 25-80	6-20 0.6-2 6-20	Ponded for 6 to 9 months or more
12 - Canova and Terra Ceia mucks	Level and very poorly drained soils found in depressions and freshwater swamps	0-27 27-80	6-20 0.6-2	Ponded for 6 to 9 months or more

TABLE 1

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PD&E Study for SR 46
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Soil type	Description	Permeability		Approximate Depth to Normal Seasonal High Groundwater Level
		Depth (feet)	inch/hour	
13 - EauGallie and Immokalee fine sands	Nearly level and poorly drained soil found on broad plains on the flatwoods	0-24 24-54 54-80	6-20 0.6-2 0.2-0.6	Within 12 inches of natural ground surface for 1-4 months
15 - Felda and Manatee mucky fine sands, depressional	Nearly level and very poorly drained soil found in depressions	0-19 19-50	2-6 0.6-2	Ponded for 6 to 9 months or more
16 - Immokalee sand	Nearly level and poorly drained soil found on broad plains on the flatwoods	0-36 36-56 56-80	6-20 0.6-2 0.2-0.6	Less than 12 inches
17 - Brighton, Samsula, and Sanibel mucks	Nearly level and very poorly drained soils found in depressions and freshwater marshes and swamps	0-80	6-20	Ponded for 6 to 9 months or more
18 - Malabar fine sand	Nearly level and poorly drained soil in sloughs and poorly defined drainageways	0-48 48-70 70-80	6-20 < 0.2 6-20	Less than 12 inches
19 - Manatee, Floridana, and Holopaw soils, frequently flooded	Nearly level and very poorly drained and poorly drained soils found on flood plains	0-50 50-80	2-6 < 0.06	Less than 12 inches
20 - Myakka and EauGallie fine sands	Nearly level and poorly drained soils found on broad plains on the flatwoods	0-18 18-41 41-80	6-20 0.6-2 0.2-0.6	Less than 12 inches
21 - Nittaw mucky fine sand, depressional	Nearly level and very poorly drained soil found in depressions, freshwater marshes and swamps	0-10 10-50 50-80	6-20 0.06-2 6-20	Ponded for 6 to 9 months or more
22 - Nittaw muck, occasionally flooded	Nearly level and very poorly drained soil found on the flood plains	0-10 10-60 60-80	6-20 0.06-2 6-20	Less than 12 inches

TABLE 1

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PD&E Study for SR 46
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Soil type	Description	Permeability		Approximate Depth to Normal Seasonal High Groundwater Level
		Depth (feet)	inch/hour	
23 - Nittaw, Okeelanta and Basinger soils, frequently flooded	Nearly level and poorly to very poorly drained soils found on the flood plains	0-9 9-80	6-20 0.06-2	Less than 12 inches
25 - Pineda fine sand	Nearly level and poorly drained soil found on low hammocks and broad, poorly defined drainageways	0-26 26-68 68-80	6-20 < 0.2 2-6	Less than 12 inches
26 - Udorthents, excarvated	Excavated areas of unconsolidated or heterogeneous soils which have been removed for use in roadway construction or as fill	Varies	Varies	Varies
27 - Pomello fine sand, 0 to 5 % slopes	Nearly level to gently sloping and moderately well drained soil found on low ridges and knolls on the flatwoods	0-31 31-50 50-80	> 20 2-6 6-20	36-60 inches
29 - St. Johns and EauGallie fine sands	Nearly level and poorly drained soil found on the flood plains	0-80	6-20	Less than 12 inches
33 - Terra Ceria muck, frequently flooded	Nearly level and very poorly drained soil found on the flood plains	0-80	6-20	At or above ground surface

TABLE 2

Laboratory Test Results
SR 46 PD&E
SR to CR 426
Seminole County, Florida

Boring No.	Approx. Station	Approx. Offset (ft)	Stratum No.	Approx. Depth (ft)	Natural Moisture Content (%)	Percent Passing Sieve Size (%)					Organic Content (%)	Atterberg Limits		AASHTO Class.
						#10	#40	#60	#100	#200		LL	PI	
PB-7	236+00	300 L	1	0 - 3	13	100	97	81	22	10	-	-	-	A-3
SW-5	325+00	82 L	1	15.5 - 20	17	100	97	85	34	10	-	-	-	A-2-4
SW-9	348+00	80 L	1	0 - 3	4	100	98	84	22	2	-	-	-	A-3
SW-10	352+60	85 L	1	2 - 5.5	1	100	97	84	27	3	-	-	-	A-3
PB-1	20+00	1,750 L	2	0 - 2	24	100	99	94	50	18	2	-	-	A-2-4
PB-10	316+00	150 R	2	0 - 6	11	-	-	-	-	-	2	-	-	A-8
PB-4	146+00	260 L	3	13.5 - 15	17	100	86	63	31	20	-	-	-	A-2-4
PB-5	151+00	350 L	3	3 - 8	18	100	97	86	44	16	-	NP	NP	A-2-4
PB-1	20+00	1,750 L	3	17 - 20	23	100	99	95	68	31	-	NP	NP	A-2-4
PB-6	172+00	250 L	4	10 - 14	33	100	100	98	79	73	-	52	70	A-7-6
SW-6	325+00	85 R	4	7 - 10	12	100	97	89	77	43	-	-	-	A-7-6
PB-3	86+55	300 L	4	4 - 10	21	100	100	97	78	35	-	-	-	A-2-4
SW-3	312+00	85 L	5	0 - 1	35	-	-	-	-	-	11	-	-	A-8
PB-2	45+00	600 L	5	0 - 2	20	-	-	-	-	-	3	-	-	A-8

TABLE 3

Field Permeability Test Results
SR 46 PD&E Study
Seminole County, Florida

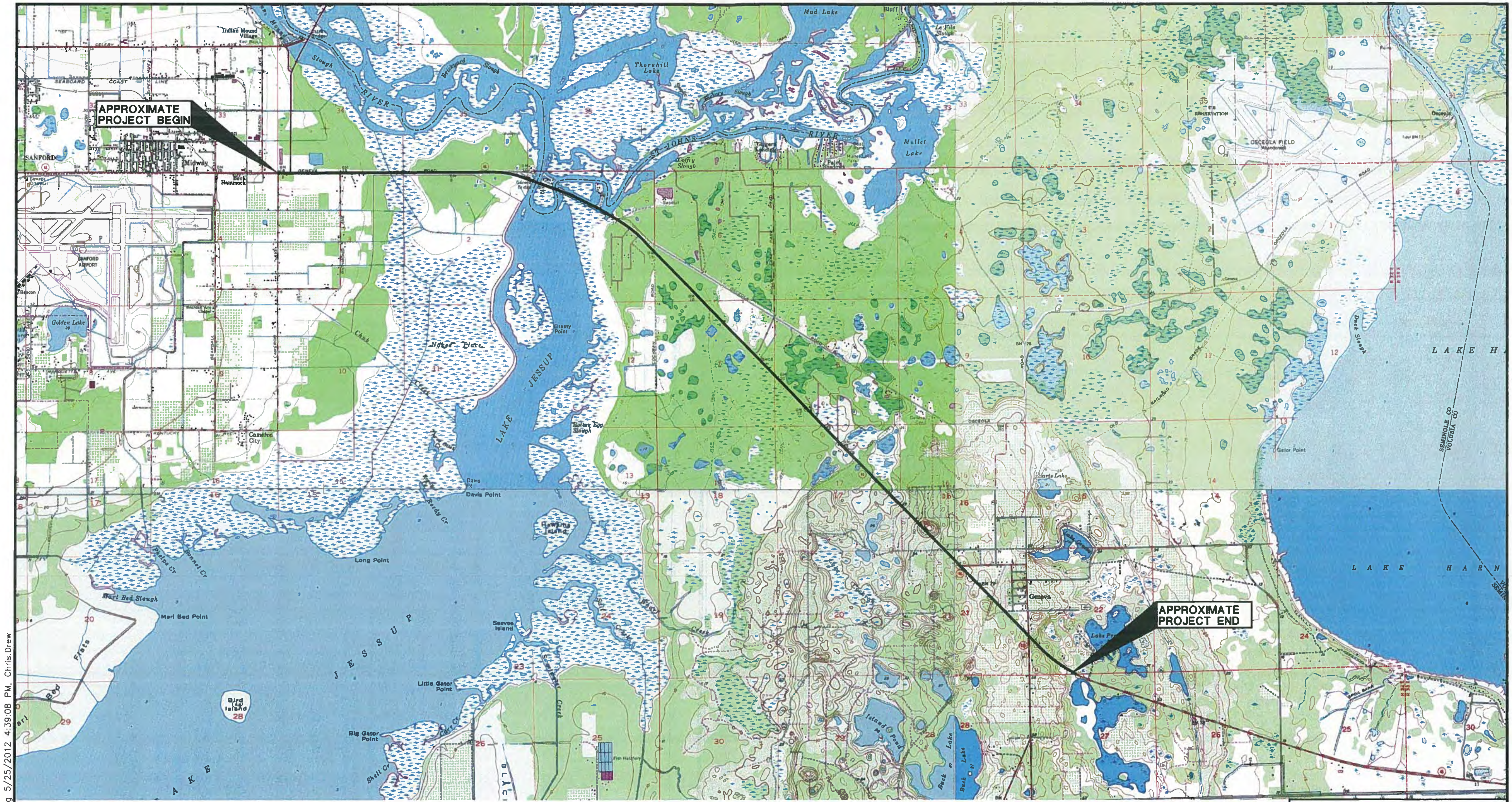
Pond	Boring	Station	Offset (ft)	Test Depth (ft)	Stratum	Measured Permeability Rate (in/hr)
E	PB-9	301+00	150 R	8 - 9	1	0.4
F	PB-10	316+00	150 R	3 - 4	2	5.6
G	PB-11	329+00	200 R	3 - 4	1	5.0
H	PB-12	385+00	150 R	9 - 10	1	> 20

TABLE 4

Double Ring Infiltrometer Test Results
SR 46 PD&E Study
Seminole County, Florida

Boring	Station	Offset (ft)	Infiltration Rate* (ft/day)
SW-1	300+00	80 L	51.8
SW-2	305+00	95 R	45.6
SW-3	312+00	85 L	117.1
SW-4	317+00	85 R	84.2
SW-5	325+00	82 L	106.5
SW-6	329+00	85 R	56.5
SW-7	336+00	80 L	60.5
SW-8	341+00	85 R	79.6
SW-9	348+00	80 L	19.4
SW-10	352+60	80 R	83.5
SW-11	360+00	85 L	44.4
SW-12	365+00	90 R	52.1

* A maximum rate of 40 ft/day should be used in design.



SECTIONS 1, 2, 3, 6, 7, 8, 16, 17, 21 & 22
TOWNSHIP 20 SOUTH
RANGES 31 & 32 EAST

OBTAINED FROM U.S.G.S. QUAD MAP: OSTEEN, FLORIDA 1980, OVIEDO, FLORIDA 1987 & GENEVA, FLORIDA 1977

N

0 2000 4000

APPROXIMATE SCALE: 1"=4000'

QUADRANGLE LOCATION

SITE LOCATION MAP

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

PROJECT DEVELOPMENT AND ENVIRONMENT
STATE ROAD 46
SEMINOLE COUNTY, FLORIDA

DRAWN BY: CD	CHECKED BY:	DATE: 05/15/12
FILE NO. 11-6445	APPROVED BY:	FIGURE: 1

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FIGURE NO. 2A

N

0 250 500

SCALE: 1"=500'

LEGEND

AUGER BORING LOCATION

NOTES:

1. AERIAL PHOTO OBTAINED FROM FLORIDA RESOURCES & ENVIRONMENTAL ANALYSIS CENTER, DATED 2009.
2. SOIL SURVEY INFORMATION OBTAINED FROM U.S. DEPARTMENT OF AGRICULTURAL, NATURAL RESOURCES CONSERVATION SERVICE, DATED 08/28/07.

SOIL LEGEND

4 - ASTATULA FINE SAND, 0 TO 5% SLOPES
5 - ASTATULA FINE SAND, 5 TO 8% SLOPES
6 - ASTATULA-APOPKA FINE SANDS, 0 TO 5% SLOPES
7 - ASTATULA-APOPKA FINE SANDS, 5 TO 8% SLOPES
8 - ASTATULA-APOPKA FINE SANDS, 8 TO 12% SLOPES
9 - BASINGER AND DELRAY FINE SANDS
10 - BASINGER, SAMSULA, AND HONTOON SOILS, DEPRESSIONAL
11 - BASINGER AND SMYRNA FINE SANDS, DEPRESSIONAL
12 - CANOVA AND TERRA CEIA MUCKS
13 - EAUGALLIE AND IMMOKALEE FINE SANDS
15 - FELDA AND MANATEE MUCKY FINE SANDS, DEPRESSIONAL
16 - IMMOKALEE SAND
17 - BRIGHTON, SAMSULA AND SANIBEL MUCKS
18 - MALABAR FINE SAND
19 - MANATEE, FLORIDANA AND HOLOPAW SOILS, FREQUENTLY FLOODED
20 - MYAKKA AND EAUGALLIE FINE SANDS
21 - NITTAW MUCKY FINE SAND, DEPRESSIONAL
22 - NITTAW MUCK, OCCASIONALLY FLOODED
23 - NITTAW, OKEELANTA AND BASINGER SOILS, FREQUENTLY FLOODED
25 - PINEDA FINE SAND
26 - UDORTHENTS, EXCAVATED
27 - POMELLO FINE SAND, 0 TO 5% SLOPES
29 - ST. JOHNS AND EAUGALLIE FINE SANDS
33 - TERRA CEIA MUCK, FREQUENTLY FLOODED

BORING LOCATION PLAN

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE
DESIGNED BY	ZCB	05/12	CADD BY	CD	05/12

SUPERVISED BY: ZAN C. BATES, P.E. FLA. REG. NO. 49917

APPROVED BY

DATE

Ardaman & Associates, Inc.

STATE ROAD 46

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FIGURE NO. 2B

LEGEND

AUGER BORING LOCATION

NOTES:
1. AERIAL PHOTO OBTAINED FROM FLORIDA RESOURCES & ENVIRONMENTAL ANALYSIS CENTER, DATED 2009.
2. SOIL SURVEY INFORMATION OBTAINED FROM U.S. DEPARTMENT OF AGRICULTURAL, NATURAL RESOURCES CONSERVATION SERVICE, DATED 08/28/07.

N

0 250 500
SCALE: 1"=500'

SOIL LEGEND

4 - ASTATULA FINE SAND, 0 TO 5% SLOPES
5 - ASTATULA FINE SAND, 5 TO 8% SLOPES
6 - ASTATULA-APOPKA FINE SANDS, 0 TO 5% SLOPES
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22 - NITTAW MUCK, OCCASIONALLY FLOODED
23 - NITTAW, OKEELANTA AND BASINGER SOILS, FREQUENTLY FLOODED
25 - PINEDA FINE SAND
26 - UDORTHENTS, EXCAVATED
27 - POMELLO FINE SAND, 0 TO 5% SLOPES
29 - ST. JOHNS AND EAUGALLIE FINE SANDS
33 - TERRA CEIA MUCK, FREQUENTLY FLOODED

BORING LOCATION PLAN

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE
DESIGNED BY	ZCB	05/12	CADD BY	CD	05/12

SUPERVISED BY: ZAN C. BATES, P.E. FLA. REG. NO. 49917

APPROVED BY

DATE

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STATE ROAD 46

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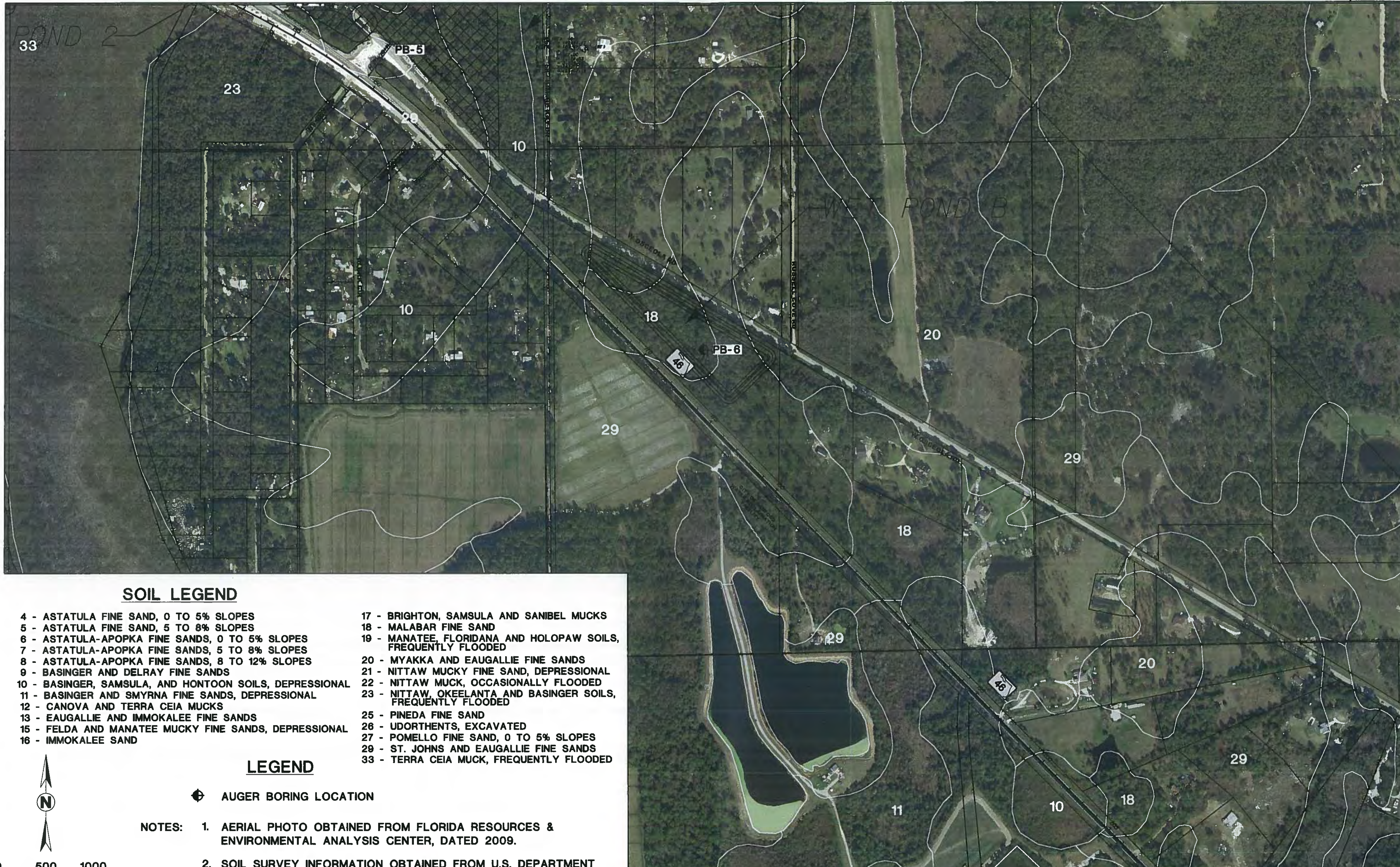
FIGURE NO. 2C



SOIL LEGEND

4 - ASTATULA FINE SAND, 0 TO 5% SLOPES
5 - ASTATULA FINE SAND, 5 TO 8% SLOPES
6 - ASTATULA-APOPKA FINE SANDS, 0 TO 5% SLOPES
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27 - POMELLO FINE SAND, 0 TO 5% SLOPES
29 - ST. JOHNS AND EAUGALLIE FINE SANDS
33 - TERRA CEIA MUCK, FREQUENTLY FLOODED

LEGEND

AUGER BORING LOCATION

N

0 500 1000
SCALE: 1"=1000'

NOTES:
1. AERIAL PHOTO OBTAINED FROM FLORIDA RESOURCES & ENVIRONMENTAL ANALYSIS CENTER, DATED 2009.
2. SOIL SURVEY INFORMATION OBTAINED FROM U.S. DEPARTMENT OF AGRICULTURAL, NATURAL RESOURCES CONSERVATION SERVICE, DATED 08/28/07.

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BORING LOCATION PLAN

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE
DESIGNED BY	ZCB	05/12	CADD BY	CD	05/12

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DATE

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STATE ROAD 46

FIGURE NO. 2D

SOIL LEGEND

4 - ASTATULA FINE SAND, 0 TO 5% SLOPES
5 - ASTATULA FINE SAND, 5 TO 8% SLOPES
6 - ASTATULA-APOPKA FINE SANDS, 0 TO 5% SLOPES
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27 - POMELLO FINE SAND, 0 TO 5% SLOPES
29 - ST. JOHNS AND EAUGALLIE FINE SANDS
33 - TERRA CEIA MUCK, FREQUENTLY FLOODED

LEGEND

AUGER BORING LOCATION

N

0 250 500
SCALE: 1"=500'

NOTES:
1. AERIAL PHOTO OBTAINED FROM FLORIDA RESOURCES & ENVIRONMENTAL ANALYSIS CENTER, DATED 2009.
2. SOIL SURVEY INFORMATION OBTAINED FROM U.S. DEPARTMENT OF AGRICULTURAL, NATURAL RESOURCES CONSERVATION SERVICE, DATED 08/28/07.

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BORING LOCATION PLAN

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE
DESIGNED BY	ZCB	05/12	CADD BY	CD	05/12

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DATE

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STATE ROAD 46

FIGURE NO. 2E

SOIL LEGEND

4 - ASTATULA FINE SAND, 0 TO 5% SLOPES
5 - ASTATULA FINE SAND, 5 TO 8% SLOPES
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LEGEND

AUGER BORING LOCATION

N

0 250 500
SCALE: 1"=500'

NOTES:
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BORING LOCATION PLAN

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE
DESIGNED BY	ZCB	05/12	CADD BY	CD	05/12

SUPERVISED BY: ZAN C. BATES, P.E. FLA. REG. NO. 49917

APPROVED BY

DATE

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STATE ROAD 46

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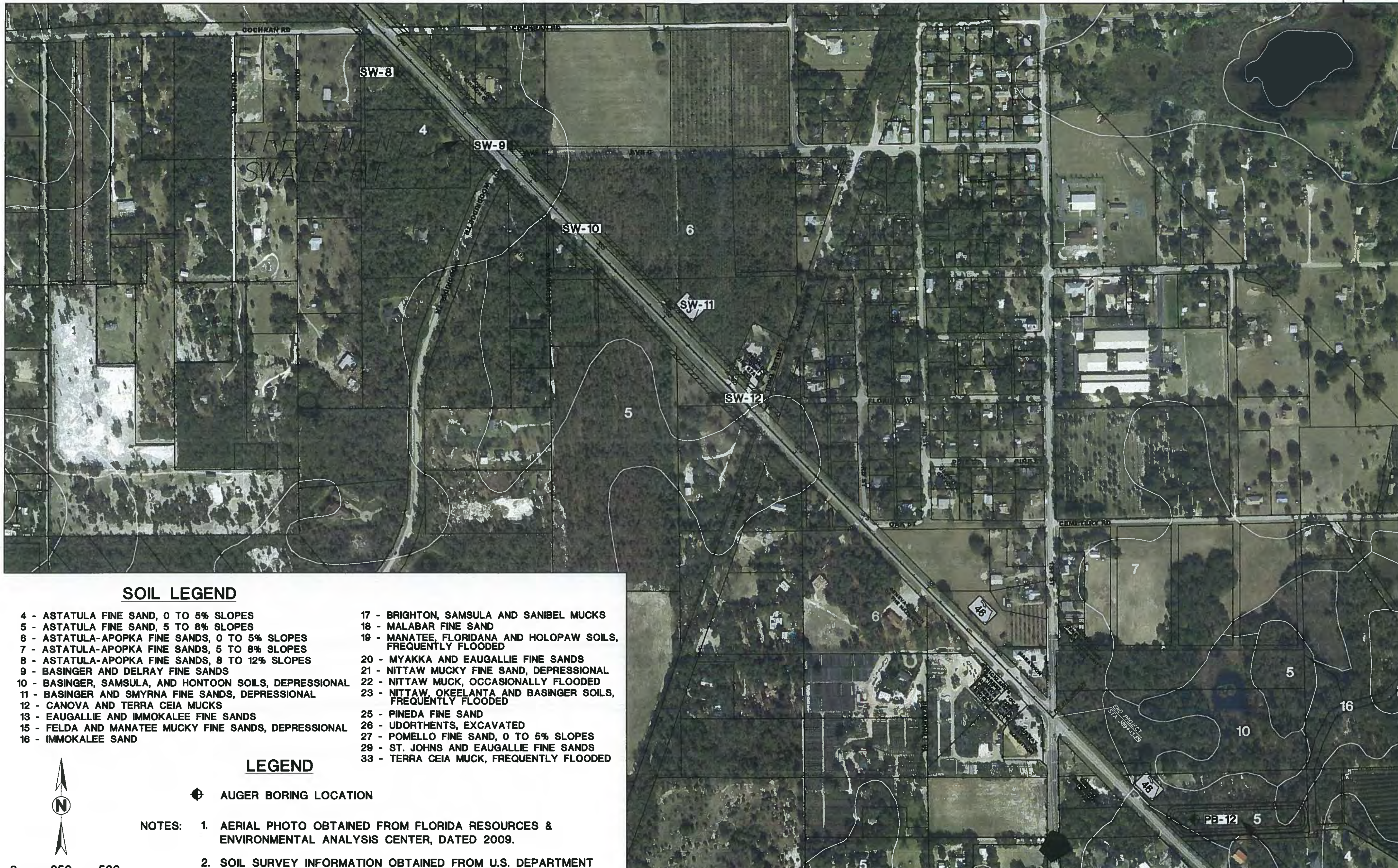
FIGURE NO. 2F



SOIL LEGEND

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LEGEND

AUGER BORING LOCATION

NOTES:
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2. SOIL SURVEY INFORMATION OBTAINED FROM U.S. DEPARTMENT OF AGRICULTURAL, NATURAL RESOURCES CONSERVATION SERVICE, DATED 08/28/07.

N

0 250 500
SCALE: 1"=500'

BORING LOCATION PLAN

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE
DESIGNED BY	ZCB	05/12	CADD BY	CD	05/12

SUPERVISED BY: ZAN C. BATES, P.E. FLA. REG. NO. 49917

APPROVED BY

DATE

Ardaman & Associates, Inc.

STATE ROAD 46

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FIGURE 3

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

DATE OF SURVEY : MARCH - MAY, 2012
SURVEY MADE BY : TATE, BAKER
SUBMITTED BY : ZAN BATES, P.E.

FINANCIAL PROJECT ID : 240216-4-28-01

DISTRICT : FIVE
ROAD NO : 46
COUNTY : SEMINOLE

CROSS SECTION SOIL SURVEY FOR THE DESIGN OF ROADS

SURVEY BEGINS STA. : 00+00 SURVEY ENDS STA. : 389+01

	ORGANIC CONTENT		MOISTURE CONTENT		SIEVE ANALYSIS RESULTS % PASS						ATTERBERG LIMITS (%)			SOIL CLASSIFICATION		CORROSION TEST RESULTS				
STRATUM	NO. OF TESTS	% ORGANIC	NO. OF TESTS	MOISTURE CONTENT	NO. OF TESTS	10 MESH	40 MESH	60 MESH	100 MESH	200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTIC INDEX	AASHTO GROUP	DESCRIPTION	NO. OF TESTS	RESISTIVITY ohms cm	CHLORIDE ppm	SULFATES ppm	pH
1	---	---	4	1-17	4	100	97-98	81-85	22-34	2-10	0	---	---	A-3	LIGHT BROWN TO DARK BROWN, GRAY BROWN AND ORANGE BROWN FINE SAND TO FINE SAND WITH SILT	0	---	---	---	---
2	2	2	2	11-24	1	100	99	94	50	18	0	---	---	A-2-4	LIGHT BROWN TO DARK BROWN, GRAY BROWN AND ORANGE BROWN AND GREEN BROWN SILTY FINE SAND, OCCASIONAL ORGANICS	0	---	---	---	---
3	---	---	3	17-23	3	100	86-99	63-95	31-68	16-31	2	NP	NP	A-2-4	BROWN AND GRAY FINE SAND WITH CLAY TO CLAYEY FINE SAND	0	---	---	---	---
4	---	---	3	12-33	3	100	97-100	89-98	77-79	35-73	1	52	70	A-8	GREEN GRAY CLAYEY FINE SAND TO SANDY CLAY	0	---	---	---	---
5	2	3-11	2	20-35	0	---	---	---	---	---	0	---	---	A-7-6	DARK BROWN MUCKY FINE SAND TO ORGANIC MUCK	0	---	---	---	---
6	---	---	---	---	---	---	---	---	---	---	0	---	---	---	DEBRIS TYPICALLY CONSISTING OF HOUSEHOLD TRASH	0	---	---	---	---
																0	---	---	---	---

NOTES:

1. STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. ANY STRATUM CONNECTING LINES THAT ARE SHOWN ARE FOR ESTIMATING EARTHWORK ONLY AND DO NOT INDICATE ACTUAL STRATUM LIMITS. SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED AS INDICATED IN SECTION 2-4 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION. FOR FURTHER DETAILS, SEE SECTION 120-3 OF THE STANDARD SPECIFICATIONS.

2. LEGEND ▽ ESTIMATED NORMAL SEASONAL HIGH WATER TABLE
   LEGEND ▼ DEPTH GROUNDWATER WAS ENCOUNTERED ON DATE DRILLED

3. THE VALUES REPRESENTED BY A "---" ARE UNMEASURED SOIL PARAMETERS.

4. STRATA NOS 1, 2 AND 3 SHALL BE TREATED AS SELECT (S) MATERIAL IN ACCORDANCE WITH FDOT INDEX 500 AND INDEX 505.

5. STRATUMS NOS 2 AND 3 MAY RETAIN EXCESS MOISTURE AND MAY BE DIFFICULT TO DRY AND COMPACT.

6. STRATUM NO 4 SHALL BE TREATED AS PLASTIC (P) IN ACCORDANCE WITH FDOT INDEX 500 AND INDEX 505.

7. STRATUM NO 5 SHALL BE TREATED AS MUCK (M) MATERIAL IN ACCORDANCE WITH FDOT INDEX 500 AND INDEX 505.

8. "NP" DENOTES NON-PLASTIC.

9. REMOVAL OF MUCK AND PLASTIC MATERIAL OCCURRING WITHIN ROADWAY SHALL BE ACCOMPLISHED IN ACCORDANCE WITH INDEX NO. 500 UNLESS OTHERWISE SHOWN ON THE PLANS. THE MATERIAL USED IN EMBANKMENT CONSTRUCTION SHALL BE IN ACCORDANCE WITH INDEX NO. 505 OF FDOT DESIGN STANDARDS.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD:
ZAN C. BATES, P.E.
FL./REG. NO. 49917
Ardaman & Associates, Inc.
8008 S. ORANGE AVENUE
P.O. BOX 593003
ORLANDO, FL. 32859-3003
FLA. REG NO. 5950

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

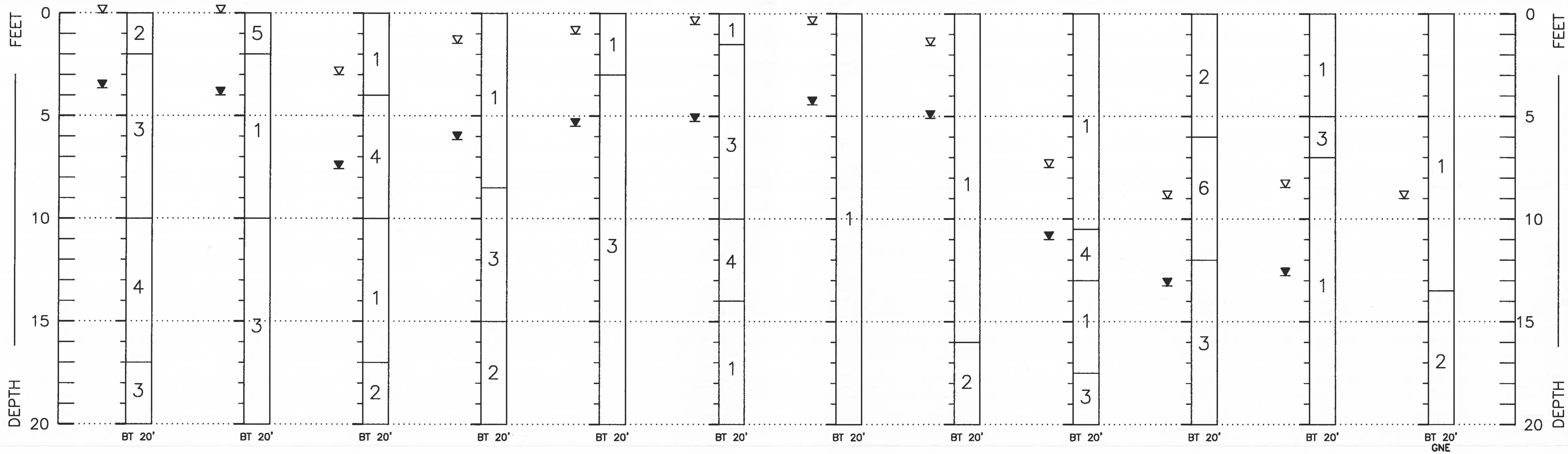
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 46	SEMINOLE	240216-4-28-01

ROADWAY SOIL SURVEY

SHEET NO.

FIGURE NO. 4

BORING	PB-1	PB-2	PB-3	PB-4	PB-5	PB-6	PB-7	PB-8	PB-9	PB-10	PB-11	PB-12
DATE	04/06/12	04/06/12	04/03/12	03/29/12	03/30/12	03/30/12	03/29/12	03/29/12	05/15/12	03/29/12	04/05/12	04/05/12
STATION	20+00	45+00	86+55	146+00	151+00	172+00	236+00	279+00	301+00	316+00	329+00	398+25
OFFSET	1750' L	600' L	300' L	260' L	350' L	250' L	300' L	215' L	150' R	150' R	200' R	145' L



LEGEND

- ▼ DEPTH GROUNDWATER WAS ENCOUNTERED ON DATE DRILLED
- ▽ DEPTH TO ESTIMATED NORMAL SEASONAL HIGH WATER TABLE
- GNE GROUNDWATER NOT ENCOUNTERED ON DATE DRILLED
- BORING STATION AND OFFSET REFERENCED TO PROJECT CENTERLINE

ROADWAY BORING PROFILES

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE
DESIGNED BY	ZCB	05/12	CADD BY	CD	05/12

SUPERVISED BY: ZAN C. BATES, P.E. FLA. REG. NO. 49917

APPROVED BY

DATE

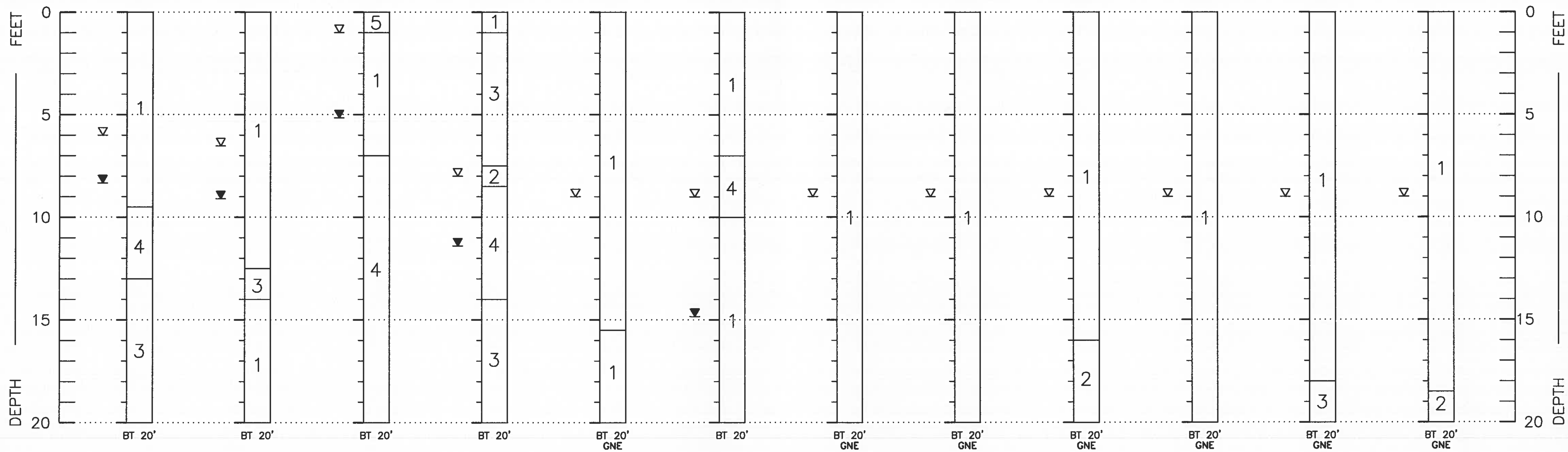
Ardaman & Associates, Inc.

STATE ROAD 46

T:\Orlando\11\11-6445\11644503.dwg 6/20/2012 10:08:42 AM, tom.taylor

FIGURE NO. 5

BORING	SW–1	SW–2	SW–3	SW–4	SW–5	SW–6	SW–7	SW–8	SW–9	SW–10	SW–11	SW–12
DATE	03/30/12	05/15/12	03/30/12	05/15/12	03/30/12	04/03/12	03/30/12	03/30/12	03/30/12	03/30/12	03/30/12	04/05/12
STATION	300+00	305+00	312+00	317+00	325+00	329+00	336+00	341+00	348+00	352+60	360+00	365+00
OFFSET	80' L	95' R	85' L	85' R	82' L	85' R	80' L	85' R	80' L	80' R	85' L	90' R



LEGEND

▼ DEPTH GROUNDWATER WAS ENCOUNTERED ON DATE DRILLED

▽ DEPTH TO ESTIMATED NORMAL SEASONAL HIGH WATER TABLE

GNE GROUNDWATER NOT ENCOUNTERED ON DATE DRILLED

BORING STATION AND OFFSET REFERENCED TO PROJECT CENTERLINE

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ROADWAY BORING PROFILES

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE	APPROVED BY
DESIGNED BY	ZCB	05/12	CADD BY	CD	05/12	
SUPERVISED BY: ZAN C. BATES, P.E. FLA. REG. NO. 49917						DATE

Ardaman & Associates, Inc.

STATE ROAD 46

APPENDIX I

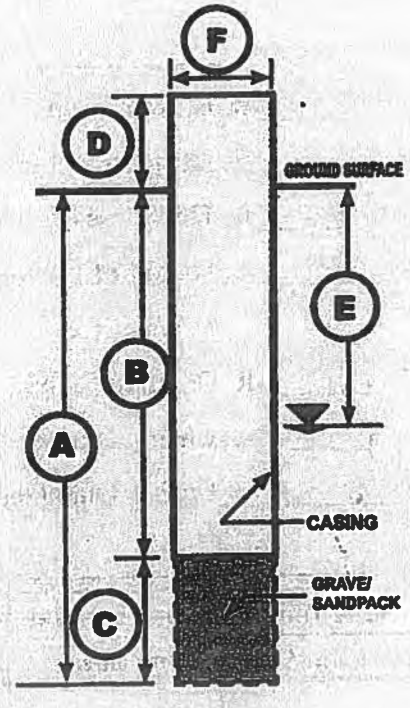
Auger Boring and Field Permeability Test Procedures

AUGER BORINGS

Auger borings are used when a relatively large, continuous sampling of soil strata close to ground surface is desired. A 4-inch diameter, continuous flite, helical auger with a cutting head at its end is screwed into the ground in 5-foot sections. It is powered by the rotating action of the Kelly bar of a rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is classified and representative samples put in bags or jars and brought back to the laboratory for classification testing.

BOREHOLE PERMEABILITY TEST

1. Drill a borehole at the location and depth to be tested. The borehole should be of a diameter such that the casing snugly fits in the borehole.



2. Insert a casing, snugly fit, to the bottom of the borehole.

3. Clean the cuttings from the borehole with a bucket auger and/or water under pressure carefully. Verify proper depth of boring. Do not overextend during clearing.

4. Allow the water level to stabilize and record.. It is very important to measure the groundwater level accurately and after sufficient time for stabilization.

5. Place a 12 inches thick gravel or clean graded sand (e.g. #10-20) layer (unless otherwise directed) in the bottom of the casing and pull the casing up to the top of the gravel/ sand. Some additional gravel/sand may be required to provide sand/gravel to the bottom of the casing. These measurements should be made within the nearest 1 inch. The gravel/sand pack should be considerably coarser than the soil being tested and should be free of soil or other contamination such as silt or clay. A pea-gravel for testing coarse sand or 10-20 sand for testing fine sand should be adequate.

6. Sill the casing with water and provide a surge several times to suspend silt in the system. Use potable water for testing. Pump water into the casing or bail water from the casing until most of the silt is removed.

7. Fill the casing with water to the top and note the rate that the water drops. This will be an indication of the quantity of water required to run the test. Use an appropriately sized and calibrated container to add water to the casing.

8. Again fill the casing and maintain the water level at the top of the casing. Measure the quantity of water added during each one minute interval for the test duration. The test should continue until the flow is stabilized and for at least 20 minutes, when testing above the groundwater level, or 10 minutes, when testing below the groundwater level.

9. If a falling head test is specified or otherwise appropriate, measure the depth to the water in the casing at 15 second intervals for the first minute, then at 30 second intervals to 5 minutes. Thereafter, measure the water level in the casing at 1 minute intervals to at least 10 minutes or until the water level is within a few inches of the original water level.

10. Perform test two (2) times unless otherwise instructed.

APPENDIX II

Double Ring Infiltration Test Results

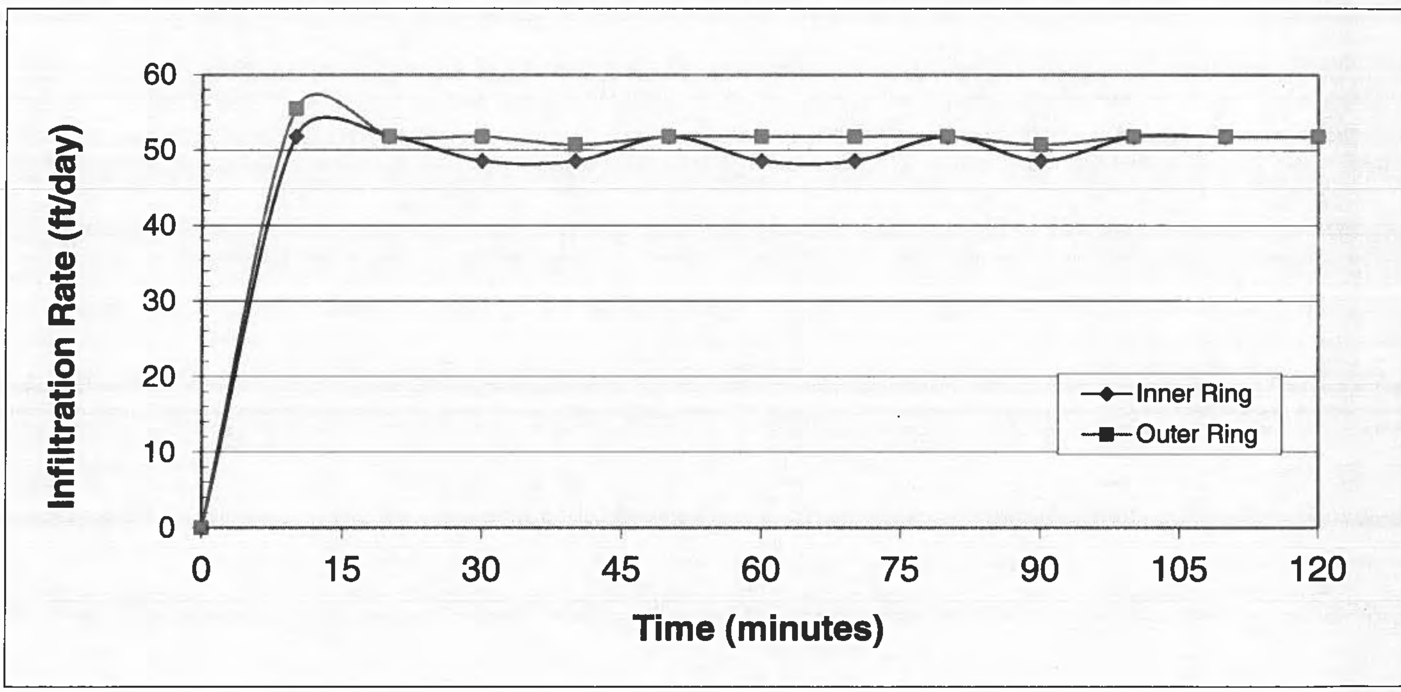
Project : SR 46 PD&E
Location : SW-1

A & A File No. : 11-6445

Date : 3/4/12
Time : 0

AREA (in^2)
Inner Ring : 113.1
Outer Ring : 452.4
Annular Space : 339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
10	8000	8000	4.32	25700	25700	4.62	51.80	55.47
20	8000	16000	8.63	24000	49700	8.94	51.80	51.80
30	7500	23500	12.68	24000	73700	13.26	48.56	51.80
40	7500	31000	16.73	23500	97200	17.48	48.56	50.72
50	8000	39000	21.04	24000	121200	21.80	51.80	51.80
60	7500	46500	25.09	24000	145200	26.12	48.56	51.80
70	7500	54000	29.14	24000	169200	30.43	48.56	51.80
80	8000	62000	33.45	24000	193200	34.75	51.80	51.80
90	7500	69500	37.50	23500	216700	38.97	48.56	50.72
100	8000	77500	41.82	24000	240700	43.29	51.80	51.80
110	8000	85500	46.13	24000	264700	47.61	51.80	51.80
120	8000	93500	50.45	24000	288700	51.92	51.80	51.80



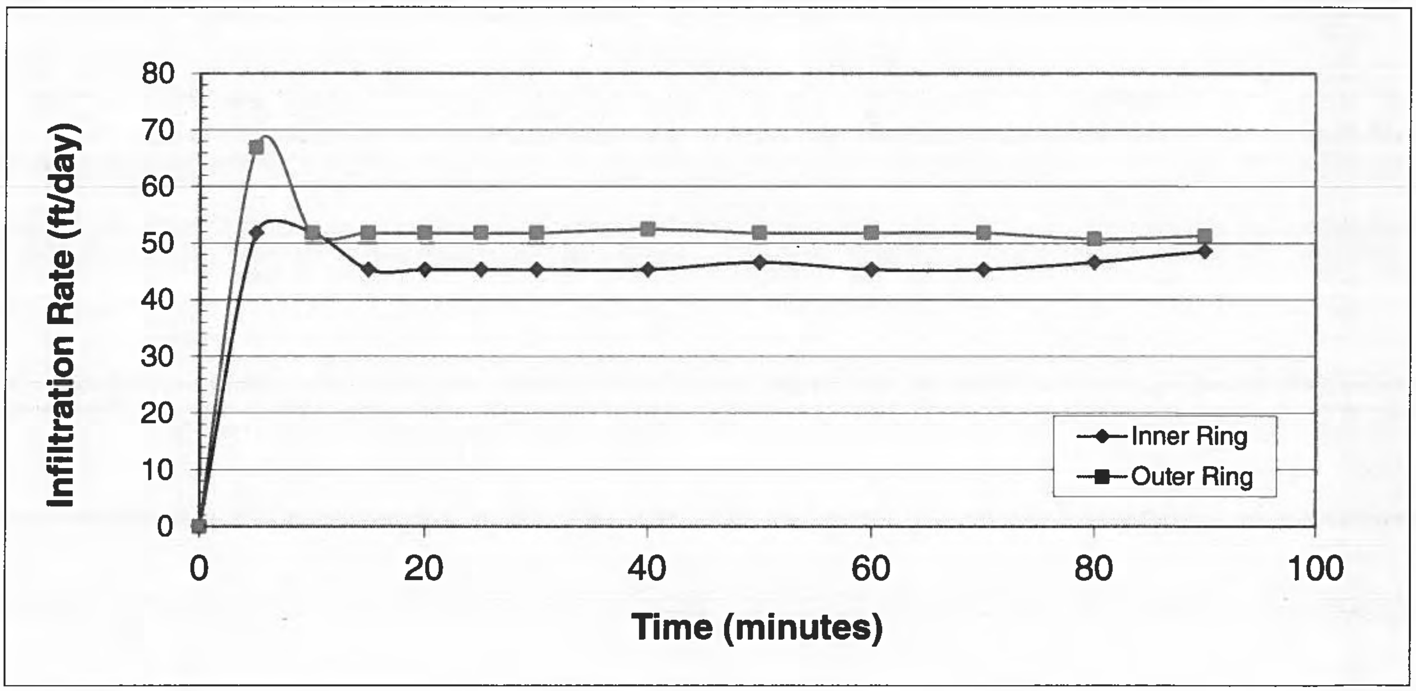
Project : SR 46 PD&E
Location : SW-2

A & A File No. : 11-6445

Date : 5/31/12
Time : 0

AREA (in^2)
Inner Ring : 113.1
Outer Ring : 452.4
Annular Space : 339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
5	4000	4000	2.16	15500	15500	2.79	51.80	66.91
10	4000	8000	4.32	12000	27500	4.95	51.80	51.80
15	3500	11500	6.21	12000	39500	7.10	45.32	51.80
20	3500	15000	8.09	12000	51500	9.26	45.32	51.80
25	3500	18500	9.98	12000	63500	11.42	45.32	51.80
30	3500	22000	11.87	12000	75500	13.58	45.32	51.80
40	7000	29000	15.65	24300	99800	17.95	45.32	52.45
50	7200	36200	19.53	24000	123800	22.27	46.62	51.80
60	7000	43200	23.31	24000	147800	26.58	45.32	51.80
70	7000	50200	27.09	24000	171800	30.90	45.32	51.80
80	7200	57400	30.97	23500	195300	35.13	46.62	50.72
90	7500	64900	35.02	24000	219300	39.44	48.56	51.26



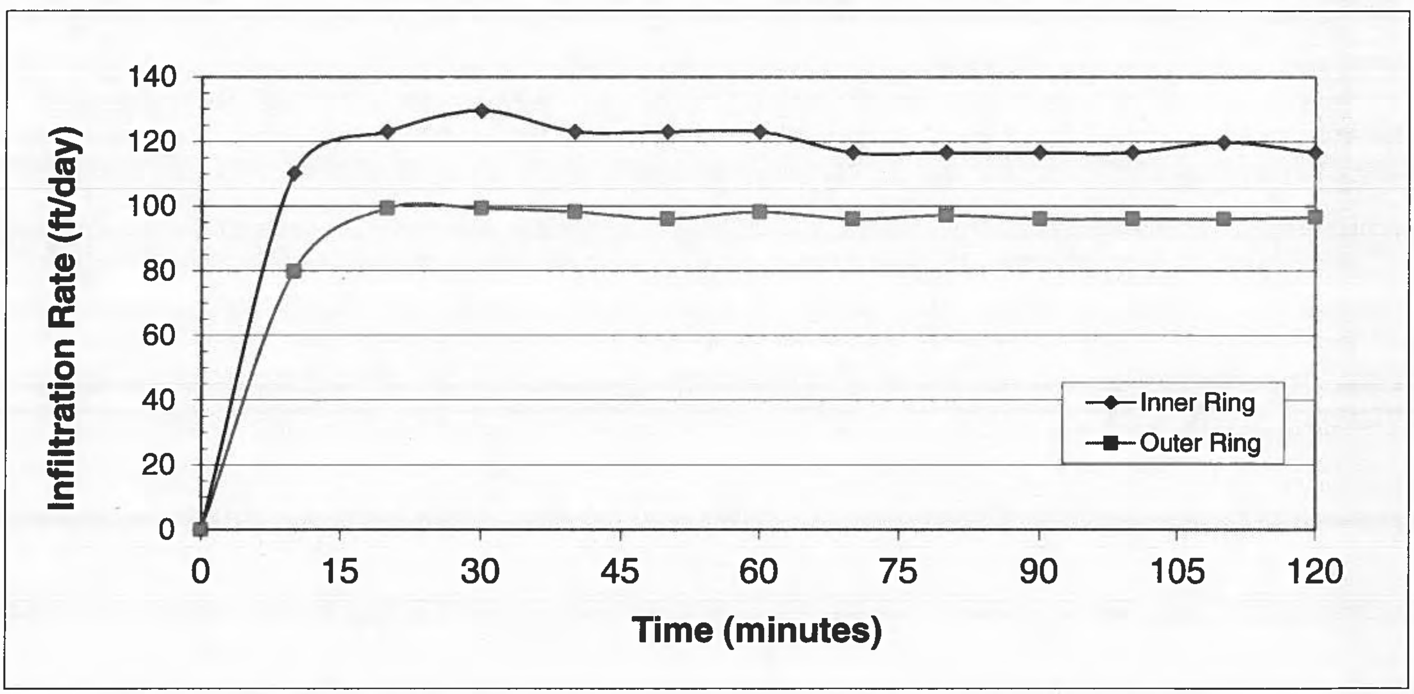
Project : SR 46 PD&E
Location : SW-3

A & A File No. : 11-6445

Date : 3/2/12
Time : 0

AREA (in^2)	
Inner Ring :	113.1
Outer Ring :	452.4
Annular Space :	339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
10	17000	17000	9.17	37000	37000	6.65	110.07	79.86
20	19000	36000	19.42	46000	83000	14.93	123.02	99.28
30	20000	56000	30.22	46000	129000	23.20	129.50	99.28
40	19000	75000	40.47	45500	174500	31.38	123.02	98.20
50	19000	94000	50.72	44500	219000	39.39	123.02	96.04
60	19000	113000	60.97	45500	264500	47.57	123.02	98.20
70	18000	131000	70.68	44500	309000	55.58	116.55	96.04
80	18000	149000	80.40	45000	354000	63.67	116.55	97.12
90	18000	167000	90.11	44500	398500	71.67	116.55	96.04
100	18000	185000	99.82	44500	443000	79.68	116.55	96.04
110	18500	203500	109.80	44500	487500	87.68	119.78	96.04
120	18000	221500	119.51	45000	532500	95.77	116.55	96.58



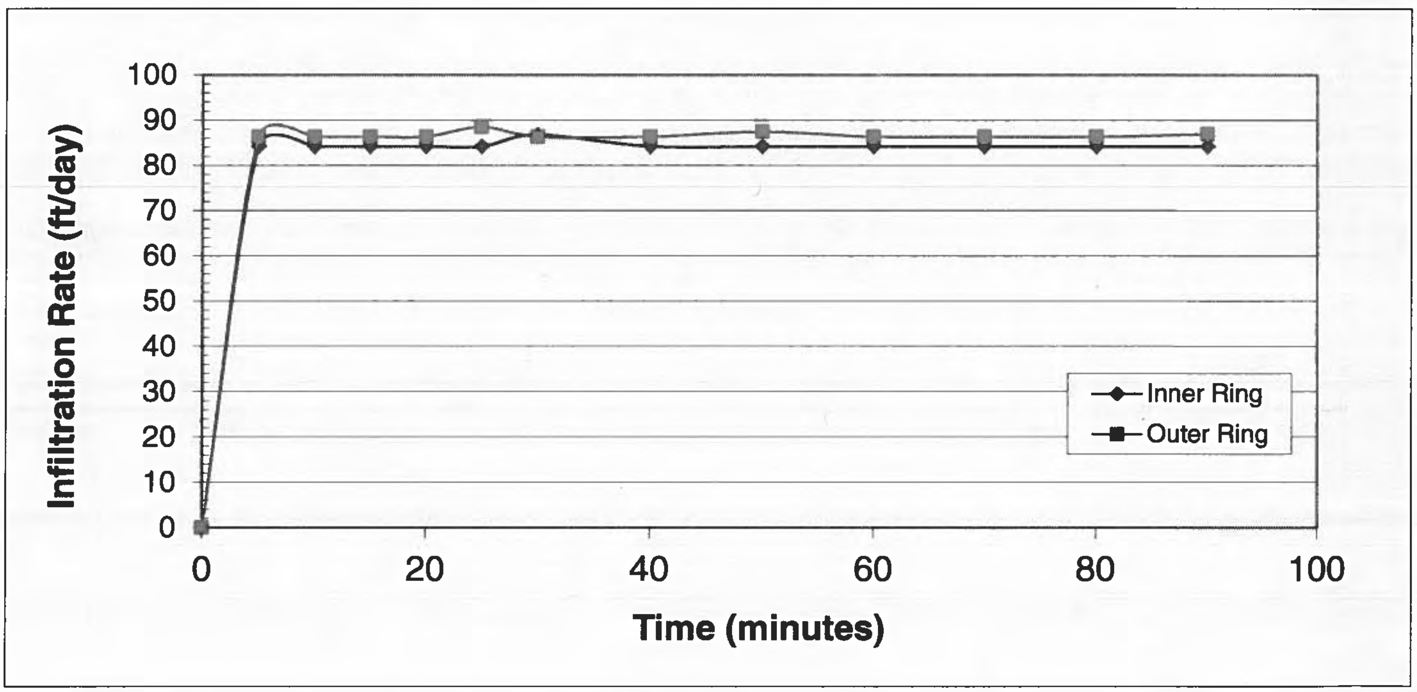
Project : SR 46 PD&E
Location : SW-4

A & A File No. : 11-6445

Date : 5/31/12
Time : 0

AREA (in^2)
Inner Ring : 113.1
Outer Ring : 452.4
Annular Space : 339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
5	6500	6500	3.51	20000	20000	3.60	84.17	86.33
10	6500	13000	7.01	20000	40000	7.19	84.17	86.33
15	6500	19500	10.52	20000	60000	10.79	84.17	86.33
20	6500	26000	14.03	20000	80000	14.39	84.17	86.33
25	6500	32500	17.54	20500	100500	18.08	84.17	88.49
30	6700	39200	21.15	20000	120500	21.67	86.76	86.33
40	13000	52200	28.17	40000	160500	28.87	84.17	86.33
50	13000	65200	35.18	40500	201000	36.15	84.17	87.41
60	13000	78200	42.19	40000	241000	43.35	84.17	86.33
70	13000	91200	49.21	40000	281000	50.54	84.17	86.33
80	13000	104200	56.22	40000	321000	57.73	84.17	86.33
90	13000	117200	63.24	40500	361500	65.02	84.17	86.87



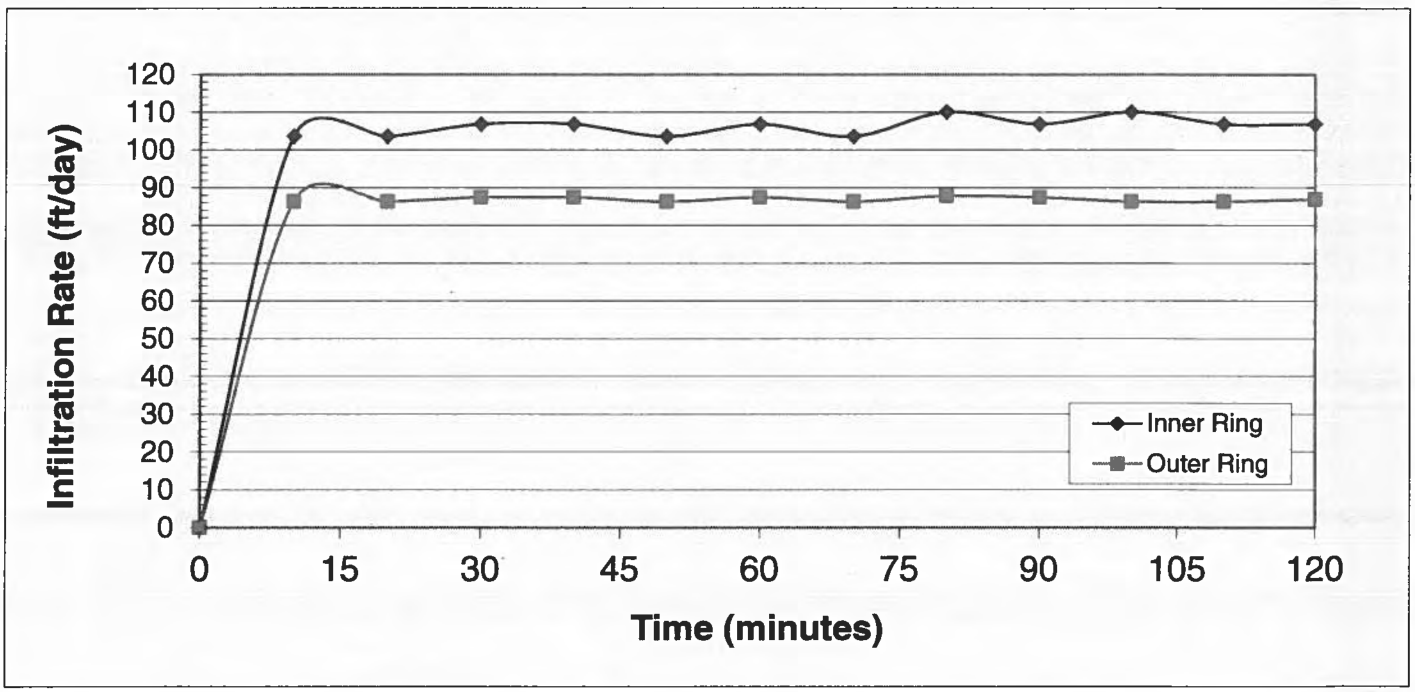
Project : SR 46 PD&E
Location : SW-5

A & A File No. : 11-6445

Date : 4/6/12
Time : 0

AREA (in^2)	
Inner Ring :	113.1
Outer Ring :	452.4
Annular Space :	339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
10	16000	16000	8.63	40000	40000	7.19	103.60	86.33
20	16000	32000	17.27	40000	80000	14.39	103.60	86.33
30	16500	48500	26.17	40500	120500	21.67	106.83	87.41
40	16500	65000	35.07	40500	161000	28.96	106.83	87.41
50	16000	81000	43.71	40000	201000	36.15	103.60	86.33
60	16500	97500	52.61	40500	241500	43.44	106.83	87.41
70	16000	113500	61.24	40000	281500	50.63	103.60	86.33
80	17000	130500	70.41	40700	322200	57.95	110.07	87.84
90	16500	147000	79.32	40500	362700	65.23	106.83	87.41
100	17000	164000	88.49	40000	402700	72.43	110.07	86.33
110	16500	180500	97.39	40000	442700	79.62	106.83	86.33
120	16500	197000	106.29	40500	483200	86.91	106.83	86.87



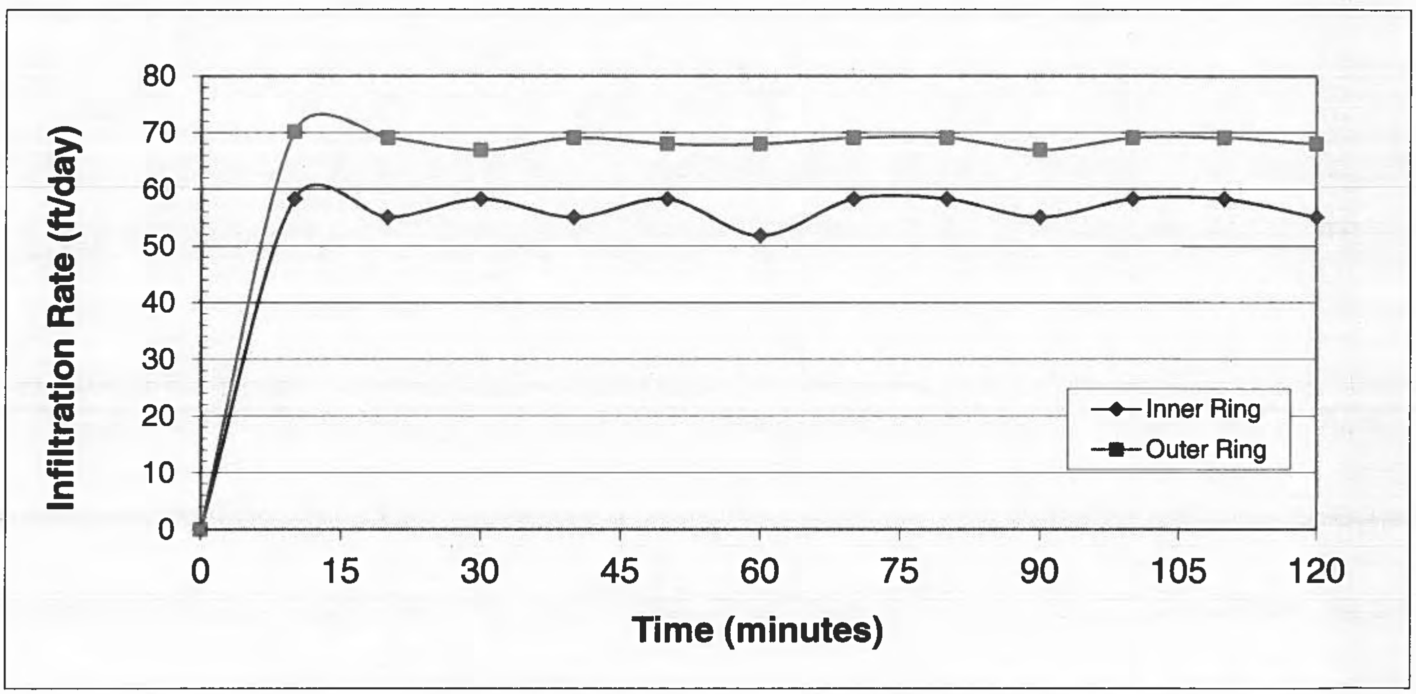
Project : SR 46 PD&E
Location : SW-6

A & A File No. : 11-6445

Date : 3/3/12
Time : 0

AREA (in^2)
Inner Ring : 113.1
Outer Ring : 452.4
Annular Space : 339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
10	9000	9000	4.86	32500	32500	5.85	58.27	70.14
20	8500	17500	9.44	32000	64500	11.60	55.04	69.06
30	9000	26500	14.30	31000	95500	17.18	58.27	66.91
40	8500	35000	18.88	32000	127500	22.93	55.04	69.06
50	9000	44000	23.74	31500	159000	28.60	58.27	67.99
60	8000	52000	28.06	31500	190500	34.26	51.80	67.99
70	9000	61000	32.91	32000	222500	40.02	58.27	69.06
80	9000	70000	37.77	32000	254500	45.77	58.27	69.06
90	8500	78500	42.36	31000	285500	51.35	55.04	66.91
100	9000	87500	47.21	32000	317500	57.10	58.27	69.06
110	9000	96500	52.07	32000	349500	62.86	58.27	69.06
120	8500	105000	56.65	31000	380500	68.44	55.04	67.99



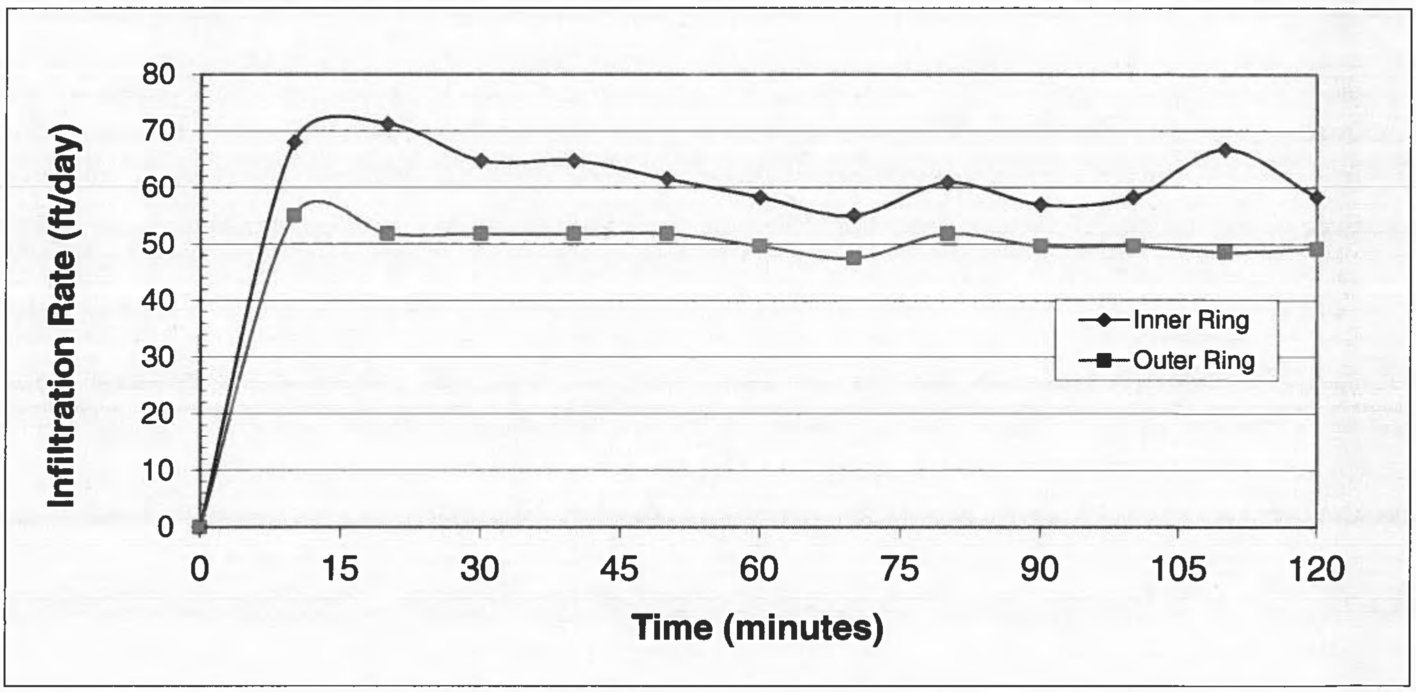
Project : SR 46 PD&E
Location : SW-7

A & A File No. : 11-6445

Date : 3/30/12
Time : 0

AREA (in^2)
Inner Ring : 113.1
Outer Ring : 452.4
Annular Space : 339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
10	10500	10500	5.67	25500	25500	4.59	67.99	55.04
20	11000	21500	11.60	24000	49500	8.90	71.22	51.80
30	10000	31500	17.00	24000	73500	13.22	64.75	51.80
40	10000	41500	22.39	24000	97500	17.54	64.75	51.80
50	9500	51000	27.52	24000	121500	21.85	61.51	51.80
60	9000	60000	32.37	23000	144500	25.99	58.27	49.64
70	8500	68500	36.96	22000	166500	29.95	55.04	47.48
80	9400	77900	42.03	24000	190500	34.26	60.86	51.80
90	8800	86700	46.78	23000	213500	38.40	56.98	49.64
100	9000	95700	51.64	23000	236500	42.54	58.27	49.64
110	10300	106000	57.19	22500	259000	46.58	66.69	48.56
120	9000	115000	62.05	23000	282000	50.72	58.27	49.10



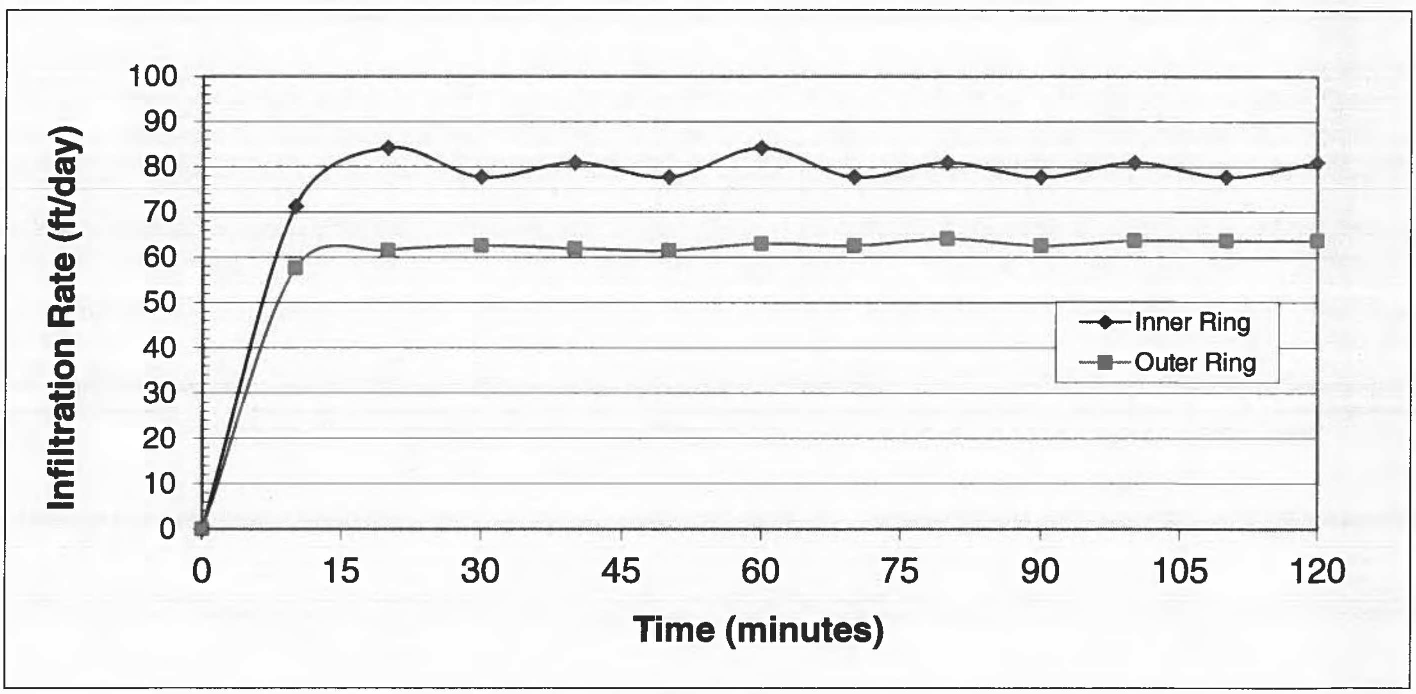
Project : SR 46 PD&E
Location : SW-8

A & A File No. : 11-6445

Date : 4/6/12
Time : 0

AREA (in^2)	
Inner Ring :	113.1
Outer Ring :	452.4
Annular Space :	339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
10	11000	11000	5.94	26700	26700	4.80	71.22	57.63
20	13000	24000	12.95	28500	55200	9.93	84.17	61.51
30	12000	36000	19.42	29000	84200	15.14	77.70	62.59
40	12500	48500	26.17	28700	112900	20.31	80.94	61.94
50	12000	60500	32.64	28500	141400	25.43	77.70	61.51
60	13000	73500	39.66	29200	170600	30.68	84.17	63.02
70	12000	85500	46.13	29000	199600	35.90	77.70	62.59
80	12500	98000	52.88	29700	229300	41.24	80.94	64.10
90	12000	110000	59.35	29000	258300	46.46	77.70	62.59
100	12500	122500	66.10	29500	287800	51.76	80.94	63.67
110	12000	134500	72.57	29500	317300	57.07	77.70	63.67
120	12500	147000	79.32	29500	346800	62.37	80.94	63.67



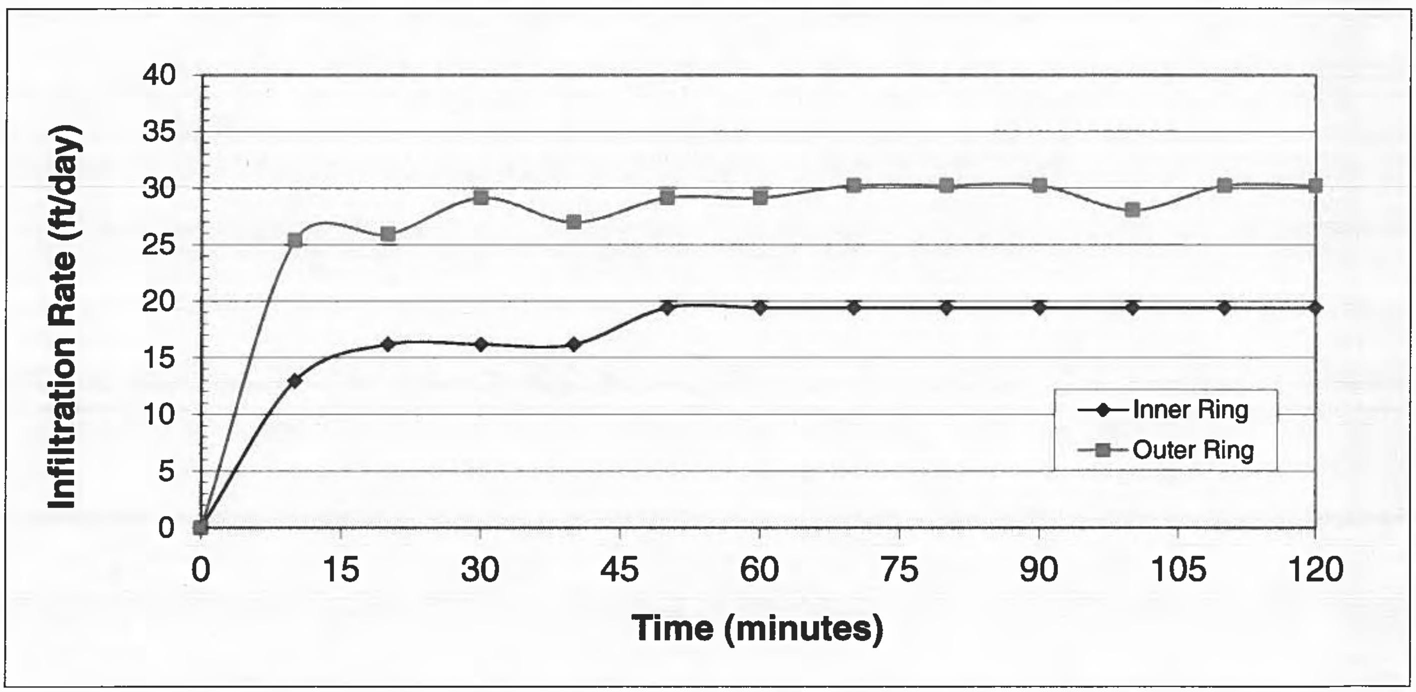
Project : SR 46 PD&E
Location : SW-9

A & A File No. : 11-6445

Date : 3/4/12
Time : 0

AREA (in^2)
Inner Ring : 113.1
Outer Ring : 452.4
Annular Space : 339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
10	2000	2000	1.08	11750	11750	2.11	12.95	25.36
20	2500	4500	2.43	12000	23750	4.27	16.19	25.90
30	2500	7000	3.78	13500	37250	6.70	16.19	29.14
40	2500	9500	5.13	12500	49750	8.95	16.19	26.98
50	3000	12500	6.74	13500	63250	11.38	19.42	29.14
60	3000	15500	8.36	13500	76750	13.80	19.42	29.14
70	3000	18500	9.98	14000	90750	16.32	19.42	30.22
80	3000	21500	11.60	14000	104750	18.84	19.42	30.22
90	3000	24500	13.22	14000	118750	21.36	19.42	30.22
100	3000	27500	14.84	13000	131750	23.70	19.42	28.06
110	3000	30500	16.46	14000	145750	26.21	19.42	30.22
120	3000	33500	18.08	14000	159750	28.73	19.42	30.22



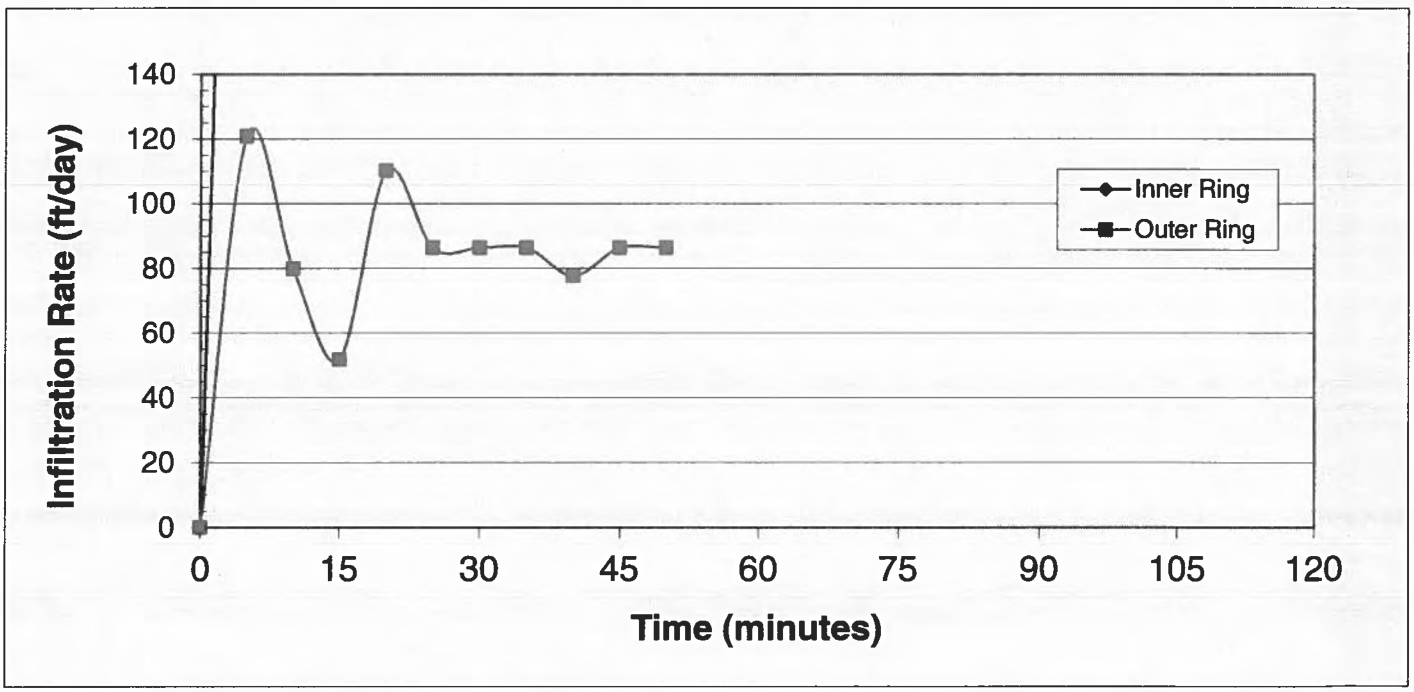
Project : SR 46 PD&E
Location : SW-10

A & A File No. : 11-6445

Date : 3/30/12
Time : 0

AREA (in^2)
Inner Ring : 113.1
Outer Ring : 452.4
Annular Space : 339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
5	32000	32000	17.27	28000	28000	5.04	414.39	120.86
10	23000	55000	29.68	18500	46500	8.36	297.84	79.86
15	31000	86000	46.40	12000	58500	10.52	401.44	51.80
20	40000	126000	67.99	25500	84000	15.11	517.99	110.07
25	32000	158000	85.25	20000	104000	18.71	414.39	86.33
30	28000	186000	100.36	20000	124000	22.30	362.59	86.33
35	28000	214000	115.47	20000	144000	25.90	362.59	86.33
40	28000	242000	130.58	18000	162000	29.14	362.59	77.70
45	28000	270000	145.68	20000	182000	32.73	362.59	86.33
50	29500	299500	161.60	20000	202000	36.33	382.01	86.33
80		299500	161.60		202000	36.33	0.00	0.00
90		299500	161.60		202000	36.33	0.00	0.00



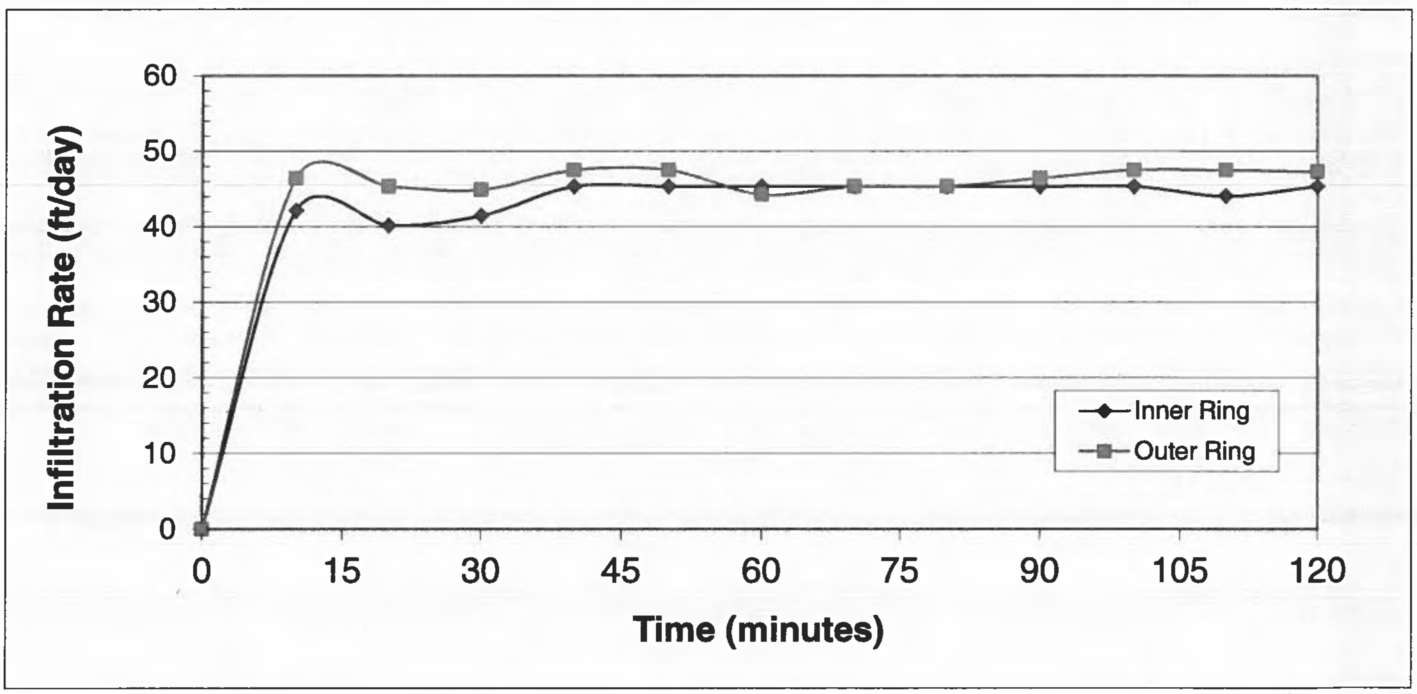
Project : SR 46 PD&E
Location : SW-11

A & A File No. : 11-6445

Date : 3/2/12
Time : 0

AREA (in^2)
Inner Ring : 113.1
Outer Ring : 452.4
Annular Space : 339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
10	6500	6500	3.51	21500	21500	3.87	42.09	46.40
20	6200	12700	6.85	21000	42500	7.64	40.14	45.32
30	6400	19100	10.31	20800	63300	11.38	41.44	44.89
40	7000	26100	14.08	22000	85300	15.34	45.32	47.48
50	7000	33100	17.86	22000	107300	19.30	45.32	47.48
60	7000	40100	21.64	20500	127800	22.99	45.32	44.24
70	7000	47100	25.41	21000	148800	26.76	45.32	45.32
80	7000	54100	29.19	21000	169800	30.54	45.32	45.32
90	7000	61100	32.97	21500	191300	34.41	45.32	46.40
100	7000	68100	36.74	22000	213300	38.36	45.32	47.48
110	6800	74900	40.41	22000	235300	42.32	44.03	47.48
120	7000	81900	44.19	21800	257100	46.24	45.32	47.27



Project : SR 46 PD&E

Location : SW-12

A & A File No. : 11-6445

Date : 3/3/12

Time : 0

AREA (in^2)

Inner Ring : 113.1

Outer Ring : 452.4

Annular Space : 339.3

ELAPSED TIME (min)	INNER RING INTAKE (ml)	INNER RING CUMMUL INTAKE (ml)	INNER RING CUMMUL INTAKE (inch)	ANNULAR RING INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (ml)	ANNULAR RING CUMMUL INTAKE (inch)	INNER RING INFILTRATION RATE (ft/day)	ANNULAR RING INFILTRATION RATE (ft/day)
0	0	0	0.00	0	0	0.00	0.00	0
10	8000	8000	4.32	22000	22000	3.96	51.80	47.48
20	8000	16000	8.63	23000	45000	8.09	51.80	49.64
30	8250	24250	13.08	23000	68000	12.23	53.42	49.64
40	8000	32250	17.40	23500	91500	16.46	51.80	50.72
50	8000	40250	21.72	24000	115500	20.77	51.80	51.80
60	8250	48500	26.17	23500	139000	25.00	53.42	50.72
70	8000	56500	30.49	24000	163000	29.32	51.80	51.80
80	8000	64500	34.80	24000	187000	33.63	51.80	51.80
90	8000	72500	39.12	23000	210000	37.77	51.80	49.64
100	8000	80500	43.44	24000	234000	42.09	51.80	51.80
110	8000	88500	47.75	24000	258000	46.40	51.80	51.80
120	8000	96500	52.07	24000	282000	50.72	51.80	51.80