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1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of the proposed

We understand that construction will consist of the following components:

Facility	Levels	Details
Hotel Tower	14	Steel frame or cast in place concrete
Parking Structure	5	Precast concrete
Ballroom/Bingo	2	Masonry or Light Gauge Steel
Gaming	1	Masonry or Light Gauge Steel
Housekeeping	1	Masonry or Light Gauge Steel

Adjacent areas will be landscaped or paved to support moderate passenger and light commercial truck traffic. Landscaped areas will be utilized for storm water retention and disposal.

l an investigation on this property in 2007; Speedie Project Number 071403SA, dated August 30, 2007. Construction on this phase was never started. The investigation included 8 borings to depths of 21.5 to 101.5 feet. The borings completed were in the north parking lot and the northeast corner of the existing hotel. This information along with some additional borings will be used to provide a comprehensive Geotechnical Report. The December 11, 2009 Terracon Report number 65095069 for the last expansion project was also made available and reviewed for this report. That data is available on request.

2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

The site is bounded on the north by a multi-event building, on the south and west by active farm fields and on the east by followed by active farm fields. The site is occupied with the existing casino buildings and parking lots. The construction will expand the casino to the north and east into the parking areas and to the south in the landscaped/retention areas. While no fill was identified, it is possible that fill exists with the presence of exiting structures onsite. Refer to the following historical aerial photos:

2.2 Geologic Conditions

The site is **located within an area** that has undergone considerable subsidence due to groundwater removal. Subsidence of several feet has been recorded in the immediate area of the site. Areas of subsidence are known to produce earth fissuring, which has affected areas within several miles of the site. **No evidence of earth fissures was observed on the site**. Although it is unlikely, it is possible that earth fissures exist at depth and are not visible due to surface disruption on the site. Fissure gullies form over subsurface irregularities such as bedrock highs, which cause tensional stresses and differential subsidence. Where such anomalies are not present, subsidence tends to be uniform over a wide area, this having minimal effect on surficial structures. The closest known active earth fissures are located in approximately 5 miles to the northwest and 5 miles to the east from this site. Based on local experience earth fissures historically have **not** been a problem in the immediate area.

It is not known if subsidence at this site has stopped, if it is continuing, or at what rate it may be occurring. However, the absence of observable fissures indicates that the structural effects on buildings should be minimal. Subsidence is a basin wide phenomenon that would result in differential elevation changes over long distances, which should not affect the type of buildings proposed for this site.

If any cracks, crevasses, or fissures are noted during site excavation this office should be notified immediately. A representative from this office will then visit the site, assess the feature and make recommendations regarding restorative measures.

2.3 Seismic Design Parameters

The project area is located in a seismic zone that is considered to have low historical seismicity. The seismicity of the area has had only three magnitude 3.0 events in over 100 years.

The site is located within the Uniform Building Code (UBC) earthquake Region 1. Liquefaction is not considered a concern as groundwater exceeds 15 meters below ground surface. In fact, regional groundwater is reported to be on the order of 90 to 150 feet deep in the area.

Based on a boring advanced to 100 feet, and based on the nature of the subsoils encountered in the borings and geology in the area, a Site Class Definition, Class D (Table 1615.1.1, 2003 IBC, and Table 1613.5.2, 2006 IBC) may be used for design of the structures. In addition, the following seismic parameters may be used for design (based on 2002 USGS maps adopted by 2006 IBC):

Table 2.3.1 Seismic Parameters

MCE[1] spectral response acceleration for 0.2 second period, S_S:	0.162g
MCE[1] spectral response acceleration for 1.0 second period, S_1:	0.055g
Site coefficient, Fa:	1.6
Site coefficient, Fv:	2.4
MCE[1] spectral response acceleration adjusted for site class, S_{MS}:	0.259g
MCE[1] spectral response acceleration adjusted for site class, S_{M1}:	0.132g
5% Damped spectral response acceleration, S_{DS}:	0.173g
5% Damped spectral response acceleration, S_{D1}:	0.088g
NOTE 1: MCE = maximum considered earthquake	

2.4 General Subsurface Conditions

Subsoil conditions at the site consist primarily of interbedded layers of lean clay, sandy lean clay, clayey sand, poor to well-graded sands, silty clayey sands and sandy silt to the termination depths of the borings at 16.5 to 61.5 feet below grade. Subordinate amounts of gravel and varying degrees of calcareous cementation were encountered throughout the profile. The asphalt parking lot ranged from 3 to 4 inches of asphalt on 4 to 8 inches of aggregate base. Standard Penetration Test values range from 4 to 50+ blows per foot. Groundwater was not encountered during this investigation but was encountered in the previous investigation in 2007 at a depth of 90 feet below grade. Based on visual and tactile observation, the soils were in a 'dry' to 'moist' state at the time of investigation.

Laboratory testing indicates in-situ dry density of the upper soils ranged from 96 to 105 pcf and water contents ranging from 7.6 to 18.1 percent at the time of investigation. Liquid limits range from non-plastic to 43 percent. Plasticity indices range from non-plastic to 24 percent. The upper clay soils exhibit volume increase due to wetting of 1.0 to 2.4 percent when compacted to moisture and density levels normally expected during construction. Undisturbed samples displayed **minor (1.5 to 2.0%)** compression under incremental loading to a maximum confining load of 3,200 psf and **moderate to significant (2.0 to 12.0%)** additional compression when saturated with water. Direct shear testing indicated that the upper soils have a friction angle of 43 to 48 degrees and cohesion of 232 to 910 psf. Direct shear tests in 2007 indicated that the upper soils had a friction angle of 28 to 49 with cohesion of 640 to 900 psf. Corrosive test data tested in 2007 indicates the soils have a pH of 7.6 with a resitivity of 1330 ohm-centimeters, a sulfate content of 94 ppm and a chloride content of 140 ppm.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Analysis of the field and laboratory data indicates that subsoils at the site are generally favorable for the support of lightly to moderately loaded structures on shallow foundations and slab-on-grade subject to remedial earthworks. As the loads are expected to be larger for the tower and parking garage, recommendations for the use of drilled shafts are provided as loads are anticipated to be too large for shallow spread footings. Special site preparation will be required with respect to the current uses, existing structures and related elements and underground utilities.

Laboratory and field testing indicates that the upper soils are of low density and are susceptible to additional compression due to inundation. This could cause excessive settlement resulting in cracking problems. In addition the site is currently occupied by parking lots and associated structures. Accordingly, recommendations are made to over-excavate and recompact the bearing soils to increase density and reduce the potential for collapse. This will also ensure a uniform bearing condition for the new foundations. Attention must be paid to provide and maintain proper drainage to limit the potential for water infiltration of deeper soils. This includes during construction when foundations are open and most vulnerable.

Additions should not be structurally connected to the existing building in order to prevent any detrimental effects that may result due to differential settlement. **If it is not feasible** to separate the buildings, the design should take the potential for differential settlement at the interface with the existing wall into account. Elastic settlement of all new foundations should be anticipated as estimated below. Differential settlement equal to total can occur between new and old foundations. If new foundations are located contiguous to the old, some interaction should be expected. The amount will depend on separation distance. The new foundations should be located at the same bottom of footing elevation as the existing. Accordingly, the existing building plans should be reviewed to determine that depth.

Since over-excavation, extending a distance at least equal to the depth beyond the edges of the footing is a recommended option, the new parallel wall foundations should be kept away from the existing wall foundations to reduce interaction and prevent having to provide temporary support for the existing wall. In general, avoid excavating into the zone of influence below the old foundation. That would be defined as a 1:1 slope projected down and away from the top edge of the old footing. Perpendicular walls intersecting the existing walls or individual spreads footings should not create a major problem provided that the excavation is not allowed to remain open for an extended period of time. We presume if the original shallow spread footing on fill option was used, the fill should extend a few feet from the footings. Adjustments can be made in the field on a case by case basis depending on conditions found when the footings are exposed. Using lean concrete (1 sack) slurry backfill below the footings is an option but still needs to extend beyond the edges equal to the depth due to the variable soil conditions below. The loads need to be spread out.

For minor structures such as screen/planter walls not connected to the main building, a lower bearing pressure can be used for design. **However, it will be imperative that a representative of this office examine foundation excavations and confirm the presence of firm/medium dense soils.** In order to help minimize settlement, it is recommended that the exposed bottom of footing excavation be moisture conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698.

For standard foundations to perform as expected, attention must be paid to provide proper drainage to limit the potential for water infiltration of deeper soils. It is assumed that the landscape plan will use mostly low water use or "green" desert type plants (xeriscape). It is preferred to keep irrigated plants at least 5 feet away from structures with irrigation schedules set and maintained to run intermittingly. **Unpaved planter areas should be sloped at least 5 percent for a distance of at least 10 feet away from the building.** It is understood that this may not be possible due to ADA maximum slope requirements for the adjacent sidewalks and patios. The slope may be reduced to 2 percent provided extra care is taken to ensure sidewalks and other hardscape features do not create a “dam” that prevents positive drainage away from the buildings, creating a "pond" adjacent to the building. Roof drainage should also be directed away from the building in paved scuppers. Pre-cast loose splash blocks should not be used as they can be dislodged and/or eroded. Roof drains should not be allowed to discharge into planters adjacent to the structure. It is preferred that they be directed to discharge to pavement (per photo example), retention basins or discharge points located at least 10 feet away from the building.

It is reiterated that shallow spread footings for **lightly to moderately loaded structures** are recommended for the exterior walls and other light interior columns since this is the most economical system available. However, this shallow system relies on the dry strength of the unsaturated native soils. A limited depth of re-compaction is recommended to increase density of the near surface soils that are more likely to encounter seasonal moisture changes. **The deeper native soils are moisture sensitive and could experience differential settlement if subjected to significant surface water infiltration.** Recognizing the need to minimize significant water penetration adjacent to the building perimeter that could detrimentally impact the building foundation, the following additional recommendations are made to protect foundations:

1. Take extra precaution to backfill and compact native soil fill to 95 percent in all exterior wall locations.
2. Avoid utility trenches passing through retention basins leading to the building. If unavoidable, backfill the trench with MAG Section 728 ½-sack CLSM to cut off preferred drainage paths.
3. Create and maintain positive drainage away from the exterior wall for a minimum of 10 feet.
4. Avoid sidewalks, curbs or other elements that create a dam that could cause water to pond within 5 feet of the perimeter wall.
5. Include no irrigated landscape materials in the first 3 feet next to the building.
6. Between 3 feet and 5 feet, include only landscape materials that can be irrigated with a maximum of 1 gallon per hour emitter heads. Set and maintain irrigation controllers to prevent 24/7 flows.
7. Any landscape materials requiring greater than 1 gallon per hour irrigation, including turf, shall be at least 5 feet from the outside face of the building.
8. All irrigation feeder lines, other than those that supply individual emitters, shall not be placed closer than 5 feet to the building.

Ground water is not expected to be a factor in the design or construction of shallow foundations and underground utilities. Excavation operations should be relatively straightforward although cemented soils may impede progress and possibly require the use of heavier equipment.

It is not known whether underground services related to the existing facility will be removed. If any utility is located within 5 feet of any proposed foundation, relocation and/or abandonment of the utility should be provided. They should either be removed and replaced with engineered fill or abandoned in-place. In the case of manholes and pipelines, it may be possible to abandon them in-place. The tops of manholes should be removed and filled with a weak (>500 psi) cementitious grout. Pipelines larger than 6 inches should be capped and filled with grout.

As noted above (and reported by on site staff from previous work) some soft wet subgrade areas were detected during our investigation. There is some potential to uncover wet, unstable subgrade soils when old pavements are removed. Therefore there should be a contingency plan to remove and replace additional subgrade soils if soft, wet areas are encountered. If it is not possible to remove the wet soils and replace with dry soils or millings, or allow the soils to dry, other means (such as cement treating the soils, geogrids, etc.) may be used to stabilize. Alternatively it may be possible to use the millings and existing aggregate base to stabilize any areas that require stabilization, provided the asphalt millings are prepared and meet the requirements of M.A.G. Standard Specification Section 702 for AB. If cement treating is being used, it should be done following the guidelines of M.A.G. Standard Specification Section 311. If geogrids are used, it is recommended to use 12 inches of AB or millings installed on a layer of Tensar TX140 or better installed per manufacture recommendations.

Prior to placing structural fill below footing bottom elevation, the exposed grade should be scarified to a depth of 8 inches, moisture conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698. Pavement areas should be scarified, moisture conditioned and compacted in a similar manner.

All cut areas and areas above footing bottom elevation that are to receive floor slab only fill should be scarified 8 inches, moisture conditioned to at least optimum to 3 percent above optimum and lightly but uniformly compacted to 90 but not more than 95 percent of maximum dry density as determined by ASTM D-698.

3.3 Foundation Design

The following bearing capacities may be used for design.

For exterior slabs on grade, frequent jointing is recommended to control cracking and reduce tripping hazards should differential movement occur. It is also recommended to pin the landing slab to the building floor/stem wall. This will reduce the potential for the exterior slab lifting and blocking the operation of out-swinging doors. Pinning typically consists of 16 inch long ½-inch ASTM A36 smooth steel dowels placed at 12-inch centers.

For the lazy river/activity pool it is recommended to pin the slab together with ½-inch ASTM A36 smooth steel dowels or diamond dowels. The deck should not be connected to the pool walls in the event that movement does occur. A suitable joint sealant detail should be used at the juncture between the deck and wall. Consideration may also be given to sealing the joints between slabs to prevent water infiltration.

3.2 Site Preparation

The entire area to be occupied by the proposed construction should be stripped of all vegetation, debris, rubble and obviously loose surface soils. Any existing structures and foundation elements should be removed in their entirety along with soil disturbed by this activity. Carefully remove all concrete and other elements as well as any deleterious materials that may be encountered. The entire affected building pad area should be over-excavated at least 12 inches to aid in location of other buried hazards (i.e. foundations, utilities, etc.). If encountered, they should be removed and the resulting excavation widened as necessary to provide access for compaction equipment. The existing asphaltic concrete may be cold-milled in-place to a gradation similar to that of an ABC and it, along with the existing aggregate base, stockpiled for reuse under new slabs-on-grade and under paved areas as sub-base. Final grades should allow for the placement of 12 inches of non-expansive fill on the building pads.

For lightly loaded structures, subsoils directly beneath shallow foundation elements should be further over-excavated to depths of **at least 2 to 4 feet** below proposed footing bottom elevation (depending on which option is used), or existing grade, whichever is deeper, extending at least 5 feet beyond footing edges and re-compacted as set forth herein. The width of excavation can be reduced to equal the depth below the footing (i.e. 2 or 4 feet) if tight controls on the footing edges are provided. The entire building pad does not require deep over-excavation provided that footing lines can be accurately located during earthwork operations. It may be more feasible to just over-excavate the entire building pads if the building footprint is relatively small. Using lean concrete (1 sack) slurry backfill below the footings is an option but still needs to extend beyond the edges equal to the depth due to the variable (loose in some areas) soil conditions below. The foundation loads need to be spread out. A representative of the geotechnical engineer should examine the subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials. Fill placement and quality should be as defined in the "Fill and Backfill" section of this report.

Table 3.3.1 Allowable Bearing Capacity

Structure	Foundation Type	Foundation Depth	Bearing Medium	Allowable Bearing Capacity (psf)
Minor Structures	Spread	1.5 ft.	Compacted Native Soils	1,500 (See Note 1)
Lightly to Moderately Loaded Structures	Spread Footings	2.0 ft.	Min 2' Engineered Fill	2,500 (See Note 2)
Lightly to Moderately Loaded Structures	Spread Footings	2.0 ft.	Min 4' Engineered Fill	5,000 (See Note 3)
Hotel Tower & Parking Structure	Drilled Shafts	15.0 ft. min.	Dense Native Soil	See Charts (See Note 4)

Notes:

1. For minor structures such as screen walls, planter walls, etc. not connected to any main structure. Scarification and compaction of the subgrade to 95 percent standard proctor to at least 8 inches depth is required.
2. Bearing Depth refers to minimum depth below lowest finished exterior grade within 5' of structure. Footings to bear on minimum of **2' of engineered fill** + 8" pre-compacted subgrade. Continuous and square footings should **not exceed 5 feet and 10 feet respectively** to stay within settlement tolerances.
3. Bearing Depth refers to minimum depth below lowest finished exterior grade within 5' of structure. Footings to bear on minimum of **4' of engineered fill** + 8" pre-compacted subgrade. Continuous and square footings should **not exceed 5 feet and 10 feet respectively** to stay within settlement tolerances.
4. Depth refers to minimum length of drilled shaft caissons bearing in dense/very stiff native soils. Design curves can be found in the appendix.

These bearing capacities refer to the total of all loads, dead and live, and are net pressures. They may be increased one-third for wind, seismic or other loads of short duration. These values may be increased by one-third as the allowable toe pressure for retaining walls. All footing excavations should be level and cleaned of all loose or disturbed materials. **Positive drainage away from the proposed buildings must be maintained at all times.**

Caissons should consist of drilled shaft foundations bearing in the dense/very stiff native soils. A minimum drilled shaft length of 15 feet is recommended. Significant sloughing could occur in the sand layers resulting in concrete quantities higher than neat dimension calculations. Full length casing or other means (slurry) **may be required** to maintain open excavations. The means and methods of maintaining open shafts and minimizing/limiting structural concrete quantities is up to the contractor. A minimum caisson diameter of 36 inches is recommended to facilitate installation and cleaning. All caissons should be examined by a representative of the geotechnical engineer to verify cleaning, depth, dimensions and proper bearing strata. Straight shaft caissons may be "machine cleaned" provided the contractor can show the ability to adequately remove loose material. Adjacent caisson base (tip) elevations should not vary by more than 45 degrees.

A minimum allowable distance of 3 caisson diameters, center-to-center, is recommended between caissons for reasons of construction safety and to reduce **axial** group action. This limitation ensures that newly placed caissons are not damaged during the subsequent placement of adjacent caissons. This distance may be reduced to 2 diameters if one of the caissons has been in place for enough time to allow concrete to set and cure. A load bearing reduction factor of 0.7 should be applied to individual caissons within a proximity of two diameters, center-to-center, of each other. If adjacent caissons are of different diameters, an average of the diameters should be used for determining spacing. All caissons should be examined by a representative of the geotechnical engineer to verify cleaning, depth, dimensions and proper bearing strata. A separate set of reduction factors are recommended to reduce **lateral** group action. These can be provided on request. Lateral load analysis of drilled shaft foundations can be provided on request at additional cost.

Continuous wall footings and isolated rectangular footings should be designed with minimum widths of 16 and 24 inches respectively, regardless of the resultant bearing pressure. Lightly loaded interior partitions (less than 800 plf) may be supported on reinforced thickened slab sections (minimum 12 inches of bearing width).

Estimated settlements under design loads are on the order of ½ to 1-inch, virtually all of which will occur during construction. Post-construction differential settlements will be on the order of one-half the total settlement, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content. **Positive drainage away from structures and controlled routing of roof runoff must be provided and maintained to prevent ponding adjacent to perimeter walls.** Planters requiring heavy watering should not be placed adjacent to or within 5 feet of the building. Care should be taken in design and construction to insure that domestic and interior storm drain water is contained to prevent seepage. Roof drainage should be directed to paved areas or storm drains. They should not discharge into planters adjacent to the structures.

Continuous footings and stem walls should be reinforced to distribute stresses arising from small differential movements, and long walls should be provided with control joints to accommodate these movements. Reinforcement and frequent control joints are suggested to allow slight movement and prevent minor floor slab cracking especially in floor areas to be covered with hard tile.

3.4 Lateral Pressures

The following equivalent fluid lateral pressure values may be utilized for the proposed construction:

Active Pressures	
Unrestrained Walls	35 pcf
Restrained Walls	60 pcf
Passive Pressures	
Continuous Footings	300 pcf
Spread Footings or Drilled Piers	350 pcf
Coefficient of Friction (w/ passive pressure)	0.35
Coefficient of Friction (w/out passive pressure)	0.45

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain. Expansive soils should not be used as retaining wall backfill, except as a surface seal to limit infiltration of storm/irrigation water. The expansive pressures could greatly increase active pressures.

3.5 Fill and Backfill

Native soils are considered suitable for use in general grading and engineered fills but should **not** be used in the top 12-inches of pad fill or as retaining wall backfill. The top 12-inches of pad fill should be completed with an approved low or non-expansive soil, either approved imported common borrow or select granular soil. If select granular soils are used, the 4 inches of under-slab aggregate base may be included as part of the top 12-inches. Otherwise, 12-inches of approved common borrow should be used in addition to the normal 4 inches of aggregate base.

If imported common fill for use in site grading is required, it should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. In general, the fill should have 100 percent passing the 3-inch sieve and no more than 60 percent passing the 200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Fill should be placed on subgrade, which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±2 percent (optimum to +3 percent for under-slab fill). Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows:

A.	Building Areas		
	1.	Below footing level	95
	2.	Below slabs-on-grade (non-expansive soils)	95
	3.	Below slabs-on-grade (expansive soils) (Not recommended for the top 12-inches of pad)	90-95 (max)
B.	Pavement Subgrade or Fill		95
C.	Utility Trench Backfill		95
D.	Aggregate Base Course		
	1.	Below floor slabs	95
	2.	Below asphalt paving	100
E.	Landscape Areas		90
F.	Pool Decking		90-95 (max)

3.6 Utilities Installation

Trench excavations for utilities can be accomplished by conventional trenching equipment. Trench walls should stand near-vertical for the short periods of time required to install shallow utilities although some sloughing may occur in looser and/or sandier soils requiring laying back of side slopes and/or temporary shoring. Adequate precautions must be taken to protect workmen in accordance with all current governmental regulations.

Backfill of trenches above bedding zones may be carried out with native excavated material. This material should be moisture-conditioned, placed in 8-inch lifts and mechanically compacted. Water settling is not recommended. Compaction requirements are summarized in the "Fill And Backfill" section of this report.

3.7 Slabs-on-Grade

To facilitate fine grading operations and aid in concrete curing, a 4-inch thick layer of granular material conforming to the gradation for aggregate base (A.B.) as per M.A.G. Specification Section 702 should be utilized beneath the slab. Dried subgrade soils **must** be re-moistened prior to placing the aggregate base if allowed to dry out, especially if fine-grained soils are used in the top 12-inches of the pad.

The native soils are capable of storing a significant amount of moisture, which could increase the natural vapor drive through the slab. Accordingly, if moisture sensitive flooring and/or adhesive are planned, the use of a vapor barrier or low permeability concrete should be considered. Vapor barriers do increase the potential for slab curling and water entrapment under the slab. Accordingly, if a vapor barrier is used, additional precautions such as low slump concrete, frequent jointing and proper curing will be required to reduce curling potential and detailed to prevent the entrapment of outside water sources.

3.8 Asphalt Concrete Pavement

If earthwork in paved areas is carried out to finish subgrade elevation as set forth herein, the subgrade will provide adequate support for pavements. The location designation is for reference only. **The designer/owner should choose the appropriate sections to meet the anticipated traffic volume and life expectancy.** The section capacity is reported as daily ESALs, Equivalent 18 kip Single Axle Loads. Typical heavy trucks impart 1.0 to 2.5 ESALs per truck depending on load. It takes approximately 1,200 passenger cars to impart 1 ESAL.

Table 3.8.1 Pavement Sections

Area of Placement	Daily 18-kip ESALs		Flexible		Rigid
	AC	PCCP	AC (0.39)	ABC (0.12)	PCCP
Auto Parking	4	7	2.0”	6.0”	5.0”
Main Drives / Truck Parking	14	19	3.0”	6.0”	6.0”
	30	43	3.0”	8.0”	7.0”

Notes:

1. Designs are based on AASHTO design equations and ADOT correlated R-values.
2. The PCCP thickness is increased to provide better load transfer, and reduce potential for joint and edge failures. Design PCCP per ACI 330R-87.
3. Full depth asphalt or increased asphalt thickness can be increased by adding 1.0-inch asphalt for each 3 inches of base course replaced.

Pavement Design Parameters:

Assume:	One 18 kip Equivalent Single Axle Load(ESAL)/Truck
Life:	20 years
Subgrade Soil Profile:	
% Passing #200 sieve:	69%
Plasticity Index:	14%
k:	100 pci (assumed)
R value:	24 (per ADOT tables)
M_R:	14,200 (per AASHTO design)

These designs assume that all subgrades are prepared in accordance with the recommendations contained in the "Site Preparation" and "Fill and Backfill" sections of this report, and paving operations carried out in a proper manner. If pavement subgrade preparation is not carried out immediately prior to paving, the entire area should be proof-rolled at that time with a heavy pneumatic-tired roller to identify locally unstable areas for repair.

Pavement base course material should be aggregate base per M.A.G. Section 702 Specifications. Asphalt concrete materials and mix design should conform to M.A.G. 710. It is recommended that a ½-inch or ¾-inch mix designation be used for the pavements. The actual mix design may be dependent on the selected pavement section and the specified minimum lift thicknesses for the different types of mixes. **Follow M.A.G. Section 710 for recommended minimum lift thicknesses.** Pavement installation should be carried out under applicable portions of M.A.G. Section 321 and municipality standards. The asphalt supplier should be informed of the pavement use and be required to provide a mix that will provide stability and be aesthetically acceptable. Some of the newer M.A.G. mixes are very coarse and could cause placing and finish problems. A mix design should be submitted for review to determine if it will be acceptable for the intended use.

For sidewalks and other areas not subjective to vehicular traffic a 4-inch section of concrete will be sufficient. For trash and dumpster enclosures a thicker section of 6 inches of concrete is recommended.

Portland Cement Concrete Pavement must have a minimum 28-day flexural strength 600 psi (compressive strength of approximately 4,000 psi). It may be cast directly on the prepared subgrade with proper compaction (reduced) and the elevated moisture content as recommended in the report. Lacking an aggregate base course, attention must be paid to using low slump concrete and proper curing, especially on the thinner sections. No reinforcing is necessary. Joint design and spacing should be in accordance with

ACI recommendations. Construction joints should contain dowels or be tongue-and-grooved to provide load transfer. Tie bars are recommended on the joints adjacent to unsupported edges. Maximum joint spacing in feet should not exceed 2 to 3 times the thickness in inches. Joint sealing with a quality silicone sealer is recommended to prevent water from entering the subgrade allowing pumping and loss of support.

Proper subgrade preparation and joint sealing will reduce (but not eliminate) the potential for slab movements (thus cracking) on the expansive native soils. Frequent jointing will reduce uncontrolled cracking and increase the efficiency of aggregate interlock joint transfer.

4.0 GENERAL

The scope of this investigation and report includes only regional published considerations for seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, not any site specific studies. The scope does not include any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice for a preliminary investigation; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Geotechnical Engineer observe and test the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

APPENDIX

SOIL LEGEND

SAMPLE DESIGNATION	DESCRIPTION	
AS	**Auger Sample**	A grab sample taken directly from auger flights.
BS	**Large Bulk Sample**	A grab sample taken from auger spoils or from bucket of backhoe.
S	**Spoon Sample**	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.
RS	**Ring Sample**	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
LS	**Liner Sample**	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
ST	**Shelby Tube**	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
--	**Continuous Penetration Resistance**	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.

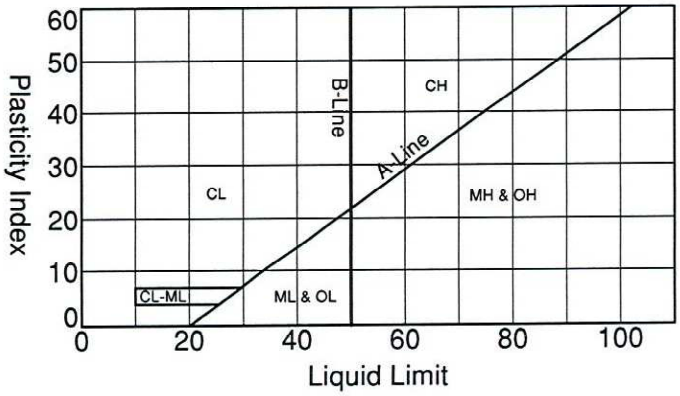
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICAL PRESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size ◆	mm	Sieve Size ◆
SANDS				
Fine	0.075	#200	0.42	#40
Medium	0.420	#40	2.00	#10
Coarse	2.000	#10	4.75	#4
GRAVELS				
Fine	4.75	#4	19	0.75" ✖
Coarse	19	0.75" ✖	75	3" ✖
COBBLES	75	3" ✖	300	12" ✖
BOULDERS	300	12" ✖	900	36" ✖

◆U.S. Standard ✖Clear Square Openings



Rig Type: **CME-75 4X4**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)

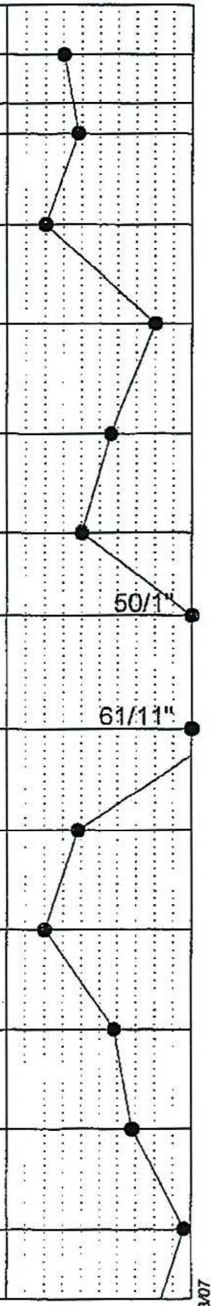
Graphic Log

Visual Classification

Visual Classification	Depth
3" of Asphalt on 4" of Aggregate Base	0.6
Stiff Brown to Light Brown SANDY LEAN CLAY (CL-Moist to Dry) Very Stiff Light Brown SANDY LEAN CLAY (CL-Dry)	8.5
Loose Light Brown POORLY GRADED SAND (SP-Dry) with Trace Gravel and Silt	14.0
Hard Light Brown SANDY LEAN CLAY (CL-Dry) with Weak to Moderate Calcareous Cementation	19.0
Very Stiff Light Brown SANDY SILTY CLAY (CL/ML-Dry)	23.0
Medium Dense Light Brown POORLY GRADED SAND with SILT (SP/SM-Dry)	26.0
Very Stiff Light Brown SANDY SILTY CLAY (CL/ML-Dry) with Weak Calcareous Cementation	29.0
Hard Light Brown SANDY LEAN CLAY (CL-Dry) with Moderate to Strong Calcareous Cementation Encountered Little Gravel from 31' to 35'	35.0
Hard Brown SANDY SILTY CLAY (CL/ML-Moist)	39.0
Brown POORLY GRADED SAND with SILT (SP/SM-Dry to Moist)	40.0
Very Stiff Brown SANDY CLAY (CL-Moist) with Weak Calcareous Cementation, Trace Gravel	43.0
Stiff Brown SANDY FAT CLAY (CH-Moist)	50.0
Medium Dense Light Brown POORLY GRADED SAND with SILT (SP/SM-Dry) Trace Gravel	54.0
Brown SANDY CLAY (CL-Moist)	55.0
Dense Light Brown WELL-GRADED SAND with GRAVEL (SW-Dry)	64.0

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
S-1	2.5	NT	NT
BS-3	5.0	NT	NT
S-2	6.5	NT	NT
RS-4	11.0	NT	NT
RS-5	16.0	13.3	93.7
S-6	21.5	NT	NT
S-7	26.5	NT	NT
S-8	30.6	NT	NT
S-9	36.4	NT	NT
S-10	41.5	NT	NT
S-11	46.5	21.7	NT
S-12	51.5	NT	NT
S-13	56.5	NT	NT
S-14	61.5	NT	NT

Penetration Resistance Blows per Foot



Continued on Next Page

Boring Date: **8-6-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

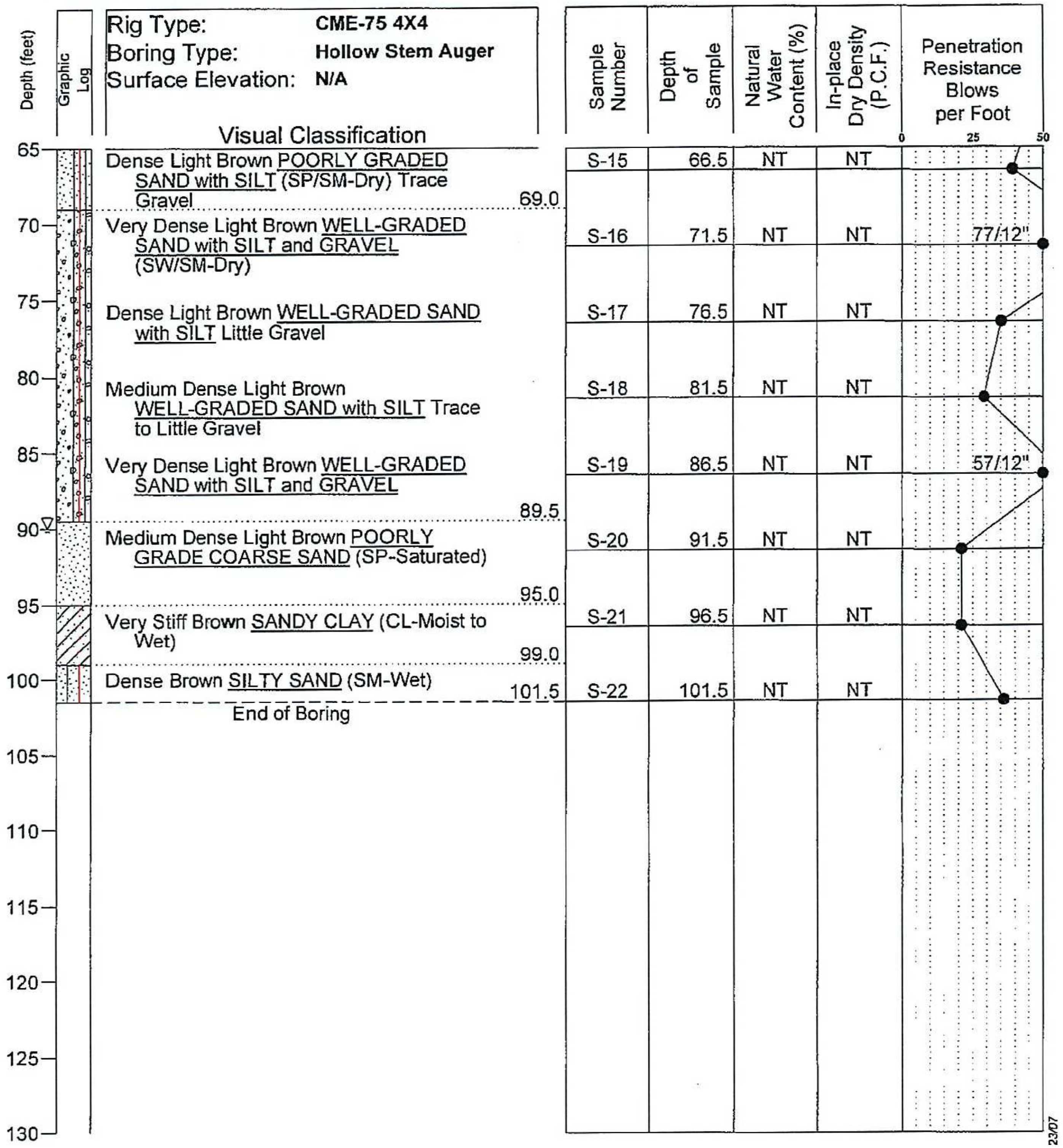
Water Level

Depth	Hour	Date	
90.0	**10:45:00 AM**	**8/6/2007**	∇
			▼

NT = Not Tested

23/07

Rig Type: **CME-75 4X4**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
65–69.0	Dense Light Brown POORLY GRADED SAND with SILT (SP/SM-Dry) Trace Gravel	S-15	66.5	NT	NT	
69.0–89.5	Very Dense Light Brown WELL-GRADED SAND with SILT and GRAVEL (SW/SM-Dry)	S-16	71.5	NT	NT	77/12"
	Dense Light Brown WELL-GRADED SAND with SILT Little Gravel	S-17	76.5	NT	NT	
	Medium Dense Light Brown WELL-GRADED SAND with SILT Trace to Little Gravel	S-18	81.5	NT	NT	
	Very Dense Light Brown WELL-GRADED SAND with SILT and GRAVEL	S-19	86.5	NT	NT	57/12"
89.5–95.0	Medium Dense Light Brown POORLY GRADE COARSE SAND (SP-Saturated)	S-20	91.5	NT	NT	
95.0–99.0	Very Stiff Brown SANDY CLAY (CL-Moist to Wet)	S-21	96.5	NT	NT	
99.0–101.5	Dense Brown SILTY SAND (SM-Wet)	S-22	101.5	NT	NT	
101.5	End of Boring					

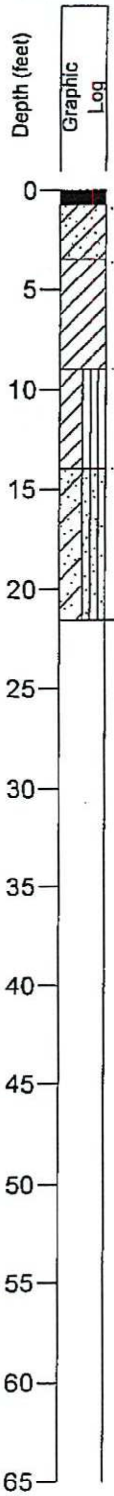
Boring Date: **8-6-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date	
90.0	**10:45:00 AM**	**8/6/2007**	∇
			▼

NT = Not Tested

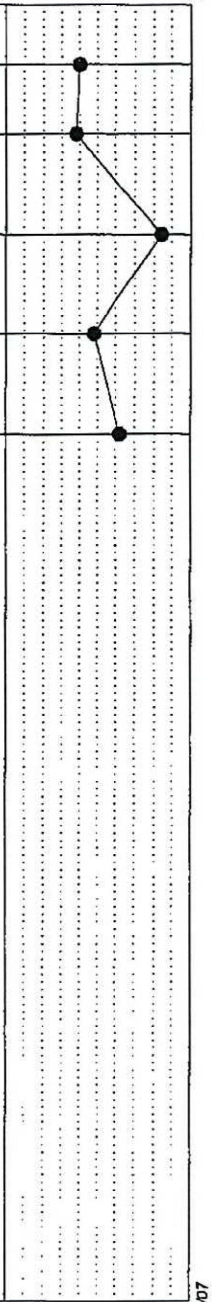
Rig Type: **CME-75 4X4**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification	
5.5" of Asphalt on 3" of Aggregate Base	0.8
Very Stiff Dark Brown SANDY CLAY (CL-Moist)	3.5
Very Stiff Brown SANDY LEAN CLAY (CL-Moist)	9.0
Hard Brown to Light Brown SANDY SILTY CLAY (CL/ML-Dry)	14.0
Medium Dense to Dense Light Brown SILTY CLAYEY SAND (SC/SM-Dry)	21.5
End of Boring	

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
RS-1	3.0	NT	NT
S-2	6.5	NT	NT
S-3	11.5	NT	NT
S-4	16.5	NT	NT
S-5	21.5	NT	NT

Penetration Resistance Blows per Foot



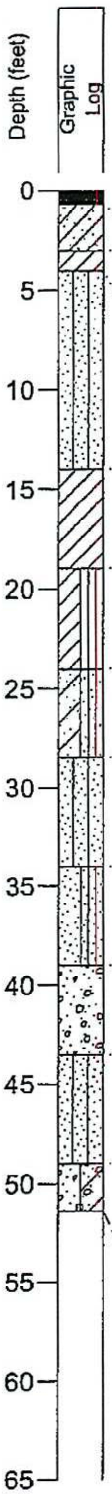
Boring Date: **8-7-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

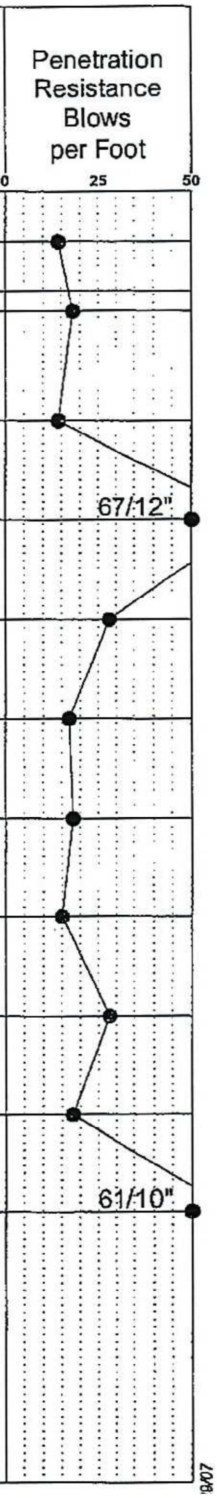
NT = Not Tested

Rig Type: **CME-75 4X4**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification	
3" of Asphalt on 5" of Aggregate Base	0.7
Stiff Dark Brown SANDY CLAY (CL-Moist)	3.0
Brown SANDY LEAN CLAY (CL-Dry to Moist)	4.0
Medium Dense Brown SILTY SAND (SM-Dry) with Some Gravel	14.0
Hard Light Brown SANDY LEAN CLAY (CL-Dry) with Moderate to Strong Calcareous Cementation	19.0
Very Stiff Brown SANDY SILTY CLAY (CL/ML-Moist)	24.0
Medium Dense Brown SILTY CLAYEY SAND (SC/SM-Moist)	28.5
Medium Dense Brown SILTY SAND (SM-Dry) with Interbedded Layer of Clayey Sand	34.0
Medium Dense Light Brown POORLY GRADED SAND with SILT (SP/SM-Dry)	39.0
Medium Dense Light Brown WELL-GRADED SAND (SW-Dry) with Little Silt	43.5
Medium Dense Brown SILTY SAND (SM-Dry) Encountered Layer of Gravel at 47.5'	49.0
Very Dense Brown WELL-GRADED SAND with CLAY and GRAVEL (SW/SC-Dry to Moist)	51.3
End of Boring	

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
S-1	2.5	NT	NT
BS-2	5.0	NT	NT
RS-3	6.0	10.9	94.1
S-4	11.5	NT	NT
S-5	16.5	NT	NT
S-6	21.5	NT	NT
S-7	26.5	NT	NT
S-8	31.5	NT	NT
S-9	36.5	NT	NT
S-10	41.5	NT	NT
S-11	46.5	NT	NT
S-12	51.3	NT	NT



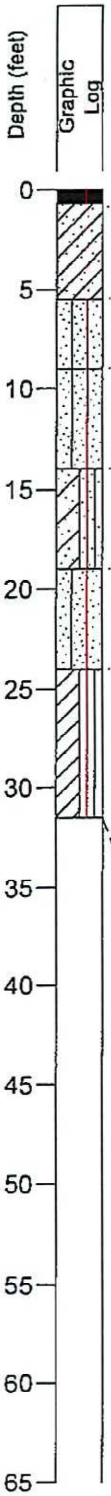
Boring Date: **8-7-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

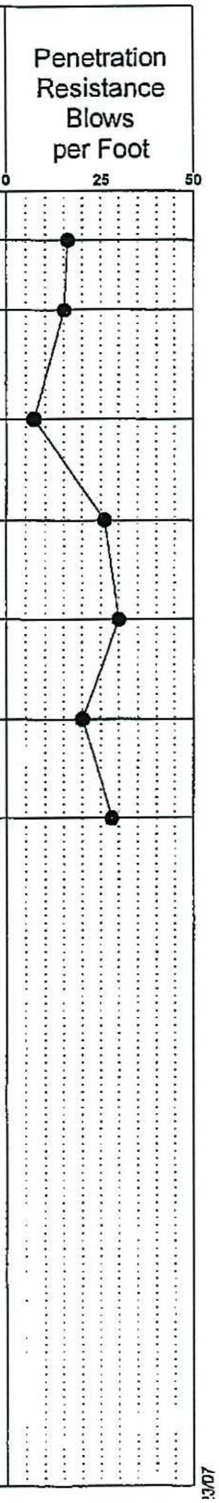
NT = Not Tested

Rig Type: **CME-75 4X4**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
3" of Asphalt on 5" of Aggregate Base	0.7				
Very Stiff Dark Brown SANDY CLAY (CL-Moist)	5.5	S-1	2.5	NT	NT
Medium Dense Brown SILTY SAND (SM-Dry) with Little to Some Gravel	9.0	RS-2	6.0	NT	NT
Loose Brown SILTY SAND (SM-Dry)	14.0	S-3	11.5	NT	NT
Medium Dense Brown SILTY CLAYEY SAND (SC/SM-Dry)	19.0	S-4	16.5	NT	NT
Dense Brown to Light Brown SILTY SAND (SM-Dry) with Weak Calcareous Cementation, Trace Clay	24.0	S-5	21.5	NT	NT
Very Stiff Brown SANDY SILTY CLAY (CL/ML-Dry to Moist)		S-6	26.5	NT	NT
Very Stiff Brown to Light Brown SANDY SITLY CLAY (CL/ML-Dry) with Weak to Moderate Calcareous Cementation	31.5	S-7	31.5	NT	NT

End of Boring



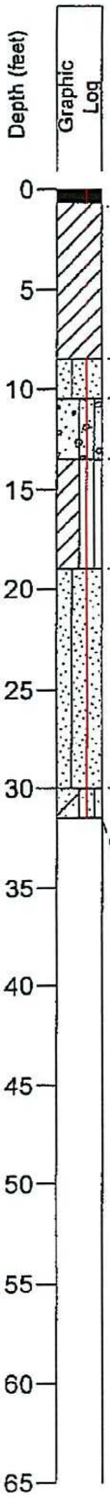
Boring Date: **8-7-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date	
Free Water was Not Encountered			▽
			▼

NT = Not Tested

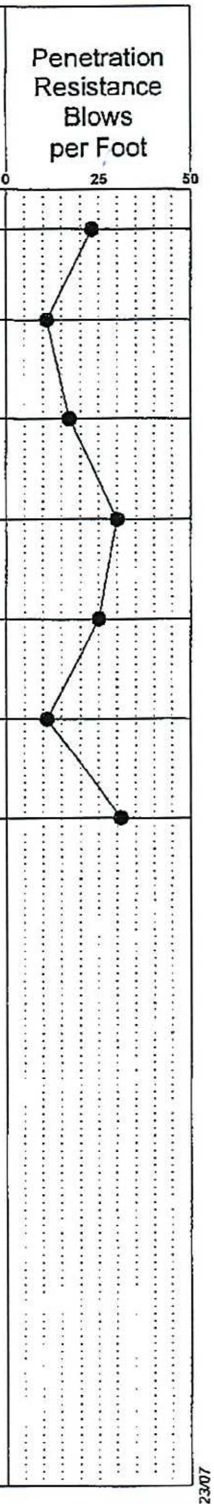
Rig Type: CME-75 4X4
Boring Type: Hollow Stem Auger
Surface Elevation: N/A



Depth	Visual Classification
0.7	3" of Asphalt on 5" of Aggregate Base
8.5	Very Stiff to Stiff Light Brown SANDY LEAN CLAY (CL-Dry) with Weak Calcareous Cementation
10.5	Brown SILTY SAND (SM-Dry)
13.5	Medium Dense Brown WELL-GRADED SAND with SILT (SW/SM-Dry)
19.0	Hard Brown SANDY SILTY CLAY (CL/ML-Dry) with Weak Calcareous Cementation
	Medium Dense Brown SILTY SAND (SM-Dry)
30.0	Medium Dense Brown SILTY SAND (SM-Dry to Moist) with Trace Clay
31.5	Dense Light Brown SILTY CLAYEY SAND (SC/SM-Dry) with Moderate Calcareous Cementation

End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
RS-1	2.0	11.5	91.8
S-2	6.5	NT	NT
S-3	11.5	NT	NT
S-4	16.5	NT	NT
S-5	21.5	NT	NT
S-6	26.5	NT	NT
S-7	31.5	NT	NT



23/07

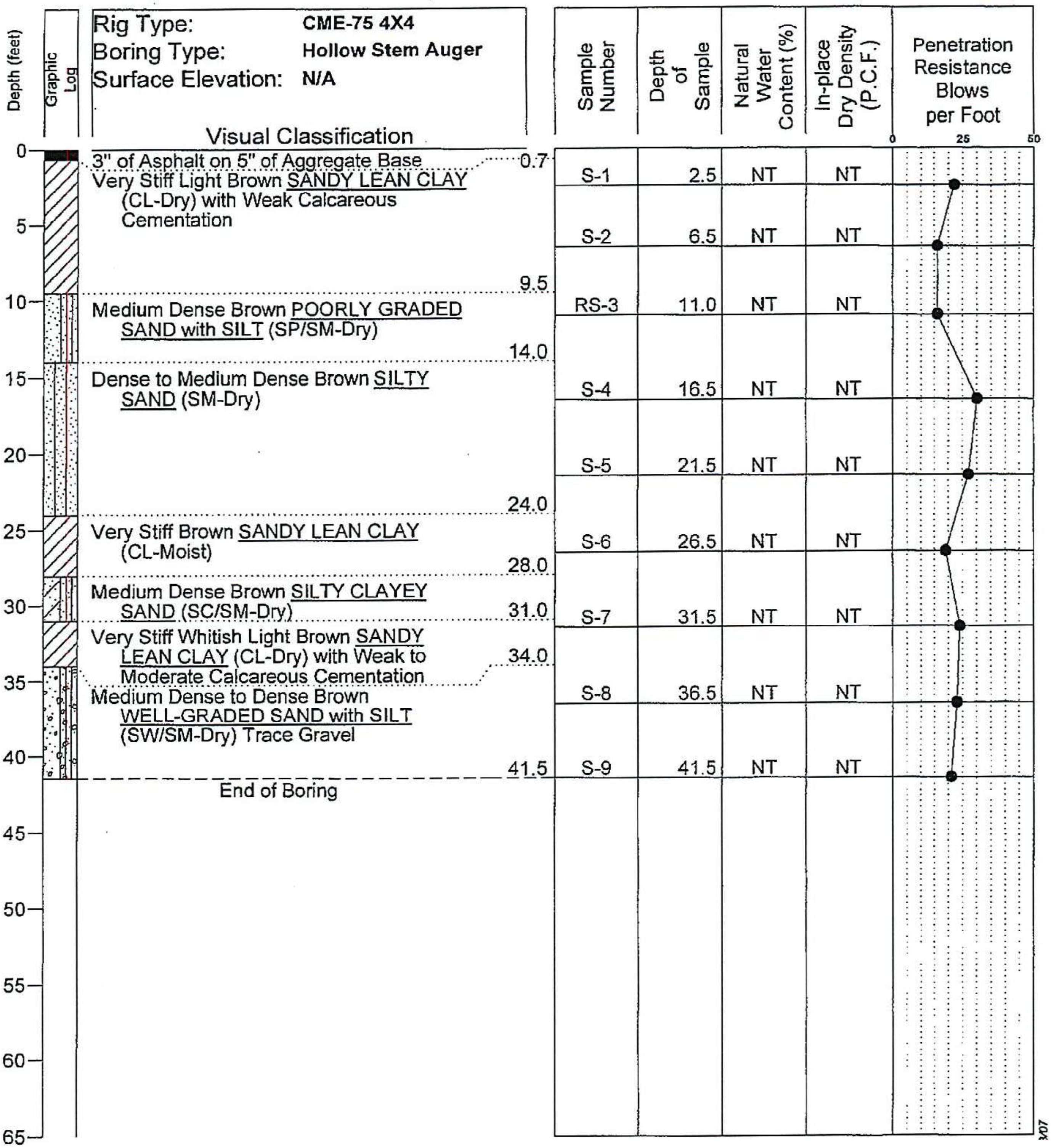
Boring Date: **8-7-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

Rig Type: **CME-75 4X4**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification	
3" of Asphalt on 5" of Aggregate Base	0.7
Very Stiff Light Brown SANDY LEAN CLAY (CL-Dry) with Weak Calcareous Cementation	9.5
Medium Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry)	14.0
Dense to Medium Dense Brown SILTY SAND (SM-Dry)	24.0
Very Stiff Brown SANDY LEAN CLAY (CL-Moist)	28.0
Medium Dense Brown SILTY CLAYEY SAND (SC/SM-Dry)	31.0
Very Stiff Whitish Light Brown SANDY LEAN CLAY (CL-Dry) with Weak to Moderate Calcareous Cementation	34.0
Medium Dense to Dense Brown WELL-GRADED SAND with SILT (SW/SM-Dry) Trace Gravel	41.5
End of Boring	

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
S-1	2.5	NT	NT
S-2	6.5	NT	NT
RS-3	11.0	NT	NT
S-4	16.5	NT	NT
S-5	21.5	NT	NT
S-6	26.5	NT	NT
S-7	31.5	NT	NT
S-8	36.5	NT	NT
S-9	41.5	NT	NT

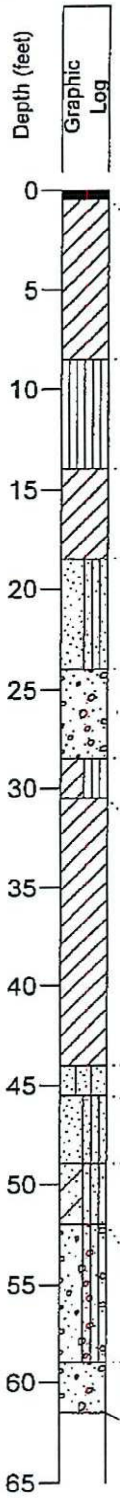
Boring Date: **8-7-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date	
Free Water was Not Encountered			▽
			▼

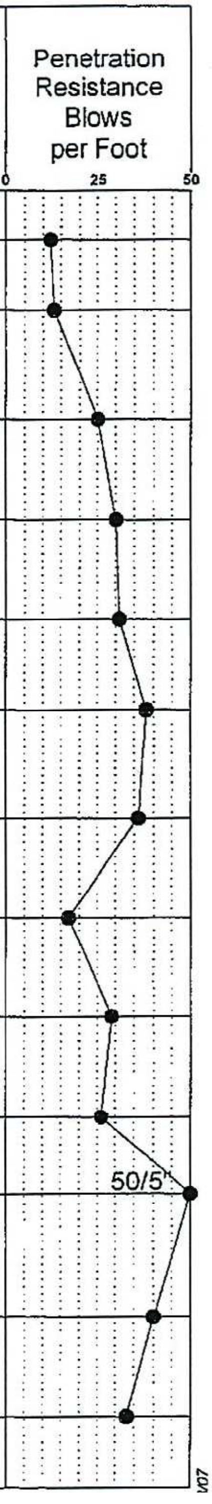
NT = Not Tested

Rig Type: **CME-75 4X4**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification	
2" of Asphalt on 4" on Aggregate Base	0.5
Stiff Brown SANDY LEAN CLAY (CL-Dry to Moist) with Weak Calcareous Cementaiton Stiff Light Brown SANDY LEAN CLAY	8.5
Very Stiff Light Brown SANDY SILT (ML-Dry)	14.0
Hard Light Brown SANDY LEAN CLAY (CL-Dry) with Weak to Moderate Calcareous Cementation	18.5
Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry)	24.0
Dense Brown WELL-GRADED SAND (SW-Dry) with Little Silt, Trace Gravel	28.5
Brown SANDY SILTY CLAY (CL/ML-Dry to Moist)	30.5
Hard Brown SANDY LEAN CLAY (CL-Dry) with Trace Moderate to Strong Calcareous Cementation Very Stiff Brown SANDY LEAN CLAY (CL-Dry to Moist) Very Stiff Brown SANDY LEAN CLAY (CL-Dry) with Moderate Calcareous Cementation	44.0
Brown SILTY SAND (SM-Dry)	45.5
Medium Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry)	49.0
Very Dense Whitish Light Brown SILTY CLAYEY SAND (SC/SM-Dry) with Strong Calcareous Cementation	52.0
Dense Brown WELL-GRADED SAND with SILT (SW/SM-Dry to Moist) with Trace Gravel	59.0
Dense Brown WELL-GRADED SAND with GRAVEL (SW-Dry)	61.5
End of Boring	

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
S-1	2.5	NT	NT
RS-2	6.0	NT	NT
S-3	11.5	NT	NT
S-4	16.5	NT	NT
S-5	21.5	NT	NT
RS-6	26.0	3.4	107.1
S-7	31.5	NT	NT
S-8	36.5	NT	NT
S-9	41.5	NT	NT
S-10	46.5	NT	NT
S-11	50.4	NT	NT
S-12	56.5	NT	NT
S-13	61.5	NT	NT



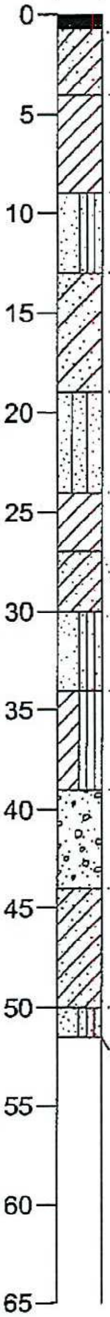
Boring Date: **8-8-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

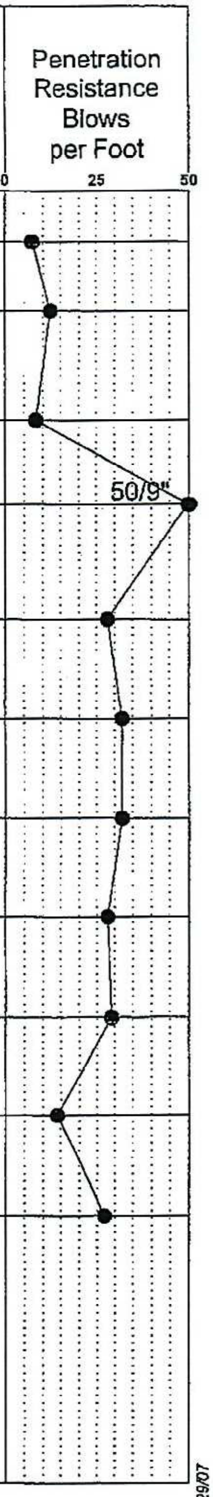
Rig Type: **CME-75 4X4**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification

3" of Asphalt on 5" of Base 0.7
Firm Brown SANDY CLAY (CL-Moist) 4.0
Stiff Brown SANDY LEAN CLAY (CL-Moist) 9.0
Loose Brown POORLY GRADED SAND with SILT (SP/SM-Dry to Moist) 13.0
Very Dense Light Brown CLAYEY SAND (SC-Dry) with Gravel, Moderate Calcareous Cementation 19.0
Medium Dense Brown SILTY SAND (SM-Dry) 24.0
Hard Brown to Light Brown SANDY LEAN CLAY (CL-Dry to Moist) with Trace Moderate to Strong Calcareous Cementation 27.0
Brown SANDY CLAY 30.0
Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry to Moist) 34.0
Very Stiff Brown to Light Brown SANDY SILTY CLAY (CL/ML-Dry) with Weak to Moderate Calcareous Cementation 39.0
Medium Dense Light Brown WELL-GRADED SAND (SW-Dry to Moist) with Little Silt 44.0
Stiff Brown SANDY CLAY (CL-Moist) with Weak Calcareous Cementation 50.0
Medium Dense Brown POORLY GRADED SAND with SILT (SP/SM-Dry) 51.5
End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
S-1	2.5	NT	NT
RS-2	6.0	12.5	103.6
S-3	11.5	NT	NT
RS-4	15.8	20.3	93.1
S-5	21.5	NT	NT
S-6	26.5	NT	NT
S-7	31.5	NT	NT
S-8	36.5	NT	NT
S-9	41.5	NT	NT
S-10	46.5	NT	NT
S-11	51.5	NT	NT



Boring Date: **8-8-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

Water Level

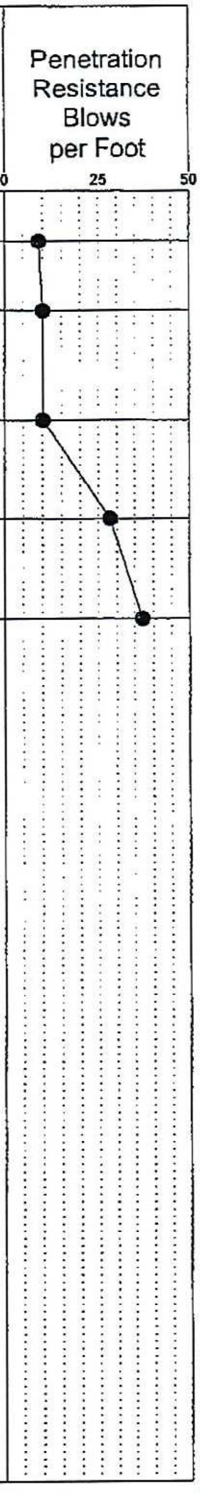
Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

Rig Type: **CME-75 4X4**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	
0	3" of Asphalt on 5" of Aggregate Base	0.7
	Stiff Dark Brown SANDY CLAY (CL-Moist)	5.0
5	Stiff Brown LEAN CLAY (CL-Moist)	9.0
10	Loose Brown SILTY SAND (SM-Dry to Moist)	14.0
15	Very Stiff to Hard Light Brown SANDY LEAN CLAY (CL-Dry) with Weak Calcareous Cementation	21.5
	End of Boring	

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
S-1	2.5	NT	NT
RS-2	6.0	19.6	94.1
S-3	11.5	NT	NT
S-4	16.5	NT	NT
S-5	21.5	NT	NT



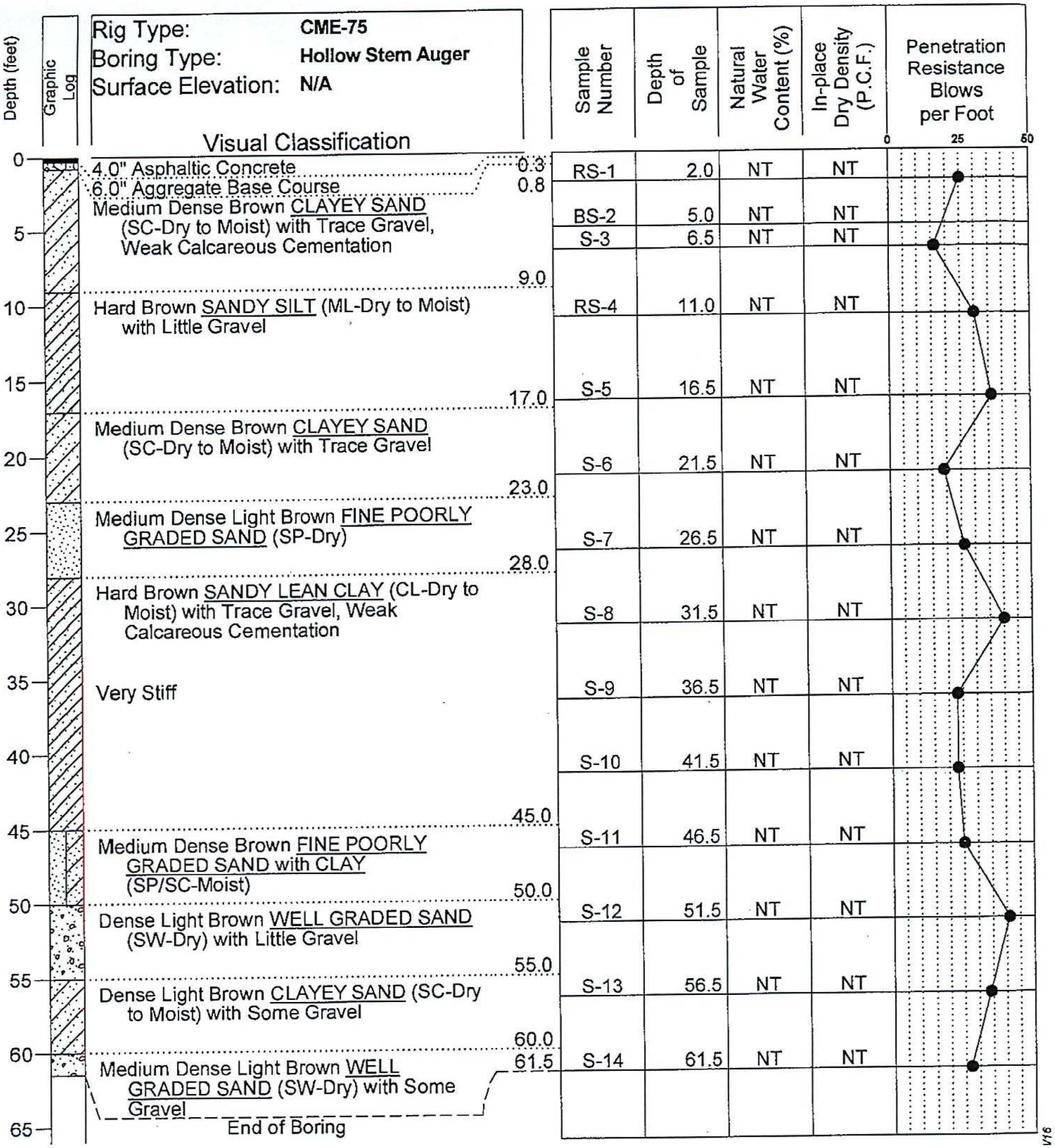
Boring Date: **8-8-07**
Field Engineer/Technician: **S. Sweeten**
Driller: **R. Quezada**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification

Depth (ft)	Visual Classification
0.3	4.0" Asphaltic Concrete
0.8	6.0" Aggregate Base Course
9.0	Medium Dense Brown CLAYEY SAND (SC-Dry to Moist) with Trace Gravel, Weak Calcareous Cementation
17.0	Hard Brown SANDY SILT (ML-Dry to Moist) with Little Gravel
23.0	Medium Dense Brown CLAYEY SAND (SC-Dry to Moist) with Trace Gravel
28.0	Medium Dense Light Brown FINE POORLY GRADED SAND (SP-Dry)
45.0	Hard Brown SANDY LEAN CLAY (CL-Dry to Moist) with Trace Gravel, Weak Calcareous Cementation Very Stiff
50.0	Medium Dense Brown FINE POORLY GRADED SAND with CLAY (SP/SC-Moist)
55.0	Dense Light Brown WELL GRADED SAND (SW-Dry) with Little Gravel
60.0	Dense Light Brown CLAYEY SAND (SC-Dry to Moist) with Some Gravel
61.5	Medium Dense Light Brown WELL GRADED SAND (SW-Dry) with Some Gravel

End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
RS-1	2.0	NT	NT
BS-2	5.0	NT	NT
S-3	6.5	NT	NT
RS-4	11.0	NT	NT
S-5	16.5	NT	NT
S-6	21.5	NT	NT
S-7	26.5	NT	NT
S-8	31.5	NT	NT
S-9	36.5	NT	NT
S-10	41.5	NT	NT
S-11	46.5	NT	NT
S-12	51.5	NT	NT
S-13	56.5	NT	NT
S-14	61.5	NT	NT

Boring Date: **1-19-16**
Field Engineer/Technician: **R. Markley**
Driller: **R. Hamm**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date	
Free Water was Not Encountered			▽
			▼

NT = Not Tested