FOUNDATION INVESTIGATION
MAGILL RESIDENCE
38TH Street and McKinley Boulevard
Sacramento, California

RANEY GEOTECHNICAL INC. JOB NO. 3294-001

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January 8, 2009

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403 38th Street
Sacramento, CA 95816

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INTRODUCTION

This firm has completed a Foundation Investigation for a residence planned to be constructed adjacent to the existing residence at 403 38th Street in Sacramento. The purpose of this investigation has been to provide data pertinent to design and construction of the proposed house. This report presents the results of the investigation.

Field exploration for this investigation has included the completion of two borings in the planned house area. Boring 1 was drilled with a truck mounted drill rig to a depth of 15 feet below the existing ground surface. Boring 2 was augured using hand equipment to a depth of about eight feet below the existing site grade. Both disturbed and relatively undisturbed soil samples were obtained from the borings for classification and laboratory testing. The boring locations are shown on Plate 1, *Plot Plan*; logs of the borings are shown on Plates 2 and 3, *Log of Boring*. The results of moisture content, dry unit weight and unconfined compressive strength tests are included on the logs at the depths of each sample tested. The nomenclature used to describe the soils on the logs is defined on Plate 4, *Unified Soil Classification System*.

PROPOSED CONSTRUCTION

We understand it is planned to split the property into two parcels for the future construction of a new residence on the northerly half. The new house would be expected to be of one or two story wood frame construction with a footprint area similar to the existing residence. The new house would be set back about 60 feet from 38th Street. The new house foundation loads are expected to be light and common to this type of construction.

SITE CONDITIONS

SURFACE

The 403 38th Street parcel encompasses about one-half acre on the easterly side of 38th Street and about 100 feet southerly of McKinley Boulevard. The property is bordered on the north, east and south by

existing homes. Most of the property lines are delineated by wood fences. A concrete masonry fence exists along a portion of the northerly property line. The existing 403 38th Street residence is a wood frame structure occupying the southerly half of the property. A six-foot wood fence separates the westerly front and easterly backyard halves of the northerly portion of the property. Most of the northerly half between the fence and the street supports a portland cement concrete driveway that is partially overlaid with asphalt concrete. Some rose bushes and grass are between the driveway and the northerly property line. The remainder of the northerly half easterly of the fence is covered with mowed weeds and a few fruit trees growing along the edges. A review of aerial photographs indicates that this portion of the parcel formerly supported a garage and gardens. The northerly edge of this area appears to be slightly depressed below surrounding grades. The owner has indicated that an east-west trending slough is believed to have previously crossed this area.

SUBSURFACE

Both test borings encountered loose to very loose fill materials on the surface and extending to depths on the order of six feet. The fills were observed to consist of interlayered dark brown and light brown fine sandy silts and very silty fine sands with occasional gravel and brick rubble. These fills may represent backfill of a former swale or slough, or may be related to excavations made for demolition of previous construction.

Beneath the fill and extending to a depth of about eight feet, loose/medium stiff gray-brown and rust fine sandy clayey silts and loose, light gray-brown fine to medium sands were observed. From eight feet to the 15-foot maximum boring depth, stiff to hard/dense and variably cemented gray-brown to light brown clayey fine sandy silts and silty fine sandy clays were encountered.

CONCLUSIONS

BEARING CAPACITY

The fills present to maximum depths of at least six feet are loose and poorly compacted. In their present state these fills would be expected to settle over an indefinite period of time, and are not considered suitable for support of the house construction. The native undisturbed soils beneath the fills are indicated to be of moderate strength and are considered capable of supporting the planned residential construction with negligible settlements. Engineered fills placed and compacted in accordance with our recommendations also are expected to be capable of supporting the planned improvements.

Support of the house may be accomplished by overexcavation of the old fill materials and replacement as engineered fill. With the old fill soils properly recompacted, the proposed house may be supported on conventional shallow spread foundations. Alternatively, the old fill materials may be left in place and the house supported on deep foundations that extend through the old fills and bear on the firm native soils at depth. We note that with the deep foundation alternative, any floor slabs supported on the existing fills are likely to settle significantly over time. Alternative recommendations for either overexcavation and recompaction of old fill materials together with use of shallow foundations, or use

of deep foundations that extend through the old fill, are presented in the earthwork and foundation sections below. The foundation alternative may be chosen on the basis of economics and architectural design considerations.

EXPANSIVE SOILS

The near surface soils consist of low plasticity silts and sands that have low expansion potential. Expansive soils are not expected to have a significant effect on the planned house construction.

GROUNDWATER

Groundwater was not encountered in the test borings completed for this investigation. The permanent groundwater table in the area normally is present at depths on the order of 25 feet below the existing ground surface. Our experience indicates that groundwater levels can fluctuate with rainfall and and stage of the nearby American River. During extreme rainfall years with prolonged high river stages, groundwater can rise to within several feet of the ground surface level. During high rainfall years we have observed groundwater on nearby sites as high as about six feet below the ground surface. Based on our observations, we conclude that groundwater will remain several feet below the ground surface and should not have a significant effect on the completed construction. Any deep utility or other construction excavations approaching six feet in depth may encounter groundwater during extreme rainfall conditions.

Because of their relatively low permeability, the surface soils can retain high moisture contents during the wet season. High moisture content soils can be unstable under construction equipment and would require considerable aeration in order to achieve a moisture content that will allow compaction. The prospect of high moisture content conditions and unstable surface soils should be considered in scheduling of earthwork construction.

The variably cemented and clayey soils at depth are of relatively low permeability and prevent vertical drainage of the overlying soils. During the wet season, precipitation percolating into the surface soils can become perched on top of the cemented and clayey soils, and form a seasonal, localized shallow water table. Foundation or other construction excavations approaching the clayey and cemented soil horizons may experience perched water inflow if attempted during or shortly following the wet season.

For a better understanding of subsurface conditions, reference should be made to Plates 2 and 3, *Log of Boring*.

RECOMMENDATIONS

EARTHWORK CONSTRUCTION

The construction areas should be cleared of any surface vegetation, trees, shrubs, stumps, significant root systems, fences, foundations, slabs, rubble pieces exceeding three inches in maximum dimension, rubbish, and any other existing construction or debris. Underground pipes within two feet of original

or final grade should be removed. Any abandoned underground pipes exceeding two inches in diameter should be removed regardless of depth.

If the house will be supported on shallow spread foundations, then all existing fills should be removed from the building pad area. For earthwork purposes the building pad is defined as extending five feet outside building wall lines, or to the outer edges of any adjacent portland cement concrete flatwork, whichever is greater. This is expected to require excavation to depths of up to about six feet below the existing ground surface over most of the new house area.

Any excavations required for removal of the above items should be cleaned of loose, saturated or soft materials so that firm undisturbed soils are exposed. Deep excavations required for the removal of the above items should be sloped back to a dish-shaped configuration allowing through passage of compaction equipment and backfilled with engineered fill placed and compacted in accordance with the following recommendations.

Following clearance, areas designated to receive engineered fill as well as building pad and new driveway or slab subgrades completed in excavation or left at existing grade should be scarified to a depth of eight inches, brought to a uniform near optimum moisture condition and recompacted in place to at least 90 percent of the maximum dry density determined by ASTM D1557-02 test procedure.

Engineered fill should be placed in lifts not exceeding six inches in compacted thickness, brought to a uniform near optimum moisture content, and compacted to at least 90 percent in accordance with the above standard. On site soils, including existing fill materials that have been overexcavated, are suitable for use as engineered fill provided they are processed to remove significant organic matter, rubble, rubbish, or other undesirable substances. Imported fill materials should have a plasticity index of ten or less and should be approved by our firm prior to importation to the site.

The upper six inches of all final pavement/slab subgrades should be compacted to at least 90 percent of the ASTM D1557-02 maximum dry density regardless of whether final subgrade elevation is attained by filling, cutting, or is left at existing grade.

A representative of this firm should be present during grading operations to aid in identifying old fill materials that must be recompacted, and to test and observe earthwork construction.

FOUNDATIONS

The proposed house may be supported on continuous and/or isolated shallow spread foundations based on a building pad that has been cleared of all old fill materials and built with compacted engineered fill placed in accordance with the recommendations of this report. Alternatively, the house may be supported on deep spread or pier foundations that extend through the existing fills and bear on the underlying native undisturbed soils.

Shallow Spread Foundations

Shallow spread foundations may be based on native undisturbed soils or engineered fills placed and compacted in accordance with the recommendations of this report. Foundations for single story

structures should extend at least 12 inches below the soil building pad or surrounding soil grade level, whichever is lower. Foundations for two story structures should extend to a minimum depth of 18 inches. All foundations should have a minimum width of 12 inches. Foundations so established may be sized for maximum allowable bearing pressures of 2100 pounds per square foot (psf) for dead plus live load, or 2800 psf for total load, including the effects of wind and seismic forces. The weight of foundation concrete may be disregarded in sizing computations.

Deep Foundations

If the existing loose fill materials are left in place, then the house should be supported on foundations extending through the fill and penetrating at least four inches into native undisturbed soils. Such foundations may consist of conventionally excavated deepened spread foundations, or drilled cast-in-place concrete piers, or a combination of spread foundations and piers. The foundations should extend to the depth necessary to achieve the required bearing in undisturbed soils, and should extend at least 18 inches below the lowest surrounding soil grade level. All foundation excavations should be observed by our representative prior to concrete placement to verify that appropriate bearing soils are engaged. All foundations should have a minimum width of 12 inches. Foundations so established may be sized for maximum allowable bearing pressures of 2500 pounds per square foot (psf) for dead plus live load, or 3200 psf for total load, including the effects of wind and seismic forces. The weight of foundation concrete may be disregarded in sizing computations.

General Requirements

Continuous foundations should contain at least four No. 4 reinforcing bars – two each, top and bottom, as a minimum.

Resistance to lateral forces may be computed using either friction or passive pressure, but not both, except as recommended below. A coefficient of friction of 0.25 acting between the bases of the footings and the supporting subgrades may be utilized for design. Passive resistance for existing soils or properly compacted fills acting against appropriate faces of spread foundations may be considered equivalent to a fluid weighing 250 pounds per cubic foot. A combination of both friction and passive pressure may be utilized provided that the larger mode of resistance is reduced by 50 percent. The recommended friction and passive pressure values have been modified by appropriate factors of safety and may be applied directly in design.

Foundation excavations should be clean and free of all loose and/or soft materials, and the bearing materials should be in a firm, moist condition when foundation concrete is placed.

SEISMIC DESIGN

In design using the lateral force provisions of the 2007 California Building Code, the parameters in Table 1 are considered appropriate for this site.

TABLE 1

Period (seconds)	Mapped Spectral Response Accelerations (g)		Site Class	Site Coefficients		Maximum Considered Earthquake Spectral Response Accelerations (g)		Design Spectral Response Accelerations (g)	
0.2	S_S	0.562	D	F_a	1.351	S_{MS}	0.759	S_{DS}	0.506
1	S_1	0.236		F_v	1.927	S_{M1}	0.455	S_{D1}	0.303

SLAB-ON-GRADE FLOORS

If left in place, the existing loose fills are likely to settle over time. If the house will have a concrete slab-on-grade floor, we suggest the old fills be removed and replaced as compacted engineered fill. If the existing fills are left as is, interior floor slabs as well as any exterior patios or walkways can be expected to settle. Use of reinforcement, such as No. 3 bars spaced on 15-inch centers in each direction, can reduce cracking associated with settlement of the supporting subgrade. The reinforcement should be chaired at or above the middepth of the slab.

Interior concrete slab-on-grade floors should be underlain by a minimum four-inch thick blanket of free draining granular material to serve as a capillary moisture barrier. The granular material should be graded such that 100 percent will pass a one-inch sieve and none will pass a No. 4 sieve. A plastic membrane at least ten-mils thick should be provided to retard moisture vapor migration beneath living area floor slabs. The membrane may be placed either above or below the gravel layer. If placed over the gravel layer, one to two inches of clean sand may be spread over the membrane for protection, if desired.

The flooring adhesives in current use are extremely sensitive to slab moisture. Recent experience suggests that even with the recommended membrane, some floors may still be susceptible to moisture vapor problems, particularly with impermeable floor coverings such as sheet vinyl, rubber, and wood/wood laminates. To minimize slab moisture problems, care must be taken to ensure that the gravel layer is at least four inches thick throughout the slab area, and that the vapor membrane is continuous beneath the extent of the slab. The membrane should overlap at least 12 inches and should be cut tight around all plumbing stands and other penetrations. All punctures and tears should be sealed with membrane manufacturer-approved sealing tape or overlain by a patching membrane. Use of proprietary membrane systems that include materials for sealing seams and penetrations can improve resistance to vapor penetration. Vehicle traffic should not be allowed on the membrane; foot traffic should be minimized. The under-slab and and gravel layers should be protected from precipitation and

other moisture; wetting of the sand over the membrane prior to concrete placement should be minimized. If greater assurance against moisture problems is desired, consideration should be given to the use of a quality commercial concrete sealant. We strongly urge use of a sealant or other water proofing system beneath wood and other highly moisture sensitive flooring.

LIMITATIONS

This report necessarily assumes uniform variation of soils between borings. Our recommendations are based upon this assumed uniformity and the information provided regarding the proposed construction. If unusual conditions are encountered during construction, the contractor or his representative should notify this firm immediately so that alternate written recommendations can be made.

This report is applicable only to the proposed residence, as described herein, and should not be utilized for design or construction on any other site.

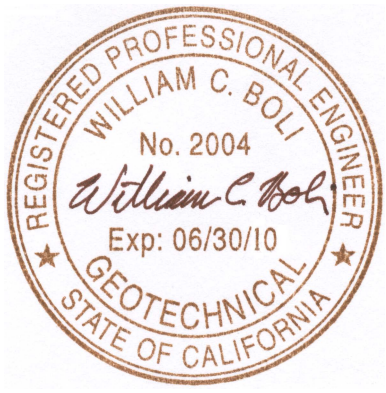
oOo

The following Plates are attached and complete this report:

Plate 1 - Plot Plan
Plate 2 - Log of Boring, Boring 1
Plate 3 - Log of Boring, Boring 2
Plate 4 - Unified Soil Classification System

Sincerely,

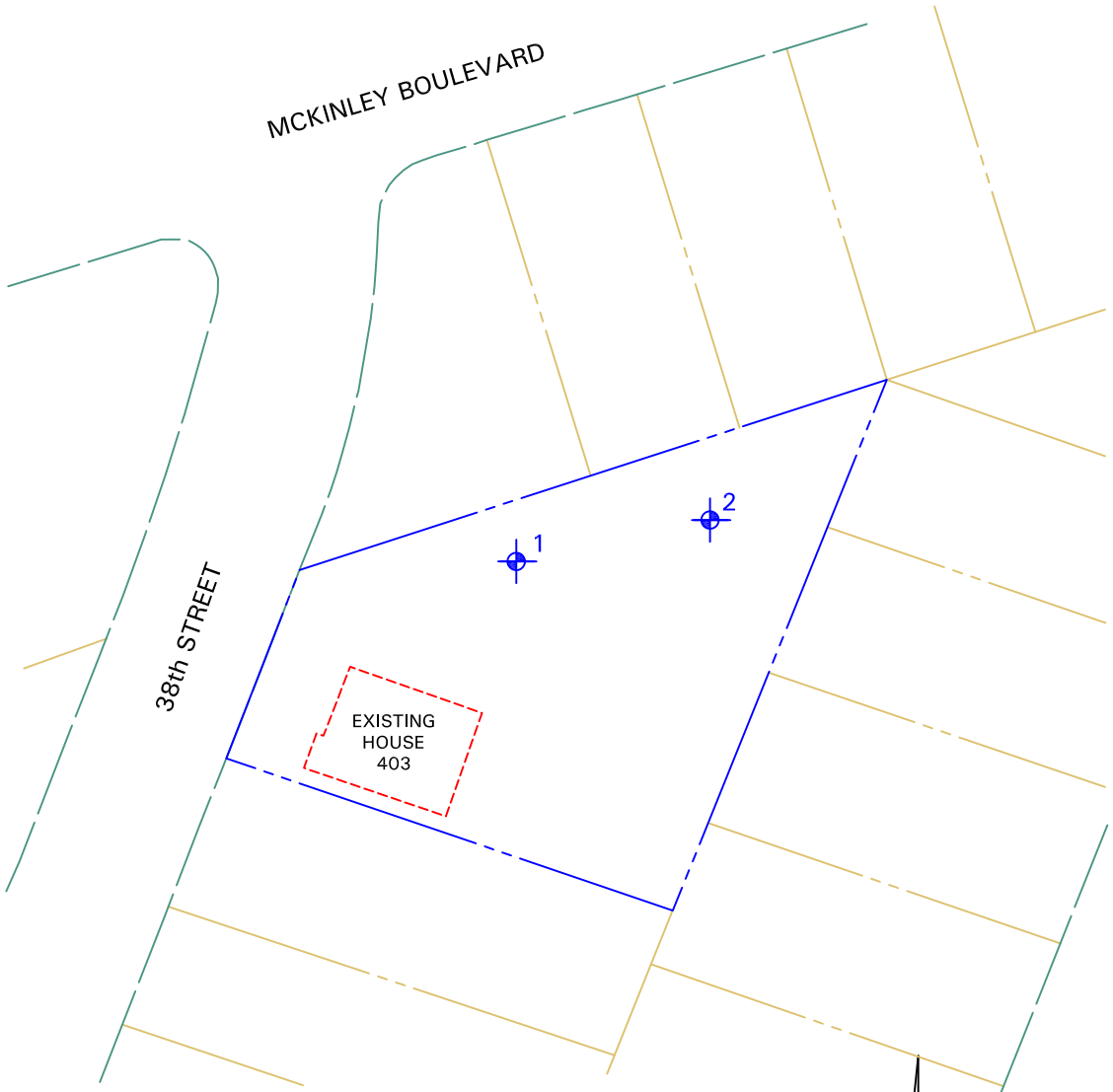
RANEY GEOTECHNICAL INC.



William C. Boli
Geotechnical Engineer No. 2004

(5) addressee

PROJECT NUMBER: 3294-001 DRAWN BY: WCB
PLATE NUMBER: 1 DATE: 1/2/09



KEY:

2 BORING LOCATION

NOTES:

1. BORING LOCATIONS SHOWN ARE APPROXIMATE ONLY.

2. PREPARED FROM AN ASSESSORS PARCEL MAP.

APPROXIMATE SCALE

0 30 60
FEET

PLOT PLAN

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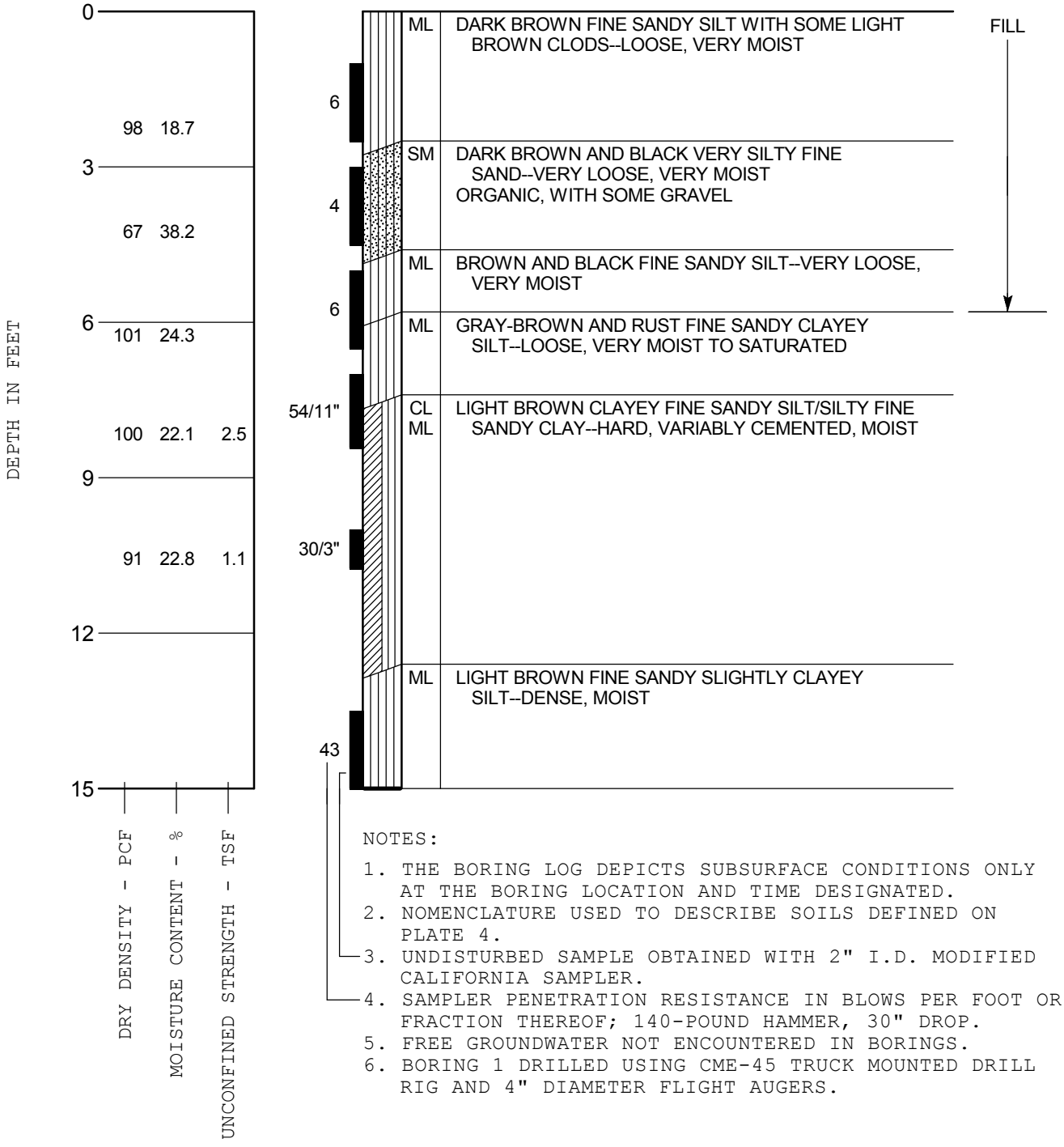
PROJECT NUMBER: 3294-001 DRAWN BY: WCB
PLATE NUMBER: 2 DATE: 12/31/08

BORING 1

DRILLED: 12/11/08



NOTES:

1. THE BORING LOG DEPICTS SUBSURFACE CONDITIONS ONLY AT THE BORING LOCATION AND TIME DESIGNATED.
2. NOMENCLATURE USED TO DESCRIBE SOILS DEFINED ON PLATE 4.
3. UNDISTURBED SAMPLE OBTAINED WITH 2" I.D. MODIFIED CALIFORNIA SAMPLER.
4. SAMPLER PENETRATION RESISTANCE IN BLOWS PER FOOT OR FRACTION THEREOF; 140-POUND HAMMER, 30" DROP.
5. FREE GROUNDWATER NOT ENCOUNTERED IN BORINGS.
6. BORING 1 DRILLED USING CME-45 TRUCK MOUNTED DRILL RIG AND 4" DIAMETER FLIGHT AUGERS.

LOG OF BORING

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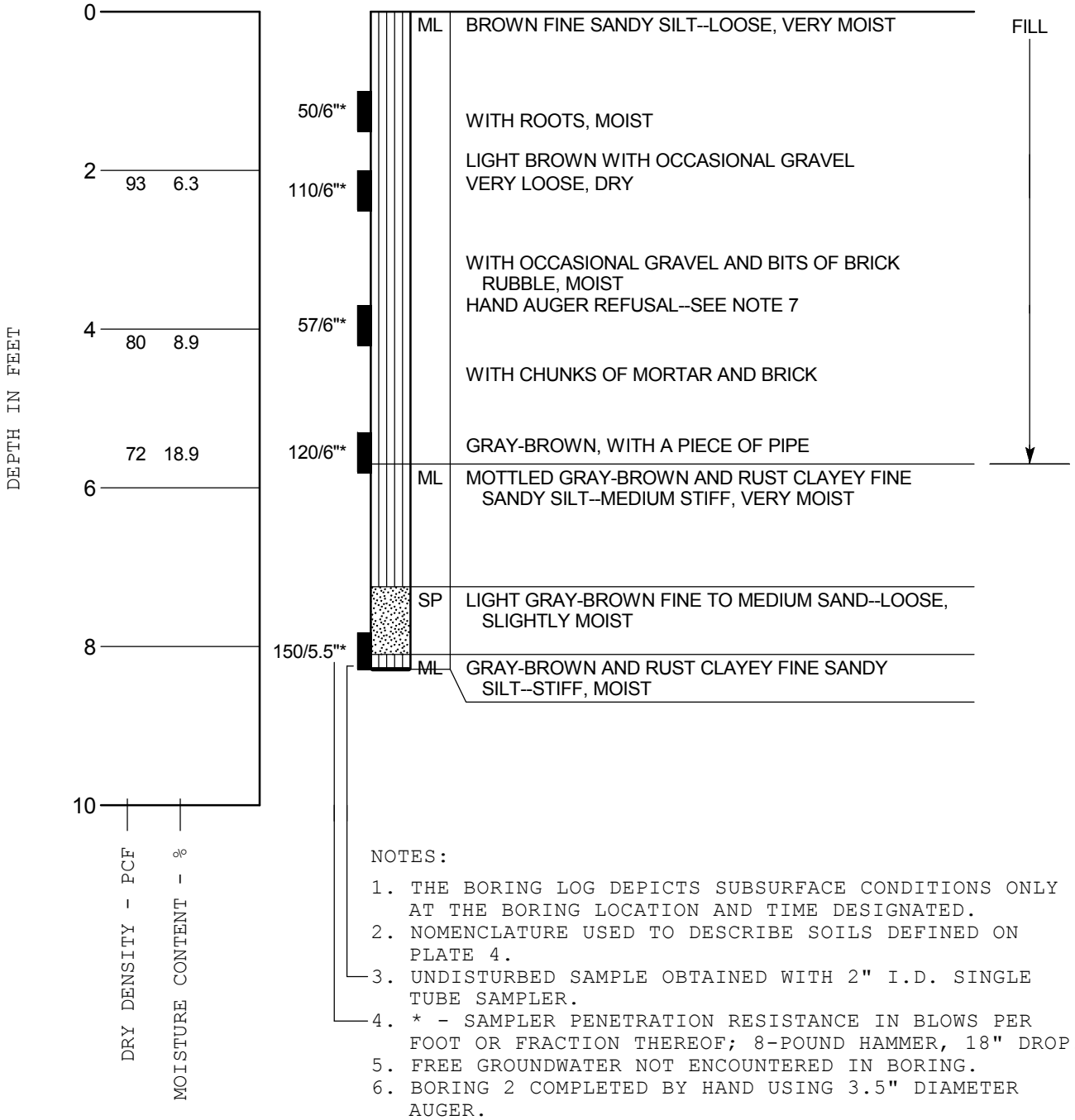
PLATE 2

PROJECT NUMBER: 3294-001
PLATE NUMBER: 3

DRAWN BY: WCB
DATE: 12/31/08

BORING 2

DRILLED: 12/30/08



NOTES:

1. THE BORING LOG DEPICTS SUBSURFACE CONDITIONS ONLY AT THE BORING LOCATION AND TIME DESIGNATED.
2. NOMENCLATURE USED TO DESCRIBE SOILS DEFINED ON PLATE 4.
3. UNDISTURBED SAMPLE OBTAINED WITH 2" I.D. SINGLE TUBE SAMPLER.
4. * - SAMPLER PENETRATION RESISTANCE IN BLOWS PER FOOT OR FRACTION THEREOF; 8-POUND HAMMER, 18" DROP.
5. FREE GROUNDWATER NOT ENCOUNTERED IN BORING.
6. BORING 2 COMPLETED BY HAND USING 3.5" DIAMETER AUGER.
7. AT ORIGINAL LOCATION BORING 2 ENCOUNTERED REFUSAL ON RUBBLE AT 41" DEPTH. REAUGURED BORING ONE FOOT TO NORTH AND ENCOUNTERED REFUSAL ON RUBBLE AT SAME DEPTH. MOVED FIVE FEET TO SOUTH WEST AND ENCOUNTERED REFUSAL ON RUBBLE AT 18" DEPTH. MOVED 12 FEET TO SOUTHWEST AND REAUGURED TO 41", THEN CONTINUED BORING TO COMPLETION.

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LOG OF BORING

PLATE 3

PROJECT NUMBER: 3294-001
PLATE NUMBER: 4

GRAPH	SYMBOL	DESCRIPTION	MAJOR DIVISIONS		
	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES	CLEAN GRAVELS WITH LESS THAN 5% FINES	GRAVEL AND GRAVELLY SOILS	COARSE GRAINED SOILS MORE THAN 50% LARGER THAN NO. 200 SIEVE
	GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES			
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	GRAVELS WITH MORE THAN 12% FINES	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES			
	SW	WELL GRADED SANDS, GRAVELLY SANDS	CLEAN SANDS WITH LESS THAN 5% FINES	SANDS AND SANDY SOILS	
	SP	POORLY GRADED SANDS, GRAVELLY SANDS			
	SM	SILTY SANDS, SAND-SILT MIXTURES	SANDS WITH MORE THAN 12% FINES	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES			
	ML	INORGANIC SILTS, ROCK FLOUR, OR CLAYEY SILTS WITH SLIGHT PLASTICITY	LIQUID LIMIT LESS THAN 50	SILTS AND CLAYS	FINE GRAINED SOILS MORE THAN 50% SMALLER THAN NO. 200 SIEVE
	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			
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTS, ELASTIC SILTS	LIQUID LIMIT GREATER THAN 50	SILTS AND CLAYS	
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS			
	OH	ORGANIC CLAYS AND ORGANIC SILTS OF MEDIUM TO HIGH PLASTICITY			
	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT	HIGHLY ORGANIC SOILS		

UNIFIED SOIL CLASSIFICATION SYSTEM

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PLATE 4