

GEOTECHNICAL ENGINEERING REPORT

**PROPOSED PUBLIC WORKS FACILITY
IOWA CITY, IOWA**

**JOB NO. 06995251.01
February 18, 2000**

Prepared for:

**CITY OF IOWA CITY
Iowa City, Iowa 52240**

Prepared by:

**TERRACON
Cedar Rapids, Iowa 52406**

Terracon

February 18, 2000

Terracon

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City of Iowa City
Civic Center
410 East Washington Street
Iowa City, Iowa 52240

Attention: Mr. Charles J. Schmadeke, P.E.
Director of Public Works

RE: Geotechnical Engineering Report
Proposed Public Works Facility
Iowa City, Iowa
Job No. 06995251.01

Dear Mr. Schmadeke:

We are submitting the subsurface exploration results for the referenced project. The attached report presents the findings of the subsurface exploration and provides recommendations regarding the design and construction of the foundations, floor slabs, and pavement sections for the Public Works Facility, as well as preliminary recommendations for the proposed future development.

We appreciate the opportunity to be of service to you and look forward in assisting you during the construction phase. If you have any questions concerning this report, or if we may be of further service to you, please contact us.

Sincerely,
TERRACON



Brian F. Gisi, E.I.T., M.S.
Project Engineer

BFG:AMG/amdreports06995251.01

Enclosures

Copies to: Addressee (2)
Mr. Mark Logan, MMS Consultants (1)



Andre M. Gallet, P.E.
Iowa No. 13430

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GEOTECHNICAL ENGINEERING REPORT

PROPOSED PUBLIC WORKS FACILITY IOWA CITY, IOWA

JOB NO. 06995251.01

February 18, 2000

INTRODUCTION

Subsurface exploration for the proposed Public Works Facility to be located southwest of the intersection of Napoleon Lane and South Gilbert Street in Iowa City, Iowa has been completed. Thirty-seven (37) borings were proposed at this site; however, due to the inaccessibility of some borings, a total of thirty-five (35) soil borings were performed for this development. The individual boring logs and a Boring Location Diagram are included with this report. The purpose of this report was to obtain subsurface information and, based on this data, provide recommendations regarding the design and construction of the foundations, floor slabs, pavements, and general site preparation for the proposed Public Works Facility, as well as preliminary recommendations for a possible future expansion area.

PROJECT DESCRIPTION

It is our understanding the proposed development will be located southwest of the intersection of Napoleon Lane and South Gilbert Street in Iowa City, Iowa. The Public Works Facility will consist of the construction of four single-story structures, storage bins for sand and salt, a truck wash, and a fueling area. The single-story structures will consist of an approximate 40 foot by 160 foot office building, a 140 foot by 250 foot enclosed garage, a 100 foot by 140 foot combination equipment storage and warehouse building, and a 120 foot by 220 foot vehicle service shop. Structure load and loading conditions were not available at the time of this report; however, we have assumed the structures will be supported by load-bearing walls and individual columns with maximum loads on the order of about 2 to 4 kips per linear foot, and 50 to 75 kips, respectively. A future expansion area west of the vehicle service shop is also being considered. Ancillary construction of parking and drive areas within the facility are also planned.

Based on the supplied topographic information, the area of the proposed development is currently relatively level with existing grades ranging from about 648 to 651 feet. We understand the finished floor of the main complex which will consist of the office building, enclosed garage, and equipment storage building will be at an elevation of about 653 feet. The finished floor of the vehicle service shop has not yet been finalized, but is anticipated to be on the order of about 652.5 feet. Based on the anticipated finished floor elevation, fill thicknesses of about 3 feet or less will be required to achieve the finished grade. Minor grade changes are also assumed for the development of parking and drive areas.

SITE EXPLORATION PROCEDURES

Field Exploration

The field exploration consisted of drilling and sampling thirty-five (35) borings to depths of about 10 to 20 feet below the existing grade. The original boring locations were selected by Terracon personnel based on the supplied site plan; however, these locations were modified by MMS Consultants based on alterations made to the site prior to our mobilization. It should be noted that Borings 30 and 35 were not accessible to the drill rig. The approximate location of each boring is shown on the attached Boring Location Diagram. The boring locations were staked and surveyed in the field by MMS Consultants; however, the ground surface elevations indicated on the boring logs have been rounded to the nearest ½ foot. The location and elevation of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a track-mounted rotary drilling rig using continuous flight solid-stemmed augers to advance the boreholes. Representative samples were obtained using split-barrel sampling procedures in accordance with ASTM Specification D-1586. In the split-barrel sampling procedure, a standard 2-inch O.D. split-barrel sampling spoon is driven into the ground with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the standard penetration resistance value. These values are indicated on the boring logs at the depths of occurrence. The samples were sealed and returned to the laboratory for testing and classification.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

Laboratory Testing

Selected samples retrieved from the borings were tested to determine their natural water contents. A hand penetrometer was used to measure the approximate unconfined compressive strength of the cohesive samples. The hand penetrometer test has been correlated with the unconfined compression test and provides a more reliable estimate of the soil's consistency and strength than visual observation alone. The results of the laboratory tests are shown on the boring logs, adjacent to the soil profiles, at their corresponding sample depths.

As part of the testing program, the recovered samples were classified in accordance with the attached General Notes and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbol for the Unified Soil Classification System is shown on the boring logs, and a brief description of the Unified System is included in this report.

SUBSURFACE CONDITIONS

Geology

Geologic information was obtained from a review of the soil survey of Johnson County by the Soil Conservation Service/United States Department of Agriculture. Geologically, the proposed development is located in the Nodaway – Lawson – Waukee Association. In general, these soils consist of stream deposited (alluvial) soils. This area is typified as having a groundwater table greater than 5 feet with somewhat droughty conditions. The sandy soils have a rapid permeability and slow runoff.

Soil Conditions

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types. In-situ, the transition between materials may be gradual. Please review the individual boring logs for a detailed description of the soils encountered at this site. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows.

The borings generally encountered about 1.5 to 5 feet of dark brown, very loose to medium dense, fine to medium sand with varying amounts of clay, clay nodules, seams, and layers. Where clay layers were encountered, they consisted of stiff to very stiff, sandy lean clay deposits. Below the surficial sand and clay deposits, the borings encountered brown, very loose to medium dense, fine to medium and fine to coarse sand with varying amounts of clay and gravel to the borings' termination depths of about 10 to 20 feet below the existing ground surface.

Groundwater Conditions

The borings were monitored during drilling operations for the presence and level of groundwater. Water levels observed in the borings are noted on the individual boring logs. At that time, groundwater was observed at depths of about 19.5 to 20 feet in Borings 9, 11, 16, 21, 25, and 34; however, groundwater was not observed in the remaining borings during drilling operations or in any of the borings during observation of delayed groundwater levels.

Dry cave-in depths ranging from about 6.5 to 18.5 feet were measured when delayed groundwater levels were measured. At the time the borings were drilled, the groundwater table at the boring locations was apparently below the maximum drilling depth. However, it should be noted that the borings were performed during a relatively dry season, and fluctuations in the groundwater table can occur due to seasonal variations in the amount of rainfall, runoff, river level, and other factors not evident at the time the borings were performed. In addition, perched water can develop over low permeability soil strata following periods of heavy or prolonged precipitation. This possibility should be considered when developing design and construction plans and specifications for the project. Long term monitoring in cased holes or piezometers would be necessary to accurately evaluate the potential range of groundwater conditions on the site.

ENGINEERING RECOMMENDATIONS

Geotechnical Considerations

Based on the information obtained from the subsurface exploration, it is our opinion that the site soils are suitable to support the proposed structures on spread footings. However, special design and construction considerations will be required due to the presence of very loose to loose sandy deposits. Further details are provided below.

Foundation Support

Office Building, Enclosed Garage, and Warehouse/Storage Buildings

Borings 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 18, 20, and 21 were performed within this main complex of structures. We understand the finished floor of the proposed complex will be about 653 feet. Based on the topographic information provided, it appears about 3 feet of fill will be required to achieve the desired finished grade. Depending on the foundation bearing elevations, either structural fill or sandy soils will be encountered during foundation excavations. We recommend the sandy soils encountered at the foundation bearing elevation be moisture conditioned and surficially compacted with hand-held vibratory equipment prior to concrete placement. Spread footings designed and constructed as recommended in this report and bearing on properly compacted structural fill or native, medium dense sand could be designed for a maximum net allowable bearing pressure of 2,500 psf. It should be noted that loose sandy deposits may be encountered at the foundation bearing elevation. If it is not possible to improve these soils by means of surficial compaction, we recommend the soils be overexcavated and replaced with well-compacted structural fill as described in the **Foundation Excavations** section of this report. The net bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation.

Vehicle Maintenance Shop, Truck Wash, and Pump Canopy

Borings 3, 25, 26, 30, 34, 35, and 36 were performed within these structures. We understand the finished floor of the vehicle maintenance shop will be about 652.5 feet. The finished floor of the truck wash is anticipated to be at about 653 feet. Based on the topographic information provided, it appears less than 3 feet of fill will be required to achieve the desired finished grades. Depending on the foundation bearing elevations, either structural fill or sandy soils will be encountered during foundation excavations. We recommend the sandy soils encountered at the foundation bearing elevation be moisture conditioned and surficially compacted with hand-held vibratory equipment prior to concrete placement. Spread footings designed and constructed as recommended in this report and bearing on properly compacted structural fill or native, medium dense sand could be designed for a maximum net allowable bearing pressure of 2,000 psf. The net bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The allowable bearing pressure presented above could be increased by 33% for resistance to transient loading such as that due to wind.

General Foundation Recommendations

The wall bearing footings should be designed with a minimum width of 16 inches, while the individual column footings should have minimum widths of 2.5 feet. Perimeter footings and footings beneath unheated areas should be designed with a minimum embedment depth of 3.5 feet, as measured from the base of the footing to the lowest adjacent outside grade for frost protection.

The actual magnitude of settlement that will occur beneath the foundations would depend upon the variations within the subsurface soil profile, the actual structural loading conditions, the embedment depth of the footings, the actual thickness of compacted fill, and the quality of the earthwork operations. Assuming that the foundation related earthwork and the foundation designs are completed in accordance with our recommendations, it is our opinion that settlements will be about 1 inch or less. Differential settlements on the order of $\frac{1}{2}$ to $\frac{2}{3}$ of the total settlement could occur across the building areas.

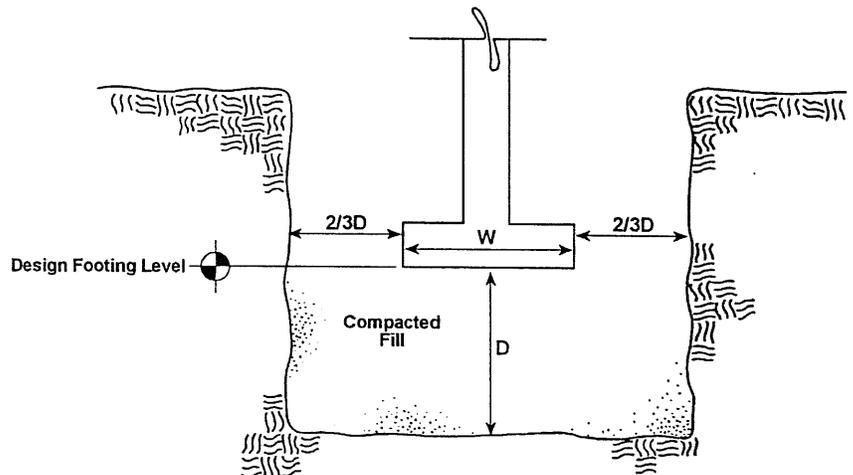
Groundwater within footing excavations is not anticipated; however, if encountered, it should be removed as soon as possible to minimize disturbance of bearing soils. Where high moisture conditions are encountered at footing bearing elevations, consideration should be given to stabilizing the bottom of the excavations with well-graded crushed stone, or a lean concrete mud mat to provide a working base for construction.

Foundation Excavations

All excavations should be sloped or braced as required by OSHA Regulations to provide stability and safe working conditions. All footing excavations should be observed and tested by Terracon personnel. In the event that unsuitable bearing soils are encountered in the footing excavations, the excavations should be extended deeper to suitable soils and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations.

The footings could also bear on properly compacted backfill extending down to the suitable native soils. Overexcavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation.

The overexcavation should then be backfilled up to the footing base elevation with approved structural fill placed in lifts of 6 inches or less in loose thickness and compacted to at least 98% of the soil's maximum standard Proctor dry density (ASTM D-698). An overexcavation and backfill procedure diagram is illustrated in the adjacent figure.



The base of all footing excavations should be free of water and loose soils prior to placement of concrete. If groundwater is encountered during construction, it should be maintained a minimum of 1 foot below the foundation bearing elevation during footing construction. Should the soils at the bearing level become disturbed, the affected soil should be removed prior to placement of concrete. Concrete should be placed as soon as possible after excavating to minimize disturbance of bearing soils.

Floor Slab Design and Construction

We understand salt and storage bins are proposed at the southwest section of the facility. Depending on the amount of storage planned in these areas, settlements in excess of 1 inch could occur if large contact pressures are anticipated on the floor slabs. An overexcavation procedure could be implemented in these areas to help control settlements. We would be pleased to provide further information once the facility has been finalized, and maximum salt and/or sand storage heights are established.

A minimum 6-inch thick granular base such as relatively clean, well-graded crushed stone containing less than 6% passing the U.S. No. 200 sieve is recommended directly below floor slabs. This material will serve as a leveling course, a capillary moisture break, a help provide load distribution. Care will be necessary to avoid contaminating this layer with soil prior to floor slab placement. Construction joints should be used to isolate the floor slab from load-bearing walls and/or isolated columns in order to allow for differential movement.

Pavements

Subgrades for support of pavements should be prepared as discussed below. We recommend the upper 1 foot of the pavement subgrade be compacted to at least 98% of the material's standard Proctor maximum dry density (ASTM D-698). In addition, prior to fill placement, the subgrade should be prepared as indicated in the **Earthwork** section of this report. It should be noted that the sandy soils can easily rut under construction equipment; thus, we recommend a granular base course beneath the pavement to stabilize the subgrade and help expedite construction.

For light vehicle loads (automobiles), we recommend 4 inches of asphaltic cement concrete (ACC) (minimum surface course thickness of 2 inches) over a 6-inch crushed stone base and 5.5 inches of ACC over a 6-inch crushed stone base for lightly loaded drive areas. We understand some pavement and drive areas will be subject to heavy truck traffic. In these areas, we recommend a minimum thickness of 6.5 inches of ACC over a 6-inch crushed stone base be used. The crushed stone base should consist of a dense-graded material meeting the specifications IDOT 4120.04.

As an alternative, Portland cement concrete could be considered. For Portland cement concrete (PCC), 5 inches is typical in automobile parking areas and 6 inches is typical in low volume drives. For dumpster and delivery truck areas, a minimum 7-inch thick Portland cement concrete is recommended. It should be noted that a 4-inch thick crushed stone base beneath the PCC sections will help stabilize the anticipated sandy subgrade soils. A Portland cement concrete mix designed with a minimum 28-day modulus of rupture of 600 psi should be used for concrete pavements. This is roughly equivalent to a 28-day compressive strength of 4,000 psi. Concrete mix designs should also include air entrainment.

The material identification as presented on the Iowa Department of Transportation (IDOT) Standard Specifications for Highway and Bridge Construction is as follows:

Asphaltic Surface - IDOT Type A Asphaltic Cement Concrete: Section 2303

Asphaltic Base - IDOT Type B Asphaltic Cement Concrete, Class I: Section 2303

Concrete Pavement - IDOT Portland Cement Concrete Type C: Section 2301

The above sections represent minimum design thicknesses and as such periodic maintenance should be anticipated. Higher traffic volumes may require thicker pavement sections. Additional recommendations can be provided after traffic volumes and loads are known. Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and contribute to premature pavement deterioration. Periodic maintenance should be anticipated for minimum pavement thicknesses. This maintenance would consist of the sealing of cracks and repair in isolated distressed areas.

Earthwork

In preparing the site for construction, all deleterious materials such as organic soil, or loose, soft, frozen, or otherwise unsuitable materials should be stripped from below the proposed building and pavement areas. Based on the data obtained from our subsurface exploration, it appears that stripping depths will generally be less than ½ foot; however, greater depths may be required in isolated locations. The actual stripping depth will be variable and should be evaluated by Terracon personnel during construction.

After rough grade has been established and prior to placement of fill, the exposed subgrade should be surficially compacted with a steel-drum vibratory roller. In addition, we recommend the area be thoroughly proofrolled. The surficial compaction and proofrolling of subgrade soils aids in providing a firm base for compaction of new fill and delineating soft or disturbed areas that may exist below subgrade level. Unsuitable areas observed at this time should be improved by compaction or by undercutting and replacing with suitable compacted fill. Subgrade stability should be observed by a geotechnical engineer during construction.

It should be noted that the soils encountered on the site are susceptible to disturbance from construction activities, particularly if the soil is wetted by surface water or seepage. Care should be taken during the site grading operation to minimize disturbance of the bearing soils. Heavy equipment traffic directly on bearing surfaces should be avoided in saturated soils. If unstable soils are encountered, it may be necessary to use a layer of well-graded crushed stone (2 inch maximum particle size) to increase subgrade stability and help expedite construction.

All fill materials should consist of approved materials, free of organic and debris. The fill should be a low plasticity cohesive soil with a liquid limit less than 45% and a plasticity index less than 20%, or a granular soil. Some adjustments in the moisture content of on-site soils may be required to achieve adequate compaction. The soil's water content at the time of compaction should be at -1 to +3% of the soils optimum moisture value as determined by the

standard Proctor test (ASTM D-698) for cohesive soils and $\pm 3\%$ for well-graded, granular soils.

All fill materials should be placed and compacted in lifts not exceeding 9 inches in loose thickness. All fill material placed above the footing base elevation for lightly loaded floor slab support should be compacted to at least 95% of the soil's maximum standard Proctor dry density (ASTM D-698). All fill material placed below the footing base elevation should be compacted to at least 98% of the soil's maximum standard Proctor dry density. The higher degree of fill compaction below footings should extend laterally beyond the exterior edges of the perimeter footings for at least 8 inches per foot of fill thickness below the footing base elevation.

In pavement areas, all fill materials should be compacted to at least 95% of material's maximum standard Proctor dry density with the exception of the upper 12 inches of the subgrade. The upper 12 inches should be compacted to at least 98% of the material's maximum standard Proctor dry density.

Upon completion of filling operations, care should be taken to minimize the subgrade disturbance and maintain the subgrade moisture content prior to construction of foundations and floor slabs. On-site subgrade soils are highly susceptible to disturbance from construction activity. Weather conditions such as freezing, thawing, rain, or dry weather can also contribute to subgrade disturbance. Equipment traffic directly on bearing surfaces should be avoided when possible to minimize disturbance of bearing soils, particularly on high moisture content soils or saturated soils. Therefore, care should be taken during the site grading operation to provide adequate site drainage and minimize disturbance of the bearing soils. If the subgrade should become saturated, desiccated, or disturbed, the affected material should be removed or replaced, or these materials should be scarified, moisture conditioned as necessary, and recompacted prior to construction of footings or floor slabs. If time elapses between subgrade preparation and further construction, subgrades should be reworked and retested prior to placement of structures.

Adequate surface drainage should be provided at the site in order to minimize wetting of the foundation soils. Excessive moisture can significantly reduce the soils bearing capacity and contribute to foundation settlement. For protection of the footing bearing soils, we recommend that the surrounding grades be sloped away from the structures on all sides. In addition, roof drainage should be collected by a system of gutters and downspouts and transmitted by pipe to a stormwater drainage system or discharged at least 8 feet away from the structures. As an alternative, splash blocks may be used as long as the ground surface is paved and slopes away from the structures.

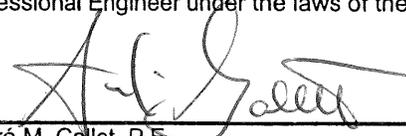
GENERAL COMMENTS

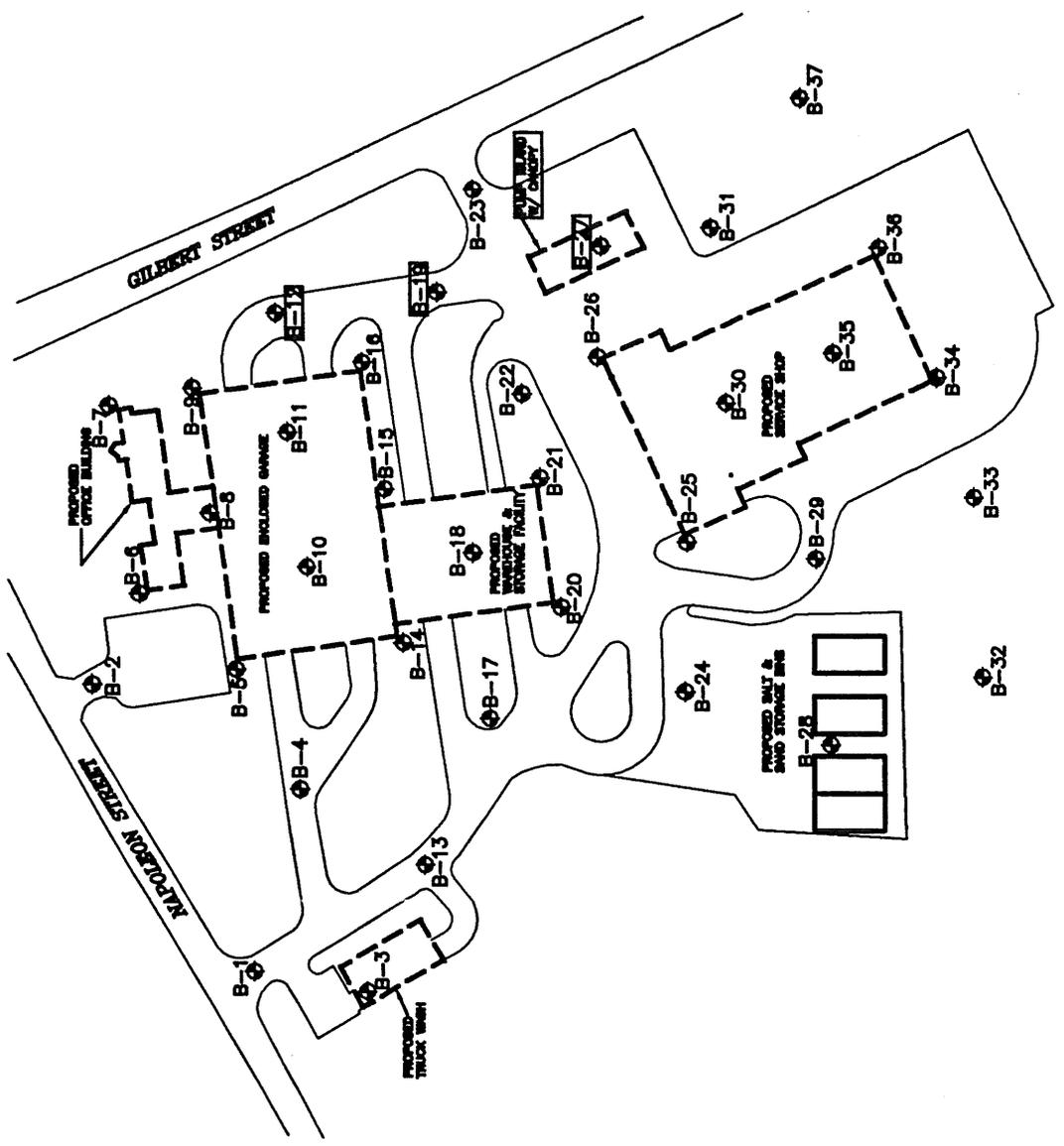
Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide testing and observation during excavation, grading, foundation and construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations which may occur between borings or across the site. The nature and extent of such variations may not become evident until construction. If variations appear, it will be necessary to reevaluate the recommendations of this report.

The scope of services for this project does not include either specifically or by implication any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. In the event that changes in the nature, design, or location of the project as outlined in this report, are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes, and either verifies or modifies the conclusions of this report in writing.

	<p>I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.</p> <p> _____ André M. Gallet, P.E. 2/18/00 Date</p> <p>My license renewal date is December 31, 2000.</p>
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0 100
 Approximate Scale
 (Feet)

LEGEND
 ◆ -- Approximate Location of Boring

SOIL BORING LOCATION DIAGRAM
PUBLIC WORKS FACILITY
 IOWA CITY, IOWA
 PROJECT NO. 06602251
 DATE: 08/11/2006

Terracon
 3/17/2006

LOG OF BORING NO. 1

OWNER/CLIENT City of Iowa City		ARCHITECT/ENGINEER MMS Consultants, Inc.						
SITE South of Napoleon Park Iowa City, Iowa		PROJECT Proposed Public Works Facility						
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL					
		NUMBER	TYPE					
		RECOVERY, in.	SPT - N BLOWS / ft.					
		WATER CONTENT, %	DRY UNIT WT pcf					
		UNCONFINED STRENGTH, psf						
3"	3" Root Zone <u>CLAYEY FINE TO MEDIUM SAND</u> , Dark Brown, Loose		PA					
4.5	<u>SANDY LEAN CLAY</u> , Brown, Stiff	1	SS	12	6	13		
5		2	SS	14	5	13		*4000
10	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> , Brown, Loose to Medium Dense	3	SS	12	7	4		
		4	SS	18	13	9		
	BOTTOM OF BORING							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ NONE	WD	∇ NONE (2/4/00)
WL	∇		∇
WL	DCI @ 8.5' (2/4/00)		

Terracon

BORING STARTED		2-1-00	
BORING COMPLETED		2-1-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/18/00

LOG OF BORING NO. 2

OWNER/CLIENT <p style="text-align: center;">City of Iowa City</p>	ARCHITECT/ENGINEER <p style="text-align: center;">MMS Consultants, Inc.</p>
SITE <p style="text-align: center;">South of Napoleon Park Iowa City, Iowa</p>	PROJECT <p style="text-align: center;">Proposed Public Works Facility</p>

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES				TESTS		
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3.5	3" Root Zone <u>FINE TO MEDIUM SAND, TRACE CLAY</u> Dark Brown, Loose	18	SP 1	SS	18	4	6		
5	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> Brown, Loose to Medium Dense Becoming coarser with depth.	18	SP 2	SS	18	5	6		
10	BOTTOM OF BORING	18	SP 3	SS	18	9	5		
		18	SP 4	SS	18	20	5		

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual. *Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ NONE	WD	∇
WL	∇		∇
WL	Backfilled		



BORING STARTED		2-7-00	
BORING COMPLETED		2-7-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 3

OWNER/CLIENT <p style="text-align: center;">City of Iowa City</p>	ARCHITECT/ENGINEER <p style="text-align: center;">MMS Consultants, Inc.</p>
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SITE <p style="text-align: center;">South of Napoleon Park Iowa City, Iowa</p>	PROJECT <p style="text-align: center;">Proposed Public Works Facility</p>
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS			
				NUMBER	TYPE	RECOVERY, in.	SPT-N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
2.5	3" Root Zone <u>CLAYEY FINE TO MEDIUM SAND</u> , Dark Brown, Loose				PA					
5	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> , Brown, Medium Dense			SC	1	SS	18	8	6	
5						PA				
12	<u>FINE TO MEDIUM SAND, TRACE CLAY & GRAVEL</u> , Brown, Loose to Medium Dense			SP	2	SS	6	10	2	
12						PA				
12				SP	3	SS	6	6	3	
12						PA				
15	<u>FINE TO COARSE SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense			SP	4	SS	8	20	4	
15						PA				
20				SP/SW	5	SS	14	21	9	
20						PA				
20				SP/SW	6	SS	12	29	11	
20	BOTTOM OF BORING									

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft	
WL <input checked="" type="checkbox"/> NONE	WD <input checked="" type="checkbox"/> NONE (2/4/00)
WL <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DCI @ 18.5' (2/4/00)	



BORING STARTED		2-1-00	
BORING COMPLETED		2-1-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

LOG OF BORING NO. 4

OWNER/CLIENT City of Iowa City		ARCHITECT/ENGINEER MMS Consultants, Inc.							
SITE South of Napoleon Park Iowa City, Iowa		PROJECT Proposed Public Works Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3	1-1/2" Root Zone <u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES,</u> Dark Brown, Medium Dense	1	PA SS	16	15	5			
5	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY SEAMS,</u> Brown, Loose to Medium Dense	2	PA SS	12	9	5			
10	BOTTOM OF BORING	3	PA SS	14	16	4			
		4	PA SS	18	11	5			

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft		<h1 style="font-size: 2em;">Terracon</h1>	BORING STARTED		2-3-00		
WL	∇ NONE		WD	∇ NONE (2/4/00)	BORING COMPLETED		2-3-00
WL	∇			∇	RIG	#5 FOREMAN	TM
WL	DCI @ 8.5' (2/4/00)			APPROVED	BFG	JOB # 06995251	

LOG OF BORING NO. 5

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT-N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3	1-1/2" Root Zone <u>CLAYEY FINE TO MEDIUM SAND</u> , Dark Brown, Loose	3	SC	1	SS	14	5	5	
					PA				
		5	SP	2	SS	10	7	4	
					PA				
	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> , Brown, Loose to Medium Dense		SP	3	SS	16	16	3	
					PA				
			SP	4	SS	12	7	3	
		10			PA				
					PA				
		12.5			PA				
			SP/SW	5	SS	16	11	5	
	<u>FINE TO COARSE SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense				PA				
		15			PA				
			SP/SW	6	SS	14	14	6	
		20							
	BOTTOM OF BORING	20							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft	
WL ∇ NONE	WD ∇ NONE (2/4/00)
WL ∇	∇
WL	DCI @ 18.5' (2/4/00)



BORING STARTED		2-3-00	
BORING COMPLETED		2-3-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/18/00

LOG OF BORING NO. 7

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS	
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %
2.5	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> Dark Brown, Medium Dense	1	PA					
		2	SS	18	12	3		
		3	PA					
		4	SS	18	15	4		
	5		PA					
	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> Brown, Medium Dense	5	SS	18	16	4		
		6	PA					
		7	SS	18	23	2		
		8	PA					
		9	SS	18	23	2		
		10	PA					
		11	SS	18	23	2		
		12	PA					
		13	SS	18	23	2		
		14	PA					
		15	SS	18	23	2		
		16	PA					
		17	SS	18	23	2		
		18	PA					
		19	SS	18	23	2		
		20	PA					
	<u>FINE TO COARSE SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense	20	SS	18	16	5		
		21	PA					
		22	SS	18	13	4		
	BOTTOM OF BORING	20						

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft	
WL ∇ NONE	WD ∇ NONE (2/9/00)
WL ∇	∇
WL	



BORING STARTED	2-7-00
BORING COMPLETED	2-7-00
RIG #5	FOREMAN TM
APPROVED BFG	JOB # 06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 8

OWNER/CLIENT City of Iowa City		ARCHITECT/ENGINEER MMS Consultants, Inc.							
SITE South of Napoleon Park Iowa City, Iowa		PROJECT Proposed Public Works Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES			TESTS			
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3	2" Root Zone <u>FINE TO MEDIUM SAND WITH CLAY</u> Dark Brown, Loose	-		PA					
		-	SP 1	SS	16	8	4		
		-		PA					
		-	SP 2	SS	18	10	3		
		5		PA					
		-	SP 3	SS	18	9	3		
		-		PA					
		-	SP 4	SS	18	17	4		
		10		PA					
		-		PA					
		-	SP/SW 5	SS	18	23	5		
		15		PA					
		-		PA					
		-	SP/SW 6	SS	18	29	5		
		20							
	BOTTOM OF BORING	20							

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▽ NONE (2/9/00)
WL	▽	▽	
WL	DCI @ 18.5' (2/9/00)		



BORING STARTED		2-7-00	
BORING COMPLETED		2-7-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

LOG OF BORING NO. 10

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3	2" Root Zone <u>FINE TO MEDIUM SAND WITH CLAY</u> Dark Brown, Loose	3	PA						
5	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY SEAMS</u> Brown, Medium Dense	5	PA						
10	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY SEAMS</u> Brown, Medium Dense	10	PA						
13	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY SEAMS</u> Brown, Medium Dense	13	PA						
15	<u>FINE TO MEDIUM SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense	15	PA						
20	<u>FINE TO MEDIUM SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense	20	PA						
20	BOTTOM OF BORING	20							

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▽ NONE (2/9/00)
WL	▽	▽	▽
WL			



BORING STARTED	2-7-00
BORING COMPLETED	2-7-00
RIG #5	FOREMAN TM
APPROVED BFG	JOB # 06995251

LOG OF BORING NO. 11

OWNER/CLIENT <p style="text-align: center;">City of Iowa City</p>	ARCHITECT/ENGINEER <p style="text-align: center;">MMS Consultants, Inc.</p>
SITE <p style="text-align: center;">South of Napoleon Park Iowa City, Iowa</p>	PROJECT <p style="text-align: center;">Proposed Public Works Facility</p>

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
5	3" Root Zone <u>FINE TO MEDIUM SAND, TRACE CLAY,</u> Dark Brown, Loose	5			PA				
			SP	1	SS	18	9	4	
					PA				
			SP	2	SS	18	9	3	
					PA				
			SP	3	SS	18	14	3	
					PA				
			SP	4	SS	18	21	3	
					PA				
			SP/SW	5	SS	18	28	4	
					PA				
			SP/SW	6	SS	18	21	8	
	BOTTOM OF BORING	20							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft	
WL ∇ 20	WS ∇ NONE (2/9/00)
WL ∇	∇
WL	DCI @ 18.5' (2/9/00)



BORING STARTED		2-7-00	
BORING COMPLETED		2-7-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 13

OWNER/CLIENT <p style="text-align: center;">City of Iowa City</p>	ARCHITECT/ENGINEER <p style="text-align: center;">MMS Consultants, Inc.</p>
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SITE <p style="text-align: center;">South of Napoleon Park Iowa City, Iowa</p>	PROJECT <p style="text-align: center;">Proposed Public Works Facility</p>
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS			
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
3	1-1/2" Root Zone <u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> Dark Brown, Loose	3			PA					
6.5	<u>FINE TO MEDIUM SAND, TRACE CLAY,</u> Brown, Loose	6.5		SP	1	SS	18	6	4	
10	<u>CLAYEY FINE TO MEDIUM SAND,</u> Brown, Loose	10		SP	2	SS	14	6	8	
						PA				
				SC	3	SS	16	6	10	
						PA				
				SC	4	SS	10	7	9	
	BOTTOM OF BORING	10								

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	☒ NONE	WD	☒ NONE (2/4/00)
WL	☒		☒
WL			DCI @ 8' (2/4/00)



BORING STARTED		2-3-00	
BORING COMPLETED		2-3-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

LOG OF BORING NO. 16

OWNER/CLIENT <p style="text-align: center;">City of Iowa City</p>	ARCHITECT/ENGINEER <p style="text-align: center;">MMS Consultants, Inc.</p>
SITE <p style="text-align: center;">South of Napoleon Park Iowa City, Iowa</p>	PROJECT <p style="text-align: center;">Proposed Public Works Facility</p>

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
2.5	2" Root Zone <u>CLAYEY FINE TO MEDIUM SAND</u> , Dark Brown, Loose				PA				
			SC	1	SS	12	5	4	
					PA				
			SP	2	SS	12	11	4	
		5			PA				
			SP	3	SS	18	13	4	
					PA				
			SP	4	SS	18	11	3	
		10			PA				
			SP/SW	5	SS	18	20	4	
		15			PA				
			SP/SW	6	SS	18	16	6	
		20							
	BOTTOM OF BORING								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual. *Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft	
WL ∇ 19.5	WS ∇ NONE (2/9/00)
WL ∇	∇
WL	DCI @ 18' (2/9/00)



BORING STARTED		2-7-00	
BORING COMPLETED		2-7-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 17

OWNER/CLIENT City of Iowa City		ARCHITECT/ENGINEER MMS Consultants, Inc.								
SITE South of Napoleon Park Iowa City, Iowa		PROJECT Proposed Public Works Facility								
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES			TESTS				
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
3	1-1/2" Root Zone <u>FINE TO MEDIUM SAND, TRACE CLAY & ROOTLETS</u> , Dark Brown, Medium Brown	-	SP	1	SS	16	10	5		
10	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> , Brown, Medium Dense	5	SP	2	SS	18	11	3		
		-			PA					
		-	SP	3	SS	14	15	3		
		-			PA					
		-	SP	4	SS	18	11	3		
	BOTTOM OF BORING	10								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft	
WL ∇ NONE	WD ∇ NONE (2/9/00)
WL ∇	∇
WL	DCI @ 6.5' (2/9/00)



BORING STARTED	2-4-00
BORING COMPLETED	2-4-00
RIG #5	FOREMAN TM
APPROVED BFG	JOB # 06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 19

OWNER/CLIENT <p style="text-align: center;">City of Iowa City</p>	ARCHITECT/ENGINEER <p style="text-align: center;">MMS Consultants, Inc.</p>
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SITE <p style="text-align: center;">South of Napoleon Park Iowa City, Iowa</p>	PROJECT <p style="text-align: center;">Proposed Public Works Facility</p>
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
4.5	1-1/2" Root Zone <u>FINE TO MEDIUM SAND WITH CLAY, TRACE OCCASIONAL CLAY NODULES,</u> Dark Brown, Loose to Medium Dense				PA				
			SP	1	SS	14	5	6	
					PA				
			SP	2	SS	12	12	6	
10	<u>FINE TO MEDIUM SAND, TRACE CLAY,</u> Brown, Medium Dense				PA				
			SP	3	SS	16	11	5	
					PA				
			SP	4	SS	18	15	6	
	BOTTOM OF BORING	10							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft	
WL ∇ NONE	WD ∇ NONE (2/7/00)
WL ∇	∇
WL	DCI @ 8' (2/7/00)



BORING STARTED		2-4-00	
BORING COMPLETED		2-4-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 20

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3	1-1/2" Root Zone <u>FINE TO MEDIUM SAND, TRACE CLAY</u> Dark Brown, Loose	3			PA				
			SP	1	SS	16	7	4	
					PA				
		5	SP	2	SS	12	8	4	
	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> Brown, Loose to Medium Dense				PA				
			SP	3	SS	14	9	3	
					PA				
			SP	4	SS	10	11	4	
		10			PA				
			SP/SW	5	SS	14	12	7	
	<u>FINE TO COARSE SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense				PA				
		15							
			SP/SW	6	SS	16	10	5	
		20							
	BOTTOM OF BORING	20							

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▽ NONE (2/7/00)
WL	▽	▽	▽
WL	DCI @ 17' (2/7/00)		



BORING STARTED	2-4-00
BORING COMPLETED	2-4-00
RIG	#5 FOREMAN TM
APPROVED BFG	JOB # 06995251

LOG OF BORING NO. 21

OWNER/CLIENT City of Iowa City		ARCHITECT/ENGINEER MMS Consultants, Inc.							
SITE South of Napoleon Park Iowa City, Iowa		PROJECT Proposed Public Works Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES			TESTS			
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3.5	1-1/2" Root Zone <u>FINE TO MEDIUM SAND, TRACE CLAY</u> Dark Brown, Loose	16	SP	1	SS	16	6	5	
13	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> Brown, Loose to Medium Dense	12	SP	2	SS	12	9	3	
20	<u>FINE TO COARSE SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense	14	SP	3	SS	14	11	4	
		10				10	17	3	
		15				16	14	6	
		20				12	17	7	
	BOTTOM OF BORING	20							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft	
WL ∇ 19.5	WS ∇ NONE (2/7/00)
WL ∇	∇
WL	WCI @ 18' AB



BORING STARTED		2-4-00	
BORING COMPLETED		2-4-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 22

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3	1-1/2" Root Zone <u>CLAYEY FINE TO MEDIUM SAND</u> , Dark Brown, Loose	3	SC	1	SS	14	3	6	
5	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> , Brown, Loose to Medium Dense	5	SP	2	SS	16	8	3	
10		10	SP	3	SS	14	10	4	
15		15	SP	4	SS	18	10	3	
20		20	SP	5	SS	12	14	4	
20	<u>FINE TO MEDIUM SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense	20	SP	6	SS	16	19	4	
20	BOTTOM OF BORING	20							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▽ NONE (2/7/00)
WL	▽	WD	▽
WL	DCI @ 18.5' (2/7/00)		



BORING STARTED	2-4-00
BORING COMPLETED	2-4-00
RIG #5	FOREMAN TM
APPROVED BFG	JOB # 06995251

LOG OF BORING NO. 23

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS	
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %
3.5	1-1/2" Root Zone <u>FINE TO MEDIUM SAND, TRACE CLAY & OCCASIONAL CLAY NODULES</u> , Dark Brown, Loose	3.5	PA					
5	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> , Brown, Medium Dense	5	PA					
		SP 1	SS	12	5	7		
		SP 2	SS	16	12	6		
		SP 3	SS	14	11	4		
10	BOTTOM OF BORING	10	PA					
			SP 4	SS	18	11	4	

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

WATER LEVEL OBSERVATIONS, ft			
WL	<input checked="" type="checkbox"/> NONE	WD	<input checked="" type="checkbox"/> NONE (2/7/00)
WL	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
WL	DCI @ 8' (2/7/00)		



BORING STARTED	2-4-00
BORING COMPLETED	2-4-00
RIG	#5 FOREMAN TM
APPROVED BFG	JOB # 06995251

LOG OF BORING NO. 24

OWNER/CLIENT City of Iowa City		ARCHITECT/ENGINEER MMS Consultants, Inc.									
SITE South of Napoleon Park Iowa City, Iowa		PROJECT Proposed Public Works Facility									
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS				
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	
2.5	1-1/2" Root Zone <u>FINE TO MEDIUM SAND, TRACE CLAY,</u> Dark Brown, Very Loose			PA							
				SP	1	SS	10	2	6		
				SP	2	SS	14	8	4		
		5		PA							
				SP	3	SS	16	9	17		
				SP	4	SS	14	11	4		
				SP	5	SS	12	12	5		
13	<u>FINE TO MEDIUM SAND, TRACE CLAY,</u> Brown, Loose to Medium Dense			PA							
				SP	4	SS	14	11	4		
				SP	5	SS	12	12	5		
15	<u>FINE TO COARSE SAND, TRACE CLAY</u> <u>& GRAVEL,</u> Brown, Medium Dense			SP/SW	5	SS	12	12	5		
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft	
WL ∇ NONE	WD ∇ NONE (2/4/00)
WL ∇	∇
WL	DCI @ 14' (2/4/00)



BORING STARTED		2-3-00	
BORING COMPLETED		2-3-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 25

OWNER/CLIENT <p style="text-align: center;">City of Iowa City</p>	ARCHITECT/ENGINEER <p style="text-align: center;">MMS Consultants, Inc.</p>
SITE <p style="text-align: center;">South of Napoleon Park Iowa City, Iowa</p>	PROJECT <p style="text-align: center;">Proposed Public Works Facility</p>

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3	3-1/2" Root Zone <u>CLAYEY FINE TO MEDIUM SAND</u> , Dark Brown, Loose	3	SC	1	SS	14	5	6	
5	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> Brown, Medium Dense	5	SP	2	SS	12	10	4	
7		PA							
9		SP	3	SS	16	10	3		
11		SP	4	SS	14	13	3		
13.5	<u>FINE TO MEDIUM SAND, TRACE CLAY & GRAVEL</u> , Brown, Very Loose to Medium Dense	13.5	SP/SW	5	SS	16	15	7	
15		PA							
20	BOTTOM OF BORING	20							

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 20	WS	▽ NONE (2/7/00)
WL	▽	▽	▽
WL	DCI @ 18' (2/7/00)		



BORING STARTED		2-4-00	
BORING COMPLETED		2-4-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

LOG OF BORING NO. 26

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3.5	3-1/2" Root Zone <u>FINE TO MEDIUM SAND WITH CLAY</u> Dark Brown, Loose	3.5			PA				
12	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> Brown, Medium Dense	12		SP	1	SS	14	7	5
				SP	2	SS	16	10	3
						PA			
				SP	3	SS	14	13	3
						PA			
				SP	4	SS	18	12	4
						PA			
				SP	5	SS	16	14	4
						PA			
				SP	6	SS	16	14	5
						PA			
20	BOTTOM OF BORING	20							

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	☒ NONE	WD	☒ NONE (2/7/00)
WL	☒		☒
WL			



BORING STARTED	2-4-00
BORING COMPLETED	2-4-00
RIG	#5 FOREMAN TM
APPROVED	BFG JOB # 06995251

LOG OF BORING NO. 27

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS	
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %
3	1-1/2" Root Zone <u>FINE TO MEDIUM SAND WITH CLAY</u> Dark Brown, Very Loose	3		PA				
			SP	1	SS	16	2	6
				PA				
		5	SP	2	SS	16	8	5
				PA				
	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> Brown, Loose to Medium Dense		SP	3	SS	18	10	5
				PA				
			SP	4	SS	14	11	3
				PA				
		10		PA				
			SP	5	SS	16	18	5
15	BOTTOM OF BORING	15						

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual. *Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft WL <input checked="" type="checkbox"/> NONE WD <input checked="" type="checkbox"/> NONE (2/7/00) WL <input checked="" type="checkbox"/> _____ <input checked="" type="checkbox"/> _____ WL _____ DCI @ 11.5' (2/7/00)	Terracon	BORING STARTED 2-4-00 BORING COMPLETED 2-4-00 RIG _____ #5 FOREMAN TM APPROVED BFG JOB # 06995251
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BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 28

OWNER/CLIENT <p style="text-align: center;">City of Iowa City</p>	ARCHITECT/ENGINEER <p style="text-align: center;">MMS Consultants, Inc.</p>
SITE <p style="text-align: center;">South of Napoleon Park Iowa City, Iowa</p>	PROJECT <p style="text-align: center;">Proposed Public Works Facility</p>

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES				TESTS		
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3.5	<u>CLAYEY FINE TO MEDIUM SAND</u> , Dark Brown, Loose	12	SC	1	SS	12	3	11	
5	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> , Brown, Loose	10	SP	2	SS	10	6	7	
12		8			PA				
15	<u>FINE TO MEDIUM SAND, TRACE GRAVEL</u> , Brown, Medium Dense	14	SP	3	SS	8	9	5	
		10			PA				
		7			SP	4	7	6	
		15			PA				
	BOTTOM OF BORING	15							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ NONE	WD	∇ NONE (2/4/00)
WL	∇		∇
WL			



BORING STARTED	2-3-00
BORING COMPLETED	2-3-00
RIG	#5 FOREMAN TM
APPROVED BFG	JOB # 06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 31

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3.5	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> Dark Brown, Very Loose	-	-	-	PA	-	-	-	-
5	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> Brown, Loose to Medium Dense	-	-	-	PA	-	-	-	-
10	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> Brown, Loose to Medium Dense	-	-	-	PA	-	-	-	-
15	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> Brown, Loose to Medium Dense	-	-	-	PA	-	-	-	-
15	BOTTOM OF BORING	-	-	-	-	-	-	-	-

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual. *Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▽ NONE (2/7/00)
WL	▽	▽	▽
WL	DCI @ 13' (2/7/00)		



BORING STARTED	2-4-00
BORING COMPLETED	2-4-00
RIG #5	FOREMAN TM
APPROVED BFG	JOB # 06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 32

OWNER/CLIENT <p style="text-align: center;">City of Iowa City</p>	ARCHITECT/ENGINEER <p style="text-align: center;">MMS Consultants, Inc.</p>
SITE <p style="text-align: center;">South of Napoleon Park Iowa City, Iowa</p>	PROJECT <p style="text-align: center;">Proposed Public Works Facility</p>

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
1-1/2" Root Zone					PA				
<u>VERY SANDY LEAN CLAY</u> , Brown, Stiff to Very Stiff			CL	1	SS	16	7	12	*3500
4.5					PA				
			CL	2	SS	16	8	12	*5000
		5			PA				
<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY SEAMS</u> , Brown, Medium Dense			SP	3	SS	12	11	4	
					PA				
			SP	4	SS	14	12	11	
		10			PA				
12.5									
<u>FINE TO COARSE SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense			SP/SW	5	SS	14	16	7	
		15							
BOTTOM OF BORING		15							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ NONE	WD	∇ NONE (2/4/00)
WL	∇		∇
WL	DCI @ 13' (2/4/00)		



BORING STARTED		2-3-00	
BORING COMPLETED		2-3-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

LOG OF BORING NO. 33

OWNER/CLIENT City of Iowa City		ARCHITECT/ENGINEER MMS Consultants, Inc.							
SITE South of Napoleon Park Iowa City, Iowa		PROJECT Proposed Public Works Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
3	6" Crushed Stone			PA					
3	<u>SANDY LEAN CLAY</u> , Dark Brown, Stiff		CL	1	SS	18	13		*4000
6	<u>SANDY LEAN CLAY</u> , Brown, Stiff		CL	2	SS	18	8	14	*3500
6					PA				
13	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> Brown, Medium Dense		SP	3	SS	14	13	3	
13					PA				
15	<u>FINE TO COARSE SAND, TRACE CLAY & GRAVEL</u> , Brown, Medium Dense		SP/SW	5	SS	12	11	7	
15	BOTTOM OF BORING				PA				

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft				BORING STARTED		2-3-00	
WL	∇ NONE	WD	∇ NONE (2/4/00)	BORING COMPLETED		2-3-00	
WL	∇		∇	RIG	#5	FOREMAN	TM
WL	DCI @ 12' (2/4/00)			APPROVED	BFG	JOB #	06995251



LOG OF BORING NO. 34

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
5	6" Crushed Stone				PA					
	<u>FINE TO MEDIUM SAND, TRACE CLAY,</u> Dark Brown, Very Loose to Loose		SP	1	SS	18	7	6		
					PA					
			SP	2	SS	14	2	6		
12	<u>FINE TO MEDIUM SAND, TRACE CLAY,</u> Brown, Loose to Medium Dense				PA					
			SP	3	SS	18	4	7		
					PA					
			SP	4	SS	16	21	6		
					PA					
20	<u>FINE TO COARSE SAND, TRACE CLAY & GRAVEL,</u> Brown, Loose to Medium Dense		SP/SW	5	SS	12	5	13		
					PA					
			SP/SW	6	SS	14	10	11		
	BOTTOM OF BORING									

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 19.5	WS	▽ NONE (2/4/00)
WL	▽		▽
WL		DCI @ 18' (2/4/00)	



BORING STARTED	2-3-00
BORING COMPLETED	2-3-00
RIG #5	FOREMAN TM
APPROVED BFG	JOB # 06995251

LOG OF BORING NO. 36

OWNER/CLIENT City of Iowa City	ARCHITECT/ENGINEER MMS Consultants, Inc.
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SITE South of Napoleon Park Iowa City, Iowa	PROJECT Proposed Public Works Facility
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS	
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %
3	6" Crushed Stone <u>FINE TO MEDIUM SAND WITH CLAY</u> Dark Brown, Medium Dense	3			PA			
5	<u>FINE TO MEDIUM SAND, TRACE CLAY WITH OCCASIONAL CLAY NODULES</u> Brown, Loose to Medium Dense	5			PA			
		6	SP	1	SS	18	26	5
		7			PA			
		8	SP	2	SS	16	6	4
		9			PA			
		10	SP	3	SS	18	8	5
		11			PA			
		12	SP	4	SS	14	8	7
		13			PA			
		14	SP	5	SS	10	13	9
		15			PA			
		16			PA			
		17			PA			
		18	SP	6	SS	14	16	9
		19			PA			
	BOTTOM OF BORING	20						

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft

WL	∇ NONE	WD	∇
WL	∇		∇
WL	Backfilled		



BORING STARTED	2-4-00
BORING COMPLETED	2-4-00
RIG	#5 FOREMAN TM
APPROVED	BFG JOB # 06995251

LOG OF BORING NO. 37

OWNER/CLIENT City of Iowa City		ARCHITECT/ENGINEER MMS Consultants, Inc.							
SITE South of Napoleon Park Iowa City, Iowa		PROJECT Proposed Public Works Facility							
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
5	6" Crushed Stone			PA					
	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> Dark Brown, Loose to Medium Dense		SP	1	SS	16	22	5	
				PA					
			SP	2	SS	14	6	4	
		5		PA					
			SP/CL	3	SS	18	10	16	
	<u>FINE TO MEDIUM SAND, TRACE CLAY</u> <u>WITH OCCASIONAL CLAY SEAMS</u> Brown, Medium Dense			PA					
			SP	4	SS	14	11	8	
		10		PA					
			SP	5	SS	16	15	4	
		15							
	BOTTOM OF BORING								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft

WL	▽ NONE	WD	▽
WL	▽		▽
WL	Backfilled		



BORING STARTED		2-4-00	
BORING COMPLETED		2-4-00	
RIG	#5	FOREMAN	TM
APPROVED	BFG	JOB #	06995251

BOREHOLE 06995251.GPJ TERRACON.GDT 2/11/00

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS : Split Spoon - 1½" I.D., 2" O.D., unless otherwise noted	PS : Piston Sample
ST : Thin-Walled Tube - 2" O.D., Unless otherwise noted	WS : Wash Sample
PA : Power Auger	FT : Fish Tail Bit
HA : Hand Auger	RB : Rock Bit
DB : Diamond Bit - 4", N, B	BS : Bulk Sample
AS : Auger Sample	PM : Pressuremeter
HS : Hollow Stem Auger	DC : Dutch Cone
	WB : Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level	WS : While Sampling
WCI : Wet Cave In	WD : While Drilling
DCI : Dry Cave In	BCR : Before Casing Removal
AB : After Boring	ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Q_u , 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
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

Major Component Of Sample	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

Terracon

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests^A

Soil Classification

Group Symbol Group Name^B

Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well-graded gravel ^F
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel ^F
		Gravels with Fines More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ^E	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand ^I
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand ^I
		Sands with Fines More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}
		Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}	
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silt and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K, L, M}
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K, L, M}
	Silt and Clays Liquid limit 50 or more	inorganic	Liquid limit — oven dried < 0.75	OL	Organic clay ^{K, L, M, N}
			Liquid limit — not dried		Organic silt ^{K, L, M, O}
		organic	PI plots on or above "A" line	CH	Fat clay ^{K, L, M}
			PI plots below "A" line	MH	Elastic silt ^{K, L, M}
Highly organic soils	Primarily organic matter, dark in color, and organic odor	Liquid limit — oven dried < 0.75	OH	Organic clay ^{K, L, M, P}	
		Liquid limit — not dried		Organic silt ^{K, L, M, Q}	

^ABased on the material passing the 3-in. (75-mm) sieve.

^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^CGravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

^DSands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

$${}^E C_u = D_{60}/D_{10} \quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.

^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^HIf fines are organic, add "with organic fines" to group name.

^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^JIf Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^KIf soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.

^LIf soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

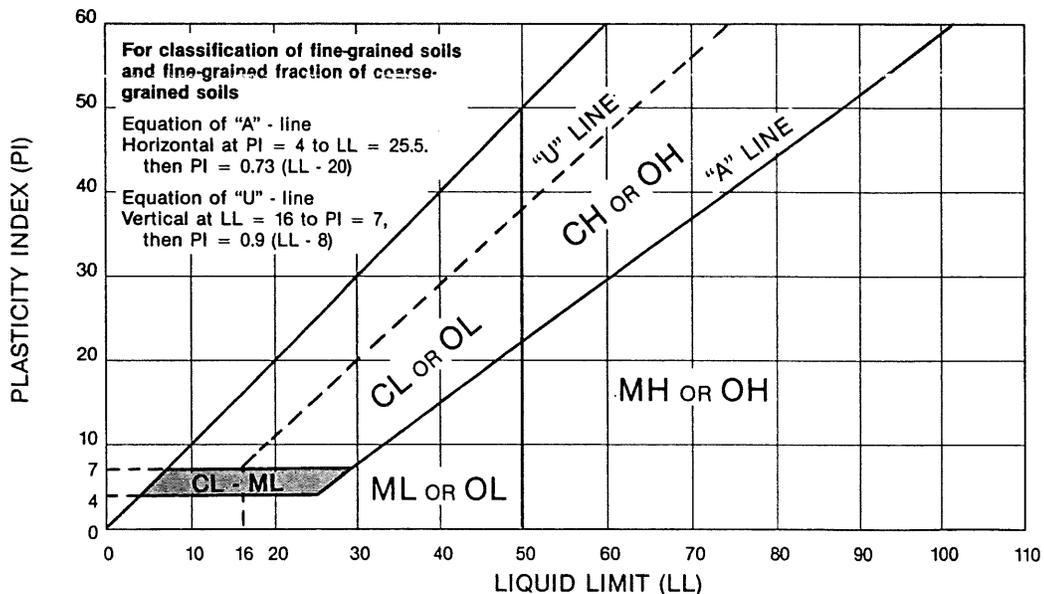
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



Terracon