GEOTECHNICAL EVALUATION
AGUA FRIA LEVEE WEST PAL 18
AVONDALE, ARIZONA

PREPARED FOR:
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009-6399

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
3202 East Harbour Drive
Phoenix, Arizona 85034

June 17, 2011
Project No. 600550016

Excerpt from:

Agua Fria River FEMA Levee Certification Package for Levee ID #18

Contract Number: FCD 2010C027 Assignment #5

Prepared for:
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

Prepared by:
WEST Consultants, Inc.
8950 S 52nd Street
Suite 210
Tempe, AZ 85284

June 2011
Revised: August 2011

WEST
CONSULTANTS, INC.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
Date Signed 08-22-2011
ARIZONA, U.S.A.

Expires 3/31/2014

APPENDIX A

MT-2 Forms for Levee ID #18

MT-2 Forms for Levee ID #18

Topic: Geotechnical Considerations

Prepared by:
Ninyo & Moore

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20598-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program; Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: _____

Note: Fill out one form for each flooding source studied.

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization.....complete Section B
Bridge/Culvert.....complete Section C
Dam.....complete Section D
Levee/Floodwall.....complete Section E
Sediment Transport.....complete Section F (if required)

Description of Modeled Structure

1. Name of Structure: _____

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure: _____

Downstream Limit/Cross Section: _____

Upstream Limit/Cross Section: _____

2. Name of Structure: _____

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure: _____

Downstream Limit/Cross Section: _____

Upstream Limit/Cross Section: _____

3. Name of Structure: _____

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure: _____

Downstream Limit/Cross Section: _____

Upstream Limit/Cross Section: _____

NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.

B. CHANNELIZATION

Flooding Source: _____

Name of Structure: _____

1. Hydraulic Considerations

The channel was designed to carry _____ (cfs) and/or the _____-year flood.

The design elevation in the channel is based on (check one):

☐ Subcritical flow ☐ Critical flow ☐ Super critical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions

☐ Other locations (specify): _____

2. Channel Design Plans

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Accessory Structures

The Channelization includes (check one):

☐ Levees [Attach Section (E Levee/Floodwall)] ☐ Drop structures ☐ Super elevated sections

☐ Transitions in cross sectional geometry ☐ Debris basin/design basin [Attach Section D (Dam/Basin)] ☐ Energy dissipater

☐ Weir ☐ Other (describe): _____

4. Sediment Transport Considerations

Are the hydraulics of the channel affected by sediment transport? ☐ Yes ☐ No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source: _____

Name of Structure: _____

1. This revision reflects (check one):

☐ Bridge/culvert not modeled in the FIS

☐ Modified bridge/culvert previously modeled in the FIS

☐ New analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
If different hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

☐ Dimensions (height, width, span, radius, length)

☐ Shape (culverts only)

☐ Material

☐ Beveling or Rounding

☐ Wing Wall Angle

☐ Skew Angle

☐ Distance Between Cross Sections

☐ Erosion Protection

☐ Low Chord Elevations - Upstream and Downstream

☐ Top of Road Elevations - Upstream and Downstream

☐ Structure Invert Elevations - Upstream and Downstream

☐ Stream Invert Elevation - Upstream and Downstream

☐ Cross-Section Locations

4. Sediment Transport Considerations

Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☐ No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

D. DAM/BASIN

Flooding Source: _____

Name of Structure: _____

1. This request is for (check one): ☐ Existing dam/basin ☐ New dam ☐ Modification of existing dam/basin
2. The dam/basin was designed by (check one): ☐ Federal agency ☐ State agency ☐ Private organization ☐ Local government agency

   Name of the agency or organization: _____

3. The dam was permitted as (check one): ☐ Federal Dam ☐ State Dam

   Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

   Permit or ID number _____ Permit Agency or Organization: _____

   ☐ Local Government Dam ☐ Private Dam

Provide related drawings, specifications and supporting design information.

4. Does the project involve revised hydrology? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2)

Was the dam/basin designed using critical duration storm? (Must account for the maximum volume of runoff)

☐ Yes, provide supporting documents with your completed Form 2.

☐ No, provide written explanation and justification for not using the critical duration storm.

5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☐ No

   If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered?

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

FEQUENCY (% annual chance)	Stillwater Elevation Behind the Dam/Basin FIS	REVISED
10-year (10%)	_____	_____
50-year (2%)	_____	_____
100-year (1%)	_____	_____
500-year (0.2%)	_____	_____
Normal Pool Elevation	_____	_____

7. Please attach a copy of the formal Operation and Maintenance Plan.

E. LEVEE/FLOODWALL

1. System Elements

   a. This Levee/Floodwall analysis is based on (check one): ☐ upgrading of an existing levee/ floodwall system ☐ a newly constructed levee/ floodwall system ☐ reanalysis of an existing levee/ floodwall system

   b. Levee elements and locations are (check one):

   ☐ earthen embankment, dike, berm, etc. Station _____ to _____

   ☐ structural floodwall Station _____ to _____

   ☐ other (describe): _____ Station _____ to _____

   c. Structural Type (check one): ☐ monolithic cast-in place reinforced concrete ☐ reinforced concrete masonry block ☐ sheet piling

   ☐ other (describe): _____

   d. Has the levee/floodwall system been certified by a Federal agency to provide protection from the base flood? ☐ Yes ☐ No

   If Yes, by which agency? _____

   e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

   1. Plan of the levee embankment and floodwall structures Sheet Numbers _____
   2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers _____
   3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers _____

4. A layout detail for the embankment protection measures. Sheet Numbers _____
5. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers _____

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

3.0 feet or more at the downstream end and throughout ☐ Yes ☐ No

3.5 feet or more at the upstream end ☐ Yes ☐ No

4.0 feet within 100 feet upstream of all structures and/or constrictions ☐ Yes ☐ No

Coastal

1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater) ☐ Yes ☐ No

2.0 feet above the 1%-annual-chance stillwater surge elevation ☐ Yes ☐ No

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? ☐ Yes ☐ No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. Opening through the levee system (check one): ☐ exists ☐ does not exist

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data
In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers (USACE) EM-1110-2-1906 Form 2086.)

4. Embankment Protection

a. The maximum levee slope land side is: _____

b. The maximum levee slope flood side is: _____

c. The range of velocities along the levee during the base flood is: _____ (min.) to _____ (max.)

d. Embankment material is protected by (describe what kind): _____

e. Riprap Design Parameters (check one): ☐ Velocity ☐ Tractive stress
Attach references

Reach	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
					D_{100}	D_{50}	Thickness	
Sta _____ to _____								
Sta _____ to _____								
Sta _____ to _____								
Sta _____ to _____								
Sta _____ to _____								
Sta _____ to _____								

(Extend table on an added sheet as needed and reference each entry)

f. Is a bedding/filter analysis and design attached? ☐ Yes ☒ No

g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

5. Embankment and Foundation Stability

a. Identify locations and describe the basis for selection of critical location for analysis:

See Section 8.1. of Geotechnical Evaluation Report. Agua Fria Levee PAL 18, Avondale, Arizona by NInyo & Moore, June 17, 2011.

☒ Overall height: Sta.: River MP 5.43 , height 20 ft.

☒ Limiting foundation soil strength

Strength ϕ = 28 degrees, c = 150 psf

Slope: SS = 1 (h) to 1 (v)

(Repeat as needed on an added sheet for additional locations)

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):

Spencer method and circular failure surfaces. For additional details, see Section 8.1. of Geotechnical Evaluation Report. Agua Fria Levee PAL 18, Avondale, Arizona by NInyo & Moore, June 17, 2011.

c. Summary of stability analysis results: The ranges of Safety Factor for the 6 critical sections analyzed are presented below:

Case	Loading Conditions	Critical Safety Factor	Criteria Min.
I	End of construction	2.4 to 4.8	1.3
II	Sudden drawdown	1.0 to 2.1	1.0
III	Critical flood stage	2.5 to 4.9	1.4
IV	Steady seepage at flood stage	2.5 to 4.9	1.4
VI	Earthquake (Case I)	2.0 to 3.9	1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

5. Embankment and Foundation Stability (continued)

d. Was a seepage analysis for the embankment performed? ☒ Yes ☐ No

If Yes, describe methodology used: steady state using finite element analysis

e. Was a seepage analysis for the foundation performed? ☒ Yes ☐ No

f. Were uplift pressures at the embankment landside toe checked? ☐ Yes ☒ No

g. Were seepage exit gradients checked for piping potential? ☒ Yes ☐ No

h. The duration of the base flood hydrograph against the embankment is less than 24 hours.

Attach engineering analysis to support construction plans.

6. Floodwall and Foundation Stability

a. Describe analysis submittal based on Code (check one): ☐ UBC (1988) ☐ Other (specify): _____

b. Stability analysis submitted provides for: ☐ Overturning ☐ Sliding If not, explain: _____

c. Loading included in the analysis were: ☐ lateral earth @ PA= _____ psf; Pp = _____ psf

☐ Surcharge-Slope @ _____, ☐ surface _____ psf

☐ Wind @ Pw = _____ psf

☐ Seepage (Uplift): _____ ☐ Earthquake @ Peq = _____ %g

☐ 1%-annual-chance significant wave height _____ ft.

☐ 1%-annual-chance significant wave period _____ sec.

d. Summary of Stability Analysis Results: Factors of Safety.
Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept. 1986; USACE EM 1110-2-2502)
Note: (Extend table on an added sheet as needed and reference)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

f. Foundation scour protection ☐ is, ☐ is not provided. If provided, attach explanation and supporting documentation.
Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specific construction elevations to maintain the established freeboard margin? ☐ Yes ☒ No

b. The computed range of settlement is _____ ft. to _____ ft.

7. Settlement (continued)

c. Settlement of the levee crest is determined to be primarily from: ☐ Foundation consolidation ☒ Embankment compression

☒ Other (describe): see Section 8.3.1. of Geotechnical Evaluation Report by Ninyo & Moore, dated June 17, 2011

d. Differential settlement of floodwalls ☐ has ☐ has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: _____ acres

Draining to ponding area: _____ acres

b. Relationships Established

Ponding elevation vs. storage ☐ Yes ☐ No

Ponding elevation vs. gravity flow ☐ Yes ☐ No

Differential head vs. gravity flow ☐ Yes ☐ No

c. The river flow duration curve is enclosed: ☐ Yes ☐ No

d. Specify the discharge capacity of the head pressure conduit: _____ cfs

e. Which flooding conditions were analyzed?

* Gravity flow (Interior Watershed) ☐ Yes ☐ No
* Common storm (River Watershed) ☐ Yes ☐ No
* Historical ponding probability ☐ Yes ☐ No
* Coastal wave overtopping ☐ Yes ☐ No

If No for any of the above, attach explanation.

f. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. ☐ Yes ☐ No If No, attach explanation

g. The rate of seepage through the levee system for the base flood is none cfs

h. The length of levee system used to drive this seepage rate in item g: N/A ft.

i. Will pumping plants be used for interior drainage? ☐ Yes ☐ No

If Yes, include the number of pumping plants: _____ For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? ☐ Yes ☐ No

8. Interior Drainage (continued)

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104 and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☒ is not a problem

Hydrocompaction ☐ is ☒ is not a problem

Heave differential movement due to soils of high shrink/swell ☐ is ☒ is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Attach supporting documentation.

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities flood side of the structure?

☐ Yes ☐ No Attach supporting documentation.

d. Sediment Transport Considerations:

Was sediment transport considered? ☐ Yes ☐ No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why sediment transport was not considered.

10. Operational Plan and Criteria

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP regulations? ☐ Yes ☐ No

b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations?

☐ Yes ☐ No

c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?

☐ Yes ☐ No If the answer is No to any to the above, please attach supporting documentation.

11. Maintenance Plan

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP regulations?

☐ Yes ☐ No If No please attach supporting documentation.

12. Operations and Maintenance Plan

Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

CERTIFICATION OF THE LEVEE DOCUMENTATION

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statements may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name	License No.	Expiration Date
Company Name	Telephone No.	Fax No.
Signature	Date	E-Mail Address

F. SEDIMENT TRANSPORT

Flooding Source: _____

Name of Structure: _____

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or base on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume _____acre-feet

Debris load associated with the base flood discharge: Volume _____acre-feet

Sediment transport rate _____(percent concentration by volume)

Method used to estimate sediment transport: _____

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: _____

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: _____

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

CERTIFICATION BY REGISTRATION PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms instruction. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name	License No.	Expiration Date
Steven D. Nowaczyk, P.E.	34866	06-30-2012
Company Name	**Telephone No.**	**Fax No.**
Ninyo & Moore	602-243-1600	602-243-2699
Signature	**E-mail Address**	**Date**
Steven D. Nowaczyk	snowaczyk@ninyoandmoore.com	06/17/11

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form name and (Number)	Required if.....
☐ Riverine Hydrology & Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☒ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culvert, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Registered Professional Engineer (Civil) CERTIFICATE NO. 34866 STEVEN D. NOWACZYK Date Signed ..... ARIZONA U.S.A.

Seal (optional)

EXPIRES: 06/30/12

NOTE: Certification provided by Ninyo & Moore is for geotechnical sections only.

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

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3202 East Harbour Drive
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Mr. Frank Brown, P.E., CFM
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009-6399

Subject: Geotechnical Evaluation
Agua Fria Levee West, PAL 18
Avondale, Arizona

Dear Mr. Brown:

In accordance with our revised proposal dated February 24, 2011, Ninyo & Moore has performed a geotechnical evaluation of the Agua Fria Levee West from south of Lower Buckeye Road and north of Indian School Road, in Avondale, Arizona. The attached report presents our methodology, findings, conclusions, and recommendations regarding the geotechnical conditions at the project site.

We appreciate the opportunity to be of service to you during this phase of the project. If you have any questions or comments regarding this report, please call at your convenience.

Sincerely,
NINYO & MOORE

Marek J. Kasztalski, P.E., P.M.P., LEED A.P.
Senior Geotechnical Engineer

Steven D. Nowaczyk, P.E.
Principal Engineer

Registered Professional Engineer (Civil)
CERTIFICATE NO. 34866
STEVEN D. NOWACZYK
Date Signed 6-17-11
ARIZONA U.S.A.
EXPIRES: 06/30/12

MJK/SAH/SDN/clj

Distribution: (1) Addressee (via email, 2 3-Ring Copies, 3 DVD's)

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1. INTRODUCTION

In accordance with our revised proposal dated February 24, 2011, we have performed a geotechnical evaluation of the Agua Fria Levee West, from south of Lower Buckeye Road and north of Indian School Road in Avondale, Arizona. The purpose of this work assignment is to provide certification documentation and recommendations for additional work, if necessary, for support of The Federal Emergency Management Agency (FEMA's) accreditation of the Agua Fria Levee System (specifically for Agua Fria Levee West PAL 18), located along portions of the west banks of the Agua Fria River, from about 1,800 feet south of Lower Buckeye Road to 2,500 feet north of Indian School Road. Currently this levee is provisionally accredited by FEMA and shown as providing protection from the 1 percent annual chance (base) flood on the most recent Flood Insurance Rate Map. The Provisionally Accredited Levee (PAL) agreement between the Flood Control District of Maricopa County (District) and FEMA is due to expire on June 25, 2011. For this levee to be fully accredited by FEMA, and continue to be shown as providing flood protection on the Flood Insurance Rate Map (FIRM) panel beyond the PAL expiration date, the levee must be certified to FEMA as meeting the criteria set forth in Title 44, Code of Federal Regulations Part 65.10 (44 CFR §65.10).

As part of the levee certification process, Ninyo & Moore reviewed available data and information, provided engineering analyses based upon the available data and information, and conducted field reconnaissance as necessary to demonstrate whether the requirements of 44 CFR §65.10, Section (b) *Design Criteria*, Subsections 4) *Embankment and Foundation Stability* and (5) *Settlement,* have been met.

2. SCOPE OF SERVICES

The scope of our services for the project generally included the following:

- Participation in meetings with the FCDMC Project Manager, including a combined scoping session and kickoff meeting and project review meetings.

Collecting and reviewing available relevant data and information regarding the Agua Fria Levee West. The data were collected from the FCDMC, FEMA, Arizona Department of Transportation

(ADOT), the adjacent cities, and other sources as appropriate. Data and information collected included the following:

- Design reports/memorandums
- Geomorphic analysis
- Hydrologic and hydraulic studies, reports, and models
- Geotechnical engineering investigation reports
- Sediment transport study reports
- Floodplain delineation and flood insurance studies
- Specifications
- River cross sections
- Surveying for land subsidence
- Current and historic topographic mapping data, including horizontal and vertical control tabulation, hard-copy and electronic file
- Current and historic aerial photography
- Levee monitoring for bank stabilization
- Pertinent correspondence
- Land ownership, rights-of-way, easements and other applicable District Geographic Information System (GIS) layers/databases
- Operation and maintenance plans/manuals and inspection reports
- Information on District-permitted construction activity on and around the levee
- Reviewing the collected data and information to assess the adequacy (or deficiency) of the levee relative to the *Design Criteria,* Subsections (4) and (5). This included conducting engineering calculations and analyses utilizing the collected data as necessary to address the factors specified in Subsections (4) and (5). For the data and information to be considered adequate to address these subsections, it must satisfactorily address the questions, requested information, and criteria in FEMA MT-2 Form 3, Sections E.5 and 7, although we were not responsible for completion of the FEMA form. The results of the review and analyses are presented in this Geotechnical Report (see below).

- Preparing mapping for use in the field reconnaissance activities using GIS layers/databases provided by the District.
- Conducting a field reconnaissance of the levee in conjunction with the FCDMC's Project Manager, to assess existing conditions as they pertain to the *Design Criteria,* Subsections (4) and (5). Field reconnaissance findings are documented in this Geotechnical Report.
- Performing stability analyses, seepage analyses and settlement calculations on the critical two-dimensional cross sections selected along the levee system.
- Developing a work plan for further evaluation and mitigation of the trouble spots identified by the US Army Corps of Engineers (USACE) Continuing Eligibility Inspection (CEI) for the levee.
- Preparing this draft Geotechnical Report for the District's review following data and information collection and review and field reconnaissance.

3. FEMA REQUIREMENTS FOR LEVEE CERTIFICATION

As part of a mapping project, it is the levee owner's or community's responsibility to provide data and documentation to show that a levee meets the requirements of Section 65.10 of the National Flood Insurance Program (NFIP) regulations. The FEMA requirements in Section 65.10 are separated into five categories:

- General criteria
- Design criteria
- Operations plans and criteria
- Maintenance plans and criteria
- Certification requirements

3.1. General Criteria

As mentioned above, FEMA will recognize only the levee systems that meet minimum design, operation, and maintenance standards that are consistent with the level of protection sought.

Section 65.10 describes the types of information FEMA needs to recognize that a levee system provides protection from the base flood; that information must be supplied to FEMA by the community. The FEMA review is solely to establish appropriate risk zone determination for NFIP maps.

3.2. Design Criteria

FEMA has established levee design criteria for levee freeboard, closures of penetrations through the levee, levee embankment protection, levee embankment and foundation stability, settlement, interior drainage, and other design criteria. These criteria are summarized in the following items. Please note that the following criteria are not part of this report: 3.2.1, 3.2.2, 3.2.3, and 3.2.6.

3.2.1. Freeboard

For reverie levees, a minimum freeboard of 3 feet above the water-surface level of the base flood must be provided. An additional 1 foot of freeboard must also be provided within 100 feet on either side of structures (e.g., bridge) or wherever the flow is constricted. An additional 0.5 feet of freeboard must be provided at the upstream ends of the levee, tapering to the minimum at the downstream end of the levee.

3.2.2. Closures

The levee closure requirement is that all openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice.

3.2.3. Embankment Protection

Engineering analyses must be submitted to demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability.

3.2.4. Embankment and Foundation Stability

Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability. The factors that shall be addressed in the analyses include:

- Depth of flooding;
- Duration of flooding;
- Embankment geometry and length of seepage path at critical locations;
- Embankment and foundation materials;
- Embankment compaction;
- Penetrations;
- Other design factors affecting seepage (e.g., drainage layers);
- Other design factors affecting embankment and foundation stability (e.g., berms).

3.2.5. Settlement

Engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum freeboard standards set forth in Section 2.2.1.This analysis must address:

- Embankment loads;
- Compressibility of embankment soils;
- Compressibility of foundation soils;
- Age of the levee system;
- Construction compaction methods.

A detailed settlement analysis using procedures such as those described in U.S. Army Corps of Engineers (USACE) Engineering Manual No. EM 1100-2-1904 must be submitted.

3.2.6. Interior Drainage

An analysis must be submitted that identifies the source(s) of such flooding; the extent of the flooded area; and, if the average depth is greater than 1 foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters. Interior drainage systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. For areas of interior drainage that have average depths greater than 1 foot, mapping must be provided depicting the extents of the interior flooding, along with supporting documentation.

3.2.7. Other Design Criteria

In unique situations, such as those where the levee system has relatively high vulnerability, FEMA may require that other design criteria and analyses be submitted to show that the levees provide adequate protection. In such situations, sound engineering practice will be the standard on which FEMA will base its determinations. FEMA also will provide the rationale for requiring this additional information.

3.3. Operations

For a levee system to be recognized, the operational criteria must be as described below. All closure devices or mechanical systems for internal drainage, whether manual or automatic, must be operated in accordance with an officially adopted operation manual, a copy of which must be provided to FEMA by the operator when levee or drainage system recognition is being sought or when the manual for a previously recognized system is revised in any manner. All operations must be under the jurisdiction of a federal or state agency, an agency created by federal or state law, or an agency of a community participating in the NFIP.

3.3.1. Closures

Operation plans for closures must include the following:

- Documentation of the flood warning system, under the jurisdiction of federal, state, or community officials, that will be used to trigger emergency operation activities; and demonstration that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before floodwaters reach the base of the closure;
- A formal plan of operation, including specific actions and assignments of responsibility by individual name or title;
- Provisions for periodic operation, at not more than one-year intervals, of the closure structure(s) for testing and training purposes.

3.3.2. Interior Drainage Systems

Interior drainage systems associated with levee systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. FEMA will recognize these drainage systems on NFIP maps for flood protection purposes only if the following minimum criteria are included in the operation plan:

- Documentation of the flood warning system, under the jurisdiction of federal, state, or community officials, that will be used to trigger emergency operation activities; and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system;
- A formal plan of operation, including specific actions and assignments of responsibility by individual name or title;
- Provision for manual backup for the activation of automatic systems;
- Provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes (no more than one year shall elapse between either the inspections or the operations).

3.3.3. Other Operation Plans and Criteria

FEMA may require other operating plans and criteria to ensure that adequate protection is provided in specific situations. In such cases, sound emergency management practice will be the standard upon which FEMA determinations will be made.

3.4. Maintenance

For levee systems to be recognized as providing protection from the base flood, the following maintenance criteria must be met:

- Levee systems must be maintained in accordance with an officially adopted maintenance plan, and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner.
- All maintenance activities must be under the jurisdiction of a federal or state agency, agency created by federal or state law, or an agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance.
- The maintenance plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and how its associated structures and systems are maintained.
- At a minimum, the maintenance plan shall specify maintenance activities to be performed, frequency of their performance, and the person, by name or title, responsible for their performance.

3.5. Certification

Data submitted to support that a given levee system complies with the requirements set forth above must be Certified by a Registered/Licensed Professional Engineer. Also, certified as-built plans of the levee must be submitted. Certifications are subject to the definition given in 44 CFR Section 65.2 of the NFIP regulations, as follows:

§ 65.2 Definitions.

- For the purpose of this part. A certification by a registered professional engineer or other party does not constitute a warranty or guarantee of performance, expressed or implied. Certification of data is a statement that the data is accurate to the best of the certifier's knowledge. Certification of analyses is a statement that the analyses have been performed correctly and in accordance with sound engineering practices. Certification of structural works is a statement that the works are designed in accordance with sound engineering practices to provide protection from the base flood. Certification of "as built" conditions is a statement that the structure(s) has been built according to the plans being certified, is in place, and is fully functioning.

- For the purposes of this part, "reasonably safe from flooding" means base flood waters will not inundate the land or damage structures to be removed from the Special Flood Hazard Area (SFHA) and that any subsurface waters related to the base flood will not damage existing or proposed buildings.

In lieu of these structural requirements, a federal agency with responsibility for levee design may certify that the levee has been adequately designed and constructed to provide protection against the base flood.

4. SUMMARY OF REVIEWED DOCUMENTS

4.1. Methodology of Documents Reviewed

Ninyo & Moore reviewed available documents and information related to the Agua Fria Levee Improvements project. Many of the documents were obtained from the District, via Mr. Frank Brown, Senior Civil Engineer, who had collected the documents related to the subject project. Further, we examined reference lists provided in the existing reports to find additional relevant documents to include in our review. In some cases, original and complete copies of older references were not available; however, pertinent data from those reports were included in more recent reports. In addition, we have contacted various agencies and municipalities, such as, U.S. Army Corps of Engineers (USACE), Arizona Department of Transportation (ADOT), Maricopa County Department of Transportation (MCDOT), and City of Avondale. Finally, we have researched the archives of Ninyo & Moore for pertinent documents.

An initial review of each document was performed to evaluate its relevance to the geotechnical aspects of the project. A document was considered relevant if it contained information about one of the following:

- Geotechnical data at or near the Agua Fria River between Indian School Road and South of Lower Buckeye Road; and/or
- Structural information for the West Levee, PAL 18.

Next, the pertinent documents were carefully reviewed and summarized. A complete list of reviewed documents is included in Appendix F to this report.

4.2. Previous Geotechnical Documents

Numerous studies have been performed for the Agua Fria channelization program as well as for the development of associated nearby structures and developments (bridges, control structures, pipelines and others). The findings of the geotechnical and/or hydrological studies performed at/near the west-side levee PAL ID #18, are presented in the following sections. The approximate locations of the borings and test pits and/or trenches associated with these studies are shown on Figures A-A, A-B and A-C in Appendix A. The exploratory logs are presented in Appendix A and the laboratory test results are presented in Appendix B.

4.2.1. Geotechnical Investigation – Channelization – Agua Fria River, Thomas Road & I-10 (SHB, 1982)

In 1982, Sergent, Hauskins & Beckwith Consulting Geotechnical Engineers conducted a soil exploration for the design and construction of the channel embankment between Thomas Road and I-10. The objective of this investigation was to evaluate the physical properties of the subsoils underlying the site to provide recommendations for the design of channel embankments and other earthwork elements of the project. The exploration included: 14 soil borings advanced to depths of 7.5 to 26 feet (borings #1 through #14). The laboratory testing included sieve analyses, Atterberg limits in-situ unit weights and moisture contents, direct shear tests and permeability tests. Based on the test borings, the site soil profile generally consisted of stratified deposits of low plasticity silty sands and sands with occasional sandy silt interbeddings. (see Appendix A-1 and B-1)

4.2.2. Geotechnical Investigation, Agua Fria River Channelization, Thomas Road to Indian School Road (SHB, 1983)

In 1983, Sergent, Hauskins & Beckwith Consulting Geotechnical Engineers conducted a field sampling and laboratory testing on Agua Fria River channel materials for analysis of unconfined compressive strength of a sand-gravel-cement mixture for the design

and construction of the channel embankment between Thomas Road and Indian School Road. The evaluation consisted of visually identifying and classifying soils observed in six test pits excavated with a backhoe. The laboratory testing included sieve analyses. Gradation analyses indicate the channel area samples obtained at the test pit locations are primarily poorly graded sands with very little gravel. (see Appendix A-2 and B-2)

4.2.3. Geotechnical Investigation on Grade Control Structure at Indian School Rd Bridge and Agua Fria River (DEE, 1984)

In 1984, Desert Earth Engineering conducted a soil exploration for the design and construction of a 1,340-ft-long soil-cement grade control dike on the Agua Fria River just south of Indian School Road. The exploration included four soil borings advanced to depths of up to 25 feet. The laboratory testing included sieve analyses and Atterberg limits tests. Based on the test borings, the site soil profile generally consisted of non-plastic sands with variable percentage of gravels and cobbles. (see Appendix A-3 and B-3)

4.2.4. Geotechnical Engineering Report on Agua Fria Channelization, 500 ft South of Interstate 10 to McDowell Road (DEE, 1984)

In 1984, Desert Earth Engineering conducted a soil exploration for the design and construction of the channel embankment between Thomas Road and I-10. This geotechnical investigation had three aspects. One was a subsurface investigation to provide foundation design information for a 1,450-ft grade control structure across the Aqua Fria River 500 ft downstream of Interstate 10. The second was an investigation to evaluate subsurface soils to a depth of 20 ft over a 60-acre proposed siltation basin. This basin was to be located immediately north of 1-10 and east of the Agua Fria River channel. The third aspect was to perform soil-cement mix designs for the channel levies and the grade control structure. The exploration included 11 soil borings advanced to an approximate depth of 20 feet depths of 7.5 to 26 feet (borings B-1 through B-11), including three borings (B-1 through B-3) advanced for the proposed control structure. The laboratory testing included sieve analyses and Atterberg limits. Based on the test borings, the site

soil profile generally consisted of stratified deposits of poorly graded and well-graded sands with gravels and cobbles. (see Appendix A-4 and B-4)

4.2.5. Geotechnical Engineering Report on Agua Fria Soil Cement Design and Permeability Study (DEE, 1985)

In 1985, Desert Earth Engineering prepared a report covering soil-mix design recommendations for the Agua Fria improvements project. The study was based on previous explorations including 34 backhoe trenches excavated on the banks and in the riverbed and four borings advanced along the proposed grade control structure just south of Indian School Road. The laboratory testing included sieve analyses and laboratory (remolded) permeability. Based on the test borings and trenches, the site soil profile generally consisted of non-plastic sands and silty sands with variable percentage of gravels and cobbles. (see Appendix A-5 and B-5)

4.2.6. Geotechnical Investigation, Proposed Bridge Van Buren over Agua Fria River (SHB, 1985)

In 1985, Sergent, Hauskins & Beckwith Consulting Geotechnical Engineers conducted a soil exploration for the proposed Van Buren Bridge over Agua Fria River. The objective of this investigation was to evaluate the physical properties of the subsoils underlying the site in order to provide recommendations for foundation and abutment design. The exploration included 11 soil borings including nine advanced to depth ranging from of 12 feet to 37 feet below existing grade to auger refusal and two borings advanced to a depth of 80 and 89 feet using a percussion drilling technique. The laboratory testing included in situ moisture content and dry density, sieve analyses and Atterberg limits. Based on the test borings, the site soil profile generally consisted of highly stratified deposits of silty sands and clayey sands with gravels and cobbles. (see Appendix A-6 and B-6)

4.2.7. Site Materials Evaluation, Agua Fria River Improvements, Buckeye Road to Interstate 10 (WTI, 1986)

In 1986, Western Technologies Inc. conducted an evaluation of the materials in the Agua Fria River channel. The purpose of the evaluation was to identify the types of soils present in the channel bed; which are proposed for use in levee and soil cement bank protection construction for the above referenced project. The evaluation consisted of visually identifying and classifying soils observed in 25 test pits excavated with a backhoe. The laboratory testing included in situ moisture content and dry density and sieve analyses. Based on the test borings, the site soil profile generally consisted of stratified deposits of sands and silty sands and occasional sandy silt lenses. (see Appendix A-7 and B-7)

4.2.8. Soil Investigation – Tres Rios Landing (CIT, 2002)

In 2002, Construction Inspection and Testing (CIT) conducted a soil investigation for the Tres Rios development, a residential subdivision including proposed single-family homes and residential streets. This development is located between Dysart Road and the west bank of the Agua Fria River, on the south side of Buckeye Road, in Avondale, Arizona. The exploration included: 10 backhoe pit test holes to depths of 6 to 10 feet (Test Holes B1 through B10), 10 pavement sample test holes to a depth of 3 feet (Test Holes BC1 through BC10), and two percolation test holes to a depth of 3.5 feet (Test Holes P1 and P2). Based on the test holes, the site soil profile generally consisted of stratified deposits of silty sands and sandy silts. Silty to sandy clay soils were noted in 3 of the 25 test holes. (see Appendix A-8 and B-8)

4.2.9. Geotechnical Investigation – Indian School Distribution Waterline (CH2M Hill, 2002)

In 2002, CH2M Hill conducted a soil exploration for the design of the Indian School 20-inch Distribution Waterline for El Mirage Road to 115th Street. The waterline alignment spans the Agua Fria River just south of Indian School Road. The exploration included: six soil borings advanced to depths of 15 to 25 feet (borings B-1 through B-6).

The laboratory testing included sieve analyses, Atterberg limits, in-situ unit weights and moisture contents, a laboratory compaction (Proctor) test and consolidation (response to wetting). Based on the test borings, the site soil profile generally consisted of low plasticity silty sands. Sandy silt and clayey sand soils were encountered in two of the 6 exploratory borings. (see Appendix A-9 and B-9)

4.2.10. Geotechnical Evaluation – Lower Buckeye Waterline (N&M, 2004)

In 2004, N&M conducted a geotechnical evaluation for the proposed water transmission line in Avondale, Arizona. This development is located along Lower Buckeye Road from intersection with 4th Street to El Mirage Road, in Avondale, Arizona. The exploration included five borings advanced to depths ranging from approximately 10 feet to 25 feet below existing ground surface (borings B1 through B5). The laboratory testing included, in-situ moisture content and dry density, sieve analyses, and Atterberg limits. Based on the field and laboratory test results, the site alluvium soil profile generally consisted of stratified deposits of sandy silts, silty sands, and poorly graded sands, with occasional silty clay and clayey gravel layers. (see Appendix A-10 and B-10)

4.2.11. Geotechnical Evaluation – Avondale Municipal Operations Center (N&M, 2005)

In 2005, N&M conducted a geotechnical evaluation for the proposed improvements to the Avondale Municipal Operations Center. This development is located at the southwest corner of Lower Buckeye Road and Dysart Road, in Avondale, Arizona. The exploration included 8 borings advanced to depth ranging from approximately 2 to 16.5 feet below existing ground surface (borings B-1 through B-8) and performance of two field percolation tests. The laboratory testing included, in-situ moisture content and dry density, sieve analyses, Atterberg limits, consolidation (response-to-wetting), and expansion index. Based on the field and laboratory test results, the site alluvium soils encountered in boring B-1 and B-2 generally consisted of sand, sandy silt and silt, with some gravels, cobbles and boulders. (see Appendix A-11 and B-11)

4.2.12. Pavement Evaluation – Wal-Mart Store No. 2544 (N&M, 2007)

In 2007, N&M conducted a pavement evaluation for Wal-Mart Store No. 2544. This development is located near the northeast corner of the intersection of Interstate I-10 and Dysart Road, in Avondale, Arizona. The exploration included 11 borings advanced to a depth of approximately 2 feet below existing ground surface (borings C1 through C11). The laboratory testing included, in-situ moisture content and dry density, sieve analyses, and Atterberg limits. Based on the field and laboratory test results, the site alluvium soils encountered immediately under the pavement structure generally consisted of sandy clay. (see Appendix A-12 and B-12)

4.2.13. Geotechnical Evaluation – Agua Fria Connector Trail (N&M, 2007)

In 2007, N&M conducted a geotechnical evaluation for proposed multi-use path. This development is located along the west bank of the Agua Fria River between Riley Drive and Van Buren Street, in Avondale, Arizona. The exploration included six hand-auger borings advanced to a depth of approximately 3 feet below existing ground surface (borings B1 through B6). The laboratory testing included, in-situ moisture content and dry density, sieve analyses, and Atterberg limits. Based on the field and laboratory test results, the site alluvium soils encountered in boring B-1 generally consisted of sandy silt. The fill encountered in each of the borings on top of the embankment generally consisted of poorly graded to well-graded fine to coarse sand with little gravel, silt and cobbles. (see Appendix A-13 and B-13)

4.2.14. Geotechnical Design Report – Ehrenberg-Phoenix Highway (I-10) Outside Widening, Sarival Avenue to Dysart Road, Maricopa County, Arizona (URS, 2008)

In 2008, URS conducted a geotechnical evaluation for the design of foundations for bridges, sound walls and retaining walls for the Ehrenberg-Phoenix Highway (I-10) Outside Widening project between Sarival Avenue and Dysart Road in Maricopa County, Arizona. The bridges for this project consisted of 5 overpasses, including the Dysart Road interchange and Agua Fria River Bridge. The exploration for the Dysart

Road Overpass included 10 borings advanced to depth ranging from approximately 11 feet to 100 feet below existing ground surface. The exploration for the I-10 Bridge widening included 23 borings advanced to an approximate depth of 99 feet below existing ground surface, including the borings for the east abutment. The laboratory testing included in-situ moisture content and dry density, sieve analyses, Atterberg limits, consolidation, swell potential, direct shear, laboratory maximum dry density and optimum moisture content. Based on the field and laboratory test results, the alluvium soils encountered in boring in the area of the proposed Dysart Road overpass generally consisted of sand, silty sand, sandy silt and sandy clay. The native soils along the I-10 Bridge over Agua Fria River consisted primarily of stratified deposits of sands, sands with silt, silty sands with variable percentage of gravels and cobbles, and gravels with silt, cobbles and boulders. (see Appendix A-14 and B-14)

4.2.15. Geotechnical Evaluation – Elm Lane Drainage Mitigation (N&M, 2009)

In 2009, N&M conducted a geotechnical evaluation for the proposed Elm Lane Drainage Mitigation project. This development is located along Central Avenue and along Elm Lane, north of Lower Buckeye Road and west of the Agua Fria River, in Avondale, Arizona. The exploration included four borings advanced to approximately 20 feet below existing ground surface (borings B1 through B4). The laboratory testing included, in-situ moisture content and dry density, sieve analyses, Atterberg limits, and consolidation (response-to-wetting). Based on the field and laboratory test results, the site soil profile generally consisted of stratified deposits of sandy clays, sandy silts and silty sands. (see Appendix A-15 and B-15)

4.3. Design and Historic Construction

The following sections describe the original construction of the Agua Fria River improvements.

4.3.1. Contract Documents and Special Provisions

Contract Documents and Special Provisions for Agua Fria River Improvements Phase I: Roosevelt Irrigation Channel Reconstruction and Siphon, Phase II: Agua Fria River Channelization and Bank Protection Contract No. FCD 85-10, prepared by Flood Control District of Maricopa County. Invitation for Bids dated March 4, 1985.

The scope of work covered the Agua Fria River from 500 feet south of Thomas Road to 2,900 feet north of Indian School Road and along the Roosevelt Irrigation District Canal System 3,000 feet east and west of the Agua Fria River. The work was to be performed in accordance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction, Edition of 1979. The project consisted of furnishing all material, labor, and equipment necessary to construct levees, soil-cement bank protection, a soil-cement grade-control structure, utility tower protection measures, channel and canal excavation, canal embankment, shotcrete canal lining, inverted siphon, gravel pit backfill, culverts, flap gates, and other incidental items as shown on the plans or as specified herein.

Below is a summary of typical construction requirements for the main work items from the Special Provisions.

Section 203 - Channel Excavation

This item of work included excavation, removal of existing levees and bank protection, gravel pit backfill, watering, grading, shaping, and compaction. Excavated material, exclusive of old tires, rubbish, and other unsuitable materials, was to be used in fill areas and other areas within the project limits as directed by the Engineer. Embankment/fill, where designated, was to be placed in eight (8) inch loose lifts and compacted to 90.0 percent of maximum density as determined by Arizona Test Method 225.

Section 212 - Levees

The top six inches of ground on which levees are to be constructed should be compacted to a density of not less than 95.0 percent of the maximum density. Earth material

for levees should be placed in uniform horizontal layers not exceeding eight (8) inches in depth before compaction. Each layer of earth material for levee construction should be compacted to a density of not less than 95.0 percent of the maximum density (in accordance with the requirements of Arizona Test Method 225).

Section 220 - Riprap Construction

This work should consist of furnishing all plant, labor, equipment, and materials and performing all work necessary, including toe excavation, backfill, and dewatering, to place a protective covering of erosion-resistant material on the slopes of embankments. The riprap materials should have rock size less than 36 inches. The types of riprap included in the specification are:

- Dumped Riprap: Dumped riprap consists of rock that is dumped in place on a filter blanket or prepared slope to form a well graded mass with a minimum of voids.
- Grouted Riprap: Grouted riprap consists of dumped riprap with all or part of the rock interstices filled with Portland Cement grout.

The gravel filter blanket should consist of one or more layers of gravel, crushed rock, or sand. Gradation: 100% passing 4" sieve, 0-5% passing ½" sieve.

Filter fabric for riprap construction should be Mirafi 600X or approved equal.

Section 221 - Soil Cement Bank Protection

Before soil-cement processing begins, the area on which soil-cement will be placed should be graded and shaped to lines and grades as shown on the Plans or as directed by the Engineer. The subgrade should be compacted to a minimum of ninety (90%) percent.

The soil cement mixture should be placed on the moistened subgrade embankment, or previously completed soil cement with spreading equipment that will produce layers of such widths and thicknesses as are necessary for compaction to the required dimensions of the completed soil-cement layers. The compacted layers of soil-cement should not

exceed eight (8) inches in thickness, nor be less than four (4) inches in thickness. Soil cement should be uniformly compacted to a minimum of 98% of maximum density as determined by field density tests. Wheel rolling with only hauling equipment should not be an acceptable method of compaction.

The design requirements for the soil-cement bank protection should be such that it has a compressive strength of 750 psi at the end of 7 days plus 2% additional cement added for erosion resistance.

Contract Documents and Special Provisions for Agua Fria River Improvements, I-10 to Thomas Road, Contract No. FCD 85-16, prepared by Dibble & Associates Consulting Engineers and Simons Li, & Associates, Inc. Invitation for Bids dated July 8, 1985.

The scope of work covered the Agua Fria River from approximately 680 feet south of Interstate 10 to approximately 200 feet south of Thomas Road. The work was to be performed in accordance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction, Edition of 1979. The improvements included the construction of the levees, soil cement bank protection, soil cement grade control structures, channel excavation, utility tower protection and other incidental items. The Special Provisions provide generally the same construction requirements as those in the section above.

Specifications for Agua Fria River Levees, Maricopa County, Arizona, prepared by the U.S. Army Corps of Engineers, Los Angeles District, dated March 18, 1987.

The scope of work covered the Agua Fria River from Buckeye Road to Broadway Road. The document contains Technical Provisions containing general construction specifications, as well as the Contractor's Quality Control Plan.

4.3.2. Levee Construction Plans (As Builts)

We have reviewed the following documents:

- Gila River Basin, Phoenix, Arizona and Vicinity (including New River), Agua Fria River Levees (Buckeye Road to Broadway Road), by US Army Corps of Engineers, Los Angeles District, Record Drawings as Constructed, with illegible date.

- Flood Control District of Maricopa County, Construction Plans for Agua Fria River Improvements, Buckeye Road to I-10, Contract No. FCD 85-37, by Simons, Li & Associates, Inc., Record Drawings stamped 5/22/1986.

- Flood Control District of Maricopa County, Construction Plans for Agua Fria River Improvements, Phase I – RID Canal Reconstruction & Siphon; Phase II, Channelization & Bank Protection, Contract No. FCD 85-37, by Simons, Li & Associates, Inc., Record Drawings stamped 5/21/1986.

Construction quality control documentation was not available for our review.

See Appendix G for relevant River Mile Posts, wherever as-built stations are referred to in this section of the Report.

Record Drawings for Buckeye Rd to Broadway Rd Reach.

The plans and profiles cover the southerly-most reach of the levee from the end of the access ramp at approximate Station 11+39 to Buckeye Road Bridge at approximate Station 105+79. The drawings show soil-cement face of the upstream slope over the entire alignment. The soil-cement has a 1(H):1(V) slope and the mostly earthen downstream slope is 3(H):1(V). Typical configuration of the West Levee soil cement protection is presented on Figure 2 in this Report. The crest to toe height generally varies between 7 and 15 feet on both sides of the levee, except within the access ramp, where the levee slopes down to the existing ground elevation. The ramp is soil-cement protected on both upstream and downstream sides up to Station 15+00. The toe of soil-cement is buried approximately 13 to 19 feet below existing ground surface at the upstream slope toe. The crest width is shown as 15 feet. A concrete lined diversion channel is shown on the downstream side between approximately Station 39+00 and Station 54+00 (at and immediately south of the Lower Buckeye Road). The channel is up to approximately 5 feet deep. (see Appendix A-16)

Record Drawings for Buckeye Rd to I-10 Reach and Bank Protection at Thomas Rd Closure

The plans and profiles cover the reach of the levee from Buckeye Road Bridge at approximate Station 3+37 to the Interstate 10 Bridge at approximate Station 81+88. The plans show the typical levee cross-section similar to that described for the previous reach, however, there are more details provided. The final soil-cement cover with after trimming is shown as 8.0 feet. Lift thickness and compaction efforts are provided for the soil-cement and earthen fill of the levee. The upstream slope is covered with soil-cement over the entire alignment. The soil-cement has a 1(H):1(V) slope and the earthen downstream slope is 3(H):1(V). The crest to toe height generally varies between 15 and 18 feet on the upstream side of the levee, and is generally lower on the earthen downstream side. The toe of soil-cement is buried approximately 8.5 feet below existing ground surface at the upstream slope toe. Immediately south of I-10, between approximate Station 67+03 and Station 76+12, the cross section is different in that the total levee height on the upstream and downstream side is approximately 19 feet and 12.5 feet respectively, and the soil cement toe is buried approximately 13 feet below the upstream slope toe. The crest width is shown as 14 feet throughout.

The plans show gravel pit areas within the levee footprint, which needed to have been backfilled prior to the levee construction. The construction detail shows that the pit be backfilled with classified fill within the levee foundation area and to a minimum depth of 10 feet within the channel outside of the levee footprint with minimum compaction of 95 percent. The unclassified fill was to be placed in other depths/areas with minimum 85 percent compaction. The classified fill is defined as material excavated from project limits; which is free of debris, roots, trees, trash and other objectionable matter.

Record Drawings for Thomas Rd to Indian School Road Reach

These plans and profiles cover the northerly-most reach of the levee from south of the Thomas Road closure at Station 0+0 to approximately 1,600 feet north of Indian School Road at Station 75+25.

The drawings provide details of soil-cement and riprap protection. Typical configurations of the West Levee soil cement and riprap protection are presented in this Report on Figure 2 and 3, respectively. Soil-cement protected levee cross-section is similar to that specified in other record drawings. The crest to toe (equilibrium line) height generally varies between 15 and 18 feet on the upstream side of the levee, and is generally lower on the earthen downstream side. Three rip-rap sections are shown:

Station 23+58.23 to Station 36+11.78,

Station 39+50.48 to Station 47+25.00, and

Station 57+04.65 to Station 59+18.65.

The slope of riprap is 3(H):1(V) and the construction detail specifies a 6-inch thick gravel filter blanket and filter fabric Mirafi 600X or equal to be placed under the 30-inch thick rip-rap cover. Riprap gradation should meet a D_{50} = 18" requirement.

The levee crest width is shown as 14 feet for the soil cement cross-section and 15 feet for the riprap cross-section. The toe down depth for both soil-cement and rip rap is shown as 8.5 feet from the equilibrium line.

The gravel pit backfill specification is similar to that described for the previous reach above.

This set of record drawings includes also construction plans for the Roosevelt Irrigation District canal reconstruction and siphon.

4.3.3. Construction Plans for Bridge Structures Over Agua Fria River

We have reviewed plans related to the construction of bridge structures in the vicinity or over the Agua Fria River. Below is a brief synopsis of the reviewed documents.

State of Arizona, State Highway Department, Plan and Profile of Proposed State Highway Buckeye - Phoenix, Maricopa County, BR-S-371(5), As Built Drawings, Dated 7-28-1975

This set of plans contains Foundation Data Sheets for the Buckeye Road (also known as Maricopa County Highway 85 or MC85) Bridge over the Agua Fria River, in Avondale, Arizona. A total of 18 borings were drilled to depths ranging from approximately 25 to 80 feet below existing grade, of which 11 borings were advanced with Standard Penetration Testing and soil sampling. The borings were performed in 1968/1969. The soil profile shows stratified deposits of sand, sand with silt and gravel, and sandy gravels with cobbles and occasional boulders. (see Appendix A-17)

Maricopa County Highway Department, Plans for the Construction of Indian School Road Bridge Widening at Agua Fria River, Project No. 60300, As Built Drawings, Dated 4-27-1978

This set of plans contains Foundation Data Sheets for the Indian School Road Bridge over the Agua Fria River widening, in Avondale, Arizona. The foundation logs included in the plans for the bridge widening are from the original bridge construction plans (1969). The original foundation exploration included borings to the south in anticipation of a future widening. A total of 20 borings were drilled to depths ranging from approximately 45 to 80 feet below existing grade with Standard Penetration Testing and soil sampling. The borings were performed in 1966. The soil profile shows stratified deposits of sand, sand with silt and gravel, and sandy gravels with cobbles and occasional boulders and lime cementation. (see Appendix A-18)

State of Arizona, Department of Transportation, Highways Division, Plan and Profile of Proposed Ehrenberg - Phoenix Maricopa County, I-IG-10-2 (37), As Built Drawings Dated 3-31-1980

This set of plans contains Foundation Data Sheets for the I-10 Overpass at Dysart Road, in Avondale, Arizona. Borings were advanced at each abutment of the one-span westbound and eastbound structures. A total of eight borings were drilled to depths ranging from approximately 15 to 80 feet below existing grade, of which 4 borings were advanced with Standard Penetration Testing and soil sampling. The borings were performed in 1975. The soil profile shows stratified deposits of silty clay and silty sand with lime cementation. (see Appendix A-19)

Maricopa County Highway Department, Plans for the Construction of McDowell Road Bridge at Agua Fria River, Project No. 68105, As Built Drawings, Dated 1-6-1986

This set of plans contains Foundation Data Sheets for the McDowell Road Bridge over the Agua Fria River, in Avondale, Arizona. A total of 10 borings were drilled to depths ranging from approximately 10 to 80 feet below existing grade with Standard Penetration Testing and soil sampling. The borings were performed in 1982. The soil profile shows stratified deposits of sand, sand with silt and gravel, clayey sand and sandy gravels with cobbles and occasional boulders and lime cementation. (see Appendix A-20)

Maricopa County Highway Department, Plans for the Construction of Van Buren Road Bridge at Agua Fria River, Project No. 68220, As Built Drawings, Dated 3-9-1988

This set of plans contains Foundation Data Sheets for the Van Buren Road Bridge over the Agua Fria River, in Avondale, Arizona. The borings were taken from a previous geotechnical study by Sergent, Hauskins & Beckwith Consulting Geotechnical Engineers, 1985. The exploration included 11 soil borings including 9 advanced to

depth ranging from of 12 feet to 37 feet below existing grade to auger refusal and 2 borings advanced to a depth of 80 and 89 feet using a percussion drilling technique. The site soil profile generally consisted of highly stratified deposits of silty sands and clayey sands with gravels and cobbles. (see Appendix A-21)

Maricopa County Highway Department, Plans for the Construction of Scour Protection for Indian School Road Bridge at Agua Fria River, Project No. 68937, As Built Drawings, Dated June 2001

This set of plans contains a plan sheet with two test pits excavated at the existing Indian School Road over the Agua Fria River, in Avondale, Arizona. The test pits were excavated to a depth of approximately 16 feet below existing grade. The soil profile shows stratified deposits of sandy gravel and gravelly sand, with some cobbles and non-plastic fines. (see Appendix A-22)

4.3.4. Other Construction Documents

Skunk Creek and the New Agua Fria Rivers Supplement to Design Memorandum No. 3, General Design Memorandum - Phase II, Project Design - Part 4

This set of plans contains 15 test trench logs and laboratory test results of typical streambed materials south of Roosevelt Canal (see Appendix A-23 and B-23).

4.4. Inspection by the U.S. Army Corps of Engineers

In November 2009, the USACE performed the Continuing Eligibility Inspection of the Agua Fria Levee River levees, which was required for participation in the USACE Public Law (PL) 84-99 Rehabilitation and Inspection Program (RIP). As a result of the Inspection, the project was rated "minimally acceptable" and therefore, the District has two years to improve or fix the trouble spots and obtain an acceptable rating, otherwise, the project will be removed from active status and placed on inactive status. The following findings related to the embankment condition were reported as a result of the Inspection:

- Vegetation that needs removal,
- Debris near toe or in channel that needs removal,
- The channel side portion of levee appears "wavy" and portion of soil cement repair bulges out.
- Minor erosion on or near the levee embankment;
- Several minor settlement irregularities;
- Scattered fragmenting of topping on levee crest;
- Cracking on crest and slopes of levee.

4.5. FCDMC Inspections

We have reviewed inspection reports prepared by the District for the Agua Fria River. The following documents were reviewed:

- Annual Inspection Reports from the period 2001 to 2010;
- Maintenance Inspection Reports from the period 2001 to 2010 (reports from 2003 were not available);
- Special Inspection Reports from 2007.

The inspections were conducted and the reports refer to the following four Agua Fria River reaches:

- Reach 1: ½ mile north of Indian School Road to Thomas Road;
- Reach 2: Thomas Road to Interstate 10;
- Reach 3: Interstate 10 to MC 85 (Buckeye Road); and
- Reach 4: MC 85 to Broadway Road.

4.5.1. Annual Inspection Reports

The 2001 inspection was conducted for the whole project alignment. The report stated that generally the Agua Fria River channelization and soil cement bank protection were

in good condition. Some spalling and cracking of the soil cement on the crest throughout the project was noted.

The 2002 report contains similar conclusions with additional repair of the access ramps north of McDowell Road. In 2003, the deterioration of the soil cement cap on the crest was again emphasized, as well as removal or thinning out of dense deep-rooted vegetation. The 2003 and 2004 inspections reported similar comments and added surface cracks on the upstream face and scattered rodent activities. Erosion/rilling of the downstream slope was first noted in the 2005 report, as well as aggravated crest deteriorations in some areas along Reach 3.

The 2007 Inspection report contains clear repair recommendations:

- The crest erosion;
- The upstream embankment face deterioration;
- Scattered erosion and rills and rodent activities on the downstream slope.

Also a need for monitoring of the upstream embankment face was indicated. Photographs of the typical deterioration modes were included. The reports of the following Annual Inspections (2008 through 2010) provided generally similar observations and recommendations. In the 2009 report it was noted that Reach 4 was in relatively better condition.

4.5.2. Maintenance Inspection Reports

In 2001, the Inspection Reports were prepared separately for each reach. Generally, the following observations were made:

- The existence of cracking and deterioration of soil cement in some locations of the crest;
- Erosion of downstream slope (Reach 2 and 3);
- Rodent activity;

- Unwanted vegetation;
- Reach 4 in relatively good condition

The 2002 report contained similar observations. The 2004 inspection report stated good condition of the upstream levee embankment in along Reach 1 and 3 and severe downstream slope erosion/rilling along Reach 2 and 3. The reports of inspections conducted in the following years contained similar comments with increasing concern about vehicular vandalism. Cracking of the upstream levee slope was mentioned in the 2007 Inspection report. The 2008 Inspection Report stated the continued decay of the final lift of the soil cement levees and indicated the need for continued monitoring. The most recent reports (2009 and 2010) contained similar observations and recommendations.

These reports do not provide description of any remedial measures taken to repair the above mentioned deficiencies.

4.5.3. Special Inspection Reports

Several Work Control Center Inspection reports were reviewed. Those documents reported some activities of the bank restoration and fence repairs. Details were not provided, however it appears the repairs were not part of the overall levee maintenance program.

5. FIELD RECONNAISSANCE

5.1. Site Description and Background

Based on our document review, the West Levee was constructed under Agua Fria River Improvements program with several contracts (FCD 85-10, FCD 85-16) administered by the District and the USACE. The main construction activities were performed in 1986 and 1987. The Levee is owned, maintained and operated by the District.

The project site extends to the north approximately 2,500 feet north of Indian School Road and to the south approximately 1,800 feet south of Lower Buckeye Road. The total length of

the project is approximately 6 miles. The northern portions of the project are situated within portions of sections 24, 25, 36, and 35 in Township 2 North Range 1 West. The southern portions of the project are situated within portions of sections 2, 11, 14, and 22 in Township 1 North Range 1 West. The levee system in our study area is located in Avondale, Arizona. The approximate location of the site is depicted on the Site Location Map (Figure 1).

According to a baseline study map produced by Stanley Consultants, which indicates river miles designated for the Agua Fria River, our study area is located between river mile 8.6 to the north and 2.6 to the south (Figure 1). At the time of our evaluation, the upstream face of the levee was constructed of soil-cement between mile markers 2.2 to 7.9 and 8.4 to 8.6. The crest of the levee in these areas were generally constructed of an approximately 8 foot wide section of soil-cement adjacent to the upstream face in conjunction with an approximately 6 foot wide section of soil fill embankment that extended west. The downstream face in these areas were constructed of soil fill embankment. From mile marker 7.7 to 8.4, the levee was constructed of soil fill embankment. Overlying the soil fill embankment on the upstream face in this area was boulder size rip rap up to 3 feet in size. Isolated areas of soil-cement construction were also observed within this section on the upstream face.

Locations west of the downstream toe of the levee in our study area generally consisted of commercial and residential developments with interspersed areas of undeveloped property. A large gravel mining operation was located between river mile marker 7.7 to 8.5.

Based on the Phoenix South (1979), Arizona-Maricopa Co., 30-Minute by 60-Minute United States Geological Survey (USGS) Topographic Quadrangle Maps, the northern reach of the site lies at an average elevation of approximately 1010 feet relative to mean sea level (MSL) and the southern reach of the site lies at an average elevation of approximately 940 feet relative to MSL. Based on the information from this topographic map, the topography in the site vicinity generally slopes from the north down to the south.

Several aerial photographs from the Flood Control District of Maricopa County were reviewed for this project. A brief description of our review is provided for areas to the west of

the levee in our study area. For consistency, the levee was divided into three sections and aerial photographs from the same year were reviewed for each section. The first section is located between Indian School Road and Interstate 10. A 1949 aerial photograph depicted this section being utilized for agricultural purposes. Aerial photographs from 1959 and 1969 depicted the section in a similar condition. An aerial photograph from 1979 depicted the area between Thomas Road and Indian School Road being utilized for gravel mining purposes. The soil cement levee was first depicted in a 1996 aerial photograph with large-scale residential development south of Thomas Road. Aerial photographs from 2000, 2006, and 2009 generally depicted the section in a similar condition with little change.

The second section is located between Interstate 10 and Buckeye Road. A 1949 aerial photograph depicted this section being utilized mainly for agricultural purposes with a commercial development to the north of Van Buren Road. Aerial photographs from 1959 and 1969 depicted the section in a similar condition. Aerial photography from 1979 did not cover this section. The soil cement levee was first depicted in a 1996 aerial photograph with mixed residential and commercial development observed from Van Buren Road north to Interstate 10. Aerial photographs from 2000, 2006, and 2009 generally depicted the section in a similar condition with increased commercial development between Buckeye Road and Van Buren Road.

The third section is located between Buckeye Road and a location approximately 0.35 miles south of Lower Buckeye Road. A 1949 aerial photograph depicted this section generally undisturbed native desert with limited agriculture to the west. A 1959 aerial photograph depicted agricultural development encroaching east towards the river south of Lower Buckeye Road. Aerial photography from 1979 depicted a channelization feature south of Lower Buckeye Road on the west bank commercial developments to the north. The soil cement levee was first depicted in a 1996 aerial photograph. Aerial photographs from 2000, 2006, and 2009 generally depicted the section with increased commercial development and some residential development.

5.2. Field Observations

As required by the scope of this project, Ninyo & Moore has performed a field evaluation of the levee on the west side of the Agua Fria River in Avondale, Arizona. Ninyo & Moore performed its field investigation between the dates of March 28, 2011, and March 31, 2011. The results of this investigation are summarized below.

Our observations include the stretch of the Agua Fria River west bank levee R-18 bounded by two levee terminuses: approximately 1,800 feet south of Lower Buckeye Road, and approximately 2,500 feet north of Indian School Road. River crossings were observed on Lower Buckeye Road (low water crossing), Buckeye Road, Van Buren Road, Interstate 10, McDowell Road, and Indian School Road.

In general the levee is bounded by the Agua Fria River channel to the east, and either maintained city land, or un-maintained land to the west. The terminuses of the levee slope into the Agua Fria River channel.

Two Subdivisions were observed within our study area, one just north of Lower Buckeye Road, and the other just south of Thomas road. Both of these subdivisions store excess water in detention basins adjacent to the toe of the downstream side of the levee.

The following general features were observed during our field investigation.

- Areas of vegetation growth on the downstream side of the levee that appear to be in excess of acceptable limitation.
- Several areas that appear to have been maintained by use of troweled cement materials, or shotcrete cement materials are poorly adhered to the substrate, and are in various stages of deterioration.
- Several erosion features were observed on the downstream side, and upstream side of the levee and included:
    - Rilling of the down stream side of the levee in regular intervals and of various severities. Typically beginning at the crest of the levee and commonly in conjunction with biological disturbances such as burrowing;

- Scouring of soil cement materials on the upstream side of the levee resulting in 6 to 10 inch deep crevasses that vary in length from a few feet to several tens of feet in length. These features occur at various heights along the face of the levee;
- Blocky erosion at various locations on the levee;
- Raveling of the soil cement on the crest of the levee in various locations.

- Regular hairline up to 1/16-inch wide longitudinal cracking throughout the levee with intervals within 20 to 40 feet; and
- Standing water was observed periodically along the levee;

The observations mentioned above are documented in Appendix C.

6. GEOLOGY AND SUBSURFACE CONDITIONS

The geology and subsurface conditions at the site are described in the following sections.

6.1. Geologic Setting

The project site is located in the Sonoran Desert Section of the Basin and Range physiographic province, which is typified by broad alluvial valleys separated by steep, discontinuous, subparallel mountain ranges. The mountain ranges generally trend north-south and northwest-southeast. The basin floors consist of alluvium with thicknesses extending to several thousands of feet.

The basins and surrounding mountains were formed approximately 10 to 18 million years ago during the mid- to late-Tertiary. Extensional tectonics resulted in the formation of horsts (mountains) and grabens (basins) with vertical displacement along high-angle normal faults. Intermittent volcanic activity also occurred during this time. The surrounding basins filled with alluvium from the erosion of the surrounding mountains as well as from deposition from rivers. Coarser-grained alluvial material was deposited at the margins of the basins near the mountains.

The surficial geology of the site consists of Holocene to Pleistocene (<10,000 years to 750,000 years) alluvial deposits. The units generally consist of silt, sand, and fine gravel to cobbles (Demsey, 1989). These deposits have soil development with stage I to III calcic horizons. Active and recently active channel deposits are located within the channelized river system with no soil visible soil development.

6.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on our review of available documents, and our understanding of the general geology of the area. The following sections provide generalized descriptions of the materials encountered. More detailed descriptions are presented on the boring logs in Appendix A.

6.2.1. Levee Embankment

The Agua Fria River improvement projects involved partial realignment of the river channel and construction of the levees. Based on our document review described earlier in this report, where the levee had existed prior to the construction, the improvements consisted of shaping the slopes with raising the levee height, as necessary, and placement of the upstream face protection (soil-cement or rip rap). Required additional fill material was borrowed from the river channel bottom. In areas, where the levee had not existed, it had to be constructed using borrow from the river channel. Gravel pits existed in several areas between Thomas Road and Indian School Road. Those were backfilled with classified fill before the levee construction. Therefore, the levee embankment, although described as a homogeneous earth fill, includes some pre-construction material (old levee), as well as the new fill placed and compacted in accordance with the project specifications. Generally, the embankment soils include mostly sands, sands with silt and silty sands with low to no plasticity. Variable percentage of gravels is present. Clayey soils, if any, does not form continuous strata but may be encountered as scattered pockets and interbeddings.

6.2.2. Embankment Foundation Soils and the River Channel

Stratified alluvium should be generally expected under the levee embankment. The alluvium consists of sand, gravel, silty to clayey sand and gravel mixtures. Percentage of cobbles and boulders varies and is not consistent.

The river channel deposits are strongly stratified with prevailing sands, silty sands and gravels/boulders. Non-continuous, relatively thin sandy silt and clay strata are frequently encountered at or near the surface. Shallow clayey soils tend to be more common south of Lower Buckeye Road. Occasionally, construction debris and other man-made uncontrolled fill material are present in various locations scattered across the alignment.

6.3. Groundwater

Based on well data from the Arizona Department of Water Resources (ADWR), the approximate depth to the regional groundwater table is estimated to be on the order of 130 feet below ground surface (bgs) in the northern portions of the study area and on the order of 40 feet bgs in the southern portions of the study area. Groundwater levels can fluctuate due to seasonal variations, irrigation, groundwater withdrawal or injection, and other factors and could extend above the ground surface when the river is flowing.

7. GEOLOGIC HAZARDS

The following sections describe potential geologic hazards at the site, including land subsidence and earth fissures, faulting and seismicity, surface rupture, and liquefaction.

7.1. Land Subsidence and Earth Fissures

Groundwater depletion, due to groundwater pumping, has caused land subsidence and earth fissures in numerous alluvial basins in Arizona. It has been estimated that subsidence has affected more than 3,000 square miles and has caused damage to a variety of engineered structures and agricultural land (Schumann and Genualdi, 1986). From 1948 to 1983, exces-

sive groundwater withdrawal has been documented in several alluvial valleys where groundwater levels have been reportedly lowered by up to 500 feet. With such large depletions of groundwater, the alluvium has undergone consolidation resulting in large areas of land subsidence.

In Arizona, earth fissures are generally associated with land subsidence and pose an ongoing geologic hazard. Earth fissures generally associated with land subsidence form near the margins of geomorphic basins where significant amounts of groundwater depletion have occurred. Reportedly, earth fissures have also formed due to tensional stress caused by differential subsidence of the unconsolidated alluvial materials over buried bedrock ridges and irregular bedrock surfaces. Facies changes in the unconsolidated alluvial materials may also cause differential subsidence resulting in tensional stress (Schumann and Genualdi, 1986).

Based on our field reconnaissance and review of the referenced material, there are no known earth fissures underlying the study area. Based on our research, the closest earth fissure to the site is located approximately 3 miles to the north of the study area, near Luke Air Force Base (Shipman, 2007). Continued groundwater withdrawal in the area may result in subsidence and the formation of new fissures or the extension of existing fissures.

7.2. Faulting and Seismicity

The site lies within the Sonoran zone, which is a relatively stable tectonic region located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico (Euge et al., 1992). This zone is characterized by sparse seismicity and few Quaternary faults. Based on our field observations, review of pertinent geologic data, and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest fault to the site is the Sand Tank Fault Zone, located approximately 35 miles to the southwest of the site (Pearthree, 1998). Approximately 2 meters of displacement has occurred along this fault within late Pleistocene deposits (750,000 to 500,000 years), but the upper Pleistocene and Holocene deposits (less than 250,000 years) are not displaced.

Based on a Probabilistic Seismic Hazard Assessment for the conterminous United States, issued by the USGS (2009), the site is located in a zone where the peak ground acceleration with a 2 percent probability of being exceeded in 50 years, is 0.07g.

8. ANALYSES

8.1. Critical Cross Sections

We have selected critical levee cross-sections for our engineering analyses based on data collected from several sources, including:

- - design and as-built documentation;
- - field reconnaissance;
- - Final Agua Fria River HEC-RAS model dated June 10, 2011, provided by the District.
- Agua Fria Levee Final Scour Analysis Report, Levee ID#8, Levee ID#16,and Levee ID#18, provided to Ninyo & Moore June 15, 2011, prepared by WEST Consultants, Inc..

The selection was based on several criteria, such as the height and slope of the levee embankment, the toe down depth, the overall levee configuration and the type of the upstream face protection. Cross-sections at the following locations were selected as representative sections and analyzed for seepage, stability and settlement:

- Mile Post 3.73;
- Mile Post 4.09
- Mile Post 4.95
- Mile Post 5.43;
- Mile Post 6.04;
- Mile Post 8.16.

8.2. Form MT-2, Section E5, Embankment and Foundation Stability

The following subsections present the results of our analyses performed to analyze embankment and foundation stability at the critical sections previously selected, as discussed in Section 8.1 above.

8.2.1. Soil Parameters

The soil engineering parameters we used for our seepage and stability analyses were obtained from review on the construction documents, review available geotechnical data from the area as described above, and our judgment and experience with similar soils from the area. The soil properties that were developed for these materials, and used in our analyses, are presented in the table below.

Table 1 –Geotechnical Design Properties

Material	Unsaturated Unit Weight (pcf)	Saturated Unit Weight (pcf)	Effective Strength		Saturated Permeability, k	
			phi' (deg.)	c' (psf)	(cm/s)	(ft/s)
Embankment Fill	120	133	29	150	1E-05	3.3E-07
Soil Cement	125	136	20	2000	1E-07	3.3E-09
Rip Rap	127	142	40	0	1	3.28E-02
Native Alluvium	110	127	28	150	5E-05	1.6E-06
Random Fill	105	125	25	150	5E-05	1.6E-06
Filter Fabric	-	-	25	-	1	3.28E-02

8.2.2. Seepage Analyses

Seepage was modeled using SVFlux™ seepage modeling software, which is part of SVOffice 2009, Version 2.3.00, from SoilVision Systems Ltd. For this project, SVFlux™ was used to model water flow through soils, and can be used to model both steady state and transient conditions using partially saturated and saturated soil properties. The program uses a finite element solver to solve the partial differential equation for water flow through soil.

The flood-stage water level used for our analyses at each critical section was obtained from the Draft Final Agua Fria HEC-RAS model provided to us by the District, June 10, 2011.

Based on the relatively short duration of high water flow in the channel (only a few hours), the likelihood of steady-state seepage conditions developing through the embankment is remote; however, we conservatively modeled the steady-state seepage condition for our study. Modeling steady-state seepage conditions is conservative for stability analyses of the downstream slope because the seepage forces assumed will result in lower factors of safety for slope stability failure, and will also result in seepage near the landside levee toe, which is the most conservative case for evaluating seepage exit gradients.

In general accordance with USACE Engineering Manual EM 1110-2-1913 (USACE, 2000), a maximum exit gradient (i = 0.5) is used as an acceptance criteria for seepage exiting the levee toe. Based on the steady-state seepage analyses, the maximum exit gradients noted for the critical sections analyzed are shown on the following table.

Table 2 – Calculated Factors of Safety for Seepage Exit Gradients

Critical Section River Station (miles)	Exit Gradient i_{max} (ft/ft)	Factor of Safety
3.73	0.26	1.9
4.09	See Note	N/A
4.95	See Note	N/A
5.43	See Note	N/A
6.04	See Note	N/A
8.16	See Note	N/A
Notes: 1. Flood water level is lower than the landside levee toe, thus no seepage exists the levee.		

8.2.3. Stability Analyses

Slope stability was evaluated using SVSlope software, which is part of SVOffice 2009, Version 2.3.00, from SoilVision Systems Ltd. SVSlope can be used to estimate slope stability using a variety of methods. For this project, the Spencer method, one of several limit equilibrium method of slices, and circular failure surfaces, were used. For the Spencer method, it is assumed that the ratio of interslice shear force to the interslice normal force is constant throughout the sliding mass. For the various cases analyzed which included seepage, the location of the phreatic surface and the pore pressure distribution across the soil mass were imported using pore water pressure transfer files from seepage analyses performed with SVFlux software, as discussed in Appendix D.

Slope stability analyses of the levee embankment were performed for the following four cases at each critical section:

- End of construction, for both riverside and landside slopes
- Sudden drawdown from flood level for the riverside slope
- Steady seepage at flood stage for the landside slope
- Earthquake (end of construction case) for both riverside and landside slopes

For the cases with seepage (Cases 2 and 3), we assumed a scour depth based on Agua Fria Levee Scour Analysis Report, Levee ID#8, Levee ID#16,and Levee ID#18, dated June 15, 2011, prepared by WEST Consultants, Inc.. For Case 2 (sudden drawdown), we assumed that, when the flood ends, a scour hole remains at the embankment toe which contains water. We assume water remains in this scour hole below the elevation of the lowest point in the channel cross-section. This low point elevation (the thalweg) is listed as part of the HEC-RAS output. In our opinion, this is a conservative assumption, because we anticipate that the scour hole will generally fill in rapidly with soil as the flood recedes.

The minimum acceptable factors of safety, from EM 1110-2-1913 (USACE, 2000) are presented in the following table:

Table 3 – Minimum Acceptable Slope Stability Factors of Safety

Case	Required Factor of Safety
1. End of construction	1.3
2. Sudden drawdown	1.0 – 1.2 (see note 1)
3. Steady seepage at flood stage	1.4
4. Earthquake	1.0
Notes: 1. F.S. = 1.0 applies to pool levels prior to drawdown for conditions where these water levels are unlikely to persist for long periods preceding drawdown, F.S. = 1.2 applies to pool level, likely to persist for long periods prior to drawdown.	

A summary of the results of the slope stability analyses is presented in Table 4 below. Based on the tabulated results, the levee configuration meets the requirements for minimum slope stability factor of safety for the critical sections analyzed.

Table 4 – Calculated Factors of Safety for Slope Stability

Case	Section River Station (miles)	Computed Factor of Safety	Minimum Factor of Safety
1. End of construction, Riverside	3.73 4.09 4.95 5.43 6.04 8.16	3.1 3.5 2.7 2.4 2.6 2.7	1.3
1. End of construction, Landside	3.73 4.09 4.95 5.43 6.04 8.16	2.8 3.4 3.2 2.9 3.0 4.8	1.3
2. Sudden drawdown, Riverside	3.73 4.09 4.95 5.43 6.04 8.16	1.0 1.1 1.2 1.3 1.5 2.1	1.0
3. Steady seepage at flood stage, Landside	3.73 4.09 4.95 5.43 6.04 8.16	2.5 3.3 3.0 2.7 3.0 4.9	1.4
4. Earthquake, end of construction, Riverside	3.73 4.09 4.95 5.43 6.04 8.16	2.7 3.2 2.0 2.1 2.3 2.2	1.0
4. Earthquake, end of construction, Landside	3.73 4.09 4.95 5.43 6.04 8.16	2.3 2.8 2.6 2.4 2.5 3.9	1.0

8.3. Form MT-2, Section E.7

8.3.1. Settlement Analyses

Based on our review of the geotechnical exploration data for the area, the predominant soil type encountered within the zone of foundation influence is medium dense to very dense granular soils, and the levee embankment fills were constructed with predominantly granular soils (mostly silty sands and sands). For this reason, most if not all of the settlement experienced by the levee embankment likely occurred during construction or shortly after, with little long-term movement predicated. Because the levee embankments were constructed decades ago, it is our opinion that most of the static levee settlement has already occurred.

8.4. Form MT-2 Section E.8.g

8.4.1. Seepage Through the Levee

For five of the six critical cross-sections that we studied, the water surface elevations at peak flow were lower than the landside toe elevations of the levees. Therefore, no seepage can exit the levees for these cases. At Station 3.73, the steady-state seepage analysis shows flow exiting at the base of the embankment landside toe. However, it is our opinion that a steady state flow regime will not occur for several reasons including the following:

- High flow rates in the channel will occur for less than 24 hours
- Relatively low permeability of the soil cement channel lining and the width of the embankment (over 70 feet wide)

In our opinion, seepage will not exit the landside toe of the embankment at MP 3.73 either during or after a flood event.

8.5. Form MT-2 Section E.9.a

8.5.1. Liquefaction

The depth to the regional groundwater along the levee alignment is on the order of 130 feet bgs in the northern portions of the study area and on the order of 40 feet bgs in the southern portions of the study area. Based on the lack of near surface water and the low ground motion hazard (relatively low ground accelerations), the potential for liquefaction is not considered to be a design issue.

8.5.2. Hydrocompaction

Based on our review of the design plans and documents, it appears that no laboratory hydrocompaction (collapse) tests were performed as part of the original levee geotechnical studies. However, based on more recent geotechnical exploration data performed in the vicinity of the Agua Fria channel (both sampler blow count data and laboratory collapse testing), it appears that a variable thickness of about 0 to 5 feet of somewhat collapsible soil may have been present at the levee locations. Based on the plans, no significant overexcavation of potentially collapsible soils was planned or executed. After decades of foundation loading and occasional flows of water in the channel, we are not aware of any evidence of collapse-induced settlement that has been documented following flood flows, nor did our reconnaissance reveal any evidence of significant settlement. For this reason, it is our opinion that evidence suggests that any remaining hydrocompaction potential is probably low. However, it would be difficult to quantify this potential without further exploration and testing.

8.5.3. Heave differential movement due to soils of high shrink/swell

Clayey soils with medium to high plasticity's are often subject to heave and differential movement in response to changes in moisture content, due to flooding or seasonal variability. Based on our review of geotechnical data collected for this study, the predominant soil types encountered in the shallow foundation soils (upper 20 feet) were sands, silty sands, and gravels, which were generally non-plastic. Layers of clayey soils

such as clayey sands, sandy clays, or clayey gravels were rarely encountered - only a very few boring or test pit locations in or near the channel exhibited clayey layers, and those layers were generally less than about 5 feet thick. In our opinion, due to general lack of soils with high shrink/swell potential, differential movement of the levee due to shrink/swell is not a problem.

9. CONCLUSIONS AND RECOMMENDATIONS

The following summarizes the concerns noted during our geotechnical evaluation of the existing Agua Fria River Levee West:

- A number of historic documents pertaining to the levee, the river channel and adjacent improvements was collected and reviewed. However, construction quality control documentation was not available for our review. The geotechnical data indicates that the levee embankment and the foundation soils consist primarily of non-plastic sands, sands with silt, silty sands with variable percentage of gravels, cobbles and boulders. The types of deposits appear to be relatively consistent throughout the project site.

- The review of the District's Inspection reports and the findings of our field reconnaissance are in concurrence with the findings of the U.S. Army Corps of Engineers Continuing Eligibility Inspection conducted in 2009. The main areas of concern include:

    - Regular, transverse cracking in the soil cement embankment protection, probably penetrating the full thickness of the soil cement cover and extending to the toe down portion;

    - Scouring of soil cement materials on the upstream side of the levee;

    - Deterioration of the soil cement top lift on the levee crest, which is severe in some locations;

    - Erosion of the earthen downstream slope of the levee

    - Rip rap cover is generally in good condition;

    - Unwanted vegetation, animal burrows and debris.

In our opinion, the deficiencies noted presently do not pose significant risk to the overall levee integrity, and they are not expected to significantly affect its performance. However, they should be subject to continuous monitoring and repaired on a case-by-case basis using District operations and maintenance staff.

- We have performed the geotechnical analyses to demonstrate that the levee meets National Flood Insurance Program (NFIP) requirements as described in Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44 CFR Section 65.10b), Subsections (4) and (5). These analyses included stability, seepage and settlement at selected critical levee cross sections. The results of our geotechnical analyses indicate that the design criteria stipulated in the relevant U.S. Army Corps of Engineers Engineer Manuals are satisfied for all analyzed cross sections.

- Based on our findings and results of our analyses we are of the opinion that additional geotechnical exploration work to obtain the necessary data and provide additional analyses specified in Section 65.10b, Subsections (4) and (5) of the Code of Federal Regulations is not needed.

10. LIMITATIONS

The geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

Our conclusions, recommendations, and opinions are based on a review of the available documents and geotechnical analyses. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if war-

ranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use of our client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

11. SELECTED REFERENCES

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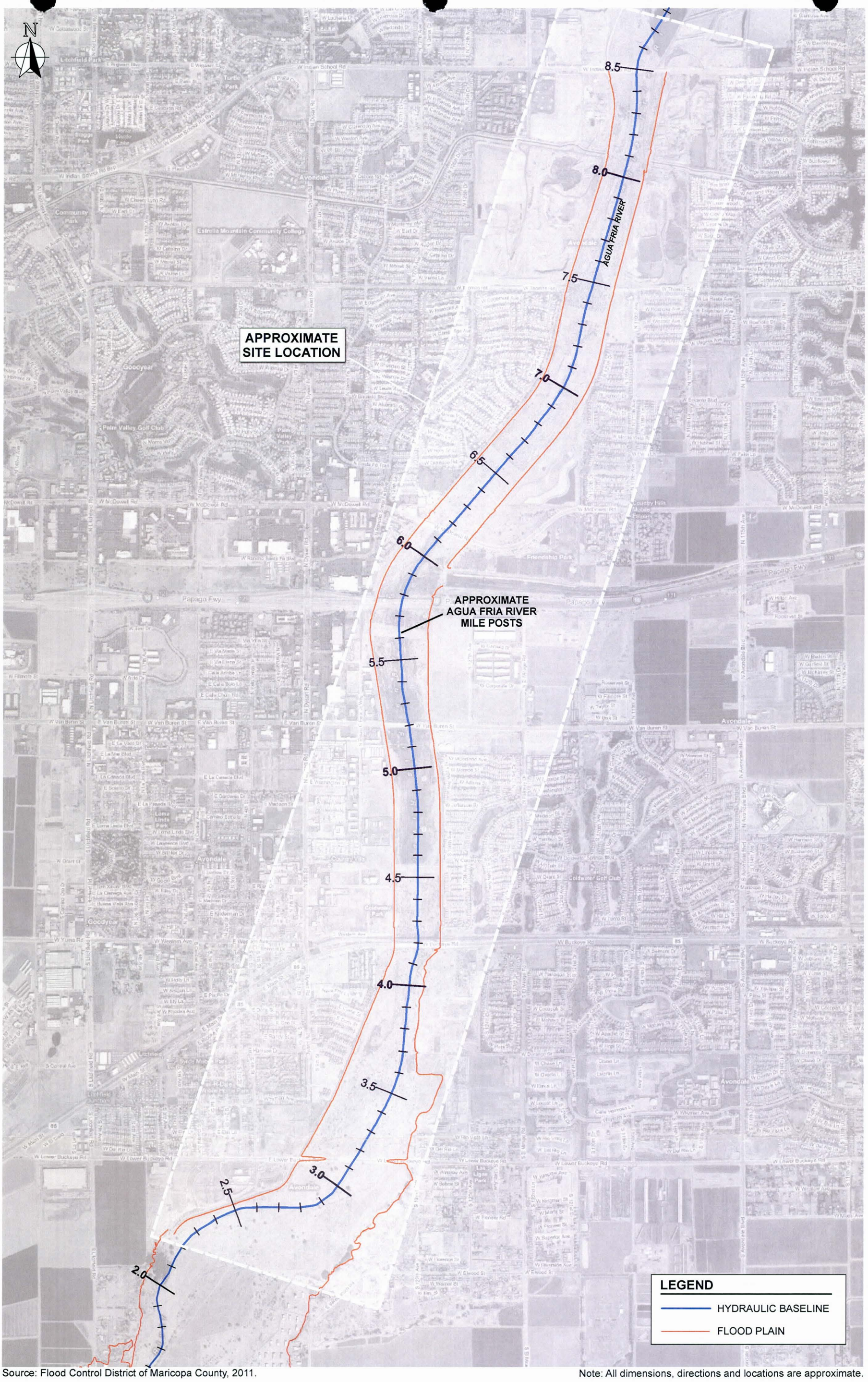
Ninyo & Moore



Source: Flood Control District of Maricopa County, 2011.

Note: All dimensions, directions and locations are approximate.

SCALE IN FEET

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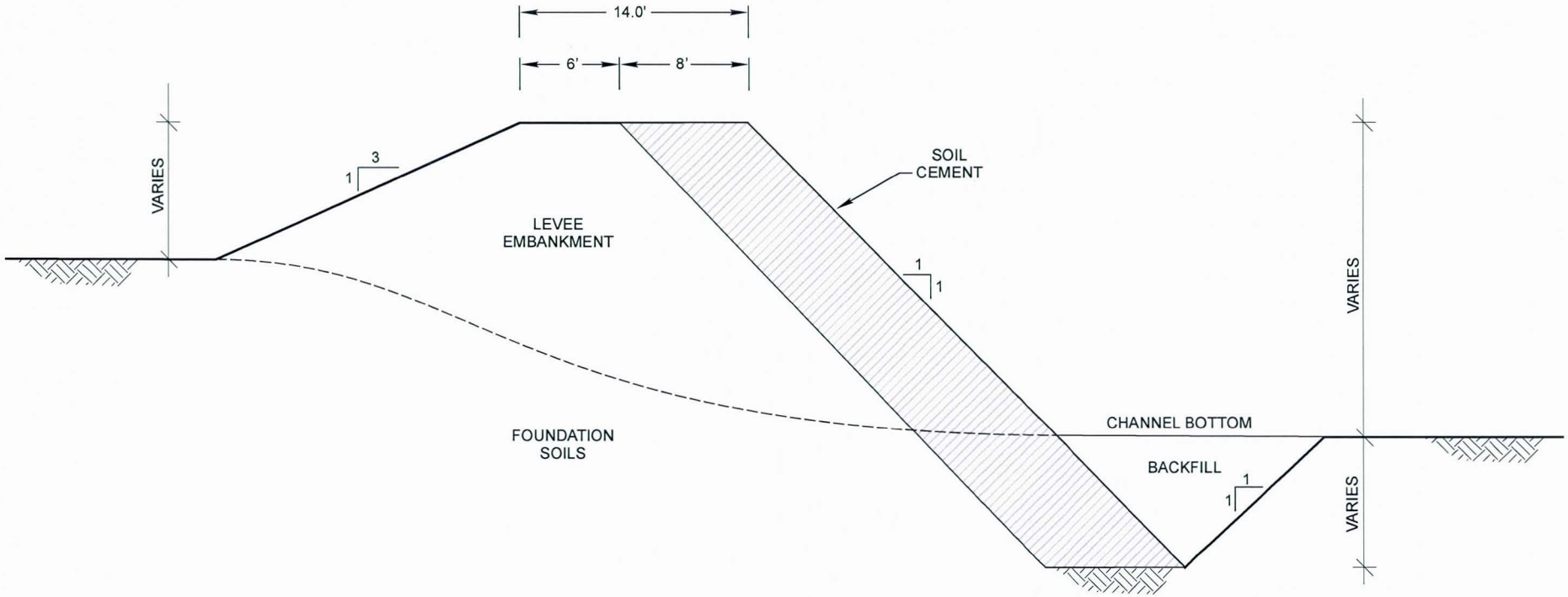
file no: 0550slm0511

Ninyo & Moore		SITE LOCATION MAP	FIGURE
PROJECT NO: 600550016	DATE: 6/11	AGUA FRIA LEVEE WEST, PAL 18 AVONDALE, ARIZONA	1

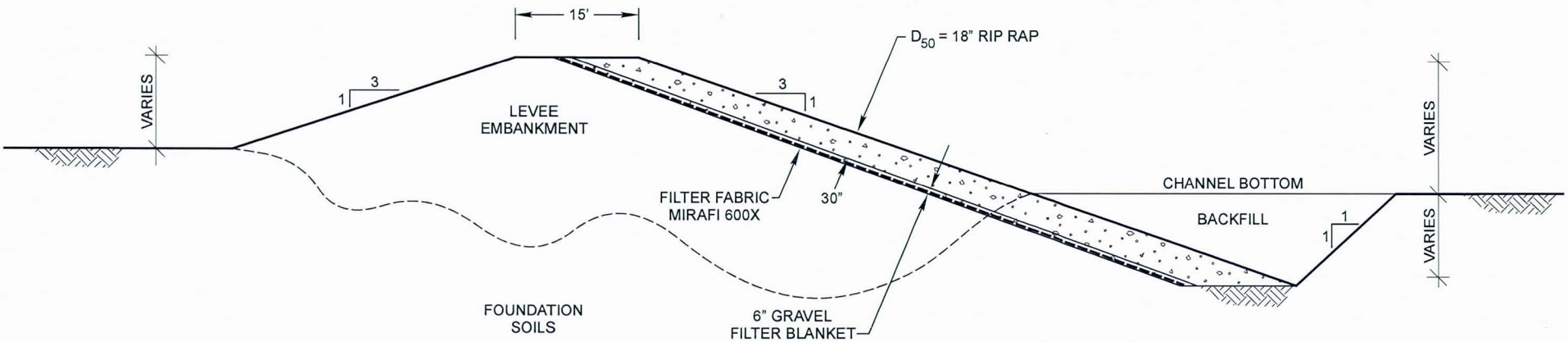


NOT TO SCALE

Note: All dimensions, directions and locations are approximate.

Ninyo & Moore	TYPICAL WEST LEVEE SECTION - SOIL-CEMENT PROTECTION	FIGURE
PROJECT NO: 600550016 / DATE: 6/11	AGUA FRIA LEVEE WEST, PAL 18 AVONDALE, ARIZONA	2

file no: 0550xsec0511a

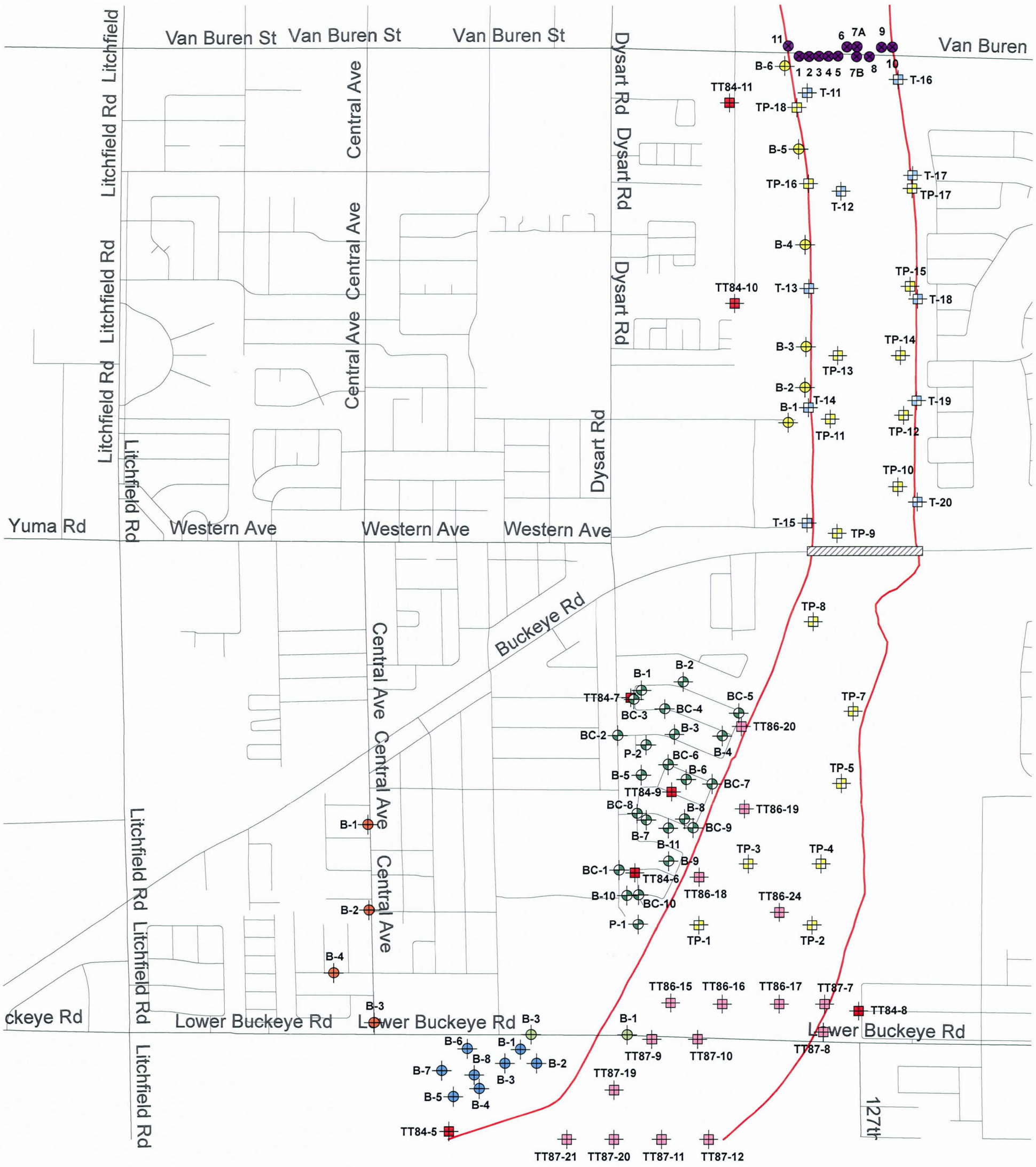


NOT TO SCALE

Note: All dimensions, directions and locations are approximate.

Ninyo & Moore	TYPICAL WEST LEVEE SECTION - RIP RAP PROTECTION	FIGURE
PROJECT NO: 600550016 / DATE: 6/11	AGUA FRIA LEVEE WEST, PAL 18 AVONDALE, ARIZONA	3

file no: 0550xsec0511b



LEGEND

B-1	Boring Location (Ninyo & Moore, 2004, #600727001)
B-1	Boring Location (Ninyo & Moore, 2005, #601017001)
B-1	Boring Location (Ninyo & Moore, 2007, #601886001)
B-1	Boring Location (Ninyo & Moore, 2009, #602498001)
B-1	Boring Location (CIT, 2002)
1	Boring Location (Plummer Hason & Associates, 11/85; and Sargent, Hauskins, & Beckwith, 3/14/1985)
TT84-5	Test Pit Location (USACE, May 1986)
TT86-15	Test Pit Location (USACE, July 1987)
TP-18	Test Pit Location (WTI, 1987)
T-20	Test Pit Location (Desert Earth, 1985)
	Buckeye Road Bridge Includes 40 Test Boring Locations, (ADOT, 1975)

N

SCALE 1 : 12,000

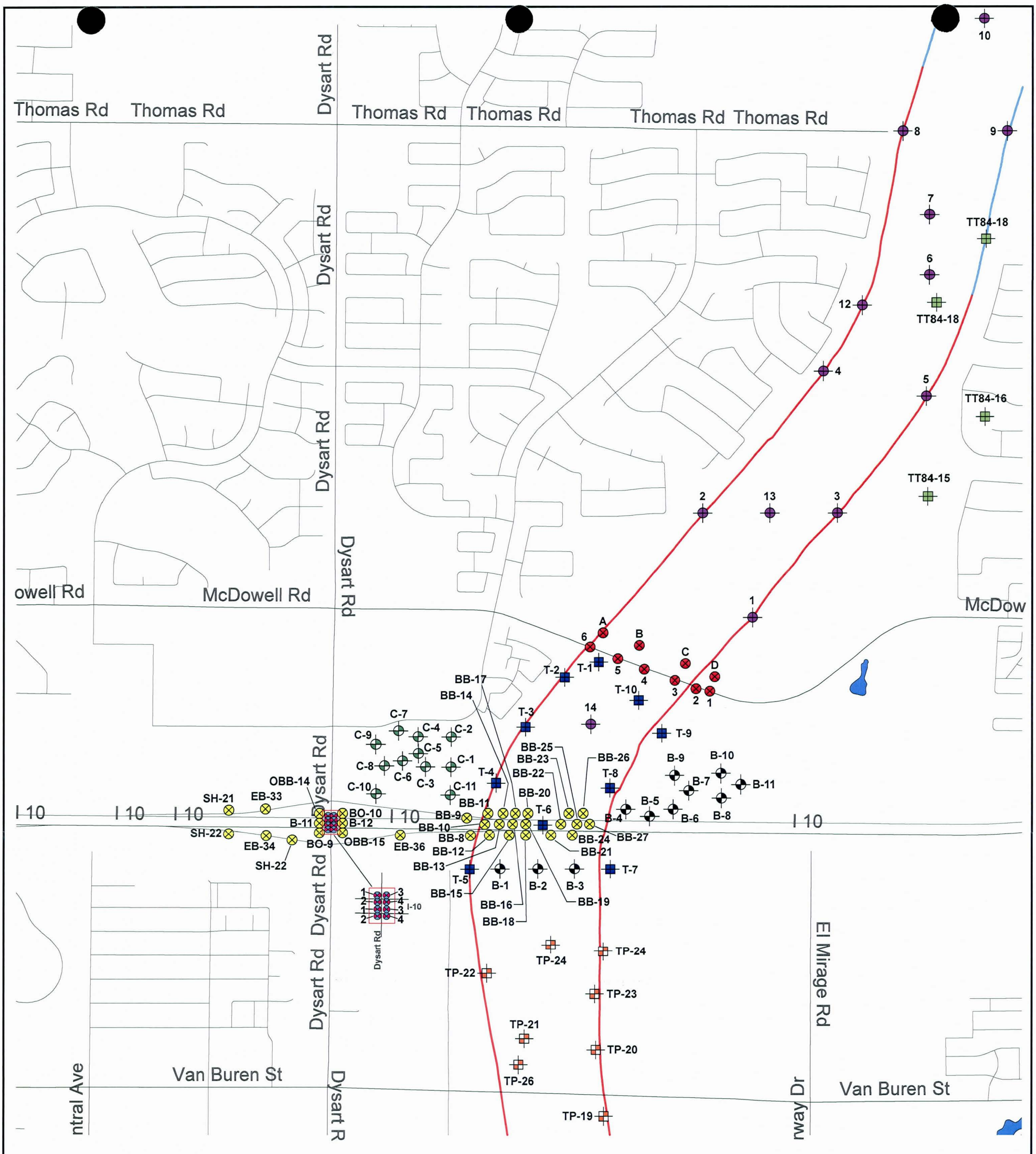
1,000 0 1,000 2,000 3,000

FEET

Note: All dimensions, directions and locations are approximate.
Source: Maricopa County Assessor's GIS Dept., 2011.

Ninyo & Moore		EXPLORATION LOCATION MAP - LOWER BUCKEYE ROAD TO VAN BUREN STREET	FIGURE
PROJECT NO: 600550016	DATE: 6/11	AGUA FRIA LEVEE WEST, PAL 18 AVONDALE, ARIZONA	A-A

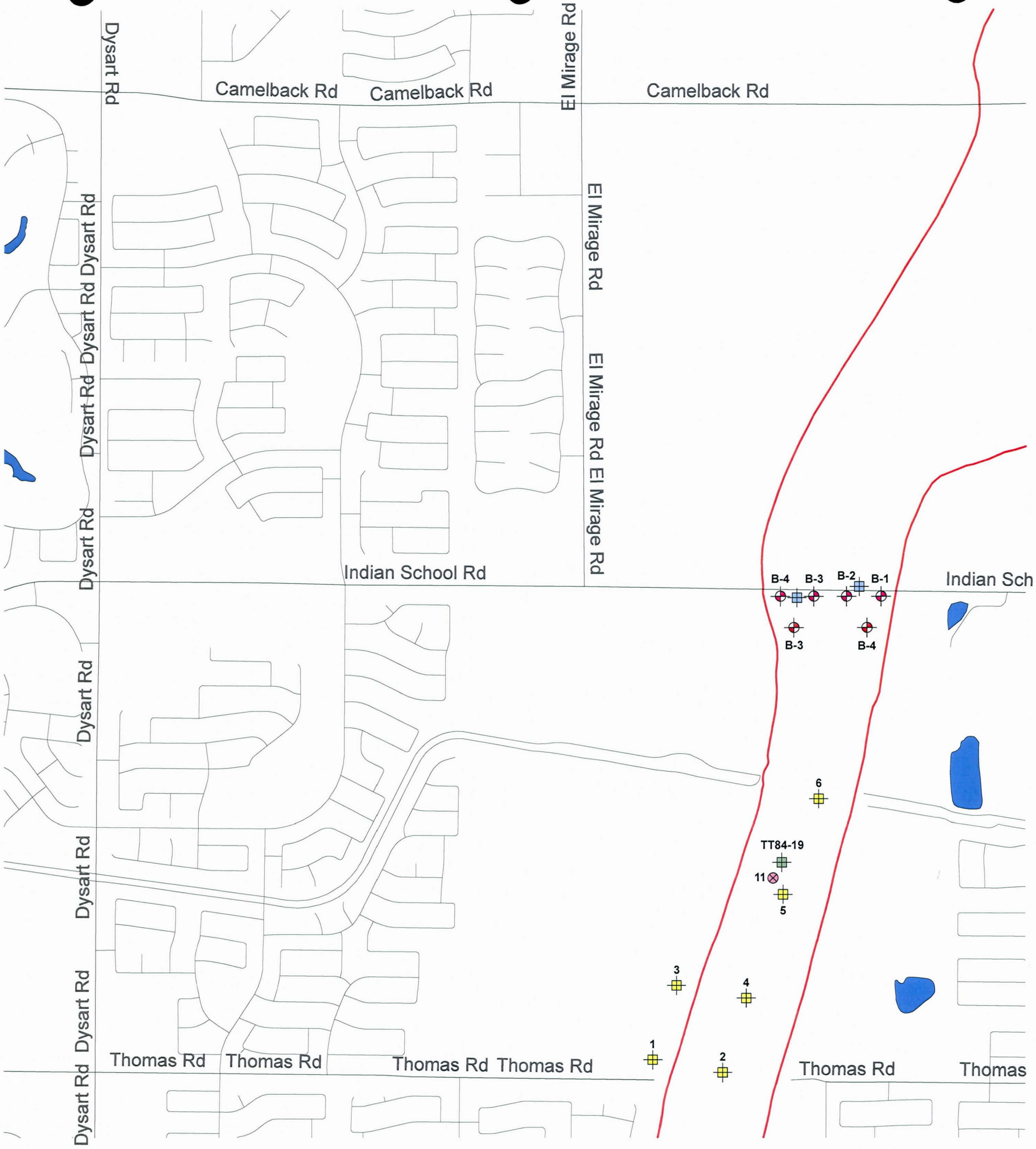
file no: 0550blm0511a



Note: All dimensions, directions and locations are approximate.
Source: Maricopa County Assessor's GIS Dept., 2011.

Ninyo & Moore	EXPLORATION LOCATION MAP - VAN BUREN STREET TO THOMAS ROAD	FIGURE
PROJECT NO: 600550016 / DATE: 6/11	AGUA FRIA LEVEE WEST, PAL 18 AVONDALE, ARIZONA	A-B

file no: 0550blm0511b



LEGEND

B-4	Boring Location (Desert Earth Engineering, 1984)
B-4	Boring Location (CH2M Hill, 2002)
11	Boring Location (Sergent, Huskins, & Beekwith, 6/18/1982)
TT84-19	Test Pit Location (USACE, May 1986)
6	Test Pit (Sergent, Huskins, & Beekwith, 9/26/1983)
	Test Pit (Michael Baker Jr., Inc., 6/11/1998)

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SCALE 1 : 12,000

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FEET

Note: All dimensions, directions and locations are approximate.
Source: Maricopa County Assessor's GIS Dept., 2011.

Ninyo & Moore	EXPLORATION LOCATION MAP - THOMAS ROAD TO INDIAN SCHOOL ROAD	FIGURE
PROJECT NO: 600550016 / DATE: 6/11	AGUA FRIA LEVEE WEST, PAL 18 AVONDALE, ARIZONA	A-C

file no: 0550blm0511c

Ninyo & Moore

APPENDIX A

EXPLORATORY LOGS

A-1

PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 1

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	14				moist	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown
			X	S	9			SP-SM	medium dense to loose	
5			X	S	19					
10			X	S	17			SM	slightly moist to moist medium dense	SILTY SAND, some gravel, traces of clay, nonplastic to low plasticity, brown
15			X	S	42			SW-SM	moist dense	SAND, some silt & gravel, well graded, nonplastic, brown
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

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.

SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 2

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	13			ML	moist moderately firm	SANDY SILT, low plasticity to nonplastic, brown
			X	S	18					
5			X	S	15				moist medium dense to very dense	SAND, some silt, trace of gravel, predominantly fine to medium, nonplastic, brown to light brown
								SP		
10			X	S	17					
15			X	U	100/8" (no recovery)					
20										Stopped auger at 14'6" Sampler refused at 15'2"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
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.

A-6

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JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 3

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	12			SM	moist medium dense	SILTY SAND, predominantly fine, nonplastic, brown
			X	U	31	93	9			
5			X	S	9				moist dense to loose	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown
								SP		
10			X	S	23					
								SW-SM	moist medium dense	SAND, some silt & gravel, nonplastic, brown to reddish-brown
15			X	S	27					
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

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.

A-7

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 4

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	16			ML	moist firm	SANDY SILT, low plasticity to nonplastic, brown
			X	S	11			SP-SM	moist medium dense	SAND, some silt, predominantly fine to medium, nonplastic, brown
5			X	S	14					
								SW-SM	moist medium dense	SAND, considerable gravel, some silt, well graded, nonplastic, brown
10			X	S	12		6			
								SP-SM	moist medium dense	SAND, some silt & gravel, predominantly fine to medium, nonplastic, reddish-brown to brown
15			X	S	23		7			
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
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.

A-8

SERGENT, HAUSKINS & BECKWITH

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 5

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	14			ML	dry	SANDY SILT, low plasticity to nonplastic, light brown to tan
			X	S	23(no recovery)				moderately firm	
5			X	S	25			SP-SM	slightly moist to moist medium dense	SAND, some to considerable silt, predominantly fine, nonplastic, light brown to tan
10			X	S	26			SW-SM	moist medium dense to dense	SAND, some silt & gravel, well graded, nonplastic, brown
15			X	S	34					
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
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.

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 6

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	14		13	ML	moist moderately firm	SANDY SILT, nonplastic, dark brown
			X	S	40			SM		
5			X	S	21		6	SP-SM	moist very firm	SILTY SAND, trace of gravel, predominantly fine, low plasticity to nonplastic, brown to dark brown
10			X	S	13			SW		note: some thin sandy silt lenses
									moist medium dense	SAND, considerable silt, predominantly fine, nonplastic, brown to light brown
15			X	S	14			SC		
									moist medium dense	SAND, some silt & gravel, well graded, nonplastic, brown to light brown
20									moist moderately firm	CLAYEY SAND, trace of gravel, predominantly medium, low plasticity to nonplastic, reddish-brown
										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
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.

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 7

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	17			SM	dry to moist firm	SILTY SAND, predominantly fine, nonplastic, brown
			X	S	46			ML	moist very firm	SANDY SILT, low plasticity to nonplastic, brown
5			X	S	20			SP	moist medium dense	SAND, some silt, trace of gravel, predominantly fine to medium, nonplastic, light brown
10			X	S	31			SW	moist to very moist dense	SAND, some silt & gravel, well graded, nonplastic, light brown
15			X	S	34					
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

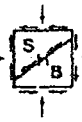
SAMPLE TYPE

A – Auger cuttings. B – Block sample

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.



A-11

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 8

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	24			SM	moist firm	SILTY SAND, predominantly fine, nonplastic, brown
			X	S	21		13	ML	moist firm to hard	SANDY SILT, low plasticity to nonplastic, brown
5			X	U	77 (no recovery)					
								SP-SM	moist medium dense	SAND, some silt & gravel, predominantly fine to medium, nonplastic, light brown to brown
10			X	S	19					
								SM-SW	moist very dense	SAND, considerable silt, some gravel, well graded, nonplastic, light brown
15			X	S	40					
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
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.

A-12

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 9

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	14			SP	slightly moist	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown
			X	S	9				medium dense to loose	
5			X	S	8			SW	slightly moist	SAND, some silt & gravel, well graded, nonplastic, brown
				S	50/0"				loose to very dense	note: trace of cobbles below 7'
10										Auger refused at 7'6" Sampler refused at 7'6"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

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.

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 10

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	4				dry to moist	SAND, some fine gravel, trace of silt, predominantly fine to medium, nonplastic, light brown
			X	S	9			SP	very loose to medium dense	
5			X	S	18		3			
10			X	S	50/2"			SW-SM	moist to very moist very dense	SAND, considerable silt & gravel, some cobbles, well graded, nonplastic, brown
15			X	S	50/2"					
20										Stopped auger at 14'6" Sampler refused at 15'2"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
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.

A-14

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 11

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	26				slightly moist	SILTY SAND, predominantly fine, nonplastic, brown
			X	S	12			SM	firm to very firm	
5			X	U	48		8			
10			X	S	20			SP	moist medium dense to dense	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown
15			X	S	35					
20			X	S	37			SM	moist very firm to hard	SILTY SAND, considerable gravel, trace of clay, well graded, nonplastic to low plasticity, brown
25			X	S	72					
30										Stopped auger at 24'6" Stopped sampler at 26'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
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.

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JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 12

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	12			ML	moist moderately firm	SANDY SILT, low plasticity to nonplastic, brown
			X	U	32	102	8			
5			X	S	12			SP	moist medium dense	SAND, some silt, trace of gravel, predominantly fine, nonplastic, light brown
10			X	S	18			SW	moist medium dense	SAND, some silt & gravel, well graded, nonplastic, brown to light brown
15			X	S	50/5½"			SW-SM	moist very dense	SAND, considerable gravel, some silt, well graded, nonplastic to low plasticity, brown

Stopped auger at 14'6"
Sampler refused at 14'11½"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
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.

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JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 13

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	16		12	ML	moist to saturated	SANDY SILT, nonplastic, brown
			X	S	7		30		firm	
5			X	S	10		5		very moist to moist	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown to light brown
								SP	loose	
10			X	S	7		4			
15			X	S	19			SW	moist medium dense	SAND, some gravel, trace of clay, well graded, nonplastic to low plasticity, brown
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

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.

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JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 14

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	7				dry to moist	SAND, some silt, predominantly fine to medium, nonplastic, light brown
			X	S	7		21	SP-SM	loose to medium dense	
5			X	S	14					
									very moist	SILTY SAND, some gravel, trace of clay, predominantly fine to medium, nonplastic to low plasticity, dark brown
10			X	S	46			SM	very firm	
15			X	S	41					
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

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.

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A-2

PROJECT SLA Job No. AZ-MC-05

JOB NO. LT83-3753 DATE 8-24-83

LOG OF TEST PIT NO. 1

Backhoe Type Case 580B

Location

Elevation

Datum

GROUND WATER

DEPTH	HOUR	DATE

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							SILT, nonplastic
2½		X			ML		
5		X			SP-SM		SAND, poorly graded, sand-silt mixture, nonplastic, very few cobbles
							Backhoe stopped at 6'

DATE 8-24-83

LOG OF TEST PIT NO. 2

Backhoe Type Case 580B

Location

Elevation

Datum

GROUND WATER

DEPTH	HOUR	DATE

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							SAND, poorly graded, nonplastic
2½		X			SP		
5		X			GP		GRAVEL, poorly graded, nonplastic, very few cobbles
							Backhoe stopped at 5½'

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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PROJECT SLA Job No. AZ-MC-05

JOB NO. LT83-3753 DATE 8-24-83

LOG OF TEST PIT NO. 3

Backhoe Type Case 580B

Location

Elevation

Datum

GROUND WATER

DEPTH	HOUR	DATE

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							SILTY SAND, nonplastic, very few cobbles
2½		X			SM		
5							
							Backhoe stopped at 6'

DATE 8-24-83

LOG OF TEST PIT NO. 4

Backhoe Type Case 580B

Location

Elevation

Datum

GROUND WATER

DEPTH	HOUR	DATE

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							SAND, poorly graded, nonplastic, very few cobbles
2½		X			SP		
5							
							Backhoe stopped at 6'

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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PROJECT SLA Job No. AZ-MC-05

JOB NO. LT83-3753 DATE 8-24-83

LOG OF TEST PIT NO. 5

Backhoe Type Case 580B

Location

Elevation

Datum

GROUND WATER

DEPTH	HOUR	DATE

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SP		SAND, poorly graded, nonplastic, trace of clay 1½'-2½'
2½		X			SP		SAND, some gravel, poorly graded, non-plastic, very few cobbles
5							
							Backhoe stopped at 6'

DATE 8-24-83

LOG OF TEST PIT NO. 6

Backhoe Type Case 580B

Location

Elevation

Datum

GROUND WATER

DEPTH	HOUR	DATE

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							SAND, poorly graded, nonplastic, very few cobbles
2½		X			SP		
5							
							Backhoe stopped at 6'

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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A-3

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING: See Site Plan Figure #1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

BORING NO.: B-1

SHEET: 1 of 2

ENGINEER: RWP

TIME: 7:30

DATE: 12 Sept 84

DATUM

ELEVATION 1000

CASING DEPTH

SURFACE CONDITIONS: River Bottom

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(SP) brown M-C SAND w/trace gravel; moist subrounded to subangular, loose
			1			
			2			cobbles
			3			
			4			
			5			
SS	18/18	8/8/6	6			
			7			
			8			
			9			
			10			
SS	18/18	2/1/2	11			
			12			
			13			
			14			
			15			(SW-SC)trace clay, very slightly plastic, well graded,
SS	18/18	11/14/9	16			
			17			
			18			
			19			
			20			coarse, gravel & cobbles, rounded to subrounded

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Ave

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH

BORING NO.: B-1

SHEET: 2 of 2

ENGINEER: RMP

TIME: 9:15

DATE: 12 Sept 84

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			20			(SP) brown medium SAND, moist, subrounded
SS	18/18	5/11/14	21			
			22			
			23			rocky drilling, cobbles
			24			rocky
			25			
			26			auger refusal @25.0'
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

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JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr.

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
	CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2
		SHEET 1 OF 1
	SAMPLING METHOD: Split-spoon Penetrometer	ENGINEER: RMP
		TIME: 1:30-2:30
DATUM	ELEVATION 1000 / CASING DEPTH	DATE: 12 Sept 84

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River bottom
			0			(SP) brown M-C SAND w/trace gravel, moist subangular, gap-graded
			1			
			2			occasional small cobbles
			3			
			4			
			5			split spoon refusal twice @ 5.0' - cobbles at bottom of hole
SS	0 / 0		6			coarse gravel - small cobbles in auger cuttings, rounded to subrounded
			7			
			8			
			9			
			10			(SP-SC) slight trace of clay
SS	11 / 10	7/15(5")	11			split spoon refusal after 11', rock
			12			cobbles
			13			cobbles & coarse gravel
			14			
			15			split spoon refusal after 6", rock
SS	6 / 0	13(6")	16			
			17			
			18			
			19			Auger refusal @ 17.5', rock
			20			

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JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr.

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
10 ft North of B-2	CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2a
		SHEET 1 OF 1
	SAMPLING METHOD	ENGINEER RMP
	Split-spoon Penetrometer	TIME
		DATE 12 Sept 84
DATUM	ELEVATION 1000 / CASING DEPTH	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW) brown SAND with trace gravel
			1			Occasional coarse gravel and cobbles
			2			
			3			
			4			Rocky Auger refusel @ 4.0 ft/ 2 times
			5			
			6			
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr.

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
30' NE of B-2	CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2b
		SHEET 1 OF 1
		ENGINEER RMP
	SAMPLING METHOD: Split-spoon Penetrometer	TIME 2:50-3:30
		DATE 12 Sept 84
DATUM	ELEVATION 1000 / CASING DEPTH	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0			Brown SAND with trace gravel
			1			Occasional cobbles
			2			
			3			Auger refusel @ 3.0 ft/ moved 1.0' SW
			4			
			5			
			6			
			7			Cobbles
			8			
			9			
			10			Boulder @ 10.0 ft
			11			
			12			Cobbles, very rocky
			13			
			14			Auger refusal @ 14.0
			15			
			6			
			7			
			8			
			9			
			0			

CHECKED

DATE

desert earth engineering

JOB NO	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Ave

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO
See Site Plan, Figure 1	CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2d
		SHEET 1 of 1
	SAMPLING METHOD	ENGINEER RMP
	Split-spoon Penetrometer	TIME 6:30-6:45
		DATE 13 Sept 84
DATUM	ELEVATION 1002	CASING DEPTH

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW) Brown SAND with trace gravel, moist subangular to subrounded, loose, wll-graded
			1			
			2			Occasional cobbles
			3			
			4			Rocky
			5			
			6			Auger refusal @ 5.0 ft
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

desert earth engineering

JOB NO	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Ave.

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
See Site Plan, Figure 1	CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-3
		SHEET 1 OF 1
	SAMPLING METHOD	ENGINEER RMP
	Split-spoon Penetrometer	TIME 6:45-7:20
		DATE 13 Sept 84
DATUM ELEVATION 1003	CASING DEPTH	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW) Brown SAND w/trace gravel, moist, loose subrounded to subangular, well-graded
			1			
			2			
			3			
			4			
			5			
			6			Rocky
			7			
			8			
			9			Occasional cobbles, rounded to subrounded
			10			
			11			
			12			
			13			Rocky, coarse gravel-and-cobble seam
			14			
			15			
SS	11/6	31/50/5"	16			Split spoon on a cobble final 6"
			17			Auger refusal @ 16.0'
			18			
			19			
			20			

desert earth engineering

JOB NO	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Pria Ave

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
See Site Plan, Figure 1	CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-4
		SHEET 1 OF
	SAMPLING METHOD	ENGINEER RHP
	Split-spoon Penetrometer	TIME 7:30-7:40
		DATE 13Sept 84
DATUM	ELEVATION 1005 / CASING DEPTH	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULK-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW) Brown SAND w/trace gravel & occasional cobbles, loose, dry, well-graded
			1			
			2			
			3			
			4			Large cobble or boulder
			5			
			6			Auger refusal @ 4.5'/ moved 2' south refusal @ 4.5' again
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr.

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
See Site Plan, Figure 1	CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-4a
		SHEET 1 OF 2
	SAMPLING METHOD	ENGINEER
	Split-spoon Penetrometer	RMP
		TIME 7:40-
		DATE
DATUM	CASING DEPTH	13 Sept 84

ELEVATION 1005

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW-SC) Brown SAND w/trace gravel, moist, loose
			1			1" layers of varved clay
						occasional cobbles
			2			1st Auger refusal @ 2.0 ft
			3			
			4			
			5			
			6			
			7			Occasional cobbles
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

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JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO.: B-4a

SHEET: 2 OF 2

ENGINEER: RMP

TIME: 8:30

DATE: 13Sept 84

DATUM

ELEVATION 1005

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			20			Cobbles and coarse gravel
			21			
			22			Auger refusal @ 21.0 ft
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

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A-4

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JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING: See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer and Ring Sampler

CASING DEPTH:

BORING NO.: B-1

SHEET: 1 OF 1

ENGINEER: RMP

TIME: 1:00

DATE: 31 Oct 84

DATUM: ELEVATION 967

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-ROSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						Loose riverbed sand
			0		(SW)	brown clean SAND; almost dry, well-graded
			1			
			2			
			3			
			4			
			5			
			6			cobbles and coarse gravel; subrounded to subangular
			7			trace clay, moist
			8			
			9			
SS	18/18	11/13/17	10			
			11			cobbles and gravel
			12			
			13			
			14			
SS	18/18	16/17/14	15			
			16			cobbles
			17			
			18			
SS	3/0	15 (3")	19			split-spoon refusal on a cobble @ 19.5
			20			auger refusal @ 20.0'

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING

See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer and Ring Sampler

CASING DEPTH:

BORING NO.: B-2

SHEET: 1 OF 2

ENGINEER: RMP

TIME: 12:10

DATE: 31 Oct 84

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(SP)	brown F-M SAND; loose, almost dry
			1			
			2			
			3			
			4			
			5		(SW)	sand more well-graded, dense
SS	18/18	5/16/24	6			
			7			trace clay, slightly moist
			8			some gravel, small cobbles, subrounded
			9			cobble
			10			
SS	18/18	12/17/16	11			
			12			coarse gravel & cobbles, subrounded
			13			
			14			slow drilling
			15			red-brown, trace clay; fractured rock in sampler
SS	12/12	28/27	16			
			17			rocky drilling; cobbles & possibly small boulders
			18			
			19			
			20			

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JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING: See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer and Ring Sampler

CASING DEPTH:

BORING NO.: B-2

SHEET: 2 OF 2

ENGINEER: RMP

TIME:

DATE: 31 Oct 84

DATUM: ELEVATION 969

SURFACE CONDITIONS

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			20			
SS	16 / 10	8/6/20(4")	21			red-brown GRAVELLY SAND with clay; moist slightly plastic. This material is the matrix of a SAND-GRAVEL-COBBLE seam that started @ 11.5'
			22			
			23			Auger refusal @ 22.0' Two teeth lost
			24			
			25			
			26			
			27			
			28			
			29			
			30			
			31			
			32			
			33			
			34			
			35			
			36			
			37			
			38			
			39			
			40			

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JOB NO.	CLIENT	LOCATION
84-209	Simons, Li	I-10 and AF

LOCATION OF BORING: See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO.: B-3

SHEET: 1 OF 2

ENGINEER: RMP

TIME:

DATE: 19 Sept 84

DATUM: ELEVATION:

SURFACE CONDITIONS: River bottom

SAMPLE TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(SP) brown f-m SAND with trace gravel, almost dry
			1			
			2			
			3			
			4			
			5			some fractured rock in sampler
S	18/18	6/14/16	6			
			7			rocky
			8			occasional coarse gravel, moist
			9			(SW) sand well-graded
			10			
S	18/18	6/6/7	11			
			12			
			13			
			14			
			15			
S	18/18	7/11/11	16			
			17			
			18			
			19			
			20			

log continued on next page

desert earth engineering

JOB NO	CLIENT	LOCATION
84-200	Simons, Li & Associates	Siltation Basin

LOCATION OF BORING: See Site Plan Figure #1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO. B-4

SHEET 1 OF 1

ENGINEER RKP

TIME 7:00-7:50

DATE 14 Sept 84

DATUM

ELEVATION

SURFACE CONDITIONS: flat flood plain

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(SP) brown fine SAND, moist, loose
			1			
			2			coarser sand
			3			cobbles, trace gravel
			4			
			5			some varved SAND w/some clay, slightly plastic
SS	18/18	15/14/19	6			
			7			
			8			
			9			
			10			Layered, SAND-CLAY-SILT mixes, mostly sand, slightly plastic
SS	18/18	9/21/14	11			
			12			(SW) well-graded SAND w/trace gravel, moist subangular to subrounded
			13			
			14			
			15			
SS	18/18	8/17/18	16			almost dry
			17			
			18			
			19			rocky; gravel & cobbles, subrounded
			20			bottom 20.0

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desert earth engineering

JOB NO	CLIENT	LOCATION
84-200	Simons, Li & Associates	Siltation Basin

LOCATION OF BORING: See Site Plan Figure #1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO: B- 5

SHEET: 1 OF 1

ENGINEER: RMP

TIME: 8:30-9:15

DATE: 14 Sept 84

DATUM: ELEVATION:

SURFACE CONDITIONS: flat flood plain

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(SM) brown SILTY SAND, slightly moist, loose, nonplastic
SS	18/10	3/2/3	1			
			2			
			3			
			4			dry
			5			
			6			
			7			
			8			with some silt
			9			gravel
			10			(SW) almost clean SAND, loose, well-graded
SS	18/18	5/10/6	11			
			12			
			13			
			14			cobbels & coarse gravel, subangular to subrounded
			15			
			16			
			17			
			18			
			19			bottom @ 20.0'
			20			

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desert earth engineering

JOB NO.	CLIENT	LOCATION
84-200	Simons, Li & Associates	Siltation Basin

LOCATION OF BORING: See Site Plan Figure #1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO.: B-6

SHEET: 1 OF 1

ENGINEER: RMP

TIME: 10:30-10:50

DATE: 14 Sept 84

DATUM: ELEVATION:

SURFACE CONDITIONS: flat flood plain

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(ML) brown SANDY SILT, moist, loose, nonplastic
			1			
			2			dry
			3			
			4			
			5			
			6			rocky-cobbles or coarse gravel
			7			(SP-SM) light brown fine SAND w/trace silt
			8			slightly coarser sand
			9			
			10			rocky - coarse gravel
			11			
			12			
			13			
			14			
			15			rocky - coarse gravel, slightly moist
			16			(SW) sand well-graded
			17			
			18			
			19			bottom @ 20.0'
			20			

desert earth engineering

JOB NO	CLIENT	LOCATION
84-200	Simons, Li & Associates	Siltation Basin

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
See Site Plan Figure #1	CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-7
		SHEET 1 OF 1
	SAMPLING METHOD	ENGINEER RMP
	Split-spoon Penetrometer	TIME 12:20-12:50
		DATE 14 Sept 84
DATUM ELEVATION	CASING DEPTH	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS: flat flood plain
			0			(SM) light brown SILTY SAND w/trace gravel, dry, loose, nonplastic
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			(SP-SM) brown fine-medium SAND w/trace silt dry
			9			gravel
			10			
			11			
			12			(SW-SM) sand more well-graded gravel & cobbles
			13			
			14			
			15			
			16			
			17			cobbles
			18			
			19			bottom @ 20.0'
			20			gravel seam

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JOB NO.	CLIENT	LOCATION
84-200	Simons, Li & Associates	Siltation Basin

LOCATION OF BORING

See Site Plan Figure #1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO.: B-8

SHEET: 1 OF 1

ENGINEER: RMP

TIME: 10:55-12:00

DATE: 14 Sept 84

DATUM

ELEVATION

SURFACE CONDITIONS

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(SM) brown SILTY SAND w/trace gravel, slightly moist, loose, nonplastic
			1			
			2			
			3			
			4			with some silt
			5			
SS	18 / 18	7/7/8	6			rocky - coarse gravel
			7			rocky
			8			
			9			(SP) fine-medium almost lean SAND, medium dense
			10			
SS	18 / 18	5/6/7	11			
			12			some gravel
			13			
			14			
			15			
			16			
			17			
			18			
			19			bottom @ 20.0'
			20			

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JOB NO.	CLIENT	LOCATION
84-209	Simons, Li	Siltation Basin

LOCATION OF BORING: See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO.: B-9

SHEET: OF

ENGINEER: RMP

TIME: 7:50

DATE: 19 Sept 84

DATUM: ELEVATION:

SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(SP) brown fine SAND with trace silt and gravel; loose non-plastic
			1			
			2			
			3			(SM) drier, slightly more silt
			4			
SS	18/18	6/6/6	5			
			6			
			7			
			8			clean sand, slightly moist
			9			
			10			
			11			
			12			trace gravel
			13			
			14			(SW) trace gravel, more well-graded
SS	18/	12/12/22	15			
			16			
			17			gravel
			18			
			19			
			20			bottom at 19.5ft

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JOB NO.	CLIENT	LOCATION
84-209	Simons, Li	Siltation Basin

LOCATION OF BORING: See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO: B-10

SHEET: OF

ENGINEER: RMP

TIME: 7:00

DATE: 19 Sept 84

DATUM: ELEVATION:

SURFACE CONDITIONS: Flat field

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(SP) brown fine SAND with trace gravel and trace salt, slightly moist, loose
			1			
			2			
			3			
			4			(SM) brown SILTY fine SAND, dry, loose, non-plastic
			5			
			6			(SP) brown F-M SAND with trace gravel, loose dry
			7			
			8			
			9			
SS	18/18	5/6/9	10			
			11			
			12			(SW) sand more well-graded
			13			
			14			
			15			
			16			more gravel
			17			
			18			
			19			
			20			bottom at 19.5ft

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JOB NO.	CLIENT	LOCATION
84-209	Simons, Li	Siltation Basin

LOCATION OF BORING: See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO.: B-11

SHEET: OF

ENGINEER: RMP

TIME: 6:30

DATE: 19 Sept 84

DATUM: ELEVATION:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	DULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0			(SP) brown f-m SAND with trace gravel, loose moist, rounded to subrounded
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
SS	18/18	5/5/6	10			
			11			
			12			
			13			
			14			slight rockiness - gravel
			15			
			16			
			17			
			18			
			19			
			20			bottom at 19.5ft

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A-5

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APPENDIX A

Soil Boring Logs

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JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING: See Site Plan Figure #1

DRILLING METHOD & EQUIPMENT: CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO.: B-1

SHEET: 1 OF 2

ENGINEER: RMP

TIME: 7:30

DATE: 12 Sept 84

DATUM:

ELEVATION: 1000

SURFACE CONDITIONS: River Bottom

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(SP) brown M-C SAND w/trace gravel; moist subrounded to subangular, loose
			1			
			2			cobbles
			3			
			4			
			5			
SS	18/18	8/8/6	6			
			7			
			8			
			9			
			10			
SS	18/18	2/1/2	11			
			12			
			13			
			14			
			15			(SW-SC)trace clay, very slightly plastic, well graded,
SS	18/18	11/14/9	16			
			17			
			18			
			19			
			20			coarse gravel & cobbles, rounded to

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JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH

BORING NO.: B-1

SHEET: 2 of 2

ENGINEER: RMP

TIME: 9:15

DATE: 12 Sept 84

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			20			(SP) brown medium SAND, moist, subrounded
SS	18/18	5/11/14	21			
			22			
			23			rocky drilling, cobbles
			24			rocky
			25			
			26			auger refusal @25.0'
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			

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#61

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

BORING NO.: B-2

SHEET: 1 OF 1

ENGINEER: RMP

SAMPLING METHOD: Split-spoon Penetrometer

TIME: 1:30-2:30

DATE: 12 Sept 84

CASING DEPTH:

DATUM

ELEVATION 1000

SURFACE CONDITIONS: River bottom

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	
			0			(SP) brown M-C SAND w/trace gravel, moist subangular, gap-graded
			1			
			2			occasional small cobbles
			3			
			4			
			5			split spoon refusal twice @ 5.0' - cobbles at bottom of hole
SS	0/0		6			coarse gravel - small cobbles in auger cuttings, rounded to subrounded
			7			
			8			
			9			
			10			(SP-SC) slight trace of clay
SS	11/10	7/15(5")	11			split spoon refusal after 11', rock
			12			cobbles
			13			cobbles & coarse gravel
			14			
			15			split spoon refusal after 6", rock
SS	6/0	13(6")	16			
			17			
			18			
			19			Auger refusal @ 17.5', rock
			20			

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
10 ft North of B-2	CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2a
		SHEET 1 OF 1
	SAMPLING METHOD: Split-spoon Penetrometer	ENGINEER: RMP
		TIME:
		DATE: 12 Sept 84
DATUM	ELEVATION 1000 / CASING DEPTH	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW) brown SAND with trace gravel
			1			Occasional coarse gravel and cobbles
			2			
			3			
			4			Rocky Auger refusel @ 4.0 ft/ 2 times
			5			
			6			
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
30' NE of B-2	CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2b
		SHEET 1 OF 1
	SAMPLING METHOD	ENGINEER RMP
	Split-spoon Penetrometer	TIME 2:50-3:30
		DATE 12 Sept 84
DATUM	ELEVATION 1000	CASING DEPTH

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0			Brown SAND with trace gravel
			1			Occasional cobbles
			2			
			3			Auger refusel @ 3.0 ft/ moved 1.0' SW
			4			
			5			
			6			
			7			Cobbles
			8			
			9			
			10			Boulder @ 10.0 ft
			11			
			12			Cobbles, very rocky
			13			
			14			Auger refusal @ 14.0
			15			
			6			
			7			
			8			
			9			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
See Site Plan, Figure 1	CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2d
		SHEET 1 OF 1
	SAMPLING METHOD	ENGINEER RMP
	Split-spoon Penetrometer	TIME 6:30-6:45
		DATE 13 Sept 84
DATUM	ELEVATION 1002	CASING DEPTH

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULK-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW) Brown SAND with trace gravel, moist subangular to subrounded, loose, wll-graded
			1			
			2			Occasional cobbles
			3			
			4			Rocky
			5			
			6			Auger refusal @ 5.0 ft
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Avr.

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
See Site Plan, Figure 1	CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-3
		SHEET 1 OF 1
	SAMPLING METHOD	ENGINEER RHP
	Split-spoon Penetrometer	TIME 6:45-7:20
		DATE 13 Sept 84
DATUM ELEVATION 1003	CASING DEPTH	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS: River Bottom
			0			(SW) Brown SAND w/trace gravel, moist, loose subrounded to subangular, well-graded
			1			
			2			
			3			
			4			
			5			
			6			Rocky
			7			
			8			
			9			Occasional cobbles, rounded to subrounded
			10			
			11			
			12			
			13			Rocky, coarse gravel-and-cobble seam
			14			
			15			
SS	11/6	31/50/5"	16			Split spoon on a cobble final 6"
			7			Auger refusal @ 16.0'
			8			
			9			

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Avr.

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
See Site Plan, Figure 1	CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-4
		SHEET 1 OF
	SAMPLING METHOD	ENGINEER RMP
	Split-spoon Penetrometer	TIME 7:30-7:40
		DATE 13Sept 84
DATUM	ELEVATION 1005	CASING DEPTH

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULK-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW) Brown SAND w/trace gravel & occasional cobbles, loose, dry, well-graded
			1			
			2			
			3			
			4			Large cobble or boulder
			5			
			6			Auger refusal @ 4.5'/ moved 2' south refusal @ 4.5' again
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Avr.

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
See Site Plan, Figure 1	CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-4a
		SHEET 1 OF 2
	SAMPLING METHOD: Split-spoon Penetrometer	ENGINEER: RMP
		TIME: 7:40-
		DATE: 13 Sept 84
DATUM	ELEVATION 1005	CASING DEPTH

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS: River Bottom
			0			(SW-SC) Brown SAND w/trace gravel, moist, loose
			1			1" layers of varved clay
						occasional cobbles
			2			1st Auger refusal @ 2.0 ft
			3			
			4			
			5			
			6			
			7			Occasional cobbles
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: CME-45 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

BORING NO.: B-4a

SHEET: 2 OF 2

ENGINEER: RMP

TIME: 8:30

DATE: 13Sept 84

DATUM

ELEVATION 1005

CASING DEPTH

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			20			Cobbles and coarse gravel
			21			
			22			Auger refusal @ 21.0 ft
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING: See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT: CASE 580 Backhoe equipped with 18" bucket

BORING NO.: T-1

SHEET: OF

ENGINEER: RMP

SAMPLING METHOD:

TIME:

DATE: 6 Nov 84

CASING DEPTH:

DATUM: ELEVATION:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(SW)	brown SAND with trace gravel & occasional cobbles; slightly moist, soft
			1			
			2			
			3			side slopes below 3' nearly vertical
B			4			slightly fewer cobbles, moist
			5			
			6			
			7			
			8			
			9			
			10			harder
			11			
			12			
			13			
			4			bottom @ 12.5'
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT

SAMPLING METHOD

CASING DEPTH

DATUM

ELEVATION

BORING NO.	SHEET	ENGINEER	TIME	DATE
T-2	OF	RMP	8:20	6 Nov 84

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0			(SP) brown medium SAND with trace coarse gravel slightly moist, side slopes @ 1:1
			1			
			2			occasional 6-18" seams of well-graded SAND with some gravel, few cobbles
			3			
			4		(SM)	SILTY SAND pockets; moist, soft
			5			
			6			
			7			
			8			
			9			
			10			
			11			bottom @ 10.5'
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
		T-3
		SHEET OF
	SAMPLING METHOD	ENGINEER RMP
		TIME 9:00
DATUM ELEVATION	CASING DEPTH	DATE 6 Nov 84

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT.	SOIL GRAPH	SURFACE CONDITIONS
			0			(SP-SM) brown fine SAND with trace silt; dry loose
			1			clean SAND
			2			piece of rebar @2.0', side slopes @ 1:1 to 2:1
			3			some layers of well-graded SAND with some gravel
			4			
			5			
			6			no significant change in material
			7			
			8			
			9			
			10			
			11			bottom @ 10.5'
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: Case 580 backhoe with 18" bucket

BORING NO.: T-4

SHEET: OF

ENGINEER: RMP

SAMPLING METHOD

TIME: 9:55

DATE: 6 Nov 84

CASING DEPTH

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT.	SOIL GRAPH	SURFACE CONDITIONS
			0		(SM)	brown SILTY SAND; medium dense,
			1			occasional coarse gravel, vertical
						side slopes
			2			
B			3			
			4			
			5			
			6			less silt, some lime cementation
			7			
			8			brown SAND with trace silt; dense
			9			
			10			vertical side slopes entire depth
			11			
			12			backhoe refusal @ 10.5'; very hard caliche layer
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: Case 580 backhoe

BORING NO.: T-5

SHEET: OF

ENGINEER: RMP

SAMPLING METHOD

TIME: 10:30

DATE: 6 Nov 84

DATUM

ELEVATION

CASING DEPTH

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULK-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(SM)	brown SILTY SAND, soft
			1			
			2			
			3			
			4			
			5			
			6			Bottom of hole at 6.0'
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD. BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: Case 580 backhoe with 18" bucket

BORING NO.: T-6

SHEET: OF

ENGINEER: RMP

SAMPLING METHOD

TIME: 10:40

DATE: 6 Nov 84

CASING DEPTH

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(SP)	brown fine-to-medium SAND with trace gravel; medium dense, dry. slopes 1:1
			1			
			2			
			3			
			4			
			5			coarse gravel seam
			6			
			7			
			8			
			9			material consistent 0-10'. No cobbles encountered
			10			
			11			bottom @ 10.0'
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT

BORING NO. T-7

SHEET OF

ENGINEER RMP

SAMPLING METHOD

TIME 11:23

DATE 6 Nov 84

CASING DEPTH

DATUM ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(SP)	brown fine SAND with some silt, dry
			1			some roots
			2			
			3			
			4			
			5			
			6			
			7			slightly moist
			8			material consistent to 8.0'
			9			bottom @ 8.0'
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: Case 580 backhoe equipped with 18" bucket

BORING NO.: T-8

SHEET: OF

ENGINEER: RMP

SAMPLING METHOD

TIME: 11:33

DATE: 6 Nov 84

CASING DEPTH

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						BANK
			0			(SM) brown SAND with some silt; slightly moist
			1			some coarse gravel pockets,
			2			(SP) brown, almost clean, fine-to-medium SAND
			3			
			4			
			5			
			6			(SW) SAND is well-graded
			7			
			8			
			9			
			10			
			11			
			12			
			13			bottom @ 11.5'
			14			
			15			
			16			
			17			
			18			
			19			
			20			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: Case 580 backhoe

BORING NO.: T-9

SHEET: OF

ENGINEER: RMP

SAMPLING METHOD

TIME: 12:16

DATE: 6 Nov 84

CASING DEPTH

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						Bank
			0			(SM) brown SILTY SAND
			1			
			2			
			3			
			4			
			5			
			6			
			7			bottom @ 6.0'
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-209	Simons, Li & Associates	AF & I-10

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: Case 580 backhoe

BORING NO.: T-10

SHEET: OF

ENGINEER: RMP

SAMPLING METHOD

TIME: 12:22

DATE: 6 Nov 84

CASING DEPTH

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT.	SOIL GRAPH	SURFACE CONDITIONS
						Riverbed - gravel & cobbles on surface
			0		(SW)	brown SAND with trace gravel and occasional cobbles; slightly moist, well-graded, rounded to subrounded
			1			
			2			
			3			large fragments of concrete at 3-4'
			4			bottom @ 4'
			5			
			6			
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-211	Simons, Li & Associates	AF & VB

LOCATION OF BORING: See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT: Case 580 backhoe equipped with 18" bucket

BORING NO.: T-11

SHEET: OF

ENGINEER: RMP

SAMPLING METHOD:

TIME: 1:50

DATE: 6 Nov 84

CASING DEPTH:

DATUM: ELEVATION:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(GW)	SANDY GRAVEL
			1		(SP)	brown fine SAND with trace gravel; dry loose
			2			
			3			side slopes @ 1:1 from 0-15'
			4			
			5			
			6		(SW)	SAND is well-graded
			7			
			8			
			9		(SP)	brown clean F-M SAND with trace gravel and occasional cobbles; medium dense, dry
			10			
			11			
			12			
			13			
			14			
			15			bottom @ 15.0'
			16			
			17			
			18			
			19			
			20			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-211	Simons, Li & Associates	AF & VB

LOCATION OF BORING: See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT

SAMPLING METHOD

CASING DEPTH

BORING NO.: T-12

SHEET: OF

ENGINEER: RMP

TIME: 2:00

DATE: 6 Nov 84

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(SW)	brown well-graded SAND with trace gravel and occasional cobbles
			1			
			2			
			3			brown-red SAND with trace silt 1-2" gravel & cobble seams every 6-12" from 2.5 - 20'
			4			
			5			
			6			
			7			
			8			
			9			
			10			
			11			
			12			
			13			
			14			
			15			material consistent 2.5 - 20'
			16			
			17			
			18			
			19			bottom @ 20.0'
			20			

CHKD BY

DATE

desert earth engineering	JOB NO. 84-211	CLIENT Simons, Li & Associates	LOCATION AF & VB

LOCATION OF BORING	DRILLING METHOD & EQUIPMENT	BORING NO.
See Site Plan, Figure 1	Case 580 backhoe equipped with 18" bucket	T-13
		SHEET OF
	SAMPLING METHOD	ENGINEER RMP
		TIME 2:11
DATUM ELEVATION	CASING DEPTH	DATE 6 Nov 84

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(SW)	brown well-graded SAND with trace gravel; dry, medium dense
			1			
			2			
			3			occasional fine gravel seams 2.5 - 4'
			4			
			5			pockets with trace to some silt
			6			
			7			side slopes 1.5:1
			8			
			9			bottom @ 8.0'
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

DATE ____ CHKD BY ____

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-211	Simons, Li & Associates	AF & VB

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: Case 580 backhoe

BORING NO.: T-14

SHEET ___ OF ___

ENGINEER: RMP

SAMPLING METHOD

TIME: 2:45

DATE: 6 Nov 84

CASING DEPTH

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						Farmer's field
			0			(SM) brown SILTY SAND; dry, loose, some organics
			1			
			2			some 3-6" layers of fine SAND
			3			
			4			
			5		(SP)	brown, fine-to-medium SAND
			6			
			7			
			8			
			9			
			10			
			11			
			12			
			3			bottom @ 12.0'
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY ___

DATE ___

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-211	Simons, Li & Associates	AF & VB

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: Case 580 backhoe

BORING NO.: T-15

SHEET: OF

ENGINEER: RMP

SAMPLING METHOD

TIME: 3:10

DATE: 6 Nov 84

CASING DEPTH

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0			red-brown SAND with trace gravel and clay,
			1			intermixed with garbage, very
						odiferous.
			2			tent fabric
			3			bottles, grass cuttings
			4			tire, tree stump,
						newspapers at 4.0' dated July, 1980
			5			palm fronds
						pipe fittings
			6			old telephone wire
						aerosal spray can
			7			mattress, two-by-four
			8			paper plates, grass cuttings
			9			tennis shoe, comics, plastic buckets
			10			hose, tomato juice cans
			11			door screen, August 1980 newspaper
			12			palm verde branch
			3			bottom @ 12.5'
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-211	Simons, Li & Associates	AF & VB

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: Case 580 backhoe

SAMPLING METHOD

CASING DEPTH

BORING NO.: T-16

SHEET OF

ENGINEER: RMP

TIME: 1:25

DATE: 7 Nov 84

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT.	SOIL GRAPH	SURFACE CONDITIONS
			0			(SM) brown SILTY fine SAND
			1			
			2			
			3			
			4			
			5			
			6			(SW) brown SAND with some gravel; dry, well-graded
			7			cobble and coarse gravel seam
			8			(GP) brown, fine SAND
			9			well-graded, moist
			10			
			11			
			12			
			3			
			4			bottom @12.5'
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-211	Simons, Li & Associates	AF & VB

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT

SAMPLING METHOD

CASING DEPTH

BORING NO. T-17

SHEET OF

ENGINEER RMP

TIME 1:50

DATE 7 Nov 84

DATUM ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(SM)	brown SILTY fine SAND
			1			
			2			
			3			
			4			
			5			varved 6-8" layers of CLAY
			6		(SP)	fine brown SAND
			7		(SW)	well-graded SAND with some gravel
			8			
			9			occasional cobbles
			10			
			11			
			12			
			13			
			4			bottom @13.0'
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-211	Simons, Li & Associates	AF & VB

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT

BORING NO. T-18

SHEET OF

ENGINEER RMP

SAMPLING METHOD

TIME 2:05

DATE 7 Nov 84

CASING DEPTH

DATUM ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT.	SOIL GRAPH	SURFACE CONDITIONS
			0		(ML)	brown SANDY SILT; dry medium dense some roots to about 4.0'
			1			
			2			
			3			
			4			intermittent SAND layers alternating with SILTY SAND and trace gravel
			5			
			6		(SM)	SAND with some SILT; occasional seams of clean sand.
			7			
			8			
			9			gravel seam
			10			
			11			cobble
			12			bottom @ 11.0'
			13			
			14			
			15			
			16			
			17			
			18			
			19			
			20			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-211	Simons, Li & Associates	AF & VB

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT

SAMPLING METHOD

CASING DEPTH

BORING NO. T-19

SHEET OF

ENGINEER RMP

TIME 2:30

DATE 7 Nov 84

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT.	SOIL GRAPH	SURFACE CONDITIONS
			0			(SM) brown SILTY SAND; dry, medium dense
			1			
			2			
			3			
			4			
			5			slightly moist
			6			
			7			
			8			some varved red-black clay and some in small pockets, moist, very platic
			9			
			10			(SW) brown SAND with trace gravel
			11			
			12			gravel seam
			13			
			14			bottom @ 14.0'
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

desert earth engineering

JOB NO.	CLIENT	LOCATION
84-211	Simons, Li & Associates	AF & VB

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT

SAMPLING METHOD

CASING DEPTH

BORING NO. T-20

SHEET OF

ENGINEER RMP

TIME 2:55

DATE 7 Nov 84

DATUM ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0		(SM)	brown SILTY fine SAND, loose
			1			occasional small gravel and sand seams, denser
			2			
			3			
			4			
			5			
			6			
			7			slightly more sand
			8			
			9		(SW)	clean SAND with some gravel
			10			
			11			
			12			
			13			
			14			bottom @ 14.0'
			15			
			16			
			17			
			18			
			19			
			20			

CHKD BY

DATE

#61

A-6

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 2-4-85

LOG OF TEST BORING NO. 1

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 971.0'±

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			S		11			ML	moist moderately firm	CLAYEY SILT, medium plasticity, brown note: lens of sandy silt at 4'6"
5			S		50/5"			SP	moist very dense to medium dense	SAND, poorly graded, fine grained, subangular to subrounded, nonplastic, light brown note: some cobbles at 5'6"
10			S		21					
15			S		25			SC	moist medium dense	CLAYEY SAND, some gravel, medium to coarse grained sand, rounded to subrounded, nonplastic, brown
20			S		50/6"			GC	moist very dense	CLAYEY SAND, considerable gravel, poorly graded, rounded sand, nonplastic, brown note: cobbles & large gravel at 17'6"
25										Auger refused at 23' Hole caved to 7'6"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 2-4-85

LOG OF TEST BORING NO. 2

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 970.0'±

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			S		18			SM	moist medium dense	SILTY SAND, fine grained, nonplastic, brown
5			S		17			SP	slightly moist medium dense	SAND, some gravel, poorly graded, coarse grained sand, rounded to subrounded, nonplastic, gray
10			S		49			GP	moist dense	SAND, GRAVEL & COBBLES, poorly graded, rounded to subangular, nonplastic, gray
15			S		47			SP & GP	moist dense	SILTY SAND, some gravel, poorly graded, fine to medium grained sand, nonplastic, gray to brown
20			S		50/5"			GP	moist very dense	CLAYEY SAND, GRAVEL & COBBLES, coarse grained sand, rounded, low to medium plasticity, brown
25			S		79			GP	very moist very dense	SAND, GRAVEL & COBBLES, poorly graded, subrounded, nonplastic, brown
30										Auger refused at 27'6" Hole caved to 8'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 1-31, 2-1, 2-12-85

LOG OF TEST BORING NO. 3

RIG TYPE CME-55 & Mobile B-80

BORING TYPE 6½" HSA & 4½" ODEX

SURFACE ELEV. 968.0'±

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50									very wet saturated below 43'	SILTY SAND, considerable gravel, gravel ¼" to ½", quartz, chert & volcanics, subangular to angular, nonplastic to low plasticity, various colors note: increased coarse grained sand, gravel ½" to 1", subrounded
55										
60			S-50/5½" (no recovery)							
				A						CLAYEY SAND, some gravel, poorly graded, fine grained, subangular, medium plasticity, brown note: more gravel below 72'
65								SC		
70				A						
75										
				A						
80										Auger refused at 19' Began ODEX at 19' Stopped ODEX at 80'

GROUND WATER

DEPTH	HOUR	DATE

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 1-31, 2-1, 2-12-85

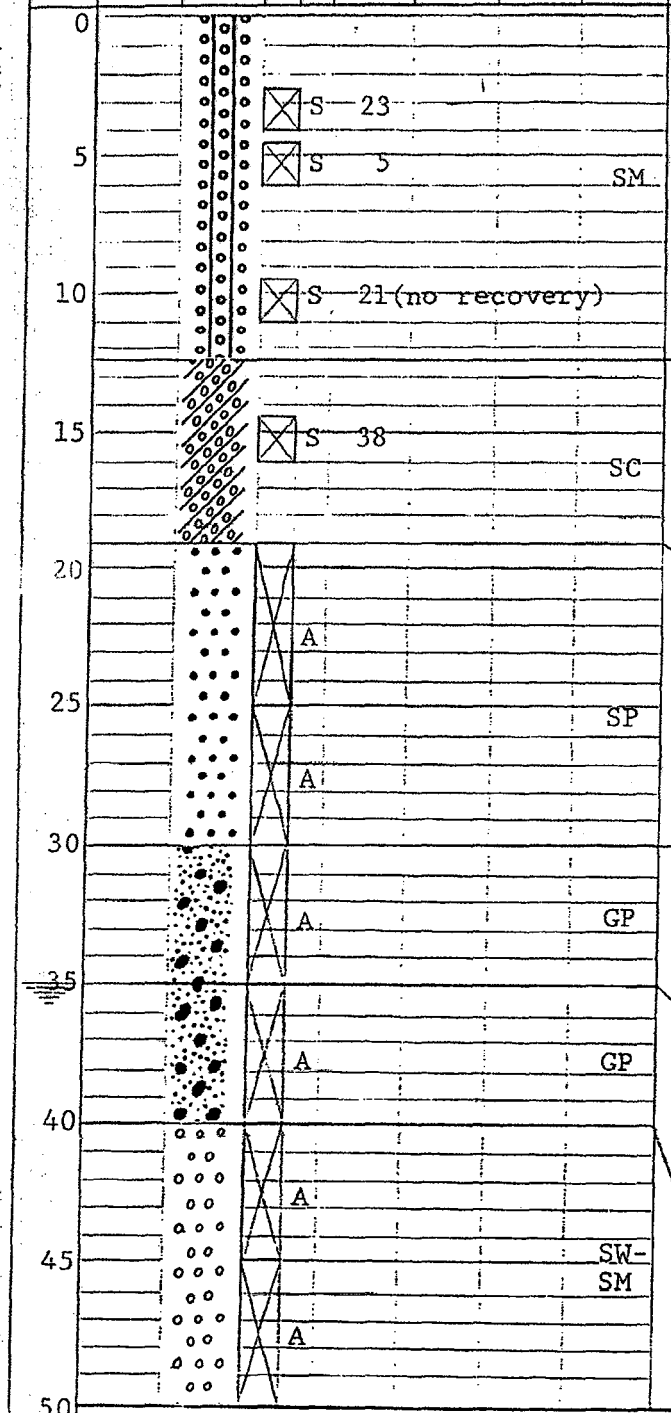
LOG OF TEST BORING NO. 3

RIG TYPE CME-55 & Mobile B-80

BORING TYPE 6½" HSA & 4½" ODEX

SURFACE ELEV. 968.0'±

DATUM



REMARKS	VISUAL CLASSIFICATION
moist loose to medium dense	SILTY SAND, some gravel, poorly graded, rounded, nonplastic to low plasticity, dark brown note: some rubble & miscellaneous fill to approximately 4'
moist dense	CLAYEY SAND, some gravel, poorly graded, subangular to subrounded sand, slightly lime cemented, low plasticity, brown
very moist to moist	SAND, considerable 3/8" to ½" gravel, coarse grained, subrounded to subangular, nonplastic, brown note: less gravel with depth
moist to very moist	GRAVEL, considerable coarse to very coarse grained sand, gravel 3/8" to 3/4", subrounded, nonplastic, brown
wet	GRAVEL, some very coarse grained sand, gravel 3/8" to ½", subrounded, nonplastic, brown note: some clay from 38' to 39'

GROUND WATER

DEPTH	HOUR	DATE
35'	1:00p	2-1

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 2-1-85

LOG OF TEST BORING NO. 4

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 966.0'±

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			S		50/2"			SM	moist very dense	SILTY SAND, poorly graded, rounded, nonplastic, brown note: concrete fragments & other fill
5			S		13				moist medium dense to very dense	GRAVELLY SAND, considerable silt, well graded, subangular, nonplastic, gray to brown note: asphalt fragments from 13' to 15'
10			U		12	112	7	GW		
15			S		50/4"					
20										Auger refused at 16' Hole caved to 13'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 2-1-85

LOG OF TEST BORING NO. 5

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 964.0'±

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM	moist medium dense	SILTY SAND, some clay, low plasticity, brown
				S	33				moist medium dense to dense	SAND, some gravel, poorly graded, rounded to subangular, nonplastic, brown
5				S	22			SP		note: man-made fill with concrete fragments
10				S	32			SP-SC	moist dense	CLAYEY SAND, some gravel, poorly graded, rounded to subangular, low plasticity, brown
15				S	50/5"			GP		note: small cobbles to large gravel at 17'
20									moist very dense	CLAYEY SAND, GRAVEL & COBBLES, poorly graded, subrounded to subangular, low plasticity, brown
										Auger refused at 19' Hole caved to 17'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 2-1-85

LOG OF TEST BORING NO. 6

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 963.0'±

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0									moist medium dense	SAND, poorly graded, rounded to subrounded, nonplastic, brown note: trace of concrete fragments
			☒	S	15			SP		
5			☒	S	26					
									moist very dense	SAND, GRAVEL & COBBLES, poorly graded, subrounded, nonplastic, brown note: increasing size of cobbles below 10'
10			☒	S	65			GP		
15										Auger refused at 12' Hole caved to 10'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 2-13-85

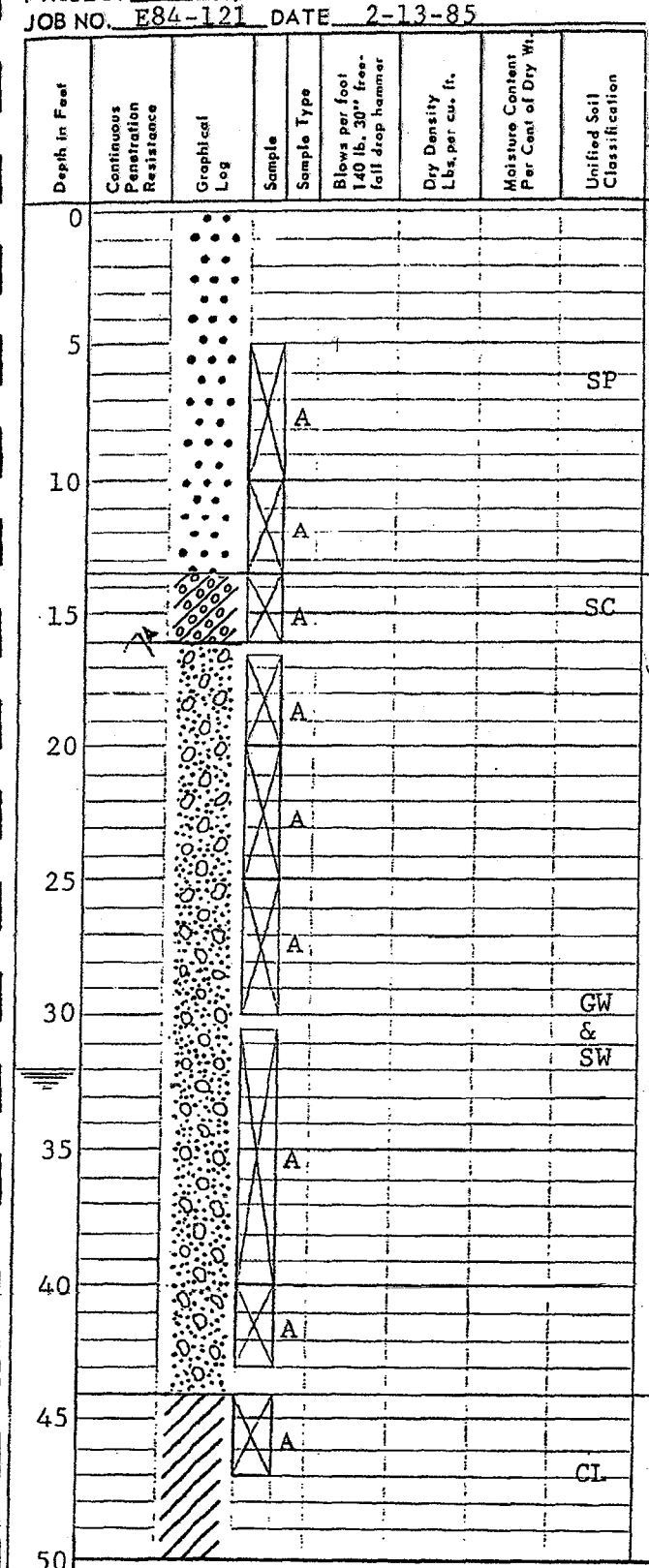
LOG OF TEST BORING NO. 7A&B

RIG TYPE Mobile B-80

BORING TYPE 6½" HSA & 4½" ODEX

SURFACE ELEV. 963.0'±

DATUM



REMARKS	VISUAL CLASSIFICATION
moist to very moist	SAND & GRAVEL, trace of clay, poorly graded, coarse grained, subangular, nonplastic, dark gray
very moist	CLAYEY SAND & GRAVEL, well graded, coarse grained, subangular, low plasticity, brown
moist	GRAVEL & SAND, well graded, coarse grained, subangular, nonplastic, dark gray note: thin layer of fine grained sand between 20' to 21' in depth note: small amount of clay below 38'
very moist to moist at 32'	
slightly moist	SILTY CLAY, considerable sand, weakly lime cemented, low plasticity, brown

GROUND WATER

DEPTH	HOUR	DATE
35'	11:00	2-15

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge
JOB NO. E84-121 DATE 2-13-85

LOG OF TEST BORING NO. 7A&B

RIG TYPE Mobile B-80
BORING TYPE 6½" HSA & 4½" ODEX
SURFACE ELEV. 963.0'±
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50				S	13				very moist moderately firm to very firm	CLAYEY SAND, well graded, fine grained, low plasticity, brown note: very clean sand at 50' to 52', increase in clay content with depth between 53' to 56' note: considerable clay between 75' to 78'
55				A						
60				A						
65								SC		
70										
75				A						
80				S	33					
85										Auger refused at 16' Began ODEX at 16' Stopped ODEX at 81'

GROUND WATER

DEPTH	HOUR	DATE

SAMPLE TYPE
A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 2-4-85

LOG OF TEST BORING NO. 8

RIG TYPE CME-55

BORING TYPE 6⅛" Hollow Stem Auger

SURFACE ELEV. 964.0'±

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0									moist medium dense to very dense	SAND & GRAVEL, poorly graded, angular to sub-angular, nonplastic, brown note: coarse grained gravel & small cobbles below 7' increasing to large cobbles with depth
5								SP		
10			S		50/4"					
15			S		42			SC	moist dense	CLAYEY SAND, considerable gravel & cobbles, poorly graded, subangular, low plasticity, brown
20										Auger refused at 16' Hole caved to 13'9"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 1-31-85

LOG OF TEST BORING NO. 9

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 966.0'±

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0									moist medium dense	SAND, some silt & gravel, poorly graded, rounded, nonplastic, brown note: considerable gravel below approximately 10'
				S	18		4			
5				S	15		3			
								SP-SM		
10				S	24		5			
15				S	53		22		moist very dense	SILTY SAND, fine grained, low plasticity, brown
								SM		
20				S	66		5		moist very dense	SAND, GRAVEL & COBBLES, poorly graded, rounded, nonplastic, brown
								GP		
25				S	50		4	SP-SM	moist dense to very dense	SAND, trace of silt & gravel, poorly graded, rounded, nonplastic, light brown
30				S	43				moist dense to very dense	GRAVEL, some sand, poorly graded, subangular to rounded, nonplastic, light brown
								GP		
35				S	50/4"					
40										Auger refused at 37' Hole caved to 19'

GROUND WATER

DEPTH	HOUR	DATE
33.5'	10:30	1-31

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 1-23-85

LOG OF TEST BORING NO. 10

RIG TYPE Becker Hammer Drill

BORING TYPE 6 5/8" O.D. Pipe

SURFACE ELEV. 970.0'±

DATUM

Depth in Feet	Blows Per Foot	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	0								moist dense	SILTY, GRAVELLY SAND, well graded, angular, rounded to subangular gravel, slightly lime cemented, nonplastic, brown note: cobbles below 10'
	0									
	6									
	6									
5	2			A						
	12									
	21									
	6									
	10							SW		
10	2									
	20									
	32									
	26									
	19									
15	23			A						
	31									
	72									
	51								moist dense	CLAYEY, GRAVELLY SAND, some cobbles, well graded, subrounded to angular gravel, slightly lime cemented, low plasticity, dark brown
	45									
20	20							SC		
	11									
	27									
	25									
	4			A						
25	15								moist very dense	GRAVELLY SAND, some cobbles, well graded, angular, subangular to rounded gravel, slightly lime cemented, low plasticity, brown
	18									
	32									
	26							SW		
	58									
30	50									
	55									
	54									
	49									
	28									
35	28			A					moist very dense	SANDY, CLAYEY GRAVEL, some cobbles, well graded, subangular to rounded, slightly lime cemented, medium plasticity, brown
	45									
	45									
	65									
	40									
40	37									
	65									
	71							GW-GC		
	38									
	79			A			5			
45	144									
	42									
	50									
	76									
	104									
50	99									

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 1-23-85

LOG OF TEST BORING NO. 10

RIG TYPE Becker Hammer Drill

BORING TYPE 6 5/8" O.D. Pipe

SURFACE ELEV. 970.0'±

DATUM

Depth in Feet	Blows Per Foot	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50	164									
	93									
	63							GW-GC		
	46									
	30			A						
55	43									
	21								very moist very dense	CLAYEY, GRAVELLY SAND, some cobbles, well graded, angular, sub-angular gravel, slightly lime cemented, medium to high plasticity, brown
	23									
	13							SW		
	11									
60	22									
	159									
	72									
	20			A					very moist firm	CLAYEY SAND, some gravel, angular well graded sand, subrounded poorly graded gravel, slightly lime cemented, medium plasticity, dark brown
65	14									
	3									
	8									
	24									
	42									
70	22									
	32							SC		
	62									
	36									
	37			A			23			
75	39									
	26									
	38									
	66									
	28									
80	2									
	37									
	71									
	63								very moist firm	SILTY SAND, some clay & gravel, poorly graded, fine grained, subrounded gravel, slightly lime cemented, low plasticity, dark brown
	37			A			20			
85	33									
	21							SM		
	42									
	61									
	126									
90										Stopped hammer at 89'

GROUND WATER

DEPTH	HOUR	DATE

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 1-24-85

LOG OF TEST BORING NO. 11

RIG TYPE Becker Hammer Drill

BORING TYPE 6 5/8" O.D. Pipe

SURFACE ELEV. 972.0'±

DATUM

Depth in Feet	Blows Per Foot	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	28								slightly moist to moist very dense	GRAVELLY, SILTY SAND, poorly graded, fine to medium grained, subangular to subrounded gravel, slightly lime cemented, nonplastic, brown note: cobbles below 20'
	16									
	11									
	11									
	12			A						
5	3									
	1									
	1									
	1									
	4									
10	1									
	1									
	1									
	4							SP		
	8			A						
15	10									
	16									
	21									
	16									
	28									
20	28									
	26									
	25									
	17			A						
	23									
25	46									
	27									
	40								moist very dense	SANDY, SILTY GRAVEL, some cobbles, well graded, subrounded to angular, angular sand, moderately lime cemented, nonplastic, brown
	64									
	49									
30	50									
	33									
	46									
	51			A			5			
	43									
35	27									
	33									
	14									
	37									
	41							GP		
40	47									
	56									
	92									
	36			A						
	45									
45	150									
	100									
	118									
	106									
50	80									

GROUND WATER

DEPTH	HOUR	DATE

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT Proposed Bridge

JOB NO. E84-121 DATE 1-24-85

LOG OF TEST BORING NO. 11

RIG TYPE Becker Hammer Drill

BORING TYPE 6 5/8" O.D. Pipe

SURFACE ELEV. 972.0'±

DATUM

Depth in Feet	Blows Per Foot	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50	77							GP		
	61									
	68								moist	SANDY, CLAYEY GRAVEL,
	55			A					very dense	some silt & cobbles,
	82									well graded, subrounded
55	47							GC		to angular, slightly
	49									lime cemented, low plas-
	47									ticity, brown
	23									
60	14								very moist	SANDY CLAY, some gravel,
	20								to saturated	poorly graded, medium
	23									grained sand, slightly
	26								very firm	lime cemented, medium
	21			A			8			plasticity, brown
65	42									
	38									
	24									
	45									
	58									
70	62									
	40									
	57									
	31									
	48			A						
75	70							CL		
	100									
	47									
	36									
	66									
80	23									
	25									
	60									
	85									
	35			A						
85	31									
	13									
	48									
	28									
	20									
90										Stopped hammer at 89'

GROUND WATER

DEPTH	HOUR	DATE
85'	12:00	1-24

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

Test Pit No. 1

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2146J003

Elev. Top of Hole 946 Location: Station-37+00, 610' Lt Prepared By J. Phillips Date 9/19/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0-0.5				ML	Brown Sandy Silt				35	65	x	x	x	x	x	x
0.5-2.0		106.0	0.0	SP	Light Grey-Brown Coarse to Fine Sand				97	3	x	x	x	x	—	x
2.0-3.5		95.9	1.0	SP	Grey-Brown Fine Sand				99	1	x	x	x	x	—	x
3.5				ML	2" Layer of Brown Clayey Silt				100		—	—	x	x	x	x
3.5-6.0		103.7	1.7	SW	Grey-Brown Coarse Sand w/ Gravel	2"		4	95	1	x	x	x	x	—	x

GROUNDWATER CONDITIONS

Date 9/19/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 2

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 944 Location: Station-37+00, 350' Rt Prepared By D. Cole Date 9/19/86

Type/Size of Boring Backhoe Rig Type ------ Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med. Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0-0.5				SP-SW	Grey-Brown Medium Sand				100		X	X	X	X	---	X
0.5-5		105.0	2.0	SW	Grey-Brown Coarse Sand with Gravel			10	90		X	X	X	X	---	X

GROUNDWATER CONDITIONS

Date 9/19/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 3

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 949 Location: Station-30+00, 250' Lt Prepared By J. Phillips Date 9/19/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well Medium Poor	Grain Shape Angular Subangular Subrounded Rounded	Relative Density Loose Med Dense Dense Very Dense	Plasticity None Low Medium High	Consistency Soft Firm Stiff Very Stiff Hard	Cementation None Light Moderate
0-1.5		107.7	0.9	SP	Grey-Brown Medium Sand w/ Trace Gravel	2"		3	94	3	X	X	X	X	--	X
1.5-5.0		97.6	2.0	SW	Grey-Brown Coarse Sand w/ Gravel	4"	1	10	89		X	X	X	X	--	X

GROUNDWATER CONDITIONS

Date 9/19/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 4

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 946 Location: Station-30+00, 350' Rt Prepared By D. Cole Date 9/19/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max Size	Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation (well, medium, poor)	Grain Shape (Angular, Subangular, Subrounded, Rounded)	Relative Density (Loose, Dense, Very Dense)	Plasticity (None, Low, Medium, High)	Consistency (Soft, Firm, Stiff, Very Stiff, Hard)	Cementation (None, Light, Moderate)
0-0.2				ML	Light Brown Sandy Silt				20	80		x	--	x	x	x	x
0.2-1.0				GW	Grey-Brown Sandy Gravel	3"	1	50	49	--	x	x	x	x	--	x
1.0-4.+		103.4	0.8	SW	Grey-Brown Coarse Sand w/ Gravel	1"		7	92	1	x	x	x	x	--	x

GROUNDWATER CONDITIONS

Date 9/19/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION OF THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 5

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 949 Location: Station-22+30, 380' Rt Prepared By D. Cole Date 9/23/86

Type/Size of Boring Backhoe Rig Type -- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0-3.0				SW	Grey-Brown Coarse Sand w/ Gravel & Cobbles	6"	1	10	89		X	X	X	X	--	X
3.0-4.0				SP-SW	Grey-Brown Medium Sand			1	99		X	X	X	X	--	X
4.0-5.5		84.1	4.7	SM	Brown Fine Silty Sand				81	19	X	X	X	X	--	X
5.5-6.0				SP-SW	Grey-Brown Medium Sand w/ Gravel	1"		5	95		X	X	X	X	--	X

GROUNDWATER CONDITIONS

Date 9/23/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 7

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 951 Location: Station-12+00, 300' Rt Prepared By J. Phillips Date 9/23/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med. Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0-0.5				SM	Light Brown Fine Silty Sand				85	15	X	X	X	X	--	X
0.5-4.5				SW	Grey-Brown Gravely Sand w/ Cobbles	6"	1	20	79		X	X	X	X	--	X
4.5-6				SW	Grey-Brown Coarse Sand w/ Gravel			5	95		X	X	X	X	--	X

GROUNDWATER CONDITIONS

Date 9/23/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 8

Project: Agua Fria River Improvements Reach 3 (FCD 85-37)

Job No. 2156J003

Elev. Top of Hole: 952

Location: Station-2+00, 325' Lt

Prepared By: J. Phillips

Date: 9/23/86

Type/Size of Boring: Backhoe

Rig Type: ---

Reviewed By: C. Jacquemin

Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution %				Gradation	Grain Shape	Relative Density	Plasticity	Consistency	Cementation
							Boulder/Cobbles	Gravel	Sand	Silt & Clay	Well / Medium / Poor	Angular / Subangular / Subrounded / Rounded	Loose / Med Dense / Dense / Very Dense	None / Low / Medium / High	Soft / Firm / Stiff / Very Stiff / Hard	None / Light / Moderate
0-0.5				SP-SM	Grey-Brown Fine Sand				90	10		X	X	X	X	—	X
0.5-0.7				SW	Grey-Brown Coarse Sand w/ Gravel	2"		20	80		X		X	X	X	—	X
0.7-1.0				ML	Brown Sandy Silt				30	70		X	—	X	X	X	X
1.0-1.5				SP-SW	Grey-Brown Medium Sand				97	3		X	X	X	X	—	X
1.5-4+				SW	Grey-Brown Coarse Sand w/ Gravel	2"		15	85		X		X	X	X	—	X

GROUNDWATER CONDITIONS

Date 9/23/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 9

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 958 Location: Station 7+00, 200" Lt Prepared By J. Phillips Date 9/23/86

Type/Size of Boring Backhoe Rig Type ---- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well, Medium, Poor)	Grain Shape (Angular, Subangular, Subrounded, Rounded)	Relative Density (Loose, Med. Dense, Dense, Very Dense)	Plasticity (None, Low, Medium, High)	Consistency (Soft, Firm, Stiff, Very Stiff, Hard)	Cementation (None, Light, Moderate)
0-6.0				SW	Grey-Brown Coarse Sand w/Gravel	3"	1	15	84	---	X	X	X	X	---	X

GROUNDWATER CONDITIONS

Date 9/23/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 10

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 956 Location: Station 12+00, 400' Rt Prepared By J. Phillips Date 9/23/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med. Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0-0.5				SM	Grey-Brown Silty Sand				70	30	X	X	X	X	—	X
0.5-3.0		108.0		SP	Grey Fine Sand				96	4	X	X	X	X	—	X
3.0-5+				SW	Grey-Brown Coarse Sand w/ Gravel			15	85		X	X	X	X	—	X

GROUNDWATER CONDITIONS

Date 9/23/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 11

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37)

Job No. 2156J003

Elev. Top of Hole: 958 Location: Station 20+00, 300' Lt

Prepared By: J. Phillips Date: 9/23/86

Type/Size of Boring: Backhoe Rig Type: ---

Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation: Well / Medium / Poor	Grain Shape: Angular / Subangular / Subrounded / Rounded	Relative Density: Loose / Dense / Very Dense	Plasticity: None / Low / Medium / High	Consistency: Soft / Firm / Stiff / Very Stiff / Hard	Cementation: None / Light / Moderate
0-0.5				SM	Grey-Brown Fine Silty Sand			1	84	15	X	X	X	X	—	X
0.5-6				SW	Grey-Brown Coarse Sand w/ Gravel	3"		15	85		X	X	X	X		X

GROUNDWATER CONDITIONS

Date 9/23/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 12

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole: 960 Location: Station 20+00, 400' Rt. Prepared By: J. Phillips Date: 9/23/86

Type/Size of Boring: Backhoe Rig Type: --- Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0-0.5				SM-SP	Grey-Brown Fine Silty Sand				90	10	X	X	X	X	—	X
0.5-2.0				SP	Grey-Brown Fine Sand w/ Trace Gravel			1	95	4	X	X	X	X	—	X
2.0-4.0				SW	Grey-Brown Coarse Sand w/Gravel	3"	1	15	84		X	X	X	X	—	X
4.0-7+				SP	Grey-Brown Coarse Sand				100		XX	X	X	X	—	X

GROUNDWATER CONDITIONS

Date 9/23/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 13

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole: 961 Location: Station 27+00, 300' Lt Prepared By: J. Phillips Date: 9/24/86

Type/Size of Boring: Backhoe Rig Type: --- Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution %				Gradation	Grain Shape	Relative Density	Plasticity	Consistency	Cementation
							Boulder/Cobbles	Gravel	Sand	Silt & Clay	Well / Medium / Poor	Angular / Subangular / Subrounded / Rounded	Loose / Med Dense / Dense / Very Dense	None / Low / Medium / High	Soft / Firm / Stiff / Very Stiff / Hard	None / Light / Moderate
0-4+				SW	Grey- Brown Coarse Sand w/ Gravel	2"		5	95		x	x	x	x	—	x

GROUNDWATER CONDITIONS

Date 9/24/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 14

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 963 Location: Station 27+00, 300' Rt Prepared By J. Phillips Date 9/24/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0-0.3				SM	Grey-Brown Fine Sand				80	20	X	X	X	X	--	X
0.3-1.0				SW-SP	Grey-Brown Medium Sand w/ Trace Gravel			1	98	1	X	X	X	X	--	X
1.0-2.0				SP	Grey-Brown Coarse Sand w/ Gravel			10	90		X	X	X	X	--	X
2.0-7+				SW-SP	Grey-Brown Coarse Sand w/ Trace Gravel			1	98	1	X	X	X	X	--	X

GROUNDWATER CONDITIONS

Date 9/24/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 15

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 966 Location: Station 34+00, 470' Rt Prepared By J. Phillips Date 9/24/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well Medium Poor	Grain Shape Angular Subangular Subrounded Rounded	Relative Density Loose Med Dense Dense Very Dense	Plasticity None Low Medium High	Consistency Soft Firm Stiff Very Stiff Hard	Cementation None Light Moderate
0-1.0				SM	Grey-Brown Medium Silty Sand w/Trace Gravel	½"		1	84	15	x	x	x	x	---	x
1.0-1.5				SM	Grey-Brown Fine Silty Sand				85	15	x	x	x	x	---	x
1.5-2.5				ML	Brown Fine Sandy Silt				45	55	x	x	x	x	---	x
2.5-5.0				SW-SP	Grey-Brown Medium Sand				95	5	x	x	x	x	---	x
5.0-7+				SP	Grey-Brown Coarse Sand w/ Gravel	1"		13	83	4	x	x	x	x	---	x

GROUNDWATER CONDITIONS

Date 9/24/86 No Groundwater Encountered X

Date ..... Time ..... Depth .....

Date ..... Time ..... Depth .....

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 16

Project Agua Fria Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 970 Location: Station 45+00, 550' Lt Prepared By J. Phillips Date 9/24/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Soft / Very Soft / Hard	Cementation None / Light / Moderate
0-0.2				SM	Grey-Brown Fine Silty Sand w/ Gravel and Aspahlt Concrete Contamination	2"		10	75	15	X	X	X	X	---	X
0.2-1.10				SM	Brown Fine Silty Sand				70	30	X	X	X	X	---	X
1.0-4+				SW	Grey-Brown Coarse Sand w/ Gravel	3"		20	80		X	X	X	X	---	X

GROUNDWATER CONDITIONS

Date 9/24/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 17

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole: 968 Location: Station 45+00, 550' Rt Prepared By: J. Phillips Date: 9/24/86

Type/Size of Boring: Backhoe Rig Type: -- Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well	Uniform	Poor	Grain Shape Angular	Subangular	Subrounded	Rounded	Relative Density Loose	Med Dense	Dense	Very Dense	Plasticity None	Low	Medium	High	Consistency Soft	Firm	Stiff	Very Stiff	Hard	Cementation None	Light	Moderate
0-2.0		93.1	2.2	ML	Brown Fine Silty Sand				50	50		x		—				x				x					—				x		
2.0-6.0				SM	Grey-Brown Fine Silty Sand				70	30		x		x				x				x					—				x		
6.0-6.3				ML	Brown Sandy Silt				20	80		x		—				x				x				x					—		
6.3-10+				SW	Grey-Brown Coarse Sand w/ Gravel	1"		10	85	5	x			x				x				x					—				x		

GROUNDWATER CONDITIONS

Date 9/24/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 18

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole: 970 Location: Station 52+00, 550 Lt Prepared By: J. Phillips Date: 9/24/86

Type/Size of Boring: Backhoe Rig Type: --- Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med. Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Soft / Very Soft / Hard	Cementation None / Light / Moderate
0-0.5				SM	Grey-Brown Medium Sand w/ Gravel	2"		20	65	15	X	X	X	X	—	X
0.5-1.5				SM	Grey-Brown Fine Silty Sand				70	30	X	X	X	X	—	X
1.5-6.0				SW	Grey-Brown Medium Sand w/ Gravel	1"		5	95		X	X	X	X	—	X
6.0-8.0				SW	Grey-Brown Coarse Sand w/ Gravel	2"		15	85		X	X	X	X	—	X
8.0-10+				SW	Grey-Brown Medium Sand w/ Gravel	1"		10	90		X	X	X	X	—	X

GROUNDWATER CONDITIONS

Date 9/24/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION OF THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 19

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole: 970 Location: Station 55+00, 550' Rt Prepared By: J. Phillips Date: 9/25/86

Type/Size of Boring: Backhoe Rig Type: --- Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med. Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0.2.5				SM	Brown Fine silty Sand w/ Trace Gravel	2"		1	69	30	x	x	x	x	---	x
2.5-6.5				SW	Grey-Brown Coarse Sand w/ Gravel	3"		15	85		x	x	x	x	---	x
6.5-8.5				SW	Grey-Brown Medium Sand w/ Gravel	2"		5	95		x	x	x	x	---	x
8.5-10+				SW	Grey-Brown Coarse Dand w/ Gravel	3"		15	85		x	x	x	x	---	x

GROUNDWATER CONDITIONS

Date 9/25/86 No Goundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE. THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 20

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole: 973 Location: Station 61+00, 550' Rt Prepared By: J. Phillips Date: 9/25/86

Type/Size of Boring: Backhoe Rig Type: --- Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max Size	Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation: Well / Medium / Poor	Grain Shape: Angular / Subangular / Subrounded / Rounded	Relative Density: Loose / Med Dense / Dense / Very Dense	Plasticity: None / Low / Medium / High	Consistency: Soft / Firm / Stiff / Very Stiff / Hard	Cement: None / Light / Moderate
0-4.0				SM	Grey-Brown Fine Silty Sand				75	25		x	x	x	---	x
4.0-7.0				SW	Grey-Brown Coarse Sand w/ Gravel	3"		15	85		x	x	x	x	---	x
7.0-10+				SW	Grey-Brown Coarse Sand w/ Gravel and Trace Cobbles	6"	1	19	77	3	x	x	x	x	---	x

GROUNDWATER CONDITIONS

Date 9/25/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 21

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 984 Location: Station 62+50, 265' Lt Prepared By J. Phillips Date 9/25/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0.8.0				SM	Grey-Brown Gravelly Sand w/ Cobbles	6"	5	25	45	25	X	X	X	X	---	X

GROUNDWATER CONDITIONS

Date 9/25/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 22

Project Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 981 Location: Station 69+50, 530' Lt Prepared By J. Phillips Date 9/25/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Rounded	Relative Density Loose / Med. Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0.40					Debris Consisting of Concrete, Block, Wood and Other Construction Materials											

GROUNDWATER CONDITIONS

Date 9/25/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 23

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37)

Job No. 2156J003

Elev. Top of Hole: 973 Location: Station 67+00, 550' Rt

Prepared By: J. Phillips Date: 9/25/86

Type/Size of Boring: Backhoe Rig Type: ---

Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well Medium Poor	Grain Shape Angular Subangular Subrounded Rounded	Relative Density Loose Med Dense Dense Very Dense	Plasticity None Low Medium High	Consistency Soft Firm Stiff Very Stiff Hard	Cementation None Light Moderate
0-1.5				SM	Brown Fine Silty Sand				60	40	x	—	x	x	—	x
1.5-5.0				SM	Grey-Brown Fine Silty Sand				85	15	x	x	x	x	—	x
5.0-10+				SW	Grey-Brown Coarse Sand w/ Gravel and Trace Cobbles	4"	1	15	82	2	x	x	x	x	—	x

GROUNDWATER CONDITIONS

Date 9/25/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 24

Project Agua Fria Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Elev. Top of Hole 971 Location: Station 74+00, 50' Rt Prepared By J. Phillips Date 9/25/86

Type/Size of Boring Backhoe Rig Type --- Reviewed By C. Jacquemin Date 10/15/86

Depth (ft)	Sample Type	Dry Density (pcf)	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0-20				SP	Grey-Brown Fine Sand w/ Gravel	2"		1	94	5	x	x	x	x	---	x
2.0-4.0				SP-SM	Grey-Brown Fine Silty Sand				90	10	x	x	x	x	---	x
4.0-6+				SW	Grey-Brown Coarse Sand w/ Gravel	3"		10	89	1	x	x	x	x	---	x

GROUNDWATER CONDITIONS

Date 9/25/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 24

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156I003

Elev. Top of Hole: 975 Location: Station 73+00, 700' Rt. Prepared By: J. Phillips Date: 9/25/86

Type/Size of Boring: Backhoe Rig Type: --- Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Stiff / Very Stiff / Hard	Cementation None / Light / Moderate
0-2.0				SM	Brown Fine Silty Sand				70	30		x	x	x	--	x
2.0-4.0				SW	Grey-Brown Medium Sand w/ Gravel	½"		5	93	2	x	x	x	x	--	x
4.0-4.5				SM	Grey-Brown Fine Silty Sand				85	15	x	x	x	x	--	x
4.5-10+				SW	Grey-Brown Coarse Sand w/ Gravel	2"		10	90		x	x	x	x	--	x

GROUNDWATER CONDITIONS

Date 9/25/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Test Pit No. 26

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37)

Job No. 2156J003

Elev. Top of Hole: 973 Location: Station 61+00, 315' Lt

Prepared By: J. Phillips Date: 9/25/86

Type/Size of Boring: Backhoe Rig Type: ---

Reviewed By: C. Jacquemin Date: 10/15/86

Depth (ft)	Sample Type	Dry Density pcf	Water Content %	Soil Classification	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	Max. Size	Particle Size Distribution % Boulder/Cobbles	Gravel	Sand	Silt & Clay	Gradation Well / Medium / Poor	Grain Shape Angular / Subangular / Subrounded / Rounded	Relative Density Loose / Med Dense / Dense / Very Dense	Plasticity None / Low / Medium / High	Consistency Soft / Firm / Soft / Very Soft / Hard	Cementation None / Light / Moderate
0-2.0				SM	Grey-Brown Silty Sand w/ Gravel/Cobbles	4"	1	24	55	20	x	x	x	x	---	x
2.0-3.5				SP	Grey-Brown Fine Silty Sand				95	5	x	x	x	x	---	x
3.5-4.0				CL	Black and Brown Organic Silty Sandy Clay				5	95	x		x	x	x	---
4.0-7.0				SP	Grey Brown Fine Silty Sand w/ four 1" Thick Clay Levers at 6" Intervals				95	5	x	x	x	x	---	x
7.0-8.0				CL	Black and Brown Organic Silty Sandy Clay				5	95	x	---	x	x	x	---
8.0-9+				SP	Grey-Brown Fine Silty Sand				95	5	x	x	x	x	---	x

GROUNDWATER CONDITIONS

Date 9/25/86 No Groundwater Encountered X

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

NOTE: THESE DATA REPRESENT CONDITIONS AT THE LOCATION ON THE DATE THE FIELD WORK WAS PERFORMED AND SHOULD NOT BE INFERRED TO REPRESENT OTHER LOCATIONS OR DATES.

Project: Agua Fria River Improvements - Reach 3 (FCD 85-37) Job No. 2156J003

Source of Material Agua Fria River - Lower Buckeye Road to Interstate 10

Reviewed By C. Jacquemin Date 10/15/86

Hole No.	Location	Depth	Classification AASHTO	Classification Unified			Sieve Analysis - Accum % Passing 200	100	40	16	10	4	¼	⅛	¾	1	1½	2	3	Lab No./I.D.
1	-37+00,610' Lt	0-0.5		ML			65	88	96	99	100									
1	-37+00,610' Lt	0.5-2.0		SP			3	16	65	94	97	99	99	99	100					
1	-37+00,610' Lt	2.0-3.5		SP			1	12	88	99	100									
1	-37+00,610' Lt	3.8-6.0		SW			1	3	25	78	87	94	96	98	100					
2	-37+00,350' Rt	0.5-5.0		SW			0	1	25	67	80	89	91	94	97	98	100			
3	-30+00,250' Lt	0-1.5		SP			3	10	60	92	95	97	97	97	99	99	99	100		
4	-30+00,350' Rt	1.0-4.0		SW			1	2	37	75	85	93	94	96	98	100				
5	-22+30,380' Rt	4.0-5.5		SM			19	42	88	98	99	100								
10	12+00,400' Rt	0.5-3.0		SP			4	25	95	100										
15	34+00,470' Rt	1.5-2.5		ML			55	83	98	100										
15	34+00,470' Rt	5.0-7.0		SW			4	5	23	65	79	87	90	94	99	100				

TABULATION OF TEST RESULTS

A-8

CONSTRUCTION INSPECTION & TESTING CO.

Boring Log

For: CMX, L.L.C.
Project: Tres Rios Landing`
Location Of Project: SEC, Dysart road and Buckeye Road
Boring No. B1
Location: See Site Plan

Date: 4/18/02 **Proj. No.** 02-20817-1
Type Of Boring: Backhoe
Field Party: Howard/Cowell
Boring No.
Location: See Site Plan

1-		Silty Fine sand, non plastic, damp, tan
2-		
3-		
4-		
5-		Sandy Silt, low PI, moist, light brown
6-		
7-		
8-		Silty Fine Sand, non plastic, damp, tan
9-		
10-		Bottom at 10'

1-		Fine Sandy Silt, low PI, damp, light brown
2-		
3-		Silty fine sand, non plastic, damp, tan
4-		
5-		
6-		
7-		
8-		Bottom at 8'
9-		
10-		

#67

Boring Log

For: CMX, L.L.C.
Project: Tres Rios Landing
Location Of Project: SEC, Dysart road and Buckeye Road
Boring No. B3
Location: See Site Plan

Date: 4/18/02 **Proj. No.** 02-20817-1
Type Of Boring: Backhoe
Field Party: Howard/Cowell
Boring No. B4
Location: See Site Plan

1-		Fine Sandy Silt, low PI, damp, light brown
2-		
3-		Silty Fine Sand, non plastic, damp, tan
4-		
5-		
6-		Increase in percentage of silt, moist below 6'
7-		
8-		Bottom at 8'
9-		
10-		

1-		Fine Sandy Silt, low PI, damp, light brown
2-		
3-		Silty Fine Sand, non plastic, damp, tan
4-		
5-		
6-		
7-		
8-		Bottom at 8'
9-		
10-		

CONSTRUCTION INSPECTION & TESTING CO.

Boring Log

For: CMX, L.L.C.
Project: Tres Rios Landing`
Location Of Project: SEC, Dysart road and Buckeye Road
Boring No. B5
Location: See Site Plan

Date: 4/18/02 **Proj. No.** 02-20817-1
Type Of Boring: Backhoe
Field Party: Howard/Cowell
Boring No. B6
Location: See Site Plan

		Silty fine Sand, non plastic, damp, tan
1-		
2-		
3-		
4-		
5-		
6-		less Silty below 6'
7-		
8-		
9-		
10-		Bottom at 10'

		Fine Sandy Silt, low – non plastic, damp, light brown
1-		
2-		Silty Fine Sand, non plastic, damp, tan
3-		
4-		
5-		
6-		trace of gravel below 6.5'
7-		
8-		Bottom at 8'
9-		
10-		

Boring Log

For: CMX, L.L.C.
Project: Tres Rios Landing
Location Of Project: SEC, Dysart road and Buckeye Road
Boring No. B7
Location: See Site Plan

Date: 4/18/02 **Proj. No.** 02-20817-1
Type Of Boring: Backhoe
Field Party: Howard/Cowell
Boring No. B8
Location: See Site Plan

1-	Fine Sandy Silt, low PI, damp, light brown
2-	
3-	
4-	
5-	Silty Sand and Gravel with Cobbles 6" in Size, non plastic, damp, tan
6-	
7-	
8-	Bottom at 8'
9-	
10-	

1-	Fine Sand Silt, low PI, damp, light brown
2-	
3-	
4-	Silty Fine Sand, non plastic, damp, tan
5-	
6-	
7-	
8-	silty sand with trace of gravel, non plastic, damp, tan
9-	
10-	Bottom at 10'

Boring Log

For: CMX, L.L.C.
Project: Tres Rios Landing`
Location Of Project: SEC, Dysart road and Buckeye Road
Boring No. B9
Location: See Site Plan

Date: 4/18/02 **Proj. No.** 02-20817-1
Type Of Boring: Backhoe
Field Party: Howard/Cowell
Boring No. B10
Location: See Site Plan

1-		Silty Sand with Trace of Gravel, low – non plastic, moist, tan
2-		
3-		Silty Sandy Clay, low PI, moist, brown
4-		
5-		
6-		
7-		
8-		Bottom at 8'
9-		
10-		

1-		Gravelly Silty Sand, low PI, damp, light brown
2-		
3-		Silty Sand, non plastic, moist, tan
4-		
5-		
6-		
7-		
8-		gravelly below 8'
9-		
10-		Bottom at 10'

CONSTRUCTION INSPECTION & TESTING CO.

Boring Log

For: CMX, L.L.C.
Project: Tres Rios Landing`
Location Of Project: SEC, Dysart road and Buckeye Road
Boring No. B11
Location: See Site Plan

Date: 4/18/02 **Proj. No.** 02-20817-1
Type Of Boring: Backhoe
Field Party: Howard/Cowell
Boring No.
Location:

		Silty Clay, high PI, light brown
1-		
2-		
3-		
4-		
5-		
		Silty Sand, non plastic, damp, tan
6-		Bottom at 6'
7-		
8-		
9-		
10-		

1-		
2-		
3-		
4-		
5-		
6-		
7-		
8-		
9-		
10-		

A-9

BORING LOG

BORING NO. B-3

File: CH2M Avondale Waterline Date Printed: 6/12/02

PROJECT:	City of Avondale Water Distribution Line	PROJECT NO.:	02035
CLIENT:	CH2M Hill	DATE:	5/3/02
LOCATION:	El Mirage Road & Indian School	ELEVATION:	n/a
DRILLER:	Geomechanics Southwest, Inc.	LOGGED BY:	A. Rashid
DRILLING METHOD:	CME-75 8" rotary HSA		
DEPTH TO - WATER> INITIAL:	none encountered	AFTER 24 HOURS:	n/a

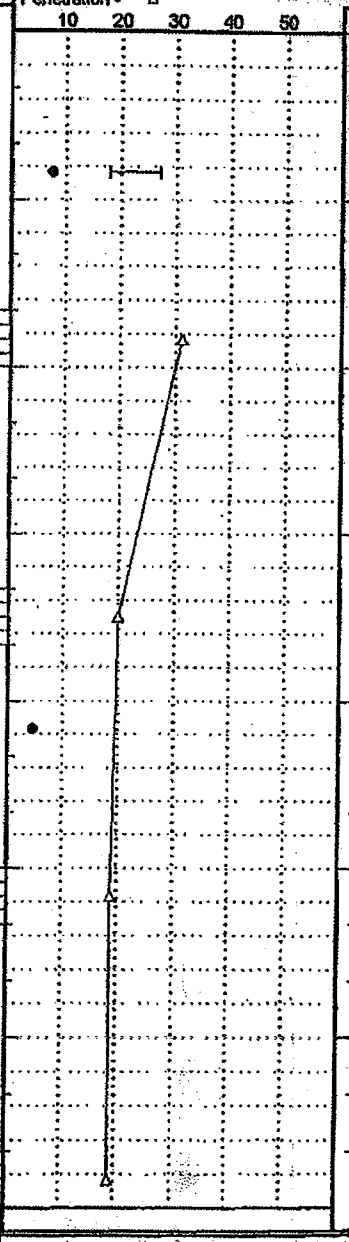
DEPTH (feet)	Description	SOIL TYPE	BULK	SAMPLERS
0	(SC) Brown clayey SAND with gravel; moist, medium dense			
3				
6	(SM) Brown silty SAND; damp, medium dense			
9				
12				
15				
18				

TEST RESULTS

Plastic Limit ⊢—⊣ Liquid Limit

Water Content - ●

Penetration - △



HOQUE & ASSOCIATES

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Figure

#31

BORING LOG

BORING NO. B-3

File: CH2M Avondale Waterline Date Printed: 6/12/02

PROJECT:	City of Avondale Water Distribution Line	PROJECT NO.:	02035
CLIENT:	CH2M Hill	DATE:	5/3/02
LOCATION:	El Mirage Road & Indian School	ELEVATION:	n/a
DRILLER:	Geomechanics Southwest, Inc.	LOGGED BY:	A. Rashid
DRILLING METHOD:	CME-75 8" rotary HSA		
DEPTH TO - WATER> INITIAL:	none encountered	AFTER 24 HOURS:	n/a

DEPTH (feet)	Description	SOIL TYPE	BULK	SAMPLERS	TEST RESULTS (Plastic Limit ⊢—⊣ Liquid Limit; Water Content - ●; Penetration - △; 10 20 30 40 50)
21	(SM) Brown silty SAND; damp, medium dense				
	Auger refusal at 22'. Borehole backfilled with auger cuttings.				
24					
27					
30					
33					
36					
39					

HOQUE & ASSOCIATES

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Figure

BORING LOG

BORING NO. B-4

File: CH2M Avondale Waterline Date Printed: 6/12/02

PROJECT:	City of Avondale Water Distribution Line	PROJECT NO.:	02035
CLIENT:	CH2M Hill	DATE:	5/3/02
LOCATION:	El Mirage Road & Indian School	ELEVATION:	n/a
DRILLER:	Geomechanics Southwest, Inc.	LOGGED BY:	A. Rashid
DRILLING METHOD:	CME-75 8" rotary HSA		
DEPTH TO - WATER> INITIAL:	none encountered	AFTER 24 HOURS:	n/a

DEPTH (feet)	Description	SOIL TYPE	BULK	SAMPLERS	TEST RESULTS (Plastic Limit ⊢——⊣ Liquid Limit; Water Content - ●; Penetration - Δ; 10 20 30 40 50)
0	(SM) Brown silty SAND with gravel; damp, medium dense				
3					
	dense				
6					
	Auger refusal at 8'. Borehole backfilled with auger cuttings.				
9					
12					
15					
18					

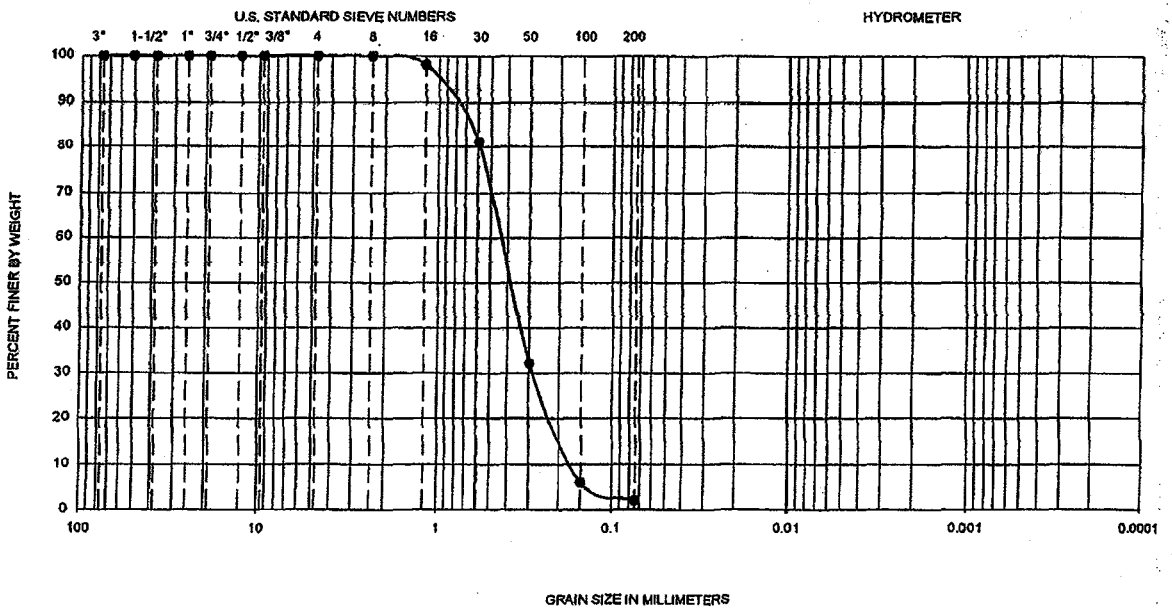
This information pertains only to this boring and should not be interpreted as being indicative of the site.

HOQUE & ASSOCIATES

Figure

A-10

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-1	3.5-5	NP	NP	NP	0.17	0.28	0.42	2.5	1.1	2	SP

NP - INDICATES NON-PLASTIC
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

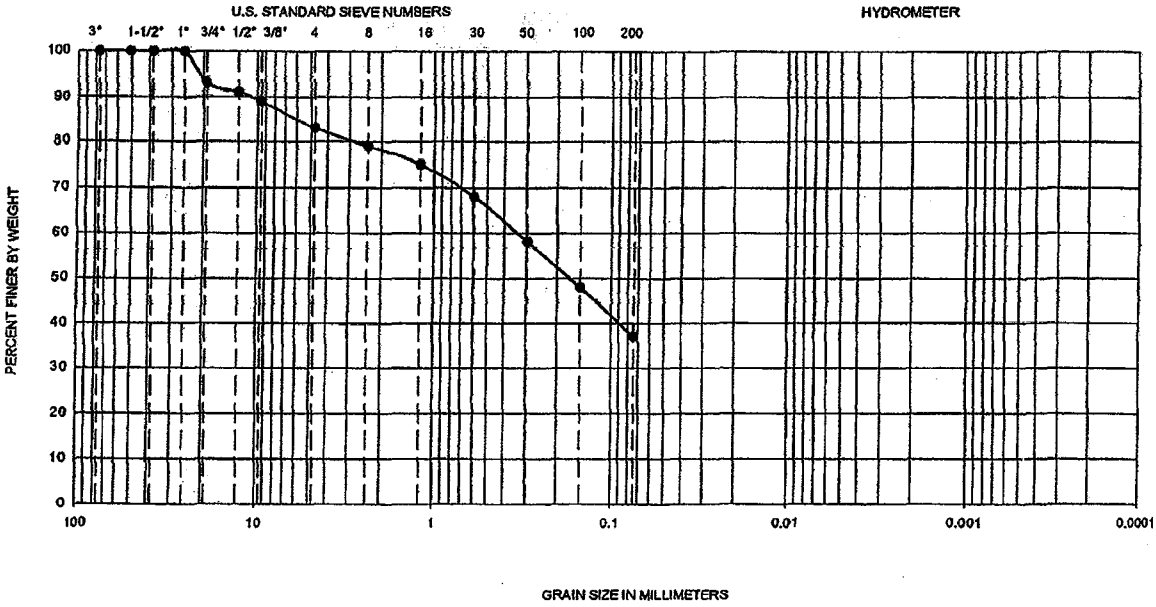
GRADATION TEST RESULTS
LOWER BUCKEYE WATERLINE
4TH STREET TO EL MIRAGE ROAD
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600727001	7/04	B-1

SIEVE B-13.5-5 1690

#68

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-3	1-2.5	NP	NP	NP	--	--	--	--	--	37	SM

NP - INDICATES NON-PLASTIC
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63

Ninyo & Moore

GRADATION TEST RESULTS

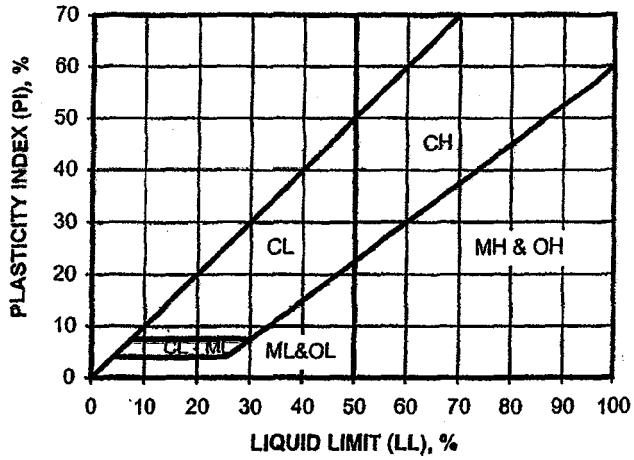
LOWER BUCKEYE WATERLINE
4TH STREET TO EL MIRAGE ROAD
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600727001	7/04	B-2

SIEVE B-3 1-2.5 1690

SYMBOL	LOCATION	DEPTH (FT)	LL (%)	PL (%)	PI (%)	U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction)	U.S.C.S. (Entire Sample)
●	B-1	3.5-5	NP	NP	NP	NP	SP
■	B-3	1-2.5	NP	NP	NP	NP	SM
◆	B-5	1-2.5	NP	NP	NP	NP	SM

NP - Indicates non-plastic



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-00

Ninyo & Moore

ATTERBERG LIMITS TEST RESULTS

LOWER BUCKEYE WATERLINE
4TH STREET TO EL MIRAGE ROAD
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600727001	7/04	B-4

ATTERBERG b-3 1-2.5 1690

CORROSIVITY TEST RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH *	RESISTIVITY * (ohm-cm)	WATER-SOLUBLE SULFATE CONTENT IN SOIL ** (%)	CHLORIDE CONTENT *** (ppm)
B-3	0-5	8.0	1,610	0.003	63

* PERFORMED IN GENERAL ACCORDANCE WITH ADOT TEST METHOD ARIZ 236b
** PERFORMED IN GENERAL ACCORDANCE WITH ADOT TEST METHOD ARIZ 733
*** PERFORMED IN GENERAL ACCORDANCE WITH ADOT TEST METHOD ARIZ 736

Ninyo & Moore

CORROSIVITY TEST RESULTS

LOWER BUCKEYE WATERLINE
4TH STREET TO EL MIRAGE ROAD
AVONDALE , ARIZONA

PROJECT NO.	DATE	FIGURE
600727001	7/04	B-5

A-11

Ninyo & Moore

TEST PIT LOG

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE
601017001	01/05

DATE EXCAVATED 12/29/04 TEST PIT NO. B-1

GROUND ELEVATION -- LOGGED BY TLC

METHOD OF EXCAVATION 3.5" Diameter Hand Auger

LOCATION See Boring Location Map

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■					SM	ALLUVIUM: Brown, damp to moist, medium dense, silty fine to coarse SAND; few gravel.
	■						
1		■					Fine- to medium-grained.
		■		10.0	100		
		■					
2	■						
	■						Some clay.
3							Total depth = 2.9 feet. (Refusal on gravel/cobbles/boulders) Groundwater not encountered. Backfilled on 12/29/04.
4							
5							
6							

SCALE = 1 in./1 ft.

FIGURE A-1

#7

Ninyo & Moore

TEST PIT LOG

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE
601017001	01/05

DATE EXCAVATED 12/29/04 TEST PIT NO. B-2

GROUND ELEVATION -- LOGGED BY TLC

METHOD OF EXCAVATION 3.5" Diameter Hand Auger

LOCATION See Boring Location Map

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■					SP	ALLUVIUM: Brown, damp to moist, loose to medium dense, fine to medium SAND; few silt trace gravel; scattered cobbles at the surface.
1	■	■					
2	■	■					
3	■						Total depth = 3.0 feet. Groundwater not encountered. Backfilled on 12/29/04.
4							
5							
6							

SCALE = 1 in./1 ft.

FIGURE A-2

Ninyo & Moore

TEST PIT LOG

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE
601017001	01/05

DATE EXCAVATED 12/29/04 TEST PIT NO. B-3

GROUND ELEVATION -- LOGGED BY TLC

METHOD OF EXCAVATION 3.5" Diameter Hand Auger

LOCATION See Boring Location Map

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■			3.8	104	SM	FILL: Brown to dark brown, damp to moist, silty fine to coarse SAND; trace gravel; debris including plastic, pieces of wood, fabric, PVC, concrete and asphalt debris at the surface. Approximately 1" of clay at the surface.
1		■				SP	ALLUVIUM: Reddish brown to yellow, damp, medium dense, fine to coarse SAND; trace silt.
2	■						Total depth = 2.1 feet. (Refusal on gravel/cobbles/boulders) Groundwater not encountered. Backfilled on 12/29/04.
3							
4							
5							
6							

SCALE = 1 in./1 ft.

FIGURE A-3

Ninyo & Moore

TEST PIT LOG

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE
601017001	01/05

DATE EXCAVATED 12/29/04 TEST PIT NO. B-4

GROUND ELEVATION -- LOGGED BY TLC

METHOD OF EXCAVATION 3.5" Diameter Hand Auger

LOCATION See Boring Location Map

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■					CL	FILL: Brown, damp, stiff, fine sandy CLAY; piece of wood.
	■	■				SM	ALLUVIUM: Brown, damp, medium dense to dense, silty fine SAND.
1		■		6.4	107		
	■	■					Scattered nodules of dark brown, damp, stiff to very stiff, silty clay.
2	■						
3							Total depth = 2.4 feet. (Refusal on gravel/cobbles/boulders) Groundwater not encountered. Backfilled on 12/29/04.
4							
5							
6							

SCALE = 1 in./1 ft.

FIGURE A-4

Ninyo & Moore

TEST PIT LOG

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE
601017001	01/05

DATE EXCAVATED 12/29/04 TEST PIT NO. B-5

GROUND ELEVATION – LOGGED BY TLC

METHOD OF EXCAVATION 3.5" Diameter Hand Auger

LOCATION See Boring Location Map

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■					CL	FILL: Brown, damp, stiff, fine sandy CLAY; some silt; pieces of wood and PVC plastic, piece of rusted metal.
1		■		9.6	107	SM	Brown, damp, medium dense, silty fine to coarse SAND; little gravel; cotton fabric at top of sampler.
2	■						Pieces of plastic cup.
							Total depth = 2.1 feet. (Refusal of gravel/cobbles/boulders) Groundwater not encountered. Backfilled on 12/29/04.
3							
4							
5							
6							

SCALE = 1 in./1 ft.

FIGURE A-5

DATE DRILLED 01/06/05 BORING NO. B-6

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME-75, 6.5" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY TLC LOGGED BY TLC REVIEWED BY RDL

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALTIC CONCRETE: Approximately 4" thick.
						GM	AGGREGATE BASE: Approximately 5" thick.
						CL	Brown, damp, silty GRAVEL; some sand and clay.
		35	17.1	112			FILL: Brown, damp to moist, very stiff, silty CLAY; trace sand; scattered caliche specks and nodules.
		3				SM	Brown, damp, very loose, silty SAND; little clay; pieces of glass observed in spoils.
5		40					Medium dense.
		12				SP	ALLUVIUM: Brown, damp, medium dense, fine to coarse SAND; trace gravel.
10							
15		16					Loose.
							Total depth = 16.5 feet. Groundwater not encountered. Backfilled on 01/06/05.
20							

Ninyo & Moore

BORING LOG

AVONDALE MUNCIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601017001	01/05	A-6

DATE DRILLED 01/06/05 BORING NO. B-7

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME-75, 6.5" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY TLC LOGGED BY TLC REVIEWED BY RDL

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ML	FILL: Dark brown to brown, damp, very dense, sandy SILT; fine sand, trace clay and gravel.
			92/9"	6.1	107			Light brown.
								Lenses of dark brown silty clay.
			82/9"					Piece of plastic; trace gravel; iron staining.
5								
			88/8"					Scattered chips of mica.
							SM	ALLUVIUM: Pale brown, damp, medium dense, fine to coarse SAND.
			17					
10								
			18					Loose.
15								
			14					Medium dense; no recovery.
								Total depth = 16.5 feet. Groundwater not encountered. Backfilled on 01/06/05.
20								

Ninyo & Moore

BORING LOG

AVONDALE MUNCIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601017001	01/05	A-7

DATE DRILLED 01/06/05 BORING NO. B-8

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING CME-75, 6.5" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY TLC LOGGED BY TLC REVIEWED BY RDL

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0		56				SM	FILL: Light brown, damp, very dense, silty fine SAND; scattered chips/pieces of mica; iron staining.
		92/9"	4.3	103			Scattered pieces of wood.
5		18				SM	ALLUVIUM: Light brown, damp, medium dense, silty fine SAND.
						ML	Light brown, damp, very stiff, clayey SILT; scattered caliche nodules.
		23	1.7	111		SM	Light brown, damp, medium dense, silty fine to coarse SAND.
10		22				SP	Light brown, damp, medium dense, fine to coarse SAND; few gravel.
15							Total depth = 15.0 feet. Groundwater not encountered. Backfilled on 01/06/05.
20							

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BORING LOG

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601017001	01/05	A-8

A-12

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 3 inches thick.
							GP-GM	AGGREGATE BASE: Approximately 6 inches thick. Brown, damp, medium dense, GRAVEL with silt and sand.
							CL	ALLUVIUM: Brown, damp, very stiff, sandy CLAY.
2								Total Depth = 2 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
4								
6								
8								

DATE DRILLED 06/12/07 BORING NO. C-1

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-1

69

DATE DRILLED 06/12/07 BORING NO. C-2

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 2 inches thick.
							GP	AGGREGATE BASE: Approximately 5 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with fine to medium sand; trace silt.
							CL	ALLUVIUM: Brown, damp, stiff, sandy CLAY.
2								Total Depth = 2 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
4								
6								
8								

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-2

DATE DRILLED 06/12/07 BORING NO. C-3

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 2.5 inches thick.
							GP	AGGREGATE BASE: Approximately 4 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with fine to medium sand; few silt.
							CL	ALLUVIUM: Brown, damp, stiff, sandy CLAY.
2								Total Depth = 1.5 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
4								
6								
8								

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-3

DATE DRILLED 06/12/07 BORING NO. C-4

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 3 inches thick.
							GP	AGGREGATE BASE: Approximately 4 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with fine to medium sand; few silt.
							CL	ALLUVIUM: Brown, damp, stiff, CLAY with sand.
2								Total Depth = 2 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
4								
6								
8								

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-4

DATE DRILLED 06/12/07 BORING NO. C-5

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 3.5 inches thick.
							SP	AGGREGATE BASE: Approximately 2 inches thick.
							CL	Brown, damp, loose, poorly graded SAND; trace fine gravel.
				16.1	96.2			ALLUVIUM: Brown, moist, hard, sandy CLAY.
								Total Depth = 1.5 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
2								
4								
6								
8								

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-5

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 1.75 inches thick.
							GP	AGGREGATE BASE: Approximately 3 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with fine to medium sand; trace silt.
							CL	ALLUVIUM: Brown, damp, stiff, sandy CLAY.
2								Total Depth = 2 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
4								
6								
8								

DATE DRILLED 06/12/07 BORING NO. C-6

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-6

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 2 inches thick.
							GP	AGGREGATE BASE: Approximately 6 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with fine to medium sand; trace silt.
		X					CL	ALLUVIUM: Brown, damp, hard, sandy CLAY.
								Total Depth = 1 foot. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
2								
4								
6								
8								

DATE DRILLED 06/12/07 BORING NO. C-7

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-7

DATE DRILLED 06/12/07 BORING NO. C-8

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 2.25 inches thick.
						GP	AGGREGATE BASE: Approximately 5 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with fine to medium sand; trace silt.
2						CL	ALLUVIUM: Brown, damp, stiff, sandy CLAY.
4							Total Depth = 2.5 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
6							
8							

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	C-8

DATE DRILLED 06/12/07 BORING NO. C-9

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 2 inches thick.
							GP	AGGREGATE BASE: Approximately 4 inches thick. Brown, moist, loose to medium dense, poorly graded GRAVEL with fine to medium sand; few silt.
				12.4	101.3		CL	ALLUVIUM: Brown, damp, very stiff, sandy CLAY.
2								Total Depth = 1.5 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
4								
6								
8								

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-9

DATE DRILLED 06/12/07 BORING NO. C-10

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 2.25 inches thick.
							GP	AGGREGATE BASE: Approximately 4 inches thick. Brown, moist, loose to medium dense, poorly graded GRAVEL with fine to medium sand; few silt.
							ML	ALLUVIUM: Brown, damp, medium dense, sandy SILT.
		■		13.6	85.3			
2								Total Depth = 2 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
4								
6								
8								

Ninyo & Moore

BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-10

DATE DRILLED 06/12/07 BORING NO. C-11

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Hand-Auger

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0								ASPHALT CONCRETE: Approximately 2.75 inches thick.
							GP	AGGREGATE BASE: Approximately 7 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with fine to medium sand; few silt.
		■					CL	ALLUVIUM: Brown, damp, stiff, sandy CLAY.
								Total Depth = 1.5 feet. Groundwater not encountered during excavation. Backfilled and asphalt patched on 06/12/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
2								
4								
6								
8								

Ninyo & Moore

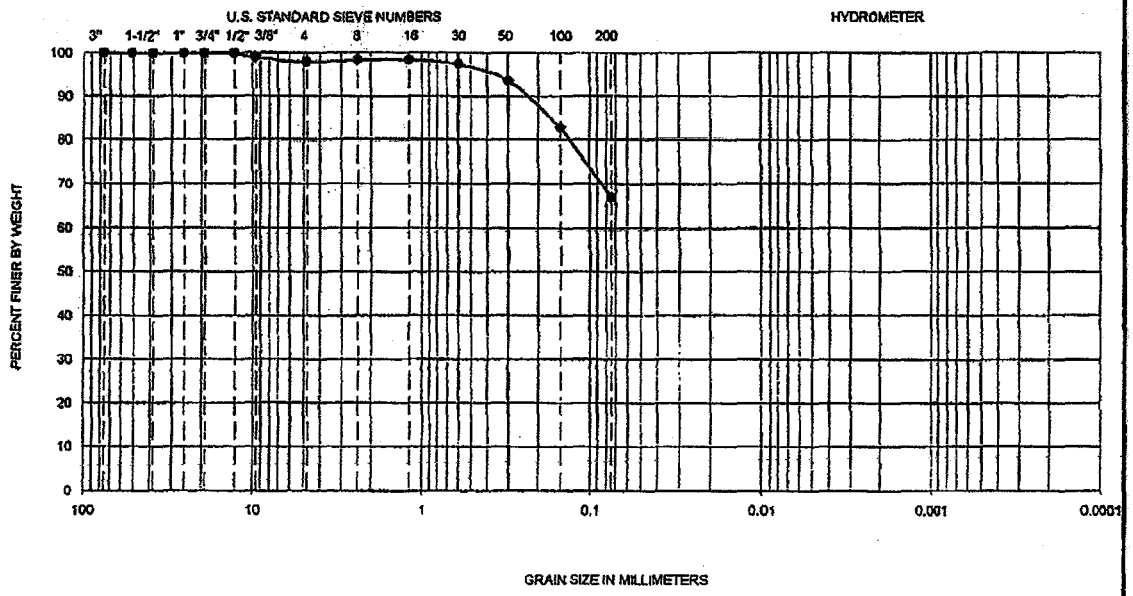
BORING LOG

WAL-MART STORE NO. 2544
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601871001	06/07	A-11

A-13

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-1	0-2	NP	NP	NP	--	--	--	--	--	67	ML

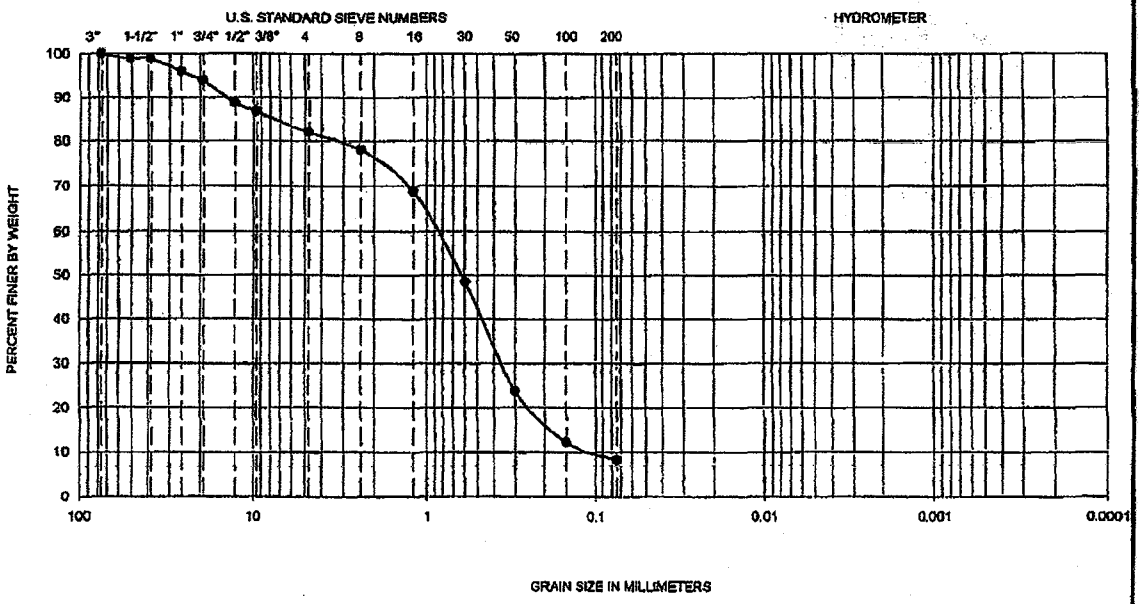
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

NP - INDICATES NON PLASTIC

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	AGUA FRIA CONNECTOR TRAIL AVONDALE, ARIZONA	B-1
601886001 / 07/07		

#170

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



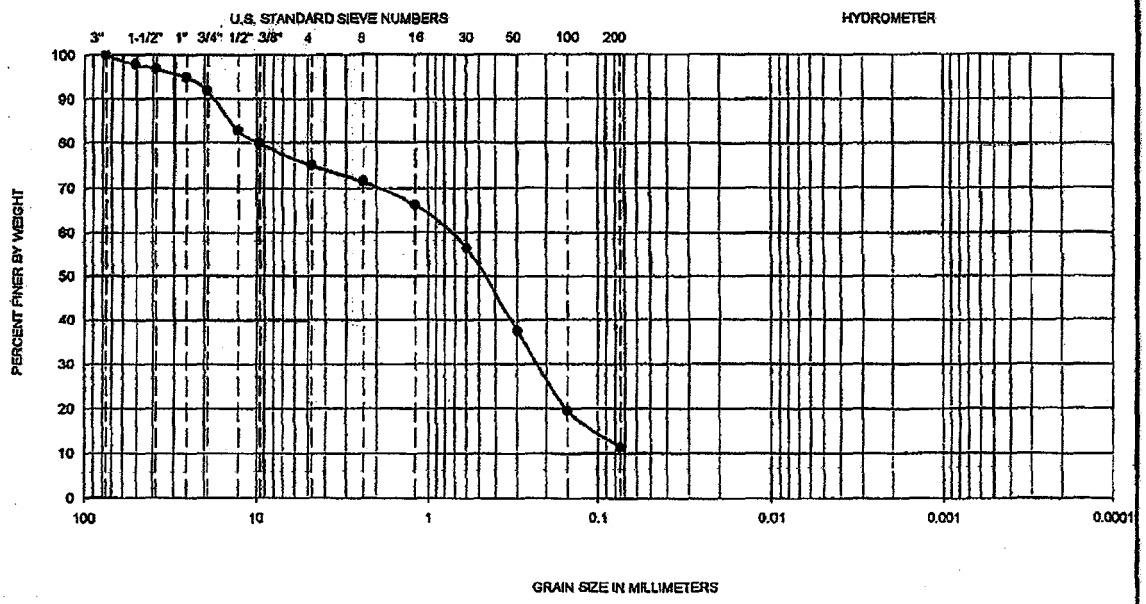
Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-4	0-2	NP	NP	NP	0.11	0.38	0.85	7.7	1.5	8	SW-SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

NP - INDICATES NON PLASTIC

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	AGUA FRIA CONNECTOR TRAIL AVONDALE, ARIZONA	B-2
601886001 / 07/07		

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-6	0-2	NP	NP	NP	0.06	0.25	0.75	12.5	1.4	11	SW-SM

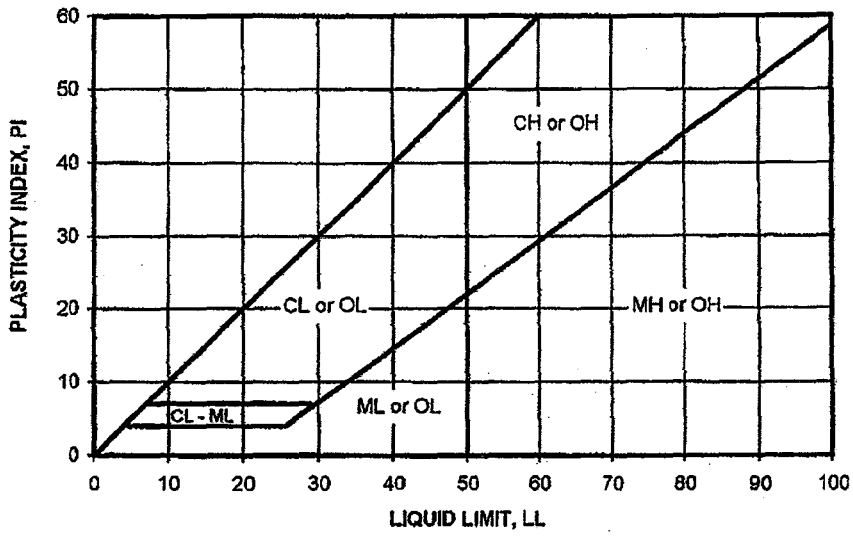
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

NP - INDICATES NON PLASTIC

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	AGUA FRIA CONNECTOR TRAIL AVONDALE, ARIZONA	B-3
601886001 / 07/07		

SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 4 Sieve)	USCS (Entire Sample)
●	B-1	0-2	NP	NP	NP	ML	ML
■	B-4	0-2	NP	NP	NP	ML	SW-SM
◆	B-6	0-2	NP	NP	NP	ML	SW-SM

NP - INDICATES NON-PLASTIC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-05

Ninyo & Moore	ATTERBERG LIMITS TEST RESULTS	FIGURE
PROJECT NO. 601886001 / DATE 07/07	AGUA FRIA CONNECTOR TRAIL AVONDALE, ARIZONA	B-4

LOG OF BORING NO. BB-08

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS #200
	SILTY SAND; trace gravel, brown, very dense, moist.	26		38								
				59								
		28		47								
				21								
		30		18								
			SM	23	X	SS BS	69	14		0	0	63
		32		14								
				15								
		34		21								
				58								
		36		63								
				70								
		38		28								
	39 949.5			36								
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace cobbles, brown, very dense, moist.	40	GP-GM	58	X	SS BS	50/6"					
				50								
		42		49								
				32								
		44		50								
				36								
		46		22								
				32								
		48		65								
				64								
		50		66								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	Not Measured	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-14-06		
BORING COMPLETED	12-14-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-08

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND: trace cobbles, brown, very dense, moist.		GP-GM	67	X	SS	80/3"					
		52		22								
				17								
		54		57								
				45								
		56		47								
				36								
		58		22								
				36								
		60		53								
			GP-GM	29	X	SS	80/3"					
		62		18								
				27								
		64		28								
				42								
		66		28								
				42								
		68		17								
				60								
		70		58								
	71 917.5		GP-GM	53	X	SS BS	75/5"					
	POORLY GRADED SAND WITH SILT AND GRAVEL: brown, very dense, moist, moderately cemented.	72		44								
				20								
		74		20								
				19								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ Not Measured	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-14-06		
BORING COMPLETED	12-14-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-08

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	-#200
	POORLY GRADED SAND WITH SILT AND GRAVEL: brown, very dense, moist, moderately cemented.	76		25								
				21								
		78		22								
				25								
		80		29								
			SP-SM	30		SS BS	65					23
		82		24								
				27								
		84		45								
				80								
	Note: Occasional cobbles below 85'.	86		107								
				111								
		88		35								
				94								
		90		80								
			SP-SM	81		SS	50/5"					
		92		48								
				61								
		94		53								
				74								
		96		59								
				79								
		98		188								
	99.5 889		SP-	95		SS	50/6"					
	Bottom of BORING	100										

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	Not Measured	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-14-06		
BORING COMPLETED	12-14-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-08

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS #200
			SM									

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ Not Measured	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-14-06		
BORING COMPLETED	12-14-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-09

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 997.0 ft

Depth, ft.	Description	Elev.	USCS Symbol	Hammer Blows	Sample Interval	Sample Type	Blows/Ft.	Water Content, %	Dry Density pcf	Liquid Limit	Plasticity Index	#200
0.75	PORTLAND CEMENT CONCRETE PAVEMENT (9")	996.5										
1.75	POORLY GRADED GRAVEL WITH SILT AND SAND; brown, very dense, moist, weakly cemented.	995.5	GP-GM			SS	50/3"					
2	Man-made fill, SILTY SAND trace gravel, occasional small cobbles, brown, very dense, moist, no cementation.			52								
				17								
4				16								
				15								
6				23								
				39								
8				36								
				34								
10				28								
			SM	30		SS	50/6"					
12				27								
				28								
14				47								
15	SILTY SAND; trace gravel, brown, very dense, moist, weakly cemented.	982		23								
16				17								
				21								
18				25								
				19								
20				14								
			SM	19		SS	50/6"					
22				14								
				14								
24				16								
				33								

Note: Poorly graded gravel with silt and sand (GP-GM) with cobble interbed at 24' to 26'.

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ Not Measured	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	1-22-07		
BORING COMPLETED	1-22-07		
RIG	AP 1000	FOREMAN	CER
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-09

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
SILTY SAND; trace gravel, brown, very dense, moist, weakly cemented.	26		62								
			86								
	28		40								
Note: Gravel and cobble content increases with depth.			34								
	30		31								
		SM	26	X	SS	70					
	32		18								
			21								
	34		20								
			24								
	36		11		BS						
Note: Thinly interbedded sandy clay (CL) lenses for 36' to 44'.			14								
	38		18								
			15								
	40		18								
		SM	24	X	SS	57	13		42	22	56
	42		23								
			19								
44 953	44		32								
POORLY GRADED GRAVEL WITH CLAY AND SAND; occasional to trace cobbles, brown, very dense, moist to wet, no cementation.			15								
	46		46								
			89								
	48		36								
			43								
	50		35								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	Not Measured	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	1-22-07		
BORING COMPLETED	1-22-07		
RIG	AP 1000	FOREMAN	CER
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-09

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH CLAY AND SAND; occasional to trace cobbles, brown, very dense, moist to wet, no cementation.		GP-GC	40	X	SS	50/3					
		52		30								
				41								
		54		24								
				23								
		56		37								
				15								
		58		17								
				31								
		60		25								
	Note: Silty Sand (SM) with trace gravel layer from 57' to 60'.		GP-GC	46	X	SS	50	10		51	30	7
		62		41								
				43								
		64		39								
				45								
	Note: Moisture content increases below 65'.	66		96								
				43								
		68		41								
				26								
		70		52								
			GP-GC	35	X	SS	50/6"					
	72 925	72		18								
	POORLY GRADED SAND WITH GRAVEL; trace silt, brown, very dense, wet, weakly cemented.			16								
		74		38								
				27								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ Not Measured	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	1-22-07		
BORING COMPLETED	1-22-07		
RIG	AP 1000	FOREMAN	CER
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-09

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS #200
POORLY GRADED SAND WITH GRAVEL; trace silt, brown, very dense, wet, weakly cemented.	76		30								
			36								
	78		24								
			37								
	80		61								
		GP-GC	44	X	SS	50/2"					
	82		30								
			36								
Note: Gravel content decreases below 84'.	84		33								
			36								
86 911	86		33								
WELL GRADED SAND WITH SILT trace gravel, brown, dense to very dense, wet, no cementation.			28								
	88		19								
			16								
	90		20								
		SW-SM	16	X	SS	52					
	92		16								
			15								
	94		14								
			12								
	96		11								
			10								
	98		11								
			13								
	100	SW-		X	SS	42	17		0	0	9

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ Not Measured	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	1-22-07		
BORING COMPLETED	1-22-07		
RIG	AP 1000	FOREMAN	CER
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-09

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH: ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS #200
	100.5 896.5		SM		X							
	Bottom of BORING.											

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ Not Measured	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	1-22-07		
BORING COMPLETED	1-22-07		
RIG	AP 1000	FOREMAN	CER
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-10

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 972.5 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200	DESCRIPTION
	SP-SM	5		BS							**POORLY GRADED SAND WITH SILT AND GRAVEL**; occasional cobbles, brown, dense to very dense, dry to moist.
2		10									
		10									
4		10									
		10									
6		11									
		18									
8		10									
		15									
10		15									
	SP-SM	10		SS	50						
12		12									
		10									
14		8									
		16									
16		13									
		13									
18		37									
		46									
20		27									
	GP-GM	19		SS / BS	50/6"	2		0	0	5	
22		17									
		23									
24		31									
		17									

17 — 955.5

POORLY GRADED GRAVEL WITH SILT AND SAND; trace cobbles, brown, very dense, moist.

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft	
WL ▽ 61 ft. WD	▼
WL ▽	▼
WL Backfilled Upon Completion	

Terracon

BORING STARTED	12-10-06		
BORING COMPLETED	12-10-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-10

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace cobbles, brown, very dense, moist.	26		70								
				21								
		28		24								
				31								
		30		24								
			GP-GM	17	X	SS	50/6"					
		32		21								
				22								
		34		39								
				22								
		36		38								
	Note: Thinly interbedded sandy clay lenses from 36' to 44'.			104								
		38		75								
				32								
		40		25								
			GP-GM	56	X	SS	50/3"					
		42		79								
				57								
		44		38								
				23								
		46		20								
				18								
		48		17								
				13								
	50 922.5	50		15								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 61 ft. WD	▽	
WL	▽	▽	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-10-06		
BORING COMPLETED	12-10-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-10

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH GRAVEL; trace silt, brown, very dense, moist.		SP	12	X	SS	50/6"					
52	920.5	52		15								
	POORLY GRADED GRAVEL WITH SILT AND SAND; some cobbles, brown, medium dense to very dense, moist.			17								
		54		32								
				20								
		56		13								
				20								
		58		24								
				19								
60	912.5	60		12								
	SILTY SAND; trace to some gravel, trace clay, brown, very dense, moist to wet, some thinly interbedded clayey sand lenses. ∇		SM	13	X	SS BS	29			39	19	48
		62		11								
				12								
		64		14								
				30								
		66		18								
				15								
		68		49								
				41								
		70		33								
			SM	38	X	SS BS	50/5"					
		72		32								
				37								
		74		30								
				32								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 61 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-10-06		
BORING COMPLETED	12-10-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-10

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND, trace to some gravel, trace clay, brown, very dense, moist to wet, some thinly interbedded clayey sand lenses.	76		75								
				68								
		78		78								
				44								
		80		58								
			SM	79		SS BS	50/6"					
		82		65								
				67								
		84		53								
				44								
		86		112								
				44								
		88		45								
				34								
		90		28								
			SM	20		SS	15					
		92		18								
				26								
		94		16								
				21								
		96		28								
				30								
		98		20								
	99.5 873			20								
			SM			SS	50/6"					
	Bottom of BORING.	100										

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 61 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-10-06		
BORING COMPLETED	12-10-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BBORE LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-11

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.0 ft

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
POORLY GRADED SAND WITH SILT trace fine gravel, brown, dense to very dense, dry to moist.		SP-SM	0		BS						
	2		27								
			18								
	4		15								
			12								
	6		18								
			27								
	8		20								
			22								
	10		11								
		SP-SM	11		SS	48					
	12		19								
			15								
	14		19								
			17								
	16		35								
			61								
	18		23								
19 955			23								
POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, moist.	20		25								
		GP-GM	21		SS	50/6"					
	22		27								
			27								
	24		26								
			29								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 63 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-12-06		
BORING COMPLETED	12-12-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/2/07

LOG OF BORING NO. BB-11

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, moist.	26		27								
				34								
		28		78								
				72								
		30		30								
			GP-GM	16		SS BS	50/5"			0	0	6
		32		21								
				26								
		34		23								
				25								
		36		43								
				42								
		38		40								
				39								
		40		34								
			GP-GM	49		SS	50/3"					
		42		20								
				51								
		44		47								
				39								
		46		21								
				41								
		48		43								
				27								
		50		48								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 63 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-12-06		
BORING COMPLETED	12-12-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-11

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, moist.		GP-GM	35	X	SS	50/6"					
	52		19								
			30								
	54		24								
			33								
	56		42								
57 917			38								
POORLY GRADED SAND WITH SILT trace to some gravel, brown, very dense, moist.	58		26								
			26								
	60		22								
		SP-SM	21	X	SS BS	55					
	62		19								
∇			23								
	64		32								
			17								
	66		20								
			32								
	68		23								
69 905			19								
SILTY SAND; trace clay, some gravel, brown, very dense, moist.	70		26								
		SM	53	X	SS BS	77/6"					
	72		44								
			31								
	74		33								
			30								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 63 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-12-06		
BORING COMPLETED	12-12-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-11

OWNER: Arizona Department of Transportation
ENGINEER: URS Corporation
SITE: Avondale, Arizona
PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND, trace clay, some gravel, brown, very dense, moist.	76		45								
				58								
		78		43								
				39								
		80		35								
			SM	46		SS BS	50/6"					
		82		64								
				92								
		84		117								
				74								
		86		75								
				65								
		88		65								
				45								
		90		82								
			SM	48		SS	50/3"					
		92		50								
				47								
		94		31								
	95 879			32								
	POORLY GRADED SAND WITH SILT trace gravel, brown, dense, wet.	96		30								
				30								
		98		21								
				55								
		100	SP-			SS	34					

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 63 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-12-06		
BORING COMPLETED	12-12-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-11

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	100.5 873.5		SM		X							
	Bottom of BORING.											

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 63 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-12-06		
BORING COMPLETED	12-12-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-12

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 972.5 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH GRAVEL; trace to some silt, brown, very dense, dry to moist.		SP	0		BS						
		2		4								
				16								
		4		10								
				14								
		6		18								
				32								
		8		26								
				20								
		10		16								
			SP	16	X	SS	67/6"					
		12		23								
				14								
		14		14								
				12								
		16		10								
				10								
		18		12								
	19 953.5			16								
	POORLY GRADED SAND WITH SILT AND GRAVEL; trace cobbles, brown, very dense, moist.	20		26	X	SS	50/3"					
			SP-SM	44								
		22		30								
				28								
		24		55								
				80								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 64 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-7-06		
BORING COMPLETED	12-7-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-12

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH SILT AND GRAVEL; trace cobbles, brown, very dense, moist.	26		21								
				19								
		28		24								
				17								
		30		18								
	Note: Fines become clayey below 30'.		SP-SM	12	X	SS BS	50/6"			31	9	10
		32		13								
				16								
		34		42								
				32								
		36		24								
				38								
		38		37								
				26								
		40		30								
			SP-SM	22	X	SS	50/6"					
		42		33								
				39								
		44		94								
				66								
		46		25								
				23								
		48		20								
				27								
		50		21								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 64 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-7-06		
BORING COMPLETED	12-7-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-12

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH SILT AND GRAVEL; trace cobbles, brown, very dense, moist.		SP-SM	18	X	SS	50/6"					
		52		20								
				25								
	54 — 918.5	54		20								
	SILTY SAND; trace to some gravel, brown, dense, moist to wet.			14								
		56		8								
				8								
		58		11								
				11								
		60		7								
			SM	12	X	SS BS	45					
		62		11								
				7								
	∇	64		8								
				11								
		66		26								
				22								
		68		15								
				23								
		70		35								
			SM	20	X	SS	50/5"					
		72		18								
				17								
		74		28								
				18								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 64 ft.	WD	∇
WL	∇		∇
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-7-06		
BORING COMPLETED	12-7-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-12

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND; trace to some gravel, brown, dense, moist to wet.	76		35								
				66								
		78		34								
	79 893.5			80								
	POORLY GRADED SAND WITH SILT trace to some gravel, light brown, very dense, moist to wet.	80		33								
			SP-SM	34	X	SS BS	50/6"					
		82		29								
				57								
		84		19								
				17								
		86		19								
				17								
		88		34								
				36								
		90		13								
			SP-SM	15	X	SS	80/6"					
		92		11								
				12								
		94		59								
				80								
		96		19								
				8								
	Note: Considerable gravel at 98'.	98		20								
				23								
	99.5 873		SP-		X	SS	50/6"					
	Bottom of BORING	100										

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 64 ft. WD	∇	
WL	∇	∇	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-7-06		
BORING COMPLETED	12-7-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-12

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
			SM									

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 64 ft.	WD	▽
WL	▽		▽
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-7-06		
BORING COMPLETED	12-7-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR200D.GDT 2/21/07

LOG OF BORING NO. BB-13

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 973.5 ft

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
POORLY GRADED SAND WITH SILT AND GRAVEL; brown, medium dense to dense, dry to moist.		SP-SM	5		BS				0	0	3
	2		0								
			0								
	4		1								
			12								
	6	SP-SM	13	X	SS	29					
			12								
	8		15								
			16								
	10		9								
			9								
	12		7								
			9								
	14		9								
			9								
Note: Silt content increases with depth.	16	SP-SM	8	X	SS	31					
			9								
	18		9								
			9								
20 953.5	20		10								
POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, dry to moist.		GP-GM	9		BS				0	0	12
	22		13								
			15								
	24		30								
			58								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 63 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-10-06		
BORING COMPLETED	12-10-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-13

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, dry to moist.	26	GP-GM	40		SS	50/2"					
				26								
		28		16								
				14								
		30		14								
				39								
		32		92								
				42								
		34		19								
				32								
		36	GP-GM	42		SS	50/4"					
				77								
		38		50								
				77								
		40		19								
			GP-GM	37		BS						
		42		73								
				37								
		44		41								
				41								
		46	GP-GM	59		SS	50/3"					
				46								
		48		29								
				33								
		50		28								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 63 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-10-06		
BORING COMPLETED	12-10-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-13

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	-#200
POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, dry to moist.			21								
	52		34								
			68								
	54		29								
			27								
		GP-GM		X	SS	50/4"					
	56		34								
57 916.5			15								
SILTY SAND; trace to some gravel, brown, very dense, moist to wet.	58		17								
			14								
	60		7								
			10								
	62		10								
∇			10								
	64		8								
			25								
		SM	11	X	SS	85/6"					
	66		14								
			15								
	68		16								
	70		13								
		SM	14	↕	BS				0	0	24
	72		14								
			12								
	74		15								
			16								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 63 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-10-06		
BORING COMPLETED	12-10-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-13

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND, trace to some gravel, brown, very dense, moist to wet.		SM		X	SS	50/6"					
		76		33								
				26								
		78		75								
				62								
		80		65								
				71								
		82		58								
				93								
		84		57								
				59								
			SM		X	SS	50/6"					
		86		35								
				40								
		88		93								
				110								
		90		104								
				39								
		92		29								
				35								
		94		252								
	Note: Becomes moderately cemented below 94'.			84								
			SM		X	SS	35					
		96		16								
				14								
		98		12								
	99 874.5			26								
	Bottom of BORING.	100										

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 63 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-10-06		
BORING COMPLETED	12-10-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-14

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.5 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	-#200	DESCRIPTION
		0						0	0	7	**POORLY GRADED SAND WITH SILT** trace fine gravel, occasional cobbles, brown, very dense, dry to moist.
2	SP-SM	0		BS							
		0									
4		0									
		3									
6	SP-SM	2		SS	66						
		4									
8		6									
		16									Note: Gravel and cobble content increases with depth.
10		27									
		26									
12		21									
		29									
14		28									
		19									
16	SP-SM	26		SS	50/6"						
		40									
18		20									
19		17									955.5
20		12									**SILTY GRAVEL WITH SAND** trace to some cobbles, brown, very dense, moist.
		9									
22		29									
		70									
24		53									
		39									

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 64 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-13-06		
BORING COMPLETED	12-13-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-14

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY GRAVEL WITH SAND trace to some cobbles, brown, very dense, moist.		GM		X	SS	50/6"					
		26		16								
				12								
		28		54								
				53								
		30		26								
			GM	17		BS						
		32		49								
				60								
		34		48								
				62								
			GM		X	SS	50/6"					
		36		27								
				33								
		38		29								
				32								
		40		27								
				29		BS				0	0	13
		42		48								
	43 931.5			44								
	CLAYEY SAND, brown, very dense, moist.	44		13								
				12								
			SC		X	SS	50/3"					
		46		48								
				66								
		48		42								
				24								
	50 924.5	50		21								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 64 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-13-06		
BORING COMPLETED	12-13-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-14

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS #200
POORLY GRADED GRAVEL WITH SAND; some cobbles, brown, very dense, moist.			32								
	52		22								
			25								
	54		43								
			20								
		GP		X	SS	50/3"					
	56		17								
57 917.5			16								
SILTY SAND; some gravel, brown, very dense, moist.	58		13								
			22								
	60		17								
			22								
	62		21								
			20								
Note: Note becomes moderately cemented at 65'. ∇	64		17								
			30								
		SM		X	SS	76/6"					
	66		22								
			36								
	68		32								
			44								
	70		50								
			45		BS				0	0	27
	72		47								
			42								
	74		41								
			39								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 64 ft. WD	∇	
WL	∇	∇	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-13-06		
BORING COMPLETED	12-13-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-14

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND; some gravel, brown, very dense, moist.	76	SP-SM	28	X	SS	80/6"					
				65								
		78		33								
				45								
		80		71								
				49								
		82		51								
				77								
		84		69								
				76								
		86	SP-SM	50	X	SS	67					
	87 887.5			55								
	POORLY GRADED SAND WITH SILT trace gravel, brown, very dense, wet.	88		46								
				45								
		90		60								
				79								
		92		68								
				57								
		94		34								
				49								
		96	SP-SM	103	X	SS						
				43								
		98		38								
	99 875.5			54								
	Bottom of BORING.	100										

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 64 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-13-06		
BORING COMPLETED	12-13-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-15

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.0 ft

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
POORLY GRADED SAND WITH SILT trace fine gravel, brown, dense, dry to moist.			9		BS				0	0	7
	2		15								
			15								
	4		11								
			11								
	6		11								
			16								
	8	SP-SM	11		SS	48					
			10								
	10		7								
			29								
	12		27								
			31								
	14		25								
15 959			29								
POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some some cobbles, brown, very dense, moist.	16	GP-GM	15		SS	50/4"					
			24								
	18		54								
			40								
	20		14		BS						
			18								
	22		16								
			34								
	24		89								
			63								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft	
WL ▽ 64 ft. WD ▽	
WL ▽	▽
WL Backfilled Upon Completion	

Terracon

BORING STARTED	12-7-06		
BORING COMPLETED	12-7-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-15

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some some cobbles, brown, very dense, moist.		GP-GM	25	X	SS	50/4"					
		26		27								
				25								
		28		32								
				16								
		30		13								
				16								
		32		15								
				15								
		34		22								
			GP-GM	29	X	SS	50/4"					
		36		46								
				34								
		38		49								
	39 935			42								
	SILTY GRAVEL WITH SAND cobbles and boulders, brown, very dense, moist.	40		72		BS				0	0	12
				130								
		42		164								
				221								
		44		211								
			GM	230	X	SS	50/3"					
		46		318								
				41								
		48		46								
				29								
		50										

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 64 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-7-06		
BORING COMPLETED	12-7-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR20CD.GDT 3/21/07

LOG OF BORING NO. BB-15

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
SILTY GRAVEL WITH SAND cobbles and boulders, brown, very dense, moist.			13								
	52		23								
			20								
	54		42								
			36								
		GM			SS	50/6"					
	56		58								
			31								
	58		16								
59 915			12								
SILTY SAND, trace fine gravel, brown, dense to very dense, moist to wet.	60		8		BS				0	0	35
			17								
	62		19								
			19								
∇	64		17								
			19								
		SM			SS	53					
	66		6								
			14								
	68		12								
			8								
	70		8								
			12								
	72		9								
			10								
	74		11								
			14								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 64 ft. WD	∇	
WL	∇	∇	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-7-06		
BORING COMPLETED	12-7-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-15

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND, trace fine gravel, brown, dense to very dense, moist to wet.	76	SM	14	X	SS	52					
				25								
		78		32								
				49								
		80		31								
				23								
		82		37								
				28								
		84		47								
				23								
		86	SM	10	X	SS	27					
				15								
		88		27								
				10								
		90		10								
				13								
		92		13								
				20								
		94		20								
				28								
			SP		X	SS	50/6"					
		96		20								
				41								
		98		64								
				143								
		100										

88 886

POORLY GRADED SAND trace to some silt, brown, very dense, wet.

Note: Increase in gravel content at 97'.

99 875

Bottom of BORING.

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 64 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-7-06		
BORING COMPLETED	12-7-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-17

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.0 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
		5		BS				0	0	9
2		5								
		8								
4		11								
		15								
6		16								
		14								
8		13								
		13								
10		7								
	SP-SM	9	X	SS	43					
12		8								
		10								
14		12								
		11								
16		10								
		19								
18		20								
		39								
20		21								
	GP-GM	26	X	SS	50/6"					
22		139								
		60								
24		61								
		29								

POORLY GRADED SAND WITH SILT
trace gravel, brown, dense, dry to moist.

17 957

POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, dense to very dense, moist to wet.

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 61 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-18-06		
BORING COMPLETED	12-18-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-17

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND, trace to some cobbles, brown, dense to very dense, moist to wet.	26		41								
				15								
		28		11								
				20								
		30		12								
	Note: Interbedded with poorly graded sand with silt and gravel (SP-SM) from 30' to 40'.		GP-GM	13		SS BS	42			0	0	9
		32		13								
				11								
		34		20								
				39								
		36		47								
				67								
		38		47								
				31								
		40		39								
			GP-GM	68		SS	50/3"					
		42		47								
				26								
		44		31								
				16								
		46		16								
				14								
		48		16								
				38								
		50		35								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 61 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-18-06		
BORING COMPLETED	12-18-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-17

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, dense to very dense, moist to wet.		GP-GM	30		SS	50/6"					
						BS						
		52		58								
				37								
		54		54								
				28								
		56		31								
				36								
		58		14								
				16								
		60		18								
			GP-GM	21		SS	50/6"					
		62		11								
				13								
	64 910	64		24								
	SILTY SAND; some gravel, brown, very dense, wet.			22		BS						
		66		16								
				21								
		68		19								
				19								
		70		13								
			SM	29		SS	50/6"					
		72		45								
				54								
		74		44								
				45								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 61 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-18-06		
BORING COMPLETED	12-18-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-17

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND, some gravel, brown, very dense, wet.	76		46								
				53								
		78		93								
				61								
		80		64								
			SM	49	X	SS	50/6"					
		82		85								
				73								
		84		963								
				53								
		86		55		BS						37
				47								
		88		34								
	89 885			28								
	CLAYEY SAND, brown, very dense, wet, moderately cemented.	90		81								
			SC	91	X	SS	50/3"					
		92		57								
				35								
		94		48								
				100								
		96		59								
	97 877			30								
	POORLY GRADED SAND WITH SILT some gravel, brown, very dense, wet.	98		28								
				26								
	99.5 874.5		SP		X	SS	25/6"					
	Bottom of BORING	100										

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 61 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-18-06		
BORING COMPLETED	12-18-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-17

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS #200
			SM									

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 61 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-18-06		
BORING COMPLETED	12-18-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-18

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 972.5 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200	DESCRIPTION
		10		BS				0	0	7	**POORLY GRADED SAND WITH SILT** trace to some gravel, brown, very dense, dry to moist.
2		12									
		10									
4		17									
		20									
6		18									
		28									
8		16									
		19									
10		10									
	SP-SM	11		SS	68						
12		11									
		11									
14		12									
		16									
16		58									Note: Increase in gravel content at 16'.
		62									
18		53									
		34									19 — 953.5
20		40									**POORLY GRADED GRAVEL WITH SILT AND SAND**; brown, very dense, moist.
	GP-GM	51		SS BS	50/6"			0	0	7	
22		49									
		35									
24		34									
		14									

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 67 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-6-06		
BORING COMPLETED	12-6-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/2/07

LOG OF BORING NO. BB-18

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; brown, very dense, moist.	26		44								
				31								
		28		18								
				26								
		30		6								
			GP-GM	5		SS	50/6"					
		32		6								
				13								
		34		13								
				16								
	Note: Cobbles at 36' to 42'.	36		32								
				30								
		38		66								
				52								
		40		42								
			GP-GM	41		SS	50/6"					
		42		48								
				36								
		44		29								
				29								
		46		27								
				26								
		48		34								
				18								
	50 922.5	50		18								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 67 ft. WD	▼
WL	▼	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-6-06		
BORING COMPLETED	12-6-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECHER LOG b5065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-18

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SAND; trace to some silt, brown, very dense, moist.		GP		X	SS	50/6"					
				19								
		52		17								
				23								
		54		30								
				22								
		56		14								
				14								
		58		17								
				17								
60	912.5	60		16								
	SILTY SAND WITH GRAVEL; trace clay, brown, medium dense to very dense, wet.		SM		X	SS	50/6"					
				20		BS						
		62		14								
				19								
		64		13								
				16								
		66		10								
	∇			14								
		68		15								
				12								
		70		7								
			SM	18	X	SS BS	68					
		72		14								
				14								
		74		48								
				22								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 67 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-6-06		
BORING COMPLETED	12-6-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-18

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND WITH GRAVEL; trace clay, brown, medium dense to very dense, wet.	76		16								
				37								
		78		41								
				20								
		80		11								
			SM	9		SS BS	58			31	8	26
		82		22								
				26								
		84		16								
				21								
		86		19								
				28								
		88		16								
				19								
		90		2								
			SM	15		SS	20					
		92		22								
				21								
		94		16								
				29								
		96		114								
	Note: Moderately cemented from 96' to 98'.			165								
		98		100								
				67								
	99.5 873		SM			SS	50/5"					
	Bottom of BORING.	100										

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 67 ft. WD	▽	
WL	▽	▽	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-6-06		
BORING COMPLETED	12-6-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-19

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 973.0 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
		3		BS						
2		10								
		10								
4		9								
		7								
	SP-SM	7		SS	24					
6										
		9								
8		8								
		16								
10		14								
		13								
12		15								
		12								
14		12								
15		12								
	GP-GM	17		SS	50/6"					
16		14								
		14								
18		13								
		18								
20		70								
		40								
22		67								
		82								
24		14								

POORLY GRADED SAND WITH SILT AND GRAVEL; brown, medium dense to very dense, dry to moist.

958

POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, dense to very dense, moist.

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 63 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-9-06		
BORING COMPLETED	12-9-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-19

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101 L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, dense to very dense, moist.		GP-GM	15	X	SS	50/6"					
		26		10								
				8								
	Note: Reduced number of cobbles from 25' to 37'.	28		6								
				8								
		30		16								
				16								
		32		15								
				8								
		34		10								
			GP-GM	7	X	SS	39					
		36		9								
				37								
		38		57								
				51								
		40		140								
				109								
		42		24								
				8								
		44		40								
	Note: Reduced number of cobbles from 45' to 50'.		GP-GM	40	X	SS	50/6"					
		46		42								
				71								
		48		55								
		50		24								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 63 ft. WD	▼	
WL	▽	▼	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-9-06		
BORING COMPLETED	12-9-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-19

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, dense to very dense, moist.			19								
		52		21								
				51								
		54		30								
				21								
			GP-GM		X	SS	50/6"					
		56		18								
				20								
		58		22								
				26								
		60		14								
				13								
		62		16								
	∇			23								
		64		23								
	65 908			16								
	POORLY GRADED SAND WITH SILT trace to some gravel, brown, very dense, wet.		SP-SM		X	SS	64					
		66		10								
				12								
		68		12								
				16								
		70		12								
				13								
		72		17								
				16								
		74		40								
	75 898			34								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft	
WL ∇ 63 ft. WD	∇
WL ∇	∇
WL Backfilled Upon Completion	

Terracon

BORING STARTED	12-9-06		
BORING COMPLETED	12-9-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECHER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-19

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH GRAVEL; trace silt, brown, very dense, wet.		SP		X	SS	50/6"					
		76		49								
				50								
		78		63								
				50								
	80 893	80		41								
	POORLY GRADED SAND WITH CLAY brown, very dense, wet.			43								
		82		54								
				29								
		84		32								
				36								
			SP-SC		X	SS	50/6"					
		86		26								
				28								
		88		19								
				25								
		90		12								
				13								
		92		15								
				137								
		94		51								
	95 878			36								
	WELL GRADED SAND WITH SILT trace gravel, brown, medium dense to dense, wet.		SW-SM		X	SS	32					
		96		9								
				16								
		98		17								
	99 874			15								
	Bottom of BORING.	100										

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

WATER LEVEL OBSERVATIONS, ft	
WL	▽ 63 ft. WD ▽
WL	▽ ▽
WL	Backfilled Upon Completion

Terracon

BORING STARTED	12-9-06		
BORING COMPLETED	12-9-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BORING LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-20

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 972.5 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS #200
		23		BS						
2		40								
		34								
4		33								
		13								
	SM	6		SS	70	4		0	0	12
6										
		14								
8		16								
		35								
10		25								
		17								
12		16								
		43								
14		33								
		24								
	GP-GM	20		SS	50/6"					
16		20								
		20								
18		31								
		14								
20		15		BS				0	0	7
		23								
22		17								
		23								
24		22								

SILTY SAND; trace to some gravel, brown, very dense, dry to moist.

10 — 962.5

POORLY GRADED SAND WITH GRAVEL; trace silt, occasional cobbles, brown, very dense, moist.

15 — 957.5

POORLY GRADED GRAVEL WITH SILT AND SAND; occasional to trace cobbles, brown, very dense, moist.

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 65 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-12-06		
BORING COMPLETED	12-12-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-20

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101 L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; occasional to trace cobbles, brown, very dense, moist.	26	GP-GM	25		SS	50/3"					
				31								
		28		36								
				22								
		30		12								
				12								
		32		14								
				15								
		34		32								
				37								
			GP-GM	39		SS	50/4"					
		36		85								
		38		84								
				76								
		40		45								
				59								
		42		30								
				68								
		44		44								
				53								
			GP-GM	39		SS BS	50/5"					
		46		44								
		48		56								
				27								
		50		29								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 65 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-12-06		
BORING COMPLETED	12-12-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-20

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	-#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; occasional to trace cobbles, brown, very dense, moist.			17								
		52		21								
				38								
		54		31								
				29								
	Note: Becomes thinly interbedded with clayey sand (SC) below 55'.		GP-GM	28		SS	50/3"					
		56		22								
		58		18								
				25								
		60		17								
				16								
	62 910.5	62		15								
	POORLY GRADED SAND WITH SILT some gravel, occasional cobbles, brown, very dense, moist to wet.			15								
		64		24								
				25								
		66	SP-SM	17		SS	50/6"					
				24								
		68		274								
				14								
		70		20								
				27		BS						
		72		23								
				27								
		74		25								
				35								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 65 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-12-06		
BORING COMPLETED	12-12-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-20

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH SILT some gravel, occasional cobbles, brown, very dense, moist to wet.		SP-SM		X	SS	50/6"					
		76		28								
				48								
	78 894.5	78		61								
	POORLY GRADED SAND WITH CLAY AND GRAVEL; brown, very dense, wet.			73								
		80		56								
				65								
		82		79								
				45								
	84 888.5	84		42								
	POORLY GRADED SAND WITH SILT trace gravel, brown, very dense, wet.			39								
			SP-SM		X	SS	50/6"					
		86		107								
				67								
		88		67								
				60								
		90		60								
				40								
		92		34								
				20								
		94		20								
				21								
			SP-SM		X	SS	50/5"					
		96		30								
				20								
		98		21								
	99 873.5			37								
	Bottom of BORING.	100										

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 65 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-12-06		
BORING COMPLETED	12-12-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BEDROCK LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-21

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 973.0 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
		22		BS				0	0	12
2		23								
		13								
4		13								
		13								
	SM	13	X	SS	46					
6										
		13								
8		17								
		40								
10		18								
		20								
12		30								
		13								
14		20								
		13								
	SM	13	X	SS	31					
16										
		10								
18		13								
		39								
20		25								
		25		BS				0	0	8
22		54								
		84								
24		54								
		12								

SILTY SAND, trace to some gravel, brown, dense, dry to moist.

19 954

POORLY GRADED SAND WITH SILT AND GRAVEL; brown, dense, moist.

Note: Trace to some cobbles from 20' to 25'.

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 65 ft. WD	▼	
WL	▽	▼	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-6-06		
BORING COMPLETED	12-6-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-21

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH SILT AND GRAVEL; brown, dense, moist.	26	SP-SM	15	X	SS	36					
				6								
		28		4								
				20								
	30 943	30		11								
	POORLY GRADED GRAVEL WITH SILT AND SAND; occasional to trace cobbles, brown, very dense, moist.			22								
		32		40								
				64								
		34		23								
				21								
		36	GP-GM	70		SS BS	50/3"					
				69								
		38		108								
				120								
		40		53								
				46								
		42		47								
				60								
		44		23								
				30								
			GP-GM	49	X	SS	50/4"					
		46		30								
		48		33								
				63								
		50		32								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 65 ft. WD	▼	
WL	▽	▼	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-6-06		
BORING COMPLETED	12-6-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-21

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	-#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; occasional to trace cobbles, brown, very dense, moist.			28								
		52		48								
				40								
	54 919	54		25								
	SILTY SAND; trace to some fine gravel, brown, dense to very dense, moist to wet.			15								
			SM	15		SS BS	50/6"					
		56		10								
		58		9								
				15								
		60		9								
				8								
		62		7								
				8								
		64		13								
	∇			12								
			SM	3		SS BS	42			0	0	30
		66		7								
		68		20								
				40								
		70		31								
				27								
		72		13								
				20								
		74		29								
				16								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 65 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED			12-6-06
BORING COMPLETED			12-6-06
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BEGINER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-21

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND; trace to some fine gravel, brown, dense to very dense, moist to wet.		SM	25	X	SS	50/5"					
		76		30								
				28								
		78		20								
				23								
		80		11								
				20								
		82		26								
				12								
		84		19								
			SM	23	X	SS	50/6"					
		86		28								
				16								
		88		13								
				10								
		90		11								
				12								
		92		12								
				15								
		94		10								
	95 878											
	POORLY GRADED SAND WITH SILT trace fine gravel, brown, very dense, wet.		SP-SM	10	X	SS	50/6"					
		96		18								
				12								
		98		11								
	99 874											
	Bottom of BORING.	100										

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 65 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-6-06		
BORING COMPLETED	12-6-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BORING LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-22

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.0 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
		25		BS				0	0	11
2		31								
		38								
4		21								
		20								
6		13								
		14								
8		15								
		16								
10		10								
	SP-SM	11	X	SS	32					
12		6								
		9								
14		22								
		20								
16		16								
		15								
18		13								
		13								
20		7								
	SP-SM	8	X	SS	50/4"					
22		11								
		8								
24		13								
		21								

POORLY GRADED SAND WITH SILT AND GRAVEL; brown, loose to dense, dry to moist.

25 949

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 66 ft. WD	▼	
WL	▽	▼	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-8-06		
BORING COMPLETED	12-8-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-22

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; cobbles and boulders, brown, very dense, moist.	26		57								
				62								
		28		56								
				26								
		30		23								
			GP-GM	43	X	SS	50/6"					
		32		47								
				58								
		34		71								
				35								
		36		71								
				100								
		38		35								
				30								
		40		20								
			GP-GM	36	X	SS BS	50/6"					
		42		44								
				15								
		44		36								
				62								
		46		57								
				38								
		48		39								
				74								
	50 924	50		45								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 66 ft. WD	▽	
WL	▽	▽	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-8-06		
BORING COMPLETED	12-8-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-22

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH SILT AND GRAVEL; trace to some clay, brown, very dense, moist to wet.		SP-SM	30	X	SS	50/6"					
		52		9								
				10								
		54		11								
				14								
		56		18								
				20								
	Note: Grades to clayey sand from 58' to 62'.	58		33								
				30								
		60		23								
			SP-SM	40	X	SS BS	50/6"			31	14	28
		62		29								
				14								
		64		40								
				27								
	∇	66		34								
				36								
		68		12								
				23								
		70		38								
			SP-SM	30	X	SS BS	50/6"					
		72		43								
				46								
		74		44								
				28								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 66 ft. WD	∇	
WL	∇	∇	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-8-06		
BORING COMPLETED	12-8-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-22

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH SILT AND GRAVEL; trace to some clay, brown, very dense, moist to wet.	76		28								
				83								
		78		103								
				46								
	80 894	80		36								
	POORLY GRADED SAND WITH CLAY brown, very dense, wet.		SC	12	X	SS BS	59					
		82		43								
				38								
		84		36								
	85 889			18								
	POORLY GRADED SAND WITH SILT trace to some gravel, brown, very dense, wet.	86		29								
				42								
		88		30								
				12								
		90		7								
			SP-SM	7	X	SS	31					
		92		8								
				4								
		94		10								
				12								
		96		20								
				14								
	Note: Trace gravel below 98'.	98		15								
	99.5 874.5		SP-	32	X	SS	53					
	Bottom of BORING	100										

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 66 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-8-06		
BORING COMPLETED	12-8-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-22

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: #200
			SM		X							

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 66 ft. WD	∇	
WL	∇	∇	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-8-06		
BORING COMPLETED	12-8-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2005.GDT 2/21/07

LOG OF BORING NO. BB-23

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.0 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
		13		BS				0	0	10
2		12								
		10								
4		11								
		10								
6		17								
		12								
8		13								
		16								
10		21								
	GP-GM	24		SS	58					
12		12								
		21								
14		19								
		16								
16		16								
		15								
18		15								
		19								
20		13								
	GP-GM	12		SS	50/6"					
22		9								
		14								
24		11								
		11								

WELL GRADED SAND WITH SILT AND GRAVEL; occasional cobbles, brown, dense to very dense, dry to moist.

10 964

POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, moist.

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ Not Measured	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-11-06		
BORING COMPLETED	12-11-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-23

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, moist.	26		20								
				15								
		28		26								
				22								
		30		19								
			GP-GM	18	X	SS BS	50/6"					
		32		20								
				36								
		34		20								
				24								
	Note: Cobble content increases below 34'.	36		25								
				25								
		38		21								
				24								
		40		51								
			GP-GM	39	X	SS	50/6"					
		42		30								
				33								
		44		42								
				67								
		46		36								
				41								
		48		26								
				48								
		50		55								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	Not Measured	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-11-06		
BORING COMPLETED	12-11-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG #65065088.GPJ TERR2000.GDT 2/2/07

LOG OF BORING NO. BB-23

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, moist.		GP-GM	50	X	SS	50/6"					
		52		24								
				22								
		54		26								
				19								
		56		19								
				22								
	58 916			28								
	SANDY SILT; some gravel, occasional cobbles, brown, hard, moist.	58		14								
				17								
		60	SP-SM	21	X	SS BS	58			0	0	53
		62		13								
				32								
		64		15								
				16								
		66		32								
				37								
		68		25								
				21								
		70		274								
	Note: Becomes moderately cemented at 72'.		SP-SM	49	X	SS BS	36					
		72		124								
				72								
		74		46								
	75 899			53								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	Not Measured	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-11-06		
BORING COMPLETED	12-11-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-23

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH SILT trace to some gravel, brown, medium dense to very dense, wet, moderately cemented.	76		44								
				43								
		78		35								
				26								
		80		27								
			SP-SM	70	X	SS	50/6"					
		82		52								
				92								
		84		45								
				59								
		86		112								
				47								
		88		44								
				54								
		90		45								
			SP-SM	40	X	SS	50					
		92		40								
				28								
		94		19								
				23								
		96		25								
				34								
		98		30								
				26								
		100	SP-		X	SS	24					

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ Not Measured	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-11-06		
BORING COMPLETED	12-11-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-23

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	100.5 873.5		SM		X							
	Bottom of BORING.											

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ Not Measured	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-11-06		
BORING COMPLETED	12-11-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-24

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND, some gravel, occasional cobbles, brown, dense, dry to moist.			15		BS				0	0	15
		2		24								
				28								
		4		23								
				19								
		6		21								
				20								
		8		19								
				15								
		10		11								
			SM	11	X	SS	20					
		12		12								
				12								
		14		7								
				8								
		16		9								
				12								
		18		12								
				12								
		20		17								
	Note: Trace cobbles from 20' to 25'.		SM	10	X	SS	55					
		22		14								
				20								
		24		14								
	25 949			18								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 66 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-5-06		
BORING COMPLETED	12-5-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-24

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, moist.	26		25		BS						
				30								
		28		40								
				47								
		30		25								
			GP-GM	18		SS	50/3"					
		32		30								
				22								
		34		41								
				51								
		36		20								
				53								
		38		49								
				31								
		40		13								
			GP-GM	9		SS BS	50/6"			0	0	10
		42		13								
				30								
		44		47								
				68								
		46		69								
				65								
		48		63								
				52								
	50 924	50		16								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 66 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-5-06		
BORING COMPLETED	12-5-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-24

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND; some gravel, brown, very dense, moist to wet.		SM			SS	50/6"					
				6		BS						
		52		7								
				12								
		54		15								
				34								
		56		12								
				20								
		58		22								
				27								
		60		18								
			SM			SS	50/6"					
				9								
		62		20								
				16								
		64		10								
				10								
	∇	66		20								
				29								
		68		41								
				36								
		70		16								
			SM	17		SS BS	50/6"			24	4	32
		72		8								
				9								
		74		14								
				26								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 66 ft.	WD	∇
WL	∇		∇
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-5-06		
BORING COMPLETED	12-5-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2003.GDT 2/21/07

LOG OF BORING NO. BB-24

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	-#200
	SILTY SAND; some gravel, brown, very dense, moist to wet.	76		35								
				35								
		78		17								
				26								
		80		12								
			SM	11	X	SS	50/6"					
		82		47								
				28								
		84		11								
				53								
		86		27								
				30								
		88		59								
				20								
	90 884	90		3								
	POORLY GRADED SAND trace to some silt and gravel, brown, dense, wet.		SP	3	X	SS	23					
		92		3								
	93 881			12								
	POORLY GRADED SAND WITH SILT AND GRAVEL; brown, very dense, wet.	94		11								
				15								
		96		10								
				13								
		98		40								
	99.5 Note: Possible cobbles at 99'. 874.5		SP	25	X	SS	50/6"					
	Bottom of BORING	100										

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 66 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-5-06		
BORING COMPLETED	12-5-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-24

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
			SM									

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 66 ft. WD	▽	
WL	▽	▽	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-5-06		
BORING COMPLETED	12-5-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-25

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.0 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED SAND WITH SILT trace to some gravel, brown, dense to very dense, moist.			7		BS						
		2		12								
				12								
		4		12								
				12								
		6	SP-SM	11	X	SS	40					
				16								
		8		14								
				24								
		10		13								
				12								
		12		12								
				16								
		14		13								
				13								
		16	SP-SM	10	X	SS	32					
				21								
		18		16								
				16								
	Note: Occasional cobbles from 20' to 25'.	20		8								
				10								
		22		14								
				24								
		24		22								
	25 949			17								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 62 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-8-06		
BORING COMPLETED	12-8-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-25

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, very dense, moist.		GP-GM		X	SS	50/6"					
		26		14								
				27								
		28		30								
				40								
		30		24						0	0	7
				10								
		32		28								
				56								
		34		33								
				42								
			GP-GM		X	SS	50/6"					
		36		67								
				27								
		38		40								
				103								
		40		26								
				29								
		42		15								
				45								
		44		31								
				18								
			GP-GM		X	SS	50/5"					
		46		27								
				22								
		48		28								
				48								
	50 924	50		32								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 62 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-8-06		
BORING COMPLETED	12-8-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-25

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND; trace to some gravel, brown, very dense, moist.			11								
		52		21								
				11								
		54		11								
				12								
			SM	14	X	SS	50/6"					
		56		25								
		58		25								
				30								
		60		34								
				12								
	∇	62		28								
				21								
		64		19								
	65 909			19								
	SILTY SAND WITH GRAVEL; brown, very dense, moist.		SM	50	X	SS	50/6"					
		66		52								
		68		49								
				35								
		70		24						0	0	29
				28								
		72		20								
				23								
		74		30								
				26								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 62 ft.	WD	∇
WL	∇		∇
WL	Backfilled Upon Completion		

Terracon

BORING STARTED			12-8-06
BORING COMPLETED			12-8-06
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-25

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND WITH GRAVEL; brown, very dense, moist.		SM	15	X	SS	85					
		76		35								
				67								
		78		28								
				36								
		80		59								
				34								
		82		15								
				24								
		84		9								
85	889											
	POORLY GRADED SAND WITH CLAY brown, very dense, wet.		SC	20	X	SS	50/6"					
		86		84								
				16								
		88		15								
				10								
		90		12								
				19								
		92		27								
				25								
		94		10								
95	879											
	POORLY GRADED SAND WITH GRAVEL; trace silt, brown, very dense, wet.		SP	12	X	SS	50/6"					
		96		28								
				34								
		98		15								
99	875											
	Bottom of BORING.	100										

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 62 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-8-06		
BORING COMPLETED	12-8-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-26

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.5 ft

DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
		10		BS				0	0	15
2		11								
		13								
4		16								
		23								
	SM	20	X	SS	65					
6										
		14								
8		14								
		20								
10		12								
		15								
12		16								
		24								
14		39								
		31								
	SM	16	X	SS	65					
16										
		15								
18		38								
		43								
20		45								
		50								
22		37								
		34								
24		55								
		23								

SILTY SAND, trace to some gravel, occasional to trace cobbles, brown, very dense, dry to moist.

18 — 956.5

POORLY GRADED GRAVEL WITH SILT AND SAND, some gravel, trace to some cobbles, brown, very dense, moist.

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 63 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-11-06		
BORING COMPLETED	12-11-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

LOG OF BORING NO. BB-26

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; some gravel, trace to some cobbles, brown, very dense, moist.	26	GP-GM	22	X	SS	50/6"					
				19								
		28		19								
				25								
		30		25								
				20		BS						
		32		40								
				62								
		34		34								
				63								
			GP-GM	28	X	SS	50/6"					
		36		49								
		38		73								
				92								
		40		56								
				37						0	0	10
		42		92								
				112								
		44		43								
				64								
			GP-GM	62	X	SS	50/4"					
		46		58								
		48		55								
				28								
	50 924.5	50		19								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 63 ft. WD	▼
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-11-06		
BORING COMPLETED	12-11-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-26

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND; trace to some gravel, occasional cobbles, brown, very dense, moist.			24								
		52		18								
				17								
		54		17								
				21								
			SM	29	X	SS BS	53					
		56										
				24								
		58		28								
				35								
		60		30								
				29								
		62		35								
	∇			55								
	64 910.5	64		38								
	SILTY SAND WITH GRAVEL; brown, very dense, wet.			27								
			SM	28	X	SS BS						
		66		47								
		68		46								
				35								
		70		56								
				68								
		72		56								
				58								
		74		51								
				64								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 63 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-11-06		
BORING COMPLETED	12-11-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-26

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	-#200
SILTY SAND WITH GRAVEL, brown, very dense, wet.		SP		X	SS	50/6"					
	76		36								
			64								
	78		100								
			78								
	80		64								
			86		BS				42	18	38
	82		102								
			95								
	84		36								
85 889.5			44								
POORLY GRADED SAND trace clay, brown, very dense, wet.		SP		X	SS	75					
	86		50								
			53								
	88		74								
			71								
	90		68								
			78								
	92		45								
			47								
	94		47								
			46								
		SP		X	SS	50/6"					
	96		44								
			45								
	98		48								
99 875.5			36								
Bottom of BORING.	100										

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 63 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-11-06		
BORING COMPLETED	12-11-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-27

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

Approx. Surface Elev.: 974.0 ft

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
SILTY SAND; trace fine gravel, brown, loose to medium dense, dry to moist.			14		BS				0	0	18
	2		18								
			14								
	4		13								
			16								
	6		15								
			15								
	8		10								
			12								
	10		1								
		SM	2	X	SS	8					
	12		7								
			6								
	14		9								
			11								
	16		12								
			14								
	18		9								
			10								
20 954	20		14								
POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, dense to very dense, moist.		GP-GM	19	X	SS	30					
	22		32								
			33								
	24		48								
			41								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 65 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-4-06		
BORING COMPLETED	12-4-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/2/07

LOG OF BORING NO. BB-27

OWNER: Arizona Department of Transportation

ENGINEER: URS Corporation

SITE: Avondale, Arizona

PROJECT: I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	POORLY GRADED GRAVEL WITH SILT AND SAND; trace to some cobbles, brown, dense to very dense, moist.	26		63								
				24								
		28		20								
				14								
		30		10								
			GP-GM	11		SS BS	50/6"			0	0	8
		32		19								
				21								
		34		46								
				71								
		36		292								
				207								
		38		72								
				106								
		40		53								
			GP-GM	25		SS	50/5"					
		42		52								
				31								
	Note: Fines become clayey at 44'.	44		25								
				29								
		46		31								
				16								
		48		21								
				52								
	50 924	50		23								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 65 ft. WD	∇
WL	∇	∇
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-4-06		
BORING COMPLETED	12-4-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-27

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	#200
	SILTY SAND, some gravel, brown, very dense, moist to wet.		SM	16		SS BS	50/3"					
		52		13								
				18								
		54		10								
				10								
		56		9								
				13								
		58		11								
				13								
		60		8								
			SM	28		SS	50/6"					
		62		22								
				32								
		64		24								
	∇			37								
		66		53								
				25								
		68		23								
				10								
		70		8								
	Note: Fines become clayey and moderately cemented at 70'.		SM	17		SS BS	50/6"			0	0	43
		72		18								
				32								
	Note: Gravel content increases.	74		49								
				26								

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 65 ft. WD	∇	
WL	∇	∇	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-4-06		
BORING COMPLETED	12-4-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-27

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	-#200
	SILTY SAND; some gravel, brown, very dense, moist to wet.	76		38								
				39								
		78		18								
				21								
		80		8								
	Note: Becomes wet at 80'.		SM	14	X	SS	50					
		82		9								
				53								
		84		20								
				23								
		86		10								
				12								
		88		10								
				19								
		90		2								
	Note: Loose below 90'.		SM	2	X	SS	8					
		92		6								
				13								
		94		16								
				16								
		96		10								
				20								
		98		21								
				13								
		100	SM		X	SS	8					

Continued Next Page

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

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 65 ft. WD	▽
WL	▽	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-4-06		
BORING COMPLETED	12-4-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR2000.GDT 2/21/07

LOG OF BORING NO. BB-27

OWNER	ENGINEER
Arizona Department of Transportation	URS Corporation
SITE	**PROJECT**
Avondale, Arizona	I-10 Widening (Sarival Road to SR 101L)

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	HAMMER BLOWS	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: #200
	100.5 873.5				X							
	Bottom of BORING.											

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 65 ft. WD	▽	
WL	▽	▽	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	12-4-06		
BORING COMPLETED	12-4-06		
RIG	AP 1000	FOREMAN	MJD
APPROVED	SDN	JOB #	65065088

BECKER.LOG 65065088.GPJ TERR2005.GDT 2/21/07

PROJECT I-10 (Papago) Outside Widening
Sarival Avenue to Dysart Road
TRACS No. H6879 01L
Maricopa County, Arizona

JOB NO. 6-117-001063 DATE 1/24/07

LOCATION Dysart Road TIOP (EB)
I-10 Centerline Sta. 6840+10, 60' R
RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1013' ±
DATUM HDR Basemap

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count (S) Per 6-inches (U) Per 12-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification or Rock Unit	REMARKS	VISUAL CLASSIFICATION
0										13" Asphaltic Concrete (AC)
				A				CL	slightly moist to moist	FILL SANDY CLAY, predominantly fine grained, subangular to subrounded, medium plasticity, brown
				U	11	114	16		moderately firm	
								SC	slightly moist	FILL CLAYEY SAND, predominantly fine to medium grained, subangular to subrounded sand, nonplastic to low plasticity, brown
5				U	27				firm	
								SC	slightly moist	FILL CLAYEY SAND WITH GRAVEL, some predominantly fine grained, subangular to subrounded gravel, predominantly fine grained, subangular to subrounded, medium plasticity, brown to light brown
10				S	7-13-13				firm to very firm	
										note: decrease in coarse grained gravel, reddish-brown below 14'
15				S	5-11-15		16			
										note: weakly cemented, light brown below 18'
20				U	43	109	17			
								CL	slightly moist	Native SANDY CLAY, trace of silt, occasional fine grained, angular gravel, fine to medium grained, angular to subangular, weakly cemented, low plasticity, brown
25				S	5-6-7		12		moderately firm	

GROUNDWATER

DEPTH(ft)	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 - Thin Walled Shelby tube sample
MC - Modified California ring sample
NR - No Recovery

LOG OF TEST BORING NO. BO-9

PROJECT I-10 (Papago) Outside Widening
Sarival Avenue to Dysart Road
TRACS No. H6879 01L
Maricopa County, Arizona

JOB NO. 6-117-001063 DATE 1/24/07

LOCATION Dysart Road TIOP (EB)
I-10 Centerline Sta. 6840+10, 60' R
RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1013' ±
DATUM HDR Basemap

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count (S) Per 6-inches (U) Per 12-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification or Rock Unit	REMARKS	VISUAL CLASSIFICATION
25								CL	slightly moist moderately firm	SANDY CLAY, continued
30				S	6-5-5		14			
35				U	55	96	13	SM	slightly moist hard	SILTY SAND, predominantly fine grained, subangular to subrounded, weakly cemented, nonplastic, brown
40				S	40-40-46		17	CL	slightly moist hard	SANDY CLAY, predominantly fine grained, subangular to subrounded, weakly to moderately cemented, medium plasticity, light brown
45				S	6-18-28			ML	slightly moist very firm	SANDY SILT, fine grained, weakly cemented, nonplastic, brown
50				U	65	107	4	SP-SM	slightly moist very firm to hard	SAND WITH SILT, predominantly fine grained, angular to subangular, weakly cemented, nonplastic, brown to light brown

GROUNDWATER

DEPTH(ft)	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 - Thin Walled Shelby tube sample
MC - Modified California ring sample
NR - No Recovery

LOG OF TEST BORING NO. BO-9

PROJECT I-10 (Papago) Outside Widening
Sarival Avenue to Dysart Road
TRACS No. H6879 01L
Maricopa County, Arizona

JOB NO. 6-117-001063 DATE 1/24/07

LOCATION Dysart Road TIOP (EB)
I-10 Centerline Sta. 6840+10, 60' R
RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1013' ±
DATUM HDR Basemap

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count (S) Per 6-inches (U) Per 12-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification or Rock Unit	REMARKS	VISUAL CLASSIFICATION
50								SP-SM	slightly moist very firm to hard	SAND WITH SILT, continued note: increase in fines content & uncemented below 53'
								SP-SM	slightly moist medium dense to very dense	SAND WITH SILT, predominantly fine grained, nonplastic, light brown
55				S	8-15-18		13			
60				S	8-13-17					note: well graded, subangular to subrounded sand, trace to some coarse grained, subangular to subrounded gravel below about 63'
65				U	100/10"	117	15			note: water added at intermittent depths below about 65'
								SC	slightly moist very firm to hard	CLAYEY SAND WITH GRAVEL, some predominantly fine grained, subangular to subrounded gravel, predominantly fine to medium grained, subangular to subrounded, weakly cemented, low to medium plasticity, brown to gray
70				S	50/3"					
75				S	10-15-25					

GROUNDWATER

DEPTH(ft)	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 - Thin Walled Shelby tube sample
MC - Modified California ring sample
NR - No Recovery

LOG OF TEST BORING NO. BO-9

PROJECT I-10 (Papago) Outside Widening
Sarival Avenue to Dysart Road
TRACS No. H6879 01L
Maricopa County, Arizona

JOB NO. 6-117-001063 DATE 1/24/07

LOCATION Dysart Road TIOP (EB)
I-10 Centerline Sta. 6840+10, 60' R
RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1013' ±
DATUM HDR Basemap

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count (S) Per 6-inches (U) Per 12-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification or Rock Unit	REMARKS	VISUAL CLASSIFICATION
75			X					SC	slightly moist very firm to hard	CLAYEY SAND WITH GRAVEL, continued
80			X	S	27-35-35					
								GC	slightly moist hard to very firm	CLAYEY GRAVEL WITH SAND, considerable well graded, subangular to subrounded sand, predominantly coarse grained, subangular to subrounded, weakly cemented, low plasticity, brown to gray note: possible cobbles below about 85'
85			X	S	24-50/5 1/2"		4			
90			X	S	24-18-24					
								SC	slightly moist very firm to hard	CLAYEY SAND, predominantly fine grained, subangular to subrounded, medium plasticity, brown
95			X	S	8-19-17					
				U	60	104	20			Stopped Auger at 98'6" Stopped Sampler at 99'6"
100										

GROUNDWATER

DEPTH(ft)	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 - Thin Walled Shelby tube sample
MC - Modified California ring sample
NR - No Recovery

LOG OF TEST BORING NO. BO-9

PROJECT I-10 (Papago) Outside Widening
Sarival Avenue to Dysart Road
TRACS No. H6879 01L
Maricopa County, Arizona

JOB NO. 6-117-001063 DATE 2/6/07

LOCATION Dysart Road TIOP (WB)
I-10 Centerline Sta. 6842+50, 70' L
RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1013' ±
DATUM HDR Basemap

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count (S) Per 6-inches (U) Per 12-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification or Rock Unit	REMARKS	VISUAL CLASSIFICATION
0										12" PCCP
				A						FILL
								SC	slightly moist to moist	CLAYEY SAND, predominantly fine grained, subangular to subrounded, weakly cemented, medium plasticity, brown
				U	27	123	11		firm	
								SC-SM		FILL
5				S	15-9-7				slightly moist firm	CLAYEY SILTY SAND WITH GRAVEL, fine grained, angular to subangular gravel, predominantly fine to medium grained, angular to subrounded, weakly cemented, low plasticity, brown
								SC	slightly moist	FILL SAND WITH CLAY, fine grained, subangular to subrounded sand, low to medium plasticity, brown
10				U	15	107	16		moderately firm	
								CL	slightly moist	FILL CLAY WITH SAND, rare fine grained, angular gravel, predominantly fine grained, angular sand, low plasticity, brown
15				S	6-10-11				moderately firm to firm	
										note: weakly cemented below 18'
20				S	6-10-8		18			
								CL	slightly moist moderately firm to firm	Native CLAY WITH SAND, predominantly fine grained, subangular to subrounded, weakly cemented, medium plasticity, brown
25				S	5-5-4					

GROUNDWATER

DEPTH(ft)	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 - Thin Walled Shelby tube sample
MC - Modified California ring sample
NR - No Recovery

LOG OF TEST BORING NO. BO-10

PROJECT I-10 (Papago) Outside Widening
Sarival Avenue to Dysart Road
TRACS No. H6879 01L
Maricopa County, Arizona

JOB NO. 6-117-001063 DATE 2/6/07

LOCATION Dysart Road TIOP (WB)
I-10 Centerline Sta. 6842+50, 70' L
RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1013' ±
DATUM HDR Basemap

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count (S) Per 6-inches (U) Per 12-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification or Rock Unit	REMARKS	VISUAL CLASSIFICATION
25			X					CL	slightly moist moderately firm to firm	CLAY WITH SAND, continued
30				U	28	105	15			
35			X	S	12-14-14		17			note: moderately cemented below about 34'
40				U	50	101	24	CL	slightly moist to moist very firm to firm	SANDY CLAY, predominantly fine grained, subangular to subrounded sand, weakly to moderately cemented, medium plasticity, light brown to tan
45			X	S	9-13-15		29			note: decrease in clay content below about 45'
50			X	S	12-12-17		5	SM	slightly moist firm to very firm	SAND WITH SILT, trace to some predominantly coarse grained, angular gravel, fine to medium grained, angular to subangular, nonplastic, brown

GROUNDWATER

DEPTH(ft)	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 - Thin Walled Shelby tube sample
MC - Modified California ring sample
NR - No Recovery

LOG OF TEST BORING NO. BO-10

PROJECT I-10 (Papago) Outside Widening
Sarival Avenue to Dysart Road
TRACS No. H6879 01L
Maricopa County, Arizona

JOB NO. 6-117-001063 DATE 2/6/07

LOCATION Dysart Road TIOP (WB)
I-10 Centerline Sta. 6842+50, 70' L
RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1013' ±
DATUM HDR Basemap

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count (S) Per 6-inches (U) Per 12-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification or Rock Unit	REMARKS	VISUAL CLASSIFICATION
50			X					SM	slightly moist to moist firm to very firm	**SAND WITH SILT,** continued
55				U	57	116	8			
								SP-SC/ GP-GC	slightly moist hard	**SAND & GRAVEL WITH CLAY,** trace of silt, well graded, angular to subrounded gravel, predominantly fine to medium grained, angular sand, weakly cemented, low plasticity, brown to gray
60			X	S	27-40-30		4			
										note: decrease in gravel content below about 64'
65			X	S	50/4"					
										note: possible occasional cobbles encountered below about 68'
70				U	100/10"	119	3			
										note: decrease in coarse grained gravel content below 74'
75			X	S	50/5"		5			

GROUNDWATER

DEPTH(ft)	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 - Thin Walled Shelby tube sample
MC - Modified California ring sample
NR - No Recovery

LOG OF TEST BORING NO. BO-10

PROJECT I-10 (Papago) Outside Widening
Sarival Avenue to Dysart Road
TRACS No. H6879 01L
Maricopa County, Arizona

JOB NO. 6-117-001063 DATE 2/6/07

LOCATION Dysart Road TIOP (WB)
I-10 Centerline Sta. 6842+50, 70' L
RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1013' ±
DATUM HDR Basemap

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count (S) Per 6-inches (U) Per 12-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification or Rock Unit	REMARKS	VISUAL CLASSIFICATION
75								SC-SM	slightly moist hard	SAND & GRAVEL WITH CLAY, continued
								SC	slightly moist hard	SAND WITH GRAVEL & CLAY, trace of silt, fine grained, angular to subrounded gravel, predominantly medium grained, angular sand, weakly cemented, low plasticity, brown to gray
80			X	S	20-50/6"					
								SC	slightly moist hard	CLAYEY SAND, trace of fine grained, subangular to subrounded gravel, predominantly fine to medium grained, subangular to subrounded, nonplastic to low plasticity, weakly cemented, light brown to gray
85				U	78	111	5			
										note: trace to some coarse grained, subangular to subrounded gravel below about 88'
90			X	S	50/5 1/2"					
										Stopped Auger at 93'
95										
100										

GROUNDWATER

DEPTH(ft)	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 - Thin Walled Shelby tube sample
MC - Modified California ring sample
NR - No Recovery

LOG OF TEST BORING NO. BO-10

LOG OF BORING NO. EB-33

CLIENT	ENGINEER
URS	URS
SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona	PROJECT: I-10 Outside Widening

Boring Location: STA 6831+93; 130 ft. Lt.

Approx. Surface Elev.: 996.5 ft

Description	Elev.	Depth, ft.	USCS Symbol	Graphic	Type	Recovery (in)	Blows/ft.	Plasticity Index	#200	Method of Drilling	Recovery (%)	RQD (%)
FILL - CLAYEY SAND; light brown, medium dense, damp to moist.	2.5 / 994		SC		RS		27					
NATIVE - LEAN CLAY; brown, very stiff, slightly damp, weak cementation.	5 / 991.5	5	CL		RS		36					
SANDY LEAN CLAY; light brown, hard.			CL		RS		50/10"					
dark brown, very stiff, no to weak cementation.	10 / 986.5	10	CL		RS		50					
SANDY SILT; brown, very stiff, slightly damp, no to weak cementation.	11 / 985.5		ML		RS		27					
Bottom of BORING.												

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

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

DRILLING COMPANY: Wilcox	
DRILLING FOREMAN: NJO	
BORING STARTED	12-26-07
BORING COMPLETED	12-26-07
RIG: ACKER ADII	FOREMAN: JCR
APPROVED: CER	JOB #: 65075093

CORE LOG 2006 65075093.GPJ TERR2000.GDT 1/25/08

LOG OF BORING NO. EB-34

CLIENT	ENGINEER
URS	URS
SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona	PROJECT: I-10 Outside Widening

Boring Location: STA 6832+29; 146 ft. Rt.

Approx. Surface Elev.: 997 ft

Depth, ft.	Description	USCS Symbol	Sample Type	Recovery (in)	Blows/ft.	Plasticity Index	#200	Method of Drilling	Recovery (%)	RQD (%)
	FILL - SANDY LEAN CLAY; brown, stiff, damp.	CL	RS		22	11	61			
2 (995)	NATIVE - SANDY LEAN CLAY; brown, very stiff, slightly damp. hard.	CL	RS		44					
5	very stiff, nodules observed.	CL	RS		39					
		CL	RS		37					
10		CL	RS		25					
11 (986)	Bottom of BORING.									

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

DRILLING COMPANY: Wilcox
DRILLING FOREMAN: JCR

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-27-07
BORING COMPLETED	12-27-07
RIG: ACKER ADII	FOREMAN: NJO
APPROVED: CER	JOB #: 65075093

CORE LOG 2000 65075093.GPJ TERR2000.GDT 1/25/08

LOG OF BORING NO. EB-35

CLIENT: URS	ENGINEER: URS
SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona	PROJECT: I-10 Outside Widening

Boring Location: STA 6835+27; 190 ft. Rt.

Approx. Surface Elev.: 994.5 ft

DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/FT.	TESTS: PLASTICITY INDEX	TESTS: #200	METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)	Description
	SC		RS		16						**CLAYEY SAND**; brown to light brown, dense, damp to moist.
	SC		RS		50						
5	CL		RS		34						5.5 989 **SANDY LEAN CLAY**; some silt, brown to light brown, very stiff, slightly damp, no to weak cementation.
	CL		RS		26						
10	CL		RS		24						nodules observed. 11 983.5

Bottom of BORING.

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

DRILLING COMPANY: Wilcox
DRILLING FOREMAN: JCR

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-27-07
BORING COMPLETED	12-27-07
RIG: ACKER ADII	FOREMAN: JCR
APPROVED: CER	JOB #: 65075093

LOG OF BORING NO. EB-36

CLIENT	ENGINEER
URS	URS
SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona	PROJECT: I-10 Outside Widening

Boring Location: STA 6849+35; 128 ft. Rt.

Approx. Surface Elev.: 1000 ft

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	TYPE	RECOVERY (in)	BLOWS/FT.	TESTS: PLASTICITY INDEX	#200	METHOD OF DRILLING	CORE DATA: RECOVERY (%)	RQD (%)
1 — **FILL - SANDY LEAN CLAY**; brown, stiff, moist. (999)		CL		RS		10					
NATIVE - CLAYEY SAND WITH GRAVEL; brown to light brown, loose, slightly damp, no to weak cementation. very dense.		SC		RS		50/8"					
	5	SC		RS		50/10"					
		SC		RS		50/9"					
9 — **SANDY LEAN CLAY**; brown, hard, slightly damp, weak cementation. (991)	10	CL		RS		50/10"					
11 — **Bottom of BORING.** (989)											

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

DRILLING COMPANY: Wilcox
DRILLING FOREMAN: JCR

WATER LEVEL OBSERVATIONS, ft	
WL ▽ None WD	▽
WL ▽	▽
WL Backfilled Upon Completion	

Terracon

BORING STARTED	12-27-07
BORING COMPLETED	12-27-07
RIG ACKER ADII	FOREMAN JCR
APPROVED CER	JOB # 65075093

LOG OF BORING NO. OBB-14

CLIENT: URS	ENGINEER: URS
SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona	PROJECT: I-10 Outside Widening

Boring Location: STA 6840+22; 113 ft. Lt.

Approx. Surface Elev.: 1006.2 ft

Depth, ft.	USCS Symbol	Graphic	Type	Recovery (in)	Blows/ft.	Plasticity Index	#200	Method of Drilling	Recovery (%)	RQD (%)
	CL		SS		5 - 8 - 11					
	CL		RS		29					
5	CL		SS		10 - 14 - 14					
10	CL		RS		41	14	80			
15	CL		SS		5 - 6 - 10					
20	CL		RS		44					
25	SM		SS		6 - 26 - 50/5					

FILL - SANDY LEAN CLAY; light brown, very stiff, slightly damp.

10 — 996

FILL - LEAN CLAY WITH SAND; light brown, very stiff, slightly damp.

17 — 989

NATIVE - LEAN CLAY WITH SAND; light brown to brown, hard, slightly damp.

25 — 981

Continued Next Page

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

DRILLING COMPANY: Yellow Jacket
DRILLING FOREMAN: NJO

WATER LEVEL OBSERVATIONS, ft	
WL ▽ None WD	▼
WL ▽	▼
WL Backfilled Upon Completion	

Terracon

BORING STARTED	12-18-07
BORING COMPLETED	12-19-07
RIG CME 850	FOREMAN NJO
APPROVED CER	JOB # 65075093

LOG OF BORING NO. OBB-14

CLIENT: URS

ENGINEER: URS

SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona

PROJECT: I-10 Outside Widening

DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	TYPE	RECOVERY (in)	BLOWS/FT.	TESTS: PLASTICITY INDEX	#200	METHOD OF DRILLING	CORE DATA: RECOVERY (%)	RQD (%)
30	SP		RS		50/3"					
35	SP		SS		3 - 7 - 9					
40	ML		RS		61	0	90			
45	ML		SS		4 - 5 - 9					
50	CL ML		RS		41	7	58			

GRAPHIC LOG

30 — 976

SILTY SAND WITH GRAVEL; light brown, very dense, slightly damp, weak cementation.

POORLY GRADED SAND WITH GRAVEL; tan, dense, slightly damp, no to weak cementation.

medium dense.

40 — 966

SANDY SILT; tan, hard, slightly damp, weak cementation.

50 — 956

SANDY SILTY CLAY; brown, medium dense, slightly damp, weak cementation.

Continued Next Page

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

DRILLING COMPANY: Yellow Jacket
DRILLING FOREMAN: NJO

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-18-07
BORING COMPLETED	12-19-07
RIG CME 850	FOREMAN NJO
APPROVED CER	JOB # 65075093

LOG OF BORING NO. OBB-14

CLIENT: URS	ENGINEER: URS
SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona	PROJECT: I-10 Outside Widening

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	TYPE	RECOVERY (in)	BLOWS/FT.	TESTS: PLASTICITY INDEX	#200	METHOD OF DRILLING	CORE DATA: RECOVERY (%)	RQD (%)
	SANDY SILTY CLAY; brown, medium dense, slightly damp, weak cementation.											
	55 — 951	55										
	SANDY LEAN CLAY; brown, very stiff, slightly damp, weak cementation.		CL	X	SS		5 - 8 - 16					
	60 — 946	60										
	LEAN CLAY; brown, hard, damp, weak cementation.		CL		RS		58					
	65 — 941	65										
	CLAYEY SAND WITH GRAVEL; light brown, dense, slightly damp.		SC	X	SS		8 - 17 - 21					
	70 — 936	70										
	POORLY GRADED SAND WITH GRAVEL; light brown, medium dense to dense, slightly damp.		SP		RS		50/5"					
		75	SP	X	SS		24 - 19 - 14					

Continued Next Page

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

DRILLING COMPANY: Yellow Jacket
DRILLING FOREMAN: NJO

WATER LEVEL OBSERVATIONS, ft	
WL ▽ None WD	▼
WL ▽	▼
WL Backfilled Upon Completion	

Terracon

BORING STARTED	12-18-07		
BORING COMPLETED	12-19-07		
RIG	CME 850	FOREMAN	NJO
APPROVED	CER	JOB #	65075093

LOG OF BORING NO. OBB-14

CLIENT: URS

ENGINEER: URS

SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona

PROJECT: I-10 Outside Widening

Depth, ft.	USCS Symbol	Samples: Type	Recovery (in)	Blows/ft.	Tests: Plasticity Index	#200	Method of Drilling	Core Data: Recovery (%)	RQD (%)
80	SP	RS		50/5"					
85	CL	SS		3 - 5 - 8					
90	CL	RS		40					
95	SC SM	SS		4 - 5 - 11					
100	SP	RS		91					

POORLY GRADED SAND WITH GRAVEL; light brown, medium dense to dense, slightly damp.

85 921

SANDY LEAN CLAY; brown, stiff, moist, no to weak cementation.

92 914

SILTY CLAYEY SAND; brown, medium dense, slightly damp, no to weak cementation.

99 907

100 906 **POORLY GRADED SAND WITH GRAVEL**; dense, slightly damp, no to weak cementation.

Bottom of BORING.

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

DRILLING COMPANY: Yellow Jacket
DRILLING FOREMAN: NJO

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-18-07		
BORING COMPLETED	12-19-07		
RIG	CME 850	FOREMAN	NJO
APPROVED	CER	JOB #	65075093

LOG OF BORING NO. OBB-15

CLIENT: URS	ENGINEER: URS
SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona	PROJECT: I-10 Outside Widening

Boring Location: STA 6842+55; 90 ft. Rt.

Approx. Surface Elev.: 1010.6 ft

Depth, ft.	Description	Elev.	USCS Symbol	Graphic	Type	Recovery (in)	Blows/ft.	Plasticity Index	-#200	Method of Drilling	Recovery (%)	RQD (%)
	FILL - POORLY GRADED SAND WITH SILT AND GRAVEL; some fines, brown to tan, medium dense, slightly damp.		SP-SM		RS		18					
2	**FILL - CLAYEY SAND WITH GRAVEL**; brown to light brown, medium dense, slightly damp.	1008.5	SC		SS		3 - 7 - 9					
5	**FILL - SANDY LEAN CLAY**; trace gravel, brown, very stiff, slightly damp.	1005.5	CL		RS		39					
10			CL		SS		7 - 16 - 17					
15			CL		RS		62					
20	very stiff.		CL		SS		5 - 7 - 12					
22	**NATIVE - LEAN CLAY WITH SAND**; brown, hard, slightly damp, weak cementation.	988.5										
25	stiff.		CL		RS		13					

Continued Next Page

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

DRILLING COMPANY: Yellow Jacket
DRILLING FOREMAN: MWH

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-17-07		
BORING COMPLETED	12-18-07		
RIG	CME 850	FOREMAN	MWH
APPROVED	CER	JOB #	65075093

CORE LOG 2000 65075093.GPJ TERR2000.GDT 1/25/08

LOG OF BORING NO. OBB-15

CLIENT	ENGINEER
URS	URS
SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona	PROJECT: I-10 Outside Widening

Elevation	Description	DEPTH, ft.	USCS SYMBOL	GRAPHIC	TYPE	RECOVERY (in)	BLOWS/FT.	PLASTICITY INDEX	#200	METHOD OF DRILLING	RECOVERY (%)	RQD (%)
	NATIVE - LEAN CLAY WITH SAND; brown, hard, slightly damp, weak cementation.											
30 / 980.5	**SILT WITH SAND**; brown, stiff, slightly damp, weak cementation.	30	ML	X	SS		3 - 5 - 9					
	very stiff.	35	ML		RS		27					
37.5 / 973	**LEAN CLAY WITH SAND**; brown, medium stiff, slightly damp, weak cementation.	40	CL	X	SS		2 - 3 - 3					
45 / 965.5	**POORLY GRADED SAND WITH CLAY**; light brown, medium dense, slightly damp.	45	SP SC		RS		29					
52 / 958.5		50	SP SC	X	SS		4 - 5 - 12					

Continued Next Page

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

DRILLING COMPANY: Yellow Jacket
DRILLING FOREMAN: MWH

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-17-07		
BORING COMPLETED	12-18-07		
RIG	CME 850	FOREMAN	MWH
APPROVED	CER	JOB #	65075093

CORE LOG 2000 65075093.GPJ TERR2000.GDT 1/25/08

LOG OF BORING NO. OBB-15

CLIENT	ENGINEER
URS	URS
SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona	PROJECT: I-10 Outside Widening

DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	TYPE	RECOVERY (in)	BLOWS/FT.	TESTS: PLASTICITY INDEX	#200	METHOD OF DRILLING	CORE DATA: RECOVERY (%)	RQD (%)	Description
											POORLY GRADED SAND WITH SILT AND GRAVEL; some fines, brown to light brown, medium dense, slightly damp.
55	SP SM		RS		26						
											gravel content increases.
60	SP SM		SS		7 - 12 - 21						light brown to tan, dense, weak cementation.
											gravel content increases.
65	SP SM		RS		68						
70	SP SM		SS		5 - 12 - 25						
75	SP SM		RS		100						very dense.

Continued Next Page

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

DRILLING COMPANY: Yellow Jacket
DRILLING FOREMAN: MWH

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED			12-17-07
BORING COMPLETED			12-18-07
RIG	CME 850	FOREMAN	MWH
APPROVED	CER	JOB #	65075093

CORE LOG 2000 65075093.GPJ TERR2002.GDT 1/25/08

LOG OF BORING NO. OBB-15

CLIENT: URS

ENGINEER: URS

SITE: Sarival Ave to Dysart Road, Maricopa County, Arizona

PROJECT: I-10 Outside Widening

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/FT.	TESTS: PLASTICITY INDEX	TESTS: -#200	METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
	POORLY GRADED SAND WITH SILT AND GRAVEL; some fines, brown to light brown, medium dense, slightly damp. medium dense.	80	SP SM		SS		5 - 7 - 12					
	light brown, very dense.	85	SP SM		RS		100/10"					
		90	SP SM		SS		11 - 21 - 29					
95	**SANDY LEAN CLAY WITH GRAVEL**; brown to light brown, very stiff, slightly damp, weak cementation. 915.5	95	CL		RS		39					
100	brown. 910.5	100	CL		SS		6 - 8 - 15					
	Bottom of BORING.											

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

DRILLING COMPANY: Yellow Jacket
DRILLING FOREMAN: MWH

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	12-17-07		
BORING COMPLETED	12-18-07		
RIG	CME 850	FOREMAN	MWH
APPROVED	CER	JOB #	65075093

PROJECT I-10 (Papago) Outside Widening
Sarival Avenue to Dysart Road
TRACS No. H6879 01L
Maricopa County, Arizona

JOB NO. 6-117-001063 DATE 11/27/06

LOCATION 2600' West of Dysart (WB)
I-10 Centerline Sta. 6816+00, 120' L
RIG TYPE CME-75
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 990' ±
DATUM HDR Basemap

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count (S) Per 6-inches (U) Per 12-inches	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification or Rock Unit	REMARKS	VISUAL CLASSIFICATION
0				S A	6-11-12		4	CL-ML	slightly moist, firm	SILT & CLAY WITH SAND, rare fine grained, subangular to subrounded gravel, predominantly fine to medium grained sand, subangular to subrounded, uncemented, low plasticity, reddish-brown
				U	21	88	8	CL	slightly moist, firm to hard	SANDY CLAY WITH GRAVEL, fine grained, subangular to subrounded gravel, well graded, subangular to subrounded sand, medium plasticity, dark brown
5				U	65		6			
10				U	65	104	6			
15				U	32	101	4	SM	slightly moist, firm	SILTY SAND, predominantly finegrained, subangular to subrounded, nonplastic, gray to light brown
20				U	36	111	2			
								GP-SP	slightly moist, very firm to hard	GRAVEL & SAND, some fine to medium grained, subangular to subrounded sand, predominantly fine grained, subangular to subrounded gravel, nonplastic
25				U	72					

GROUNDWATER

DEPTH(ft)	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 - Thin Walled Shelby tube sample
MC - Modified California ring sample
NR - No Recovery

LOG OF TEST BORING NO. SH-19

A-16

VALUE ENGINEERING PAYS

TRIAL VERSION of TIFFDLL

TT 86-16

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'	SP/SM		100	97	5	SAND with SILT, grey damp, loose, grasses around surface, hair roots.
3.0'			93	78	2	SAND with GRAVEL, multi-colored, moist, loose, caving.
6.0'	SP		100	88	3	SAND; g... moist, loose, caving.
9.0'			96	78	2	SAND with GRAVEL: grey, moist, loose, occasional cobble to ...

TT 86-17

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
1.5'	SP		100	91	1	SAND; grey, moist, some gravels
3.0'			95	68	1	SAND with GRAVEL, similar to above, gravel lense at 2 4 foot depth
4.0'	ML		100	100	74	SILT with SAND; dark brown, moist, cohesiveness indicates a clay component
6.0'	SP		100	81	3	SAND with GRAVEL, moist to damp, caving
9.0'			100	83	2	same as above.

TT 86-24

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'			100	93	2	SAND, gray, dry, loose, slight cementation, gravels to 1".
4.0'			100	91	2	SAND; brown, moist, loose.
7.0'	SP		93	83	1	SAND with GRAVEL, brown, moist, loose, slight caving.
10.0'			96	85	2	same as above

TT 87-7

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	SM	3	100	100	43	SILTY SAND: brown, wet, cohesive
4.0'	CL	12	100	100	85	CLAY: light gray, damp cohesive
	SP		100	94	2	SAND, light gray, damp, few gravel to 3/8" coarse sand, rounded
10.0'			100	84	1	

TT 87-8

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.5'	CL/ML	5	100	100	60	SANDY SILTY CLAY brown, wet due to rain
			100	97	3	SAND brown, damp, loose med to coarse, few gravel to 3/8".
	SP		100	99	2	SAME light gray, trench belled out unable to enter trench
10.0'			100	95	1	

TT 87-9

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'			100	100	2	SAND gray and brown, wet, coarse grain
5.0'	SP		100	100	3	
8.0'			100	92	1	SAME: gray, damp, coarse grain, few gravel to 3/4", cave in
10.0'			100	92	1	

TT 87-10

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'			100	93	1	SAND brown, wet, few gravel 4" max, coarse sand, rounded trench belling out early, unable to enter trench.
6.0'	SP		100	94	1	SAME light gray, damp, coarse sand, few gravel 5" max, 6" lens of gravel
9.0'			100	98	2	SAME: gray, damp, coarse sand, no gravel
10.0'			100	97	1	

TT 87-11

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'			100	98	4	SAND brown, wet, loose, coarse grained sand, rounded, few gravel 4 max,, trench belled out, unable to enter.
6.0'	SP		100	69	1	SAND with GRAVEL gray
9.0'			97	86	0	SAME: gray, damp, coarse grain, rounded, few gravel 4" max major cave in

TT 87-12

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'	SP/SM		100	97	11	SAND SILTY SAND brown, moist, fine to med sand, roots.
5.0'	SM	1	100	100	41	SILTY SAND: dark brown, dry, loose fine grain, slightly cohesive.
7.0'	SP		100	100	4	SAND. gray, dry, fine to med. sand, clean, cave in.
10.0'	SW		100	83	1	SAND. gray, dry, med to coarse sand, few gravel to 3/8"

TT 87-13

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
	SM	1	100	100	23	SILTY SAND brown, moist, fine grain
4.0'			100	99	28	SAME. gray, dry, fine grain, few gravel to 3/8", non plastic.
	SP/SM		100	98	12	SAND SILTY SAND: gray, fine grained, few gravel to 3/8", non-plastic.
10.0'			100	100	6	SAND dark grey, med grain, clean.

TT 87-14

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	SC/SM	4	100	100	45	SILTY CLAYEY SAND. gray, fine grain sand cohesive, firm digging
6.0'	CL/ML	7	100	100	50	SANDY SILTY CLAY light brown, fine grain, cohesive, hard digging
9.0'	ML	1	100	100	55	SANDY SILT light brown, fine grain.
10.0'	SP/SM		100	96	8	SAND SILTY SAND: gray dry, med to coarse sand, few gravel to 3/8", clean

TT 87-15

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	ML	3	100	100	55	SANDY SILT, brown, wet due to rain loose, med grain, slightly cohesive
4.0'	SM	2	100	97	49	SILTY SAND brown, loose, med grain
7.0'	SW		100	97	4	SAND gray, dry, loose, coarse to med sand clean.
10.0	SW/SM		100	99	8	SAND/SILTY SAND: gray, dry, loose.

TT 87-16

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'	CL/ML	6	100	100	70	SANDY SILTY CLAY brown, wet due to rain, medium grain, slightly cohesive hard digging
	CL	18	100	100	93	LEAN CLAY light brown, dry, fine to med grain, cohesive, hard digging
8.0'		14	100	99	77	
10.0'	SW		100	87	4	SANDS. gray, dry, loose, med to coarse sand, few gravel to 2½", rounded.

TT 87-17

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'	ML	2	100	92	53	reddish brown, wet due to rain, fine grain, slightly cohesive, roots, hard
	GM	16	100	71	37	SILTY GRAVEL with SAND reddish brown.
		5	100	69	18	SAME damp, fine to medium grain, gravel to 8", slightly cohesive, hard caliche
9.0'			100	74	18	very tough caliche

TT 87-18

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	ML	2	100	99	50	SANDY SILT light brown, wet top 6 due to rain, hard, fine grain, slightly cohesive, roots
4.0'	SM		100	100	33	SILTY SAND light brown, dry, med to fine grain, slightly cohesive
5.0'	GC	18	100	64	23	CLAYEY GRAVEL with SAND very tough caliche

TT 87-19

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	SP/SM		100	100	5	SAND SILTY SAND brown, top 6" wet due rain, loose, med grain, few gravel to rounded
	—		100	85	2	SAND brown, moist, loose, coarse grain, gravel to 6" poorly graded non-plastic, trench caving
	SP		96	83	1	
10.0'			93	91	1	

TT 87-20

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
			100	90	0	SAND: gray, wet, coarse grain, few gravel to 3/8".
	SP		100	97	0	SAME. dark gray, loose, few gravel 4", trench will not hold shape.
9.0'			100	77	2	SAME: reddish to dark gray, rounded, poorly graded
10.0'	SM	2	100	99	23	SILTY SAND reddish, damp, cohesive, med fine grain, gravel to 4" rounded.

TT 87-24

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
	SP		100	100	4	SAND brown, wet, med. grain non plastic
5.0'			100	97	0	SAME gray, damp, coarse grain, few gravel to 2", poorly graded
7.0'	CL	21	100	100	78	CLAY with SAND dark reddish brown, fine grain, cohesive
10.0'	SP		100	95	2	SAND: grey, moist, coarse grain sand, gravel to 3/4".

TT 87-22

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
			100	100	2	SAND brown, wet, coarse med sand, rounded, cave in
	SP		100	99	0	SAME gray, damp, loose, med grain free of rock, clean sand.
9.0'			100	96	1	

TT 87-23

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
			100	99	0	SAND. brown gray, damp, coarse grain, rounded, very few gravel 3/4" trench will not hold shape.
	SP		95	91	1	SAME gray
			100	99	1	
10.0'			100	96	1	

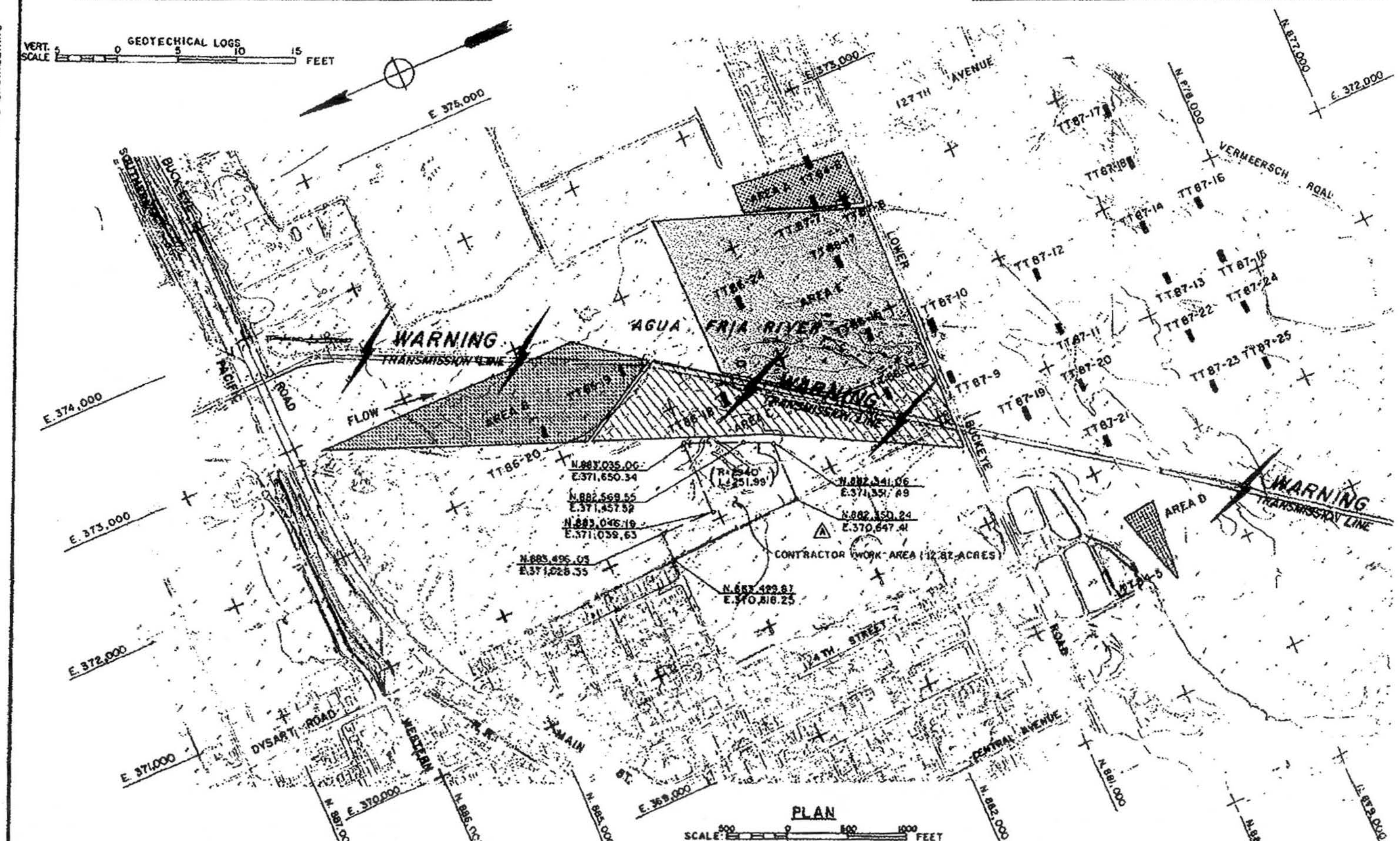
TT 87 24

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
	SM	2	100	100	20	SILTY SAND gray, top 6" wet due to rain, loose, fine to med grain
5.0'			100	100	41	SAME light brown, dry, fine grain, some cohesion
8.0'	ML	1	100	100	60	SANDY SILT light brown, dry, fine grain, some cohesion
10.0'	SP		100	100	1	SAND dark gray, dry, med to coarse sand clean

TT 87-25

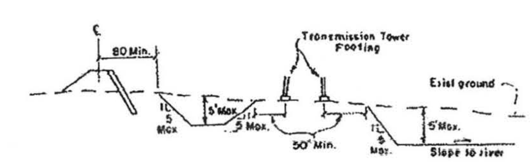
DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
	SM		100	97	16	SILTY SAND brown, moist, med to coarse, few gravel to 3/8"
5.0'			100	100	18	SAME gray, damp, loose, medium grain clean
8.0'	SW		100	94	1	SAND, brown, damp, med to coarse, few gravel to 1" trench will not hold slope
10.0'	SP		97	93	3	SAND brown, med to coarse grain, few gravel to 1".

VERT. SCALE — GEOTECHICAL LOGS 5 0 5 10 15 FEET



PLAN

SCALE 500 0 500 1000 FEET



TYPICAL PROFILE – BORROW AREAS
NOT TO SCALE

NOTES

1. SEE SHEET 4 FOR GENERAL NOTES, LEGEND, AND CLASSIFICATION SYSTEM.
2. TRENCHES EXCAVATED IN JULY 1986, MARCH 1987 AND JUNE 1984
3. SEE SHEET 4 FOR LOGS OF TEST TRENCHES 84-8, 86-20, 86-19, 86-16 AND 86-15.
4. NO GROUNDWATER ENCOUNTERED DURING EXPLORATIONS.

RECORD DRAWING AS CONSTRUCTED

CONT. NO.	REV.	DATE	POSTED	CHECKED	REVIEWED
87-C-0049	A	23 JAN 90			

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
A	REVISED CONTRACTOR WORK AREA COORDINATES		

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY:
DRAWN BY: D. VILIPPU
CHECKED BY:
SUBMITTED BY:
CHF, GEOTECHNICAL BRANCH

GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

AGUA FRIA RIVER LEVEES
(BUCKEYE ROAD TO BROADWAY ROAD)
BORROW AREA, EXPLORATION PLAN,
SOIL LOGS, AND CONTRACTOR WORK AREA

SPEC. NO. DACW09-87-R-0010
DISTRICT FILE NO. 252/207 REV. A
SHEET 5 OF 41

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

SAFETY PAYS

TRIAL VERSION OF TIFFDILL

TT84-6

DEPTH	LOG	MC	LL	PI	-4	-200	DESCRIPTION
1.0'	ML				100	52	SANDY SILT; light brown, dry, very loose.
2.5'	SW/SM				98	12	SAND/SILTY SAND; light brown, damp, loose.
					74	6	GRAVELLY SAND; brown, damp, loose, gravel.
	SP/SM				100	9	SAND/SILTY SAND; brown, damp, loose.
7.5'							
	*						SAME; occasional gravel.
13.0'							GRAVELLY SAND; brown, [illegible] loose, cobbles to 8".

TT84-7

DEPTH	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
	SM				100	19		SILTY SAND; light grey, dry, very loose, hairlike roots.
		4.4			99	16		brown, moist, loose.
5.0'								
	SP SM	3.1.5			96	10		SAND/SILTY SAND; brown, moist, few gravel, very loose.
8.0'								
9.0'	SP				89	2		SAND; multicolored, damp, coarse.
9.5'	SP/SM	1.5			99	5		SAND/SILTY SAND; brown, occasional cobbles.

TT84-8

DEPTH	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
1.0'	*							SILTY SAND; brown, dry, medium dense, fine grained.
	ML				100	71		SANDY SILT; dry to damp, dense to medium dense, 2 zone tense at 3'.
4.0'								
5.0'	SP/SM	3.2			100	7		SAND/SILTY SAND; brown, damp to moist, loose, medium to fine grained.
5.3'	ML	6.2			100	58		SANDY SILT; dark brown, damp to moist, stiff.
		12.1			98	3.7		SAND; brown, damp to moist, loose, coarse grain,
	SP	3.0			100	2		medium to fine grain.
12.0'					76	1		GRAVELLY SAND; coarse grained, few fine grained gravel.

TT84-5

DEPTH	LOG	MC	LL	PI	-4	-2	N	DESCRIPTION
1.5'	SM	3.4			99	11		SAND/SILTY SAND; Light brown, dry, very loose.
2.0'	SP				80	2		SAND; Multicolor, damp, loose, 20% gravel
	SW				95	1		SAND, Dark brown, moist.
7.0'								Increase in gravel at 7'-0".

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS				GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than half of material is larger than no. 200 sieve size.	GRAVELS More than half of coarse fraction is smaller than 3" but larger than no. 4 sieve size		Clean gravels	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
			Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than no. 4 sieve size		Clean sands	SW	Well-graded sands, gravelly sands, little or no fines.
				SP	Poorly-graded sands, gravelly sands, little or no fines.
			Sands with fines	SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than half of material is smaller than no. 200 sieve size.	SILTS AND CLAYS		Low liquid limit	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts, with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
				OL	Organic silts and organic silty clays of low plasticity
			High liquid limit	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
				CH	Inorganic clays of high plasticity.
				OH	Organic clays of medium to high plasticity, organic silts.
Highly organic soils				Pt	Peat and other highly organic soils

NOTES:

1. Boundary Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example, GW-GC, well-graded gravel sand mixture with clay binder.
2. All sieve sizes on this chart are U. S. Standard.
3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus no. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart, and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
4. The Soil Classification System is based on the American Society for Testing and Materials (ASTM)
   a. (ASTM) D2487 Standard Test Method for Classification of Soils for Engineering Purposes.
   b. (ASTM) D2488 Standard Practice for description and identification of Soils (Visual Manual Procedure).

TT86-15

DEPTH	LOG	MC	LL	PI	-4	-200	DESCRIPTION
	SM				99	15	SILTY SAND, brownish grey, dry, loose, roots and grasses on ground surface.
3.0'							
4.0'	SP/SM				95	7	SAND with SILT, multicolored, moist, loose,
7.0'					98	8	brown, moist, loose, slight caving.
10.0	SP				94	2	SAND, grey, moist, loose, slight caving continues.

TT86-18

DEPTH	LOG	MC	LL	PI	-4	-200	DESCRIPTION
2.0'	SW/SM				99	12	SAND with SILT, brown, moist, loose, vegetation on ground surface.
5.0'	SM				85	19	SILTY SAND with GRAVEL, brown, moist, loose to dense, some hard clay lumps.
7.0'					94	18	SILTY SAND, brown, moist, loose, some cementation.
10.0	SP				92	2	SAND, brown, moist, loose.

TT86-20

DEPTH	LOG	MC	LL	PI	-4	-200	DESCRIPTION
2.0'					78	1	SAND with GRAVEL, grey, moist, roots.
4.0'					79	1	dark grey, damp, loose, occasional gravel to 1".
7.0'	SP				87	1	SAND, dark grey, damp, loose, occasional gravel to 1".
10.0'					80	1	SAND with GRAVEL, dark grey, damp, loose, occasional gravel to 1".

TT84-9

DEPTH	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
1.3'	CL	31	12		100	84		SANDY CLAY, light brown to brown, damp to moist, dense, some hair roots.
1.5'	SM	20	11		100	33		light brown, dry, hard, hair roots.
					99	43.5		SILTY SAND; light brown, dry, dense, coarse to fine grain, cemented.
	SP/SM				100	6		SAND/SILTY SAND; grey, dry, dense to loose, medium grain sand, some caving.
8.0'								

TT86-19

DEPTH	LOG	MC	LL	PI	-4	-200	DESCRIPTION
2.0'					98	1	SAND, greyish brown, moist, loose, roots, slight caving.
4.0'	SP				77	2	SAND with GRAVEL, grey, moist, loose, sub-rounded gravels.
7.0'					81	2	same as above.
9.0					94	2	same as above, occasional cobbles to 5".

LEGEND

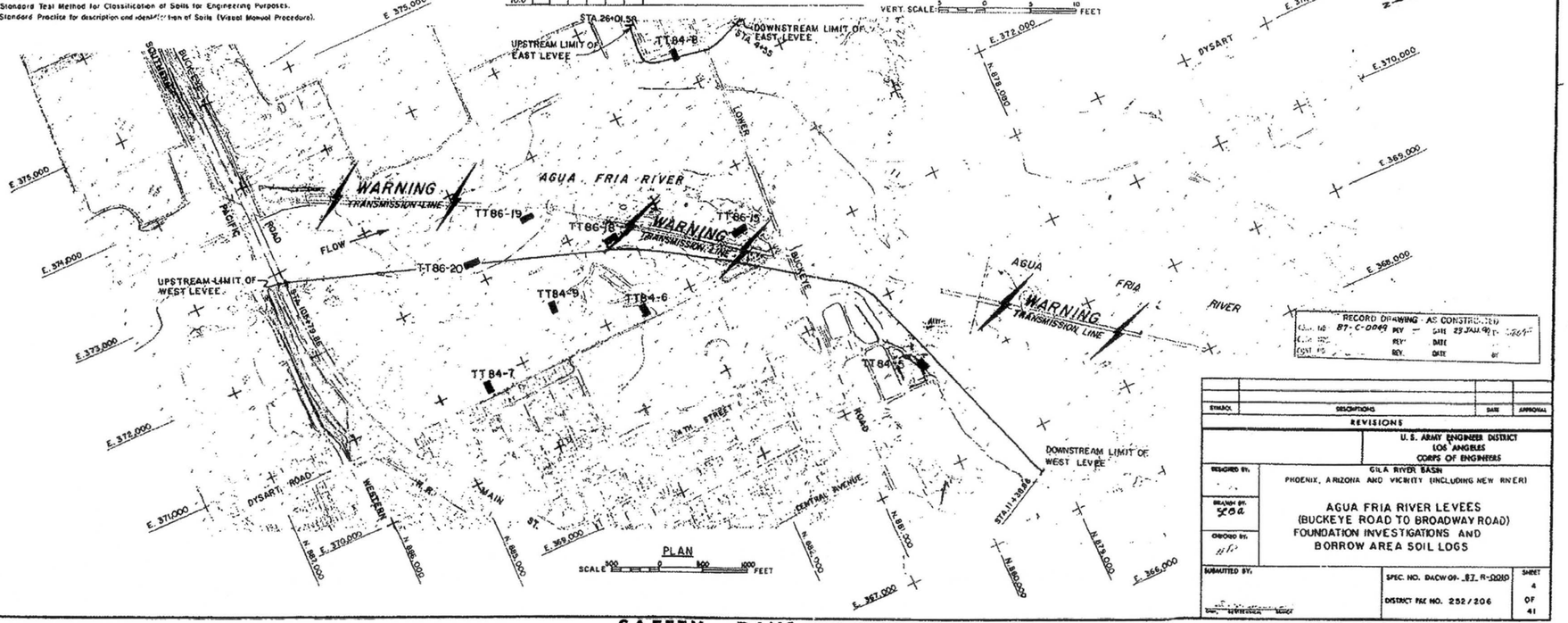
T.T.	84-8
▬	LOCATION AND NUMBER OF TEST TRENCH.
T.H.	80-46
●	LOCATION AND NUMBER OF TEST HOLE.
M C	FIELD MOISTURE CONTENT IN PERCENT OF DRY WEIGHT.
L L	LIQUID LIMIT.
P I	PLASTICITY INDEX (LIQUID LIMIT MINUS PLASTIC LIMIT).
N P	NONPLASTIC
-4	PERCENT OF MATERIAL BY WEIGHT PASSING NO. 4 SIEVE.
-200	PERCENT OF MATERIAL BY WEIGHT PASSING NO. 200 SIEVE.
X	DENOTES VISUAL CLASSIFICATION OF SOILS.
K	NUMBER OF BLOWS OF A 140-POUND DROPHAMMER FALLING 30 INCHES REQUIRED TO DRIVE A SAMPLING SPOON ONE FOOT. OUTSIDE DIAMETER OF SPOON IS 2 INCHES; INSIDE DIAMETER IS 1-3/8 INCHES. PROCEDURE IS CALLED STANDARD PENETRATION TEST.
W	DEPTH TO WATER.

NOTES:

1. LEVEE ALIGNMENT IS APPROXIMATE
2. PLAN TO BE USED FOR LOCATION OF TRENCHES ONLY
3. TRENCHES EXCAVATED IN JUNE 1984 AND JULY 1986.
4. NO GROUNDWATER ENCOUNTERED DURING EXPLORATIONS.

GEOTECHNICAL LOGS

VERT. SCALE: 5 0 5 10 FEET



PLAN

SCALE: 500 0 500 1000 FEET

RECORD DRAWING - AS CONSTRUCTED
Contract No. 87-C-0049 REV. — DATE 23 JUL 90 BY [illegible]
REV. DATE BY

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY:
DRAWN BY: [illegible]
CHECKED BY: [illegible]

GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

AGUA FRIA RIVER LEVEES
(BUCKEYE ROAD TO BROADWAY ROAD)
FOUNDATION INVESTIGATIONS AND
BORROW AREA SOIL LOGS

SUBMITTED BY:
CHIEF, ENGINEERING DIVISION

SPEC. NO. DACW09-87-R-0010
DISTRICT FILE NO. 252/206

SHEET 4 OF 41

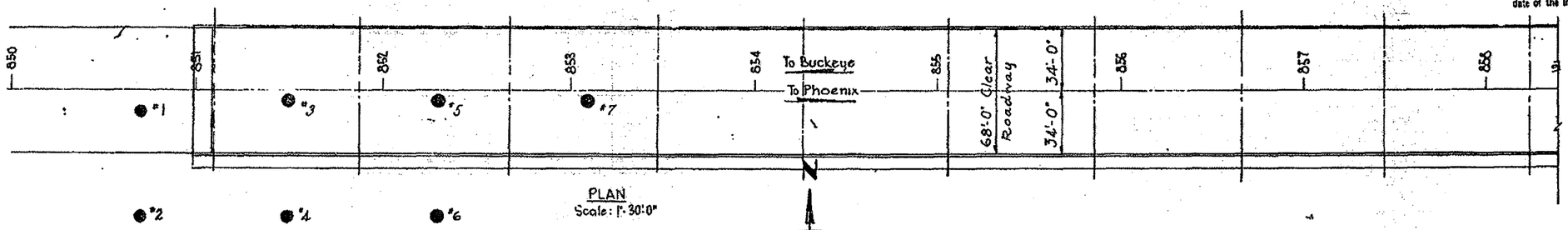
ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

A-17

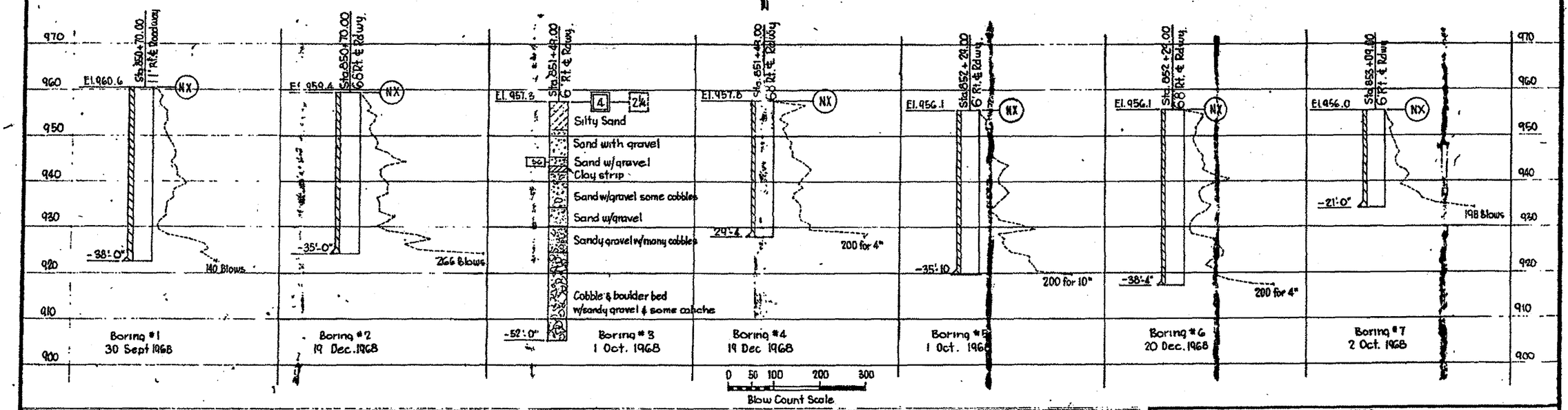
BUCKEYE - PHOENIX HWY.
MARICOPA COUNTY

BR-S-371(5) :: 44-315 ~~944~~

The absence of a ground water indication does not constitute a representation that ground water will not be present during construction. If ground water is encountered herein only when [illegible] investigation and represents that condition only on the date of the investigation.



PLAN
Scale: 1" = 30'-0"



CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

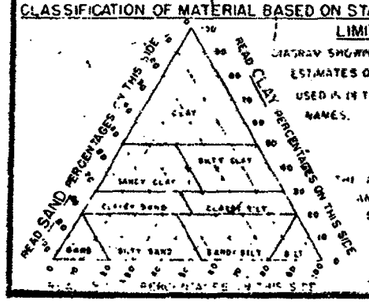


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN THE TERMINATION OF CLASS NAMES.

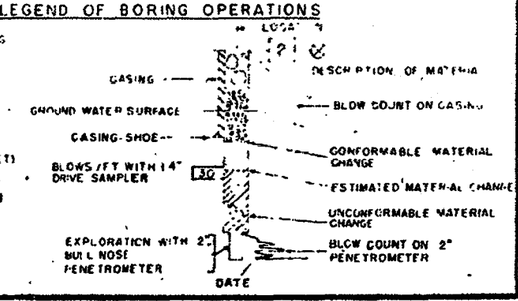
THE TERMS "COARSE, MEDIUM, AND FINE" REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- CLAY
- SILT
- SAND
- GRAVEL
- CALICHE
- [illegible] MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- 2" PENETROMETER
- CASING
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- CORE BORING
- TEST PIT



NOTES

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NX CASING IS DRIVEN WITH 342 POUND HAMMER, 30" FREE FALL, NO CUSHION.
BX CASING AND 2" PENETROMETER ARE DRIVEN WITH 140 POUND HAMMER, 30" FREE FALL, NO CUSHION.

		DATE
LAYOUT	R.R.	8-68
DESIGN		
ARCHITECTURE		
DRAFT	RWB	1-69
TRACED		
CHECKED	[illegible]	2-69

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

STA. 857 +
FOUNDATION DATA SHEET
AGUA FRIA RIVER BRIDGE - AVONDALE

SHEET NO. 3 OF 37

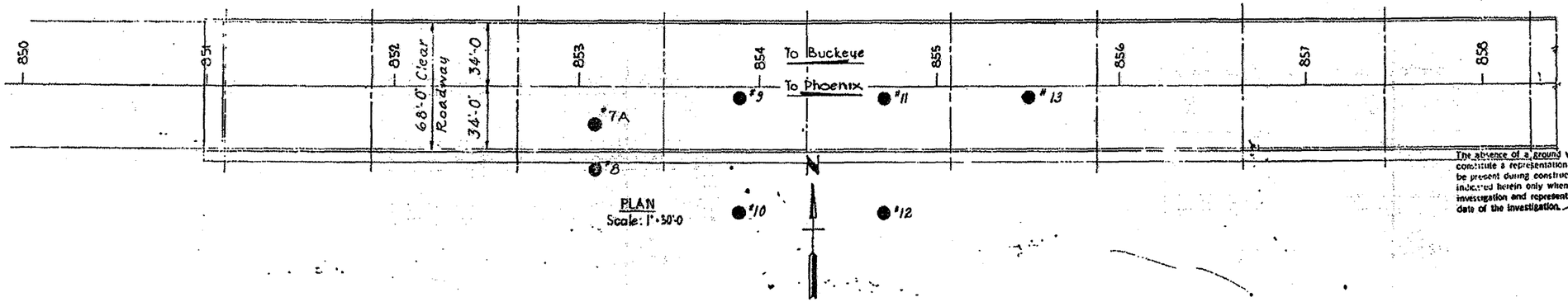
BR-S-371(5)

PE-305

#37

BUCKEYE - PHOENIX HWY
MARICOPA COUNTY

BR-S-371(5) 9-15-74



PLAN
Scale: 1" = 50'-0

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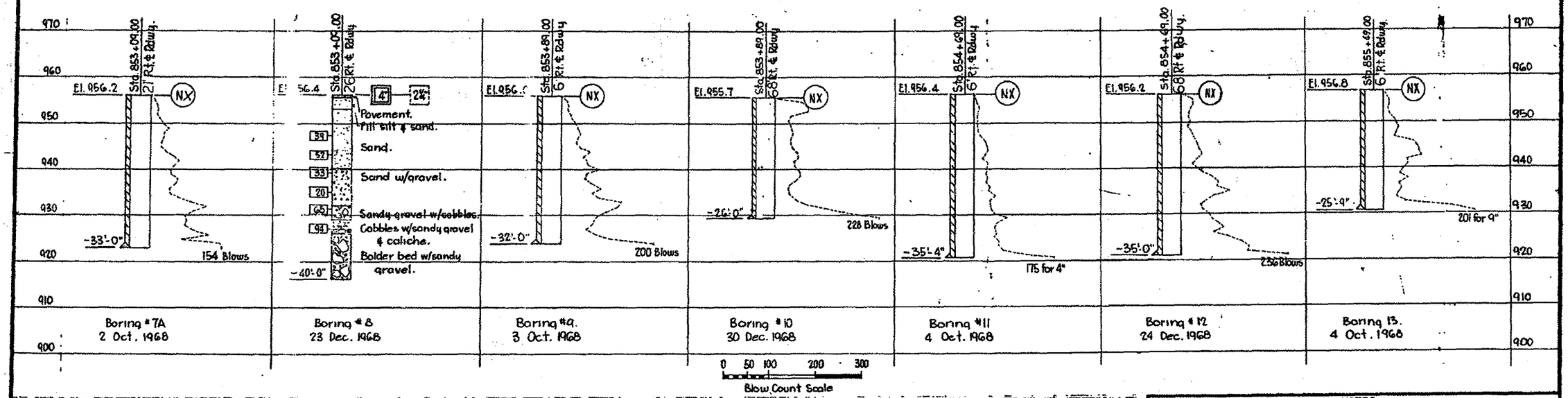


CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

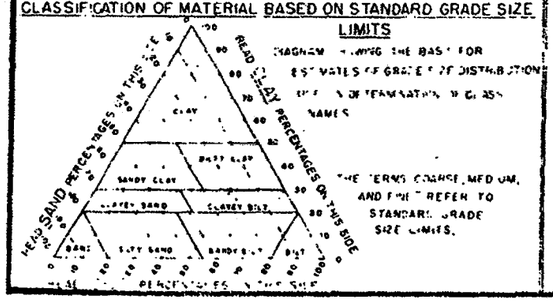


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE OF DISTRIBUTION OF A SOIL OF TRANSITIONAL TO CLASS NAMES

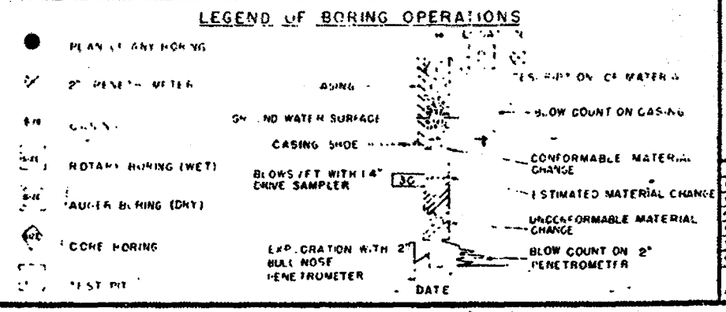
THE TERMS COARSE, MEDIUM, AND FINE REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- CALICHE
- [illegible] MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- 2" PENETROMETER
- [illegible]
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- CORE BORING
- TEST PIT



NOTES

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		DATE
LAYOUT	R R	8-68
DESIGN		
ARCHITECTURE		
DRAWN	RWB	1-69
TRACED		
CHECKED	[illegible]	[illegible]

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

STA. 857 +
FOUNDATION DATA SHEET
AGUA FRIA RIVER BRIDGE - AVONDALE

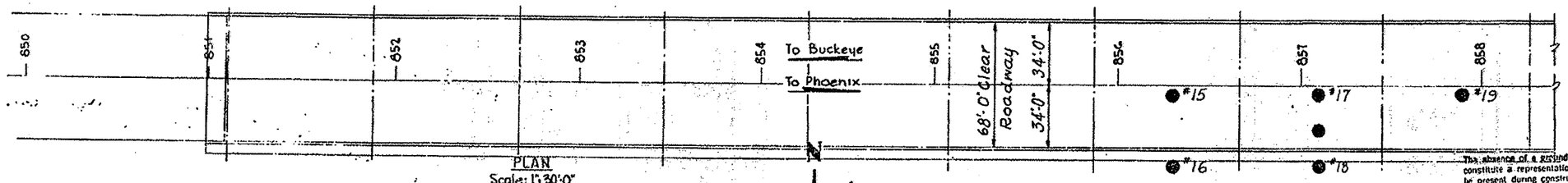
SHEET NO. 4 OF 3

BRIDGE ENGINEER

BR-S-371(5) PE-305

BUCKEYE - PHOENIX HWY
MARICOPA COUNTY

BR-371(5) 8-15-74



PLAN
Scale: 1" = 30'-0"

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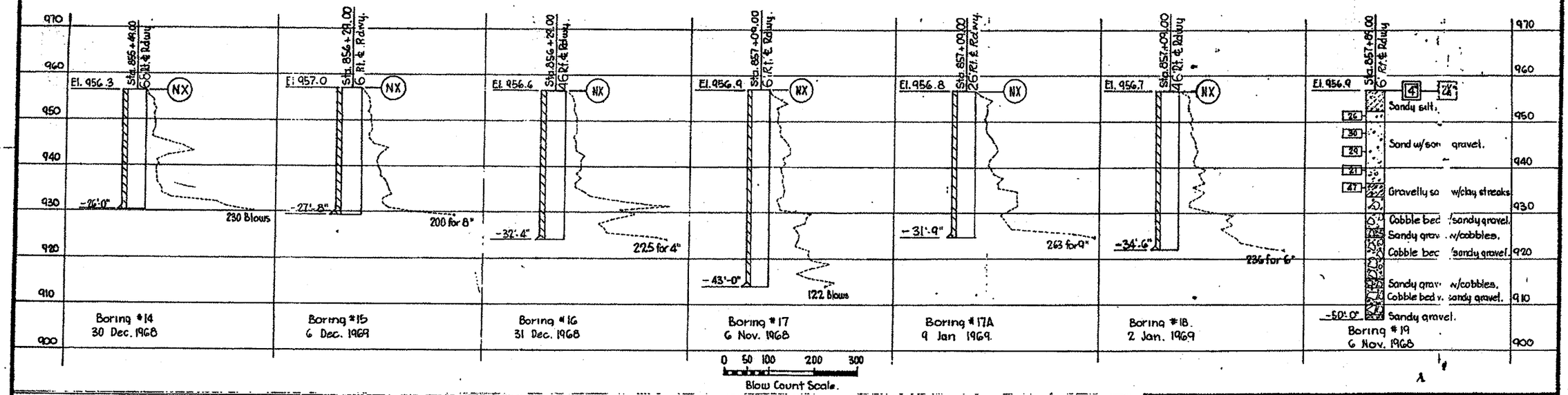

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

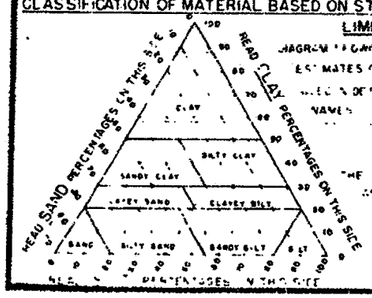

DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION AND DETERMINATION OF CLASS NAMES.

THE TERMS COARSE, MEDIUM, AND FINE REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- BOULDER
- CALICHE
- SOIL
- ESTIMATED MATERIAL
- SAND
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- CLAY
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- 2" PENETROMETER
- CASING
- GROUND WATER SURFACE
- CASING SHOE
- ROTARY BORING (WET)
- BLOWS/FT WITH 1.4" DRIVE SAMPLER
- AUGER BORING (DRY)
- CORE BORING
- EXPLORATION WITH 2" BULL NOSE PENETROMETER
- TEST PIT
- DESCRIPTION OF MATERIAL
- BLOW COUNT ON CASING
- CONFORMABLE MATERIAL CHANGE
- ESTIMATED MATERIAL CHANGE
- UNCONFORMABLE MATERIAL CHANGE
- BLOW COUNT ON 2" PENETROMETER
- DATE

NOTES

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		DATE
LAYOUT	R.E.	8-66
DESIGN		
ARCHITECTURE		
DRAWN	R.M.B.	1-69
TRACED		
CHECKED	HAL	7-69

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

STA. 857 +
FOUNDATION DATA SHEET
AGUA FRIA RIVER BRIDGE - AVONDALE

SHEET NO. 5 OF 3

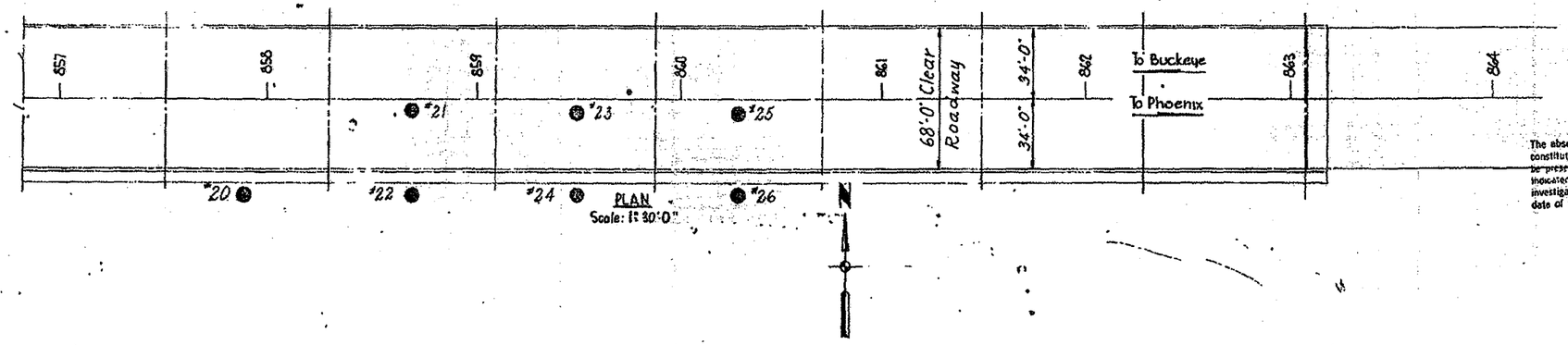
DRAWING NUMBER | DRAWING NUMBER | BRIDGE ENGINEER

BR-S-371(5)

PE-305

BUCKEYE - PHOENIX HWY
MARICOPA COUNTY

BR-S-371(5) 8-15-74



PLAN
Scale: 1" = 30'-0"

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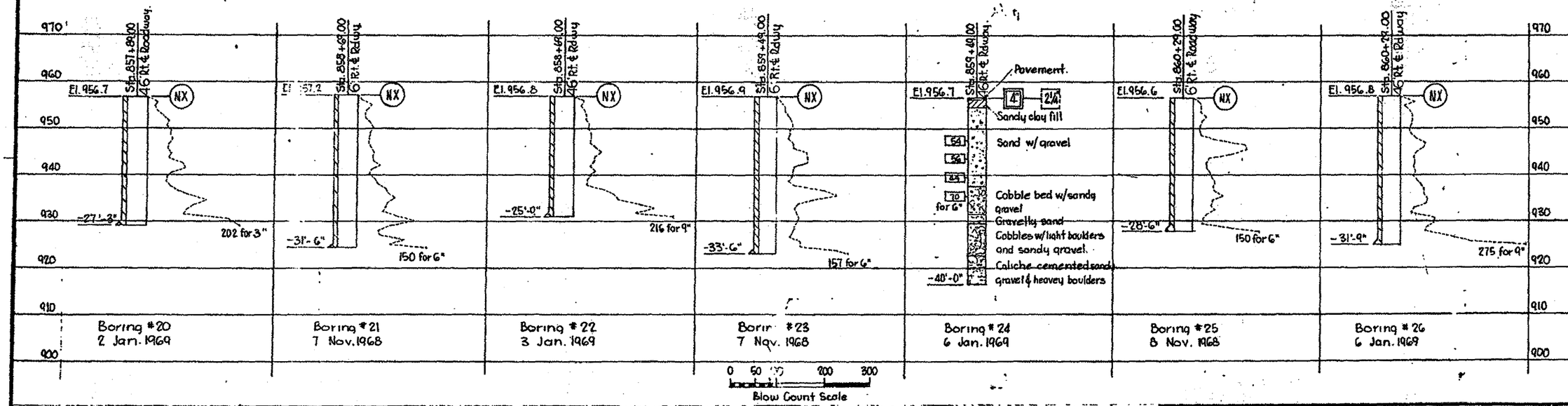


CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

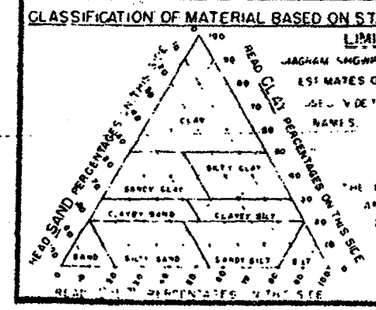


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION AND DETERMINATION OF GRADE NAMES.

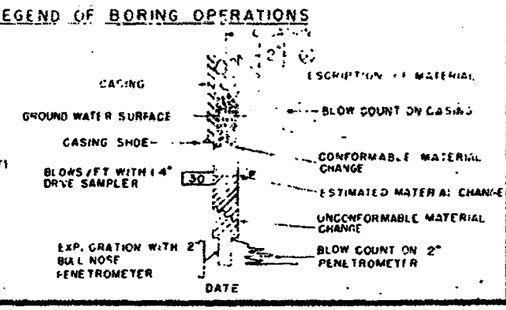
THE TERMS COARSE, MEDIUM, AND FINE REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- Rock
- Caliche
- Fill
- Fill Material
- Sand
- Igneous Rock
- Silt
- Sedimentary Rock
- Clay
- Metamorphic Rock

LEGEND OF BORING OPERATIONS

- Plan of Any Boring
- 2" Penetrometer
- Casing
- Rotary Boring (Wet)
- Auger Boring (Dry)
- Core Boring



NOTES

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		DATE
SURVEYED	R.R.	6-68
DESIGNED		
RECOMMENDED		
DRAWN	R.W.B.	1-69
TRACED		
CHECKED		

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

STA 857 +
FOUNDATION DATA SHEET
AGUA FRIA RIVER BRIDGE - AVONDALE

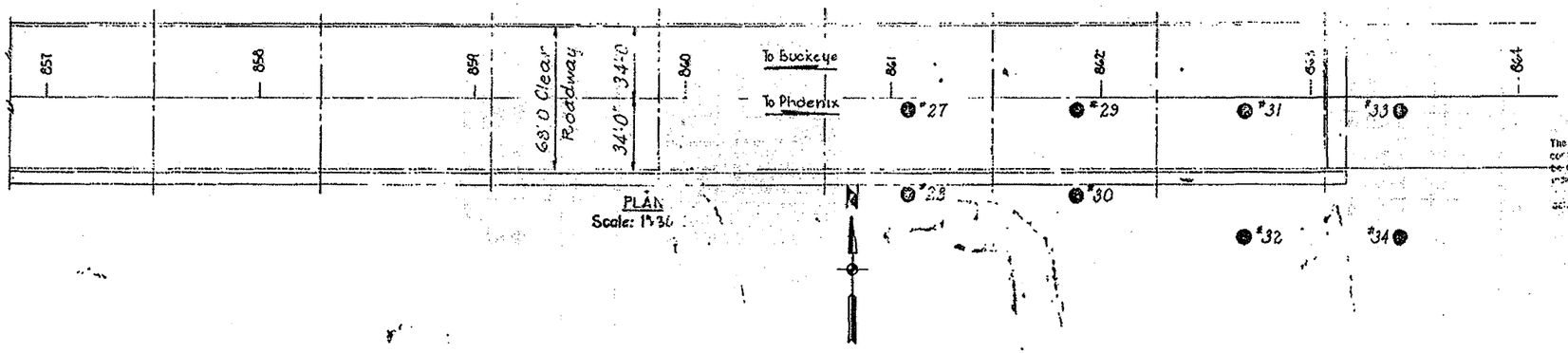
SHEET NO. 6 OF 37

BRIDGE NUMBER | DRAWING NUMBER | BRIDGE ENGINEER

BR-S-371(5)

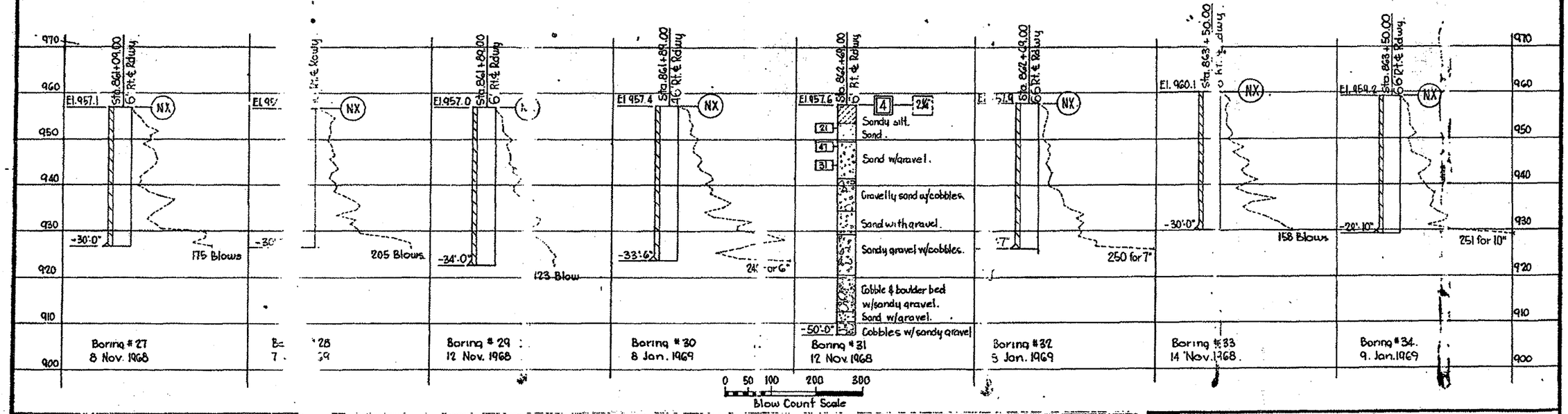
BR-S-371 PHOENIX INDY
MARICOPA COUNTY

3-15-74 AA



PLAN
Scale: 1"=30'

The absence of a ground water indication does not constitute a representation that ground water will not be present during construction. Ground water is indicated herein only when [illegible] during the [illegible] investigation and [illegible] condition only on the date of the investigation.



CLASSIFICATION OF MATERIAL BASED ON STANDARD [illegible] SIZE LIMITS

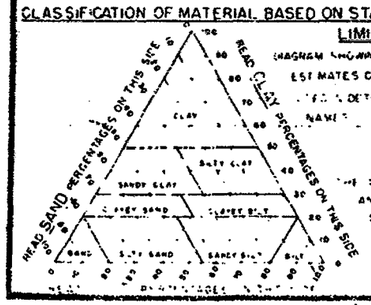


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADATION DISTRIBUTION [illegible] DETERMINATION OF CLASS NAMES

THE TERMS [illegible] AND FINE REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- [illegible]
- CALICHE
- [illegible]
- [illegible]
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- [illegible]
- 2" PENETROMETER
- CASING
- GROUND WATER SURFACE
- CASING SHOE
- ROTARY BORING (WET)
- BLOWS/FT WITH 1.4" DRIVE SAMPLER
- AUGER BORING (DRY)
- CORE BORING
- EXPLORATION WITH 2" BULL NOSE PENETROMETER
- DESCRIPTION OF MATERIAL
- BLOW COUNT ON CASING
- CONFORMABLE MATERIAL CHANGE
- ESTIMATED MATERIAL CHANGE
- UNCONFORMABLE MATERIAL CHANGE
- BLOW COUNT ON 2" PENETROMETER

DATE

NOTES

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BX CASING AND 2" PENETROMETER ARE DRIVEN WITH 140 POUND HAMMER, 30" FREE FALL, NO CUSHION.

		DATE
LAYOUT	R.R.	8-68
DESIGN		
SUBSTRUCTURE		
DRAWN	RWB	1-68
TRACED		
CHECKED	[illegible]	[illegible]

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

STA 857 +
FOUNDATION DATA SHEET
AGUA FRIA RIVER BRIDGE - AVONDALE

SHEET NO. 7 OF 37

DRAWING NUMBER

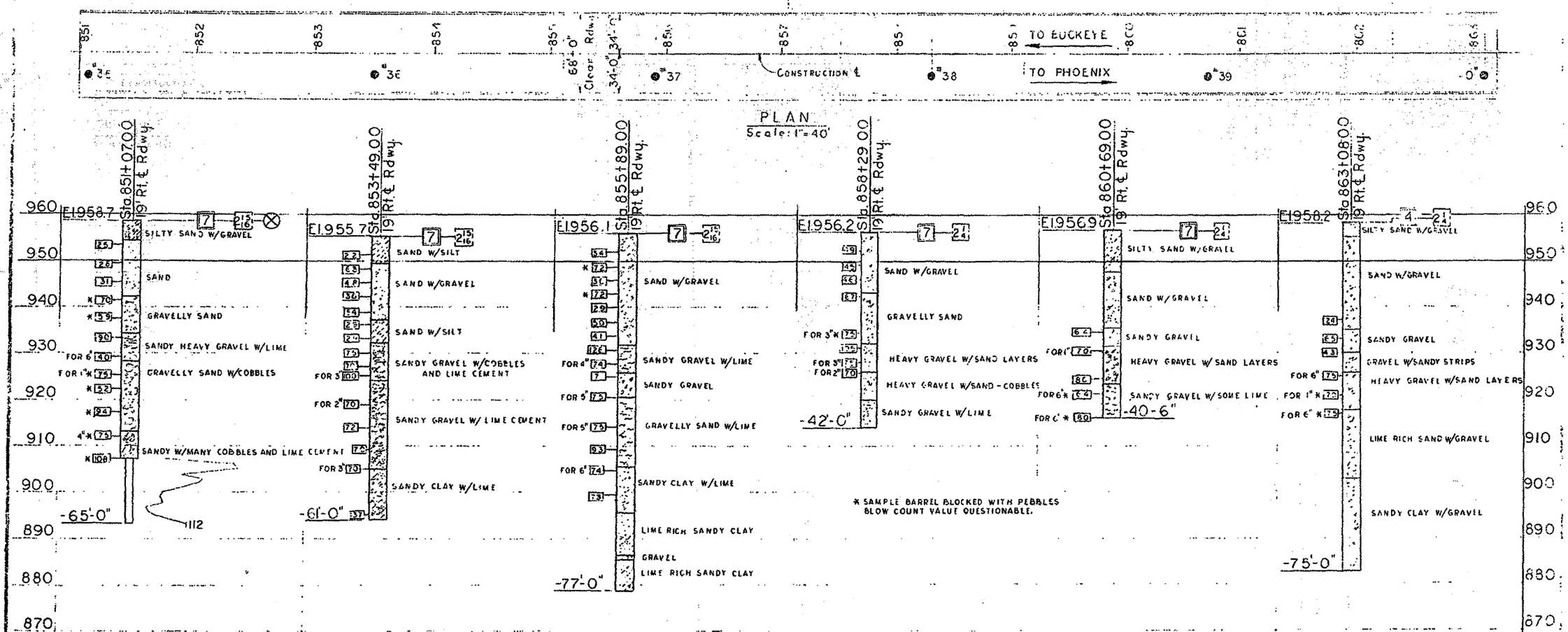
BRIDGE ENGINEER

BR-S-371 (5)

PE-305

BUCKEYE-PHOENIX HWY.
MARICOPA COUNTY

BR-S-371(5)



LEGEND OF EARTH MATERIALS

LEGEND OF BORING OPERATIONS

HAC 1-72
DLC 1-72
NAB 1-72

HIGHWAY DIVISION

STATION 857+
AGUA FRIA RIVER BRIDGE

8 37

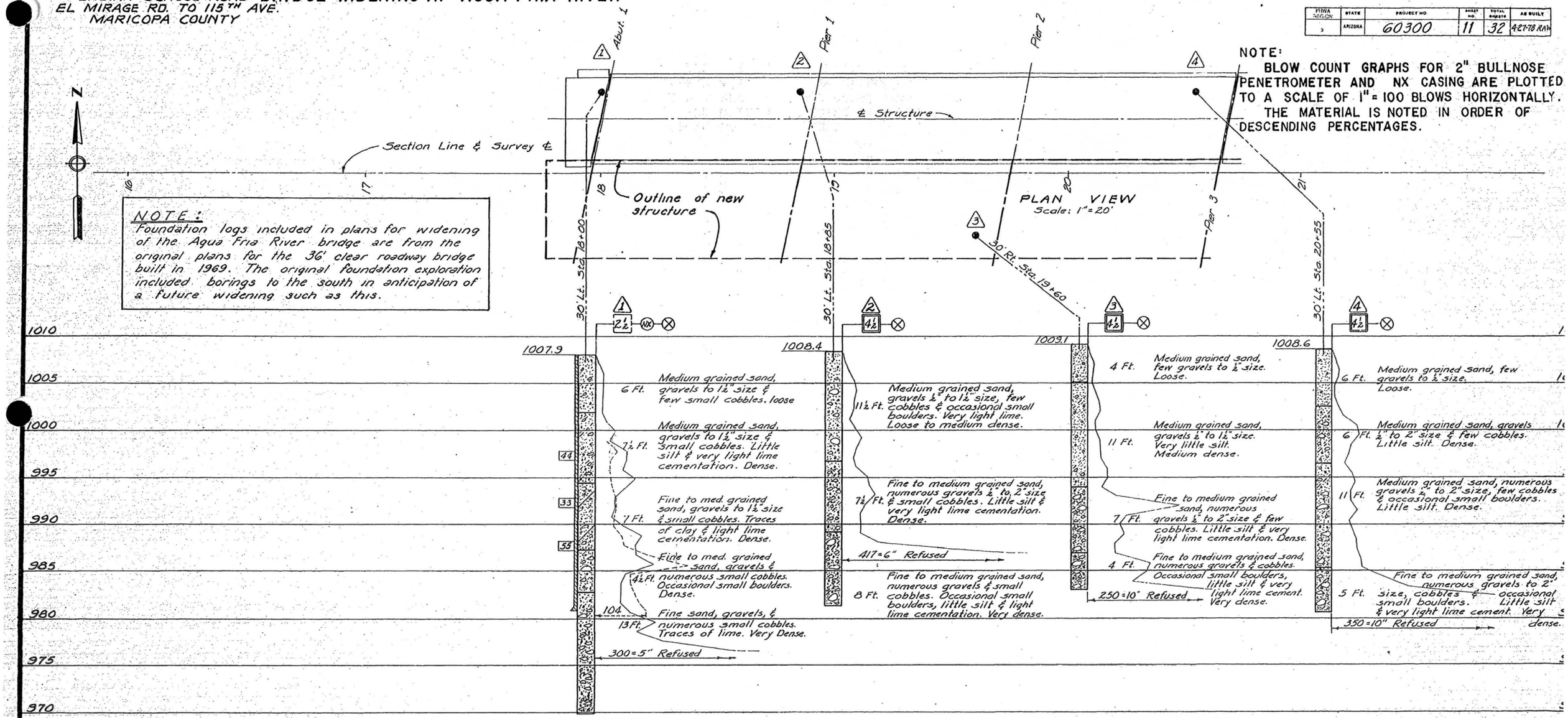
BR-S-371(5)

A-18

INDIAN SCHOOL ROAD BRIDGE WIDENING AT AGUA FRIA RIVER
EL MIRAGE RD. TO 115TH AVE.
MARICOPA COUNTY

FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZONA	60300	11	32	4-27-78 RAH

NOTE:
BLOW COUNT GRAPHS FOR 2" BULLNOSE PENETROMETER AND NX CASING ARE PLOTTED TO A SCALE OF 1" = 100 BLOWS HORIZONTALLY. THE MATERIAL IS NOTED IN ORDER OF DESCENDING PERCENTAGES.



NOTE:
Foundation logs included in plans for widening of the Agua Fria River bridge are from the original plans for the 36' clear roadway bridge built in 1969. The original foundation exploration included borings to the south in anticipation of a future widening such as this.

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

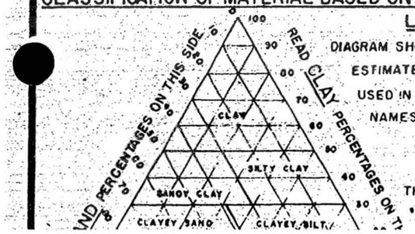


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

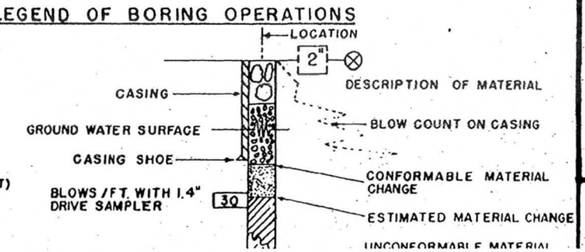
THE TERMS "COARSE, MEDIUM, AND FINE" REFER TO STANDARD GRADE

LEGEND OF EARTH MATERIALS

- COBBLES OR BOULDERS
- CALICHE
- GRAVEL
- FILLED MATERIAL
- SAND
- IGNEOUS ROCK
- SILT
- SEDIMENTARY ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- 2" PENETROMETER
- CASING
- ROTARY BORING (WET)
- AUGER BORING (DRY)



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BX CASING AND 2" PENETROMETER IS DRIVEN WITH 140 POUND HAMMER, 30" FREE NO CUSHION.

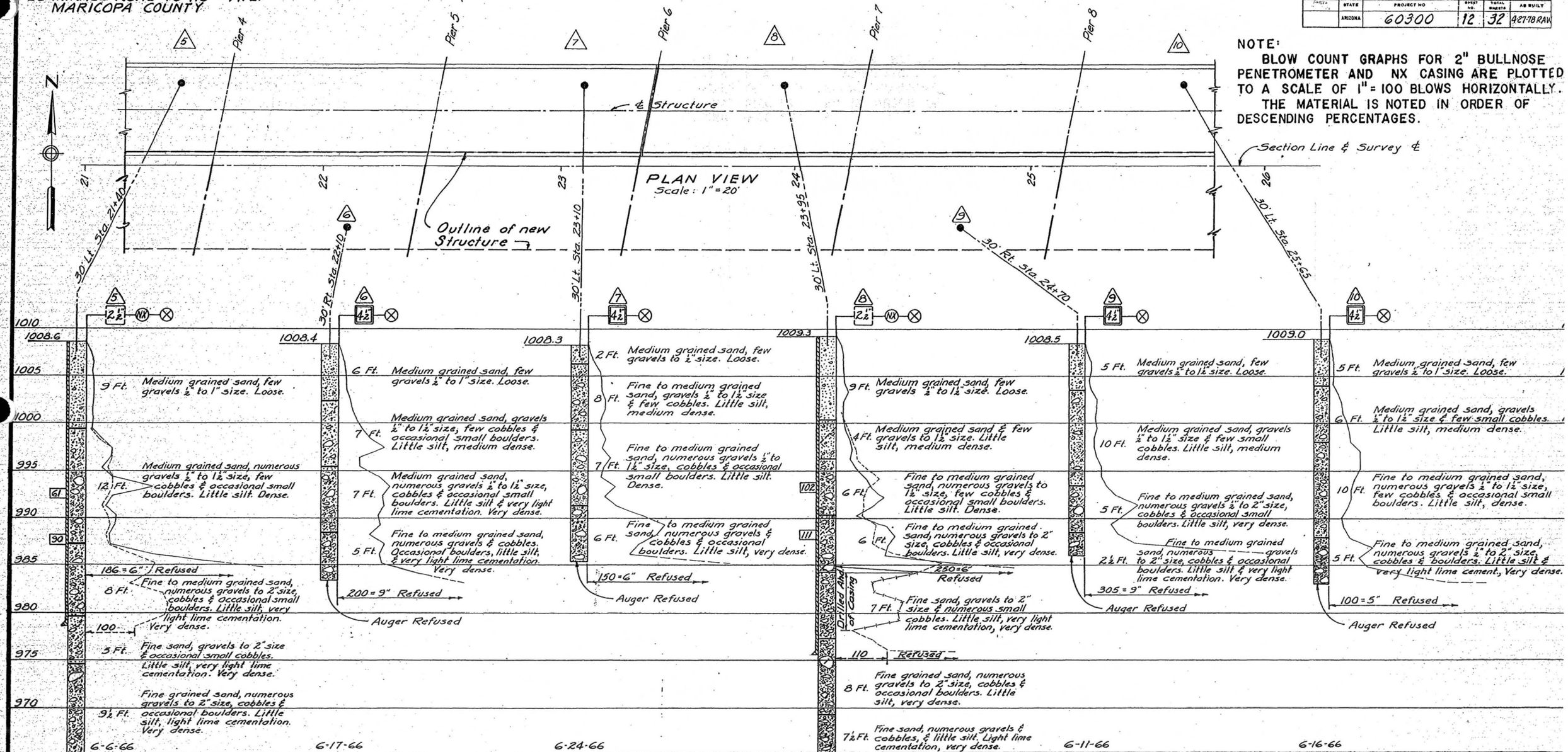
MARICOPA COUNTY HIGHWA DEPARTMENT

SCALE: Noted | FOUNDATION DATA | DRAWN BY:

INDIAN SCHOOL ROAD BRIDGE WIDENING AT AGUA FRIA RIVER
EL MIRAGE ROAD TO 115TH AVE.
MARICOPA COUNTY

STATE	PROJECT NO	SHEET NO.	TOTAL SHEETS	AS BUILT
ARIZONA	60300	12	32	4-27-78 RAW

NOTE:
BLOW COUNT GRAPHS FOR 2" BULLNOSE PENETROMETER AND NX CASING ARE PLOTTED TO A SCALE OF 1" = 100 BLOWS HORIZONTALLY. THE MATERIAL IS NOTED IN ORDER OF DESCENDING PERCENTAGES.



CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

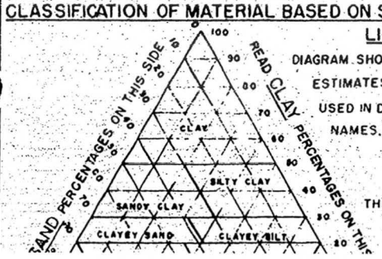


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

THE TERMS "COARSE, MEDIUM, AND FINE" REFER TO STANDARD GRADE

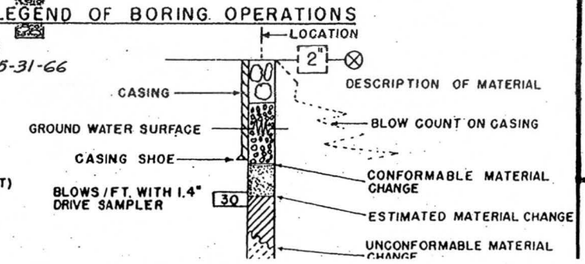
LEGEND OF EARTH MATERIALS

- COBBLES OR BOULDERS
- GRAVEL
- SAND
- SILT
- CALICHE
- FILLED MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- 2" PENETROMETER
- CASING
- ROTARY BORING (WET)
- AUGER BORING (DRY)

5-31-66



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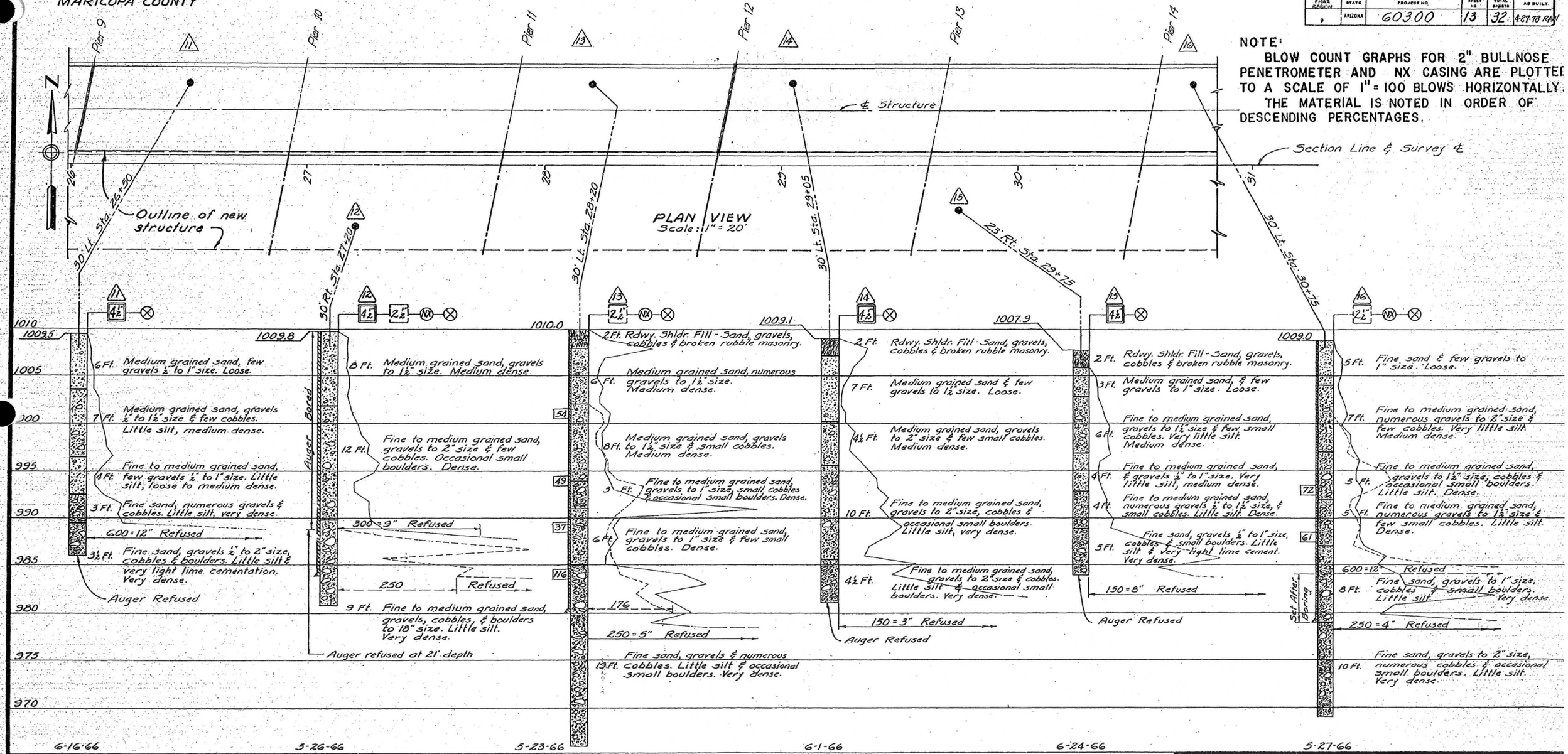
MARICOPA COUNTY HIGHWA DEPARTMENT

SCALE: Noted | FOUNDATION DATA | DRAWN BY:
DATE: 6-66 | REVISED:

INDIAN SCHOOL ROAD BRIDGE WIDENING AT AGUA FRIA RIVER
EL MIRAGE RD. TO 115TH AVE.
MARICOPA COUNTY

FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZONA	60300	13	32	4-27-78 RAN

NOTE:
BLOW COUNT GRAPHS FOR 2" BULLNOSE PENETROMETER AND NX CASING ARE PLOTTED TO A SCALE OF 1" = 100 BLOWS HORIZONTALLY. THE MATERIAL IS NOTED IN ORDER OF DESCENDING PERCENTAGES.



CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

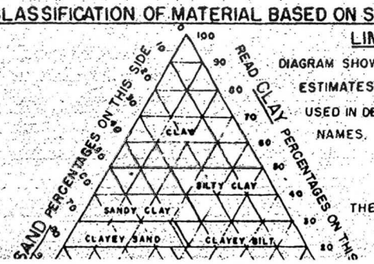


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

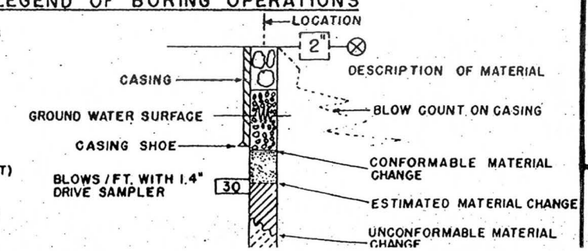
THE TERMS "COARSE, MEDIUM, AND FINE" REFER TO STANDARD GRADE

LEGEND OF EARTH MATERIALS

- COBBLES OR BOULDERS
- CALICHE
- GRAVEL
- FILLED MATERIAL
- SAND
- IGNEOUS ROCK
- SILT
- SEDIMENTARY ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- 2" PENETROMETER
- CASING
- ROTARY BORING (WET)
- AUGER BORING (DRY)



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MARICOPA COUNTY HIGHW DEPARTMENT

SCALE: Noted	FOUNDATION DATA	DRAWN BY:
DATE: 7-66		REVISED:

INDIAN SCHOOL ROAD BRIDGE WIDENING AT AGUA FRIA RIVER
EL MIRAGE RD. TO 115TH AVE.
MARICOPA COUNTY

	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
	ARIZONA	60300	14	32	4-21-78 RAW

NOTE:
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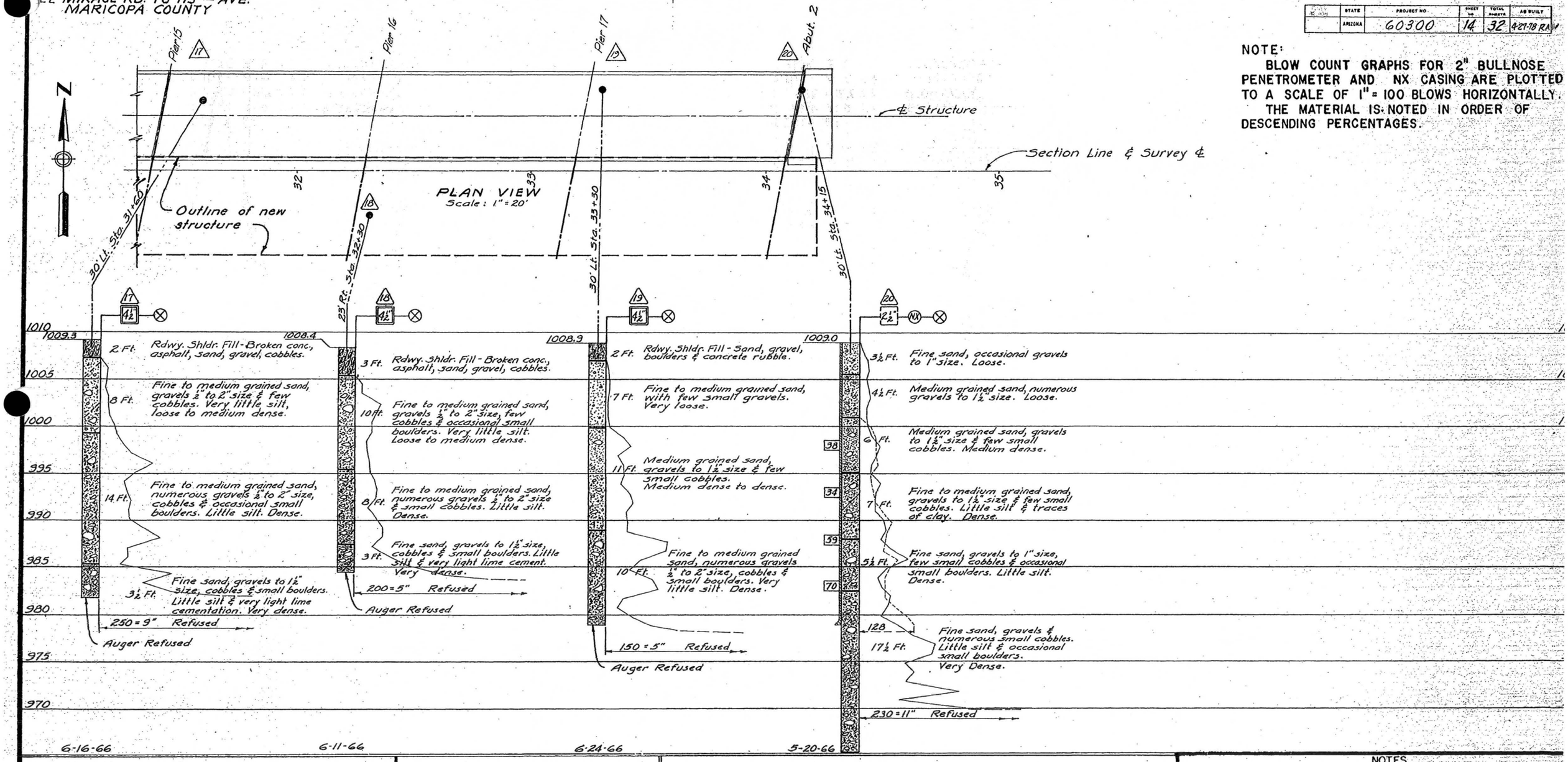


CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

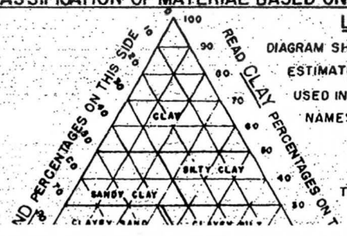


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

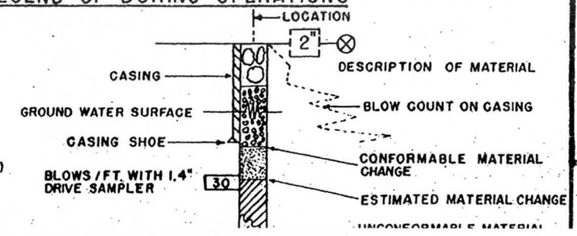
THE TERMS "COARSE, MEDIUM, AND FINE" REFER TO

LEGEND OF EARTH MATERIALS

- COBBLES OR BOULDERS
- CALICHE
- GRAVEL
- FILLED MATERIAL
- SAND
- IGNEOUS ROCK
- SILT
- SEDIMENTARY ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- 2" PENETROMETER
- CASING
- ROTARY BORING (WET)
- AUGER BORING (DRY)



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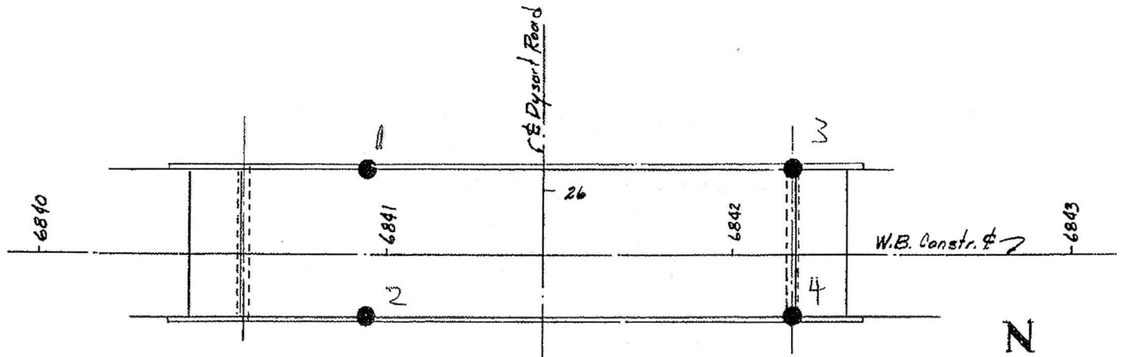
MARICOPA COUNTY HIGHWAY DEPARTMENT

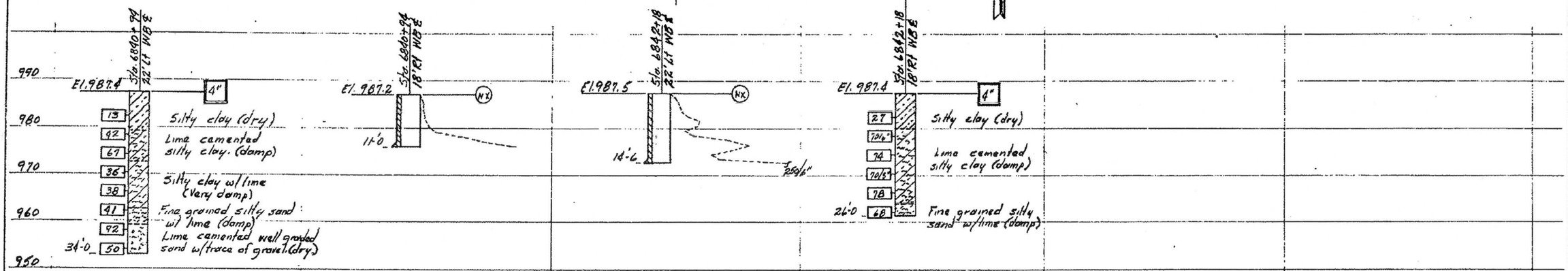
SCALE: Noted | FOUNDATION DATA

A-19

GREENBERG-PHOENIX HWY
GILLARD AVE-DYSART RD.
MARICOPA COUNTY

I-IG-10-2(37) PE 155 7-6-79





BORING NO 1
30 May 1975

BORING NO 2
29 May 1975

BORING NO. 3
3 June 1975

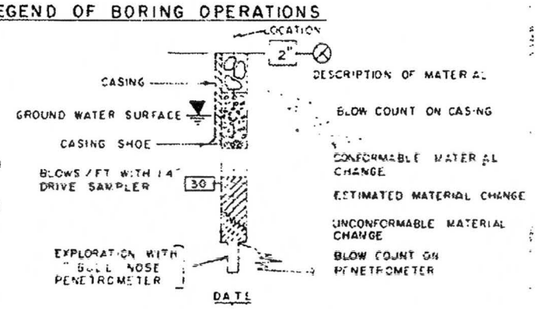
BORING NO.4
2 June 1975

LEGEND OF EARTH MATERIALS

- COBBLES OR BOULDERS
- GRAVEL
- SAND
- SILT
- CLAY
- VOLCANIC CINDERS OR ASH (TUFF)
- LIME
- FILLED MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- PENETROMETER
- CASING
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- CORE BORING
- TEST PIT



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CASING IS DRIVEN WITH 340 POUND HAMMER, 30" FREE FALL, NO CUSHION.
PENETROMETER ARE DRIVEN WITH 140 POUND HAMMER, 30" FREE FALL, NO CUSHION.

0 50 100 200 300
Blow Count Scale

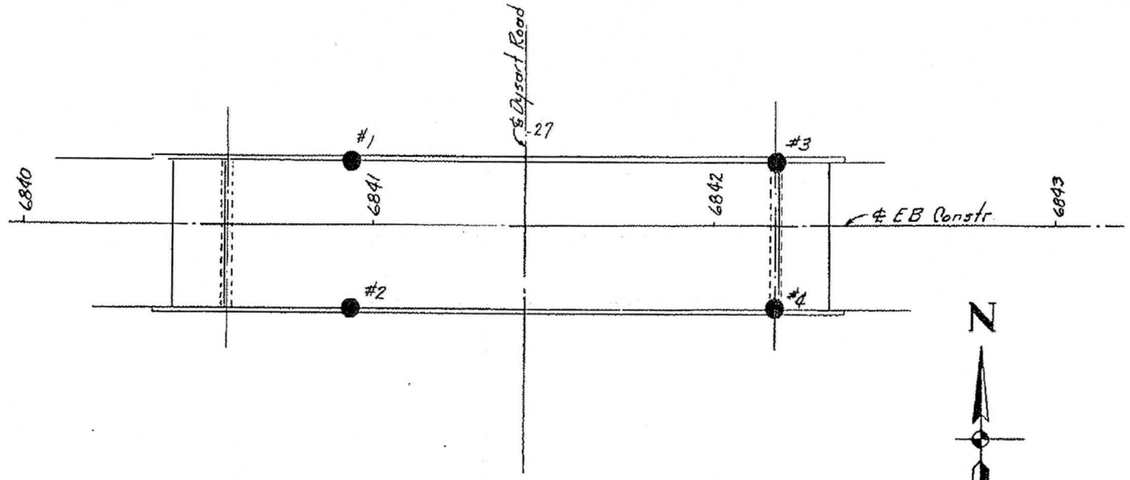
		DATE	ARIZONA DEPARTMENT OF TRANSPORTATION
LAYOUT			DIVISION OF HIGHWAYS
DESIGN			STRUCTURES SECTION
DESIGN CKD			STA. 6841+ W.B.
DRAWN	WCB	9-75	DYSART ROAD T.I.O.P.
DRAWN CKD	KMH	9-75	FOUNDATION DATA SHEET
APPROVED			

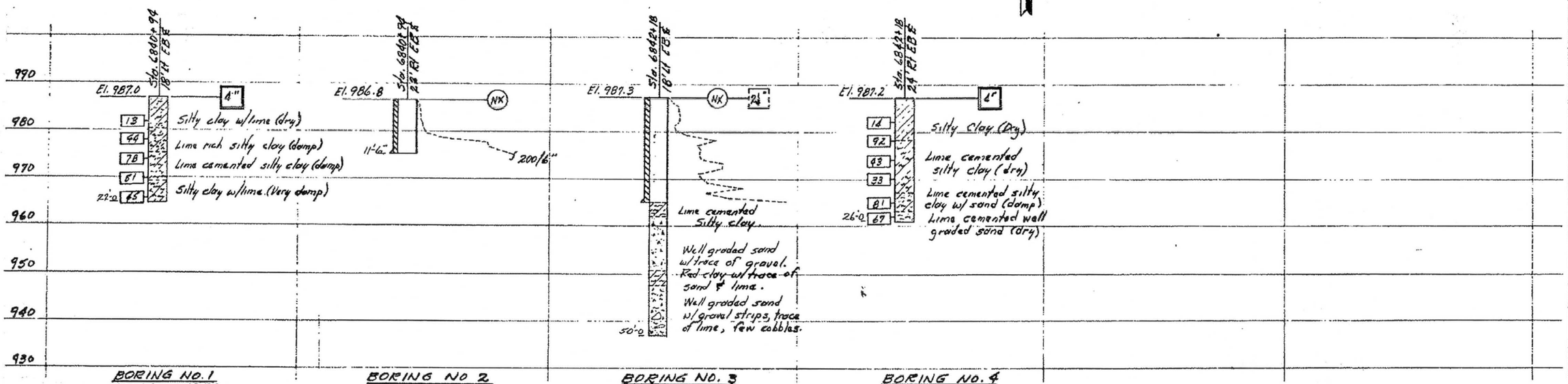
SHEET NO 5 OF 14 — I-10 Maricopa 1724 — I-IG-10-2(37)

#34

EHRENBERG - PHOENIX HWY
BULLARD AVE - DYSART RD.
MARICOPA COUNTY.

I-16-10-2(37) 155 7-6-79



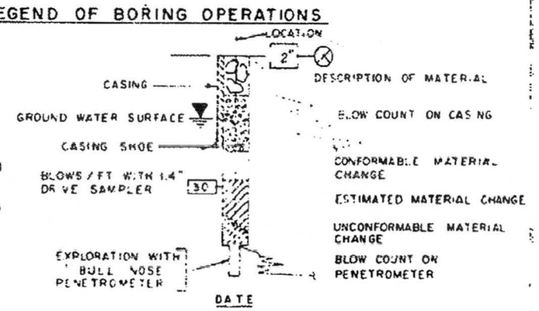


LEGEND OF EARTH MATERIALS

- COBBLES OR BOULDERS
- LIME
- GRAVEL
- FILLED MATERIAL
- SAND
- IGNEOUS ROCK
- SILT
- SEDIMENTARY ROCK
- CLAY
- METAMORPHIC ROCK
- VOLCANIC CINDERS OR ASH (TUFF)

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- PENETROMETER
- CASING
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- CORE BORING
- TEST PIT



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CASING AND PENETROMETER ARE DRIVEN WITH 140 POUND HAMMER, 30" FREE FALL, NO CUSHION.

0 50 100 200 300
Blow Count Scale

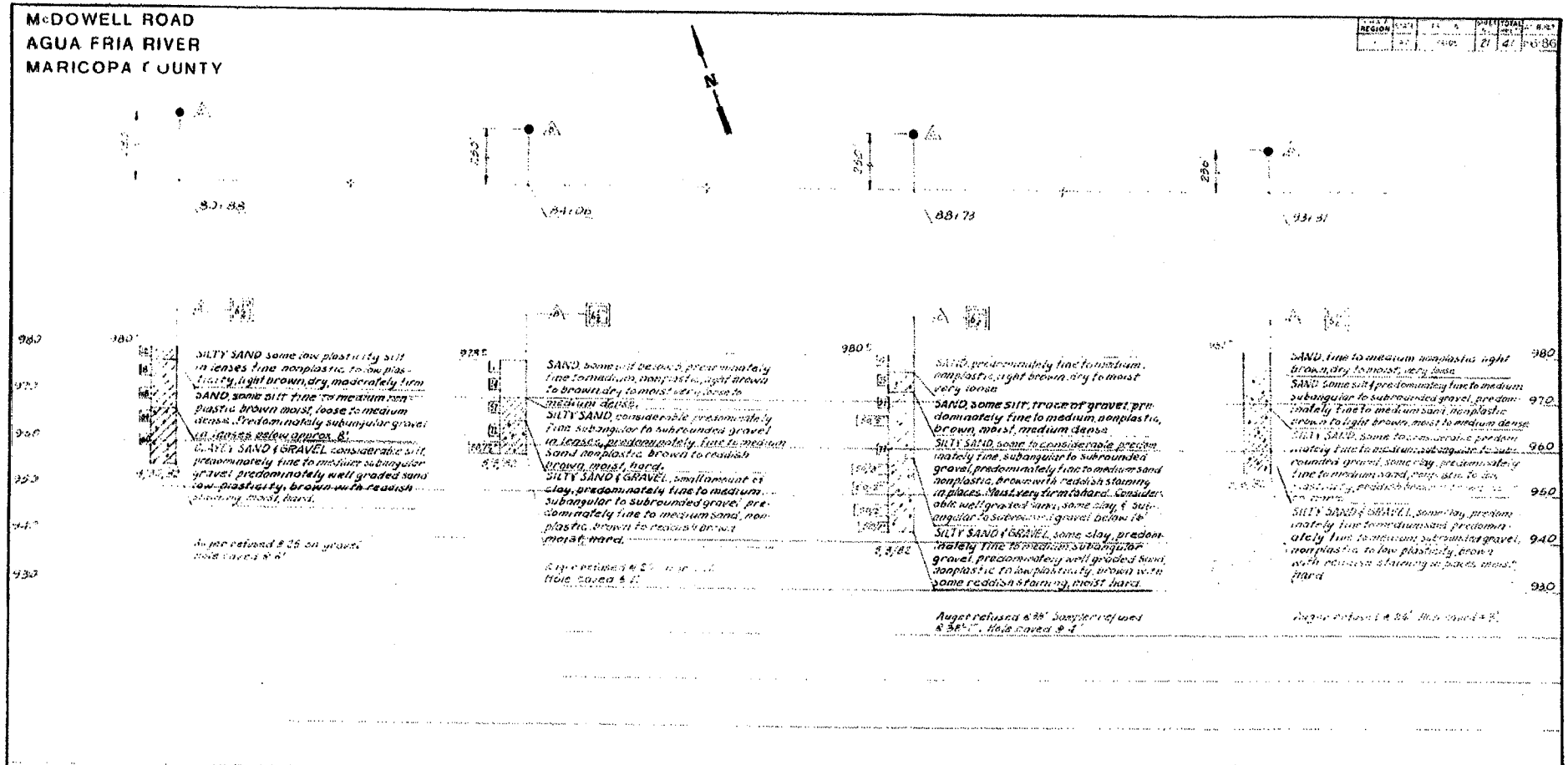
	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS STRUCTURES SECTION
LAYOUT		
DESIGN		
DESIGN CKD		
DRAWN WEB	9-75	STA 6841+ EB.
DRAWN KMH	9-75	DYSART ROAD T.I.O.P.
APPROVED		EXPLORATION LOG SHEET

SHEET NO. 4 OF 14 | 5-10 Maricopa 1728 | I-16-10-2(37)

Registered Professional Engineer (Civil) Certificate Expires Dec. 31, 19 Ronald Clancy Bullard Arizona, U.S.A.

A-20

McDOWELL ROAD
AGUA FRIA RIVER
MARICOPA COUNTY



LEGEND OF EARTH MATERIALS

- COBBLES & BOULDERS
- GRAVEL
- SAND
- SILT
- CLAY
- LIME
- FILLED MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- " " PENETROMETER
- CASING
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- BORING NUMBER
- CORE BORING

LOCATION
ELEV.
CASING
CASING SHOE
BLOWS/FT WITH 140# DRIVE SAMPLER
EXPLORATION WITH 2" BULL NOSE PENETROMETER
DATE
DESCRIPTION OF MATERIAL
BLOW COUNT ON CASING
CONFORMABLE MATERIAL CHANGE
ESTIMATED MATERIAL CHANGE
UNCONFORMABLE MATERIAL CHANGE
BLOW COUNT ON 2" PENETROMETER

GENERAL NOTES

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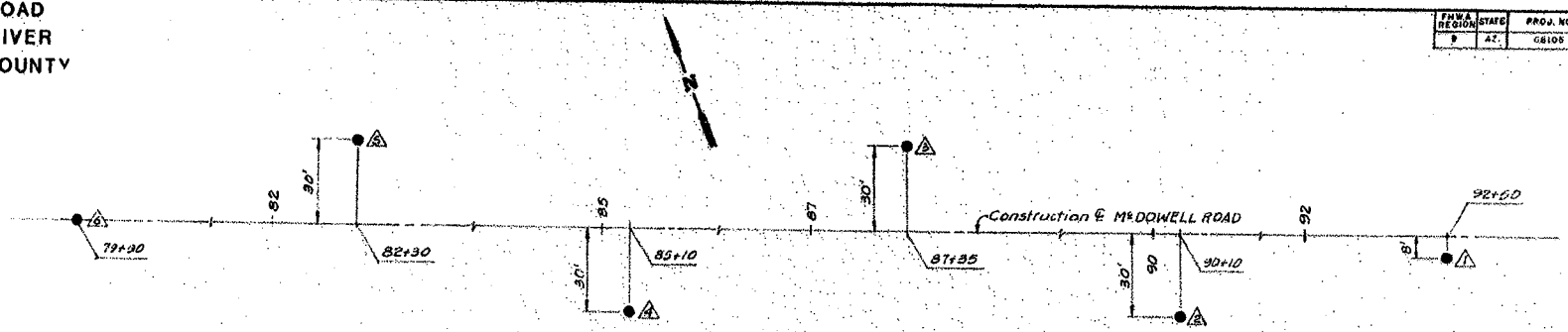
NX CASING IS DRIVEN WITH 342 LB. HAMMER, 30" FREE FALL, NO CUSHION. BX CASING AND 2" PENETROMETER ARE DRIVEN WITH 140 LB. HAMMER, 30" FREE FALL, NO CUSHION.
BLOW COUNT GRAPHS FOR 2" PENETROMETER & NX CASING ARE PLOTTED TO SCALE OF 1"=100 BLOWS HORIZ. MATERIAL NOTED IN ORDER OF DESCENDING PERCENTAGES.

Foundation information shown was plotted from data furnished by Sergent, Hauskins & Beckwith Consulting Engrs. of Phoenix, Az.

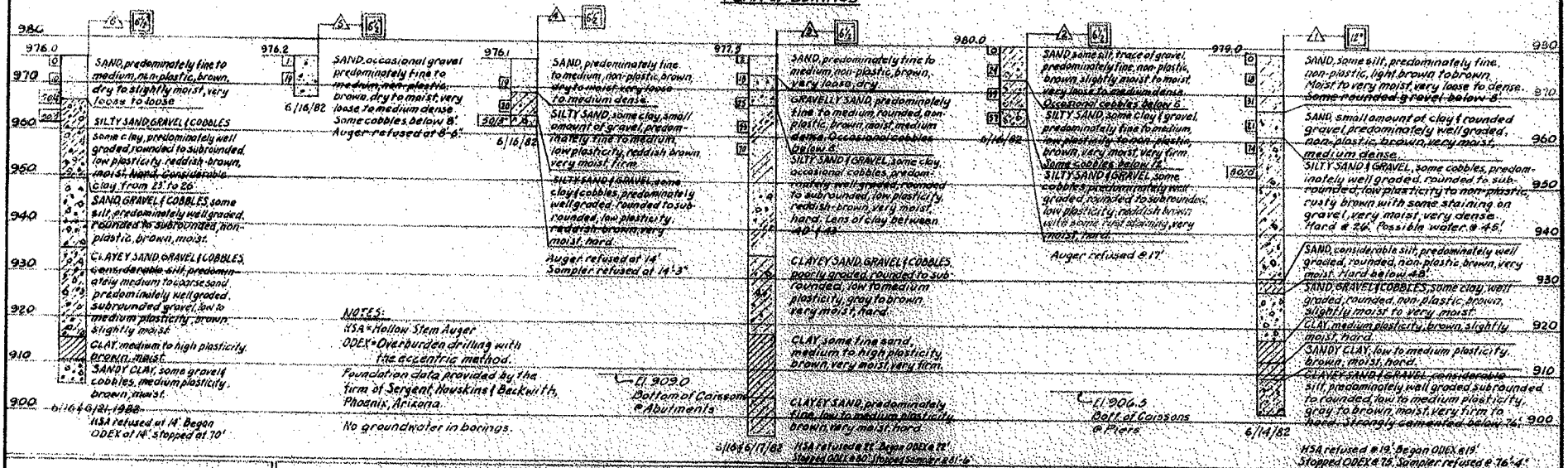
MARICOPA COUNTY
HIGHWAY DEPARTMENT
SCALE 1"=5'
DATE 6/82
FOUNDATION DATA
DRAWN
CHECKED
McDOWELL ROAD
BRIDGE over AGUA FRIA RIVER
HOFFMAN-MILLER ENGINEERS INC.
PHOENIX ARIZONA
DRAWING NUMBER 3 of 23

McDOWELL ROAD
AGUA FRIA RIVER
MARICOPA COUNTY

FHWA REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	AZ.	G8105	20	41	6-86



PLAN OF BORINGS



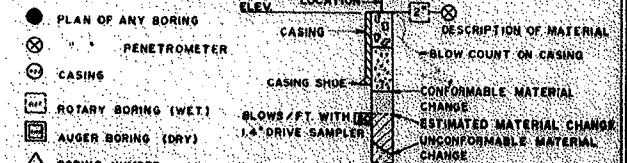
NOTES:
HSA = Hollow Stem Auger
ODEX = Overburden drilling with the eccentric method.
Foundation data provided by the firm of Sergent, Hauskins & Beckwith, Phoenix, Arizona.
No groundwater in borings.

LEGEND OF EARTH MATERIALS

- COBBLES or BOULDERS
- GRAVEL
- SAND
- SILT
- CLAY
- LIME
- FILLED MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- PENETROMETER
- CASING
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- BORING NUMBER
- CORE BORING



GENERAL NOTES

INFORMATION CONTAINED ON THIS SHEET IS MADE AVAILABLE TO PROSPECTIVE BIDDERS FOR INFORMATION ONLY AND IS NOT TO BE CONSIDERED A PART OF THE CONTRACT PAPERS.
CLASSIFICATION OF MATERIALS IS IN ACCORDANCE WITH AASHTO "MANUAL ON FOUNDATION INVESTIGATIONS". CLASSIFICATION OF EARTH MATERIALS IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS.
THE ABSENCE OF A GROUND WATER INDICATION DOES NOT CONSTITUTE A REPRESENTATION THAT GROUND WATER WILL NOT BE PRESENT DURING CONSTRUCTION. GROUND WATER IS INDICATED ONLY WHEN FOUND DURING THE FOUNDATION INVESTIGATION AND REPRESENTS THAT CONDITION ONLY ON THE DATE OF THE INVESTIGATION.
INFORMATION IS DEVELOPED AS ACCURATELY AS POSSIBLE BY THE METHODS UTILIZED, HOWEVER, THE ENGINEER ACCEPTS NO RESPONSIBILITY FOR ANY CONDITIONS ENCOUNTERED WHICH MAY BE AT VARIANCE FROM INFORMATION CONTAINED HEREIN.
SS CASING IS DRIVEN WITH 340 LB. HAMMER, 30" FREE FALL, NO CUSHION. BX CASING AND 2" PENETROMETER ARE DRIVEN WITH 140 LB HAMMER, 30" FREE FALL, NO CUSHION.
BLOW COUNT GRAPHS FOR 2" PENETROMETER & BX CASING ARE PLOTTED TO SCALE OF 1"=100 BLOWS HORIZ. MATERIAL NOTED IN ORDER OF DESCENDING PERCENTAGES.

Foundation information shown was plotted from data furnished by Sergent, Hauskins & Beckwith Consulting Engrs. of Phoenix, Az.

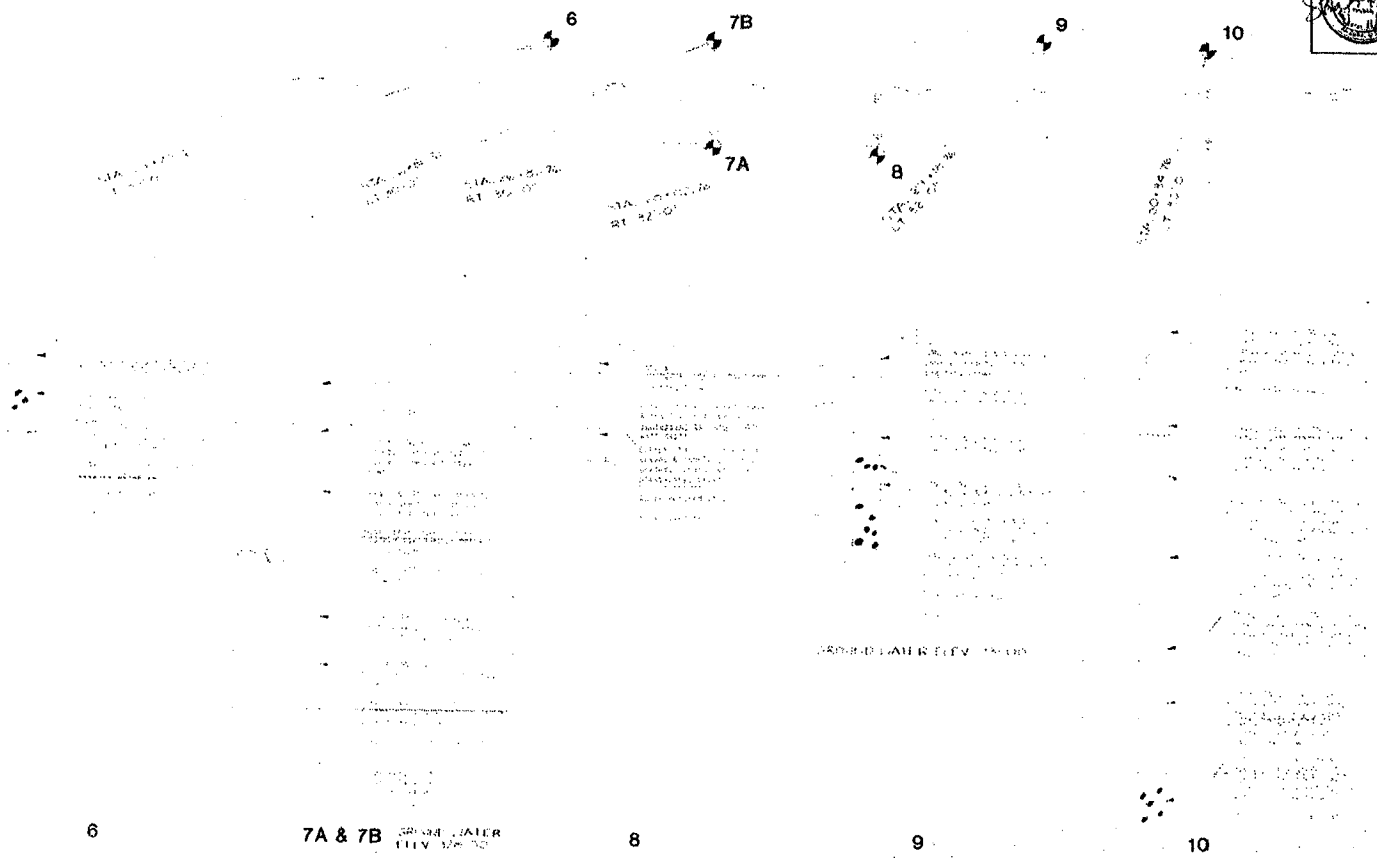
MARICOPA COUNTY
HIGHWAY DEPARTMENT

DATE	FOUNDATION DATA	BRIDGE NO.
1-81	McDOWELL ROAD BRIDGE over AGUA FRIA RIVER	

MOFFATT & NICHOL ENGINEERS
PHOENIX
APPROVED

A-21

VAN BUREN - AGUA FRIA RIVER BRIDGE
MARICOPA COUNTY



		08220	13	39	

MARICOPA COUNTY HIGHWAY DEPT.

VAN BUREN STREET BRIDGE
OVER AGUA FRIA RIVER

BORING LOGS

DES. S.H.
DR. E.M.
CHK. E.M.P.
DATE 2-86

SHEET NO. S4
TOTAL SHEETS 39

VAN BUREN STREET-AGUA FRIA RIVER BRIDGE
MARICOPA COUNTY

BORING NO. 11 1 2 3 4 5

		68220	12	39	

MARICOPA COUNTY HIGHWAY DEPT.

VAN BUREN STREET BRIDGE
OVER AGUA FRIA RIVER

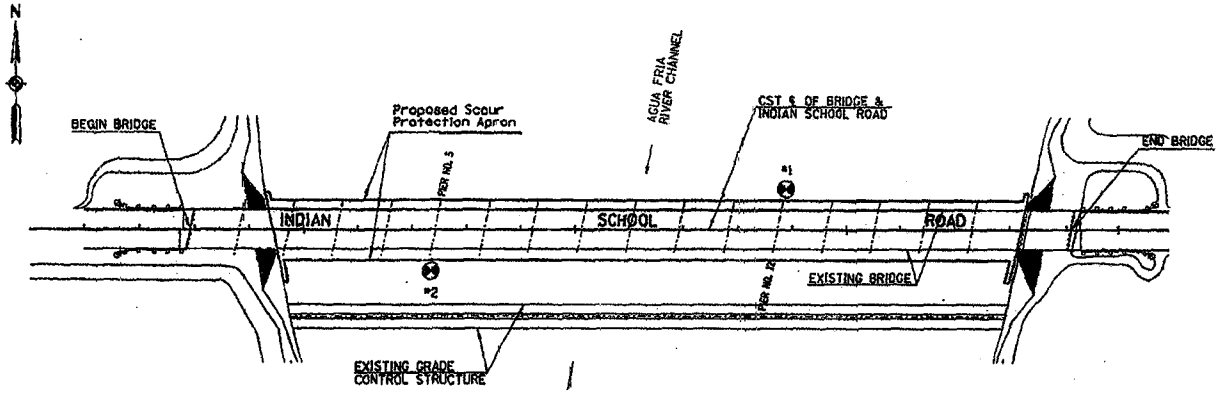
BORING LOGS

S.H.
E.M.
E.M.P.
DATE 2-86

S3 39

A-22

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68937	4	4	JUNE 2001 AS-BUILT



SITE PLAN
NOT TO SCALE

TEST PIT LOCATION 1

Depth, feet	Blows/Foot C	Blows/Foot M/R	Sample Type	Dry Density, pcf	Water Content %	Unified Classification	Description
						GP	Sandy Gravel, Trace Silt, Some Cobbles. Occasional Debris; light brown/gray, nearly dry, loose to medium dense, non-plastic fines.
5						SP	Gravelly Sand, Trace Silt, Occasional to Some Cobbles; light brown/gray, nearly dry, loose to medium dense, non-plastic fines.
10							
15							Stopped excavating at 13 feet due to extensive caving. No groundwater Observed.
20							
25							
30							

TEST PIT LOCATION 2

Depth, feet	Blows/Foot C	Blows/Foot M/R	Sample Type	Dry Density, pcf	Water Content %	Unified Classification	Description
						GP	Sandy Gravel, Trace Silt, Some Cobbles. Occasional Debris; light brown/gray, nearly dry, loose to medium dense, non-plastic fines, occasional boulders.
5							
10						SP	Gravelly Sand, Trace Silt, Occasional to Some Cobbles; light brown/gray, nearly dry, loose to medium dense, non-plastic fines.
15							Stopped excavating at 13 feet due to extensive caving. No Groundwater Observed.
20							
25							
30							

NOTES:

INFORMATION CONTAINED ON THIS SHEET IS MADE AVAILABLE TO PROSPECTIVE BIDDERS FOR INFORMATION PURPOSES ONLY, AND IS NOT TO BE CONSIDERED A PART OF THE CONTRACT DOCUMENTS.

FOR FUTHER INFORMATION REFER TO RICKER, ATKINSON, McBEE & ASSOCIATES, INC. REPORT NO. G01718.

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

DATA PRESENTED IS A SIMPLIFICATION.

AS BUILT

NO.	REVISION	BY	DATE
1			
2			
3			
4			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

INDIAN SCHOOL ROAD AT AGUA FRIA RIVER
PROJECT NO. 68937

	BY	DATE
DESIGNED	R. BABES	6/98
DRAWN	L. LOPEZ	6/98
CHECKED	R. BRUESOL & BURROWS	6/98

Baker
Michael Baker Jr., Inc.

LOG OF BORINGS

SHEET 4 OF 4

TRACS NO.

A-23

VALUE ENGINEERING PAYS

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

TT84-6

Depth	LOG	MC	LL	PI	-4	-200	N	Description
1.0'	ML				100	52		SANDY SILT; light brown, dry, very loose.
2.5'	SW SM				98	12		SAND/SILTY SAND; light brown, damp, loose, occasional gravels and cobbles to 4".
					74	6		GRAVELLY SAND; brown, damp, loose, gravel.
	SP SM				100	9		SAND/SILTY SAND; brown, damp, loose.
7.5'								SAME; occasional gravel.
13.0'	*							GRAVELLY SAND; brown, damp, loose, cobbles to 8".

TT84-7

Depth	LOG	MC	LL	PI	-4	-200	N	Description
	SM				100	19		SILTY SAND; light grey, dry, very loose, hairlike roots.
		4.4			99	16		brown, moist, loose.
5.0'	SP SM	31.5			96	10		SAND/SILTY SAND; brown, moist, few gravel, very loose.
8.0'								
9.0'	SP				89	2		SAND; multicolored, damp, coarse.
9.5'	SP/SM	1.9			99	6		SAND/SILTY SAND; brown, occasional cobbles.

TT84-8

Depth	LOG	MC	LL	PI	-4	-200	N	Description
1.0'	*							SILTY SAND; brown, dry, medium dense, fine grained.
	ML				100	71		SANDY SILT; dry to damp, dense to medium dense, 2" sand lense at 3'.
4.0'								
5.0'	SP/SM	3.2			100	7		SAND/SILTY SAND; brown, damp to moist, loose, medium to fine grained.
5.3'	ML	16.2			100	58		SANDY SILT; dark brown, damp to moist, stiff.
		2.1			98	3		SAND; brown, damp to moist, loose, coarse grain,
	SP	3.0			100	2		medium to fine grain.
12.0'					76	1		GRAVELLY SAND; coarse grained, few fine grained gravel.

TT84-9

Depth	LOG	MC	LL	PI	-4	-200	N	Description
1.3'	CL		31	12	100	64		SANDY CLAY; light brown to brown, damp to moist, dense, some hair roots.
			20	11	100	93		light brown, dry, hard, hair roots.
1.5'	SM				99	23		SILTY SAND; light brown, dry, dense, coarse to fine grain, cemented.
	SP SM				100	6		SAND/SILTY SAND; grey, dry, dense to loose, medium grain sand, some caving.
8.0'								

TT84-10

Depth	LOG	MC	LL	PI	-4	-200	N	Description
1.0'	CL		21	8	100	71		SANDY CLAY; dark brown, moist, stiff to hard.
2.0'	GM			NP	56	26		SILTY SANDY GRAVEL; dark brown, moist, very dense, gravel to 3".
3.8'	ML			NP	86	53		GRAVELLY SANDY SILT; dark brown, moist, very stiff to stiff, fine sand.
4.5'	SP/SM				98	9		SAND/SILTY SAND; brownish grey, damp, med. dense to loose, medium grain.
4.8'	ML			NP	100	72		SANDY SILT; dark brown, damp, medium dense, fine grain sand.
6.9'	SP				51	2		GRAVELLY SAND; light brown, damp, loose to dense, coarse to medium grain.
7.5'	SM				100	50		SILTY SAND; dark brown, wet, medium stiff.
10.5'	SP				96	3		SAND; grey, moist, loose, coarse to medium grain, few gravel to 1/2 inch.

TT84-11

Depth	LOG	MC	LL	PI	-4	-200	N	Description
2.0'	*							CALICHE; brown to white, wet to dry, loose to very dense, sand and silt cemented, wet and loose at surface due to ponded water, well cemented thereafter.

EXPLORATIONS PERFORMED DURING JUNE AND JULY 1984.

GEOTECHNICAL LOGS

VERT. SCALE: 5 0 5 10 FEET

PLAN

SCALE 500 0 500 1000 FEET

NOTES:

1. REFER TO PLATE 6 FOR BASIS OF CLASSIFICATION.
2. REFER TO PLATE 2 FOR LEGEND AND GENERAL NOTES.

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

SKUNK CREEK AND THE NEW AND AGUA FRIA RIVERS
(ARIZONA CANAL DIVERSION CHANNEL TO GILA RIVER)

LOCATIONS AND LOGS OF
TEST HOLES AND TEST TRENCHES
TT84-6 TO 11

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

SAFETY PAYS

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than half of material is larger than no. 200 sieve size.	GRAVELS More than half of coarse fraction is larger than no. 4 sieve size.	Clean gravels	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than no. 4 sieve size.	Clean sands	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than half of material is smaller than no. 200 sieve size.	SILTS AND CLAYS	Low liquid limit.	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts, with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
			OL	Organic silts and organic silty clays of low plasticity.
		High liquid limit.	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity.
			OH	Organic clays of medium to high plasticity, organic silts.
Highly organic soils			Pt	Peat and other highly organic soils.

NOTES:

1. Boundary Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example, GW-GC, well-graded gravel-sand mixture with clay binder.
2. All sieve sizes on this chart are U. S. Standard.
3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus no. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart, and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.
4. The Soil Classification System is based on the American Society for Testing and Materials (ASTM).
   a. (ASTM) D2487 Standard Test Method for Classification of Soils for Engineering Purposes.
   b. (ASTM) D2487 Standard Recommended Practice for Description of Soils (Visual Manual Procedure).

TH84-1

	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
1.0'	SM				100	50		SILTY SAND; Light brown, dry, dense.

TH84-2

	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
1.0'	ML				91	70		SANDY SILT; Light brown, dry, dense.

TH84-4

	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
	SP			NP	97	0		SAND; Light grey, dry, very loose.
2.0'		2.2			76	2		GRAVELLY SAND; More gravel.
6.0'	GP	3.4			40	2		SANDY GRAVEL; Dark brown, moist, dense, coarse grained sand, cobbles to 6".
7.5'	SP				91	3		SAND; Very loose, gravel.
12.5'	SP SM				88	6		SAND/SILTY SAND; Dense w/gravels and silts.

TT84-5

	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
	SP-SM	3.4			98	11		SAND/SILTY SAND; Light brown, dry, very loose.
1.5'	SP				80	2		SAND; Multicolor, damp, loose, 20% gravel
2.0'	SW				95	1		SAND; Dark brown, moist.
7.0'								Increase in gravel at 7'-0"

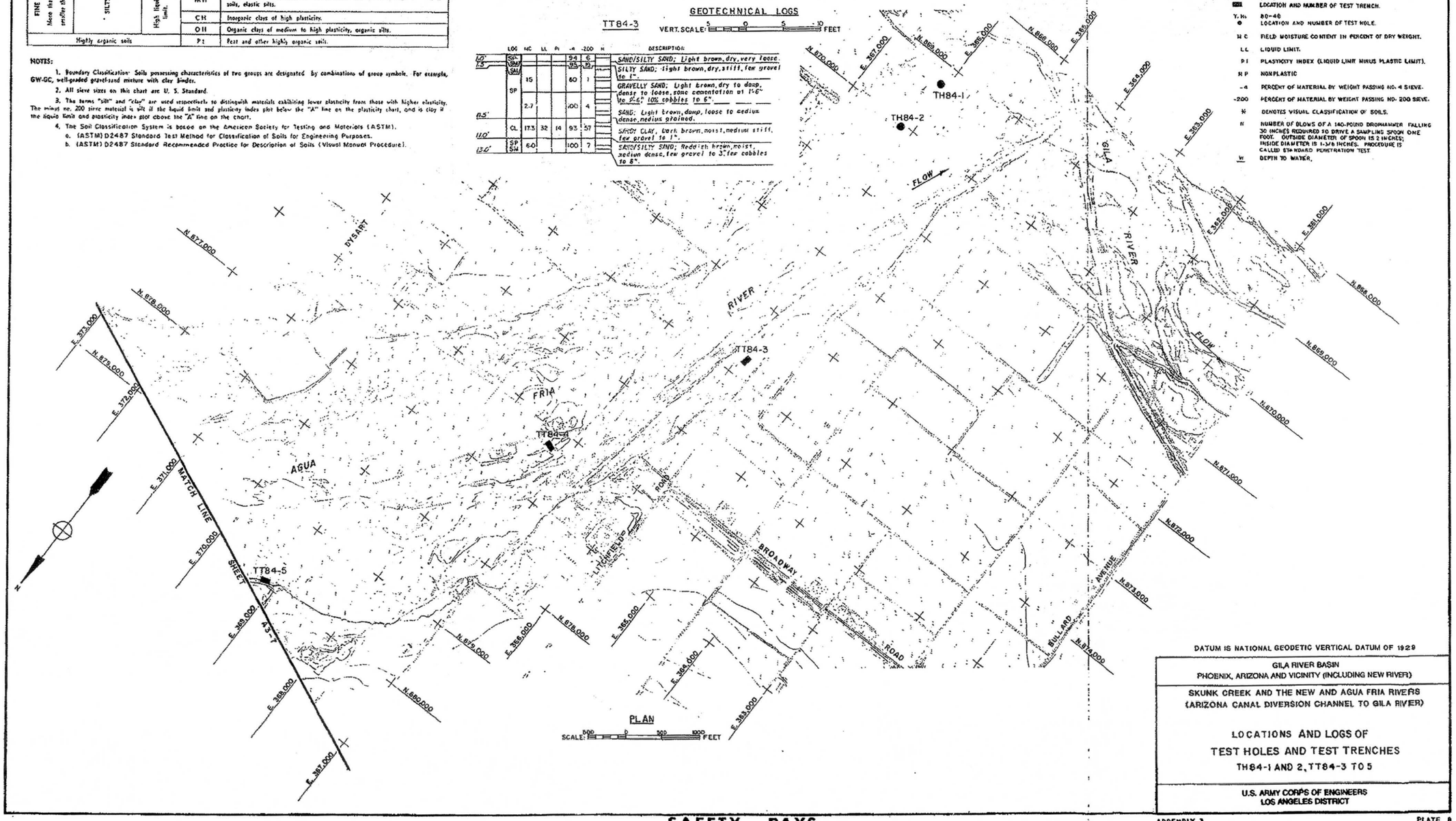
EXPLORATIONS PERFORMED DURING JUNE AND JULY 1984

GEOTECHNICAL LOGS

VERT. SCALE: 5 0 5 10 FEET

TT84-3

	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
1.0'	SM				94	6		SAND/SILTY SAND; Light brown, dry, very loose.
1.5'	SM				95	19		SILTY SAND; Light brown, dry, stiff, few gravel to 1".
	SP	15			60	1		GRAVELLY SAND; Light brown, dry to damp, dense to loose, zone cementation at 1'-6" to 2'-6", 10% cobbles to 6".
8.5'		2.7			100	4		SAND; Light brown, damp, loose to medium dense, medium grained.
11.0'	CL	17.3	32	14	93	57		SANDY CLAY; Dark brown, moist, medium stiff, few gravel to 1".
13.0'	SP SM	6.0			100	7		SAND/SILTY SAND; Reddish brown, moist, medium dense, few gravel to 3", few cobbles to 8".



LEGEND

T.T.	84-5
	LOCATION AND NUMBER OF TEST TRENCH.
T.H.	80-48
	LOCATION AND NUMBER OF TEST HOLE.
M C	FIELD MOISTURE CONTENT IN PERCENT OF DRY WEIGHT.
L L	LIQUID LIMIT.
P I	PLASTICITY INDEX (LIQUID LIMIT MINUS PLASTIC LIMIT).
N P	NONPLASTIC
-4	PERCENT OF MATERIAL BY WEIGHT PASSING NO. 4 SIEVE.
-200	PERCENT OF MATERIAL BY WEIGHT PASSING NO. 200 SIEVE.
N	DENOTES VISUAL CLASSIFICATION OF SOILS.
N	NUMBER OF BLOWS OF A 140-POUND DROPHAMMER FALLING 30 INCHES REQUIRED TO DRIVE A SAMPLING SPOON ONE FOOT. OUTSIDE DIAMETER OF SPOON IS 2 INCHES; INSIDE DIAMETER IS 1-3/8 INCHES. PROCEDURE IS CALLED STANDARD PENETRATION TEST.
W	DEPTH TO WATER.

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

SKUNK CREEK AND THE NEW AND AGUA FRIA RIVERS
(ARIZONA CANAL DIVERSION CHANNEL TO GILA RIVER)

LOCATIONS AND LOGS OF
TEST HOLES AND TEST TRENCHES
TH84-1 AND 2, TT84-3 TO 5

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

TT84-12

LOG	MC	LL	PI	-4	-200	N	
2.8'	ML		NP	100	60		SANDY SILT; Brown, damp, dense, fine grain.
	SP			99	4		SAND; Dark brown, moist, medium dense.
				90	1		dark brown to grey, moist to dry, medium dense to loose, medium to coarse grain, few gravel to 1-1/2"
				98	3		brown, moist, medium dense, medium grains, occasional gravel to 1".
				91	2		dark brown, very moist, medium dense to dense, medium to coarse grain.
11.5'				86	2		brown, wet, loose, coarse grain, few gravel to 1".
13.5'	SW SM			72	6		GRAVELLY SAND/SILTY GRAVELLY SAND; Reddish brown, very wet, dense, coarse grain, gravel, 10% cobbles to 5".

TT84-13

LOG	MC	LL	PI	-4	-200	N	
1.0'	GP			29	1		SANDY GRAVEL, Brown to grey, moist, medium dense, coarse grained, hair roots.
	SP			64	1		GRAVELLY SAND; Grey moist, medium dense, coarse grain sand, gravel, occasional cobble to 6".
5.0'				80	1		brown to grey, wet gravel to 1-1/2".

TT84-14

LOG	MC	LL	PI	-4	-200	N	
3.0'	ML		NP	100	62		SANDY SILT; Light brown, dry, hard.
6.0'	SM		NP	99	26		SILTY SAND; Light brown, dry, medium dense to dense, fine grained
	SP			86	2		SAND; Grey to brown, dry to damp, very loose to loose, predominately medium grain.
				92	3		light brown, damp, medium dense, few gravel to 2", some silty sand pockets.
			NP	55	2		GRAVELLY SAND: Dark brown, moist, medium dense, gravel, 10% cobbles to 10".
							wet, coarse grain, few cobbles to 10".
16.5'			NP	63	3		

TT84-15

LOG	MC	LL	PI	-4	-200	N	
	SP SM			96	11		SAND/SILTY SAND, Brown, moist, medium dense, few gravel to 3/4, 2" thick silt lense.
3.4' 3.7'	SM		NP	100	25		SILTY SAND; Dark brown, moist, medium stiff, hair roots.
6.2'	SP SM			99	8		SAND/SILTY SAND; Grey, dry to damp, dense, mostly fine grain, silt lenses 1/4"-1/2" thick.
8.2'	SP			82	1		GRAVELLY SAND; Light brown and grey, damp, dense, gravel to 1", slightly cemented.
11.5'	*						SAND; 5% gravel, 5% cobbles to 6".

TT84-16

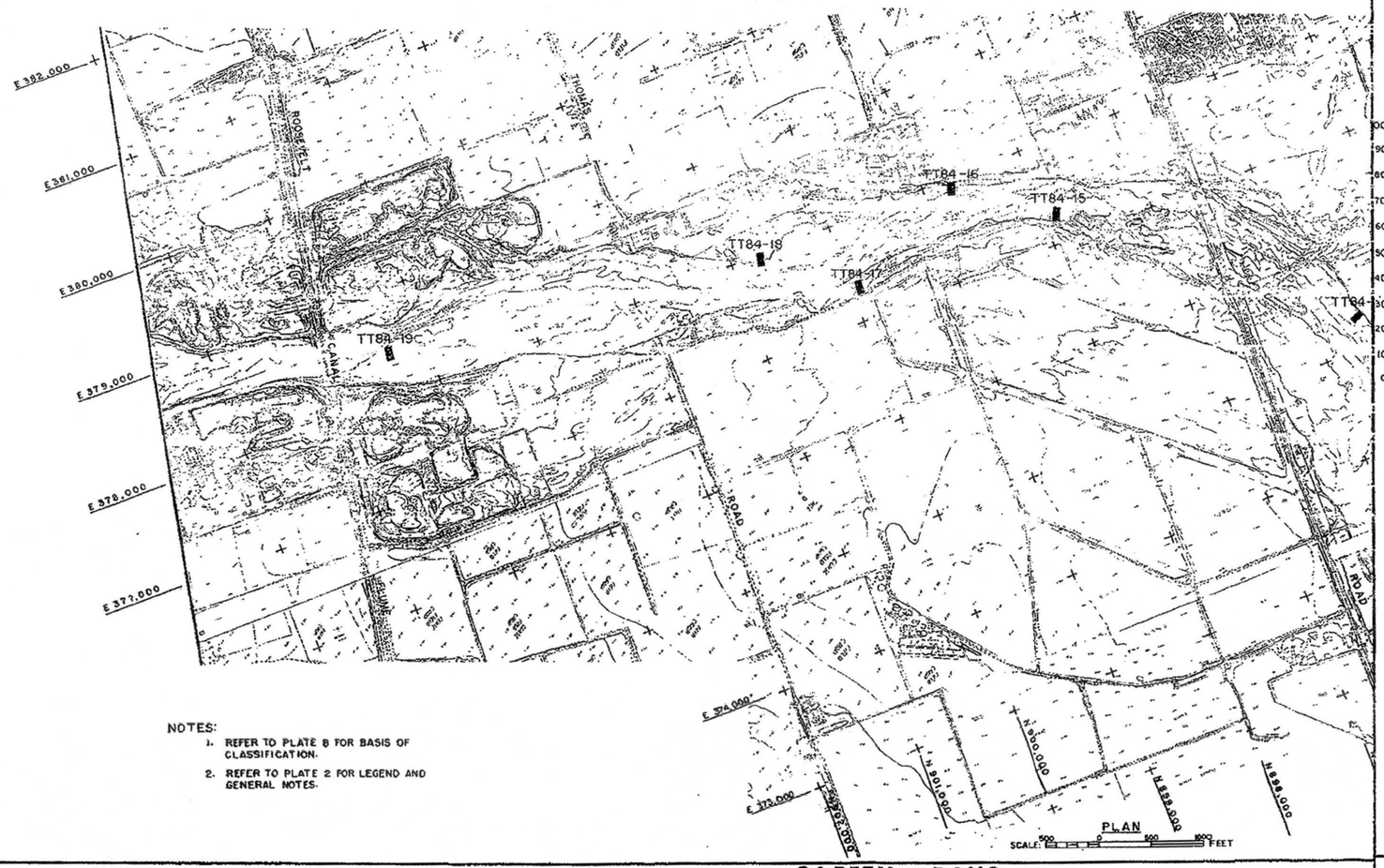
LOG	MC	LL	PI	-4	-200	N	
2.7'	SP		NP	98	3		SAND; Grey to brown, damp to moist, coarse to medium grain, loose.
	SM						SILTY SAND; Brown, moist, dense, mostly fine grain, some roots.
7.7'		27	3	94	50		
8.7'	SC	20	10	100	34		CLAYEY SAND; Dark brown, damp, hard to very hard, breaks in sheets, veins of white deposit 1/16" thick.
10.0'	ML	31	7	100	65		SANDY SILT; Dark brown, damp, hard to very hard, breaks easy, cohesive.

TT84-17

LOG	MC	LL	PI	-4	-200	N	
	SP SM			98	11		SAND/SILTY SAND; Light brown to grey, medium dense, fine grain, large quantity of hair roots.
3.9' 4.7'	SP			80	1		GRAVELLY SAND; Grey, dry, dense, gravel to 1-1/2"
5.6'	SP SM			99	5		SAND/SILTY SAND; Grey, dry, dense, fine grain.
				93	2		SAND; Brown, damp, dense, occasional gravel to 1-1/2".
				63	1		GRAVELLY SAND; Light brown, moist, medium dense, occasional cobble to 5".
	SP						GRAVELLY SAND: Reddish brown, wet, medium dense. 5% cobbles to 10", cohesive binder.
16.6'				61	1		

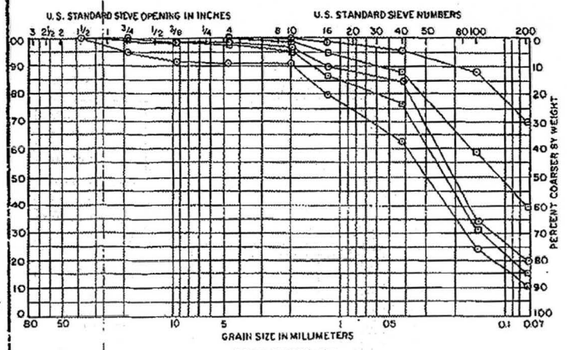
GEOTECHNICAL LOGS

VERT. SCALE: 5 0 5 10 FEET



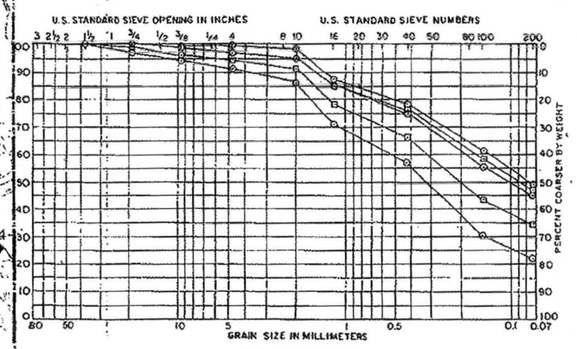
NOTES:

1. REFER TO PLATE 8 FOR BASIS OF CLASSIFICATION.
2. REFER TO PLATE 2 FOR LEGEND AND GENERAL NOTES.



BANK MATERIALS
TEST TRENCHES TT84-1,2,5,6,7,8 and 9

⊙– UPPER AND LOWER GRADATION LIMITS
⊡– UPPER AND LOWER QUARTILES
⊙– MEAN GRADATION



BANK MATERIALS
TEST TRENCHES TT84-37,39 and 40

GRADATION CURVES

⊙– UPPER AND LOWER GRADATION LIMITS
⊡– UPPER AND LOWER QUARTILES
⊙– MEAN GRADATION

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

SKUNK CREEK AND THE NEW AND AGUA FRIA RIVERS
(ARIZONA CANAL DIVERSION CHANNEL TO GILA RIVER)

LABORATORY TEST RESULTS OF
TYPICAL BANK MATERIALS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

#18

Ninyo & Moore

APPENDIX B

EXPLORATORY TEST RESULTS

APPENDIX B

EXPLORATORY TEST RESULTS

B-1

TABULATION OF TEST RESULTS

Job No. E82-49
W/O 1

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	SIEVE ANALYSIS-ACCUM % PASSING #200	#100	#40	#16	#10	#4	.25"	.375"	.75"	1"	1.5"	2"	LAB NO
4	9.5′-11′	SW-SM	-	NP	6	8	21	54	65	73	74	77	84	87	100		2-49-18
4	14.5′-16′	SP-SM	-	NP	7	8	23	53	64	81	86	92	100				2-49-19
6	0.5′-2′		-	NP													2-49-24
6	4.5′-6′		NA	-	9	19	79	97	98	100							2-49-26
8	2.5′-4′	ML	-	NP	61	79	94	99	99	100							2-49-35
10	4.5′-6′	SP	-	NP	2	4	22	68	84	96	98	100					2-49-43
11	4.5′-5.5′	SM	-	NP	43	65	92	98	99	99	100						2-49-48
13	0.5′-2′	ML	-	NP	56	79	97	99	100								2-49-58
14	2.5′-4′	SP-SM	-	NP	6	13	57	97	99	99	100						2-49-64

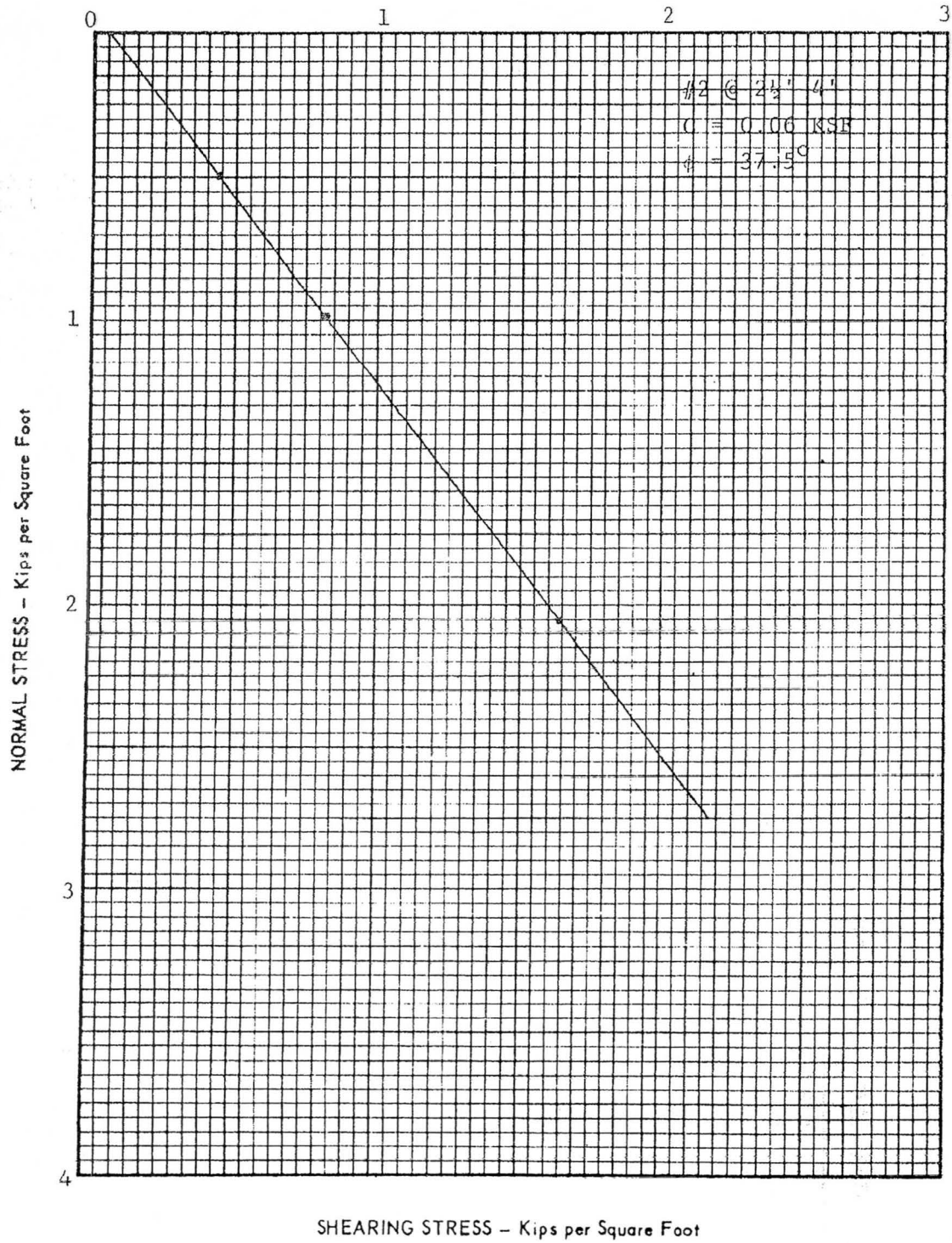
TABULATION OF TEST RESULTS

Job No. E82-49
W/O 2

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	#200	#100	#40	#16	#10	#4	.25"	.375"	.75"	1"	1.5"	2"	LAB NO
					SIEVE ANALYSIS-ACCUM % PASSING												
4	1'-2'	SM	-	NP	47	67	88	95	96	97	97	97	97	100			2-49-68
9	1'-2'	SP-SM	-	NP	5	9	36	64	72	81	83	86	92	95	99	100	2-49-69

SUMMARY OF DIRECT SHEAR TESTS

PROJECT Channelization - Agua Fria River **JOB NO.** E82-49-7



SOIL MOISTURE CONDITION

- ○ – INSITU
- ● – SUBMERGED

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REPORT ON LABORATORY TESTS

DATE _____

PROJECT Channelization - Agua Fria River JOB NO. E82-49
LOCATION Thomas Road & I-10, Maricopa County, AZ LAB NO. 2-49-7
SAMPLE #2 @ 2½'-4'

DIRECT SHEAR TESTS

IN SITU - POINT NO. 1 (= ± 0.50 KSF)

INITIAL MOISTURE CONTENT	4.3	%
DRY DENSITY (PCF)	100.6	
SUBMERGED		
FINAL MOISTURE CONTENT	19.7	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	(+).007	INCHES
SHEARING STRESS, T MAX.	0.44	KSF

IN SITU - POINT NO. 2 (= ± 1.00KSF)

INITIAL MOISTURE CONTENT	3.8	%
DRY DENSITY (PCF)	101.9	
SUBMERGED		
FINAL MOISTURE CONTENT	18.9	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	(+).008	INCHES
SHEARING STRESS, T MAX.	0.81	KSF

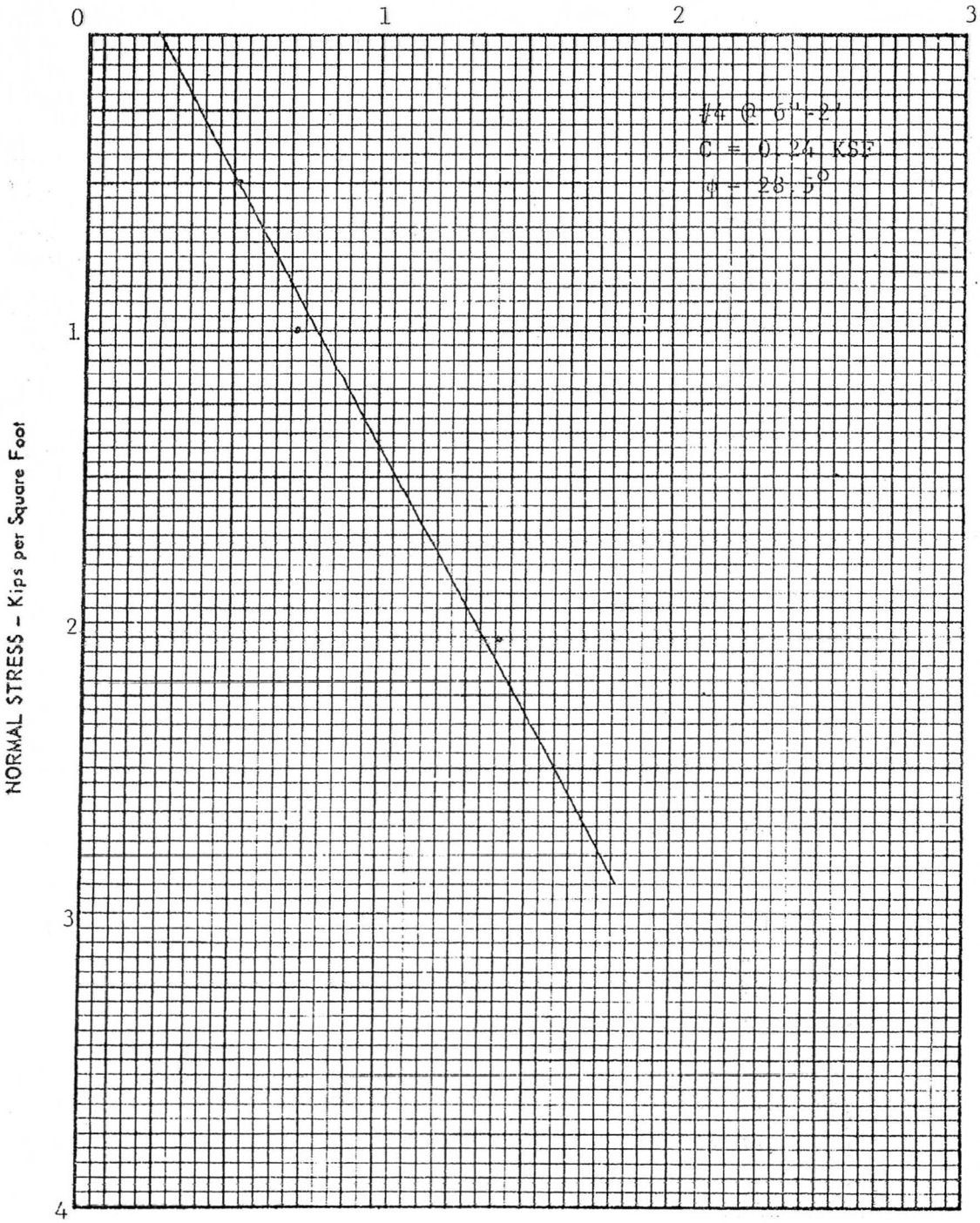
IN SITU - POINT NO. 3 (= ± 2.06 KSF)

INITAL MOISTURE CONTENT	3.6	%
DRY DENSITY (PCF)	101.7	
SUBMERGED		
FINAL MOISTURE CONTENT	19.4	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	(+).003	INCHES
SHEARING STRESS, T MAX.	1.64	KSF

REMOLDED TO Est. 95 % OF Max. γ Dry

SUMMARY OF DIRECT SHEAR TESTS

PROJECT Channelization - Agua Fria River **JOB NO.** E82-49-15



SOIL MOISTURE CONDITION

O – INSITU
● – SUBMERGED

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REPORT ON LABORATORY TESTS

DATE _____

PROJECT Channelization - Agua Fria River JOB NO. E82-49
LOCATION Thomas Road & I-10, Maricopa County, AZ LAB NO. 2-49-15
SAMPLE #4 @ 6"-2' W/O No. 1

DIRECT SHEAR TESTS

IN SITU - POINT NO. 1 (= ± 0.50 KSF)

INITIAL MOISTURE CONTENT	8.2	%
DRY DENSITY (PCF)	110.6	
SUBMERGED		
FINAL MOISTURE CONTENT	17.9	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	(+).001	INCHES
SHEARING STRESS, T MAX.	0.51	KSF

IN SITU - POINT NO. 2 (= ± 1.00 KSF)

INITIAL MOISTURE CONTENT	7.8	%
DRY DENSITY (PCF)	108.5	
SUBMERGED		
FINAL MOISTURE CONTENT	17.5	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	( ).000	INCHES
SHEARING STRESS, T MAX.	0.72	KSF

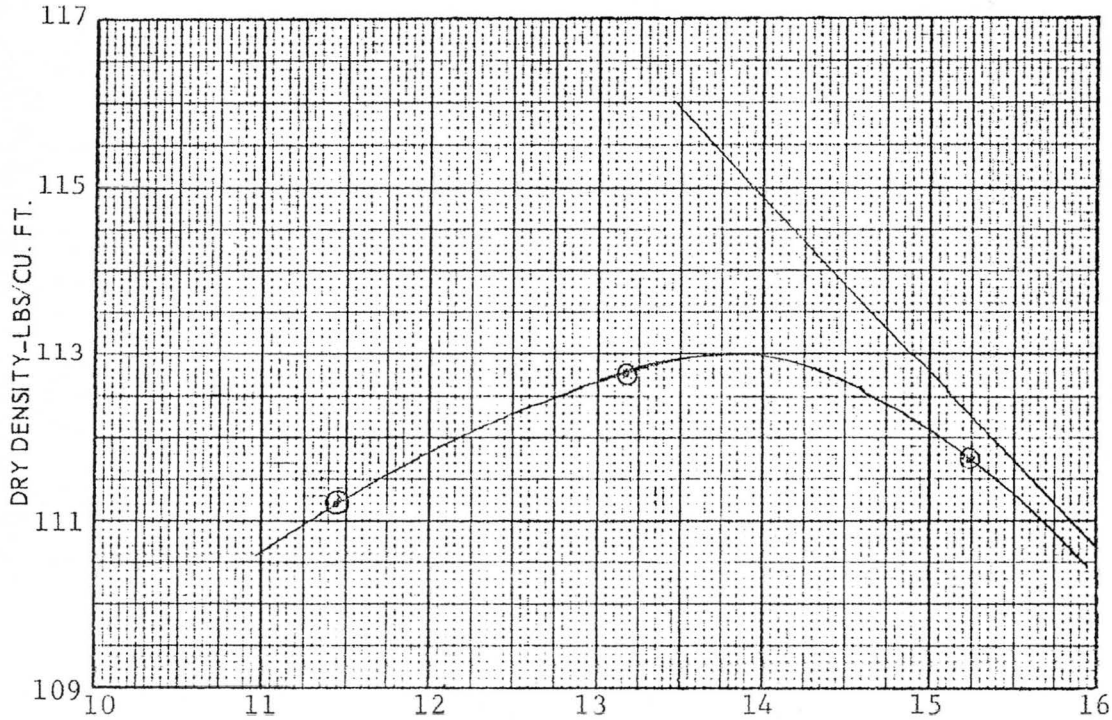
IN SITU - POINT NO. 3 (= ± 2.06 KSF)

INITAL MOISTURE CONTENT	7.8	%
DRY DENSITY (PCF)	110.5	
SUBMERGED		
FINAL MOISTURE CONTENT	17.3	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	( ).000	INCHES
SHEARING STRESS, T MAX.	1.41	KSF

REMOLDED TO Est. 95 % OF Max. γ Dry

SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT Channelization - Agua Fria River **JOB NO.** E82-49



CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
A	Boring #4 @ 1'-2'	13.8	113.0	D698	A	2-49-68

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHTO T99 and ASTM D698 (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHTO T180 and ASTM D1557 (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

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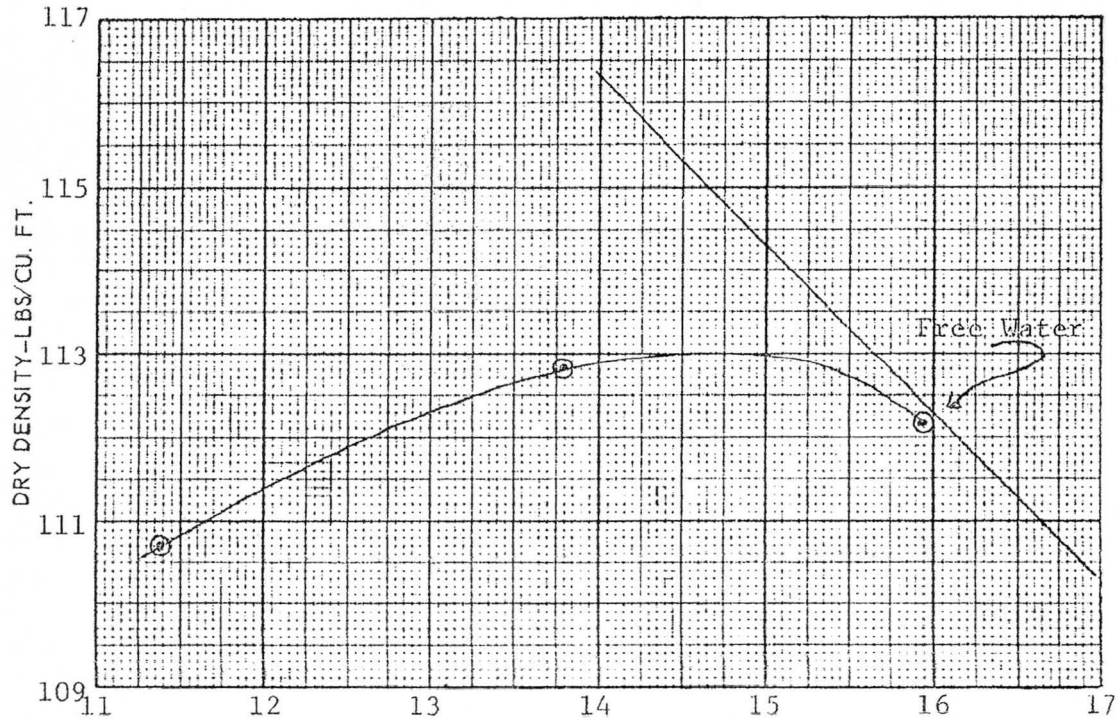
SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT Channelization - Agua Fria River **JOB NO.** E82-49



MOISTURE CONTENT – % DRY WEIGHT

CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
B	Boring #9 @ 1'-2'	14.8	113.0	D698	A	2-49-69

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHTO T99 and ASTM D698 (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHTO T180 and ASTM D1557 (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

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REPORT ON LABORATORY TESTS

DATE _____

PROJECT Channelization - Agua Fria River JOB NO. E82-49

LOCATION Thomas Road & I-10; Maricopa County, AZ LAB NO. 2-49-68

PERMEABILITY TEST
(Pressurized Permeameter)

Sample Boring #4 @ 1'-2'

Remolded to Density of 109.4 PCF at 13.0 %

Diameter 4.920 cm Length 5.08 cm Area 19.01 cm^2 Vol. 96.62 cc

W_s 169.4 grms. w_o 13.0 % w_f 16.9 % G_s _____ V_s _____ cc

Void Ratio _____ Dry Density _____ PCF Trials _____ days

Pressure (PSI)	Head (inches)	Q (cc)	Time (min.)	K (cm/sec)	K (ft/yr)	Remarks
F.H.	48.8	52	1080	1.7×10^{-6}	2	Input "Q"
		10	1080	3.3×10^{-7}	0.3	Output "Q"
	47.8	94	2916	1.2×10^{-6}	1.2	Input "Q"
		16	2916	3.3×10^{-7}	0.3	Output "Q"
	46.5	147	6918	8.0×10^{-7}	0.8	Input "Q"
5	185.9	113	1650	6.4×10^{-7}	0.7	Input "Q"
		73	1650	4.2×10^{-7}	0.4	Output "Q"
5	185.7	71	1463	4.6×10^{-7}	0.5	Input "Q"
		46	1463	3.0×10^{-7}	0.3	Output "Q"
5	182.6	56	1474	3.6×10^{-7}	04	Input "Q"
		33	1474	2.0×10^{-7}	0.2	Output "Q"

REPORT ON LABORATORY TESTS

DATE _____

PROJECT Channelization - Agua Fria River JOB NO. E82-49

LOCATION Thomas Road & I-10; Maricopa County, AZ LAB NO. 2-49-69

PERMEABILITY TEST
(Pressurized Permeameter)

Sample Boring #9 @ 1'-2'

Remolded to Density of 108.5 PCF at 14.9 %

Diameter 4.92 cm Length 5.08 cm Area 19.01 cm^2 Vol. 96.62 cc

W_s 168.0 grms. w_o 14.9 % w_f 18.0 % G_s _____ V_s _____ cc

Void Ratio _____ Dry Density _____ PCF Trials _____ days

Pressure (PSI)	Head (inches)	Q (cc)	Time (min.)	K (cm/sec)	K (ft/yr)	Remarks
F.H.	42.5	195	8	1.0×10^{-3}	1040	Input ≠ Output
	42.3	290	26	4.6×10^{-4}	479	
	42.9	265	41	2.6×10^{-4}	273	
	40.1	380	132	1.3×10^{-4}	130	
	43.5	240	135	7.2×10^{-5}	74	
	43.4	280	311	3.6×10^{-5}	38	
	40.6	400	383	4.5×10^{-5}	47	
Constant =	66.0	920	1213	2.0×10^{-5}	21	
	66.0	760	1463	1.4×10^{-5}	15	

B-2

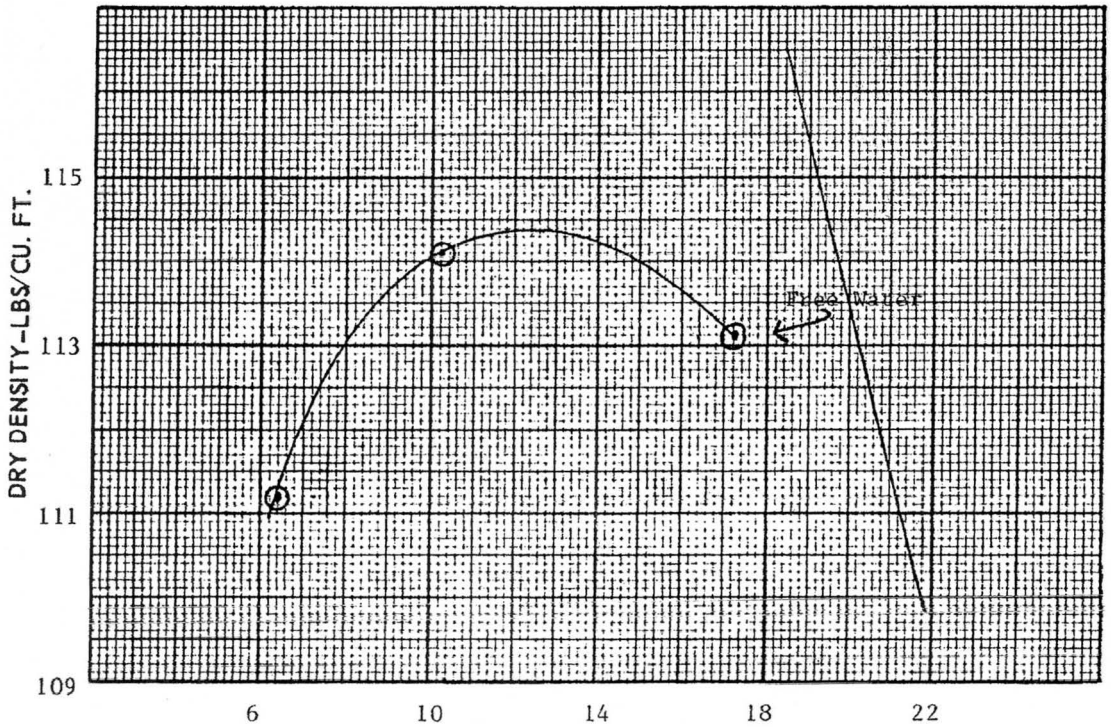
TABULATION OF TEST RESULTS

Job No. LT83-3753

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	SIEVE ANALYSIS-ACCUM % PASSING #200	#100	#50	#40	#30	#16	#10	#8	#4	.25"	.375"	.5"	LAB NO
					.75"	1"	1.5"	2"	2.5"	3"	3.5"	4"	6"	8"	10"	12"	
TEST PIT (TP) #1	2'-3'	ML	-	NP	68.9	80	89	93	95	98	99	99	100				3-3753-1
TP-1	5'-6'	SP-SM	-	NP	6.9	9	11	13	18	44	64	69	83	87	91	93	
					96	96	100										3-3753-2
TP-2	2.5'-3.5'	SP	-	NP	0	3	19	31	41	59	70	73	82	85	88	91	
					93	94	98	100									3-3753-3
TP-2	4.5'-5.5'	GP	-	NP	.4	1	2	3	6	12	17	19	29	36	47	57	
					68	72	83	90		100							3-3753-4
TP-3	2'-3'	SM	-	NP	23.6	37	58	73	83	93	95	95	96	96	97	97	
					97	100											3-3753-5
TP-4	2'-3'	SP	-	NP	.4	2	12	28	51	80	87	88	92	93	95	98	
					100												3-3753-6
TP-5	1.5'-2.5'	SP	-	NP	3.2	4	11	20	32	56	67	70	76	78	81	83	
					86	89	92	95		100							3-3753-7
TP-5	4'-5'	SP	-	NP	2.2	3	7	15	24	43	52	54	62	65	69	72	
					76	80	89	92		94		100					3-3753-8
TP-6	2'-3'	SP	-	NP	.2	1	12	25	44	81	92	94	97	98	98	100	3-3753-9

SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT Agua Fria River Channelization SLA Job No. AZ-MC-05 **JOB NO.** LT83-3753



CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
	TP-4 @ 2'-3' & TP-6 @ 2'-3'					
	with 6.5% Cement Phoenix Type II	12.4	114.4	AASHTO T134	B	3-3753-6 & 9

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHTO T99 and ASTM D698 (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHTO T180 and ASTM D1557 (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

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REPORT ON LABORATORY TESTS

DATE

PROJECT: Agua Fria River Channelization SLA Job No. AZ-MC-05 — JOB NO. LT83-3753

LOCATION: Thomas Rd. to Indian School Rd.; Maricopa County — LAB NO. 3-3753-6 & 9

CLIENT: Simons, Li & Associates, Inc. — ADDRESS: P. O. Box 2712 Tucson, AZ 85702

SOURCE OF SAMPLE: TP-4 @ 2'-3' & TP-6 @ 2'-3' Combined

MATERIAL: Poorly Graded Sand — SAMPLED BY: SHB/RIC

SUBMITTED BY: SHB/RIC — REQUESTED BY: John B. Lynch, P.E.

TESTED: ADOT 241/AASHTO T134 compaction — DATE RECEIVED: -

TEST RESULTS

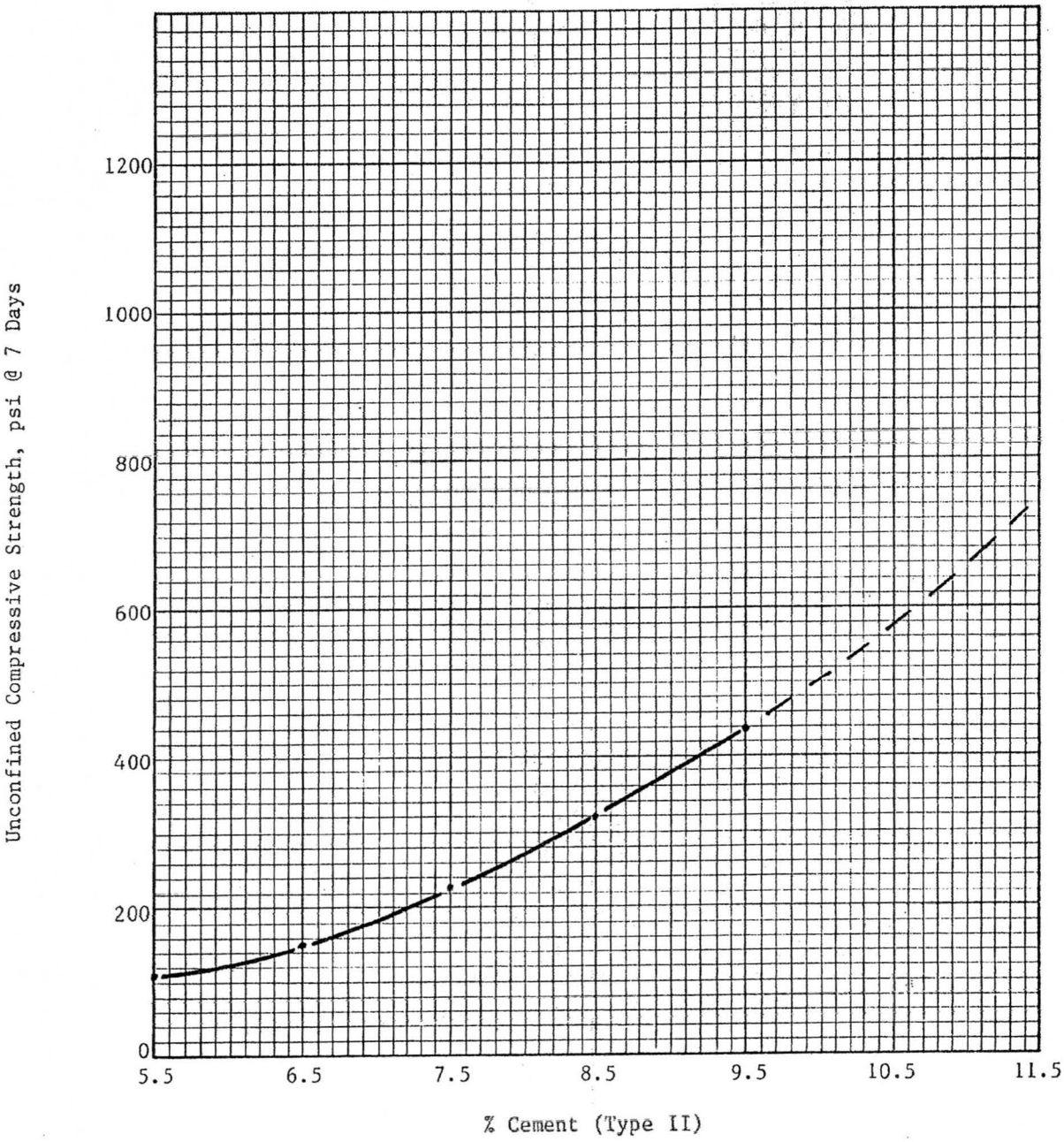
CEMENT TREATED SAND

Cement: Phoenix Type II Low Alkali

LAB NO. 3753-6 & 9	A	B	C	D	E
SAMPLE			(average of 3 specimens)		
Cement, %	5.5	6.5	7.5	8.5	9.5
MOISTURE %	11.8	12.6	12.3	10.6	11.7
DRY DENSITY (PCF)	112.1	113.3	114.5	114.6	116.7
SPECIMEN DIA. (IN.)	4.0	4.0	4.0	4.0	4.0
SPECIMEN HT. (IN.)	4.58	4.58	4.58	4.58	4.58
UNCONFINED COMPRESSIVE STRENGTH PSI @ 7 Days	106	152	225	320	439

PROJECT Agua Fria River Channelization
SLA Job No. AZ-MC-05 JOB NO. LT83-3753

Source TP-4 @ 2'-3' & TP-6 @ 2'-3' with Phoenix Type II Cement Lab No. 3-3753-6 & 9



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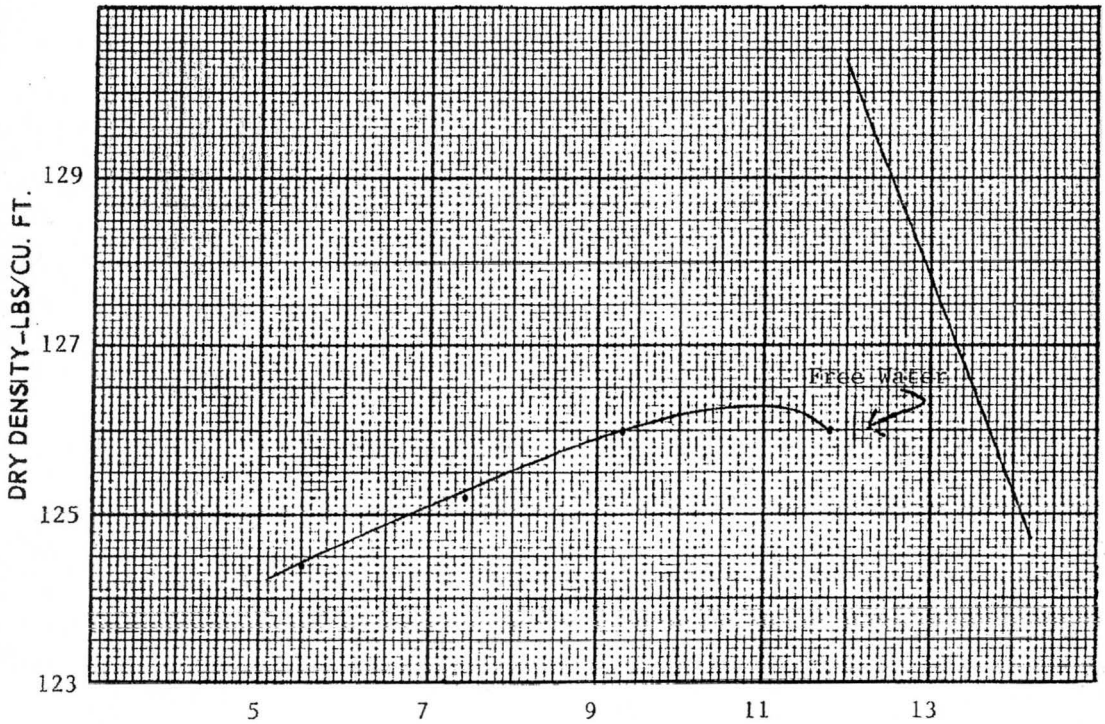
SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT Agua Fria River Channelization
SLA Job No. AZ-MC-05 **JOB NO.** LT83-3753



CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
	TP-5 @ 1.5'-2.5' & 4'-5'					
	with 6.0% Cement Phoenix Type II	10.8	126.2	AASHTO T134	B	3-3753-7 &8

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHTO T99 and ASTM D698 (Standard Proctor)

METHOD	MATERIAL	MOLD DIAMETER	MOLD HEIGHT	NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.56"	3	56	5.5 LBS.	12"	12,317

AASHTO T180 and ASTM D1557 (Modified Proctor)

METHOD	MATERIAL	MOLD DIAMETER	MOLD HEIGHT	NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

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REPORT ON LABORATORY TESTS

DATE _____

PROJECT Agua Fria River Channelization SLA Job No. AZ-MC-05 JOB NO. LT83-3753

LOCATION Thomas Rd. to Indian School Rd.; Maricopa County LAB NO. 3-3753-7 & 8

CLIENT Simons, Li & Associates, Inc. ADDRESS P. O. Box 2712 Tucson, AZ 85702

SOURCE OF SAMPLE TP-5 Combined Samples of 1.5' to 2.5' and 4' to 5'

MATERIAL Poorly Graded Sand w/some Gravel SAMPLED BY SHB/RIC

SUBMITTED BY SHB/RIC REQUESTED BY John B. Lynch, P.E.

TESTED ADOT 241/AASHTO T134 compaction DATE RECEIVED -

TEST RESULTS

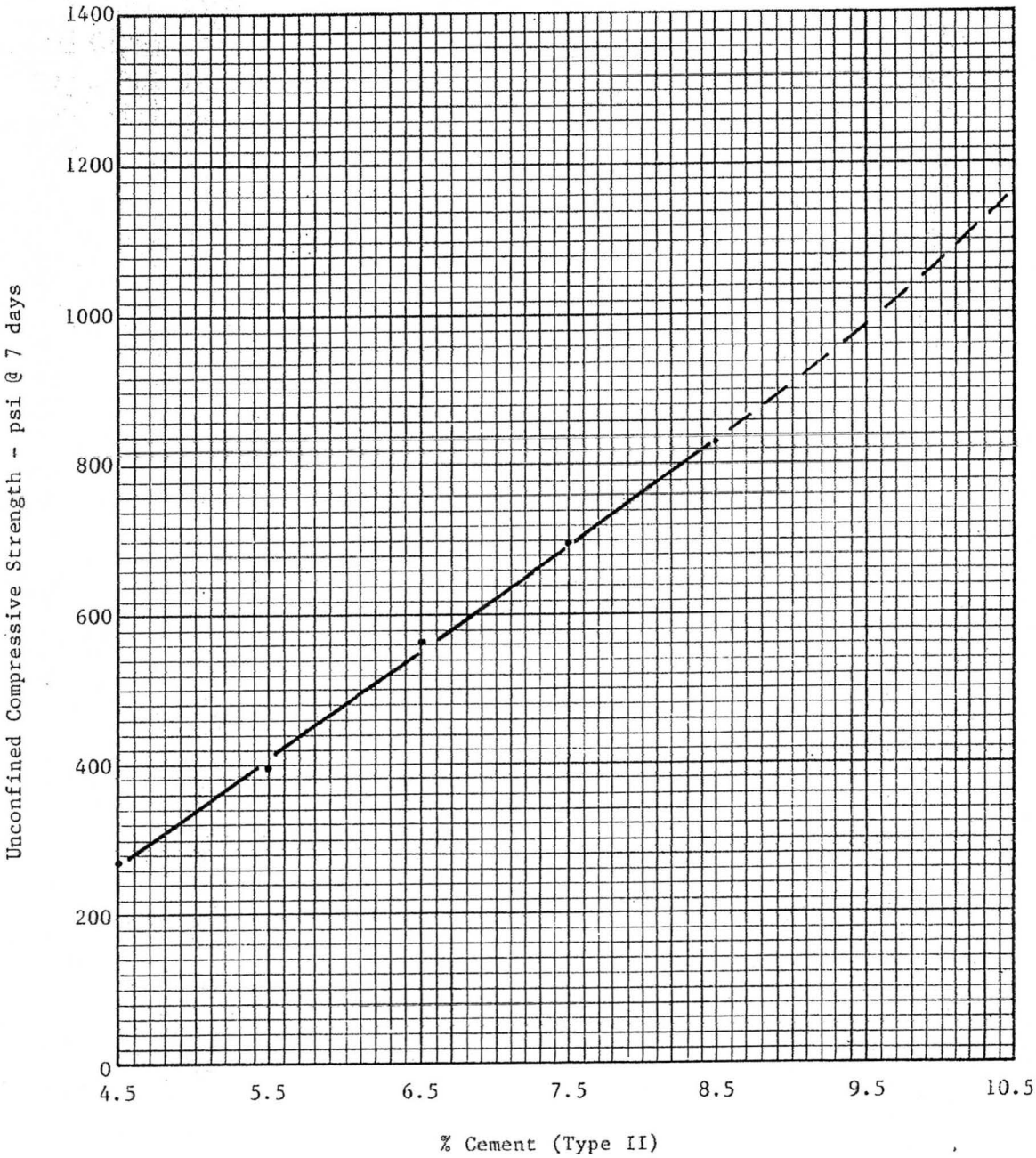
CEMENT TREATED SAND WITH SOME GRAVEL

Cement: Phoenix Type II - Low Alkali

LAB NO. 3753-7 & 8	A	B	C	D	E
SAMPLE		(average of 3 specimens)			
Cement, %	4.0	5.0	6.0	7.0	8.0
MOISTURE %	9.5	9.3	9.3	9.2	9.4
DRY DENSITY (PCF)	122.4	123.5	125.0	125.9	127.6
SPECIMEN DIA. (IN.)	4.0	4.0	4.0	4.0	4.0
SPECIMEN HT. (IN.)	4.58	4.58	4.58	4.58	4.58
UNCONFINED COMPRESSIVE STRENGTH PSI @ 7 days	269	397	561	697	831

PROJECT Agua Fria River Channelization
SLA Job No. AZ-MC-05 JOB NO. LT83-3753

Source TP-5 @ 1.5'-2.5' & 4'-5' with Phoenix Type II Cement Lab No. 3-3753-7 & 8



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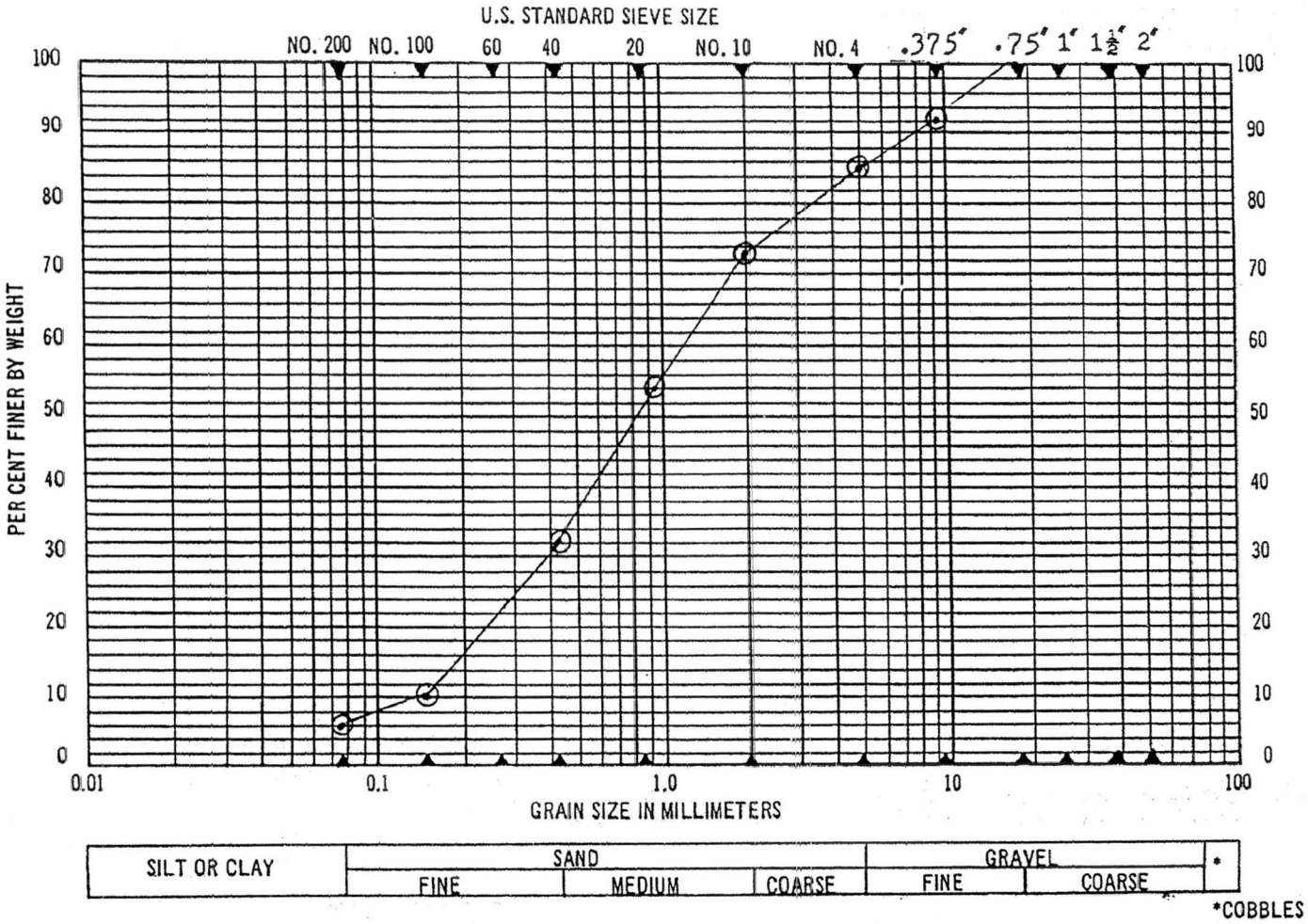
B-3

JOB NO. 84-208 BY TH DATE 5 Oct 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-1	10-11.5		(SP) SAND with some gravel

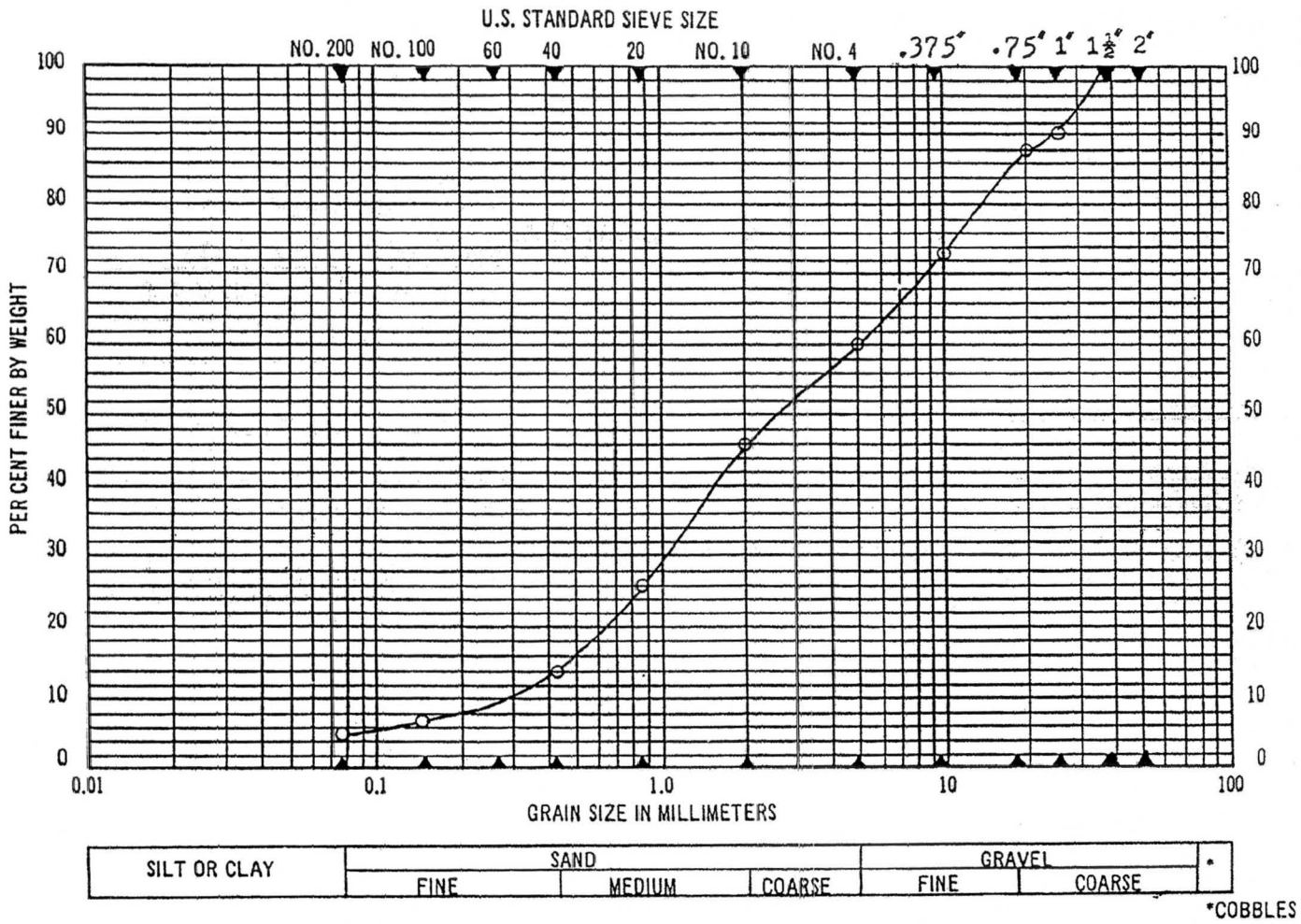


GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering

JOB NO. 84-208 BY RMP DATE 27 Sep 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-1	15-16.5		(SP) medium-to-coarse GRAVELLY SAND

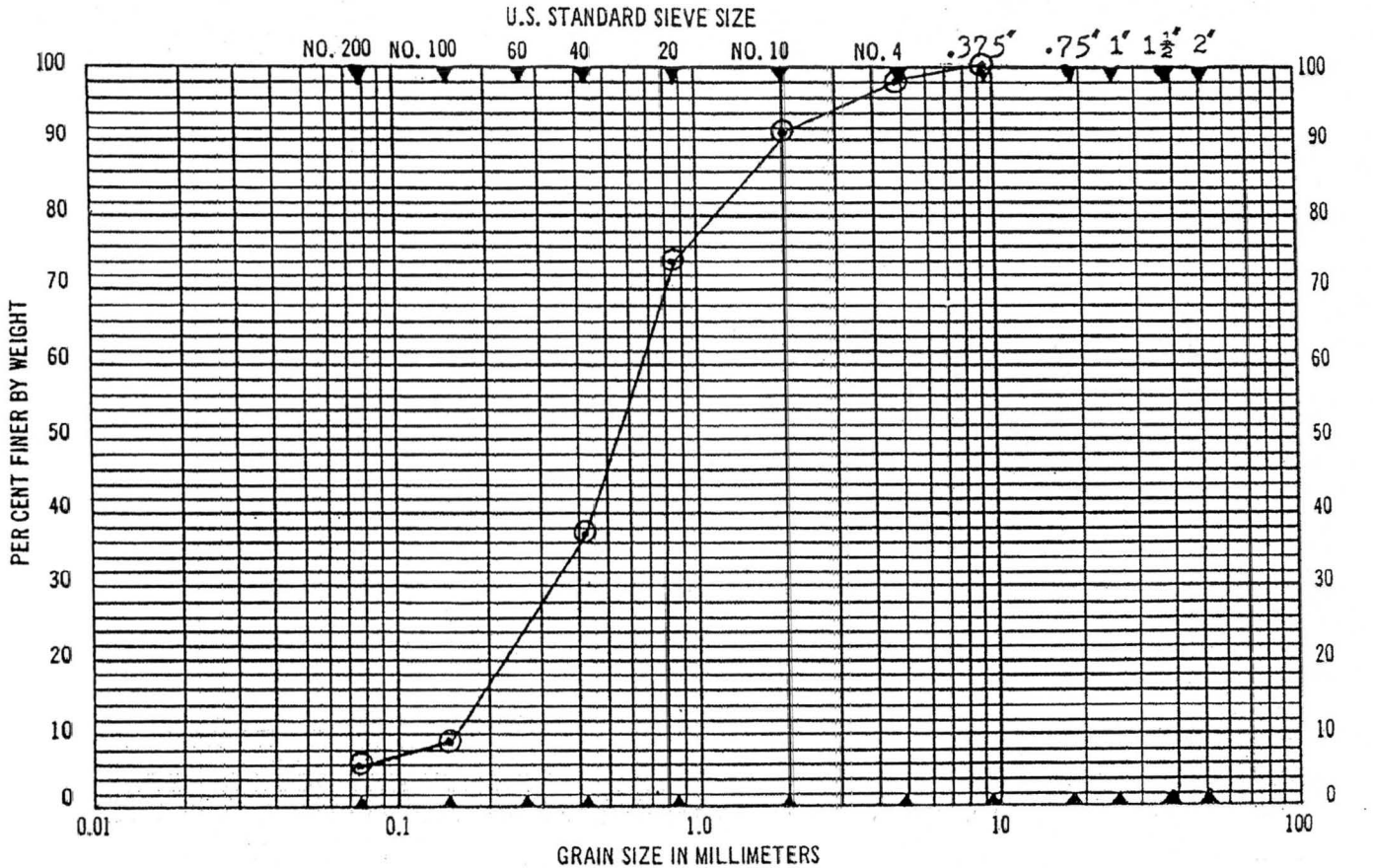


GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering

JOB NO. 84-208 BY TH DATE 8 Oct 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-1	20-21.5		(SP) fine-to-medium SAND with trace silt



GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering

APPENDIX C

Fill Specification

ENGINEERED FILL SPECIFICATION

The engineered fill material or aggregate base course (ABC) material composing such a fill should be thoroughly mixed for uniform consistency, be completely free of vegetation, roots, rubble, debris or other deleterious matter, and shall conform to the following specifications.

Gradation (ASTM D422) Sieve Size	% Passing by Weight Fill	ABC
6"	100	--
1 1/2"	--	100
#4	--	45-90
#200	50 Max	0-12
Plastic Index (ASTM D424)	12 Max	5 Max
Percent Expansion	1.0 Max	0.0
Abrasion	--	50 Max
Soluble Sulfates (%)	0.10 Max	0.10 Max

*Expansion shall be measured during saturation of a remolded sample compacted to 95% of Standard Proctor (ASTM D698) density at optimum moisture content which is subject to a load intensity of 1 PSI.

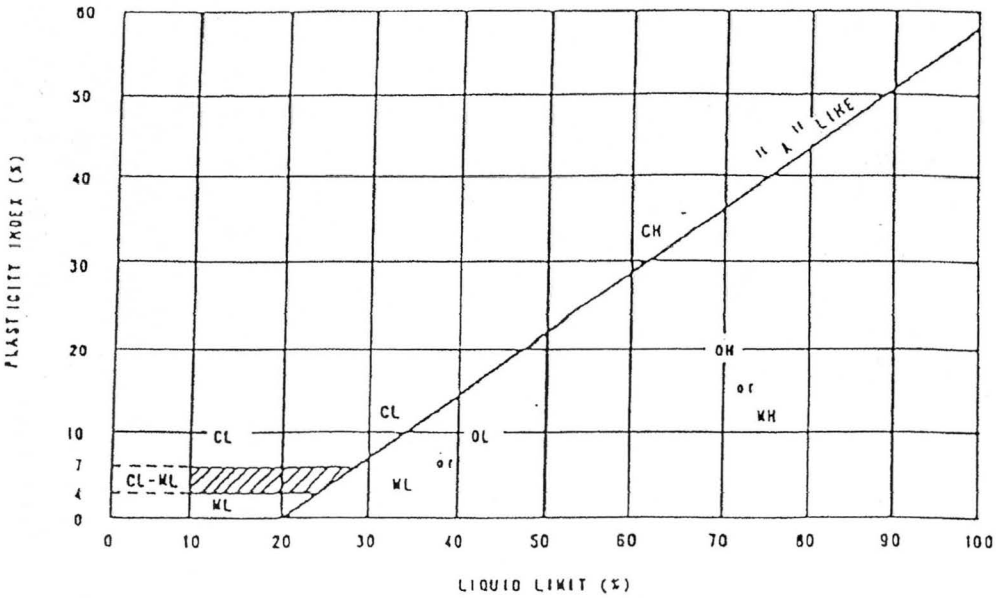
B-4

JOB 84-209

DATE 9 Oct 84

BY RMP

PLASTICITY CHART



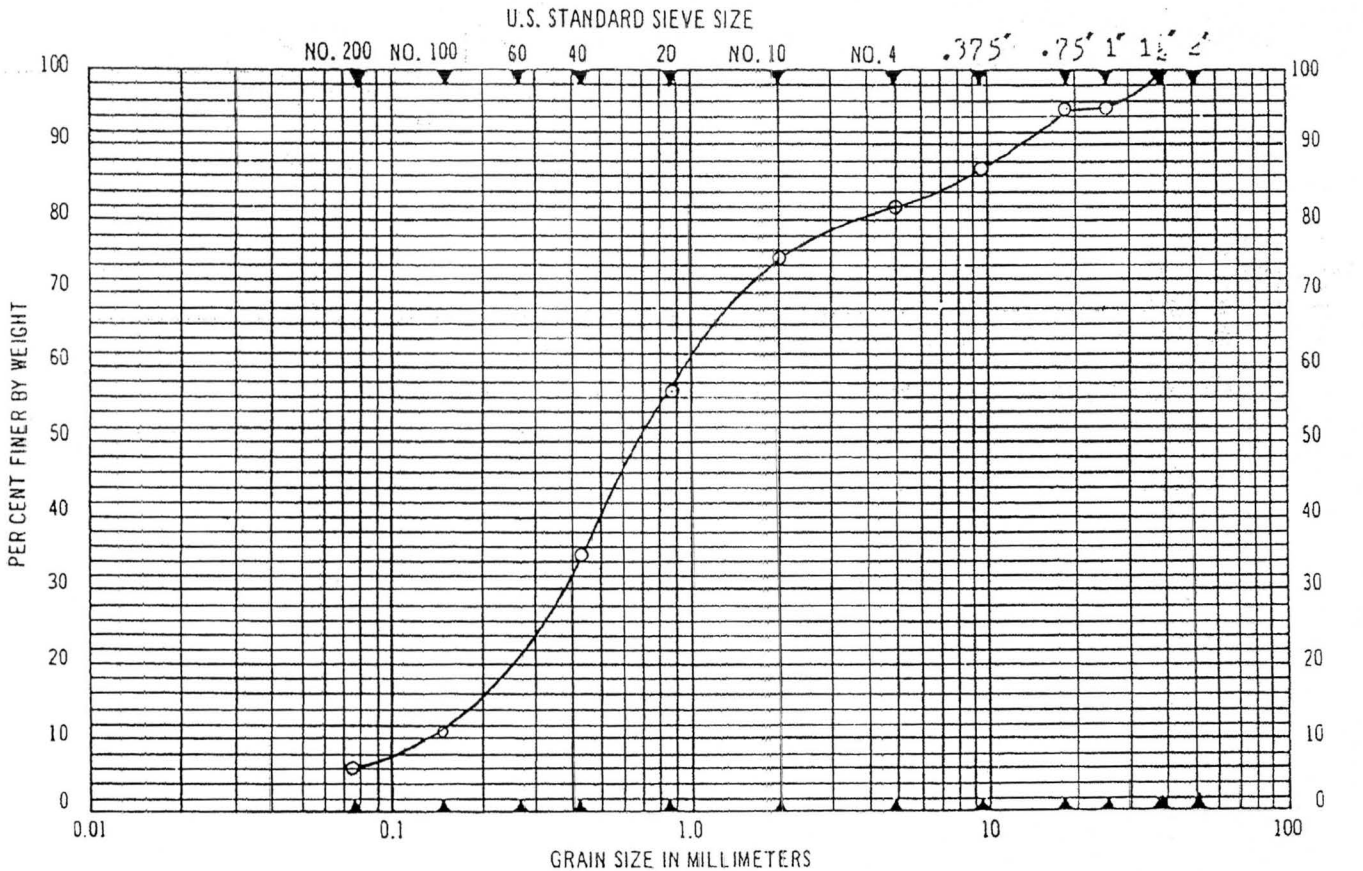
PLASTICITY DATA

KEY SYMBOL	HOLE NO	DEPTH (feet)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	UNIFIED SOIL CLASSIFICATION SYMBOL	% PASSING # 200
	B-3	25-26.5	30	13	SC	14

desert earth engineering

JOB NO. 84-209 BY RMP DATE 19 Oct 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-3	5-6.5		(SW) SAND with some gravel



SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

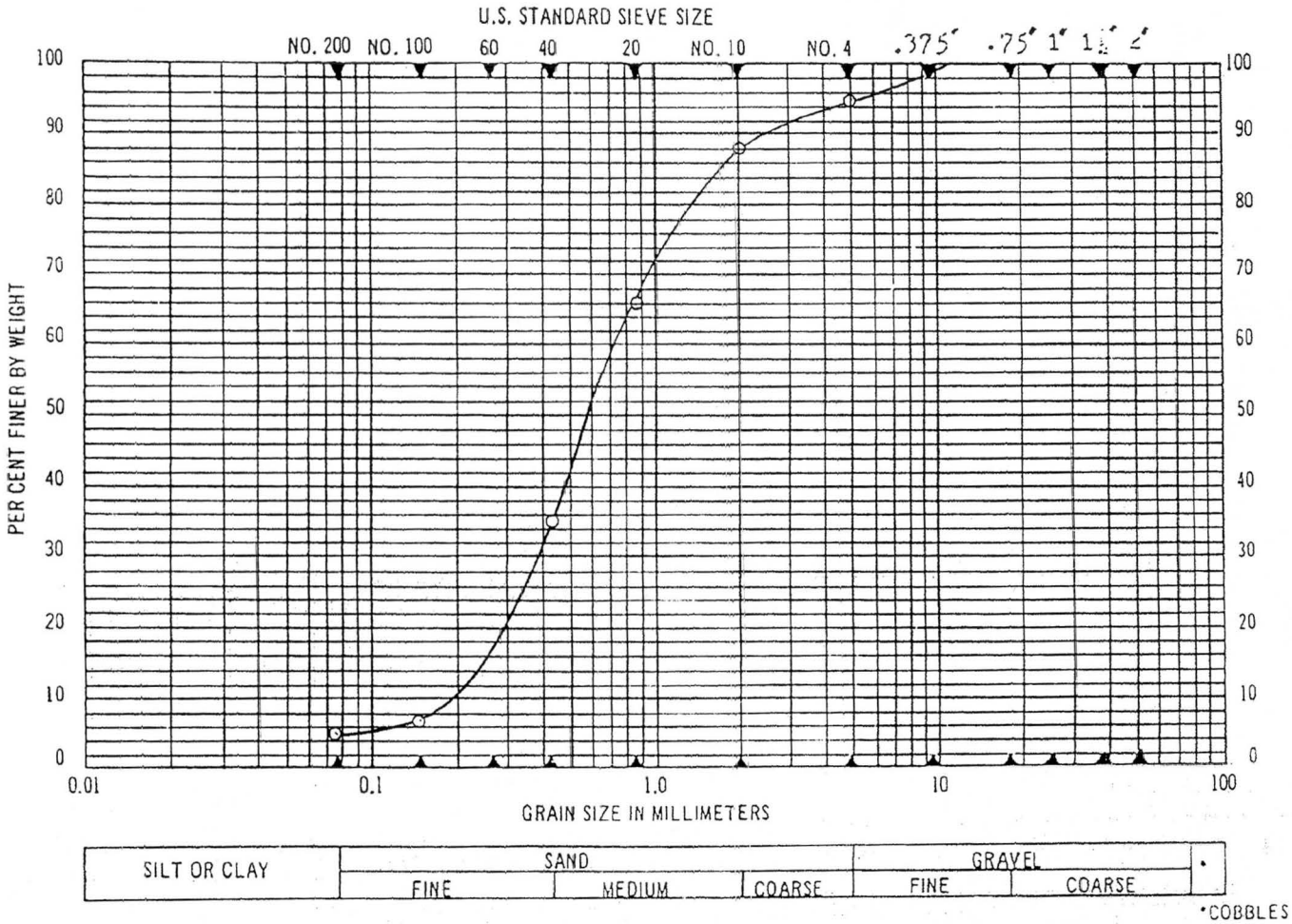
*COBBLES

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering

JOB NO. 84-209 BY RMP DATE 19 Oct 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-3	10-11.5		(SP) f-m SAND with trace gravel and silt

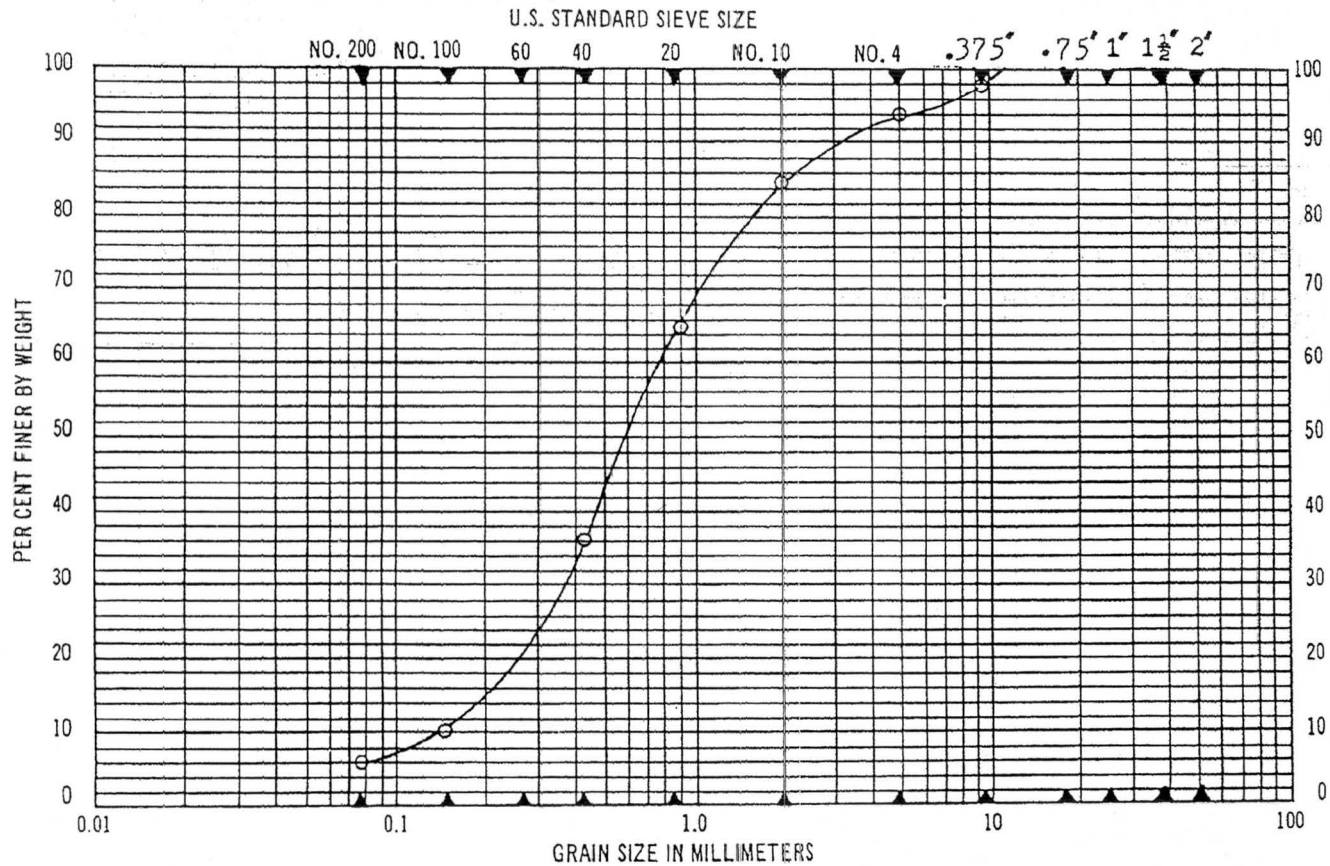


GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering

JOB NO. 84-209 BY RMP DATE 27 Sep 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-4	15-16.5		(SW) well-graded SAND with some gravel



SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

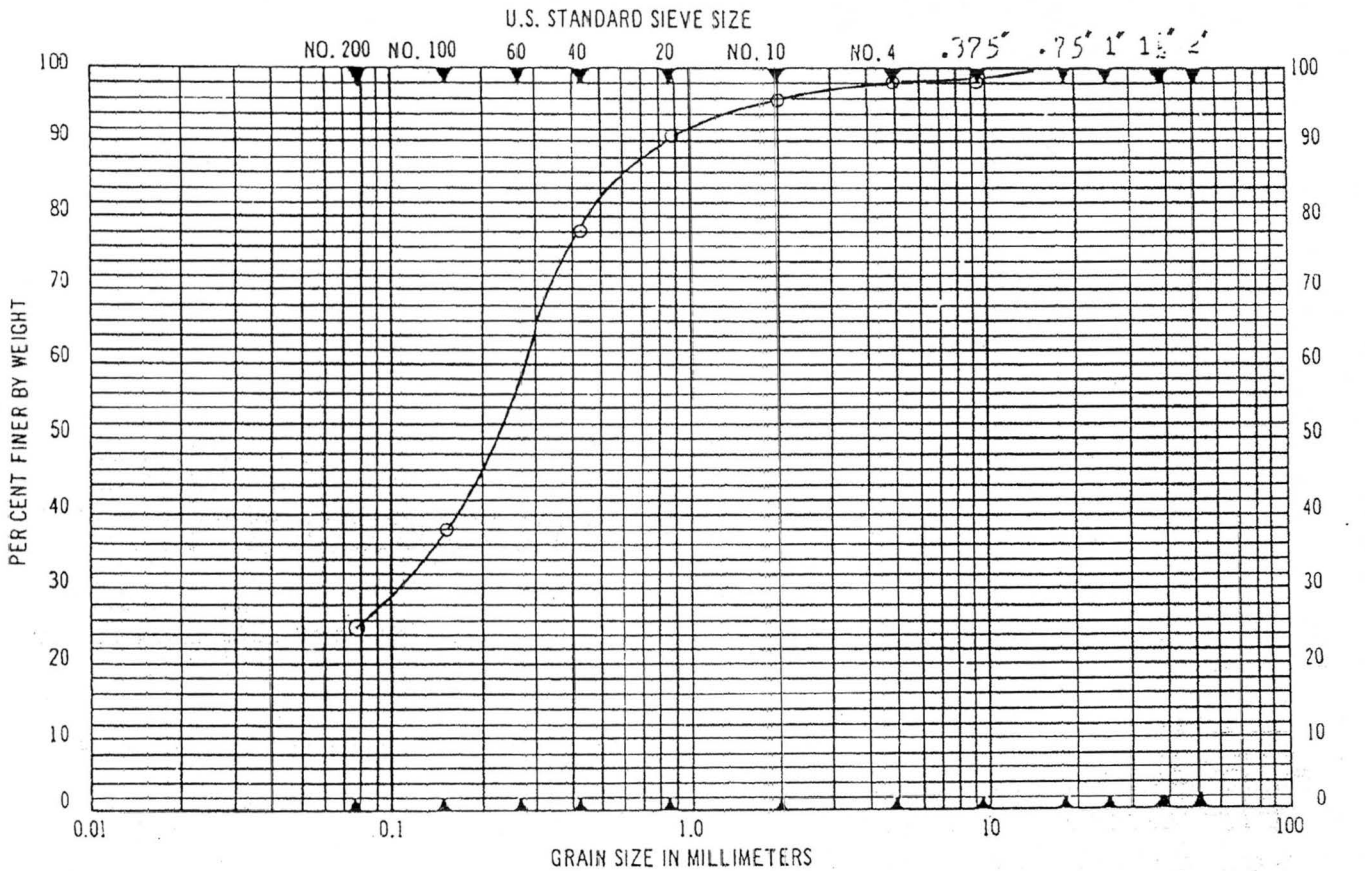
*COBBLES

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering

JOB NO. 84-209 BY RMP DATE 16 Oct 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-9	4.5-6		(SM) f-m SAND with some silt



SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

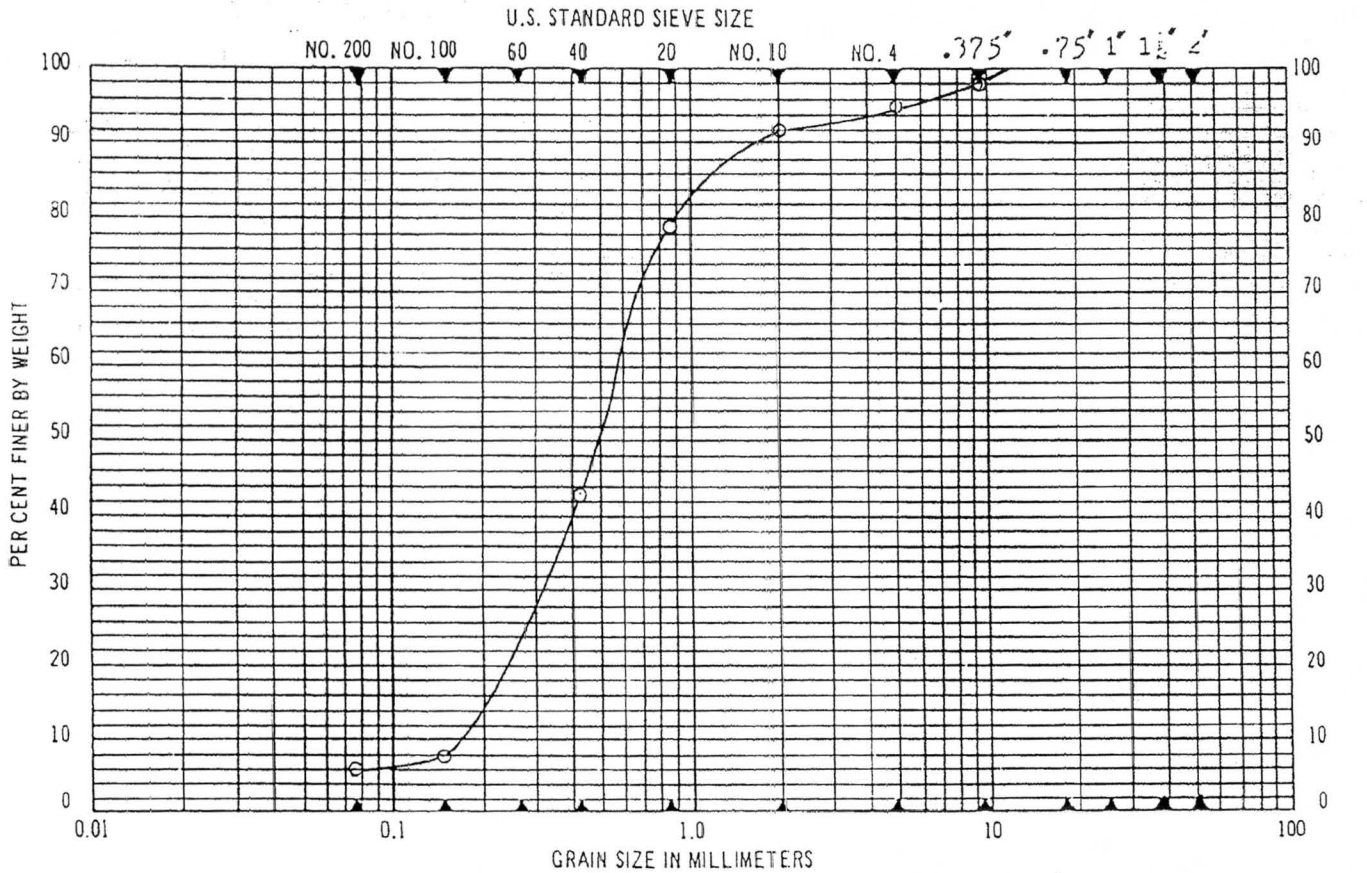
*COBBLES

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering

JOB NO. 84-209 BY RMP DATE 19 Oct 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-10	9.5-11		(SP) F-M SAND with trace silt and gravel



SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

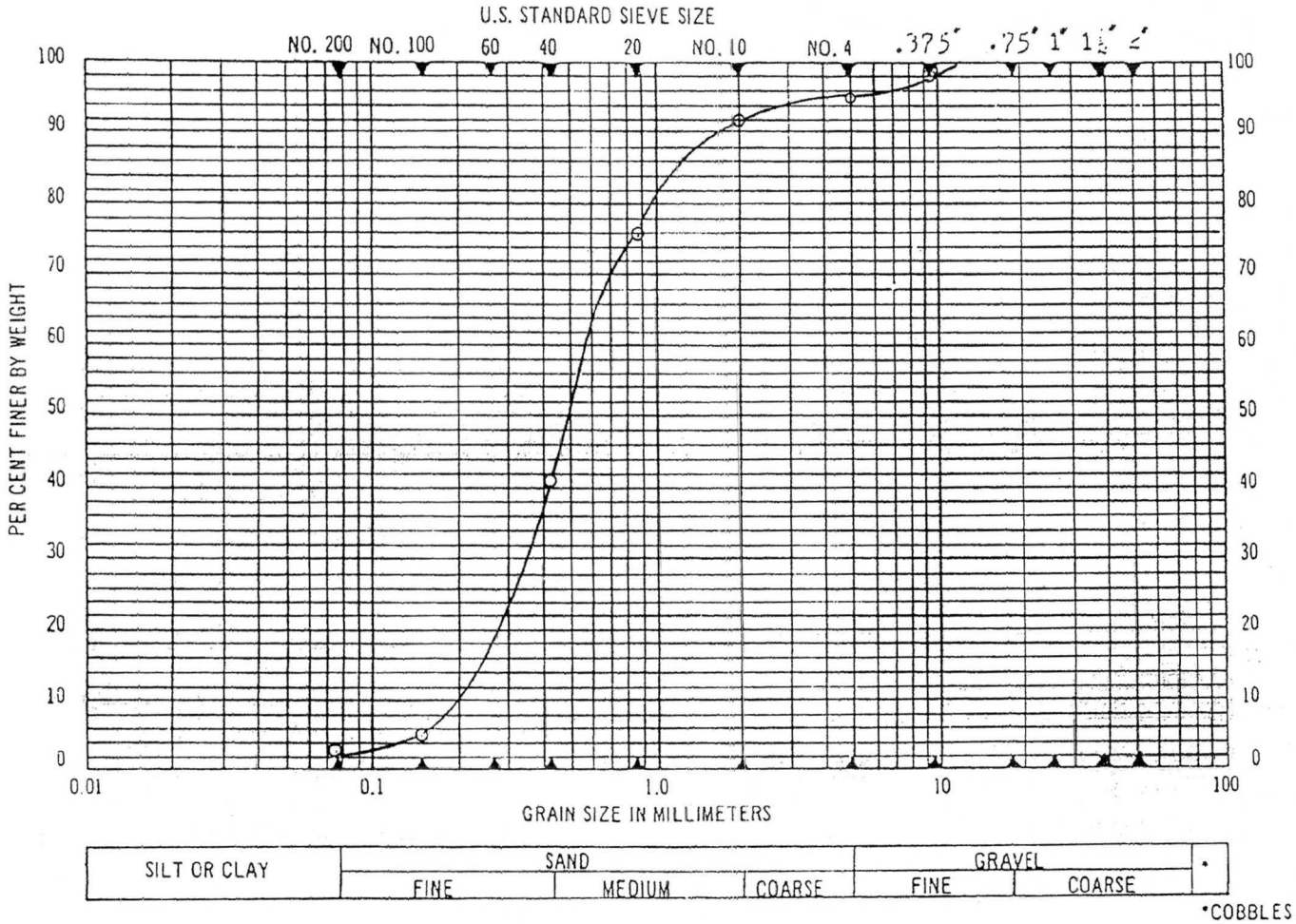
*COBBLES

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering

JOB NO. 84-209 BY RMP DATE 16 Oct 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-11	9.5-11		(SP) f-m SAND with trace gravel silt



GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering

B-5

#161

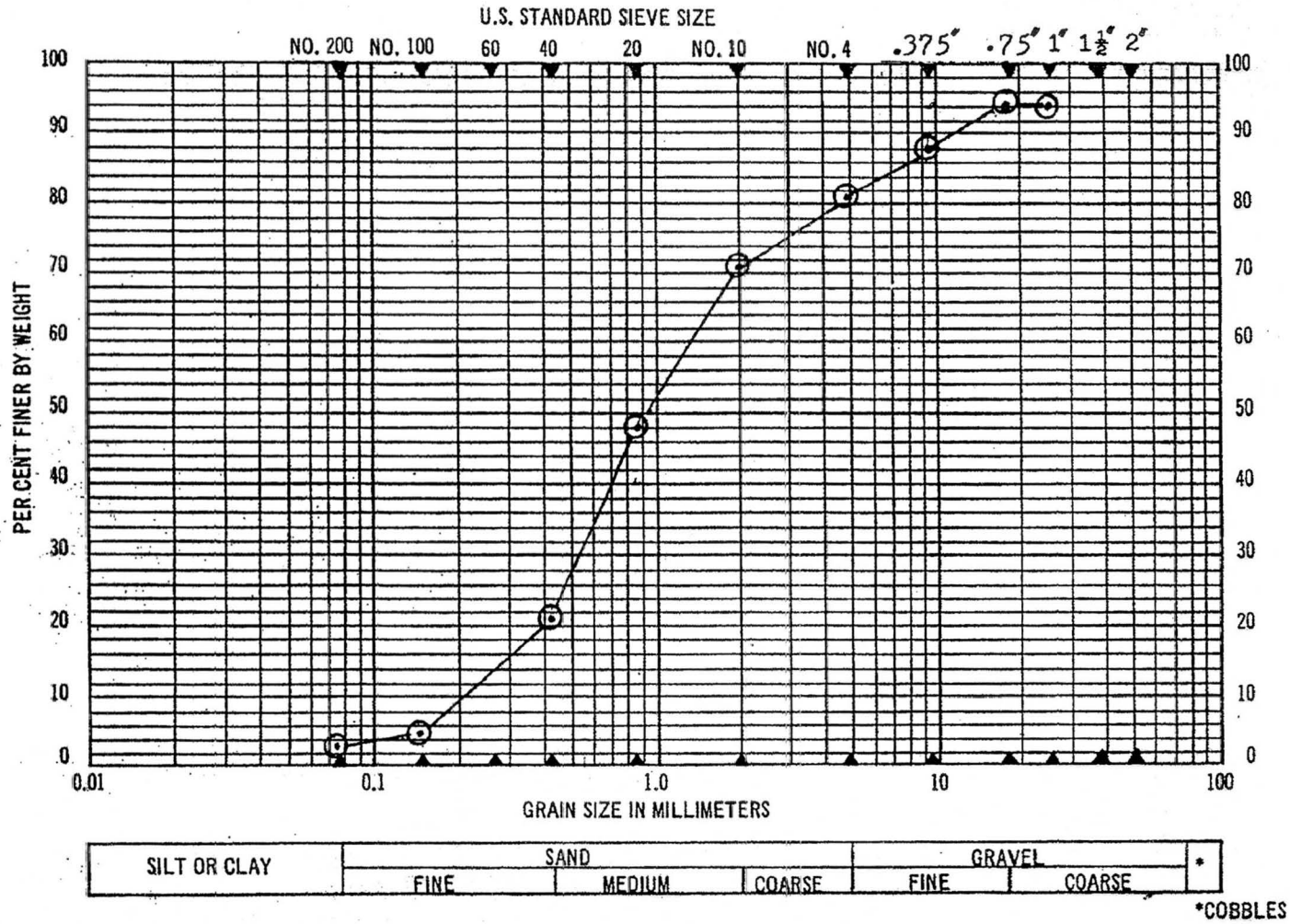
APPENDIX B

Laboratory Results

#61

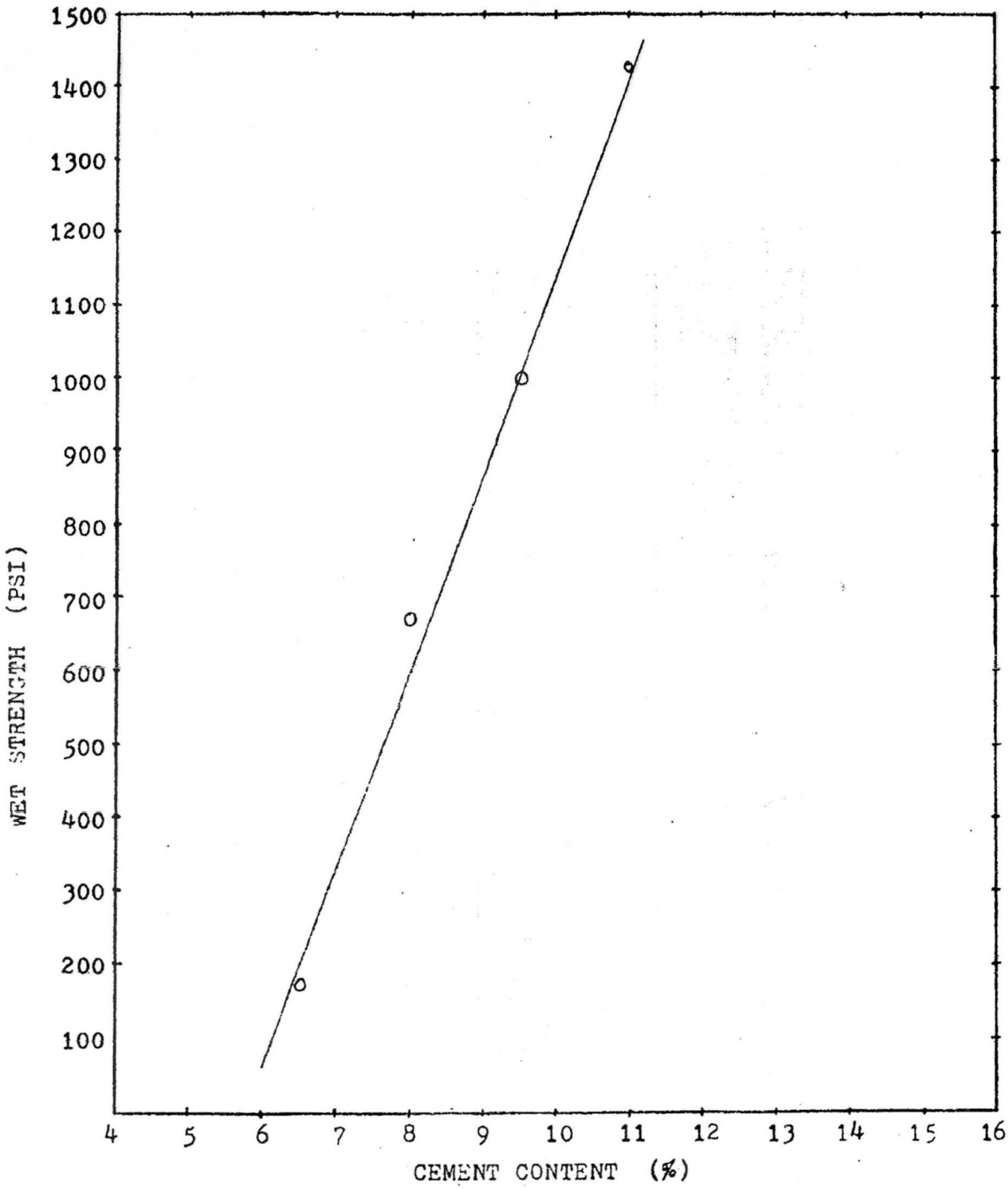
JOB NO. 84-208 BY TH DATE 7 Nov 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
Sample 1				(SW) SAND with some gravel and trace silt



GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering



SOIL-CEMENT
DRY STRENGTH VS. CEMENT CONTENT

Sample Description SAND w/some gravel + trace silt

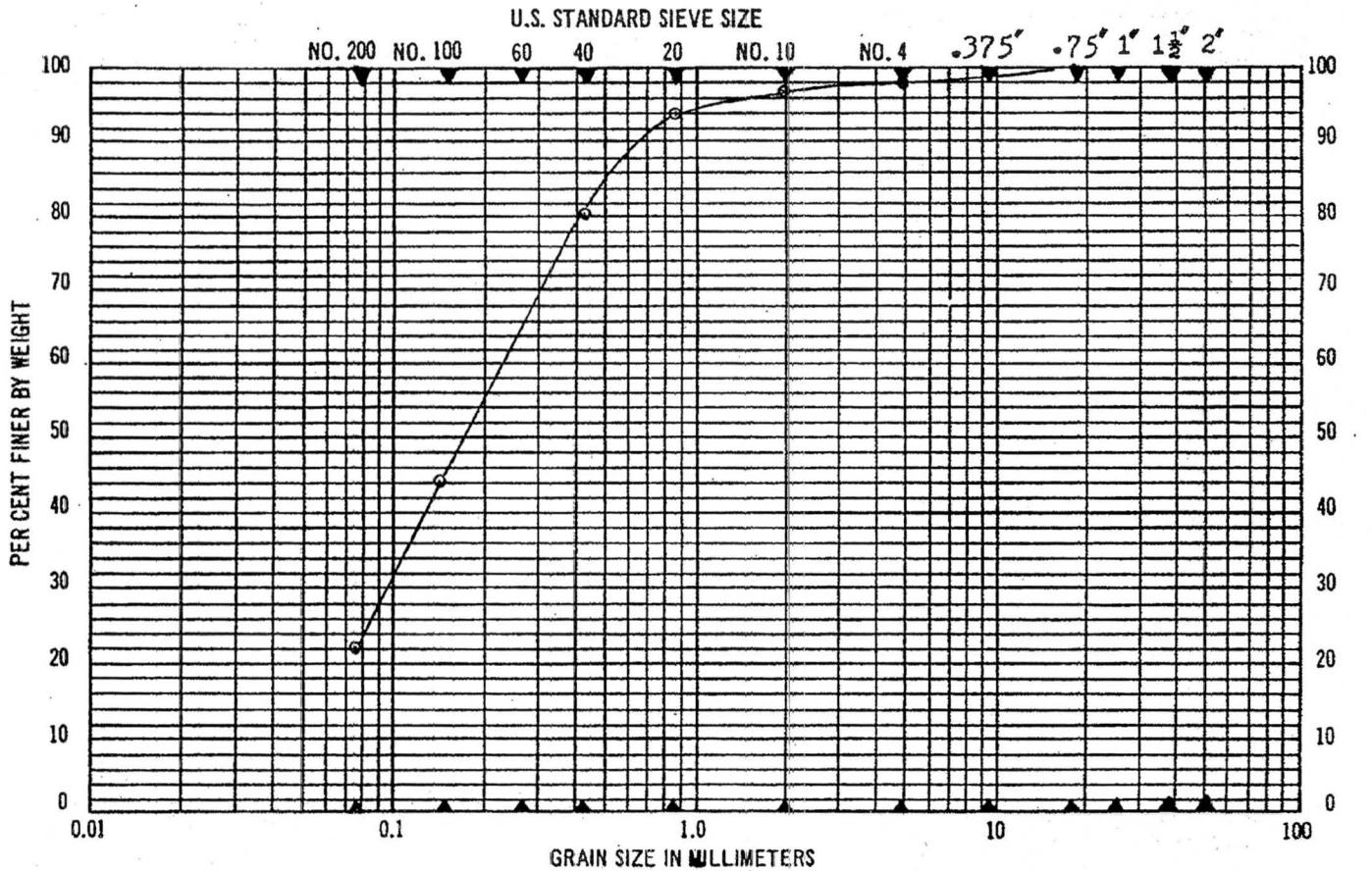
Sample Source

Sample No. 1

Desert Earth Engineering consulting geotechnical engineers			
Drawn by: RMF	Date 1-14-85	Checked by: RMF	Date 2/25/85
Sheet of	Job No. 84-208	Figure No.	

JOB NO. 84-209A BY RMP DATE 11 Feb 85

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
Sample 2				SAND with some silt and trace gravel

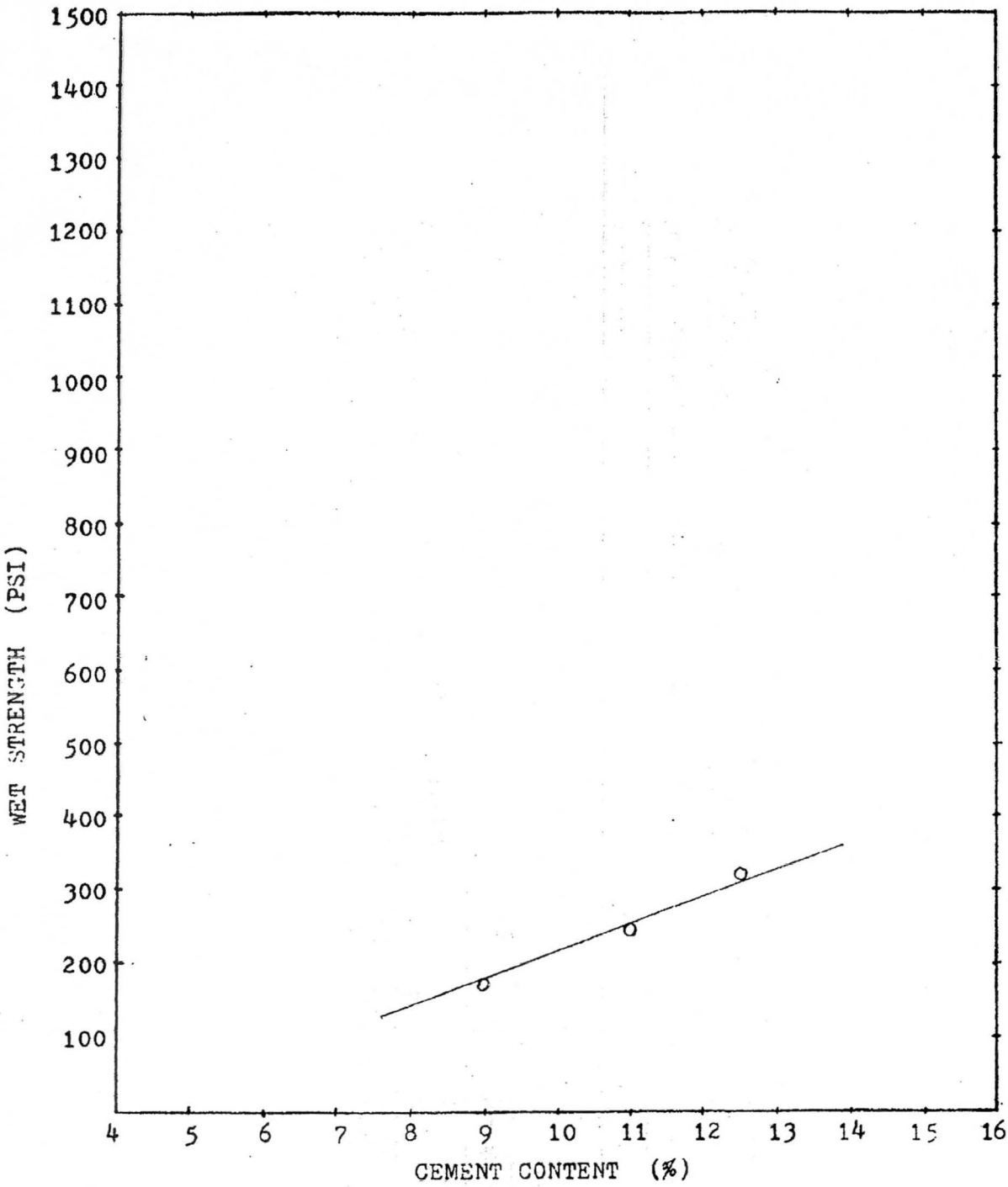


SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

*COBBLES

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering



SOIL-CEMENT
DRY STRENGTH VS. CEMENT CONTENT

Sample Description _____

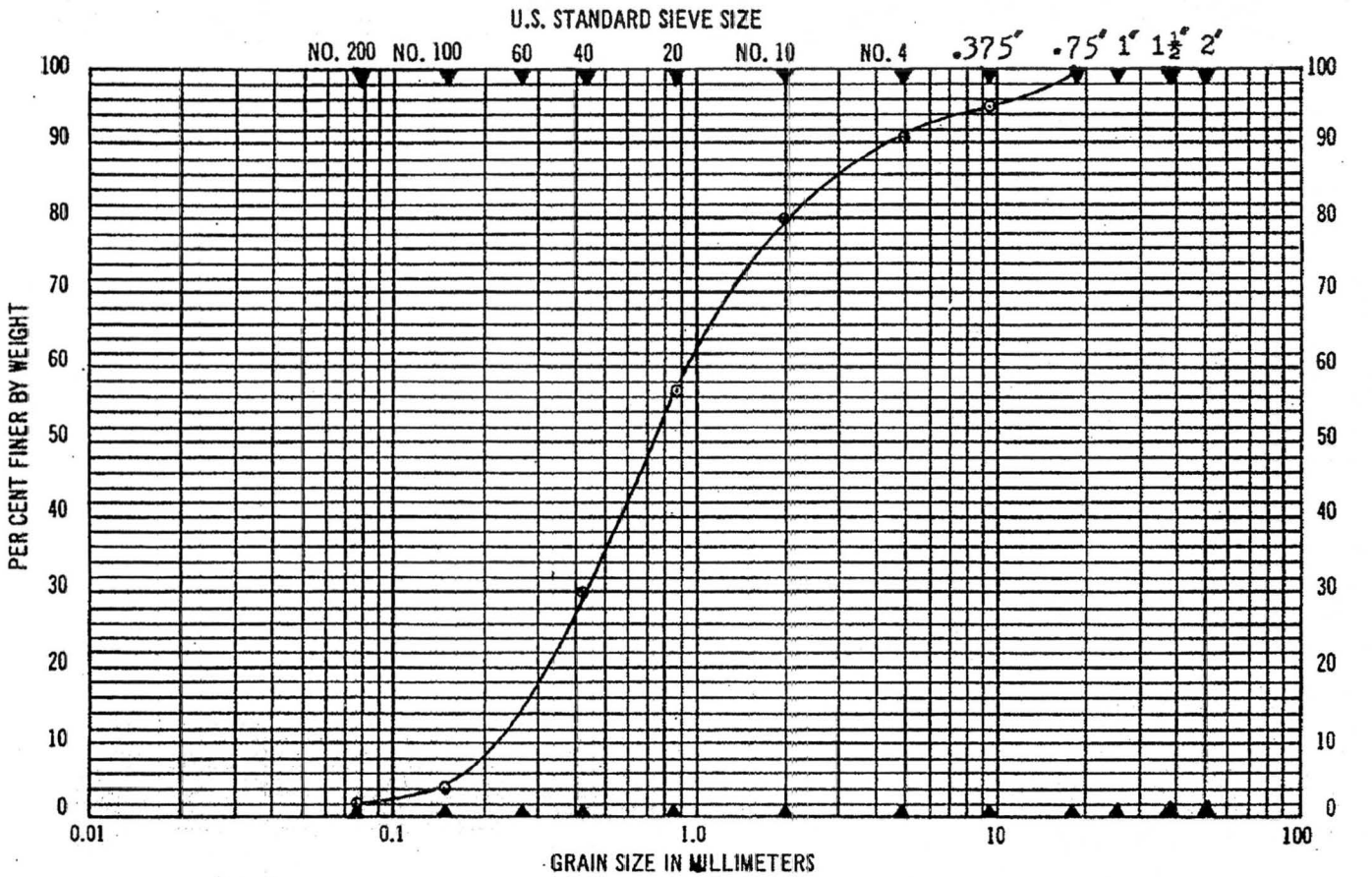
Sample Source _____

Sample No. 2

Desert Earth Engineering consulting geotechnical engineers			
Drawn by: RMP	Date 1-14-85	Checked by: RJ	Date 2/25/85
Sheet of	Job No. 84-209	Figure No.	

JOB NO. 84-209B BY RMP DATE 11 Feb 85

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
Sample 3				SAND with trace gravel and silt

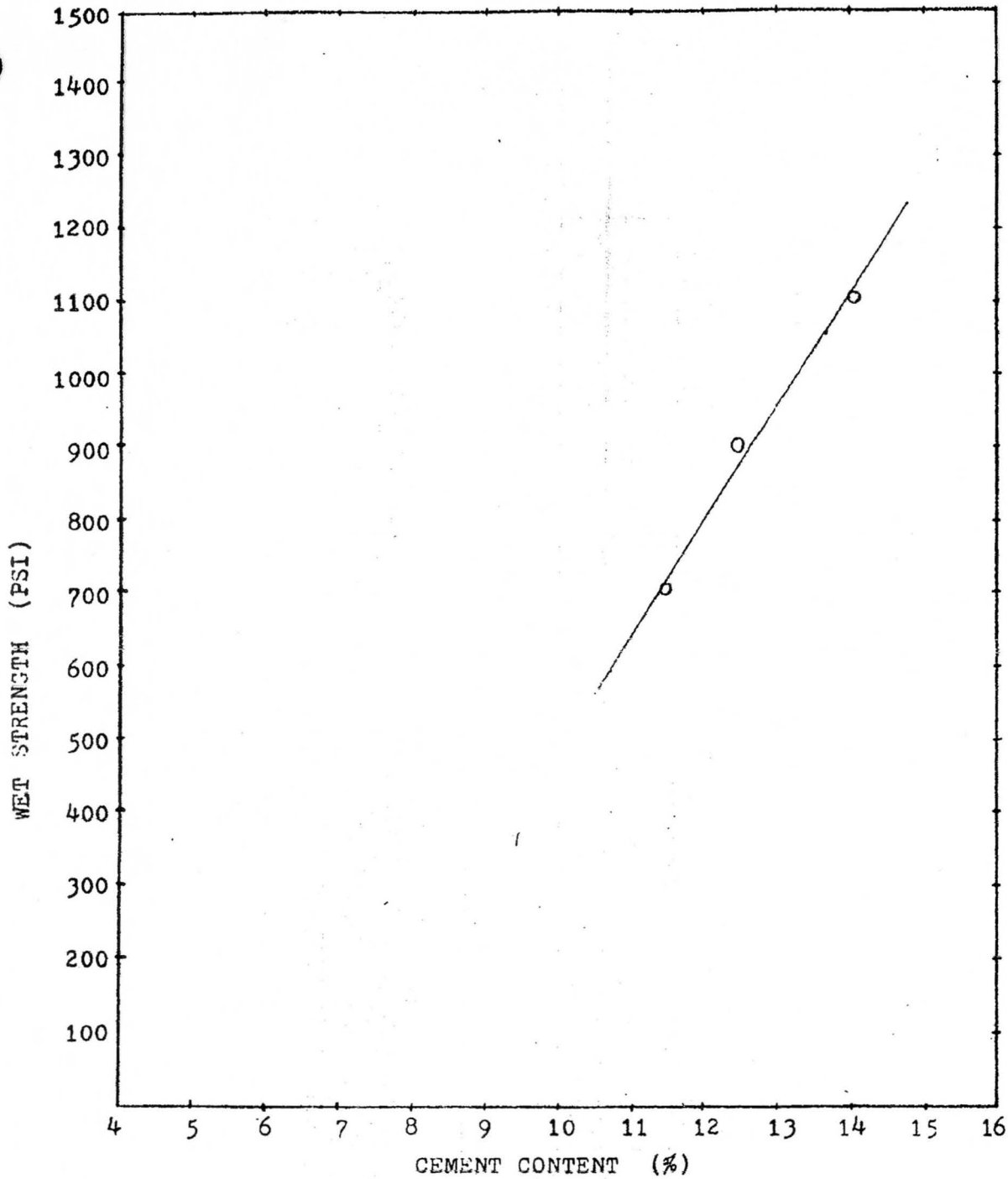


SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

*COBBLES

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering



SOIL-CEMENT
DRY STRENGTH VS. CEMENT CONTENT

Sample Description _____

_____

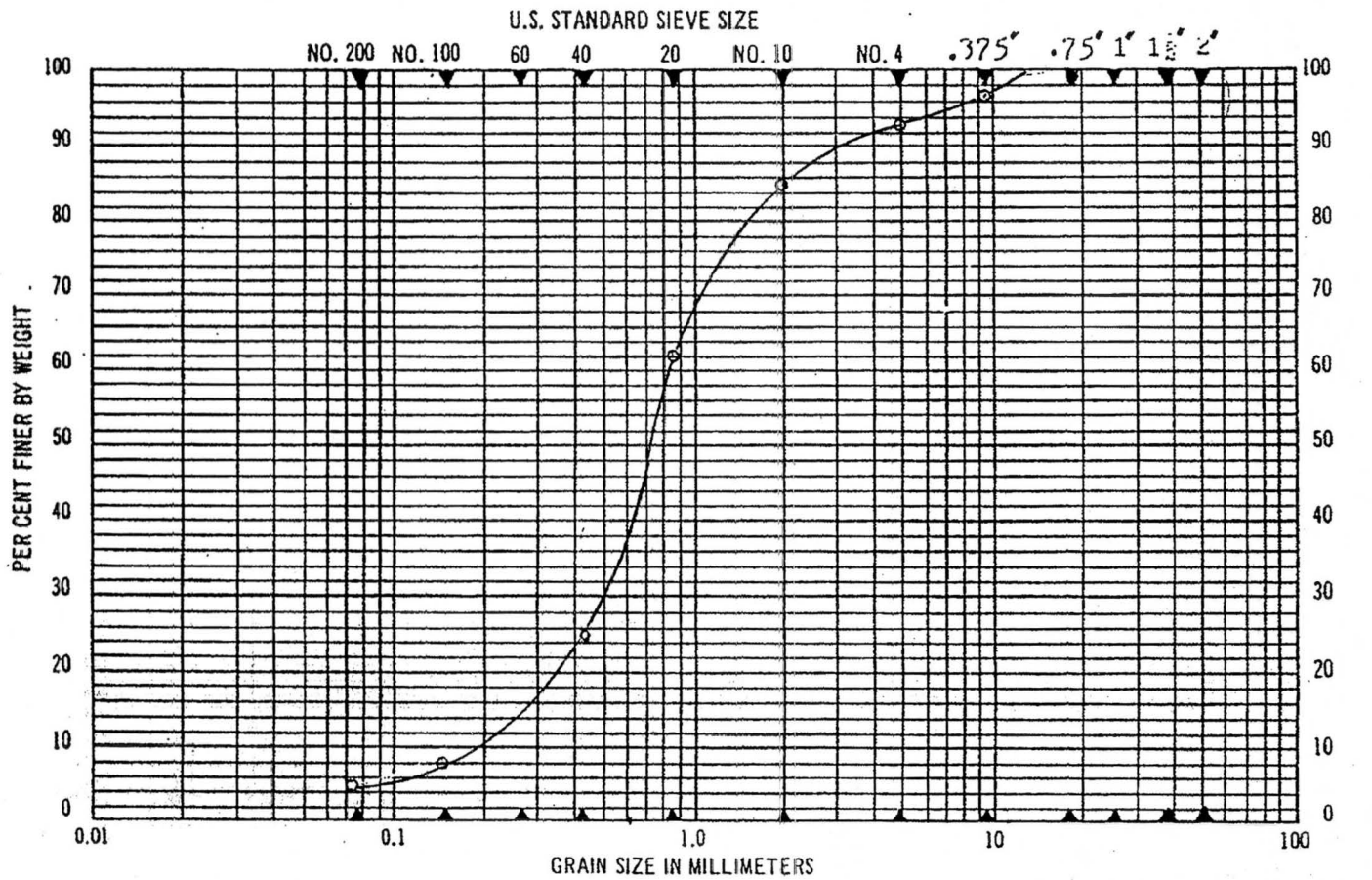
Sample Source _____

Sample No. 3

Desert Earth Engineering consulting geotechnical engineers			
Drawn by: RMP	Date 1-14-85	Checked by: RJF	Date 2/25/85
Sheet of	Job No. 84-209	Figure No.	

JOB NO. 84-211 BY RMP DATE 27 Dec 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
Sample 4				SAND with trace silt and gravel

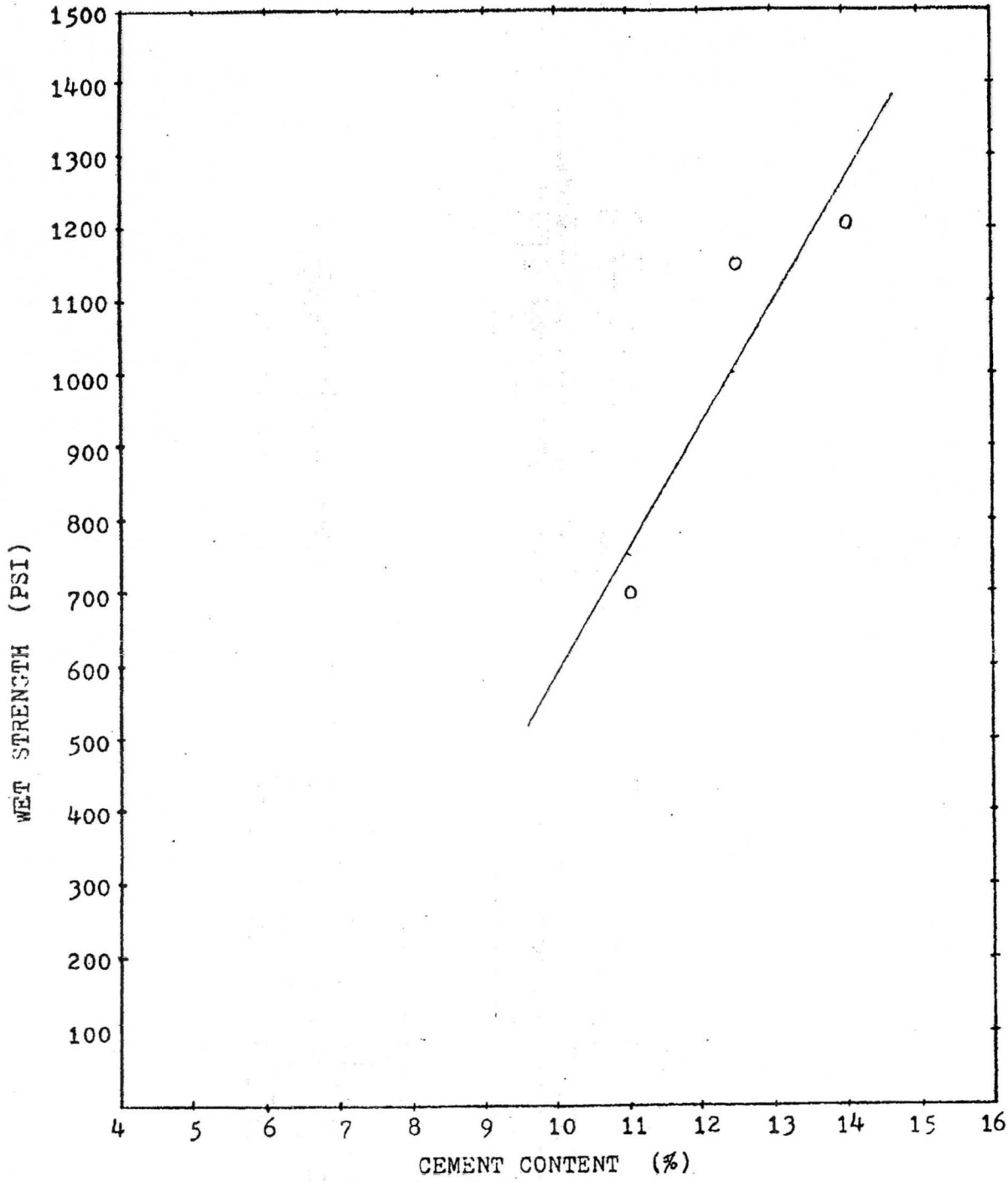


SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

*COBBLES

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering



SOIL-CEMENT
DRY STRENGTH VS. CEMENT CONTENT

Sample Description: SAND w/ trace fines & gravel

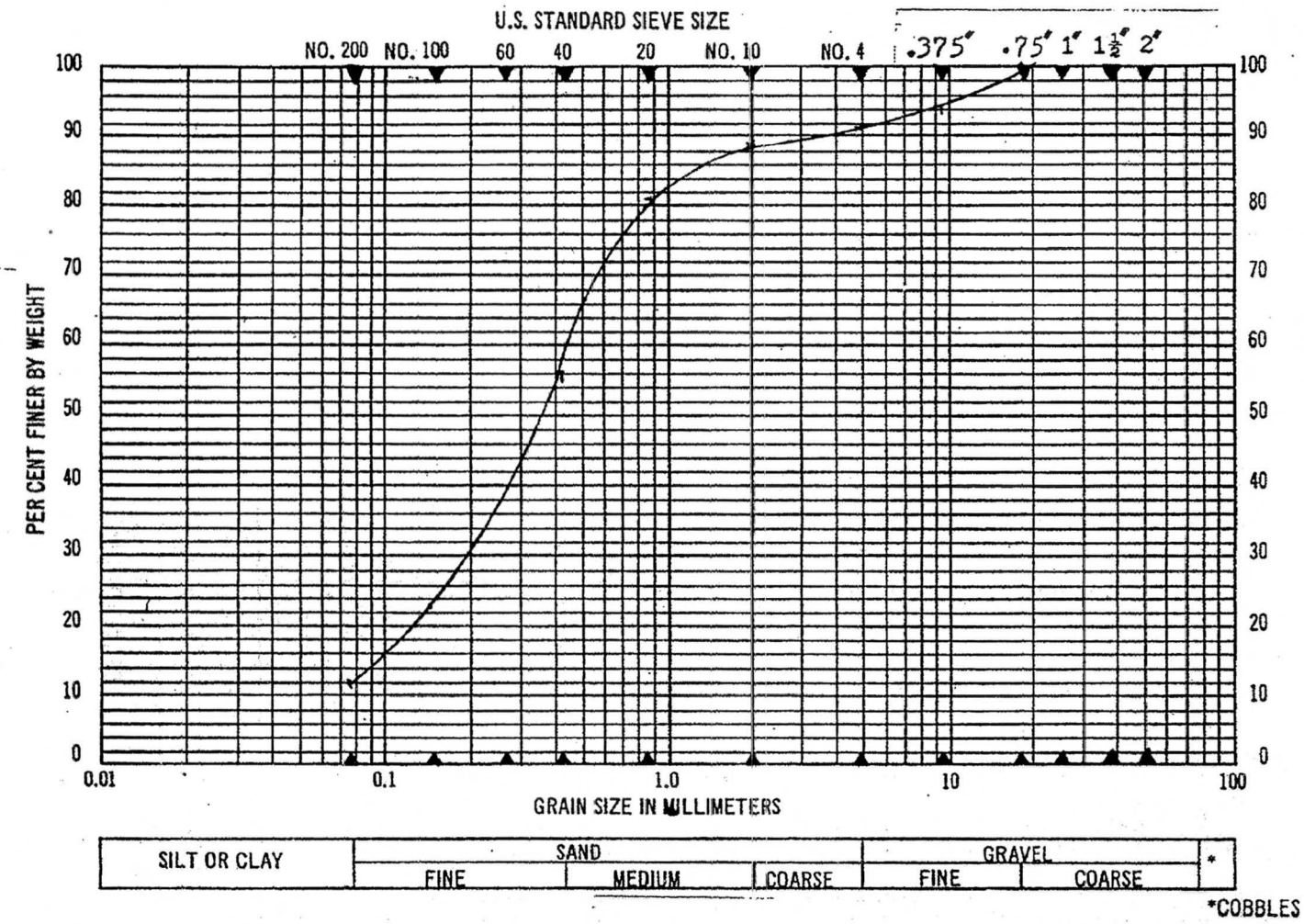
Sample Source

Sample No. X

Desert Earth Engineering consulting geotechnical engineers			
Drawn by: RMP	Date 1-14-85	Checked by: RJ	Date 2/25/85
Sheet of	Job No. 84-211	Figure No.	

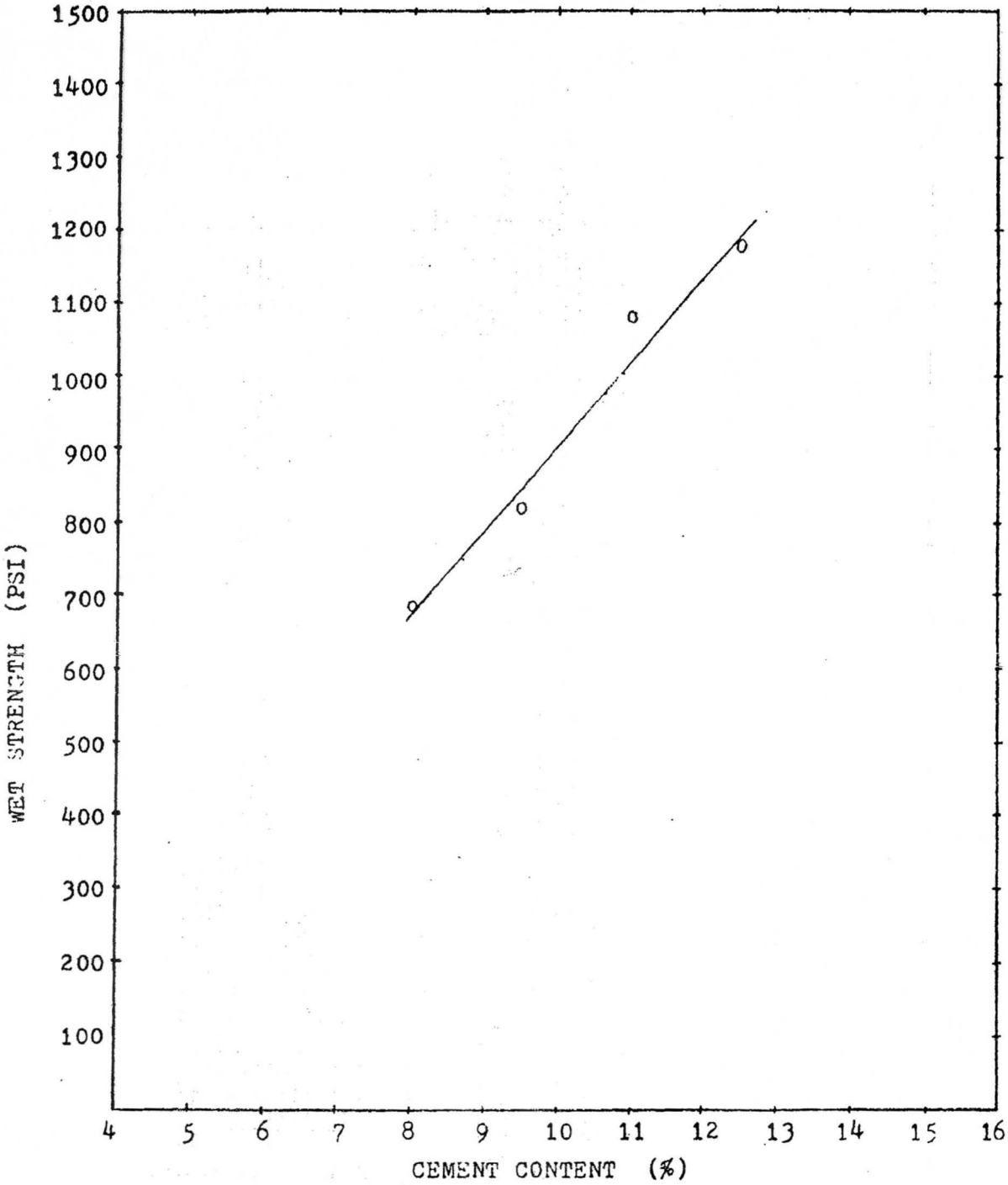
JOB NO. 84-307 BY RMP DATE 22 Jan 85

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
Sample 5				SAND with some silt and trace gravel



GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)

desert earth engineering



SOIL-CEMENT
DRY STRENGTH VS. CEMENT CONTENT

Sample Description _____

Sample Source _____

Sample No. 5

Desert Earth Engineering consulting geotechnical engineers			
Drawn by: RMP	Date 1-14-85	Checked by: RJ	Date 2/25/85
Sheet of	Job No. 84-307	Figure No.	

B-6

SERGENT, HAUSKINS & BECKWITH

TABULATION OF TEST RESULTS

Job No. E84-121

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	SIEVE ANALYSIS-ACCUM % PASSING #200 .75"	#100 1"	#50 1.5"	#40 2"	#30 2.5"	#16 3"	#10 3.5"	#8 4"	#4 6"	.25" 8"	.375" 10"	.5" 12"	LAB NO
1	39'-49'	GW-GC	36	15	10 81	12 85	15 92	18 96	22 100	31	37	39	46	53	64	73	4-121-6
1	69'-79'	SC	42	18	49 94	55 100	65	68	72	76	79	80	85	87	89	92	4-121-9
1	79'-89'	SM	33	9	36 95	47 100	67	72	75	78	79	79	81	82	85	86	4-121-10
11	29'-39'	GP	20	NP	4.3 56	6 63	8 77	10 89	14 93	26 100	33	34	39	42	45	51	4-121-14
11	59'-69'	SC	41	20	31 80	34 83	42 89	46 94	51 100	60	64	64	67	69	72	76	4-121-17
3	40'-45'	SW-SM	24	2	11 100	14	21	25	30	40	47	50	66	75	88	96	4-121-24
3	14.5'-16'	SC	36	19	13 100	15	20	26	38	74	84	87	91	92	95	97	4-121-28
5	9.5'-11'	SP-SC	28	8	8.5 79	11 100	16	21	26	38	46	48	56	60	68	75	4-121-37
9	9.5'-11'	SP-SM	-	NP	6.8 84	10 100	21	31	42	60	61	62	72	75	79	82	4-121-44
9	24.5'-26'	SP-SM	-	NP	6.8	14	32	49	66	89	95	97	100				4-121-47

SERGENT, HAUSKINS & BECKWITH

TABULATION OF TEST RESULTS

Job No. E84-121

HOLE NO	DEPTH	MOISTURE CONTENT	LAB NO
1	39'-49'	5.2 %	4-121-6
1	69'-79'	23.3 %	4-121-9
1	79'-89'	19.8 %	4-121-10
11	29'-39'	4.6 %	4-121-14
11	59'-69'	8.1 %	4-121-17
3	40'-45'	0 %	4-121-24
3	14.5'-16'	9.6 %	4-121-28
5	9.5'-11'	6.4 %	4-121-37
9	9.5'-11'	5.2 %	4-121-44
9	24.5'-26'	4 %	4-121-47

B-8

EXISTING SOIL CHARACTERISTICS

Project: Tres Rios Landing
Location: SEC, Dysart Road and Buckeye Road
For: CMX, L.L.C.

Date: 4/18/02
Type Of Sample: Soil
Source: 0-3'

	% Passing (Sieve Size)							Atterberg Limits		
Location	1	½	#4	#10	#40	#100	#200	LL	PL	PI
BC1					99	94	81			NP
BC2					100	95	71			NP
BC3				99	77	35	14			NP
BC4					99	74	30			NP
BC5					100	90	46			NP
BC6			97	94	48	12	9			NP
BC7			93	90	72	49	41			NP
BC8				100	90	64	39			NP
BC9			97	95	78	64	57	25	20	5
BC10			88	82	52	33	24			NP

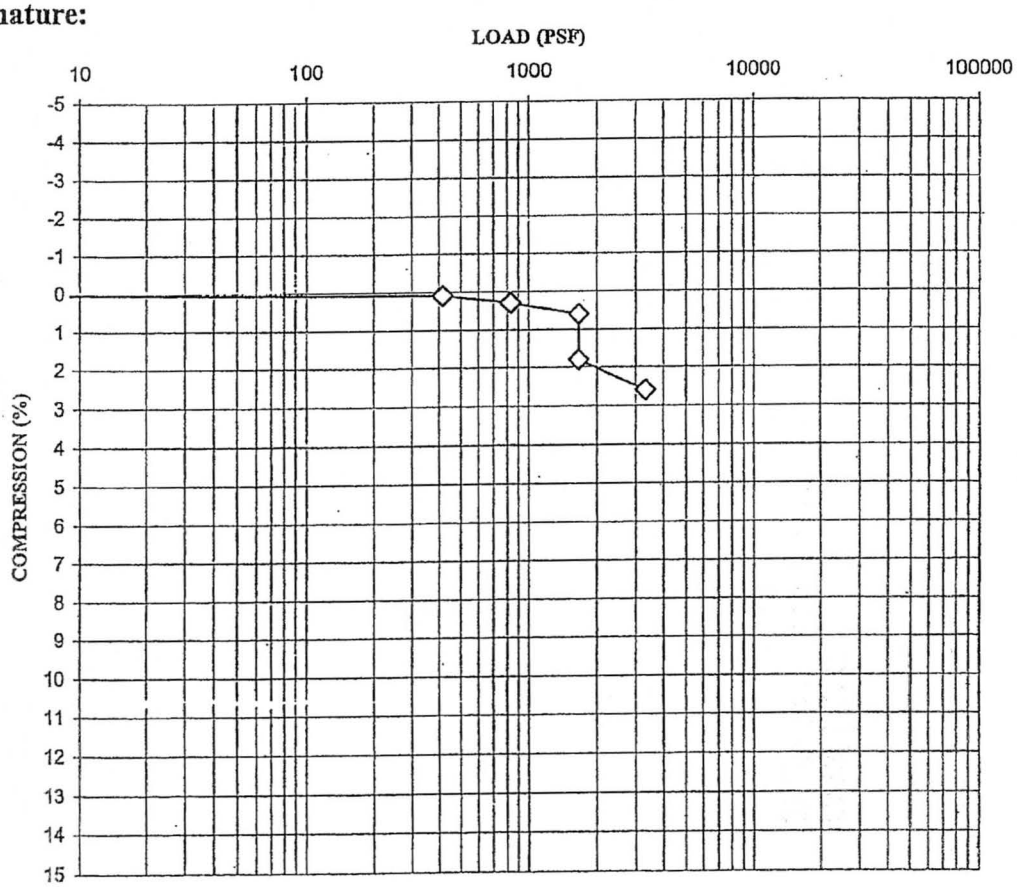
#67

CONSTRUCTION INSPECTION & TESTING CO.

CONSOLIDATION TEST DATA SHEET

Date: 4/18/02
Project No.: 02-20817-1
Project: Tres Rios Landing
Location: SEC. Dysart Road and Buckeye Road

Signature:



B4 (1.5-2.5')

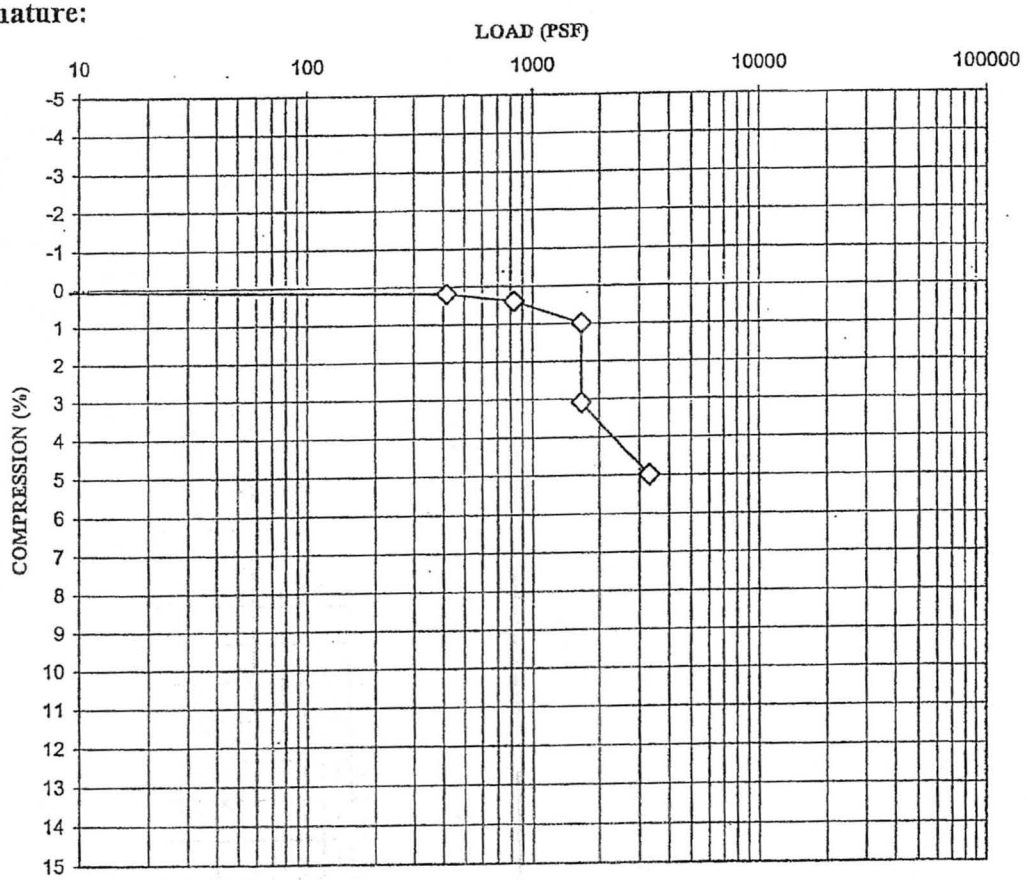
Moisture Content: 1.8%
Dry Unit Wt.: 99.9 pcf
Sample Type: Undisturbed
Load @ Saturation: 1659 psf

CONSTRUCTION INSPECTION & TESTING CO.

CONSOLIDATION TEST DATA SHEET

Date: 4/18/2002
Project No.: 02-20817-1
Project: Tres Rios Landing
Location: SEC. Dysart Road and Buckeye Road

Signature:



B5 (1.5-2.5')

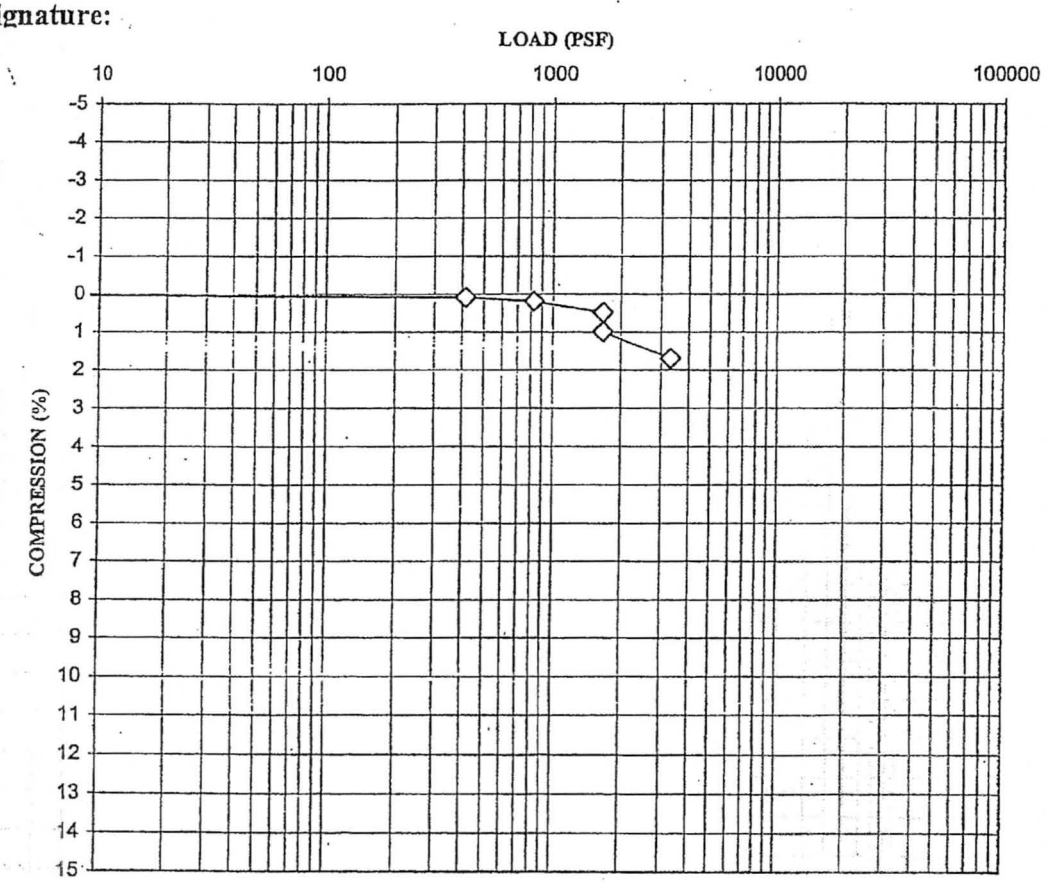
Moisture Content: 0.9%
Dry Unit Wt.: 80.3 pcf
Sample Type: Undisturbed
Load @ Saturation: 1659 psf

CONSTRUCTION INSPECTION & TESTING CO.

CONSOLIDATION TEST DATA SHEET

Date: 4/18/2002
Project No.: 02-20817-1
Project: Tres Rios Landing
Location: SEC. Dysart Road and Buckeye Road

Signature:



B10 (2.5-3.5')

Moisture Content: 0.9%
Dry Unit Wt.: 100.9 pcf
Sample Type: Undisturbed
Load @ Saturation: 1659 psf

EXISTING SOIL CHARACTERISTICS

Project: Tres Rios Landing
Location: SEC, Dysart Road and Buckeye Road
For: CMC, L.L.C.

Date: 4/18/02
Type Of Sample: Soil
Source:

Location		% Passing (Sieve Size)							Atterberg Limits		
		1	½	#4	#10	#40	#100	#200	LL	PL	PI
B1	0-1.5'				100	89	63	27			NP
B1 (B)	0-1.5'			87	82	57	42	31			NP
B11	1.5-5'					100	99	98	51	23	28
B9	2-3'					95	80	67	27	18	9
B5	2-4'				99	65	46	23			NP
B4	5-7'				99	68	13	4			NP

Tres Rios Landing
SEC, Dysart Road and Buckeye Road
Avondale, Arizona
CIT Project No. 02-20817-1

Swell Test On Disturbed Recompacted Soil Sample

Location	Depth	Surcharge	Dry Density	% Swell
B11	1.5-5'	100 PSF	91.7 PCF	5.6

Percent expansion upon soaking of remolded sample compacted to approximately 95% of the maximum ASTM D-698 density at approximately 2 to 3 percent below optimum.

Moisture Determination

Location	0-1.5'	1.5-5'	2-3'	2-4'	5-7'
B1	0.5%	-	-	-	-
B1 (B)	3.5%	-	-	-	-
B4	-	-	-	-	0.7%
B5	-	-	-	2.0%	-
B9	-	-	16.6%	-	-
B11	-	17.4%	-	-	-

Standard Proctor Test

Location	Dry Density	Optimum Moisture
B4 @ 0-3'	101.0 PCF	19.0%

B-9

#4 GRADATION & PI

HOQUE & ASSOCIATES
1797 W. University Dr., Ste. 167
Tempe, Arizona 85281
Tel : 480-921-1368
Fax : 480-921-0194

Client :	CH2M Hill	HA Project No. :	02035
Project :	City of Avondale Waterline	HA Lab No.:	02L721
Location:	Indian Scool & Mirage Road	Date Received :	5/3/02
	Avondale, Arizona	Test Required :	
Material :	Clayey SAND with gravel	Gradation	x
Mat. Source :	B-3 (0'-5')	-200 Wash	x
Sampled By :	AR	PI	x
Sampled Date :	5/3/02	Proctor	
Submitted by :	AR	Test Dates :	5/16/02

[ ] ASTM D1348 [x] ARIZ 201c [ ] AASHTO T-89/90

Sample Weight		Coarse/Fine Factor	
+ #4	987.9	Coarse Factor :	
- #4	4212.1	Fine Factor :	
Total	5200.0		

Natural Moisture	
Wet WT (g) :	1263.9
Dry WT (g):	245.5
% Moisture:	7.5

Sieve US/mm	Wt. Retained	% Retained	%Passing	Specs
3"/75	0.0	0	100	
2-1/2"/ 62.5	0.0	0	100	
2"/50	0.0	0	100	
1-1/2"/ 37.5	0.0	0	100	
1" / 25	0.0	0	100	
3/4" / 19	36.5	1	99	
1/2"/12.5	161.5	4	95	
3/8" / 9.5	94.6	2	93	
1/4" / 6.3	204.3	4	89	
No.4 /4.75	454.0	9		
Min #4			80	
+#4 Total	987.9		WBW (Wet):	510.0
-#4: Wet	4212.1		WBW (Dry):	474.4
-#4: Dry	3918.4		WAW (Dry):	321.8
Total	4906.3		Elutration:	152.6
#8 /2.36	43.2	7	73	
#10 / 2.00	11.8	2	71	
#16 /1.18	36.6	6	65	
#30 / 0.60	71.9	12	52	
#40/ 0.425	43.8	7	45	
#50 / 0.30	34.9	6	39	
#100 / 0.15	44.7	8	32	
#200 /0.075	27.5	5		
-#200/0.075	8.5		27.1	
Total	321.8			
Elutration	152.6			

USCS: SC

PLASTICITY INDEX (AASHTO T-89 & 90)

Liquid Limit		Plastic Limit	
Tare Wt. :	14.08	Tare Wt. :	5.12
Wet Wt. :	30.82	Wet Wt. :	14.41
Dry Wt. :	26.59	Drt Wt. :	13.91
# of Blows	25		
Blos Factr	1.0000		
LL =	26	PL =	18

PLASTICITY INDEX = 8

BLOWS FACTOR	
20	0.9758
21	0.9806
22	0.9855
23	0.9903
24	0.9952
25	1
26	1.0048
27	1.0097
28	1.0145
29	1.0194
30	1.0242

Tested By : AR
Checked By : KT

#31

#4 GRADATION & PI

HOQUE & ASSOCIATES
1797 W. University Dr., Ste. 167
Tempe, Arizona 85281
Tel : 480-921-1368
Fax : 480-921-0194

Client :	CH2M Hill	HA Project No. :	02035
Project :	City of Avondale Waterline	HA Lab No.:	02L723
Location:	Indian Scool & Mirage Road	Date Received :	5/3/02
	Avondale, Arizona	Test Required :	
Material :	Silty SAND	Gradation	x
Mat. Source :	B-3 (10'-15')	-200 Wash	x
Sampled By :	AR	PI	x
Sampled Date :	5/3/02	Proctor	
Submitted by :	AR	Test Dates :	5/16/02

[ ] ASTM D1348 [x] ARIZ 201c [ ] AASHTO T-89/90

Sample Weight		Coarse/Fine Factor	
+ #4	326.3	Coarse Factor :	
- #4	4284.8	Fine Factor :	
Total	4611.1		

Natural Moisture	
Wet WT (g) :	290.4
Dry WT (g):	277.9
% Moisture:	4.5

Sieve US/mm	Wt. Retained	% Retained	%Passing	Specs
3"/75	0.0	0	100	
2-1/2"/ 62.5	0.0	0	100	
2"/50	0.0	0	100	
1-1/2"/ 37.5	0.0	0	100	
1" / 25	42.9	1	99	
3/4" / 19	41.5	1	98	
1/2"/12.5	88.9	2	96	
3/8" / 9.5	46.9	1	95	
1/4" / 6.3	66	2	94	
No.4 /4.75	39.6	1		
Min #4			93	
+#4 Total	326.3		WBW (Wet):	516.2
-#4: Wet	4284.8		WBW (Dry):	494.0
-#4: Dry	4100.4		WAW (Dry):	437.2
Total	4426.7		Elutration:	56.8
#8 /2.36	19.9	4	89	
#10 / 2.00	5.6	1	88	
#16 /1.18	23.2	4	84	
#30 / 0.60	69.1	11	72	
#40/ 0.425	56.3	11	62	
#50 / 0.30	63.8	12	50	
#100 / 0.15	136.5	26	24	
#200 /0.075	63.2	12		
-#200/0.075	10.0		12.5	
Total	437.2			
Elutration	56.8			

USCS: SM

PLASTICITY INDEX (AASHTO T-89 & 90)

Liquid Limit		Plastic Limit	
Tare Wt. :	0.00	Tare Wt. :	0.00
Wet Wt. :	0.00	Wet Wt. :	0.00
Dry Wt. :	0.00	Drt Wt. :	0.00
# of Blows	0		
Blos Factr	0.0000		
LL =	n/a	PL =	n/a

PLASTICITY INDEX = nonplastic

BLOWS FACTOR	
20	0.9758
21	0.9806
22	0.9855
23	0.9903
24	0.9952
25	1
26	1.0048
27	1.0097
28	1.0145
29	1.0194
30	1.0242

Tested By : AR
Checked By : KT

#4 GRADATION & PI

HOQUE & ASSOCIATES, INC.
1797 W. University Dr., Ste. 167
Tempe, Arizona 85281
Tel : 480-921-1368
Fax : 480-921-0194

Client :	CH2M Hill	HA Project No. :	02035
Project :	City of Avondale Waterline	HA Lab No.:	02L733
Location:	Indian Scool & Mirage Road	Date Received :	5/3/02
	Avondale, Arizona	Test Required :	
Material :	Silty SAND with gravel	Gradation	x
Mat. Source :	B-4 (5'-8')	-200 Wash	x
Sampled By :	AR	PI	x
Sampled Date :	5/3/02	Proctor	
Submitted by :	AR	Test Dates :	5/16/02

[ ] ASTM D1348 [x] ARIZ 201c [ ] AASHTO T-89/90

Sample Weight		Coarse / Fine Factor	
+ #4	1876.0	Coarse Factor :	
- #4	2879.1	Fine Factor :	
Total	4755.1		

Natural Moisture	
Wet WT (g) :	282.4
Dry WT (g):	269.1
% Moisture:	4.9

Sieve US/mm	Wt. Retained	% Retained	%Passing	Specs
3"/75	0.0	0	100	
2-1/2"/ 62.5	0.0	0	100	
2"/50	0.0	0	100	
1-1/2"/ 37.5	0.0	0	100	
1" / 25	185.4	4	96	
3/4" / 19	339.9	7	89	
1/2"/12.5	423.1	9	79	
3/8" / 9.5	316.9	7	73	
1/4" / 6.3	394.2	9	64	
No.4 /4.75	222.5	5		
Min #4			59	
+#4 Total	1876.0		WBW (Wet):	544.6
-#4: Wet	2879.1		WBW (Dry):	519.0
-#4: Dry	2743.5		WAW (Dry):	405.6
Total	4619.5		Elutration:	113.4
#8 /2.36	216.1	7	52	
#10 / 2.00	114.0	2	51	
#16 /1.18	149.5	6	45	
#30 / 0.60	73.1	8	37	
#40/ 0.425	45.5	5	32	
#50 / 0.30	40.9	5	27	
#100 / 0.15	69.3	8	19	
#200 /0.075	42.5	5		
-#200/0.075	9.2		14.0	
Total	405.6			
Elutration	113.4			

USCS: SM

PLASTICITY INDEX (AASHTO T-89 & 90)

Liquid Limit		Plastic Limit	
Tare Wt. :	0.00	Tare Wt. :	0.00
Wet Wt. :	0.00	Wet Wt. :	0.00
Dry Wt. :	0.00	Drt Wt. :	0.00
# of Blows	0		
Blos Factr	0.0000		
LL =	n/a	PL =	n/a

PLASTICITY INDEX = nonplastic

BLOWS FACTOR	
20	0.9758
21	0.9806
22	0.9855
23	0.9903
24	0.9952
25	1
26	1.0048
27	1.0097
28	1.0145
29	1.0194
30	1.0242

Tested By : AR
Checked By : KT

IN-SITU DENSITY OF RING SAMPLE

HOQUE & ASSOCIATES
1797 W. University Dr., Ste. 167
Tempe, Arizona 85281
Tel : 480-921-1368
Fax : 480-921-0194

Client: CH2M Hill

Project: City of Avondale Waterline

Job No. 02035

Location of Project: Indian Scool & Mirage Road
Avondale, Arizona

Boring No. B-3

Description of Soil: Clayey SAND with gravel (SC)

Depth: 5'

Tested By: PW

Date of Test: 5/20/02

Sample Data

Wet Unit Weight: 120.4

Moisture Content: 4.7%

Sample Dimensions:

Diameter: 2.414"
Height: 3.0"

IN-SITU DENSITY OF RING SAMPLE

HOQUE & ASSOCIATES
1797 W. University Dr., Ste. 167
Tempe, Arizona 85281
Tel : 480-921-1368
Fax : 480-921-0194

Client: CH2M Hill

Project: City of Avondale Waterline

Job No. 02035

Location of Project: Indian Scool & Mirage Road
Avondale, Arizona

Boring No. B-4

Description of Soil: Silty SAND with gravel (SM)

Depth: 5'

Tested By: PW

Date of Test: 5/20/02

Sample Data

Wet Unit Weight: 130.2 pcf

Moisture Content: 4.9%

Sample Dimensions:

Diameter: 2.414"
Height: 2.0"

pH & RESISTIVITY

HOQUE ASSOCIATES
1797 W University Dr. , Ste. 167
Tempe, Arizona 85281
Tel: 480-921-1368
Fax: 480-921-0194

Client :	CH2M Hill	HA Project No. :	02035
Project :	City of Avondale Waterline	HA Lab No.:	02L721
Location:	Indian School & Mirage Road	Date Received :	5/3/02
	Avondale, Arizona	Test Dates :	5/17/02
Material :			
Mat. Source :	B-3 (0'-5')		
Sampled By :	AR		
Sampled Date :	5/3/02		
Submitted by :	AR		

Dist. Water (ml)	Resistance (ohms)
200	
50	
50	
50	400
50	410
50	
50	

Calculations: SBF = 6.67 cm
Resistivity = Lowest Resistance X SBF

pH Reading: 8.4

Resistivity: 2670

Tested By: AR
Checked By: KT

pH & RESISTIVITY

HOQUE ASSOCIATES
1797 W University Dr., Ste. 167
Tempe, Arizona 85281
Tel: 480-921-1368
Fax: 480-921-0194

Client :	CH2M Hill	HA Project No. :	02035
Project :	City of Avondale Waterline	HA Lab No.:	02L733
Location:	Indian School & Mirage Road	Date Received :	5/3/02
	Avondale, Arizona	Test Dates :	5/17/02
Material :			
Mat. Source :	B-4 (5'-8')		
Sampled By :	AR		
Sampled Date :	5/3/02		
Submitted by :	AR		

Dist. Water (ml)	Resistance (ohms)
200	
50	
50	
50	180
50	160
50	165
50	

Calculations: SBF = 6.67 cm
Resistivity = Lowest Resistance X SBF

pH Reading: 8.2

Resistivity: 1070

Tested By: AR
Checked By: KT

IAS Laboratories

2515 East University Drive
Phoenix, Arizona 85034
(602) 273-7248
Fax (602) 275-3836

MAY 28 2002

Date:	May 22, 2002
Submitted by:	Ken
Report to:	Hoque & Associates
Project#:	02035/Distribution Water Line
Report #:	6617073

Soil Analysis Report

Sender ID	Depth	IAS Lab. No.	[1] Sulfur (SO_4-S) ppm	[2] Chloride ppm
B-1	0-5	951	9.6	13
B-2	5-10	952	2.5	6.9
B-3	0-5	953	17	26
B-4	5-8	954	1129	32
B-5	5-10	955	18	49
B-6	0-5	956	11	22

[1] ADOT Method ARIZ 733

[2] ADOT Method ARIZ 736

B-10

DATE DRILLED 07/09/04 BORING NO. B-1

GROUND ELEVATION ±942' MSL SHEET 1 OF 1

METHOD OF DRILLING CME-75, 6.5" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Automatic Hammer) DROP 30"

SAMPLED BY MDE LOGGED BY MDE REVIEWED BY RDL

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SP	ALLUVIUM: Light brown, dry to damp, medium dense, poorly graded SAND with trace fine gravel.
			17					
			8					Loose.
5								
			13					Medium dense. Thin (less than 2 inches thick) layers of brown clay.
			30					
10								
			10					
15							GC	Brown, damp, medium dense, clayey GRAVEL with fine to coarse sand.
								Total depth = 15.0 feet. Groundwater not encountered. Backfilled with on-site soils on 07/09/04.
20								

Ninyo & Moore

BORING LOG

LOWER BUCKEYE WATERLINE
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600727001	07/04	A-1

#68

DATE DRILLED 07/09/04 BORING NO. B-3

GROUND ELEVATION ±945' MSL SHEET 1 OF 1

METHOD OF DRILLING CME-75, 6.5" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Automatic Hammer) DROP 30"

SAMPLED BY MDE LOGGED BY MDE REVIEWED BY RDL

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0			67/8"				SM	FILL: Pale brown, dry to damp, very dense, silty SAND with fine gravel.
			21				SM	ALLUVIUM: Light brown, dry to damp, dense, silty SAND with fine gravel.
5			12					Loose. Thin (less than 1 inch thick) brown clay layers.
			7					Medium dense.
10								Total depth = 10.0 feet. Groundwater not encountered. Backfilled with on-site soils on 07/09/04.
15								
20								

Ninyo & Moore

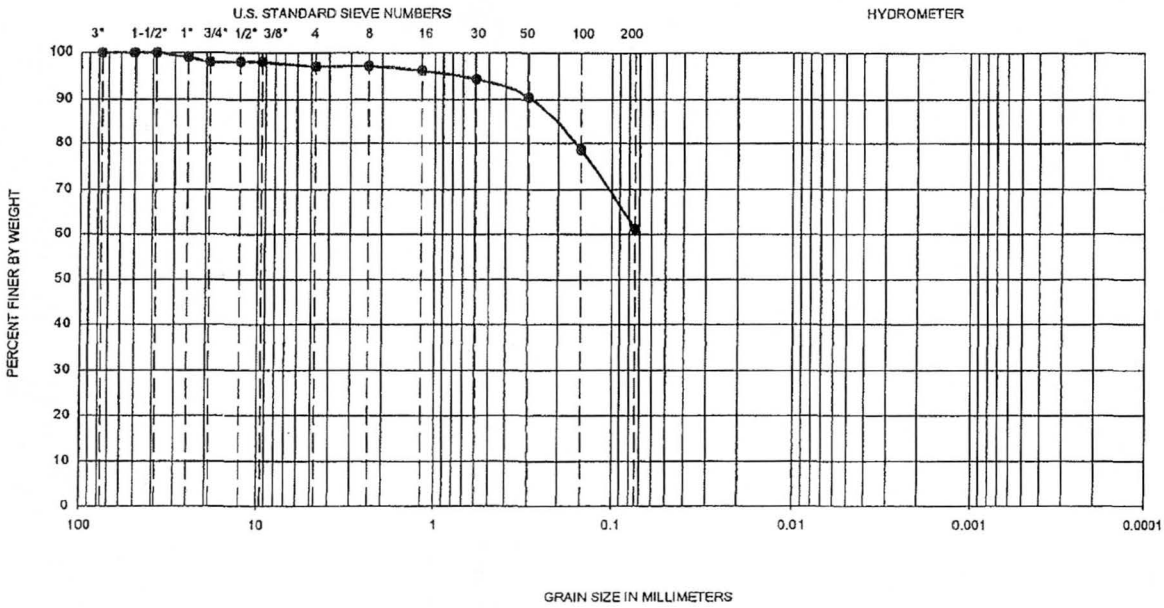
BORING LOG

LOWER BUCKEYE WATERLINE
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600727001	07/04	A-4

B-11

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-7	0-5	NP	NP	NP	--	--	--	--	--	61	ML

NP-INDICATES NON-PLASTIC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM C 136

Ninyo & Moore

GRADATION TEST RESULTS

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

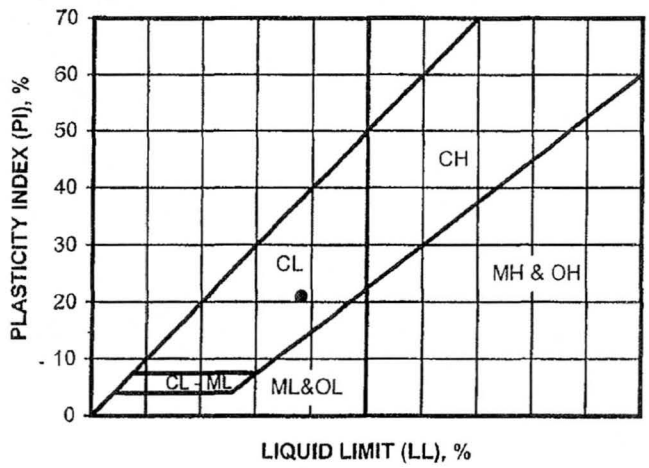
PROJECT NO.	DATE	FIGURE
601017001	01/05	B-1

SPLITSIEVE B-7 0-5

#71

SYMBOL	LOCATION	DEPTH (FT)	LL (%)	PL (%)	PI (%)	U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction)	U.S.C.S. (Entire Sample)
●	B-6	1.0-2.5	38	17	21	CL	CL
■	B-7	0-5	NP	NP	NP	NP	ML

NP - Indicates non-plastic



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-00

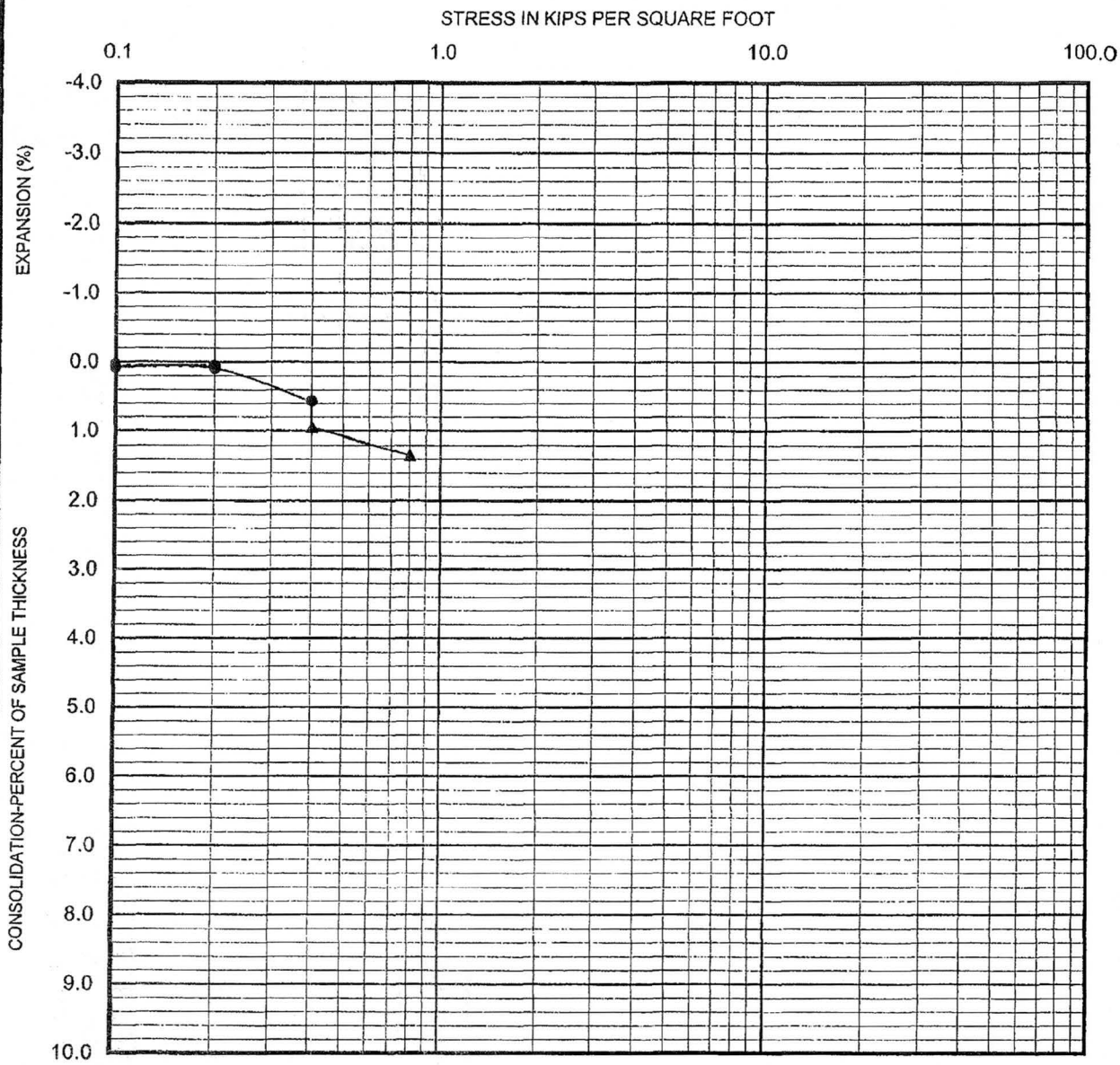
Ninyo & Moore

ATTERBERG LIMITS TEST RESULTS

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601017001	01/05	B-2

ATTERBERG P9646



Seating Cycle		Boring No.	B-1
Loading Prior to Inundation		Depth (ft.)	0.8-1.8
Loading After Inundation		Soil Type	SM
Rebound Cycle		PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-96	

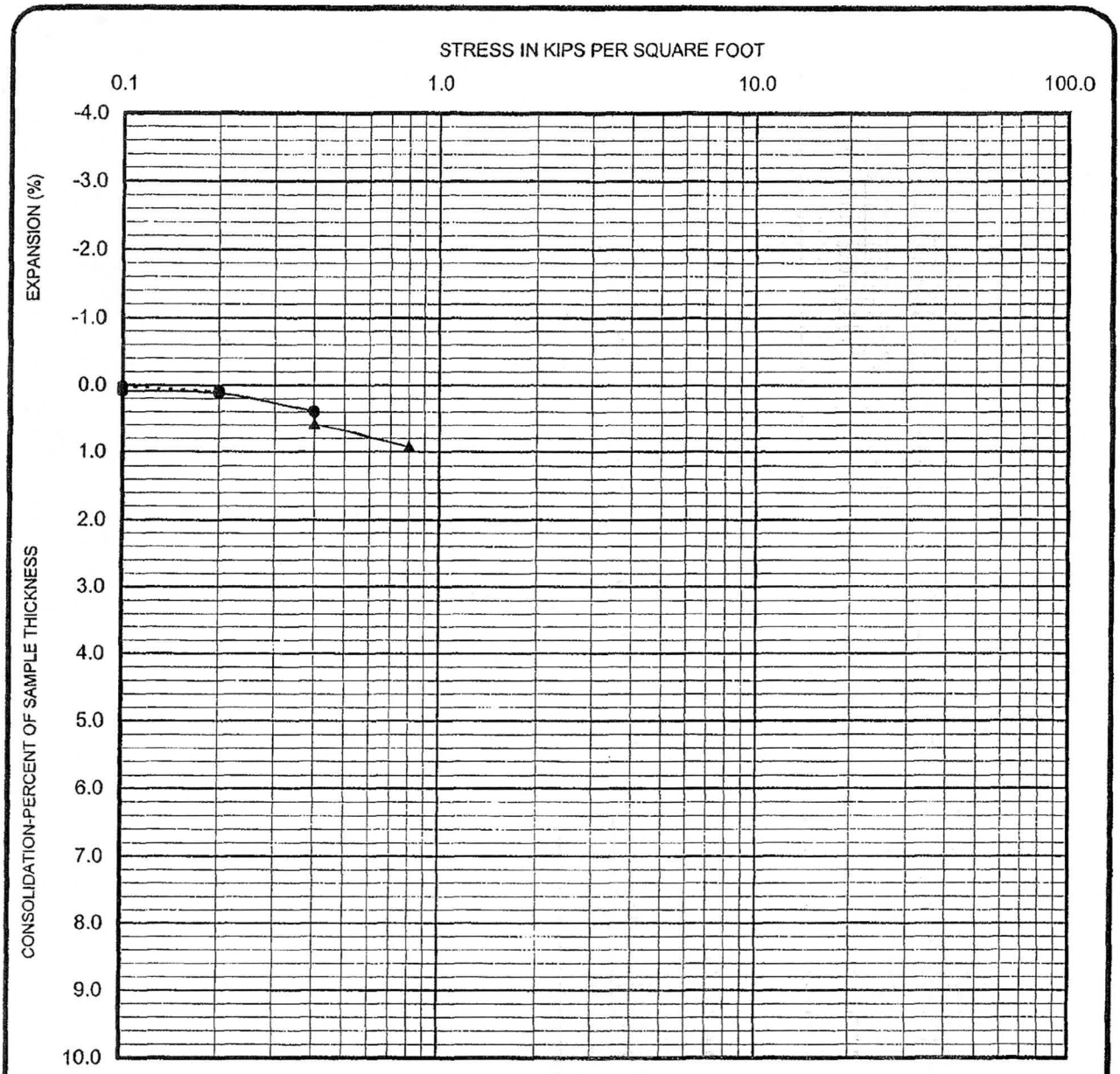
Ninyo & Moore

CONSOLIDATION TEST RESULTS

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601017001	01/05	B-3

CONSOLIDATION B-1 0.8-1.8



Seating Cycle		Boring No.	B-5
Loading Prior to Inundation		Depth (ft.)	0.7-1.7
Loading After Inundation		Soil Type	SM
Rebound Cycle		PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-96	

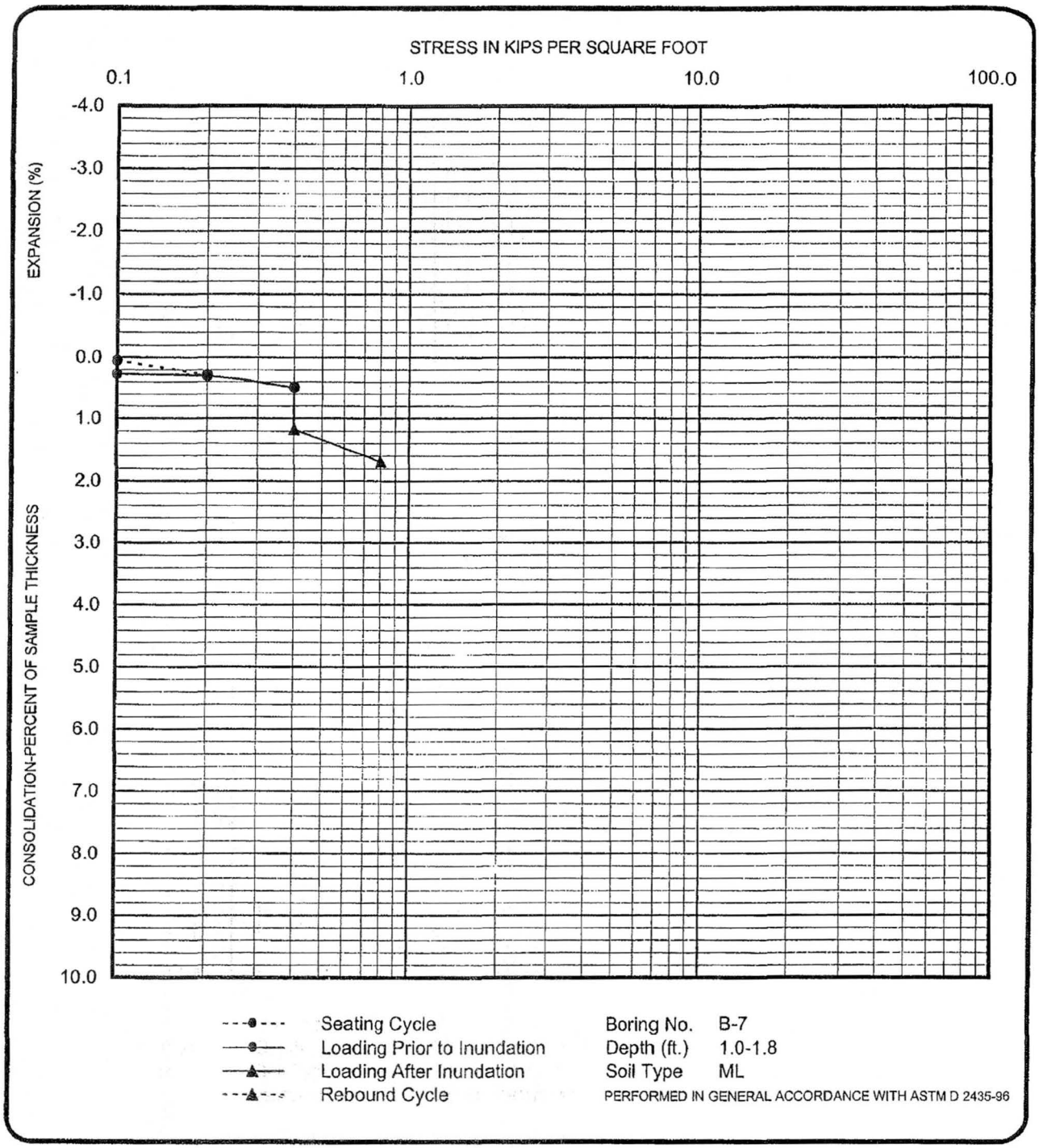
Ninyo & Moore

CONSOLIDATION TEST RESULTS

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601017001	01/05	B-4

CONSOLIDATION B-5 0.7-1.7



Ninyo & Moore

CONSOLIDATION TEST RESULTS

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601017001	01/05	B-5

CONSOLIDATION B-7 1.0-1.8

EXPANSION INDEX TEST RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (IN)	EXPANSION INDEX	EXPANSION POTENTIAL
B-6	0.8-5.0	10.6	108.9	5.4	0.0368	39	Low

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4829-03

Ninyo & Moore

EXPANSION INDEX TEST RESULTS

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601017001	01/05	B-6

ASTM-EI - B-6 0.5-5.0

CORROSIVITY TEST RESULTS

SAMPLE ID	DEPTH (FT)	pH *	RESISTIVITY * (ohm-cm)	WATER-SOLUBLE SULFATE CONTENT IN SOIL ** (%)	CHLORIDE CONTENT *** (ppm)
B-8	0-5	8.1	821	0.0066	35

* PERFORMED IN GENERAL ACCORDANCE WITH ADOT TEST METHOD ARIZ 236b
** PERFORMED IN GENERAL ACCORDANCE WITH ADOT TEST METHOD ARIZ 733
*** PERFORMED IN GENERAL ACCORDANCE WITH ADOT TEST METHOD ARIZ 736

Ninyo & Moore

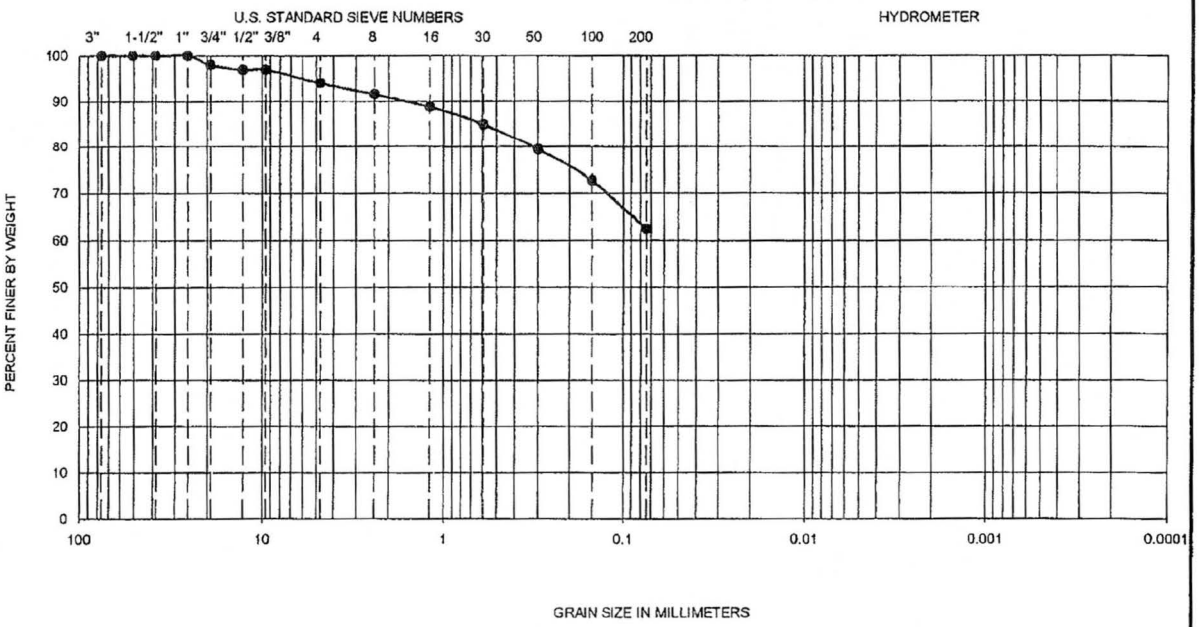
CORROSIVITY TEST RESULTS

AVONDALE MUNICIPAL OPERATIONS CENTER
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601017001	01/05	B-7

B-12

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



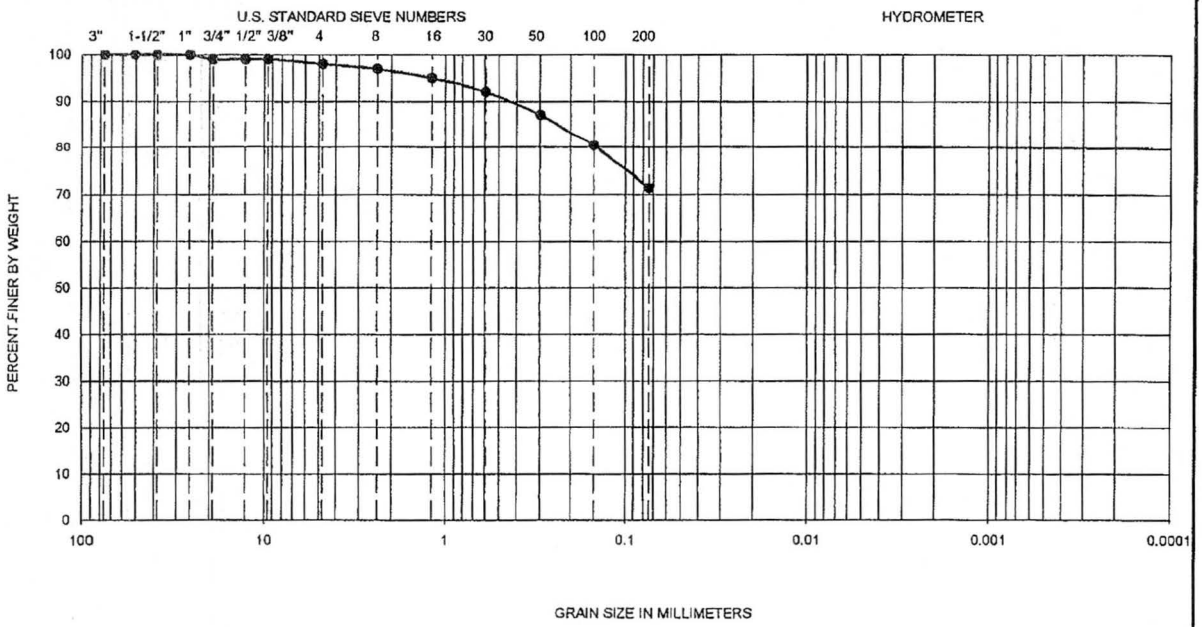
Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	C-1	0.8-2	28	19	9	--	--	--	--	--	62	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	WAL-MART STORE NO. 2544 AVONDALE, ARIZONA	B-1
601871001 / 06/07		

#69

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

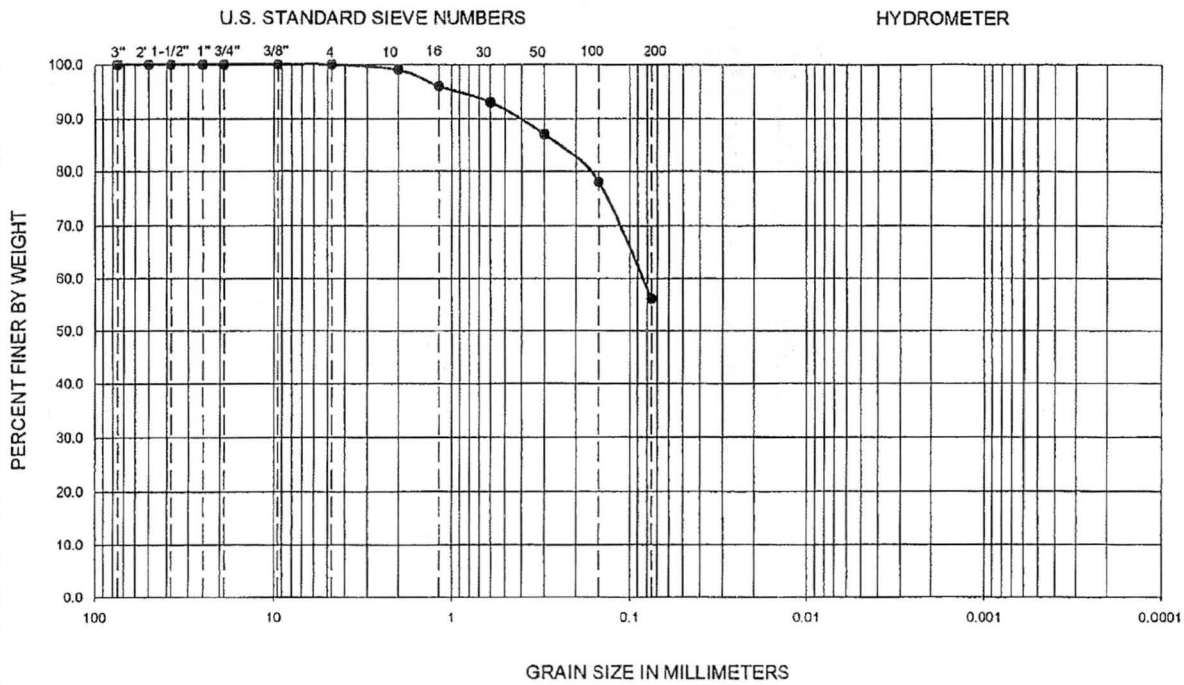


Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	C-4	0.6-2	40	22	18	--	--	--	--	--	72	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	WAL-MART STORE NO. 2544 AVONDALE, ARIZONA	B-2
601871001 / 06/07		

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

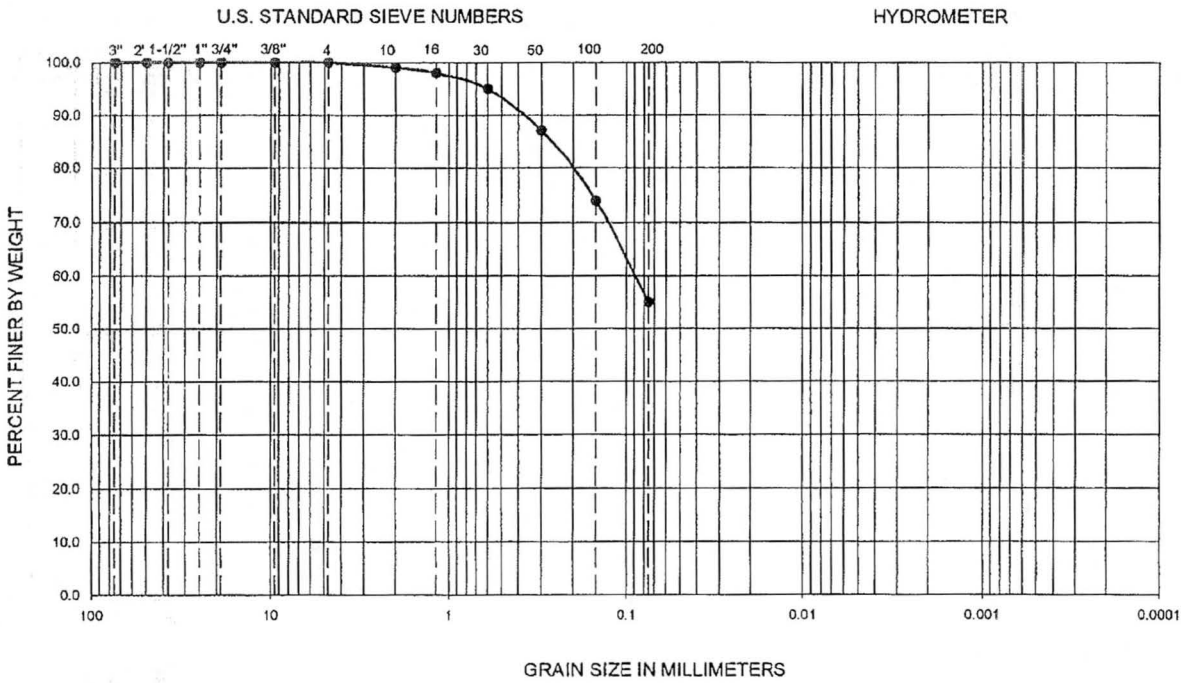


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	C-5	0.5-1.5	42	20	22	--	--	--	--	--	56	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	WAL-MART STORE NO. 2544 AVONDALE, ARIZONA	B-3
601871001 / 06/07		

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

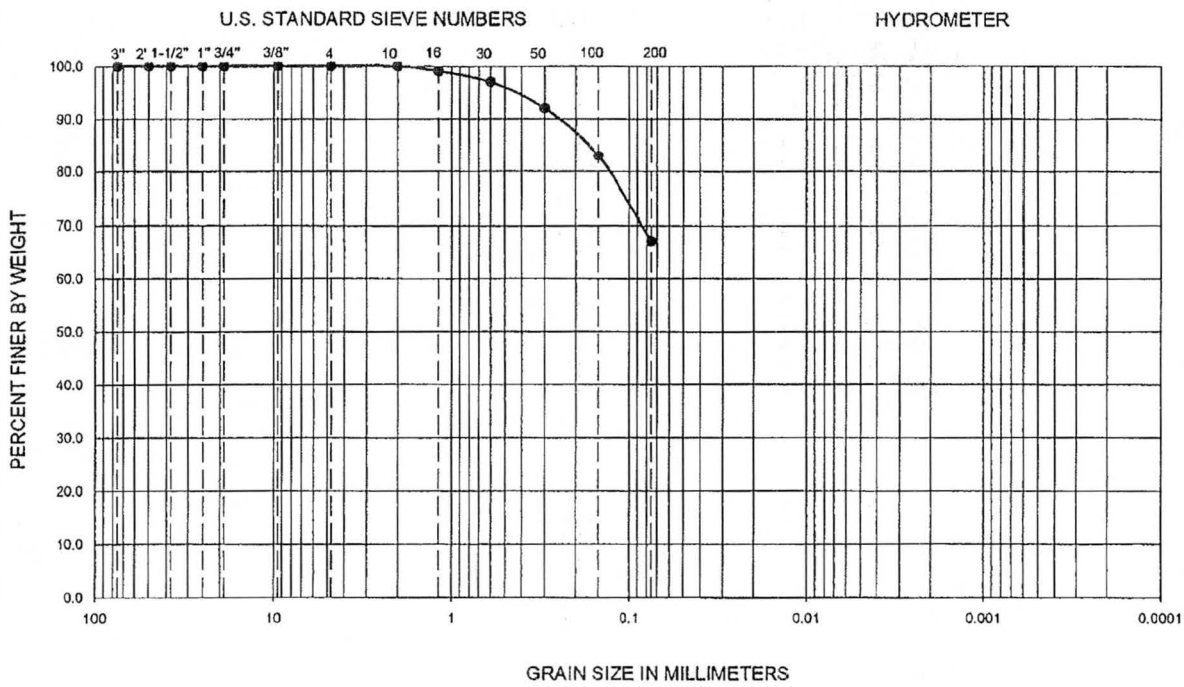


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	C-9	0.5-1.5	29	19	10	--	--	--	--	--	55	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	WAL-MART STORE NO. 2544 AVONDALE, ARIZONA	B-4
601871001 / 06/07		

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

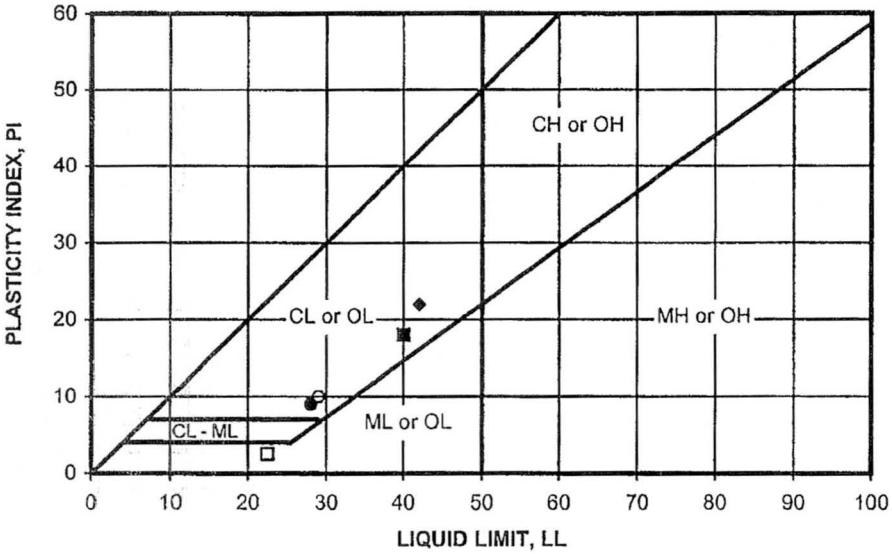


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	C-10	0.5-2	23	20	3	--	--	--	--	--	67	ML

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	WAL-MART STORE NO. 2544 AVONDALE, ARIZONA	B-5
601871001 / 06/07		

SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS (Entire Sample)
●	C-1	0.8-2	28	19	9	CL	CL
■	C-4	0.6-2	40	22	18	CL	CL
◆	C-5	0.5-1.5	42	20	22	CL	CL
○	C-9	0.5-1.5	29	19	10	CL	CL
□	C-10	0.5-2	23	20	3	ML	ML



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-05

Ninyo & Moore	ATTERBERG LIMITS TEST RESULTS	FIGURE
PROJECT NO. 601871001 / DATE 06/07	WAL-MART STORE NO. 2544 AVONDALE, ARIZONA	B-6

B-13

DATE DRILLED 07/05/07 BORING NO. B-1

GROUND ELEVATION – SHEET 1 OF 1

METHOD OF DRILLING Manual

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY HAH

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■						ML	ALLUVIUM: Brown, damp to moist, loose to medium dense, sandy SILT; trace gravel.
2.5	■	■		10.0	75.6			
								Total Depth = 3 feet. Groundwater not encountered during drilling. Backfilled on 07/05/07 promptly after completion of drilling. Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
5								
7.5								
10								

Ninyo & Moore

BORING LOG

AGUA FRIA CONNECTOR TRAIL
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601886001	07/07	A-1

#70

DATE DRILLED 07/05/07 BORING NO. B-2

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Manual

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY HAH

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■						SP	EMBANKMENT FILL: Brown, damp, dense, poorly graded fine to coarse SAND; few to little gravel; cobbles noted.
2.5		■		2.0	112.2			
								Total Depth = 3 feet. Groundwater not encountered during drilling. Backfilled on 07/05/07 promptly after completion of drilling. Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
5								
7.5								
10								

Ninyo & Moore

BORING LOG

AGUA FRIA CONNECTOR TRAIL
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601886001	07/07	A-2

DATE DRILLED 07/05/07 BORING NO. B-3

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Manual

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY HAH

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SP	EMBANKMENT FILL: Brown, damp, medium dense to dense, poorly graded fine to coarse SAND; few to little gravel.
		■		1.4	106.5			
2.5								
								Total Depth = 3 feet. Groundwater not encountered during drilling. Backfilled on 07/05/07 promptly after completion of drilling. Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
5								
7.5								
10								

Ninyo & Moore

BORING LOG

AGUA FRIA CONNECTOR TRAIL
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601886001	07/07	A-3

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SW-SM	EMBANKMENT FILL: Brown, damp, medium dense to dense, well graded fine to coarse SAND with silt; trace to few gravel; cobbles noted.
2.5				3.6	106.7			
								Total Depth = 3 feet. Groundwater not encountered during drilling. Backfilled on 07/05/07 promptly after completion of drilling. Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
5								
7.5								
10								

DATE DRILLED 07/05/07 BORING NO. B-4

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Manual

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY HAH

Ninyo & Moore

BORING LOG

AGUA FRIA CONNECTOR TRAIL
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601886001	07/07	A-4

DATE DRILLED 07/05/07 BORING NO. B-5

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Manual

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY HAH

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SP	EMBANKMENT FILL: Brown, damp, dense to very dense, poorly graded fine to coarse SAND; trace to few gravel.
2.5		■		7.5	111.4			Moist.
								Total Depth = 2.9 feet. Groundwater not encountered during drilling. Backfilled on 07/05/07 promptly after completion of drilling. Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
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7.5								
10								

Ninyo & Moore

BORING LOG

AGUA FRIA CONNECTOR TRAIL
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601886001	07/07	A-5

DATE DRILLED 07/05/07 BORING NO. B-6

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Manual

DRIVE WEIGHT 30 lbs. DROP 24"

SAMPLED BY DM LOGGED BY DM REVIEWED BY HAH

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SW-SM	EMBANKMENT FILL: Brown, damp, medium dense, well graded fine to coarse SAND with silt; few to little gravel; cobbles noted.
2.5				1.9	104.6			
								Total Depth = 3 feet. Groundwater not encountered during drilling. Backfilled on 07/05/07 promptly after completion of drilling. Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
5								
7.5								
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Ninyo & Moore

BORING LOG

AGUA FRIA CONNECTOR TRAIL
AVONDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
601886001	07/07	A-6

B-14

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity			Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits LL	PL	PI	Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	
EB-31	0	CL	106	11													1, 2
EB-31	2.5	CL	89	10													1, 2
EB-31	5	CL	95	7													1, 2
EB-32	0	CL	94	9	68	26	16	10									1
EB-32	2.5	CL	93	7													1, 2
EB-32	5	CL	96	8													1, 2
EB-33	0	SC	106	10													1, 2
EB-33	2.5	CL	108	16													1, 2
EB-34	0	CL	101	8	61	29	18	11									1
EB-34	2.5	CL	108	10													1, 2
EB-35	0	SC	103	13													1, 2
EB-35	5	CL	97	10													1, 2
EB-36	0		77	29													1, 2
EB-36	1	SC			45	29	18	11									
NWB-01	0	SC-SM	105	5													1, 2
NWB-01	5	CL	96	5													1, 2
NWB-02	2.5	CL	95	5	61	32	20	12									1
NWB-03	0	CL-ML	109	8	52	25	19	6									1
NWB-03	5	SC	98	4													1, 2
NWB-03	10	SP	101	2													1, 2
NWB-05	0	SM	111	7													1, 2
NWB-05	2.5	CL			50	26	15	11									
NWB-05	5	SC	97	5													1, 2
NWB-05/06	15	SM			17	NP	NP	NP									
NWB-06	2.5	SM	106	4													1, 2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

Terracon

SUMMARY OF LABORATORY RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

SOIL PROPERTIES 65075093.GPJ TERR2000.GDT 1/25/08

#59

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity			Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits LL	PL	PI	Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	
OBB-13	50	CL	102	20	72	48	24	24								40	1
OBB-13	60	SC	104	12													1, 2
OBB-13	70	ML	94	28													1, 2
OBB-13	80	SP	116	3													1, 2
OBB-13	99	SP	115	5													1, 2
OBB-14	2.5	CL	104	9													1, 2
OBB-14	10	CL	113	10	80	33	18	15								120	1
OBB-14	20	CL	108	10													1, 2
OBB-14	40	ML	93	7	90	NP	NP	NP									1
OBB-14	50	CL-ML	105	8	58	25	18	7									1
OBB-14	60	CL	94	15													1, 2
OBB-14	90	CL	101	22													1, 2
OBB-14	99	SP	118	5													1, 2
RWB-01	0	SC	92	5													1, 2
RWB-01	5	CL	102	7													1, 2
RWB-01	10	CL	104	8													1, 2
RWB-02	2.5	SC	100	8													1, 2
RWB-02	7.5	CL	107	10													1, 2
RWB-02	15	CL			61	37	16	21									
RWB-03	2.5	CL		9	68	37	18	19									
RWB-03	5	CL												8.6		52	2
RWB-03	7.5	CL	117	10													1, 2
RWB-04	0	CL	93	8													1, 2
RWB-04	5	SC	101	8													1, 2
RWB-04	10	CL	114	9													1, 2

REMARKS
1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

Terracon

SUMMARY OF LABORATORY RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

Borehole No.	Depth (ft.)	USCS Soil Class.	Atterberg Limits		SILT or CLAY	SAND								GRAVEL								COBBLES and BOULDERS
						Fine			Medium			Coarse		Fine				Coarse				
			LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1½"	2"	3"	>3"
EB-01	0	CL	27	9	55	67	78	83	88	93	96	97	100									
EB-02	5	CL	34	14	69	78	87	92	95	98	99	99	100									
EB-03	0	CL-ML	27	7	59	71	83	88	92	95	96	97	98	99	100	100	100					
EB-05	0	CL	27	8	54	64	75	80	86	91	92	93	95	100								
EB-05	5	SC	29	9	44	52	60	65	69	74	77	78	84	89	97	99	100					
EB-08	0	CL	28	10	54	64	74	80	86	93	95	95	97	98	99	99	100	100				
EB-09	0	SM	NP	NP	17	24	38	47	58	71	76	77	82	85	89	92	95	98				
EB-11	0	SC-SM	25	7	18	24	33	39	47	57	62	63	71	74	80	86	93	96	99	100		
EB-13	0	SC	29	10	44	55	67	73	77	81	83	83	86	87	88	88	88	88	94	100		
EB-16	2.5	CL	37	19	62	73	84	90	93	96	97	98	98	99	99	100	100					
EB-17	4	SC	29	10	38	47	59	65	70	76	79	80	83	85	88	90	92	93	95	95	100	100
EB-21	2.5	SC-SM	25	5	19	24	35	45	57	71	80	82	91	93	97	99	99	100				
EB-23	0	CL-ML	25	6	58	70	82	87	91	94	96	97	98	98	99	99	99	100				
EB-25	0	CL	28	11	57	69	81	87	92	96	97	98	99	99	100	100	100					
EB-26	0	CL	28	12	65	76	87	92	96	98	99	99	100	100								
EB-28	2.5	SM	22	3	45	59	80	88	93	96	97	97	98	98	99	99	100					
EB-29	2.5	CL	33	15	69	81	90	93	96	98	99	99	100									
EB-30	0	SC	27	11	46	56	69	75	82	88	91	92	95	97	98	99	99	100	100			
EB-32	0	CL	26	10	68	79	88	91	94	97	98	98	98	99	99	99		99	100			
EB-34	0	CL	29	11	61	71	79	83	87	91	93	93	96	97	98	99	100	100				
EB-36	1	SC	29	11	45	54	62	65	69	73	75	76	80	82	86	89	95	98	99	100		
NWB-02	2.5	CL	32	12	61	70	79	83	87	91	94	95	100									
NWB-03	0	CL-ML	25	6	52	62	73	79	84	90	92	92	96	97	100	100	100					
NWB-05	2.5	CL	26	11	50	61	73	80	87	95	97	97	99	99	100	100						
NWB-05/06	15	SM	NP	NP	17	24	37	49	60	78	88	91	97	98	100	100						

REMARKS
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Terracon

SUMMARY OF GRAIN SIZE DISTRIBUTION

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

Borehole No.	Depth (ft.)	USCS Soil Class.	Atterberg Limits		SILT or CLAY	SAND								GRAVEL								COBBLES and BOULDERS
						Fine			Medium			Coarse		Fine				Coarse				
			LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1½"	2"	3"	>3"
OBB-01	20	SC	33	14	20	25	34	40	49	64	72	74	78	80	83				100			
OBB-01	40	ML	38	13	83	95	98	99	100	100	100											
OBB-01	65	CH	56	32	76	81	84	84	85	85	85	86	86	87	88	90	94	96				
OBB-01	70	CL	49	28	91	96	99	100	100	100	100											
OBB-02	2.5	CL	31	10	53	64	73	78	81	86	89	89	91	91	93	95	100					
OBB-02	15	SW-SM	NP	NP	11	15	23	31	42	71	84	86	93	94	97	97	97	100				
OBB-02	35	SM	NP	NP	14	20	41	58	69	82	87	89	94	95	97	99	100					
OBB-02	80	CH	57	30	96	97	98	98	99	100	100											
OBB-03	40	ML			75	83	90	92	95	99	100	100										
OBB-03	60	CH	53	28	89	95	98	98	98	98	98	99	100									
OBB-03	80	SW-SM	NP	NP	12	16	32	49	67	86	90	91	93	94	95	96	98	98				
OBB-04	10	CL	33	17	62	74	86	91	95	98	99	99	100									
OBB-04	45	ML	NP	NP	69	78	90	94	96	99	100											
OBB-04	60	ML	34	6	84	89	91	91	92	92	93	93	94	95	96	97	98	100				
OBB-06	5	CL	29	13	69	79	89	92	95	98	100	100	100									
OBB-06	35	SC	34	14	49	55	60	63	66	71	79	82	100									
OBB-06	65	SP-SM	NP	NP	7	10	16	22	31	44	53	55	65	69	76	82	92	96	100			
OBB-07	10	SC-SM	28	6	29	42	60	69	76	87	92	93	98	98	100	100						
OBB-07	20	SM	NP	NP	22	39	60	66	70	77	84	86	96	96	97	97	98	100				
OBB-08	10	SC	33	12	36	52	72	79	85	91	94	94	96	96	99	100						
OBB-08	30	CL	36	15	71	77	79	80	81	85	89	91	100									
OBB-09	35	CL	33	15																		
OBB-09	65	GC	29	10	16	17	18	19	27	38	42	44	49	52	58	63	72	78	100			
OBB-10	0	CL	29	12	68	77	85	89	92	95	96	97	98	98	99	100						
OBB-10	15	SM	NP	NP	26	43	55	60	65	73	80	83	91	93	96	98	100					

REMARKS
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Terracon

SUMMARY OF GRAIN SIZE DISTRIBUTION

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

Borehole No.	Depth (ft.)	USCS Soil Class.	Atterberg Limits		SILT or CLAY	SAND								GRAVEL								COBBLES and BOULDERS
						Fine			Medium			Coarse		Fine				Coarse				
			LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1½"	2"	3"	>3"
OBB-10	50	CL			63																	
OBB-11	15	SM			26																	
OBB-11	30	GC	45	23	44	49	54	56	59		64	65	66	67		68		69		76	100	100
OBB-11	50	ML	23	2	52	92	100															
OBB-11	65	SM	33	9	39	50	59	63	67	76	79	80	82	83	85	89	90	97				
OBB-12	15	CL	30	14	62	75	85	89	92	95	96	97	98	98			98	99	100			
OBB-12	45	CL	46	20	55	64	70	73	75	77	79	79	82	83	84	85	85	85	85	100		
OBB-12	60	CH	51	26	82	87	88	88	88	89	90	91	93	93	95	96	100					
OBB-13	40	SM	28	4	30	41	61	72	80	87	90	91	94	96	97	98	100					
OBB-13	50	CL	48	24	72	81	85	86	86	86	87	87	87	88	90	92	96	97	100			
OBB-14	10	CL	33	15	80	90	96	97	98	99	100	100	100									
OBB-14	40	ML	NP	NP	90	98	99	100	100	100	100	100										
OBB-14	50	CL-ML	25	7	58	75	89	93	97	99	100	100	100									
RWB-02	15	CL	37	21	61	74	85	88	90	92	94	95	100									
RWB-03	2.5	CL	37	19	68	78	88	92	95	97	98	99	100	100								
RWB-06	15	SC	34	16	24	31	40	56	63	71	76	78	84	86	91	94	100					
RWB-07	0	CL	34	15	53	68	85	90	93	96	97	97	98	98	99	99	100					
RWB-07	10	CL	35	16	70	81	90	93	95	97	98	99	100									
RWB-09	10	CL	31	13	58	69	82	88	92	97	98	99	100									
RWB-12	5	CL	40	16	72	85	91	93	95	97	99	99	100									
RWB-13	5	CL	39	14	63	75	81	84	86	89	92	93	99	100	100							
RWB-14	5	ML	32	8																		
RWB-15	3	CL	38	19	56	66	77	83	87	93	95	96	99	100	100							
RWB-16	0	CL	30	12	53	65	81	87	92	96	98	99	100									
RWB-18	2.5	CL	42	21	67	76	86	90	93	96	98	98	99	100	100							

REMARKS
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Terracon

SUMMARY OF GRAIN SIZE DISTRIBUTION

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Corrosivity					Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			pH	Resistivity (ohm-cm)	Water Soluble			
						LL	PL	PI			Salts (ppm)	Sulfates (ppm)	Chlorides (ppm)	
OBB-01	35	CL										22		2
OBB-01	65	CH	100	25	76	56	24	32				52		1
OBB-02	2.5	CL	99	7	53	31	21	10				54		1
OBB-02	50	SC	114	8								15		1, 2
OBB-02	80	CH	90	31	96	57	27	30				33		1
OBB-03	30	SC	109	14								83		1, 2
OBB-03	60	CH			89	53	25	28				27		
OBB-04	15	CL										28		2
OBB-04	55	CL										18		2
OBB-06	0	SC										11	61	2
OBB-06	25	CL	108	7								19		1, 2
OBB-06	55	CL										32		2
OBB-08	0								8.0	130		23	140	2
OBB-08	35	CL										30	170	2
OBB-10	5	CL	104	8								83		1, 2
OBB-10	35	CL	94	20								24		1, 2
OBB-10	55	CL	100	23								30		1, 2
OBB-11	20	SM	91	11								44		1, 2
OBB-11	55	ML										11		2
OBB-12	0	CL	111	14								16	93	1, 2
OBB-12	15	CL	115	8	62	30	16	14				56		1
OBB-12	45	CL			55	46	26	20				35		
OBB-13	10	CL	105	9								14		1, 2
OBB-13	50	CL	102	20	72	48	24	24				40		1
OBB-14	10	CL	113	10	80	33	18	15				120		1

REMARKS
1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.

Terracon

SUMMARY OF LABORATORY RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

Borehole No.	Depth (ft.)	USCS Soil Class.	Atterberg Limits		SILT or CLAY	SAND								GRAVEL								COBBLES and BOULDERS
						Fine			Medium			Coarse		Fine				Coarse				
			LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1½"	2"	3"	>3"
BB-08	30	ML	NP	NP	63	83	93	97	99	100	100	100	100									
BB-08	80	SP-SM			23	30	42	49	57	67	72	73	78	80	84	86	91	93	97	98	100	100
BB-09	40	CL	42	22	56	69	85	92	96	99	100	100	100									
BB-09	60	GP-GC	51	29	7	9	12	14	16	20	24	26	34	38	45	51	71	89	100			
BB-09	99	SW-SM	NP	NP	9	13	23	33	49	79	91	93	98	99	99	100						
BB-10	20	GW-GM	NP	NP	5	7	10	12	15	22	27	28	37	42	52	60	75	84	93	96	100	100
BB-10	60	SC	39	19	48	58	69	78	86	97	98	99		100	100							
BB-11	30	GP-GM	NP	NP	6	8	12	16	22	33	38	40	46	49	55	59	67	73	81	87	95	95
BB-12	30	SW-SC	31	9	10	13	18	22	27	39	49	51	60	65	73	79	87	90	95	96	98	98
BB-13	0	SP	NP	NP	3	5	15	24	35	54	64	67	74	77	81	85	91	94	97	100	100	100
BB-13	20	SM	NP	NP	12	17	27	32	39	52	56	60	68	72	79	84	90	93	96	98	100	100
BB-13	70	SM	NP	NP	24	34	54	65	74	86	91	93	97	98	99	99	100	100				
BB-14	0	SP-SM	NP	NP	7	12	33	50	66	85	92	93	96	97	98	99	99	100	100			
BB-14	40	GM	NP	NP	13	17	23	28	33	42	45	46	50	53	58	63	72	78	85	92	99	99
BB-14	70	SM	NP	NP	27	38	56	67	75	83	86	86	89	89	91	92	94	98	99	100		
BB-15	0	SW-SM	NP	NP	7	19	27	42	59	83	90	91	95	96	98	98	99	100	100			
BB-15	40	GM	NP	NP	12	16	24	30	35	43	48	49	55	58	64	68	76	86	94	97	100	100
BB-15	60	SM	NP	NP	35	46	61	73	83	93	95	96	97	97	98	99	99	100	100			
BB-16	0	SP-SM	NP	NP	5	11	25	36	48	60	66	67	71	73	75	77	79	96	99	99	100	100
BB-16	30	GP-GM	NP	NP	9	12	19	23	27	32	35	36	40	43	49	54	62	68	78	83	93	93
BB-17	0	SP-SM	NP	NP	9	20	53	70	81	93	96	96	98	98	98	99	99	99	99	100		
BB-17	30	SP-SM	NP	NP	9	12	20	29	41	53	56	57	60	61	65	68	75	78	85	90	100	100
BB-17	85				37	47	60	67	73	79	81	82	84	85	87	89	94	97	100			
BB-18	0	SP-SM	NP	NP	7	12	30	44	59	78	85	87	91	92	94	95	96	97	98	98	100	100
BB-18	20	GP-GM	NP	NP	7	9	12	16	21	30	34	36	41	45	52	57	67	75	87	93	100	100

REMARKS
1.
2.
3.
4.

Terracon

SUMMARY OF LABORATORY RESULTS

Project: I-10 Widening (Sarival Road to SR 101L)
Site: Avondale, Arizona
Job #: 65065088
Date: 2-16-07

Borehole No.	Depth (ft.)	USCS Soil Class.	Atterberg Limits		SILT or CLAY	SAND								GRAVEL								COBBLES and BOULDERS
						Fine			Medium			Coarse		Fine				Coarse				
			LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1½"	2"	3"	>3"
BB-18	80	SM	31	8	26	35	53	63	71	79	81	81	83	84	85	86	87	89	91	93	94	94
BB-20	5	SM	NP	NP	12	21	44	58	69	85	90	91	93	94	97	98	100					
BB-20	20	SP-SM	NP	NP	7	10	14	18	23	41	50	52	57	65	69	73	79	83	89	94	100	100
BB-21	0	SM	NP	NP	12	19	35	47	61	78	85	86	90	91	92	94	96	97	98	98	100	100
BB-21	20	SP-SM	NP	NP	8	9	13	17	25	40	47	49	55	58	64	69	78	84	92	97	100	100
BB-21	65	SM	NP	NP	30	39	54	68	79	87	89	90	94	95	98	99	100					
BB-22	0	SW-SM	NP	NP	11	15	22	29	38	56	66	69	78	81	86	89	94	96	97	98	100	100
BB-22	60	SC	31	14	28	35	46	52	59	69	73	74	81	83	87	89	94	95	97	98	100	100
BB-23	0	SW-SM	NP	NP	10	17	34	46	57	72	77	78	82	85	86	88	90	92	96	99	100	100
BB-23	60	ML	NP	NP	53	61	70	75	79	83	85	85	86	87	89	91	94	95		97	100	100
BB-24	0	SM	NP	NP	15	22	38	48	59	75	82	83	88	89	91	93	95	96	97	98	100	100
BB-24	40	GP-GM	NP	NP	10	13	20	26	31	37	41	42	47	49	54	59	69	77	89	95	100	100
BB-24	70	SC-SM	24	5	32	40	55	64	71	78	81	82	85	87	89	90	93	94	96	98	100	100
BB-25	30	GP-GM	NP	NP	7	9	12	15	20	34	40	41	47	50	55	58	65	71	81	88	97	97
BB-25	70	SM	NP	NP	29	36	51	59	65	72	75	76	81	82	85	87	91	94	98	100		
BB-26	0	SM	NP	NP	15	22	37	48	59	76	84	85	89	90	93	94	96	97	98	99	100	100
BB-26	40	GW-GM	NP	NP	10	12	17	20	23	28	32	33	39	42	49	53	63	69	78	84	97	97
BB-26	80	GC	42	17	38	45	51	54	55	56	57	58	59	62	67	71	75	79	84	93	95	95
BB-27	0	SM	NP	NP	18	27	48	62	75	89	94	95	98	99	99	99	100	100	100	100	100	100
BB-27	30	GP-GM	NP	NP	8	11	16	20	24	31	34	35	39	42	47	51	58	65	75	80	90	90
BB-27	70	SM	NP	NP	43	51	60	64	68	74	78	79	85	87	91	94	96	96	97	99	100	100
BB-28	5	SM	NP	NP	16	26	44	56	67	83	88	89	93	93	95	96	100					
BB-28	20	GW-GM	NP	NP	6	9	13	16	19	25	29	31	37	40	45	49	56	63	74	87	100	100
BB-30	40	SP	NP	NP	4	6	11	17	30	57	64	65	69	70	73	75	79	82	86	89	97	97
BB-30	50	GW-GM	NP	NP	8	10	14	18	21	27	30	31	37	41	47	51	60	68	79	84	100	100

REMARKS
1.
2.
3.
4.

Terracon

SUMMARY OF LABORATORY RESULTS

Project: I-10 Widening (Sarival Road to SR 101L)
Site: Avondale, Arizona
Job #: 65065088
Date: 2-16-07

Borehole No.	Depth (ft.)	USCS Soil Class.	Atterberg Limits		SILT or CLAY	SAND								GRAVEL								COBBLES and BOULDERS
						Fine			Medium			Coarse		Fine				Coarse				
			LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1½"	2"	3"	>3"
BB-30	70	ML	NP	NP	53	77	89	92	94	95	95	95		96		96	100					

REMARKS
1.
2.
3.
4.

Terracon

SUMMARY OF LABORATORY RESULTS

Project: I-10 Widening (Sarival Road to SR 101L)
Site: Avondale, Arizona
Job #: 65065088
Date: 2-16-07

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TABLE B-1
SUMMARY OF LABORATORY TEST RESULST (BO-series)

Station Reference (I-10 Median Centerline)	Offset	Boring Number[1]	Depth (ft)		USCS/Group Symbol	Percent Fines (minus 200)	Plasticity Index	Moisture Content (%)	In Place Dry Density (pcf)[2]	Direct Shear Peformed (ASTM D3080)	Consolidation Performed (ASTM D2435)	Swell Potential (%)	Chlorides (ppm)[3]	Soluble Sulfates (ppm)[3]
			Begin	End										
6790+10	70' L	BO-08	64.5	65.5		---	---	4.5	110.0	---	---	---	---	---
6790+10	70' L	BO-08	74.5	57.1	SC	41	17	---	---	---	---	---	---	---
6790+10	70' L	BO-08	74.5	75.1		---	---	8.9	---	---	---	---	---	---
6790+10	70' L	BO-08	79.5	81.0		---	---	4.3	---	---	---	---	---	---
6790+10	70' L	BO-08	84.5	86.0	SP-SM	11	NP	---	---	---	---	---	---	---
6840+55	70' R	BO-09	2.0	3.0		---	---	14.4	---	---	---	0	---	---
6840+55	70' R	BO-09	9.5	11.0	SC	46	14	---	---	---	---	---	---	---
6840+55	70' R	BO-09	14.5	16.0		---	---	16.0	---	---	---	---	---	---
6840+55	70' R	BO-09	19.5	20.5		---	---	16.7	108.6	---	---	---	---	---
6840+55	70' R	BO-09	24.5	26.0		---	---	11.7	---	---	---	---	---	---
6840+55	70' R	BO-09	29.5	31.0		---	---	13.5	---	---	---	---	190	93
6840+55	70' R	BO-09	34.5	35.5	SM	41	NP	12.7	95.7	---	---	---	---	---
6840+55	70' R	BO-09	39.5	41.0		---	---	16.9	---	---	---	---	---	---
6840+55	70' R	BO-09	44.5	46.0	ML	68	NP	---	---	---	---	---	---	---
6840+55	70' R	BO-09	49.5	50.5	SP-SM	9.8	NP	4.4	106.5	Yes	---	---	---	---
6840+55	70' R	BO-09	54.5	56.0		---	---	12.8	---	---	---	---	---	---
6840+55	70' R	BO-09	59.5	61.0	SP-SM	11	NP	---	---	---	---	---	---	---
6840+55	70' R	BO-09	64.5	65.3		---	---	15.2	117.3	---	---	---	72	18
6840+55	70' R	BO-09	74.5	76.0	SC	17	16	---	---	---	---	---	---	---
6840+55	70' R	BO-09	84.5	85.4		---	---	3.8	---	---	---	---	---	---
6840+55	70' R	BO-09	98.5	99.5		---	---	19.8	104.2	---	---	---	---	---
6842+50	70' L	BO-10	2.0	3.0		---	---	10.8	123.3	---	Yes	---	---	---
6842+50	70' L	BO-10	4.5	6.0	SC-SM	31	7	---	---	---	---	---	---	---
6842+50	70' L	BO-10	9.5	10.5		---	---	16.0	106.6	---	---	---	---	---
6842+50	70' L	BO-10	14.5	16.0	CL	79	14	---	---	---	---	---	---	---
6842+50	70' L	BO-10	19.5	21.0		---	---	17.6	---	---	---	---	---	---
6842+50	70' L	BO-10	24.5	26.0	CL	78	9	---	---	---	---	---	256	132

[1]Identifiers B-# and BO-# on individual lab data sheets are interchangeable
[2](pcf) = pounds per cubic foot
[3](ppm) = parts per million

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TABLE B-1
SUMMARY OF LABORATORY TEST RESULST (BO-series)

Station Reference (I-10 Median Centerline)	Offset	Boring Number[1]	Depth (ft)		USCS/Group Symbol	Percent Fines (minus 200)	Plasticity Index	Moisture Content (%)	In Place Dry Density (pcf)[2]	Direct Shear Peformed (ASTM D3080)	Consolidation Performed (ASTM D2435)	Swell Potential (%)	Chlorides (ppm)[3]	Soluble Sulfates (ppm)[3]
			Begin	End										
6842+50	70' L	BO-10	29.5	30.5		---	---	15.2	104.6	---	---	---	---	---
6842+50	70' L	BO-10	34.5	36.0		---	---	17.2	---	---	---	---	---	---
6842+50	70' L	BO-10	39.5	40.5		---	---	24.3	100.8	---	---	---	---	---
6842+50	70' L	BO-10	44.5	46.0		---	---	28.6	---	---	---	---	---	---
6842+50	70' L	BO-10	49.5	51.0		---	---	4.9	---	---	---	---	---	---
6842+50	70' L	BO-10	54.5	55.5	SM	13	NP	8.3	115.8	Yes	---	---	---	---
6842+50	70' L	BO-10	59.5	61.0		---	---	4.3	---	---	---	---	91	15
6842+50	70' L	BO-10	64.5	64.9	SC-SM	18	7	---	---	---	---	---	---	---
6842+50	70' L	BO-10	69.5	70.4		---	---	3.4	119.4	---	---	---	---	---
6842+50	70' L	BO-10	74.5	74.9		---	---	5.2	---	---	---	---	---	---
6842+50	70' L	BO-10	79.5	80.5	SC	12	9	---	---	---	---	---	---	---
6842+50	70' L	BO-10	84.5	85.5		---	---	5.4	111.2	---	---	---	---	---
Average:						40.8	15.0	11.9	111.9				87.6	39.2
Standard Deviation						21.7	9.9	7.4	30.6				65.3	34.2
Maximum:						79	42	45	318				256	132
Minimum:						6	2	2	76				19	5
Count:						147	147	147	147	10	2	3	147	147

[1]Identifiers B-# and BO-# on individual lab data sheets are interchangeable
[2](pcf) = pounds per cubic foot
[3](ppm) = parts per million

PROJECT:	I-10 Shoulder Widening	JOB NO:	6-117-001063
LOCATION:	Maricopa County, Arizona	WORK ORDER NO:	6
SAMPLE SOURCE:	SEE BELOW	DATE ASSIGNED:	2/7/07

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

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

PERCENT PASSING BY WEIGHT

BO-10 @ 4.5-6.0'	SC-SM	27	7	31	38	46	52	59	71	76	79	84	86	90	92	100	100	100	100	100	100	100	372
BO-10 @ 14.5-16.0'	CL	36	14	79	88	93	94	95	96	97	98	99	99	99	100	100	100	100	100	100	100	100	374
BO-10 @ 24.5-26.0'	CL	26	9	78	88	95	96	98	99	100	100	100	100	100	100	100	100	100	100	100	100	100	376
BO-10 @ 54.5-55.5'	SM	NV	NP	13	20	39	52	64	77	82	83	86	87	89	90	90	90	100	100	100	100	100	382
BO-10 @ 64.5-64.9'	SC-SM	24	7	18	23	30	35	40	50	56	58	67	72	78	81	85	85	100	100	100	100	100	384
BO-10 @ 79.5-80.5'	SC	31	9	12	14	19	22	26	39	47	49	59	63	71	87	100	100	100	100	100	100	100	387

AASHTO R18

REVIEWED BY CS

PROJECT:	I-10 Shoulder Widening	JOB NO:	6-117-001063
LOCATION:	Maricopa County, Arizona	WORK ORDER NO:	7
SAMPLE SOURCE:	SEE BELOW	DATE ASSIGNED:	2/12/07

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

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

PERCENT PASSING BY WEIGHT

BO-9 @ 44.5-46.0'	ML	NV	NP	68	86	96	98	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	422
BO-9 @ 49.5-50.5'	SP-SM	NV	NP	9.8	15	38	69	92	99	99	100	100	100	100	100	100	100	100	100	100	100	100	423
BO-9 @ 59.5-61.0'	SP-SM	NV	NP	11	16	39	56	67	82	88	89	90	90	92	92	94	100	100	100	100	100	100	425
BO-9 @ 74.5-76.0'	SC	35	16	17	22	27	32	40	59	68	70	76	78	83	83	91	91	100	100	100	100	100	428

AASHTO R18

REVIEWED BY

amec

TABLE B-2
SUMMARY OF LABORATORY TEST RESULTS (SH-series)

Station Reference (I-10 Median Centerline)	Offset	Boring Number	Depth (ft)		USCS/Group Symbol	Percent Fines (minus 200)	Plasticity Index	Moisture Content (%)	In Place Dry Density (pcf)[1]	Direct Shear Peformed (ASTM D3080)	Consolidation Performed (ASTM D2435)	Swell Potential (%)	Maximum Dry Density (pcf) (ASTM D698A)	Optimum Moisture Content (%)
			Begin	End										
6803+00	110' R	SH-18	24.5	25.5		---	---	10.0	---	---	---	---	---	---
6803+00	110' R	SH-18	29.5	30.5		---	---	2.6	---	---	---	---	---	---
6816+00	120' L	SH-19	0.0	1.5		---	---	3.8	---	---	---	---	---	---
6816+00	120' L	SH-19	0.0	5.0	CL-ML	54	6	---	---	---	---	---	115.2	13.2
6816+00	120' L	SH-19	2.0	3.0		---	---	7.7	88.3	---	---	---	---	---
6816+00	120' L	SH-19	4.5	5.5		---	---	5.9	---	---	---	---	---	---
6816+00	120' L	SH-19	9.5	10.5	CL	51	18	6.0	104.1	---	---	---	---	---
6816+00	120' L	SH-19	14.5	15.5	SM	21	NP	4.1	100.5	Yes	---	---	---	---
6816+00	120' L	SH-19	19.5	20.3		---	---	1.9	110.6	---	---	---	---	---
6816+00	120' L	SH-19	34.5	36.0		---	---	3.1	---	---	---	---	---	---
6648+00	105' R	SH-02	0.0	5.0	ML	57	NP	---	---	---	---	---	110.8	13.8
6648+00	105' R	SH-02	2.0	3.0		---	---	4.4	106.5	---	---	---	---	---
6648+00	105' R	SH-02	4.5	5.5	CL	63	15	13.4	89.6	Yes	---	---	---	---
6648+00	105' R	SH-02	9.5	10.5		---	---	5.7	107.8	---	---	---	---	---
6648+00	105' R	SH-02	14.5	15.5		---	---	3.0	112.9	---	---	---	---	---
6648+00	105' R	SH-02	19.5	20.5		---	---	2.2	---	---	---	---	---	---
6648+00	105' R	SH-02	24.5	26.0	SM	15	NP	3.2	---	---	---	---	---	---
6648+00	105' R	SH-02	29.5	31.0		---	---	5.0	---	---	---	---	---	---
6816+00	110' R	SH-20	0.0	1.5		---	---	2.7	---	---	---	---	---	---
6816+00	110' R	SH-20	0.0	5.0	CL	64	9	---	---	---	---	---	116.3	13.3
6816+00	110' R	SH-20	2.0	3.0		---	---	7.0	91.6	---	---	---	---	---
6816+00	110' R	SH-20	4.5	5.5	CL	66	9	5.8	89.1	---	Yes	-2	---	---
6816+00	110' R	SH-20	9.5	10.5	SP-SM	8.4	NP	3.0	102.8	Yes	---	---	---	---
6816+00	110' R	SH-20	14.5	15.5		---	---	2.3	118.4	---	---	---	---	---
6816+00	110' R	SH-20	24.5	25.5		---	---	1.7	---	---	---	---	---	---
6816+00	110' R	SH-20	29.5	31.0		---	---	1.2	---	---	---	---	---	---
6829+00	140' L	SH-21	0.0	5.0	CL	64	9	---	---	---	---	---	114.5	14
6829+00	140' L	SH-21	0.0	1.5		---	---	4.2	---	---	---	---	---	---

[1](pcf) = pounds per cubic foot

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TABLE B-2
SUMMARY OF LABORATORY TEST RESULTS (SH-series)

Station Reference (I-10 Median Centerline)	Offset	Boring Number	Depth (ft)		USCS/Group Symbol	Percent Fines (minus 200)	Plasticity Index	Moisture Content (%)	In Place Dry Density (pcf)[1]	Direct Shear Peformed (ASTM D3080)	Consolidation Performed (ASTM D2435)	Swell Potential (%)	Maximum Dry Density (pcf) (ASTM D698A)	Optimum Moisture Content (%)
			Begin	End										
6829+00	140' L	SH-21	2.0	3.0		---	---	8.2	101.9	---	---	---	---	---
6829+00	140' L	SH-21	4.5	5.5	CL	79	12	10.1	105.8	Yes	---	---	---	---
6829+00	140' L	SH-21	9.5	10.5	ML	78	12	10.7	91.7	---	Yes	-0.1	---	---
6829+00	140' L	SH-21	14.5	15.5		---	---	8.3	103.3	---	---	---	---	---
6829+00	140' L	SH-21	19.5	20.3		---	---	6.3	---	---	---	---	---	---
6829+00	140' L	SH-21	24.5	25.5		---	---	7.0	102.0	---	---	---	---	---
6829+00	140' L	SH-21	34.5	36.0		---	---	2.2	---	---	---	---	---	---
6829+00	140' R	SH-22	0.0	1.5		---	---	3.5	---	---	---	---	---	---
6829+00	140' R	SH-22	0.0	5.0	CL	75	9	---	---	---	---	---	114	13.9
6829+00	140' R	SH-22	4.5	5.5	CL	70	16	---	---	---	---	0	---	---
6829+00	140' R	SH-22	9.5	10.5		---	---	10.7	96.1	---	---	---	---	---
6829+00	140' R	SH-22	14.5	15.5	ML	76	9	---	---	Yes	---	---	---	---
6829+00	140' R	SH-22	19.5	20.5		---	---	10.0	93.9	---	---	---	---	---
6829+00	140' R	SH-22	24.5	25.5		---	---	18.4	96.8	---	---	---	---	---
6829+00	140' R	SH-22	29.5	31.0		---	---	2.2	---	---	---	---	---	---
6829+00	140' R	SH-22	34.5	36.0		---	---	2.3	---	---	---	---	---	---
6656+00	140' L	SH-03	0.0	1.5		---	---	3.1	---	---	---	---	---	---
6656+00	140' L	SH-03	0.0	5.0	CL-ML	54	4	---	---	---	---	---	112.4	13.6
6656+00	140' L	SH-03	2.0	3.0		---	---	6.2	94.2	---	Yes	-12.5	---	---
6656+00	140' L	SH-03	4.5	5.5		---	---	5.9	102.5	---	---	---	---	---
6656+00	140' L	SH-03	9.5	10.5	SC	44	12	7.0	100.4	Yes	---	---	---	---
6656+00	140' L	SH-03	14.5	15.2		---	---	13.6	85.7	---	---	---	---	---
6656+00	140' L	SH-03	19.5	20.4	SM	46	NP	11.0	87.6	---	---	---	---	---
6656+00	140' L	SH-03	24.5	26.0		---	---	17.5	---	---	---	---	---	---
6656+00	140' L	SH-03	29.5	30.4		---	---	10.7	---	---	---	---	---	---
6656+00	130' R	SH-04	0.0	1.5		---	---	4.0	---	---	---	---	---	---
6656+00	130' R	SH-04	0.0	5.0	CL-ML	52	7	---	---	---	---	---	112.9	13.6
6656+00	130' R	SH-04	2.0	3.0		---	---	5.2	99.4	---	---	---	---	---

[1](pcf) = pounds per cubic foot

PROJECT:	I-10 Shoulder Widening	JOB NO:	6-117-001063
LOCATION:	Maricopa County, Arizona	WORK ORDER NO:	2
SAMPLE SOURCE:	SEE BELOW	DATE ASSIGNED:	12/6/06

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

				Silt or	SAND								GRAVEL									COBBLES	
				Clay	Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	USCS	LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"	6"	Lab #
PERCENT PASSING BY WEIGHT																							
SH-15 @ 4.5-5.5'	CL	38	15	52	64	80	86	90	93	95	95	97	98	100	100	100	100	100	100	100	100	100	173
SH-15 @ 14.5-15.5'	SP-SM	NV	NP	11	23	57	76	89	98	99	99	100	100	100	100	100	100	100	100	100	100	100	175
SH-20 @ 0.0-5.0'	CL	27	9	64	75	85	89	93	97	98	98	99	99	100	100	100	100	100	100	100	100	100	180
SH-20 @ 4.5-5.5'	CL	31	9	66	84	93	96	97	98	98	98	99	100	100	100	100	100	100	100	100	100	100	183
SH-20 @ 9.5-10.5'	SP-SM	NV	NP	8.4	18	41	59	73	89	95	96	98	99	100	100	100	100	100	100	100	100	100	184
SH-22 @ 0.0-5.0'	CL	27	9	75	85	92	94	95	98	98	99	100	100	100	100	100	100	100	100	100	100	100	190
SH-22 @ 4.5-5.5'	CL	39	16	70	77	83	84	85	88	89	90	93	95	98	99	100	100	100	100	100	100	100	193
SH-22 @ 14.5-15.5'	ML	38	9	76	79	82	83	84	86	89	89	94	95	98	100	100	100	100	100	100	100	100	195
SH-21 @ 0.0-5.0'	CL	27	9	64	76	84	87	90	93	94	95	96	97	99	99	100	100	100	100	100	100	100	200
SH-21 @ 4.5-5.5'	CL	30	12	79	88	93	94	95	96	96	96	97	97	98	99	100	100	100	100	100	100	100	203

AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	JOB NO:	6-117-001063
LOCATION:	Maricopa County, Arizona	WORK ORDER NO:	2
SAMPLE SOURCE:	SEE BELOW	DATE ASSIGNED:	12/6/06

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

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

PERCENT PASSING BY WEIGHT

SH-21 @ 9.5-10.5'	ML	38	12	78	88	93	94	95	96	97	97	99	99	100	100	100	100	100	100	100	100	100	204
SH-19 @ 0.0-5.0'	CL-ML	26	6	54	68	80	86	90	96	97	98	99	99	100	100	100	100	100	100	100	100	100	209
SH-19 @ 9.5-10.5'	CL	42	18	51	60	63	64	65	69	72	73	78	81	90	94	100	100	100	100	100	100	100	213
SH-19 @ 14.5-15.5'	SM	NV	NP	21	40	65	76	83	92	94	95	98	98	100	100	100	100	100	100	100	100	100	214

AASHTO R18

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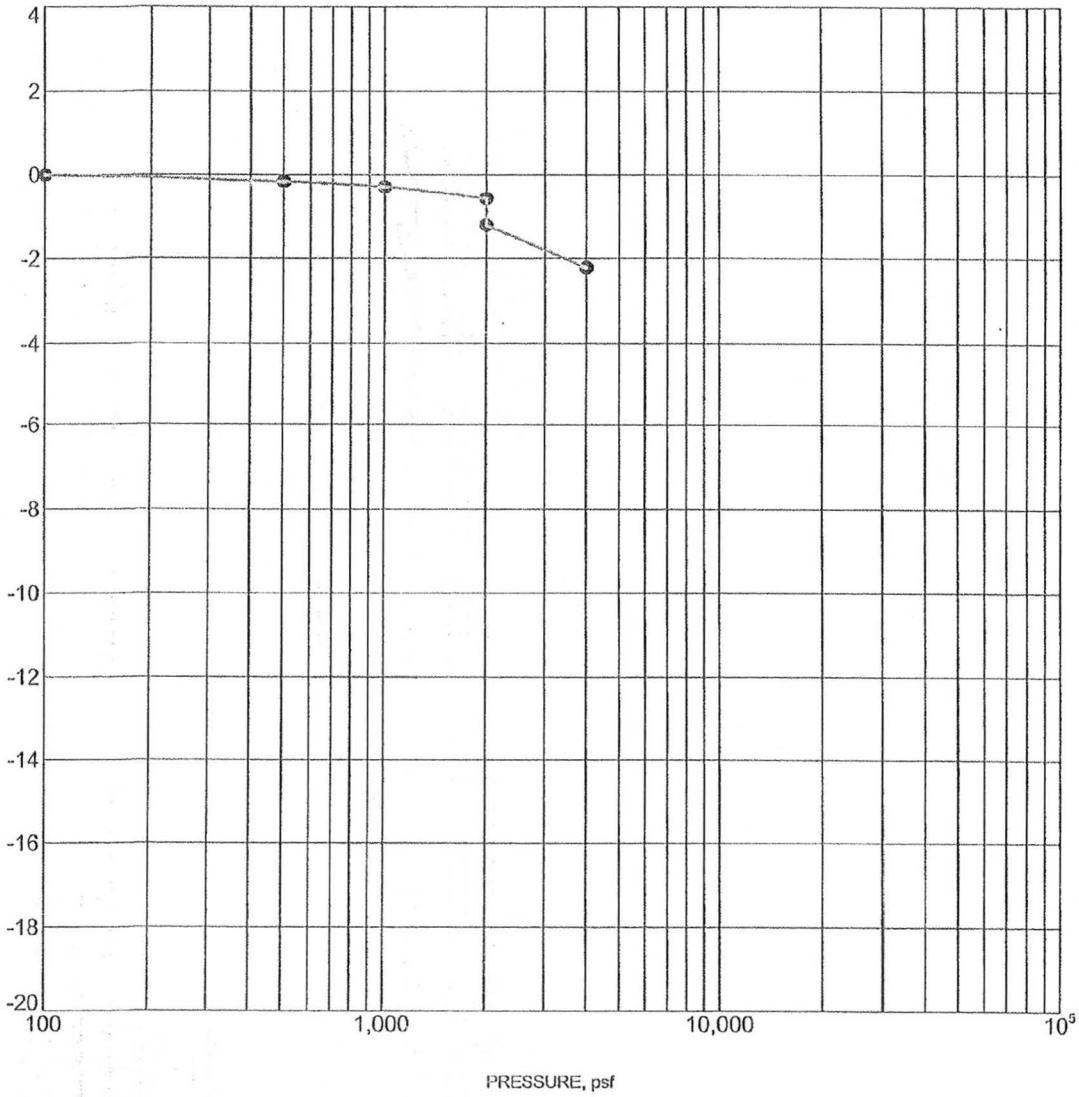


Specimen Identification			Classification	γ_d , pcf	WC,%
●	EB-33	0.0ft	CLAYEY SAND(SC)	106	10

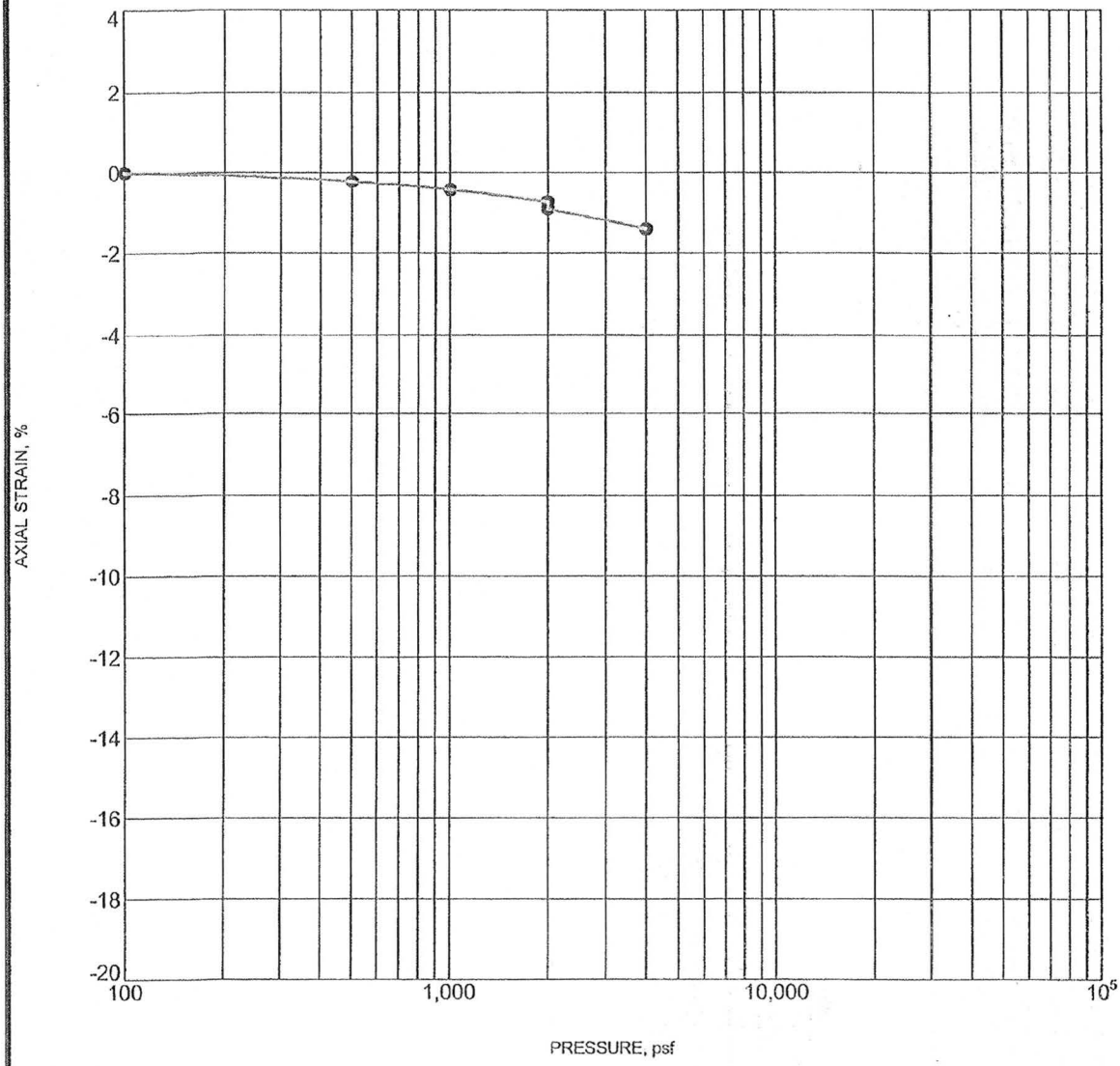
Notes: Water added at 2000 psf.

Terracon

CONSOLIDATION TEST RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

TC CONSOL STRAIN 65075093.GPJ TERRACON.GDT 1/25/08



Specimen Identification			Classification	γ_d , pcf	WC,%
●	EB-33	2.5ft	CLAYEY SAND(SC)	108	16

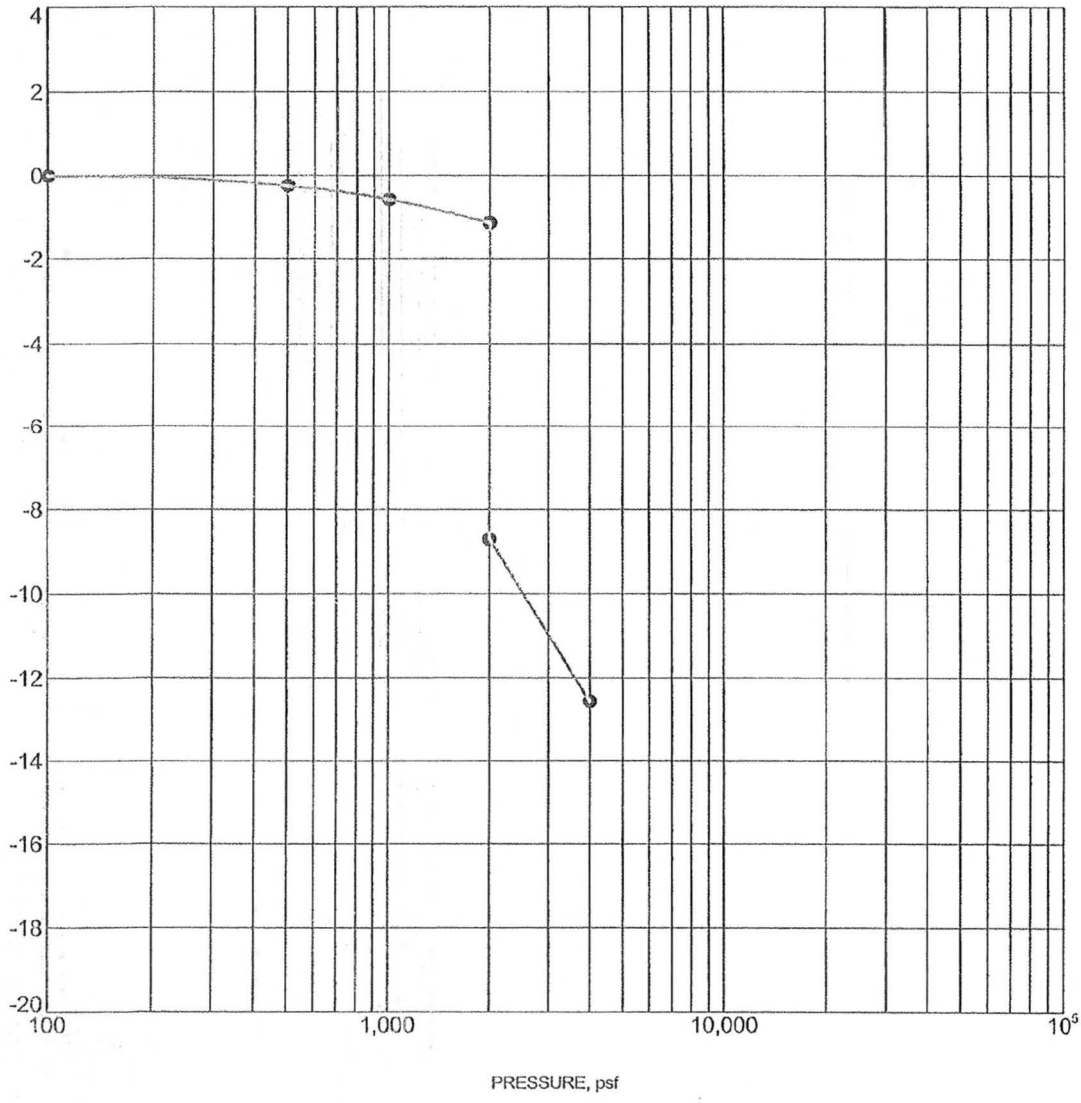
Notes: Water added at 2000 psf.

Terracon

CONSOLIDATION TEST RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

TC CONSOL STRAIN 65075093.GPJ TERRACON.GDT 1/25/08



Specimen Identification		Classification	γ_d , pcf	WC,%
● EB-34	0.0ft	SANDY LEAN CLAY(CL)	93	8

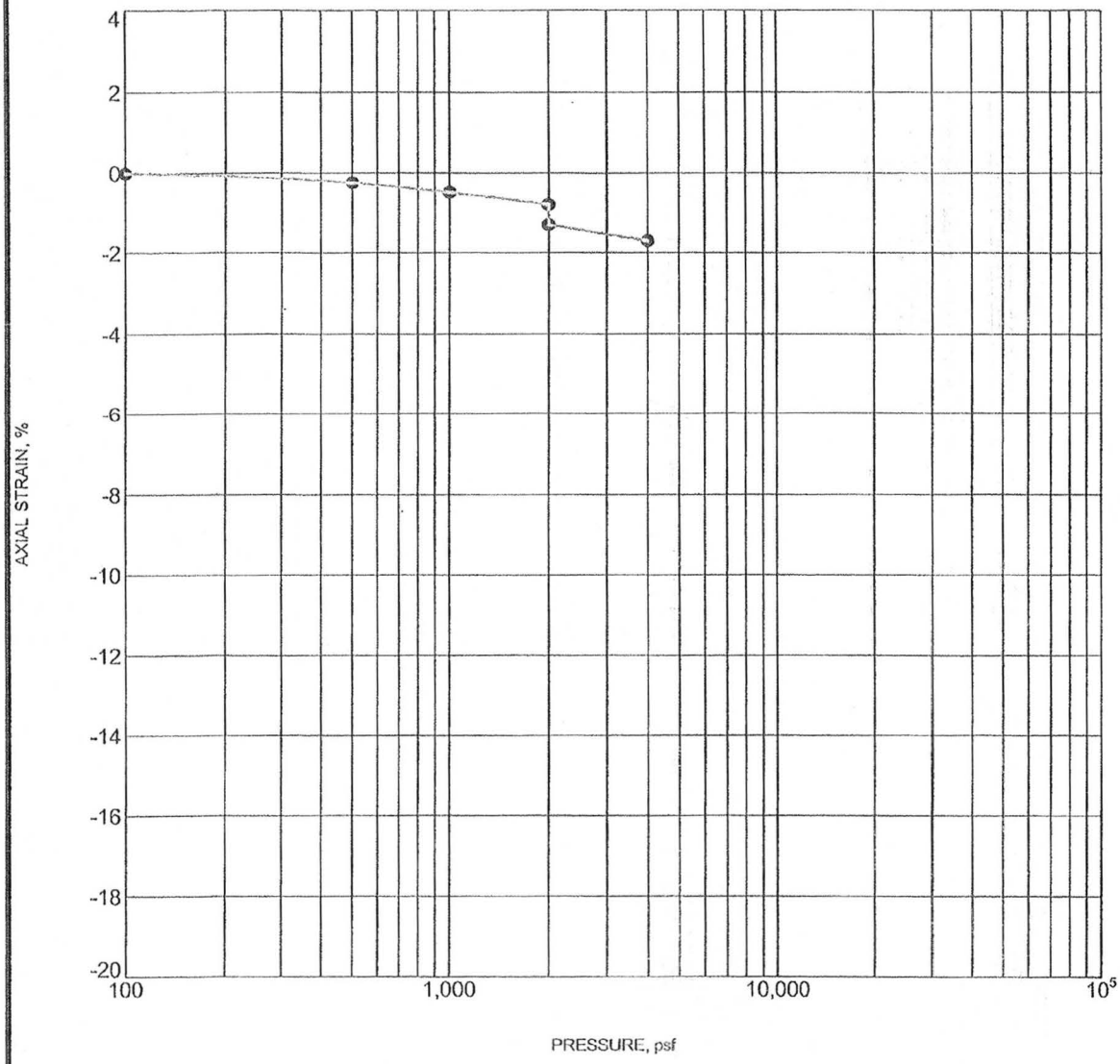
Notes: Water added at 2000 psf.

Terracon

CONSOLIDATION TEST RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

TC CONSOL STRAIN 65075093.GPJ TERRACON.GDT 1/25/08



Specimen Identification			Classification	γ_d , pcf	WC,%
●	EB-34	2.5ft	SANDY LEAN CLAY(CL)	118	10

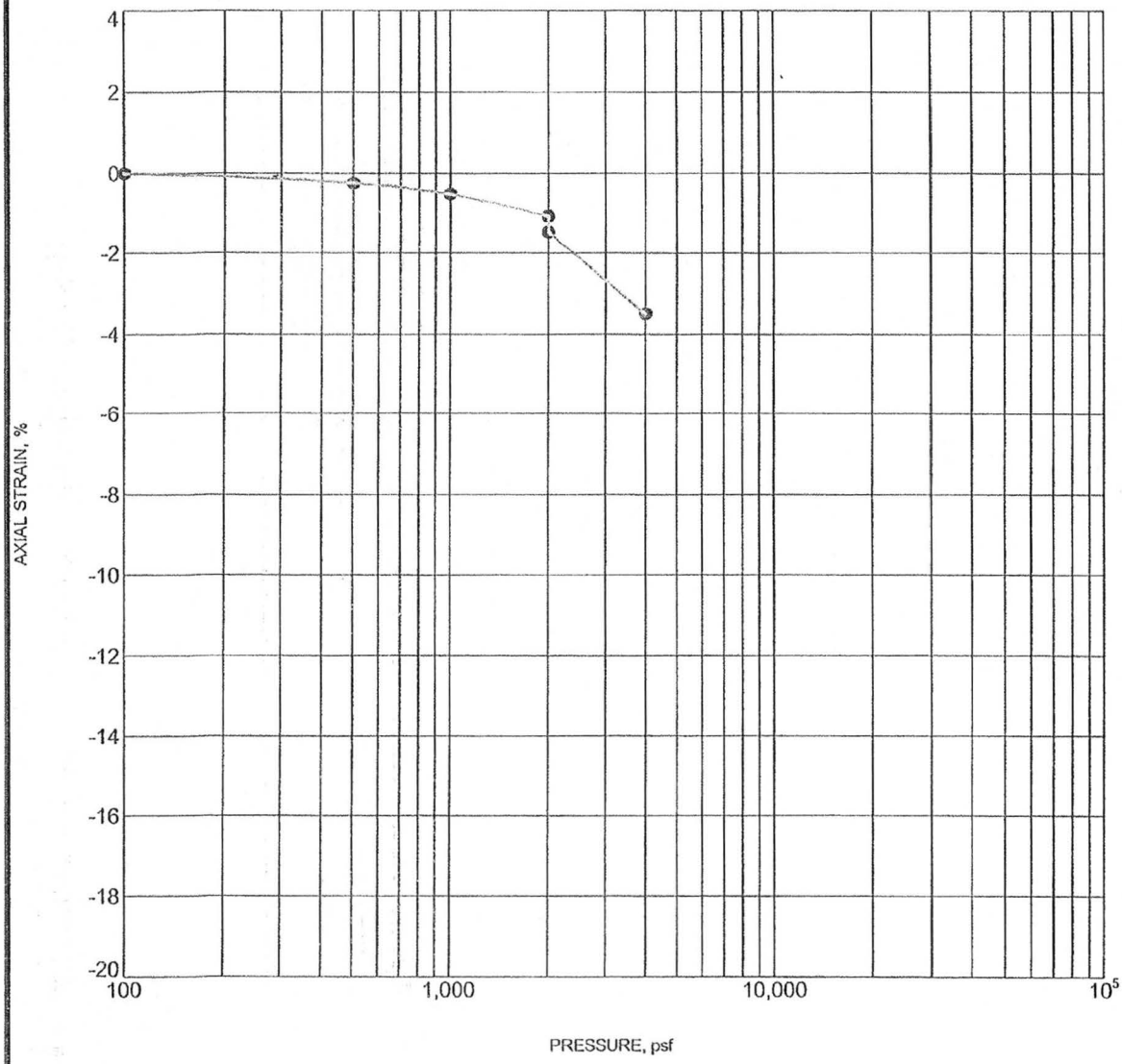
Notes: Water added at 2000 psf.

Terracon

CONSOLIDATION TEST RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

TC CONSOL STRAIN 65075093.GPJ TERRACON.GDT 1/25/08



Specimen Identification			Classification	γ_d , pcf	WC,%
●	EB-35	0.0ft	CLAYEY SAND(SC)	108	13

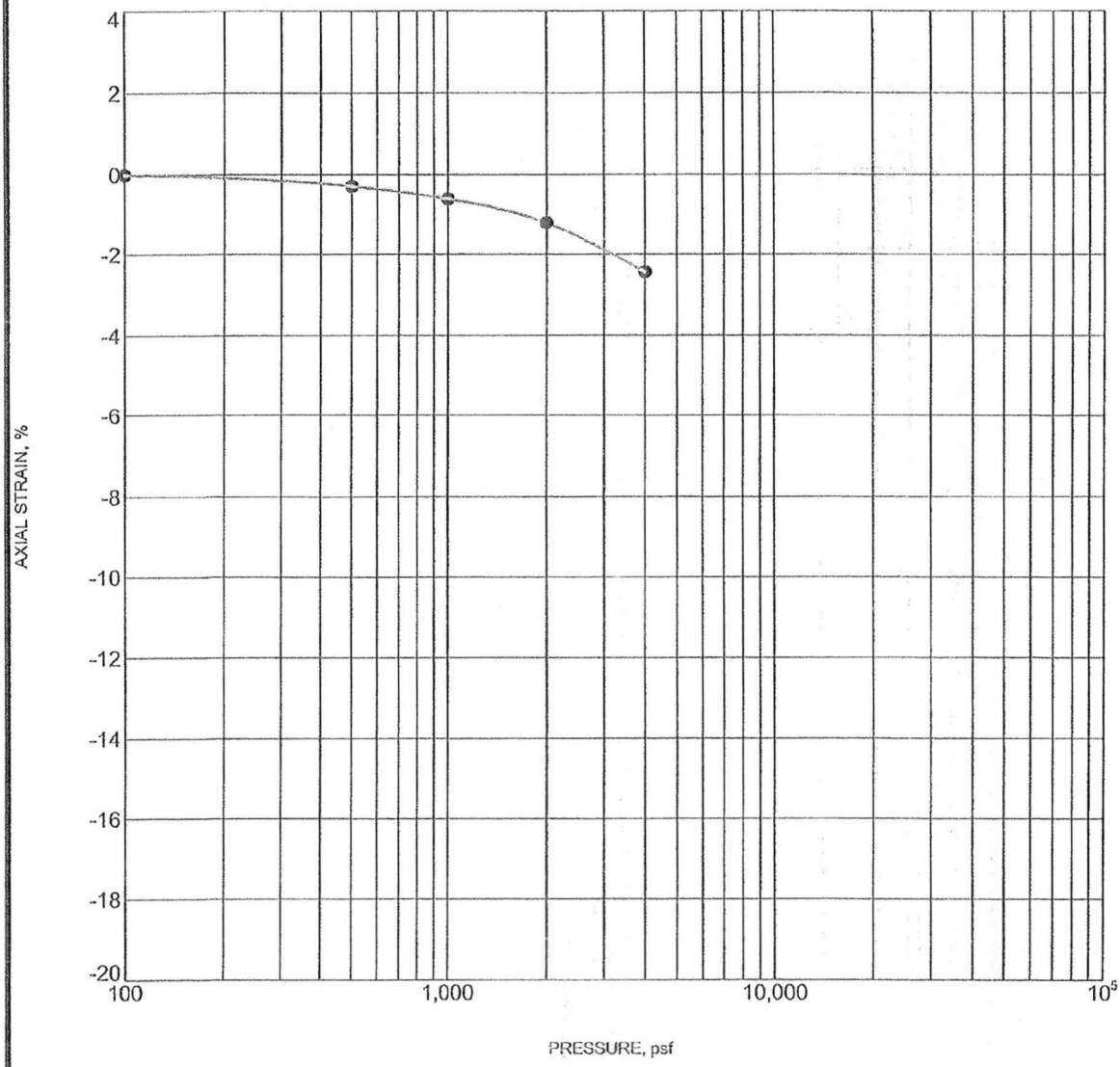
Notes: Water added at 2000 psf.

TC CONSOL STRAIN 65075093.GPJ TERRACON.GDT 1/25/08

Terracon

CONSOLIDATION TEST RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08



Specimen Identification			Classification	γ_d , pcf	WC,%
●	EB-35	5.0ft	CLAYEY SAND(SC)	103	11

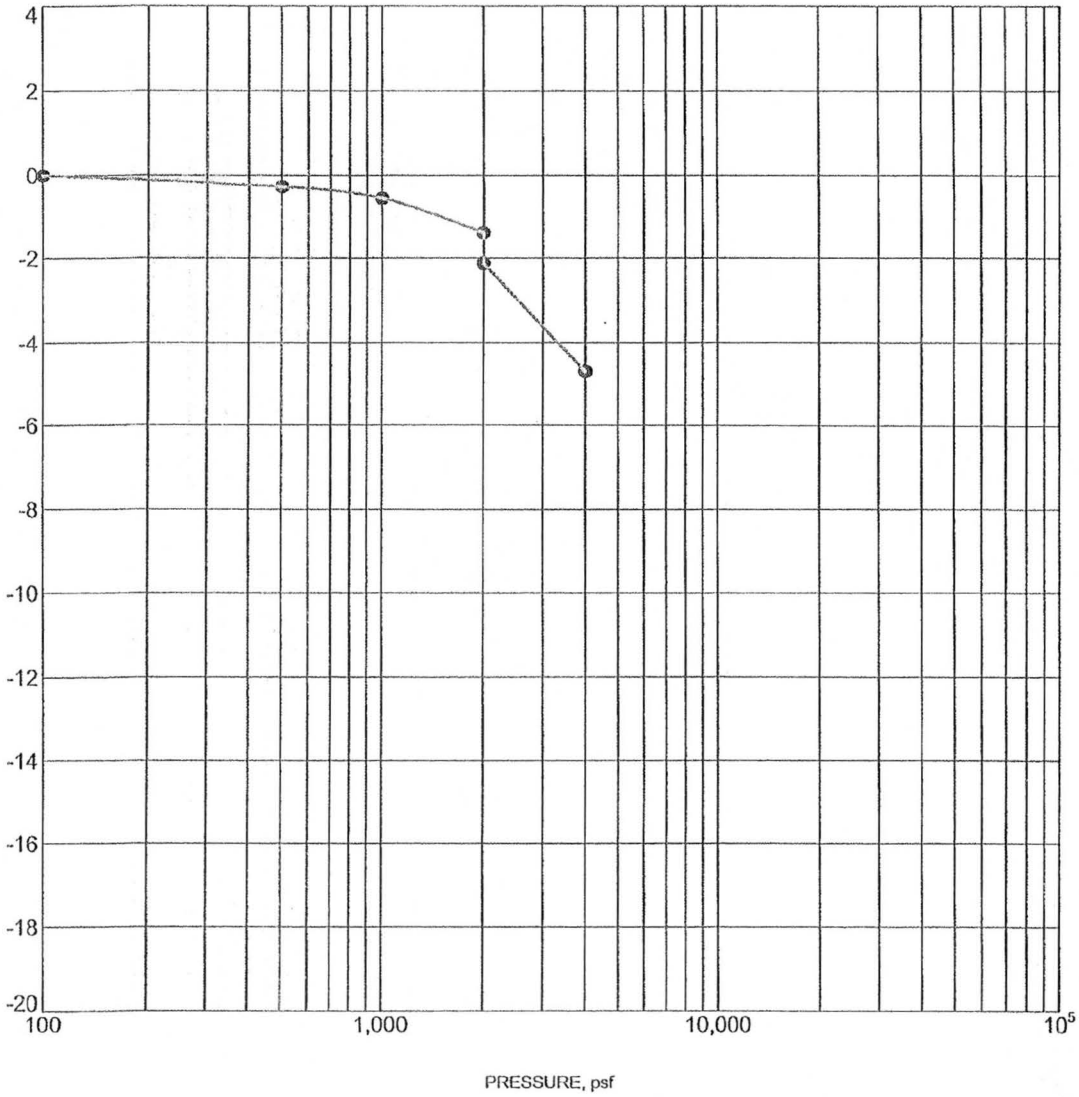
Notes: Water added at 2000 psf.

Terracon

CONSOLIDATION TEST RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

TC CONSOL STRAIN 65075093.GPJ TERRACON.GDT 1/25/08



Specimen Identification		Classification	γ_d , pcf	WC,%
● EB-36	0.0ft	SANDY LEAN CLAY(CL)	89	29

Notes: Water added at 2000 psf.

TC CONSOL STRAIN 65075093.GPJ TERRACON.GDT 1/25/08

Terracon

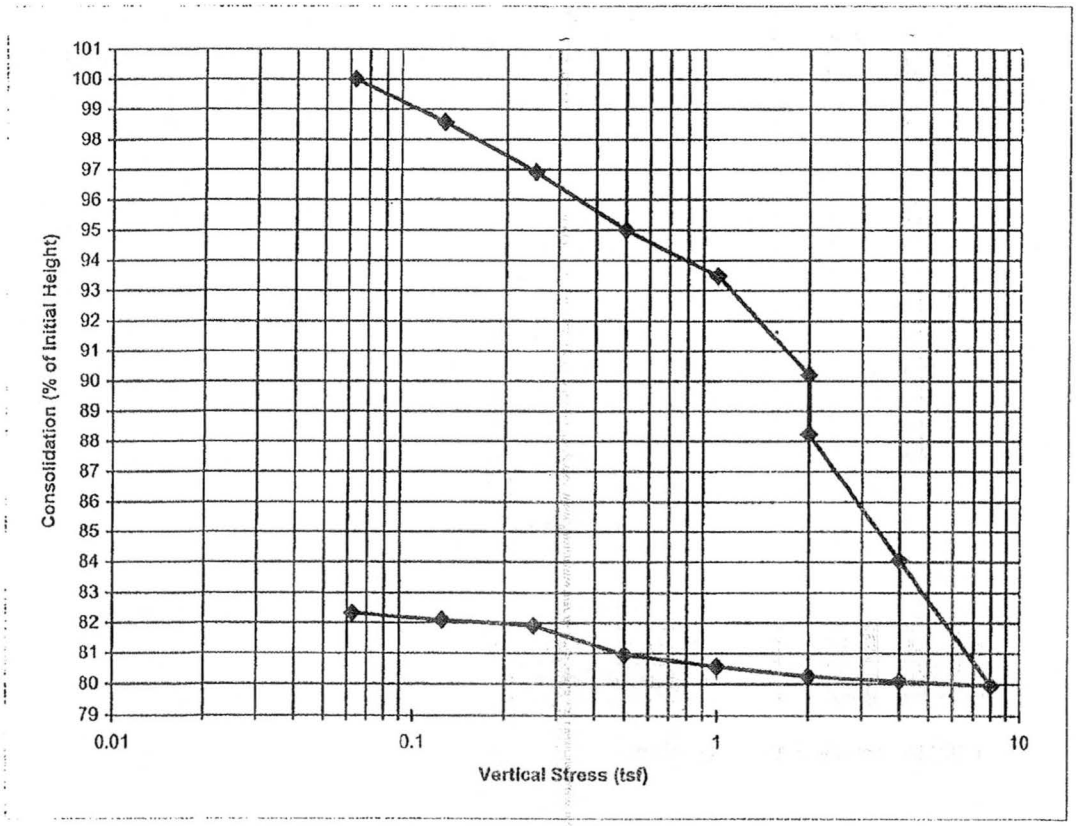
CONSOLIDATION TEST RESULTS

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	2
MATERIAL:	Soil	**LAB NO:**	183
SAMPLE SOURCE:	SH-20 @ 4.5-5.5'	**DATE ASSIGNED:**	12/6/06
SAMPLE PREP:	Insitu		

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL VOLUME (cu.in)	4.60	FINAL VOLUME (cu.in)	3.68
INITIAL MOISTURE CONTENT	5.8%	FINAL MOISTURE CONTENT	23.9%
INITIAL DRY DENSITY(pcf)	89.1	FINAL DRY DENSITY(pcf)	111.1
INITIAL DEGREE OF SATURATION	16%	FINAL DEGREE OF SATURATION	105%
INITIAL VOID RATIO	1.10	FINAL VOID RATIO	0.68
ESTIMATED SPECIFIC GRAVITY	2.995	SATURATED AT	2 tsf



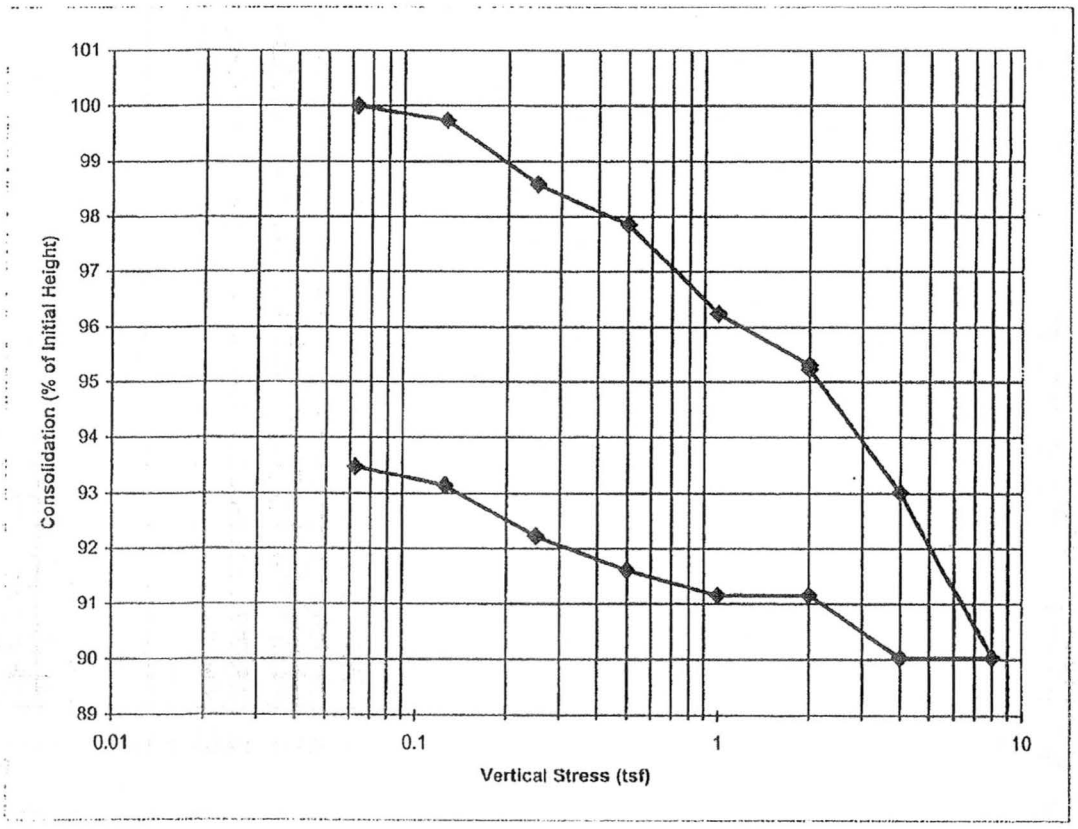
AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	2
MATERIAL:	Soil	**LAB NO:**	204
SAMPLE SOURCE:	SH-21 @ 9.5-10.5'	**DATE ASSIGNED:**	12/6/06
SAMPLE PREP:	Insitu		

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL VOLUME (cu.in)	4.60	FINAL VOLUME (cu.in)	4.14
INITIAL MOISTURE CONTENT	10.7%	FINAL MOISTURE CONTENT	29.2%
INITIAL DRY DENSITY(pcf)	91.7	FINAL DRY DENSITY(pcf)	101.5
INITIAL DEGREE OF SATURATION	31%	FINAL DEGREE OF SATURATION	105%
INITIAL VOID RATIO	1.03	FINAL VOID RATIO	0.83
ESTIMATED SPECIFIC GRAVITY	2.975	SATURATED AT	2 tsf



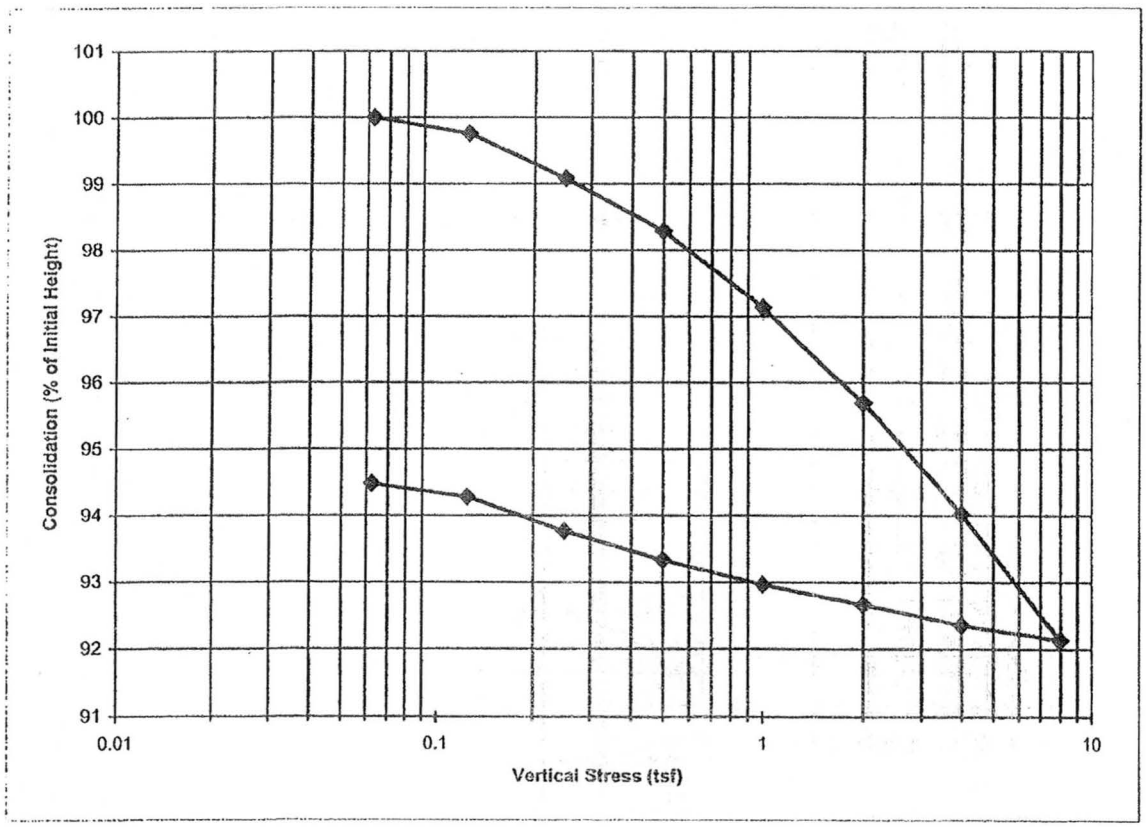
AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	6
MATERIAL:	Soil	**LAB NO:**	371
SAMPLE SOURCE:	BO-10 @ 2.0-3.0'	**DATE ASSIGNED:**	2/7/07
SAMPLE PREP:	Insitu		

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL VOLUME (cu.in)	4.60	FINAL VOLUME (cu.in)	4.24
INITIAL MOISTURE CONTENT	10.8%	FINAL MOISTURE CONTENT	15.0%
INITIAL DRY DENSITY(pcf)	123.3	FINAL DRY DENSITY(pcf)	133.4
INITIAL DEGREE OF SATURATION	58%	FINAL DEGREE OF SATURATION	101%
INITIAL VOID RATIO	0.59	FINAL VOID RATIO	0.46
		SATURATED AT	0.25 tsf



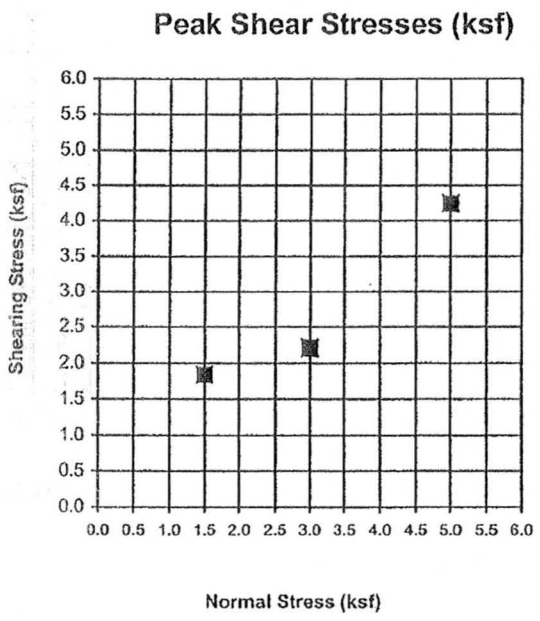
AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	2
MATERIAL:	Soil	**LAB NO:**	214
SAMPLE SOURCE:	SH-19 @ 14.5-15.5'	**DATE ASSIGNED:**	12/06/2006
SAMPLE PREPARATION:	Insitu		
	Innundated for 30 minutes prior to shear		

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)

Initial thickness of specimen (in.):	1.00		
Initial diameter of specimen (in.):	2.42		
Shearing device used:	DigiShear Automated Shear Test System by Trautwein Soil Testing Equipment		
Rate of deformation (in/min):	0.016		
Direct shear point:	1	2	3
Dry mass of specimen (g):	127.5	119.6	116.9
Initial Moisture Content:	3.8%	4.3%	4.1%
Initial Wet Density (lb per cu.ft):	109.5	103.2	100.7
Initial Dry Density (lb per cu.ft):	105.6	99.0	96.8
Final Moisture Content:	25.6%	29.7%	31.5%
Final Wet Density (lb per cu.ft):	132.5	128.3	127.2
Final Dry Density (lb per cu.ft):	105.5	99.0	96.7
Normal Stress (ksf):	1.5	3.0	5.0
Maximum Shearing Stress (kips per sq. ft):	1.84	2.21	4.24
Vertical Deformation @ Max Shear (in):	0.018	0.041	0.040
Horizontal Deformation @ Max Shear (in):	0.329	0.477	0.468



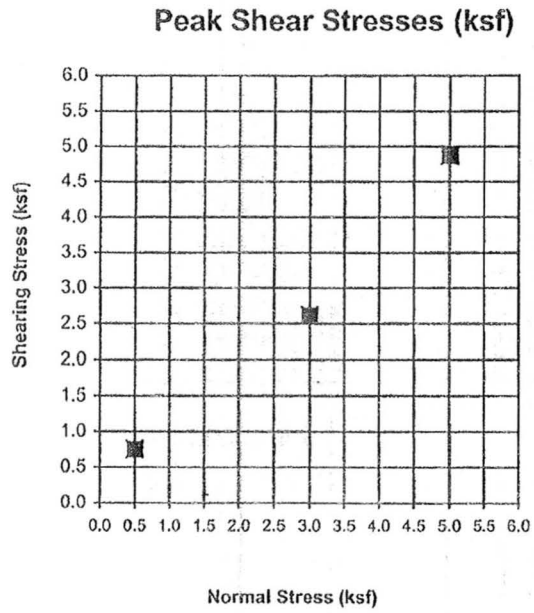
AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	2
MATERIAL:	Soil	**LAB NO:**	184
SAMPLE SOURCE:	SH-20 @ 9.5-10.5'	**DATE ASSIGNED:**	12/06/2006
SAMPLE PREPARATION:	Inaitu Innundated for 30 minutes prior to shear		

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)

Initial thickness of specimen (in.):	1.00		
Initial diameter of specimen (in.):	2.42		
Shearing device used:	DigiShear Automated Shear Test System by Trautwein Soil Testing Equipment		
Rate of deformation (in/min):	0.016		
Direct shear point:	1	2	3
Dry mass of specimen (g):	123.2	120.3	128.7
Initial Moisture Content:	3.2%	2.6%	3.1%
Initial Wet Density (lb per cu.ft):	105.3	102.2	109.8
Initial Dry Density (lb per cu.ft):	102.0	99.7	106.6
Final Moisture Content:	24.1%	22.0%	20.7%
Final Wet Density (lb per cu.ft):	126.6	121.5	128.6
Final Dry Density (lb per cu.ft):	102.0	99.6	106.5
Normal Stress (ksf):	0.5	3.0	5.0
Maximum Shearing Stress (kips per sq. ft):	0.75	2.62	4.87
Vertical Deformation @ Max Shear (in):	0.035	0.029	0.041
Horizontal Deformation @ Max Shear (in):	0.496	0.420	0.499



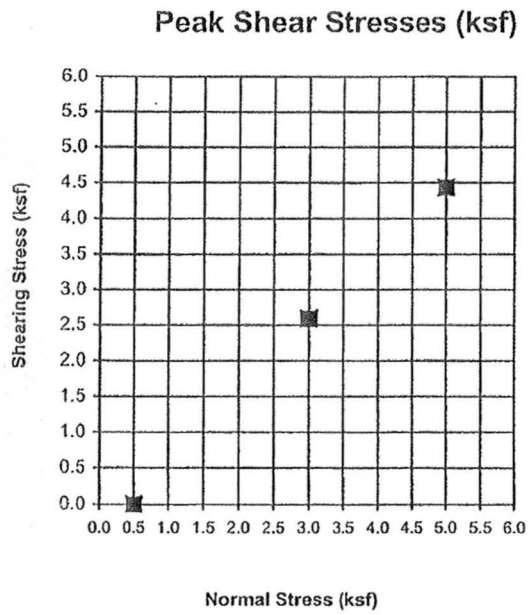
AASHTO R16

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	2
MATERIAL:	Soil	**LAB NO:**	203
SAMPLE SOURCE:	SH-21 @ 4.5-5.5'	**DATE ASSIGNED:**	12/06/2006
SAMPLE PREPARATION:	Insitu Innundated for 30 minutes prior to shear		

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)

Initial thickness of specimen (in.):	1.00		
Initial diameter of specimen (in.):	2.42		
Shearing device used:	DigiShear Automated Shear Test System by Trautwein Soil Testing Equipment		
Rate of deformation (in/min):	0.016		
Direct shear point:	1	2	3
Dry mass of specimen (g):	130.0	127.4	126.0
Initial Moisture Content:	8.1%	9.5%	12.6%
Initial Wet Density (lb per cu.ft):	116.3	115.5	117.4
Initial Dry Density (lb per cu.ft):	107.7	105.5	104.3
Final Moisture Content:	24.2%	26.0%	30.7%
Final Wet Density (lb per cu.ft):	133.7	132.9	136.3
Final Dry Density (lb per cu.ft):	107.6	105.4	104.3
Normal Stress (ksf):	0.5	3.0	5.0
Maximum Shearing Stress (kips per sq. ft):	0.00	2.59	4.43
Vertical Deformation @ Max Shear (in):	0.000	0.036	0.047
Horizontal Deformation @ Max Shear (in):	0.000	0.494	0.468



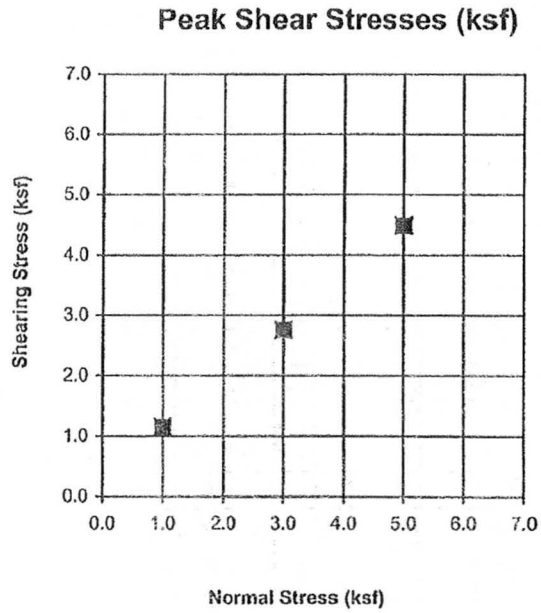
AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	JOB NO:	6-117-001063
LOCATION:	Maricopa County, Arizona	WORK ORDER NO:	7
MATERIAL:	Soil	LAB NO:	423
SAMPLE SOURCE:	BO-9 @ 49.5-50.5'	DATE ASSIGNED:	02/12/2007
SAMPLE PREPARATION:	Insitu Innundated for 30 minutes prior to shear		

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)

Initial thickness of specimen (in.):	1.00		
Initial diameter of specimen (in.):	2.42		
Shearing device used:	DigiShear Automated Shear Test System by Trautwein Soil Testing Equipment		
Rate of deformation (in/min):	0.016		
Direct shear point:	1	2	3
Dry mass of specimen (g):	127.9	128.3	129.5
Initial Moisture Content:	4.4%	4.3%	4.4%
Initial Wet Density (lb per cu.ft):	110.5	110.7	111.8
Initial Dry Density (lb per cu.ft):	106.0	106.2	107.2
Final Moisture Content:	3.9%	3.8%	3.9%
Final Wet Density (lb per cu.ft):	110.1	110.3	111.4
Final Dry Density (lb per cu.ft):	105.9	106.2	107.2
Normal Stress (ksf):	1.0	3.0	5.0
Maximum Shearing Stress (kips per sq. ft):	1.16	2.76	4.49
Vertical Deformation @ Max Shear (in):	0.014	0.018	0.028
Horizontal Deformation @ Max Shear (in):	0.381	0.500	0.493



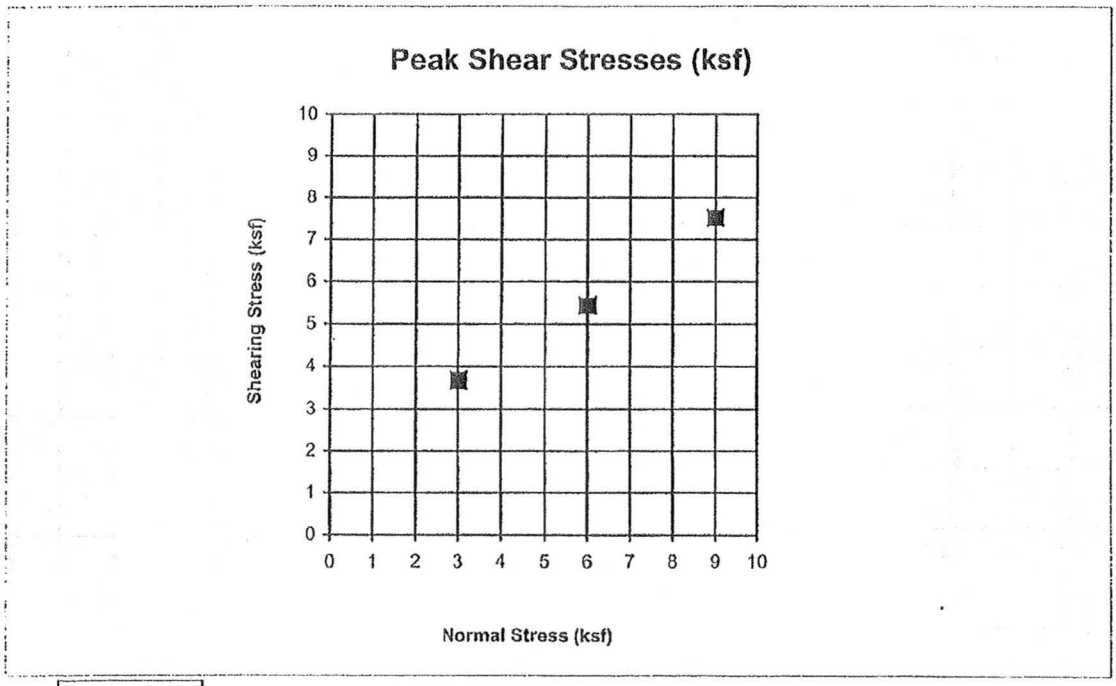
AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	JOB NO:	6-117-001063
LOCATION:	Maricopa County, Arizona	WORK ORDER NO:	6
MATERIAL:	Soil	LAB NO:	382
SAMPLE SOURCE:	BO-10 @ 54.5-55.5'	DATE ASSIGNED:	02/07/2007
SAMPLE PREPARATION:	Insitu Innundated for 30 minutes prior to shear		

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)

Initial thickness of specimen (in.):	1.00		
Initial diameter of specimen (in.):	2.42		
Shearing device used:	DigiShear Automated Shear Test System by Trautwein Soil Testing Equipment		
Rate of deformation (in/min):	0.016		
Direct shear point:	1	2	3
Dry mass of specimen (g):	140.7	135.6	143.0
Initial Moisture Content:	7.3%	8.7%	8.8%
Initial Wet Density (lb per cu.ft):	124.9	122.0	128.9
Initial Dry Density (lb per cu.ft):	116.5	112.3	118.5
Final Moisture Content:	7.2%	8.1%	8.8%
Final Wet Density (lb per cu.ft):	124.8	121.4	128.8
Final Dry Density (lb per cu.ft):	116.5	112.3	118.4
Normal Stress (ksf):	3.0	6.0	9.0
Maximum Shearing Stress (kips per sq. ft):	3.67	5.44	7.51
Vertical Deformation @ Max Shear (in):	0.012	0.031	0.003
Horizontal Deformation @ Max Shear (in):	0.456	0.438	0.371



AASHTO R18

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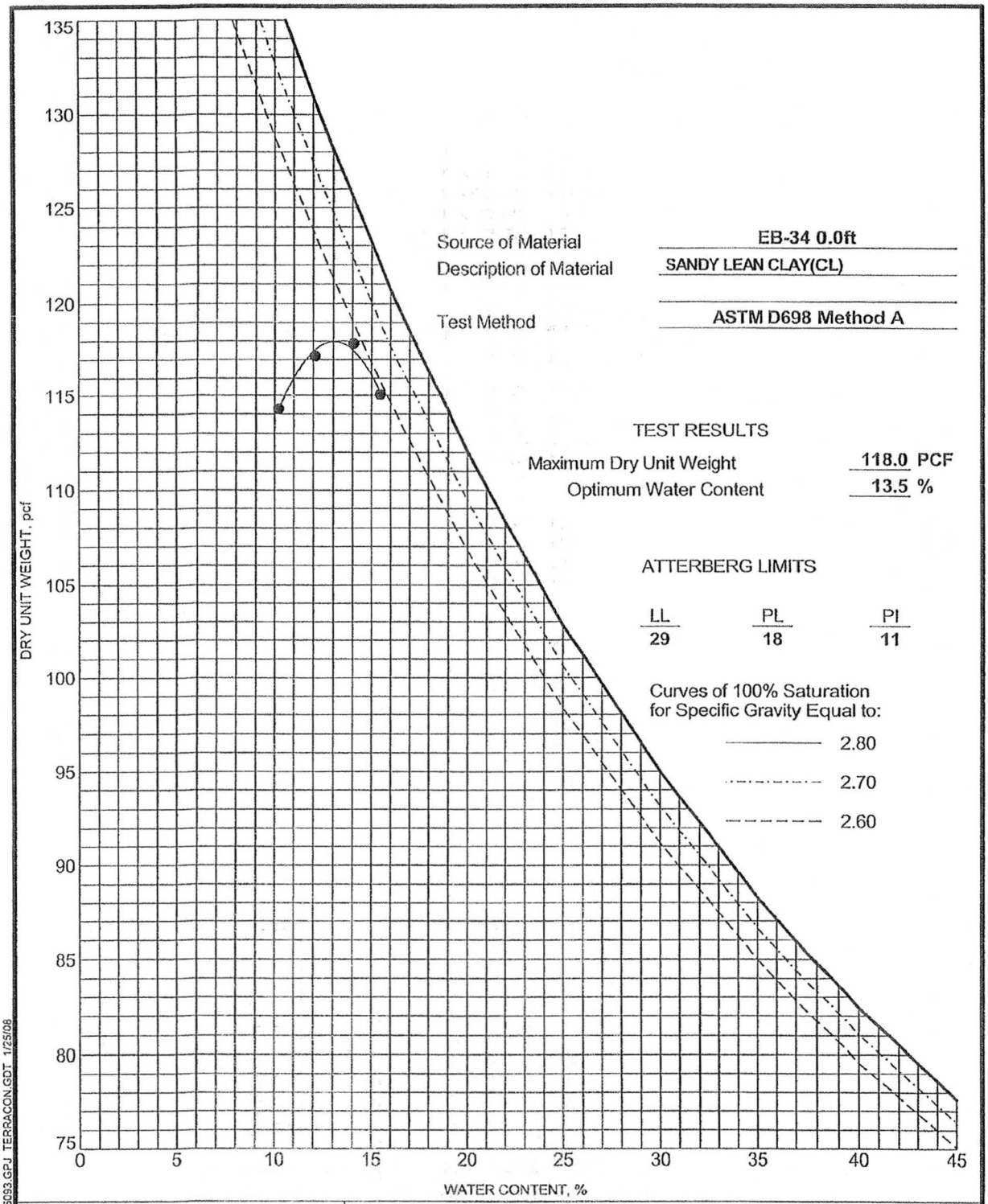
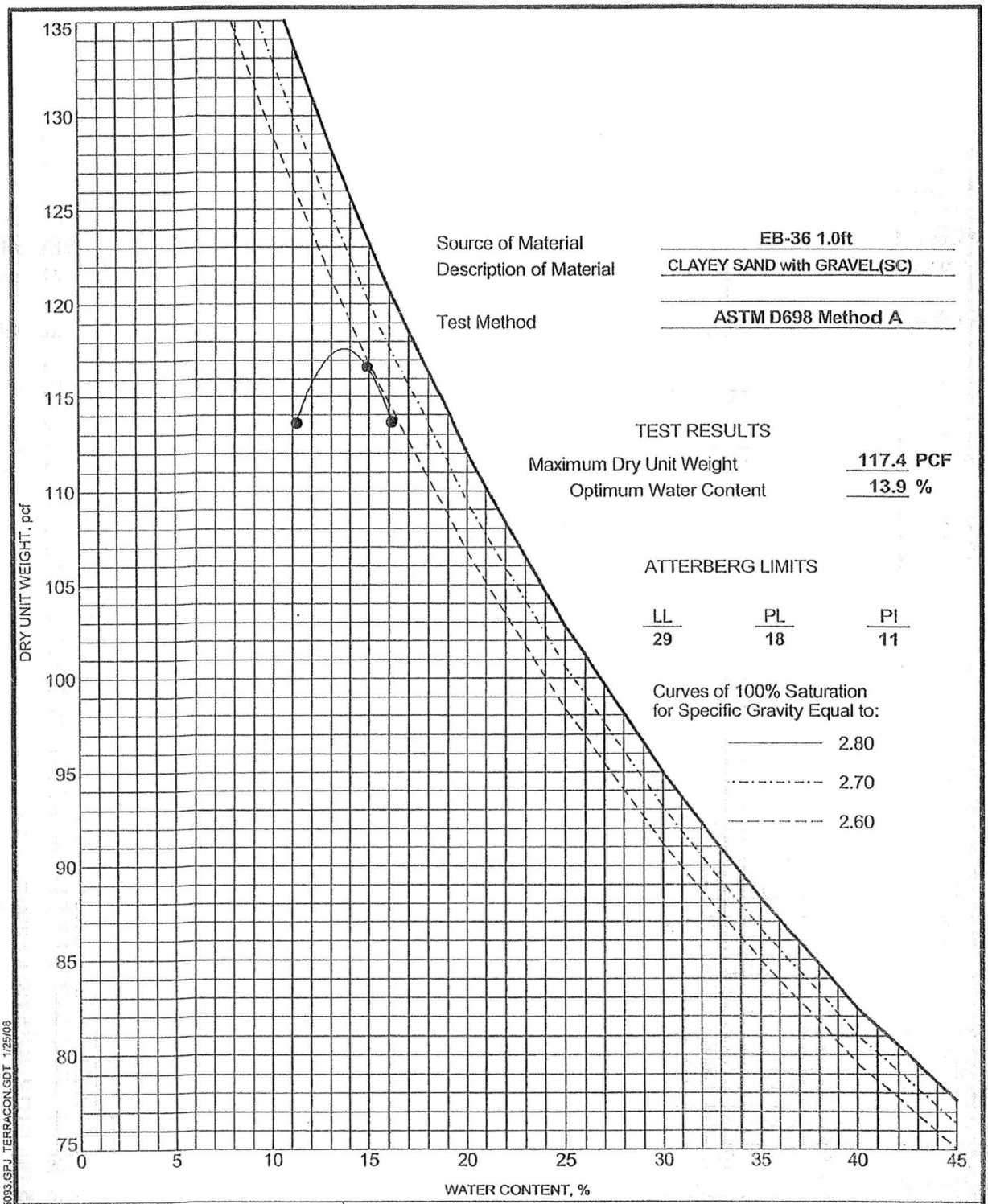


Terracon

MOISTURE-DENSITY RELATIONSHIP

Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

TC COMPACTION 65075093.GPJ TERRACON.GDT 1/25/08



Terracon

MOISTURE-DENSITY RELATIONSHIP

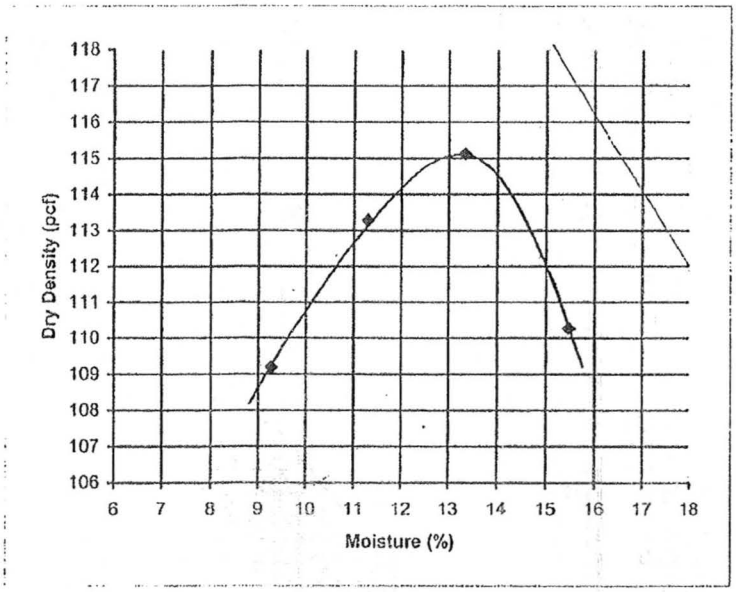
Project: I-10 Outside Widening
Site: Sarival Ave to Dysart Road Maricopa County, Arizona
Job #: 65075093
Date: 1-25-08

TC COMPACTION 65075093.GPJ TERRACON.GDT 1/25/08

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	2
MATERIAL:	Soil	**LAB NO:**	209
SAMPLE SOURCE:	SH-19 @ 0.0-5.0'	**DATE ASSIGNED:**	12/6/06

LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)
SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES (ASTM C136/C117)
DETERMINING PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS (AASHTO T89 & T90)

MAXIMUM DRY DENSITY (pcf):	115.2
OPTIMUM MOISTURE (%):	13.2



SIEVE SIZE	PERCENT PASSING
6"	100
4"	100
3"	100
2"	100
1 1/2"	100
1 1/4"	100
1"	100
3/4"	100
1/2"	100
3/8"	100
1/4"	99
#4	99
#8	98
#10	97
#16	96
#30	90
#40	86
#50	80
#100	68
#200	54

ATTERBERG LIMITS

LL:	26
PL:	20
PI:	6
USCS:	CL-ML

NOTE: THE ZERO AIR VOIDS CURVE REPRESENTS A SPECIFIC GRAVITY OF: 2.651 ASSUMED.

THIS IS A SUMMARIZED REPORT OF THE REFERENCED PROCEDURES AND DOES NOT INCLUDE ALL REPORTING REQUIREMENTS. ADDITIONAL DATA CAN BE PROVIDED AT CLIENT'S REQUEST.

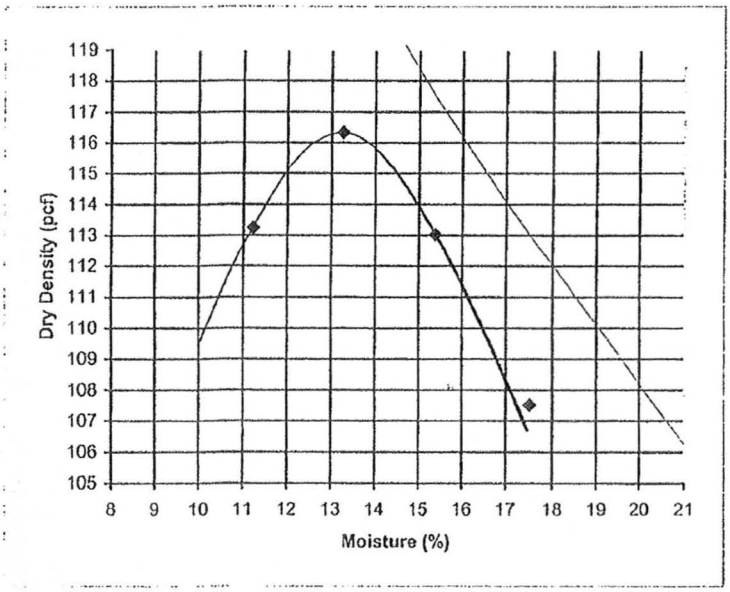
AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	2
MATERIAL:	Soil	**LAB NO:**	180
SAMPLE SOURCE:	SH-20 @ 0.0-5.0'	**DATE ASSIGNED:**	12/6/06

LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING
STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)
SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES (ASTM C136/C117)
DETERMINING PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS (AASHTO T89 & T90)

MAXIMUM DRY DENSITY (pcf):	116.3
OPTIMUM MOISTURE (%):	13.3



SIEVE SIZE	PERCENT PASSING
6"	100
4"	100
3"	100
2"	100
1 1/2"	100
1 1/4"	100
1"	100
3/4"	100
1/2"	100
3/8"	100
1/4"	99
#4	99
#8	98
#10	98
#16	97
#30	93
#40	89
#50	85
#100	75
#200	64

ATTERBERG LIMITS

LL:	27
PL:	18
PI:	9
USCS:	CL

NOTE: THE ZERO AIR VOIDS CURVE REPRESENTS A SPECIFIC GRAVITY OF: 2.651 ASSUMED.

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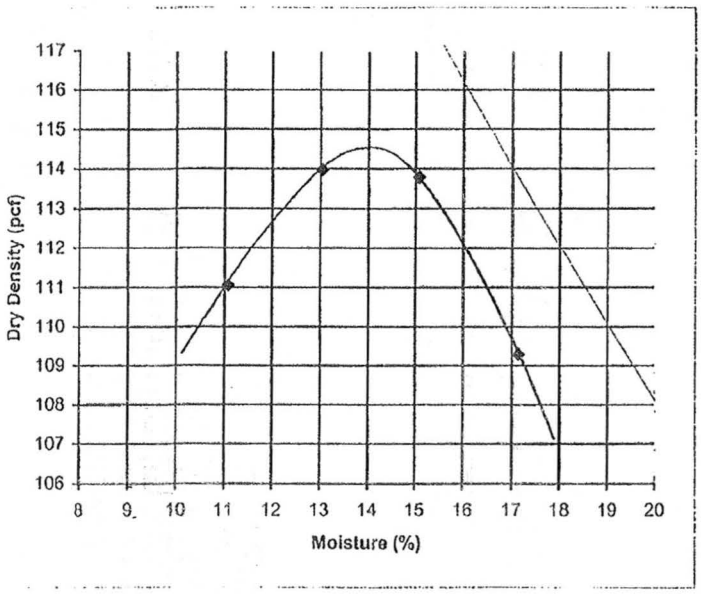
AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	2
MATERIAL:	Soil	**LAB NO:**	200
SAMPLE SOURCE:	SH-21 @ 0.0-5.0'	**DATE ASSIGNED:**	12/6/06

LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)
SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES (ASTM C136/C117)

MAXIMUM DRY DENSITY (pcf):	114.5
OPTIMUM MOISTURE (%):	14.0



SIEVE SIZE	PERCENT PASSING
6"	100
4"	100
3"	100
2"	100
1 1/2"	100
1 1/4"	100
1"	100
3/4"	100
1/2"	99
3/8"	99
1/4"	97
#4	96
#8	95
#10	94
#16	93
#30	90
#40	87
#50	84
#100	76
#200	64

NOTE: THE ZERO AIR VOIDS CURVE REPRESENTS A SPECIFIC GRAVITY OF: 2.651 ASSUMED.

THIS IS A SUMMARIZED REPORT OF THE REFERENCED PROCEDURES AND DOES NOT INCLUDE ALL REPORTING REQUIREMENTS. ADDITIONAL DATA CAN BE PROVIDED AT CLIENT'S REQUEST.

AASHTO R18

REVIEWED BY

PROJECT:	I-10 Shoulder Widening	**JOB NO:**	6-117-001063
LOCATION:	Maricopa County, Arizona	**WORK ORDER NO:**	2
MATERIAL:	Soil	**LAB NO:**	See Below
SAMPLE SOURCE:	See Below	**DATE ASSIGNED:**	12/6/06

MOISTURE CONTENT OF SOIL (ASTM D2216)

LAB #	BORING & DEPTH	WET WT. (gram)	DRY WT. (gram)	MOISTURE CONTENT
72	SH-5 @ 0.0-1.5'	592.8	580.3	2.2%
78	SH-5 @ 24.5-25.4'	874.4	752.6	16.2%
79	SH-5 @ 29.5-30.5'	871.2	794.0	9.7%
82	SH-6 @ 0.0-1.5'	374.6	364.7	2.7%
85	SH-6 @ 9.5-10.5'	680.8	657.6	3.5%
88	SH-6 @ 24.5-26.0'	654.7	586.4	11.6%
92	SH-8 @ 0.0-1.5'	171.4	166.7	2.8%
97	SH-8 @ 19.5-20.0'	1353.0	1256.1	7.7%
99	SH-8 @ 29.5-31.0'	1048.6	1003.6	4.5%
102	SH-12 @ 0.0-1.5'	327.4	319.5	2.5%
104	SH-12 @ 4.5-5.5'	729.0	690.3	5.6%
109	SH-12 @ 29.5-29.8'	334.6	320.7	4.3%
110	SH-12 @ 34.5-35.5'	596.4	583.0	2.3%
112	SH-18 @ 0.0-1.5'	179.0	172.4	3.8%
118	SH-18 @ 24.5-25.5'	716.3	651.0	10.0%
119	SH-18 @ 29.5-30.5'	1332.0	1298.5	2.6%
122	SH-14 @ 0.0-1.5'	242.9	234.3	3.7%
129	SH-14 @ 29.5-31.0'	700.4	595.7	17.6%
130	SH-14 @ 34.5-36.0'	692.6	639.1	8.4%
132	SH-16 @ 0.0-1.5'	263.2	255.9	2.9%
138	SH-16 @ 24.5-25.0'	678.3	571.6	18.7%
140	SH-16 @ 34.5-36.0'	798.3	681.2	17.2%
148	SH-13 @ 24.5-25.5'	723.4	611.6	18.3%
149	SH-13 @ 29.5-30.5'	756.8	590.6	28.1%
157	SH-7 @ 19.5-20.5'	282.3	207.4	36.1%
158	SH-7 @ 24.5-25.5'	786.4	757.5	3.8%
159	SH-7 @ 29.5-31.0'	657.1	625.6	5.0%
160	SH-7 @ 34.5-36.0'	573.1	557.1	2.9%
162	SH-17 @ 0.0-1.5'	160.6	150.6	6.6%
166	SH-17 @ 14.5-15.5'	460.1	417.4	10.2%
168	SH-17 @ 29.5-31.0'	166.9	150.4	11.0%
178	SH-15 @ 29.5-30.5'	755.5	648.2	16.6%
181	SH-20 @ 0.0-1.5'	232.8	226.6	2.7%
187	SH-20 @ 24.5-25.5'	1776.9	1747.9	1.7%
188	SH-20 @ 29.5-31.0'	319.5	315.8	1.2%
191	SH-22 @ 0.0-1.5'	265.3	256.3	3.5%
198	SH-22 @ 29.5-31.0'	673.9	659.2	2.2%
199	SH-22 @ 34.5-36.0'	618.6	604.4	2.3%
201	SH-21 @ 0.0-1.5'	209.9	201.4	4.2%
206	SH-21 @ 19.5-20.3'	852.6	802.1	6.3%
208	SH-21 @ 34.5-36.0'	426.5	417.3	2.2%
210	SH-19 @ 0.0-1.5'	168.0	161.9	3.8%
212	SH-19 @ 4.5-5.5'	383.2	362.0	5.9%
217	SH-19 @ 34.5-36.0'	181.3	175.8	3.1%

Reveiwed by: CG

PROJECT:	I-10 Shoulder Widening	JOB NO:	6-117-001063
LOCATION:	Maricopa County, Arizona	WORK ORDER NO:	7
MATERIAL:	Soil	LAB NO:	See Below
SAMPLE SOURCE:	See Below	DATE ASSIGNED:	2/12/07

MOISTURE CONTENT OF SOIL (ASTM D2216)

LAB #	BORING & DEPTH	WET WT. (gram)	DRY WT. (gram)	MOISTURE CONTENT
391	BO-5 @ 2.0-3.5'	421.2	408.9	3.0%
395	BO-5 @ 19.5-21.0'	230.6	213.8	7.9%
398	BO-5 @ 34.5-36.0'	397.4	352.6	12.7%
401	BO-5 @ 49.5-49.7'	273.8	239.3	14.4%
403	BO-5 @ 59.5-60.7'	393.9	344.8	14.2%
413	BO-9 @ 2.0-3.0'	526.2	460.0	14.4%
416	BO-9 @ 14.5-16.0'	433.0	373.3	16.0%
418	BO-9 @ 24.5-26.0'	412.0	368.7	11.7%
419	BO-9 @ 29.5-31.0'	287.6	253.4	13.5%
421	BO-9 @ 39.5-41.0'	507.0	433.8	16.9%
424	BO-9 @ 54.5-56.0'	386.7	342.7	12.8%
429	BO-9 @ 84.5-85.4'	368.3	354.9	3.8%

AASHTO R18

REVIEWED BY

Terracon

4685 South Ash Avenue, Suite H-4
Tempe, Arizona 85282
(480) 897-8200 FAX(480) 897-1133

RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL ASTM D2844

CLIENT: Not Reported
PROJECT: EB34 0-2.5'
LOCATION:
TERRACON NO.

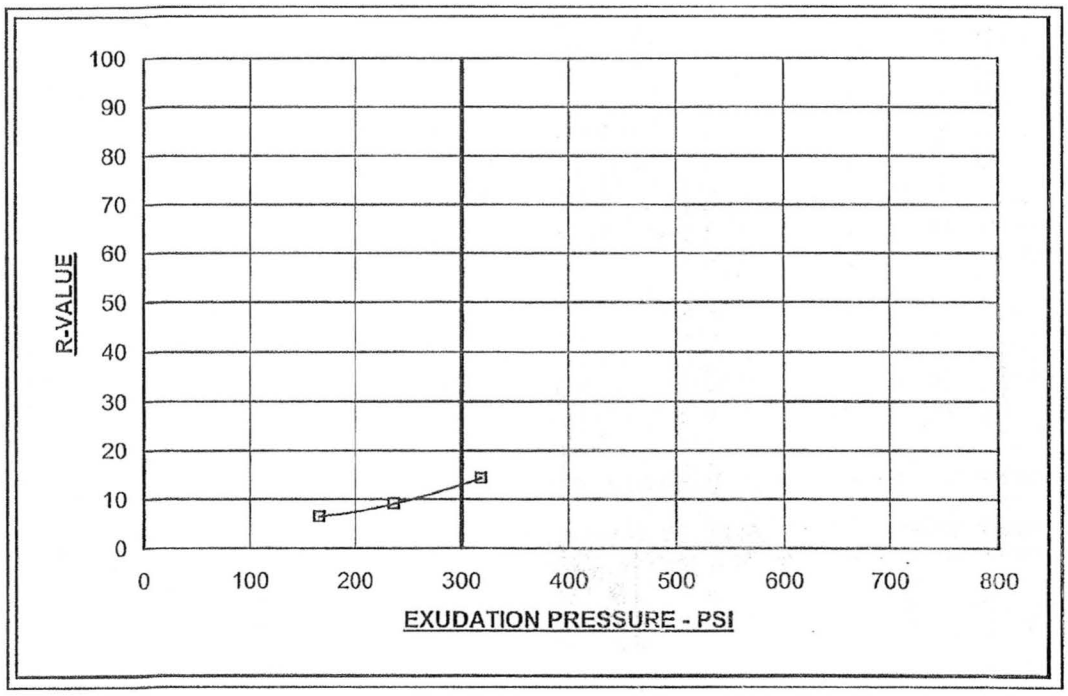
DATE OF TEST:

CLASSIFICATION: Not performed

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
COMPACTION PRESSURE (PSI)	150	200	275
DENSITY (PCF)	114.0	112.3	117.4
MOISTURE CONTENT (%)	17.2	16.1	15.3
EXPANSION PRESSURE (PSI)	-0.25	-0.16	0.19
HORIZONTAL PRESSURE @ 160 PSI	139	128	125
SAMPLE HEIGHT (INCHES)	2.50	2.70	2.40
EXUDATION PRESSURE (PSI)	166.3	237.9	318.2
CORRECTED R-VALUE	6.4	9.0	14.5
UNCORRECTED R-VALUE	6.4	8.4	15.1

R-VALUE @ 300 PSI EXUDATION PRESSURE = 13



Terracon

4685 South Ash Avenue, Suite H-4
Tempe, Arizona 85282
(480) 897-8200 FAX(480) 897-1133

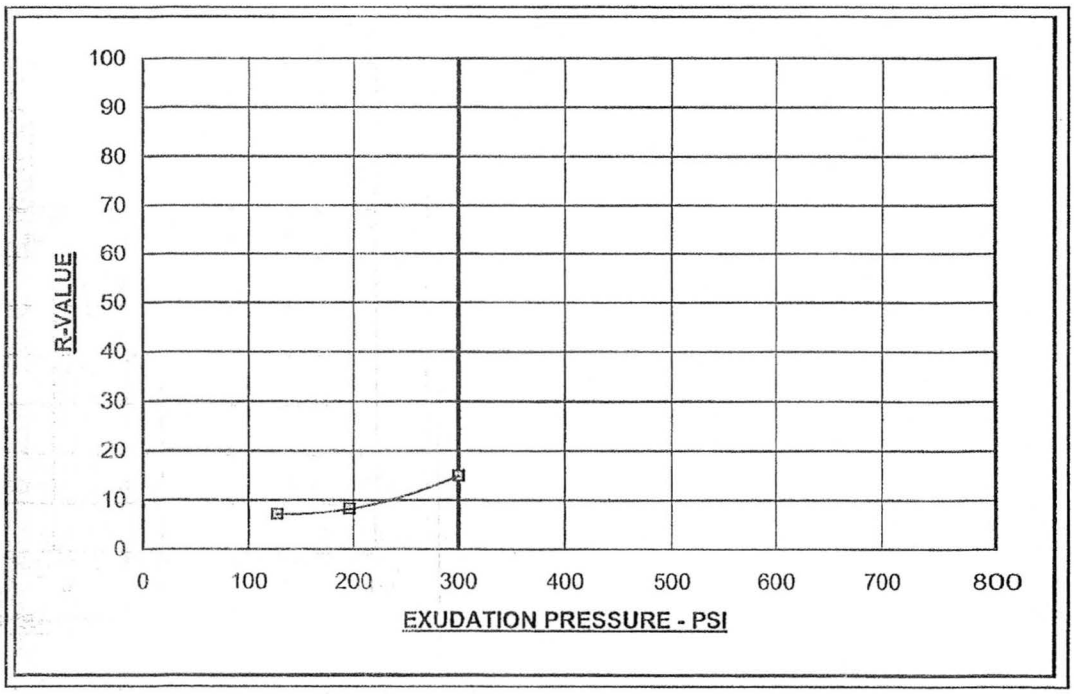
RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL ASTM D2844

CLIENT:	Not Reported	DATE OF TEST:	11-Jan-08
PROJECT:	65075093		
LOCATION:	EB36 0-2.5'		
TERRACON NO.		CLASSIFICATION:	Not performed

SAMPLE DATA TEST RESULTS

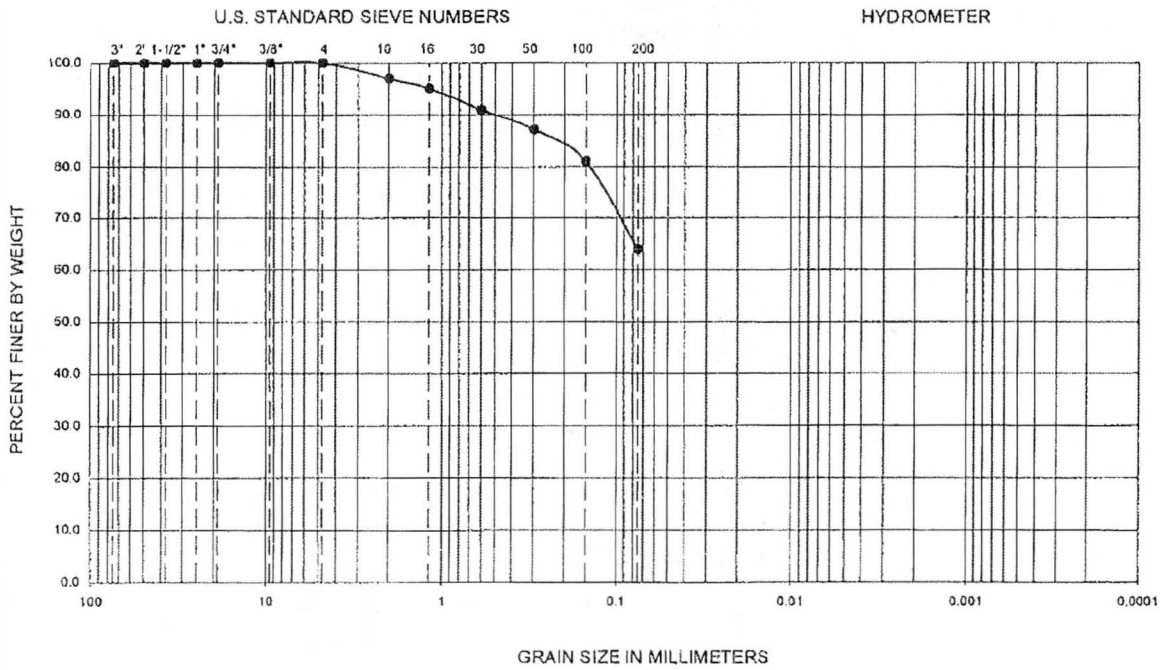
TEST SPECIMEN NO.	1	2	3
COMPACTION PRESSURE (PSI)	125	200	300
DENSITY (PCF)	114.8	113.6	119.3
MOISTURE CONTENT (%)	16.8	15.9	14.4
EXPANSION PRESSURE (PSI)	-0.22	-0.19	-0.06
HORIZONTAL PRESSURE @ 160 PSI	142	138	124
SAMPLE HEIGHT (INCHES)	2.60	2.40	2.40
EXUDATION PRESSURE (PSI)	127.3	196.9	300.3
CORRECTED R-VALUE	7.1	8.2	15.0
UNCORRECTED R-VALUE	6.8	8.5	15.6

R-VALUE @ 300 PSI EXUDATION PRESSURE = 15



B-15

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-1	13.5-14.8	NP	NP	NP	--	--	--	--	--	64	ML

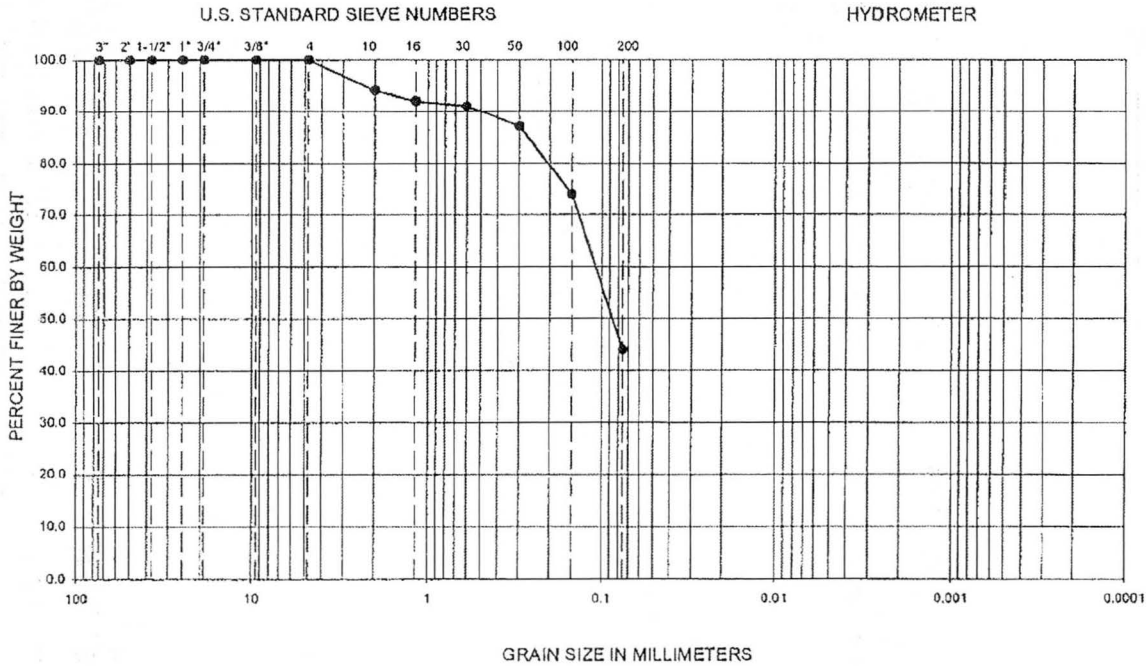
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

NP - INDICATES NON-PLASTIC

Ninyo & Moore		GRADATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	ELM LANE DRAINAGE MITIGATION AVONDALE, ARIZONA	B-1
602498001	3/09		

77

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-2	8.5-9.8	NP	NP	NP	--	--	--	--	--	44	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

NP - INDICATES NON-PLASTIC

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	ELM LANE DRAINAGE MITIGATION AVONDALE, ARIZONA	B-2
602498001 / 3/09		

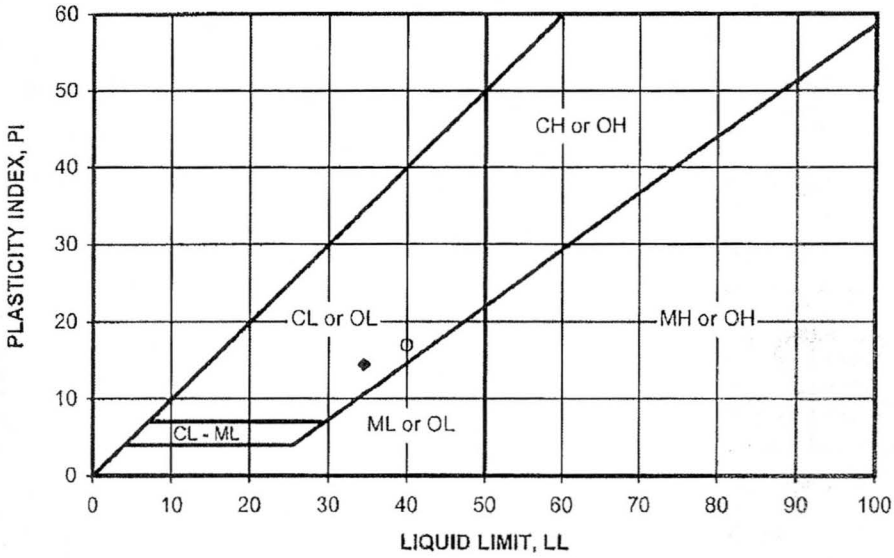
SAMPLE LOCATION	SAMPLE DEPTH (FT)	DESCRIPTION	PERCENT PASSING NO. 4	PERCENT PASSING NO. 200	USCS (TOTAL SAMPLE)
B-3	3.5-5	SANDY CLAY	98	73	CL
B-4	8.5-9.8	SANDY CLAY	97	59	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1140-00

Ninyo & Moore		NO. 200 SIEVE ANALYSIS	FIGURE
PROJECT NO.	DATE	ELM LANE DRAINAGE MITIGATION AVONDALE, ARIZONA	B-3
602498001	3/09		

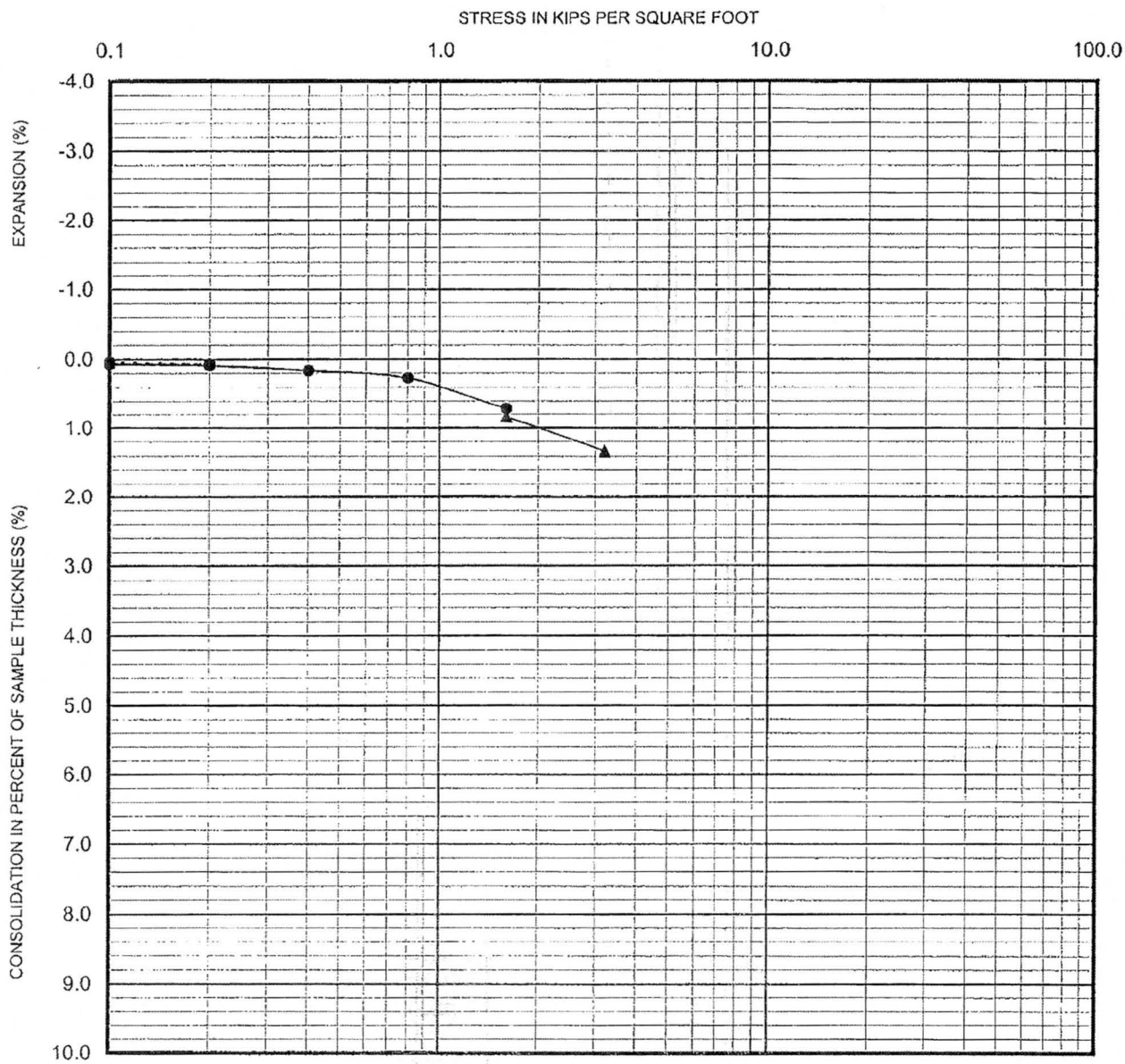
SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS (Entire Sample)
●	B-1	13.5-14.8	NP	NP	NP	ML	ML
■	B-2	8.5-9.8	NP	NP	NP	ML	SM
◆	B-3	3.5-5	35	20	15	CL	CL
○	B-4	8.5-9.8	40	23	17	CL	CL

NP - INDICATES NON-PLASTIC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-05

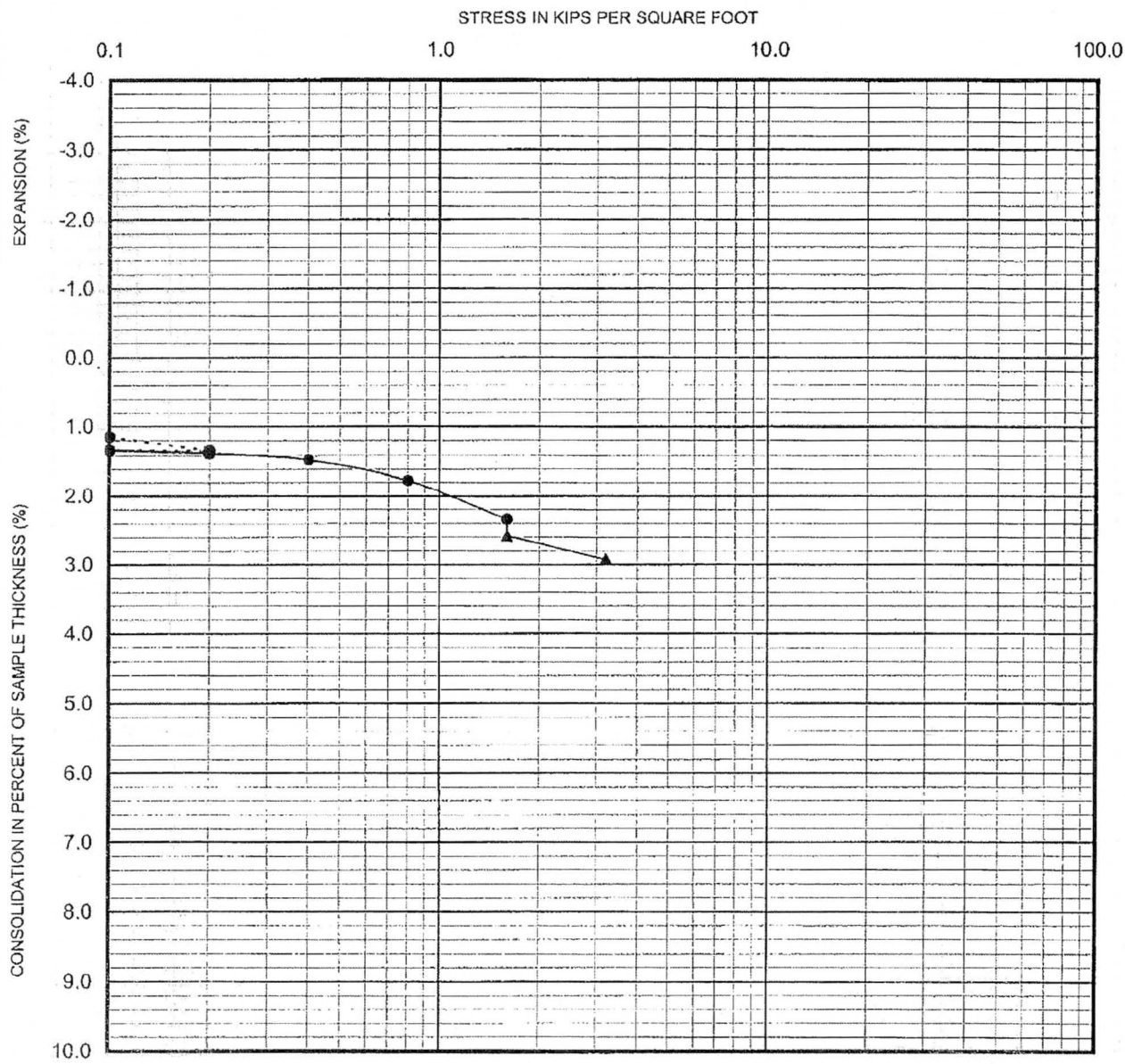
Ninyo & Moore	ATTERBERG LIMITS TEST RESULTS	FIGURE
PROJECT NO. 602498001 / DATE 3/09	ELM LANE DRAINAGE MITIGATION AVONDALE, ARIZONA	B-4



Sample Location	B-1
Depth (ft.)	13.5-14.8
Soil Type	ML

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-04

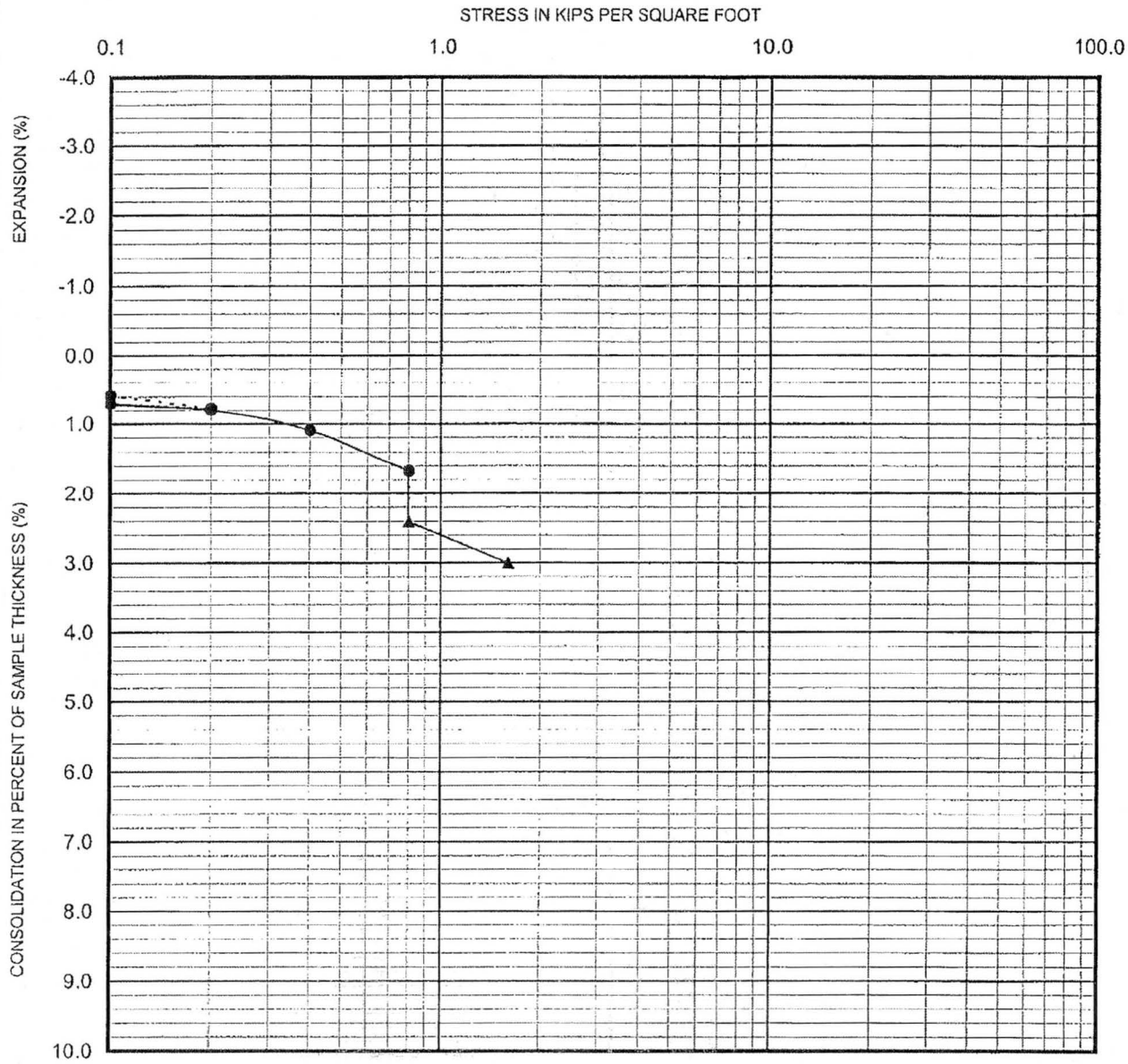
Ninyo & Moore	CONSOLIDATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	ELM LANE DRAINAGE MITIGATION AVONDALE, ARIZONA	B-5
602498001 / 3/09		



Seating Cycle		Sample Location	B-3
Loading Prior to Inundation		Depth (ft.)	13.5-15
Loading After Inundation		Soil Type	CL
Rebound Cycle			

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-04

Ninyo & Moore		CONSOLIDATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	ELM LANE DRAINAGE MITIGATION AVONDALE, ARIZONA	B-6
602498001	3/09		



Seating Cycle		Sample Location	B-4
Loading Prior to Inundation		Depth (ft.)	8.5-9.8
Loading After Inundation		Soil Type	CL
Rebound Cycle			

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-04

Ninyo & Moore		CONSOLIDATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	ELM LANE DRAINAGE MITIGATION AVONDALE, ARIZONA	B-7
602498001	3/09		

B-16

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH [1]	RESISTIVITY [1] (Ohm-cm)	SULFATE CONTENT [2]		CHLORIDE CONTENT [3] (ppm)
				(ppm)	(%)	
B-2	5-10	8.8	2,804	1100	0.110	640
B-4	15-20	8.9	1,368	122	0.012	260

[1] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 236b
[2] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 733
[3] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 736

Ninyo & Moore		CORROSIVITY TEST RESULTS	FIGURE
PROJECT NO.	DATE	ELM LANE DRAINAGE MITIGATION AVONDALE, ARIZONA	B-8
602498001	3/09		

TRIAL VERSION of TIFFDLL

TT 86-16

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'	SP/SM		100	97	5	SAND with SILT, grey damp, loose, grasses at ground surface, hair roots.
3.0'			93	78	2	SAND with GRAVEL, multi-colored, moist, loose, caving.
6.0'	SP		100	88	3	SAND; grey, moist, loose, caving
9.0'			96	78	2	SAND with GRAVEL: grey, moist, loose, occasional cobble to

TT 86-17

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
1.5'	SP		100	91	1	SAND; grey, moist, some gravels
3.0'			95	68	1	SAND with GRAVEL, similar to above, gravel lense at 2 4 foot depth.
4.0'	ML		100	100	74	SILT with SAND; dark brown, moist, cohesiveness indicates a clay component
6.0'	SP		100	81	3	SAND with GRAVEL, moist to damp, caving
9.0'			100	83	2	same as above.

TT 86-24

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'			100	93	2	SAND, grey, dry, loose, slight cementation, gravels to 1".
4.0'			100	91	2	SAND; brown, moist, loose.
7.0'	SP		93	83	1	SAND with GRAVEL, brown, moist, loose, slight caving
10.0'			96	85	2	same as above

TT 87-7

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	SM	3	100	100	43	SILTY SAND: brown, wet, cohesive
4.0'	CL	12	100	100	85	CLAY: light gray, damp cohesive
	SP		100	94	2	SAND. light gray, damp, few gravel to 3/8" coarse sand, rounded
10.0'			100	84	1	

TT 87-8

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.5'	CL/ML	5	100	100	60	SANDY SILTY CLAY brown, wet due to rain
	SP		100	97	3	SAND: brown, damp, loose med to coarse, few gravel to 3/8".
			100	99	2	SAME: light gray, trench belled out unable to enter trench
10.0'			100	95	1	

TT 87-9

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'			100	100	2	SAND gray and brown, wet, coarse grain
5.0'			100	100	3	
8.0'	SP		100	92	1	SAME gray, damp, coarse grain, few gravel to 3/4", cave in
10.0'			100	92	1	

TT 87-10

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'			100	93	1	SAND brown, wet, few gravel 4" max, coarse sand, rounded trench belling out early, unable to enter trench.
6.0'	SP		100	94	1	SAME. light gray, damp, coarse sand, few gravel 5" max, 8" lens of gravel
9.0'			100	98	2	SAME gray, damp, coarse sand, no gravel
10.0'			100	97	1	

TT 87-11

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'			100	98	4	SAND brown, wet, loose, coarse grained sand, rounded, few gravel 4 max., trench belled out unable to enter.
6.0'	SP		100	89	1	SAND with GRAVEL gray.
9.0'			97	86	0	SAME gray, damp, coarse grain, rounded, few gravel 4" max major cave in

TT 87-12

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'	SP/SM		100	97	11	SAND SILTY SAND brown, moist, fine to med sand, roots.
5.0'	SM	1	100	100	41	SILTY SAND: dark brown, dry, loose fine grain, slightly cohesive.
7.0'	SP		100	100	4	SAND gray, dry, fine to med. sand, clean, cave in.
10.0'	SW		100	83	1	SAND gray, dry, med to coarse sand, few gravel to 3/8"

TT 87-13

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
	SM	1	100	100	23	SILTY SAND brown, moist, fine grain
4.0'			100	99	28	SAME gray, dry, fine grain, few gravel to 3/8, non plastic.
	SP/SM		100	98	12	SAND SILTY SAND: gray, fine grained, few gravel to 3/8", non-plastic.
10.0'			100	100	6	SAND dark gray, med grain, clean.

TT 87-14

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	SC/SM	4	100	100	45	SILTY CLAYEY SAND. gray, fine grain sand cohesive, firm digging
6.0'	CL/ML	7	100	100	50	SANDY SILTY CLAY light brown, fine grain, cohesive, hard digging
9.0'	ML	1	100	100	55	SANDY SILT light brown, fine grain.
10.0'	SP/SM		100	95	8	SAND SILTY SAND. gray dry, med to coarse sand, few gravel to 3/8", clean

TT 87-15

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	ML	3	100	100	55	SANDY SILT, brown, wet due to rain loose, med grain, slightly cohesive
4.0'	SM	2	100	97	49	SILTY SAND brown, loose, med. grain
7.0'	SW		100	97	4	SAND gray, dry, loose, coarse to med sand clean.
10.0	SW/SM		100	99	8	SAND/SILTY SAND: gray, dry, loose.

TT 87-16

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'	CL/ML	6	100	100	70	SANDY SILTY CLAY brown, wet due to rain, medium grain, slightly cohesive hard digging
	CL	18	100	100	93	LEAN CLAY light brown, dry, fine to med grain, cohesive, hard digging
8.0'		14	100	99	77	
10.0'	SW		100	87	4	SANDS. gray, dry, loose, med to coarse sand, few gravel to 2½", rounded.

TT 87-17

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
2.0'	ML	2	100	92	53	reddish brown, wet due to rain, fine grain, slightly cohesive, roots, hard
	GM	16	100	71	37	SILTY GRAVEL with SAND reddish brown.
		5	100	69	18	SAME damp, fine to medium grain, gravel to 8", slightly cohesive, hard caliche
9.0'			100	74	18	very tough caliche

TT 87-18

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	ML	2	100	99	50	SANDY SILT light brown, wet top 6 due to rain, hard, fine grain, slightly cohesive, roots
4.0'	SM		100	100	33	SILTY SAND: light brown, dry, med to fine grain, slightly cohesive.
5.0'	GC	18	100	64	23	CLAYEY GRAVEL with SAND: very tough caliche

TT 87-19

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
3.0'	SP/SM		100	100	5	SAND SILTY SAND: brown, top 6" wet due rain, loose, med grain, few gravel to rounded
	—		100	85	2	SAND brown, moist, loose, coarse grain, gravel to 6", poorly graded non-plastic, trench caving
	SP		96	83	1	
10.0'			93	91	1	

TT 87-20

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
	SP		100	90	0	SAND: gray, wet, coarse grain, few gravel to 3/8".
			100	97	0	SAME. dark gray, loose, few gravel 4", trench will not hold shape.
9.0'			100	77	2	SAME: reddish to dark gray, rounded, poorly graded
10.0'	SM	2	100	99	23	SILTY SAND: reddish, damp, cohesive, med fine grain, gravel to 4" rounded

TT 87-24

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
	SP		100	100	4	SAND: brown, wet, med grain non plastic
5.0'			100	97	0	SAME gray, damp, coarse grain, few gravel to 2", poorly graded
7.0'	CL	21	100	100	78	CLAY with SAND dark reddish brown, fine grain, cohesive
10.0'	SP		100	95	2	SAND, grey, moist, coarse grain sand, gravel to 3/8".

TT 87-22

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
			100	100	2	SAND brown, wet, coarse med sand, rounded, cave in.
	SP		100	99	0	SAME gray, damp, loose, med grain free of rock, clean sand.
9.0'			100	98	1	

TT 87-23

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
			100	99	0	SAND brown gray, damp, coarse grain, rounded, very few gravel 3/4" trench will not hold shape.
	SP		95	91	1	SAME gray
			100	99	1	
10.0'			100	96	1	

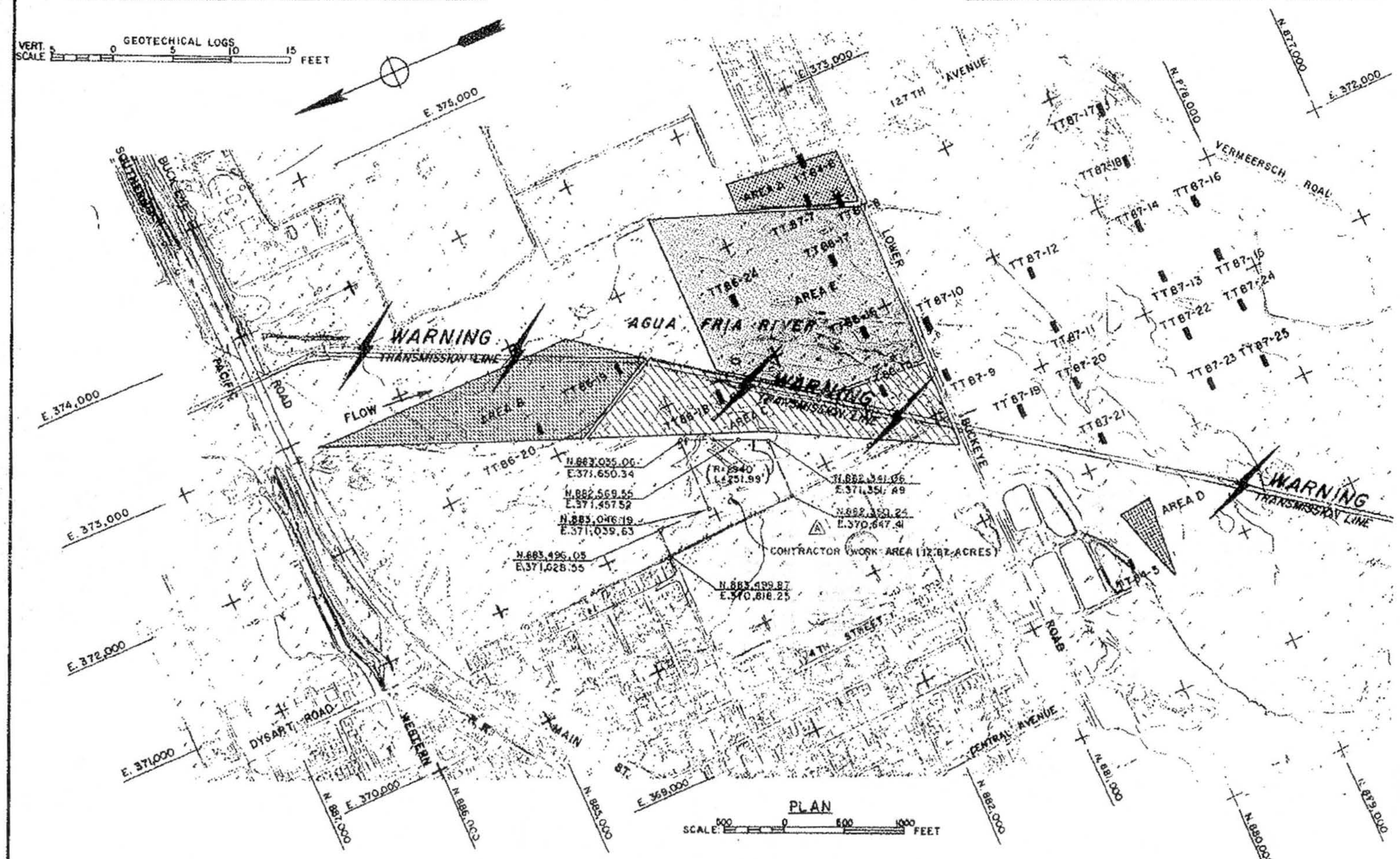
TT 87 24

DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
	SM	2	100	100	20	SILTY SAND gray, top 6" wet due to rain, loose, fine to med grain
5.0'			100	100	41	SAME light brown, dry, fine grain, some cohesion
8.0'	ML	1	100	100	60	SANDY SILT light brown, dry, fine grain, some cohesion
10.0'	SP		100	100	1	SAND dark gray, dry, med to coarse sand clean

TT 87-25

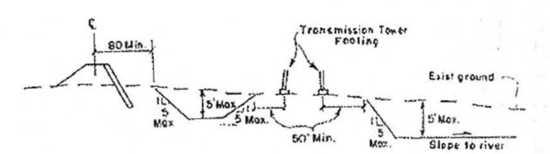
DEPTH	LOG	PI	1½	-4	-200	DESCRIPTION
	SM		100	97	18	SILTY SAND. brown, moist, med to coarse, few gravel to 3/8"
5.0'			100	100	18	SAME gray, damp, loose, medium grain clean
8.0'	SW		100	94	1	SAND. brown, damp, med to coarse, few gravel to 1" trench will not hold slope
10.0'	SP		97	93	3	SAND brown, med to coarse grain, few gravel to 1"

VERT. SCALE GEOTECHICAL LOGS 5 0 5 10 15 FEET



PLAN

SCALE 500 0 500 1000 FEET



TYPICAL PROFILE - BORROW AREAS
NOT TO SCALE

NOTES

1. SEE SHEET 4 FOR GENERAL NOTES, LEGEND, AND CLASSIFICATION SYSTEM.
2. TRENCHES EXCAVATED IN JULY 1986, MARCH 1987 AND JUNE 1984
3. SEE SHEET 4 FOR LOGS OF TEST TRENCHES 84-8, 86-20, 86-19, 86-18 AND 86-15
4. NO GROUNDWATER ENCOUNTERED DURING EXPLORATIONS.

RECORD DRAWING AS CONSTRUCTED

CONT NO.	REV.	DATE	POSTED	CHECKED	REVIEWED
87-C-0049	A				

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
A	REVISED CONTRACTOR WORK AREA COORDINATES		

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY:
DRAWN BY: D. VILPPU
CHECKED BY:

GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

AGUA FRIA RIVER LEVEES
(BUCKEYE ROAD TO BROADWAY ROAD)
BORROW AREA, EXPLORATION PLAN, SOIL LOGS, AND CONTRACTOR WORK AREA

SUBMITTED BY:
CHF, GEOTECHNICAL BRANCH

SPEC. NO. DACW09-87-B-0010
DISTRICT FILE NO. 252/207 REV. A
SHEET 5 OF 41

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

TRIAL VERSION OF TIEDOLL

TT84-6

DEPTH	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
1.0'	ML				100	52		SANDY SILT; light brown, dry, very loose.
2.5'	SM				98	12		SANDY SILT; light brown, damp, loose.
					74	6		SILTY SAND; brown, damp, loose, gravel.
7.5'	SP/SM				100	9		SILTY SAND; brown, damp, loose.
								SAME; occasional gravel.
13.0'								GRAVELLY SAND; brown, damp, loose, cobbles to 8".

TT84-7

DEPTH	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
					100	19		SILTY SAND; light grey, dry, very loose, hair-like roots.
	SM	4.4			99	16		brown, moist, loose.
5.0'								
	SP SM	3.5			96	10		SAND/SILTY SAND; brown, moist, few gravel, very loose.
8.0'								
9.0'	SP				89	2		SAND; multicolored, damp, coarse.
9.5'	SP/SM	1.9			99	6		SAND/SILTY SAND; brown, occasional cobbles.

TT84-8

DEPTH	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
1.0'	*							
	ML				100	71		SILTY SAND; brown, dry, medium dense, fine grained.
4.0'								SANDY SILT; dry to damp, dense to medium dense, 2" sand lense at 3'.
5.0'	SP/SM	3.2			100	7		SAND/SILTY SAND; brown, damp to moist, loose, medium to fine grained.
5.3	ML	16.2			100	55		SANDY SILT; dark brown, damp to moist, stiff.
		27.1			98	3		SANDY SILT; dark brown, damp to moist, stiff.
	SP	3.0			100	2		SAND; brown, damp to moist, loose, coarse grain.
								medium to fine grain.
12.0'					76	1		GRAVELLY SAND; coarse grained, few fine grained gravel.

TT84-5

DEPTH	LOG	MC	LL	PI	-4	-2	N	DESCRIPTION
	SP-SM	3.4			99	11		SAND/SILTY SAND; Light brown, dry, very loose.
1.5'	SP				80	2		SAND; Multicolor, damp, loose, 20% gravel
2.0'								
	SW				95	1		SAND, Dark brown, moist.
7.0'								Increase in gravel of 7'-0".

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS				GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than half of material is larger than no. 200 sieve size	GRAVELS More than half of coarse fraction is larger than no. 4 sieve size		Clean gravels	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
				GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
			Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than no. 4 sieve size		Clean sands	SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly graded sands, gravelly sands, little or no fines
			Sands with fines	SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than half of material is smaller than no. 200 sieve size.	SILTS AND CLAYS		Low liquid limit	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts, with slight plasticity.
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
				OL	Organic silts and organic silty clays of low plasticity
			High liquid limit	MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silts
				CH	Inorganic clays of high plasticity.
				OH	Organic clays of medium to high plasticity, organic silts.
Highly organic soils				Pt	Peat and other highly organic soils

NOTES:

1. Boundary Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example, GW-GC, well-graded gravel sand mixture with clay binder.
2. All sieve sizes on this chart are U. S. Standard.
3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus no. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart, and is clay, if the liquid limit and plasticity index plot above the "A" line on the chart.
4. The Soil Classification System is based on the American Society for Testing and Materials (ASTM)
   a. (ASTM) D2487 Standard Test Method for Classification of Soils for Engineering Purposes.
   b. (ASTM) D2488 Standard Practice for description and identification of Soils (Visual Manual Procedure).

TT86-15

DEPTH	LOG	MC	LL	PI	-4	-200	DESCRIPTION
	SM				99	15	SILTY SAND, brownish grey, dry, loose, roots and grasses on ground surface.
3.0'							
4.0'	SP/SM				95	7	SAND with SILT, multicolored, moist, loose.
					98	8	brown, moist, loose, slight caving.
7.0'							
10.0	SP				94	2	SAND, grey, moist, loose, slight caving continues.

TT86-18

DEPTH	LOG	MC	LL	PI	-4	-200	DESCRIPTION
2.0'	SW/SM				99	12	SAND with SILT, brown, moist, loose, vegetation on ground surface.
5.0'	SM				85	19	SILTY SAND with GRAVEL, brown, moist, loose to dense, some hard clay lumps.
7.0'					94	18	SILTY SAND, brown, moist, loose, some cecentation.
10.0	SP				92	2	SAND, brown, moist, loose

TT86-20

DEPTH	LOG	MC	LL	PI	-4	-200	DESCRIPTION
2.0'					78	1	SAND with GRAVEL, grey, moist, roots.
4.0'	SP				79	1	dark grey, damp, loose, occasional gravel to 1".
7.0'					87	1	SAND, dark grey, damp, loose, occasional gravel to 1".
10.0'					80	1	SAND with GRAVEL, dark grey, damp, loose, occasional gravel to 1".

TT84-9

DEPTH	LOG	MC	LL	PI	-4	-200	N	DESCRIPTION
1.3'	CL	31	12		100	84		SANDY CLAY, light brown to brown, damp to moist, dense, some hair roots.
1.0'	SM	20	11		100	35		
					99	23		light brown, dry, hard, hair roots.
	SP/SM				100	6		SILTY SAND; light brown, dry, dense, coarse to fine grain, cemented.
8.0'								SAND/SILTY SAND; grey, dry, dense to loose, medium grain sand, some caving.

TT86-19

DEPTH	LOG	MC	LL	PI	-4	-200	DESCRIPTION
2.0'					98	1	SAND, greyish brown, moist, loose, roots, slight caving.
4.0'	SP				77	2	SAND with GRAVEL, grey, moist, loose, sub-rounded gravels
7.0'					81	2	same as above.
9.0					94	2	same as above, occasional cobbles to 5".

LEGEND

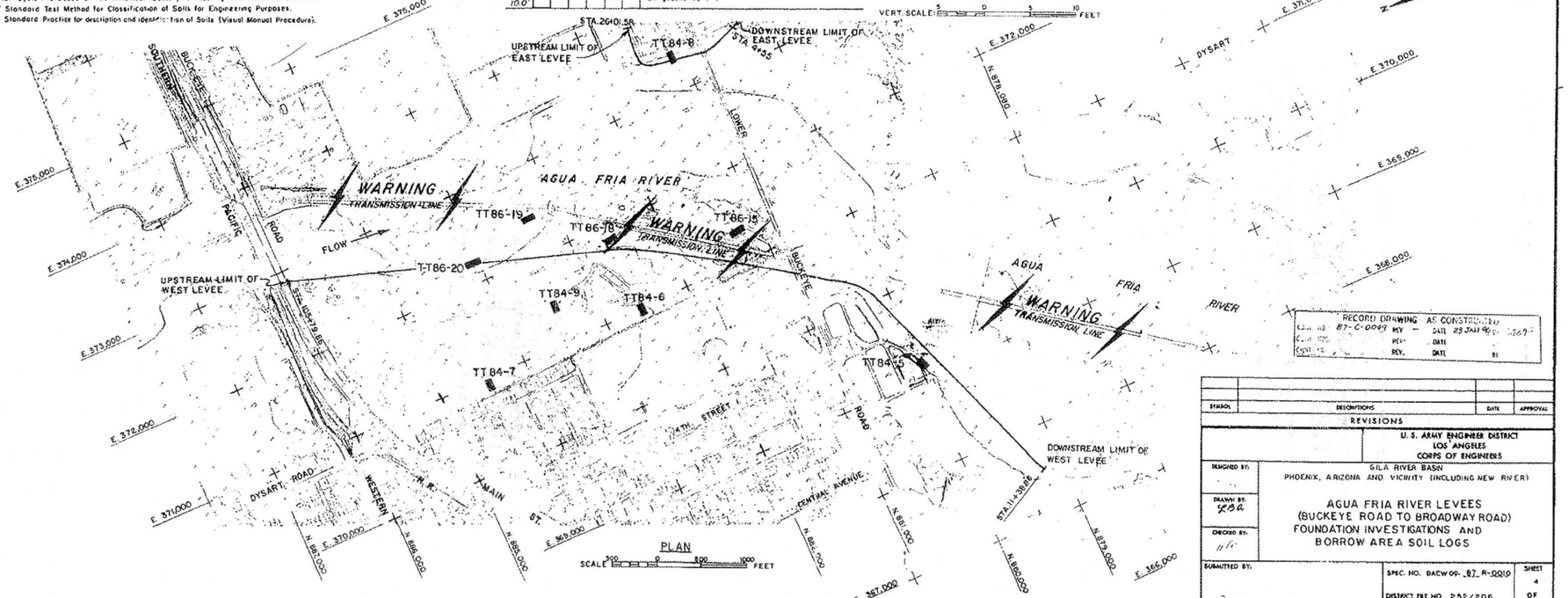
T.T.	86-6 LOCATION AND NUMBER OF TEST TRENCH.
T.H.	86-45 LOCATION AND NUMBER OF TEST HOLE.
M.C.	FIELD MOISTURE CONTENT IN PERCENT OF DRY WEIGHT.
L.L.	LIQUID LIMIT.
P.I.	PLASTICITY INDEX (LIQUID LIMIT MINUS PLASTIC LIMIT).
N.P.	NONPLASTIC
-4	PERCENT OF MATERIAL BY WEIGHT PASSING NO. 4 SIEVE.
-200	PERCENT OF MATERIAL BY WEIGHT PASSING NO. 200 SIEVE.
K	DENOTES VISUAL CLASSIFICATION OF SOILS.
N	NUMBER OF BLOWS OF A 140-POUND DROPHAMMER FALLING 30 INCHES REQUIRED TO DRIVE A SAMPLING SPOON ONE FOOT. OUTSIDE DIAMETER OF SPOON IS 2 INCHES; INSIDE DIAMETER IS 1-3/8 INCHES. PROCEDURE IS CALLED STANDARD PENETRATION TEST.
W	DEPTH TO WATER.

NOTES:

1. LEVEE ALIGNMENT IS APPROXIMATE.
2. PLAN TO BE USED FOR LOCATION OF TRENCHES ONLY
3. TRENCHES EXCAVATED IN JUNE 1984 AND JULY 1986.
4. NO GROUNDWATER ENCOUNTERED DURING EXPLORATIONS.

GEOTECHNICAL LOGS

VERT. SCALE 5 0 5 10 FEET



PLAN

SCALE 500 0 500 1000 FEET

RECORD DRAWING AS CONSTRUCTED
87-C-0049 REV — DATE 23 JAN 90
REV: DATE
REV. DATE

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

DESIGNED BY:
DRAWN BY: KBA
CHECKED BY:

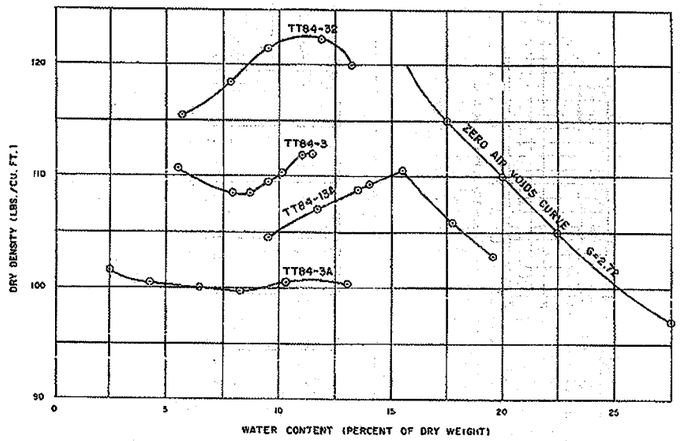
AGUA FRIA RIVER LEVEES
(BUCKEYE ROAD TO BROADWAY ROAD)
FOUNDATION INVESTIGATIONS AND
BORROW AREA SOIL LOGS

SUBMITTED BY:

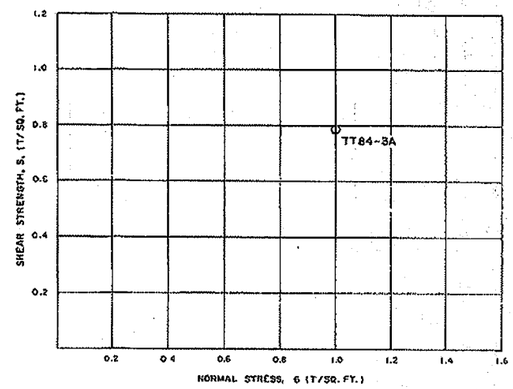
SPEC. NO. DACW09-87-R-0010
DISTRICT FILE NO. 252/206
SHEET 4 OF 41

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

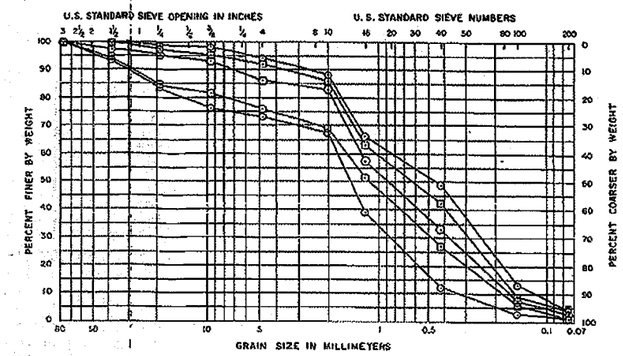
B-23



COMPACTION TESTS



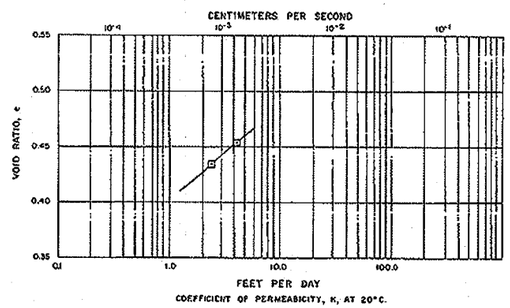
DIRECT SHEAR TEST



STREAMBED MATERIALS

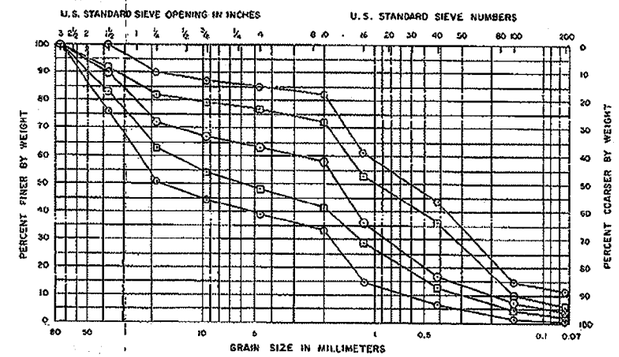
TEST TRENCHES TT84-3, 4, 5, 7, and 8

⊙ UPPER AND LOWER GRADATION LIMITS
⊡ UPPER AND LOWER QUARTILES
⊙ MEAN GRADATION



PERMEABILITY

⊡ TEST TRENCH 84-32



STREAMBED MATERIALS

TEST TRENCHES TT84-23, 24, 25, 26, 32, 36, 37, 38, 39 and 40

GRADATION CURVES

⊙ UPPER AND LOWER GRADATION LIMITS
⊡ UPPER AND LOWER QUARTILES
⊙ MEAN GRADATION

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

SKUNK CREEK AND THE NEW AND AGUA FRIA RIVERS
(ARIZONA CANAL DIVERSION CHANNEL TO GILA RIVER)

LABORATORY TEST RESULTS OF
TYPICAL STREAMBED MATERIALS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

TT84-12

	LOG	MC	LL	PI	-4	-200	N	
2.8'	ML			NP	100	60		SANDY SILT; Brown, damp, dense, fine grain.
	SP				99	4		SAND; Dark brown, moist, medium dense.
					90	1		dark brown to grey, moist to dry, medium dense to loose, medium to coarse grain, few gravel to 1-1/2".
					98	3		brown, moist, medium dense, medium grains, occasional gravel to 1".
11.5'					91	2		dark brown, very moist, medium dense to dense, medium to coarse grain.
13.5'	SW SM				86	2		brown, wet, loose, coarse grain, few gravel to 1".
					72	6		GRAVELLY SAND/SILTY GRAVELLY SAND: Reddish brown, very wet, dense, coarse grain, gravel, 10% cobbles to 5".

TT84-13

	LOG	MC	LL	PI	-4	-200	N	
1.0'	GP				29	1		SANDY GRAVEL; Brown to grey, moist, medium dense, coarse angular, hair roots.
	SP				64	1		GRAVELLY SAND; Grey moist, medium dense, coarse grain sand, gravel, occasional cobble to 6".
5.0'					80	1		brown to grey, wet gravel to 1-1/2".

TT84-14

	LOG	MC	LL	PI	-4	-200	N	
3.0'	ML			NP	100	62		SANDY SILT; Light brown, dry, hard.
6.0'	SM			NP	99	26		SILTY SAND; Light brown, dry, medium dense to dense, fine grained
	SP				96	2		SAND; Grey to brown, dry to damp, very loose to loose, predominately medium grain.
					92	3		light brown, damp, medium dense, few gravel to 2", some silty sand pockets.
				NP	55	2		GRAVELLY SAND: Dark brown, moist, medium dense, gravel, 10% cobbles to 10".
16.5'				NP	63	3		wet, coarse grain, few cobbles to 10".

TT84-15

	LOG	MC	LL	PI	-4	-200	N	
3.4'	SP SM				96	11		SAND/SILTY SAND, Brown, moist, medium dense, few gravel to 3/4, 2" thick silt lense.
4.7'	SM			NP	100	25		SILTY SAND; Dark brown, moist, medium stiff, hair roots
6.2'	SP SM				99	8		SAND/SILTY SAND: Grey, dry to damp, dense, mostly fine grain, silt lenses 1/4-1/2" thick.
8.3'	SP				82	1		GRAVELLY SAND; Light brown and grey, damp, dense, gravel to 1", slightly cemented.
11.5'								SAND; 5% gravel, 5% cobbles to 6".

TT84-16

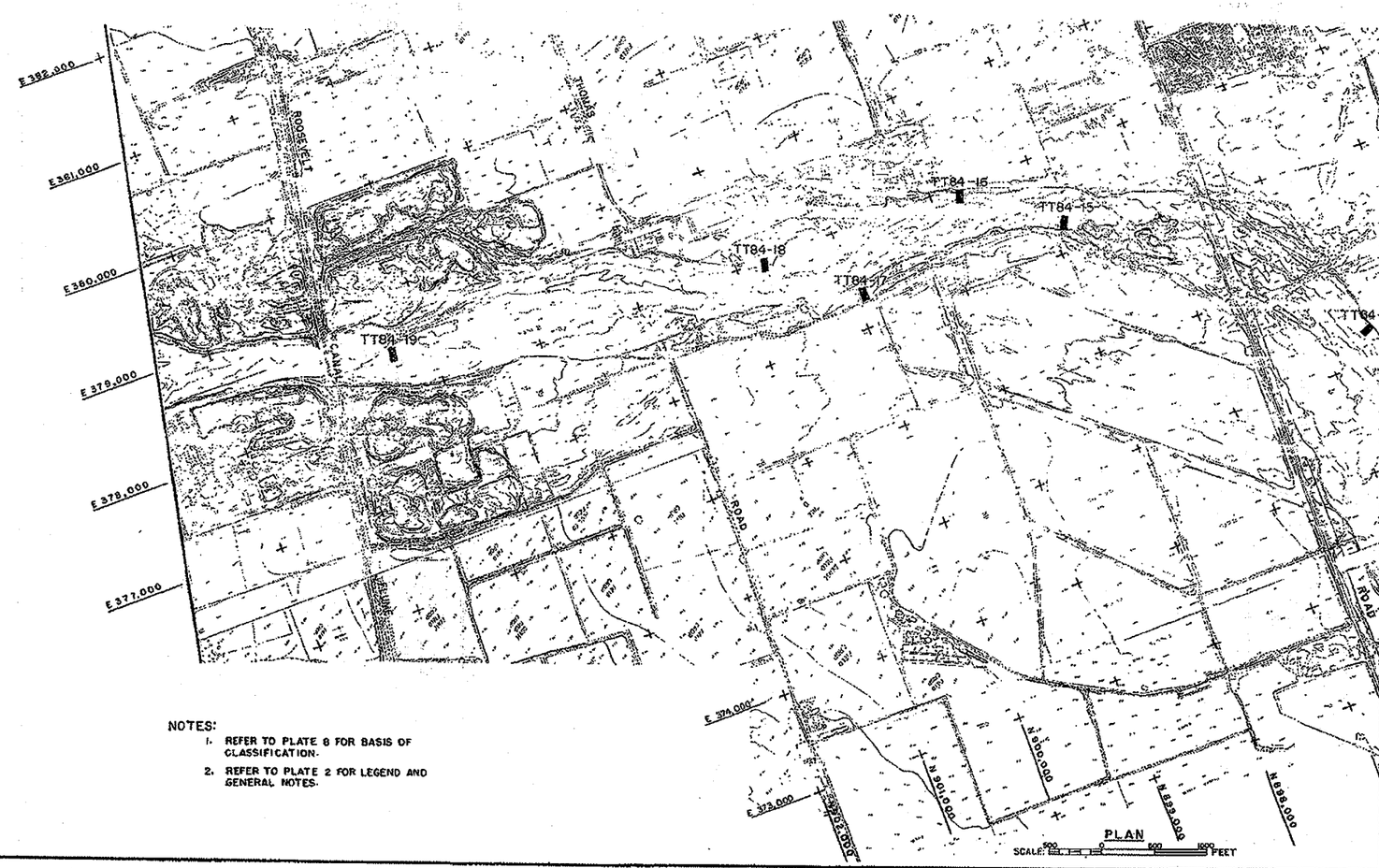
	LOG	MC	LL	PI	-4	-200	N	
2.7'	SP			NP	98	3		SAND; Grey to brown, damp to moist, coarse to medium grain, loose.
	SM							SILTY SAND; Brown, moist, dense, mostly fine grain, some roots.
7.7'			27	3	94	50		
8.7'	SC		20	10	100	34		CLAYEY SAND; Dark brown, damp, hard to very hard, breaks in sheets, veins of white deposit 1/16" thick.
10.0'	ML		31	7	100	68		SANDY SILT; Dark brown, damp, hard to very hard, breaks easy, cohesive.

TT84-17

	LOG	MC	LL	PI	-4	-200	N	
3.5'	SP SM				98	11		SAND/SILTY SAND: Light brown to grey, medium dense, fine grain, large quantity of hair roots.
5.7'	SP				80	1		GRAVELLY SAND: Grey, dry, dense, gravel to 1-1/2".
8.8'	SP SM				99	5		SAND/SILTY SAND: Grey, dry, dense, fine grain.
	SP				95	2		SAND; Brown, damp, dense, occasional gravel to 1-1/2".
					63	1		GRAVELLY SAND: Light brown, moist, medium dense, occasional cobble to 5".
16.6'					61	1		GRAVELLY SAND: Reddish brown, wet, medium dense, 5% cobbles to 10", cohesive binder.

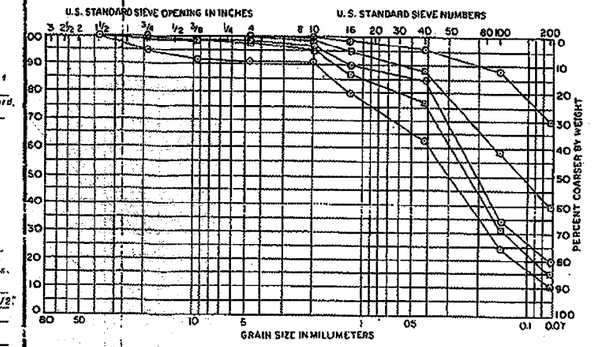
GEOTECHNICAL LOGS

VERT. SCALE: 5 0 5 10 FEET



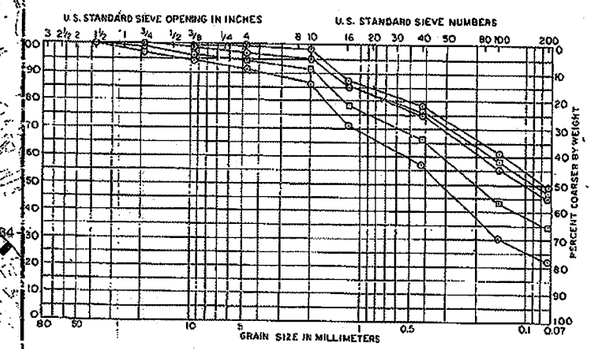
NOTES:

1. REFER TO PLATE 8 FOR BASIS OF CLASSIFICATION.
2. REFER TO PLATE 2 FOR LEGEND AND GENERAL NOTES.



BANK MATERIALS
TEST TRENCHES TT84-1,2,5,6,7,8 and 9

⊙ - UPPER AND LOWER GRADATION LIMITS
⊟ - UPPER AND LOWER QUARTILES
⊙ - MEAN GRADATION



BANK MATERIALS
TEST TRENCHES TT84-37, 39 and 40

GRADATION CURVES

⊙ - UPPER AND LOWER GRADATION LIMITS
⊟ - UPPER AND LOWER QUARTILES
⊙ - MEAN GRADATION

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

SKUNK CREEK AND THE NEW AND AGUA FRIA RIVERS
(ARIZONA CANAL DIVERSION CHANNEL TO GILA RIVER)

LABORATORY TEST RESULTS OF
TYPICAL BANK MATERIALS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Ninyo & Moore

APPENDIX C

SITE RECONNAISSANCE SUMMARY

C-1

Ninyo & Moore

Report of Levee Evaluation and Field Observations From South End of Levee to Van Buren

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
1	Unwanted Vegetation Growth	M	A	The levee has little or no unwanted vegetation (trees bush or undesirable weeds, except for vegetation that is properly contained and/or situated on over built section, such that the mandatory 3 foot root free zone is preserved around the levee profile. The levee has been recently mowed. The vegetation free zone extends 15 feet from both the landside and river side toes of the levee to the centerline of the tree. If the levee access easement doesn't extend to the described limits, then the vegetation free zone must be maintained to the easement Limits	Vegetation growth is predominant on the downstream face of the levee south of Lower Buckeye Road and is less abundant as you proceed north of Lower Buckeye Road. There is evidence of an irrigation system on the downstream face south of Lower Buckeye Road that may not be functional at this time. This area now appears unmaintained and overgrown (Photos 1, 2). The subdivision between Lower Buckeye Road and Buckeye Road appears to maintain the downstream side of the levee, however there are some large diameter (over 6 inch) trees at the toe of the levee (Photos 15-17). Upstream from the subdivision there are several unmaintained trees, and shrubs (Photo 18).
			M	Minimal vegetation growth (brush, weeds, or trees 2 inches in diameter or smaller) is present within the zones described above. This vegetation must be removed but does not currently threaten the operation or integrity of the levee	
			U	Significant vegetation growth is present within the zones described above and must be removed to reestablish or ascertain levee integrity.	
2	Sod Cover	NA	A	There is good coverage of sod over the levee.	There is no sod on this reach of levee
			M	Approximately 25% of the sod cover is missing or damaged over a significant portion or over significan portions of the levee embankment. This may be the result of over-grazing or feeding on the levee, unauthorized vehicular traffic, chemical or insect problems, or burning during inappropriate seasons.	
			U	Over 50% of the sod cover is missing or damaged over a significant portion of the levee embankment.	
			NA	Surface protection is provided by other means.	
3	Encroachments	M	A	No trash, debris, unauthorized farming activity, structures, excavation, or other obstruction present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish the proper function of the levee.	There are some encroachments in this stretch of levee especially at bridge crossings where there is evidence of human activity and associated debris. (Photo 19)
			M	Trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
			U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operation and maintenance, emergency operations or negatively impact the integrity of the levee.	
			NA		

Ninyo & Moore

Report of Levee Evaluation and Field Observations From South End of Levee to Van Buren

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
4	Closure Structures (Stop Log, Earthen Closures, Gates, Sandbags closures	N/A	A	Closure structures in good repair. Placing equipment stoplogs, and other materials are readily available at all times. Components are clearly marked and installation instructions readily available. Trial Erections have been accomplished in accordance with the O&M Manual.	There are no closure structures in this stretch of levee.
			U	Any of the following issues is cause for their rating: Closure structure in poor condition. Parts missing or corroded. Placing equipment may not e available within the anticipated warning time. The storage vaults cannot be opened during the time of inspection. Components of closure are not clearly marked and installation instruction are not readily available. trial erections have not been accomplished in accordance with the O&M manual.	
			NA	There are no closure structures	
5	Slope Stability	A	A	No slides, sloughs, tension cracking, slope depressions, or bulges are present.	
			M	Minor slope stability problems that do not pose an immediate threat to the levee embankment	
			U	Major slope stability problems identified that must be repaired to reestablish the integrity of the levee embankment.	
6	Erosion/Bank Caving	M	A	No erosion or bank caving is observed on the landward or stream ward sides of the levee that might endanger its stability.	There are periodic rills, burrowing, cracking, and scouring along this stretch of levee that if left unresolved may ultimately result in structural significant deficiencies (Photos 3-5, 7, 9-13, 17)
			M	There are areas where minor erosion is occurring or has occurred on or near the levee embankment, but the levee integrity is not threatened.	
			U	Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7	Settlement 1	A	A	No Observed Depression in crown. Records exist and indicate no unexplained historical changes	There is no evidence of settlement.
			M	Minor irregularities that do not threaten integrity of levee. Records are incomplete or inconclusive.	
			U	Obvious variation in elevation over significant reaches. No records exist or records indicate that design elevation is compromised.	

Ninyo & Moore

Report of Levee Evaluation and Field Observations From South End of Levee to Van Buren

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
8	Depressions/Rutting	A	A	There are scattered, shallow ruts, pot holes, or other depressions on the levee that are related to levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without ponded water.	There are no features that would indicate the levee has settled. It appears that the levee is draining as planned.
			M	There are some infrequent minor depressions less than 6 inches deep in the levee crown, embankment or access roads that will pond water.	
			U	There are depressions greater than 6 inches deep that will pond water.	
9	Cracking	M	A	Minor longitudinal, transverse, or desiccation cracks with no vertical movement along crack. No cracks extend continuously through the levee crest	There are regular transverse cracks of the soil cement armour for this reach of the levee. They are up to 1/16-inch wide and may penetrate the entire width and height of the soil cement. There is no evidence of vertical movement or rotation. Lineal alignment of vegetation at the toe of the upstream face of the levee in conjunction with the cracks may suggest continuation of the cracks below the ground surface. (Photos 8, 22, 24)
			M	Longitudinal an/or transverse cracks up to 6 inches in depth with no vertical movement along the crack. No cracks extend continuously through the levee crest. Longitudinal cracks are no longer than the height of the levee.	
			U	Cracks exceed 6 inches in depth. Longitudinal cracks are longer than the height of the levee and/or exhibit vertical movement along the crack. Transverse cracks extend through out the entire levee width.	
10	Animal control	M	A	Continuous animal burrow control program in place that includes the elimination of active burrowing and the filling in of existing burrows.	Burrowing is evident throughout this stretch of levee, and in some locations has enabled erosion on the crest and down stream side of the levee. (Photos 3-5)
			M	The existing animal burrow control program needs to be improved. Several burrows are present which may lead to seepage or slope stability problems, and require immediate attention	
			U	Animal burrow control program is not effective or is nonexistent.	

Ninyo & Moore

Report of Levee Evaluation and Field Observations From South End of Levee to Van Buren

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
11	Culverts/discharge pipes	A	A	There are no breaks, holes, or cracks in the discharge pipes/culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present are in good condition with 100% of the original coating still in place or have been relined with appropriate material. Condition of pipes has been verified using visual inspection methods.	There is no evidence of excessive erosion or degredation to pipes penetrating the levee.
			M	There are a small number of erosion pinholes or cracks that could leak water and need to be repaired but the entire lengths of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal.	
			U	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or has already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert.	
12	Riprap revetments & Bank protection	A	A	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Riprap intact with no woody vegetation present	There is no riprap within this streach of levee.
			M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
			U	Significant rip rap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses	

Ninyo & Moore

Report of Levee Evaluation and Field Observations From Van Buren Street to Thomas Road

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
1	Unwanted Vegetation Growth	A	A	The levee has little or no unwanted vegetation (trees, bush or undesirable weeds, except for vegetation that is properly contained and/or situated on over built section, such that the mandatory 3 foot root free zone is preserved around the levee profile. The levee has been recently mowed. The vegetation free zone extends 15 feet from both the landside and river side toes of the levee to the centerline of the tree. If the levee access easement doesn't extend to the described limits, then the vegetation free zone must be maintained to the easement Limits	Vegetation growth in this area is minimal and consists of sparse shrubs, and sparse ground cover (Photo 47). Density of vegetation increases at inlet structures through this stretch.
			M	Minimal vegetation growth (brush, weeds, or trees 2 inches in diameter or smaller) is present within the zones described above. This vegetation must be removed but does not currently threaten the operation or integrity of the levee	
			U	Significant vegetation growth is present within the zones described above and must be removed to reestablish or ascertain levee integrity.	
2	Sod Cover	NA	A	There is good coverage of sod over the levee.	There is no sod on this reach of levee
			M	Approximately 25% of the sod cover is missing or damaged over a significant portion or over significant portions of the levee embankment. This may be the result of over-grazing or feeding on the levee, unauthorized vehicular traffic, chemical or insect problems, or burning during inappropriate seasons.	
			U	Over 50% of the sod cover is missing or damaged over a significant portion of the levee embankment.	
			NA	Surface protection is provided by other means.	
3	Encroachments	M	A	No trash, debris, unauthorized farming activity, structures, excavation, or other obstruction present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish the proper function of the levee	At the I-10 bridge construction site there has been some excavation of the soil cement materials on the embankment unde the bridge. It is unknown if that has been authorized by the District. (photo 41)
			M	Trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
			U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operation and maintenance, emergency operations or negatively impact the integrity of the levee.	
			NA		

Ninyo & Moore

Report of Levee Evaluation and Field Observations From Van Buren Street to Thomas Road

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
4	Closure Structures (Stop Log, Earthen Closures, Gates, Sandbags closures	NA	A	Closures Structure in Good repair. Placing equipment, stoplogs, and other materials are readily available at all times. Components are clearly marked and installation instructions readily available. Trial Erections have been accomplished in accordance with the O&M Manual.	There are no closure structures in this stretch of levee.
			U	Any of the following issues is cause for their rating: Closure structure in poor condition. Parts missing or corroded. Placing equipment may not e available within the anticipated warning time. The storage vaults cannot be opened during the time of inspection. Components of closure are not clearly marked and installation instruction are not readily available. trial erections have not been accomplished in accordance with the O&M manual.	
			NA	There are no closure structures	
5	Slope Stability	A	A	No slides, sloughs, tension cracking, slope depressions, or bulges are present.	
			M	Minor slope stability problems that do not pose an immediate threat to the levee embankment	
			U	Major slope stability problems identified that must be repaired to reestablish the integrity of the levee embankment.	
6	Erosion/Bank Caving	M	A	No erosion or bank caving is observed on the landward or stream ward sides of the levee that might endanger its stability.	There are periodic rills, burrowing, cracking, and scouring along this stretch of levee that if left unresolved may ultimately result in structurally significant deficiencies (Photos 38-40, 43, 45, 47-48)
			M	There are areas where minor erosion is occurring or has occurred on or near the levee embankment, but the levee integrity is not threatened.	
			U	Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7	Settlement 1	A	A	No Observed Depression in crown. Records exist and indicate no unexplained historical changes	There is no evidence of settlement.
			M	Minor irregularities that do not threaten integrity of levee. Records are incomplete or inconclusive.	
			U	Obvious variation in elevation over significant reaches. No records exist or records indicate that design elevation is compromised.	

Ninyo & Moore

Report of Levee Evaluation and Field Observations From Van Buren Street to Thomas Road

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
8	Depressions/Rutting	A	A	There are scattered, shallow ruts, pot holes, or other depressions on the levee that are related to levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without ponded water.	There are no features that would indicate the levee has settled. It appears that the levee is draining as planned.
			M	There are some infrequent minor depressions less than 6 inches deep in the levee crown, embankment, or access roads that will pond water.	
			U	There are depressions greater than 6 inches deep that will pond water.	
9	Cracking	M	A	Minor longitudinal, transverse, or desiccation cracks with no vertical movement along crack. No cracks extend continuously through the levee crest	There are regular transverse cracks of the soil cement armour for this reach of the levee. They are up to 1/16-inch wide and may penetrate the entire width and height of the soil cement. There is no evidence of vertical movement or rotation. Lineal alignment of vegetation at the toe of the upstream face of the levee in conjunction with the cracks may suggest continuation of the cracks below the ground surface. (Photos 8, 22, 24)
			M	Longitudinal an/or transverse cracks up to 6 inches in depth with no vertical movement along the crack. No cracks extend continuously through the levee crest. Longitudinal cracks are no longer than the height of the levee.	
			U	Cracks exceed 6 inches in depth. Longitudinal cracks are longer than the height of the levee and/or exhibit vertical movement along the crack. Transverse cracks extend through out the entire levee width.	
10	Animal control	M	A	Continuous animal burrow control program in place that includes the elimination of active burrowing and the filling in of existing burrows.	Burrowing is evident throughout this stretch of levee, and in some locations has enabled erosion on the crest and downstream face of the levee. (Photos 43, 47)
			M	The existing animal burrow control program needs to be improved. Several burrows are present which may lead to seepage or slope stability problems, and require immediate attention	
			U	Animal burrow control program is not effective or is nonexistent.	

Ninyo & Moore

Report of Levee Evaluation and Field Observations From Van Buren Street to Thomas Road

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
11	Culverts/discharge pipes	A	A	There are no breaks, holes, or cracks in the discharge pipes/culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present are in good condition with 100% of the original coating still in place or have been relined with appropriate material. Condition of pipes has been verified using visual inspection methods.	There is no evidence of excessive erosion or degredation to pipes penetrating the levee. (Photos 35-37)
			M	There are a small number of erosion pinholes or cracks that could leak water and need to be repaired, but the entire lengths of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal.	
			U	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or has already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert.	
12	Riprap revetments & Bank protection	A	A	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Riprap intact with no woody vegetation present	Riprap appears to be intact, with no displacement or large vegetation around the discharge at McDowell Road
			M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
			U	Significant rip rap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses	

Ninyo & Moore

Report of Levee Evaluation and Field Observations From Thomas Road to North End of Levee

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
1	Unwanted Vegetation Growth	A	A	The levee has little or no unwanted vegetation (trees, bush or undesirable weeds, except for vegetation tha is properly contained and/or situated on over built section, such that the mandatory 3 foot root free zone is preserved around the levee profile. The levee has been recently mowed. The vegetation free zone extends 15 feet from both the landside and river side toes of the levee to the centerline of the tree. If the levee access easement doesn't extend to the described limits, then the vegetation free zone must be maintained to the easement Limits	Vegetation growth in this area is minimal and consists of sparse shrubs, and sparse ground cover (Photo 47). Density of vegetation increases at inlet structures through this stretch
			M	Minimal vegetation growth (brush, weeds, or trees 2 inches in diameter or smaller) is present within the zones described above. This vegetation must be removed but does not currently threaten the operatio or integrity of the levee	
			U	Significant vegetation growth is present within the zones described above and must be removed to reestablish or ascertain levee integrity.	
2	Sod Cover	N/A	A	There is good coverage of sod over the levee.	There is no sod on this reach of levee
			M	Approximately 25% of the sod cover is missing or damaged over a significant portion or over significant portions of the levee embankment. This may be the result of over-grazing or feeding on the levee, unauthorized vehicular traffic, chemical or insect problems, or burning during inappropriate seasons.	
			U	Over 50% of the sod cover is missing or damaged over a significant portion of the levee embankment.	
			NA	Surface protection is provided by other means.	
3	Encroachments	A	A	No trash, debris, unauthorized farming activity, structures, excavation, or other obstruction present within the easement area. Encroachments have bee previously reviewed by the Corps, and it was determined that they do not diminish the proper function of the levee.	There are no encroachments on this section of levee.
			M	Trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
			U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operation and maintenance, emergency operations or negatively impact the integrity of the levee.	
			NA		

Ninyo & Moore

Report of Levee Evaluation and Field Observations From Thomas Road to North End of Levee

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
4	Closure Structures (Stop Log, Earthen Closures, Gates, Sandbags closures	N/A	A	Closures Structure in Good repair. Placing equipment stoplogs, and other materials are readily available at all times. Components are clearly marked and installation instructions readily available. Trial Erections have been accomplished in accordance with the O&M Manual.	There are no closure structures in this stretch of levee.
			U	Any of the following issues is cause for their rating: Closure structure in poor condition. Parts missing or corroded. Placing equipment may not e available within the anticipated warning time. The storage vaults cannot be opened during the time of inspection Components of closure are not clearly marked and installation instruction are not readily available. trial erections have not been accomplished in accordance with the O&M manual.	
			NA	There are no closure structures	
5	Slope Stability	A	A	No slides, sloughs, tension cracking, slope depressions, or bulges are present.	
			M	Minor slope stability problems that do not pose an immediate threat to the levee embankment	
			U	Major slope stability problems identified that must be repaired to reestablish the integrity of the levee embankment.	
6	Erosion/Bank Caving	M	A	No erosion or bank caving is observed on the landward or stream ward sides of the levee that migh endanger its stability.	There is periodic rills, burrowing, cracking, and scouring along this stretch of levee that if left unresolved may ultimately result in structurally significant deficiencies (Photos 38-40, 43, 45, 47-48)
			M	There are areas where minor erosion is occurring or has occurred on or near the levee embankment, but the levee integrity is not threatened.	
			U	Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7	Settlement 1	A	A	No Observed Depression in crown. Records exist and indicate no unexplained historical changes	There is no evidence of settlement.
			M	Minor irregularities that do not threaten integrity of levee. Records are incomplete or inconclusive.	
			U	Obvious variation in elevation over significant reaches. No records exist or records indicate that design elevation is compromised.	

Ninyo & Moore

Report of Levee Evaluation and Field Observations From Thomas Road to North End of Levee

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
8	Depressions/Rutting	A	A	There are scattered, shallow ruts, pot holes, or other depressions on the levee that are related to levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without ponded water.	There are no features that would indicate the levee has settled. It appears that the levee is draining as planned.
			M	There are some infrequent minor depressions less than 6 inches deep in the levee crown, embankment, or access roads that will pond water.	
			U	There are depressions greater than 6 inches deep that will pond water.	
9	Cracking	M	A	Minor longitudinal, transverse, or desiccation cracks with no vertical movement along crack. No cracks extend continuously through the levee crest	There are regular transverse cracks of the soil cement armour for this reach of the levee. They are up to 1/16-inch wide and may penetrate the entire width and height of the soil cement. There is no evidence of vertical movement or rotation. Lineal alignment of vegetation at the toe of the upstream face of the levee in conjunction with the cracks may suggest continuation of the cracks below the ground surface. (Photos 8, 22, 24)
			M	Longitudinal an/or transverse cracks up to 6 inches in depth with no vertical movement along the crack. No cracks extend continuously through the levee crest. Longitudinal cracks are no longer than the height of the levee.	
			U	Cracks exceed 6 inches in depth. Longitudinal cracks are longer than the height of the levee and/or exhibit vertical movement along the crack. Transverse cracks extend through out the entire levee width.	
10	Animal control	M	A	Continuous animal burrow control program in place that includes the elimination of active burrowing and the filling in of existing burrows.	Burrowing is evident throughout this stretch of levee, and in some locations has enabled erosion on the crest and downstream face of the levee. (Photos 43, 47)
			M	The existing animal burrow control program needs to be improved. Several burrows are present which may lead to seepage or slope stability problems, and require immediate attention	
			U	Animal burrow control program is not effective or is nonexistent.	

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Report of Levee Evaluation and Field Observations From Thomas Road to North End of Levee

Project: **Agua Fria Levee Evaluation** Project No.: **600550016**

Rating Item		Rating	Guideline	Description	Explanation
11	Culverts/discharge pipes	A	A	There are no breaks, holes, or cracks in the discharge pipes/culverts that would result in significar water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present are in good condition with 100% of the original coating still in plac or have been relined with appropriate material. Condition of pipes has been verified using visual inspection methods.	There is no evidence of excessive erosion or degredation to pipes penetrating the levee (photo 35-37)
			M	There are a small number of erosion pinholes or cracks that could leak water and need to be repaired, but the entire lengths of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may b ovalized in some locations but does not appear to be approaching a curvature reversal.	
			U	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or has already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert.	
12	Riprap revetments & Bank protection	A	A	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Riprap intact with no woody vegetatio present	Riprap appears to be intact, with no displacement or large vegetation. (photo 49)
			M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
			U	Significant rip rap displacement, exposure of bedding or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses	

C-2

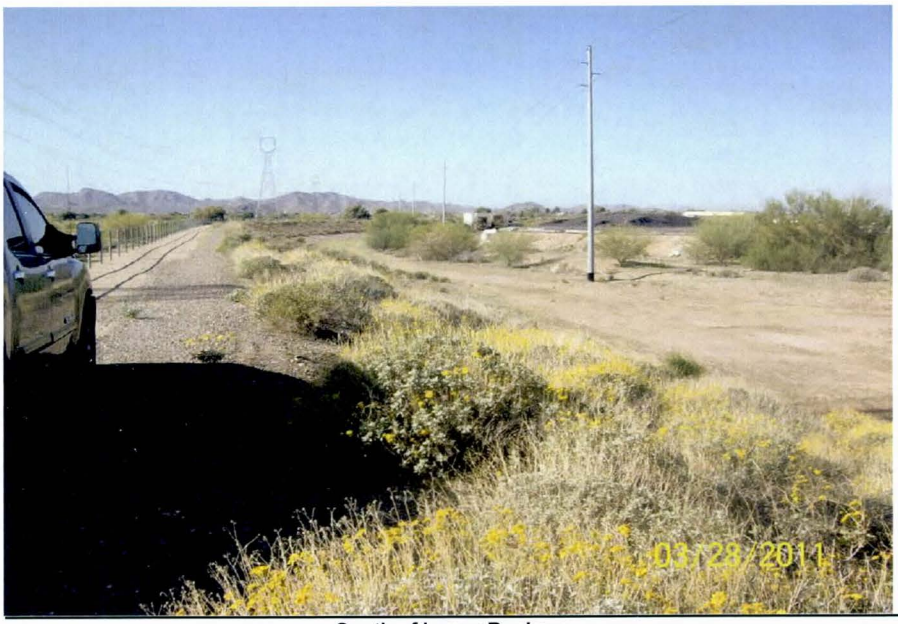

Photo No. 1 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.420486° long -112.341601°: Vegetation growth on the downstream side of the levee, and channel on the downstream side of the levee with soil cement at the curve of the levee.

Photo No. 2 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.420486° long -112.341601°: Vegetation growth on the downstream side of the levee.

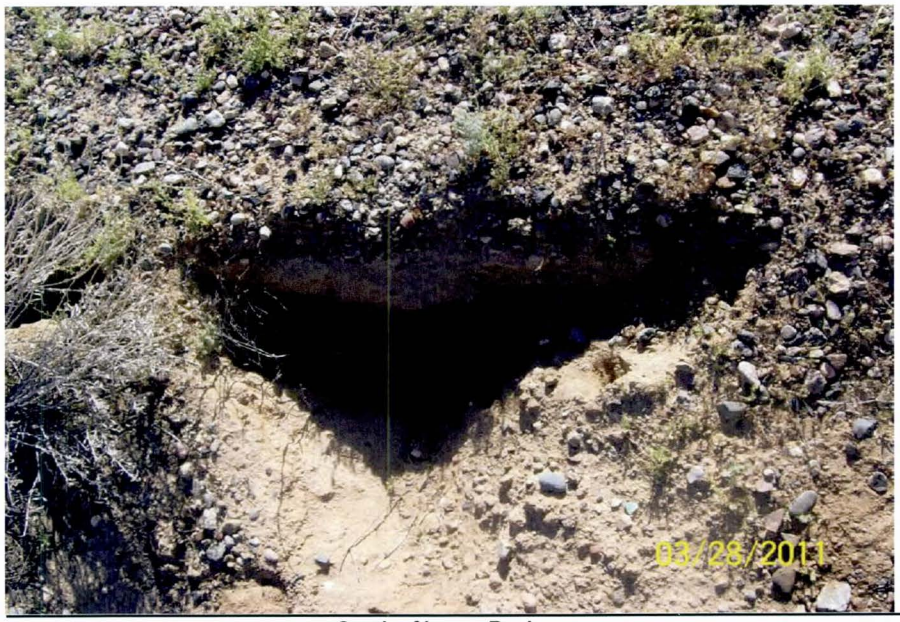

Photo No. 3 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.419690° Long -112.342177°: Biological disturbance (burrowing) on downstream side of levee.

Photo No. 4 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.419690° Long -112.342177° Biological disturbance (burrowing) on downstream side of levee.

Photo No. 5 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.419690° Long -112.342177°: Biological disturbance (burrowing) on the downstream side of the levee causing an erosional scarp approximately 25 feet in length at the crest of the levee.

Photo No. 6 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.419690° Long -112.342177°: Typical size of vegetation present on the down stream side of the levee.

Photo No. 7 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.416053° Long -112.351346°: Erosion on the Down stream side of the levee near the southern end of the levee. Approximately 3 feet high by 10 feet long.

Photo No. 8 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.417819° Long -112.346465°:Typical crack on the upstream side of the levee. Occurrence is regular with a spacing on the order of 20 to 40 feet between each.

Photo No. 9 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.417229° Long -112.348680°: Example of blockey erosion on upstream side of the levee.

Photo No. 10 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.417819° Long -112.346465° Erosion at apparent lift boundary on the upstream side of the levee approximately 10 inches deep by 4 inches high extending 20 feet. Can see the imprint of the compaction equipment at intervals of 4 to 6 inches to the crest of the levee.

Photo No. 11 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.417819° Long -112.346465° Erosion at apparent lift boundary on the upstream side of the levee approximately 10 inches deep by 4 inches high extending 20 feet. Can see the imprint of the compaction equipment at intervals of 4 to 6 inches to the crest of the levee.

Photo No. 12 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.418155° Long -112.345118° Typical condition of apparent maintenance on the upstream side of the levee.

Photo No. 13 **Location:** **South of Lower Buckeye Road** **Date: 03/28/2011**

Lat 33.418839° Long -112.342805°: Erosion of the bottom foot of the upstream side of the levee extending 10 feet and being approximately 4 inches deep.

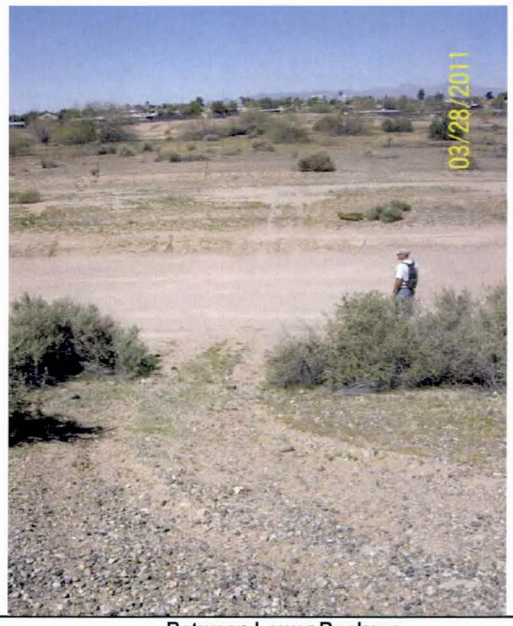

Photo No. 14 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.421938° Long -112.340710°: Apparent levee Access from channel on the down stream side of levee.

Photo No. 15 **Location: Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.424186° Long -112.339287°: Property boundary for subdivision on downstream side of the levee. Beginning of maintained landscape, and levee access from within the subdivision.

Photo No. 16 **Location: Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.425184° Long -112.338567°: Sidewalk and vegetation with trunk diameter greater than 6 inches at the downstream toe of the levee.

Photo No. 17 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.430626° Long -112.336013°: Erosion caused by human access to the levee on the down stream side from subdivision.

Photo No. 18 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.432155° Long -112.335269°: View looking upstream on the downstream side of the levee and the end of the maintained levee. Vegetation with trunk diameter greater than 6 inches and unmaintained shrubs on downstream face of the levee.

Photo No. 19 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.434926° Long -112.334100°: View looking upstream at Buckeye Road crossing at the abutment for the bridge with debris in tunnel under the bridge.

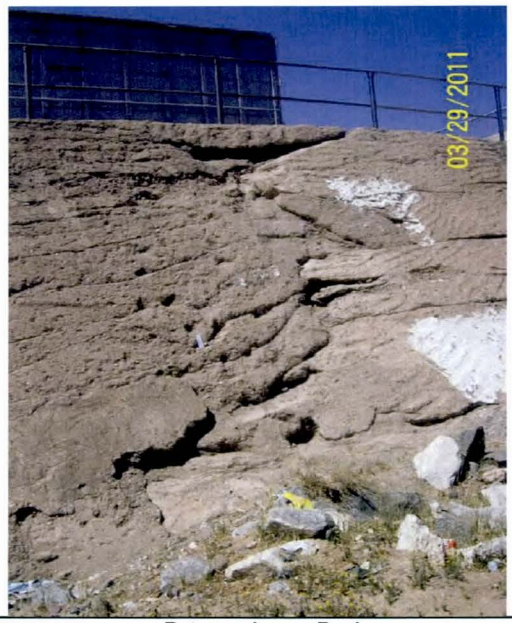

Photo No. 20 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.434926° Long -112.334100°: On the upstream face of the levee a junction of original soil cement and soil cement placed during the construction of the Buckeye Road crossing.

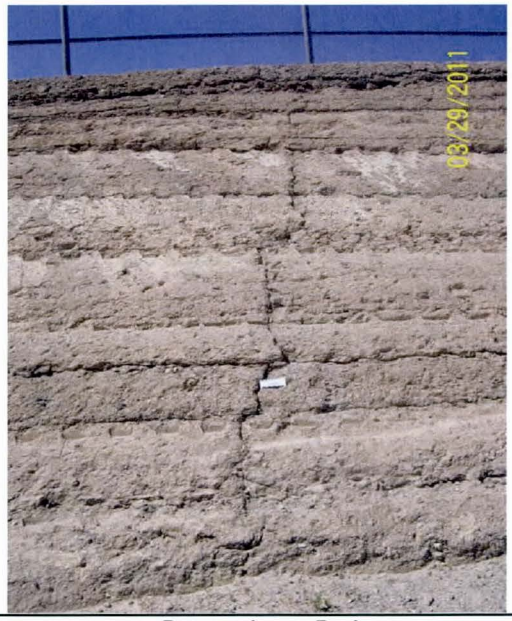

Photo No. 21 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.433600° Long -112.334405°: Typical crack on the upstream side of the levee. Occurrence is regular with a spacing on the order of 20 to 40 feet between each.

Photo No. 22 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.433600° Long -112.334405°: Typical crack on the upstream side of the levee. Occurrence is regular with a spacing on the order of 20 to 40 feet between each. Continues through the ramp, vegetation indicates increased moisture in the same plane as the crack.

Photo No. 23 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.432494° Long -112.334958°: Erosion and flaking of apparent cement patching on the bottom foot of the upstream face of the levee.

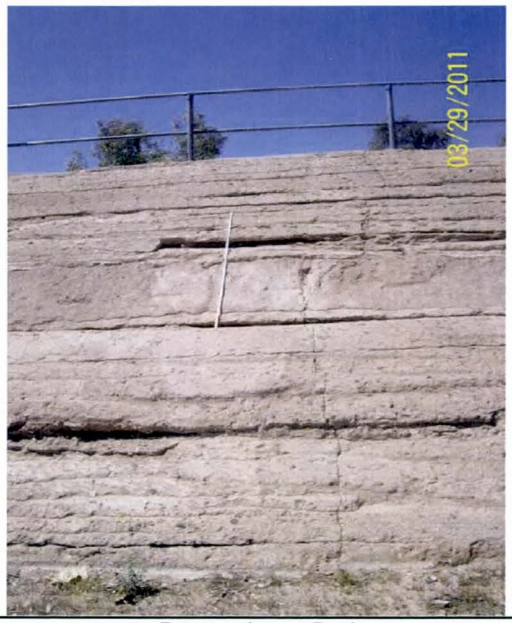

Photo No. 24 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.4430590° Long -112.335873°: Erosion and flaking of apparent cement patching on the bottom foot of the upstream face of the levee.

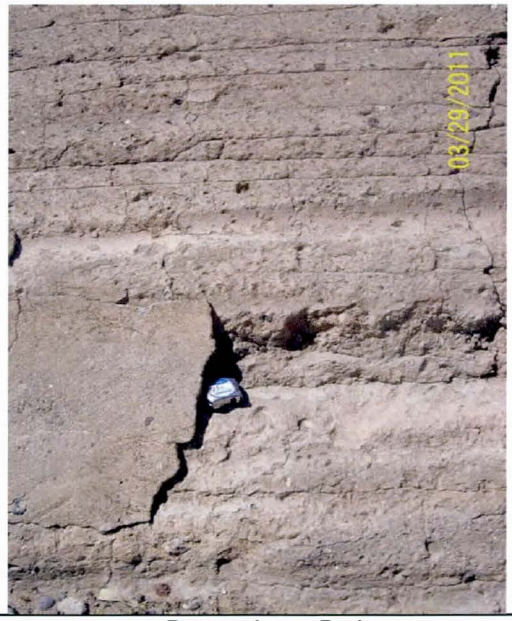

Photo No. 25 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.4430590° Long -112.335873°: Erosion and flaking of apparent cement patching on the bottom foot of the upstream face of the levee.

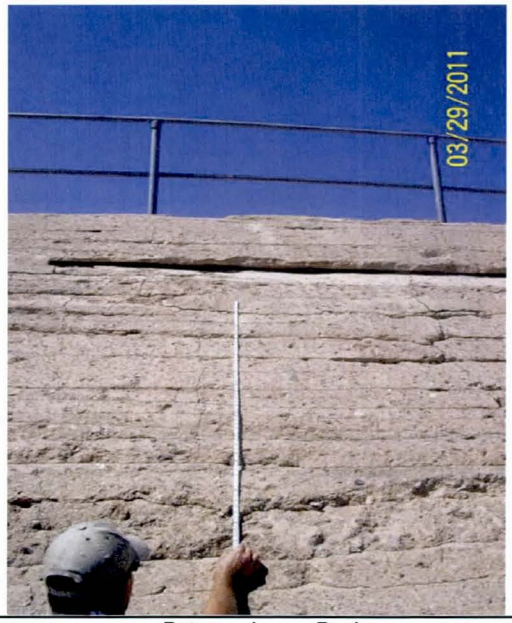

Photo No. 26 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.430590° Long -112.335873°: Erosion of a lift layer at the top 2 feet of the levee.

Photo No. 27 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.425184° Long -112.338567°: Upstream face of the levee showing evidence of erosion of the bottom 2 feet of the levee, approximately 10 inches deep and 20 feet long.

Photo No. 28 **Location:** **Between Lower Buckeye Road and Buckeye Road** **Date: 03/28/2011**

Lat 33.421123° Long -112.341066°: Upstream face of the levee showing evidence of erosion, and maintenance with evidence of the cement patching materials flaking off.

Photo No. 29 **Location: Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.448769° Long -112.334809°: View looking down stream south of Van Buren of the crest of the levee showing evidence of raveling of the crest.

Photo No. 30 **Location: Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.448614° Long -112.334869°: On the downstream face of the levee a typical erosional rill. Rilling is typically 40 feet spacing between rills.

Photo No. 31 **Location: Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.447364° Long -112.334601°: Looking downstream a the crest of the levee showing raveling of the crest 2 inches deep.

Photo No. 32 **Location: Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.444133° Long -112.334160°: View of the downstream face of the levee showing rutting caused by off road vehicles.

Photo No. 33 **Location:** **Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.443620° Long -112.334151°: 10 inch deep by 3.5 feet wide rill formed on the downstream side of the levee.

Photo No. 34 **Location:** **Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.442871° Long -112.334138°: Erosional scarp approximately 8 inches deep at the soil cement boundary at the crest of the levee on the down stream side. Extends approximately 10 feet.

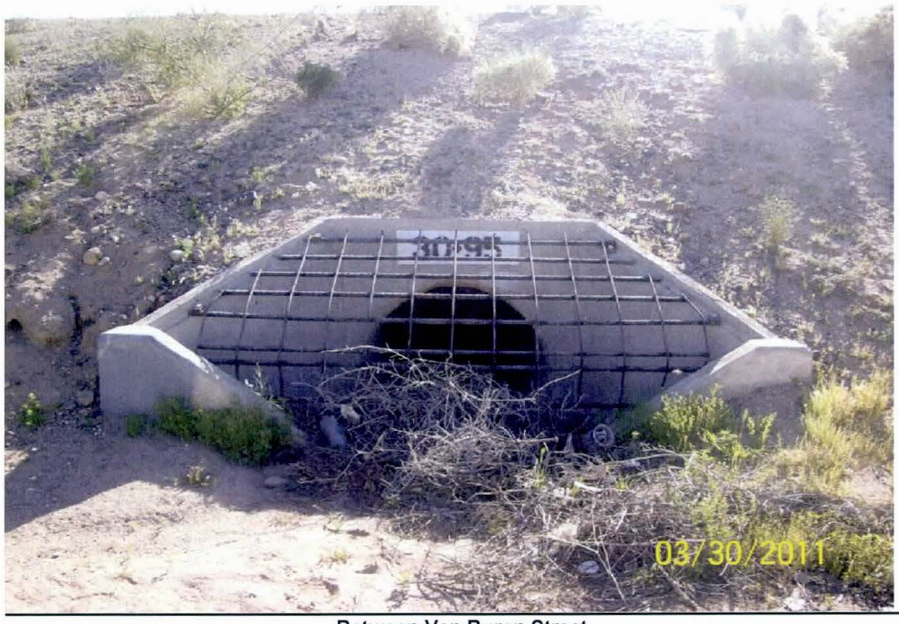

Photo No. 35 **Location:** **Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.4425213° Long -112.334147°: Typical view of a penetration on the down stream face of the levee. Minor erosion is seen on the headwalls.

Photo No. 36 **Location:** **Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.4425213° Long -112.334147°: View looking upstream of typical penetration on the downstream face of the levee.

Photo No. 37 **Location: Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.4425213° Long -112.334147°: View of the erosion on the headwall for the typical penetration with some damage to the concrete.

Photo No. 38 **Location: Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.443777° Long -112.334049°: Erosion of several lift layers on the upstream face of the levee from the ground level to 3 feet above ground level. Erosion is on the order of 10 inches deep in some locations.

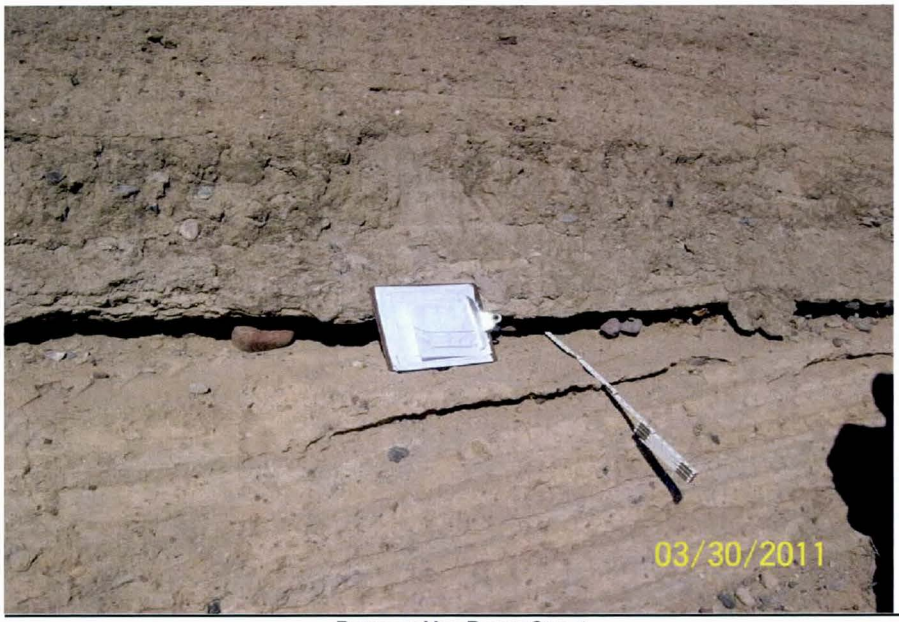

Photo No. 39 **Location: Between Van Buren Street and Buckeye Road** **Date: 03/28/2011**

Lat 33.446661° Long -112.334257°: Erosion of lift layer approximately 3 feet from ground surface on the upstream side of the levee.

Photo No. 40 **Location: Between Van Burn Street and Thomas Road** **Date: 03/28/2011**

Lat 33.452505° Long -112.335517°: Erosional rills observed on the down stream face becoming more frequent and larger. The character of the downstream soils has changed, and there is less vegetation.

Photo No. 41 **Location: Between Van Burn Street and Thomas Road** **Date: 03/28/2011**

Lat 33.456944° Long -112.335953°: Construction of the I10 overpass and evidence of removal of 8 inches or so of the soil cement levee upstream face.

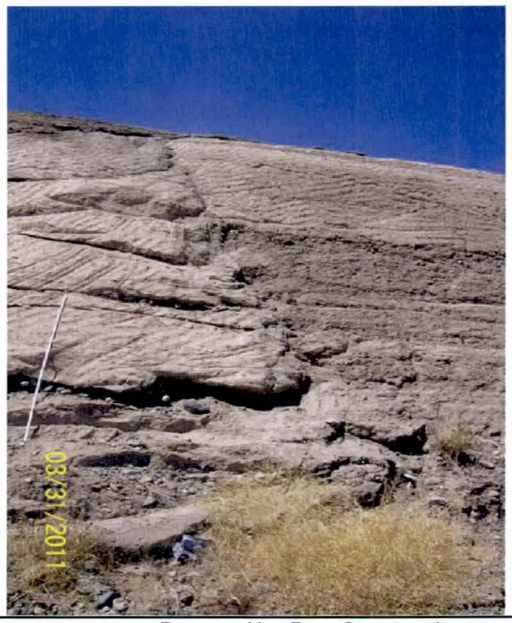

Photo No. 42 **Location: Between Van Burn Street and Thomas Road** **Date: 03/28/2011**

Lat 33.458201° Long -112.335399°: View of the upstream face of the levee just north of the I10 overpass. Showing contact of 2 soil cement materials.

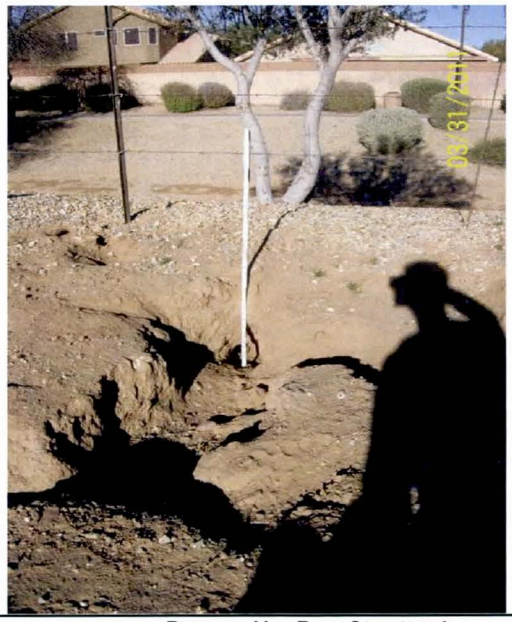

Photo No. 43 **Location: Between Van Burn Street and Thomas Road** **Date: 03/28/2011**

Lat 33.476039° Long -112.321389°: Erosion and burrowing evident on the down stream side of the levee near subdivision south of Thomas road.

Photo No. 44 **Location: Between Van Burn Street and Thomas Road** **Date: 03/28/2011**

Lat 33.468612° Long -112.326257°: View looking upstream on the upstream side of the levee showing an intact section of soil cement repair.

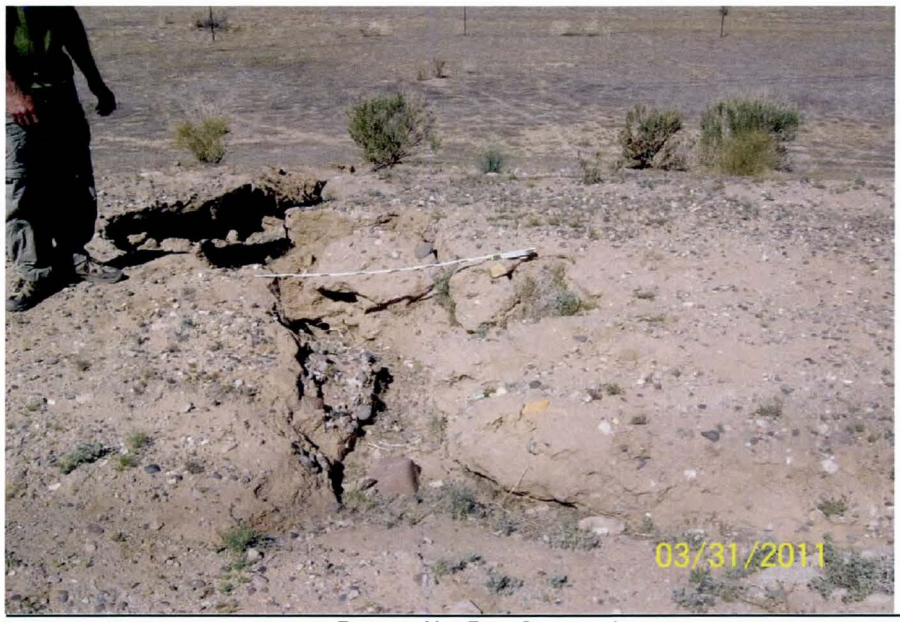

Photo No. 45 **Location:** **Between Van Burn Street and Thomas Road** **Date: 03/28/2011**

Lat 33.468612° Long -112.326257°: Large rill formed on the downstream face of the levee Approximately 2.5 feet wide and 10 inches deep.

Photo No. 46 **Location:** **Between Van Burn Street and Thomas Road** **Date: 03/28/2011**

Lat 33.477471° Long -112.320878°: Standing water in the channel approximately 5 inches deep appears to be coming from a penetration on the down stream face of the levee handling discharge from a pump station.

Photo No. 47 **Location: From Van Buren Street to End of Levee North of Indian** **Date: 03/28/2011**

Lat 33.481424° Long -112.319730°: View of an erosional scarp looking downstream on the downstream face of the levee extending approximately 200 feet from photo location.

Photo No. 48 **Location: From Van Buren Street to End of Levee North of Indian** **Date: 03/28/2011**

Lat 33.481424° Long -112.319730°: View of an erosional scarp looking downstream on the downstream face of the levee extending approximately 200 feet from photo location.

Project Name: Agua Fria Levee Evaluation **Project No.: 600550016**

Photo No. 49 **Location: From Van Buren Street to End of Levee North of Indian** **Date: 03/28/2011**

Lat 33.482805° Long -112.319236°: View looking up stream of rip rap section of levee with mining operations present on the down stream side of the levee.

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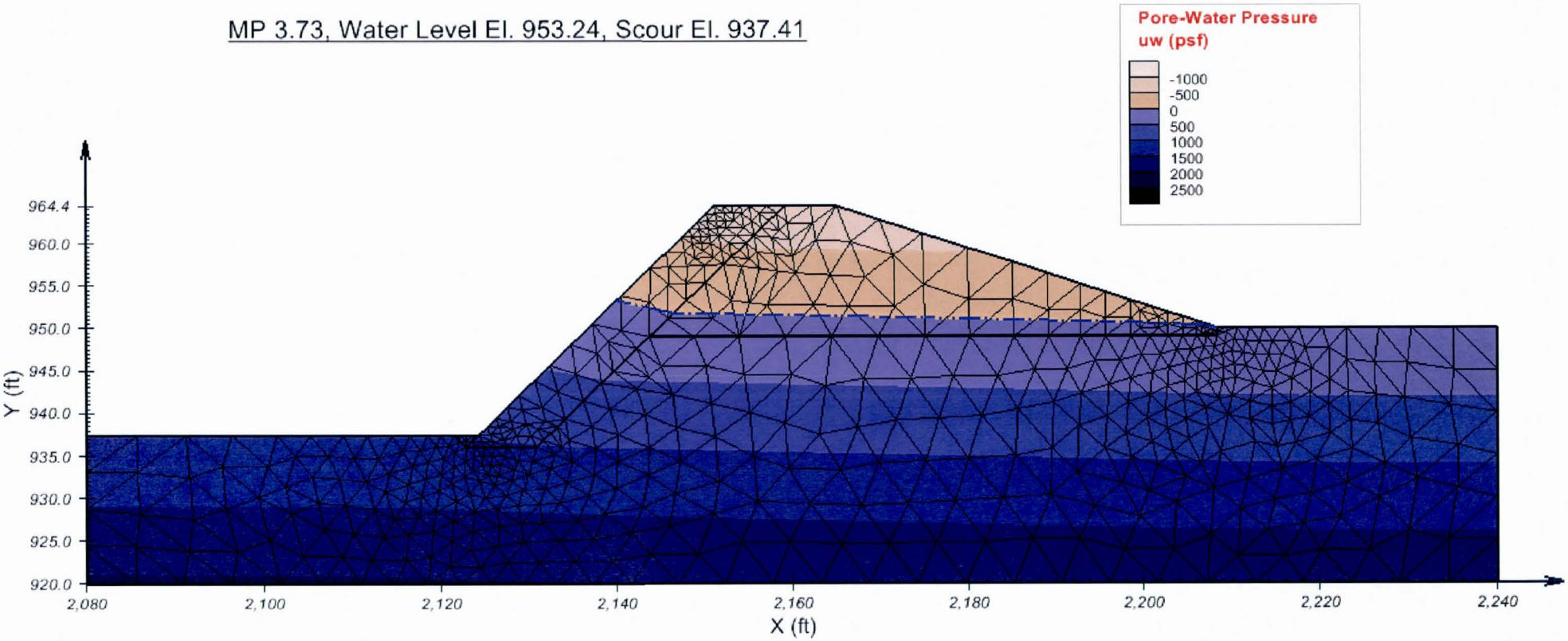
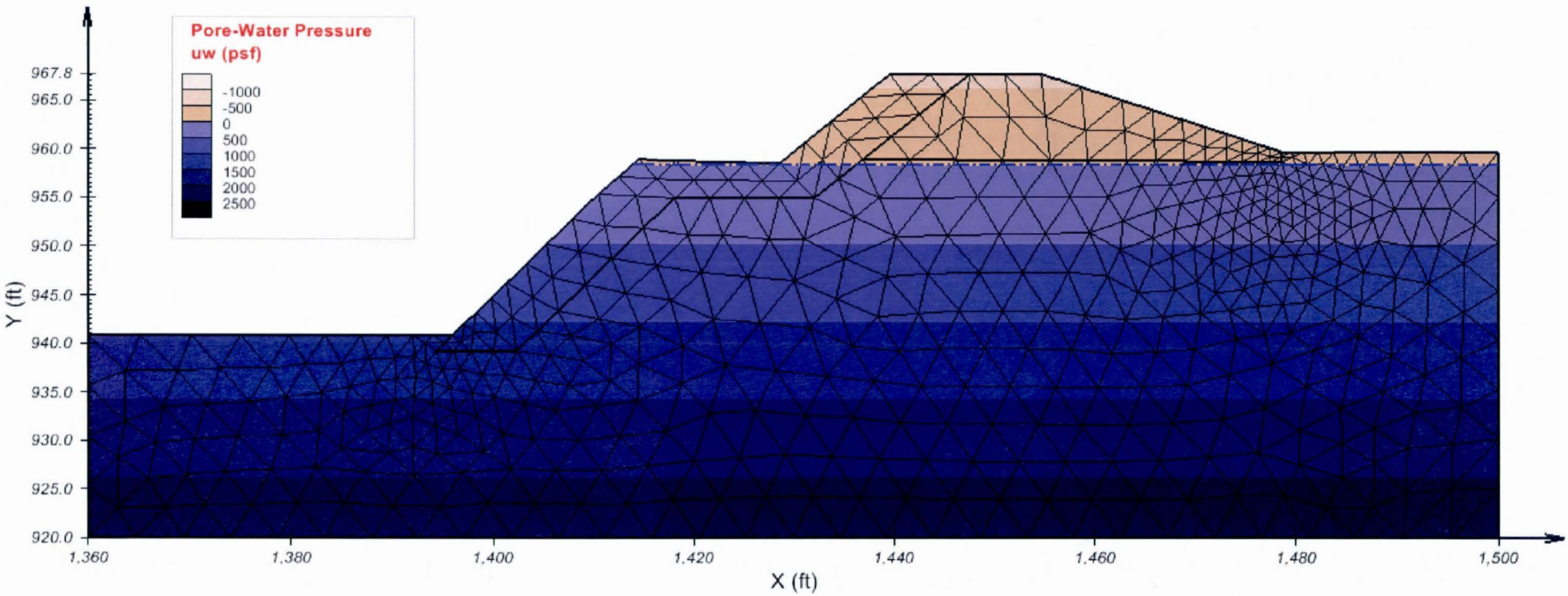
APPENDIX D

SEEPAGE ANALYSIS

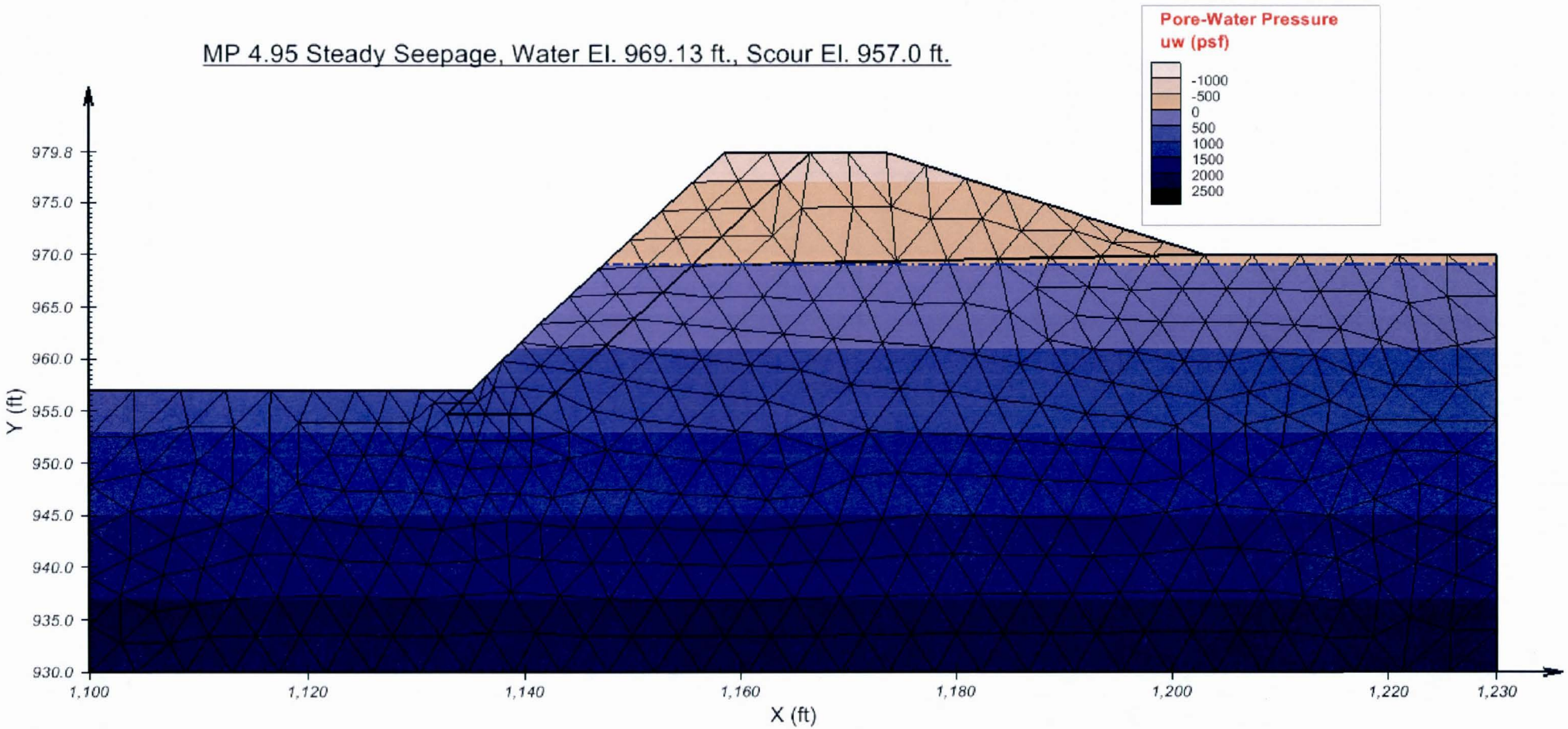
MP 3.73, Water Level El. 953.24, Scour El. 937.41



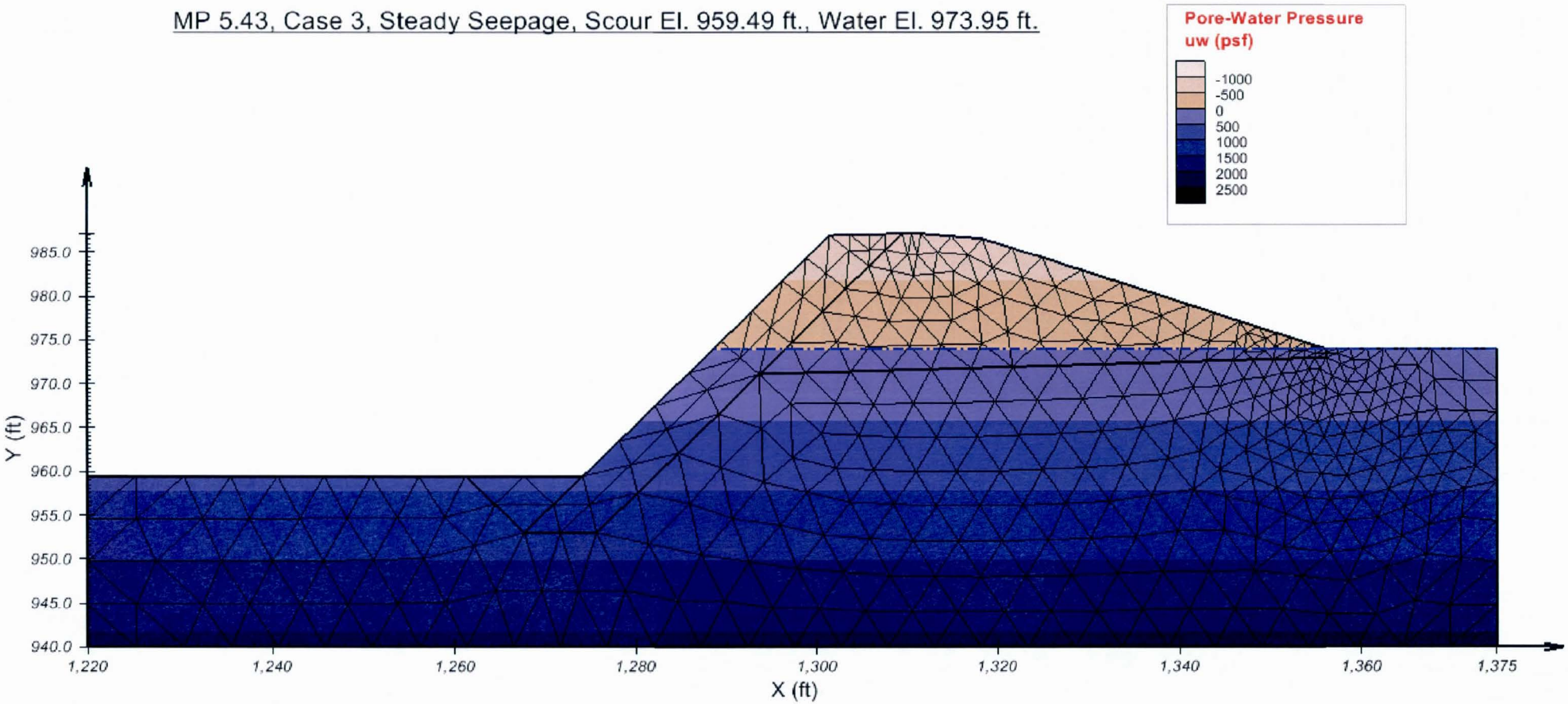
MP 4.09, Steady Seepage, Water El. 958.42 ft., Scour El. 940.84 ft.



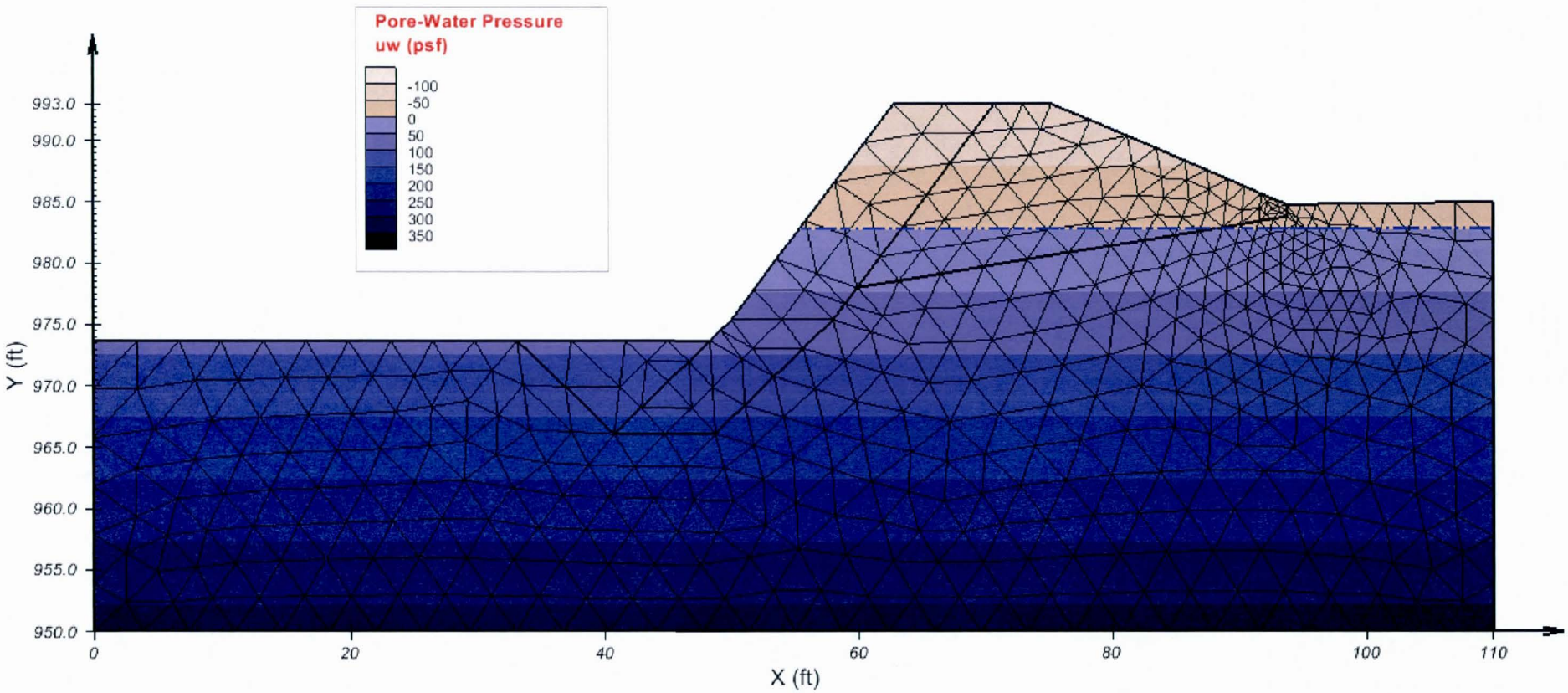
MP 4.95 Steady Seepage, Water El. 969.13 ft., Scour El. 957.0 ft.



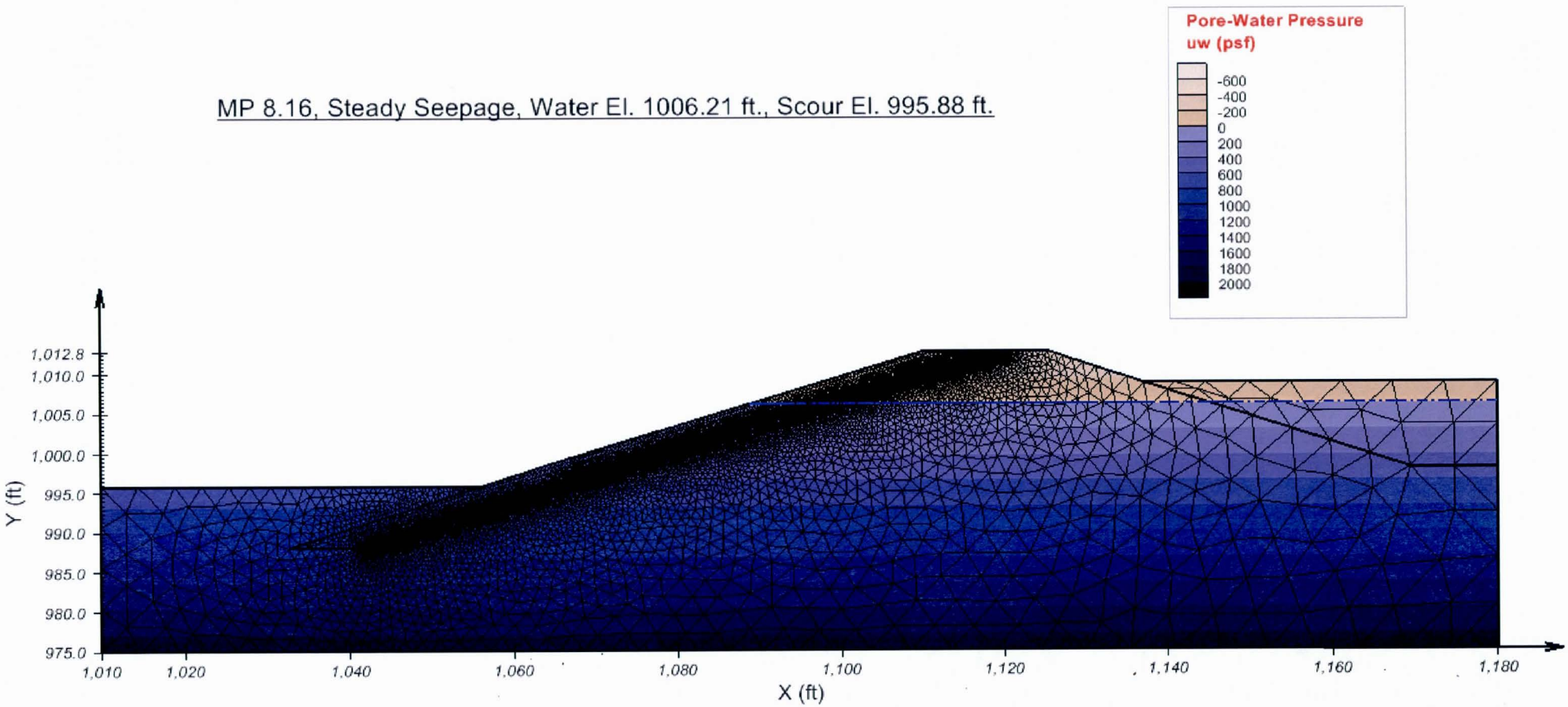
MP 5.43, Case 3, Steady Seepage, Scour El. 959.49 ft., Water El. 973.95 ft.



MP 6.04, Steady Seepage, Water El. 982.9 ft., Scour El. 973.7 ft.



MP 8.16, Steady Seepage, Water El. 1006.21 ft., Scour El. 995.88 ft.



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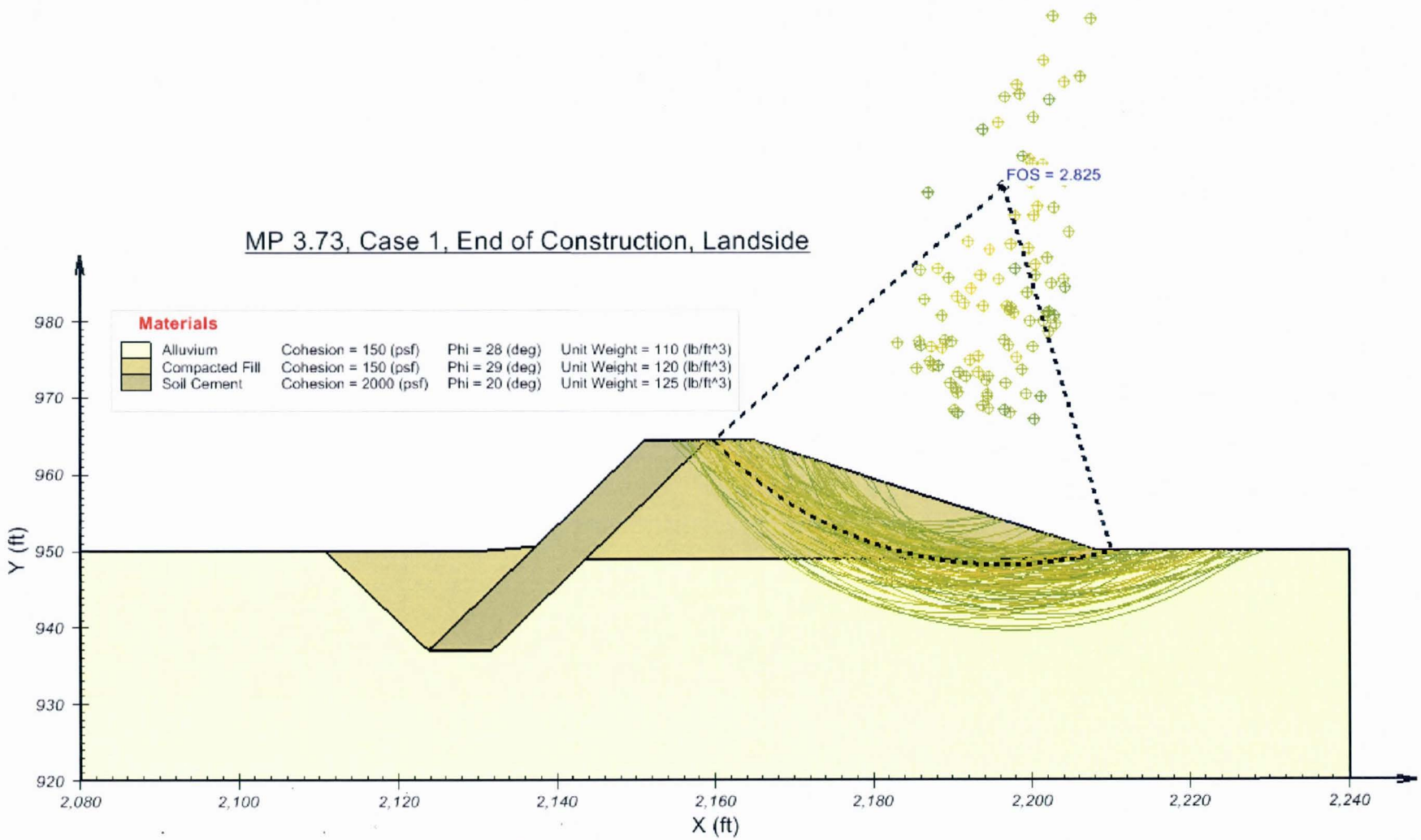
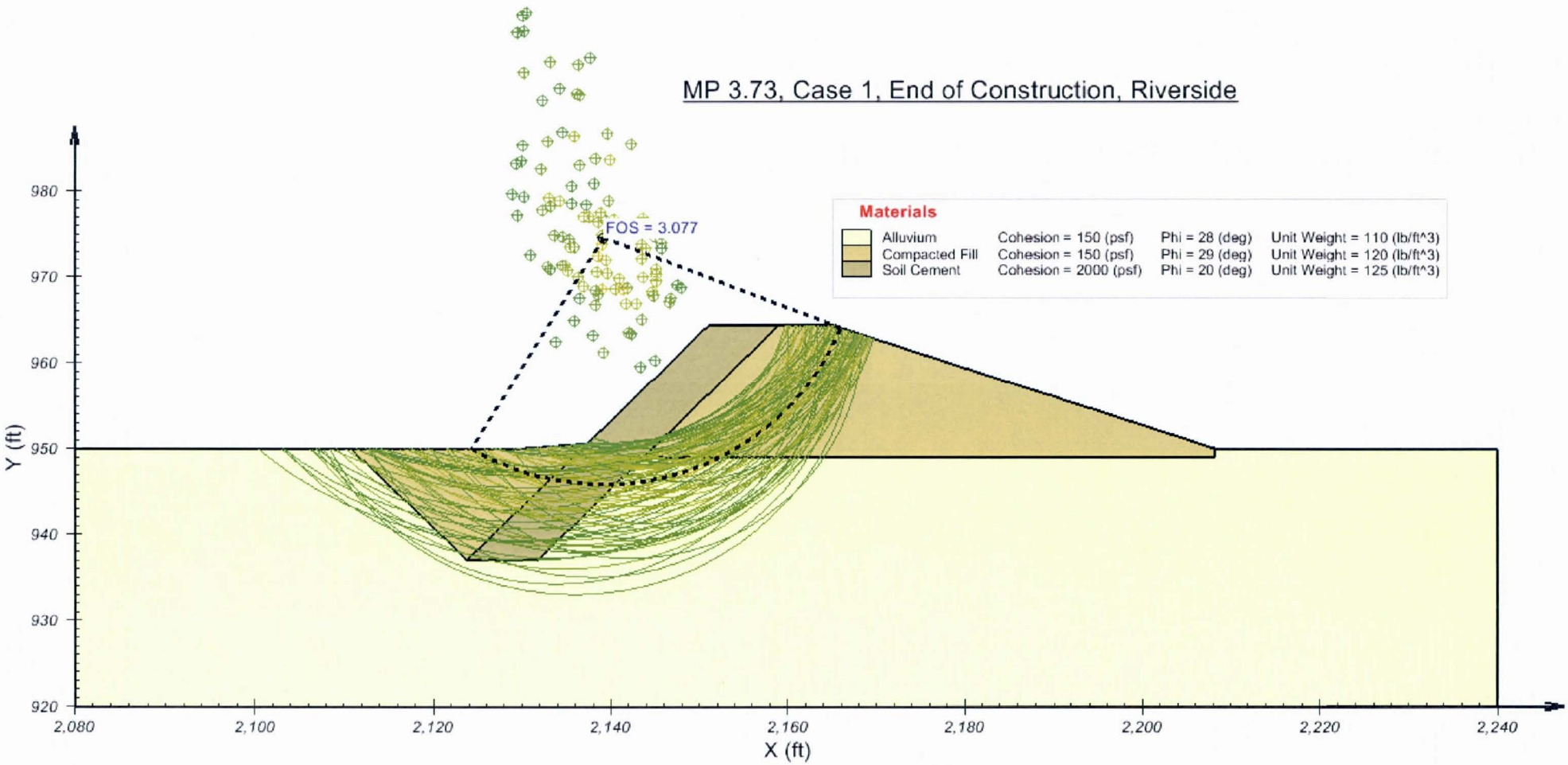
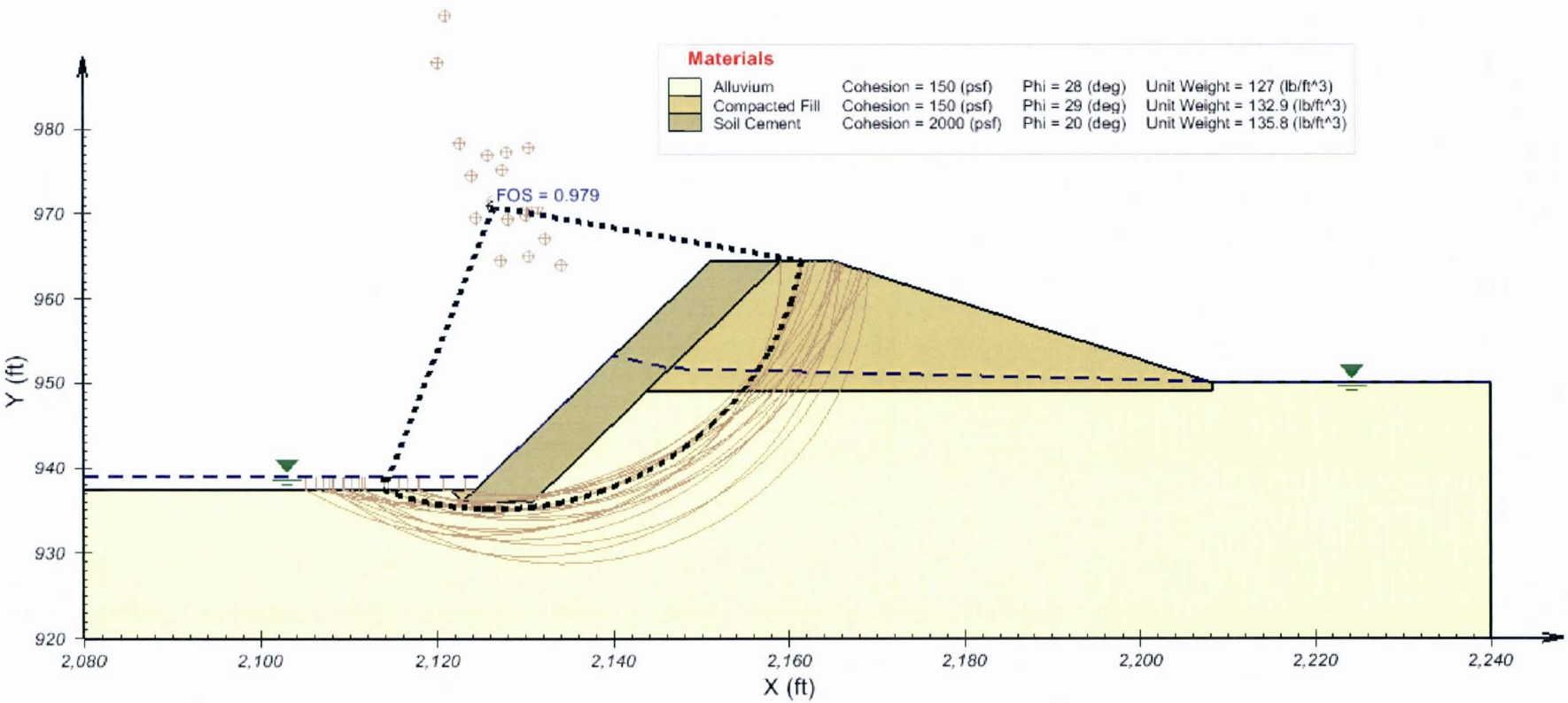
APPENDIX E

STABILITY ANALYSIS

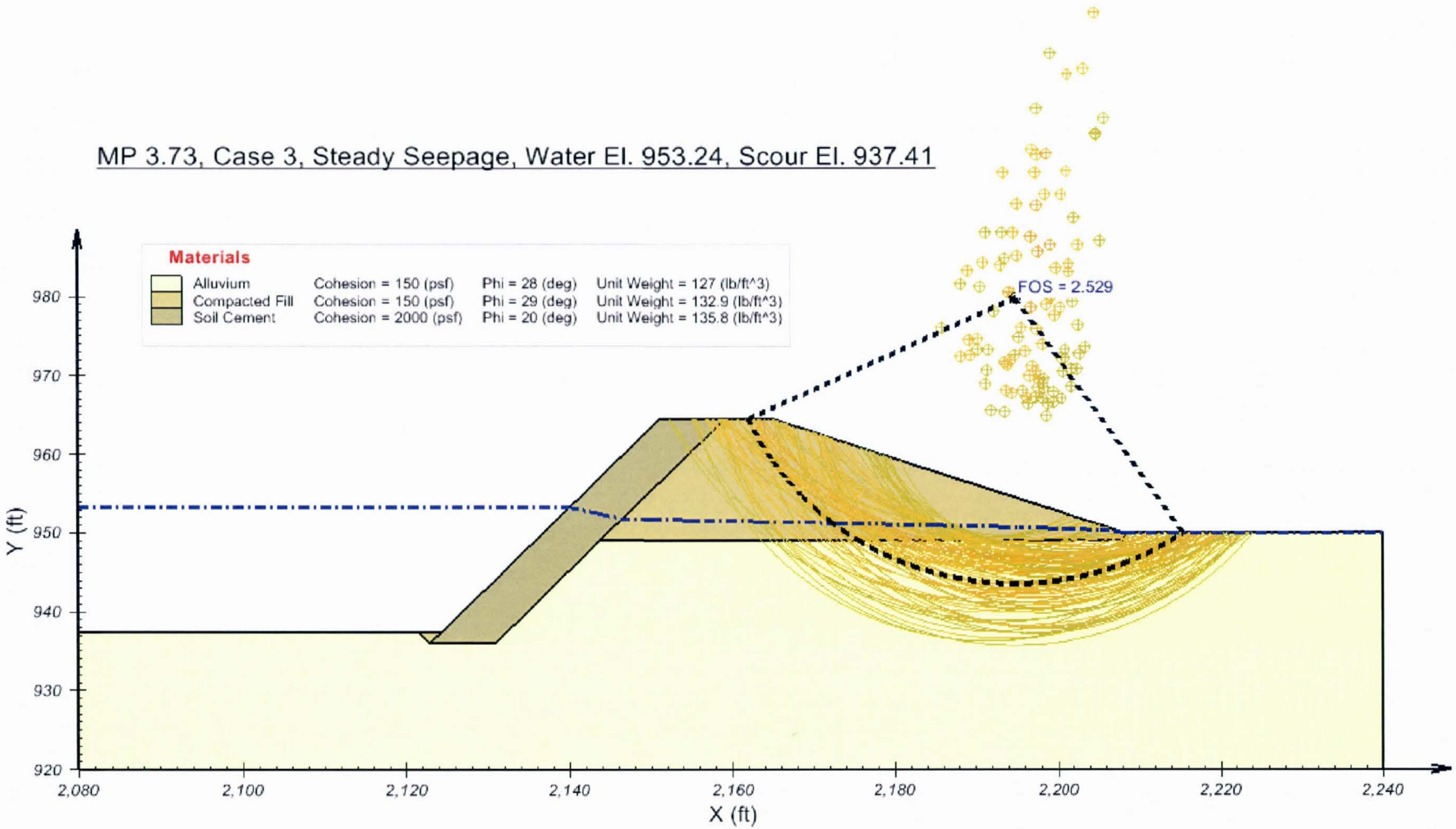

MP 3.73, Case 1, End of Construction, Landside
FOS = 2.825
Materials
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Y (ft)
980
970
960
950
940
930
920
2,080
2,100
2,120
2,140
2,160
2,180
2,200
2,220
2,240
X (ft)


MP 3.73, Case 1, End of Construction, Riverside
FOS = 3.077
Materials
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Y (ft)
980
970
960
950
940
930
920
2,080
2,100
2,120
2,140
2,160
2,180
2,200
2,220
2,240
X (ft)

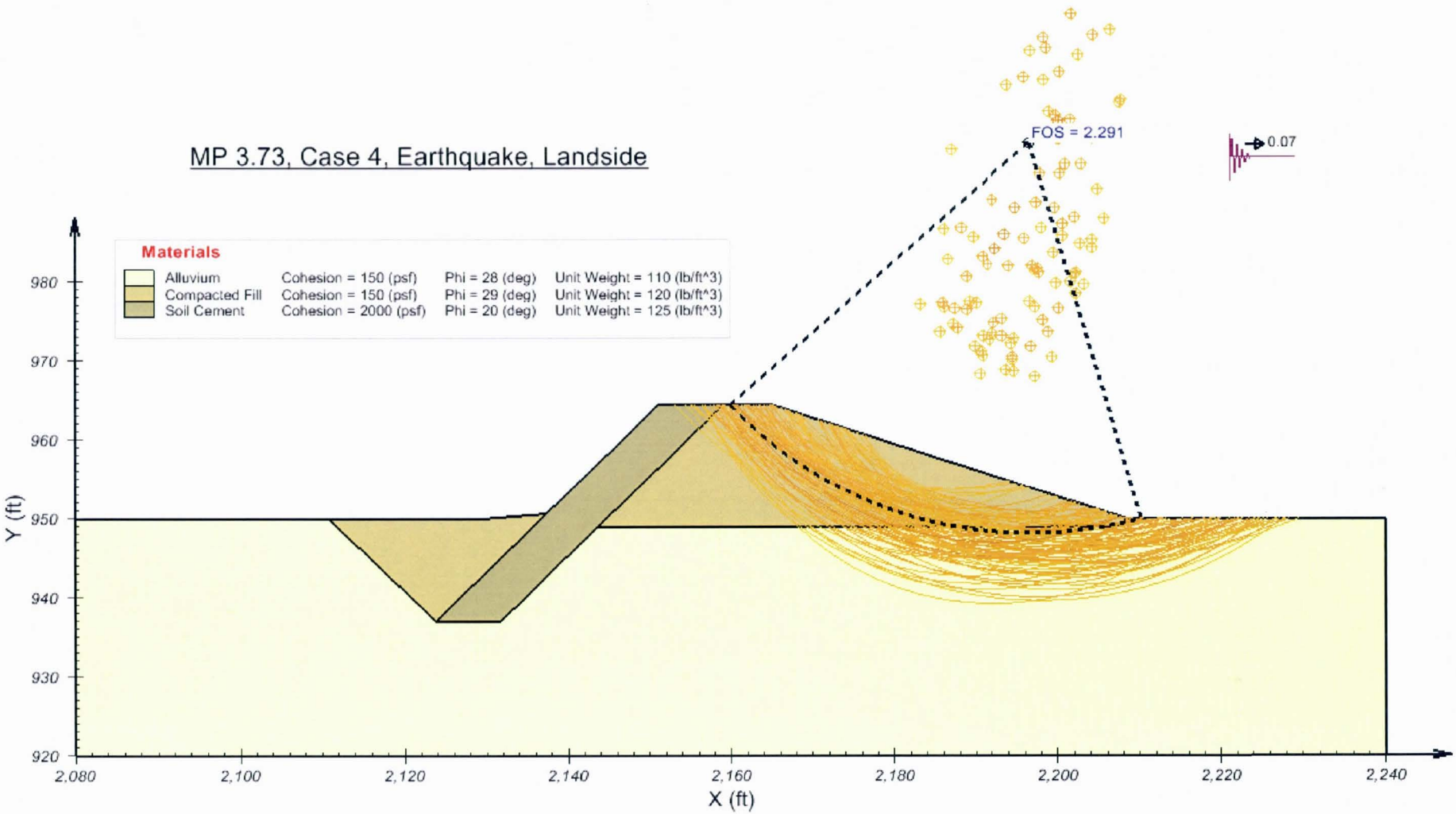
MP 3.73, Case 2, Rapid Drawdown, Water El. 953.24 ft, Scour El. 937.41 ft.



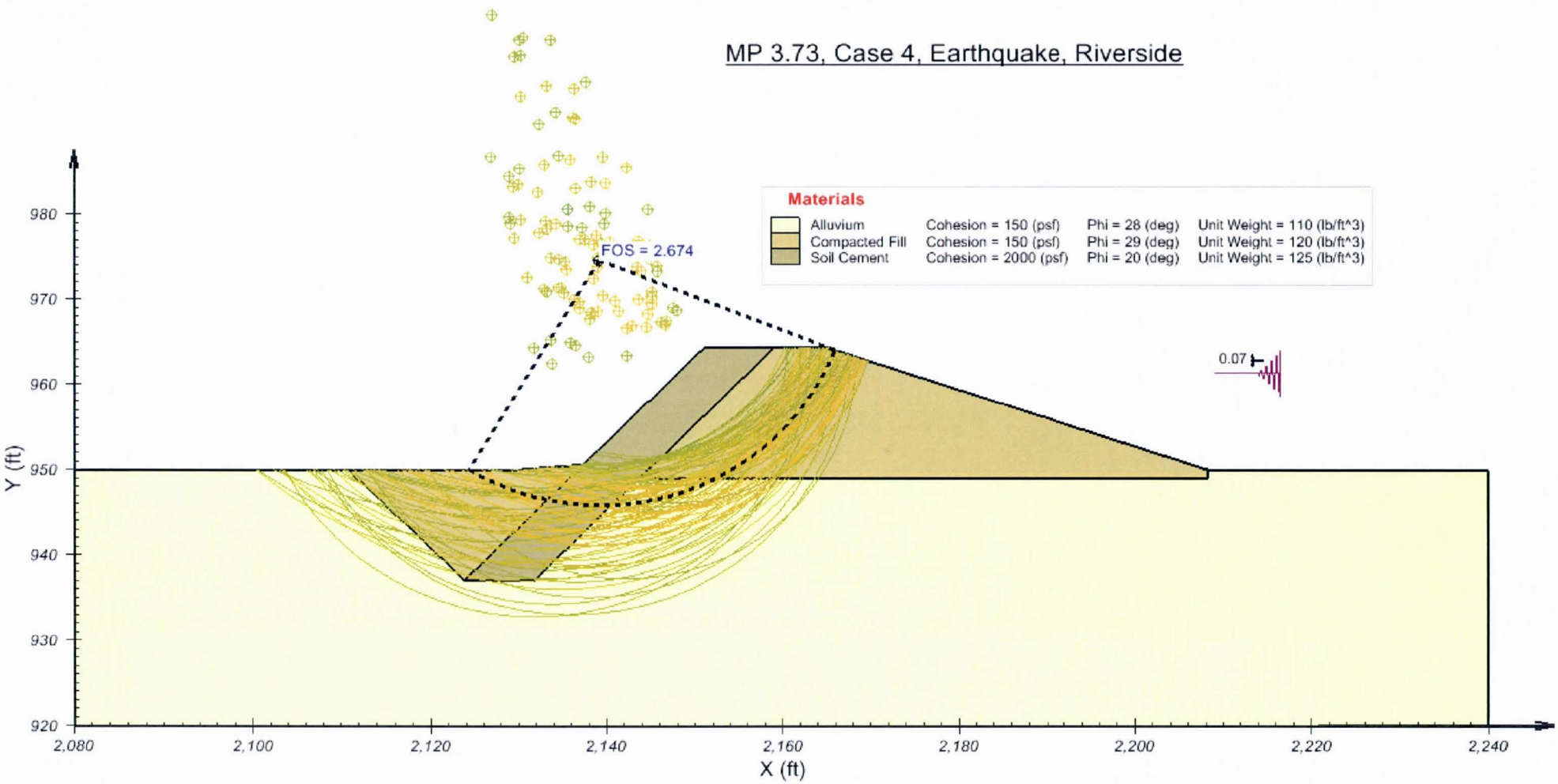
MP 3.73, Case 3, Steady Seepage, Water El. 953.24, Scour El. 937.41

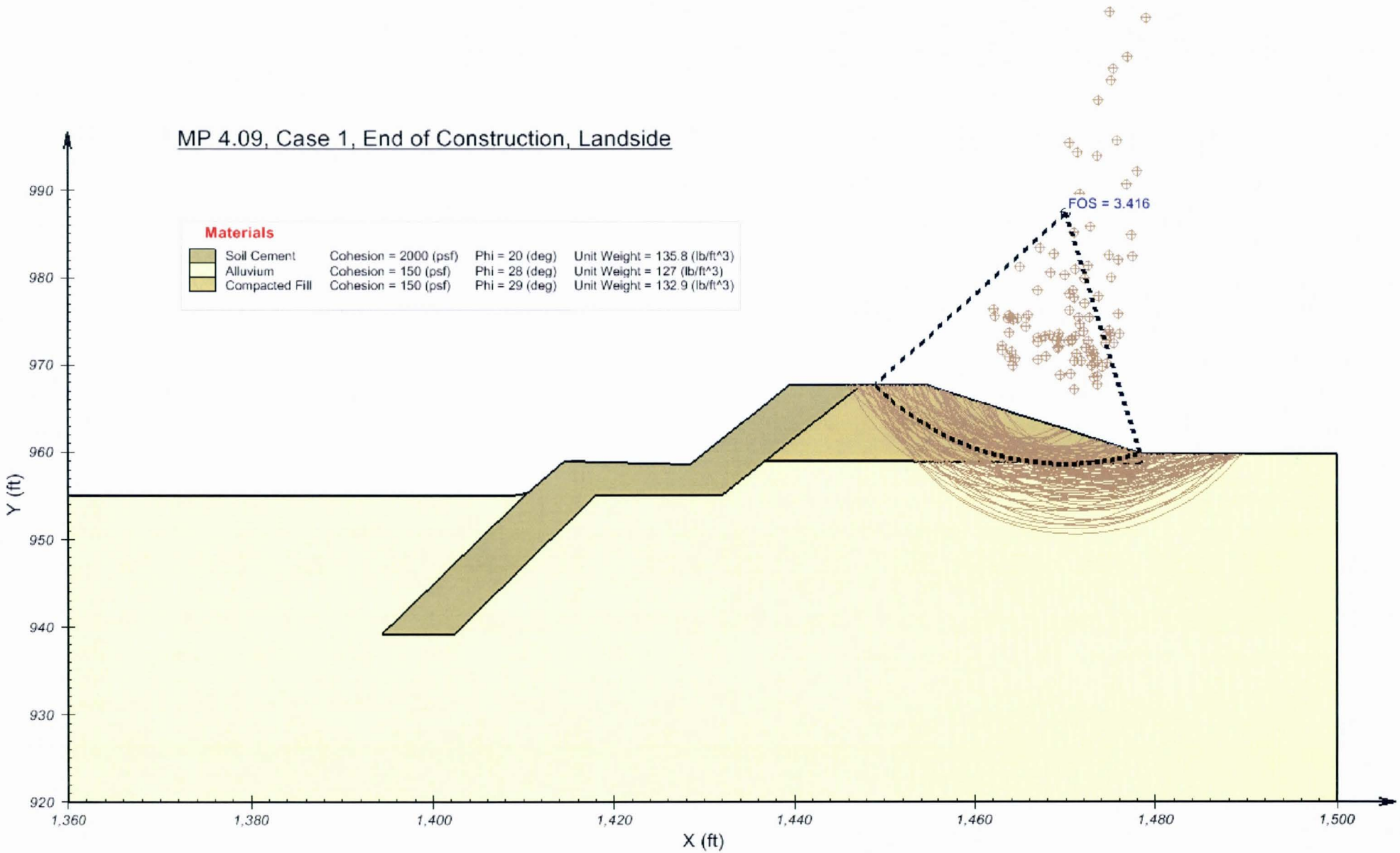


MP 3.73, Case 4, Earthquake, Landside

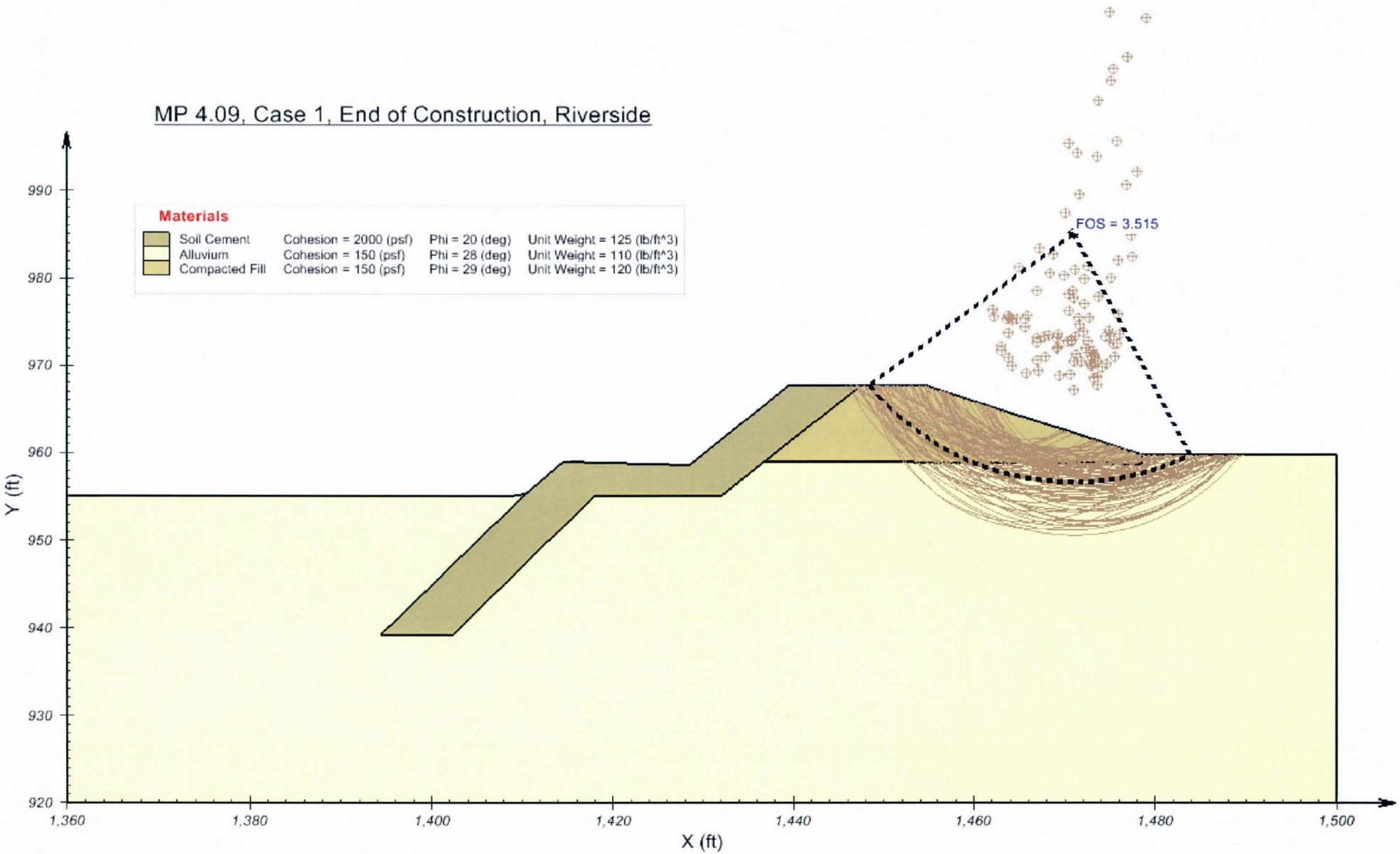


MP 3.73, Case 4, Earthquake, Riverside

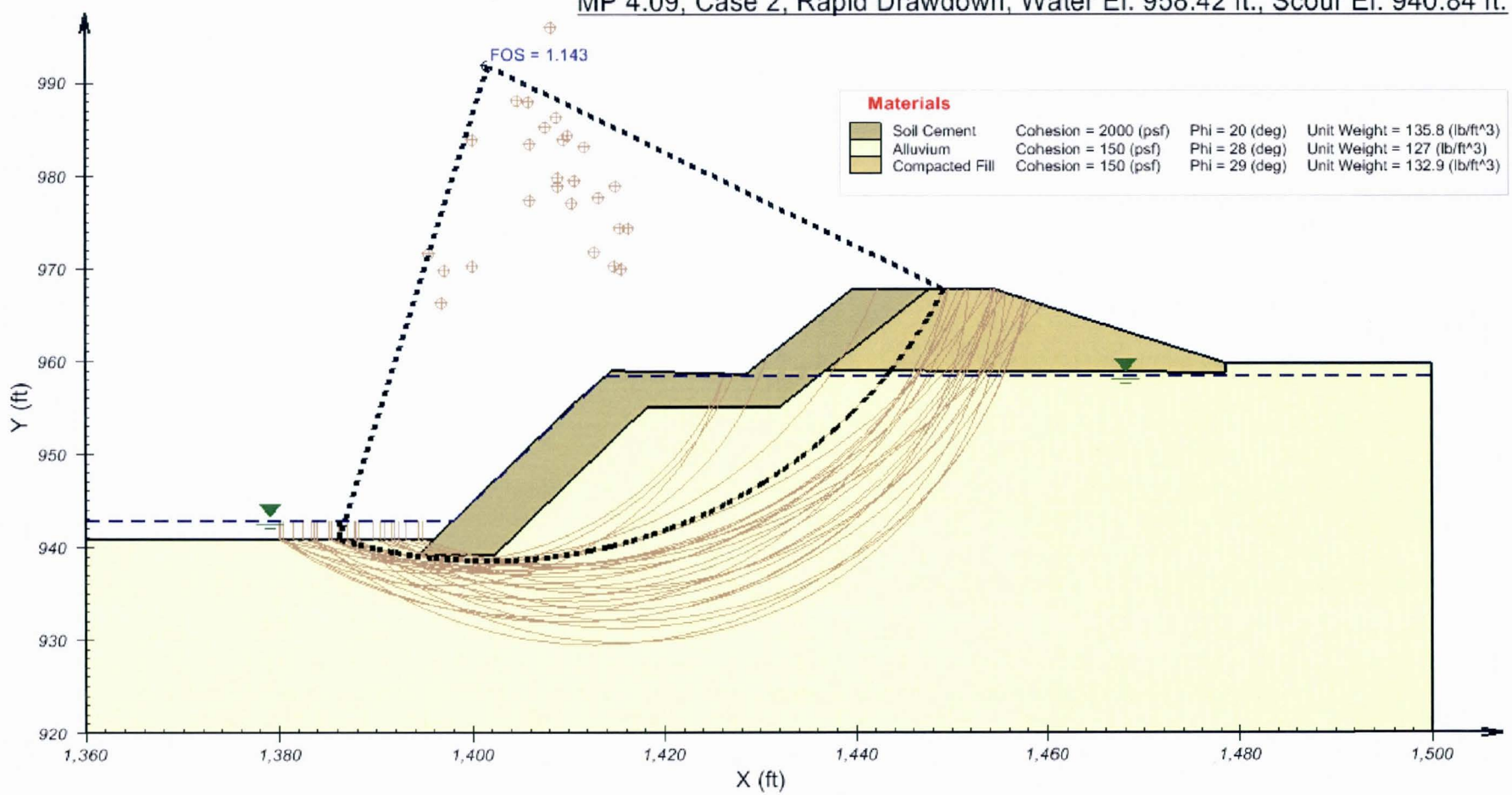


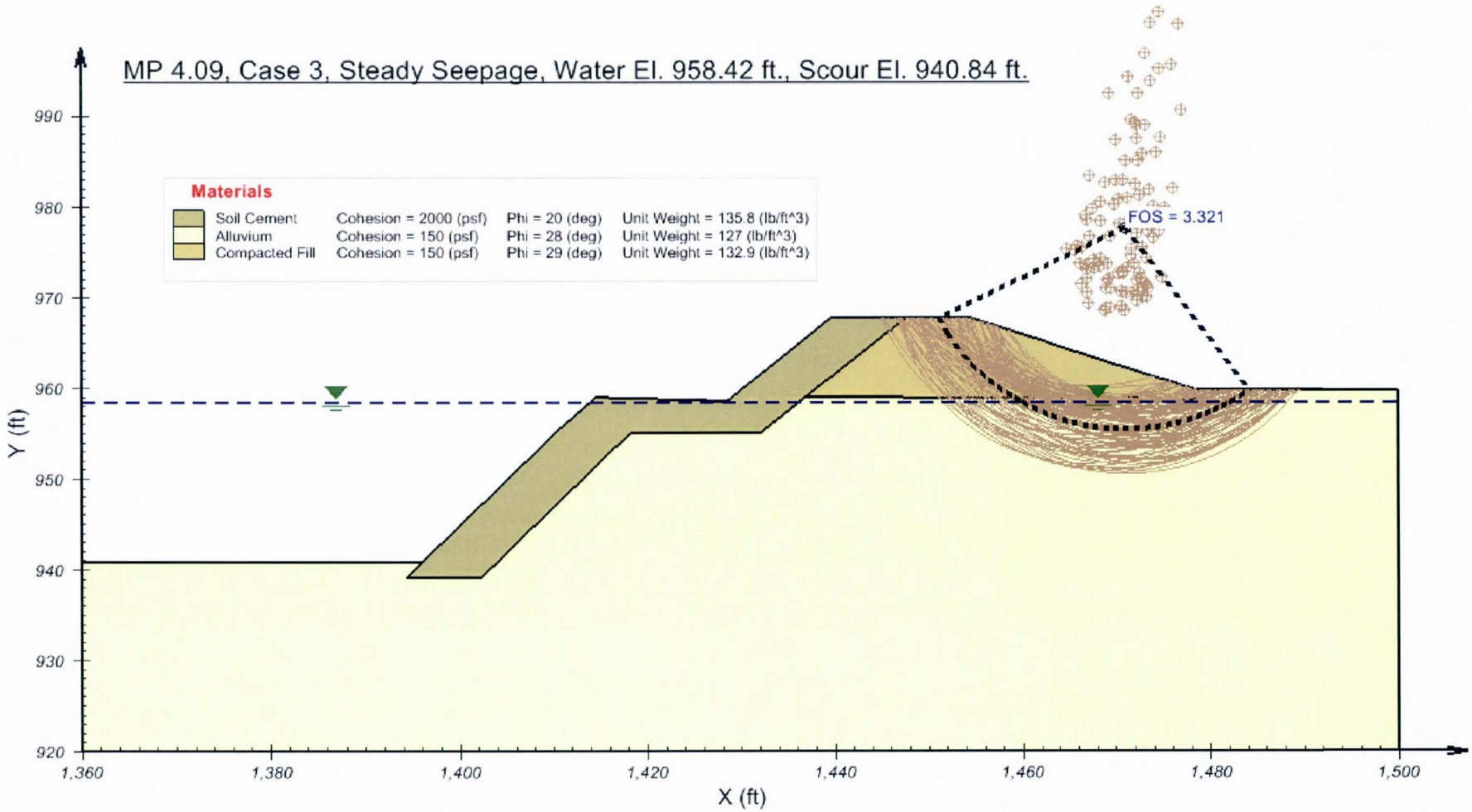

MP 4.09, Case 1, End of Construction, Landside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 135.8 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 127 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 132.9 (lb/ft^3)
FOS = 3.416
Y (ft)
990
980
970
960
950
940
930
920
X (ft)
1,360
1,380
1,400
1,420
1,440
1,460
1,480
1,500

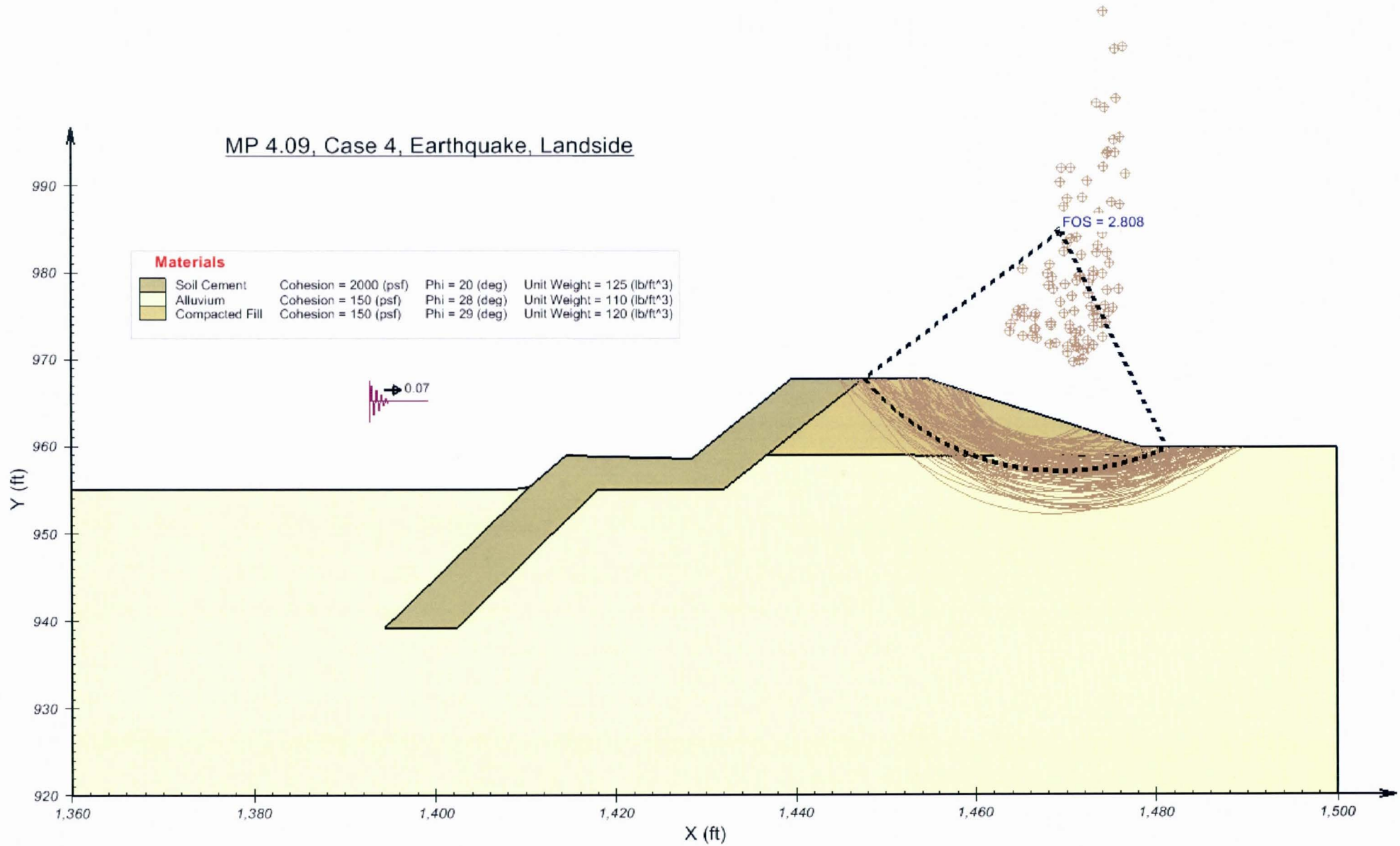
MP 4.09, Case 1, End of Construction, Riverside

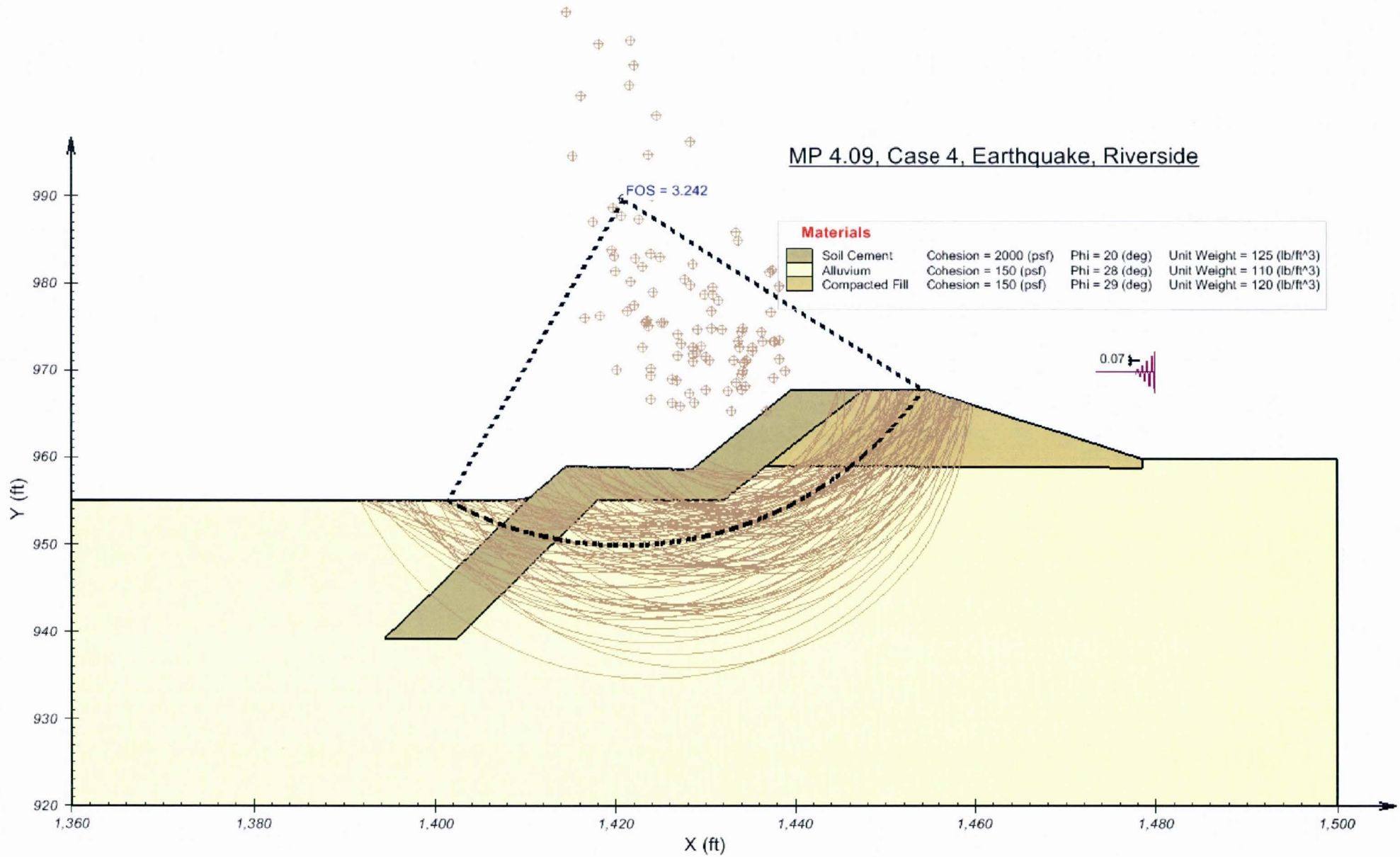


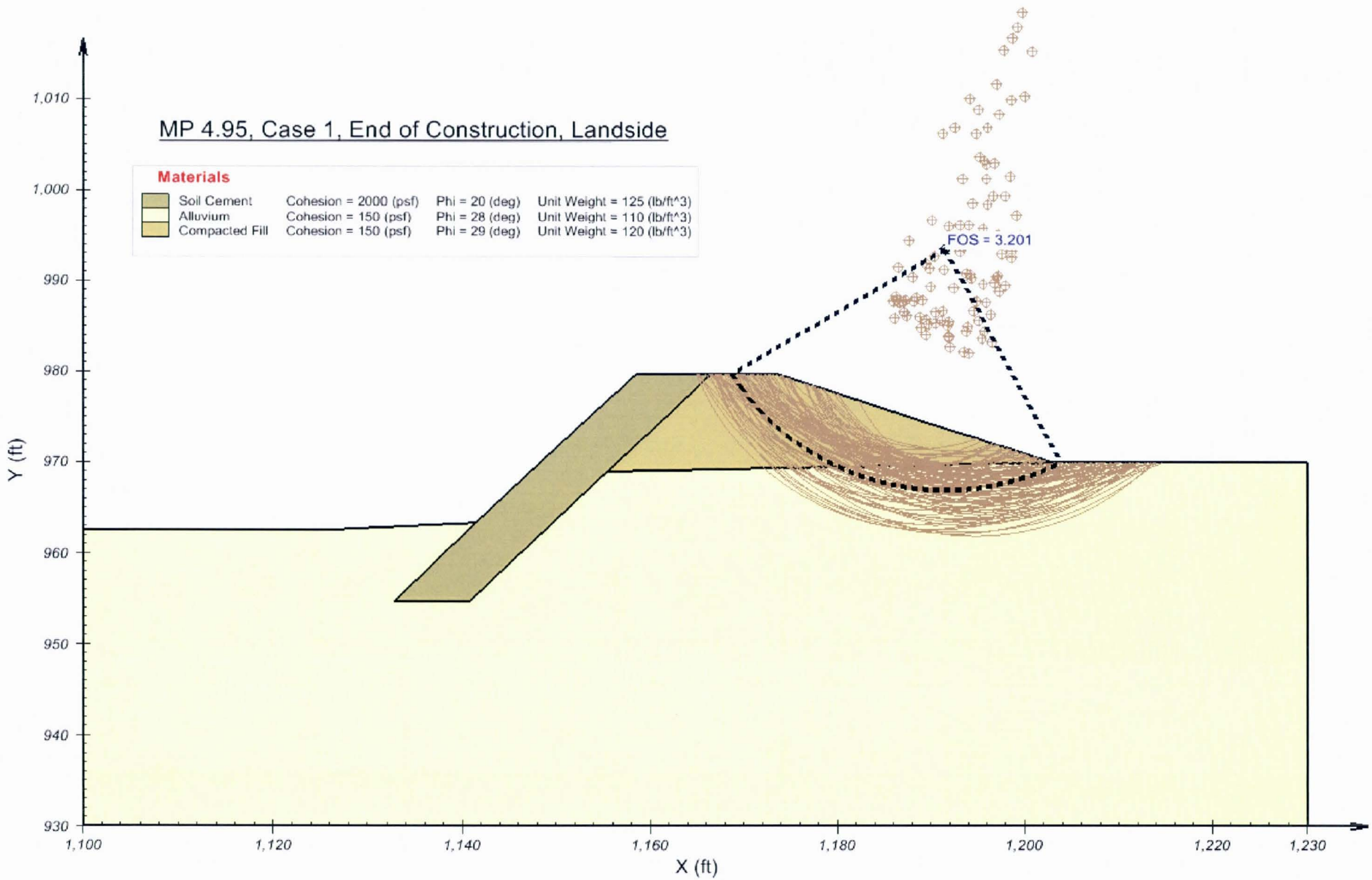
MP 4.09, Case 2, Rapid Drawdown, Water El. 958.42 ft., Scour El. 940.84 ft.

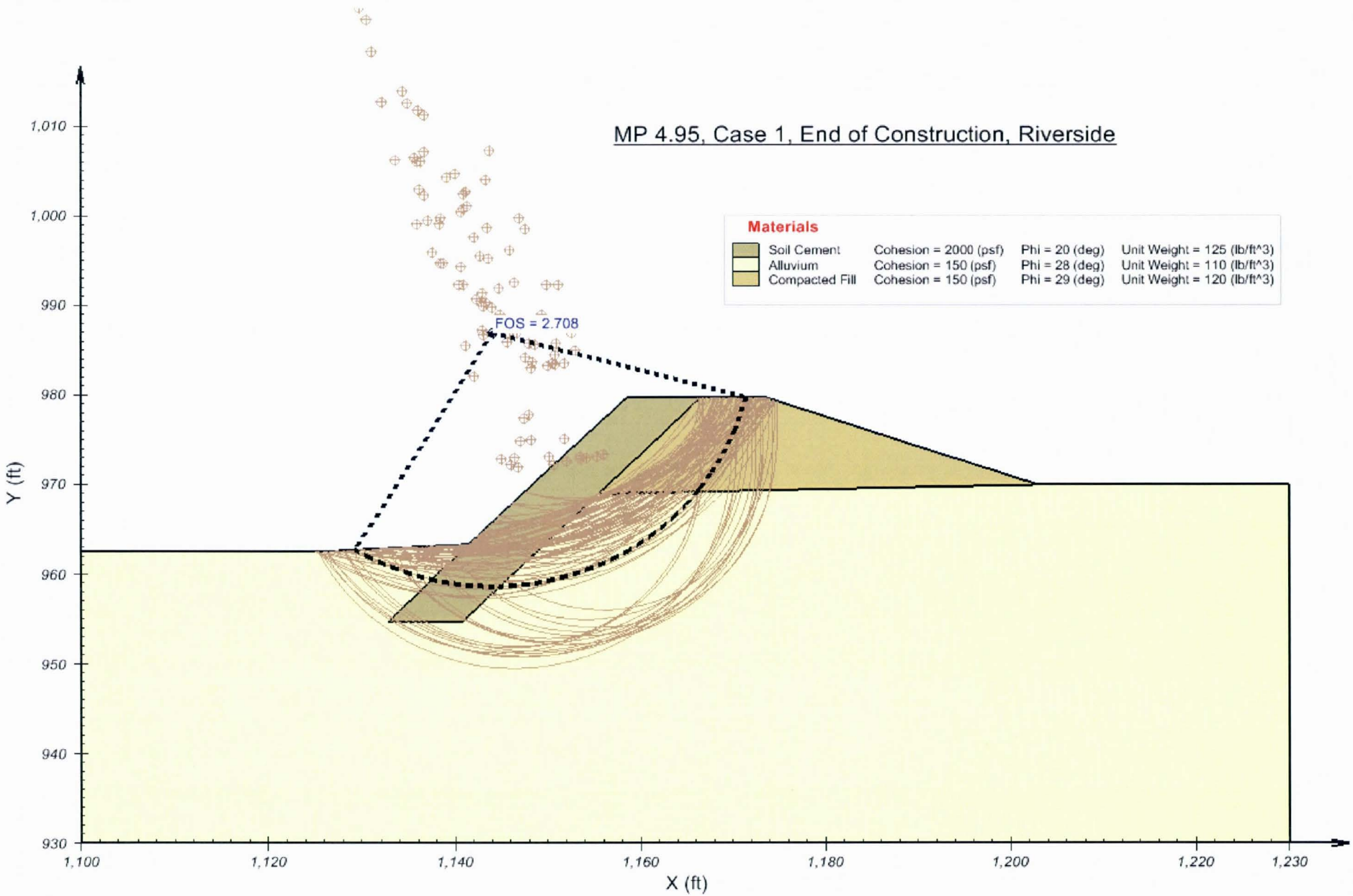


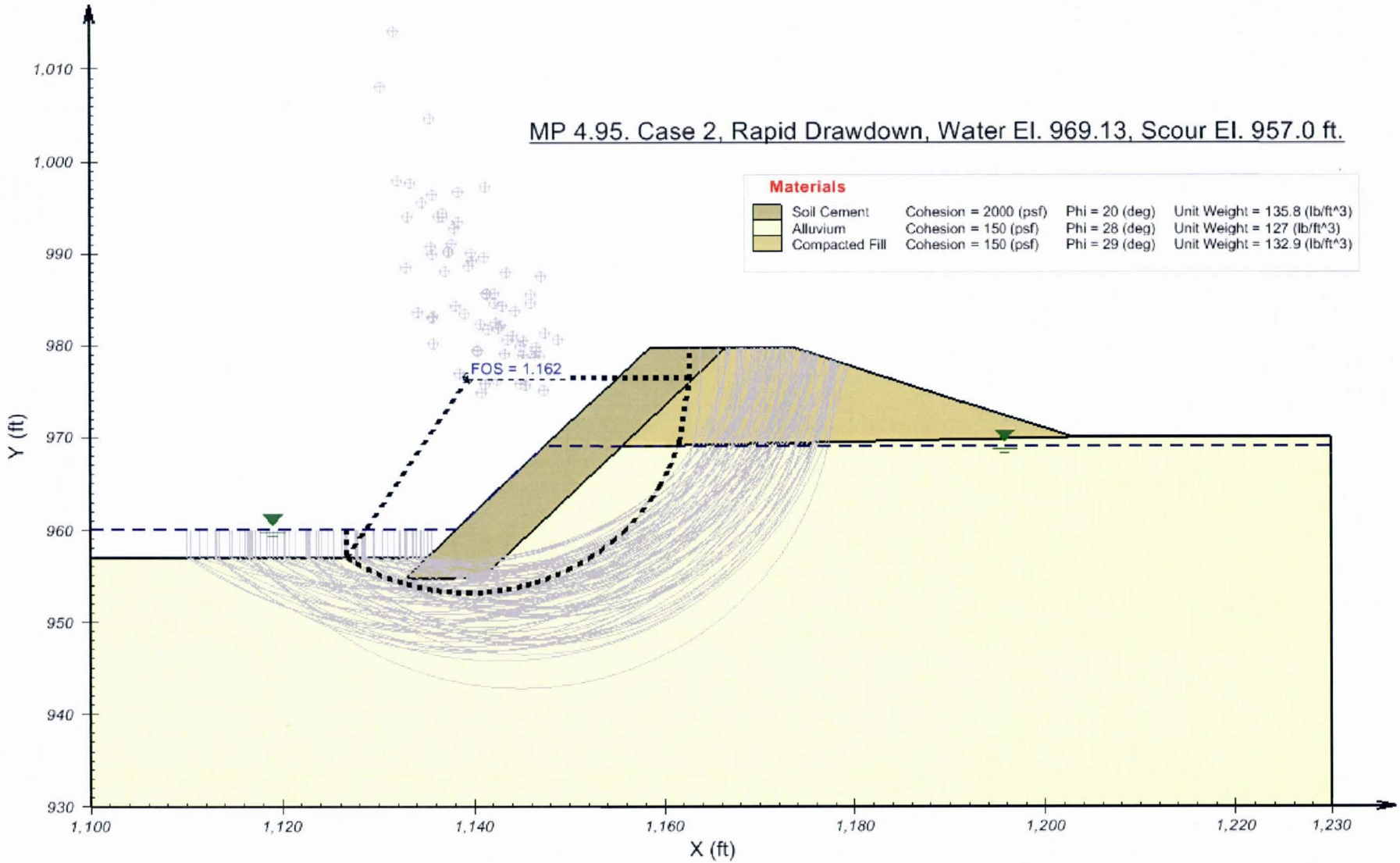

MP 4.09, Case 3, Steady Seepage, Water El. 958.42 ft., Scour El. 940.84 ft.
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 135.8 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 127 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 132.9 (lb/ft^3)
FOS = 3.321
Y (ft)
990
980
970
960
950
940
930
920
1,360
1,380
1,400
1,420
1,440
1,460
1,480
1,500
X (ft)

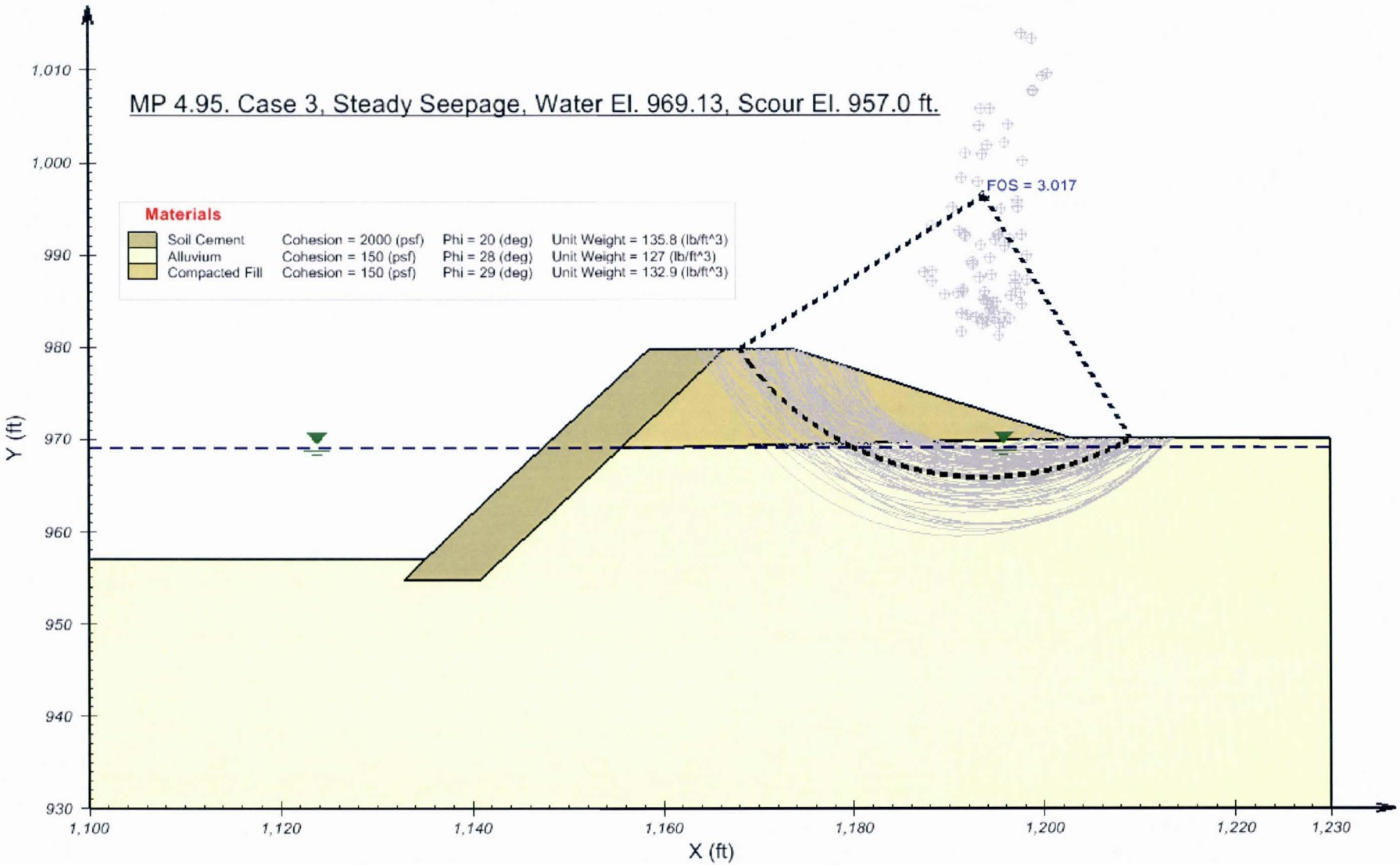

MP 4.09, Case 4, Earthquake, Landside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
0.07
FOS = 2.808
Y (ft)
990
980
970
960
950
940
930
920
X (ft)
1,360
1,380
1,400
1,420
1,440
1,460
1,480
1,500

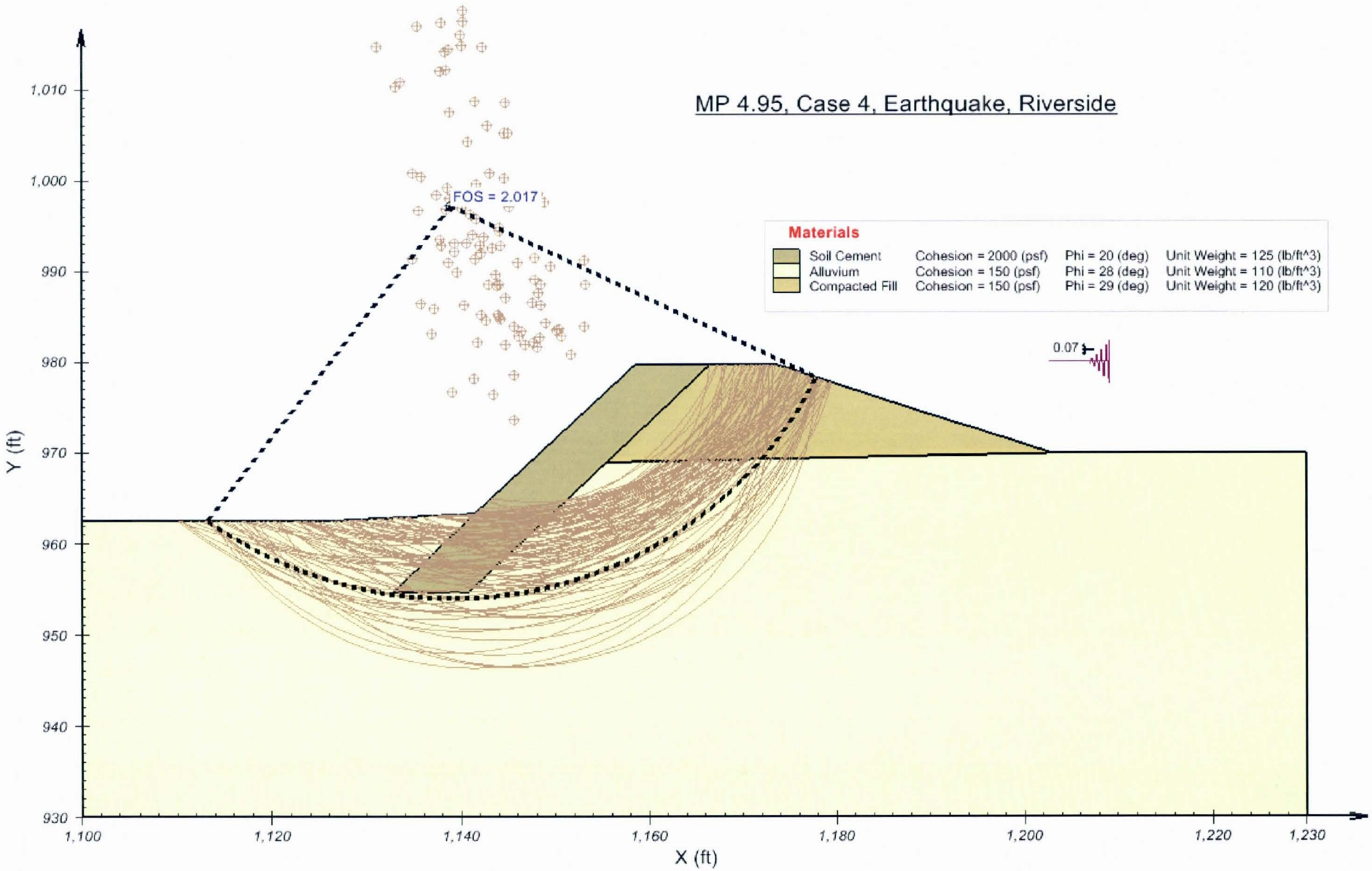

MP 4.09, Case 4, Earthquake, Riverside
FOS = 3.242
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
0.07
Y (ft)
990
980
970
960
950
940
930
920
X (ft)
1,360
1,380
1,400
1,420
1,440
1,460
1,480
1,500

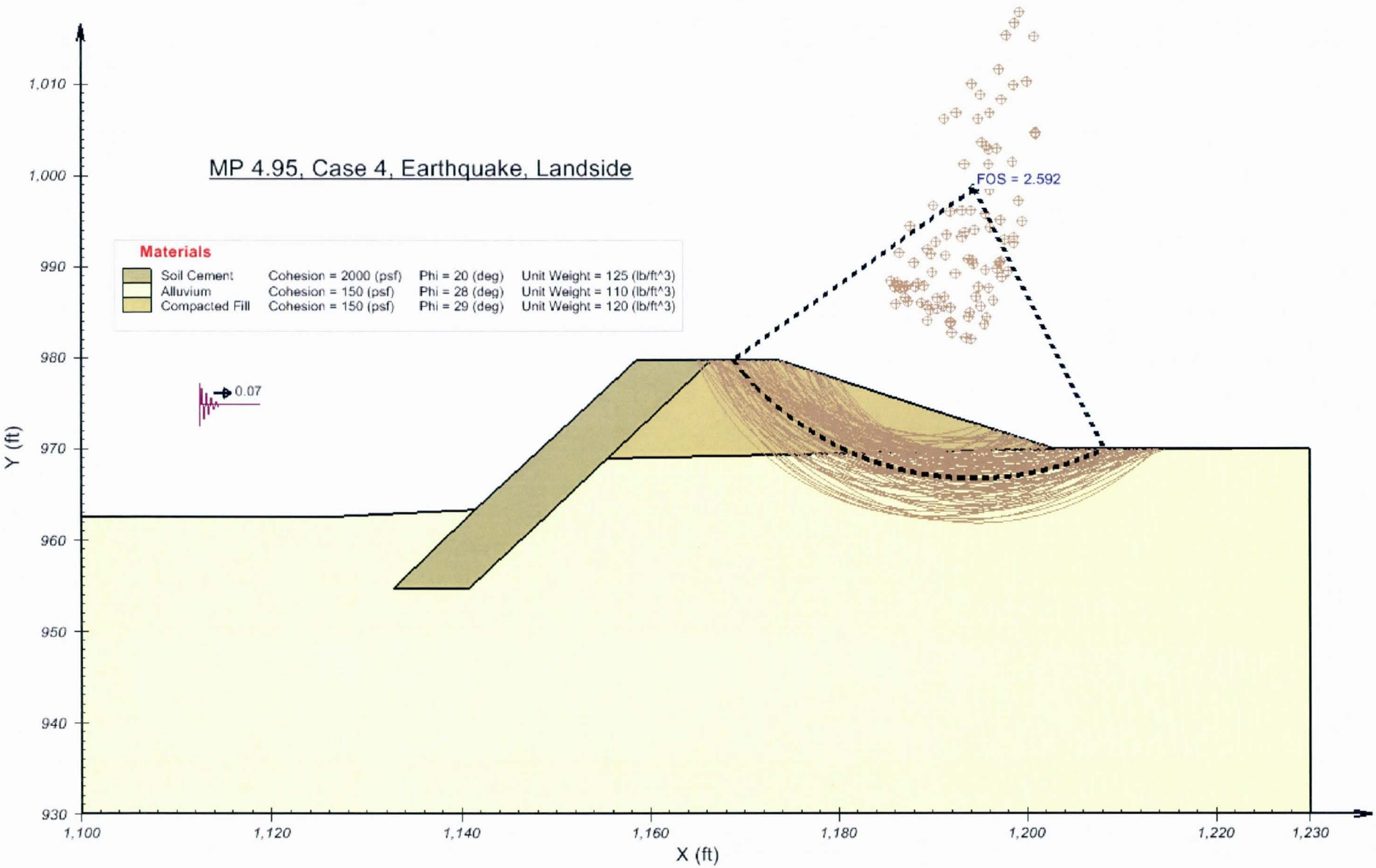

MP 4.95, Case 1, End of Construction, Landside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
FOS = 3.201
Y (ft)
1,010
1,000
990
980
970
960
950
940
930
X (ft)
1,100
1,120
1,140
1,160
1,180
1,200
1,220
1,230

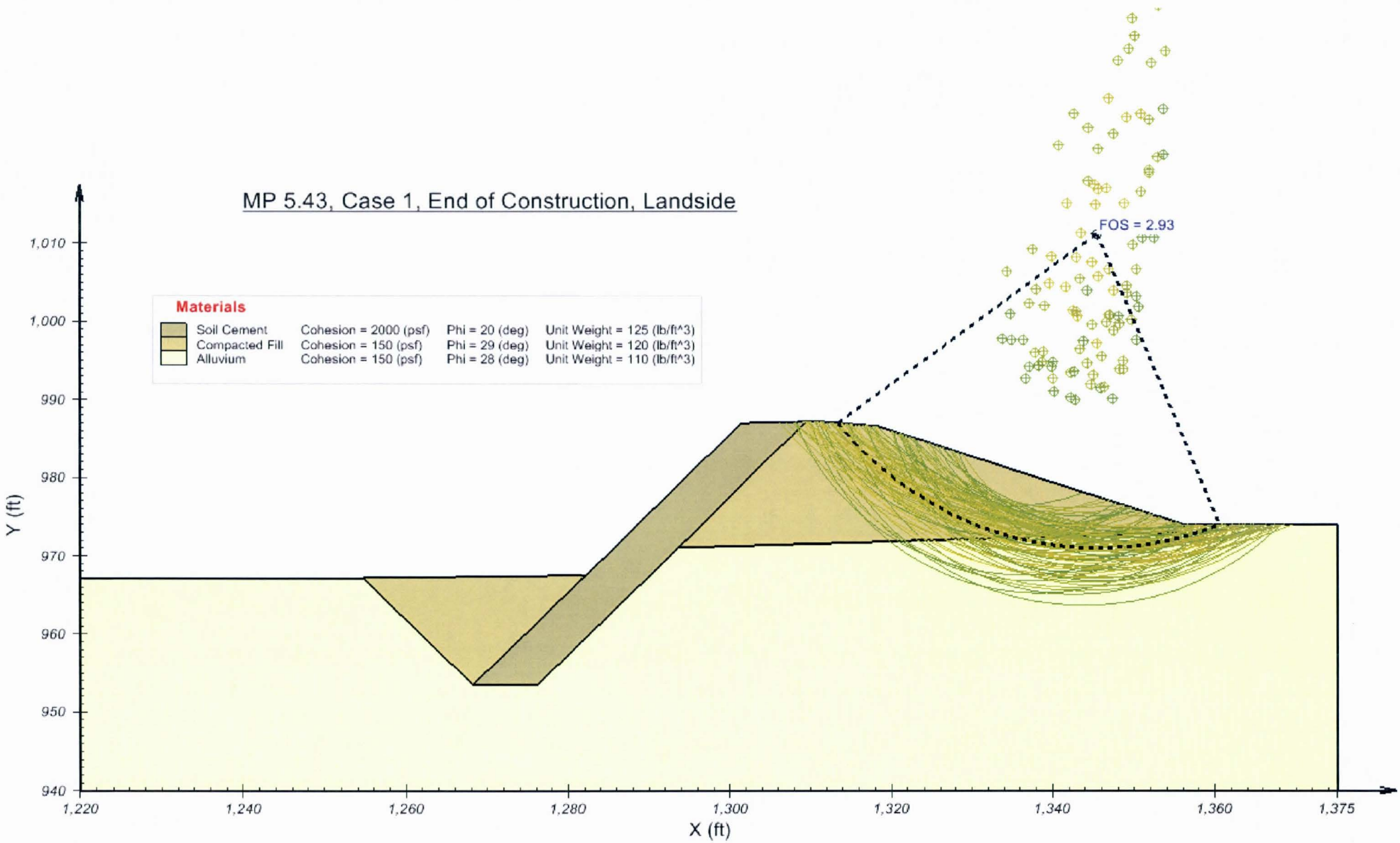

MP 4.95, Case 1, End of Construction, Riverside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
FOS = 2.708
Y (ft)
1,010
1,000
990
980
970
960
950
940
930
X (ft)
1,100
1,120
1,140
1,160
1,180
1,200
1,220
1,230

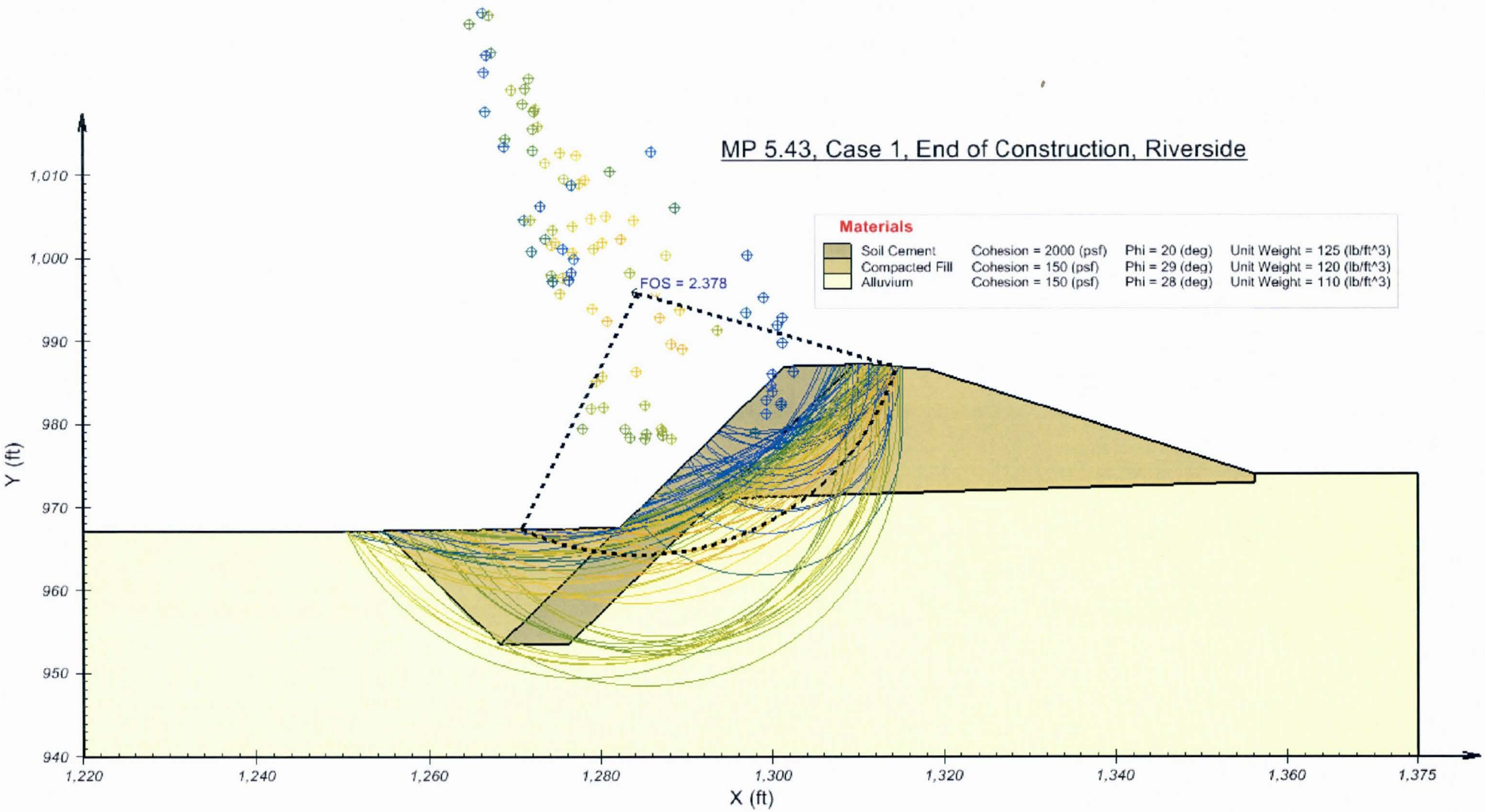

MP 4.95. Case 2, Rapid Drawdown, Water El. 969.13, Scour El. 957.0 ft.
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 135.8 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 127 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 132.9 (lb/ft^3)
FOS = 1.162
Y (ft)
1,010
1,000
990
980
970
960
950
940
930
X (ft)
1,100
1,120
1,140
1,160
1,180
1,200
1,220
1,230


MP 4.95. Case 3, Steady Seepage, Water El. 969.13, Scour El. 957.0 ft.
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 135.8 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 127 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 132.9 (lb/ft^3)
FOS = 3.017
Y (ft)
1,010
1,000
990
980
970
960
950
940
930
1,100
1,120
1,140
1,160
1,180
1,200
1,220
1,230
X (ft)

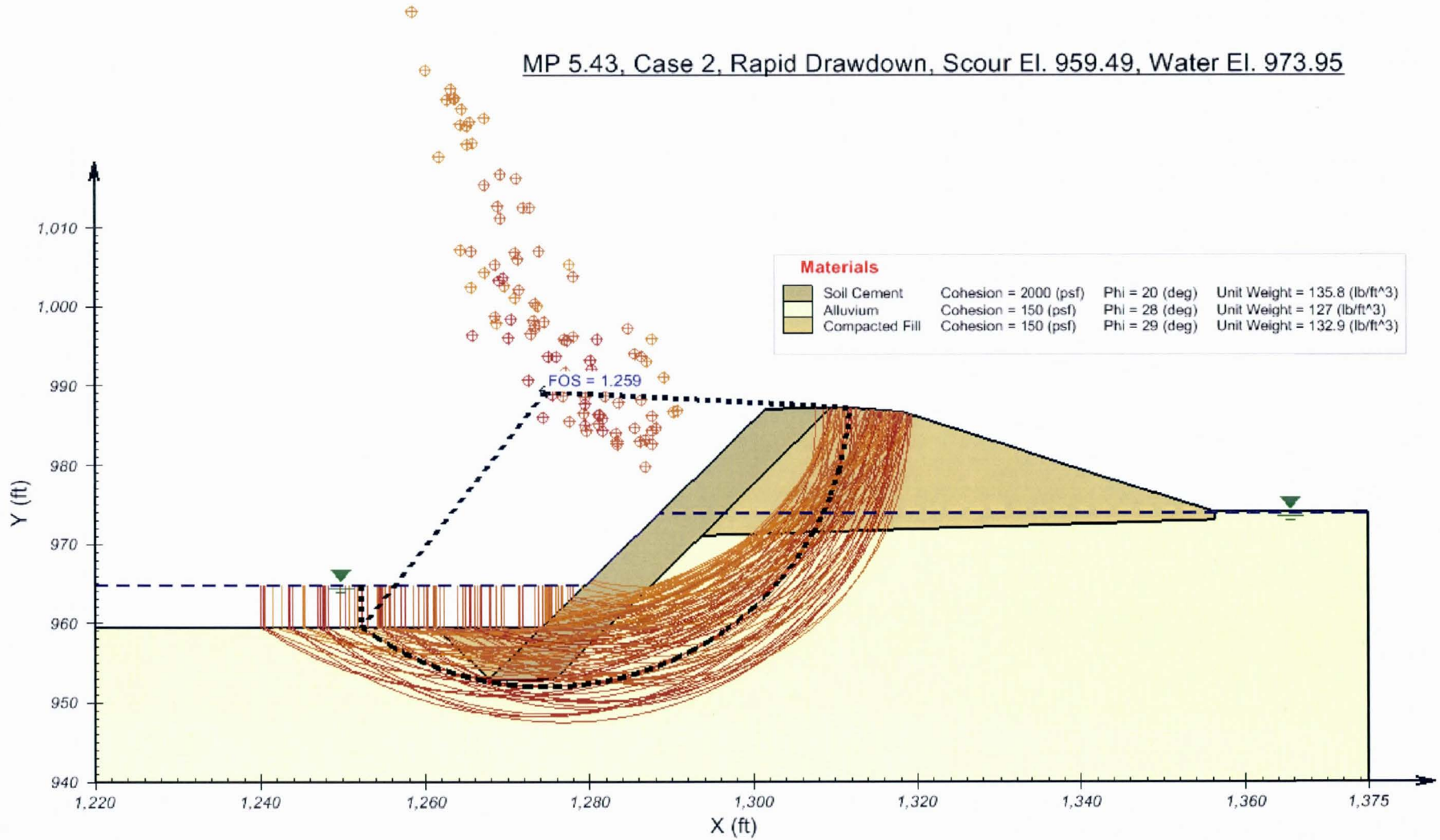

MP 4.95, Case 4, Earthquake, Riverside
FOS = 2.017
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
0.07
Y (ft)
1,010
1,000
990
980
970
960
950
940
930
X (ft)
1,100
1,120
1,140
1,160
1,180
1,200
1,220
1,230

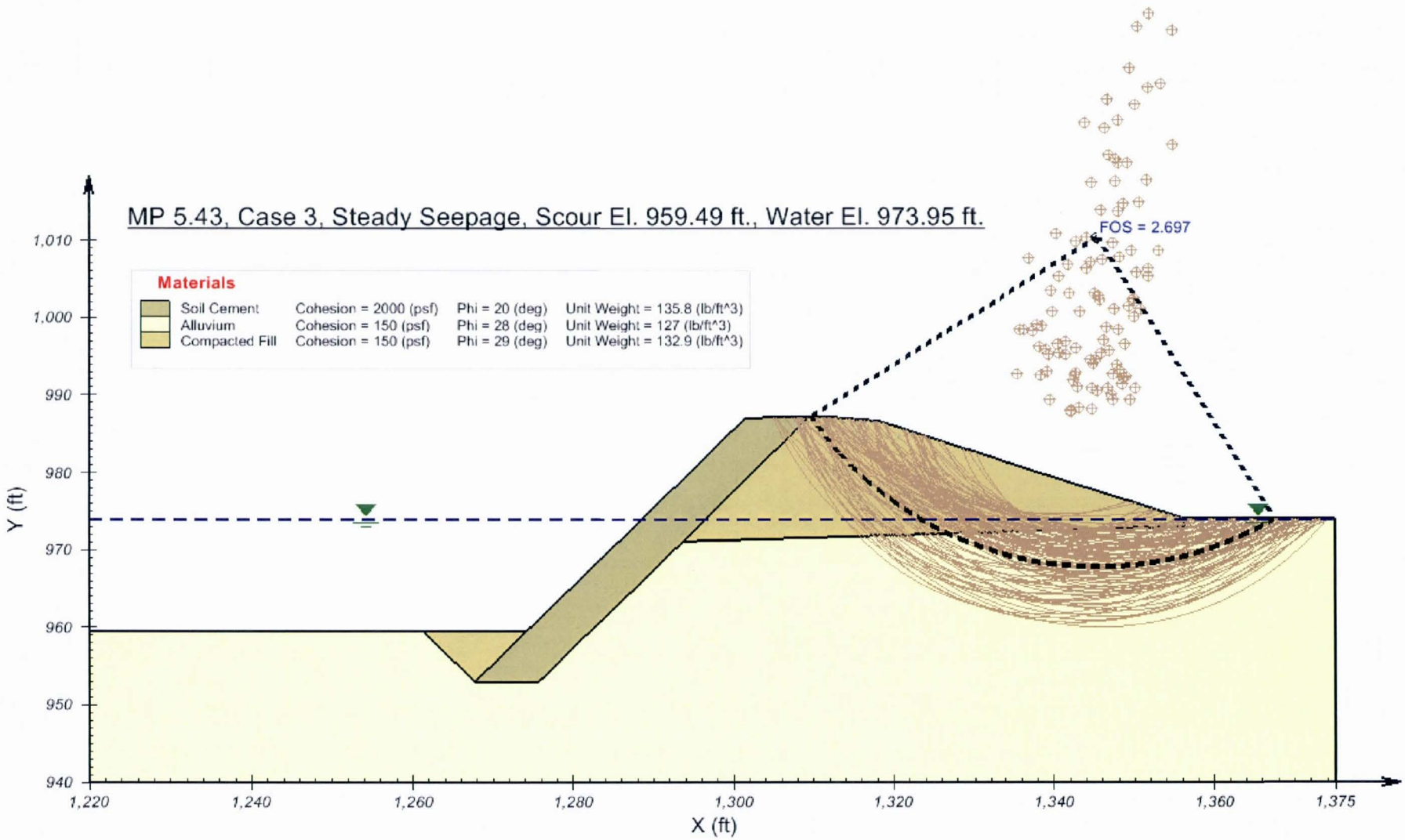

MP 4.95, Case 4, Earthquake, Landside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
0.07
FOS = 2.592
Y (ft)
1,010
1,000
990
980
970
960
950
940
930
X (ft)
1,100
1,120
1,140
1,160
1,180
1,200
1,220
1,230

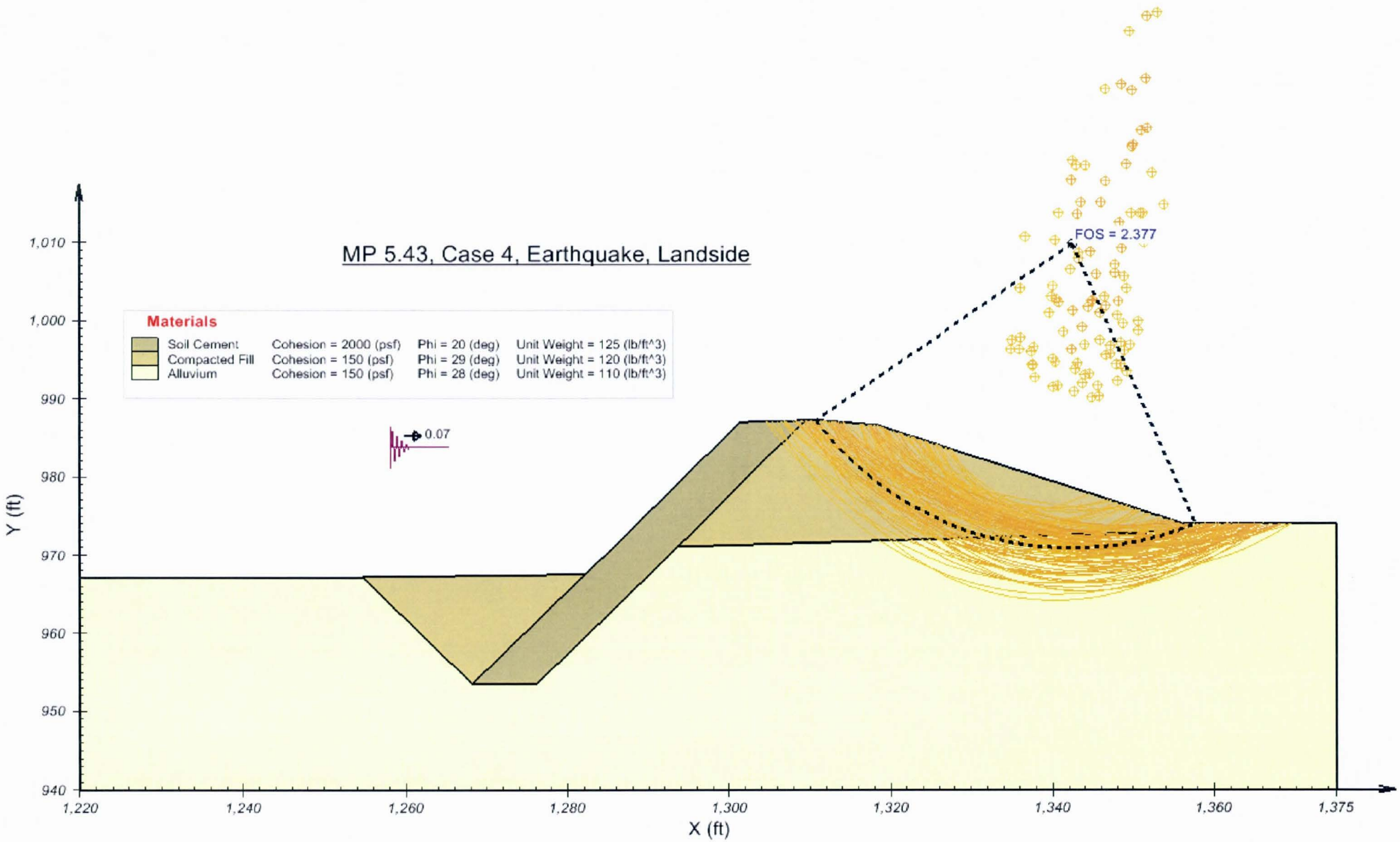

MP 5.43, Case 1, End of Construction, Landside
FOS = 2.93
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Y (ft)
1,010
1,000
990
980
970
960
950
940
X (ft)
1,220
1,240
1,260
1,280
1,300
1,320
1,340
1,360
1,375

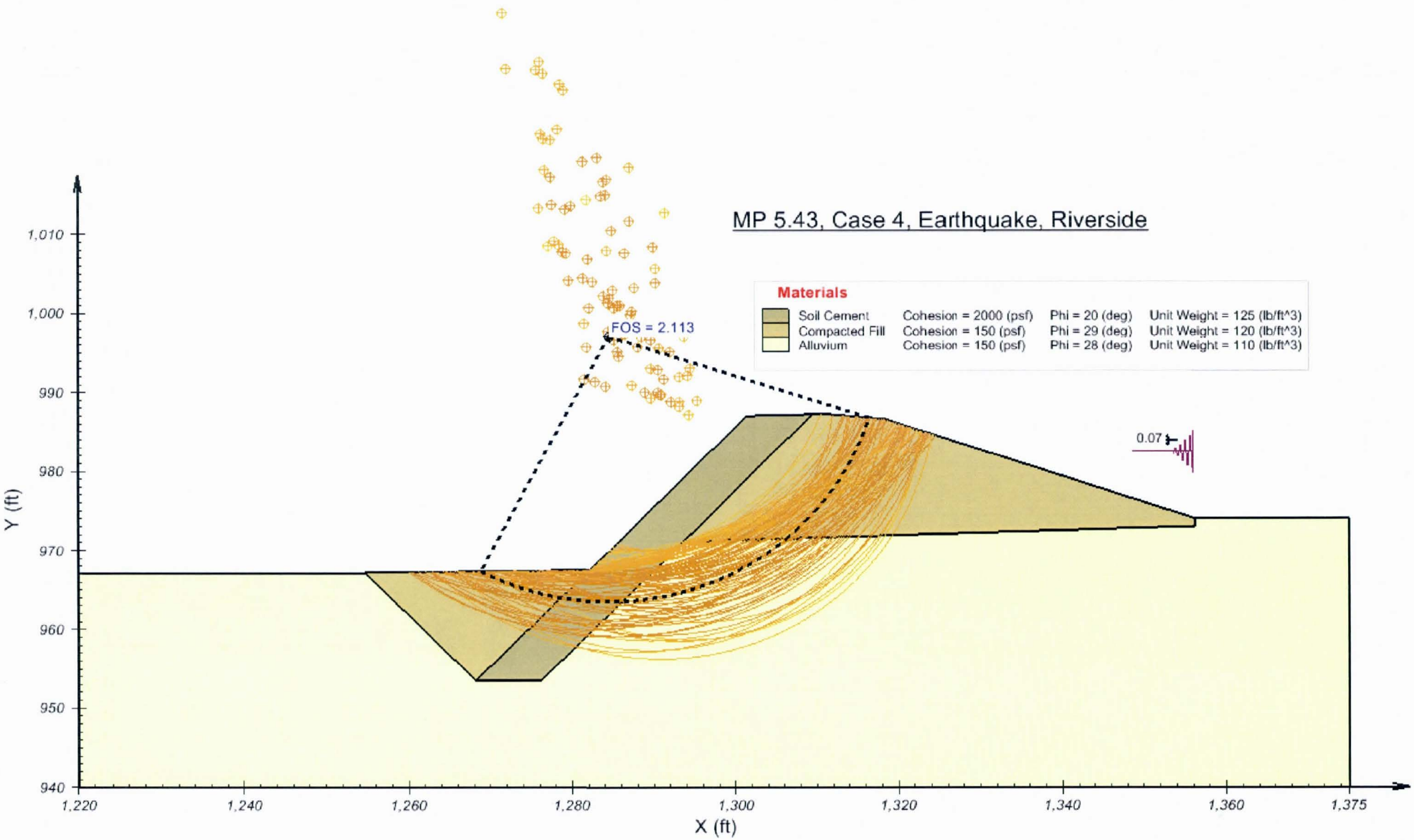

MP 5.43, Case 1, End of Construction, Riverside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
FOS = 2.378
Y (ft)
1,010
1,000
990
980
970
960
950
940
X (ft)
1,220
1,240
1,260
1,280
1,300
1,320
1,340
1,360
1,375

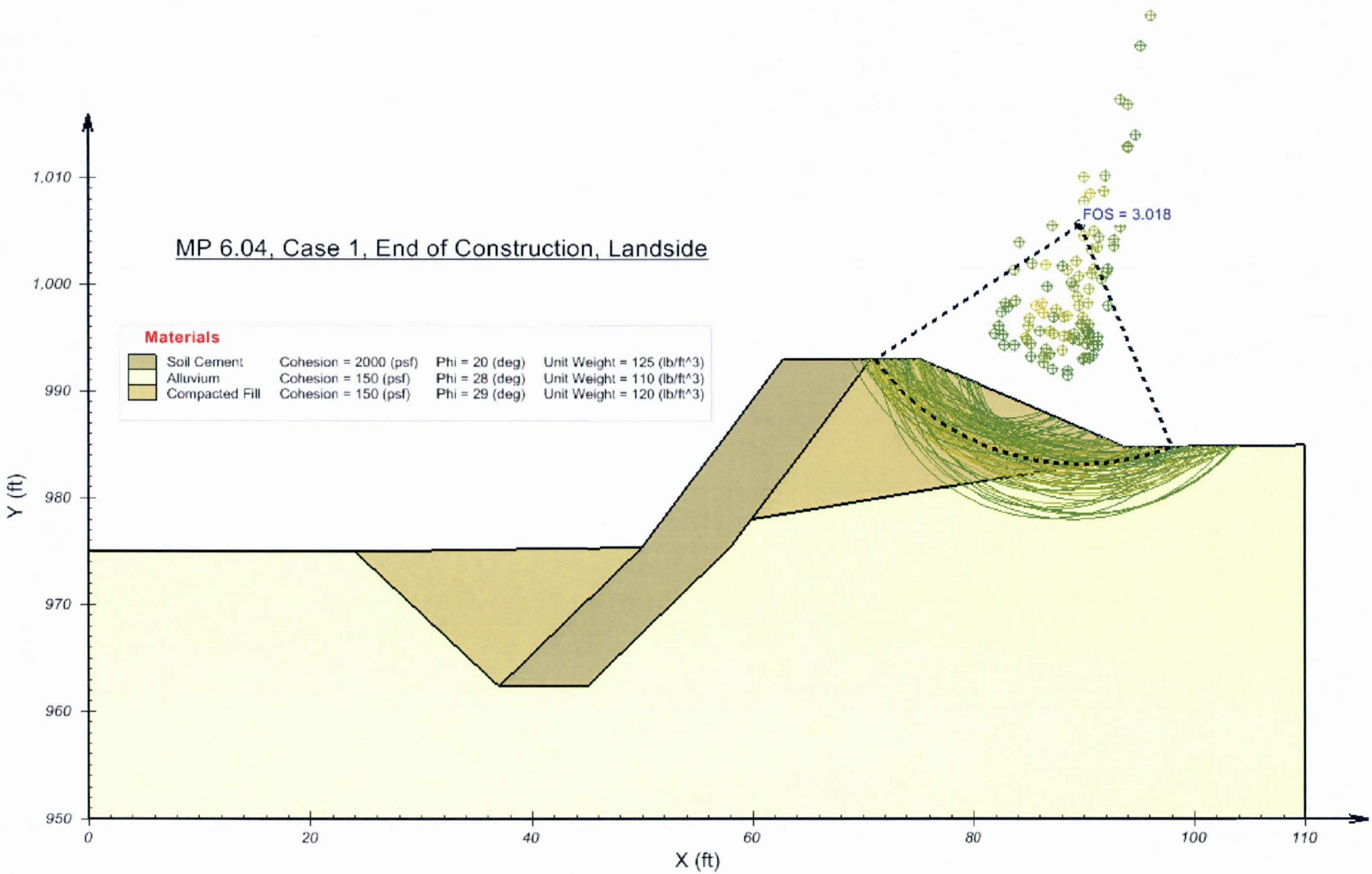
MP 5.43, Case 2, Rapid Drawdown, Scour El. 959.49, Water El. 973.95

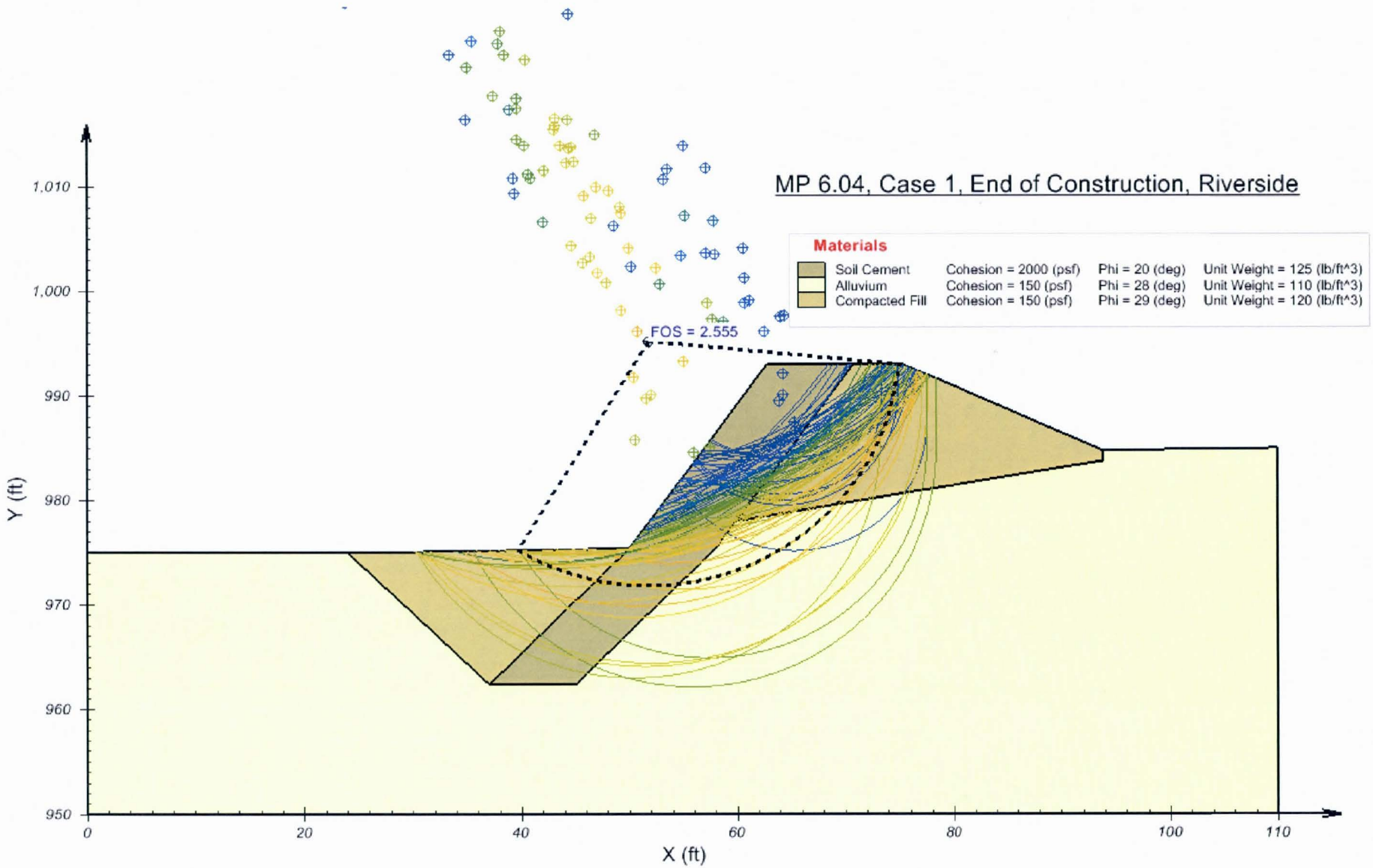



MP 5.43, Case 3, Steady Seepage, Scour El. 959.49 ft., Water El. 973.95 ft.
FOS = 2.697
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 135.8 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 127 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 132.9 (lb/ft^3)
Y (ft)
1,010
1,000
990
980
970
960
950
940
X (ft)
1,220
1,240
1,260
1,280
1,300
1,320
1,340
1,360
1,375

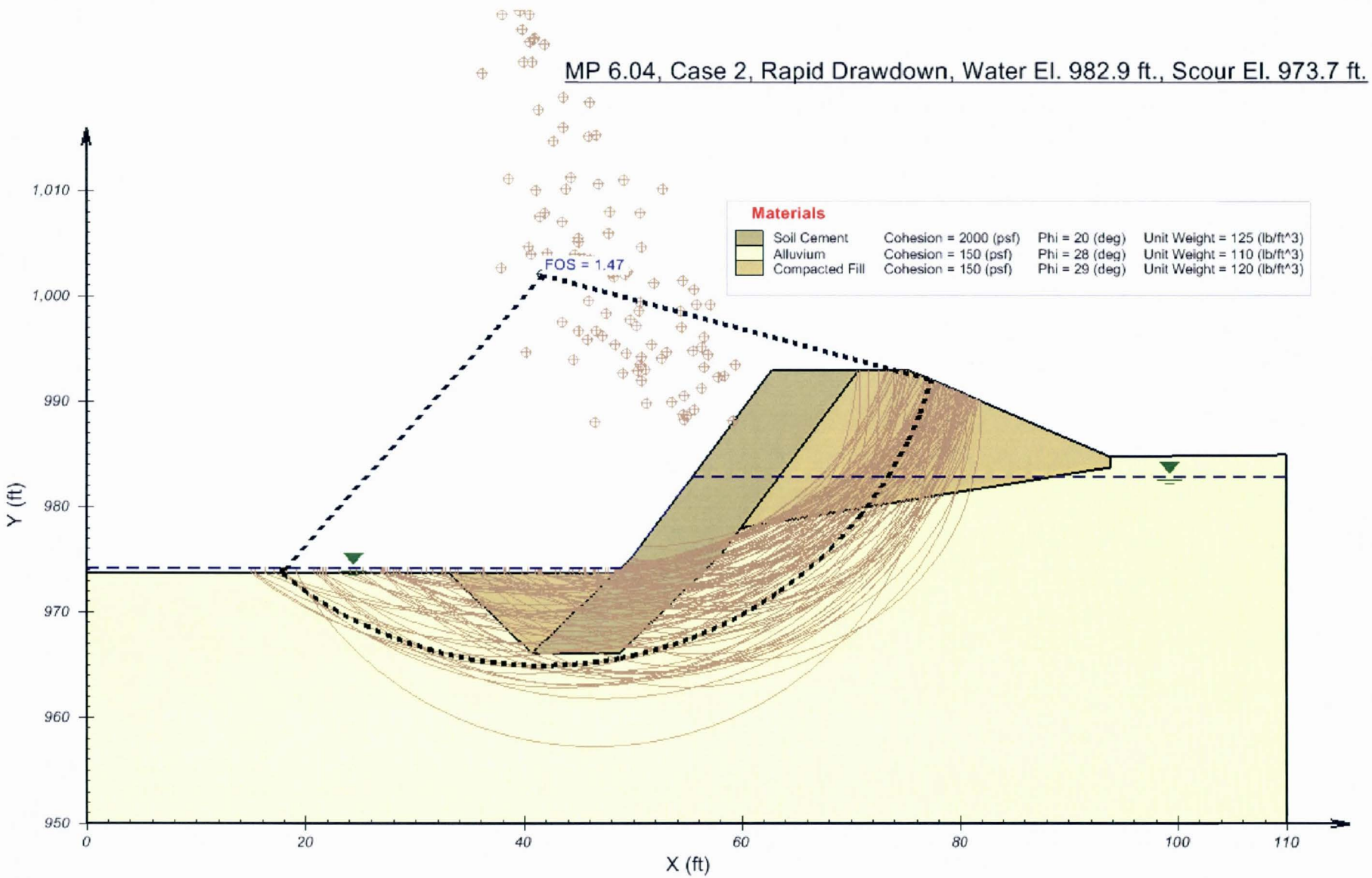

MP 5.43, Case 4, Earthquake, Landside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
0.07
FOS = 2.377
Y (ft)
1,010
1,000
990
980
970
960
950
940
X (ft)
1,220
1,240
1,260
1,280
1,300
1,320
1,340
1,360
1,375

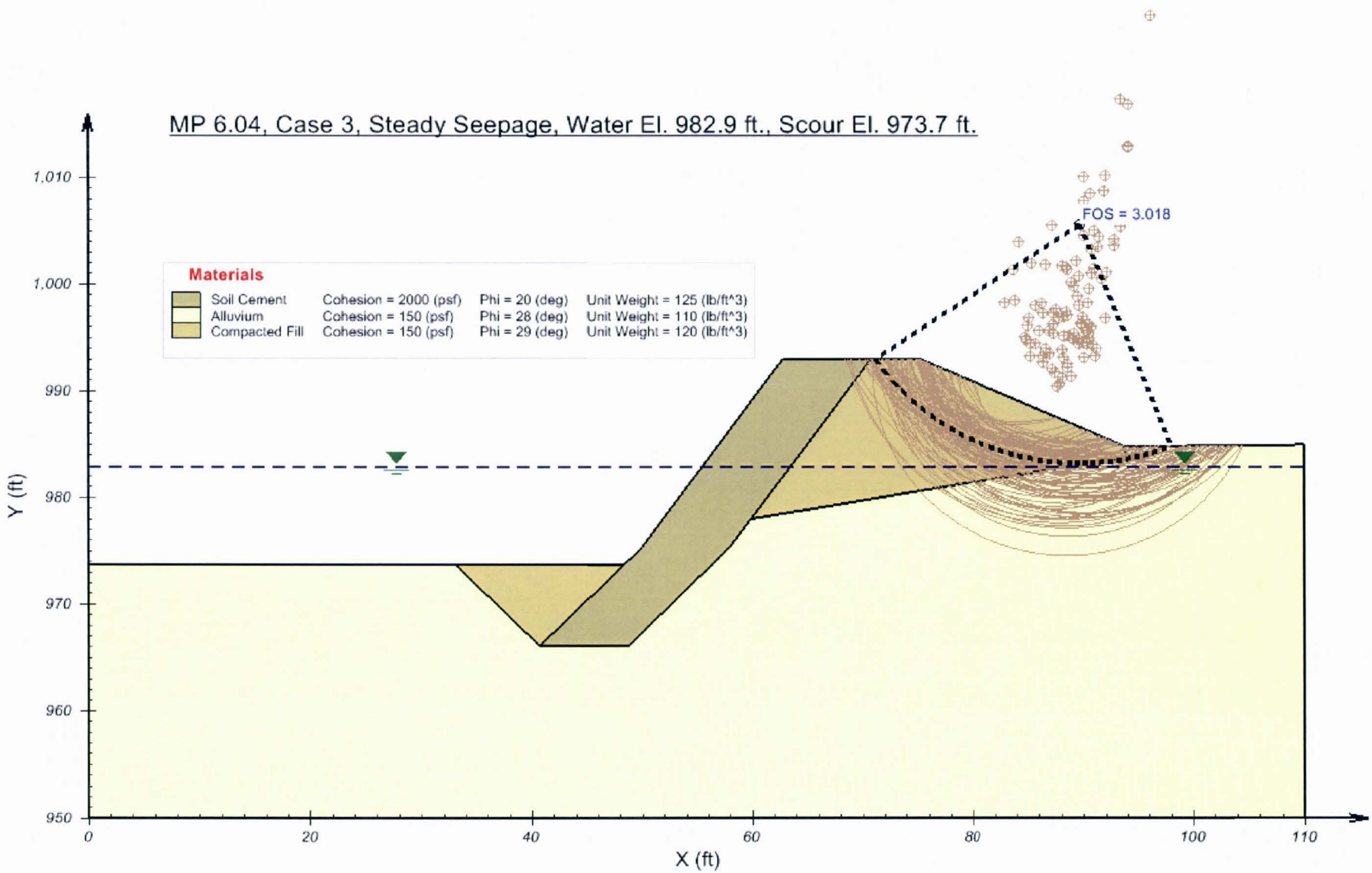

MP 5.43, Case 4, Earthquake, Riverside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
FOS = 2.113
0.07
Y (ft)
1,010
1,000
990
980
970
960
950
940
X (ft)
1,220
1,240
1,260
1,280
1,300
1,320
1,340
1,360
1,375

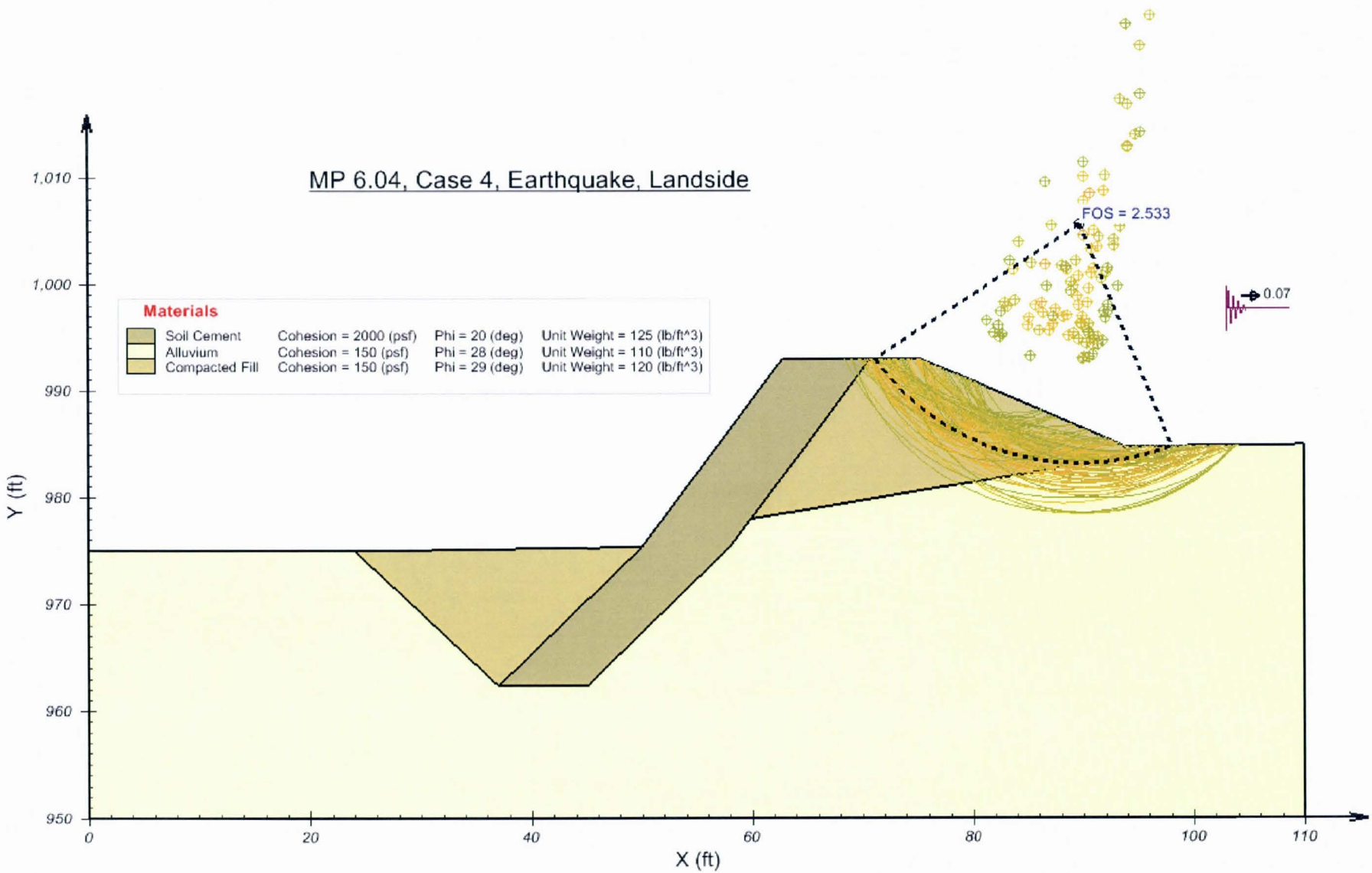

MP 6.04, Case 1, End of Construction, Landside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
FOS = 3.018
Y (ft)
1,010
1,000
990
980
970
960
950
X (ft)
0
20
40
60
80
100
110

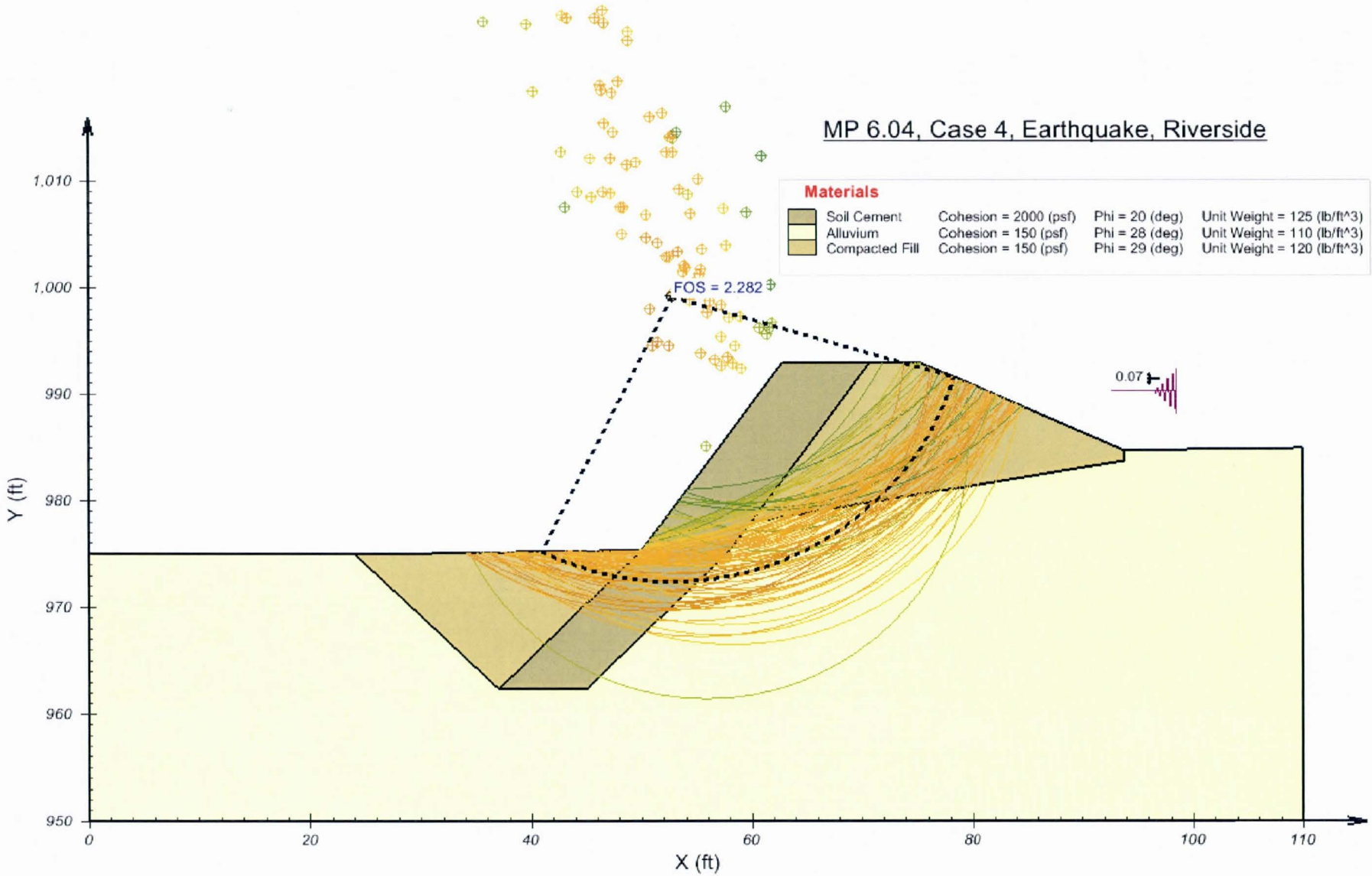

MP 6.04, Case 1, End of Construction, Riverside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
FOS = 2.555
Y (ft)
1,010
1,000
990
980
970
960
950
X (ft)
0
20
40
60
80
100
110

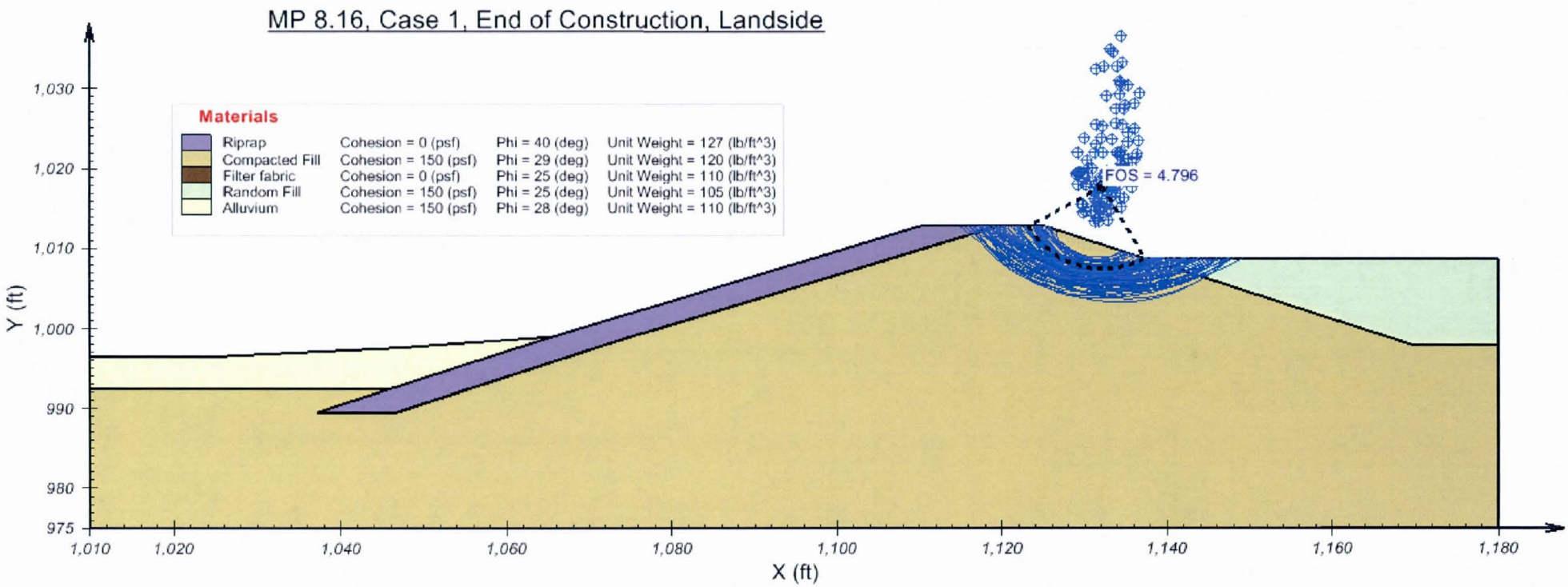
MP 6.04, Case 2, Rapid Drawdown, Water El. 982.9 ft., Scour El. 973.7 ft.

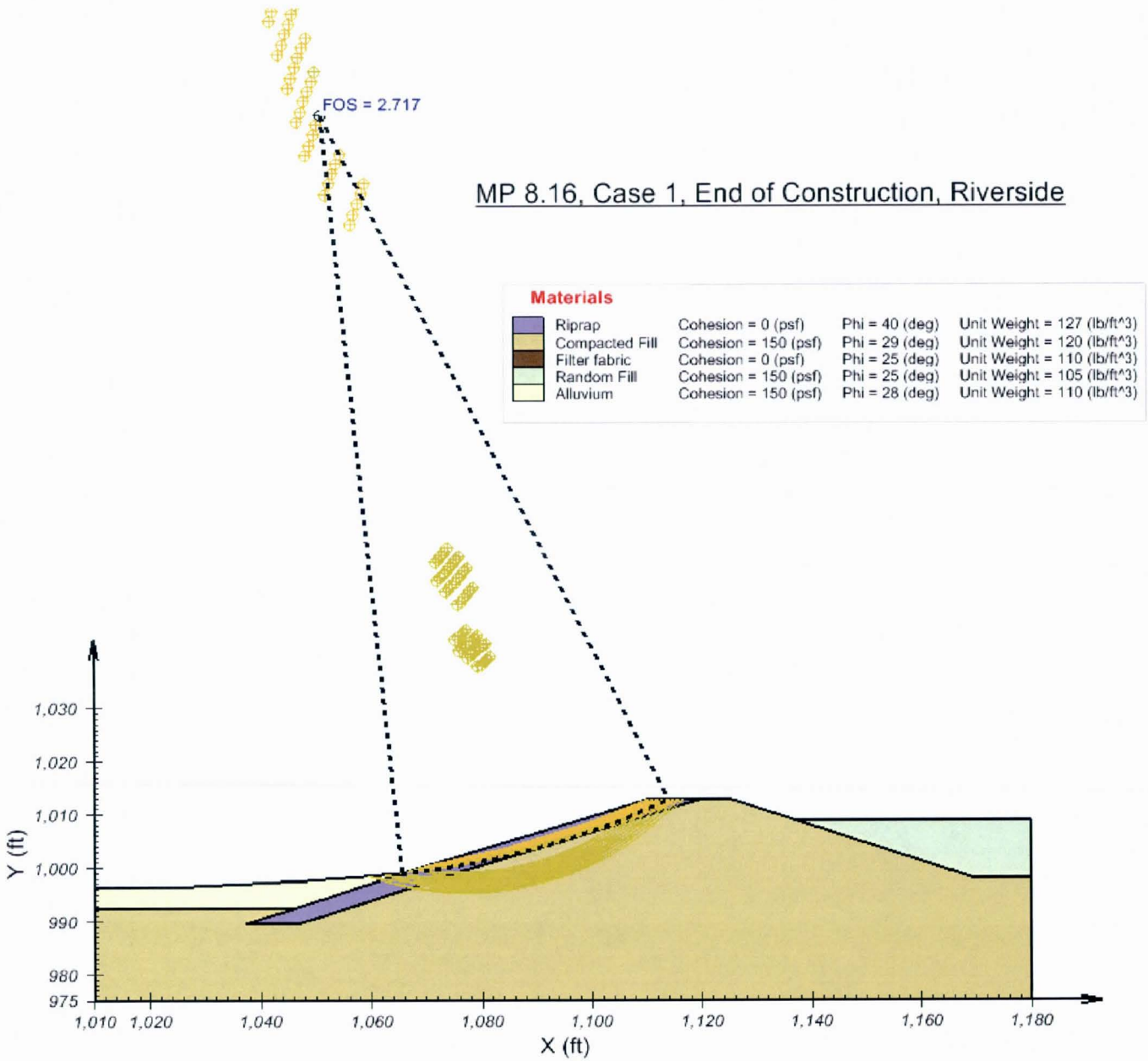



MP 6.04, Case 3, Steady Seepage, Water El. 982.9 ft., Scour El. 973.7 ft.
FOS = 3.018
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Y (ft)
1,010
1,000
990
980
970
960
950
X (ft)
0
20
40
60
80
100
110

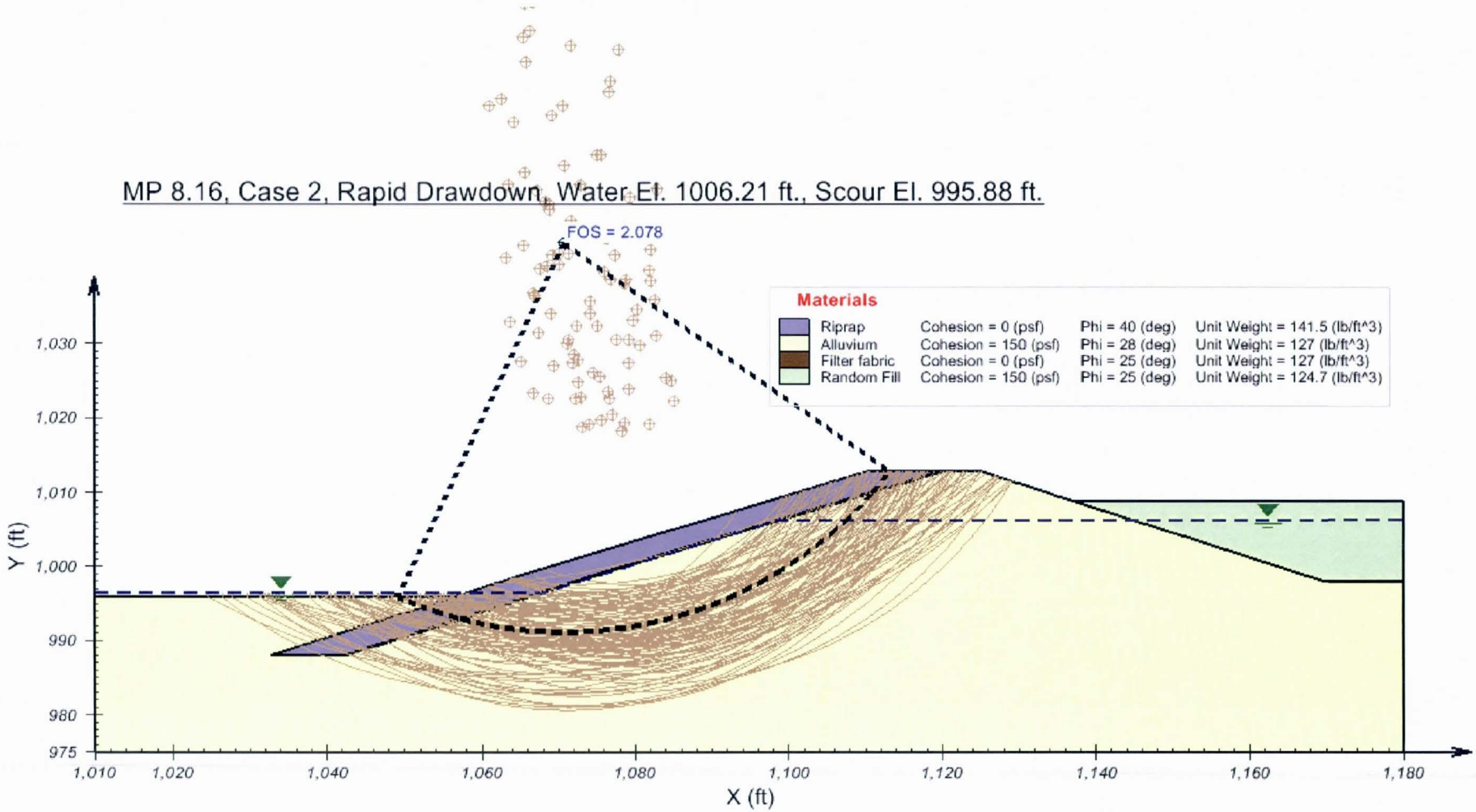

MP 6.04, Case 4, Earthquake, Landside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
FOS = 2.533
0.07
Y (ft)
1,010
1,000
990
980
970
960
950
X (ft)
0
20
40
60
80
100
110


MP 6.04, Case 4, Earthquake, Riverside
Materials
Soil Cement Cohesion = 2000 (psf) Phi = 20 (deg) Unit Weight = 125 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
FOS = 2.282
0.07
Y (ft)
1,010
1,000
990
980
970
960
950
X (ft)
0
20
40
60
80
100
110

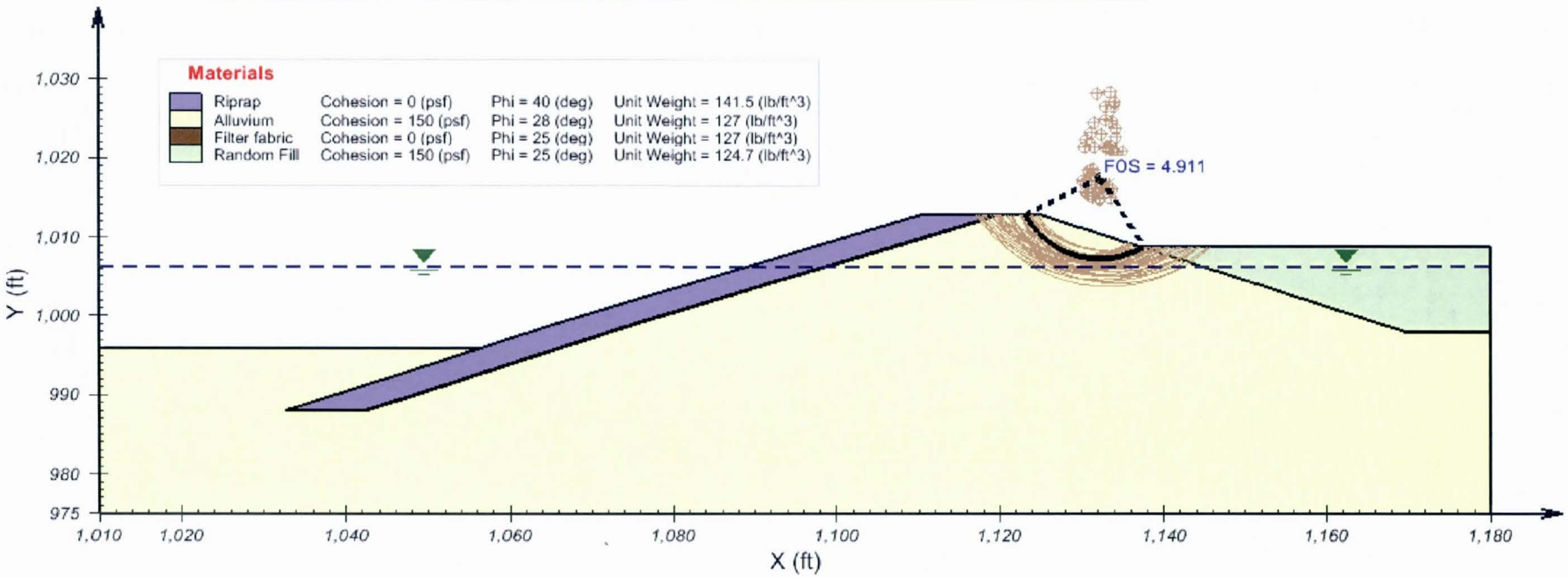

MP 8.16, Case 1, End of Construction, Landside
Materials
Riprap Cohesion = 0 (psf) Phi = 40 (deg) Unit Weight = 127 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Filter fabric Cohesion = 0 (psf) Phi = 25 (deg) Unit Weight = 110 (lb/ft^3)
Random Fill Cohesion = 150 (psf) Phi = 25 (deg) Unit Weight = 105 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
FOS = 4.796
Y (ft)
1,030
1,020
1,010
1,000
990
980
975
1,010
1,020
1,040
1,060
1,080
1,100
1,120
1,140
1,160
1,180
X (ft)

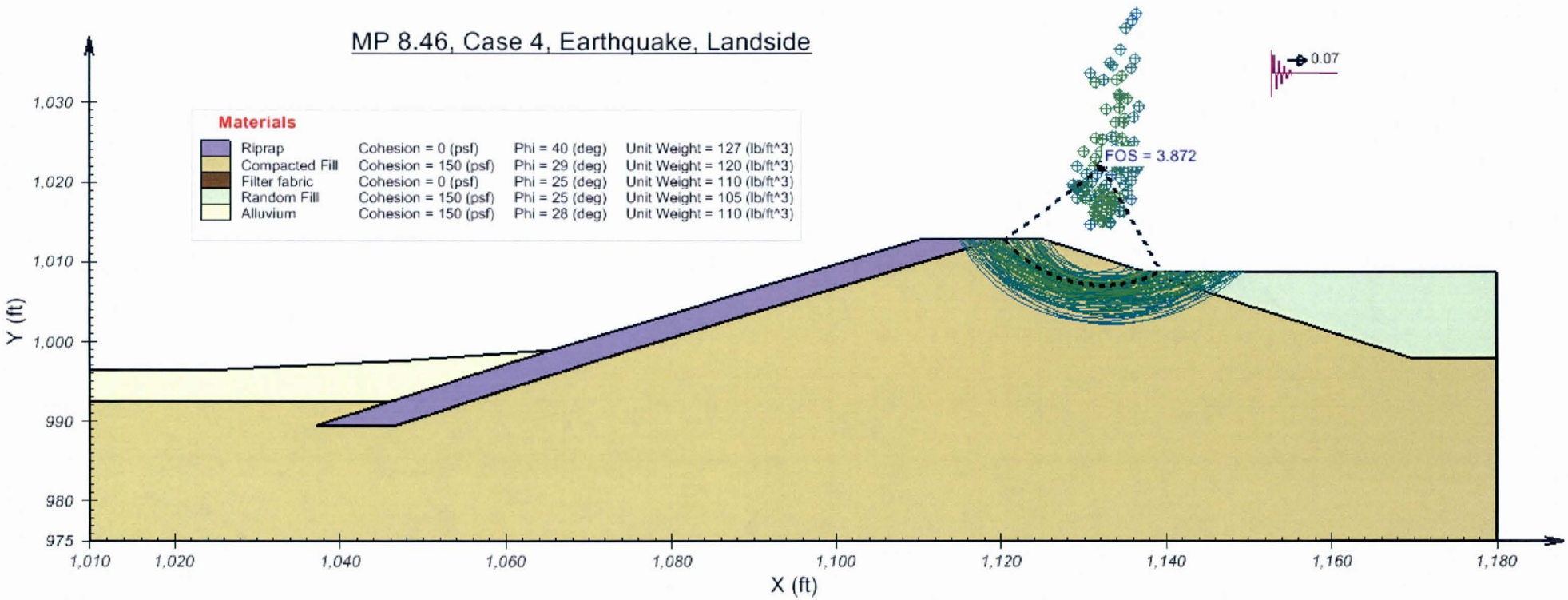

FOS = 2.717
MP 8.16, Case 1, End of Construction, Riverside
Materials
Riprap Cohesion = 0 (psf) Phi = 40 (deg) Unit Weight = 127 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Filter fabric Cohesion = 0 (psf) Phi = 25 (deg) Unit Weight = 110 (lb/ft^3)
Random Fill Cohesion = 150 (psf) Phi = 25 (deg) Unit Weight = 105 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
Y (ft)
1,030
1,020
1,010
1,000
990
980
975
1,010 1,020 1,040 1,060 1,080 1,100 1,120 1,140 1,160 1,180
X (ft)

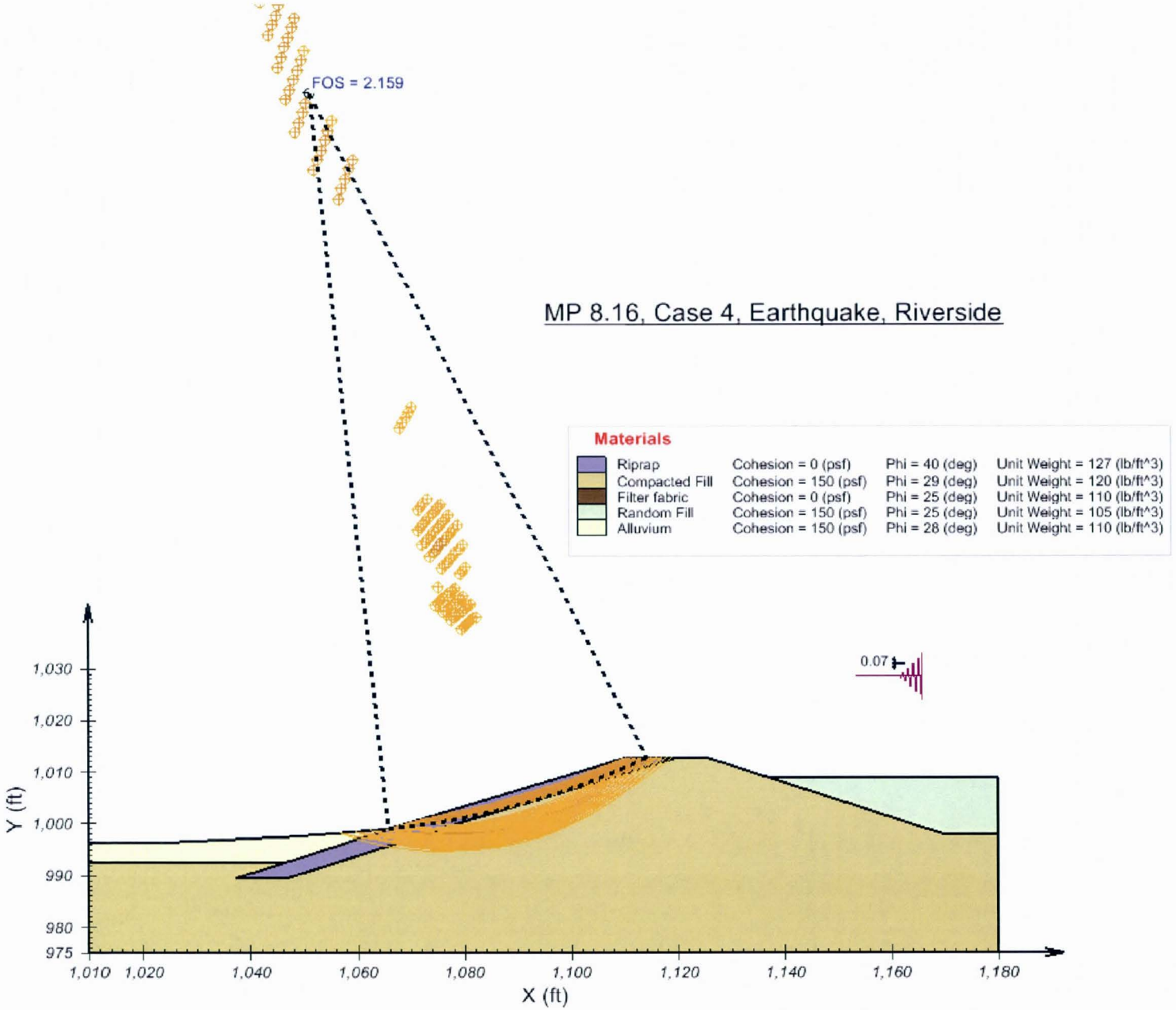
MP 8.16, Case 2, Rapid Drawdown, Water El. 1006.21 ft., Scour El. 995.88 ft.



MP 8.16, Case 3, Steady Seepage, Water El. 1006.21, Scour El. 995.88 ft.




MP 8.46, Case 4, Earthquake, Landside
Materials
Riprap Cohesion = 0 (psf) Phi = 40 (deg) Unit Weight = 127 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Filter fabric Cohesion = 0 (psf) Phi = 25 (deg) Unit Weight = 110 (lb/ft^3)
Random Fill Cohesion = 150 (psf) Phi = 25 (deg) Unit Weight = 105 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
FOS = 3.872
0.07
Y (ft)
1,030
1,020
1,010
1,000
990
980
975
1,010
1,020
1,040
1,060
1,080
1,100
1,120
1,140
1,160
1,180
X (ft)


FOS = 2.159
MP 8.16, Case 4, Earthquake, Riverside
Materials
Riprap Cohesion = 0 (psf) Phi = 40 (deg) Unit Weight = 127 (lb/ft^3)
Compacted Fill Cohesion = 150 (psf) Phi = 29 (deg) Unit Weight = 120 (lb/ft^3)
Filter fabric Cohesion = 0 (psf) Phi = 25 (deg) Unit Weight = 110 (lb/ft^3)
Random Fill Cohesion = 150 (psf) Phi = 25 (deg) Unit Weight = 105 (lb/ft^3)
Alluvium Cohesion = 150 (psf) Phi = 28 (deg) Unit Weight = 110 (lb/ft^3)
0.07
Y (ft)
1,030
1,020
1,010
1,000
990
980
975
1,010
1,020
1,040
1,060
1,080
1,100
1,120
1,140
1,160
1,180
X (ft)

Ninyo & Moore

APPENDIX F

LIST OF REVIEWED DOCUMENTS

AGUA FRIA LEVEE WEST PAL 18

Reviewed Project Specific Documents And Reports

Prepared by	Title	Date	Prepared for
ADOT	ADOT Plan and Profile of Proposed State Highway, Buckeye -Phoenix, Maricopa County, Project S-371 (1), As Built	December-61	ADOT
ADOT	ADOT Plan and Profile of Proposed State Highway Buckeye - Phoenix, Maricopa County, BR-S-371(5) As Built	July-75	
ADOT	ADOT Highway Division, Plan and Profile of Proposed Ehrenberg - Phoenix Maricopa County, I-IG-10-2 (37) As Built	March-80	ADOT
ADOT	ADOT Highway Division, Plan and Profile of Proposed State Highway Ehrenberg - Phoenix, Maricopa County, I-10-2 (44), As Built	March-80	ADOT
ADOT	State of Arizona, Department of Transportation, Highway Division, Plan and Profile of Proposed Ehrenberg - Phoenix Maricopa County, I-10-2 (75)As Built	March-84	ADOT
ALPHA Geotechnical & Materials, Inc.	Geotechnical Subsurface Exploration, Rose Garden Lane Drainage Channel, Phoenix, Arizona	August-04	Wood, Patel, & Associates
AMEC	Draft Geotechnical Study for FEMA Partial Certification, Camelback Ranch Levee South	August-10	FCDMC
Arizona State Highway Commission	ADOT Plan and Profile of Proposed County Highway Indian School Road, Approach to Bridge Over Agua Fria River, As-Builts		
Baker	MCDOT, Plans for the Construction of Scour Protection for Indian School Rd Bridge at Agua Fria River, Project No. 68937 As Built	June-01	MCDOT
Cannon and Assoc.	Final Bridge Scour Assessment Reports for 16 Maricopa County Bridges, Volume I	July-96	MCDOT
CH2M Hill	Geotechnical Investigation Report Indian School Distribution Waterline	September-02	City of Avondale
Civil Eng. Dept	Agua Fria River Sediment Transport Study	January-92	FCDMC
Civil Eng. Dept	Agua Fria River Sediment Transport Study	February-94	FCDMC
Construction Inspection & Testing Co.	Soil Investigation, Tres Rios Landing, SEC Dysart Road and Buckeye Road, Avondale, AZ	April-02	CMX, LLC
Desert Earth Engineering	Geotechnical Engineering Investigation on Agua Fria River Channelization, Grade Control Structure, at Indian School Rd Bridge	October-84	Simons Li & Ass.
Desert Earth Engineering	Geotechnical Engineering Investigation on Agua Fria Channelization, 500 ft Downstream of Interstate 10 to McDowell Rd, SLA Project No. AZ-MC-07	November-84	Simons Li & Ass.
Desert Earth Engineering	Geotechnical Engineering Investigation on Agua Fria Soil Cement Design and Permeability Study at Agua Fria River, Phoenix, Arizona	February-85	Simons Li & Ass.
Dibble & Associates Consulting, Engineers	MCDOT, Plans for the Construction of McDowell Road Bridge at Agua Fria River, Project No. 68105, As Built	June-86	MCDOT
Dibble and Assoc.	Contract Documents and Special Provisions For Agua Fria River Improvements I-10 to Thomas Rd Contract No. FCD 85-16	June-85	FCDMC
FCDMC	Contract Documents and Special Provisions For Agua Fria River Improvements Phase I, Roosevelt Irrigation District Canal Reconstruction and Siphon Phase II: Agua Fria River Channelization and Bank Protection Contract No. FCD 85-10	February-85	FCDMC
FCDMC	Inspection reports 2001 through 2010	2001-2010	FCDMC
FEMA	Flood Insurance Rate Maps		FEMA
Hoffman - Miller Engineers, Inc.	MCDOT, Plans for the Construction of Indian School Road Widening at Agua Fria River, Project No. 60300	December-76	MCDOT
Hogue & Ass., Inc.	Geotechnical Exploration Report, Sediment Sampling for Agua Fria River Water Course, Maricopa County, Az	May-01	KHA
INCA Engineers, Inc	MC 85 Highway Bridge over Agua Fria River Bridge Scour Investigation and Design of Corrective Measures	August-97	FCDMC
Jerry R. Jones & Assoc., Inc.	Agua Fria River Flood Insurance Study	January-89	FCDMC
Jerry R. Jones & Assoc., Inc.	Agua Fria River, Exhibit 4, HEC I Computer Model	October-89	FCDMC
Jerry R. Jones & Associates, Inc.	Agua Fria River, Exhibit 2, Agua Fria Profiles	October-89	FCDMC
Johannessen & Girand Consulting Engineers, Inc.	Construction Plans For Agua Fria River ImprovementsVan Buren St. Utility Relocations As-Built Contract No. FCD 86-6	March-86	FCDMC
Maricopa County Highway Department	McDOT Plans for the Construction of Indian School Road Bridge Over Agua Fria River	November-83	
Michael Baker	Bridge Scour Investigation and Desigh of Corrective Meaures, Final Report, Indian School Road Bridge on the Agua Fria River	August-97	MC Dept of Transp.
Michael Baker Jt.	Conditional Letter of Map Revision (CLOMR) Application Package fro Dysart Drain of White Tanks/Agua Fria ADMS	January-95	MCFCD
Ninyo & Moore	Geotechnical Evaluation, Avondale Municipal Operations Center, Project #601017001	January-04	City of Avondale

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Ninyo & Moore	Geotechnical Evaluation, Lower Buckeye Waterline, Avondale, Arizona, Project #600727001	July-04	Wood, Patel & Associates, Inc.
Ninyo & Moore	Pavement Evaluation, Wal-Mart Store No. 2544, 13055 West Rancho Santa Fe Blvd, Project #601871001	June-07	Kimley-Horn and Associates, Inc.
Ninyo & Moore	Geotechnical Evaluation, Agua Fria Connector Trail, Riley Drive to Van Buren Street, Project #601886001	July-07	Danelowitz & Associates, Inc.
Ninyo & Moore	Geotechnical Evaluation, Elm Lane Drainage Mitigation, Project #602498001	March-09	Entellus
Plummer, Hassan & Associates Cons. Eng.	MCDOT, Plans for the Construction of Van Buren Street Bridge over Agua Fria River, Project No. 68220, As Built	March-88	MCDOT
PRC Toups	Preliminary Report, Indian School Rd Bridge at the Agua Fria River Rehabilitation and Stabilization of Channel	January-81	MC Highway Dep.
Royden Construction Company	MCDOT, Plans for the Construction of Lower Buckeye Rd - Crossing the Agua Fria River, Project No. 69000, Record Drawings ADOT	April-96	MCDOT
Samer, Lahlum & Associates, Inc.	MCDOT, Plans for the Construction of Indian School Road Bridge at Agua Fria River, Project No. 68074	November-83	MCDOT
SHB Consulting Geotechnical Eng.	Geotechnical Investigation Report, Channelization - Agua Fria River Thomas Rd & I-10, Maricopa County, Arizona	June-82	Dibble and Ass.
SHB Consulting Geotechnical Eng.	Agua Fria River Channelization, Thomas Rd to Indian Shool Rd, Maricopa County, Arizona	September-83	Simons Li & Ass.
SHB Consulting Geotechnical Eng.	Geotechnical Investigation Report, Proposed Bridge Van Buren over Agua Fria River, Maricopa County, Az	March-85	E.M. Plummer, Consulting Eng.
Simons Li & Ass.	Recommendations Regarding Bank Protection, Utility Crossings and Maintenance Anticipated for Channelization Between I-10 and Thomas Rd	November-83	MCFCD
Simons. Li & Assoc., Inc	Flood Control District of Maricopa County, Construction Plans for Indian School Road Bridge Pier Protection	February-84	FCDMC
Simons. Li & Associates, Inc	Recommendations Regarding Bank Protection, Utility Crossings, And Maintenance Anticipated For Channelization Between I-10 and Thomas Road	November-83	FCDMC
Simons. Li & Associates, Inc	Sediment Transport Report Agua Fria River	July-84	USACE
Simons. Li & Associates, Inc	Construction Plans For Agua Fria River Improvements Phase I - R.I.D. Canal Reconstruction & Siphon Phase II - Channelization and Bank Protection Contract No. FCD 85-10	December-84	FCDMC
Simons. Li & Associates, Inc	Agua Fria River Flood Control Project Analysis of Side Drainage Requirements Buckeye Road to 1500 feet South of I-10, I-10 to McDowel Rd and Thomas Rd to Camelback	January-85	FCDMC
Simons. Li & Associates, Inc	Construction Plans For Agua Fria River Improvements, Buckeye Road to I-10 FCD 85-37	February-85	FCDMC
Simons. Li & Associates, Inc	Scour Analysis of the Agua Fria River Between Lower Buckeye Rd and Broadway Boulevard	February-88	Brown and Caldwell
The WLB Group	Technical Data Notebook, Agua Fria River Reach 4 Levee Monitoring for Bank Stabilization, FCD Contract 98-20	February-99	FCDMC
The WLB Group	Technical Data Notebook, Agua Fria River Reaches1, 2, and 3 Levee Monitoring for Bank Stabilization, FCD Contract 98-20	April-99	FCDMC
URS	Draft Foundation Design Report, Ehrenberg-Phoenix Highway (I-10), Median Widening, Sarival Avenue to Dysart Road, Maricopa Counrt	March-07	ADOT
URS	Final Geotechnical Design Report, Ehrenberg-Phoenix Highway (I-10), Outside Widening, Sarival Avenue to SR 101L (Agua Fria) Maricopa Counrt	September-08	ADOT
USACE	Skunk Creek and the New Agua Fria Rivers Design Memorandum No. 3, General Design Memorandum - Phase II, Project Design - Part 4	May-86	FCDMC
USACE	Skunk Creek and the New Agua Fria RiversPhase II General Design Memorandum Depth of Toe Protection for Bank Stabilization and Levee Design	November-86	FCDMC
USACE	Specifications for Agua Fria River Levees Maricopa County, Arizona	March-87	USACE
USACE	Gila River Basin, Phoenix, Arizona and Vicinity, Agua Fria River Levees (Buckeye Rd to Broadway Rd) Maricopa County, Arizona, Contract Drawings	July-87	USACE, LA District
USACE	Skunk Creek and the New Agua Fria Rivers Supplement to Design Memorandum No. 3, General Design Memorandum - Phase II, Project Design - Part 4	July-87	FCDMC
USACE	Operation, Maintenance, Repair Replacement and Rehabilitation Manual, Phoenix Arizona and Vicinity	May-97	FCDMC
USACE	Non-Federal Flood Control Works Inspection Program, Agua Fria River, Arizona	February-10	FCDMC
Wilson & Company	Agua Fria Mapping Survey Report, 2011	January-11	FCDMC
Wilson & Company	Agua Fria Levee Aerial Mapping FCD CO-18 Assign 4	January-11	FCDMC
WTI	Agua Fria Improvement Project, Thomas Rd to North of Indian School Rd, Construction Contract 85-10	October-85	MCFCD
WTI	Agua Fria River Improvements, Buckeye Rd to Interstate10, Contract No. FCD 85-37	February-87	MCFCD

ASU

Ninyo & Moore

APPENDIX G

RIVER MILE POSTS TO AS-BUILT STATIONING CORRELATION

APPENDIX G

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River Mile Post and As-Built Stationing Correlation

River Mile Post	As-Built Levee West Stationing	Reach
8.48	5304.8	Thomas Rd and Indian School Rd
8.44	5093.6	Thomas Rd and Indian School Rd
8.35	4618.4	Thomas Rd and Indian School Rd
8.26	4143.2	Thomas Rd and Indian School Rd
8.16	3615.2	Thomas Rd and Indian School Rd
8.07	3140	Thomas Rd and Indian School Rd
7.98	2664.8	Thomas Rd and Indian School Rd
7.88	2136.8	Thomas Rd and Indian School Rd
7.78	1608.8	Thomas Rd and Indian School Rd
7.69	1133.6	Thomas Rd and Indian School Rd
7.6	658.4	Thomas Rd and Indian School Rd
7.57	500	Thomas Rd and Indian School Rd
7.55	288.8	Thomas Rd and Indian School Rd
7.51	130.4	Thomas Rd and Indian School Rd
7.48	24.8	Thomas Rd and Indian School Rd
7.46	-186.4	Thomas Rd and Indian School Rd
7.42	-292	Thomas Rd and Indian School Rd
7.4	-397.6	Thomas Rd and Indian School Rd
7.38	18510	I-10 and Thomas Rd
7.31	18130	I-10 and Thomas Rd
7.29	18020	I-10 and Thomas Rd
7.27	17920	I-10 and Thomas Rd
7.23	17685	I-10 and Thomas Rd
7.21	17586	I-10 and Thomas Rd
7.18	17450	I-10 and Thomas Rd
7.16	17320	I-10 and Thomas Rd
7.13	17181	I-10 and Thomas Rd
7.08	17035	I-10 and Thomas Rd
7.08	16924	I-10 and Thomas Rd
7.05	16770	I-10 and Thomas Rd
7.03	16670	I-10 and Thomas Rd
7.02	16575	I-10 and Thomas Rd
6.93	16135	I-10 and Thomas Rd
6.85	15678	I-10 and Thomas Rd
6.75	15148	I-10 and Thomas Rd
6.66	14672	I-10 and Thomas Rd
6.57	14180	I-10 and Thomas Rd
6.49	13775	I-10 and Thomas Rd
6.39	13280	I-10 and Thomas Rd
6.3	12788	I-10 and Thomas Rd
6.27	12630	I-10 and Thomas Rd
6.24	12478	I-10 and Thomas Rd
6.22	12341	I-10 and Thomas Rd
6.16	12050	I-10 and Thomas Rd
6.15	12000	I-10 and Thomas Rd
6.11	11785	I-10 and Thomas Rd
6	11170	I-10 and Thomas Rd
5.97	11025	I-10 and Thomas Rd
5.94	10860	I-10 and Thomas Rd
5.84	10210	I-10 and Thomas Rd

APPENDIX G

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River Mile Post and As-Built Stationing Correlation

5.78	9660	I-10 and Thomas Rd
5.74	9404	I-10 and Thomas Rd
5.72	9369	I-10 and Thomas Rd
5.69	9229	I-10 and Thomas Rd
5.65	8193	Buckeye to I-9
5.6	7798	Buckeye to I-10
5.54	7486	Buckeye to I-10
5.47	7090	Buckeye to I-10
5.45	6977	Buckeye to I-10
5.43	6888	Buckeye to I-10
5.33	6376	Buckeye to I-10
5.24	5869	Buckeye to I-10
5.21	5769	Buckeye to I-10
5.19	5674	Buckeye to I-10
5.15	5356	Buckeye to I-10
5.05	4869	Buckeye to I-10
4.97	4457	Buckeye to I-10
4.95	4332	Buckeye to I-10
4.93	4211	Buckeye to I-10
4.84	3775	Buckeye to I-10
4.74	3317	Buckeye to I-10
4.72	3196	Buckeye to I-10
4.7	3102	Buckeye to I-10
4.61	2593	Buckeye to I-10
4.55	2276	Buckeye to I-10
4.51	2096	Buckeye to I-10
4.49	1981	Buckeye to I-10
4.47	1880	Buckeye to I-10
4.38	1383	Buckeye to I-10
4.28	875	Buckeye to I-10
4.26	781	Buckeye to I-10
4.25	696	Buckeye to I-10
4.22	563	Buckeye to I-10
4.21	475	Buckeye to I-10
4.18	328	Buckeye to I-10
4.13	10316	Buckeye Rd to Broadway Rd
4.09	10069	Buckeye Rd to Broadway Rd
4	9563	Buckeye Rd to Broadway Rd
3.92	9137	Buckeye Rd to Broadway Rd
3.88	8903	Buckeye Rd to Broadway Rd
3.85	8746	Buckeye Rd to Broadway Rd
3.81	8542	Buckeye Rd to Broadway Rd
3.73	8253	Buckeye Rd to Broadway Rd
3.62	7730	Buckeye Rd to Broadway Rd
3.53	7433	Buckeye Rd to Broadway Rd
3.43	7052	Buckeye Rd to Broadway Rd
3.34	6585	Buckeye Rd to Broadway Rd
3.24	6077	Buckeye Rd to Broadway Rd
3.15	5580	Buckeye Rd to Broadway Rd
3.05	5244	Buckeye Rd to Broadway Rd
2.95	4970	Buckeye Rd to Broadway Rd
2.85	4614	Buckeye Rd to Broadway Rd
2.74	4067	Buckeye Rd to Broadway Rd
2.64	3582	Buckeye Rd to Broadway Rd

APPENDIX G

AGUA FRIA LEVEE PAL 18

River Mile Post and As-Built Stationing Correlation

2.54	3074	Buckeye Rd to Broadway Rd
2.46	2654	Buckeye Rd to Broadway Rd
2.38	2196	Buckeye Rd to Broadway Rd
2.29	1688	Buckeye Rd to Broadway Rd
2.2	1138 - end	

Source: Agua Fria Levee Freeboard Analysis Report:Levee ID #8, #16, and #18, June 2011 by WEST Consultants, Inc.