Preliminary Geotechnical Engineering Report
Trailside South
Orange Blossom Trail and Centerview Blvd.
Kissimmee, Florida

June 23, 2015
Terracon Project No. H1155074

Prepared for:
Deerfield Land Corporation
Orlando, Florida

Prepared by:
Terracon Consultants, Inc.
Winter Park, Florida
June 23, 2015

Deerfield Land Corporation
14901 S. Orange Blossom Trail
Orlando, Florida 32806

Attn: Mr. Thomas Roehlk
P: [407] 826 4514
E: tomroehlk@tupperware.com

Re: Preliminary Geotechnical Engineering Report
Trailside South
Orange Blossom Trail and Centerview Boulevard
Kissimmee, Osceola County, Florida
Terracon Project Number: H1155074

Dear Mr. Roehlk:

Terracon Consultants, Inc. (Terracon) has completed the preliminary geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal number PH1150311 dated May 5, 2015.

This report presents the findings of the subsurface exploration and provides preliminary geotechnical recommendations concerning earthwork and the design and construction of foundations and pavements for the proposed development.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.
Certificate of Authorization Number 8830

Xuebing Zheng, E.I.
Staff Geotechnical Engineer

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<th>Description</th>
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<thead>
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<th>Exhibit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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</tr>
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EXECUTIVE SUMMARY

A preliminary geotechnical exploration has been performed for the proposed Trailside South development planned to be constructed at southwest corner of the intersection of Orange Blossom Trail and Centerview Boulevard in Kissimmee, Osceola County, Florida. Fourteen (14) borings, designated B-1 through B-14, have been performed to depths of between 10 and 20 feet below the existing ground surface in the proposed building and pavement areas.

Based on the information obtained from our geotechnical exploration, it appears that the site can be developed for the proposed project. The following geotechnical considerations were identified:

- The proposed structure may be supported on shallow foundation system bearing on the existing site soil or on newly placed engineered fill.
- Assuming proper site preparation is performed, total and differential settlement should be within tolerable limits.
- The in-place sands appear suitable for re-use as general engineered fill.
- The provided plan information does not indicate inclusion of on-site stormwater management system within the proposed development. We assume that stormwater runoff will be routed to surrounding ponds.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled GENERAL COMMENTS should be read for an understanding of the report limitations.
1.0 INTRODUCTION

A preliminary geotechnical exploration has been performed for the proposed Trailside South development planned to be constructed at southwest corner of the intersection of Orange Blossom Trail and Centerview Boulevard in Kissimmee, Osceola County, Florida as shown on the Topographic Vicinity Map included as Exhibit A-1 in Appendix A. Fourteen (14) borings, designated B-1 through B-14, have been performed to depths of between 10 and 20 feet below the existing ground surface in the proposed building and pavement areas. Logs of the borings along with a Boring Location Diagram (Exhibit A-4) are included in Appendix A of this report. Laboratory testing procedures are included in Exhibit B-1 in Appendix B.

The purpose of these services is to provide information and preliminary geotechnical engineering recommendations relative to:

- subsurface soil conditions
- preliminary foundation design
- groundwater conditions
- preliminary pavement design

2.0 PROJECT INFORMATION

2.1 Project Description

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>The proposed Trailside South development includes approximately 55,000 square feet single-story retail building.</td>
</tr>
<tr>
<td>Building Construction</td>
<td>Steel/Concrete/Brick Veneer (assumed).</td>
</tr>
<tr>
<td>Finished floor elevation</td>
<td>+90.5 feet</td>
</tr>
<tr>
<td>Maximum loads</td>
<td>Columns: 50 kips (assumed)</td>
</tr>
<tr>
<td></td>
<td>Walls: 4 kips per linear foot (assumed)</td>
</tr>
<tr>
<td></td>
<td>Slabs: 150 psf (assumed)</td>
</tr>
<tr>
<td>Grading</td>
<td>An estimated additional 2 to 6 feet of fill will be added to existing grades</td>
</tr>
</tbody>
</table>
Item | Description
--- | ---
Assumed Design traffic | Light Duty Pavement-Assumed loads of 30,000 equivalent 18-kip single axle loads (E18SALs)
 | Limited Heavy Duty Pavement-Assumed loads of 50,000 E18SALs Pavement Design Life-20 years
Stormwater Management | No drainage area has been identified on the site plan. We anticipate the stormwater runoff will be routed to the pond located to the west of the proposed development.

### 2.2 Site Location and Description

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>The proposed project site is located at southwest corner of the intersection of Orange Blossom Trail and Centerview Boulevard in Kissimmee, Florida.</td>
</tr>
<tr>
<td>Current ground cover</td>
<td>The site is currently cleared with approximately 2 to 6 feet in-place fill.</td>
</tr>
<tr>
<td>Existing topography</td>
<td>The site is relatively flat, the natural ground elevation is approximately at elevation +85 feet.</td>
</tr>
<tr>
<td>Surface Water</td>
<td>Aerial views of the proposed project site from Google Earth and the provided site plan indicated there is an existing pond to the west of the project site, and another pond to the northwest of the site.</td>
</tr>
</tbody>
</table>

### 3.0 SUBSURFACE CONDITIONS

The geology of the site is presented in the following report section. A discussion of subsurface conditions encountered in our borings follows the geology section.

### 3.1 Geology

#### 3.1.1 Regional Geology

The geology of Osceola County can be broadly divided into three layers. The lowermost and the oldest layer is the Limestone layer. The Floridan Aquifer, the primary source of potable water in Osceola County, is located within the Limestone layer. The Limestone layer can be subdivided into Avon Park Formation and Ocala Formation. Ocala Formation lies unconformably on top of Avon Park Formation.
Above the Ocala Formation lies the Hawthorn Group. The Hawthorn Group acts as a confining layer, maintaining the Floridan Aquifer beneath it and separating it from the surficial unconfined aquifer. The highly variable, diverse, lithologic character of the Hawthorn Group includes interbedded and interfingering sand, clayey sand, sandy clay, phosphatic sediment, dolomite, and limestone. The carbonate part generally occurs in the lower Hawthorn Group and contains highly variable amounts of sand, clay, and phosphorite or sand and clay. Sedimentary deposits of the Hawthorn Group underlie the entire county except in scattered areas where these deposits have been removed by erosion prior to deposition of younger units.

Above the Hawthorn Group, unconsolidated sand blankets the county. This sand consists of medium to fine sand and silt and does not contain clay or shell fragments. The surface expression of this lithologic type is generally flat to slightly undulating.

The site is located in a flat area of Osceola County which is referred to as the Osceola Plain. The Osceola Plain is bounded on the west and northwest by the higher land of the east side of the Lake Wales Ridge and the southern ends of the Mount Dora and Orlando Ridges. On the northeast, east and south it is bounded by the an outward-facing scarp which look out onto lower ground which for the most part is the solution-reduced beach ridge plain at about 25 feet elevation which is known as the solution part of the Eastern Valley.

The extreme elevation of the Osceola Plain is about 90 to 95 feet. This elevation is reached near its northern edge where it rises gradually but with increasing local relief toward the southern edge of the Orlando Ridge. Although the various parts of the Osceola Plain show little recognizable difference in relief, there is nonetheless a notable distinction in the terrain east and west of a line running approximately parallel with the axis of the Peninsula.

### 3.1.2 General Potential for Sinkhole Development

Sinkhole development occurs in Florida and varies geographically from areas with almost no potential or a very low potential to areas with a high potential where sinkholes occur frequently. The subject property is located in Area II on the United States Geological Survey map entitled “Sinkhole Type, Development, and Distribution in Florida”. The cover (over limestone bedrock) in Area II is between 30 to 200 feet thick and is predominantly sandy. Sinkholes are few, shallow, and of small diameter and develop gradually in Area II. The risk of sinkhole occurrence at most sites is small even in areas known to have a higher than average risk of sinkhole occurrence.

A review of the Florida Geologic Survey’s sinkhole database (updated March 4, 2014) reveals one reported sinkhole within three mile of the subject site. It should be noted that the number of sinkholes is based on information reported to the FGS and does not necessarily reflect the number of sinkholes confirmed by public or private industry.
During our limited shallow evaluation, we did not encounter traditional signs associated with potential sinkhole development including loss of drilling fluids, obvious raveled zones, surface depressions, etc. However, this evaluation was not planned to specifically address sinkhole potential. The risk of sinkhole occurrence at most sites is small even in areas known to have a higher than average risk of sinkhole occurrence.

If the sinkhole potential of the site is to be evaluated, additional site-specific data must be obtained. This might include using geophysical methods such as Electrical Resistivity tests and additional geotechnical tests such as Cone Penetrometer Test (CPT) soundings, dilatometer (DMT) soundings, and/or more/deeper Standard Penetration Test borings. Interpretation of the test data should be done by a professional geologist/engineer familiar with the use of these tests under local conditions. However, it should be noted that even if indicators of sinkhole activity are found, it is impossible to predict if, when or precisely where a sinkhole may occur. If requested, Terracon can assist in assessing the sinkhole potential of the location of the proposed construction.

3.2 Soil Survey

The Soil Survey of Osceola County Area, Florida as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service - NRCS), identifies the soil type at the subject site as Basinger Fine Sand (5), Placid Fine Sand (32), and Water (99). It should be noted that the Soil Survey is not intended as a substitute for site-specific geotechnical exploration; rather it is a useful tool in planning a project scope in that it provides information on soil types likely to be encountered. Boundaries between adjacent soil types on the Soil Survey maps are approximate (included in Appendix A as Exhibit A-2). Descriptions of the mapped soil units are included in Appendix A as Exhibit A-3. It should be noted that it appears that the site was previously filled, which covers the soils shown on the SCS maps.

3.3 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Approximate Depth to Bottom of Stratum (feet)</th>
<th>Material Description</th>
<th>Consistency/ Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 (termination depth) to 18.5</td>
<td>Fine sand (SP) to fine sand with silt (SP-SM) to silty fine sand (SM)</td>
<td>Loose to dense</td>
</tr>
<tr>
<td>2</td>
<td>20 (boring termination depth)</td>
<td>Clayey sand (SC) to clay (CH)</td>
<td>Loose to medium dense / very stiff</td>
</tr>
</tbody>
</table>
Conditions encountered at each boring location and results of laboratory testing are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report. Descriptions of our field exploration are included as Exhibit A-5 in Appendix A. Descriptions of our laboratory testing procedures are included as Exhibit B-1 in Appendix B. General notes for SPT borings can be found in Exhibit C-1. A more detailed description of the Unified Soil Classification System (USCS) is included as Exhibit C-2 in Appendix C.

### 3.4 Groundwater

The boreholes were observed during drilling for the presence and level of groundwater. Groundwater was observed in six (6) of the borings, varying from depths of 7.5 to 8.5 feet below existing grade. Longer term monitoring in cased holes or piezometers, possibly installed to greater depths than explored under this project scope, would be required to better define groundwater conditions at the site.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the boring was performed. In addition, perched water can develop within higher permeability soils overlying less permeable soils. Therefore, groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the boring logs.

We estimate that during the normal wet season (typically June through October) with rainfall and recharge at a maximum, groundwater levels will be 3 to 6 feet below grade. Some of the in-place fill consists of silty sand, which create some perched conditions. Our estimates of the seasonal groundwater conditions are based on the USDA Soil Survey, available survey data, the encountered soil types, recent weather conditions, and the encountered water levels. The estimated normal seasonal high groundwater tables are included in the following table:

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Approximate depth to encountered water table</th>
<th>Approximate depth to estimated average seasonal wet groundwater table</th>
<th>Approximate depth to estimated normal seasonal high groundwater table</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>8.3 feet</td>
<td>7 feet</td>
<td>6 feet</td>
</tr>
<tr>
<td>B-2</td>
<td>8.5 feet</td>
<td>7 feet</td>
<td>6 feet</td>
</tr>
<tr>
<td>B-3</td>
<td>8.5 feet</td>
<td>7 feet</td>
<td>6 feet</td>
</tr>
<tr>
<td>B-4</td>
<td>8 feet</td>
<td>6.5 feet</td>
<td>5.5 feet</td>
</tr>
<tr>
<td>B-5</td>
<td>&gt;10 feet</td>
<td>7 feet</td>
<td>6 feet</td>
</tr>
<tr>
<td>B-6</td>
<td>&gt;10 feet</td>
<td>7 feet</td>
<td>6 feet</td>
</tr>
<tr>
<td>B-7</td>
<td>7.2 feet</td>
<td>6 feet</td>
<td>5 feet</td>
</tr>
</tbody>
</table>
These seasonal water table estimates do not represent the temporary rise in water table that occurs immediately following a storm event, including adjacent to other stormwater management facilities. This is different from static groundwater levels in wet ponds and/or drainage canals which can affect the design water levels of new, nearby ponds. The seasonal high water table may vary from normal when affected by extreme weather changes, localized or regional flooding, karst activity, future grading, drainage improvements, or other construction that may occur on our around the site following the date of this report.

4.0 PRELIMINARY RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

The following preliminary evaluations and recommendations are based on the project characteristics previously described, the data obtained during our field explorations, and our experience with similar subsurface conditions, proposed development, and construction methods.

The performed borings showed consistent subsurface soil profile that is typical for the project area. The subsoil conditions described above, together with the proposed development, is considered suitable to adequately support the anticipated building.

4.1 Shallow Foundation and Site Preparation

Shallow spread footings bearing on natural sands or engineered fill should be suitable to support the proposed building column and wall loads. The engineered fill should be placed as outlined in Section 4.2, Fill Placement, of this report. Based on the assumed column load of 50 kips and wall load of 4 kip/lf, the preliminary settlement for the proposed Trailside South building are anticipated to be less than 1 inch and is estimated to be mostly elastic that will occur during and
shortly after construction. The clayey layer may cause some time dependent settlement; however, the amount of time dependent settlement is expected to be minimal due to the clay layer being stiff. Differential settlements between footings are expected to be less than ½ inches between adjacent columns.

Bearing pressures in the order of 3000 to 3500 psf are feasible for the design and sizing of the spread and wall footings for a minimum footing width of 3 feet and a minimum embedment depth of 3 feet.

Areas that will support footings, floors, pavements or new engineered fill must be properly prepared. All topsoil and unsuitable materials should be removed to a distance of 5 feet beyond the perimeter of construction. Unsuitable materials include topsoil, asphaltic concrete, buried structures, any soft unstable material and miscellaneous (non-soil) fill.

Prior to construction or placement of new engineered fill, if needed, the Geotechnical Engineer should evaluate the exposed subgrade. The evaluation should include proofrolling of the exposed subgrade. If unsuitable materials are disclosed, the Geotechnical Engineer would recommend appropriate remedial measures at that time. The proofrolling may consist of rolling all areas with ten passes of a static roller with a minimum static weight of 20,000 pounds or any equivalent. The latter five passes should be at right angles to previous passes. Any areas that yield excessively under the proofrolling operations should be removed and replaced by a suitable fill material as noted later in this report.

Proofrolling should be continued until soils to a minimum depth of 24 inches below foundation levels have achieved a minimum density of 95 percent of the maximum dry density as determined by ASTM D 1557 (Modified Proctor). In-place density tests should be conducted by a qualified Geotechnical Engineering Technician working under the direction of a registered Geotechnical Engineer. Careful moisture control may be necessary to achieve compaction. If water is added, it should be done in a way that will not promote erosion.

Care should be exercised during grading and fill placement operations. The combination of heavy construction equipment traffic and excess surface moisture can cause pumping and deterioration of the near surface soils. The severity of this potential problem depends to a great extent on the weather conditions prevailing during construction. The Contractor should exercise discretion when selecting equipment sizes and also make a concerted effort to control surface water while the subgrade soils are exposed. If such problems do arise, the operations in the affected area should be halted and the Geotechnical Engineer should be contacted to evaluate the condition.
4.2 Fill Placement

After the site has been prepared as described above and accepted by the Geotechnical Engineer, fill required to bring the site to final grade may be placed and properly compacted as follows:

- Fill should be inorganic, non-plastic, granular soil (clean sands). Preferably it should have less than 10 percent passing a No. 200 sieve. The suitability of specific soils as fill material would be based on the results from classification and compaction tests and subject to approval of the Geotechnical Engineer.

- The fill should be placed in level lifts not to exceed 12 inches loose thickness if a large roller or heavy equipment is used to compact the fill.

- The fill should be compacted to a minimum of 95 percent of the soil's modified Proctor maximum dry density as determined by ASTM Specification D-1557.

- In-place density tests should be performed on each lift by an experienced Engineering Technician working under the direction of a registered Geotechnical Engineer to verify that the recommended degree of compaction has been achieved.

- Fill should extend a minimum of 5 feet beyond building lines to prevent possible erosion or undermining of footing bearing soils. Further, fill slopes should not be steeper than 2 horizontal to 1 vertical (2H:1V).

- Fill placed in utility trenches and adjacent to footings beneath slabs on grade should also be properly placed and compacted to the specifications stated above. However, in these restricted working areas, compaction should be accomplished with lightweight, hand-guided compaction equipment and lift thicknesses should be limited to a maximum of 6 inches loose thickness.

4.3 Roadway and Pavements

The near surface soil throughout the site consisted of clean fine sands to fine sand with silt, which is suitable as subgrade for conventional pavement sections. The groundwater table was encountered at depths of 3 to 6 feet below existing ground surface, which will provide the minimum separation of 18 inches between pavement section and the seasonal high water table.

Given the above subsoil and groundwater conditions, it is our opinion that conventional flexible or rigid pavement sections may be utilized. The subsoil and groundwater conditions encountered at the project site do not appear to pose appreciable limitations to pavement design and construction.
The following table provides preliminary pavement section based on the assumptions made for traffic and subgrade strength. Final pavement design should be performed after traffic data becomes available.

<table>
<thead>
<tr>
<th>Traffic Area</th>
<th>Alternative</th>
<th>Asphalt Concrete Surface Course</th>
<th>Limerock, Soil-Cement or Crushed Concrete Base Course</th>
<th>Stabilized Subbase Course(^{1,2,3})</th>
<th>Portland Cement Concrete</th>
<th>Free Draining Subgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Duty – Passenger Cars Only</td>
<td>PCC</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>5.0</td>
<td>18.0</td>
</tr>
<tr>
<td></td>
<td>AC</td>
<td>1.5</td>
<td>6.0</td>
<td>12.0</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Heavy Duty – Driveways, Areas Accessed by</td>
<td>PCC</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>6.0</td>
<td>18.0</td>
</tr>
<tr>
<td>Truck Traffic</td>
<td>AC</td>
<td>2.0</td>
<td>8.0</td>
<td>12.0</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

1. Often referred to as Stabilized Subgrade.
2. Use coarse granular materials such as recycled crushed concrete, shell, or gravel when seasonal high groundwater is within 4 feet of the profile grade. Clay stabilization is acceptable with deeper seasonal high groundwater.
3. Some municipalities do not require stabilized subbase beneath soil-cement base.

### 5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.
The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.
APPENDIX A
FIELD EXPLORATION
Osceola County Soil Map Index
5    Basinger fine sand, 0 to 2 percent slopes
32   Placid fine sand, depressional
99   Water
Soil Survey Descriptions

5 – Basinger fine sand. This soil type is nearly level and poorly drained. It is typically found on low, broad flats and sloughs in the flatwoods. In its natural state, during years of normal rainfall, this soil type has a seasonal high water table within 10 inches (0.8 feet) of the surface, receding to a depth of between 10 and 30 inches (0.8 and 2.5 feet) during the dry season.

32 – Placid fine sand. This soil type is nearly level and very poorly drained. It is typically found in low, wet depressions and swamps in the flatwoods. In its natural state, groundwater is ponded atop this soil type for 6 to 9 months of years with normal rainfall. This soil type is sometimes associated with a surficial organic surface layer, extending to a depth of 24 inches (2.0 feet), with typical organic contents approaching 7 percent.
Field Exploration Description

The boring locations were laid out at the project site by Terracon personnel. The locations indicated on the attached diagram are approximate and were measured by a GPS. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The SPT soil borings were drilled a CME automatic hammer. The boreholes were advanced with a cutting head and stabilized with the use of bentonite (drillers’ mud). Soil samples were obtained by the split spoon sampling procedure in general accordance with the Standard Penetration Test (SPT) procedure. In the split spoon sampling procedure, the number of blows required to advance the sampling spoon the last 12 inches of an 18-inch penetration or the middle 12 inches of a 24-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. The sampling depths and penetration distance, plus the standard penetration resistance values, are shown on the boring logs.

A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Portions of the samples from the borings were sealed in glass jars to reduce moisture loss, and then the jars were taken to our laboratory for further observation and classification. Upon completion, the boreholes were backfilled with the site soil.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation of the samples.
**BORING LOG NO. B-1**

**PROJECT:** Trailside South  
**CLIENT:** Deerfield Land Corporation

**SITE:** South of Orange Blossom Tr. and Centerview Blvd.  
Kissimmee, Florida

---

**LOCATION**  
See Exhibit A-4

---

<table>
<thead>
<tr>
<th>GRAPHIC LOG</th>
<th>DEPTH (FT)</th>
<th>WATER LEVEL OBSERVATIONS</th>
<th>FIELD TEST RESULTS</th>
<th>WATER CONTENT (%)</th>
<th>ATTERBERG LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SAND WITH SILT (SP-SM), fine grained, brown to grayish-brown, medium dense</strong></td>
<td>5.5</td>
<td></td>
<td></td>
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<td></td>
<td>7.5</td>
<td></td>
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<tr>
<td><strong>SILTY SAND (SM), fine grained, grayish-brown, medium dense</strong></td>
<td>13.5</td>
<td></td>
<td></td>
<td>N=15</td>
<td>13</td>
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<td></td>
<td>18.5</td>
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<tr>
<td><strong>CLAYEY SAND (SC), fine grained, grayish-brown, medium dense</strong></td>
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---

**Boring Terminated at 20 Feet**

---

Stratification lines are approximate. In-situ, the transition may be gradual.  
Hammer Type: Automatic

---

**FIELD TEST RESULTS**

<table>
<thead>
<tr>
<th>SAMPLE TYPE</th>
<th>WATER LEVEL OBSERVATIONS</th>
<th>FIELD TEST RESULTS</th>
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<td>4-5-4 N=9</td>
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</table>

---

**GROUNDWATER INITIAL ENCOUNTERED AT 8.3'**

---

**Surface Conditions**

Groundwater Initially Encountered at 8.3'

---

**Abandonment Method**

Borings backfilled with soil cuttings upon completion.

---

**Notes**

Project No.: H1155074  
Exhibit: A-6

---

**See Appendix B for description of laboratory procedures and additional data (if any).**

---

**See Exhibit A-3 for description of field procedures.**

---

**Abandonment Method:**

Borings backfilled with soil cuttings upon completion.

---

**Notes:**

Boring Started: 5/21/2015  
Boring Completed: 5/21/2015

---

**Drill Rig:** DR-898  
**Driller:** Mark C.

---

**1675 Lee Road**  
**Winter Park, Florida**
### BORING LOG NO. B-2

**PROJECT:** Trailside South  
**SITE:** South of Orange Blossom Tr. and Centerview Blvd.  
**CLIENT:** Deerfield Land Corporation  

**LOCATION**  
See Exhibit A-4

---

**DEPTH**  

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>DEPTH (Ft.)</th>
<th>GRAPHIC LOG</th>
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</thead>
<tbody>
<tr>
<td>SILTY SAND (SM)</td>
<td>7.5</td>
<td>![Graphic Log]</td>
</tr>
<tr>
<td>SAND WITH SILT (SP-SM)</td>
<td>13.5</td>
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<tr>
<td>SILTY SAND (SM)</td>
<td>18.5</td>
<td>![Graphic Log]</td>
</tr>
<tr>
<td>CLAYEY SAND (SC)</td>
<td>20.0</td>
<td>![Graphic Log]</td>
</tr>
</tbody>
</table>

**SILTY SAND (SM), with trace roots at top, fine grained, grayish-brown, loose to dense**

**SAND WITH SILT (SP-SM), fine grained, light brown, dense**

**SILTY SAND (SM), fine grained, light grayish-brown, medium dense**

**CLAYEY SAND (SC), fine grained, grayish-brown, medium dense**

---

**FIELD TEST RESULTS**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>WATER LEVEL OBSERVATIONS</th>
<th>SAMPLE TYPE</th>
<th>FIELD TEST RESULTS</th>
<th>WATER CONTENT (%)</th>
<th>LL-PL-PI</th>
<th>ATTERBERG LIMITS</th>
<th>PERCENT FINES</th>
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**WATER LEVEL OBSERVATIONS**

- **Groundwater Initially Encountered at 8.5’**

---

**Notes:**

- Advancement Method: Mud Rotary
- Abandonment Method: Borings backfilled with soil cuttings upon completion.
- Hammer Type: Automatic
- See Exhibit A-3 for description of field procedures.
- See Appendix B for description of laboratory procedures and additional data (if any).
- See Appendix C for explanation of symbols and abbreviations.

---

**Boring Terminated at 20 Feet**

---

** TJMARCO2012.GDT  6/3/15**

---

**TERRACON 1875 Lee Road Winter Park, Florida**

**Drill Rig: DR-898**

**Driller: Mark C.**

**Project No.: H1155074**

**Exhibit: A-7**

**Boring Started: 5/21/2015**

**Boring Completed: 5/21/2015**
## BORING LOG NO. B-3

### SITE: South of Orange Blossom Tr. and Centerview Blvd.

### CLIENT: Deerfield Land Corporation

### PROJECT: Trailside South

### LOCATION

- See Exhibit A-4

<table>
<thead>
<tr>
<th>Graphic Log Location</th>
<th>Depth (Ft.)</th>
<th>Water Level Observations</th>
<th>Field Test Results</th>
<th>Water Content (%)</th>
<th>LL-PL-PI</th>
<th>Atterberg Limits</th>
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### Boring Terminated at 20 Feet

Stratification lines are approximate. In-situ, the transition may be gradual. Hammer Type: Automatic

**Advancement Method:** Mud Rotary

**Abandonment Method:** Borings backfilled with soil cuttings upon completion.

**Notes:**

See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix C for explanation of symbols and abbreviations.

**Water Level Observations:**

- Groundwater Initially Encountered at 8.5'

**Location:**

- South of Orange Blossom Tr. and Centerview Blvd.

- Kissimmee, Florida

**SITE:**

- South of Orange Blossom Tr. and Centerview Blvd.

**Client:** Deerfield Land Corporation

**Project No.:** H1155074

**Driller:** Mark C.

**Drill Rig:** DR-898

**Boring Started:** 5/21/2015

**Boring Completed:** 5/21/2015

**Exhibit:** A-8

**Report:** 1675 Lee Road

Winter Park, Florida

**Notes:**

- Use the full report for detailed information.

**Record:**

- Geologic log practices from original report.

**Validity:**

- This boring log is not valid if separated from original report.

**Date:**

- 6/3/15
**BORING LOG NO. B-4**

**PROJECT:** Trailside South  
**SITE:** South of Orange Blossom Tr. and Centerview Blvd.  
**CLIENT:** Deerfield Land Corporation

### GRAPHIC LOG

<table>
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<th>Location</th>
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<td>SAND WITH SILT (SP-SM), fine grained, grayish-brown, medium dense</td>
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### FIELD TEST RESULTS

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<th>Depth (Ft)</th>
<th>Water Level Observations</th>
<th>Sample Type</th>
<th>Field Test Results</th>
<th>Water Content (%)</th>
<th>LL-PL-PI</th>
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</table>

**Notes:**

- Groundwater Initially Encountered at 8'
- Advancement Method: Mud Rotary
- Abandonment Method: Borings backfilled with soil cuttings upon completion.
- Hammer Type: Automatic
- See Exhibit A-3 for description of field procedures.
- See Appendix B for description of laboratory procedures and additional data (if any).
- See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

- Groundwater Initially Encountered at 8'

**Hammer Type:** Automatic

**Driller:** Mark C.

**Drill Rig:** DR-898

**Project No.: H1155074**

**Exhibit:** A-9

**Boring Started:** 5/21/2015  
**Boring Completed:** 5/21/2015
1. SAND WITH SILT (SP-SM), fine grained, brown, medium dense

2. SILTY SAND (SM), fine grained, grayish-brown, medium dense

3. SAND WITH SILT (SP-SM), fine grained, grayish-brown to brown, medium dense

Boring Terminated at 10 Feet

Hammer Type: Automatic

Stratification lines are approximate. In-situ, the transition may be gradual.
6.08.010.0

SAND WITH SILT (SP-SM), fine grained, grayish-brown, loose

6.0

SAND WITH SILT (SP-SM), with trace silty sand, fine grained, grayish-brown, medium dense

8.0

SILTY SAND (SM), fine grained, brown, loose

10.0

Boring Terminated at 10 Feet

Hammer Type: Automatic

Stratification lines are approximate. In-situ, the transition may be gradual.

LOCATION
See Exhibit A-4

DEPTH
GRAPHIC LOG
See Exhibit A-4

FIELD TEST RESULTS
SAMPLE TYPE
WATER CONTENT (%)
WATER CONTENT (%)
ATTERBERG LIMITS
PERCENT FINES

3-3-5-6
N=8

2-3-2-2
N=5

3-4-3-3
N=7

5-5-4-4
N=9

3-4-4-4
N=8

PROJECT: Trailside South
CLIENT: Deerfield Land Corporation

SITE: South of Orange Blossom Tr. and Centerview Blvd.
Kissimmee, Florida

Deerfield Land Corporation
CLIENT:

Driller: Mark C.
Boring Completed: 5/21/2015
Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO-LOG-DEPTH TO BOTTOM OF PAGE. H1155074-BORINGS.GPJ TERRACON 2012.GDT 6/3/15

FIELD TEST RESULTS
PERCENT FINES
WATER CONTENT (%)
WATER CONTENT (%)
ATTERBERG LIMITS

PROJECT: Trailside South
CLIENT: Deerfield Land Corporation

SITE: South of Orange Blossom Tr. and Centerview Blvd.
Kissimmee, Florida

Deerfield Land Corporation
CLIENT:

Driller: Mark C.
Boring Completed: 5/21/2015
Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO-LOG-DEPTH TO BOTTOM OF PAGE. H1155074-BORINGS.GPJ TERRACON 2012.GDT 6/3/15

FIELD TEST RESULTS
PERCENT FINES
WATER CONTENT (%)
WATER CONTENT (%)
ATTERBERG LIMITS

PROJECT: Trailside South
CLIENT: Deerfield Land Corporation

SITE: South of Orange Blossom Tr. and Centerview Blvd.
Kissimmee, Florida

Deerfield Land Corporation
CLIENT:

Driller: Mark C.
Boring Completed: 5/21/2015
Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO-LOG-DEPTH TO BOTTOM OF PAGE. H1155074-BORINGS.GPJ TERRACON 2012.GDT 6/3/15

FIELD TEST RESULTS
PERCENT FINES
WATER CONTENT (%)
WATER CONTENT (%)
ATTERBERG LIMITS

PROJECT: Trailside South
CLIENT: Deerfield Land Corporation

SITE: South of Orange Blossom Tr. and Centerview Blvd.
Kissimmee, Florida

Deerfield Land Corporation
CLIENT:

Driller: Mark C.
Boring Completed: 5/21/2015
Exhibit: A-11

WATER LEVEL OBSERVATIONS

Groundwater Leve Not Encountered to Depth of 10'
SAND WITH SILT (SP-SM), fine grained, grayish-brown to brown, loose to medium dense

trace crumbles of silty sand at 5.5’

Boring Terminated at 10 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.
### BORING LOG NO. B-8

**PROJECT:** Trailside South  
**CLIENT:** Deerfield Land Corporation  
**SITE:** South of Orange Blosson Tr. and Centerview Blvd.  
**Kissimmee, Florida**

#### LOCATION
See Exhibit A-4

#### GRAPHIC LOG
See Exhibit A-4

#### DEPTH

<table>
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<tr>
<th>WATER LEVEL OBSERVATIONS</th>
<th>FIELD TEST RESULTS</th>
<th>ATTERBERG LIMITS</th>
<th>PERCENT FINES</th>
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<tbody>
<tr>
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<td>Sample Type</td>
<td>Water Content (%)</td>
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**Boring Terminated at 10 Feet**

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

#### Advancement Method:
Mud Rotary

#### Abandonment Method:
Borings backfilled with soil cuttings upon completion.

#### WATER LEVEL OBSERVATIONS

- **Groundwater Initially Encountered at 7.8'**

**Notes:**

- **Project No.: H1155074**
- **Drill Rig: DR-898**
- **Driller: Mark C.**
- **Boring Started: 5/21/2015**
- **Boring Completed: 5/21/2015**
- **Exhibit: A-13**
### Boring Log No. B-9

**Project:** Trailside South  
**Client:** Deerfield Land Corporation  
**Site:** South of Orange Blossom Tr. and Centerview Blvd.  
**Location:** See Exhibit A-4  

<table>
<thead>
<tr>
<th>Depth (Ft.)</th>
<th>Graphic Log</th>
<th>Depth Level to Bottom of Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>SAND WITH SILT (SP-SM), fine grained, brown, medium dense</td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>CLAYEY SAND (SC), with silty sand, fine grained, grayish-brown, medium dense</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>SAND WITH SILT (SP-SM), with silty sand, fine grained, brown to grayish-brown, medium dense</td>
<td></td>
</tr>
</tbody>
</table>

**Field Test Results**

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>Water Content (%)</th>
<th>Water Level Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LL-PL-PI</td>
<td>N=9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=18</td>
</tr>
</tbody>
</table>

**Notes:**

- **Advancement Method:** Mud Rotary
- **Abandonment Method:** Borings backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

- **Groundwater Level Not Encountered to Depth of 10 Feet**

**Hammer Type:** Automatic  
**Boring Started:** 5/21/2015  
**Boring Completed:** 5/21/2015  
**Drill Rig:** DR-898  
**Driller:** Mark C.  
**Project No.:** H1155074  
**Exhibit:** A-14
### Location

**SITE:** South of Orange Blossom Tr. and Centerview Blvd.
Kissimmee, Florida

**LOCATION**

- See Exhibit A-4

### Graphic Log

#### Location:

- See Exhibit A-4

#### Depth:

- **3.5 ft:** SAND WITH SILT (SP-SM), fine grained, grayish-brown, loose to medium dense
- **7.0 ft:** SILTY SAND (SM), fine grained, brown to grayish-brown, loose to medium dense
- **10.0 ft:** SAND WITH SILT (SP-SM), fine grained, brown, medium dense

**Boring Terminated at 10 Feet**

### Field Test Results

<table>
<thead>
<tr>
<th>Depth (Ft.)</th>
<th>Water Level Observations</th>
<th>Field Test Results</th>
<th>Water Content (%)</th>
<th>Atterberg Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-3-3-3</td>
<td></td>
<td></td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>5-4-5-5</td>
<td></td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>7-8-7-6</td>
<td></td>
<td></td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

**Hammer Type:** Automatic

### Notes:

- **Driller:** Mark C
- **Boring Completed:** 5/21/2015
- **Notes:**
  - Project No.: H1155074
  - Drill Rig: DR-898
  - Driller: Mark C.
  - Exhbit: A-15
**BORING LOG NO. B-11**

**PROJECT:** Trailside South  
**CLIENT:** Deerfield Land Corporation

**SITE:** South of Orange Blossom Tr. and Centerview Blvd.  
**Kissimmee, Florida**

**LOCATION**  
See Exhibit A-4

**GRAPHIC LOG**

<table>
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<tr>
<th>LOCATION</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.0</td>
</tr>
</tbody>
</table>

**SAND WITH SILT (SP-SM):** fine grained, brown to grayish-brown, medium dense  
trace crumbles of silty sand

Boring Terminated at 10 Feet

<table>
<thead>
<tr>
<th>DEPTH (Ft.)</th>
<th>WATER LEVEL OBSERVATIONS</th>
<th>FIELD TEST RESULTS</th>
<th>WATER CONTENT (%)</th>
<th>ATTERBERG LIMITS</th>
<th>PERCENT FINES</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td>3-5-4-4</td>
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<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>13-10-10-10</td>
<td>N=20</td>
<td></td>
<td></td>
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<tr>
<td>20</td>
<td></td>
<td>13-11-11-12</td>
<td>N=22</td>
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<td></td>
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<tr>
<td>25</td>
<td></td>
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<td>N=18</td>
<td></td>
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<tr>
<td>30</td>
<td></td>
<td>7-9-8-8</td>
<td>N=17</td>
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</tr>
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</table>

Hamilton Type: Automatic

Stratification lines are approximate. In-situ, the transition may be gradual.

**Advancement Method:** Mud Rotary  
**Abandonment Method:** Borings backfilled with soil cuttings upon completion.

**WATER LEVEL OBSERVATIONS**

*Groundwater Level Not Encountered to Depth of 10'*

Boring Started: 5/21/2015  
Boring Completed: 5/21/2015

Drill Rig: DR-898  
Driller: Mark C.

Project No.: H1155074  
Exhibit: A-16

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
**SAND WITH SILT (SP-SM)**, fine grained, brown to grayish-brown, medium dense  

- **LOCATION**: See Exhibit A-4  
- **DEPTH**: 10.0

### FIELD TEST RESULTS

<table>
<thead>
<tr>
<th>DEPTH (Ft.)</th>
<th>WATER LEVEL OBSERVATIONS</th>
<th>FIELD TEST RESULTS</th>
<th>ATM.BERG LIMITS</th>
<th>PERCENT FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>6-6-5-3 N=11</td>
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</tr>
<tr>
<td>10</td>
<td></td>
<td>9-8-8-9 N=16</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>14-13-8-9 N=21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>8-9-11-11 N=20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>15-5-7-6 N=12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Boring Terminated at 10 Feet**

- **Stratification lines are approximate. In-situ, the transition may be gradual.**
- **Hammer Type**: Automatic

**Notes:**
- **Project No.**: H1155074
- **Driller**: Mark C
- **Boring Started**: 5/21/2015
- **Boring Completed**: 5/21/2015
- **Drill Rig**: DR-898
- **Driller**: Mark C
- **Project No.**: H1155074
- **Exhibit**: A-17

**Abandonment Method:**
- Borings backfilled with soil cuttings upon completion.

**Water Level Observations:**
- **Groundwater Level Not Encountered to Depth of 10’**
**BORING LOG NO. B-13**

**PROJECT:** Trailside South  
**CLIENT:** Deerfield Land Corporation

**SITE:** South of Orange Blossom Tr. and Centerview Blvd.  
**Kissimmee, Florida**

---

**LOCATION**  
See Exhibit A-4

**DEPTH**

<table>
<thead>
<tr>
<th>WATER LEVEL OBSERVATIONS</th>
<th>FIELD TEST RESULTS</th>
<th>WATER CONTENT (%)</th>
<th>ATTERBERG LIMITS</th>
<th>PERCENT FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5-5-6-5 N=11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5-5-5-5 N=10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3-3-3-3 N=6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3-4-5-4 N=9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3-2-3-2 N=5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SAND WITH SILT (SP-SM):** fine grained, light brown to grayish-brown, loose to medium dense

---

**Boring Terminated at 10 Feet**

---

Stratification lines are approximate. In-situ, the transition may be gradual.

**Hammer Type:** Automatic

---

**Advancement Method:** Mud Rotary  
**Abandonment Method:** Borings backfilled with soil cuttings upon completion.

---

**WATER LEVEL OBSERVATIONS**

**Groundwater Leve Not Encountered to Depth of 10’**

---

**Notes:**

---

**Drill Rig:** DR-898  
**Driller:** Mark C.

---

**Project No.: H1155074  
**Exhibit:** A-18
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>GRAPHIC LOG</th>
<th>DEPTH</th>
<th>WATER LEVEL OBSERVATIONS</th>
<th>FIELD TEST RESULTS</th>
<th>PERCENT FINES</th>
<th>ATTERBERG LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAND (SP), fine grained, brown, loose to medium dense</td>
<td></td>
<td>3.5</td>
<td></td>
<td>3-5-7-5</td>
<td>N=12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.5</td>
<td></td>
<td>4-3-3-5</td>
<td>N=6</td>
<td></td>
</tr>
<tr>
<td>SILTY SAND (SM), fine grained, grayish-brown, loose</td>
<td></td>
<td>10.0</td>
<td></td>
<td>5-4-3-3</td>
<td>N=7</td>
<td></td>
</tr>
<tr>
<td>SAND WITH SILT (SP-SM), fine grained, light brown to brown, loose</td>
<td></td>
<td></td>
<td></td>
<td>4-4-4-3</td>
<td>N=8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3-5-3-5</td>
<td>N=8</td>
<td></td>
</tr>
<tr>
<td>Boring Terminated at 10 Feet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

**Notes:**
- Advancement Method: Mud Rotary
- Abandonment Method: Borings backfilled with soil cuttings upon completion.
- See Exhibit A-3 for description of field procedures.
- See Appendix B for description of laboratory procedures and additional data (if any).
- See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*Groundwater Level Not Encountered to Depth of 10'*

- Boring Started: 5/21/2015
- Boring Completed: 5/21/2015
- Drill Rig: DR-898
- Driller: Mark C.
- Project No.: H1155074
- Exhibit: A-19
APPENDIX B – LABORATORY TESTING
Laboratory Testing

During the field exploration, a portion of each recovered sample was sealed in a glass jar and transported to our laboratory for further visual observation and laboratory testing. Selected samples retrieved from the borings were tested for moisture (water) content, fines content (soil passing a US standard #200 sieve), and Atterberg’s Limits. Those results are included in this report and on the respective boring logs. The visual-manual classifications were modified as appropriate based upon the laboratory testing results.

The soil samples were classified in general accordance with the appended General Notes and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbol for the Unified Soil Classification System is shown on the boring logs and a brief description of the Unified Soil Classification System is included in Appendix B. The results of our laboratory testing are presented in the Laboratory Test Results section of this report and on the corresponding borings logs.
### General Notes

**Description of Symbols and Abbreviations**

<table>
<thead>
<tr>
<th>Sampling Method</th>
<th>Field Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auger Cuttings</td>
<td>Hand Penetrometer</td>
</tr>
<tr>
<td>Grab Sample</td>
<td>Torvane</td>
</tr>
<tr>
<td>Shelby Tube</td>
<td>Dynamic Cone Penetrometer</td>
</tr>
<tr>
<td></td>
<td>Photo-Ionization Detector</td>
</tr>
<tr>
<td></td>
<td>Organic Vapor Analyzer</td>
</tr>
</tbody>
</table>

### Descriptive Soil Classification

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

### Location and Elevation Notes

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

### General Notes

**Description of Symbols and Abbreviations**

<table>
<thead>
<tr>
<th>Sampling Method</th>
<th>Field Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auger Cuttings</td>
<td>Hand Penetrometer</td>
</tr>
<tr>
<td>Grab Sample</td>
<td>Torvane</td>
</tr>
<tr>
<td>Shelby Tube</td>
<td>Dynamic Cone Penetrometer</td>
</tr>
<tr>
<td></td>
<td>Photo-Ionization Detector</td>
</tr>
<tr>
<td></td>
<td>Organic Vapor Analyzer</td>
</tr>
</tbody>
</table>

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Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

### Location and Elevation Notes

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

### Relative Density of Coarse-Grained Soils

<table>
<thead>
<tr>
<th>STRENGTH TERMS</th>
<th>AUTOMATIC HAMMER SPT N-VALUE (BLOWS/FT.)</th>
<th>DENSITY DETERMINED BY STANDARD PENETRATION RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Loose</td>
<td>&lt; 3</td>
<td>Very Soft</td>
</tr>
<tr>
<td>Loose</td>
<td>3 - 8</td>
<td>Soft</td>
</tr>
<tr>
<td>Medium Dense</td>
<td>8 - 24</td>
<td>Medium Stiff</td>
</tr>
<tr>
<td>Dense</td>
<td>24 - 40</td>
<td>Stiff</td>
</tr>
<tr>
<td>Very Dense</td>
<td>&gt; 40</td>
<td>Very Stiff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hard</td>
</tr>
</tbody>
</table>

### Consistency of Fine-Grained Soils

<table>
<thead>
<tr>
<th>CONSISTENCY OF FINE-GRAINED SOILS</th>
<th>(50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive Term (Consistency)</td>
<td>Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance</td>
</tr>
<tr>
<td>Unconfined Compressive Strength Qu. (psf)</td>
<td></td>
</tr>
<tr>
<td>Automatic Hammer SPT N-Value (Blows/ft.)</td>
<td></td>
</tr>
<tr>
<td>Very Loose</td>
<td>&lt; 3</td>
</tr>
<tr>
<td>Loose</td>
<td>3 - 8</td>
</tr>
<tr>
<td>Medium Stiff</td>
<td>8 - 24</td>
</tr>
<tr>
<td>Stiff</td>
<td>24 - 40</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>&gt; 40</td>
</tr>
<tr>
<td>Hard</td>
<td>&gt; 8,000</td>
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### Relative Proportions of Sand and Gravel

<table>
<thead>
<tr>
<th>RELATIVE PROPORTIONS OF SAND AND GRAVEL</th>
<th>GRAIN SIZE TERMINOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive Term(s) of other constituents</td>
<td>Percent of Dry Weight</td>
</tr>
<tr>
<td>Trace</td>
<td>&lt; 15</td>
</tr>
<tr>
<td>With</td>
<td>15 - 29</td>
</tr>
<tr>
<td>Modifier</td>
<td>&gt; 30</td>
</tr>
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<td></td>
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</table>

### Plasticity Description

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<thead>
<tr>
<th>RELATIVE PROPORTIONS OF FINES</th>
<th>PLASTICITY DESCRIPTION</th>
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<td>Descriptive Term(s) of other constituents</td>
<td>Percent of Dry Weight</td>
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<tr>
<td>Trace</td>
<td>&lt; 5</td>
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<tr>
<td>With</td>
<td>5 - 12</td>
</tr>
<tr>
<td>Modifier</td>
<td>&gt; 12</td>
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</table>
# UNIFIED SOIL CLASSIFICATION SYSTEM

<table>
<thead>
<tr>
<th>Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests</th>
<th>Soil Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td><strong>B</strong></td>
</tr>
<tr>
<td><strong>Group Symbol</strong></td>
<td><strong>Group Name</strong></td>
</tr>
<tr>
<td>GW</td>
<td>Well-graded gravel</td>
</tr>
<tr>
<td>GP</td>
<td>Poorly graded gravel</td>
</tr>
<tr>
<td>GM</td>
<td>Silty gravel</td>
</tr>
<tr>
<td>GC</td>
<td>Clayey gravel</td>
</tr>
<tr>
<td>SW</td>
<td>Well-graded sand</td>
</tr>
<tr>
<td>SP</td>
<td>Poorly graded sand</td>
</tr>
<tr>
<td>SM</td>
<td>Silty sand</td>
</tr>
<tr>
<td>SC</td>
<td>Clayey sand</td>
</tr>
</tbody>
</table>

### Coarse Grained Soils:

**Gravels:**
- More than 50% of coarse fraction retained on No. 200 sieve
- Gravels with Fines: More than 12% fines
- Clean Gravels: Less than 5% fines
- Gravels with fines: More than 12% fines
- Fines classify as ML or MH
- Fines classify as CL or CH

### Sands:

- 50% or more of coarse fraction passes No. 200 sieve
- Clean Sands: Less than 5% fines
- Sands with Fines: More than 12% fines
- Fines classify as ML or MH
- Fines classify as CL or CH

### Fine-Grained Soils:

**Silts and Clays:**
- Liquid limit less than 50
- Inorganic:
  - PL > 7 and plots on or above "A" line
  - PL < 4 or plots below "A" line
- Organic:
  - Liquid limit - oven dried
  - Liquid limit - not dried

**Silts and Clays:**
- Liquid limit 50 or more
- Inorganic:
  - PL plots on or above "A" line
  - PL plots below "A" line
- Organic:
  - Liquid limit - oven dried
  - Liquid limit - not dried

**Highly organic soils:**
- Primarily organic matter, dark in color, and organic odor

### Equations and Formulas:

**Cu** = \( \frac{D_{60}}{D_{10}} \)

**Cc** = \( \frac{(D_{60})^2}{D_{10} \times D_{60}} \)

**Notes:**

- If fines are organic, add "with organic fines" to group name.
- If soil contains ≥ 15% gravel, add "with gravel" to group name.
- If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
- If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
- If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
- If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
- PL ≥ 4 and plots on or above "A" line.
- PL < 4 or plots below "A" line.
- PL plots on or above "A" line.
- PL plots below "A" line.

---

For classification of fine-grained soils and fine-grained fraction of coarse-grained soils:

- Equation of "A" line: Horizontal at PL=4 to LL=25.5, then PL=0.73 (LL=20)
- Equation of "U" line: Vertical at LL=16 to PL=7, then PL=0.9 (LL=8)