REPORT OF GEOTECHNICAL EXPLORATION

Addition to Pinemount Volunteer Fire Station #43
Lake City, Columbia County, Florida
CTI Project No. 07-00546-01

- Prepared for -

J.L. DuPree Construction Services
P.O. Box 2861
Lake City, Florida 32056

- Prepared by -

Cal-Tech Testing, Inc.
P.O. Box 1625
Lake City, Florida 32056-1625

November 2, 2007

Cal-Tech Testing, Inc.
• Engineering
• Geotechnical
• Environmental
LABORATORIES

P.O. Box 1625 • Lake City, FL 32056 Tel. (386) 755-3633 • Fax (386) 752-5456
4784 Rosselle Street • Jacksonville, FL 32254 Tel. (904) 381-8901 • Fax (904) 381-8902
2230 Greensboro Highway • Quincy, FL 32351 Tel. (850) 442-3495 • Fax (850) 442-4008

November 2, 2007

J.L. DuPree Construction Services
P.O. Box 2861
Lake City, Florida 2861

Attention: Mr. Lamar DuPree

Subject: Report of Geotechnical Exploration
Proposed Addition to Pinemount Volunteer Fire Station #43
Lake City, Florida
CTI Project No. 07-00546-01

Dear Mr. DuPree:

Cal-Tech Testing, Inc. (**CTI**) has completed the geotechnical exploration for the subject project. Verball authorization for our services was provided by you on October 30, 2007.

The following report presents the results of our field exploration and testing, an evaluation of the subsurface conditions with respect to available project characteristics, and recommendations to aid in the design and construction of the proposed building addition.

We have enjoyed assisting you and look forward to serving as your geotechnical and construction materials testing consultant for the remainder of this and future projects. Should you have any questions concerning this report, please contact our office at 386-755-3633.

Sincerely,

Cal-Tech Testing, Inc.

David B. Brown
Executive Vice President

Nabil O. Hmeidi, P.E. 11/2/07
Senior Geotechnical Engineer
Licensed, Florida No. 57842

TABLE OF CONTENTS

FIGURES

1.0 PROJECT INFORMATION

The purpose of this exploration was to develop information concerning the site and subsurface conditions in order to evaluate site preparation requirements and foundation support recommendations for the proposed building addition to the Pinemount Fire Station #43. The subject site is located on the north side of Pinemount Road (County Road No. 252) approximately 725 feet east of Birley Road in Lake City, Columbia County, Florida. This report briefly describes the field activities and presents our findings.

We have been furnished with a Site Plan prepared by Freeman Design Group dated July 12, 2007. The proposed addition will consist of an approximately 1,600 square foot, single-story building to be constructed adjacent to the east side of the existing firehouse. We understand this new addition will be used as a garage for fire fighting vehicle(s). We understand the construction will be pre-engineered metal building with a 15- to 20-foot eave height. Detailed structural information has not been provided; however, we anticipate individual column loads will not exceed 40 kips. We have assumed that soil-supported ground floor loads (dead load plus live load) in the fire station will not exceed 150 psf. We assume that less than two feet of earthwork fill will be required to achieve desired finished grade elevations.

Pavement areas is proposed infront of the new building addition. We assume that earthwork cuts or fills in the proposed pavement area will not exceed two feet.

2.0 FIELD EXPLORATION

During this geotechnical exploration, a total of 2 Standard Penetration Test (SPT) borings were drilled within the proposed building addition area to a depth of 15 feet below the existing ground surface. Approximate location of the SPT boring are shown on the attached Field Exploration Plan. These locations were selected by CTI personnel and staked in the field by our personnel using taped measurements from existing site features.

The sampling and penetration procedures of the SPT borings were accomplished in general accordance with **ASTM D-1586**, using a power rotary drill rig. The standard penetration tests were performed by driving a standard 1-3/8" I.D. and 2" O.D. split spoon sampler with a 140 pound hammer falling 30 inches. The number of hammer blows required to drive the sampler a total of 18 inches, in 6 inch increments, were recorded. The penetration resistance or "*N*" value is the summation of the last two 6 inch increments and is illustrated on the attached boring logs adjacent to their corresponding depths. Penetration resistance is used as an index to derive soil parameters from various empirical correlations. The results of the test borings are shown on the attached Generalized Subsurface Profile.

The attached Generalized Subsurface Profile graphically illustrates penetration resistances, groundwater levels (if any encountered), and soil descriptions. It should be noted the stratification lines and depth designations indicated on the boring records represent approximate boundaries between soil types. In some instances, the transition between these soil types may be gradual.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The existing site conditions were observed by our personnel during our field program. At the time of our visit, the ground surface was clear of trees and underbrush. The site topography was relatively level with elevation difference of approximately two feet.

3.2 General Area Geology

A review of the site geology indicates the subject project is underlain by Undifferentiated Quaternary Sediments (**Qu**) of the Pleistocene and Holocene epochs. These sediments consist of siliciclastics, organics and freshwater carbonates. The silicicalstics are light gray, tan, brown to dark, unconsolidated to poorly consolidated, clean to clayey, silty, fossiliferous, variably organic-bearing sands to blue green to olive green, poorly to moderately consolidated, sandy, silty, clays. Freshwater carbonates "*marls*" are buff colored to tan, unconsolidated to poorly consolidated, fossiliferous (mollusks) carbonate muds containing organics.

3.3 USDA/NRCS Soil Survey

Cursory review of the Columbia County, Florida USDA Soil Survey indicates the soils underlying the proposed building addition to consist of the **Albany fine sand (Soil Map Unit No. 1)**, 0% to 5% slopes: This soil unit consists of about 9 inches of dark grayish brown fine sand underlain by about 48 inches of light yellowish brown fine sand, mottled with brown and white; and pale yellow fine sand, mottled with red and white. These soils are underlain by light yellowish brown fine sandy loam, mottled with brown and light gray; and gray sandy clay loam that has strong brown mottles to a depth of about 80 inches below natural ground surface. The soil survey indicates the apparent[1] high water table at about 1 to 2.5 feet below the ground surface during the period of December to March.

3.4 Subsurface Conditions

Initially, the soil profile as disclosed by SPT borings B-1 and B-2 consisted of about 12 inches of light gray, silty fine sand (SP-SM) with trace of organic (topsoil). This surficial layer was underlain by about 4½ feet of light tan, silty fine sand (SM-SP). Beneath this startum, the soil profile consisted of about 9½ feet of reddish tan and light gray, mottled, clayey fine sand (SC) to boring termination depth of 15 feet below the existing ground surface. These soils have a relative density ranging from very loose to very dense with Standard penetration resistance or "*N*" values ranging from 3 to exceeding 50 Blows Per Foot (BPF). As indicated on the attached Genarlized Subsurfcae Profile, the very loose soils were encountered within the upper 5 feet of the existing ground surface.

---

[1] *Thick zone of free water in the soil indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soils.*

For a more detailed description of the subsurface conditions encountered, please refer to the attached Generalized Subsurface Profile (Figure No. 1). Note that the transition between soil types may be gradual and not abrupt as indicated by the boring logs; therefore, the thickness of soil layers should be considered approximate.

3.5 Groundwater

At the time of completion of drilling, no groundwater was encountered in the SPT and auger borings. We note that due to the relatively short time frame of the field exploration, the groundwater may not have had sufficient time to stabilize. For a true groundwater level reading, piezometers may be required. In any event, fluctuation in groundwater levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, and other site-specific factors. Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

4.0 RECOMMENDATIONS FOR FOUNDATION DESIGN & SITE PREPARATION

The recommendations presented in this report are based upon available project information, anticipated loading conditions, and data obtained during our field program. If the structural information is incorrect or the location of the structure changes, please contact this office so our recommendations may be reviewed and/or revised. Discovery of any site or subsurface condition during construction, which deviates from the data collected during this exploration, should be reported to us for evaluation. Assessment of site environmental conditions or presence of pollutants was beyond the scope of this exploration.

4.1 General

Based on our evaluation of the encountered subsoils, anticipated loading conditions and our past experience with similar projects, it is our professional opinion that the site can be made suitable for the support of the proposed developments. The developments should include the usual clearing, stripping and removal of surface vegetation, topsoil and any other deleterious materials that fall within the building and parking areas. This operation should be followed by proofrolling/compaction of the near surface in-situ soils and any additional fill soils required to achieve final grades.

4.2 Foundation Support

The subject site is considered acceptable for the support of the proposed addition on a conventional shallow foundation system. Provided individual column footings and continuous wall footings bear on compacted acceptable existing soils or newly placed structural fill soils, the shallow foundation may be designed using an allowable net soil bearing pressure of 2,500 psf.

Due to the varying density of the upper soils, it is recommended the exposed subgrade be proofrolled and proof compacted to a depth of 5 feet below the existing ground surface prior to concrete placement (including bottom of footings, slab-on-grade, and pavement areas). This may require the overexcavation and recompaction of the upper 5 feet of the existing soils. Soils should be proof compacted to a minimum of 95% of the modified Proctor maximum dry density (ASTM D-1557). All properly compacted structural fill should consist of non-plastic, inorganic, granular soil containing less than 10 percent material passing the 200 mesh sieve (i.e., relatively clean sand).

In using net pressures, the weight of the footing and backfill over the footing need not be considered. Hence, only loads applied at or above final grade need to be used for dimensioning footings. However, wall bearing footings should be designed with a minimum width of 18 inches, while the individual column footings should have minimum dimensions of 2 feet by 2 feet.

4.3 Settlement Analyses

Actual magnitude of settlement that will occur beneath foundations will depend upon variations within the subsurface soil profile, actual structural loading conditions, embedment depth of the footings, actual thickness of compacted fill or cut, and the quality of the earthwork operations. Assuming that the foundation related site work and foundation design is completed in accordance with the enclosed recommendations, we estimate the total settlement of the structure will be on the order of 1 inch or less. Differential settlements (between adjacent columns or along the length of a continuous wall footing) should be approximately one-half of the total settlement. This settlement is primarily the result of elastic compression of the upper loose sands, and should occur almost immediately following the application of the structural dead load during construction.

4.4 Floor Slab

Provided all unsuitable material (such as topsoil, organics, etc.) located within the proposed building addition and pavement areas (**including 5 feet outside the perimeter of the building**[2]) is undercut and replaced with well-compacted structural fill, floor slabs can be adequately supported on recompacted soils or newly placed structural fill. All exposed subgrade should be proofrolled with a fully-loaded, tandem-axle dump-truck or similar pneumatic-tired equipment. Provided the proofrolling operations do not indicate significant deflecting or pumping of the existing subgrade, the floor slab in these areas may also be designed as a slab-on-grade. Any soft or loose soils found during the proofrolling procedure should be undercut and replaced with suitable, well-compacted, engineered fill.

All floor slabs should be supported on at least 4 inches of relatively clean granular material, such as sand, sand and gravel, or crushed stone. This is to help distribute concentrated loads and equalize moisture beneath the slab. This granular material should have 100 percent passing the 1½ -inch sieve and a maximum of 10 percent passing the No. 200 sieve.

[2] *This requirement does not apply to the west side of the building addition, where it adjoins the existing firehouse.*

Based upon the soil conditions encountered at the subject site, the anticipated fill placement, and the recommended site preparation operations presented in this report, a modulus of vertical subgrade reaction (k) for the slab bearing soils of 225 pounds per square inch per inch of vertical deflection (pci) for the recommended structural fill compaction criteria.

4.5 Compaction of Subgrade

Following excavation and backfilling, exposed soils in the building area (**including 5 feet outside the perimeter of the building**) should be compacted with overlapping passes of a relatively heavy weight drum roller having a total operating static weight (weight of fuel and water included) of at least 10 tons and a drum diameter of 5 feet (**operating in static mode to minimize disturtbance of the existing foundation system**). All exposed surfaces should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density (**ASTM D-1557**) to a depth of at least 12 inches below the compacted surface. **Caution should be exercised during the compaction of soils adjacent to the existing building. New fill placed adjacent to the existing footing system may be accomplished using plate tamper.**

4.6 Structural Fill/Backfill

Structural fill should be placed in thin loose lifts not exceeding 12 inches in thickness and compacted with a heavy roller as described above. For walk-behind equipment, a loose lift thickness of 6 inches is recommended. Each lift should be thoroughly compacted to provide densities equivalent to at least 95 percent of the modified Proctor maximum dry density (ASTM D-1557). Structural fill should consist of an inorganic, non-plastic, granular soil containing less than 10 percent material passing the No. 200 mesh sieve (relatively clean sand with a Unified Soil Classification of SP or SP-SM).

Compaction of exposed soils in deeper excavations may cause pumping and/or yielding of the soils being compacted. The instability is caused by excess pore water pressure build-up in the subgrade soils being compacted. To allow this excess pore water pressure to dissipate, the contactor may temporarily halt the compaction operation or disengage the vibratory action of the compaction equipment. In any event, it is recommended to maintain a distance of at least two feet between the groundwater level and the compaction surface.

5.0 PAVEMENT DESIGN CONSIDERATION

5.1 Pavement Areas

Based on the results of our investigation and our general site preparation recommendations, it is our professional opinion that flexible and rigid pavement sections will require densification of the upper 3 feet of the very loose sand to have adequate subgrade support. This should be accomplished by removing the upper 24 inches, densifying the underlying 12 inches, and recompacting the upper 24 inches in thin loose lifts. We recommend that after finished subgrade is achieved and before the placement of grade raise fill, the entire parking and drive area be thoroughly proofrolled by a qualified engineer to delineate areas of unsuitable subgrade.

The following pavement design is based upon the estimated traffic patterns, the anticipated traffic volume and quality control per the current Florida Department of Transportation (**FDOT**) *Standard Specifications for Road and Bridge Construction;* and the American Association of State Highway and Transportation Officials (**AASHTO**) criteria. The following pavement sections were designed based on an 85.0 percent level of reliability and 0.0 percent growth rate. Effect of frost heave or soil swelling was considered negligible for the Lake City, Florida area.

5.1.1 Pavement Sections

Traffic Volume	An Equavilant Axle Load (EAL) of 18 kips per day of 86 or a total of 402,480 EALs for the design life.
Design Life	15 years, terminal serviceability = 2.5
Subgrade	3.0 feet of densified granular soils as described above[3]
Flexible Pavement	2.0 inches of Type B-12.5 Asphaltic Concrete over a minimum of 8.0 inches of limerock base material (LBR=100).
Rigid Pavement	8¼ inches of Concrete Pavement over a minium of 8 inches of limerock base material (LBR=100)

5.2 Pavement Subgrade

It is recommended that pavement subgrade be compacted to a minimum depth of 12 inches to at least 98 percent of the modified Proctor maximum dry density (ASTM D-1557). Any fill utilized to elevate the pavement areas to final subgrade elevation should consist of relatively clean fine sands (inorganic, non-expansive/non-plastic sands containing less than 10 percent, by weight, of fines).

Laboratory testes should be performed on all off-site structural fill to be used to elevate proposed pavement areas to confirm these soils meet the minimum requirements and can achieve the desired LBR values. Where subgrade stabilization is necessary, we recommend stabilization be used, as specified by the Florida Department of Transportation (FDOT) "Standard Specifications for Road and Bridge Construction," 2007 Edition, Section 160. To avoid rutting, traffic should not be allowed on pavement subgrade prior to placement and compaction of the base course materials.

[3] *Upper 12 inches consisting of stabilized subgrade (minimum LBR of 40), compacted to a minimum of 98 percent of the modified Proctor maximum dry density.*

5.3 Base Course

A limerock, graded aggregate, or crushed concrete base material may be used for this project. Typically in the Lake City, Florida area it has been our experience that limerock base is the most economical base material. The limerock base should meet the requirements of Section 911 in the current FDOT "Standard Specifications for Road and Bridge Construction,". Limerock base or graded aggregate base or crushed concrete material, if selected, should meet FDOT requirements, including compaction to 98 percent of its maximum dry density as determined by the modified Proctor Test (ASTM D-1557) and a minimum Limerock Bearing Ratio (LBR) of 100 percent at 98 percent compaction.

5.4 General Pavement Requirements

Concrete pavement should have the minimum thicknesses listed above. The pavement should include temperature reinforcement consisting of 6X6 W.W.F. made of 8 gauge grade 40 steel. A maximum joint spacing of 20 feet is recommended. The concrete pavement should have a minimum 28 day compressive strength of 4,000 psi, with a modulus of rupture of 600 psi.

Transition areas where concrete meets asphalt pavement should be thickened to avoid "*impact*" rutting resulting from sudden transfer of load from the ridged section to the flexible section. This can be accomplished by thickening the flexible pavement section to twice the thickness of the ridged section. The thickened section should be 12 inches wide (minimum) and extend along the entire length of any ridged/flexible pavement interface (for example along the front of the concrete pad for the dumpster, or entrance to the fire house).

Generally, it is desirable to maintain the ground-water level at 24 inches below the bottom of the pavement base. Pavement grading design should maintain this minimum separation whenever possible. If this separation cannot be achieved, then a permanent ground-water control system (underdrains) may be required. Water resulting from rainfall, sprinkler or irrigation system should be prevented from entering the pavement sections and deteriorate the subgrade. Therefore, pavement design should consider provisions for preventing water (surface or irrigation) from entering the pavement. This may be accomplished by sealing the interface between the asphalt edge and the concrete curb.

6.0 REPORT LIMITATIONS

This report has been prepared for the exclusive use of the **J.L. DuPree Construction Services of Lake City, Florida,** for the specific application to the project discussed herein. Our conclusions and recommendations have been rendered using generally accepted standards of geotechnical engineering practice in the State of Florida. No other warranty is expressed or implied. **CTI** is not responsible for the interpretations, conclusions, opinions, or recommendations of others based on the data contained herein. We note that the assessment of environmental conditions for the presence of pollutants in the soil, rock, or groundwater at the site was beyond the scope of the exploration. Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of the geotechnical design. We recommend that the owner retain these services and that **CTI** be allowed to continue our involvement in the project through these phases of construction.

APPENDIX