PRELIMINARY
GEOTECHNICAL ENGINEERING REPORT
LATIMER INDUSTRIAL PARK
LATIMER, IOWA

Project No. 13095021.01
April 9, 2009

Prepared for:

FRANKLIN COUNTY DEVELOPMENT ASSOCIATION
Hampton, Iowa

Prepared by:

Terracon
Cedar Falls, Iowa

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April 9, 2009

Franklin County Development Association
5 1st Street SW
Hampton, Iowa 50441

Attn: Ms. Karen Mitchell
Phone: 641-456-5668
Email: fcda_director@mchsi.com

Re: Preliminary Geotechnical Engineering Report
Latimer Industrial Park
Latimer, Iowa
Terracon Project Number: 13095021.01

Dear Ms. Mitchell:

Terracon Consultants, Inc. (Terracon) has completed the preliminary geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal number CF09064 dated March 11, 2009. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning general site development and the suitability of the site soils for the proposed development. General earthwork recommendations are also provided.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Jason P. Heinz

Jason P. Heinz, P.E.
Iowa No. 18345

Eric H. Lidholm, P.E.
Senior Principal

Enclosures

Distribution: (2) Addressee

EXECUTIVE SUMMARY

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

A preliminary geotechnical investigation has been performed for the development of the Latimer Industrial Park in Latimer, Iowa. A total of nine borings were performed to depths of approximately 15 to 20 feet below existing grades.

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed project. The following geotechnical considerations were identified:

- Lightly-loaded building structures may be supported on spread footings bearing on suitable, native soil, and/or on engineered fill over suitable, native soil. Overexcavation and replacement should be anticipated on some parcels to establish a suitable support condition for building foundations and slabs.
- Project engineers should be provided the opportunity to review the findings and preliminary recommendations contained in this report along with grading plans as they are developed. Additional exploration and evaluation should be performed for each parcel once grading plans and loading conditions have been provided.
- A relatively thick, partly-organic surface layer of soil and/or existing possible fill was encountered at some boring locations and should be removed prior to the placement of engineered fill.
- On-site soils predominately consisted of lean clay and clayey sand. These low-plasticity soil types generally appear suitable for reuse as engineered fill. However, an occurrence of moderately-plastic clay soil was encountered in Boring 7 and is not considered suitable for use as structural fill. Silt with relatively high moisture contents was also encountered and is a less desirable fill material but may be used as structural fill. Some sorting of suitable and unsuitable material should be anticipated.

Close monitoring of the construction operations discussed herein will be critical in achieving the satisfactory design subgrade support. We therefore recommend that the Terracon be retained to monitor this portion of the work.

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT
LATIMER INDUSTRIAL PARK
LATIMER, IOWA

Project No. 13095021.01
April 8, 2009

1.0 INTRODUCTION

A preliminary geotechnical engineering report has been completed for the Latimer Industrial Park in Latimer, Iowa. The industrial park will continue to be constructed in the northwest quadrant of the intersection of Iowa Highway 3 and Gull Avenue. A total of nine (9) borings were performed to depths of about 15 to 20 feet below existing grades in the area of the industrial park. Logs of the borings along with a vicinity map, and a boring location diagram are included in Appendix A of this report.

The purpose of these services is to provide information and preliminary geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- suitability of site soils
- earthwork

2.0 PROJECT INFORMATION

2.1 Project Description

Site layout	See Appendix A, Figure A-1, Boring Location Diagram
Buildings	Single-story, single to double height, plan areas unknown
Building construction	Various - Concrete masonry unit, Pre-cast concrete, or metal shells anticipated. Typical metal framing. Concrete slab-on-grade floors expected.
Building floor elevation(s)	Unknown
Maximum building loads	Columns: 160 kips (assumed) Walls: <2 to 6 kips per lineal foot (klf) (assumed) Slabs: 150 pounds per square foot (psf) (assumed)
Maximum allowable building foundation settlement	Columns and Walls: 1 inch (assumed)
Maximum mass grading cut and fill thicknesses	5 feet (assumed)
Roadway	Heavy-duty traffic, pavement section expected
Underground utility piping	Installation of new water, sanitary, and storm services expected. Invert elevations unknown.

2.2 Site Location and Description

Location	Northwest corner of the intersection of Iowa Highway 3 and Gull Avenue in Latimer, Iowa
Existing improvements	Some recent grading for new roadways, and some underground utilities are in place
Current ground cover	Mostly agricultural land with existing developments along the eastern side of the industrial park
Existing topography	Predominately natural, gently to moderately-sloped
Existing site features	None known on undeveloped parcels

3.0 SUBSURFACE CONDITIONS

3.1 Soil and Rock Conditions

Subsurface conditions encountered at the individual boring locations are described on the boring logs in Appendix A of this report. The stratification boundaries shown on the logs represent the approximate depths where changes in soil types occur; in-situ, the transition between materials is usually gradual. Please review the attached boring logs for more detailed descriptions of the soil types encountered. The following depths are in relation to the grades existing at the time the borings were performed. Based on the results of the borings, subsurface conditions can be generalized as follows.

The borings initially encountered a surficial layer of topsoil that ranged from 6 inches to 42 inches in thickness. Below the topsoil, Borings 1 through 6 and Borings 8 and 9 encountered medium stiff to stiff, brown, light brown, and gray, lean clay with varying amounts of sand and gravel and sand seams and layers, and loose to medium dense, clayey fine to medium sand, to depths of about 3 to 13 feet. Below these soil types in Borings 2 and 7 at depths of about 3 to 3½ feet, soft, light brown and gray, clayey silt with varying amounts of sand was encountered to depths of about 7 to 7½ feet. In Boring 4, medium stiff to stiff, light brown, clayey silt was encountered to a depth of about 12 feet. Below these soil types, the borings encountered brown and gray, stiff to hard, sandy lean clay with varying amounts of gravel and sand seams and layers to the borings' termination depths of about 15 to 20 feet.

A review of well logs in the area of the site indicates that sedimentary bedrock is present about 100 to 120 feet below existing grades.

3.2 Groundwater Conditions

The borings were observed during and after drilling operations for the presence and level of groundwater. During drilling operations groundwater was observed in Borings 1, 2, 4, 5, and 7 at depths of about 5½ to 16 feet below existing grades. With the exception of Boring 3, delayed groundwater level measurements were performed on Mach 23, 2009. At that time, groundwater was measured in the open portion of the boreholes at depths of about 2½ to 9½ feet below existing grades. Due to the relatively low permeability of the soil types encountered in the borings, a relatively long period of time is necessary for a groundwater level to develop and stabilize in a borehole. Long-term observations in piezometers or observation wells sealed from the influence of surface water would be required for a better evaluation of groundwater conditions at the boring locations.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. A review of the Franklin County, Iowa Soil Survey published by the United States Department of Agriculture / Soil Conservation Service indicates that Nicollet loam, Webster silty clay loam, Clarion loam, and Webster-Nicollet complex soils are present on and/or near the project site. According to the soil survey, these soils are anticipated to have seasonally high groundwater levels near the surface to greater than 6 feet below existing grades. Approximately three-fourths of the site soils however, are indicated to have seasonal water levels of at least 4 to 6 feet below existing grades. In these profiles of supraglacial over subglacial deposits, groundwater level fluctuations are common as water becomes perched (trapped) within more permeable soil seams and layers overlying lower permeability soil following periods of heavy or prolonged precipitation. Therefore, groundwater levels during construction or at other times during the life of the development may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 PRELIMINARY ENGINEERING DISCUSSION

4.1 Preliminary Site Development

Based on the information obtained from the preliminary subsurface exploration conducted, it is our opinion that the soil characteristics are generally suitable for support of the proposed development. Special geotechnical considerations will be required for development of this project in some areas due to varying thicknesses of the surficial layer of topsoil and lower-strength soil. Once the surface layer of organic soil is removed, corrective earthwork may be required to establish a suitable subgrade condition for support of structure footings, slabs, and pavements. Once site grading plans and structural loading conditions are provided, additional site preparation recommendations will be required for conventional shallow foundation construction. Thus, we recommend that additional exploration and evaluation be performed once the site layout and grading plan details have been developed further.

A limited number of borings were performed over a relatively large area. However, based on the subsurface information obtained in Borings 1, 3, 6, 8, and 9, the soil encountered below the surficial topsoil layer generally exhibited strength characteristics suitable for support of the developments anticipated. In Borings 2, 4, 5, and 7, relatively low-strength soil was present below the surficial topsoil layer to depths of about 5½ to 7½ feet. Unless final grades are planned to be lower than the existing grades, corrective measures should be anticipated during mass grading operations and/or during building and site construction for satisfactory support of conventionally designed building foundations, floor slabs, and pavements.

Moderately plastic, high moisture content lean clay soil was encountered in Boring 7 at depths of about 3½ to 7 feet. These materials can exhibit volume changes with variations in moisture content; which may adversely affect structures. Care should be taken so these higher plasticity soils are not present near the finished subgrade elevation below foundations, floor slabs, and pavements. Depending on final design grades, overexcavation of the higher plasticity materials may be recommended to minimize the material's shrink-swell potential. The thickness of overexcavation below the foundations and/or floor slabs will vary and may partially depend upon the plasticity of the soil and its swell pressure. Swell tests are recommended during the final subsurface exploration phase of this project to evaluate the swell potential of these materials. In addition, these materials should not be allowed to desiccate or become saturated during construction.

The ground surface should be sloped away from the structures and excessive irrigation of landscaping should also be avoided. These precautions should help reduce the potential of future volume changes of the underlying soil, but they will not eliminate the risk for the owner.

Depending on final grading plans and site layouts, it may be necessary to provide some means of controlling water during and after construction. This is typically accomplished with a series of ditches, drain lines, and sump pits and pumps. These systems will help "pre-drain" the site, lower and control the groundwater level, and minimize disturbance of bearing subgrades. As a minimum, subdrain systems should extend at least 2 feet below the excavation elevation. Drain lines and site drainage features should be installed as far in advance of construction as possible. In addition, where significant cut thicknesses are anticipated, consideration should be given to including provisions of perimeter foundation subdrains, subfloor drains, and pavement underdrain systems on a case by case basis.

The majority of the industrial park has been historically used as agricultural land. Although field tile subdrains were not encountered at the boring locations, they may be present in other areas of the site. Any field tile subdrains encountered during construction should be properly abandoned or rerouted to a reliable outlet, such as a storm sewer.

Additional geotechnical considerations, comments, and preliminary recommendations related to site development are presented in the following paragraphs.

4.2 Preliminary Building Foundation Recommendations

Preliminarily, it is our opinion that lightly-loaded structures could be supported on conventional spread footings designed using net allowable soil bearing pressures from 1,200 to 4,000 psf. The net allowable soil bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The recommended net allowable bearing pressures for each building site will depend on the location of the structure, design grades selected, footing bearing elevations, and the structural loading conditions.

Some overexcavation and replacement with granular fill or crushed stone should be anticipated in some areas if lower-strength soil is not removed during mass grading operations. Alternately, the use of a ground improvement system below foundations (i.e. overexcavation and replacement with rock backfill or Geopiers or stone columns) could be considered in lieu of an overexcavation and replacement approach. However, the developer and/or designer should take into consideration the suitability of the resulting subgrade to provide satisfactory support of slabs-on-grade and pavements when considering the use of a ground improvement system for a particular development.

The use of a surcharge could also be considered to prepare sites where compressible soil is present to greater depths. The actual overexcavation depths and/or method of mitigation of relatively low-strength soil would depend on the individual structure's loading conditions, foundation contact pressure, and final design grades. Overexcavation depths would be evaluated on a case by case basis. For frost protection, footings should be designed with a minimum embedment depth of 4 feet. If necessary, it should be possible to increase the foundation contact pressure by an overexcavation and replacement procedure below footings.

4.3 Site Preparation and Earthwork

4.3.1 Stripping

In preparing the site for construction, all deleterious materials such as vegetation, organic soil, or loose, soft, frozen or otherwise unsuitable materials should be removed from proposed building, pavement, and other areas of future improvements. Generally, greater thicknesses of topsoil should be anticipated in low areas or along former and existing draws and swales.

Plowing of the soils for agricultural purposes and erosion could have also created variable topsoil thicknesses in other areas. The actual stripping depth will be variable and should be evaluated by Terracon personnel during construction. Organic material should be disposed of off-site or stockpiled for use in landscaped areas. Care should be taken during stripping so the underlying soil is not disturbed.

4.3.2 Subgrade Preparation

Based on the results of the borings, the majority of the soil types encountered below the surficial topsoil layer were fine-grained (i.e. clays and silts). These soil types will be susceptible to disturbance from construction activities, particularly if the soil has high natural moisture content or is wetted by precipitation or surface water. These on-site soil types are sensitive to changes in moisture and are susceptible to disturbance from construction activities. Care should be taken during site grading operations to minimize disturbance of subgrades.

Lower-strength soil was encountered in Borings 2, 4, 5, and 7 below the topsoil and silt was encountered in Borings 2, 4, and 7 that were high in moisture content (generally greater than 20%). These soil types were typically encountered to depths of about 5½ to 7½ feet. If lower-strength soil is not removed and replaced with engineered fill (i.e. structural fill placed with moisture and density control) during mass grading operations, overexcavation and replacement of lower-strength soil during building and pavement construction may be necessary. This is especially critical in areas where fill will be placed.

Depending on final structure locations and moisture conditions at the time of construction, it may be necessary to stabilize subgrades. Where unstable lower-strength and sensitive soil types are present near or at the bearing subgrade level, removal and replacement and/or subgrade stabilization should be anticipated. Stabilization of subgrades may be accomplished by placing about 6 to 18 inches of crushed stone or by scarifying and compacting about 12 to 24 inches of the existing soil subgrade. Alternately, the use of chemical treatment or the use of geotextiles and/or geogrid could be considered to help establish a stable subgrade condition. The stability and suitability of subgrades should be observed and evaluated by Terracon personnel during construction.

4.3.3 Structural Fill Material Requirements

Structural fill should consist of material that has been sampled and evaluated by the geotechnical engineer prior to its delivery and/or placement on the site, and is free of organic matter, debris, and frozen materials. We recommend structural fill consist of a low plasticity cohesive soil with a liquid limit of 45% or less and a plasticity index of 23% or less, or an approved granular soil/material. Based on the soil types encountered in the borings, it appears that the majority of on-site, inorganic soil meets this plasticity criterion and should be suitable for reuse as structural fill. The exception was the high moisture content lean clay soil encountered in Boring 7, which does not meet the plasticity criterion recommended and its use as fill should be limited to non-structural areas. Some moisture conditioning and treatment of on-site soil should be anticipated.

4.3.4 Preliminary Compaction Requirements

Max. Lift Thickness of Structural Fill	9 inches loose when heavy equipment is used. 4 to 6 inches loose when hand-guided equipment is used.
Min. Compaction Requirement[1] for lightly-loaded building sites[2]	98% of ASTM Standard Test Method D 698; Laboratory Compaction Characteristics of Soils Using Standard Effort
Min. Compaction Requirement[1] for Heavy-duty traffic Streets[2]	98% of ASTM Standard Test Method D 698; Laboratory Compaction Characteristics of Soils Using Standard Effort
Moisture Content of Cohesive Soil	Generally -2% to +3% of optimum; per ASTM D 698
Moisture Content of Granular Material[3]	Generally -3% to +3% of optimum; per ASTM D 698

Notes:

1. We recommend all structural fill be tested for moisture content and compaction during placement. If the results of in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the moisture and compaction requirements are achieved. The degree of fill compaction below foundations, floor slabs, and pavements, should extend laterally from all edges at least 8 inches per foot of fill thickness below the base level. If granular material is a coarse sand or gravel, is of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate.
2. The level of compaction required and the thickness of engineered fill to be placed below buildings, pavements, and other improvements should be evaluated by the designer and/or geotechnical engineer after grading plans have been developed and structural loads become available. Higher levels of compaction could be required in some areas.
3. The gradation of a granular material affects its stability and the moisture content required for proper compaction.

4.3.5 Grading and Drainage

Adequate drainage should be provided on the site to reduce the impact of water on bearing subgrade soil/materials. Excessive moisture can significantly reduce a soil's support capability and contribute to soft subgrades and settlement. During earthwork operations, exposed subgrades should be properly sloped to provide rapid drainage so that saturation of the subgrades can be minimized. However, the soil types observed in the borings are easily eroded by surface water, so appropriate erosion control measures should be provided. All surface water that accumulates on structural subgrade areas should be removed as soon as possible.

4.4 Excavations

We recommend all excavations be sloped, shored, or braced to maintain stability. Excavations must be constructed in accordance with all local, state, and federal requirements including

OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, as well as other applicable codes. The individual contractor(s) is responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom.

5.0 GENERAL COMMENTS

The discussion presented in this preliminary report is based upon the limited 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 additional subsurface exploration is performed or construction is undertaken.

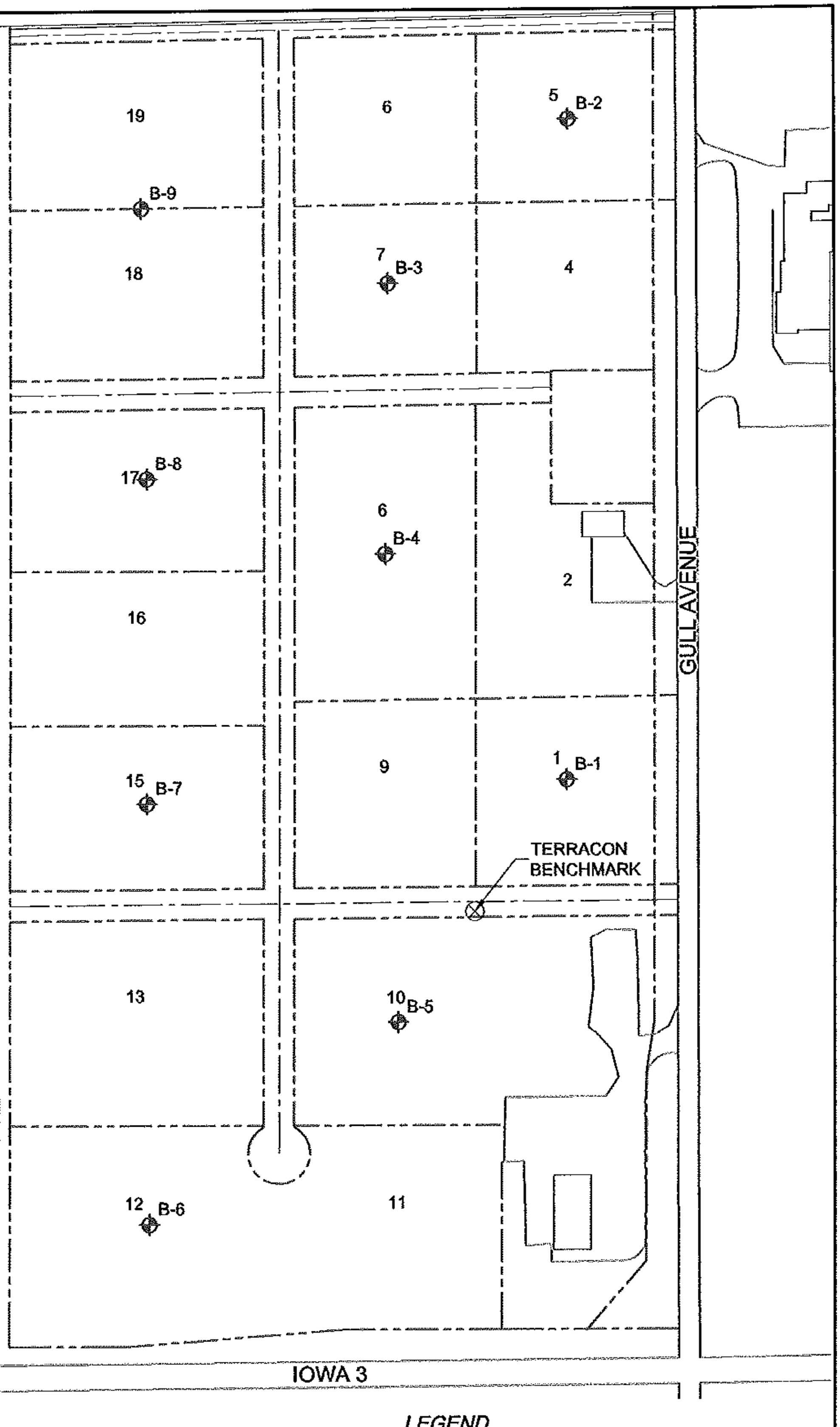
Terracon should be retained to provide additional subsurface explorations once the facility layout, site grading plans, and structural loads are further developed. Upon completion of the final subsurface explorations, Terracon should be retained to review the design plans and specifications so comments can be made regarding interpretation and implementation of our final geotechnical recommendations in the design and specifications.

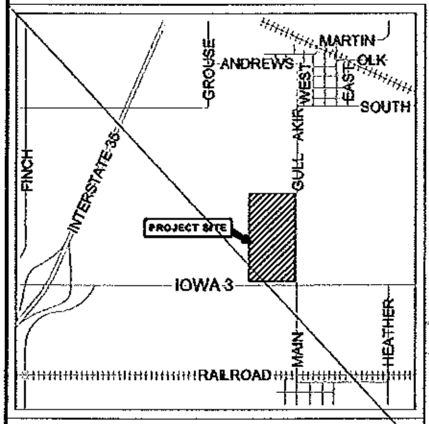
The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This preliminary 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.

APPENDIX A

FIELD EXPLORATION





SITE VICINITY 1"=1 MILE

LEGEND

⌖ - APPROXIMATE BORING LOCATION

NORTH

0 300'

APPROXIMATE DRAWING SCALE

Project No.: 13095021
Date: 04/03/09
Project Mngr: JPH
Drawn By: TK
File Name: 13095021-01.dwg
Layout Name: FIGURE A-1

Terracon
Consulting Engineers and Scientists
6612 CHANCELLOR DR CEDAR FALLS, IOWA 50613
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BORING LOCATION DIAGRAM

LATIMER INDUSTRIAL PARK
FRANKLIN COUNTY DEVELOPMENT ASSOCIATION
IOWA HIGHWAY 3 & GULL AVENUE
LATIMER, IOWA

FIG. No.

A-1

LOG OF BORING NO. 1

Page 1 of 1

CLIENT
Franklin County Development Association

SITE
Latimer, Iowa

PROJECT
Latimer Industrial Park

Boring Location: Figure A-2

Approx. Surface Elevation.: 102.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
▨	0.5 **Approx. 6" Topsoil** 101.5				PA					
▨			CL/SC	1	SS	12	5	11		*2000
▨	**SANDY LEAN CLAY, TRACE GRAVEL, WITH OCCASIONAL SAND SEAMS** Brown, Stiff ▼		CL/SC	2	ST	8		17	110	2680
▨		5			PA					
▨			CL	3	SS	18	10	18		*3500
▨					PA					
▨	8 94									
▨			CL/SC	4	ST	17		18	106	2730 *4000
▨		10			PA					
▨	**SANDY LEAN CLAY, TRACE GRAVEL, WITH OCCASIONAL SAND SEAMS** Gray Brown, Stiff to Very Stiff		CL	5	SS	18	11	18		*4500
▨	▽	15			PA					
▨			CL/SC	6	SS	18	10	17		*2500
	20 82	20								
	BOTTOM OF BORING Figure A-2									

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	▽ 16	WD ▼ 4.5	(3/23)
WL	▽	▽	
WL	WCI @ 15 ft. 3/23/09		

Terracon

BORING STARTED			3-20-09
BORING COMPLETED			3-20-09
RIG	# 977	FOREMAN	SZ
APPROVED	JPH	JOB #	13095021

LOG OF BORING NO. 2

Page 1 of 1

CLIENT
Franklin County Development Association

SITE
Latimer, Iowa

PROJECT
Latimer Industrial Park

Boring Location: Figure A-3

Approx. Surface Elevation.: 97.0 ft

GRAPHIC LOG	DESCRIPTION		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	TESTS Organic Content
1	**Approx. 12" Topsoil**	96				PA						
	LEAN CLAY WITH SAND Gray, Stiff			CL	1	SS	14	7	25		*2500	LOI= 3%
3	▼	94										
	CLAYEY SILT WITH SAND Brown Gray, Soft			ML/CL	2	ST	5		27		*1000	
	∇		5			PA						
				ML/CL	3	ST	11		30	85	650	
7.5		89.5										
						PA						
				CL	4	SS	14	9	19		*3000	
	SANDY LEAN CLAY, TRACE GRAVEL WITH OCCASIONAL SAND SEAMS Gray, Stiff		10			PA						
				CL	5	SS	16	11	14		*4000	
15	**BOTTOM OF BORING**	82	15									

Figure A-3

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	∇ 5.5	WS	▼ 2.5 (3/23)
WL	▼		∇
WL	WCI @ 10 ft. 3/23/09		

Terracon

BORING STARTED	3-20-09
BORING COMPLETED	3-20-09
RIG # 977	FOREMAN SZ
APPROVED JPH	JOB # 13095021

LOG OF BORING NO. 3

Page 1 of 1

CLIENT
Franklin County Development Association

SITE
Latimer, Iowa

PROJECT
Latimer Industrial Park

Boring Location: Figure A-4

Approx. Surface Elevation.: 103.0 ft

GRAPHIC LOG	DESCRIPTION	Depth	Elev.
▨	**Approx. 12" Topsoil**	1	102
▨	**SANDY LEAN CLAY, TRACE GRAVEL WITH SAND SEAMS AND LAYERS** Brown and Gray, Stiff	10	93
▨	**SANDY LEAN CLAY, TRACE GRAVEL WITH OCCASIONAL SAND SEAMS** Gray Brown, Stiff	15	88
	BOTTOM OF BORING Figure A-4		

DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
			PA					
	CL	1	SS	3	6	18		*2500
	CL/SC	2	ST	5		15		*3500
5			PA					
	CL/SC	3	SS	16	7	16		*2000
			PA					
	CL/SC	4	ST	16		17	104	2330
10			PA					
	CL/SC	5	SS	18	11	14		*3000
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	▼
WL	▼		∇
WL			

Terracon

BORING STARTED			3-20-09
BORING COMPLETED			3-20-09
RIG	# 977	FOREMAN	SZ
APPROVED	JPH	JOB #	13095021

LOG OF BORING NO. 4

Page 1 of 1

CLIENT
Franklin County Development Association

SITE
Latimer, Iowa

PROJECT
Latimer Industrial Park

Boring Location: Figure A-5

Approx. Surface Elevation.: 102.0 ft

DESCRIPTION	Depth, ft	Elevation
Approx. 24" Topsoil	2	100
SANDY LEAN CLAY, TRACE GRAVEL WITH OCCASIONAL SAND AND SILT SEAMS AND LAYERS Brown, Stiff ∇	6	96
▼ **CLAYEY SILT WITH SAND** Light Brown, Medium Stiff to Stiff	12	90
SANDY LEAN CLAY, TRACE GRAVEL WITH OCCASIONAL SAND SEAMS Brown, Stiff	15	87
BOTTOM OF BORING		

Figure A-5

DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
			PA					
	CL/OL	1	SS	10	6	26		
	CL/SC	2	ST	5		20		*3500
5			PA					
	ML/CL	3	ST	13		24		*1500
			PA					
	ML/CL	4	SS	14	6	28		*3000
10			PA					
	CL/SC	5	SS	18	6	24		*4000
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	∇ 5.5	WS	▼ 7.0 (3/23)
WL	▼		∇
WL	WCI @ 10 ft. 3/23/09		

Terracon

BORING STARTED	3-20-09		
BORING COMPLETED	3-20-09		
RIG	# 977	FOREMAN	SZ
APPROVED	JPH	JOB #	13095021

LOG OF BORING NO. 5

Page 1 of 1

CLIENT **Franklin County Development Association**	
SITE **Latimer, Iowa**	PROJECT **Latimer Industrial Park**

Boring Location: Figure A-6

Approx. Surface Elevation.: 98.5 ft

GRAPHIC LOG	DESCRIPTION		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
0.5	**Approx. 6" Topsoil**	98				PA					
	SANDY LEAN CLAY, TRACE GRAVEL WIITH OCCASIONAL SAND SEAMS Brown and Gray, Medium Stiff			CL/SC	1	SS	12	3	13		1500
				CL/SC	2	ST	10		17		1500
5.5		93	5			PA					
	CLAYEY FINE TO MEDIUM SAND, TRACE GRAVEL Brown, Medium Dense ∇ ▼			SC	3	SS	12	15	12		
						PA					
8		90.5									
	SANDY LEAN CLAY, TRACE GRAVEL WITH OCCASIONAL SAND SEAMS Gray Brown to Gray, Very Stiff to Hard			CL/SC	4	SS	16	20	13		*8000
			10			PA					
				CL/SC	5	SS	18	23	11		*9000+
15		83.5	15								
	BOTTOM OF BORING Figure A-6										

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	∇ 6	WS	▼ 7.0 (3/23)
WL	∇		▼
WL	WCI @ 8 ft. 3/23/09		

Terracon

BORING STARTED			3-20-09
BORING COMPLETED			3-20-09
RIG	# 977	FOREMAN	SZ
APPROVED	JPH	JOB #	13095021

LOG OF BORING NO. 6

Page 1 of 1

CLIENT
Franklin County Development Association

SITE
Latimer, Iowa

PROJECT
Latimer Industrial Park

Boring Location: Figure A-7

Approx. Surface Elevation.: 104.0 ft

GRAPHIC LOG	DESCRIPTION			DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N ** BLOWS / ft	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
▨	0.5	**Approx. 6" Topsoil**	103.5				PA					
▨		**CLAYEY FINE TO MEDIUM SAND, WITH SILT, TRACE GRAVEL** Brown and Light Brown			SC-SM	1	SS	14	11	16		
▨	5		99		SC-SM	2	ST	13		15		
▨				5	CL/SC	3	SS	14	13	14		*4000
▨							PA					
▨		**SANDY LEAN CLAY, TRACE GRAVEL WITH SAND SEAMS AND LAYERS** Brown, Stiff to Very Stiff ▼			CL/SC	4	ST	15		12		*4000
▨	13		91	10			PA					
▨					CL/SC	5	SS	18	11	14		*3000
▨		**SANDY LEAN CLAY, TRACE GRAVEL WITH OCCASIONAL SAND SEAMS** Gray Brown to Gray, Stiff		15			PA					
▨	20		84		CL/SC	6	SS	18	7	14		*3000
		BOTTOM OF BORING Figure A-7		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	WS ▼ 9.5	(3/23)
WL	▽	▼	
WL	WCI @ 15 ft. 3/23/09		

Terracon

BORING STARTED			3-20-09
BORING COMPLETED			3-20-09
RIG	# 977	FOREMAN	SZ
APPROVED	JPH	JOB #	13095021

LOG OF BORING NO. 7

Page 1 of 1

CLIENT
Franklin County Development Association

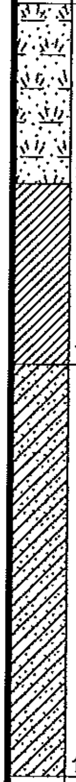
SITE
Latimer, Iowa

PROJECT
Latimer Industrial Park

Boring Location: Figure A-8

Approx. Surface Elevation.: 99.0 ft

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	
Approx. 42" Topsoil				PA						
		CL/OL	1	SS	10	4	25			
3.5 95.5		CL/OL	2	ST	2		26		*1000	
LEAN CLAY, TRACE SAND AND SILT Light Gray, Soft ▼	5			PA						
		CL	3	SS	14	3	43		*500	LL=42 PI=27
7 ∇ 92				PA						
CLAYEY FINE TO MEDIUM SAND, TRACE GRAVEL Brown and Gray Medium Dense		SC	4	ST	24		25	98	1430	
	10			PA						
		SC	5	SS	6	12	14			
15 84	15									
BOTTOM OF BORING Figure A-8										

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	∇ 7	WS	▼ 5 (3/23)
WL	∇		▼
WL	WCI @ 7 ft. 3/23/09		

Terracon

BORING STARTED	3-20-09		
BORING COMPLETED	3-20-09		
RIG	# 977	FOREMAN	SZ
APPROVED	JPH	JOB #	13095021

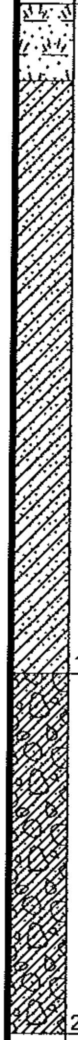
LOG OF BORING NO. 8

Page 1 of 1

CLIENT **Franklin County Development Association**	
SITE **Latimer, Iowa**	PROJECT **Latimer Industrial Park**

Boring Location: Figure A-9

Approx. Surface Elevation.: 108.0 ft



Approx. 18" Topsoil

1.5 — 106.5

CLAYEY FINE TO MEDIUM SAND, TRACE GRAVEL
Brown to Light Brown
Loose to Medium Dense

▼

13 — 95

SANDY LEAN CLAY, TRACE GRAVEL WITH OCCASIONAL SAND SEAMS
Brown to Gray, Stiff

20 — 88

BOTTOM OF BORING

Figure A-9

		SAMPLES				TESTS		
DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
			PA					
	CL/OL	1	SS	6	7			
	SC					19		*2000
	SC	2	ST	14		13	112	1780
5			PA					
	SC	3	ST	14		15		
			PA					
	CL/SC	4	SS	3	13	15		*1000
10			PA					
	CL	5	SS	16	10	15		*4500
15			PA					
	CL/SC	6	SS	18	10	13		*3500
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	WS	▼ 10 (3/23)
WL	∇		∇
WL	WCI @ 13 ft. 3/23/09		

Terracon

BORING STARTED	3-20-09		
BORING COMPLETED	3-20-09		
RIG	# 977	FOREMAN	SZ
APPROVED	JPH	JOB #	13095021

LOG OF BORING NO. 9

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CLIENT
Franklin County Development Association

SITE
Latimer, Iowa

PROJECT
Latimer Industrial Park

Boring Location: Figure A-10

Approx. Surface Elevation.: 106.5 ft

	DESCRIPTION		DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
					NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
0.5	**Approx. 6" Topsoil**	106				PA					
				SC	1	SS	14	6	19		
	▼			SC/CL	2	ST	15		16		*1500
	CLAYEY FINE TO MEDIUM SAND, TRACE GRAVEL Brown, Loose to Medium Dense		5			PA					
				SC/CL	3	SS	12	8	7		*2000
						PA					
				SC/CL	4	ST	19		14	111	1440
			10			PA					
13		93.5									
	SANDY LEAN CLAY, TRACE GRAVEL WITH OCCASIONAL SAND SEAMS Gray Brown, Stiff			CL	5	SS	18	10	13		*3500
15		91.5	15								
	BOTTOM OF BORING										

Figure A-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	▼ 4	(3/23)
WL	▼		▽	
WL	WCI @ 9 ft. 3/23/09			

Terracon

BORING STARTED	3-20-09		
BORING COMPLETED	3-20-09		
RIG	# 977	FOREMAN	SZ
APPROVED	JPH	JOB #	13095021

Field Exploration Description

The boring locations were laid out on the site by the drill crew using a site plan provided by Ryken Engineering. Ground surface elevations rounded to the nearest ½-foot are shown on the individual boring logs in Appendix A. Elevations were obtained by the drill crew using a surveyor's level and rod. The elevations were referenced to the manhole rim near the northwest property corner of J.C. Well Company as indicated on the Boring Location Diagram included in Appendix A. This temporary benchmark was assigned an arbitrary elevation of 100.0 feet. The locations and elevations 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 drill rig using continuous flight hollow-stem augers to advance the boreholes. Materials encountered in the borings were obtained using thin-walled tube and split-barrel sampling procedures.

In the split barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split barrel sampler the last 12 inches of the typical total 18 inch penetration by means of a CME automatic hammer with a free fall of 30 inches, is the standard penetration resistance value (N). The N-value is used to estimate the relative density of cohesionless soils and consistency of cohesive soils.

In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge is pushed hydraulically into the soil to obtain a relatively undisturbed sample. The samples were tagged for identification, sealed to reduce moisture loss, and transported to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site.

During drilling operations, a field log of each boring was 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 the engineer's interpretation of the field logs and include modifications based on observation and tests of the samples in our laboratory.

APPENDIX B

SUPPORTING INFORMATION

Laboratory Testing

Soil samples were tested in our laboratory to measure their dry unit weight and natural water content. Unconfined compression tests were performed on selected samples and a calibrated hand penetrometer was used to estimate the unconfined compressive strength of some samples. The calibrated hand penetrometer has been correlated with unconfined compression tests and provides a better estimate of soil consistency than visual examination alone. Select samples were also tested for plastic and liquid limits and organic content by heating. The test results are provided on the boring logs included in Appendix A.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System (USCS). Also shown are estimated USCS symbols. A brief description of the USCS is attached to this report. All classifications were performed using visual manual procedures.

APPENDIX C

SUPPORTING DOCUMENTS

Figure C-1

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-^{3}/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling	N/I:	Not Indicated due to wash boring
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. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally 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 in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	<2	Very Soft
500 – 1,000	2-3	Soft
1,001 – 2,000	4-6	Medium Stiff
2,001 – 4,000	7-12	Stiff
4,001 – 8,000	13-26	Very Stiff
8,000+	26+	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
50+	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

GRAIN SIZE TERMINOLOGY

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

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

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Figure C-2

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]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ 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	Silts 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]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay[K,L,M,N]
					Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic Silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay[K,L,M,P]
					Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels 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.

[D] Sands 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] $Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

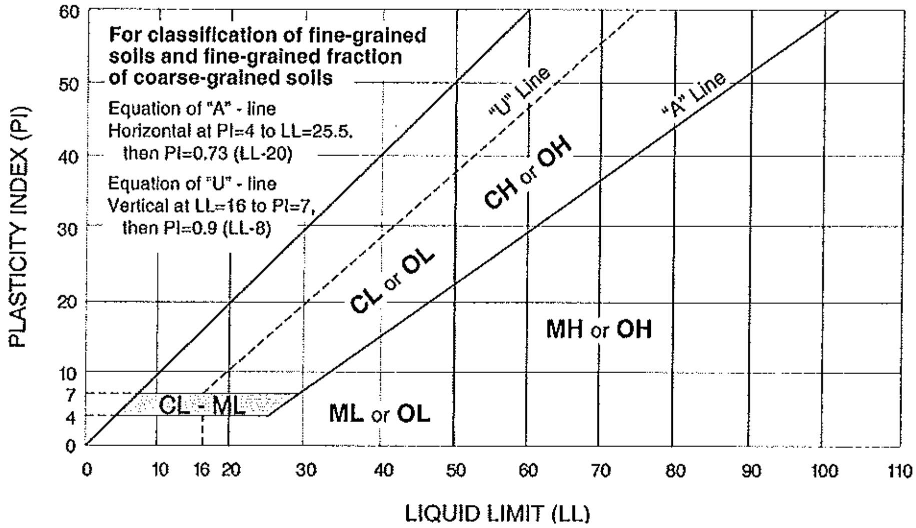
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 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.



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