DOCUMENT 3
CLARK
17

GEOTECHNICAL EXPLORATION REPORT
I-15/CHEYENNE INTERCHANGE UTILITY RELOCATION

NEAR I-15 AND CHEYENNE AVE.
NORTH LAS VEGAS, NEVADA

PROJECT NUMBER 64975178
JULY 22, 1997

Prepared for:

CH2M HILL

Prepared by:

TERRACON CONSULTANTS WESTERN, INC.
4343 SOUTH POLARIS AVENUE
LAS VEGAS, NEVADA 89103
Phone: (702) 597-9393
Fax: (702) 597-9009

Terracon

TABLE OF CONTENTS

TABLE OF CONTENTS

GEOTECHNICAL EXPLORATION REPORT
I-15/CHEYENNE INTERCHANGE UTILITY RELOCATION
NEAR I-15 AND CHEYENNE AVE.
NORTH LAS VEGAS, NEVADA

Project No. 64975178

1.0 INTRODUCTION

This report presents the results of our geotechnical exploration for the proposed I-15/Cheyenne Interchange Utility Relocation Project. The alignment is generally located near I-15 and Cheyenne Avenue in North Las Vegas, Nevada. The general location of the alignment is shown on Plate 1, Vicinity Map.

The purpose of our services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- General geology of the area
- Earthwork
- Utility trench backfill

This report is for the purpose of providing geotechnical engineering and/or testing information and requirements. The scope of our services for this project did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic material in structures, soil, surface water, groundwater or air, below or around this site.

2.0 PROJECT INFORMATION

It is our understanding that it will be necessary to relocate an existing water line to accommodate the proposed I-15/Cheyenne Avenue interchange modifications. The alignment will have a total length of approximately 700 meters. The pipeline will be 400 millimeters in diameter and will have an invert of approximately 1 to 7 meters below grade. It is our understanding that boring and jacking will occur underneath Interstate I-15. In addition, an existing 825 millimeter sewer line will be rehabilitated. The sewer will be approximately 300 meters in length and have an invert of approximately 5 to 6 meters below grade.

3.0 ALIGNMENT EXPLORATION

The scope of our services for this project included a subsurface exploration program. The subsurface exploration program consisted of drilling 5 borings to depths of approximately 6.1 and 9.1 meters below existing alignment grades. For the sewer line rehabilitation one boring (B-5) was performed. The borings were logged by a geologist during drilling and samples were obtained to aid in material classification and for possible laboratory testing. The approximate locations of the borings are shown on Plate 2, Alignment Plan. The location of the borings were determined in the field by measuring from adjacent streets and property boundaries. The location of the borings should be accurate only to the degree implied by the method used. Results of the borings are presented in Appendix A.

In addition to the borings drilled along the alignment, additional borings and laboratory test results from geotechnical explorations performed in the immediate area are presented in Appendix B. The borings and test results are presented for additional information only, contractors should draw their own conclusions as to their applicability.

- State of Nevada
  NDOT Borings - I-15/Cheyenne Interchange Reconstruction

4.0 ALIGNMENT CONDITIONS

4.1 Surface - Water Line

At the west end, the alignment started at Losee Road approximately 10 meters south of Cheyenne Avenue where it will tie in to an existing 300 millimeter water line. Losee Road was fully developed, 4 lanes wide with curbs, gutters and sidewalks on both sides. The alignment then heads east across an asphalt paved parking lot. The alignment then crosses the existing I-15 Cheyenne Avenue interchange and Union Pacific Railroad Tracks. The interchange consisted of the existing 4 lane divided highway and entrance and exit ramps. The alignment on the east side of the I-15 heads northeast and crosses through a vacant parcel of land with a prominent northeast slope. The parcel was fenced with a small amount of fill and sparse vegetation. The alignment then turns east and crosses Hamilton Street, a two lane asphalt street. East of Hamilton Street the alignment passed through a residential area. At the time of our exploration all of the residences had been demolished except for the eastern most residence. The slabs-on-grade and foundations were still in place. There was also one swimming pool which had not been removed. At Civic Center Drive the alignment turns north

and terminates at the intersection of Cheyenne Avenue and Civic Center Drive. Civic Center Drive was a fully developed 4 lane street. Site drainage was to the south by sheetflow along Losee Road and to the northeast east of I-15.

4.2 Surface - Sewer Line

The sewer line alignment is in Losee Road. The alignment begins approximately 250 meters south of Cheyenne Avenue and continues north past Cheyenne Avenue approximately 50 meters. Losee Road was fully developed, 4 lanes wide with curbs, gutters and sidewalks on both sides.

4.3 Subsurface - Water Line

Fill and/or pavement was encountered in four explorations. Asphalt pavement and aggregate base was encountered at borings B-1 and B-3. At boring B-1 there was approximately 7.9 centimeters (cm) of asphalt over 7.6 cm of aggregate base. At boring B-3 there was approximately 6.3 cm of asphalt over 25.4 cm aggregate base. The fill was approximately 0.3 to 1.3 meters in depth and generally consisted of sandy clay, gravelly clay and silty sand. There could be deeper and/or poorer quality fill in other areas of the alignment beyond our explorations.

Natural soils along the alignment generally consisted of firm to very stiff sandy clay and silty clay and loose to moderately hard silty sand, clayey sand, sandy gravel, gravelly sand and clayey gravel. Moderately hard to hard caliche was encountered in borings B-2 and B-3. The caliche was first encountered at depths of approximately 1.8 and 7.6 meters below existing alignment grades. Laboratory test results indicate that the clay soils have a low to high expansion potential. Groundwater was not encountered within the depths explored. The boring logs and laboratory test results presented in Appendix A should be referred to for more detailed information.

4.4 Subsurface - Sewer Line

At boring B-5 there was approximately 15.8 cm of asphalt over 26.7 cm of aggregate base. There could be deeper and/or poorer quality fill in other areas of the alignment beyond our exploration.

Natural soils along the alignment generally consisted of firm to stiff silty clay, clayey silt and sandy clay. Laboratory test results indicate that the clay soils have a moderate expansion potential. Groundwater was not encountered within the depths explored. The boring logs presented in Appendix A should be referred to for more detailed information.

5.0 GEOLOGIC INFORMATION

5.1 Geologic Setting

The alignment is located in the north-central portion of the Las Vegas Valley, a structural basin of late Mesozoic and Tertiary block faulting origin. The valley is physiographically characteristic of the Basin and Range Province. The Province is characterized by broad intermountain valleys and northwest trending ranges given their present relief by high angle normal faulting.

The valley floor deposits consist of Tertiary and Quaternary Age unconsolidated sediments derived from the surrounding mountains. The alluvial and lake-bed sediments are up to 1,220 meters thick and consist of predominantly fine-grained soils with interstratified sands, gravels and calcareous cemented deposits (caliche). In general, the sediments grade increasingly finer with distance from the source area and with decreasing elevation.

5.2 Tectonic Faulting and Seismicity

There are no known tectonic faults in the area of the proposed alignment. The nearest mapped fault with evidence of possible geologically recent displacement is located at the base of Frenchman Mountain, approximately 9.6 kilometers southeast of the alignment.

The subject site is located within Zone 2B as defined by the Uniform Building Code (1994 edition) on Figure 16-2 entitled Seismic Zone Map of the United States. Numerous seismic events, most of the which are a probable result of underground blasting at the Nevada Test Site (about 145 kilometers north of Las Vegas), have been felt in the Southern Nevada area and are directly attributable to deep-seated tectonic movement. A few events recorded in the Henderson area and in Lincoln County registered between 5.0 and 6.0 Richter magnitude. Most of the recorded events in the area range between 4.0 and 4.9.

5.3 Compaction Faults and Fissures

Inspection of the ground surface indicated no readily discernible evidence suggestive of recent faulting or fissuring. The nearest mapped compaction fault scarp is approximately 152 meters south of the east end of the water line alignment and 320 meters southeast of the south end of the sewer line alignment. Compaction faults are generally accepted as a phenomena resulting from deep-seated differential consolidation of alluvial materials with dissimilar grain size and compressibility characteristics.

The nearest mapped fissure zone is approximately 804 meters southwest of the west end of the water line alignment and 960 meters southwest of the south end of the sewer line alignment. The cumulative evidence indicates that fissures are the result of a subsurface erosional process. The erosional process occurs in tensional fractures at or near the surface in uncemented, relatively fine-grained soils. In general, fissures can be in two different stages/condition: (1) those that have opened to the surface and (2) those that are buried (not yet opened to the surface). It is anticipated that no fissures will be encountered along the alignment.

5.4 Subsidence

Areal land subsidence has occurred in the Las Vegas Valley. The subsidence is a result of groundwater withdrawal exceeding groundwater recharge. It is expected that subsidence will continue as groundwater withdrawal continues. Studies performed by several researchers and summarized by the Nevada Bureau of Mines and Geology estimate that subsidence on the order of 3 centimeters has occurred in the alignment area between 1963 and 1987. Based on the previous subsidence, areal subsidence due to groundwater withdrawal should not effect the project.

6.0 RECOMMENDATIONS

6.1 General

Our recommendations are based on the assumption that the soil conditions along the alignments are similar to those disclosed by the explorations. If variations are noted during construction or if changes are made in alignment plan or invert depth we should be notified so we can supplement our recommendations, as applicable.

As previously indicated, boring and jacking is planned for some parts of the water line alignment. Based on a review of the boring logs it should be an acceptable method of construction. The contractor should evaluate subsurface conditions and make his own conclusions regarding construction procedures/equipment.

As previously indicated, some of the clay soils have a high (greater than 10%) expansion potential. The highly expansive clays have the potential to undergo relatively large movements due to increases in moisture content. Therefore, flooding and jetting should not be allowed and efforts should be made to minimize potential moisture infiltration.

As indicated, there was fill encountered along the alignments. This fill would be considered uncontrolled fill unless observation and testing was performed during placement. Any uncontrolled fill that may occur beneath the pipeline should be removed and replaced with properly compacted fill. The uncontrolled fill soils can be re-used for controlled fill provided all oversize material (greater than 15.2 centimeters in diameter), unsuitable material (as determined by the geotechnical engineer), vegetation and debris is removed.

6.2 Soil Design Parameters

The following soil design parameters may be used where applicable for design of the proposed water and sewer lines:

- Coefficient of Friction[1] 0.40
- Modulus of Subgrade Reaction[2] (E´) ..... 6900 KPa (Native fine-grained soils)
- Unit Weight of Compacted Backfill ..... 19.6 to 21.2 Kn/m^3

[1] Assumes granular backfill around pipeline
[2] Bureau of Reclamation E´ for Iowa Formula

Any proposed vault structures along the pipeline alignments, may be supported by conventional foundations established on undisturbed natural soils having a consistency of at least medium dense or stiff and/or properly compacted fill. Foundations should be at least 30.5 centimeters wide and should be established at least 60 centimeters below the lowest adjacent final

compacted subgrade. Foundations established as recommended, may be designed to impose a net dead- plus live-load pressure of 94.7 kilonewtons per square meter (kN/m^2). The bearing value may be increased by 35.5 kN/m^2 for each additional 30.5 centimeters of embedment. However, the maximum net bearing value should not exceed 236.8 kN/m^2. A one-third increase may be used for wind or seismic loads.

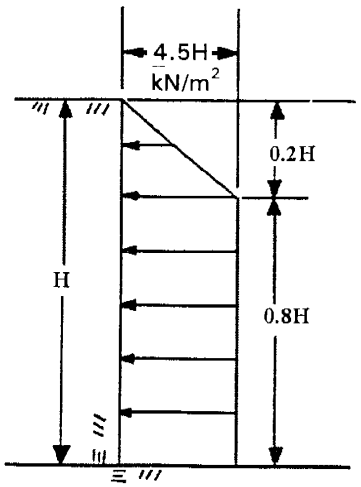
For soils above any free water surface, with level backfill and no surcharge loads, we recommend the following equivalent fluid pressures and coefficient of friction:

- Active ..... 5.4 $kN/m^2/m$
- At-Rest..... 9.6 $kN/m^2/m$
- Passive..... 38.8 $kN/m^2/m$
- Coefficient of Friction 0.30

Notes:

1. Active pressure assumes unrestrained (cantilever) wall and assumes no loading from heavy compaction equipment.
2. Passive pressure should not exceed a maximum of 142.1 kN/m^2. A one-third increase may be used for wind or seismic loads.
3. The passive pressure and the frictional resistance of the soils may be combined without reduction in determining the total lateral resistance.

Where the design includes restrained (braced) walls, above any free water, with level backfill and no surcharge loads, we recommend the wall be designed to resist an earth pressure with the distribution shown below:



Any surcharge from adjacent loadings should be added to the above pressures using a factor of 0.30. As indicated, the aforementioned pressures assume that there will be no build-up of hydrostatic pressure. Therefore, if any walls will be subject to saturated conditions we recommend that weep holes or a wall drainage system be provided, and that the structural fill behind retaining walls be granular and free draining. All walls, below grade, should be waterproofed or at least dampproofed.

Fill against foundations and structure walls should be properly placed and compacted. Backfill should be mechanically compacted in layers (15.2 to 20.3 centimeters maximum thickness); flooding should not be permitted due to on-site fine-grain/expansive soils. Backfill should be compacted to at least 90 percent of the maximum dry density obtainable by the ASTM D1557 method. Care should be taken when placing backfill so as not to damage the walls. 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 movements.

6.3 Utility Trenches

6.3.1 Excavation

- It is anticipated that excavation of the on-site natural (non-cemented) deposits for the proposed project can be accomplished with conventional earthmoving equipment.

- Based on the planned invert depths for the sewer and water line and the boring logs, we would expect caliche to be encountered along both alignments.

- Excavations penetrating moderately hard or relatively thin (less than one foot) hard layers of caliche should be able to be excavated using heavy-duty equipment.

- Excavations penetrating hard or very hard caliche will require special consideration where they are to be performed.

- Contractors should satisfy themselves as to the hardness of materials and equipment required.

- The trench width should be at least the outside diameter of the pipe plus at least 230 millimeters on each side of the pipe.

- Trenching and shoring operations should be conducted in accordance with Section 10 Nos. 1926.650 through 1926.652 of the State of Nevada Occupational Safety and Health Standards for the Construction Industry (with amendments as of August, 1991) and in accordance with 29 CFR Part 1926, Occupational Safety and Health Standards - Excavations; Final Rule (October 31, 1989). Safety of construction personnel is the responsibility of the contractor.

6.3.2 Subgrade and Bedding

Medium dense and stiff natural soils will provide good support for the proposed pipelines. Overexcavation will not be necessary except to remove existing uncontrolled fill or oversized material (greater than 15.2 centimeters in nominal diameter) or loose and soft soils. Overexcavation, if required, should extend to competent acceptable material or 1 meter below invert, whichever occurs first.

Type II aggregate base should be used for bedding and pipe zone material and should be placed below and around both the water and sewer pipes to provide uniform support. Any fill placed beneath pipes and within the pipe zone should be compacted to at least 90 percent of the maximum density obtainable by the ASTM D1557 laboratory method of compaction.

6.3.3 Trench Backfill

Backfill in the water line trench above the pipe zone should be in accordance with the recommendations presented in the Uniform Design and Construction Standards for Water Distribution Systems, 1st Edition, 1995, Section 3.09.05. Based on these requirements, trench backfill may consist of "Selected Backfill", "Granular Backfill" or "Type II". Some of the on-site soils will not meet requirements for any of the aforementioned acceptable backfill materials. Therefore, import material meeting the backfill requirements will be required. However, in areas outside of street right-of-ways on-site materials may be used as trench backfill. Backfill in the sewer line trench above the pipe zone should be in accordance with the recommendations presented in the Design and Construction Standards for Wastewater Collection Systems, 1991, Section 5.

Backfill material should be compacted by mechanical means only, flooding and jetting should not be allowed on this project. In addition, the Uniform Design and Construction Standards will not allow flooding and jetting due to the trench wall material having a Plasticity Index greater than 3.

Backfill material should be placed in loose lifts, not over 20.3 centimeters in thickness and compacted to at least 90 percent of the maximum density obtainable by the ASTM D1557 method of compaction. The upper 61 centimeters of backfill (below street subgrade) should consist of slurry cement backfill or Type II aggregate base compacted to at least 95 percent. Moisture content at the time of compaction should be between optimum and 2 percent above optimum.

Precaution should be taken during backfill to avoid damage to the pipe. Field and laboratory testing of backfill material should be performed to determine whether applicable requirements have been met.

6.4 Corrosivity

Based on experience in the area, the on-site soils possess sufficient concentrations of sulfates to be considered corrosive to concrete. We recommend Type V or equivalent sulfate resistant cement be utilized in all concrete.

7.0 OTHER SERVICES

It is recommended that a general review of final design plans and specifications be made in order that grading, backfill and remediation recommendations may be interpreted and implemented. In the event that any changes of the proposed project are planned, the conclusions and recommendations contained in this report should be reviewed and the report modified or supplemented as necessary.

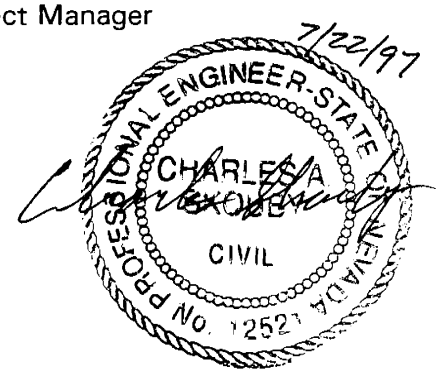
Observation of excavations should be performed prior to placement of any material to confirm that satisfactory materials are present. Field and laboratory testing of concrete and soils should be performed to determine whether applicable requirements have been met.

The analyses and recommendations in this report are based in part upon data obtained from the field exploration. The nature and extent of variations beyond the locations of the explorations may not become evident until construction. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report.

8.0 CLOSURE

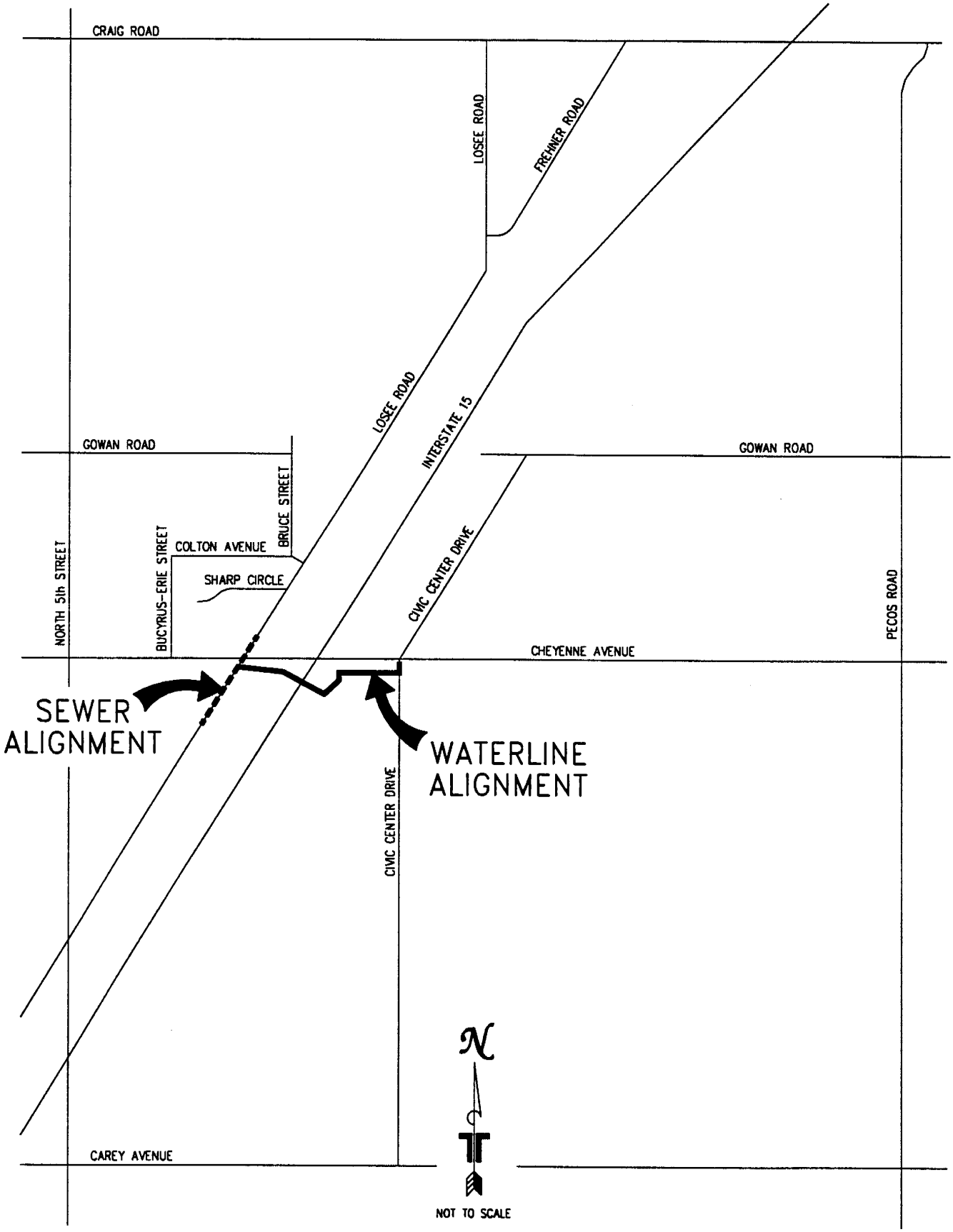
Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No warranties, either express or implied, are intended or made. We prepared this report as an aid in design and construction of the proposed project. This report is not a bidding document. Any contractor reviewing this report must draw his own conclusions regarding site conditions and specific construction techniques to be used on this project.

TERRACON CONSULTANTS WESTERN, INC.
Charles A. Skouby, P.E.
Project Manager

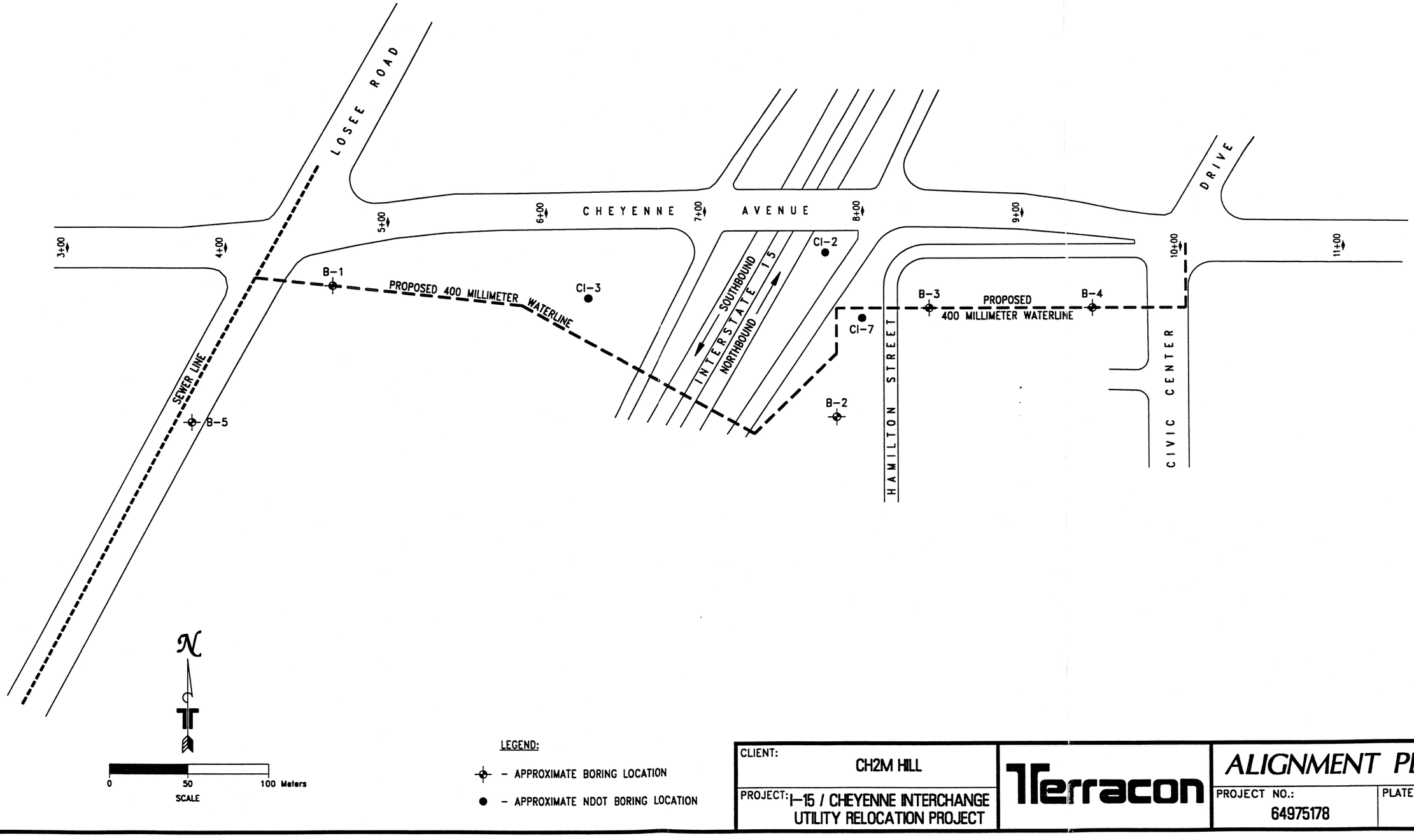


Reviewed by:

Mark J. Owens, P.E.
Director, Geotechnical Engineering



CLIENT: CH2M HILL	Terracon	VICINITY MAP	
PROJECT: I-15 / CHEYENNE INTERCHANGE UTILITY RELOCATION PROJECT		PROJECT NO.: 64975178	PLATE: 1



LEGEND:

- ⌖ – APPROXIMATE BORING LOCATION
- ● – APPROXIMATE NDOT BORING LOCATION

CLIENT: CH2M HILL	Terracon	ALIGNMENT PLAN	
PROJECT: I–15 / CHEYENNE INTERCHANGE UTILITY RELOCATION PROJECT		PROJECT NO.: 64975178	PLATE: 2

APPENDIX A

Alignment Explorations

The subsurface conditions of the site were explored by drilling 5 borings to depths of approximately 6.1 and 9.1 meters below existing alignment grades. Borings were drilled using a rotary-air drill rig (Midway 13M) with a 13.3 centimeter diameter bit.

Soils were logged during drilling and samples were obtained to aid in material classification and for possible laboratory testing. Boring logs are presented on Plates A-1 through A-10. The number of blows required to drive a 6.3 centimeter diameter sampler 30.5 centimeters are shown on the logs. The soils are generally classified by the Unified Soil Classification System. Plate B presents an explanation of material classifications used in this report.

Laboratory Testing

Laboratory testing was performed on selected samples of on-site soils. Tests were performed in general accordance with applicable ASTM or local standards.

Sieve analyses were performed to determine the grain-size distribution of representative materials. The tests were performed in general accordance with ASTM C117 and C136 and the results are presented on Plates C-1 through C-9.

Expansion tests were performed on remolded samples of the clay soils. The tests were performed from oven-dried moisture content to near saturated condition with a 60 psf surcharge load. Plate D presents the test results.

Atterberg Limits (liquid limit and plastic limit) tests along with the percent passing the No. 200 sieve were determined for selected samples to aid in determining if the native soils will meet the requirements for Select Backfill. Test results are presented below:

SAMPLE	MATERIAL DESCRIPTION	LIQUID LIMIT	PLASTICITY INDEX	PASSING NO. 200	SELECT BACKFILL
B-1 @ 1.8 to 3.3 m	CLAYEY SAND	34	12	21.6	No
B-2 @ 1.5 to 2.7 m	CLAYEY SAND	26	10	25.6	Yes
B-2 @ 5.8 to 7.3 m	SANDY CLAY	29	13	52.4	No
B-3 @ 0.9 to 2.4 m	CLAYEY SAND	21	7	28.7	Yes
B-3 @ 4.0 to 5.5 m	CLAYEY SAND	35	17	26.5	No
B-3 @ 5.5 to 7.0 m	CLAYEY SAND	24	9	17.3	Yes
B-4 @ 0.6 to 2.1 m	CLAYEY SAND	24	6	19.3	Yes
B-5 @ 0.6 to 1.5 m	SANDY CLAY	25	9	64.4	No
B-5 @ 3.6 to 5.2 m	CLAYEY SAND	26	10	34.7	Yes

LOG OF BORING NO. 1

CLIENT: **CH2M Hill**

PROJECT: **I-15/Cheyenne Interchange Utility Relocation**

BORING LOCATION: **See Plot Plan**

ELEVATION (m): **Not Measured**

SITE: **I-15 and Cheyenne Avenue**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
FILL-7.9 cm A.C. over 7.6 cm Agg. base, sl. moist, brown			FILL							
FILL-SANDY CLAY -w/some caliche gravel, sl. moist, brown						47	R			
FILL-GRAVELLY CLAY -w/sand, sl. moist, lt. brown				1						
w/A.C. layer, sl. moist, black										
SANDY CLAY -sl. moist, brown			CL							
SILTY CLAY -w/gypsum, sand, moist, brown						18	R			
SANDY CLAY -w/gravel, sl. moist, brown	stiff			2			B			
CLAYEY SAND -w/gravel, sl. moist, brown			SC							
SANDY GRAVEL -w/silt, sl. moist, brown			GM	3						
	dense					43	R			
GRAVELLY SAND -w/silt, trace clay, sl. moist, brown			SM	4						
Continued Next Page										

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES: **Groundwater not encountered.**

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED: **5-29-97**

PAGE NUMBER: **Page 1 of 2**

PROJECT NO.: **64975178**

PLATE: **A-1**

LOG OF BORING NO. 1

CLIENT:	PROJECT:
CH2M Hill	I-15/Cheyenne Interchange Utility Relocation
BORING LOCATION: See Plot Plan / ELEVATION (m): Not Measured	SITE: I-15 and Cheyenne Avenue

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
GRAVELLY SAND -w/silt, sl. moist, brown	v.dense		SM							
SILTY CLAY -w/gravel, moist, brown	stiff		CL							
				5	■	73	R			
SANDY CLAY -w/gravel, sl. moist, brown										
SILTY CLAY -w/caliche gravel, sand, sl. moist to moist, brown	very stiff									
				6						
Bottom at 6.1 meters										

THIS SUMMARY APPLIES ONLY AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES:
Groundwater not encountered.

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED: **5-29-97**

PAGE NUMBER: **Page 2 of 2**

PROJECT NO.: **64975178**

PLATE: **A-2**

LOG OF BORING NO. 2

CLIENT:	PROJECT:
CH2M Hill	I-15/Cheyenne Interchange Utility Relocation
BORING LOCATION: See Plot Plan / ELEVATION (m): Not Measured	SITE: I-15 and Cheyenne Avenue

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
FILL-SILTY SAND -w/gravel, sl. moist, brown			FILL							
SANDY CLAY -sl. moist, brown	firm-stiff		CL							
SILTY CLAY -w/sand, moist, brown	stiff			1						
CLAYEY GRAVEL -w/sand, sl. moist, brown	very dense		GC			98/ 9"	R			
partially cemented	v.d.-m.h.						B			
CALICHE (Cemented SAND & GRAVEL) -dry to sl. moist, lt. brown	hard / m.hard			2						
SANDY CLAY -w/caliche gravel, dry to sl. moist, lt. brown	very stiff		CL							
partially cemented	v.s.-m.h.									
CALICHE -dry to sl. moist, lt. brown	hard					50/ 1.5"	R			
SANDY CLAY -w/caliche gravel, sl. moist, lt. brown	very stiff		CL	3						
SILTY CLAY -w/sand, caliche gravel, moist, brown	stiff									
SANDY CLAY -w/caliche gravel, sl. moist, lt. brown	v.stiff									
CALICHE -dry to sl. moist, lt. brown	m.h.-h. / hard			4						
w/small uncemented layer	m.hard-hard					50/ 2"	R			
Continued Next Page										

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES:
Groundwater not encountered.

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED:	PAGE NUMBER:
5-29-97	Page 1 of 2
PROJECT NO.: 64975178	PLATE: A-3

LOG OF BORING NO. 2

CLIENT:	PROJECT:
CH2M Hill	I-15/Cheyenne Interchange Utility Relocation
BORING LOCATION: See Plot Plan / ELEVATION (m): Not Measured	SITE: I-15 and Cheyenne Avenue

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
SILTY CLAY -w/sand, moist, brown	stiff		CL				B			
CLAYEY SAND -moist, brown	dense		SC							
SANDY CLAY -w/caliche gravel, sl. moist, lt. brown	very stiff		CL	5						
SILTY CLAY -w/sand, moist, brown **very moist**	stiff			6		24	R			
							B			
				7		21	R			
SANDY CLAY -very moist, brown	firm to stiff			8						
SILTY CLAY -w/sand, very moist, brown	stiff			9		42	R			
Bottom at 9.1 meters										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES:
Groundwater not encountered.

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED: **5-29-97**

PAGE NUMBER: **Page 2 of 2**

PROJECT NO.: **64975178**

PLATE: **A-4**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. 3

CLIENT:	PROJECT:
CH2M Hill	I-15/Cheyenne Interchange Utility Relocation
BORING LOCATION: See Plot Plan / ELEVATION (m): Not Measured	SITE: I-15 and Cheyenne Avenue

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
FILL-6.3 cm A.C. over 25.4 cm Agg. base, sl. moist, brown			FILL							
SANDY CLAY -sl. moist, brown w/gravel	stiff		CL	1		39	R			
w/some caliche gravel							B			
w/small caliche layer	very stiff									
CLAYEY SAND -w/gravel, sl. moist, lt. brown	dense		SC							
SANDY CLAY -w/gravel, sl. moist, lt. brown	very stiff		CL	2						
moist	stiff					41	R			
SILTY CLAY -w/caliche gravel, very moist, brown				3						
CLAYEY SAND -w/gravel, moist, lt. brown	dense		SC							
SILTY CLAY -w/sand, very moist, brown	stiff		CL							
CLAYEY SAND -w/trace gravel, moist, lt. brown	dense		SC							
SILTY CLAY -w/sand, very moist, brown	stiff		CL	4		23	R			
Continued Next Page										

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES:
Groundwater not encountered.

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED:	PAGE NUMBER:
5-30-97	Page 1 of 2
PROJECT NO.: 64975178	PLATE: A-5

LOG OF BORING NO. 3

CLIENT: **CH2M Hill**

PROJECT: **I-15/Cheyenne Interchange Utility Relocation**

BORING LOCATION: **See Plot Plan**

ELEVATION (m): **Not Measured**

SITE: **I-15 and Cheyenne Avenue**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
SILTY CLAY -w/sand, trace gravel, very moist, brown	stiff		CL	5			B			
CLAYEY SAND -w/gravel, moist, brown	med. dense		SC							
w/more gravel										
SILTY SAND -w/trace gravel, sl. moist, brown			SM			41	R			
w/cal. gr., sm. cem. layers										
w/some gravel	very dense			6			B			
SANDY CLAY -w/caliche gravel, sl. moist to moist, brown	stiff		CL							
SILTY SAND -w/gravel, moist, brown	med. dense		SM	7		32	R			
CLAYEY SAND -w/caliche gravel, very moist, brown			SC							
w/small hard cemented layer	dense									
CALICHE -dry to sl. moist, lt. brown	hard									
CLAYEY SAND -w/caliche gravel, sl. moist, lt. brown	dense		SC	8						
CALICHE -dry to sl. moist, lt. brown	m.h.-h.									
	hard									
SANDY CLAY -w/cal. gr., v. moist, brown	firm-stiff		CL							
SILTY CLAY -very moist, brown						32	R			
w/caliche gravel	stiff			9						
Bottom at 9.1 meters										

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES: **Groundwater not encountered.**

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED: **5-30-97**

PAGE NUMBER: **Page 2 of 2**

PROJECT NO.: **64975178**

PLATE: **A-6**

LOG OF BORING NO. 4

CLIENT: **CH2M Hill**

PROJECT: **I-15/Cheyenne Interchange Utility Relocation**

BORING LOCATION: **See Plot Plan**

ELEVATION (m): **Not Measured**

SITE: **I-15 and Cheyenne Avenue**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
SILTY SAND -sl. moist, brown	loose		SM							
GRAVELLY SAND -w/silt, sl. moist, brown	med. dense					24	R			
CLAYEY SAND -w/gravel, sl. moist, lt. brown			SC	1			B			
SANDY CLAY -w/gravel, sl. moist, lt. brown	stiff		CL							
SILTY CLAY -w/sand, caliche gravel, moist, brown				2		19	R			
very moist										
SANDY CLAY -w/trace gravel, very moist, brown										
				3						
SILTY CLAY -w/sand, very moist, brown										
SANDY CLAY -w/trace gravel, moist, brown						31	R			
SILTY SAND -w/gypsum, moist, red brown	dense		SM	4						
Continued Next Page										

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES: **Groundwater not encountered.**

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED: **5-30-97**

PAGE NUMBER: **Page 1 of 2**

PROJECT NO.: **64975178**

PLATE: **A-7**

LOG OF BORING NO. 4

CLIENT: **CH2M Hill**

PROJECT: **I-15/Cheyenne Interchange Utility Relocation**

BORING LOCATION: **See Plot Plan**

ELEVATION (m): **Not Measured**

SITE: **I-15 and Cheyenne Avenue**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
SANDY GRAVEL -w/silt, sl. moist, lt. brown	dense		GM							
SILTY CLAY -w/sand, very moist, brown	stiff		CL	5		18	R			
				6						
Bottom at 6.1 meters										

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES: **Groundwater not encountered.**

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED: **5-30-97**

PAGE NUMBER: **Page 2 of 2**

PROJECT NO.: **64975178**

PLATE: **A-8**

LOG OF BORING NO. 5

CLIENT: **CH2M Hill**

PROJECT: **I-15/Cheyenne Interchange Utility Relocation**

BORING LOCATION: **See Plot Plan**

ELEVATION (m): **Not Measured**

SITE: **I-15 and Cheyenne Avenue**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
FILL-15.8 cm A.C. over 26.7 cm Agg. base, sl. moist, brown			FILL							
SILTY CLAY -w/sand, moist, brown	stiff		CL	1		26	R			
							B			
CLAYEY SILT -w/sand, moist, brown			ML							
SILTY CLAY -w/sand, very moist, brown	firm		CL	2		11	R			
SANDY CLAY -w/caliche gravel, moist, brown	stiff									
SILTY CLAY -w/caliche gravel, sand, very moist, brown				3						
SANDY CLAY -w/caliche gravel, moist, brown										
very moist	firm to stiff					8	R			
SILTY CLAY -w/sand, trace caliche gravel, very moist, brown				4			B			
SANDY CLAY -w/caliche gravel, sl. moist, brown	stiff									
Continued Next Page										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES: **Groundwater not encountered.**

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED: **5-29-97**

PAGE NUMBER: **Page 1 of 2**

PROJECT NO.: **64975178**

PLATE: **A-9**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. 5

CLIENT: **CH2M Hill**

PROJECT: **I-15/Cheyenne Interchange Utility Relocation**

BORING LOCATION: **See Plot Plan**

ELEVATION (m): **Not Measured**

SITE: **I-15 and Cheyenne Avenue**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS / m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
SILTY CLAY -w/sand, trace caliche gravel, moist, brown	stiff		CL	5		33	R			
				6						
Bottom at 6.1 meters										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag R = Ring SPT = Standard Penetration Test C = Cone

NOTES: **Groundwater not encountered.**

DRIVING WEIGHT (kg): **168**

Terracon

DATE DRILLED: **5-29-97**

PAGE NUMBER: **Page 2 of 2**

PROJECT NO.: **64975178**

PLATE: **A-10**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

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 an 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 & 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	Liquid limit – oven dried / 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	Liquid limit – oven dried / Liquid limit – not dried < 0.75	OL	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.

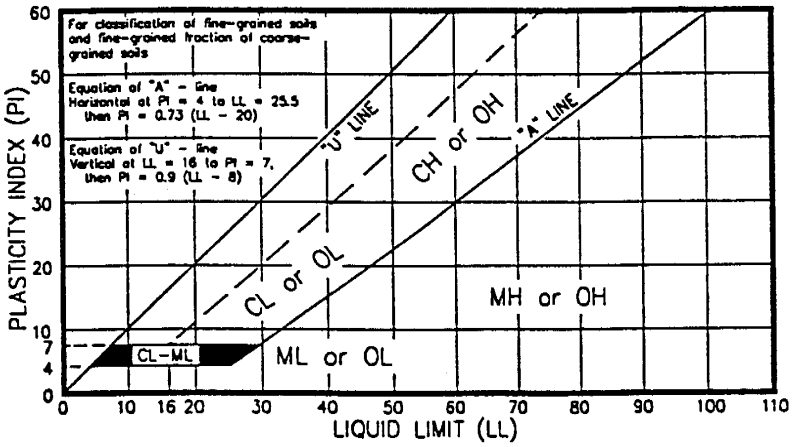
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[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.



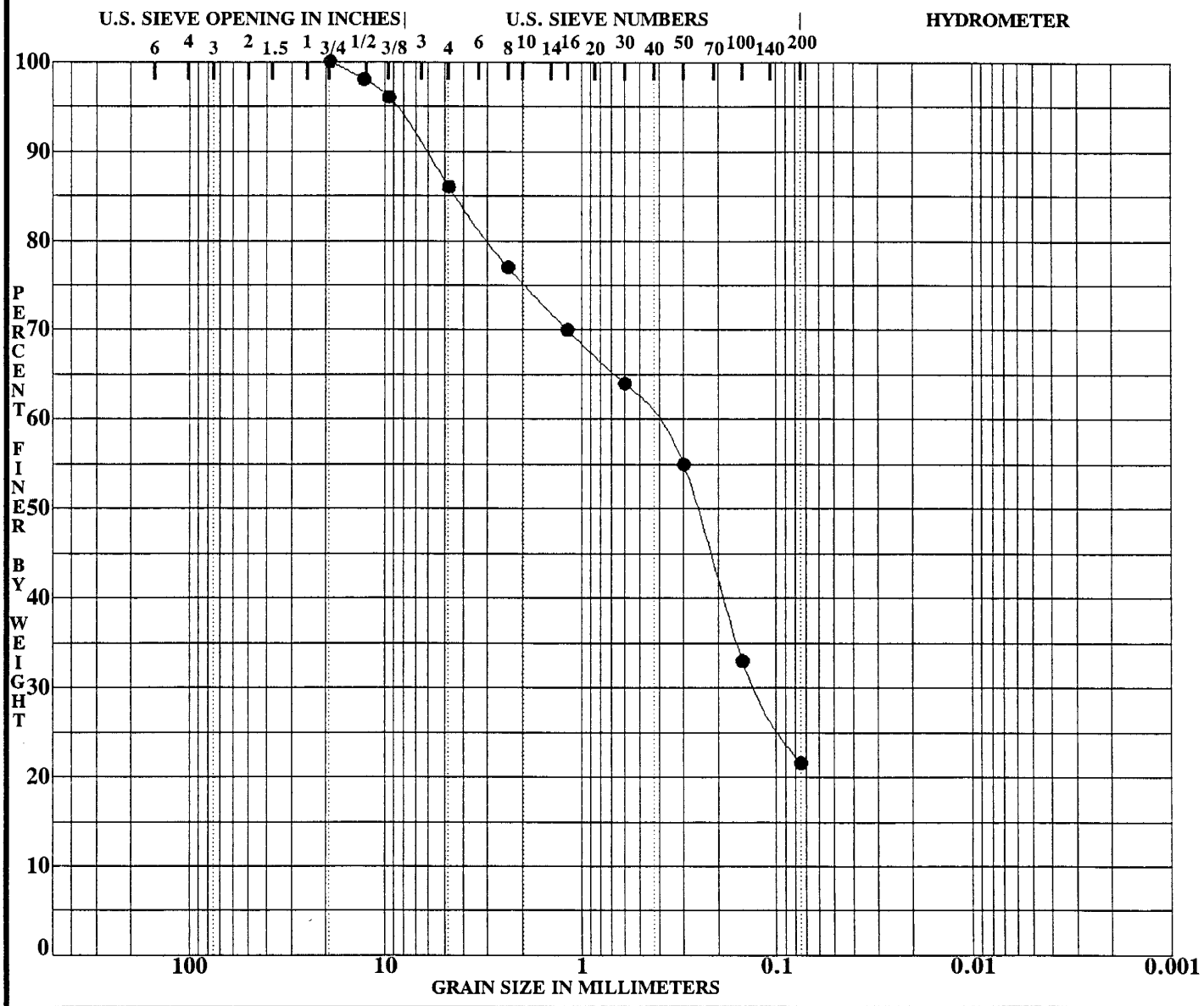
UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon

PLATE: B

SIEVE ANALYSIS TEST RESULTS

CLIENT:		PROJECT:
CH2M Hill		I-15/Cheyenne Interchange Utility Relocation
BORING NUMBER:	DEPTH:	SITE:
1	1.8-3.3 m	I-15 and Cheyenne Avenue



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

NOTES:

SOIL CLASSIFICATION: SC

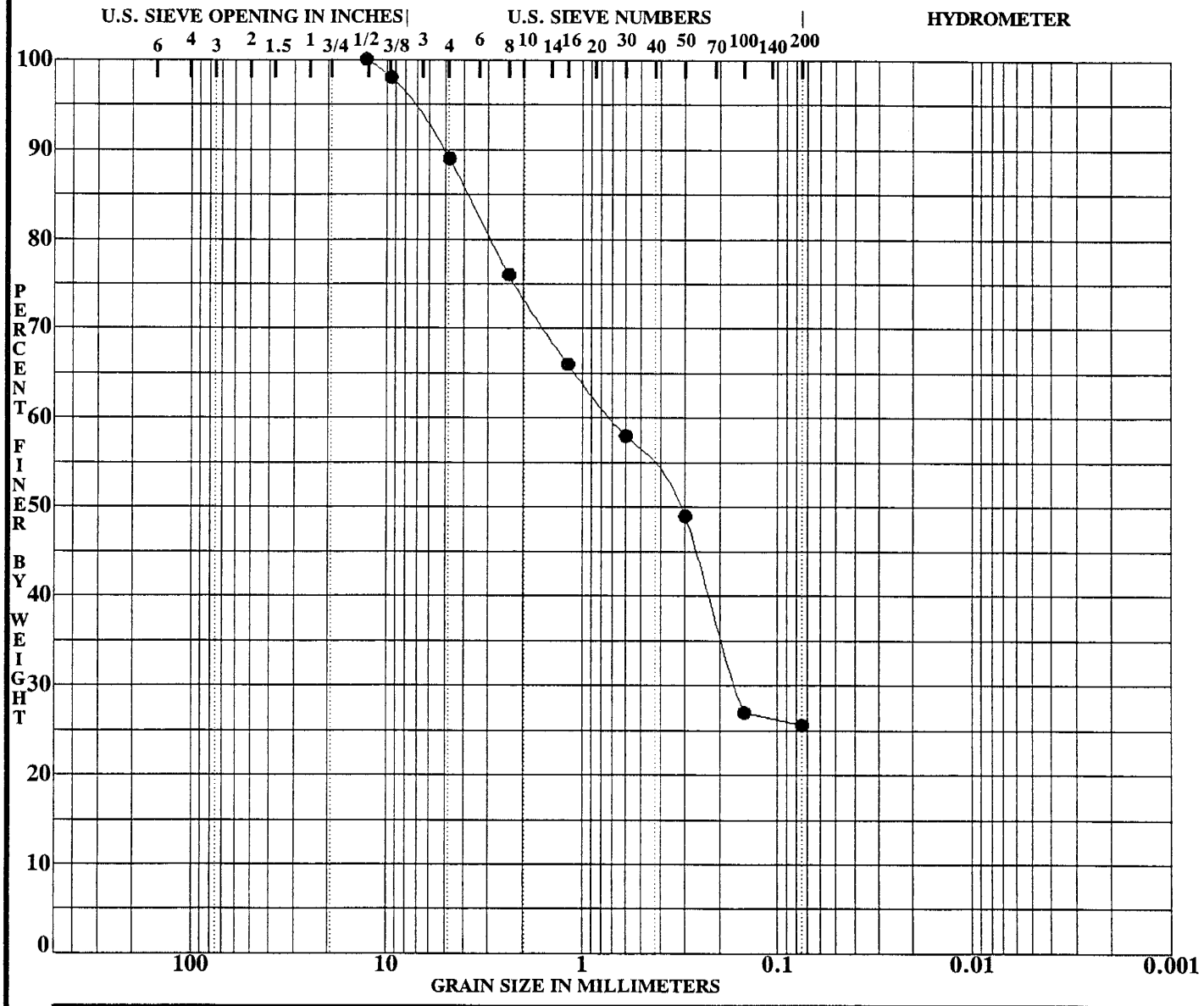
Terracon

DATE TESTED:	PAGE NUMBER:
5-29-97	Page 1 of 1
PROJECT NO.:	PLATE:
64975178	C-1

SIEVE ANALYSIS TEST RESULTS

CLIENT:	PROJECT:
CH2M Hill	I-15/Cheyenne Interchange Utility Relocation

BORING NUMBER:	DEPTH:	SITE:
2	1.5-2.7 m	I-15 and Cheyenne Avenue



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

NOTES:

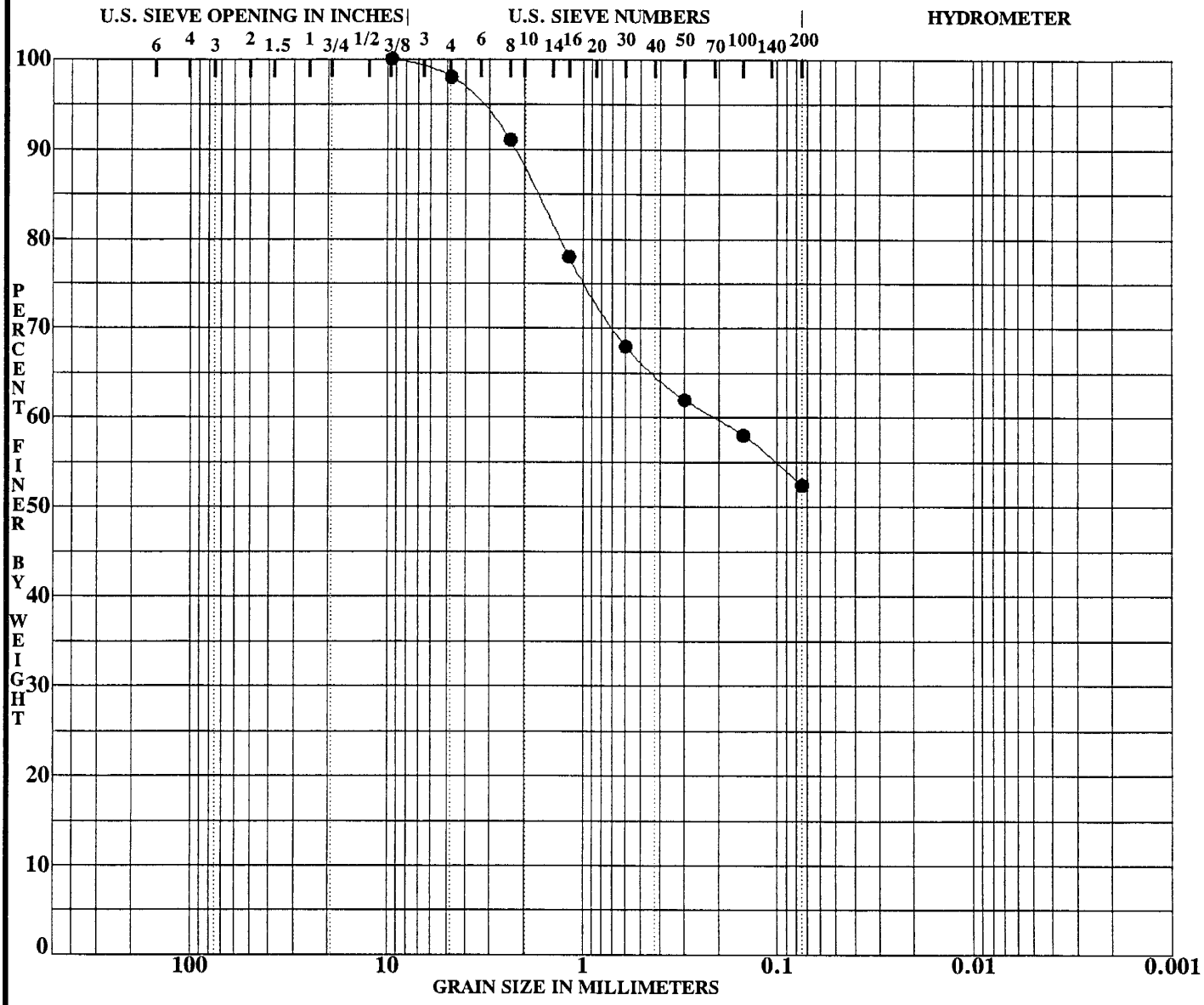
SOIL CLASSIFICATION: SC

Terracon

DATE TESTED:	PAGE NUMBER:
5-29-97	Page 1 of 1
PROJECT NO.: 64975178	PLATE: C-2

SIEVE ANALYSIS TEST RESULTS

CLIENT:		PROJECT:
CH2M Hill		I-15/Cheyenne Interchange Utility Relocation
BORING NUMBER:	DEPTH:	SITE:
2	5.8-7.3 m	I-15 and Cheyenne Avenue

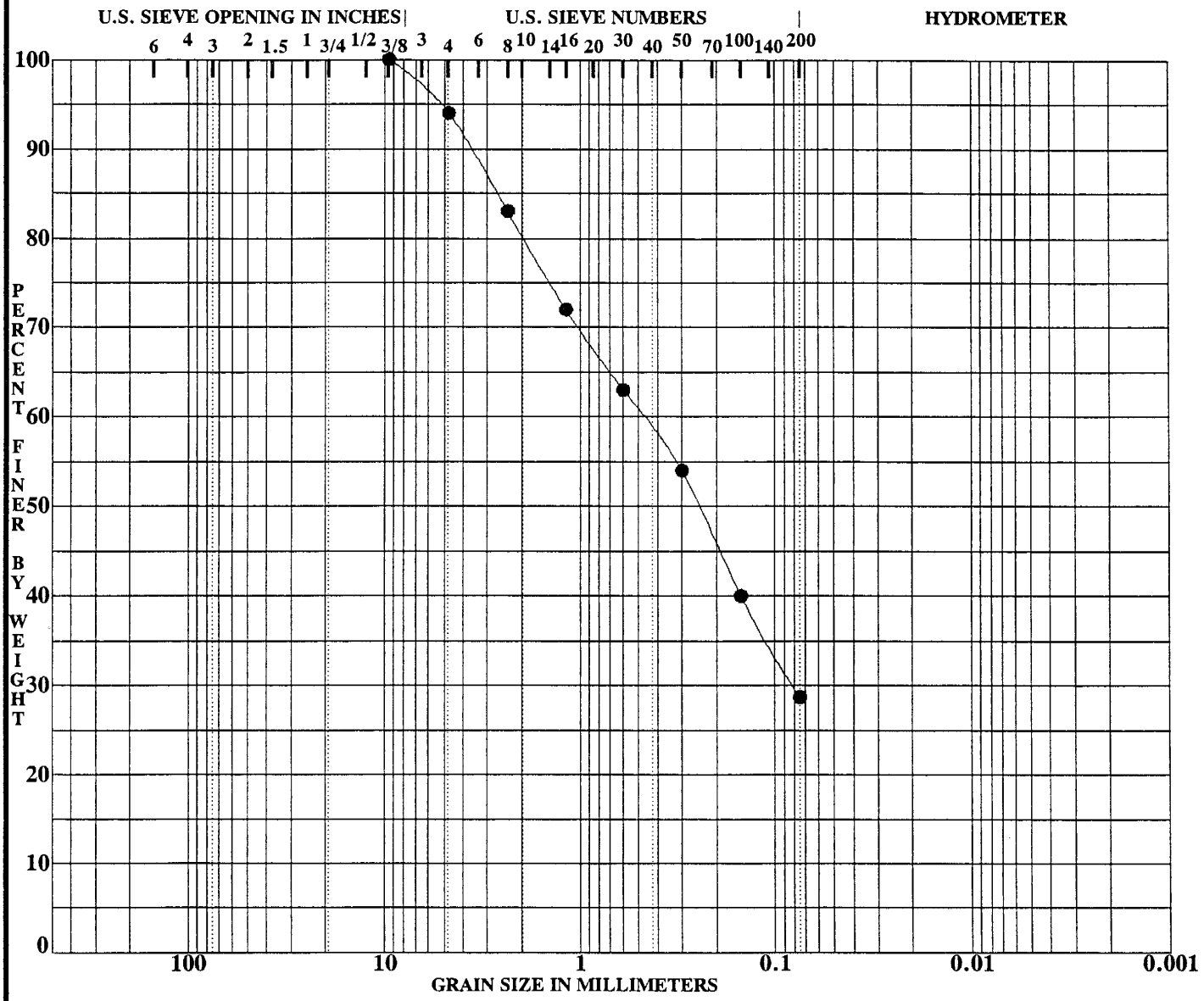


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

NOTES:		DATE TESTED:	PAGE NUMBER:
	Terracon	5-29-97	Page 1 of 1
SOIL CLASSIFICATION: CL		PROJECT NO.: 64975178	PLATE: C-3

SIEVE ANALYSIS TEST RESULTS

CLIENT:		PROJECT:
CH2M Hill		I-15/Cheyenne Interchange Utility Relocation
BORING NUMBER:	DEPTH:	SITE:
3	0.9-2.4 m	I-15 and Cheyenne Avenue

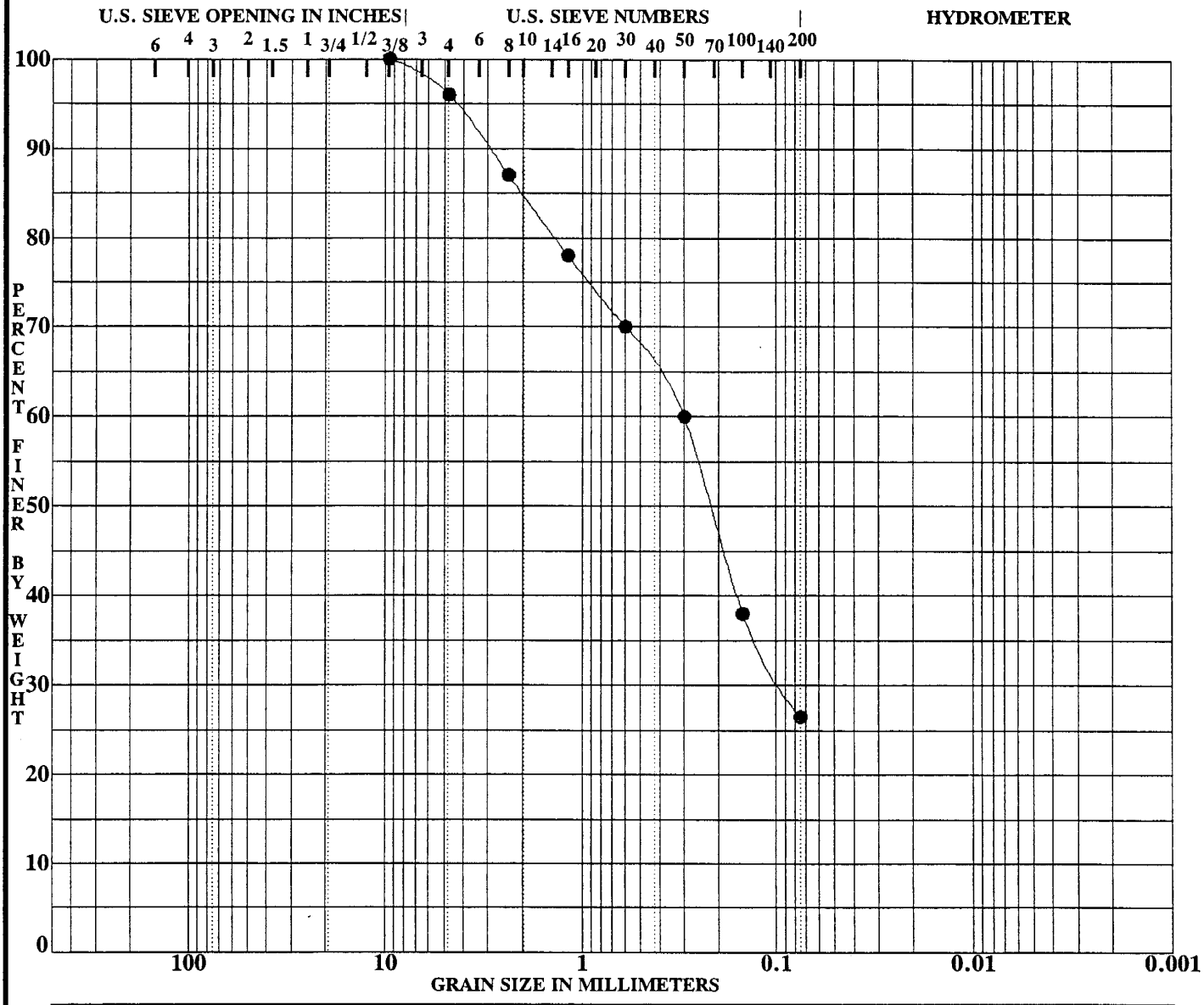


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

NOTES:		DATE TESTED:	PAGE NUMBER:
	Terracon	5-30-97	Page 1 of 1
SOIL CLASSIFICATION: SC		PROJECT NO.: 64975178	PLATE: C-4

SIEVE ANALYSIS TEST RESULTS

CLIENT:		PROJECT:
CH2M Hill		I-15/Cheyenne Interchange Utility Relocation
BORING NUMBER:	DEPTH:	SITE:
3	4.0-5.5 m	I-15 and Cheyenne Avenue

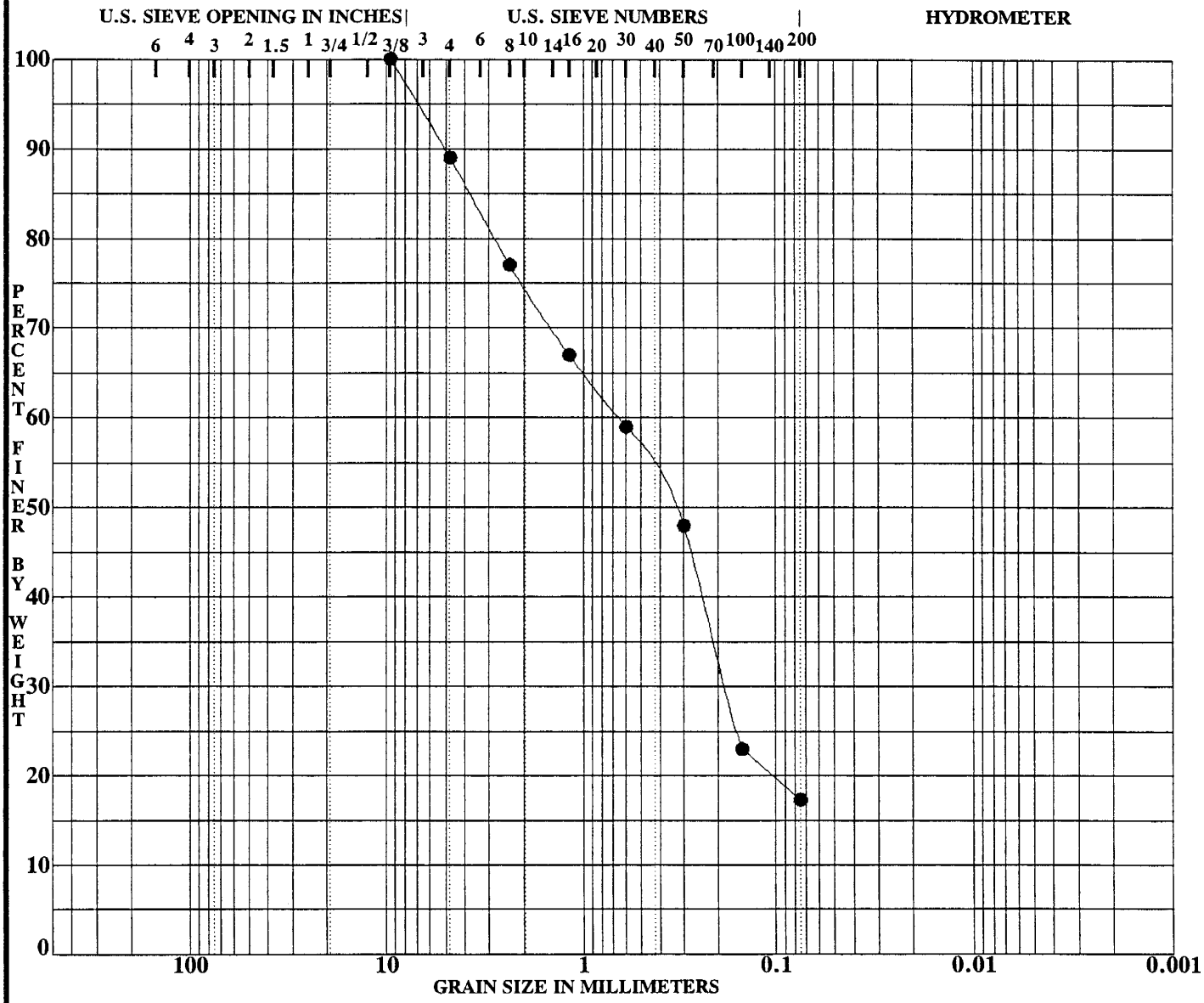


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

NOTES:		DATE TESTED:	PAGE NUMBER:
	Terracon	5-30-97	Page 1 of 1
SOIL CLASSIFICATION: SC		PROJECT NO.: 64975178	PLATE: C-5

SIEVE ANALYSIS TEST RESULTS

CLIENT:		PROJECT:
CH2M Hill		I-15/Cheyenne Interchange Utility Relocation
BORING NUMBER:	DEPTH:	SITE:
3	5.5-7.0 m	I-15 and Cheyenne Avenue

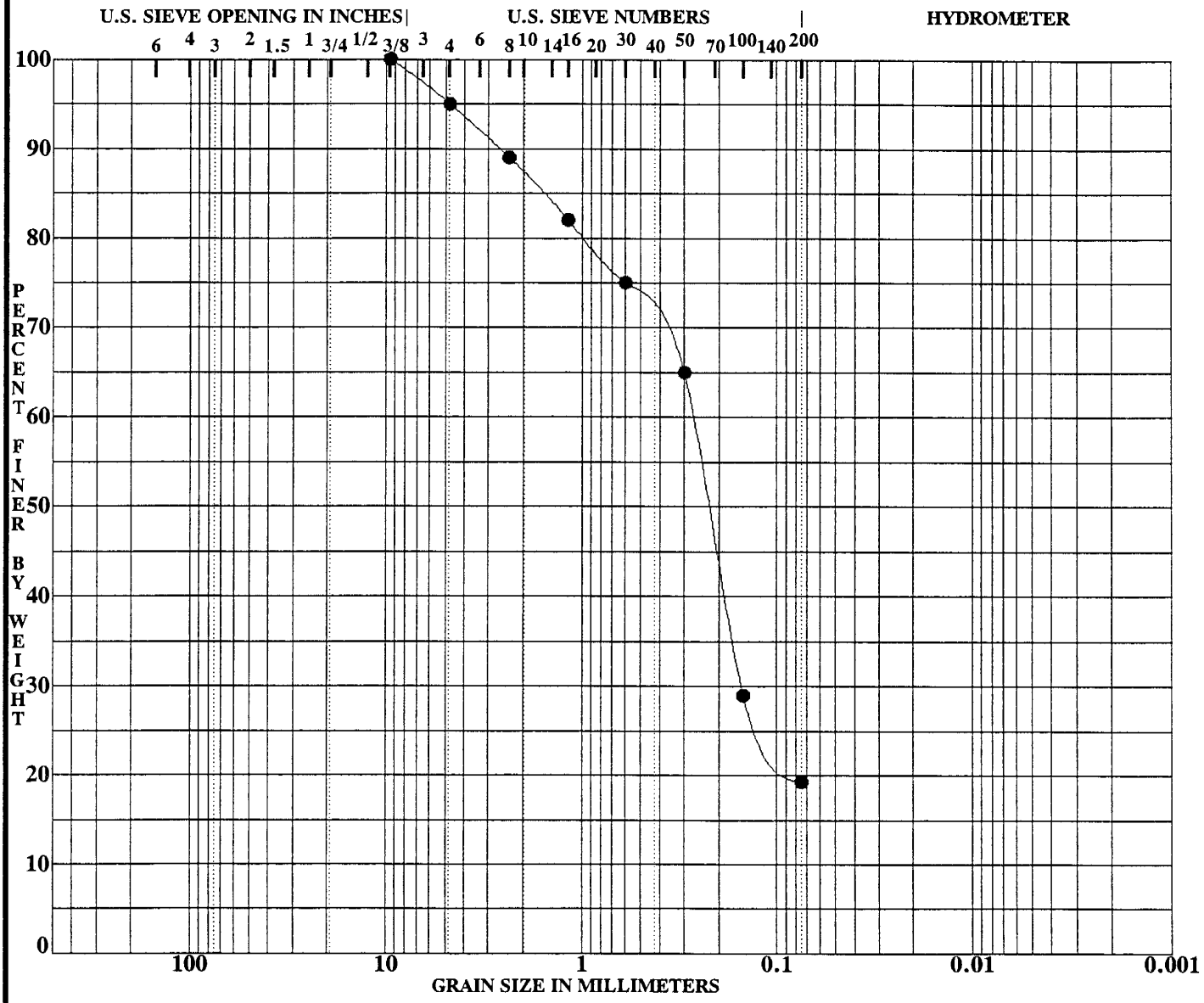


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

NOTES:		DATE TESTED:	PAGE NUMBER:
	Terracon	5-30-97	Page 1 of 1
SOIL CLASSIFICATION: SC		PROJECT NO.: 64975178	PLATE: C-6

SIEVE ANALYSIS TEST RESULTS

CLIENT:		PROJECT:
CH2M Hill		I-15/Cheyenne Interchange Utility Relocation
BORING NUMBER:	DEPTH:	SITE:
4	0.6-2.1 m	I-15 and Cheyenne Avenue



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

NOTES:

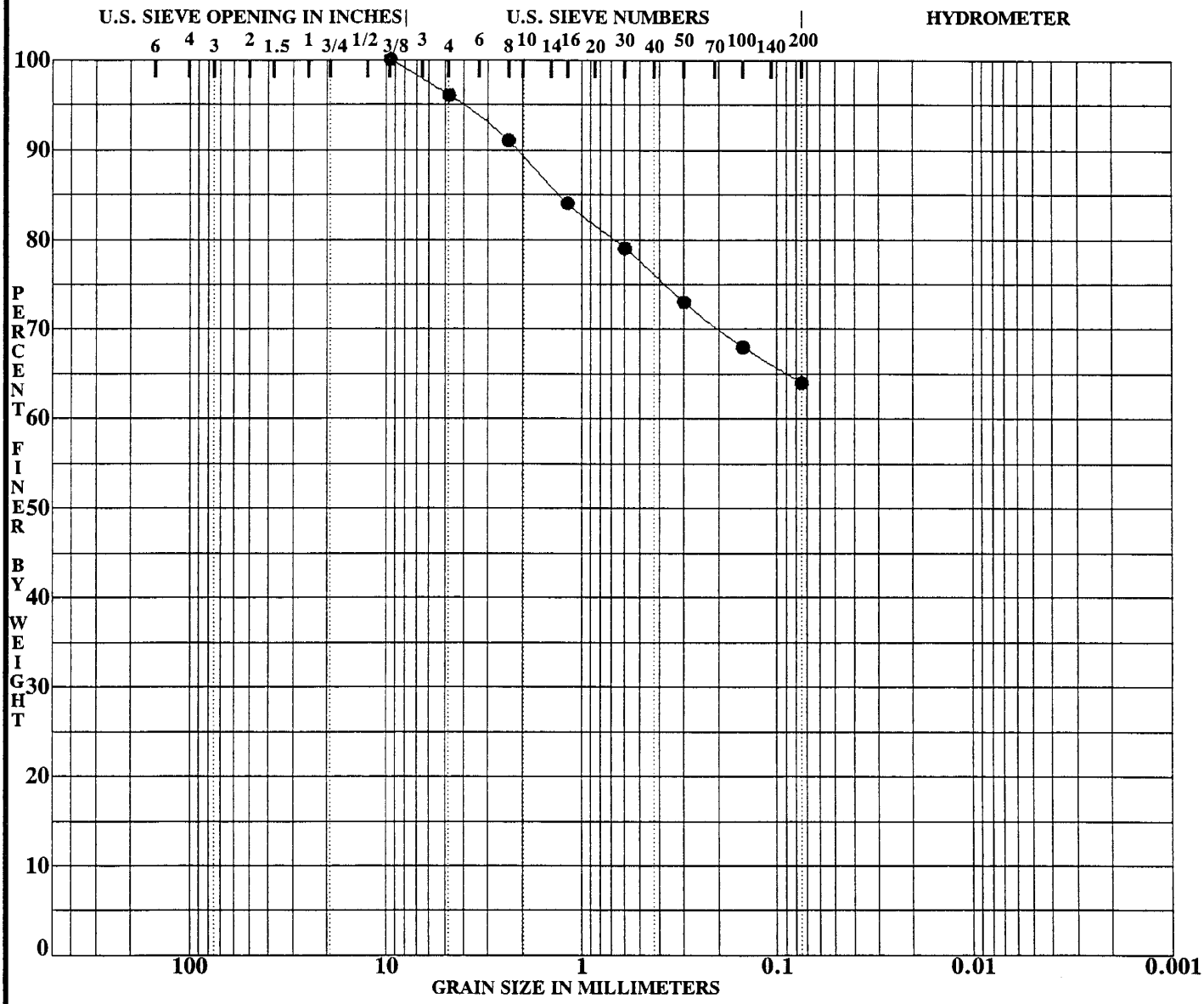
SOIL CLASSIFICATION: SC

Terracon

DATE TESTED:	PAGE NUMBER:
	Page 1 of 1
PROJECT NO.: 64975178	PLATE: C-7

SIEVE ANALYSIS TEST RESULTS

CLIENT:		PROJECT:
CH2M Hill		I-15/Cheyenne Interchange Utility Relocation
BORING NUMBER:	DEPTH:	SITE:
5	0.6-1.5 m	I-15 and Cheyenne Avenue



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

NOTES:

SOIL CLASSIFICATION: CL

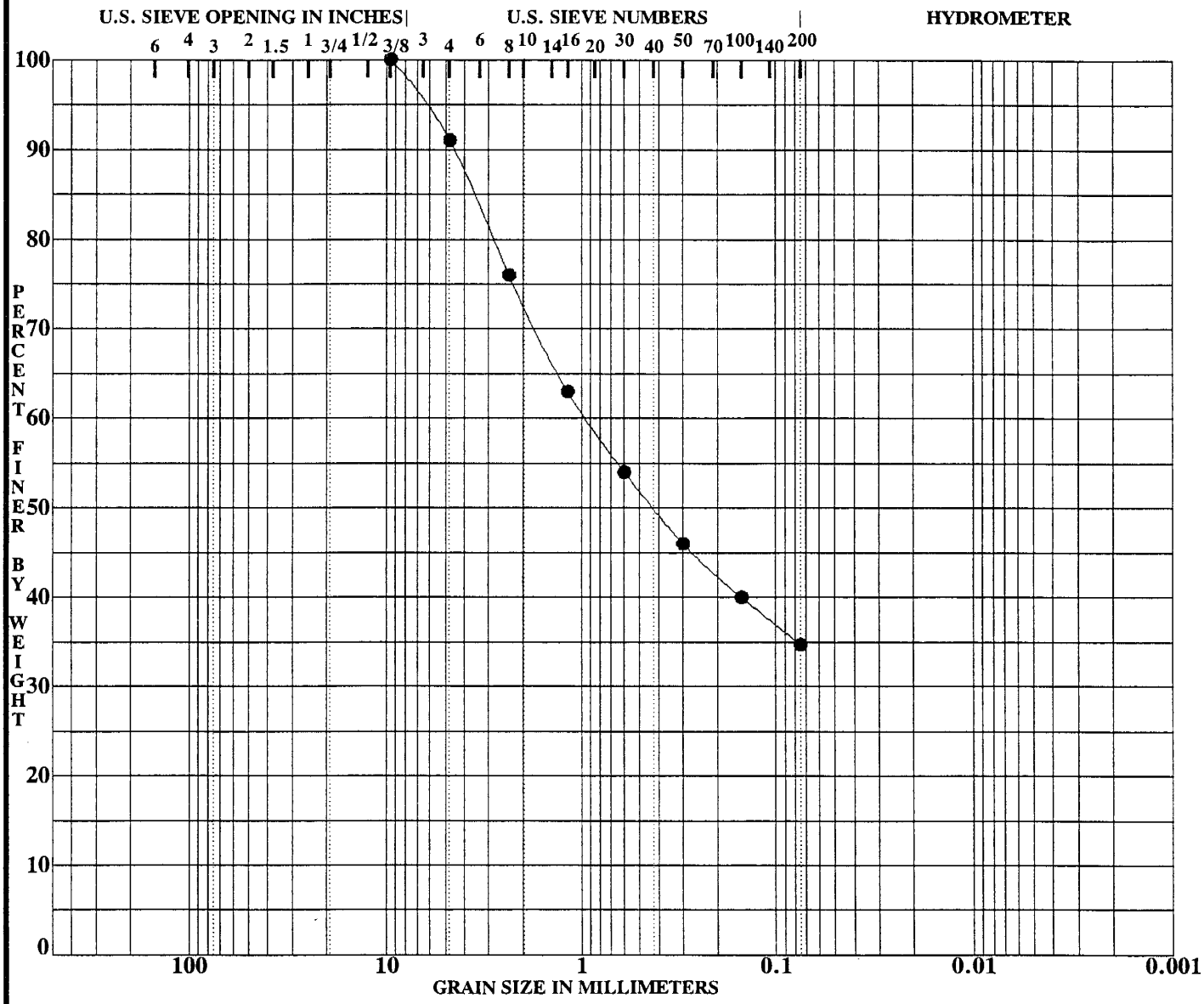
Terracon

DATE TESTED:	PAGE NUMBER:
5-29-97	Page 1 of 1
PROJECT NO.:	PLATE:
64975178	C-8

SIEVE ANALYSIS TEST RESULTS

CLIENT:	PROJECT:
CH2M Hill	I-15/Cheyenne Interchange Utility Relocation

BORING NUMBER:	DEPTH:	SITE:
5	3.6-5.2 m	I-15 and Cheyenne Avenue



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

NOTES:

SOIL CLASSIFICATION: SC

Terracon

DATE TESTED:	PAGE NUMBER:
5-29-97	Page 1 of 1
PROJECT NO.: 64975178	PLATE: C-9

SAMPLE LOCATION AND DEPTH (ft.)	SOIL DESCRIPTION	MOISTURE CONTENT (%)		DRY DENSITY (pcf)	EXPANSION * (%)
		INITIAL **	FINAL		
B-1 @ 6 ft.	SANDY CLAY	13.0	15.0	118	4.5
B-2 @ 5-9 ft.	CLAYEY SAND	9.2	12.9	127	3.7
B-2 @ 19-24 ft.	SANDY CLAY	16.3	18.5	117	5.9
B-3 @ 3-8 ft.	CLAYEY SAND	7.6	12.1	128	1.7
B-3 @ 13-18 ft.	CLAYEY SAND	11.5	21.2	118	11.3
B-4 @ 2-7 ft.	CLAYEY SAND	8.7	16.7	116	4.0
B-5 @ 2-5 ft.	SANDY CLAY	14.9	17.4	117	7.0
B-5 @ 12-17 ft.	CLAYEY SAND	17.3	19.9	113	5.8

* Test performed using a 60 psf surcharge load.

** Moisture content at time of remolding.
All samples are oven dried prior to testing.

CLIENT: CH2M HILL

PROJECT: I-15 / CHEYENNE INTERCHANGE UTILITY RELOCATION PROJECT

Terracon

EXPANSION TEST RESULTS

PROJECT NO.: 64975178

PLATE: D

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 6/12/96
END DATE: 6/12/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: NEAR PROPOSED MSE WALL ON RAMP 3A
BORING: CI-7
E.A. #: 72031-1
GROUND ELEV.: 581.8 m
HAMMER DROP SYSTEM: AUTOMATIC

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
6/12/96	dry	dry

STATION: "EM" 53+56.0
OFFSET: 74.0 m Right
ENGINEER: BAFGHI
EQUIPMENT: DRILL B-57 Unit 2362
OPERATOR: WHITED
DRILLING METHOD: HOLLOW STEM AUGER
BACKFILLED: YES DATE: 6/12/96

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOWS/ 300mm	Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
							SC SM	SILTY CLAYEY SAND with GRAVEL fill, medium dense, light brown, contains asphalt chunks	
								0.61	
							CE SM	SILTY SAND very dense, dry to slightly moist, contains strongly cemented areas.	
580.8	1 1.22								
	1.68	A	SPT		83	S,CH,W			SPT(A) refusal
579.8	2 2.74								
								2.13	
							CL	SANDY LEAN CLAY hard, moist, moderate reddish brown	
578.8	3 3.20	B	SPT	49	78	S,PI,W			
								3.66	
							SC CH	CLAYEY SAND dense, moderate reddish brown	
577.8	4 4.27								
	4.72	C	SPT	48	83	S,PI,W			
576.8	5 5.18								
								5.18	
	5.49	D	BULK			S,W	SM	SILTY SAND with GRAVEL medium dense, gravel up to 25 mm in diameter	Auger stuck in hole, removed and redrilled hole 1 m north
	5.79								
575.8	6 6.25	E	SPT	21		S,PI,W			
								6.86	
574.8	7 7.32						SM CE	SILTY FINE SAND with GRAVEL dense, pale reddish brown, contains moderately cemented layers and pockets	
	7.77	F	SPT	42		S,PI,W			
573.8	8 8.84							8.08	
							SC CL	CLAYEY SAND medium dense, moist, moderate reddish brown	
572.8	9 9.30	G	SPT	16	100	H,PI,W			
571.8									

EXP_EM 72031 6/15/97

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 6/12/96
END DATE: 6/12/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: NEAR PROPOSED MSE WALL ON RAMP 3A
BORING: CI-7
E.A. #: 72031-1
GROUND ELEV.: 581.8 m
HAMMER DROP SYSTEM: AUTOMATIC

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
6/12/96	dry	dry

STATION: "EM" 53+56.0
OFFSET: 74.0 m Right
ENGINEER: BAFGHI
EQUIPMENT: DRILL B-57 Unit 2362
OPERATOR: WHITED
DRILLING METHOD: HOLLOW STEM AUGER
BACKFILLED: YES DATE: 6/12/96

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	SAMPLE BLOWS/300mm	SAMPLE Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	10.36							10.52	
	10.82	H	SPT	135	100	S,PI,W	CE SM	10.82 SILTY SAND very dense, moist, contains strongly cemented areas, pale reddish brown	No groundwater encountered
570.8	11							B.O.H.	
569.8	12								
568.8	13								
567.8	14								
566.8	15								
565.8	16								
564.8	17								
563.8	18								
562.8	19								
561.8									

EXP_EM 72031 5/15/97

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 4/8/96
END DATE: 4/10/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: PROPOSED SE ABUT I-15 OVERPASS
BORING: CI-2
E.A. #: 72031-1
GROUND ELEV.: 587.2 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
4/15/96	14.4	572.8
5/15/96	14.4	572.8

STATION: "EM" 53+31.0
OFFSET: 24.7 m Right
ENGINEER: SALAZAR
EQUIPMENT: DRILL B-80 Unit 2041
OPERATOR: ALTIMIRANO/WHITED
DRILLING METHOD: ROTARY WASH
BACKFILLED: YES DATE: 5/16/96

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOWS/300mm	Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.61						SC	CLAYEY FINE GRAVELLY SAND fill, medium dense, moderate orange pink to light brown	
586.2	1 1.07	A	SPT	24	13	PI,W			
								1.52	
585.2	2 2.13						SM	SILTY SAND with GRAVEL fill, dense, light brown to moderate orange pink, contains partially cemented areas	
	2.59	B	SPT	36	60	PI,S,W			
584.2	3								
	3.66							3.35	
							CH	FINE SANDY FAT CLAY fill, very stiff, light brown with moderate orange pink cemented pockets and layers	
583.2	4 4.11	C	SPT	17	80	PI,H,W			
								4.57	
							SM	SILTY SAND with GRAVEL fill, medium dense, multi-colored	
								4.88	
582.2	5 5.18						SC CE	CLAYEY SAND very dense, mottled light brown and moderate orange pink, with strongly cemented pockets and thin layers	
	5.64	D	SPT	69	80	PI,S,W			
581.2	6								
	6.71								
580.2	7 7.04	E	SPT		91	PI,CH,W			SPT(E) refusal
579.2	8 8.23								
	8.50	F	SPT		88	PI,S,W			SPT(F) refusal
								8.69	
578.2	9						SM	SILTY SAND WITH GRAVEL medium dense, grayish black to light brown	
	9.75							9.30	
577.2							SP SC	POORLY GRADED SAND with CLAY and GRAVEL medium dense, contains weakly cemented areas and limey pockets, light brown	

EXP_EM 72031 5/15/97

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 4/8/96
END DATE: 4/10/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: PROPOSED SE ABUT I-15 OVERPASS
BORING: CI-2
E.A. #: 72031-1
GROUND ELEV.: 587.2 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
4/15/96	14.4	572.8
5/15/96	14.4	572.8

STATION: "EM" 53+31.0
OFFSET: 24.7 m Right
ENGINEER: SALAZAR
EQUIPMENT: DRILL B-80 Unit 2041
OPERATOR: ALTIMIRANO/WHITED
DRILLING METHOD: ROTARY WASH
BACKFILLED: YES DATE: 5/16/96

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOWS/300mm	Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	10.21	G	SPT	20	77	S,W			
								10.67	
							SM	**SILTY SAND with GRAVEL** very dense, light brown and moderate orange pink, contains strongly caliche cemented pockets and thin layers	
576.2	11								
	11.28								
	11.73	H	SPT	74	83	PI,S,W			
575.2	12								
	12.80								
								12.89	
574.2	13	I	SPT		90	S,W,PI	CL CE	**LEAN CLAY** very hard, reddish brown, dry, with cemented pockets, and layers	SPT(I) refusal on caliche
	13.11								Slight Loss Circulation Zone
								14.02	
573.2	14						CL CE	**LEAN CLAY** very stiff, light brown with white specks, contains strongly cemented thin layers (<50 mm)	Driller notes softer formation
	14.23 ▽								
	14.78	J	SPT	24	83	PI,H,W			
572.2	15								
	15.85							15.24	
							CL CE	**LEAN CLAY** hard, light brown, with moderate pale orange strongly cemented areas	
571.2	16	K	SPT	50	117	PI,C,W			
	16.31								
								16.76	
570.2	17						CL	**LEAN CLAY** hard to very stiff, light brown with occasional limey areas and caliche gravel	
	17.37								
	17.83	L	SHELBY		100	UU,UW,H,W			
569.2	18								
	18.90								
568.2	19	M	CSS		100	PI,UW,OC, H,W			
	19.35								
567.2									

EXP_EM 72031 5/15/97

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 4/8/96
END DATE: 4/10/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: PROPOSED SE ABUT I-15 OVERPASS
BORING: CI-2
E.A. #: 72031-1
GROUND ELEV.: 587.2 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
4/15/96	14.4	572.8
5/15/96	14.4	572.8

STATION: "EM" 53+31.0
OFFSET: 24.7 m Right
ENGINEER: SALAZAR
EQUIPMENT: DRILL B-80 Unit 2041
OPERATOR: ALTIMIRANO/WHITED
DRILLING METHOD: ROTARY WASH
BACKFILLED: YES DATE: 5/16/96

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOWS/300mm	Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	20.42								
	20.88	N	SPT	33	140	PI,S,W			
566.2	21								
							CL CE	21.34 LEAN CLAY hard to very hard, light brown, contains strongly cemented pockets and thin layers and occasional silty clay layers, 10% to 15% of section cemented	
	21.95								
565.2	22	O	SPT	60	133	PI,S,W			
	22.40								
564.2	23								
	23.47								
	23.73	P	SHELBY		100	PI,S,W			Bagged sample
563.2	24								
562.2	24.99								
	25.45	Q	SPT	130		PI,S,W			
561.2	26								
	26.52								
	26.97	R	CSS		136	PI,UW,OC, H,W			
560.2	27								
							CH CE	25.91 FAT CLAY with SAND hard to very hard, light brown, contains strongly cemented pockets and thin layers	
559.2	28.04								
	28.50	S	SPT	28	140	PI,H,W			
558.2	29								
	29.57								
		T	SPT	38		PI,S,W			
							CL CE	27.49 LEAN CLAY very stiff, light to moderate brown, with cemented pockets and white caliche gravel, contains intermittent silty clay layers	
557.2									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 4/8/96
END DATE: 4/10/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: PROPOSED SE ABUT I-15 OVERPASS
BORING: CI-2
E.A. #: 72031-1
GROUND ELEV.: 587.2 m
HAMMER DROP SYSTEM: SAFETY

STATION: "EM" 53+31.0
OFFSET: 24.7 m Right
ENGINEER: SALAZAR
EQUIPMENT: DRILL B-80 Unit 2041
OPERATOR: ALTIMIRANO/WHITED
DRILLING METHOD: ROTARY WASH
BACKFILLED: YES DATE: 5/16/96

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
4/15/96	14.4	572.8
5/15/96	14.4	572.8

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	SAMPLE BLOWS/300mm	SAMPLE Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	30.02								
556.2	31								
	31.09								
	31.33	U	SHELBY			PI,S,W			Collapsed tube; bagged sample
555.2	32								
	32.61								
		V	SPT	21		PI,H,W			
554.2	33								
	33.07								
553.2	34								
	34.14								
	34.32	W	SPT		92	PI,W			SPT(W) refusal, attempted Shelby 1st, crushed tube end
552.2	35								
	35.07						CL ML	SILTY CLAY with GRAVEL very stiff, light brown, limey, with caliche gravel	
	35.66								
	35.94	X1	SPT			PI,S,W			
551.2	36								
	36.12	X2	SPT			PI,S,W	CH CE	FAT CLAY light brown, with caliche gravel B.O.H.	
550.2	37								
549.2	38								
548.2	39								
	547.2								

EXP_EM 72031 5/15/97

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 4/15/96
END DATE: 4/17/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: PROPOSED SW ABUT U.P.R.R. OVERPASS
BORING: CI-3
E.A. #: 72031-1
GROUND ELEV.: 587.3 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
5/16/96	12.6	574.7

STATION: "EM" 52+61.5
OFFSET: 107.3 m Left
ENGINEER: SALAZAR
EQUIPMENT: DRILL B-80 Unit 2041
OPERATOR: WHITED/ALTAMIRANO
DRILLING METHOD: ROTARY WASH
BACKFILLED: YES DATE: 5/16/96

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOWS/300mm	Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.61						SC CL	CLAYEY SAND, fill, very dense, light brown, dry, with asphalt chunks, small cobbles, caliche chunks, minor gravel	
586.3	1 1.07	A	SPT	61	87	PI,S,W			
	1.52						CL CE	FINE SANDY LEAN CLAY hard, light brown with moderate orange pink limey cemented areas and white caliche gravel	
585.3	2 2.13								
	2.59	B	SPT	36	83	PI,S,CH,W			
584.3	3								
	3.14						CL CE	CEMENTED LEAN CLAY very hard, caliche cemented sand, gravel,and small cobbles (conglomerate-like appearance), interbedded with very stiff to strongly cemented, moderate reddish orange to light brown lean clay	Approximately 50%-60% of this layer is strongly cemented. SPT(C) Refusal
	3.66	C	SPT		0				
583.3	4								
582.3	5 5.18								
	5.36	D	SPT		0	Visual,S,W			SPT(D) Refusal
	5.49								
	5.79	E	CORE		70	Visual			Bagged sample E
581.3	6								
	6.71								
580.3	7					Visual			
		F	CORE		62				Sample F stored in core box
579.3	8 8.18								
	8.11						CL CE	SANDY LEAN CLAY very stiff, partially cemented, mottled light reddish brown and moderate orange pink, limey, contains caliche gravel and strongly cemented thin layers (<150 mm)	
	8.23	G	SPT	25	100	PI,H,CH,W			
	8.69								
578.3	9								
	9.75								
	9.75					PI,H,W	CL	FINE SANDY LEAN CLAY very stiff to hard,	SPT(H) attempted
577.3									

EXP_EM 72031 5/15/97

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 4/15/96
END DATE: 4/17/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: PROPOSED SW ABUT U.P.R.R. OVERPASS
BORING: CI-3
E.A. #: 72031-1
GROUND ELEV.: 587.3 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
5/16/96	12.6	574.7

STATION: "EM" 52+61.5
OFFSET: 107.3 m Left
ENGINEER: SALAZAR
EQUIPMENT: DRILL B-80 Unit 2041
OPERATOR: WHITED/ALTAMIRANO
DRILLING METHOD: ROTARY WASH
BACKFILLED: YES DATE: 5/16/96

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	SAMPLE BLOWS/300mm	SAMPLE Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	10.21	H	SPT	25	93		CE	light brown, contains clayey silt interbeds and intermittent cemented layers and pockets	Shelby 1st, crushed tube end
								10.67	
							CL	**LEAN CLAY** very stiff to hard, light brown	
576.3	11								
	11.28								
	11.58	I	SHELBY		100	PI,UU,UW, H,W			
575.3	12								
	12.80 ▼								
574.3	13	J	SHELBY		100	PI,CU,UW, H,W,OC,CH			
	13.29								
								14.02	
573.3	14						CL CH	**CLAY** very stiff, light brown	
	14.33								
	14.63	K	CSS		75	UW,W,PI,OC		14.63	
							CL CE	**LEAN CLAY** hard to very hard, light brown, with intermittent cemented pockets and thin layers; contains occasional thin clayey silt interbeds	
572.3	15								
	15.85								
571.3	16	L	SPT	62		PI,H,W			
	16.31								
570.3	17								
	17.37								
	17.65	M	SHELBY			PI,UU,UW, H,W			
569.3	18								
	18.90								
568.3	19.05	N	CSS			PI,H,UW,W			
567.3									

EXP_EM 72031 5/15/97

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 4/15/96
END DATE: 4/17/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: PROPOSED SW ABUT U.P.R.R. OVERPASS
BORING: CI-3
E.A. #: 72031-1
GROUND ELEV.: 587.3 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
5/16/96	12.6	574.7

STATION: "EM" 52+61.5
OFFSET: 107.3 m Left
ENGINEER: SALAZAR
EQUIPMENT: DRILL B-80 Unit 2041
OPERATOR: WHITED/ALTAMIRANO
DRILLING METHOD: ROTARY WASH
BACKFILLED: YES DATE: 5/16/96

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOWS/ 300mm	Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	20.42								
	20.88	O	SPT	62	127	PI,S,W			
566.3	21								
	21.95								
565.3	22							21.92	
	22.40	P	SPT	20	147	PI,H,W	CH CE	SANDY FAT CLAY (CH-CE), very stiff to hard, light brown, with cemented pockets, thin layers, and caliche gravel; contains black carbon filled hairline fractures	
564.3	23								
	23.47								
	23.56	Q	SHELBY		0				Sample Q not retained, crushed tube end
	24.02	R	SPT	37	133	PI,S,W			
563.3	24								
562.3	25								
								25.60	
561.3	26						CL ML	SILTY CLAY (CL-ML), very hard, light brown, with clayey silt interbeds; contains thin, strongly cemented layers and pockets	
	26.52								
	26.97	S	SPT	84	133	PI,H,W			
560.3	27								
559.3	28								
								28.96	
558.3	29						CL CE	LEAN CLAY (CL-CE), very stiff to very hard, light brown; contains strongly cemented layers, and black, carbon filled hairline fractures	
	29.57								
		T	SPT	22	140	PI,S,W			
557.3									

EXP_EM 72031 5/15/97

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 4/15/96
END DATE: 4/17/96
JOB DESCRIPTION: I-15/CHEYENNE INTCHG RECONSTRUCTION
LOCATION: PROPOSED SW ABUT U.P.R.R. OVERPASS
BORING: CI-3
E.A. #: 72031-1
GROUND ELEV.: 587.3 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.
5/16/96	12.6	574.7

STATION: "EM" 52+61.5
OFFSET: 107.3 m Left
ENGINEER: SALAZAR
EQUIPMENT: DRILL B-80 Unit 2041
OPERATOR: WHITED/ALTAMIRANO
DRILLING METHOD: ROTARY WASH
BACKFILLED: YES DATE: 5/16/96

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOWS/ 300mm	Recovery (%)	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	30.02								
556.3	31								
	31.09		SPT	85		PI,H,W			
	31.55							31.55 B.O.H.	
555.3	32								
554.3	33								
553.3	34								
552.3	35								
551.3	36								
550.3	37								
549.3	38								
548.3	39								
547.3									

DRAFT

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL SECTION
SUMMARY OF TEST RESULTS

E.A. No. 72031-1

Boring No. CI - 2 Total Depth (ft.) 118.5 ' Station or Location: 24.68 m rt "EM" 53+31

SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLER TYPE	No. BLOWS /FOOT	SOIL GROUP	DRY UNIT WT lb/ft³	WET UNIT WT lb/ft³	WATER CONTENT	% MINUS 200	PI	LL	SHEAR STRENGTH PARAMETERS TEST TYPE	PHI	CU (tsf)	QU	OTHER TESTS PERFORMED
A	2.0 - 3.5	SS	24	SC			19.2		23	41					
B	7.0 - 8.5	SS	36	SC			11.6	24	N.P.	17					
C	12.0 - 13.5	SS	17	CH			39.0	68	46	64					H
D	17.0 - 18.5	SS	69	SC/CE			18.8	35	28	59			0.43		
E	22.0 - 23.1	SS	R	SC/CE			13.5		16	29					Ch
F	27.0 - 27.9	SS	R	SC/CE			15.6	22	16	39					
G	32.0 - 33.5	SS	20	SP/SC			14.7	12					0.58		
H	37.0 - 38.5	SS	74	SM			12.2	18	2	17			0.86		
I 1	42.0 - 42.3	SS	R	SM			11.5	14							
I 2	42.3 - 43.0	SS	R	CL			14.6		10	26					
J	47.0 - 48.5	SS	24	CL/CE			27.6	50	18	36					H
K	52.0 - 53.5	SS	50	CE/CL			24		10	26					Ch
L	57.0 - 58.55	SH		CL	97.6	124.5	27.7						0.93		
L1	0 - 1.75 "	SH													wasted
L2	1.75 - 7.5 "	SH		CL	96.9	124.4	28.4	94	20	37			0.72		PI, H GS=2.73
L3	7.5 - 13.25 "	SH		CL	98.2	124.6	26.9						1.13		
L4	13.25 - 14.25 "	SH									DS @ 3ksi				
L5	14.25 - 15.25 "	SH									DS @ 4ksi				
L6	15.25 - 16.25 "	SH									DS @ 2ksi	30	0.88		
L7	16.25 - 17.25 "	SH									DS @ 2ksi				
L8	17.25 - 18.25 "	SH													wasted
M	62 - 63.7	CSS /shoe		CL											
M1	0 - 1 "	"													stored

* averaged value

NOTATION UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
UC = Unconfined Compression
S = Direct Shear
Cu = Undrained Cohesion

Shelby Tube subsample depths shown in inches.

PHI = Angle of Internal Friction - Degrees
Qu = Unconfined Compressive Strength
SH = Shelby Tube 2.87" ID
SS = Split Spoon 1.38" ID
CS = Continuous Sample 3.24" ID
3.24" ID w/tubes 3.5" ID w/o tubes
PT = Pitcher Tool
RS = Brass Rings 2.42" ID
DB = Diamond Core Barrel
CSS = Split Spoon 61.5 mm I.D.

ES = Expansive Soils
GS = Specific Gravity
OC = Consolidation
T = Triaxial Compression
Su = Undrained Shear Strength
H = Hydrometer
P = Pushed under weight of hammer and drill stem
R = Refusal

Ch = Chem Analysis
RV = R - Value
SE = Sand Equivalent
PI = Plastic Index
LL = Liquid Limit

DRAFT

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL SECTION
SUMMARY OF TEST RESULTS

E.A. No. 72031-1

Boring No. CI - 2 Total Depth (ft.) 118.5 ' Station or Location: 24.68 m rt "EM" 53+31

SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLER TYPE	No. BLOWS /FOOT	SOIL GROUP	DRY UNIT WT lb/ft³	WET UNIT WT lb/ft³	WATER CONTENT	% MINUS 200	PI	LL	SHEAR STRENGTH PARAMETERS TEST TYPE	PHI	CU (tsf)	QU	OTHER TESTS PERFORMED
M2	1 - 2 "	CSS /shoe													stored
M3	2 - 3 "	"													stored
M4	3 - 4 "	"													stored
M5	4 - 5 "	"													OC, Pc=10.2tsf
M6	5 - 6 "	"													OC, Pc=10.5tsf
M7	6 - 7 "	"													OC, Pc=9tsf
M8	7 - 8 "	"													stored
M9	8 - 9 "	"													stored
M10	9 - 10 "	"													stored
M11	12 - 18 "	"		CL	92.5	120.1	29.8	93	19	36					H, GS=2.74
N	67.0 - 68.5	SS	33	CL			30.3	96	16	33	Pkt Torvane		0.9		
O	72.0 - 73.5	SS	60	CL/CE			27.8	85	18	33	Pkt Torvane		0.47		
P	77.0 - 77.85	SH		CL/ML			24.1	97	7	28	Pkt Torvane		0.5		
Q	82.0 - 83.5	SS	130	CL/CE			25.1	91	10	28	Pkt Torvane		0.55		
R	87.0 - 88.5	CSS /shoe									Pkt Torvane		0.51		
R1	0 - 1 "	"													stored
R2	1 - 2 "	"													stored
R3	2 - 3 "	"													stored
R4	3 - 4 "	"													stored
R5	4 - 5 "	"													stored
R6	5 - 6 "	"													stored
R7	6 - 7 "	"													stored
R8	7 - 8 "	"			92.3	119.7	29.6								OC, Pc=8.3tsf

NOTATION UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
UC = Unconfined Compression
S = Direct Shear
Cu = Undrained Cohesion

Shelby Tube subsample depths shown in inches.

PHI = Angle of Internal Friction - Degrees
Qu = Unconfined Compressive Strength
SH = Shelby Tube 2.87" ID
SS = Split Spoon 1.38" ID
CS = Continuous Sample 3.24" ID
3.24" ID w/tubes 3.5" ID w/o tubes
PT = Pitcher Tool
RS = Brass Rings 2.42" ID
DB = Diamond Core Barrel
CSS = Split Spoon 61.5 mm I.D.

ES = Expansive Soils
GS = Specific Gravity
OC = Consolidation
T = Triaxial Compression
Su = Undrained Shear Strength
H = Hydrometer
P = Pushed under weight of hammer and drill stem
R = Refusal

Ch = Chem Analysis
RV = R - Value
SE = Sand Equivalent
PI = Plastic Index
LL = Liquid Limit
Pc = Preconsolidation Pressure tsf

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL SECTION
SUMMARY OF TEST RESULTS

DRAFT

E.A. No. 72031-1

Boring No. CI - 2 Total Depth (ft.) 118.5 ' Station or Location: 24.68 m rt "EM" 53+31

SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLER TYPE	No. BLOWS /FOOT	SOIL GROUP	DRY UNIT WT lb/ft³	WET UNIT WT lb/ft³	WATER CONTENT	% MINUS 200	PI	LL	SHEAR STRENGTH PARAMETERS TEST TYPE	PHI	CU (tsf)	QU	OTHER TESTS PERFORMED
R9	8 - 9 "	CSS /shoe			92.2	119.4	29.5								OC, Pc=10.8tsf
R10	9 - 10 "	"			89.8	118.1	31.5								OC, Pc=8.3tsf
R11	12 - 18 "	"		CH/CE	91.9	119.8	30.3	71	33	53					H, G=2.72
S	92-93.5	SS	28	CL/CE			33.1	88	22	40					H, GS=2.73
T	97.0 - 98.5	SS	28	CL/CE			28.1	76	24	40	Pkt Torvane		2.1		
U	102.0 - 102.8	SH		CL/CE			26.4	96	9	28	Pkt Torvane		0.5		
V	107.0 - 108.5	SS	21	CL/CE			29.6	93	17	34	Pkt Torvane		0.5		H
W	112.0 - 112.6	SS	72/R	ML-CL/CE			22.7		7	25					
X1	117.0 - 117.9	SS	27	CL/CE			30.7	72	29	47					
X2	117.9 - 118.5	SS	27	CH/CE			27.7	68	60	79					

NOTATION UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
UC = Unconfined Compression
S = Direct Shear
Cu = Undrained Cohesion

Shelby Tube subsample depths shown in inches.

PHI = Angle of Internal Friction - Degrees
Qu = Unconfined Compressive Strength
SH = Shelby Tube 2.87" ID
SS = Split Spoon 1.38" ID
CS = Continuous Sample 3.24" ID
3.24" ID w/tubes 3.5" ID w/o tubes
PT = Pitcher Tool
RS = Brass RIngs 2.42" ID
DB = Diamond Core Barrel
CSS = Split Spoon 61.5 mm I.D.

ES = Expansive Soils
GS = Specific Gravity
OC = Consolidation
T = Triaxial Compression
Su = Undrained Shear Strength
H = Hydrometer
P = Pushed under weight of hammer and drill stem
R = Refusal

Ch = Chem Analysis
RV = R - Value
SE = Sand Equivalent
PI = Plastic Index
LL = Liquid Limit
Pc = Preconsolidation Pressure tsf

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL SECTION
SUMMARY OF TEST RESULTS

DRAFT

E.A. No. 72031

Boring No. CI 3 Total Depth (ft.) 118.5 Station or Location: 107 m lt "EM" 52+61.5

SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLER TYPE	No. BLOWS /FOOT	SOIL GROUP	DRY UNIT WT lb/ft³	WET UNIT WT lb/ft³	WATER CONTENT	% MINUS 200	PI	LL	SHEAR STRENGTH PARAMETERS TEST TYPE	PHI	CU	QU	OTHER TESTS PERFORMED
A	2.0 - 3.5	SS	61	CL/CS			9.7	51	11	38					
B	7.0 - 8.5	SS	36	CL/CE			12.9	69	14	28	Pkt Torvane		1.00		CH
C	12.0	SS	R	CE											Refused
D2	17.0 - 17.6	SS	R	CL/CE			8.3	20							D1 visual
E	18.0 - 19.0	DB		CL/CE											visual
F	22.0 - 26.83	DB		CL/CE											visual
G	27.0 - 28.5	SS	25	CL/CE			31.5	61.2	18	36	Pkt Torvane		0.80		H, GS=2.68 CH
H	32.0 - 33.5	SS	25	CL/CE			30.2	64.4	11	31	Pkt Torvane		1.00		H, GS=2.67
I	37.0 - 38.0	SH		CL	99.5 *	124.8 *	25.6 *	92.9	14	32					H, GS=2.72 wasted
I 1	0 - 0.5"	SH		CL											
I 2	0.5 - 6"	SH		CL	96.3	122.6	27.3	92.9	14	32	UU		0.80		
I 3	6 - 11.5"	SH		CL	102.6	127	23.8	92.9			UU		1.40		
J	42.0 - 43.6	SH		CL	95.8	122.9	28.3 *	97.7	16	34	Cu	20.8	0.36		H, GS=2.77 CH wasted
J 1	0 - 0.5"	SH		CL											
J 2	0.5 - 6"	SH		CL	94.3	121.5	28.2	97.7			Cu 5psi				
J 3	6 - 11.5"	SH		CL	92.0	120.2	30.7	97.7	16	34	Cu 10psi				
J 4	11.5 - 17"	SH		CL	89.7	118.3	31.9	97.7			Cu 15psi				
J 5	17 - 18"	SH		CL	98.4	124.6	26.7								OC, Pc>4tsf
J 6	18 - 19"	SH		CL	104.5	129.8	24.2								OC, Pc=5.3tsf
K	47.0 - 47.75	CSS		CL/CH	81.9 *	113.2 *	38.4 *	89.7	35	51	Pkt Torvane		0.80		
K 1	0 - 3.5"	CSS		CL/CH											wasted
K 2	3.5 - 4.5"	CSS		CL/CH	86.7	116.8	34.7								OC, Pc=4.5tsf
K 3	4.5 - 9.0"	CSS		CL/CH	77.1	109.5	42	89.7	35	51					H, GS=2.71

* Averaged value

NOTATION UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
UC = Unconfined Compression
S = Direct Shear
Cu = Undrained Cohesion

Shelby Tube subsample depths shown in inches.

PHI = Angle of Internal Friction - Degrees
Qu = Unconfined Compressive Strength
SH = Shelby Tube 2.87" ID
SS = Split Spoon 1.38" ID
CS = Continuous Sample 3.24" ID
3.24" ID w/tubes 3.5" ID w/o tubes
PT = Pitcher Tool
RS = Brass Rings 2.42" ID
DB = Diamond Core Barrel
CSS = Split Spoon 61.5 mm I.D.

ES = Expansive Soils
GS = Specific Gravity
OC = Consolidation
T = Triaxial Compression
Su = Undrained Shear Strength
H = Hydrometer
P = Pushed under weight of hammer and drill stem
R = Refusal

Ch = Chem Analysis
RV = R - Value
SE = Sand Equivalent
PI = Plastic Index
LL = Liquid Limit
Pc = Preconsolidation Pressure(tsf)

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL SECTION
SUMMARY OF TEST RESULTS

DRAFT

E.A. No. 72031

Boring No. CI 3 Total Depth (ft.) 118.5 Station or Location: 107 m lt "EM" 52+61.5

SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLER TYPE	No. BLOWS /FOOT	SOIL GROUP	DRY UNIT WT lb/ft³	WET UNIT WT lb/ft³	WATER CONTENT	% MINUS 200	PI	LL	SHEAR STRENGTH PARAMETERS TEST TYPE	PHI	CU	QU	OTHER TESTS PERFORMED
L	52.0 - 53.5	SS	62	CL			25.7	92.8	11	28	Pkt Torvane		0.82		H, GS=2.69
M	57.0 - 57.75	SH		CL				96	16	35					
M 1	0 - 0.5 "	SH		CL											wasted
M 2	0.5 - 6 "	SH		CL	98.6	124.3	26.1	96.2	16	35	UU		0.6		H, GS=2.74
M 3	6 - 7 "	SH		CL				96	15	34					
M 4	7 - 8 "	SH		CL											
M 5	8 - 9"	SH		CL											
M 6	9 - 10 "	SH		CL											
N	62.0 - 62.5	CSS		CL/ML	105.8	128.6	21.6	97.4	7	27	Pkt Torvane		0.65		H, GS=2.74
O	67.0 - 68.5	SS	62	CL/CE			26.8	93	12	31	Pkt Torvane		0.6		
P	72.0 - 73.5	SS	20	CH/CE			31.4	69.4	33	52	Pkt Torvane		0.85		H, GS=2.70
Q	77.0 - 77.3	SH													not retained
R	77.3 - 78.8	SS	37	CL/CE			33.6	75	28	46					
S	87.0 - 88.5	SS	84	CL/CE			25.4	94.3	13	30	Pkt Torvane		0.52		H, GS=2.75
T	97.0 - 98.5	SS	22	CL/CE			31.8	78	24	39	Pkt Torvane		1.05		
U	102.0 - 103.5	SS	85	CL/CE			26.5	94.7	16	35					H, GS=2.71

NOTATION UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
UC = Unconfined Compression
S = Direct Shear
Cu = Undrained Cohesion

Shelby Tube subsample depths shown in inches.

PHI = Angle of Internal Friction - Degrees
Qu = Unconfined Compressive Strength
SH = Shelby Tube 2.87" ID
SS = Split Spoon 1.38" ID
CS = Continuous Sample 3.24" ID
3.24" ID w/tubes 3.5" ID w/o tubes
PT = Pitcher Tool
RS = Brass Rings 2.42" ID
DB = Diamond Core Barrel
CSS = Split Spoon 61.5 mm I.D.

ES = Expansive Soils
GS = Specific Gravity
OC = Consolidation
T = Triaxial Compression
Su = Undrained Shear Strength
H = Hydrometer
P = Pushed under weight of hammer and drill stem
R = Refusal

Ch = Chem Analysis
RV = R - Value
SE = Sand Equivalent
PI = Plastic Index
LL = Liquid Limit