STORMWATER ANALYSIS

Central Florida Endocrine and Diabetes Parking Addition

Maitland, Florida

Prepared for:
CENTRAL FLORIDA ENDOCRINE AND DIABETES

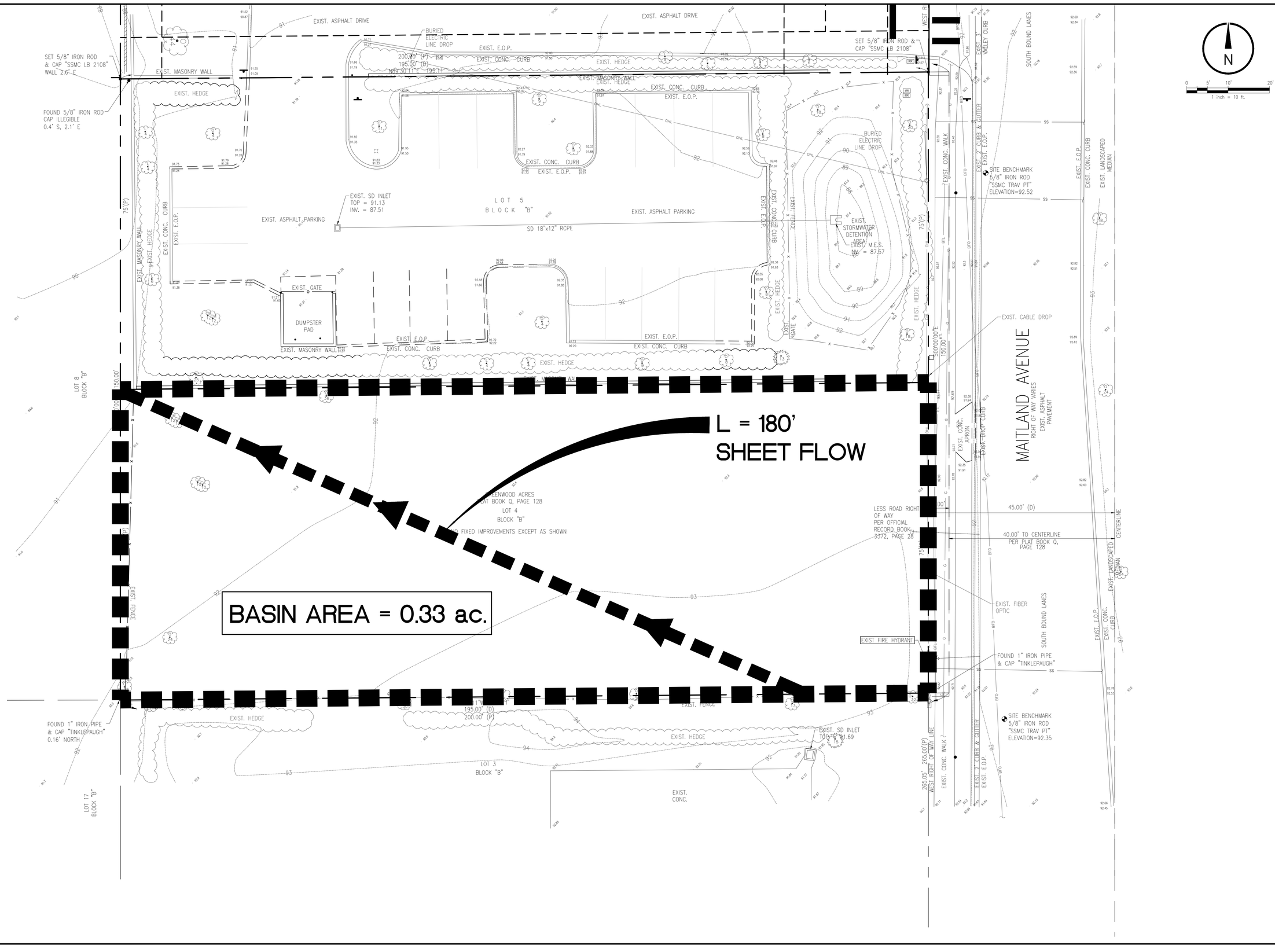
URBAN DESIGN PLANNING ENGINEERING
SKConsortium, Inc.
1053 N. ORLANDO AVE. ■ SUITE 3 ● MAITLAND ▲ FLORIDA 32751
TELEPHONE 407-629-4288 ■ FACSIMILE 407-629-1656 ● EB# 7080

February 20, 2017

URBAN DESIGN PLANNING ENGINEERING
SKConsortium, Inc.
1053 N. ORLANDO AVE. ■ SUITE 3 ● MAITLAND ▲ FLORIDA 32751
TELEPHONE 407-629-4288 ■ FACSIMILE 407-629-1656 ● EB# 7080

Central Florida Endocrine and Diabetes Parking Addition
Maitland, Florida

TABLE OF CONTENTS



SKConsortium, Inc.
URBAN DESIGN PLANNING ENGINEERING
1053 N. ORLANDO AVE. ▪ SUITE 3 ● MAITLAND ▲ FLORIDA 32751
TELEPHONE 407-629-4288 ▪ FACSIMILE 407-629-1656 ● EB# 7080

Seal: Majid Kalaghchi P.E. 41046

BASIN MAP
PARKING ADDITION LOT 4 BLOCK B
CENTRAL FLORIDA ENDOCRINE
MAITLAND, FLORIDA

10-13-16 – PRE-APPLICATION
2-20-17 – 90% REVIEW
3-7-17 – PERMIT SET
3-23-17 – PER SUFFICIENCY REV.

Issue Date and Purpose

Project Number: 1650

Drawn by: CHING CHANG
Checked: M. KALAGHCHI
File No: 1650

BM-1

URBAN DESIGN PLANNING ENGINEERING
SKConsortium, Inc.
1053 N. ORLANDO AVE. ■ SUITE 3 ● MAITLAND ▲ FLORIDA 32751
TELEPHONE 407-629-4288 ■ FACSIMILE 407-629-1656 ● EB# 7080

I. PROJECT DESCRIPTION

Central Florida Endocrine and Diabetes Consultants Medical Building is a 0.81-acre parcel within city limits of Maitland, located at the southwest corner of Sandspur Road and Maitland Avenue.

The Proposed Development includes adding a 0.33-acre parcel for additional parking improvement and stormwater retention pond.

The site is currently undeveloped with a residential home to the south. Vegetation includes scattered Oaks, Camphor and Palms.

The on-site soil is classified as Candler Urban Land Complex, a Type A category soil.

Site grades range from elev. 92.90 in the southeast corner of the site to elev. 88.90 at the northwestern portion of the site.

A. Stormwater Management System

The project consists of one basin based on topography and development characteristics of the project.

Stormwater management system for this site will consist of one retention / detention facility located in the eastern portion of the site. The retention/detention systems will meet requirements of SJRWMD and The City of Maitland.

Although the project is not within a closed basin, the pond will be designed to meet SJRWMD pollution abatement requirements, as well as retain the entire mean annual storm and the volumetric difference for pre/ post development runoff generated by 25 yr./96 hr. storm event.

This is due to the lack of proper outfall.

II. PROJECT INFORMATION - CFEDC MEDICAL BUILDING Parking Addition

A. **Existing land use:** Residential; Vegetation includes scattered Oaks, Camphor and Palms

B. **Proposed land use:** associated parking and stormwater treatment facility.

C. **Drainage Pattern:** The site slopes from elevation 92.9 to elevation **88.90** at its southeastern and western boundary.

D. **Soil types:** According to Orange County Soil Map developed by Soil Conservation Services, the entire soil composition on site is classified as **Candler Urban Land Complex, a Type A** Soil Category.

E. **Groundwater:** See geotechnical report enclosed in Appendix B. Prepared by **ECS, LTD. Normal water table:** Not Encountered within bore holes. **Seasonal high water table:** Is estimated at 10 feet below existing grade of **elevation 92.00 at elev. 82.00.**

F. **Flood Plain:** The project is not within a flood plain. FEMA classification, Zone C.

G. **Wetlands:** There are no wetlands on site.

H. **Off-site Runoff:** According to area topography maps, the existing grades on site lie above surrounding properties; therefore, there is no offsite runoff contribution to this site. (See USGS map, Exhibit 2)

III. DESIGN CRITERIA- CFEDC MEDICAL BUILDING Parking Addition

A. Retention Requirements

1. St. Johns River Water Management District

   -Provide **0.5 inch of runoff** or **1.25 inches over the impervious area** whichever is greater.
   -For **online** system provide an additional retention of **0.5 inches of runoff.**

2. City of Maitland

   -Provide **0.5 inch of runoff** from the development site or the **runoff generated from the first 1 inch of rainfall** on the developed site.

B. Detention Requirements

1. St. Johns River Water Management District

   -For all sites greater than 50% impervious the detention system shall attenuate the post Development peak discharge rate to equal pre development peak discharge rate for the mean annual storm. (P=4.3 inches in 24 hours)

C. Discharge Points:

The pond will be designed without an outfall in accordance with closed basin criteria.

D. Skimmer:

None

E. Volume Recovery:

Per SJRWMD the retention volume must be recovered 72 hours after the storm event.

IV. SITE DATA

Project area:	**1.48 acres**
Total Impervious Area	7,897 sf = 0.18 acres = 54.5%
Total Pervious Area	6,590 sf = 0.15 acres = 45.5%

V. Retention Requirements

A. Wet Detention Required

1.25" x Impervious Area:	7,897 sf x 1.25"/12" = 822 cf
1/2" of Runoff over project area:	14,487 sf x 0.5"/12" = 604 cf

Retention Required: 822 cf + 604 cf = 1,426 cf

B. Set Pond No. 1 parameters

Bottom of Pond at Elevation	= 88
Pond Top Elevation	= 92

C. Dry Pond Stage/Storage

Stage	Area (sf)	Storage(cf)
88	0	0
89	275	137.5
90	605	605
91	1080	1620
92	2424	4848

Retention Provided = 2740.5 cf > 1426 cf (SJRWMD Criteria Met)

VI. RETENTION REQUIREMENTS (Closed Basin)

Although this project is not within a closed basin, it will be designed based on SJRWMD closed basin criteria: volumetric differences between pre/ post development runoff for 25 yr./ 96 hr. storm

Pre development runoff	= 5,356 cf
Volume Post development	= 9,029 cf
Runoff Volume Required	= 3,673 cf
Volume Provided	= 4,848 cf

See the following pages for ICPR general hydrograph

VII. Hydrographs

Hydrographs for pre-development and post development conditions were developed for the Mean Annual storm using ICPR Program. See appendix A for printout.

A. Pre-Development Conditions

Total Site Area	0.33 acres = 14,487 cf
Soil Type	A (Candler, Per SCS)
Curve Number	49 (open space/grass 50%-75%, Type A soils, Per TR55)

Time of Concentration*
Kinematics Wave Eq. L = 180 feet ,
N = 0.2 (grass)
Slope = 0.015
P = 4.5 inches

Tc= $\frac{0.007\,(NL)^{0.8}}{(P)^{0.5} \times S^{0.4}}$ **= 18.67 minutes**

*See Sheet BM-1 Basin Map for Tc route

Pre-Development Runoff Volume = 545 cf (Mean Annual)
Pre-Development Runoff Volume = 5,356 cf (25yr./96hr. Storm)

See Appendix A for hydrographs

B. Post-Development Conditions

Total Site Area	0.33 acres = 14,487 cf
Soil Type	A (Candler, Per SCS)
CN-Pervious	39 (open space/grass >75%, Type A soils, Per TR55)
CN-Pavement	98
DCIA	= 54.5%

Time of Concentration
Assume conservative value

Tc total 10.00 min.

Post Development Runoff Volume = 2,930 cf (Mean Annual
Post Development Runoff Volume = 9,029 cf (25yr./96hr. Storm)

VIII. Summary

Retention required (SJRWMD pollution abatement)	= 1,426 cf
Mean Annual storm runoff volume (post development)	= 2,930 cf
Pre/ Post 25 yr./ 96 hr. volume (pre/ post difference)	= 3,673 cf
Volume Provided	= 4,848 cf

IX. Pond Recovery-Simplified Methodology

SJRWMD

Per St. Johns River Water Management District and Orange County Requirements, the pollution abatement volume shall be recovered in 72 hours.

Boring Depth	10 ft.
Existing Grade	92.5
Ground water	Not encountered
SHGWT	82.5
Pond Bottom Elev.	88
Base of Aquifer Elevation	82.5
Average Length	60 ft
Average Width	15 ft
Horizontal Permeability Rate	**37.5 ft. Per day**
Vertical Permeability Rate	**25 ft. Per day**
Porosity of soils	25%

Pollution Abatement to be recovered (SJRWMD)	**1,426 cf**
Recovery Time:	**0.0475 days**
Pollution Abatement to be recovered (entire pond)	**4,848 cf**
Recovery Time:	**0.2039 days**

See Following pages for Ponds Program Simplified methodology input and output

PONDS - Version 2.26
Copyright 1993

Written By Devo Seereeram, Ph.D., P.E.
And Robert D. Casper

Licensed Solely For Use By:
SK CONSORTIUM

Retention Pond Recovery Analysis

I. Job Information

Job Name: CFE&D PARKING ADDITION
Engineer: SK CONSORTIUM
Date: 1-31-17

II. Input Data

Equivalent Pond Length, [L] (ft):	60.00
Equivalent Pond Width, [W] (ft):	20.00
Pond Bottom Elevation, [PB] (ft above datum):	88.00
Porosity Of Material Within Pond, [p] (%):	100.00
Base Of Aquifer Elevation, [B] (ft above datum):	82.50
Water Table Elevation, [WT] (ft above datum):	82.60
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day)	37.50
Fillable Porosity of Aquifer, [n] (%):	25.00
Vertical Unsaturated Infiltration, [Iv] (ft/day):	25.00
Runoff Volume, [V] (cubic feet)	1426.00
Percent Recovery Of Runoff Volume, [PV] (%)	100.00

III. Results

UNSATURATED FLOW

Recovery Time From Unsaturated Flow, [T1] (days):	0.0475
Recovered Volume From Unsaturated Flow, [V1] (ft^3):	1426.00

SATURATED FLOW

Recovery Time From Saturated Flow, [T2] (days):	0.0000
Recovered Volume From Saturated Flow, [V2] (ft^3):	0.00
Maximum Radius Of Influence, [R] (ft):	0.00
Maximum Driving Head, [Hmax] (ft):	0.000
Minimum Driving Head, [Hmin] (ft):	0.000

TOTAL

Total Recovery Time, [T] (days):	0.0475
Total Recovered Volume, [V] (ft^3):	1426.00

PONDS - Version 2.26
Copyright 1993

Written By Devo Seereeram, Ph.D., P.E.
And Robert D. Casper

Licensed Solely For Use By:
SK CONSORTIUM

Retention Pond Recovery Analysis

I. Job Information

Job Name: CFE&D PARKING ADDITION
Engineer: SK CONSORTIUM
Date: 1-31-17

II. Input Data

Equivalent Pond Length, [L] (ft):	60.00
Equivalent Pond Width, [W] (ft):	20.00
Pond Bottom Elevation, [PB] (ft above datum):	88.00
Porosity Of Material Within Pond, [p] (%):	100.00
Base Of Aquifer Elevation, [B] (ft above datum):	82.50
Water Table Elevation, [WT] (ft above datum):	82.60
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day)	37.50
Fillable Porosity of Aquifer, [n] (%):	25.00
Vertical Unsaturated Infiltration, [Iv] (ft/day):	25.00
Runoff Volume, [V] (cubic feet)	4848.00
Percent Recovery Of Runoff Volume, [PV] (%)	100.00

III. Results

UNSATURATED FLOW

Recovery Time From Unsaturated Flow, [T1] (days):	0.0540
Recovered Volume From Unsaturated Flow, [V1] (ft^3):	1620.00

SATURATED FLOW

Recovery Time From Saturated Flow, [T2] (days):	0.1499
Recovered Volume From Saturated Flow, [V2] (ft^3):	3228.00
Maximum Radius Of Influence, [R] (ft):	22.98
Maximum Driving Head, [Hmax] (ft):	8.090
Minimum Driving Head, [Hmin] (ft):	5.400

TOTAL

Total Recovery Time, [T] (days):	0.2039
Total Recovered Volume, [V] (ft^3):	4848.00

APPENDIX A

HYDROGRAPHS & ROUTING

MEAN ANNUAL EVENT

********** Basin Summary - MEAN **********

***		
Basin Name:	PREDEV	POSTDEV
Group Name:	BASE	BASE
Node Name:	NODE1	POND1
Hydrograph Type:	SB	SB
Spec Time Inc (min):	5.00	5.00
Comp Time Inc (min):	5.00	5.00
Rainfall File:	FLMOD	FLMOD
Rainfall Amount (in):	4.50	4.50
Storm Duration (hr):	24.00	24.00
Status:	ONSITE	ONSITE
Time of Conc. (min):	18.67	10.00
Lag Time (hr):	0.00	0.00
Area (acres):	0.33	0.33
Curve Number:	49.00	39.00
DCIA (%):	0.00	54.50
Time Max (hrs):	12.25	11.92
Flow Max (cfs):	0.05	0.52
Runoff Volume (in):	0.45	2.45
Runoff Volume (cf):	545	2930

25 YR 96 HR STORM EVENT

********** Basin Summary - 25-96 **********

***

Basin Name:	PREDEV	POSTDEV
Group Name:	BASE	BASE
Node Name:	NODE1	POND1
Hydrograph Type:	SB	SB
Spec Time Inc (min):	5.00	5.00
Comp Time Inc (min):	5.00	5.00
Rainfall File:	SJRWMD96	SJRWMD96
Rainfall Amount (in):	11.50	11.50
Storm Duration (hr):	96.00	96.00
Status:	ONSITE	ONSITE
Time of Conc. (min):	18.67	10.00
Lag Time (hr):	0.00	0.00
Area (acres):	0.33	0.33
Curve Number:	49.00	39.00
DCIA (%):	0.00	54.50
Time Max (hrs):	59.92	59.92
Flow Max (cfs):	0.78	1.33
Runoff Volume (in):	4.47	7.54
Runoff Volume (cf):	5356	9029

APPENDIX B

GEOTECHNICAL REPORT

ENGINEERING CONSULTING SERVICES, LTD.
Geotechnical • Construction Materials • Environmental

October 16, 2003

Mr. Cas Suvongse
SK Consortium
1053 North Orlando Avenue, Suite 3
Maitland, Florida 32751

ECS Job No.: 24-1205

Reference: Report of Subsurface Exploration and Geotechnical Analyses, Central Florida Endocrine Parking Lot & Pond Addition, Orange County, Maitland, Florida

Dear Mr. Suvongse:

As authorized by acceptance of our proposal, dated October 8, 2003, Engineering Consulting Services, Ltd. (ECS, Ltd.) has completed the subsurface exploration and conducted geotechnical engineering analyses for the proposed Central Florida Endocrine Parking Lot and Pond Addition, located at the southwest corner of Maitland Avenue and Sandspur Road in Maitland, Florida. Our report, including the results of our subsurface exploration program, laboratory testing program, and geotechnical engineering analyses is enclosed with this letter, along with a Boring Location Plan.

Based on a current site plan provided by SK Consortium, we understand that the project will include the construction of additional parking and a stormwater management pond on the site. We have assumed the pavements will be pavements will be at or near existing grade.

The enclosed report provides recommendations on placement and compaction of new fills, drainage, construction, and other factors that may influence design and construction at the site.

This geotechnical evaluation includes an evaluation of the subsurface soil and groundwater conditions of the site and general area as described in scope of services identified in our proposal. No other non-scope considerations or additional issues were investigated, requested or proposed during this evaluation.

The conclusions and recommendations presented within this report are based upon a reasonable level of investigation within normal bounds and standards of professional practice for a site in this particular geographic and geologic setting. This report has been prepared in order to aid in the evaluation of this site and to assist the Owner and Engineer in the feasibility study of the project. The report scope is limited to the specific project and location described, and the project description represents our understanding of the significant aspects relevant to soil and foundation

characteristics.

All observations, conclusions and recommendations pertaining to geotechnical conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No other warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of SK Consortium and their successors or assigns. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties. The use of this report by any undesignated third party or parties will be at such party's sole risk and ECS disclaims liability for any such third party use or reliance.

We appreciate this opportunity to be of service to SK Consortium on the Central Florida Endocrine Parking Lot and Pond Addition. If you have any questions regarding the information and recommendations contained in the accompanying report, or if we may be of further assistance to you in any way during planning or construction of this project, please contact us.

Respectfully,

ENGINEERING CONSULTING SERVICES, LTD.

10/20/03

Bruce H. Woloshin, P.E.
Principal Engineer
P.E. 36734

Anthony J. Fiorillo, P.E.
Vice President

Report (4)

I/PROJECTS/1205/CENTRAL FLORIDA ENDOCRINE GEO.DOC

REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING ANALYSES

PROJECT

CENTRAL FLORIDA ENDOCRINE PARKING LOT AND POND ADDITION
SWC OF MAITLAND AVENUE AND SANDSPUR ROAD
MAITLAND, FLORIDA

CLIENT

Mr. Cas Suvongse
SK Consortium
1053 N. Orlando Avenue, Suite 3
Maitland, Florida 32751

Submitted By
Engineering Consulting Services, Ltd.
2815 Directors Row
Suite 500
Orlando, Florida 32809

PROJECT 24-1205

DATE October 16, 2003

TABLE OF CONTENTS

PROJECT OVERVIEW

Project Location and Proposed Construction

The Central Florida Endocrine site is located at the southwest corner of Maitland Avenue and Sandspur Road in Maitland, Florida. The site is bounded the existing medical office building to the north, Maitland Avenue to the east, a professional office building to the south, and residential development to the west.

Based on a current site plan provided by SK Consortium, we understand that the project will include the construction of additional parking and a stormwater management pond.

Scope of Work

The conclusions and recommendations contained in this report are based on our field subsurface explorations, laboratory testing, and review of available geologic and/or geotechnical data. The recent subsurface exploration program included a total of 2 soil borings, extended to depths of 10 feet. Laboratory tests were then performed on selected soil samples to identify the soils and to assist in determination of the properties of the on-site soils. We have also visited the site recently to conduct a site reconnaissance of current conditions.

The boring locations for the proposed Central Florida Endocrine Parking Lot and Pond Addition were selected and located in the field by ECS, Ltd. The Boring Location Plan is included in the Appendix.

Purposes of Exploration

The purposes of the exploration were to explore the soil and groundwater conditions at the site and to develop engineering recommendations to guide the design and construction of the current project. We accomplished these purposes by:

1. Drilling borings to explore the subsurface soil and groundwater conditions,

2. Performing laboratory tests on selected representative soil samples from the test borings to evaluate pertinent engineering properties and,

3. Evaluating the field and laboratory test results to develop appropriate engineering recommendations.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The soil borings were performed with a truck-mounted drilling rig, which utilized continuous flight augers to advance the boreholes. Drilling fluid was used in this process.

Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 18 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through a 12-inch interval is termed the Standard Penetration Test (SPT) value, or "N" value, and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of non-cohesive soils. In a less reliable way, it also indicates the consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

A field log of the soils encountered in the borings was maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were then sealed and brought to our laboratory for further visual examination and laboratory testing.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to confirm the field classifications and to determine pertinent engineering properties. The laboratory testing program included visual sample classifications, moisture content tests, washed sieve gradation tests, and permeability tests. Data obtained from the laboratory tests are included on the respective boring logs in the Appendix.

An experienced soil engineer classified each soil sample on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS). The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Unified System is included with this report. The soil engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in the field, the transitions may be gradual.

EXPLORATION RESULTS

Current Site Conditions

A site visit was conducted by an engineer from ECS, Ltd. during the drilling operation to observe existing site conditions. The site is currently partially wooded.

Regional Geology

Central Florida geologic conditions can generally be described in term of three basic sedimentary layers. The near-surface layer is primarily composed of sands containing varying amounts of silt and clay fines. These sands are underlain by a layer of clay, clayey sand, phosphate, and limestone which are locally refereed to as the "Hawthorn Formation." The third layer underlies the "Hawthorne Formation" and is composed of limestone. The thickness of these three strata varies throughout Central Florida. In general, the surficial sands typically extend to depths of 40 to 70 feet while the "Hawthorne Formation" ranges from nearly absent in some locations to thicknesses greater than 100 feet. The limestone formation may be several thousand feet thick.

The groundwater hydrogeology of Central Florida can be described in terms of the nature and relationship of the three basic geologic strata. The near-surface and stratum are fairly permeable and comprise the water table (unconfined) aquifer. The deep limestone formation of the Floridan aquifer is highly permeable due to the presence of large interconnected channels and cavities throughout the rock. The Floridan aquifer is the primary source of drinking water in Central Florida. These two permeable strata are separated by the relatively low permeability clays in the "Hawthorn Formation." The amount of groundwater flow between the two aquifer systems is dependent on the thickness and consistency of the Hawthorn clay confining beds which, as previously stated, varies widely throughout Central Florida.
The geology underlying the project site was identified on the Geologic Map of Florida (dated 1964) as undifferentiated sediment of the Pleistocene Series. The undifferentiated sediment has been referred to by many different names including marine and estuarine terrace deposits. The sediments incorporated in this category are typically quartz sands ranging from fine to coarse grained, non-indurated to poorly indurated and non-clayey to slightly clayey.

Soil Conditions

Subsurface conditions within the project were evaluated with 2 soil test borings, B-2 was drilled to a depth of 10 feet below the ground surface at the proposed pond locations; and B-1 was

Considering the results of our field exploration, and our experience with similar projects, it is our judgment that the proposed building may be supported on a shallow foundation system consisting of spread footings. The existing on-site soils are considered to be suitable for the support of the building slab on grade, provided that the subgrade soils have been properly prepared, as described in this report, and approved by the Geotechnical Engineer or their authorized representative.

Earthwork Operations

Fill Placement

Any fill to be placed on site should consist of soils classified SP per ASTM D-2487 and have less than 5 percent passing the No. 200 sieve. The upper 2 feet of the on-site soils should be suitable for reuse as compacted fill, provided that the natural moisture content is within an acceptable range to obtain compaction.

All structural fill should be placed in loose lifts, which do not exceed 12 inches in thickness, and should be compacted to at least 95 percent of the maximum dry density, as determined by the Modified Proctor Compaction Test (ASTM D-1557). Generally, the moisture content of the fill materials should be maintained between 2 % below to the optimum moisture content for the fill material, as determined by ASTM D-1557. Fill placed in non-structural areas (e.g. grassed areas) should be compacted to at least 90% of the maximum dry density according to ASTM D-1557, in order to avoid significant subsidence. The upper one foot of soils supporting slabs-on-grade and pavements should also be compacted to a minimum of 95% of the maximum dry density obtained in accordance with the ASTM Specification D-1557, Modified Proctor Method discussed above. Compliance tests should be performed at a rate of 1 test per 2,000 square feet per foot of improvement (depth) in the structures areas and 1 test per 5,000 square feet in paved areas.

If any problems are encountered during the earthwork operations, or if site conditions deviate from those encountered during our subsurface exploration, the Geotechnical Engineer should be notified immediately.

Pavement Considerations

All pavement subgrades should be prepared in accordance with the recommendations in the section entitled "**Earthwork Operations**". We recommend using a flexible pavement section on this project. Flexible pavements combine the strength and durability of several layer components to produce an appropriate and cost-effective combination of available materials.

We recommend using a three-layer pavement section consisting of stabilized subgrade, base course, and surface course. The three-layer pavement may be placed on existing, prepared subgrade or compacted embankment fill.

As a reference, Orange County has divided its commercial pavement requirements into two categories as a function of use and average daily traffic (ADT). Light duty pavements are those with projected traffic with less than 1,500 ADT and heavy duty pavements are those with greater than 1,500 ADT. The following table summarizes the County ordinance published in the Subdivision Regulations effective February 22, 1994.

Pavement Component Recommendations

Pavement Material	Light-Duty Pavement Section	Heavy-Duty Pavement Section
Surface Course Asphalt (in.)	1½	2½
Base Course Limerock or Soil-Cement (in.)	6	10
Stabilized Subgrade (in.)	6	6
Total Pavement Thickness (in.)	13½	18½

The regulation also requires a friction surface course be added to the design when more than 12,000 vehicles per day (per lane) are projected.

We recommend that subgrade materials be compacted in place according to the requirements in the "Site Preparation" section of this report. Further, stabilize the subgrade materials to a minimum Limerock Bearing Ratio (LBR) of 40 percent as specified by Florida Department of Transportation (FDOT) requirements for Type B (LBR testing) Stabilized Subgrade.

Further, the stabilized subgrade can be imported material or a blend of on-site soils and imported materials. If a blend is proposed, we recommend that the contractor perform a mix design to find the optimum mix proportions.

Where soil-cement base courses are used, Orange County has approved pavement designs in which compacted subgrade is used in lieu of stabilized subgrade. In such cases, stabilized subgrade typically is provided beneath full-depth curbs only. An advantage in deleting the stabilized subgrade is a reduction in the tendency of groundwater to "perch" on the less-pervious subgrade materials, particularly where full-depth curbs are not provided. Because compacted subgrades consisting of "clean" sand lack stability and do not contribute to the structural number of the pavement, our primary recommendation remains that stabilized subgrade be provided in conjunction with full-depth curbs.

Finally, please note that stabilized subgrade remains a requirement in any case where limerock base course is used.

We recommend the base course be either limerock or soil-cement. Limerock should have a minimum LBR of 100 percent and should be mined from an FDOT approved source. Place limerock in maximum 6-inch lifts and compact each lift to a minimum density of 95 percent of the Modified Proctor maximum dry density.

For a soil-cement base, we recommend that the contractor perform a soil-cement design with minimum seven-day strengths of 300 psi on the materials he intends to use. Place soil-cement in maximum 6-inch lifts and compact in place to a minimum density of 95 percent of the Standard Proctor maximum dry density according to specifications in ASTM D-558.

Place and finish the soil-cement according to Portland Cement Association requirements. Final review of the soil-cement base course should include manual "chaining" and/or "soundings" seven days after placement. Shrinkage cracks will form in the soil-cement mixture and you should expect reflection cracking on the surface course.

Perform compliance testing for either limerock or soil-cement at a frequency of one test per 5,000 square feet, or at a minimum of two test locations, whichever is greater.

In light duty areas where there is occasional truck traffic, but primarily passenger cars, we recommend using an asphaltic concrete, FDOT Type S-III, which has a stability of 1,000 pounds. In heavy duty areas, where truck traffic is predominant, we recommend using as asphaltic concrete, FDOT Type S-III or S-I, which has a minimum stability of 1,500 pounds.

Asphaltic concrete mixes should be a current FDOT approved design of the materials actually used. Test samples of the materials delivered to the project to verify that the aggregate gradation and asphalt content satisfies the mix design requirements. Compact the asphalt to a minimum of 95 percent of the Marshall design density.

After placement and field compaction, core the wearing surface to evaluate material thickness and to perform laboratory densities. Obtain cores at frequencies of at least one core per 3,000 square feet of placed pavement or a minimum of two cores per day's production.

One of the most critical influences on the pavement performance in Central Florida is the relationship between the pavement subgrade and the seasonal high groundwater level. Many roadways and parking areas have been destroyed as a result of deterioration of the base and the base/surface course bond. Regardless of the type of base selected, we recommend that the seasonal high groundwater and the bottom of the base course be separated by at least 12 inches.

We believe there is a strong potential for a perched groundwater table to lateral migration of ground and surface water into the parking lots pavements. In order to prevent the resulting adverse effects, we strongly recommend the use of a full-depth curb along the edges of the entire parking lot/driveways for this project. Using extruded curb sections which lie directly on top of the final asphalt level, or eliminating the curbing entirely, can allow migration of irrigation water from the landscape areas to the interface between the asphalt and the base. This migration often causes separation of the wearing surface from the base and subsequent rippling and pavement deterioration. We recommend installing landscape underdrains along all medians and along all roadways where irrigation is present to protect the asphalt pavement from excess rainfall and over irrigation.

The pavement section has been developed for the post-construction traffic conditions. It should be recognized that construction loading conditions may be more severe than in-service conditions and the Geotechnical Engineer should be advised of any traffic loading conditions that differ from those presented above in order to confirm and/or modify the flexible pavement section recommendations. Partial construction of the recommended sections to facilitate construction traffic may result in subgrade and pavement failures due to the reduced supportive qualities of a partial section and the heavy and sometimes dynamic loads associated with construction activity. Designated haul or access roads designed for heavy construction traffic should be considered for use by the Contractor to minimize damage to partial sections of final pavement. In light of potential damage associated with construction traffic, we suggest that placement of the final surface course should not occur until all the major construction has been completed for those particular pavement areas subject to construction traffic. Should distressed areas be encountered subsequent to the use of the pavement areas by construction traffic, those areas should be undercut to firm ground, and returned to planned subgrade with approved controlled, compacted fill, and the base course replaced.

Immediately prior to pavement construction, the exposed subsoils throughout the proposed paved areas must be carefully and thoroughly proof-rolled/compacted and visually examined in order to detect any yielding, soft or otherwise unsuitable soil conditions; particularly, in any previously disturbed areas such along utility lines and in areas subjected to construction traffic. In the event that any unstable conditions are encountered, the yielding and soft areas must be modified and

compacted or undercut and returned to subgrade level with approved compacted fill. All proof-rolling should be accomplished with approved equipment and must be monitored by the Geotechnical Engineer or his authorized representative. Placement of the stabilized subgrade and the base course section should occur immediately after the subsoils have been evaluated and determined suitable for pavement construction by the Geotechnical Engineer or his authorized representative.

Large, front loading trash dumpsters frequently impose concentrated front-wheel loads on pavements during loading. This type of loading typically results in rutting of the pavement and ultimately pavement failures immediately in front of the dumpster pads. Therefore, we recommend that the pavement in trash pickup areas consist of a 6-inch thick, mesh reinforced concrete slab with a minimum unconfined compressive strength of 4,000 psi, placed over natural sand subsoils.

Construction Considerations

Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are dug during the rainy season or if rain is anticipated. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, we recommend that a 1-to 3-inch thick "mud-mat" of "lean" concrete be placed on the bearing soils before the placement of reinforcing steel.

The surficial soils contain fines which are considered moderately erodible. The Contractor should provide and maintain good site drainage during earthwork operations to help maintain the integrity of the surface soils. The surface of the site should be kept properly graded in order to enhance drainage of the surface water away from the proposed construction areas during the earthwork phase. We recommend that surface drainage be diverted around the proposed building area without significantly interrupting its pattern. All erosion and sedimentation shall be controlled in accordance with sound engineering practice and current state and local requirements.

In a dry and undisturbed state, the upper 1 foot of the majority of the soil at the site will provide good subgrade support for fill placement and construction operations. However, when wet, these soils will degrade quickly with disturbance from contractor operations. Therefore, good site drainage should be maintained during earthwork operations, which will help maintain the integrity of the soil.

Closing

This report has been prepared to aid in the evaluation of this site and to assist the design team with the design of the proposed facility. The report scope is limited to this specific project and the location described. The project description represents our current understanding of the significant aspects of the proposed improvements relevant to the geotechnical considerations.

The analysis and recommendations are, of necessity, based on the information made available to us at the time of the actual writing of the report and the on-site conditions, surface and subsurface that existed at the time the exploratory borings were drilled. Further assumptions have been made that the limited exploratory borings, in relation both to the aerial extent of the site and to depth, are representative of conditions across the site. If subsurface conditions are encountered which differ significantly from those reported herein, this office should be notified immediately so that the analyses and recommendations can be reviewed for validity.

The earthwork and foundation construction operations for the site will be a primary consideration during development of this project. The placement of any new engineered fill will require adequate monitoring during construction in order to assure that the fill mass is installed properly to avoid future settlements. Because of our in-depth knowledge of the subsurface conditions at the site, we recommend that ECS monitor all earthwork and construction operations to assure that the work is being performed in accordance with the project specifications. It is also recommended that ECS be allowed to prepare or at least review the project specifications with regard to the earthwork for this site.

We would appreciate the opportunity to continue our involvement on the project during construction. Engineering Consulting Services, Ltd. is capable of providing all construction materials testing services for the project, and we would appreciate the opportunity to offer our services.

UNIFIED SOIL CLASSIFICATION SYTEM

PRIMARY DIVISIONS			GROUP SYMBOL	DESCRIPTIONS
COARSE GRAINED SOILS Sands Gravels Over 50% retained on #200 sieve	GRAVELS Over 50% of coarse material retained on #4 sieve	CLEAN GRAVEL Less than 5% passing #200 sieve	GW	Well graded gravel, many different particle sizes, little or no fines
			GP	Poorly graded, few different particle sizes, little or no fines
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SAND Over 50% of coarse material passed #4 sieve	CLEAN SANDS Less than 5% passing #200 sieve	SW	Well graded gravel, many different particle sizes, little or no fines
			SP	Poorly graded, few different particle sizes, little or no fines
		SAND WITH FINES	SM	Silty gravels, gravel-sand-silt mixtures
			SC	Clayey gravels, gravel-sand-clay mixtures
FINE GRAINED SOILS Silts Clays (Over 50% passing the #200 sieve)	SILTS AND CLAYS Liquid limit is less than 50 %		ML	Inorganic silts, slight to no plasticity
			CL	Inorganic clays, low to moderate plasticity
			OL	Organic silts and clays of low plasticity
	SILTS AND CLAYS Liquid limit is more than 50 %		MH	Inorganic silts, moderate to high plasticity
			CH	Inorganic clays, high plasticity, fat clays
			OH	Organic silts and clays of high plasticity

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols:

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core, NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HAS	Hollow Stem Auger	WS	Wash Sample

II. Correlation of Penetration Resistances to Soil Properties:

Standard Penetration (Blows/Ft) refers to the blows per foot of a 140 lb. Hammer falling 30 inches on a 2-inch OD split spoon sampler, as specified in ASTM D-1586. The blow count is commonly referred to as the N value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

Density		*Relative Properties*	
Under 4 blows/ft	Very Loose	Adjective Form	12% to 49%
4 to 10 blows/ft	Loose	With	5% to 12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense		
Over 51 blows/ft	Very Dense		

Particle Size Identification		
Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00 mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00 mm (dia. of broom straw)
	Fine	0.074 to 0.42 mm (dia. of human hair)
Silt and Clay		0.0 to 0.074 mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

Blows/ft	*Consistency*	*Unconfined Comp. Strength Q_p (tsf)*	*Degree of Plasticity*	*Plasticity Index*
Under 2	Very Soft	Under 0.25	None to Slight	0 – 4
2 to 4	Soft	0.25-0.49	Slight	5 -7
4 to 8	Med. Stiff	0.50-0.99	Medium	8 - 22
9 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
Over 30	Hard	Over 4.00		

III. Water Level Measurement Symbols:

WL	Water Level	BCR	Before Casing Removal	DCI	Dry Cave-In
WS	While Sampling	ACR	After Casing Removal	WCI	Wet Cave-In
WD	While Drilling	▽	Existing Groundwater Level	▽	Est. Seasonal High GWT

The water levels are those water levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.

CLIENT	JOB #	BORING #	SHEET
SK Consortium	1205	B-1	1 OF 1

PROJECT NAME: Central Florida Endocrine Parking Lot

ARCHITECT-ENGINEER: ECS LTD

SITE LOCATION: SWC of Maitland Avenue & Sandspur Road-Maitland-Orange County-FL

CALIBRATED PENETROMETER TONS/FT ^{2}: 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

10 20 30 40 50+

STANDARD PENETRATION BLOWS/FT. ⊗

10 20 30 40 50+

ENGLISH UNITS

SURFACE ELEVATION 0.00

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Dark Gray SAND, Loose, (SP)			
	1	SS	18	18				9 (3-5-4)
	2	SS	18	18	Brown SAND, Loose, (SP)			8 (4-3-5)
5	3	SS	18	18			-5	9 (4-5-4)
	4	SS	18	18				10 (3-5-5)
	5	SS	18	18	-200 = 2.0 percent			9 (4-5-4)
10	6	SS	18	18			-10	12 (3-5-7)
					END OF BORING @ 10.00'			
15							-15	
20							-20	
25							-25	
30								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL DRY @ 10' WS OR WD	BORING STARTED 10-10-03	
▽WL(AB) ▼WL(AC)	BORING COMPLETED 10-10-03	CAVE IN DEPTH @
▽WL >10'	RIG Mud Bug FOREMAN Amerdrill	DRILLING METHOD Mud Rotary

A.D (10-15-03) A.D (10-20-03) A.D (10-20-03) A.D (10-20-03)

CLIENT	JOB #	BORING #	SHEET
SK Consortium	1205	B-2	1 OF 1
PROJECT NAME	ARCHITECT-ENGINEER		
Central Florida Endocrine Parking Lot	ECS LTD		

SITE LOCATION
SWC of Maitland Avenue & Sandspur Road-Maitland-Orange County-FL

CALIBRATED PENETROMETER TONS/FT.²
1 2 3 4 5+
PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ
10 20 30 40 50+
STANDARD PENETRATION BLOWS/FT. ⊗
10 20 30 40 50+

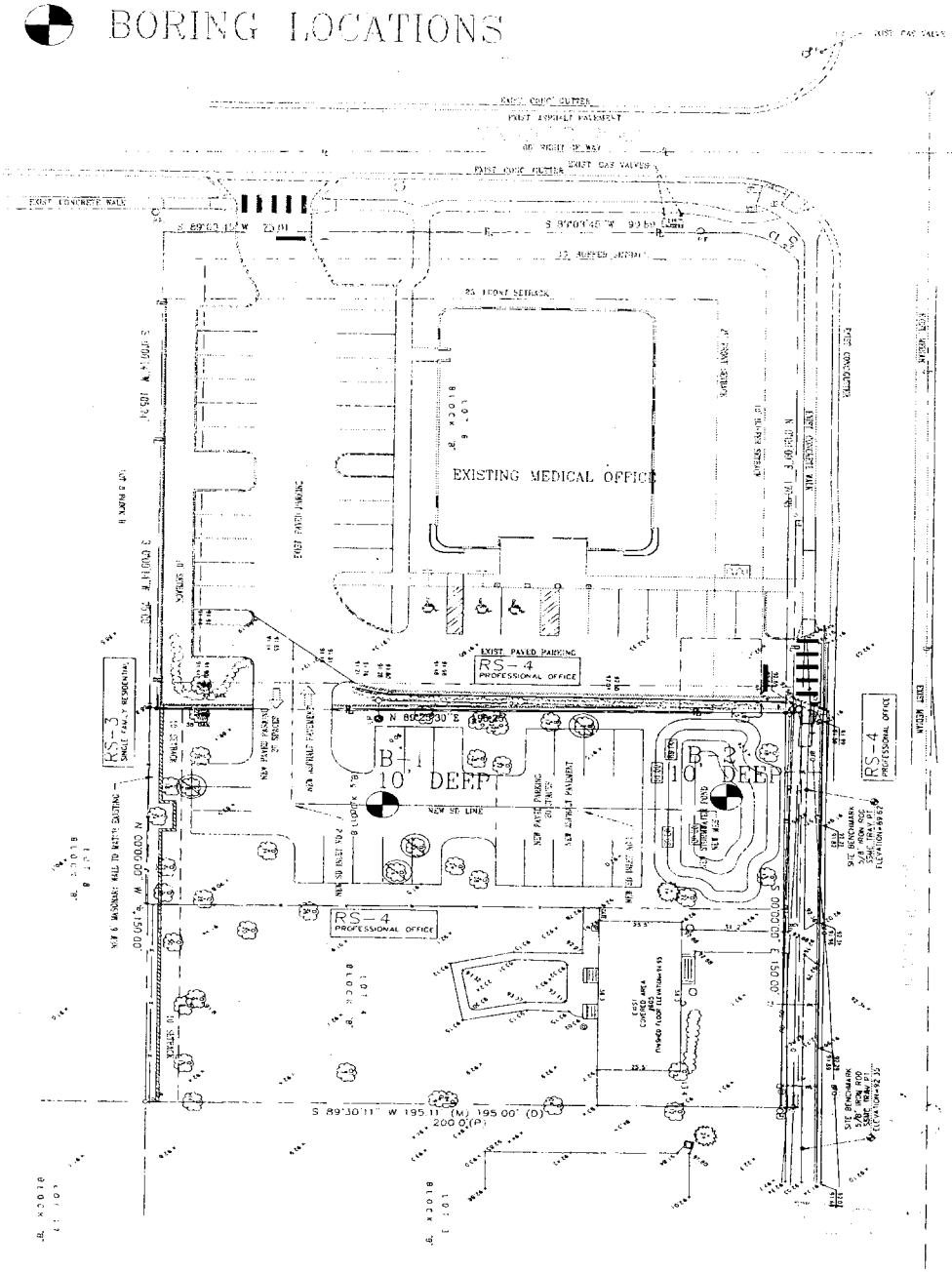
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	
					ENGLISH UNITS		
					SURFACE ELEVATION 0.00		
0					Dark Gray SAND, Loose, (SP)		
	1	SS	18	18			8 (3-3-5)
	2	SS	18	18	Brown SAND, Loose, (SP)		9 (4-4-5)
5	3	SS	18	18	k = 25.0 feet/day	-5	8 (3-4-4)
	4	SS	18	18			7 (5-4-3)
	5	SS	18	18	-200 = 2.5 percent		4.6 9 (5-4-5)
	6	SS	18	18			10 (5-4-6)
10					END OF BORING @ 10.00'	-10	
15						-15	
20						-20	
25						-25	
30							

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL DRY @ 10' WS OR WD	BORING STARTED 10-10-03	
▽WL(AB) ▼WL(AC)	BORING COMPLETED 10-10-03	CAVE IN DEPTH @
▽WL >10'	RIG Mud Bug FOREMAN Amerdrill	DRILLING METHOD Mud Rotary

A.D (10-15-03) A.D (10-20-03) A.D (10-20-03) A.D (10-20-03)

BORING LOCATIONS



Scale: Not To Scale

BORING LOCATION PLAN

N

SK Cosortium
1053 N. Orlando Avenue
Suite 3
Maitland, FL 32751

ECS LTD
ENGINEERING CONSULTING SERVICES, LTD.

Central Florida Endocrine Parking Lot
ECS Project No. 24- 1165
October 2003
Figure 1