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08/25/15

CERTIFIED TESTING SERVICES, INC.

GEOTECHNICAL ENGINEERING REPORT

LEC ENTRANCE PLAZA IMPROVEMENTS
SIOUX CITY, IOWA

CTS PROJECT NO. G4489

I hereby certify that this engineering document was prepared by me or under by direct personal supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Iowa.

Signature: James A. Bertsch 8-31-2015
Name: James A. Bertsch, P.E. (date)

My license renewal date is December 31, 2016.

Pages or sheets covered by this seal:

This bound report contains 23 pages, including this page.

CTS File No. G4489

Certified Testing Services, Inc.
419 W. 6th Street • P.O. Box 1193 • Sioux City, Iowa 51102 • Phone (712) 252-5132

August 31, 2015

Attn: Mr. Kenny Schmitz
Building Services Super
Woodbury County
Woodbury County Courthouse
620 Douglas Street
Sioux City, Iowa 51101

Re: Geotechnical Engineering Report
LEC Entrance Plaza Improvements
Sioux City, Iowa
CTS Job No. G4489

Dear Mr. Schmitz:

Certified Testing Services, Inc. is pleased to transmit our Geotechnical Engineering Report for the referenced project. This report includes the results of field and laboratory testing, and recommendations for foundation design, as well as general site development.

We appreciate the opportunity to perform this Geotechnical Study and look forward to continued participation during the design and construction phases of this project. If you have any questions pertaining to this report or if we may be of further service, please contact our office.

Respectfully submitted,
CERTIFIED TESTING SERVICES, INC.

Matthew R. Dailey, P.E. IA 19700
Staff Engineer

James A. Bertsch, P.E. IA 12121
Senior Geotechnical Engineer

MRD/JAB/jb

cc: RML Architects L.L.C.

GEOTECHNICAL ENGINEERING REPORT

LEC ENTRANCE PLAZA IMPROVEMENTS
SIOUX CITY, IOWA

CTS PROJECT NO. G4489

PREPARED FOR

ATTN: MR. KENNY SCHMITZ
BUILDING SERVICES SUPER
WOODBURY COUNTY
WOODBURY COUNTY COURTHOUSE
620 DOUGLAS STREET
SIOUX CITY, IOWA 51101

AUGUST 31, 2015

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PROJECT INFORMATION

Project Authorization

Certified Testing Services, Inc. has completed a subsurface exploration for the above referenced project. Our work was approved by the Woodbury County Commissioners at the August 18, 2015 meeting. This work was performed in accordance with CTS Proposal Number 3479 dated August 12, 2015.

Project Description

Mr. Mike Neswick of RML Architects L.L.C. presented project information through a telephone conversation and e-mails on August 11, 2015. The e-mails included Sheet A1 that was dated July 2, 2015, and titled, "Existing Spot Elevations, Law Enforcement Center Entrance Plaza", Sheet A1 that was dated July 2, 2015, and titled, "Option 1", and Sheet A1 that was dated July 2, 2015, and titled, "Option 2". CTS understands that the existing stairs and handicap ramp will be removed and replaced. CTS also understands that there will be 3 feet to 4 feet high retaining walls on frost depth footings.

Purpose and Scope of Services

The purpose of this study was to explore the subsurface conditions at the site to prepare recommendations for foundation systems for the proposed construction. Our original scope of services included coring two locations in the area of the stairs and performing hand auger borings through the cored locations to 10 feet below the existing top of concrete and a hand auger boring to a depth of 5 feet below the top of grade in the proposed new handicap ramp area. However, hand auger refusal was met in Boring 3 at 3.5 feet and an additional core was performed and then the boring was completed to the original depth. The scope of work also included select laboratory testing and preparation of this geotechnical report. This report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions and presents recommendations regarding the following:

- Suitability of site for the construction of the proposed project
- Site preparation and grading procedures for project
- Foundation types, depths, allowable bearing capacities and estimate for potential settlement
- Comments regarding factors that will impact construction and performance of the proposed construction

The scope of services does not include an environmental assessment of the site.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The improvements will be located on the south side of the existing LEC Building in Sioux City, Iowa. The improvement area is bordered by the existing building to the north, 7th Street to the south, Douglas Street to the west, and the Pioneer Bank to the east.

At the time of drilling, the surface at the boring locations was covered with landscape material at Boring B1, 4.75-inch concrete layer at Boring B2 and 4-inch concrete layer underlain by a 2-inch Styrofoam layer at Boring B3.

Subsurface Conditions

The site subsurface conditions were explored with three soil borings hand augered to depths varying from 5 feet to 10 feet below the existing ground surface in the proposed improvement area.

The boring locations and depths were chosen by CTS personnel after discussions with Mr. Mike Neswick of RML Architects. The approximate locations of the borings are indicated on the "Boring Location Plan" included in the Appendix, which is a modified version Sheet A1 that was titled, "Existing Spot Elevations". The surface elevations at the boring locations were determined in the field using conventional leveling techniques and are for general reference only. The top of slab at the center of the entrance door was used as a benchmark and an elevation of 104.53 feet was provided for the benchmark on Sheet A1.

The borings were advanced utilizing hand auger drilling methods and soil samples were routinely obtained during the drilling process. Select soil samples were later tested in the laboratory to determine the materials properties for our evaluation. Drilling, soil sampling and the laboratory testing were accomplished generally in accordance with ASTM procedures.

The subsurface conditions below the surface material consisted of silt fill material. The soil properties of the fill material are presented in the following table:

Material	Moisture Content (%)	Dry Density (PCF)	Saturation (%)	Hand Pen. (TSF)	Cone Penetrometer (Bows Per 1 ¾ Inches)
Silt Fill	13 to 23	91 to 101	53 to 76	1.0 to 3.5	7 to 25

The boring logs included in the Appendix should be reviewed for specific information at the individual boring locations. These records include soil/rock descriptions, stratifications, penetration resistances, and locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring

locations. Variations may occur and should be expected at other locations across the site. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations are also shown on the boring logs. The samples that were not altered by laboratory testing will be retained for 30 days from the date of this report and then will be discarded.

Water Level Measurements

Free water was not encountered at the time of drilling. Water levels should be expected to fluctuate with changes in climatic conditions. The water level measurements presented in this report are the levels that were measured at the time of our field activities.

EVALUATIONS AND RECOMMENDATIONS

Geotechnical Discussion

The main concern from a geotechnical standpoint is the existing undocumented fill material that was encountered to the depths explored in the borings. The fill material consisted of silt that had moisture contents that varied from 13 percent to 23 percent, dry densities that varied from 92 PCF to 101 PCF, cone penetration test results that varied from 7 blows for 1¾ inches to 25 blows for 1¾ inches, and percent compaction that varied from 88 percent to 97 percent of ASTM D698. Based on this, it is CTS's opinion that the existing undocumented fill is likely part of the foundation backfill for the building basement and was not placed in a consistent manner and is not suitable for support of the proposed structure. CTS recommends that existing fill material be removed to natural material or to competent fill material meeting the compaction recommendations of the "Site Preparation" section of this report and replaced with new structural fill meeting the recommendations of the "Site Preparation" section of this report. If the owner is willing to assume some risk of movement, the improvements may be placed on a minimum of 3 feet of new structural fill meeting the "Site Preparation" section of this report. If the owner is not willing to assume the risk of movement the fill should be removed and replaced with new structural fill material meeting the recommendations of the "Site Preparation" section of this report. In that the existing undocumented fill material is highly varied, it is impossible to estimate the amount of settlement that could occur in the future based on the improvements being placed on 3 feet of new structural fill. An alternate to supporting the improvements on grade would be to support the retaining walls and stairs on a deep foundation system consisting of helical anchors.

The seismic site classification for the site soils, in accordance with IBC 2003, is a Class E. Due to the low seismic activity in the area, we are not aware of special designs or details for foundation structures due to seismic action.

Site Preparation

CTS recommends that concrete, vegetation, roots, landscaping material, soft material, organic material, material containing frost and unsuitable soils in the construction areas be

stripped from the site and either wasted or, if suitable, stockpiled for later use in landscaping. The existing silt material is suitable for use as structural fill. A representative of the geotechnical engineer should determine the depth of removal at the time of construction.

After subgrade preparation and observation have been completed, as discussed in the "Geotechnical Discussion" section of this report, fill placement may begin. Fill materials in the improvement area should consist of silt that is free of organic or other deleterious materials, have a maximum particle size less than 3-inches, and have a liquid limit less than 45 and plasticity index less than 22. Granular material should not be used unless drains are provided that outlet to a suitable means of disposal.

Structural fill should be placed in maximum loose lifts of 4 inches for hand compaction equipment and 8 inches for riding compaction equipment and compacted to at least 95 percent of the material's standard Proctor maximum dry density. The silt material should be placed at a moisture content of from a minus 5 percent to a plus 2 percent of optimum moisture content as determined by ASTM D698. Every other lift of compacted-engineered fill should be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts.

Foundation Recommendations

The planned construction should be supported as discussed in the "Geotechnical Discussion" section. Spread footings for continuous footings for bearing walls can be designed for a net allowable soil bearing pressure of 2,000 PSF based on dead load plus design live load. Minimum dimensions of 24 inches for column footings, 12 inches for trenched footings and 18 inches for continuous footings should be used in foundation design to minimize the possibility of a local bearing capacity failure.

Exterior footings and footings in unheated areas should be located at a depth of 42 inches or deeper below the final exterior grade to provide adequate frost protection. If the building is to be constructed during the winter months or if footings will likely be subjected to freezing temperatures after foundation construction, then all footings should be protected from freezing. Interior footings should also extend down to the top of competent glacial till.

The foundation excavations should be observed by a representative of CTS prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Soft or loose soil zones encountered at the bottom of the footing excavations should be removed to the level of competent naturally deposited soils or properly compacted structural fill as directed by the geotechnical engineer.

After opening, footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, the foundation concrete should be placed during the same day the excavation is made. If it is

required that footing excavations be left open for more than one day, they should be protected to reduce evaporation or entry of moisture.

On-Grade Structures Recommendations

The on-grade structures such as sidewalks and stairs should be placed on new structural fill meeting the recommendations in the "Geotechnical Discussion" and "Site Preparation" sections of this report. Due to the silty nature of the soils, CTS recommends that sidewalks and stairs be supported on a minimum of 1.5 inches of extruded polystyrene foam board to minimize the potential for frost heave. The owner should be aware that the extruded polystyrene foam board will greatly reduce the amount of frost heave but frost heave may still occur. Granular material should not be placed under exterior slabs or sidewalks unless drains are installed to remove the water. This includes patios. Plants needing excessive water should also be avoided.

Below Grade Wall Design and Construction

The below grade walls, such as retaining walls will need to be designed to resist lateral earth pressures. Based on the types of subsurface materials encountered by the borings, equivalent fluid pressures of 60 pcf may be used as the horizontal components of the at-rest earth pressure on the below grade walls. An equivalent fluid pressure of 40 pcf may be used as the horizontal components of the active earth pressure on the freestanding below grade walls, which are permitted to rotate slightly and an equivalent fluid pressure of 300 pcf may be used as the horizontal components of the passive earth pressure. A friction factor for the base of 0.3 may be used for the base of below grade walls. These pressures are limited to a horizontal grade above the foundation wall and no additional pressures at the surface.

The values presented above were calculated assuming positive foundation drainage is provided to prevent the buildup of hydrostatic pressure. If surface loads are placed near the walls, such as traffic loads, they should be designed to resist an additional uniform lateral load of one-half of the vertical surface loads.

In that the surface will be mostly concrete, drains behind the walls will not be required. However, if they are installed, the drainage system should include a 4-inch or 6-inch diameter perforated draintile at the bottom of the backfill to collect seepage water with the tile connected to a suitable means of disposal. A clean 1½-inch or 1-inch gravel classified as "GW" and containing less than 5% passing a #200 sieve should surround the drain tile and extend to within 2 feet of the surface. A non-woven 4-ounce per square yard geotextile should be installed between the drainage material and the on-site soils to prevent infiltration of fine-grained soils into the draintile, granular drainage blanket, or granular backfill. A 2 feet thick silt cap should be placed at the surface to minimize infiltration of surface water.

CONSTRUCTION CONSIDERATIONS

CTS should be retained to provide observation and testing of construction activities

involved in the foundation, earthwork, and related activities of this project. CTS cannot accept responsibility for conditions that deviate from those described in this report, nor for the performance of the foundation system if not engaged to also provide construction observation and testing for this project.

Moisture Sensitive Soils and Weather Related Concerns

The upper fine-grained soils encountered at this site will be sensitive to disturbances caused by construction traffic and to changes in moisture content. Based on this, CTS recommends that light load bearing equipment be used to perform the site work.

Drainage and Groundwater Considerations

Water should not be allowed to collect in the excavations or on prepared subgrade of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the structures.

Free groundwater was not encountered at the time the field exploration was conducted and should not affect construction. It is possible that seasonal variations will cause fluctuations or a water table to be present in the upper soils. Additionally, perched water may be encountered in discontinuous zones within the overburden. Water should be removed from excavations by pumping. Should excessive and uncontrolled amounts of seepage occur the Geotechnical engineer should be consulted.

Excavations

In Federal Register, Volume 54, Number 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better enhance the safety of workers entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

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

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

REPORT LIMITATIONS

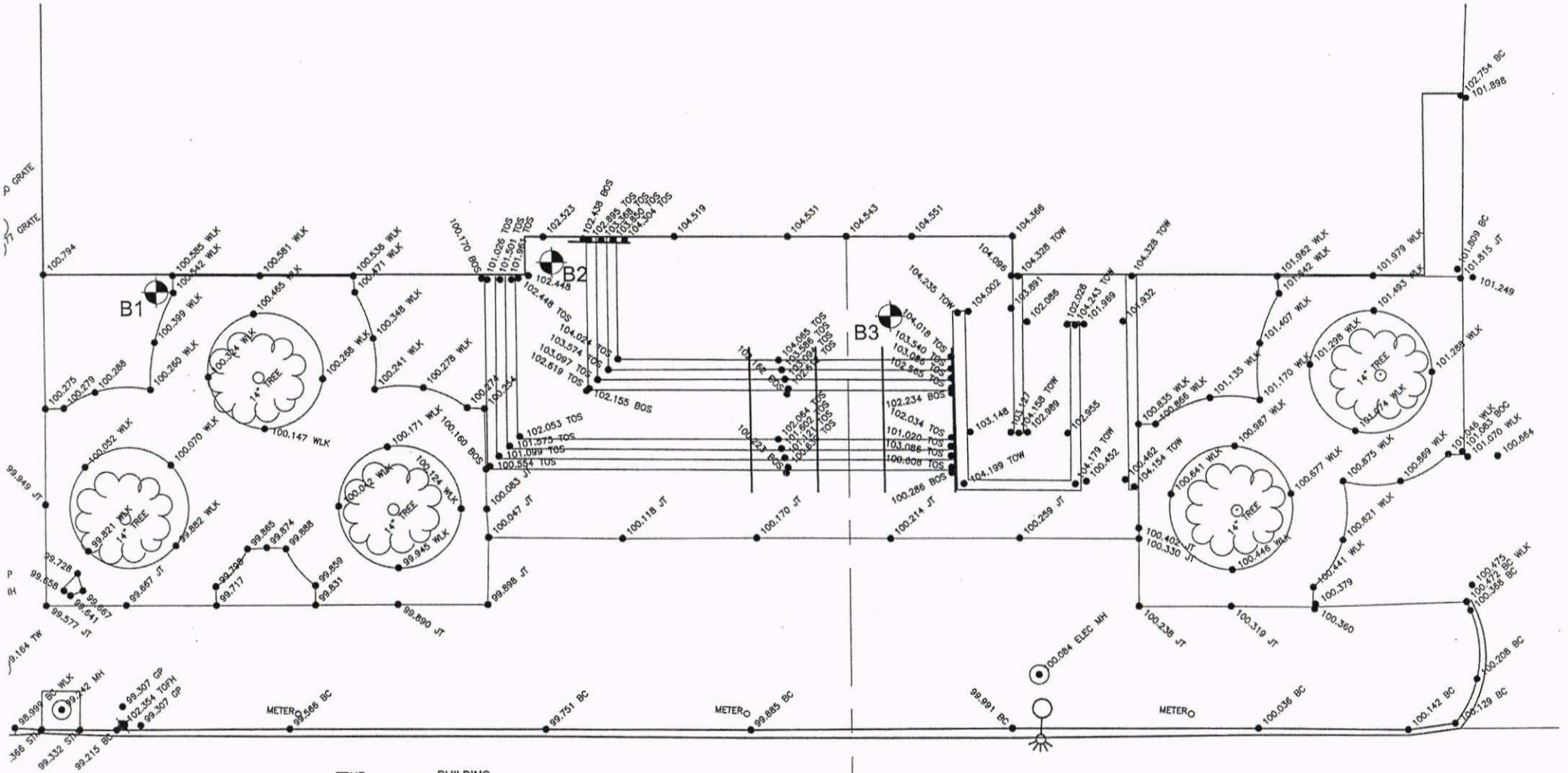
The recommendations submitted are based on the available subsurface information obtained by CTS and design details furnished by Mr. Mike Neswick of RML Architects L.L.C. If there are revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, CTS should be notified immediately to determine if changes in the foundation recommendations are required. If CTS is not retained to perform these functions, CTS will not be responsible for the impact of those conditions on the project.

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

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Woodbury County and their consultants for the specific application to the proposed LEC Entrance Plaza Improvements in Sioux City, Iowa.

APPENDIX

BORING LOCATION PLAN



TRUE NORTH

BUILDING NORTH

EXISTING SPOT ELEVATIONS
LAW ENFORCEMENT CENTER ENTRANCE PLAZA

SCALE:1" = 10'

BORING LOGS

LOG OF EXPLORATORY BORING

Job Number: G4489
Project: LEC Entrance Plaza Improvements
Date Started: 8/25/15
Date Completed: 8/25/15

Boring No.: B-1
Boring Location: Sioux City, IA
Drill Type: Hand Auger
Ground Elev.: 100.4

Shelby Tube | Standard Split Spoon | Water Level ATD
Modified California | Grab Sample | Water Level After 48 Hours

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	USCS	Blow Counts SPT (N) Blows/Foot	Moisture Content, %	Dry Density (PCF)	% Saturation	Hand Penetrometer (TSF)	Unconfined Comp. Strength (TSF)	Liquid Limit %	Plastic Limit %	Plasticity Index %	Cone Pentrometer (Blows Per 1-3/4 Inch)
			2-Inch Landscaping Mulch Layer FILL, Silt, Medium Brown, Moist											
			(Roots)			16								7
			(Clay Lumps)			13								25
5			END OF BORING AT 5 FEET FREE WATER WAS NOT ENCOUNTERED AT TIME OF DRILLING											

LOG OF EXPLORATORY BORING

Job Number: G4489
Project: LEC Entrance Plaza Improvements
Date Started: 8/25/15
Date Completed: 8/25/15

Boring No.: B-2
Boring Location: Sioux City, IA
Drill Type: Hand Auger
Ground Elev.: 102.3

Shelby Tube | Standard Split Spoon | Water Level ATD
Modified California | Grab Sample | Water Level After 48 Hours

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	USCS	Blow Counts SPT (N) Blows/Foot	Moisture Content, %	Dry Density (PCF)	% Saturation	Hand Penetrometer (TSF)	Unconfined Comp. Strength (TSF)	Liquid Limit %	Plastic Limit %	Plasticity Index %	Cone Pentrometer (Blows Per 1-3/4 Inch)
			4.75-Inch Concrete Layer											
			FILL, Silt, Medium Yellow Brown, Moist			13	101	54	3.50					
			(Sand Layers)											
						17	91	54	1.00					
5														
						18	94	64	1.00					
						21	94	71	1.00					
10			END OF BORING AT 10 FEET FREE WATER WAS NOT ENCOUNTERED AT TIME OF DRILLING											

LOG OF EXPLORATORY BORING

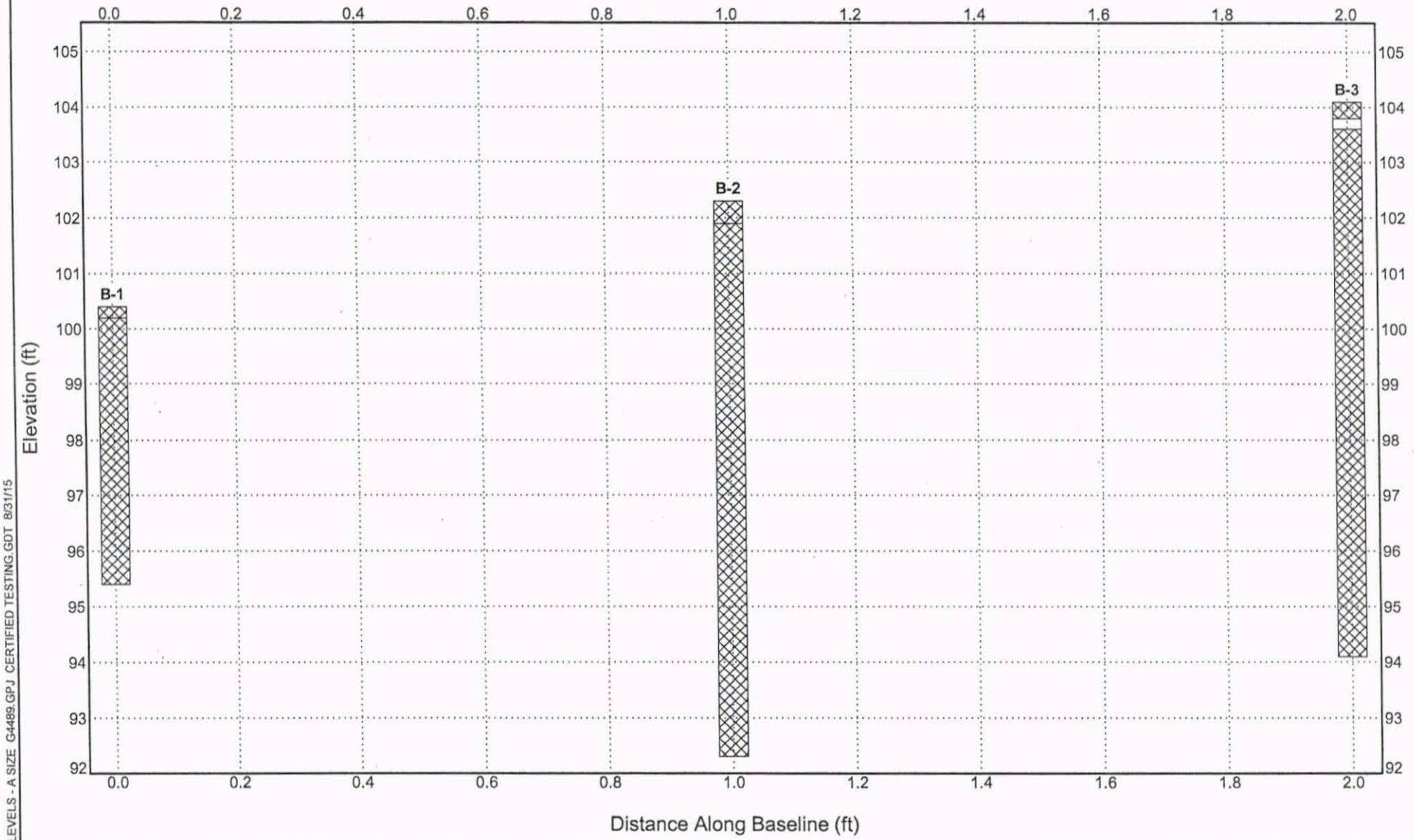
Job Number: G4489
Project: LEC Entrance Plaza Improvements
Date Started: 8/25/15
Date Completed: 8/25/15

Boring No.: B-3
Boring Location: Sioux City, IA
Drill Type: Hand Auger
Ground Elev.: 104.1

Shelby Tube | Standard Split Spoon | Water Level ATD
Modified California | Grab Sample | Water Level After 48 Hours

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	USCS	Blow Counts SPT (N) Blows/Foot	Moisture Content, %	Dry Density (PCF)	% Saturation	Hand Penetrometer (TSF)	Unconfined Comp. Strength (TSF)	Liquid Limit %	Plastic Limit %	Plasticity Index %	Cone Pentrometer (Blows Per 1-3/4 Inch)
			4-Inch Concrete Layer											
			2-Inch Styrofoam Layer											
			FILL, Silt, Medium Yellow Brown, Moist to Very Moist			19	96	68	3.00					
			(Medium Yellow Brown, Sand Layers)			17	97	62	1.00					
5						18	101	74	3.50					
						23	92	76	1.00					
10			END OF BORING AT 10 FEET FREE WATER WAS NOT ENCOUNTERED AT TIME OF DRILLING											

BORING PROFILES



LITHOLOGY AND WATER LEVELS - A SIZE G4489.GPJ CERTIFIED TESTING.GDT 8/31/15

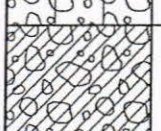
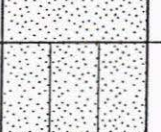
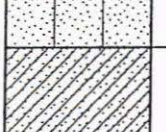
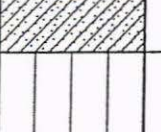
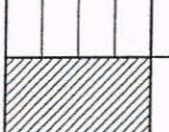
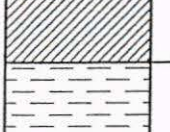
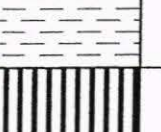
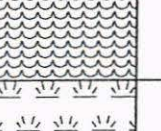
Certified Testing Services, Inc.
419 W. 6th Street, PO Box 1193
Sioux City, Iowa 51102
Telephone: 712-252-5132
Fax: 712-252-0110

LEC Entrance Plaza Improvements
Sioux City, IA

Project Number: G4489

SOIL CLASSIFICATION CHART AND GENERAL NOTES

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
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 SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

GENERAL NOTES

SAMPLING SYMBOLS:

	STANDARD PENETRATION TEST – 1 3/8: I.D., 2" O.D.
	SHELBY THIN-WALLED TUBE – 3" O.D. UNDISTURBED SAMPLE
	GRAB SAMPLE
	ROCK CORE
	AUGER SAMPLE
	NO RECOVERY

WATER LEVEL MEASUREMENT SYMBOLS:

	WATER LEVEL AT TIME OF DRILLING
	WATER LEVEL AFTER 7 DAYS

CONSISTENCY OF FINE-GRAINED SOILS	
UNCONFINED COMPRESSIVE STRENGTH, QU, PSF	CONSISTENCY
< 500	VERY SOFT
500 - 1,000	SOFT
1,001 - 2,000	MEDIUM
2,001 - 4,000	STIFF
4,001 - 8,000	VERY STIFF
8,001 - 16,000	HARD
> 16,000	VERY HARD

RELATIVE DENSITY OF COARSE GRAINED SOILS	
N-BLOWS/FT.	RELATIVE DENSITY
0 - 3	VERY LOOSE
4 - 9	LOOSE
10 - 29	MEDIUM DENSE
30 - 49	DENSE
50 - 80	VERY DENSE
80 +	EXTREMELY DENSE

RELATIVE PROPORTIONS OF SAND AND GRAVEL	
DESCRIPTIVE TERM(S) (OF COMPONENTS ALSO PRESENT IN SAMPLE)	PERCENT OF DRY WEIGHT
WITH	15 - 29
MODIFIER	> 30

GRAIN SIZE TERMINOLOGY	
MAJOR COMPONENT OF SAMPLE	SIZE RANGE
BOULDERS	OVER 12 IN. (300MM)
COBBLES	12 IN. TO 3 IN. (300 MM TO 75 MM)
GRAVEL	3 IN. TO #4 SIEVE (75MM TO 4.75MM)
SAND	#4 TO #200 SIEVE (4.75MM TO 0.075 MM)
SILT OR CLAY	PASSING #200 SIEVE (0.075MM)

RELATIVE PROPORTIONS OF FINES	
DESCRIPTIVE TERM(S) (OF COMPONENTS ALSO PRESENT IN SAMPLE)	PERCENT OF DRY WEIGHT
WITH	15 - 29
MODIFIER	> 30