

# TIERRA

February 27, 2006

D.R. Horton Homes  
14055 Riveredge Drive, Suite 200  
Tampa, Florida 33637

Attn: Ms. Anne E. Mize

**RE: Report of Geotechnical Engineering Services  
Hidden River Phase 2 – North & South  
Hillsborough County, Florida  
Tierra Project No.: 6511-06-048**

Ms. Mize:

Per your authorization, Tierra, Inc. has completed the preliminary geotechnical engineering study for the referenced project. The results of the study are provided herein.

Should there be any questions regarding the report, please do not hesitate to contact our office at (813) 989-1354. Tierra would be pleased to continue providing geotechnical services throughout the implementation of this project, and we look forward to working with you and your organization on this and future projects.

Respectfully Submitted,

**TIERRA, INC.**



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## PROJECT DESCRIPTION

### Project Information

The proposed project is located near the I-75 and Fletcher Avenue intersection in Hillsborough County, Florida. The developer proposes to design and construct four (4) three-story multi-family residential structures, each with an approximate 32,000 square foot (sf) footprint with associated access roads and parking areas for the Hidden River Phase 2 development. Hidden River Phase 2 is divided into two areas – Hidden River Phase 2 North and Hidden River Phase 2 South with each area containing two (2) of the four 32,000 sf structures and a Cabana and Pool area. Hidden River Phase 2 North also contains two (2) proposed ponds. The structures are anticipated to be supported on a post-tensioned slab foundation system or conventional shallow foundation system. This report includes preliminary recommendations and considerations.

This report includes previous Standard Penetration Test (SPT) Borings – SPT-8, SPT-9, and SPT-11 -- from July 2005 as presented in *Preliminary Report of Geotechnical Engineering Services (Revised)*.

We anticipate that the structural loading on the post-tensioned slab for the three story structures will be on the order of 600 pounds per square foot (psf). Specific information regarding actual structural loading was not available at the time of our report. The preliminary recommendations given in this report were developed assuming minimum fill of 2 feet to achieve subgrade elevation. The client should recognize that depending on the required grades and loading, the recommendations given herein may require modification.

Due to the potential for sinkhole activity in this area, Tierra recommends a Ground Penetrating Radar (GPR) survey be performed beneath each building footprint, at a minimum, to evaluate the building pad for sinkhole potential.

### Scope of Services

The objective of our study was to obtain information concerning subsurface conditions at the site in order to obtain data from which to base engineering estimates and recommendations in each of the following areas:

1. Feasibility of utilizing post-tensioned slab foundation systems or conventional shallow foundation systems for support of the structures.
2. Design parameters required for the foundation system, including allowable bearing pressures, capacities, foundation sizes, foundation levels and soil subgrade treatments.

3. Suitability of materials on-site for use as structural fill and general backfill. Engineering criteria for placement and compaction of approved fill materials.
4. General location and description of potentially deleterious materials discovered in the borings, which may interfere with construction progress, and structure performance, including existing fills or surficial organics.
5. General pavement section and construction considerations.
6. Identification of groundwater levels and estimation of Seasonal High Groundwater Table (SHGWT).

We provided the following services in order to achieve the preceding objectives:

1. Reviewed readily available published soils and topographic information. This published information was obtained from the appropriate Florida Quadrangle Map published by the United States Geological Survey (USGS) and the Soil Survey of Hillsborough County, Florida published by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS).
2. Executed a program of subsurface exploration consisting of borings, subsurface sampling and field-testing. We performed two (2) to three (3) Standard Penetration Test (SPT) borings within each proposed building footprint to depths ranging from approximately 30 to 40 feet below existing ground surface (for a total of 9 building SPT borings). In addition, we performed one (1) SPT boring within each proposed pond area to a depth of approximately 20 feet below existing ground surface (for a total of 2 pond SPT borings) and one (1) SPT boring within each proposed Cabana and Pool area to a depth of approximately 25 feet below existing ground surface (for a total of 2 SPT borings).

In July 2005, three (3) SPT borings were performed within the proposed building footprints to a depth of 40 feet below existing ground surface and these borings have been incorporated into this report. In each boring, samples were collected and SPT resistances measured virtually continuously for the top 10 feet and on intervals of 5 feet thereafter.

3. Visually classified the samples in the laboratory using the Unified Soil Classification System (USCS). Identified soil conditions at each boring location and formed an opinion of the site soil stratigraphy.
4. Collected groundwater level measurements and estimated SHGWT.
5. Prepared a formal engineering report in accordance with the request for proposal (RFP) which summarizes the course of study pursued, the field and laboratory data generated, subsurface conditions encountered and our engineering recommendations in each of the pertinent topic areas.

The scope of our services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of our client. Prior to development of this site, an environmental assessment is advisable.

## **SITE AND SUBSURFACE CONDITIONS**

### **General Site Information**

The proposed project is located near the I-75 and Fletcher Avenue intersection in Hillsborough County, Florida.

Based on the United States Geological Survey (USGS) Quadrangle Map of Thonotosassa, Florida, the ground surface elevation at the property is approximately +25 to +35 feet National Geodetic Vertical Datum of 1929 (NGVD 29).

### **Subsurface Conditions**

The subsurface conditions were explored using nine (9) Standard Penetration Test (SPT) borings within each proposed building footprint to depths ranging from approximately 30 to 40 feet below existing ground surface. In addition, we performed one (1) SPT borings within each proposed pond and Cabana and Pool area to a depths ranging from approximately 20 to 25 feet below existing ground surface. In July 2005, three (3) SPT borings were performed within the proposed building footprints to a depth of 40 feet below existing ground surface and these borings have been incorporated into this report. The borings were located in the field by a representative of Tierra with the aid of handheld Global Positioning System (GPS) equipment. The approximate boring locations are presented in the Appendix.

The SPT borings were performed with the use of a D-25 truck-mounted drill rig using Bentonite Mud drilling procedures. The soil sampling was performed in general accordance with American Society for Testing and Materials (ASTM) Test Designation D-1586 titled Penetration Test and Split-Barrel Sampling of Soils. SPT resistance N-values were taken continuously in the initial 10 feet and at intervals of 5 feet thereafter. The soil samples were classified in the field and transported to our laboratory for review.

The soil strata encountered in the borings performed at the proposed development are summarized in the following table:

Stratum Number	Soil Description	Unified Soil Classification System (USCS)
1	Gray to Brown Fine SAND to Fine SAND With Silt	SP/SP-SM
2	Brown Clayey SAND	SC
3	Brown Sandy CLAY	CL
4	Highly Weathered to Weathered LIMESTONE	-
5	Green CLAY	CH
6	CHERT	-
7	Dark Brown Silty SAND	SM

‘-‘ USCS nomenclature does not include rock classification or classification of this material

The subsurface soil stratification is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The soil profiles included in the Appendix should be reviewed for specific information at individual boring locations. These profiles include soil description, stratifications and penetration resistances. The stratifications shown on the boring profiles represent the conditions only at the actual boring location. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual.

### Hillsborough County Soil Survey

The Soil Survey of Hillsborough County, Florida published by the USDA, SCS was reviewed for general near surface soil information. This information indicates there are five (5) primary mapping units at the project location. The map unit data is summarized in the following paragraphs and table.

Basinger, Holopaw and Samsula Soils, Depressional (5) – The soils in this map unit are described as nearly level and very poorly drained. They are in swamps and depressions on the flatwoods. Undrained areas are frequently ponded for about 6 months. The slope is generally 0 to 2 percent.

Chobee Sandy Loam, Frequently Flooded (12) – This is a nearly level and very poorly drained soil on bottom lands mainly along the Hillsborough River and Blackwater

Creek. This soil is flooded for very long periods following prolonged intense rain. The slope is dominantly less than 1 percent. A seasonal high water table fluctuates from the soil surface to a depth of about 10 inches. Permeability is moderately rapid in the surface layer, slow or very slow in the subsoil, and very slow to moderately rapid in the substratum. The available water capacity is high.

Immokalee Fine Sand (21) – This is a nearly level and poorly drained soil on broad plains on the flatwoods. The slope is 0 to 2 percent. Permeability is rapid in the surface and subsurface layers and moderate in the subsoil. A seasonal high water table fluctuates from the soil surface to a depth of 10 inches for more than 2 months and recedes to a depth of 10 to 40 inches for 8 months or more.

Myakka Fine Sand (29) – The soil in this map unit is described as nearly level and poorly drained. It is on broad plains on the flatwoods. The slope is 0 to 2 percent. In most years, a seasonal high water table fluctuates from the soil surface to a depth of 10 inches for 1 to 4 months and recedes to a depth of 40 inches during prolonged dry periods.

Zolfo Fine Sand (61) – The soil in this map unit is described as nearly level and somewhat poorly drained. It is on broad, low ridges on the flatwoods. The slope is 0 to 2 percent. In most years, a seasonal high water table is at a depth of 24 to 40 inches for more than 2 to 6 months and recedes to a depth of 60 inches during prolonged dry periods.

Hillsborough County USDA Soil Survey Information							
USDA Map Unit	Soil Classification			Permeability (in/hr)	pH	Seasonal High Groundwater	
	Depth (in)	USCS	AASHTO			Depth (ft)	Months of year
5	0-7	SP	A-3	6.0-20	3.6-7.3	+2-1.0	June to Feb
	7-28	SP, SP-SM	A-3, A-2-4	6.0-20	3.6-7.3		
	28-42	SP, SP-SM	A-3, A-2-4	6.0-20	3.6-7.3		
	42-80	SP, SP-SM	A-3, A-2-4	6.0-20	3.6-7.3		
	0-6	SP, SP-SM	A-3	6.0-20	5.1-7.3	+2-1.0	June to April
	6-52	SP, SP-SM	A-3	6.0-20	5.1-7.3		
	52-80	SM, SM-SC	A-2-4	0.2-2.0	5.1-8.4		
	0-34	PT		6.0-20	4.5-5.5	+2-1.0	Jan to Dec
	34-80	SP-SM, SM, SP	A-3, A-2-4	6.0-20	3.6-5.5		
12	0-15	SP-SM, SM	A-2-4	2.0-6.0	6.1-7.3	0-1.0	June to Feb
	15-60	SC	A-2-6, A-2-7, A-6, A-7	<0.2	7.4-8.4		
	60-80	SP-SM, SM, SC, SM-SC	A-2-4, A-2-6, A-6, A-7	0.2-6.0	7.4-8.4		
21	0-8	SP, SP-SM	A-3	6.0-20	3.6-6.0	0-1.0	June to Nov
	8-36	SP, SP-SM	A-3	6.0-20	3.6-6.0		
	36-80	SP-SM, SM	A-3, A-2-4	0.6-2.0	3.6-6.0		
61	0-3	SP-SM	A-3, A-2-4	6.0-20	4.5-7.3	2.0-3.5	June to Nov
	3-60	SP-SM, SM	A-3, A-2-4	6.0-20	4.5-7.3		
	60-80	SP-SM, SM	A-3, A-2-4	0.6-2.0	3.6-6.5		

## Groundwater Information

The groundwater levels were measured at depths ranging from one (1) foot to five (5) feet below existing ground surface within the SPT borings. It should be noted that groundwater levels tend to fluctuate during periods of prolonged drought and extended rainfall and may be affected by man-made influences. In addition, a seasonal effect will also occur in which higher groundwater levels are normally recorded in rainy seasons.

Specifically within the Pond Borings B-6 and B-13, the SHGWT was estimated at approximately 1 to 1½ feet below existing ground surface, respectively. Information regarding SHGWT at specific boring locations is illustrated on Sheets 3 and 4 in the Appendix.

## **PRELIMINARY EVALUATION AND RECOMMENDATIONS**

### **General**

Based on the results of the preliminary field exploration as well as experience with the general project location and Hidden River Phase 1, the proposed structures may be supported on a post-tensioned slab foundation system or a shallow foundation system after proper site preparation. The following report sections provide our recommendations for site preparation, foundation design criteria, settlement, and construction considerations.

Based on the information provided by the client, the evaluations provided herein should be considered preliminary. Before the proposed development is finalized, Tierra recommends that a geophysical program consisting of Ground Penetrating Radar (GPR) survey be performed within each building footprint. Where anomalous conditions consistent with sinkhole activity are encountered in the GPR survey, additional borings should be performed in the deepest part of the suspect anomaly. It should be noted that based on our experience with the general project location, the proposed building pad areas may experience sinkhole activity.

Ground modification techniques such as Deep Dynamic Compaction (DDC) and Vibro-Replacement may reduce the effects of sinkhole activity at these locations. Although no immediate evidence of sinkhole activity was observed in the borings performed, ground modification may be necessary at some of the proposed building locations. Information regarding these techniques has been provided in the subsections below.

### **Site Preparation**

Prior to construction, the location of any existing underground utilities within the construction area should be established. Provisions should then be made to relocate any interfering utility lines within the construction area to appropriate locations and backfilling the excavation with compacted structural fill. In this regard, it should be noted that if abandoned underground pipes are not properly removed or plugged, they might serve as conduits for subsurface erosion, which subsequently may result in excessive settlement.

As a minimum, it is recommended that the clearing operations extend to the depth needed to remove surface vegetation and associated root materials and other material considered deleterious at least 5 feet beyond the proposed development area. Fill placement and subgrade preparation recommendations are presented in the "Construction Considerations" Section of this report.

### **Preliminary Foundation Alternatives**

Depending on the structural loads and the anticipated footing sizes, the structures may be supported on post-tensioned slab foundation systems, ground modified post-tensioned slab

foundation systems, or conventional shallow foundations. The following subsections contain preliminary recommendations for post-tensioned slab foundation systems, ground modified post-tensioned slab foundation systems, and conventional shallow foundations.

### **Post-tensioned Slab Foundation System Recommendations**

Based on discussions with the client concerning Hidden River Phase 1, a post-tensioned slab foundation system is being utilized for Hidden River Phase 1. Based on the anticipated loading for the three story structures of 600 psf; Tierra completed preliminary analyses for each proposed building location. The following table summarizes the building location, the modulus of subgrade reaction for the soils, and estimated total settlement. The structural engineer should determine the tolerance of the proposed structures to the estimated total settlement.

Building No.	In situ Modulus of Subgrade Reaction (pci)	Estimated Total Settlement (inches)
1	95	<1
2	100	<1
3	70	1½
4	80	1

The analyses did not include the benefit from structural backfill parameters. For compacted structural backfill, a value of 120 pci for the modulus of subgrade reaction can be assumed. Tierra recommends that the post-tensioned slab bear on a minimum of 2 feet of compacted structural fill or Stratum 1 (SP/SP-SM) soils.

Once structural loading and tolerances of foundation sizes are evaluated and the results of the GPR survey and subsequent borings are reviewed, foundation options outlined in the following sections may be recommended.

### **Ground Modification**

The use of vibro-replacement or DDC densifies the subsurface soils to allow for the use of post-tensioned slab foundation systems where settlement tolerance would typically require deep foundation systems be utilized. Additionally, the ground modification techniques trigger active sinkholes and remediate sinkhole conditions during the actual ground modification program.

Vibro-replacement is a ground modification technique used to densify the bearing soils resulting in higher allowable soil bearing capacities and increases soil modulus of subgrade reaction values. Typically, once vibro-replacement operations are completed, the proposed structures can be supported using post-tensioned shallow foundation systems.

DDC ground modification is comprised of dropping heavy weights onto the ground surface in order to densify soils at a specified depth. Weights typically range from 10 to 30 tons with drop heights varying from 50 to 100 feet. Impact grids typically range from 7 by 7 feet to 20 by 20 feet. DDC reduces foundation settlements, and induces settlements in collapsible soils. As with the case of Vibro-Replacement, once DDC operations are complete, higher allowable soil bearing capacities and soil modulus of subgrade reaction values would permit the use of post-tensioned shallow foundation systems.

### **Shallow Foundation Recommendations**

Based on our evaluation and analyses, these soils should be capable of supporting lightly loaded structures on shallow foundations after proper subgrade preparation, including vibratory surface compaction.

Based on the anticipated construction, field results indicate shallow foundations may be designed for a net maximum allowable bearing pressure of 2,000 psf. The foundation and floor slab should bear on properly placed and compacted cohesionless (sand) structural fill. The existing near surface sandy soils should be improved by heavy vibratory compaction after clearing operations to improve foundation support and reduce total and differential settlement. Compaction criteria are presented under the Construction Considerations Section of this report.

All footings should be embedded so that the bottoms of the foundations are a minimum of 18 inches below adjacent compacted grades on all sides. Strip or wall footings should be a minimum of 18 inches wide and pad or column footings should be a minimum of 30 inches wide. The minimum footing sizes should be used regardless of whether or not the foundation loads and allowable bearing pressures dictate a smaller size. These minimum footing sizes tend to provide adequate bearing area to develop bearing capacity and account for minor variations in the bearing materials. All footings should be constructed in a dry fashion. All footing excavations should be covered during rain events. Uncovered excavations may become oversaturated and difficult to compact during rain events. Surface run-off water should be drained away from the excavations and not allowed to pond. It is important that the structural elements be centered on the footings such that the load is transferred evenly unless the footings are proportioned for eccentric loads.

### **Settlement**

The settlement of the post-tensioned slab foundation systems supported on the compacted sand fill and natural sandy soils should occur rapidly after loading. Thus, the expected settlement should occur during construction as dead loads are imposed. Specific and final information regarding total and differential settlements will be submitted, once final layout, grading and structural loading has been determined. The structural engineer should determine the tolerance of the proposed structure to the estimated total and differential settlement.

## **Foundation Preparation and Considerations**

The existing near surface sandy soils should be improved by heavy vibratory compaction after clearing operations and completion of the ground modification program (if performed) to improve foundation support and reduce total and differential settlement. Compaction criteria are presented under the Construction Considerations Section of this report. The post-tensioned slab foundation system should be embedded so that the bottom of the foundation is a minimum of 18 inches below adjacent compacted grades on all sides. Strip or wall footings should be a minimum of 18 inches wide. The minimum footing sizes should be used regardless of whether or not the foundation loads and allowable bearing pressures dictate a smaller size. These minimum footing sizes tend to provide adequate bearing area to develop bearing capacity and account for minor variations in the bearing materials, and reduce the potential for shear failure.

All footings should be constructed in a dry fashion. All footing excavations should be covered during rain events. Uncovered excavations may become oversaturated and difficult to compact during rain events. Surface run-off water should be drained away from the excavations and not allowed to pond. It is important that the structural elements be centered on the footings such that the load is transferred evenly unless the footings are proportioned for eccentric loads.

Depending on the design of the post-tensioned slab, it may be necessary to cover bearing soils by lapped polyethylene sheeting in order to minimize the potential for floor dampness which can affect the performance of glued tile and/or carpet flooring. If used, this membrane should consist of a minimum six (6) mil single layer of non-corroding, non-deteriorating sheeting material placed to minimize seams and to cover all of the soil below the building floor. This membrane should be cut in a cross shape for pipes or other penetrations; the membrane should extend to within one-half inch of all pipes or other penetrations. All seams of the membrane should be lapped at least 12 inches. Punctures or tears in the membrane should be repaired with the same or compatible material.

As stated previously, final foundation loads were not available at the time of this report. The above preliminary foundation recommendations were based on the assumed foundation loads mentioned earlier. Tierra should be given the opportunity to review our recommendations and amend them as necessary once GPR survey results have been reviewed.

## **Pavement Considerations**

In general, following the completion of the recommended clearing and grading operations and fill placement, the compacted fill and natural shallow sandy soils should be acceptable for construction and support of a flexible (limerock, crushed concrete, or shell base) or semi-flexible (soil cement base) type pavement section. Where truck traffic or heavy loading is anticipated, such as dumpster areas, we would recommend using a rigid pavement section.

Any fill utilized to elevate the cleared pavement areas to subgrade elevation should consist of reasonably clean (maximum 12% passing #200 sieve sizes) fine sands uniformly compacted to a minimum depth of 12 inches to a minimum density of 98% of the modified Proctor maximum dry density. In areas where heavy loading is anticipated, we recommend Type B stabilized subgrade (LBR = 40%) as specified by the FDOT Standard Specifications for Road and Bridge Construction. A soil cement base should be designed according to FDOT or PCA modified short cut design procedures. Strength of 300 psi should be achieved on laboratory cured compressive strength specimens molded from samples taken from the base material as it is placed. A stabilized subgrade need not be incorporated with a soil cement base. Traffic should not be allowed on the subgrade as the base is placed to avoid rutting. Before paving, the subgrade should be checked for soundness and be true to line and grade prior to paving.

The choice of pavement base type will depend on final pavement grades. If a minimum separation of 18 inches between the bottom of the base and the seasonal high groundwater level is obtained, then a limerock, shell, or crushed concrete base can be utilized. A soil cement base should be utilized if the separation between final grade and the seasonal high groundwater is a minimum of 12 inches and less than 18 inches. Base material elevations should not be designed for saturated conditions. If the designer wishes to have base material closer than 12 inches to the SHGWT, then an underdrain system should be utilized that will maintain the 12 inches of separation. The SHGWT should be re-established relative to a known elevation prior to setting final grades. Limerock and shell base material should meet Florida Department of Transportation (FDOT) requirements including compaction to a minimum density of 98% of the modified Proctor maximum dry density and a minimum Limerock Bearing Ratio (LBR) of 100%. Crushed concrete should be graded in accordance with FDOT Standard Specification Section 901-5. As a guideline for pavement design, we recommend that the base course be a minimum of 6 inches thick in parking areas and 8 inches thick in heavily traveled drives. Before paving, the base should be checked for soundness.

The asphaltic concrete structural course should consist of at least one and one-half (1½) inches of Type S or SP asphaltic concrete material. The asphaltic concrete should meet standard FDOT material requirements and placement procedures as outlined in the current FDOT Standard Specifications for Road and Bridge Construction. The asphaltic concrete should be compacted to a minimum of 95% of the maximum laboratory density found on the mix design.

As an alternate to the above referenced flexible pavement design, a rigid (concrete) pavement design could be used. The concrete should have a minimum compressive strength of 4,000 psi at 28 days when tested in accordance with ASTM C-39. Based on our experience, a minimal thickness of five (5) inches should be utilized for standard duty applications and a minimal thickness of six (6) inches should be utilized for heavy-duty applications. The steel reinforcement within the concrete pavement should be designed by the project civil engineer. The subgrade should be prepared to achieve a minimum LBR of 20% as mixed and pulverized to a depth of 12 inches below the pavement base elevation. The subgrade soils

should be compacted to a minimum density of 98% of the modified Proctor maximum dry density.

Actual pavement section thickness should be provided by the design civil engineer based on traffic loads, volume, and the owners design life requirements. The above sections represent minimum thicknesses representative of typical load and construction practices and as such periodic maintenance should be anticipated. All pavement materials and construction procedures should conform to the FDOT or appropriate city or county requirements.

### **On Site Soil Suitability**

The suitability of the soil for reuse in construction should be evaluated against the project engineering fill requirements. Variations in the subsurface stratification should be expected between borings. The soil encountered within the pond should be considered unclassified as fill material unless verified by the contractor against engineering fill requirements.

In general, the fine sands to fine sands with silt (Stratum 1) (SP/SP-SM) may be moved and used for grading purposes, site leveling, general engineering fill, structural fill and backfill in other areas, provided the fill is free of organic materials, clay, debris or any other material deemed unsuitable for construction and evaluated against engineering fill requirements.

Plastic soils (Strata 2, 3, 5, and 7) (SC, CL, CH, and SM) should not be used for fill due to the difficulty in compaction. Depending on the time of year when construction starts, some of the plastic soils will exhibit high moisture sensitivity and become difficult to compact.

## **PRELIMINARY CONSTRUCTION CONSIDERATIONS**

### **General**

It is recommended that a qualified and certified material engineering firm be retained to provide observation and testing of construction activities involved in the foundation earthwork, and related activities of this project. Tierra cannot accept any responsibility for any conditions, which deviate from those, described in this report, if not engaged to provide construction observation and testing for this project.

### **Fill Placement and Subgrade Preparation**

The following are our recommendations for overall site preparation and mechanical densification work for the construction of the proposed development based on the anticipated construction and our boring results. These recommendations should be used as a guideline for the project general specifications prepared by the design engineer. It should be noted if DDC is chosen for ground modification, DDC should be performed after clearing operations and prior to backfilling to bring the site up to finished subgrade levels. If vibro-replacement is chosen for ground modification, vibro-replacement should be performed after finished

subgrade levels have been established.

1. The site should be cleared; this primarily includes removing debris and any deleterious materials encountered. It is recommended that any undesirable material be removed to the satisfaction of Tierra prior to beginning construction at the site. Any cavities formed should be replaced with compacted structural fill. As a minimum, it is recommended that the clearing operations extend at least five (5) feet beyond the development perimeters.
2. Following the clearing operations, the exposed existing subgrade for the building and pavement areas should be evaluated and proofrolled as directed by representatives of Tierra to confirm that all unsuitable materials have been removed. The proofrolling should consist of compaction with a large diameter, heavy vibratory drum roller. The vibratory drum roller should have a static drum weight on the order of eight (8) to ten (10) tons and should be capable of exerting a minimum impact force of 36,000 pounds (DYNAPAC CA-250 or equivalent is expected to provide acceptable results). The vibratory roller should not be used within 50 feet of any existing structures. These areas should be compacted using a fully loaded 2 cubic yard capacity front-end loader or equivalent.
3. The proofrolling equipment should make a minimum of eight (8) overlapping passes over the development area with the successive passes aligned perpendicular. It is recommended that within the building area, the natural ground, to a minimum depth of two (2) feet below stripped grade, be compacted to a dry density of at least 95% of the modified Proctor maximum dry density.
4. Following satisfactory completion of the initial compaction, the development area may be brought up to finished subgrade levels using structural fill. Imported fill should consist of fine sand with less than 12% passing the No. 200 sieve, free of rubble, organics, clay, debris and other unsuitable material. Fill should be tested and approved prior to acquisition. Approved sand fill should be placed in loose lifts not exceeding 12 inches in thickness and should be compacted to a minimum density of 95% of the modified Proctor maximum dry density. Density tests to confirm compaction should be performed in each fill lift before the next lift is placed.
5. Prior to beginning compaction, soil moisture contents may need to be controlled in order to facilitate proper compaction. If additional moisture is necessary to achieve compaction objectives, then water should be applied in such a way that it will not cause erosion or removal of the subgrade soils. A moisture content within the percentage range needed to achieve compaction is recommended prior to compaction of the natural ground and fill.

6. After compaction and proofrolling, the building foundation excavations can begin. The geotechnical engineer or a representative should observe all foundation excavations to explore the extent of any loose, soft, or otherwise undesirable materials. If the foundation excavations appear suitable as load bearing materials, the bottom of the foundation excavations should be compacted to a minimum density of 95% of the modified Proctor maximum dry density for a minimum depth of one (1) foot below the bottom of the footing depth, as determined by field density compaction tests.
7. Backfill soils placed adjacent to footings or walls should be carefully compacted with a light rubber-tired roller or vibratory plate compactor to avoid damaging the footings or walls. Approved sand fills to provide foundation embedment constraint should be placed in loose lifts not exceeding 6 inches and should be compacted to a minimum density of 95% of the modified Proctor maximum dry density.
8. If soft pockets are encountered in the footing excavations, the unsuitable materials should be removed and the proposed footing elevation may be re-established by backfilling after the undesirable material has been removed. This backfilling may be done with a very lean concrete or with a well-compacted, suitable fill such as clean sand, gravel, or crushed FDOT No. 57 or FDOT No. 67 stone. Sand backfill should be compacted to a minimum density of 95% of the modified Proctor maximum dry density.
9. Immediately prior to reinforcing steel placement, it is suggested that the bearing surfaces of all footing and floor slab areas be compacted using hand operated mechanical tampers. In this manner, any localized areas, which have been loosened by excavation operations, should be adequately recompacted.
10. A representative from our firm should be retained to provide on-site observation of earthwork and ground modification activities. Density tests should be performed in the top one (1) foot of compacted existing ground, each fill lift, and the bottom of foundation excavations. It is important that Tierra be retained to observe that the subsurface conditions are as we have discussed herein, and that foundation construction ground modification and fill placement is in accordance with our recommendations.

## **Drainage and Groundwater Concerns**

The groundwater levels presented in this report are the levels that were measured at the time of our field activities. Fluctuation should be anticipated. We recommend that the Contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this construction procedure. Care should be given to open

excavations and site grading to minimize ponding of surface water. If needed, groundwater can normally be controlled in shallow excavations or rim ditches with a sump pump. During subgrade soil preparation, any plastic soils below design grade could become disturbed by construction activities. If this becomes the case, the contractor may be directed by the owner's representative to remove the disturbed or pumping soils to a depth of 12 to 18 inches below design grade and backfill the area with structural fill.

Water should not be allowed to collect in the foundation excavation, on the floor slab areas, or on prepared subgrades of the construction either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

### **Structural Fill**

All materials to be used for structural fill or backfill should be evaluated and, if necessary, tested by Tierra, Inc. prior to placement to determine if they are suitable for the intended use. Suitable fill materials should consist of fine to medium sand with less than 12% passing the No. 200 sieve, free of rubble, organics, clay, debris or any other material deemed unsuitable for construction and evaluated against engineering fill requirements.

### **Excavations**

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations.

It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractors "responsible persons", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in all local, state, and federal safety regulations.

We are providing this information solely as a service to our client. Tierra does not assume responsibility for construction site safety or the contractor's or other party's compliance with local, state, and federal safety or other regulations.

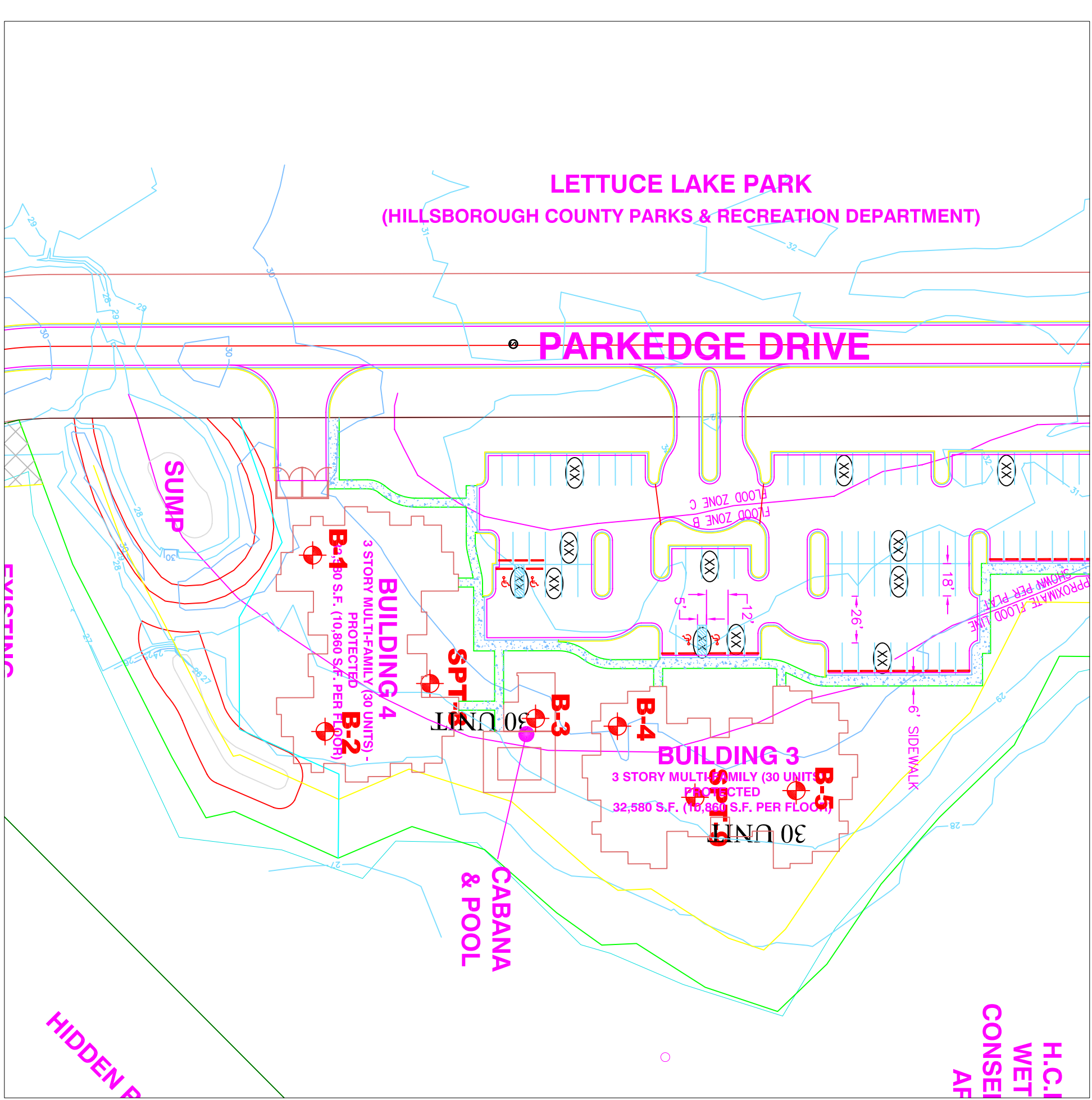
## **REPORT LIMITATIONS**

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

The scope of the exploration was intended to evaluate shallow soil conditions. The recommendations submitted are based on the available subsurface information obtained by Tierra and design details furnished by the client for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, Tierra should be notified immediately to determine if changes in the foundation recommendations are required. If Tierra is not retained to perform these functions, Tierra will not be responsible for the impact of those conditions or the geotechnical recommendations for the project.

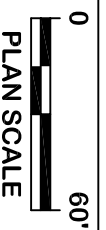
After the plans and specifications are more complete, the Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of D.R. Horton Homes, and its consultant(s) for the specific application to the proposed Hidden River Phase 2 project in Hillsborough County, Florida.

## APPENDIX



H.C.I.  
WET  
CONSEI  
AF

# BORING LOCATION PLAN



## LEGEND

⊕ Approximate SPT boring location

DRAWN	SMO
CHECKED	MEN
APPROVED	JAB
SCALE	NOTED

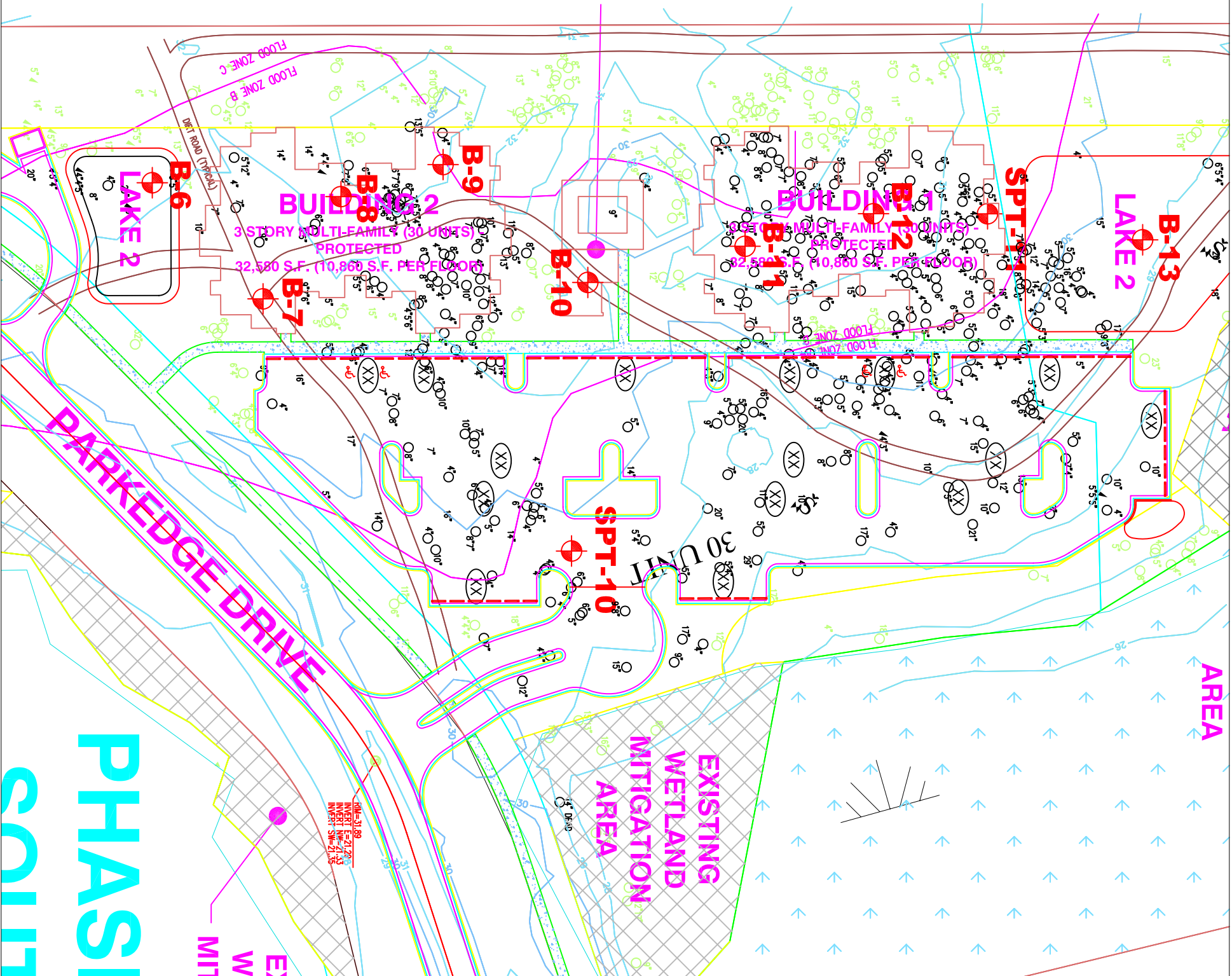
GEOTECHNICAL SERVICES  
**HIDDEN RIVER PHASE 2**  
SOUTH  
HILLSBOROUGH COUNTY, FLORIDA



DATE FEB 2006      PROJ. NO. 6511-06-048      SHEET 1

**LETTUCE LAKE PARK**  
(HILLSBOROUGH COUNTY PARKS & RECREATION DEPARTMENT)


**CABANA  
& POOL**



**BORING LOCATION PLAN**



**LEGEND**

 Approximate SPT boring location

DRAWN	SMO
CHECKED	MEN
APPROVED	JAB
SCALE	NOTED

GEOTECHNICAL SERVICES  
**HIDDEN RIVER PHASE 2**  
NORTH  
HILLSBOROUGH COUNTY, FLORIDA



DATE: FEB 2006      PROJ. NO.: 6511-06-048      SHEET 2

# SOIL PROFILE

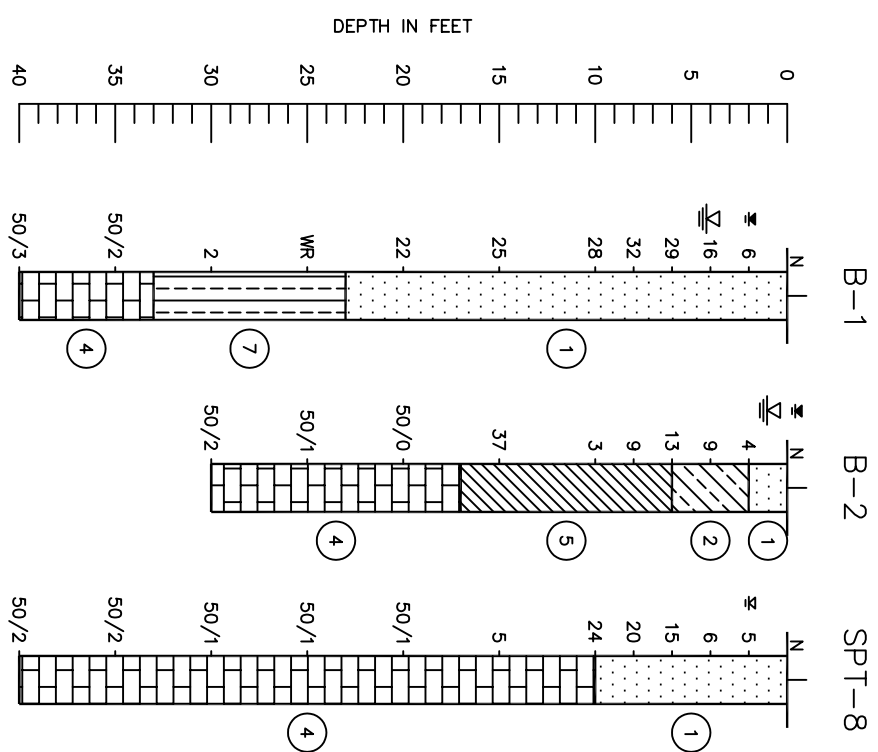
# LEGEND

- ① GRAY TO BROWN FINE SAND TO SAND WITH SILT (SP/SP-SM)
- ② BROWN CLAYEY SAND (SC)
- ③ BROWN SANDY CLAY (CL)
- ④ HIGHLY WEATHERED TO WEATHERED LIMESTONE
- ⑤ GREEN CLAY (CH)
- ⑥ CHERT
- ⑦ DARK BROWN SILTY SAND (SM)
- A WITH LIMESTONE FRAGMENTS
- A WITH CHERT FRAGMENTS

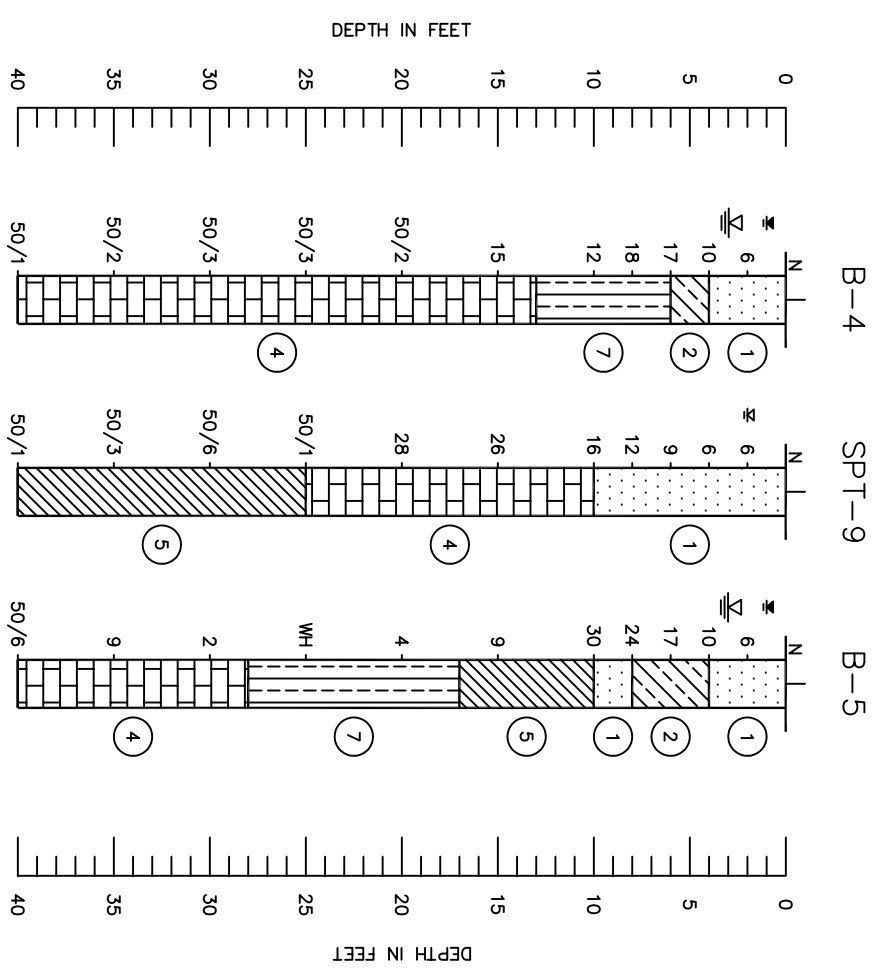
- 50/2 Number Of Blows For 4 Inches Of Penetration
- SP Unified Soil Classification System (ASTM D 2488)  
Group Symbol As Determined By Visual Review
- N Groundwater Level
- SPT N-Value In Blows/Foot For 12 Inches Of Penetration (unless otherwise noted)
- ▼ Seasonal High Groundwater Level
- ↙ 100 Loss Of Circulation Of Drilling Fluid (%)
- WR Fall Under Weight Of Rod

Note: In Boring B-2 The Seasonal High Groundwater Level Is Above Grade

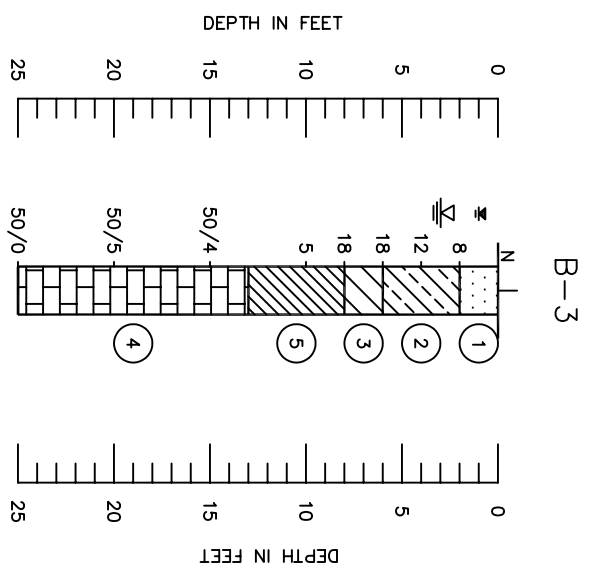
## BUILDING 4



## BUILDING 3




## CABANA & POOL



DRAWN BY:	<b>SMO</b>
CHECKED BY:	<b>MEN</b>
APPROVED BY:	<b>JAB</b>
SCALE:	<b>NOTED</b>

**GEOTECHNICAL ENGINEERING SERVICES**  
**HIDDEN RIVER PHASE 2**  
 SOUTH  
 HILLSBOROUGH COUNTY, FLORIDA



**TERRA**  
 7805 Professional Place  
 Tampa, Florida 33637  
 813-989-1354  
 FL Cert. No.: 6486

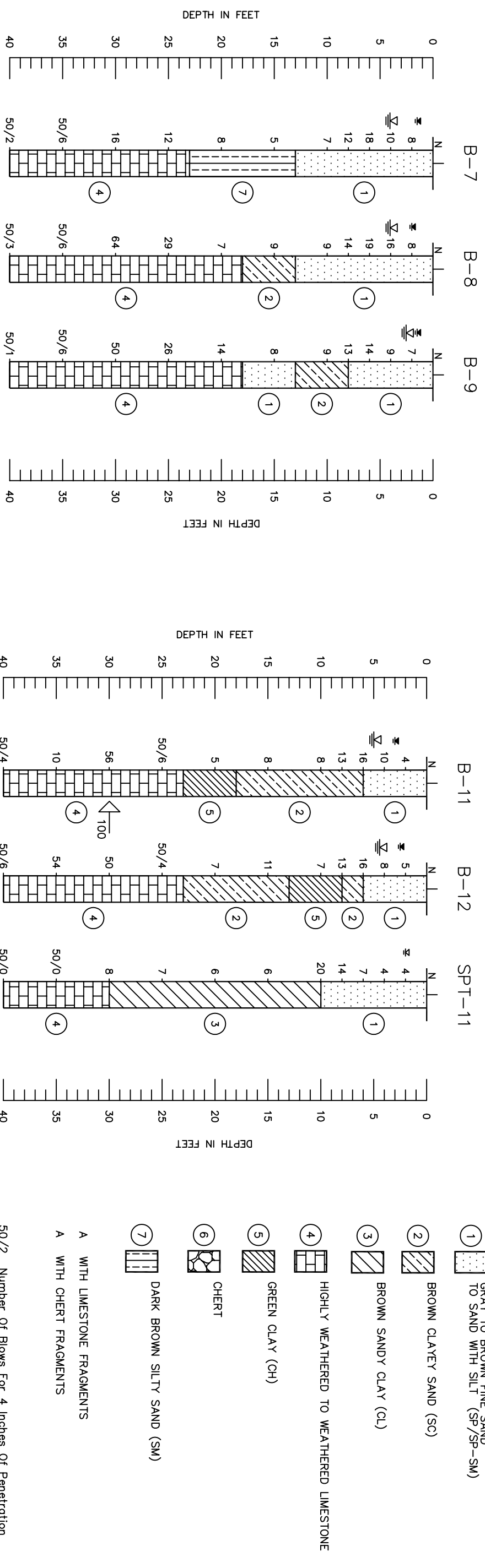
DATE:	<b>FEB 2006</b>	PROJECT NUMBER:	<b>6511-06-048</b>	SHEET 3
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# SOIL PROFILE

## BUILDING 2

## BUILDING 1

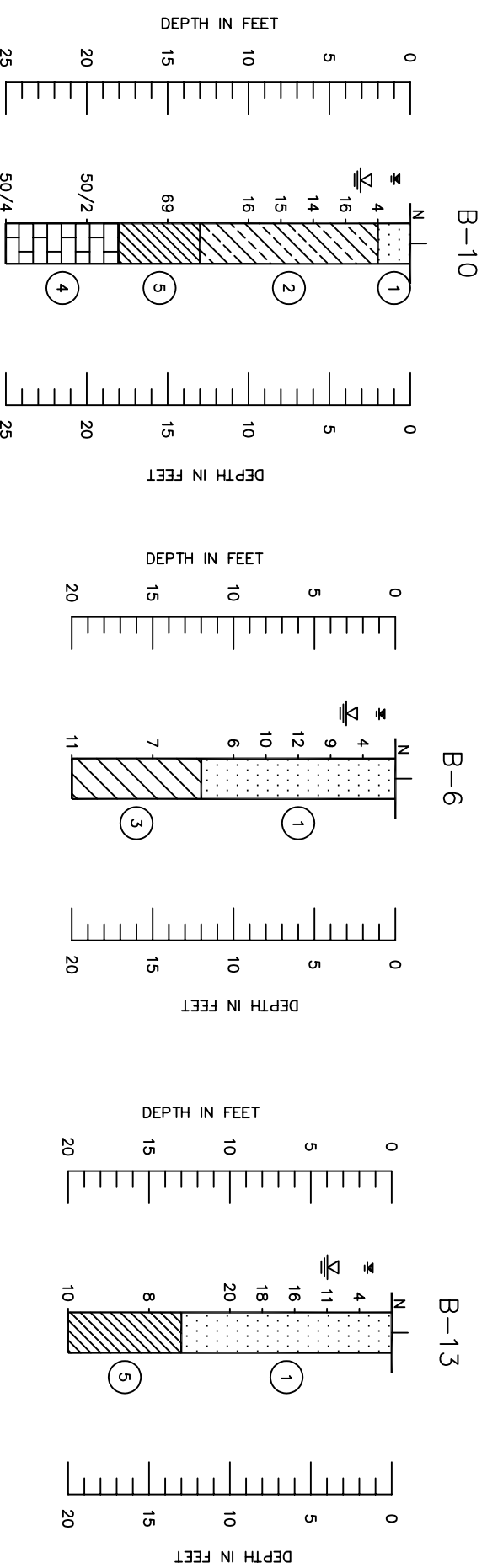
## LEGEND



## CABANA & POOL

## LAKE 2 (SOUTHERN)

## LAKE 2 (NORTHERN)



- 1 GRAY TO BROWN FINE SAND TO SAND WITH SILT (SP/SP-SW)
- 2 BROWN CLAYEY SAND (SC)
- 3 BROWN SANDY CLAY (CL)
- 4 HIGHLY WEATHERED TO WEATHERED LIMESTONE
- 5 GREEN CLAY (CH)
- 6 CHERT
- 7 DARK BROWN SILTY SAND (SM)
- A WITH LIMESTONE FRAGMENTS
- A WITH CHERT FRAGMENTS
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For 12 Inches Of Penetration  
(unless otherwise noted)
- Seasonal High Groundwater Level
- 100 Loss Of Circulation Of Drilling Fluid (%)
- WR Fall Under Weight Of Rod

DRAWN BY:	SMO
CHECKED BY:	MEN
APPROVED BY:	JAB
SCALE:	NOTED

**GEOTECHNICAL ENGINEERING SERVICES**

**HIDDEN RIVER PHASE 2**  
NORTH  
HILLSBOROUGH COUNTY, FLORIDA

7805 Professional Place  
Tampa, Florida 33637  
813-989-1354  
FL Cert. No.: 6486

DATE: FEB 2006	PROJECT NUMBER: 6511-06-048	SHEET 4
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