



November 13, 2018

Hammers Construction
1411 Woolsey Heights
Colorado Springs, Colorado 80915

Attn: Mr. Bob Green

**Re: Geotechnical Engineering Update Letter
Claremont Business Park Filing Nos. 1 and 2
State Highway 24 and Marksheffel Road
Colorado Springs, Colorado
Terracon Project No. 23055071**

Released for Permit
DEC 12 2018
MA
RBD Construction


Terracon completed geotechnical engineering exploration and Geotechnical Engineering Reports, dated October 5, 2005 and May 30, 2006 for Claremont Business Park Filing Nos. 1 and 2, respectively. We have been requested to provide an update letter for proposed construction within the development with respect to our geotechnical reports.

It is our understanding that site grading remains similar to the condition at the time of our geotechnical exploration or during materials testing services. It is our opinion that the conclusions and recommendations contained in our reports remain applicable to the site. We recommend Terracon review soil subgrade conditions for foundations, slabs, and pavements at the time of construction.

If you have any questions concerning this letter or any of our testing, inspection, design and consulting services, please do not hesitate to contact us.

Sincerely,
Terracon Consultants, Inc.


Tyler A. Compton, P.E.
Senior Staff Engineer


Robert M. Hernandez, P.E.
Geotechnical Department Manager



Copies to: Addressee (3)

GEOTECHNICAL ENGINEERING REPORT

**CLAREMONT BUSINESS PARK FILING NO. 1
STATE HIGHWAY 24 AND MARKSHEFFEL ROAD
COLORADO SPRINGS, COLORADO**

**TERRACON PROJECT NO. 23055071
October 5, 2005**

Prepared for:

**Hammers Construction
3460 Capital Drive
Colorado Springs, Colorado 80915**

Attn: Mr. Jerry Edmonds

Prepared by:

**Terracon
4172 Center Park Drive
Colorado Springs, Colorado 80916
Phone: 719-597-2116
Fax: 719-597-2117**

Terracon

October 5, 2005

Hammers Construction
3460 Capital Drive
Colorado Springs, Colorado 80915

Attn: Mr. Jerry Edmonds

Re: **Geotechnical Engineering Report**
Claremont Business Park Filing No. 1
State Highway 24 and Marksheffel Road
Colorado Springs, Colorado
Terracon Project No. 23055071

Terracon
Consulting Engineers & Scientists

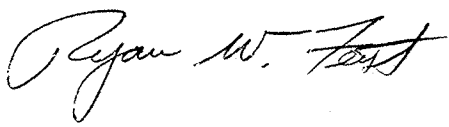
Terracon Consultants, Inc.
4172 Center Park Drive
Colorado Springs, Colorado 80916
Phone 719.597.2116
Fax 719.597.2117
www.terracon.com

Released for Permit
DEC 12 2018
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RBD Construction


Terracon has completed geotechnical engineering exploration for the proposed Claremont Business Park Filing No. 1 to be located at State Highway 24 and Marksheffel Road in Colorado Springs, Colorado. Terracon previously issued a preliminary report for this project dated August 25, 2005. This report presents final geotechnical recommendations for development of the subject lots. It should be noted that the recommendations contained in this report must be verified in writing at the time of construction by a qualified geotechnical engineer.

We appreciate being of service to you in the geotechnical engineering phase of this project, and are prepared to assist you during the construction phases as well. If you have any questions please do not hesitate to contact us.

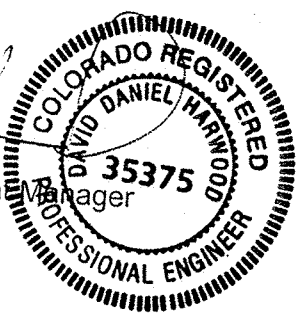
Sincerely,
TERRACON



Ryan W. Feist, P.E.
Geotechnical Engineer



David D. Harwood, P.E.
Geotechnical Department Manager



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Copies to: Addressee (3)

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GEOTECHNICAL ENGINEERING REPORT

CLAREMONT BUSINESS PARK FILING NO. 1
STATE HIGHWAY 24 AND MARKSHEFFEL ROAD
COLORADO SPRINGS, COLORADO

TERRACON PROJECT NO. 23055071
October 5, 2005

INTRODUCTION

This report contains results of our geotechnical engineering exploration for the proposed project to be located at State Highway 24 and Marksheffel Road.

The purpose of this report is to provide information and geotechnical engineering considerations relative to:

- subsurface soil conditions
- groundwater conditions
- foundation design and construction
- floor slab design and construction
- earthwork
- drainage

The information contained in this report is based upon the results of field and laboratory testing, engineering analyses, and experience with similar soil conditions, structures and our understanding of the proposed project.

PROPOSED CONSTRUCTION

Based on information provided by Mr. Ron Murphy of Hammers Construction, the proposed project will include the development of an approximate 30 acre parcel. Development will include the construction of 25 single-story, slab-on-grade commercial structures using metal frame construction. Building footprints are anticipated to be on the order of 5,000 to greater than 20,000 square feet. Wall and column loads are assumed to be on the order of 1 to 4 kips per lineal foot and 40 to 80 kips, respectively.

Mass grading of the site was nearly complete at the time of our field exploration and building pads were within about 1 foot of rough grade elevation based on survey information provided to us. A Terracon representative was present on-site during mass grading operations and provided field density observation and testing during placement of fill materials.

SITE CONDITIONS

At the time of our field explorations site grading operations were nearly complete. The site consisted of a large graded pad with drainage generally to the north. Based on our observations during grading operations, a majority of the pad area was cut to rough grade with some compacted fill placed along the northern limits of the proposed filing.

SITE EXPLORATION

The scope of the services performed for this project included site reconnaissance by a geotechnical engineer, a subsurface exploration program, laboratory testing and engineering analysis.

Field Exploration: A total of 18 test borings were drilled between August 18 and August 20, 2005 to depths of about 15 to 20½ feet below existing site grade. The borings were drilled along lot lines and within the anticipated footprint of proposed building pads. The borings were advanced with a truck-mounted drilling rig, utilizing 4-inch diameter solid-stem auger.

The borings were located in the field by the project surveyors and were staked prior to our arrival. Elevation data were obtained from the survey lath and the project civil engineer. The accuracy of boring locations and elevations should only be assumed to the level implied by the methods used.

A lithologic log of each boring was recorded by a staff engineer during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon and ring barrel samplers.

Penetration resistance measurements were obtained by driving the split-spoon and ring barrel samplers into the subsurface materials with a 140-pound hammer falling 30 inches. The penetration resistance value is a useful index to the consistency, relative density or hardness of the materials encountered.

Groundwater measurements were made in each boring at the time of site exploration. Due to the sandy soil profile and active grading operations, the borings were backfilled with auger cuttings after completion of drilling.

Laboratory Testing: Samples retrieved during the field exploration were returned to the laboratory for observation by the project geotechnical engineer, and were classified in general accordance with the Unified Soil Classification System described in Appendix C. At that time, an applicable laboratory testing program was formulated to determine engineering properties of the

subsurface materials and the field descriptions were confirmed or modified as necessary. Logs of Borings were prepared and are presented in Appendix A.

Laboratory test results are presented on the Logs of Borings and in Appendix B, and were used for the geotechnical engineering analyses, and the development of preliminary foundation and earthwork considerations. Laboratory tests were performed in general accordance with Terracon test methods.

Selected soil samples were tested for the following engineering properties:

- Water content
- Dry density
- Consolidation
- Expansion
- Grain size
- Plasticity index
- pH
- Resistivity
- Water soluble sulfate content

SUBSURFACE CONDITIONS

Soil Conditions: Based on our field logs, surface soils to a maximum depth of drilling of 20½ feet consisted of sand with varying amounts of silt and clay.

Field and Laboratory Test Results: Field test results indicate that the sand soils vary from loose to medium dense in relative density.

Laboratory test results indicate that subsoils at shallow depth are non-expansive and exhibit low to moderate compression at in-situ and elevated water contents.

Groundwater Conditions: Groundwater was not observed in the test borings at the time of field exploration. These observations represent groundwater conditions at the time of the field exploration, and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

ENGINEERING ANALYSES AND CONSIDERATIONS

Geotechnical Considerations: Based on the results of our field investigation, laboratory testing program and geotechnical analyses, development of the site is considered feasible from a geotechnical viewpoint provided that the conclusions and considerations provided herein are incorporated into the design and construction of the project. Design and construction considerations for foundation systems and other earth connected phases of the project are outlined below.

- **Spread Footings:** Due to the presence of non-swelling soils on the site, spread footing foundations bearing upon undisturbed sands are considered suitable for support for the proposed structures. The footings may be designed for a maximum allowable bearing pressure of 2,000 psf. The preliminary design bearing pressure applies to dead loads plus design live load conditions. The preliminary design bearing pressure may be increased as allowed by the local building code when considering total loads that include wind or seismic conditions.

For purposes of preliminary design, a minimum footing width of 16 inches for continuous footings and 24 inches for isolated footings has been estimated. As the preliminary design bearing capacity of footings on sands is dependent in part on footing dimensions, it is suggested that Terracon review preliminary foundation plans to evaluate if bearing capacities presented above are applicable for the proposed footings.

Lateral Earth Pressures: For level soil conditions above any free water surface, preliminary equivalent fluid pressures for unrestrained foundation elements when using on-site soils as backfill are:

- Active.....35 psf/ft
- Passive.....250 psf/ft
- Coefficient of base friction.....0.40*

*The coefficient of base friction may be combined with passive pressure as allowed by the local building code.

Where the design includes restrained elements, the following preliminary equivalent fluid pressures may be considered:

- At rest.....55 psf/ft

The preliminary lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading. Additional recommendations may be necessary if such conditions are to be included in the design.

Fill against foundation and retaining walls should be compacted to densities specified in Earthwork. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Overcompaction may cause excessive lateral earth pressures which could result in wall movement.

Seismic Considerations: On January 1, 2005, the City of Colorado Springs adopted portions of the 2003 International Building Code (IBC). To facilitate design of the project structures, we are providing seismic design parameters for the subject site based on the requirements of the 2003 IBC.

The values provided below are based on our August 18 to 20, 2005 subsurface exploration, our experience in the area, and the 2003 IBC with CD-ROM software for use in interpolating values.

Site Zip Code:	80915
Site Class.....	D
S _s	0.18g
S ₁	0.05g
F _a	1.6
F _v	2.4

Floor Slab Design and Construction: We anticipate that non-expansive soils or engineered fill will support floor slabs. Some differential movement of a slab-on-grade floor system is possible should the subgrade soils become elevated in moisture content. To reduce potential slab movements, the subgrade soils should be scarified to a minimum depth of 12 inches, adjusted to near optimum water content and compacted to a minimum of 90 percent of the maximum laboratory density determined in accordance with ASTM Test Method D-1557-02.

For structural design of concrete slabs-on-grade, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) may be used for floors supported on existing or engineered fill consisting of on-site soils.

Additional floor slab design and construction recommendations are as follows:

- Positive separations and/or isolation joints should be provided between slabs and all foundations, columns or utility lines to allow independent movement.
- Control joints should be provided in slabs to control the location and extent of cracking.
- Interior trench backfill placed beneath slabs should be compacted in accordance with recommended specifications outlined below.
- In areas subjected to heavy loading, reevaluation of slab and/or base course thickness may be required.
- If moisture sensitive floor coverings are used on interior slabs, consideration should be given to the use of barriers to minimize potential vapor rise through the slab.

- Floor slabs should not be constructed on frozen subgrade.

Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

Earthwork:

General Considerations: The following presents recommendations for site preparation, excavation, subgrade preparation and placement of engineered fills on the project.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

Subgrade Preparation: Due to the granular nature of the on-site materials, areas of soft or loose soils will likely be encountered at foundation bearing depth after excavation is completed for footings. When such conditions exist beneath planned footing areas, the subgrade soils should be recompacted prior to placement of the foundation system.

Subgrade soils beneath interior and exterior slabs should be scarified, adjusted to near optimum water content and compacted to a minimum depth of 12 inches. The water content and compaction of subgrade soils should be maintained until slab construction.

Fill Materials and Placement: On-site soils or approved imported materials free of deleterious materials and gravel larger than 3 inches may be used as fill material.

Imported soils (if required) should conform to the following:

<u>Gradation</u>	<u>Percent finer by weight (ASTM C136)</u>
3".....	70-100
No. 4 Sieve.....	50-100
No. 200 Sieve.....	35 (max)
• Liquid Limit.....	30 (max)
• Plasticity Index.....	15 (max)
• Maximum expansive potential (%)*	1.5

*Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Engineered fill materials should be compacted to a minimum of 90 percent of the maximum laboratory density determined in accordance with ASTM D-1557-01.

On-site sands and/or imported soils should be compacted at above optimum water content unless modified by the project geotechnical engineer.

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 field investigation and from other information discussed in this report. This report does not reflect variations, which may occur 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 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 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. Site safety, excavation support, and dewatering requirements are the responsibility of others. 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.

Appendix A

LOG OF BORING NO. B-01

CLIENT Hammers Construction	
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado	PROJECT Claremont Business Park, Filing No.1

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES				TESTS		
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	Approx. Surface Elev.: 6359.0 ft								
	SILTY SAND ; brown, medium dense.								
		5	SM	1	RS	6	28	15	99
			SM	2	RS	6	13	12	106
			SM	3	RS	6	18	8	109
		10	SM	4	RS	6	22	8	111
			SM	5	RS	6	24	9	110
		15							
			SC SM	6	RS	6	30	7	102
		20							
17	6342								
	SILTY TO CLAYEY SAND ; brown, medium dense.								
20.5	6338.5								
	Boring terminated at 20 ½ feet.								

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ None	WD	∇ None AD
WL	∇		∇
WL			



BORING STARTED		8-20-05	
BORING COMPLETED		8-20-05	
RIG	D-90T	FOREMAN	RKB
REVIEWED	DDH	JOB #	23055071

BOREHOLE PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-02

CLIENT
Hammers Construction

SITE **NW of Hwy 24 and Marksheffel Rd.
Colorado Springs, Colorado**

PROJECT
Claremont Business Park, Filing No.1

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	Approx. Surface Elev.: 6348.5 ft									
	SILTY SAND ; brown, medium dense.									
			SM	1	GRAB					
			SM	2	RS	12	33	5	108	
			SM	3	RS	12	31	5	107	
		5								
			SM	4	RS	12	37	5	108	
8	6340.5									
	POORLY GRADED SAND ; light brown, medium dense.									
			SP	5	RS	12	29	2	87	
		10								
14	6334.5									
	SILTY SAND ; brown, medium dense.									
			SM	6	RS	12	27	6	106	
		15								
			SM	7	SS	18	30			
		20								
20.5	6328									
	Boring terminated at 20 ½ feet.									

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

WATER LEVEL OBSERVATIONS, ft			
WL	None	WD	None
			AD
WL	None	WD	None
WL		WD	



BORING STARTED		8-18-05	
BORING COMPLETED		8-18-05	
RIG	CME-55	FOREMAN	KAS
REVIEWED	DDH	JOB #	23055071

BOREHOLE: PL 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-03

CLIENT
Hammers Construction

SITE
**NW of Hwy 24 and Marksheffel Rd.
Colorado Springs, Colorado**

PROJECT
Claremont Business Park, Filing No.1

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	Approx. Surface Elev.: 6360.5 ft									
	SILTY SAND ; brown, loose to medium dense.									
		5							Non-Plastic	
			SM	1	RS	6	14	8		94
			SM	2	RS	6	19	4		112
			SM	3	RS	6	27	4		109
			SM	4	RS	6	20	5		107
		10								
			SM	5	RS	6	34	7	99	
		15								
	17	6343.5								
	CLAYEY SAND ; brown, dense.									
		20								
			SC	6	RS	6	39	9	110	
		20								
	20.5	6340								
	Boring terminated at 20 ½ feet.									

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ None	WD	▽ None AD
WL	▽		▽
WL			



BORING STARTED		8-20-05	
BORING COMPLETED		8-20-05	
RIG	D-90T	FOREMAN	RKB
REVIEWED	DDH	JOB #	23055071

BOREHOLE PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-05

CLIENT <p style="text-align: center;">Hammers Construction</p>	
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SITE <p style="text-align: center;">NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado</p>	PROJECT <p style="text-align: center;">Claremont Business Park, Filing No.1</p>
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GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS	
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	Approx. Surface Elev.: 6364.5 ft								
	SILTY SAND ; brown, loose to medium dense.	5							
		6	SM	1	RS	6	11	18	101
		7							
		8	SM	2	RS	6	14	7	102
		9							
		10	SM	3	RS	6	17	7	106
		11							
		12	SM	4	RS	6	21	14	105
		13							
		14	SM	5	RS	6	47	9	114
		15							
	Boring terminated at 15 feet.								

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ None	WD	∇ None AD
WL	∇		∇
WL			



BORING STARTED	8-20-05
BORING COMPLETED	8-20-05
RIG	D-90T FOREMAN RKB
REVIEWED	DDH JOB # 23055071

BOREHOLE: PL 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-06

CLIENT Hammers Construction	
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado	PROJECT Claremont Business Park, Filing No.1

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	Approx. Surface Elev.: 6365.5 ft									
	SILTY SAND ; brown, medium dense.									
	with clay lenses.									Non-Plastic % < #200 = 22
			SM	1	RS	6	21	10	102	
			SM	2	RS	6	23	10	109	
		5								
			SM	3	RS	6	27	9	110	
		8.5								
	CLAYEY SAND ; brown, medium dense. ▽									
			SC	4	RS	6	22	8	112	
		10								
		12								
	SILTY SAND ; brown, medium dense.									
			SM	5	RS	6	36	11	115	
		15								
	Boring terminated at 15 feet.									

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 9.0	WD	▽ None AD
WL	▽		▽
WL			

<h1 style="font-size: 2em;">Terracon</h1>	BORING STARTED		8-20-05
	BORING COMPLETED		8-20-05
	RIG	D-90T	FOREMAN RKB
	REVIEWED	DDH	JOB # 23055071

BOREHOLE: PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-07

CLIENT Hammers Construction										
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado		PROJECT Claremont Business Park, Filing No.1								
GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 6368.0 ft	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	<u>SILTY SAND</u> ; brown, loose to medium dense.	15								
		5	SM	1	RS	6	11	9	102	
		5	SM	2	RS	6	20	8	105	
		10	SM	3	RS	6	18	8	107	
		10	SM	4	RS	6	21	13	108	
		15	SM	5	RS	6	28	8	110	
	Boring terminated at 15 feet.	15								

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

WATER LEVEL OBSERVATIONS, ft			
WL	None	WD	None
			AD
WL			
WL			



BORING STARTED		8-20-05	
BORING COMPLETED		8-20-05	
RIG	D-90T	FOREMAN	RKB
REVIEWED	DDH	JOB #	23055071

BOREHOLE PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-08

CLIENT **Hammers Construction**

SITE **NW of Hwy 24 and Marksheffel Rd.
Colorado Springs, Colorado**

PROJECT **Claremont Business Park, Filing No.1**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	Approx. Surface Elev.: 6352.5 ft									
	SILTY SAND , brown, loose.									
		5	SM	1	GRAB					Non-Plastic %<#200 = 14
			SM	2	RS	4	15	4	107	
			SM	3	RS	12	11	5	104	
			SM	4	RS	12	10	5	101	
		10	SM	5	RS	12	12	4	101	
			SM	6	RS	12	12	8	103	
		15								
	Boring terminated at 15 feet.	15								

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

WATER LEVEL OBSERVATIONS, ft			
WL	None	WD	None
AD			
WL	None		
WL			



BORING STARTED	8-18-05
BORING COMPLETED	8-18-05
RIG CME-55	FOREMAN KAS
REVIEWED DDH	JOB # 23055071

BOREHOLE PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-09

CLIENT Hammers Construction										
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado		PROJECT Claremont Business Park, Filing No.1								
GRAPHIC LOG		DESCRIPTION Approx. Surface Elev.: 6355.5 ft	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS	
					NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
		<u>SILTY SAND</u> ; brown, loose. color change to light brown below 2 ½ feet.	5							
	6	6349.5		SM	1	GRAB				
				SM	2	RS	12	11	9	100
				SM	3	RS	12	13	7	102
		<u>CLAYEY SAND</u> ; brown, medium dense.								
	10	6345.5		SC	4	RS	12	19	11	107
				SC	5	RS	12	34	11	103
		<u>SILTY SAND</u> ; brown, medium dense.	10							
	15	6340.5		SM	6	RS	12	37	4	113
		Boring terminated at 15 feet.	15							

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

WATER LEVEL OBSERVATIONS, ft			
WL	None	WD	None
			AD
WL			
WL			



BORING STARTED		8-18-05	
BORING COMPLETED		8-18-05	
RIG	CME-55	FOREMAN	KAS
REVIEWED	DDH	JOB #	23055071

BOREHOLE PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-10

CLIENT Hammers Construction	
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado	PROJECT Claremont Business Park, Filing No.1

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS	
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	Approx. Surface Elev.: 6356.5 ft								
	SILTY SAND ; brown, loose.								
			SM	1	GRAB				
			SM	2	RS	12	10	10	94
			SM	3	RS	12	12	4	104
		5							
			SM	4	RS	12	13	6	99
			SM	5	RS	12	17	9	104
		10							
			SM	6	RS	12	19	10	99
		15							
	Boring terminated at 15 feet.								

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ None	WD	∇ None AD
WL	∇		∇
WL			



BORING STARTED	8-18-05
BORING COMPLETED	8-18-05
RIG CME-55	FOREMAN KAS
REVIEWED DDH	JOB # 23055071

BOREHOLE PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-11

CLIENT Hammers Construction										
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado		PROJECT Claremont Business Park, Filing No.1								
GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 6357.5 ft	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	SILTY SAND ; brown, loose.	15								
		5	SM	1	GRAB				Non-Plastic %<#200 = 16	
			SM	2	RS	12	12	6		104
			SM	3	RS	12	18	4		105
			SM	4	RS	12	15	6		106
		10	SM	5	RS	12	15	7		103
			SM	6	RS	12	16	7		101
	Boring terminated at 15 feet.	15								

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

WATER LEVEL OBSERVATIONS, ft		
WL	None	WD
WL	None	AD
WL		



BORING STARTED	8-18-05
BORING COMPLETED	8-18-05
RIG	CME-55
FOREMAN	KAS
REVIEWED	DDH
JOB #	23055071

BOREHOLE: PL 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-12

CLIENT
Hammers Construction

SITE
**NW of Hwy 24 and Marksheffel Rd.
Colorado Springs, Colorado**

PROJECT
Claremont Business Park, Filing No.1

GRAPHIC LOG

DESCRIPTION

Approx. Surface Elev.: 6359.5 ft

SILTY SAND; brown, loose.

color change to mottled brown below 5 feet.

CLAYEY SAND; brown, medium dense.

Boring terminated at 15 feet.

DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
		NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	SM	1	GRAB					
	SM	2	RS	12	14	14	102	
	SM	3	RS	12	14	13	102	
5								
	SM	4	RS	12	17	5	110	
10	SM	5	RS	12	19	5	111	
15	SC	6	RS	12	23	9	104	

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

WATER LEVEL OBSERVATIONS, ft

WL	∇ None	WD	∇ None	AD
WL	∇		∇	
WL				

Terracon

BORING STARTED		8-18-05
BORING COMPLETED		8-18-05
RIG	CME-55	FOREMAN KAS
REVIEWED	DDH	JOB # 23055071

LOG OF BORING NO. B-13

CLIENT <p style="text-align: center;">Hammers Construction</p>										
SITE <p style="text-align: center;">NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado</p>		PROJECT <p style="text-align: center;">Claremont Business Park, Filing No.1</p>								
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	
	Approx. Surface Elev.: 6362.5 ft									
	SILTY SAND ; brown, loose.									
		5	SM	1	GRAB					
			SM	2	RS	12	15	15	102	
			SM	3	RS	12	16	10	101	
		10	SM	4	RS	12	24	13	105	
			SM	5	RS	12	24	5	109	
		14								
	6348.5		SC	6	RS	12	22	9	107	
	6347.5		SM							
		15								
	Boring terminated at 15 feet.									

LL = 24
PI = 2
%<#200 = 38

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

WATER LEVEL OBSERVATIONS, ft		
WL	None	AD
WL	None	
WL		



BORING STARTED		8-18-05	
BORING COMPLETED		8-18-05	
RIG	CME-55	FOREMAN	KAS
REVIEWED	DDH	JOB #	23055071

BOREHOLE PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-14

CLIENT Hammers Construction	
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado	PROJECT Claremont Business Park, Filing No.1

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS	
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	Approx. Surface Elev.: 6364.0 ft								
	SILTY SAND ; brown, loose to medium dense.								
			SM	1	GRAB				
			SM	2	RS	12	20	6	100
			SM	3	RS	12	13	8	101
		5							
			SM	4	RS	12	12	5	98
	8.5 6355.5								
	CLAYEY SAND ; brown, loose.								
			SC	5	RS	12	16	10	112
		10							
	12 6352								
	SILTY SAND ; brown, loose.								
			SM	6	RS	12	12	4	100
		15							
			SM	7	RS	12	12	5	101
		20							
	20 6344								
	Boring terminated at 20 feet.								

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

WATER LEVEL OBSERVATIONS, ft		
WL	None	WD
WL	None	AD
WL		



BORING STARTED	8-18-05
BORING COMPLETED	8-18-05
RIG	CME-55
FOREMAN	KAS
REVIEWED	DDH
JOB #	23055071

BOREHOLE PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-15

CLIENT Hammers Construction		PROJECT Claremont Business Park, Filing No.1							
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado		PROJECT Claremont Business Park, Filing No.1							
GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 6359.5 ft	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	<u>SILTY SAND</u> ; brown, medium dense.								
			SM	1	GRAB				
			SM	2	RS	12	26	5	107
			SM	3	RS	12	31	9	113
	color change to dark brown below 5 feet.	5							
			SM	4	RS	12	18	12	107
	color change to mottled brown below 8 1/2 feet.								
			SM	5	RS	12	33	2	109
		10							
			SM	6	RS	12	21	16	107
		15							
			SC	7	SS	18	18	15	
		20							
	19	6340.5							
	<u>CLAYEY SAND</u> ; brown, loose.								
	20.5	6339							
	Boring terminated at 20 1/2 feet.								

Non-Plastic
%<#200
= 15

BOREHOLE: PI 23055071.GPJ TERRACON.GDT 10/31/05

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

WATER LEVEL OBSERVATIONS, ft			
WL	None	WD	None
			AD
WL			
WL			



BORING STARTED	8-18-05
BORING COMPLETED	8-18-05
RIG CME-55	FOREMAN KAS
REVIEWED DDH	JOB # 23055071

LOG OF BORING NO. B-16

CLIENT Hammers Construction										
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado		PROJECT Claremont Business Park, Filing No.1								
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS			
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	Approx. Surface Elev.: 6368.0 ft									
8	SILTY SAND; brown, loose to medium dense.		SM	1	RS	12	23	4	105	
		5								
	color change to light brown below 7 feet.									
8			SM	2	RS	12	11	5	104	
	6360									
	SILTY TO CLAYEY SAND; brown, medium dense.		SM	3	RS	12	29	8	104	
		10								
			SC	4	RS	12	31	10	108	
			SM							
		15								
			SC	5	RS	12	44	8	1436	
			SM							
		17								
	6351									
	SILTY SAND; brown, medium dense.		SM	6	SS	12	30	7		
		20								
	6347.5									
	20.5									
	Boring terminated at 20 ½ feet.									

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

WATER LEVEL OBSERVATIONS, ft			
WL	None	WD	None
			AD
WL	None	WD	None
WL		WD	



BORING STARTED	8-19-05
BORING COMPLETED	8-19-05
RIG	D-50 FOREMAN KAS
REVIEWED	DDH JOB # 23055071

BOREHOLE PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-17

CLIENT Hammers Construction	
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado	PROJECT Claremont Business Park, Filing No.1

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	Approx. Surface Elev.: 6371.0 ft									
	SILTY SAND ; brown, loose to medium dense.									
			SM	1	RS	12	17	10	105	
			SM	2	RS	12	25	10	106	
		5								
			SM	3	RS	12	29	10	109	
		8								
	CLAYEY SAND ; brown, medium dense.									
			SC	4	RS	12	31	10	112	
		10								
		14								
	SILTY SAND ; brown, medium dense.									
			SM	5	RS	12	22	9	107	
		15								
		20.5								
	with clayey sand layers at 19 feet.		SM	6	SS	12	22	9		
		20								
	Boring terminated at 20 ½ feet.									

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

WATER LEVEL OBSERVATIONS, ft				
WL	∇ None	WD	∇ None	AD
WL	∇		∇	
WL				



BORING STARTED	8-19-05
BORING COMPLETED	8-19-05
RIG	D-50
FOREMAN	KAS
REVIEWED	DDH
JOB #	23055071

BOREHOLE: PI 23055071.GPJ TERRACON.GDT 10/31/05

LOG OF BORING NO. B-18

CLIENT Hammers Construction	
SITE NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado	PROJECT Claremont Business Park, Filing No.1

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED COMPRESSIVE STRENGTH, psi
	Approx. Surface Elev.: 6358.5 ft									
	SILTY SAND ; brown, medium dense.									
	color change to dark brown below 1 ½ feet.		SM	1	GRAB					
			SM	2	RS	12	22	8	113	
	with rootlets at 4 feet.		SM	3	RS	12	29	5	113	
	color change to brown below 5 feet.	5								
			SM	4	RS	12	29	5	111	
			SM	5	RS	12	33	6	110	
		10								
			SM	6	RS	12	17	13	113	
		15								
			SM	7	SS	18	25			
		20								
	Boring terminated at 20 ½ feet.									

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 15.0	WD
		▽ 15.5
		AD
WL	▽	▽
WL		

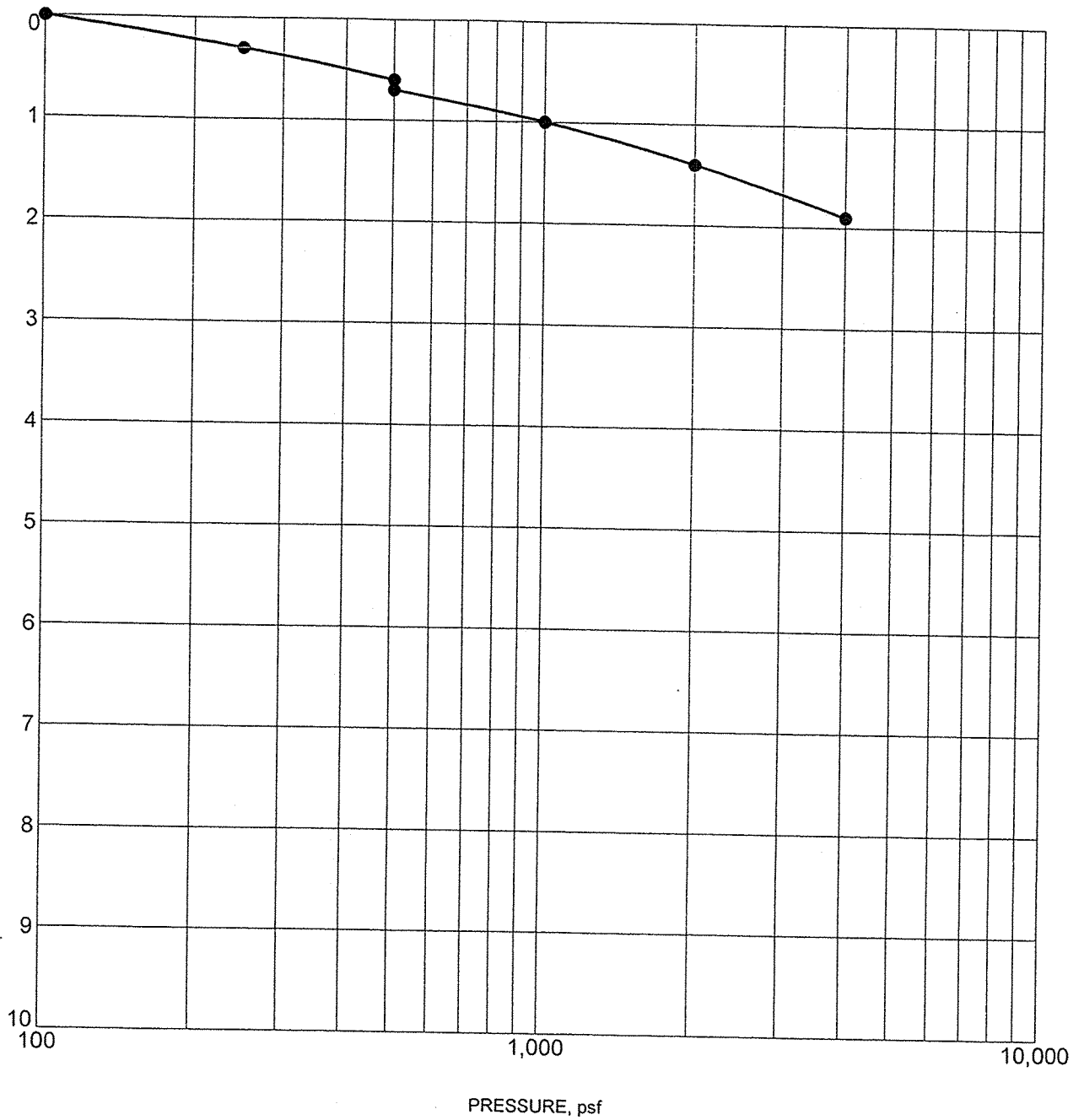


BORING STARTED	8-18-05
BORING COMPLETED	8-18-05
RIG	CME-55
FOREMAN	KAS
REVIEWED	DDH
JOB #	23055071

BOREHOLE: PI 23055071.GPJ TERRACON.GDT 10/31/05

Appendix B

AXIAL STRAIN, %



Specimen Identification	Classification	γ_d , pcf	WC, %
● B-01 4.0ft	SILTY SAND(SM)	106	12

Notes: Sample inundated with water at 500 pounds per square foot (psf).

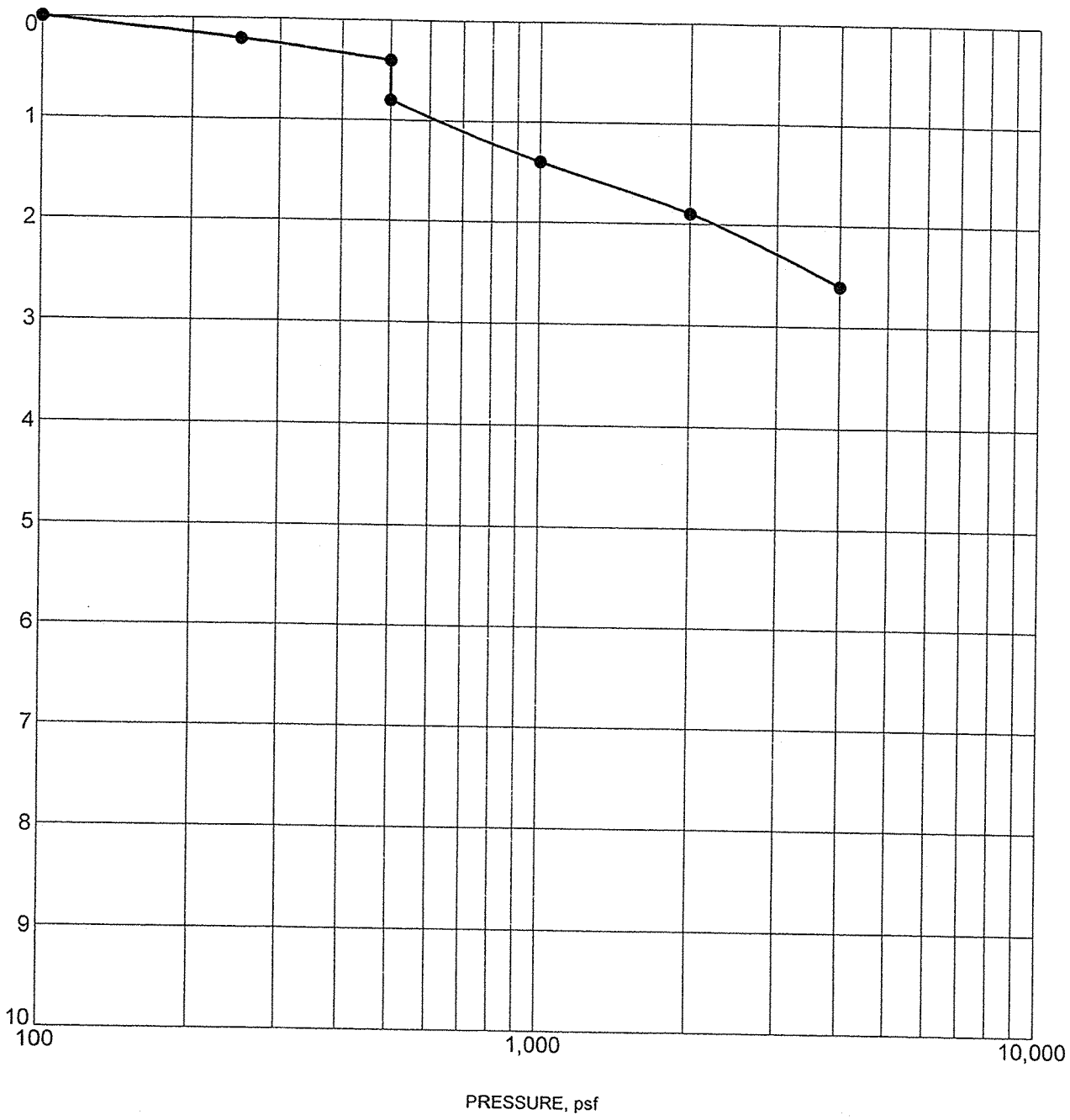
TC CONSOL. STRAIN 23055071.GPJ TERRACON.GDT 10/31/05

Terracon

CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
● B-02	2.0ft	SILTY SAND(SM)	108	5

Notes: Sample inundated with water at 500 pounds per square foot (psf).

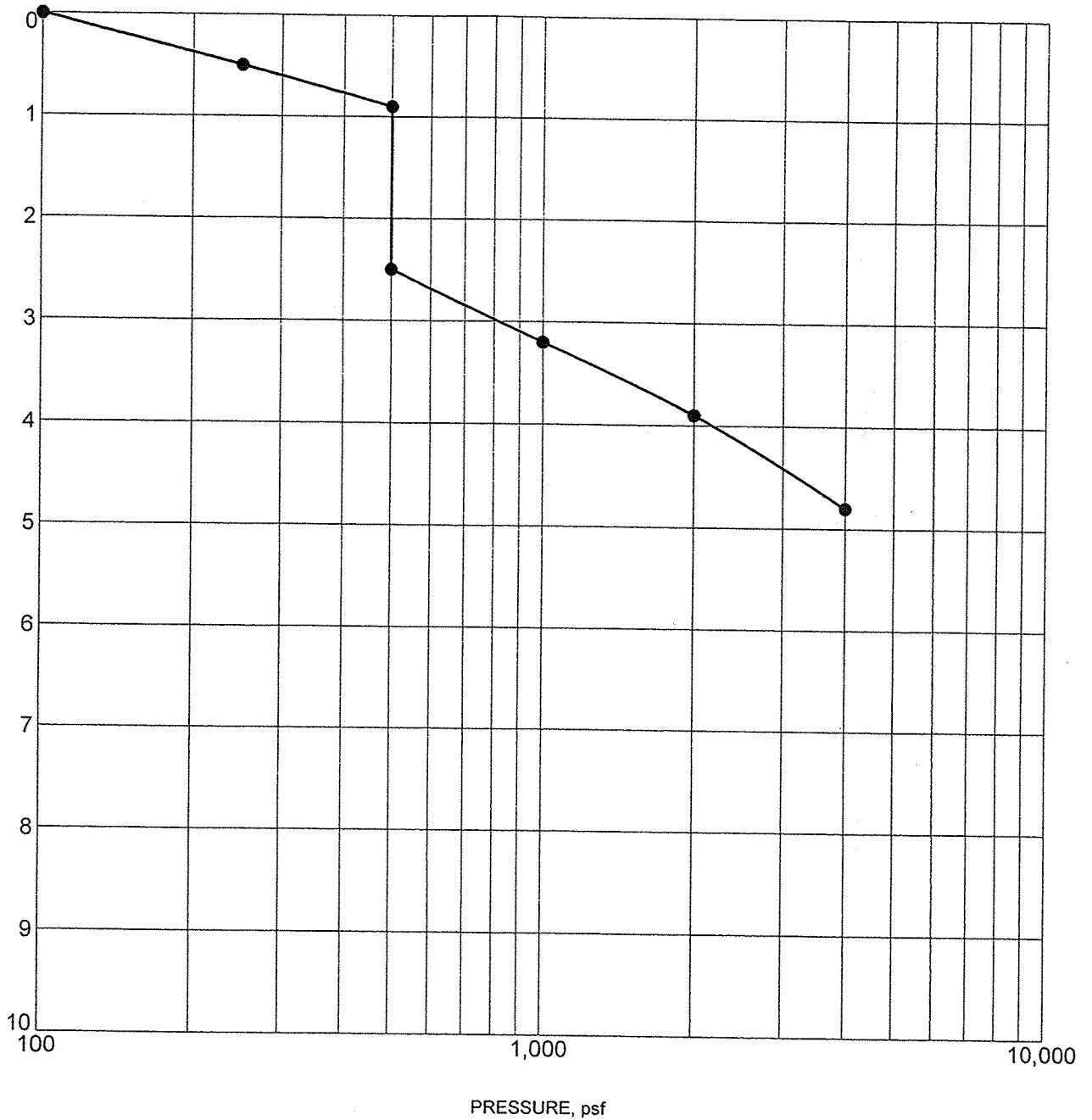
TC CONSOL STRAIN 23055071.GPJ TERRACON.GDT 10/31/05



CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
● B-03	2.0ft	SILTY SAND(SM)	94	8

Notes: Sample inundated with water at 500 pounds per square foot (psf).

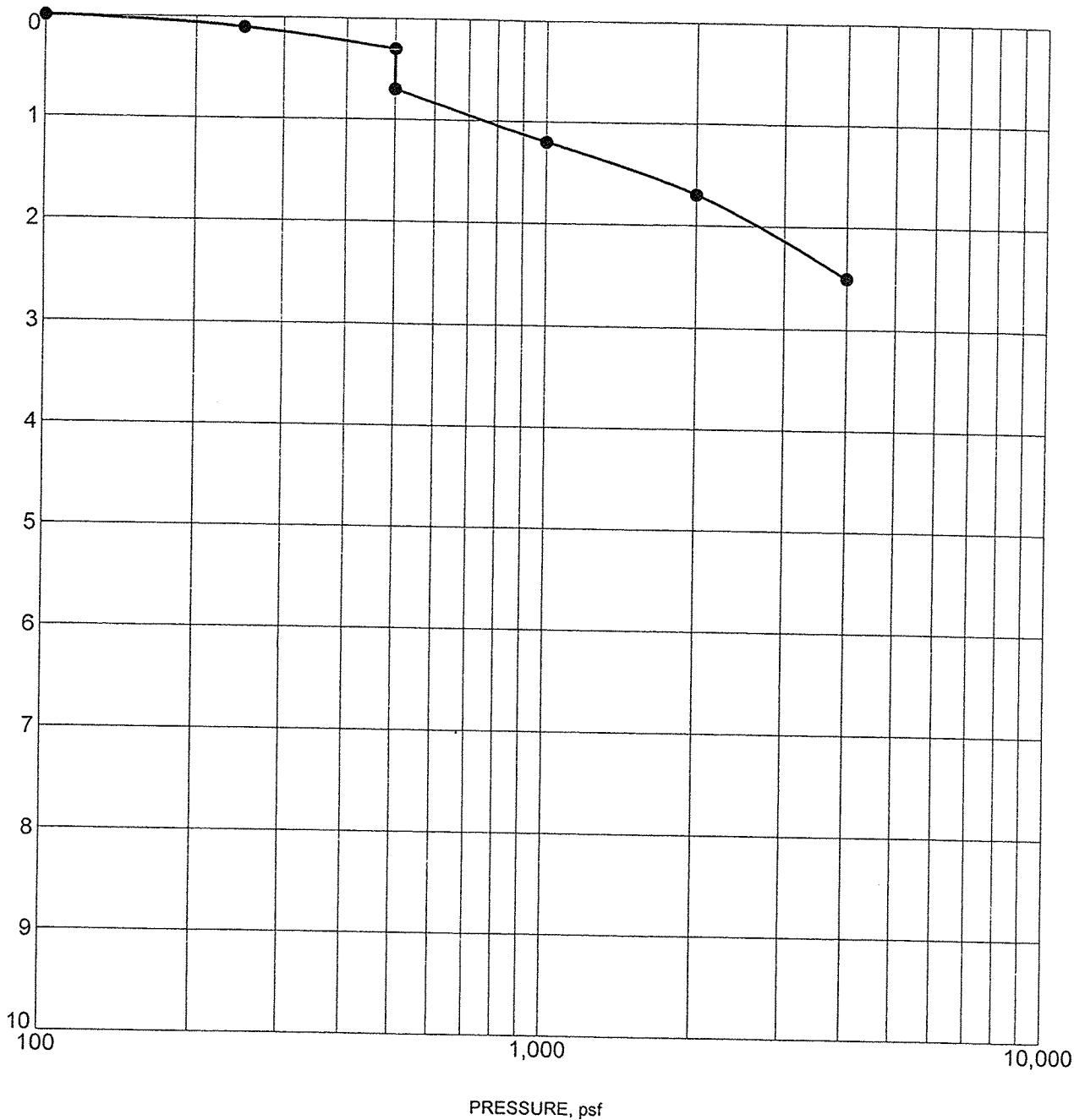
TC CONSOL STRAIN 23055071.GPJ TERRACON.GDT 10/31/05

Terracon

CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
●	B-05 4.0ft		102	7

Notes: Sample inundated with water at 500 pounds per square foot (psf).

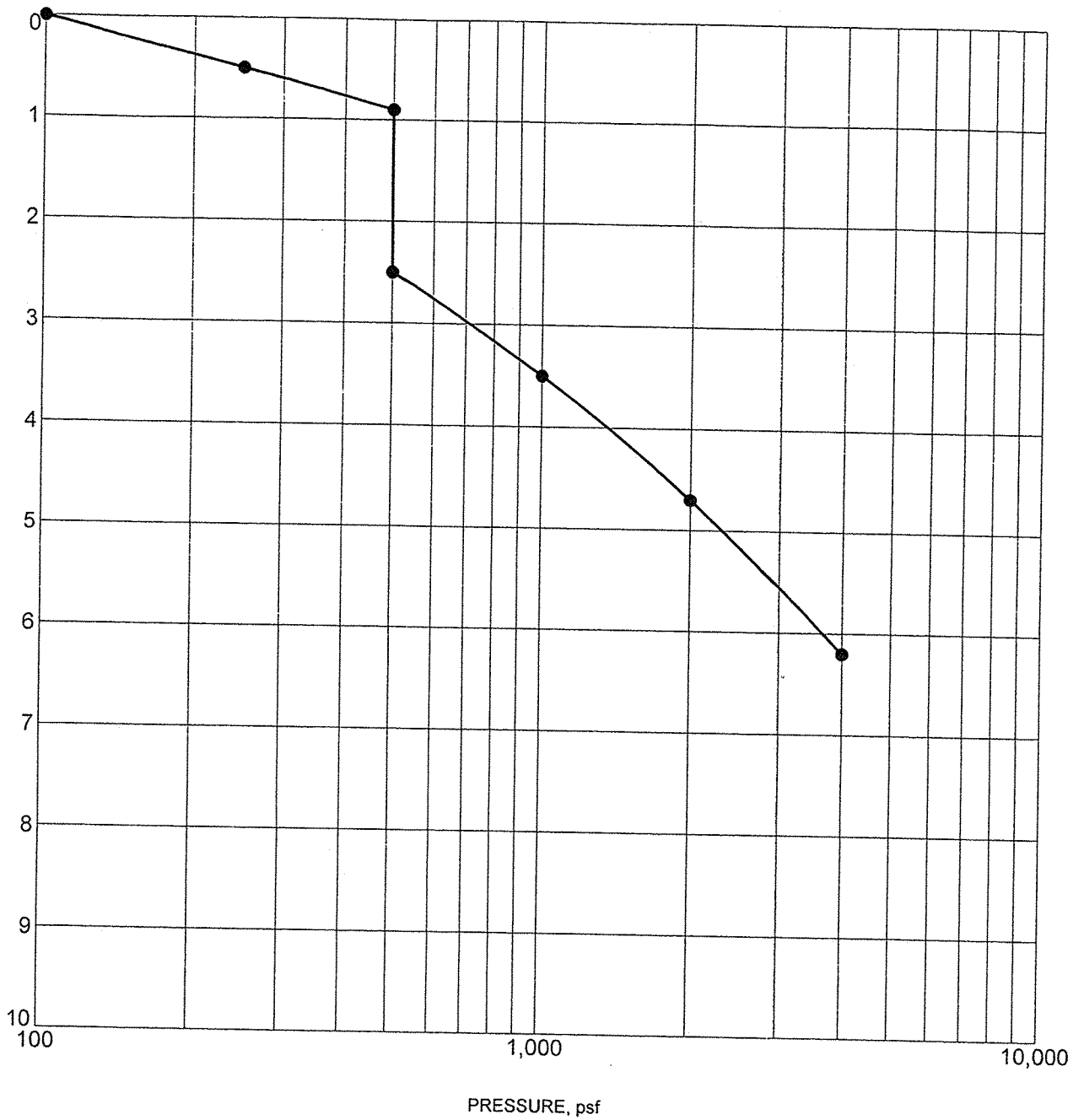
TC CONSOL_STRAIN_23055071.GPJ TERRACON.GDT 10/31/05

Terracon

CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
● B-07	2.0ft	SILTY SAND(SM)	102	9

Notes: Sample inundated with water at 500 pounds per square foot (psf).

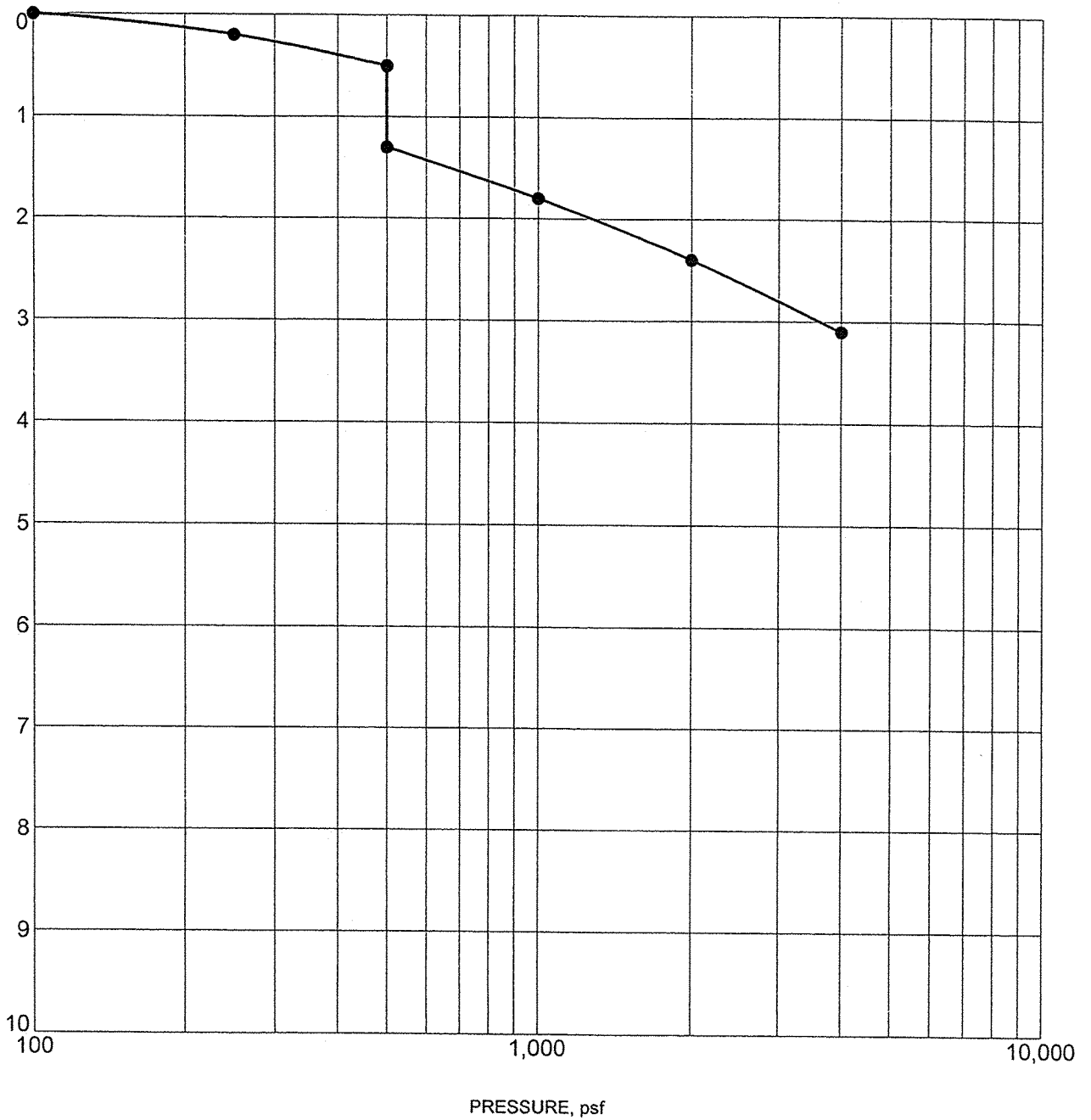
TC CONSOL STRAIN 23055071.GPJ TERRACON.GDT 10/31/05

Terracon

CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification	Classification	γ_d , pcf	WC, %
● B-08 4.0ft	SILTY SAND(SM)	104	5

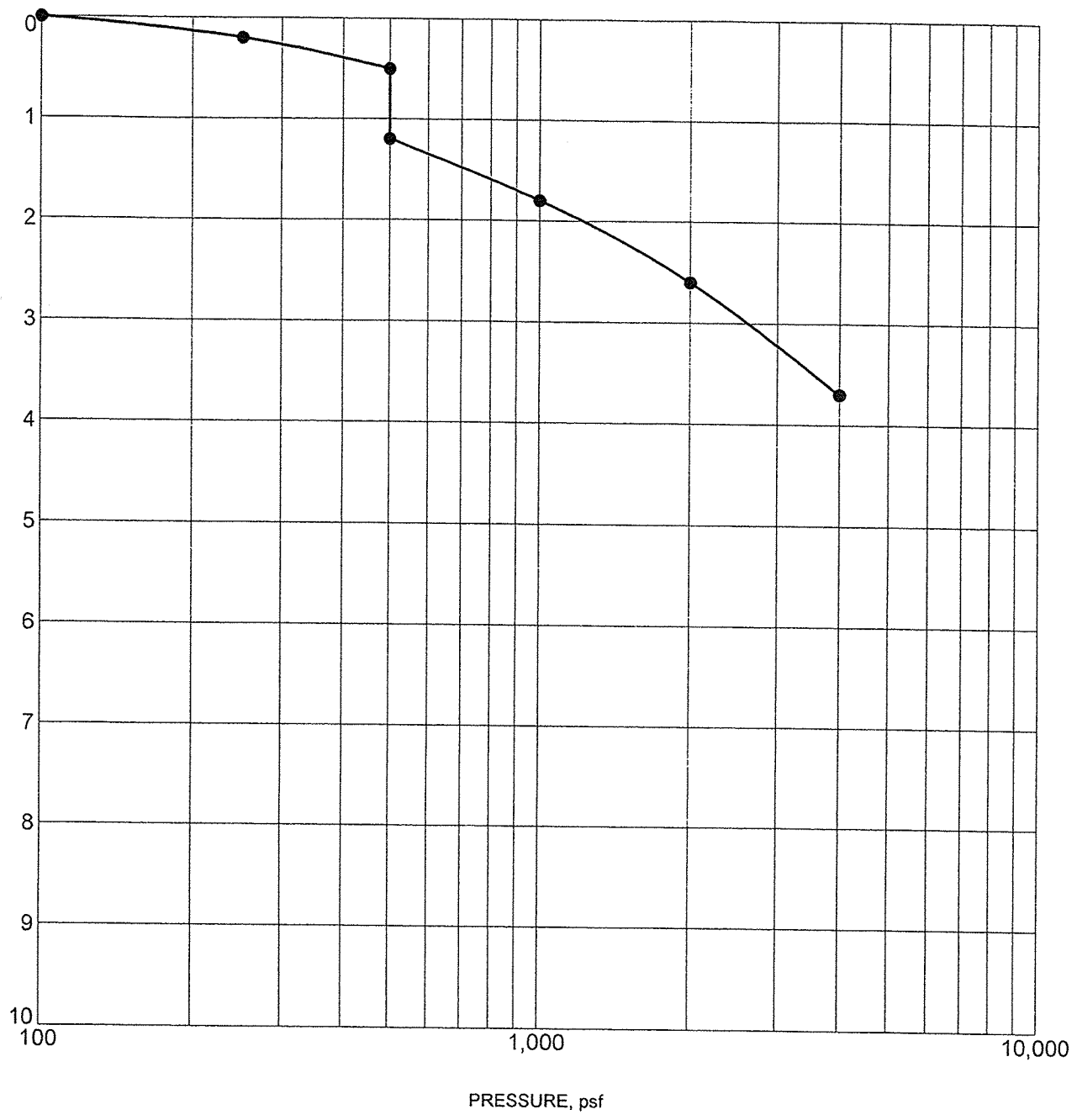
Notes: Sample inundated with water at 500 pounds per square foot (psf).

Terracon

CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification	Classification	γ_d , pcf	WC, %
● B-09 2.0ft	SILTY SAND(SM)	100	9

Notes: Sample inundated with water at 500 pounds per square foot (psf).

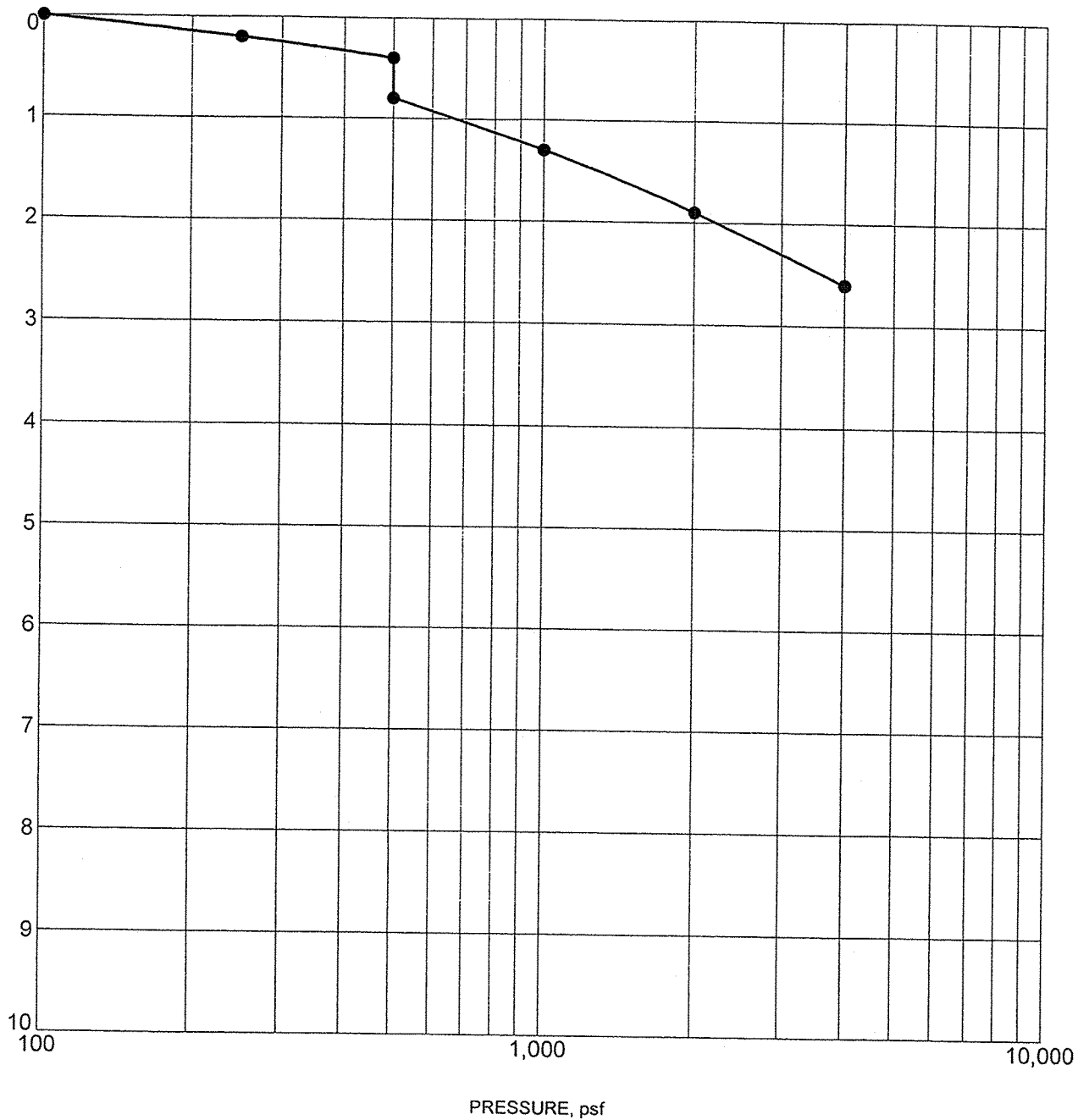
TC CONSOL. STRAIN 23055071.GPJ TERRACON.LGD 10/31/05



CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
●	B-11 4.0ft	SILTY SAND(SM)	105	4

Notes: Sample inundated with water at 500 pounds per square foot (psf).

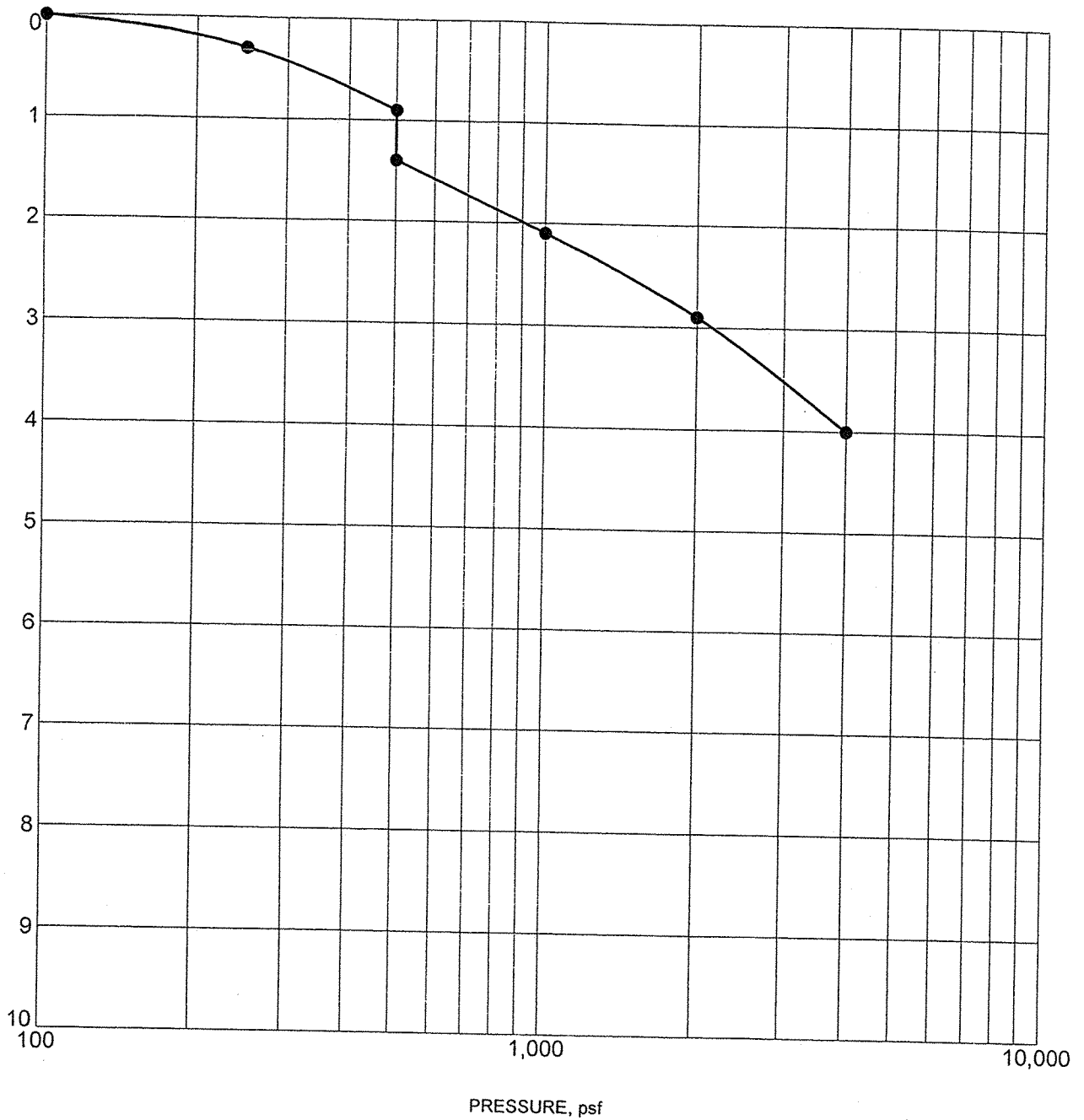
TC CONSOL STRAIN 23055071.GPJ TERRACON.GDT 10/31/05



CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
● B-13	4.0ft	SILTY SAND(SM)	101	10

Notes: Sample inundated with water at 500 pounds per square foot (psf).

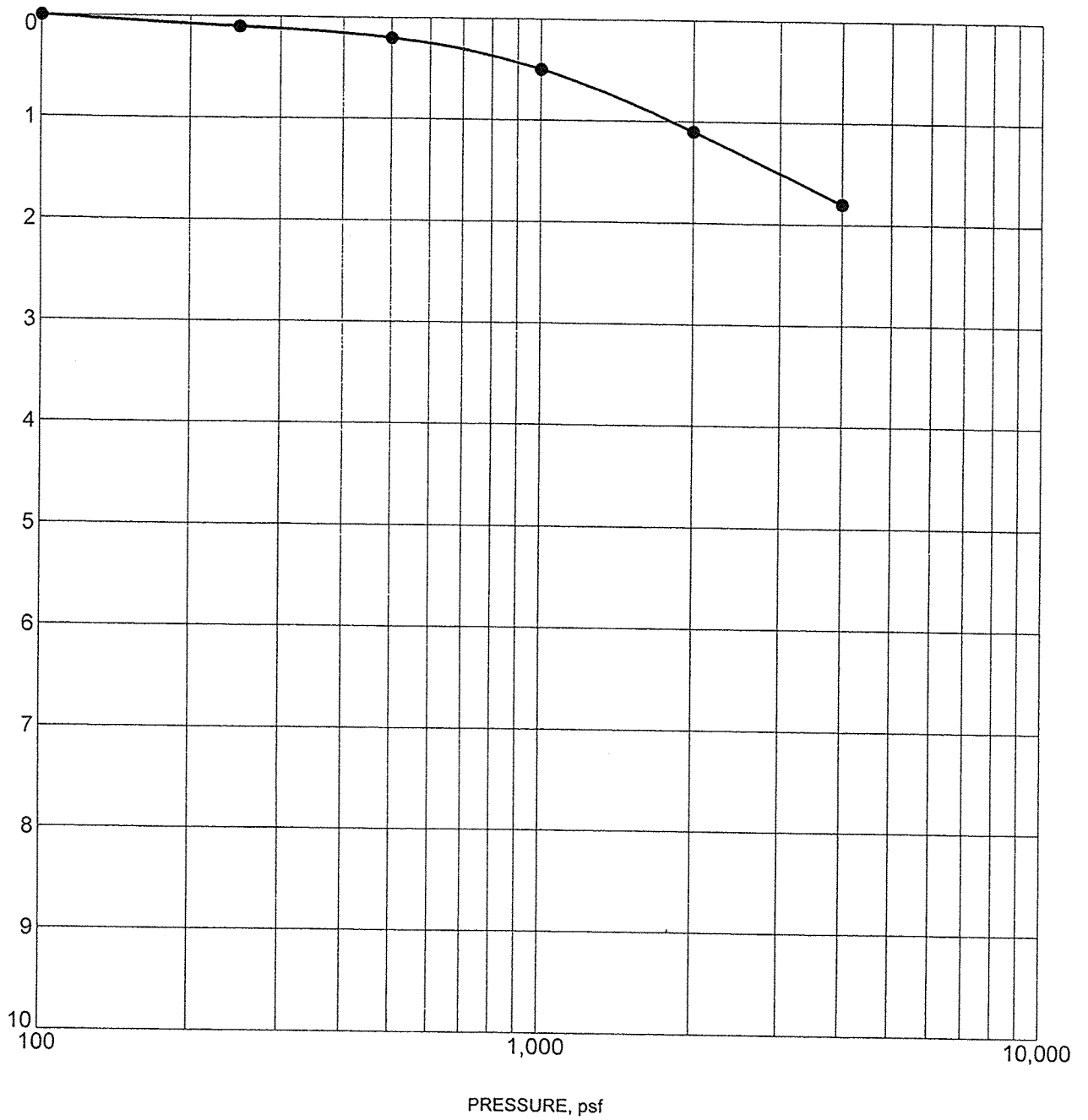
TC CONSOL STRAIN 23055071.GPJ TERRACON.GDT 10/31/05

Terracon

CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
● B-15	4.0ft	SILTY SAND(SM)	113	9

Notes: Sample inundated with water at 500 pounds per square foot (psf).

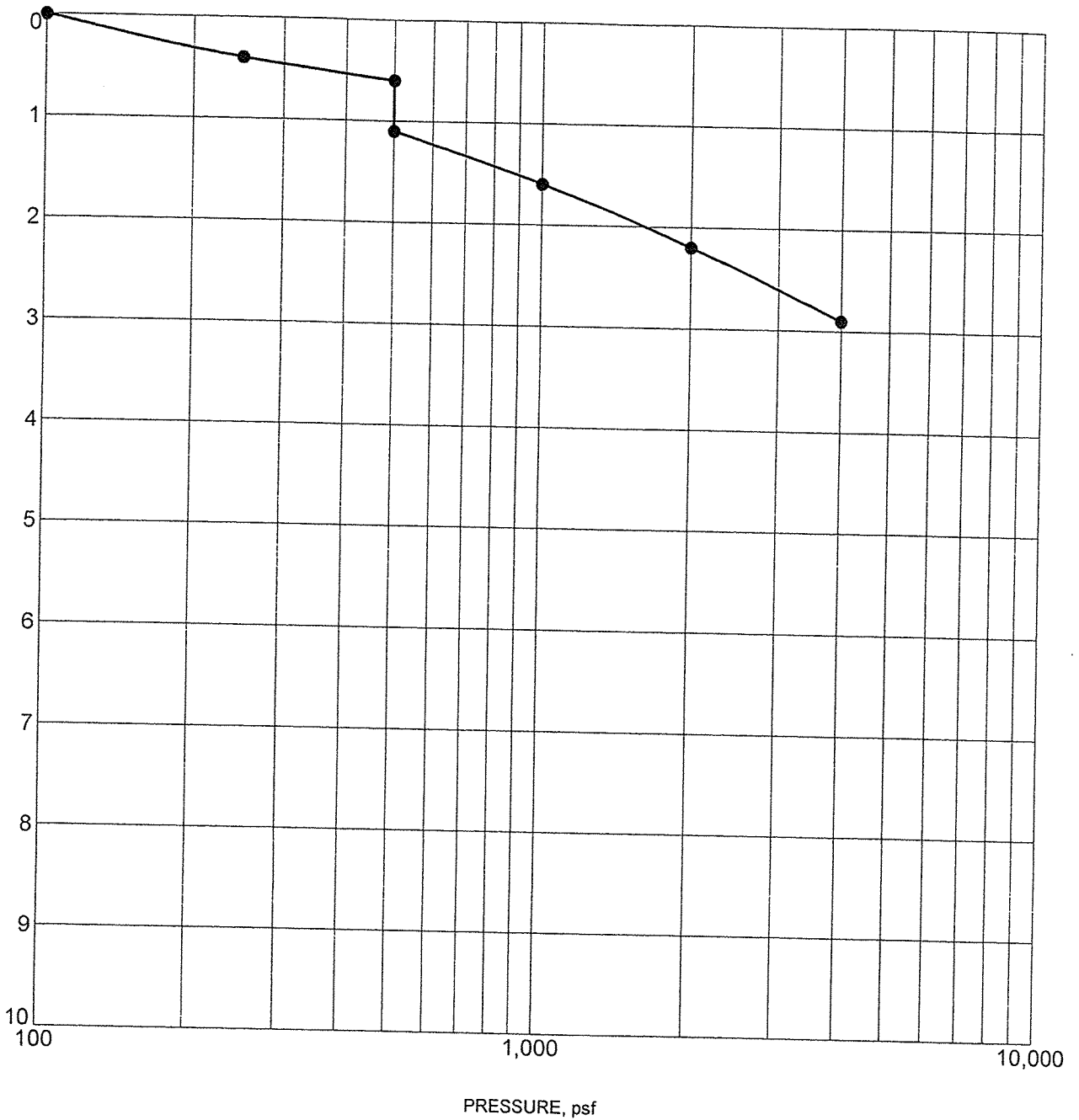
Terracon

CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

IC CONSOL STRAIN 23055071.GPJ TERRACON.GDT 10/31/05

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
●	B-17 4.0ft	SILTY SAND(SM)	106	10

Notes: Sample inundated with water at 500 pounds per square foot (psf).

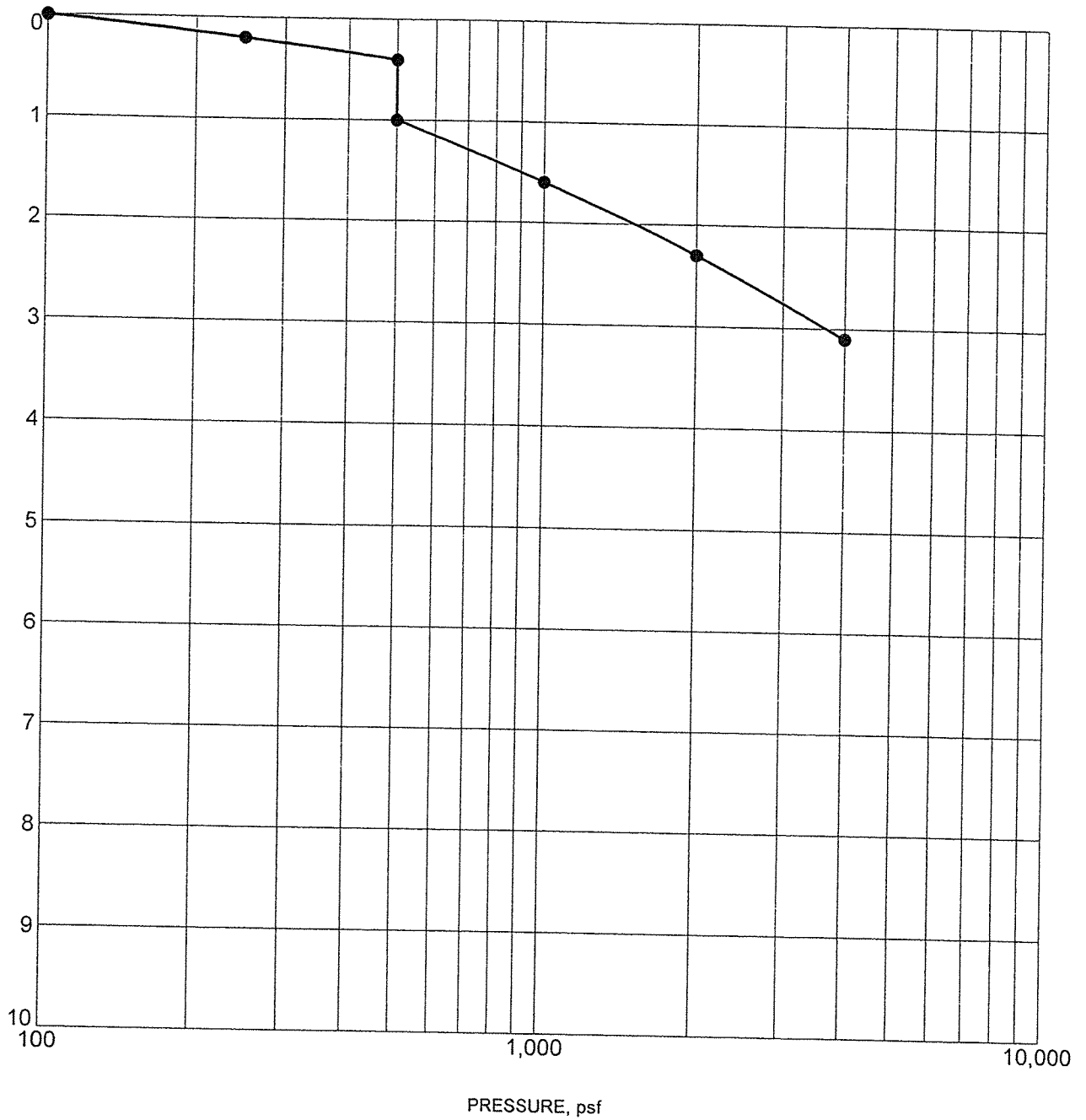
TC CONSOL STRAIN 23055071.GPJ TERRACON.GDT 10/31/05



CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

AXIAL STRAIN, %



Specimen Identification	Classification	γ_d , pcf	WC, %
● B-18 2.0ft	SILTY SAND(SM)	113	8

Notes: Sample inundated with water at 500 pounds per square foot (psf).

TC_CONSOL_STRAIN_23055071.GPJ TERRACON.GDT 10/31/05



CONSOLIDATION TEST

Project: Claremont Business Park, Filing No.1
 Site: NW of Hwy 24 and Marksheffel Rd. Colorado Springs, Colorado
 Job #: 23055071
 Date: 10-31-05

Analytical Results

TASK NO: 05082404

Report To: Ryan Feist
Company: Terracon, Inc.
4172 Center Park Drive
Colo. Springs CO 80916

Bill To: Ryan Feist
Company: Terracon, Inc.
4172 Center Park Drive
Colo. Springs CO 80916

Task No.: 05082404
Client PO:
Client Project: Claremont Ranch 2305-5071

Date Received: 8/24/05
Date Reported: 9/2/05
Matrix: Soil - Geotech

Customer Sample ID: B (1-10)

Sample Date/Time:

Lab Number: 05082404-01

Test	Units	Result	Method
Chloride - Water Soluble	%	0.0002	AASHTO T291-91
pH	units	7.0	AASHTO T289-91
Resistivity	ohm.cm	7457	AASHTO T288-91
Sulfate - Water Soluble	%	< 0.001	AASHTO T290-91

Customer Sample ID: B6 (4)

Sample Date/Time:

Lab Number: 05082404-02

Test	Units	Result	Method
Chloride - Water Soluble	%	0.0010	AASHTO T291-91
pH	units	7.2	AASHTO T289-91
Resistivity	ohm.cm	2739	AASHTO T288-91
Sulfate - Water Soluble	%	0.007	AASHTO T290-91



DATA APPROVED FOR RELEASE BY

Appendix C

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". For 3" O.D. ring samplers (RS) the penetration value is reported as the number of blows required to advance the sampler 12 inches using a 140-pound hammer falling 30 inches, reported as "blows per foot," and is not considered equivalent to 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		
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

<u>Unconfined Compressive Strength, Qu, psf</u>	<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>Consistency</u>
< 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

<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>Ring Sampler (RS) Blows/Ft.</u>	<u>Relative Density</u>
0 - 3	0-6	Very Loose
4 - 9	7-18	Loose
10 - 29	19-58	Medium Dense
30 - 49	59-98	Dense
50+	99+	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

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

GRAIN SIZE TERMINOLOGY

<u>Major Component of Sample</u>	<u>Particle Size</u>
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)

RELATIVE PROPORTIONS OF FINES

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

PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

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GENERAL NOTES

Description of Rock Properties

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to 1/4 in. deep can be excavated by hard blow on point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding and Foliation Spacing in Rock^a

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

Rock Quality Designator (RQD) ^b		Joint Openness Descriptors	
RQD, as a percentage	Diagnostic description	Openness	Descriptor
Exceeding 90	Excellent	No Visible Separation	Tight
90 – 75	Good	Less than 1/32 in.	Slightly Open
75 – 50	Fair	1/32 to 1/8 in.	Moderately Open
50 – 25	Poor	1/8 to 3/8 in.	Open
Less than 25	Very poor	3/8 in. to 0.1 ft.	Moderately Wide
		Greater than 0.1 ft.	Wide

- a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.
 b. RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976.
 U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

UNIFIED SOIL CLASSIFICATION SYSTEM

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

				Soil Classification		
				Group Symbol	Group Name ⁹	
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 Fines classify as CL or CH	GM GC	Silty gravel ^{f,g,h} 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 $1 \leq Cc \leq 3^E$ $Cu < 6$ and/or $1 > Cc > 3^E$	SW SP	Well-graded sand ⁱ Poorly graded sand ⁱ	
		Sands with Fines More than 12% fines ^d	Fines classify as ML or MH Fines Classify as CL or CH	SM SC	Silty sand ^{g,h,i} 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 $PI < 4$ or plots below "A" line ^k	CL ML	Lean clay ^{k,l,m} Silt ^{k,l,m}	
		organic	Liquid limit - oven dried < 0.75 Liquid limit - not dried	OL	Organic clay ^{k,l,m,n} Organic silt ^{k,l,m,o}	
		Silt and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line PI lots below "A" line	CH MH	Fat clay ^{k,l,m} Elastic Silt ^{k,l,m}
			organic	Liquid limit - oven dried < 0.75 Liquid limit - not dried	OH	Organic clay ^{k,l,m,p} Organic silt ^{k,l,m,o}
	Highly organic soils	Primarily organic matter, dark in color, and organic odor		PT	Peat	

^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

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

^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.

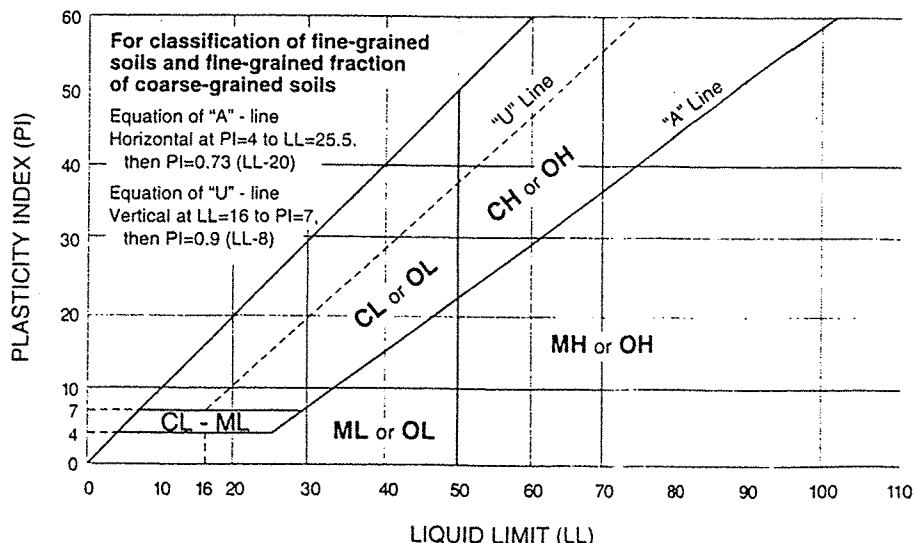
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^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.



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