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GEOTECHNICAL INVESTIGATION REPORT  
HARDBANK PROTECTION  
RED MOUNTAIN FREEWAY - PHASE III  
MCKELLIPS ROAD TO COUNTRY CLUB DRIVE  
TRACS NO. H 3878 01 C  
MARICOPA COUNTY, ARIZONA



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**GEOTECHNICAL INVESTIGATION REPORT  
HARDBANK PROTECTION  
RED MOUNTAIN FREEWAY - PHASE III  
MCKELLIPS ROAD TO COUNTRY CLUB DRIVE  
TRACS NO. H 3878 01 C  
MARICOPA COUNTY, ARIZONA**

**Submitted To:**

**Arizona Department of Transportation  
Materials Section  
1221 North 21st Avenue  
Phoenix, Arizona 85009-3740**

**Submitted By:**

**AGRA Earth & Environmental, Inc.  
3232 West Virginia Avenue  
Phoenix, Arizona 85009-1502**

**27 August 1996**

**AEE Job No. 6-117-000081  
Report No. 3**



 **AGRA**  
**Earth & Environmental**

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28 August 1996  
AEE Job No. 6-117-000081  
Report No. 3

Arizona Department of Transportation  
Materials Section  
1221 North 21st Avenue  
Phoenix, Arizona 85009-3740

**Attention: Douglas Alexander, P.E.**

Gentlemen:

**Re: HARDBANK PROTECTION  
RED MOUNTAIN FREEWAY - PHASE III  
MCKELLIPS ROAD TO COUNTRY CLUB DRIVE  
TRACS NO. H 3878 01 C  
MARICOPA COUNTY, ARIZONA**

Our Geotechnical Investigation Report addressing the Hardbank Protection for the referenced project is herewith submitted. The report includes the results of a current investigation as well as pertinent results of previous investigations in the vicinity of the proposed hardbank. In addition, results of laboratory testing are submitted, and recommendations for materials to be used in construction are presented.

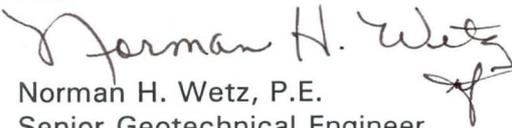
Should any questions arise concerning this report, we would be pleased to discuss them with you.

Respectfully submitted,

**AGRA Earth & Environmental, Inc.**

  
Elizabeth A. Judd, E.I.T.

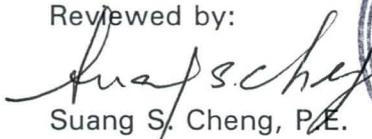
And

  
Norman H. Wetz, P.E.  
Senior Geotechnical Engineer

c: Addressee (2)  
Stanley Consultants, Inc. (8)  
Attn: Steven D. Wilcox, P.E.

met\J96\8-27-96

Reviewed by:

  
Suang S. Cheng, P.E.  
Senior Engineer



**FLOOD CONTROL DISTRICT  
OF  
MARICOPA COUNTY  
2801 W. Durango  
PHOENIX, AZ 85009**

Engineering & Environmental Services

Hardbank Protection  
Red Mountain Freeway - Phase III  
McKellips Road to Country Club Drive  
TRACS No. H 3878 01C  
Maricopa County, Arizona

AEE Job No. 6-117-000081  
Report No. 3  
27 August 1996  
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- Appendix A - Field Investigation
- Appendix B - Laboratory Test Data
- Appendix C - Stability Analysis Diagrams



## 1.0 INTRODUCTION

This report presents the results of a geotechnical investigation addressing the hardbank protection for the north side of the Red Mountain Freeway in Maricopa County, Arizona. The report provides information and recommendations for materials to be used for construction of the hardbank between McKellips Road and Country Club Drive.

## 2.0 PROJECT DESCRIPTION

It is understood that the hardbank protection will provide flood and scour protection for the Red Mountain Freeway, located on the south bank of the adjacent Salt River, during flood flows in the river. The hardbank protection will consist of a hardbank constructed of a cement-stabilized alluvium embankment that will extend from McKellips Road to about Country Club Drive, for a total length of about 2,000 feet. Exact geometrics were not available at the time of this report and it is assumed that the embankment will extend approximately 35 feet below the top of the proposed embankment. The embankment will be about 8 feet in thickness and will be placed at a slope of 1H:1V (horizontal to vertical).

## 3.0 INVESTIGATION

### 3.1 REVIEW OF EXISTING DATA

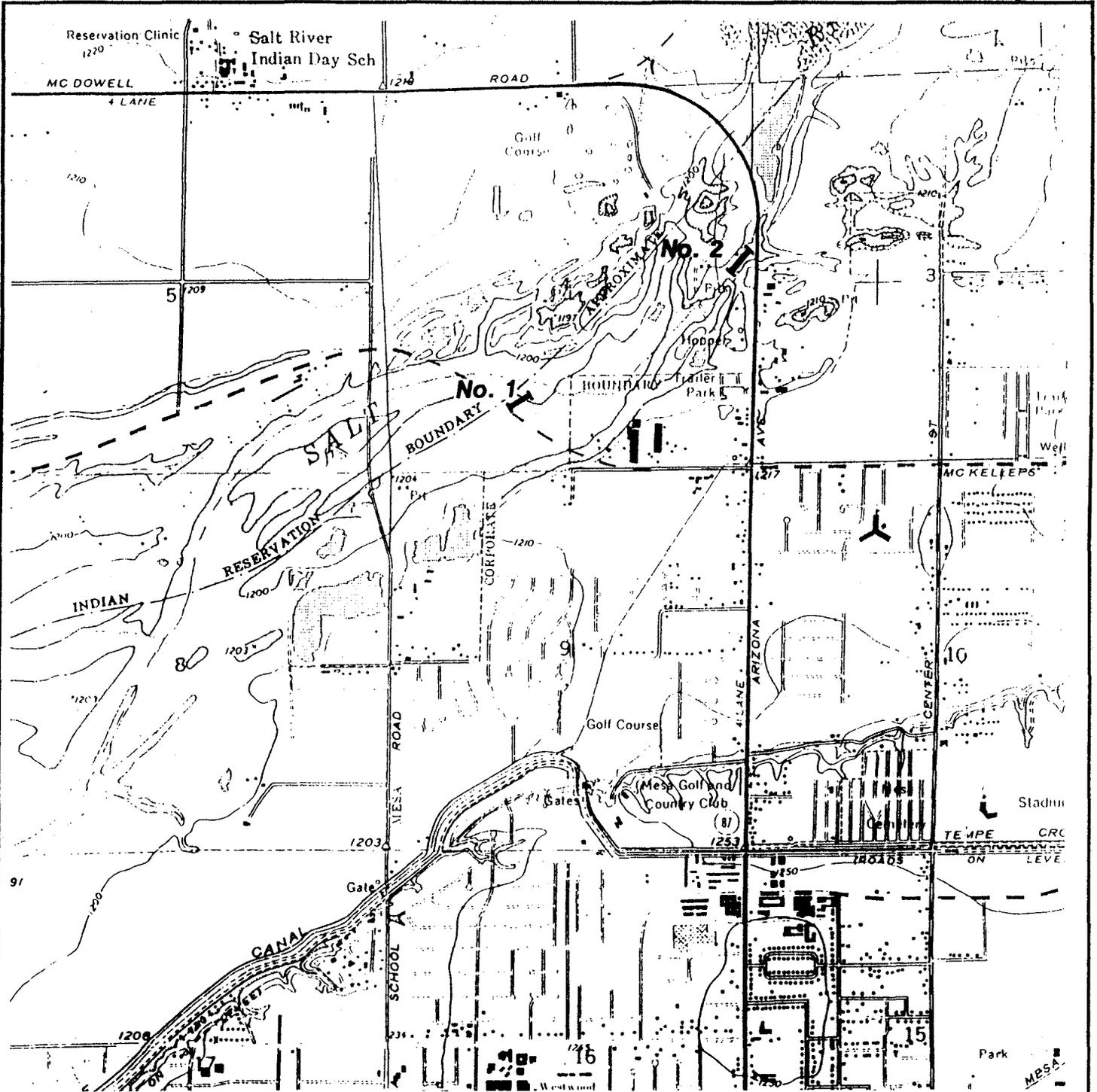
Reports of previous geotechnical investigations performed by this firm in the project area were reviewed. Borings completed for these previous reports were included in this report if considered pertinent to the project. Results of laboratory testing performed on samples obtained from the previous borings and test pits are included. The locations of borings included in the previous reports are shown on the site plans, Sheets 1 and 2 in Appendix A.

### 3.2 SURFICIAL EXPLORATION

The grain-size distribution of channel bed materials was determined at two locations in the Salt River channel adjacent to the planned Red Mountain Freeway, one determination at McKellips Road and one at Country Club Drive. The locations of these surveys are shown in Figure 1. The surficial deposits in the Salt River in this reach include a large percentage of cobbles and boulders, and it was not possible to perform laboratory sieve analysis testing to determine grain-size distribution. Therefore, grain-size distribution characteristics were estimated utilizing particle-count techniques presented by Kellerhals and Bray (1971)\*.

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\*References are listed at the end of this report.



BASE MAP : USGS 7.5 MINUTE SERIES, MESA QUADRANGLE, MARICOPA COUNTY, ARIZONA; 1982.

LEGEND

No. 1 LOCATION OF TRAVERSE LINE



**AGRA**  
 Earth & Environmental  
 3232 WEST VIRGINIA AVENUE  
 PHOENIX, AZ, U.S.A. 85009-1502

JOB NO.	6-117-000081
DESIGN	BAJ
DRAWN	SPG
DATE	8/96
SCALE	1" = 2000'

FIGURE 1 - SITE PLAN SHOWING BEDDING ANALYSIS TRAVERSE LOCATIONS

The calculated results and the grain-size distribution plots are presented in Appendix B. It should be emphasized that the estimated grain-size distributions represent only the surficial bed materials at the locations investigated. It appears that the surficial materials at both locations may represent a relatively thin armoring layer, and may not represent the channel sediments at some depth below the surface.

### **3.3 SUBSURFACE EXPLORATION**

#### **3.3.1 Exploratory Drilling**

Four percussion hammer borings were advanced utilizing an AP-1000 drill rig equipped with 9-inch diameter dual-wall drive casing. Standard penetration testing and open-end drive sampling were performed at selected intervals in the borings. Bulk samples were obtained from drill cuttings of the soils at selected intervals. Our field engineer directed the drilling program, continuously observed drilling operations, visually classified the soils, packaged and labeled soil samples, and prepared the boring logs.

The soils encountered in the borings were classified in the field using the Unified Soil Classification System (ASTM D2487), which is summarized in Appendix A. Terminology used in the description of soils, a description of drilling methods employed and logs of the borings are also presented in Appendix A. The boring locations are shown on Sheets 1 and 2 in Appendix A.

#### **3.3.2 Test Pits**

Four backhoe test pits (TP-1 through TP-4) were excavated to depths varying between about 2.5 to 25 feet below existing grade utilizing a trackhoe (Linkbelt LS-2650 or LS-5800). Our field engineer continuously observed the excavation of the test pits, visually classified the materials encountered, packaged and labeled soil samples, and prepared the logs of the test pits. Logs of the test pits are presented in Appendix A and the locations of the test pits are shown on Sheets 1 and 2 located in Appendix A.

### **3.4 LABORATORY ANALYSIS**

Grain-size analysis and Atterberg limits tests were performed on selected samples. Results of these tests are presented in Appendix B along with tests performed on samples from the earlier borings and test pits. The results of these tests are shown on the boring logs.

## 4.0 SITE CONDITIONS & GEOTECHNICAL PROFILE

### 4.1 SITE CONDITIONS

The hardbank protection is generally located near the south bank of the existing channel of the Salt River. Much of the alignment has been subjected to aggregate mining operations. These areas feature stockpiles of overburden soils from the mining operations as well as mixtures of sand, gravel, construction debris and concrete washout. This area of concrete washout is approximately from Station 518 + 10 to 521 + 20 and approximate limits are shown on Sheets 1 and 2 in Appendix A.

### 4.2 GEOTECHNICAL PROFILE

#### 4.2.1 Fill Deposits

Two primary types of fill deposits were encountered along the hardbank alignment: aggregate materials and sand and gravel materials with some to considerable construction debris. These fill materials can be generalized as follows:

- The aggregate materials fill is present from Station 513 + 00 to Station 518 + 10. These fill materials consist of sand, gravel and cobble mixtures with varying amounts of silt, clay and boulders. Some of these deposits contain cobbles and boulders ranging in size from 3 to 18 inches. These fills vary in thickness from 5 to 25 feet. In general, only minor amounts of construction debris were encountered in these fills.
- Concrete mixer truck wash-out deposits are present along the south bank of the Salt River. These fills are approximately from Station 518 + 10 to 521 + 20.
- Sand and gravel deposits with some to considerable construction debris deposits are present between Station 521 + 20 and Station 526 + 80 and in isolated areas between Station 526 + 80 and Station 532 + 00. These deposits consist of sand, gravel and cobble mixtures, with varying amounts of silt and clay, and contain considerable to minor amounts of construction debris. The construction debris consists primarily of large concrete and asphaltic concrete fragments and rubble, with some wood, metal and plastic. These deposits are about 5 to 26 feet thick in the Busby Metals yard. Isolated areas west of Country Club Drive are typically 6 to 17 feet thick. These deposits vary from dense to loose.

The approximate limits of these fills are shown on the Site Plan (Sheets 1 and 2) in Appendix A. A summary of the fill materials is presented below:

Location (stations)	Anticipated Subsurface Conditions
513+00 to 518+10	Man-made fills with some construction debris in portions of the proposed embankment.
518+10 to 521+20	Concrete mixer truck wash out materials.
521+20 to 526+80	Man-made fill with some to considerable construction debris.
526+80 to 529+90	Native soils consisting of silty sands and sand and gravel mixtures overlying sand, gravel and cobbles.
529+90 to 532+00	Fills consisting of sand, gravel and cobble mixtures with a trace to considerable construction debris.

#### 4.2.2 Native Deposits

The native soils can be generalized into a three-strata system as follows:

- **Stratum A.** Relatively fine-grained soils consisting of mixtures of silt, sand and clay generally extend to depths of about 7 to 13 feet below the existing ground. These materials are soft near the surface and become moderately firm to very firm at depth.
- **Stratum B.** Mixtures of sand and gravel with varying amounts of silt and cobbles underlie Stratum A, generally extending to depths of about 12.5 feet below the existing ground. These soils generally are loose to dense. There is an increase in the percentage of gravel and cobbles within the lower portion of Stratum B, resulting in a gradational contact between Strata B and C. Stratum B is not present in all of the borings.
- **Stratum C.** Sand, gravel and cobble (SGC) deposits with minor amounts of silt and clay underlie Stratum B. The clay content of the SGC generally increases with depth. This deposit, which is locally termed "river-run", is dense to very dense. Though dominated by gravel and cobbles up to 6 to 12 inches in diameter, boulders as large as 36 inches were encountered in the borings.

The Strata A and B soils are not present where the deeper man-made fills are present.

#### 4.4 SOIL MOISTURE & GROUNDWATER CONDITIONS

No groundwater was encountered in the test pits or borings. Soil moisture contents were generally low. It is expected that the groundwater level will fluctuate seasonally and, therefore, dewatering may be necessary during construction, depending upon the time of year construction takes place and if flows are occurring in the Salt River.

#### 5.0 DISCUSSION & RECOMMENDATIONS

##### 5.1 ANALYSIS OF RESULTS

Based on the information provided by the test pits, test borings and estimated grain-size distributions, there is sufficient granular material along the alignment for the construction of the hardbank. However, the granular material will need to be processed to provide a reasonably uniform and properly graded material. The cement content required for the cement-stabilized hardbank will be higher for the SGC materials which contain clay than those that are relatively clean. It is recommended that where clay layers are encountered within excavations, these materials be wasted due to the difficulty in blending these materials with the SGC.

##### 5.2 CEMENT-STABILIZED HARDBANK

Soil-cement and roller-compacted concrete (RCC) can be used for hardbank construction. However, availability of the required type of aggregate for these two alternatives governs construction costs. The fines content (defined as percent finer than the No. 40 sieve) of the SGC does not meet conventional requirements for either soil-cement or RCC construction. If either of these alternatives are to be used, fines will have to be imported from a borrow source to achieve a conventional mix.

It is our opinion that the Salt River alluvium can provide adequate bank protection without the addition of fines if the embankment material is plant-mixed on the site to produce cement stabilized aggregate (CSA). Based on the results of laboratory analyses, the following guidelines for gradation are recommended:

<u>Sieve Size</u> <u>(square openings)</u>	<u>Percent Passing</u> <u>by Weight</u>
3 inch	100
no. 4	30 - 65
no. 200	0 - 8

The materials should be free of organic or other deleterious material and should contain no clay lumps larger than 1.0 inch in diameter. The plasticity index of the material should be no greater than 25 when determined in accordance with the requirements of AASHTO T-90.

Where materials are nonplastic, a cement content of 6 to 7 percent is estimated to be required to achieve a 7-day minimum compressive strength of 750 psi. Where the SGC materials are clayey and have a plasticity index of 15 to 25, a cement content of 8 to 10 percent is estimated to be required. The clay will have an adverse effect on the strength of the proposed hardbank materials. It is recommended that a mix design be performed using the specific materials proposed for construction. Where possible, the clayey SGC should be avoided in the production of cement-stabilized embankment materials.

### 5.3 TEMPORARY CUT SLOPES

Temporary cut slopes of 1-1/2H:1V are recommended for the upper, cleaner portions of the SGC. Temporary cut slopes of 1-1/4H:1V are recommended for the more clayey SGC strata. Where loose man-made fill, construction debris or loose cohesionless sands are present, the slopes should be laid back at a slope of 2H:1V or flatter. Although benches are not required for stability, benches at selected elevations would provide greater protection for workmen at the bottom of the excavation. Some minor raveling as a result of precipitation and drying should be anticipated. All surface runoff should be diverted from the top of cut slopes to help prevent surface erosion of the slope. The temporary cut slopes in the clayey fill (settlement ponds) will require relatively flat slopes, possibly as flat as 4H:1V to 5H:1V. Special techniques such as use of draglines may be required to make the necessary excavation for construction.

### 5.4 PERMANENT SLOPES

Permanent slopes consisting of CSA should be placed in horizontal lifts 8 feet in horizontal width. Exact geometries were not available at the time of this report. It is assumed therefore, that the maximum embankment height will be 35 feet with a toe-down elevation of 1173 feet and a finished slope of 1H:1V. It is also assumed that the bed elevation for the Salt River will be 1177 feet. Stability analysis was performed with the above criteria, for three cases, utilizing the computer program STABL5 (Achilleos, 1988), developed by Purdue University.

Case 1, which analyzes the end of construction, determined a calculated safety factor of 1.5. Case 2, which considered the maximum water level and maximum scour, determined a safety factor of 1.7. Case 3, which considered the rapid drawdown at maximum scour, determined a safety factor of 1.4. Diagrams for each case, showing the geometry and calculated slip surfaces, are presented in Appendix C. Based on the results of the stability analyses, the

1H:1V slope will provide an adequate degree of stability. The phreatic surfaces assumed for the analyses are relatively high and will not be achieved due to the low permeability of the CSA. Lower phreatic surfaces will result in higher safety factors.

## 5.5 MAN-MADE FILL

It is recommended that a monitoring plan for excavation of the existing man-made fill be prepared and implemented by the Contractor. The monitoring plan should address the removal of any hazardous or potentially hazardous materials that may be encountered during excavation. The monitoring plan should include, as a minimum, the following items:

- Organizational structure and personnel responsibilities.
- Emergency response procedures.
- Extended investigations and remedial actions.

Excavated man-made fill materials can be reused as hardbank material, provided that all oversized material, hazardous or potentially hazardous material, organic material and debris have been removed. It is estimated that 10 to 20 percent of the existing man-made fill will have to be wasted.

Hardbank Protection  
Red Mountain Freeway - Phase III  
McKellips Road to Country Club Drive  
TRACS No. H 3878 01C  
Maricopa County, Arizona

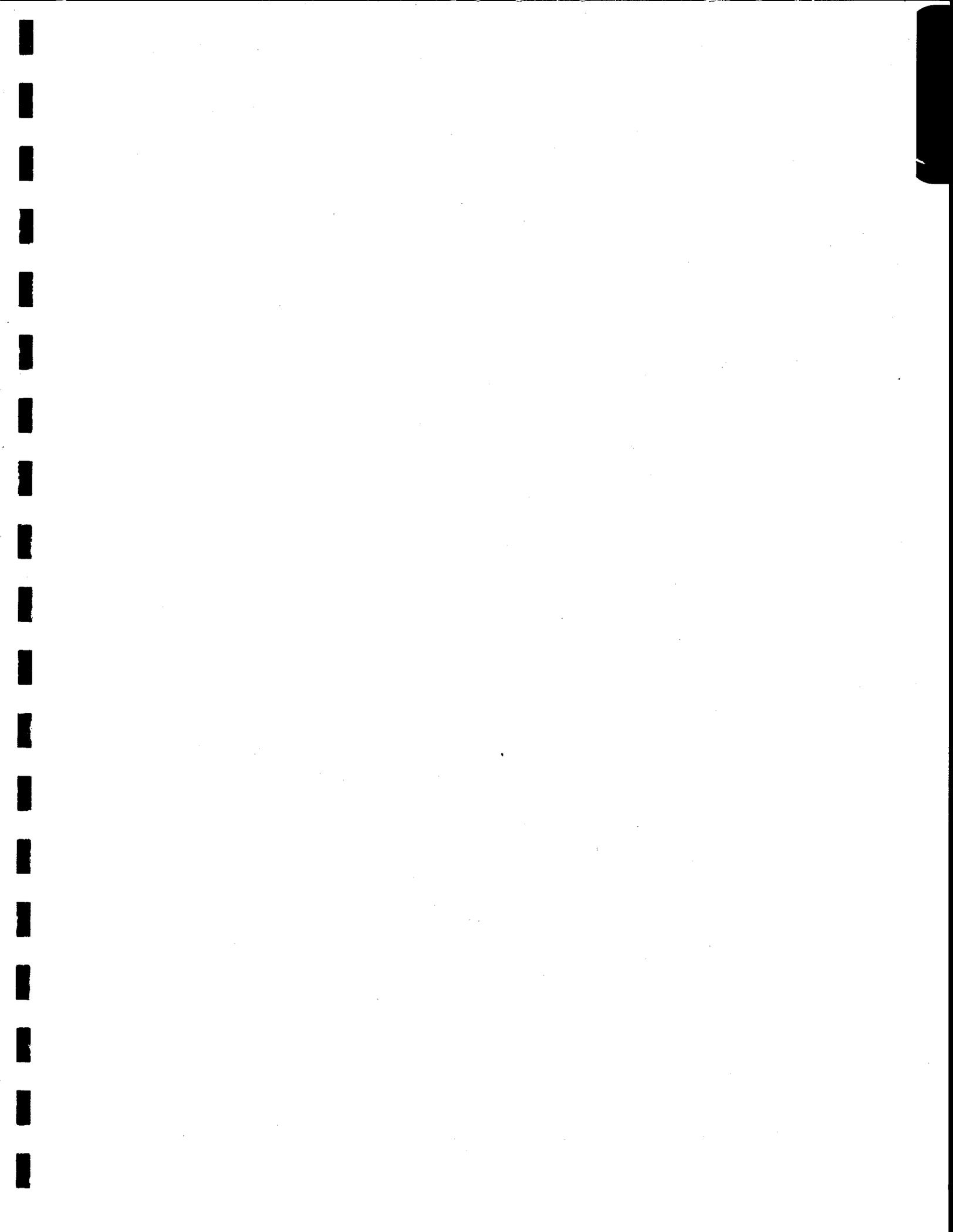
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### REFERENCES

Achilleos, E., 1988, User Guide for PC STABL 5M, Purdue University and Indiana Department of Highways, Joint Highway Research Project, Report JHRP-88/19, December.

Kellerhals, R., and Bray, D.I., 1971, Sampling Procedures for Coarse Fluvial Sediments, Journal of the Hydraulics Division, ASCE, Vol. 97, No. HY8, August, p. 1165-1180.

**APPENDIX A**  
**FIELD INVESTIGATION**



## TEST DRILLING EQUIPMENT & PROCEDURES

### Description of Subsurface Exploration Methods

Auger Boring Drilling through overburden soils is performed with 6 5/8" O.D., 3 1/4" I.D. hollow stem auger or 4 1/2" solid stem continuous flight auger. Carbide insert teeth are normally used on bits so they can penetrate soft rock or very strongly cemented soils. A CME-55 or CME-75 truck-mounted drill rig is used to advance the auger. The drill rigs are powered with six-cylinder Ford industrial engines capable of delivering about 7,000 to 8,400 foot-pounds torque to the drill spindle. The spindle is advanced with twin hydraulic rams capable of exerting 16,000 to 20,000 pounds downward force.

Generally, refusal to penetration of the auger is adopted as top of the SGC or river-run material, which normally requires other techniques for penetration. Grab samples or auger cuttings may be taken as necessary. Standard penetration tests or 2.42" diameter ring samples are taken in conjunction with the auger borings as needed, with the sampling interval and type being indicated on the boring logs.

Hammer Drill Drilling with the Hammer drill is accomplished with a Drill Systems AP1000 drill rig advancing a double-walled drive casing with a link-belt 180 diesel pile driving hammer, having a rated energy of 8,100 foot-pounds per blow. Where noted on the boring log, the hammer is equipped with a supercharger which can boost the energy to approximately 12,000 foot-pounds per blow. The supercharger is used only in portions of the boring where blow counts are relatively high. Cuttings are removed with compressed air by a reverse circulation process, and are collected in a cyclone from which grab samples are obtained. The drive casing is either 9" O.D. by 6" I.D. or 6 5/8" O.D. by 4" I.D. and employs an expendable bit of slightly larger diameter than the O.D. of the casing. Hammer blows required to advance the drive casing are recorded in 1' increments, as noted on the boring logs. Standard penetration tests or 2.42" diameter ring samples taken are noted on the boring logs.

Odex System The Odex (overburden drilling with the eccentric method) system, also referred to as the DTH (down-the-hole hammer) system, consists of a pneumatic-rotary percussion down-the-hole hammer operating at the bottom being drilled through a 5" diameter steel casing. The eccentric button percussion bit overreams the boreholes and allows advancement of the casing. The same compressed air or air-detergent (foam) mixture that operates the hammer also serves to expel the cuttings from the borehole, where they can be collected as grab samples. Retraction of the eccentric drill bit allows removal of the hammer from the center of the casing to facilitate standard penetration testing (ASTM D1586) where noted on the boring logs.

## TEST DRILLING EQUIPMENT & PROCEDURES (CONT.)

Schramm Rotadrill The Schramm T64H truck-mounted drill rig is a top drive rotary rig capable of up to 85,500 inches/pounds of torque with a pulldown capacity of 35,000 lbs. Drilling is performed with either 4", or larger, diameter Tricone roller bits or 4" to 6" diameter down-the-hole hammer. Cutting removal is facilitated by compressed air or air/water mixtures and collected in a cyclone. Where noted on the boring logs, grab samples of the cuttings were collected. When casing is required to stabilize the borehole, an Aardvark drill through casing hammer is utilized, permitting simultaneous drilling and driving of the casing. Casing penetration is recorded on the boring logs in feet per minute. Standard penetration, 2.42" diameter ring samples, Shelby tubes, pitcher tube or Denison samples taken are noted on the boring logs.

Sampling Procedures Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 test procedure. In many cases, 2" O.D., 1 3/8" I.D. samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" O.D. samplers lined with 2.42" I.D. brass rings. The driving energy is generally recorded as the number of blows of a 140-pound, 30-inch free fall drop hammer required to advance the samplers in 6-inch increments. However, in stratified soils, driving resistance is sometimes recorded in 2- or 3-inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. These values are expressed in blows per 6 inches on the boring logs. "Undisturbed" sampling of softer soils is sometimes performed with thin walled Shelby tubes (ASTM D1587), pitcher samplers, Denison samplers or continuous CME samplers. Where samples of rock are required, they are obtained by NQ diamond core drilling (ASTM D2113). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings. Also, representative samples are obtained from the cuttings from the hammer and Schramm drill rig.

Boring Records Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares the boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487), with appropriate group symbols being shown on the boring logs.

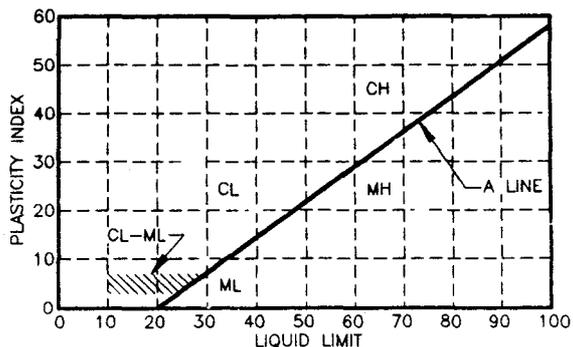
## UNIFIED CLASSIFICATION SYSTEM FOR SOILS

Soils are visually classified by the Unified Soil Classification System on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" ASTM Designation: D2487.

MAJOR DIVISION		GRAPH SYMBOL	GROUP SYMBOL	TYPICAL DESCRIPTION	
<b>COARSE-GRAINED SOILS</b> (Less than 50% passes No. 200 sieve)	<b>GRAVELS</b> (50% or less of coarse fraction passes No. 4 sieve)		GW	Well graded gravels, gravel-sand mixtures or sand-gravel-cobble mixtures.	
			GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.	
		<b>GRAVELS WITH FINES</b> (More than 12% passes No. 200 sieve)		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	<b>SANDS</b> (More than 50% of coarse fraction passes No. 4 sieve)		SW	Well graded sands, gravelly sands.	
			SP	Poorly graded sands, gravelly sands.	
		<b>SANDS WITH FINES</b> (More than 12% passes No. 200 sieve)		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
<b>FINE-GRAINED SOILS</b> (50% or more passes No. 200 sieve)	<b>SILTS</b> LIMITS PLOT BELOW "A" LINE & HATCH ZONE ON PLASTICITY CHART		ML	Inorganic silts, clayey silts with slight plasticity.	
			MH	Inorganic silts of high plasticity, silty soils, elastic silts.	
	<b>CLAYS</b> LIMITS PLOT ABOVE "A" LINE & HATCH ZONE ON PLASTICITY CHART		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	
			CH	Inorganic clays of high plasticity, fat clays, silty and sandy clays of high plasticity.	

**NOTE:** Coarse-grained soils with between 5% & 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart to have dual symbol.

**PLASTICITY CHART**



**DEFINITIONS OF SOIL FRACTIONS**

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 300mm (12in.)
Cobbles	300mm to 75mm (12in. to 3in.)
Gravel	75mm (3in.) to No. 4 sieve
Coarse gravel	75mm to 19mm (3in. to 3/4in.)
Fine gravel	19mm (3/4in.) to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

**TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY,  
CONSISTENCY OR FIRMNESS OF SOILS**

The terminology used on the boring logs to describe the relative density, consistency or firmness of soils relative to the standard penetration resistance is presented below. The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586 procedure using 2" O.D., 1 3/8" I.D. samplers.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand-gravel mixtures.

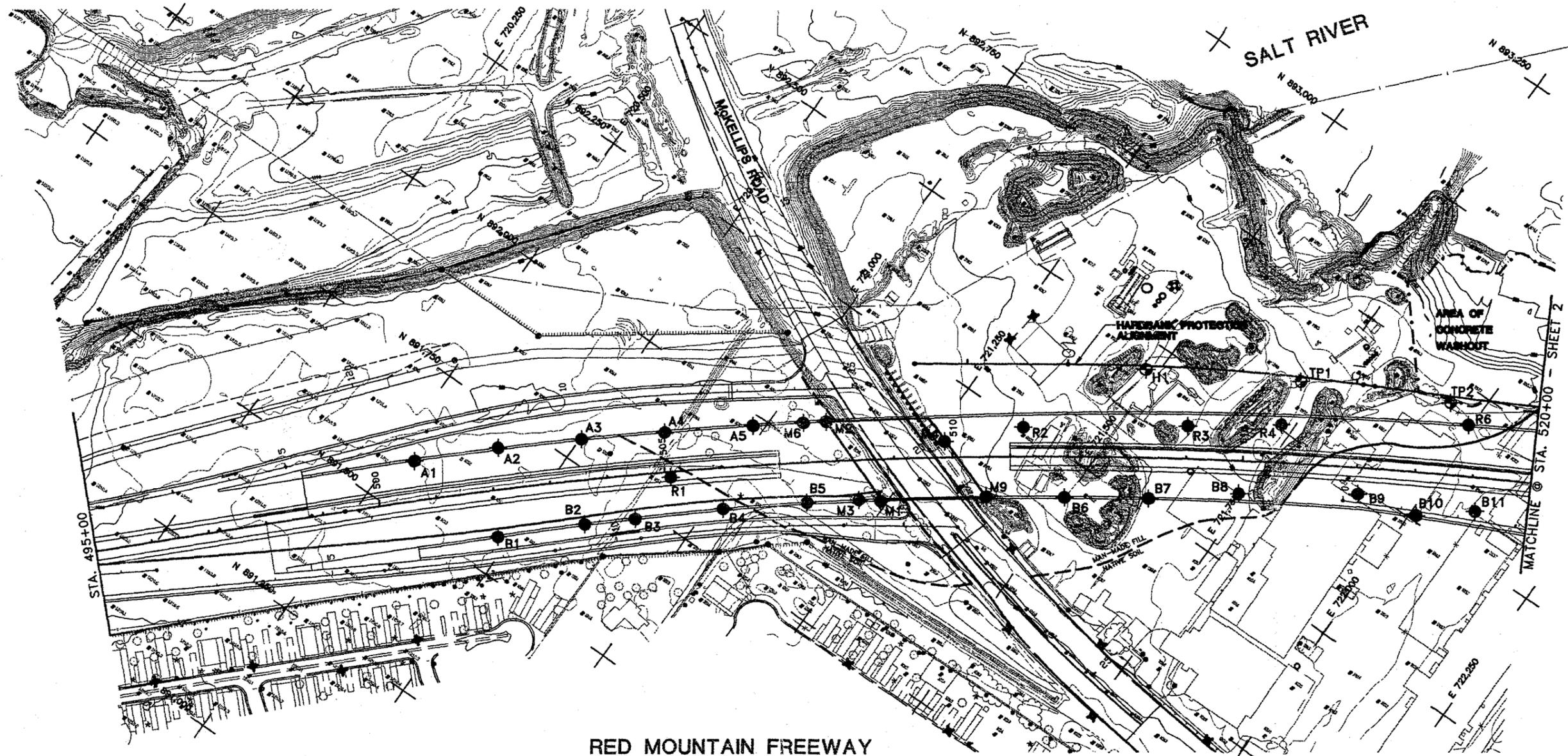
<u>N</u>	<u>Relative Density</u>
0-4	Very loose
5-10	Loose
11-30	Medium dense
31-50	Dense
50+	Very dense

2. Relative Consistency. Terms for description of clays which are saturated or near saturation.

<u>N</u>	<u>Relative Consistency</u>	<u>Remarks</u>
0-2	Very soft	Easily penetrated several inches with fist.
3-4	Soft	Easily penetrated several inches with thumb.
5-8	Medium stiff	Can be penetrated several inches with thumb with moderate effort.
9-15	Stiff	Readily indented with thumb, but penetrated only with great effort.
16-30	Very stiff	Readily indented with thumbnail.
30+	Hard	Indented only with difficulty by thumbnail.

3. Relative Firmness. Terms for description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays, cemented granular materials, silts and silty and clayey granular soils.

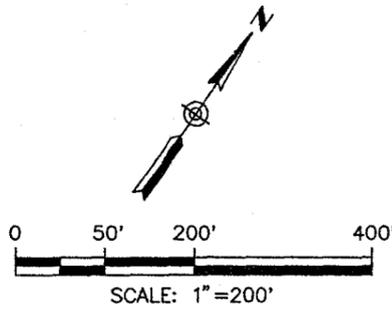
<u>N</u>	<u>Relative Firmness</u>
0-4	Very soft
5-8	Soft
9-15	Moderately firm
16-30	Firm
31-50	Very firm
50+	Hard



**RED MOUNTAIN FREEWAY**

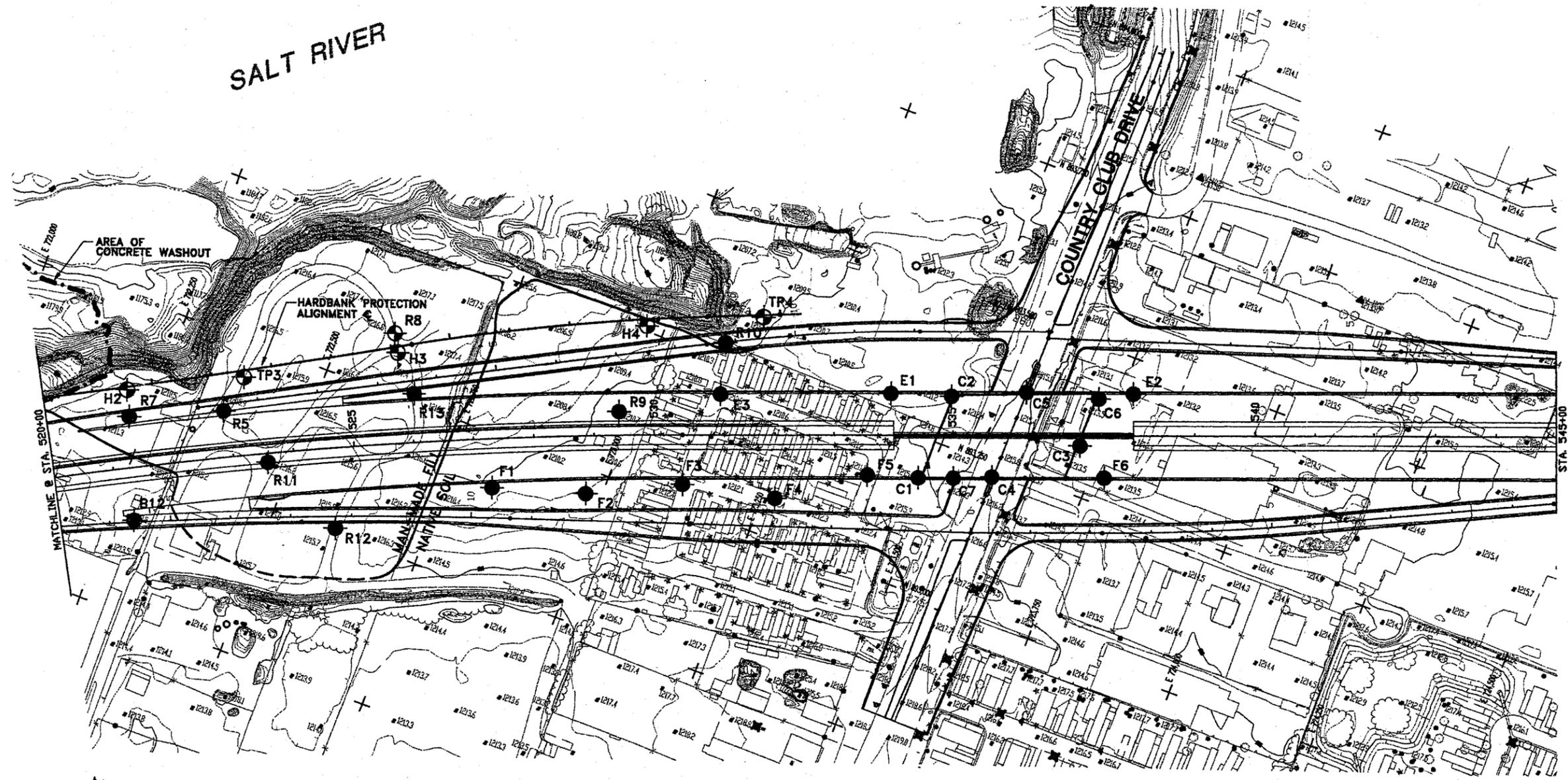
**EXPLANATION**

- ESTIMATED BOUNDARY BETWEEN DEEPER MAN-MADE FILLS AND NATIVE SOILS
- - - APPROXIMATE BOUNDARY BETWEEN MAN-MADE FILLS AND NATIVE SOILS
- · - · - APPROXIMATE BOUNDARY OF CONCRETE WASHOUT MATERIALS
- ◆ BRIDGE, RETAINING WALL BORING AND ROADWAY BORING LOCATIONS
- ⊕ HARBANK BORING AND TEST PIT LOCATIONS



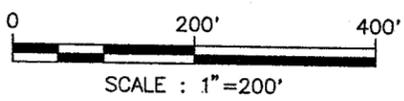
SHEET 1 OF 2

<b>AGRA</b> <i>Earth &amp; Environmental</i> 3232 WEST VIRGINIA AVENUE PHOENIX, ARIZONA, U.S.A. 85009-1502	JOB No.	6-117-000081	<b>RED MOUNTAIN FREEWAY</b> <b>PHASE III</b> <b>McKELLIPS ROAD TO COUNTRY CLUB DRIVE</b> <b>HARBANK BORINGS AND TEST PITS</b> A-5
	DESIGN	NHW	
	DRAWN	TMP	
	DATE	6/96	
	SCALE	1"=200'	



**RED MOUNTAIN FREEWAY**

- EXPLANATION**
- ESTIMATED BOUNDARY BETWEEN DEEPER MAN-MADE FILLS AND NATIVE SOILS
  - - - APPROXIMATE BOUNDARY BETWEEN MAN-MADE FILLS AND NATIVE SOILS
  - · - · - APPROXIMATE BOUNDARY OF CONCRETE WASHOUT MATERIALS
  - BRIDGE, RETAINING WALL BORING AND ROADWAY BORING LOCATIONS
  - ⊙ HARDBANK BORING AND TEST PIT LOCATIONS



<p><b>AGRA</b> Earth &amp; Environmental 3232 WEST VIRGINIA AVENUE PHOENIX, ARIZONA, U.S.A. 85009-1502</p>	JOB No.	6-117-00081	<p><b>RED MOUNTAIN FREEWAY PHASE III</b> McKELLIPS ROAD TO COUNTRY CLUB DRIVE HARDBANK BORINGS AND TEST PITS A-6</p>
	DESIGN	NHW	
	DRAWN	TMP	
	DATE	6/96	
	SCALE	1"=200'	

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. A-1

JOB NO. 6-117-000081 DATE 6-7-96

LOCATION Sta. 500 + 65, 71' L  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1211.2'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S 7-6-5			2		slightly moist  moderately firm to firm	CLAYEY SAND TO SILTY SAND, fine grained, weakly lime cemented, nonplastic to low plasticity, brown
				S 7-7-6				SC-SM		
5				U 20	82	2				
								SP	moist  medium dense	SAND, some fine grained gravel, predominantly medium to fine grained sand, subrounded to subangular, nonplastic, brown
10				S 9-10-8				GP		
									moist  dense to very dense	SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, nonplastic, brown
15										Auger refused at 13'6"
20										
25										

6-117-000081.GWH.07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill cuttings.
- S - 2" O.D. 1.38" I.D. Tube Sample.
- U - 3" O.D. 2.42" I.D. Tube Sample.
- T - 3" O.D. Thin-walled Shelby Tube.
- C - 6" O.D. Continuous Core

A-7

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. A-2

JOB NO. 6-117-000081 DATE 6-7-96

LOCATION Sta. 502+11, 71' L  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1211.6'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S 7-5-6					slightly moist	SANDY SILT, fine grained sand, weakly lime cemented, nonplastic to low plasticity, brown
				S 7-9-9				ML	moderately firm to firm	
5				S 9-10-11					slightly moist	SILTY SAND, medium to fine grained sand, subrounded to subangular, nonplastic, brown
				A				SM	firm	
10				S 4-3-2					slightly moist	SAND, some gravel, predominantly medium to fine grained sand, subrounded to subangular, nonplastic, brown
								SP	loose to medium dense	
15				S 7-9-9						SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, nonplastic, brown
								GP	slightly moist	
20				S 50/0"					very dense	Auger refused at 20' Sampler refused at 20'
25										

6-117-000081.GWH.07/29/96

GROUNDWATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill cuttings.
- S - 2" O.D. 1.38" I.D. Tube Sample.
- U - 3" O.D. 2.42" I.D. Tube Sample.
- T - 3" O.D. Thin-walled Shelby Tube.
- C - 6" O.D. Continuous Core

A-8

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. A-3

JOB NO. 6-117-000081 DATE 6-7-96

LOCATION Sta. 503 + 60, 71' L  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1211.3'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			S 4-5-3					slightly moist	SANDY SILT, fine grained sand, weakly lime cemented, nonplastic, low plasticity, brown
								soft	
			S 4-4-2						
5			S 2-2-2					moist	SAND, some gravel, predominantly medium to fine grained sand, subrounded to subangular, nonplastic, brown
								very loose to dense	
								to medium dense	
10			S 9-16-17			2	SP		
15			S 5-6-6						
20			S 28-50/1"					moist	SAND & GRAVEL, some cobbles, poorly graded, subrounded to subangular, nonplastic, brown
								very dense	
25									Auger refused at 20' Sampler refused at 20'7"

6-117-000081.GWH.07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

- SAMPLE TYPE
- A - Drill cuttings.
  - S - 2" O.D. 1.38" I.D. Tube Sample.
  - U - 3" O.D. 2.42" I.D. Tube Sample.
  - T - 3" O.D. Thin-walled Shelby Tube.
  - C - 6" O.D. Continuous Core

A-9



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. A-4

JOB NO. 6-117-000081 DATE 6-7-96

LOCATION Sta. 505 + 10, 71' L  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1211.4'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	12-7-9				slightly moist	Man-made FILL SILTY SAND TO CLAYEY SAND, medium to fine grained sand, nonplastic to low plasticity, brown
								moderately firm		
				S	8-5-6		2			Man-made FILL SAND & GRAVEL, predominantly fine grained gravel, subrounded to subangular, nonplastic, black to brown
5				S	5-4-5				slightly moist	
								GP	loose to medium dense	
10				S	12-9-25					
										Auger refused at 10' Stopped Sampler at 11'6"
15										
20										
25										

6-117-000081\_GWH 07/29/96

GROUNDWATER

SAMPLE TYPE

DEPTH	HOUR	DATE
	none	

- A - Drill cuttings.
- S - 2" O.D. 1.38" I.D. Tube Sample.
- U - 3" O.D. 2.42" I.D. Tube Sample.
- T - 3" O.D. Thin-walled Shelby Tube.
- C - 6" O.D. Continuous Core

A-10



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. A-5

JOB NO. 6-817-000081 DATE 6-7-96 & 7-1-96

LOCATION Sta. 506 + 60, 71' L  
 RIG TYPE CME-55 & AP-1000  
 BORING TYPE 6 5/8" HSA & 9" Dual-wall Percussion  
 SURFACE ELEV. 1210.8'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	29			S	7-4-3				slightly moist	FILL SAND, GRAVEL, COBBLES & BOULDERS, some silt, poorly graded, subrounded to subangular, nonplastic, brown  note: concrete from 19' to 22' & at 24'
	70									
	61			S	50/1/2"					
	58									
5	58									
	83									
	74									
	48									
	41									
10	18									
	31							GP		
	48									
	45									
	50									
15	45									
	60									
	52									
	110									
	170									
20	210									
	131									
	74									
	156									
	444									
25	210									
	154									
	197									
	160									
	110									
30	38			A					slightly moist	NATIVE SAND & GRAVEL, some cobbles, poorly graded, subrounded to subangular, nonplastic, brown
	79									
	99									
	90									
	147							GP		
35	121									
	96									
	92									
	61									
	34									
40									Stopped Hammer at 39'	
45										
50										

6-817-000081 GWH 07/29/96

GROUNDWATER

SAMPLE TYPE

DEPTH	HOUR	DATE
	none	

A - Drill Cuttings  
 S - 2" O.D., 1.38" I.D. Tube Sample.  
 U - 3" O.D., 2.42" I.D. Tube Sample.  
 NR - No Recovery  
 T - Thin Walled Shelby Tube

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. B-1

JOB NO. 6-117-000081 DATE 6-10-96

LOCATION Sta. 501 + 95, 80' R  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1211.5'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		[Diagonal Hatching]		S	7-7-6				slightly moist  moderately firm to firm	CLAYEY SAND, fine grained sand, weakly lime cemented, low plasticity, brown
				S	6-5-6		2	SC		
5				U	49	86	2			
		[Circular Symbols]						SP	slightly moist  dense	SAND, predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
				A						
					S	30-13-11			GP-GM	
10									slightly moist  medium dense	SILTY SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, nonplastic, brown
										Auger refused at 9' Stopped Sampler at 10'6"
15										
20										
25										

6-117-000081.GWH 07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

- SAMPLE TYPE
- A - Drill cuttings.
  - S - 2" O.D. 1.38" I.D. Tube Sample.
  - U - 3" O.D. 2.42" I.D. Tube Sample.
  - T - 3" O.D. Thin-walled Shelby Tube.
  - C - 6" O.D. Continuous Core

A-12



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. B-2

JOB NO. 6-117-000081 DATE 6-10-96

LOCATION Sta. 503 + 60, 80' R  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1211.7'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	11-8-8		2		slightly moist firm	<b>SILTY SAND</b> , fine grained, weakly lime cemented, nonplastic to low plasticity, brown
										SM
				S	8-10-11					
5				S	5-12-12				slightly moist medium dense	<b>SAND</b> , medium to fine grained, subrounded to subangular, nonplastic, brown
										SP
10				S	13-8-3				slightly moist medium dense to very dense	<b>SAND &amp; GRAVEL</b> , some cobbles, poorly graded, subrounded to subangular, nonplastic, brown
										GP
15				S	11-8-18					
20										
25										
										Auger refused at 18'

6-117-000081.GWH.07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

- SAMPLE TYPE**
- A - Drill cuttings.
  - S - 2" O.D. 1.38" I.D. Tube Sample.
  - U - 3" O.D. 2.42" I.D. Tube Sample.
  - T - 3" O.D. Thin-walled Shelby Tube.
  - C - 6" O.D. Continuous Core

A-13



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. B-3

JOB NO. 6-117-000081 DATE 6-7-96

LOCATION Sta. 504+42, 79' R  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1212.3'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	PID Meter Reading	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S 6-4-5					slightly moist	SANDY CLAY, fine grained sand, weakly lime cemented, nonplastic to low plasticity, brown
								moderately firm	CL	
				S 6-6-8			4			
5				S 4-8-8					slightly moist	SAND, some fine grained gravel, predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
								medium dense	SP	
10				S 20-10-10					slightly moist	SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, nonplastic, brown
								medium dense to very dense	GP	
15				S 16-46-19						
20				S 50/4"						Auger refused at 20' Sampler refused at 20'4"
25										

6-117-000081.GWH.08/08/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill cuttings.
- S - 2" O.D. 1.38" I.D. Tube Sample.
- U - 3" O.D. 2.42" I.D. Tube Sample.
- T - 3" O.D. Thin-walled Shelby Tube.
- C - 6" O.D. Continuous Core

A-14



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

**LOG OF TEST BORING NO. B-5**

JOB NO. 6-817-000081 DATE 6-10-96 & 7-1-96

LOCATION Sta. 507 + 40, 71' R  
 RIG TYPE CME-55 & AP-1000  
 BORING TYPE 6 5/8" HSA & 9" Dual-wall Percussion  
 SURFACE ELEV. 1211.7'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	33			S	13-9-				slightly moist  hard	Man-made FILL <b>CLAYEY SAND &amp; GRAVEL</b> , poorly graded, subrounded to subangular, nonplastic, brown  note: construction debris (concrete i.e.) from 7' to 12'
	16					7				
	8			S	50/5"					
	23									
	34									
5	44			S	6-3-3			GC-GM		
	40									
	25			A						
	21									
	27									
10	15		S	2-2-2		4				
	28									
	51									
	55									
15	85								slightly moist  dense to very loose	NATIVE <b>SAND, GRAVEL &amp; COBBLES</b> , poorly graded, subrounded to subangular, nonplastic, brown
	86		S	25-16-						
	52			15						
	46									
	52									
20	53		A				GP			
	83									
	50									
	138									
	156									
25	105									
	113									
	127									
	110									
	97									
30										Stopped Hammer at 29'
35										
40										
45										
50										

6-817-000081\_GWH\_07/29/96

GROUNDWATER

SAMPLE TYPE

DEPTH	HOUR	DATE
	none	

A - Drill Cuttings  
 S - 2" O.D., 1.38" I.D. Tube Sample.  
 U - 3" O.D., 2.42" I.D. Tube Sample.  
 NR - No Recovery  
 T - Thin Walled Shelby Tube

A-16

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

**LOG OF TEST BORING NO. B-6**

JOB NO. 6-817-000081 DATE 6-15-96

LOCATION Sta. 511+91, 70'R  
 RIG TYPE CME-55 & AP-1000  
 BORING TYPE 6 5/8" HSA & 9" Dual-wall Percussion  
 SURFACE ELEV. 1212.1'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	18			S	45-				slightly moist to very moist  very dense  moist  very dense to dense to loose to very dense	FILL SAND, poorly graded, nonplastic, brown
30	50/5"							SP		
10	48-50/			S						
10	5 1/2"									
5	8									
5	5			S	18-12-		11			
8	8									
8	8			A						
8	8			A						
10	15									
6	6		S	4-3-5		4	SC-SM			
6	6									
5	5									
0	0									
0	0									
15	5		S	2-55-50/1"						
0	0									
0	0									
5	5		A			12				
8	8									
20	7									
20	20									
36	36									
32	32									
30	30									
25	50		A							
27	27									
41	41									
35	35									
67	67						GP			
81	81									
163	163		A							
117	117									
71	71									
60	60									
35								Stopped Hammer at 35'		
40										
45										
50										

6-817-000081.GWH.07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. B-8

JOB NO. 6-817-000081 DATE 6-15-96

LOCATION Sta. 514 + 96, 56 R'  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1210.7'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
									0	
			A			2	GW-			
			S	50/5"			GC-			
			S	41-12-13			GM	very dense		
5									Auger refused at 5' Stopped Sampler at 5'6"	
10										
15										
20										
25										
30										
35										
40										
45										
50										

GROUNDWATER

SAMPLE TYPE

DEPTH	HOUR	DATE
	none	

A - Drill Cuttings  
 S - 2" O.D., 1.38" I.D. Tube Sample.  
 U - 3" O.D., 2.42" I.D. Tube Sample.  
 NR - No Recovery  
 T - Thin Walled Shelby Tube

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PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. B-10

JOB NO. 6-817-000081 DATE 6-6-96 & 7-2-96

LOCATION Sta. 518 + 10, 82' R  
 RIG TYPE CME-55 & AP-1000  
 BORING TYPE 6 5/8" HSA & 9" Dual-wall Percussion  
 SURFACE ELEV. 1213.7'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	7	XXX								4" Asphaltic Concrete over 4" Aggregate Base Course
6	6			S	9-6-7					moist  moderately firm to soft
6	6			S	4-3-4	11	ML-			
8	8						CL			
5	6									
14	14			U	16					
13	13							CL		
15	15									
25	25									
10	26								moist	SANDY CLAY, low to medium plasticity, dark brown
22	22							firm		
26	26									
37	37									
15	47								slightly moist	SAND & GRAVEL, some cobbles, poorly graded, subrounded to subangular, nonplastic, brown
23	23									
38	38									
62	62						GP			
48	48								very dense	
47	47									
20	82									
89	89									
100	100									
87	87									
98	98									
25	112									Stopped Hammer at 25'
30										
35										
40										
45										
50										

6-817-000081.GWH 07/29/96

GROUNDWATER

SAMPLE TYPE

DEPTH	HOUR	DATE
	none	

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube

A-21



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. B-11

JOB NO. 6-117-000081 DATE 6-6-96

LOCATION Sta. 519+11, 59' R  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1213.2'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	3-3-3			ML-CL	moist soft	SANDY CLAY TO SANDY SILT, fine grained sand, low to medium plasticity, dark brown
				U	16	115	15		moist moderately firm	SANDY CLAY, fine grained sand, low to medium plasticity, dark brown
5				A						
								SC		
10				S	18-31-27			GP	moist very dense	SAND & GRAVEL, some cobbles, poorly graded, subrounded to subangular, nonplastic, brown
15										Auger refused at 11'6"
20										
25										

6-117-000081\_GWH\_07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill cuttings.
- S - 2" O.D. 1.38" I.D. Tube Sample.
- U - 3" O.D. 2.42" I.D. Tube Sample.
- T - 3" O.D. Thin-walled Shelby Tube.
- C - 6" O.D. Continuous Core

A-22



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. E-1

JOB NO. 6-817-000081 DATE 6-7-96 & 7-2-96

LOCATION Sta. 533+95, 70' L  
 RIG TYPE CME-55 & AP-1000  
 BORING TYPE 6 5/8" HSA & 9" Dual-wall Percussion  
 SURFACE ELEV. 1211.0'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	26			S	35-48-				slightly moist to moist  hard to firm	<b>CLAYEY SAND</b> , some fine grained gravel, poorly graded sand, subrounded to subangular, weakly to moderately lime cemented, low plasticity, brown to light brown & white
	25					37				
	14			S	10-18-					
	12					20		SC		
5	37									
	47			S	11-10-					
	39					9				
	23									
	24									
	41									
10	56			S	13-41-				slightly moist  very dense	<b>SAND, GRAVEL &amp; COBBLES</b> , poorly graded, subrounded to subangular, nonplastic, brown
	48					20				
	51									
	69									
	77									
15	86									
	64									
	61							GP		
	66									
20	47									
	51			A						
	79									
	81									
	109									
25	126									
	151									
	156									
	167									
	89									
30	127									
	131									
	152									
	136									
	175									
35	213									
	222									
	294									
	275									
	263									
40	367									
	352									
	291									
	260						GP			
	297									
45	379									
	285									
	182									
	102									
	324									
50	356									

6-817-000081 GWH 07/29/96

GROUNDWATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube

A-24



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. E-1

JOB NO. 6-817-000081 DATE 6-7-96 & 7-2-96

LOCATION Sta. 533 + 95, 70' L  
 RIG TYPE CME-55 & AP-1000  
 BORING TYPE 6 5/8" HSA & 9" Dual-wall Percussion  
 SURFACE ELEV. 1211.0'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
	501									
	472									
	546							GP		
55	684								Stopped Hammer at 55'	
60										
65										
70										
75										
80										
85										
90										
95										
100										

6-817-000081 GWH 07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube

A-25



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. E-2

JOB NO. 6-117-000081 DATE 6-10-96

LOCATION Sta. 538+00, 70' L  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1212.7'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
									0	
				S 9-9-9			4			<b>SILTY SAND</b> , poorly graded, subrounded to subangular, nonplastic, brown
5				S 3-3-4				moist medium dense to loose		
				S 3-4-4			2			
				S 50/1"				GP	moist very dense	<b>SAND &amp; GRAVEL</b> , some cobbles, poorly graded, subrounded to subangular, nonplastic, brown
15										Auger refused at 13' Sampler refused at 13'1"
20										
25										

GROUNDWATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill cuttings.
- S - 2" O.D. 1.38" I.D. Tube Sample.
- U - 3" O.D. 2.42" I.D. Tube Sample.
- T - 3" O.D. Thin-walled Shelby Tube.
- C - 6" O.D. Continuous Core

A-26

6-117-000081 GWH 07/29/96

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. E-3

JOB NO. 6-817-000081 DATE 7-2-96

LOCATION Sta. 531 + 12, 70' L

RIG TYPE AP-1000

BORING TYPE 9" Dual-wall Percussion

SURFACE ELEV. 1210.3'

DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	8	XXXX								2" Asphaltic Concrete over
	6									2" Aggregate Base Course
	7									
	11									
	12							SP	moist	<b>GRAVELLY SAND</b> , fine grained gravel, poorly graded sand, subrounded to subangular, nonplastic, brown
5	11								dense	
	17			S	10-15-					
	51				28					
	23			A						
	42									
10	55			S	50/3"				slightly moist to moist	<b>SAND, GRAVEL &amp; COBBLES</b> , poorly graded, subrounded to subangular, nonplastic, brown
	57									
	82									
	48									
	81									
15	93							GP	very dense	
	83									
	58									
	30									
20	35			S	50/3"					
	42									
	41									
	49									
	83									
25	83									Stopped Hammer at 25'
30										
35										
40										
45										
50										

6-817-000081.GWH.07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube





PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. F-2

JOB NO. 6-117-000081 DATE 6-10-96

LOCATION Sta. 528 + 85, 94' R  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1210.9'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	15-12-10			ML	slightly moist firm	<b>SANDY SILT</b> , some fine grained gravel, fine grained sand, nonplastic to low plasticity, brown
				S	5-4-4			SM	moist loose to medium dense	<b>SILTY SAND</b> , predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
5				S	8-9-17					
				A				GP	moist loose	<b>SANDY GRAVEL</b> , fine grained gravel, subrounded to subangular, nonplastic, brown
10				S	4-5-4					
				S	50/2"			GP	moist very dense	<b>SAND, GRAVEL &amp; COBBLES</b> , poorly graded, subrounded to subangular, nonplastic, brown
15										Auger refused at 13' Sampler refused at 13'2"
20										
25										

6-117-000081\_GWH\_07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

- SAMPLE TYPE
- A - Drill cuttings.
  - S - 2" O.D. 1.38" I.D. Tube Sample.
  - U - 3" O.D. 2.42" I.D. Tube Sample.
  - T - 3" O.D. Thin-walled Shelby Tube.
  - C - 6" O.D. Continuous Core

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PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. F-3

JOB NO. 6-817-000081 DATE 7-2-96

LOCATION Sta. 530 + 46, 80' R  
 RIG TYPE AP-1000  
 BORING TYPE 9" Dual-wall Percussion  
 SURFACE ELEV. 1212.1'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION		
0	5	[X-X-X-X]								2" Asphaltic Concrete over		
	6									4" Aggregate Base Course		
	0	[Dotted]						SM				
	0									slightly moist	<b>SILTY SAND</b> , some fine grained gravel, predominantly medium to fine grained, subrounded to subangular, nonplastic to low plasticity, brown	
5	0			S	6-8-8				SP			
	0									moist	<b>SAND</b> , fine grained, subrounded to subangular, nonplastic, brown	
	23									medium dense		
	25	[Dotted]		S	5-8-9							
10	37								SP			
	55											
	45											
	62		[Dotted]									
15	61										moist	<b>GRAVELLY SAND</b> , well graded sand, predominantly fine grained gravel, subrounded to subangular, nonplastic, brown
	48				S	50/4"					medium dense	
	42											
	49											
	49											
	43											
20	51									moist	<b>SAND, GRAVEL &amp; COBBLES</b> , poorly graded, subrounded to subangular, nonplastic, brown	
	38									very dense		
	38								GP			
	14	[Dotted]										
25	17											
	17											
	61											
	115											
	121											
30	50											
	110											
	103											
	220											
	105											
35	105											
	130											
	155											
	220											
	190											
40										Stopped Hammer at 39'		
45												
50												

6-817-000081.GWH 07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill Cuttings  
 S - 2" O.D., 1.38" I.D. Tube Sample.  
 U - 3" O.D., 2.42" I.D. Tube Sample.  
 NR - No Recovery  
 T - Thin Walled Shelby Tube



PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. F-4

JOB NO. 6-117-000081 DATE 6-6-96

LOCATION Sta. 532+00, 104' R  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1212.0'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0									moist	<b>SILTY SAND</b> , fine grained, subrounded to subangular, nonplastic, brown
			S	4-4-2					loose to medium dense	
			U	15	91	9		SM		
5			S	4-19-34				GP	moist dense	<b>SAND &amp; GRAVEL</b> , some cobbles, poorly graded, subrounded to subangular, nonplastic, brown
										Auger refused at 6'6"
10										
15										
20										
25										

6-117-000081\_GWH.07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

- SAMPLE TYPE**
- A - Drill cuttings.
  - S - 2" O.D. 1.38" I.D. Tube Sample.
  - U - 3" O.D. 2.42" I.D. Tube Sample.
  - T - 3" O.D. Thin-walled Shelby Tube.
  - C - 6" O.D. Continuous Core

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. F-5

JOB NO. 6-117-000081 DATE 6-6-96

LOCATION Sta. 533 + 56, 66' R  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1211.5'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0									moist	<b>SILTY SAND</b> , some fine grained gravel, predominantly fine grained, subrounded to subangular, nonplastic, brown
				S	6-3-2		6		loose to very loose	
				S	2-2-1					
5										
				U	16					
				A					moist to wet	<b>SAND &amp; GRAVEL</b> , some cobbles, poorly graded, subrounded to subangular, nonplastic, black
									medium dense	
10										Stopped Auger at 10'
15										
20										
25										

6-117-000081\_GWH\_07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

- SAMPLE TYPE**
- A - Drill cuttings.
  - S - 2" O.D. 1.38" I.D. Tube Sample.
  - U - 3" O.D. 2.42" I.D. Tube Sample.
  - T - 3" O.D. Thin-walled Shelby Tube.
  - C - 6" O.D. Continuous Core

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PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. F-6

JOB NO. 6-117-000081 DATE 6-6-96

LOCATION Sta. 537 + 52, 70' R  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1213.0'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	32-17-10			GP	slightly moist	Man-made FILL GRAVEL, poorly graded, subrounded to subangular, nonplastic, gray
									medium dense	
				U	13				moist	NATIVE SILTY SAND, predominantly fine grained, subrounded to subangular, nonplastic, brown
				A					moderately firm	
5				U	8	91	13	SP	moist	SAND, fine grained, subrounded to subangular, nonplastic, brown
									loose	
									moist	SAND & GRAVEL, some cobbles, poorly graded, subrounded to subangular, nonplastic, brown
				S	2-5-29			GP	dense	
10										Auger refused at 11'
15										
20										
25										

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

- SAMPLE TYPE
- A - Drill cuttings.
  - S - 2" O.D. 1.38" I.D. Tube Sample.
  - U - 3" O.D. 2.42" I.D. Tube Sample.
  - T - 3" O.D. Thin-walled Shelby Tube.
  - C - 6" O.D. Continuous Core

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6-117-000081 GWH 07/29/96

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. H-1

JOB NO. 6-117-000081 DATE 7-12-96

LOCATION Sta. 513 + 29,155' L

RIG TYPE AP-1000

BORING TYPE 9" Dual-wall Percussion Hammer

SURFACE ELEV. 1210.8'

DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	42								slightly moist  medium dense to very loose to very dense	FILL SAND & GRAVEL, predominantly fine grained gravel, poorly graded sand, subrounded to subangular, nonplastic, brown
	58									
	25									
	14									
	12									
5	8		S	13-11-				GP		
	10				10					
	10									
	10									
10	5		S	3-4-5						
	15									
	16									
	41		A				1			
	52									
15	55									
	45		S	50/5"						
	52									
	54		A							
20	26									
	42		S	50/5"			7			
	87									
	116									
	116									
	101									
25	117									
	104		S	50/5"				GP-GM		
	137									
	177									
	120									
30	204		S	50/5"						
	157									
	318									
	167									
	286									
35	130									
	161									
	167									
	177									
	172									
40	86									
	141									
	190		A							
	210									
	236									
45	185									
	198									
	150									
	310									
	205		S	50/4"						
50										

6-117-000081.GWH.08/07/96

GROUNDWATER

SAMPLE TYPE

DEPTH	HOUR	DATE
	none	

A - Drill Cuttings  
 S - 2" O.D., 1.38" I.D. Tube Sample.  
 U - 3" O.D., 2.42" I.D. Tube Sample.  
 NR - No Recovery  
 T - Thin Walled Shelby Tube

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. H-2

JOB NO. 6-117-000081 DATE 7-18-96

LOCATION Sta. 521 + 39, 130' L

RIG TYPE AP-1000

BORING TYPE 9" Dual-wall Percussion Hammer

SURFACE ELEV. 1207.5'

DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	22								slightly moist	FILL CLAYEY SAND & GRAVEL, some cobbles, poorly graded, low to medium plasticity, brown
	20									
	14									
	11									
	10								very dense	
5	18		S	29-						
	15				50/2"					
	16									
	20									
	18		S	22-20-			8			
10	13				19			GC		
	15									
	15									
	12									
15	11									
	12		S	16-						
	12				50/5"					
	11									
	8									
20	17		S	50/3"						
	12									
	14									
	17									
	39									
25	44		S	50/3"						
	50									
	29									
	22									
	29									
30	25		S	50/2"						
	26						15	SM	slightly moist	NATIVE SILTY SAND, some fine grained gravel, poorly graded sand, subrounded to subangular, nonplastic, black to brown
	26									
	71		A						very dense	
35	101									SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, nonplastic, brown
	100		S	50/2"				GP	slightly moist	
	112									
	178									
	343								very dense	
40			S	26-						Stopped Hammer at 39' Sampler refused at 39'9"
					50/3"					

6-117-000081.GWH\_08/07/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube

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PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. H-3

JOB NO. 6-117-000081 DATE 7-10-96

LOCATION Sta. 525+83, 151' L  
 RIG TYPE AP-1000  
 BORING TYPE 9" Dual-wall Percussion Hammer  
 SURFACE ELEV. 1217.5'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	100								slightly moist  dense	Man-made FILL <b>CLAYEY SAND &amp; GRAVEL</b> , poorly graded, subrounded to subangular, low plasticity, brown  note: some construction debris (asphalt, concrete & metal pipe)
	30									
	24									
	14							GC		
5	9									
	19			S	27-21-					
	13					13				
	15									
	19									
	12			S	5-5-5					
10	8								moist  loose to very dense	NATIVE <b>SILTY SAND</b> , some fine grained gravel, predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
	9			A						
	16						3			
	40							SM		
	34									
15	33			S	23-24-					
	50					27				
	61									
	64									
	103			S	50/5"					
20	118								moist  very dense	<b>SAND, GRAVEL &amp; COBBLES</b> , poorly graded, subrounded to subangular, nonplastic, brown
	130									
	170									
	150									
25	163									
	115									
	157							GP		
	68									
	148									
	48			S	22-29-					
30	42				32					
	82									
	114									
	169									
35	194									
	94									
	97									
	87									
	86		S	50/5"						
40									Stopped Hammer at 39' Sampler refused at 39'5"	

6-117-000081.GWH\_08/07/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE  
 A - Drill Cuttings  
 S - 2" O.D., 1.38" I.D. Tube Sample.  
 U - 3" O.D., 2.42" I.D. Tube Sample.  
 NR - No Recovery  
 T - Thin Walled Shelby Tube

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

**LOG OF TEST BORING NO. H-4**

JOB NO. 6-117-000081 DATE 7-18-96

LOCATION Sta. 529 + 90, 182' L

RIG TYPE AP-1000

BORING TYPE 9" Dual-wall Percussion Hammer

SURFACE ELEV. 1207.2'

DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	14								slightly moist medium dense	FILL <b>SILTY SAND &amp; GRAVEL</b> , some cobbles, poorly graded, subrounded to subangular, nonplastic to low plasticity, light brown
	7									
	1									
	33									
5	25									
	0			S	9-4-8				slightly moist	NATIVE <b>SAND</b> , predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
	3			A						
	33						2		medium dense	SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, nonplastic, brown
	38			A						
	28			S	50/5"					
10	55									
	153								slightly moist very dense	SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, nonplastic, brown
	199									
	180									
	210									
15	190			S	50/2"					
	203									
	340									
	176									
	358			S	50/2"					
20	299									
	180									
	126									
	90									
	98									
25	270			A				1		
	180									
	160									
	150									
	201									
30	106									
	187									
	190									
	132									
	142			S	50/3"					
35										Stopped Hammer at 35' Sampler refused at 35'3"
40										
45										
50										

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube

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6-117-000081\_GWH\_08/07/96

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. R-1

JOB NO. 6-117-000081 DATE 6-10-96

LOCATION Sta. 505 + 10, 10' R  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1212.6'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	4-5-6				slightly moist	SANDY SILT, fine grained sand, weakly lime cemented, nonplastic to low plasticity, brown
									moderately firm to firm	
				S	7-8-8		3			
5				S	48-28-31			GP	slightly moist	SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, nonplastic, brown
									very dense	
										Auger refused at 5'6"
10										
15										
20										
25										

6-117-000081\_GWH\_07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE  
 A - Drill cuttings.  
 S - 2" O.D. 1.38" I.D. Tube Sample.  
 U - 3" O.D. 2.42" I.D. Tube Sample.  
 T - 3" O.D. Thin-walled Shelby Tube.  
 C - 6" O.D. Continuous Core

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. R-2

JOB NO. 6-817-000081 DATE 6-15-96

LOCATION Sta. 511 + 23, 53' L  
 RIG TYPE CME-55 & AP-1000  
 BORING TYPE 6 5/8" HSA & 9" Dual-wall Percussion  
 SURFACE ELEV. 1209.8'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	43			S	42-42-				slightly moist to moist  very dense to dense	Man-made FILL <b>CLAYEY SAND, GRAVEL &amp; COBBLES</b> , trace of clay, poorly graded sand & gravel, subrounded to rounded, nonplastic to low plasticity, brown  note: maximum particle size 6" diameter
	40				50/4"					
	37			A			2			
	52			S	42-25-					
5	27				24					
	24			S	8-9-		15			
	35				10			GP-GC		
	50									
	38									
10	25									
	20									
	25									
	44									
	42									
15	91									
	122									
	161									
	160									
	59									
20	29									
	82			A						
	200							GP		
	69									
	91									
25	73									
	90									
	191									
	106									
	160			A						
30	122									
	158									
	55									
	57									
	61							SP		
35	47									
	30			A						
	70									
	60									
	57							GP		
40	127									
									very dense	
										Stopped Hammer at 40'
45										
50										

6-817-000081\_GWH\_07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube



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PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

**LOG OF TEST BORING NO. R-3**

JOB NO. 6-117-000081 DATE 6-15-96

LOCATION Sta. 514+00, 57' L  
 RIG TYPE CME-55 & AP-1000  
 BORING TYPE 6 5/8" HSA & 9" Dual-wall Percussion Hammer  
 SURFACE ELEV. 1210.0'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	10	[Graphical Log Symbols]		S	11-13-				slightly moist	Man-made FILL <b>GRAVELLY SAND</b> , some clay, predominantly fine grained gravel, subangular to subrounded, poorly graded sand, nonplastic, brown
	60			A	13					
	40	[Graphical Log Symbols]		S	22-27-		2	GP	dense to very dense	Man-made FILL <b>SAND, GRAVEL &amp; COBBLES</b> , subrounded to rounded cobbles, poorly graded sand & gravel, subangular to subrounded, nonplastic, brown
	29				50/4"					
5	40	[Graphical Log Symbols]							slightly moist	NATIVE <b>SAND, GRAVEL &amp; COBBLES</b> , subrounded to rounded cobbles, poorly graded sand & gravel, subangular to subrounded, nonplastic, brown
	53									
	12	[Graphical Log Symbols]		A					dense to very dense	note: medium grained sand layer from 15' to 17' & 18' to 18'6"
	20									
	16	[Graphical Log Symbols]							GP	note: boulder at 27'
10	8									
	29	[Graphical Log Symbols]							slightly moist	note: maximum particle size 3" diameter
	52									
	60	[Graphical Log Symbols]							very dense	Stopped Hammer at 30'
	76									
15	16	[Graphical Log Symbols]							slightly moist	
	17									
	30	[Graphical Log Symbols]		A					very dense	
	8									
20	10	[Graphical Log Symbols]							slightly moist	
	49									
	50	[Graphical Log Symbols]							very dense	
	27									
	33	[Graphical Log Symbols]							GP	
25	89									
	130	[Graphical Log Symbols]							slightly moist	
	88									
	227	[Graphical Log Symbols]		A					very dense	
	156									
30	133	[Graphical Log Symbols]							Stopped Hammer at 30'	
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube

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6-117-000081.GWH.08/08/96

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

**LOG OF TEST BORING NO. R-4**

JOB NO. 6-817-000081 DATE 6-15-96

LOCATION Sta. 515 + 65, 65' L  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" HSA & 9" Dual-wall Percussion  
 SURFACE ELEV. 1208.2'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION	
0	14			S	33-42-50/2"				slightly moist to moist  hard	Man-made FILL SAND & GRAVEL, some cobbles, poorly graded, subrounded to rounded, nonplastic, brown  note: maximum particle size 18"	
42											
42											
46											
40											
5											
37											
53											
22											
26											
10											
30											
40											
46											
15											
15	17								moist, dense	NATIVE SAND, predominantly medium grained, nonplastic, brown	
15	24										
15	48										
15	75										
20	34								moist, dense  moist, dense  moist dense  moist very dense	SAND & GRAVEL, some cobbles, poorly graded, subrounded to rounded, nonplastic, brown  SAND, predominantly medium grained, nonplastic, brown  SAND & GRAVEL, some cobbles, poorly graded, nonplastic, brown  note: possible boulders at 35'  note: maximum particle size 6"	
20	27			A							
20	39										
20	95										
20	100										
20	75										
20	72										
25	52										
25	22										
25	56										
25	36										
25	22					A					
30	30										
30	153										
30	72										
30	64										
30	86										
35	141										
35	169										
35	124										
35	133			A							
35	67										
35	64										
40										Stopped Hammer at 40'	
45											
50											

6-817-000081\_GWH\_07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill Cuttings  
 S - 2" O.D., 1.38" I.D. Tube Sample.  
 U - 3" O.D., 2.42" I.D. Tube Sample.  
 NR - No Recovery  
 T - Thin Walled Shelby Tube

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PROJECT Red Mountain Freeway Preliminary Geotechnical Investigation LOG OF TEST BORING NO. R-5

JOB NO. 6-817-000081 DATE 6-23-96

LOCATION Sta. 522 + 95, 85' L  
 RIG TYPE CME-55  
 BORING TYPE 9" Dual-wall Percussion Hammer  
 SURFACE ELEV. 1215.9'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	70								slightly moist	Man-made FILL <b>SANDY GRAVEL</b> , some silt, some to considerable cobbles, predominantly fine to medium grained sand, subrounded, nonplastic, brown
	46									
	54									
	38									
	19									
5	20			S	15-17-			GP		
	13				18					
	11			A						
	12									
	23			S	21-					
10	16				50/3"					
	32									
	52									
	27									
	20									
15	25			S	50/5"			SP		
	21									
	20									
	21									
	110			S	50/5"					
20	152									
	75									
	121									
	101			A				GP		
25	175									
	165									
	140									
	160									
	60			S	50/3"					
30									Stopped Drill at 29' Sampler refused at 29'3"	

6-817-000081.GWH.07/29/96

GROUNDWATER

SAMPLE TYPE

DEPTH	HOUR	DATE
	none	

A - Drill Cuttings  
 S - 2" O.D., 1.38" I.D. Tube Sample.  
 U - 3" O.D., 2.42" I.D. Tube Sample.  
 NR - No Recovery  
 T - Thin Walled Shelby Tube

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. R-6

JOB NO. 6-817-000081 DATE 6-6-96 & 6-23-96

LOCATION Sta. 518 + 79, 92' L  
 RIG TYPE CME-55 & AP-1000  
 BORING TYPE 6 5/8" HSA/ 9" Dual-wall Percussion  
 SURFACE ELEV. 1212.4'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	7								slightly moist  medium dense	Man-made FILL <b>CLAYEY SAND, GRAVEL &amp; COBBLES</b> , poorly graded, subrounded to subangular, low to medium plasticity, dark brown
8	6			S	21-					
				S	50/2"					
					3-3-2					
5	5			A						
	26			S	2-3-			GP-		
	12			S	12			GC		
	23				7-10-					
	29				11					
10	24			S	14-18-					
	28			S	23					
	32				5-6-					
	32				12					
	25									
15	59									
	34			S	50/4"					
	16			A				SP		
	31								moist	NATIVE <b>SAND</b> , trace to some coarse grained subrounded gravel, predominantly medium grained, poorly graded, nonplastic, brown
20	92			S	50/3"					
	95									
	142								slightly moist  hard	<b>SAND, GRAVEL &amp; COBBLES</b> , trace of boulders, predominantly medium grained sand, subrounded gravel & cobbles, nonplastic, light grayish brown
	237							GP		
	155									
25	57									
	47			S	50/4"					
	126			A					note: increase in medium to coarse grained sand from 23'6" to 25'	
	178									
	193			S	50/3"					
	176								Stopped Drill at 29' Sampler refused at 29'3"	
30										

6-817-000081\_GWH\_07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A - Drill Cuttings  
 S - 2" O.D., 1.38" I.D. Tube Sample.  
 U - 3" O.D., 2.42" I.D. Tube Sample.  
 NR - No Recovery  
 T - Thin Walled Shelby Tube





PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. R-8

JOB NO. 6-117-000081 DATE 6-6-96

LOCATION Sta. 525 + 82, 180' L

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1217.5'

DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	5-12-21				slightly moist  very firm to soft	Man-made FILL <b>CLAYEY SAND &amp; GRAVEL</b> , occasional cobbles, poorly graded, subrounded to subangular, low to medium plasticity, brown
				S	22-18-14			GP		
5				S	4-4-3		3			
10									Auger refused at 8'	
25										

6-117-000081\_GWH\_07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

- SAMPLE TYPE
- A - Drill cuttings.
  - S - 2" O.D. 1.38" I.D. Tube Sample.
  - U - 3" O.D. 2.42" I.D. Tube Sample.
  - T - 3" O.D. Thin-walled Shelby Tube.
  - C - 6" O.D. Continuous Core

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. R-9

JOB NO. 6-117-000081 DATE 6-10-96

LOCATION Sta. 529 + 55, 53' L  
 RIG TYPE CME-55  
 BORING TYPE 6 5/8" Hollow Stem Auger  
 SURFACE ELEV. 1210.4'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	6-5-5		2		slightly moist to moist  loose	SILTY SAND, some fine grained gravel, predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
				S	4-3-3			SM		
				S	2-3-3					
5				A						
				S	50/4"			GP	moist  very dense	SAND & GRAVEL, some cobbles, poorly graded, subrounded to subangular, nonplastic, brown
10										
									Auger refused at 10' Sampler refused at 10'4"	
15										
20										
25										

6-117-000081\_GWH\_07/29/96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

- A - Drill cuttings.
- S - 2" O.D. 1.38" I.D. Tube Sample.
- U - 3" O.D. 2.42" I.D. Tube Sample.
- T - 3" O.D. Thin-walled Shelby Tube.
- C - 6" O.D. Continuous Core

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PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. R-11

JOB NO. 6-817-000081 DATE 6-23-96

LOCATION Sta. 523 + 55, 8' R  
 RIG TYPE AP-1000  
 BORING TYPE 9" Dual-wall Percussion Hammer  
 SURFACE ELEV. 1216.0'  
 DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0									slightly moist	Man-made FILL <b>SILTY GRAVEL</b> , considerable fine to medium grained sand, subrounded gravel, nonplastic, brown
28										
32										
28										
23										
5	20			S 23-18-	15					
14										
17										
21										
10	12			S 44-27-						
16					10		GM			
34										
40										
18										
15	15									
24				S 28-						
29					50/3"					
35										
28										
20	26									
18				S 50/4"						
14										
15										
16										
22										
25	16			S 50/5"						
25										
30							SP			
27										
30	120			S 50/4"						
195										
198										
> 300										
> 300							GP			
35	213									
259										
261										
223										
201				S 50/3"						
40									Stopped Drill at 39' Sampler refused at 39'3"	
45										
50										

6-817-000081\_GWH\_07/29/96

GROUNDWATER

SAMPLE TYPE

DEPTH	HOUR	DATE
	none	

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube

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PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST BORING NO. R-12

JOB NO. 6-817-000081 DATE 6-23-96

LOCATION Sta. 524 + 61, 122' R

RIG TYPE AP-1000

BORING TYPE 9" Dual-wall Percussion Hammer

SURFACE ELEV. 1215.6'

DATUM Stanley Consultants Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION	
0	22								slightly moist	Man-made FILL SANDY GRAVEL, considerable silt, trace of small cobbles, subrounded, nonplastic, light brown	
	35										
	16										
	7										
5	6										
	7				S	11-8-					GP-
	12					9					GM
	9										
	12										
10	14				S	12-14-					
	13					30					
	11										
	10										
	10										
15	14				S	19-11-					
	18				15						
	75										
	66										
20	45			S	50/3"						
	57										
	69										
	94										
	231			A							
25	311										
	> 300										
	179										
	153			S	50/2"						
30									Stopped Drill at 29' Sampler refused at 29'2"		
35											
40											
45											
50											

GROUNDWATER

SAMPLE TYPE

DEPTH	HOUR	DATE
	none	

- A - Drill Cuttings
- S - 2" O.D., 1.38" I.D. Tube Sample.
- U - 3" O.D., 2.42" I.D. Tube Sample.
- NR - No Recovery
- T - Thin Walled Shelby Tube

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PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST PIT NO. TP-1

JOB NO. 6-117-000081

DATE 7-20-96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

BACKHOE TYPE Trackhoe  
 LOCATION Sta. 515 + 95, 145' L  
 ELEVATION 1209.9'  
 DATUM Stanley Consultants Survey

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Soil/Rock Classification	REMARKS		VISUAL CLASSIFICATION	
0			D		GP	slightly moist		FILL SILTY SAND & GRAVEL, predominantly fine grained gravel, subrounded to subangular, nonplastic, brown	
			D	11	GP-GC	moist		CLAYEY GRAVEL, fine grained gravel, subrounded to subangular, low to medium plasticity, dark brown note: concrete slabs, some clayey sand	
5						moist very dense		FILL SAND, GRAVEL & COBBLES, poorly graded, subangular to subrounded, nonplastic, brown note: construction debris concrete, wood	
10					GP				
15						moist very dense		NATIVE SAND, GRAVEL, COBBLES & BOULDERS, some clay, poorly graded, subrounded to subangular, nonplastic to low plasticity, brown	
20			D		GP				
25									Stopped Trackhoe at 24'

6-117-000081.GWH.08.07.96

SAMPLE TYPE  
 B - Undisturbed Block Sample.  
 D - Disturbed Bulk Sample.  
 U - 3" O.D. 2.42" I.D. Tube Sample

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PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST PIT NO. TP-2

JOB NO. 6-117-000081

DATE 7-20-96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

BACKHOE TYPE Trackhoe  
 LOCATION Sta. 518+50, 126' L  
 ELEVATION 1211.6'  
 DATUM Stanley Consultants Survey

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Soil/Rock Classification	REMARKS	VISUAL CLASSIFICATION
0					GP	slightly moist  very dense to dense	Concrete Washout <b>SAND &amp; GRAVEL</b> , fine grained gravel, angular to subangular, nonplastic, grayish brown
5							Stopped Trackhoe at 2'6"
10							
15							
20							
25							

6-117-000081\_GWH\_08/07/96

SAMPLE TYPE

- B - Undisturbed Block Sample.
- D - Disturbed Bulk Sample.
- U - 3" O.D. 2.42" I.D. Tube Sample

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST PIT NO. TP-3

JOB NO. 6-117-000081

DATE 7-20-96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

BACKHOE TYPE Trackhoe  
 LOCATION Sta. 523 + 30, 130' L  
 ELEVATION 1216.4'  
 DATUM Stanley Consultants Survey

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Soil/Rock Classification	REMARKS	VISUAL CLASSIFICATION	
0						slightly moist  medium dense	FILL <b>CLAYEY SAND</b> , some to considerable fine grained gravel, poorly graded, subrounded to subangular, low plasticity, brown  note: considerable construction debris, concrete, barbwire, plastic bags, wiring, pipes, etc. from 0 to 12'	
5					SC			
10								
15								
16			D	4		SM	slightly moist	NATIVE <b>SILTY SAND</b> , some fine grained gravel, predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
17								
18								
19						GP	slightly moist	<b>SAND, GRAVEL &amp; COBBLES</b> , poorly graded, subrounded to subangular, nonplastic, brown
20								Stopped Trackhoe at 20'
21								
22								
23								
24								
25								

6-117-000081 GWH 08/07/96

SAMPLE TYPE  
 B - Undisturbed Block Sample.  
 D - Disturbed Bulk Sample.  
 U - 3" O.D. 2.42" I.D. Tube Sample

PROJECT Red Mountain Freeway  
Preliminary Geotechnical Investigation

LOG OF TEST PIT NO. TP-4

JOB NO. 6-117-000081

DATE 7-20-96

GROUNDWATER		
DEPTH	HOUR	DATE
	none	

BACKHOE TYPE Trackhoe  
 LOCATION Sta. 531 + 82, 197' L  
 ELEVATION 1209.1'  
 DATUM Stanley Consultants Survey

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Soil/Rock Classification	REMARKS	VISUAL CLASSIFICATION
0					GP	slightly moist	FILL Concrete Washout, construction debris, tires, concrete
5					SP	slightly moist	NATIVE SAND, predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
10					GP	slightly moist	SAND & GRAVEL, occasional cobbles, poorly graded, subrounded to subangular, nonplastic, brown
15					GP	slightly moist	SAND, predominantly medium to fine grained, subrounded to subangular, nonplastic, brown
15		D			GP	slightly moist	SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, nonplastic, brown
20							Stopped Trackhoe at 25'
25							

6-117-000081.GWH 08/07/96

SAMPLE TYPE

- B - Undisturbed Block Sample.
- D - Disturbed Bulk Sample.
- U - 3" O.D. 2.42" I.D. Tube Sample



**APPENDIX B**  
**LABORATORY TEST DATA**

**AGRA Earth & Environmental, Inc.**

**PROJECT:** RED MOUNTAIN FREEWAY - PHASE III  
**LOCATION:** MCKELLIPS & COUNTRY CLUB RDS. BRIDGES

**JOB NO:** 6-117-000081  
**WORK ORDER NO:** 1  
**DATE SAMPLED:** 07-22-96

**MECHANICAL SIEVE ANALYSIS  
 GROUP SYMBOL, USCS (ASTM D-2487)**

**SIEVE SIZES**

Location & Depth	USCS	LL	PI	Silt or	SAND								GRAVEL						COBBLES		Lab #
				Clay	Fine			Medium			Coarse	Fine			Coarse			4"	6"		
					#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"			1"	

**PERCENT PASSING BY WEIGHT**

C1 @ 5.0 - 6.5'	ML	24	1	83	89	91	92	92	92	93	93	94	94	95	95	100	100	100	100	100	100	100	33
C1 @ 10.0 - 13.5'	SP-SM	NV	NP	8.1	9	12	15	18	58	79	80	83	86	90	92	96	98	100	100	100	100	100	34
C2 @ 5.0 - 6.5'	SM	NV	NP	38	89	98	99	99	99	99	99	100	100	100	100	100	100	100	100	100	100	100	1
C2 @ 20.0 - 25.0'	SW	NV	NP	3.2	7	17	25	33	44	51	54	62	66	73	76	81	84	89	95	100	100	100	4
C3 @ 5.0 - 6.5'	ML	NV	NP	84	99	99	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	38
C6 @ 4.0 - 9.0'	SM	NV	NP	33	56	95	98	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	52
H1 @ 10.0 - 15.0'	GP	NV	NP	1.5	2	3	4	5	8	10	11	22	26	37	41	48	57	71	81	95	100	100	7
H1 @ 17.0 - 23.0'	GP-GM	NV	NP	5.5	8	11	13	15	17	20	21	28	33	43	50	67	78	88	97	100	100	100	9
H2 @ 9.0 - 10.5'	SC	34	18	34	43	52	56	59	66	70	72	78	79	82	85	85	100	100	100	100	100	100	47
H2 @ 30.0 - 35.0'	ML	NV	NP	50	65	70	73	75	78	80	80	83	86	88	90	94	96	100	100	100	100	100	49

AGRA Earth & Environmental, Inc.

PROJECT: RED MOUNTAIN FREEWAY - PHASE III  
 LOCATION: MCKELLIPS & COUNTRY CLUB RDS. BRIDGES

JOB NO: 6-117-000081  
 WORK ORDER NO: 1A  
 DATE SAMPLED: 07-22-96

MECHANICAL SIEVE ANALYSIS  
 GROUP SYMBOL, USCS (ASTM D-2487)

SIEVE SIZES

Location & Depth	USCS	LL	PI	Silt or Clay	SAND								GRAVEL						COBBLES		Lab #		
					Fine			Medium			Coarse		Fine			Coarse							
				#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/2"	2"	3"	4"	6"	

PERCENT PASSING BY WEIGHT

H3 @ 9.0 - 15.0'	SM	NV	NP	15	27	45	54	63	74	78	78	81	82	85	87	91	95	96	100	100	100	100	13
H4 @ 7.0 - 10.0'	SW	NV	NP	2.8	5	14	22	31	47	54	56	63	65	69	73	78	84	90	95	100	100	100	44
H4 @ 25.0 - 29.0'	GP	NV	NP	2.6	4	7	9	11	16	19	20	25	28	33	37	45	52	64	77	96	100	100	45
M2 @ 5.0 - 6.5'	SM	NV	NP	16	22	30	35	40	51	58	60	68	71	77	83	94	100	100	100	100	100	100	54
M2 @ 34.0 - 35.0'	GP	NV	NP	3.4	5	8	10	12	17	20	21	28	30	36	40	47	53	63	71	84	100	100	57
M4 @ 5.0 - 15.0'	GP	NV	NP	2.8	4	8	11	14	20	23	24	27	28	31	33	38	42	51	69	89	100	100	18
M4 @ 39.0 - 45.0'	GP-GC	32	11	7.1	9	16	21	27	34	36	37	40	43	50	56	72	82	92	95	100	100	100	22
M9 @ 28.0 - 31.0'	GP	NV	NP	1.9	3	5	6	8	11	14	15	21	24	31	37	46	53	65	75	84	100	100	28
M9 @ 52.0 - 55.0'	GP	NV	NP	3.1	5	9	12	15	18	22	24	34	41	57	71	93	97	100	100	100	100	100	29
TP1 @ 2.0 - 3.0'	SC	25	11	40	48	55	60	64	69	71	72	78	80	83	85	89	92	92	100	100	100	100	62

AGRA Earth & Environmental, Inc.

PROJECT: RED MOUNTAIN FREEWAY - PHASE III  
 LOCATION: MCKELLIPS & COUNTRY CLUB RDS. BRIDGES

JOB NO: 6-117-000081  
 WORK ORDER NO: 1B  
 DATE SAMPLED: 07-22-96

MECHANICAL SIEVE ANALYSIS  
 GROUP SYMBOL, USCS (ASTM D-2487)

SIEVE SIZES

Location & Depth	USCS	LL	PI	Silt or Clay	SAND									GRAVEL						COBBLES		Lab #
					Fine			Medium			Coarse			Fine			Coarse					
					#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/2"	2"	3"	

PERCENT PASSING BY WEIGHT

Location & Depth	USCS	LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/2"	2"	3"	4"	6"	Lab #		
TP3 @ 16.0 - 18.0'	SM	NV	NP	13	23	42	57	66	74	76	76	78	79	80	82	85	87	89	93	95	100	100	64		

AGRA Earth & Environmental, Inc.

PROJECT: RED MOUNTAIN FREEWAY - PHASE III  
 LOCATION: MCKELLIPS & COUNTRY CLUB RDS. BRIDGES

JOB NO: 6-117-000081  
 WORK ORDER NO: 2  
 DATE SAMPLED: 07-29-96

MECHANICAL SIEVE ANALYSIS  
 GROUP SYMBOL, USCS (ASTM D-2487)

SIEVE SIZES

Location & Depth	USCS	LL	PI	Silt or Clay	SAND								GRAVEL						COBBLES		Lab #		
					Fine				Medium		Coarse		Fine			Coarse							
				#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/2"	2"	3"	4"	6"	

PERCENT PASSING BY WEIGHT

C4 @ 5.0 - 10.0'	SM	NV	NP	17	28	40	45	51	61	65	66	69	69	71	73	80	83	94	100	100	100	100	67
C4 @ 33.0 - 37.0'	GP	NV	NP	3.4	5	7	11	15	24	31	34	42	45	52	58	70	76	85	95	100	100	100	72
C5 @ 70.0 - 75.0'	GP-GC	32	18	10	12	16	20	25	37	44	46	53	58	68	73	83	89	94	97	100	100	100	78
C5 @ 5.0 - 6.5'	SM	NV	NP	45	84	95	95	97	98	99	99	99	100	100	100	100	100	100	100	100	100	100	75

AGRA Earth & Environmental, Inc.

PROJECT: RED MOUNTAIN FREEWAY - PHASE III  
 LOCATION: MCKELLIPS & COUNTRY CLUB RDS. BRIDGES

JOB NO: 6-117-000081  
 WORK ORDER NO: 3  
 DATE SAMPLED: 08-13-96

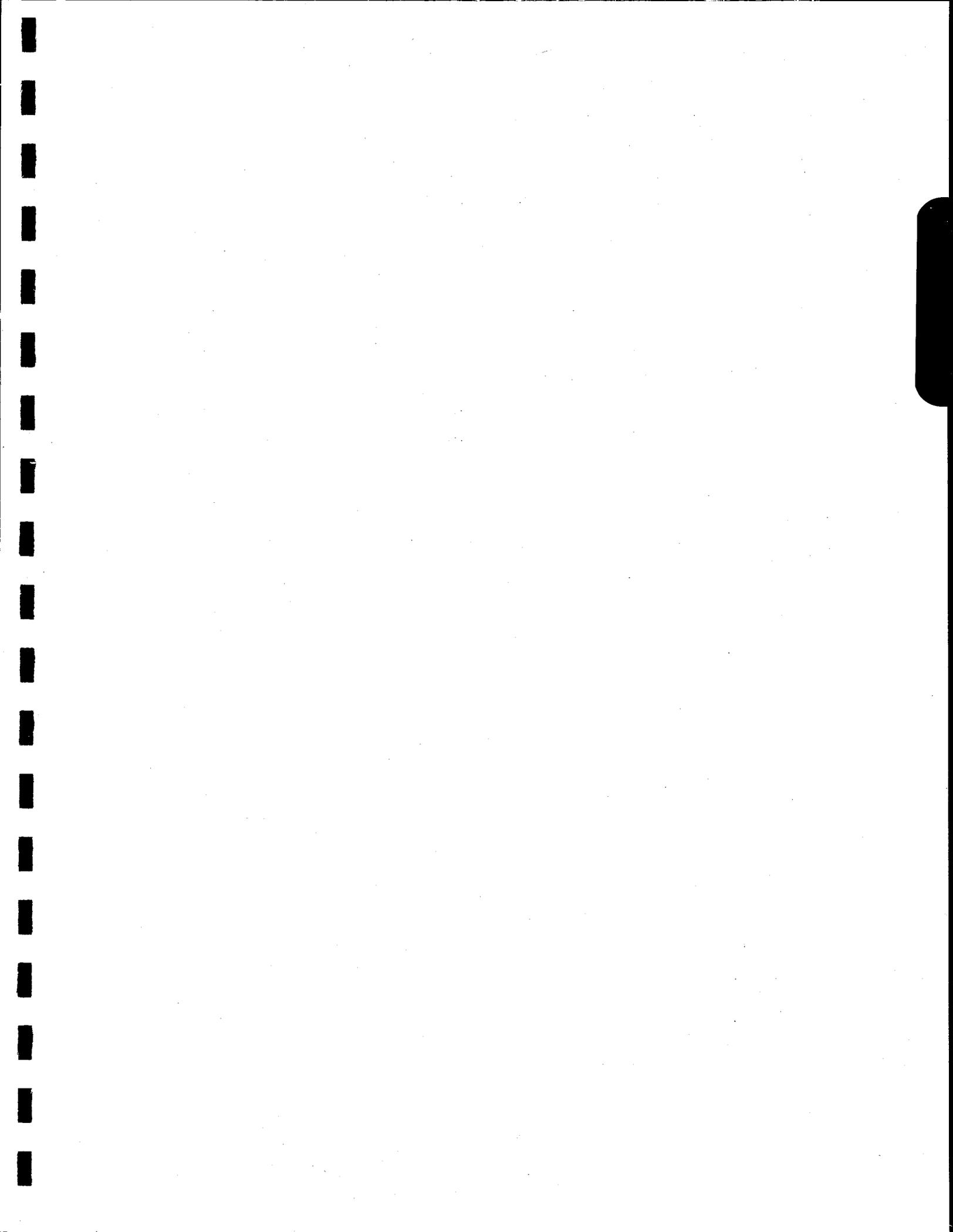
MECHANICAL SIEVE ANALYSIS  
 GROUP SYMBOL, USCS (ASTM D-2487)

SIEVE SIZES

Location & Depth	USCS	LL	PI	Silt or Clay	SAND								GRAVEL						COBBLES		Lab #	
					Fine				Medium				Coarse			Fine			Coarse			
					#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/2"	2"		3"

PERCENT PASSING BY WEIGHT

#1	---	---	---	1.6	3	8	13	18	30	38	40	51	55	61	67	79	88	98	100	100	100	100	83	



**APPENDIX C**

**STABILITY ANALYSIS DIAGRAMS**

