GEOTECHNICAL REPORT
SONOQUI WASH BASIN
NEC CHANDLER HEIGHTS RD. AND SOSSAMAN RD.
QUEEN CREEK, ARIZONA
CONTRACT FCD 2003C012

KLEINFELDER
An employee owned company

GEOTECHNICAL REPORT
SONOQUI WASH BASIN
NEC CHANDLER HEIGHTS RD. AND SOSSAMAN RD.
QUEEN CREEK, ARIZONA
CONTRACT FCD 2003C012
ASSIGNMENT NO. 6

Project Number: 57321 (1)

Kleinfelder, Inc.
1335 West Auto Drive
Tempe, Arizona 85284
(480) 763-1200

June 2005

June 17, 2005
File No.: 57321 (1)

Mr. Warren Rosebraugh, PE
Flood Control District of Maricopa County
2801 West Durango
Phoenix, Arizona 85009

SUBJECT: CONTRACT FCD 2003C012, Assignment No. 6
On-Call Geotechnical Engineering Services
Sonoqui Wash Basin
FCDMC Project Control No. 480-04-31
NEC Chandler Heights Rd. and Sossaman Rd.
Queen Creek, Arizona

Dear Mr. Rosebraugh:

Kleinfelder, Inc. (Kleinfelder) is pleased to present this geotechnical report to The Flood Control District of Maricopa County (FCDMC) for the proposed construction of the new Sonoqui Wash Basin to be constructed at the northeast corner of Chandler Heights Road and Sossaman Road, in the city of Queen Creek, in Maricopa County, Arizona. The purpose of our study was to explore and evaluate the subsurface conditions in order to develop geotechnical engineering recommendations for design and construction of the retention basin.

Based on the results of our study, the site may be developed as planned using conventional grading techniques. Recommendations regarding the geotechnical aspects of project design and construction are presented in the following report.

Recommendations provided herein are contingent on the provisions outlined in the "Additional Services" and "Limitations" sections of this report. The project Owner should become familiar with these provisions in order to assess further involvement by Kleinfelder and other potential impacts to the proposed project.

We appreciate the opportunity of providing our services for this project. If you have questions regarding this report or if we may be of further assistance, please contact the undersigned.

Sincerely,

KLEINFELDER, INC.

Steven A. Haire, P.E.
Senior Geotechnical Engineer

Reviewed By:

Carolyn (Cyndi) Newman-Crane, P.E.
Senior Project Manager

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APPENDICES

1.0 INTRODUCTION

1.1 General

In this report we present the results of our geotechnical study for the proposed Sonoqui Wash Basin to be constructed at the northeast corner of Chandler Heights Road and Sossaman Road, in the city of Queen Creek, in Maricopa County, Arizona. The project location is shown on the "Boring Location Plan", Figure 1. The purpose of the study was to explore and evaluate the subsurface conditions at three locations at the site in order to develop geotechnical engineering recommendations for project design and construction. These three locations and the depths to be explored were specified by our client, the Flood Control District of Maricopa County (FCDMC). FCDMC provided us with a plan showing existing site topography and providing the state plane coordinates of the three designated boring locations.

Our study included a site reconnaissance, subsurface exploration, representative soil sampling, field and laboratory testing, engineering analyses, and preparation of this report. This report presents recommendations for design and construction of the retention basin. The recommendations contained in this report are subject to the limitations presented in the "Limitations" section of this report.

1.2 Project Description

The proposed location of the basin is shown on the "Boring Location Plan", Figure 1. At the time of our exploration, the site had been graded, with an existing retention basin about 8 to 10 feet deep trending NW-SE near Chandler Heights Road along the south boundary of the site. The detailed grading plan for the new proposed retention basin was not available at the time this report was prepared; however, based on telephone conversations with Warren Rosebraugh, PE, with the FCDMC, it is our understanding that the existing shallow basin will be enlarged and deepened to about 15 feet below the original native site grade.

2.0 FIELD EXPLORATION

The field exploration consisted of drilling test borings to obtain the geotechnical soil profile and obtain samples for laboratory testing.

2.1 Drilling and Sampling

The drilling and sampling program was performed on May 25, 2005, and consisted of drilling three borings within the retention basin area at locations designated by FCDMD. The boring locations are shown on the "Boring Location Plan", Figure 1. The field locations of the borings were estimated by our staff professional based on rough measurements from the limits of existing landmarks; therefore, the locations of the borings shown on the attached Boring Location Plan should be considered approximate. The approximate state plane coordinates of the borings, based on the boring location plan provided by FCDMD, are presented in the table below:

BORING NO.	NORTHING (ft.)	EASTING (ft.)
B-25	813,815	776,140
B-26	813,235	776,135
B-27	813,210	776,800

The borings were drilled using a truck-mounted drill rig equipped with 6 5/8-inch hollow-stem augers to depths of about 15 feet below the existing ground surface. The depths drilled were as directed by FCDMC. Geomechanics Southwest Inc. (GSI) of Phoenix, Arizona was subcontracted to drill these borings.

A Kleinfelder, Inc. (Kleinfelder) staff geologist observed the drilling operation, classified the encountered soils, prepared boring logs, and collected soil samples for laboratory examination and testing.

Prior to the start of drilling, the Arizona Bluestake Center was contacted to locate existing utilities at the boring locations. Upon completion of the borings, the boreholes were backfilled with soil cuttings.

Relatively undisturbed samples were obtained using a California sampler with a 2.5-inch inside diameter and a 3.0-inch outside diameter. Disturbed samples were obtained using a Standard Penetration/Split-Spoon Sampler (SPT) with a 1.5-inch inside diameter and 2.0-inch outside diameter. The SPT samplers were driven a maximum of 18 inches using a 140-pound hammer falling 30 inches, and blow counts for successive 6-inch penetration intervals were recorded. California samplers were driven a maximum of 12 inches. Bulk (bag) samples of shallow soils were obtained from the auger cuttings at selected locations.

Soil classifications made in the field from auger cuttings and samples were re-evaluated in the laboratory after further examination and testing. The soils were classified in accordance with the Unified Soil Classification System presented on A-1 in Appendix A. Sample classifications, blow counts recorded during sampling, and other related information was recorded on the soil boring logs, which are presented in Appendix A.

3.0 LABORATORY TESTING

Laboratory testing performed on selected samples obtained during the field exploration for the project included:

- Moisture Content
- Sieve Analysis
- Plasticity Index
- Density
- Direct Shear
- pH & Resistivity
- Sulfate & Chloride Content
- Moisture-Density Relationship (Standard Proctor)

The results of the laboratory testing are presented in Appendix B.

4.0 SITE CONDITIONS

4.1 Geologic Setting

The project site is located in the Basin and Range Physiographic Province (Basin and Range) of central Arizona. The Basin and Range is characterized by isolated fault-bounded mountain ranges of igneous, metamorphic, deformed sedimentary, and volcanic rock separated by broad alluvium-filled valleys. The rock units are generally of Precambrian age, with erosional remnants of Paleozoic age rocks and local Cenozoic age volcanics and sediments. Bedrock is not exposed in the project vicinity, with the nearest rock outcrop approximately 3 miles south of the site in the Santan Mountains.

4.2 Site Surface Conditions

The site is currently undeveloped land, with a sparse growth of grass with occasional small brush. The site has been graded, with an existing retention basin about 8 to 10 feet deep trending NW-SE near Chandler Heights Road along the south boundary of the site. Test Boring B-26 is located at the west end of the existing basin area (see "Boring Location Plan", Figure 1). Outside of the existing retention area, the existing ground surface was relatively flat, sloping gently down to the northwest.

4.3 Soil Conditions

The soil profile encountered at the site was relatively uniform. Soils encountered throughout the depth drilled consisted primarily of sandy silty clay of low plasticity (CL-ML), interbedded with lesser amounts of non-plastic silty sand (SM). The soil consistencies generally ranged from soft to firm, becoming very firm with depth. No bedrock was encountered at the test boring locations.

Detailed descriptions of the soils encountered at the boring locations are presented on the boring logs in Appendix A.

4.4 Soil Moisture and Groundwater Conditions

No free groundwater was encountered within any of the borings drilled (to depths of about 30 feet) at the site. Soil moisture contents at the boring locations were described as damp. It should be noted that soil moisture conditions across the site may vary depending on rainfall and/or runoff conditions. Groundwater is expected to be encountered at depths generally ranging from about 300 to 500 feet below existing grade, according to regional well information provided by the Arizona Department of Water Resources.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

Based on the results of our study, the site may be developed as planned using conventional grading and construction techniques. Recommendations regarding the geotechnical aspects of project design and construction are presented in the following sections.

5.2 Excavation Conditions

The test drilling and sampling at the site were performed for design purposes. It is not possible to accurately correlate auger drilling results with the ease or difficulty of excavation for various types and sizes of equipment. The following general comments regarding excavatability are approximations based only on test boring data. More accurate information regarding excavatability should be evaluated by contractors or other interested parties using the intended equipment.

Soils encountered throughout the depths drilled were primarily soft to firm sandy silty clays, which should be fairly easy to excavate with conventional excavation equipment.

5.3 Shrink/Swell Earthwork Factors

For soils excavated on-site and then placed in compacted embankment or trench fills, earthwork shrink/swell factors (volume change) were estimated as part of our study. The estimated shrink/swell factors presented below were based primarily on comparison between in-situ densities from driven ring samples and laboratory compaction tests, and engineering judgment based on detailed boring logs. The calculated earthwork shrinkage values were rounded to the nearest 5% in agreement with ADOT standard practice. The values presented do not include losses from spillage, wind, or compaction of material to depths greater than intended below the newly placed fill. Estimated earthwork factors vary depending on the degree of compaction, as presented below:

Relative Compaction Based on Percentage of AASHTO T-99 (Standard Proctor) Maximum Density	Approximate Earthwork Shrinkage
85%	5% swell
90%	0% shrink
95%	5% shrink
100%	10% shrink

5.4 Slopes

5.4.1 General

Excavations in the site soils can most likely be made by conventional earth moving equipment. All excavations must comply with applicable local, state, and federal safety regulations, including the current Occupational Safety Health Association (OSHA) Excavation and Trench Safety Standards. Construction site safety generally is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing the information below solely as a service to our client. Under no circumstances should the information provided be interpreted to mean that Kleinfelder is

assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

5.4.2 Permanent Basin Slopes

We recommend that permanent cut and fill basin slopes subjected to standing water be constructed at a gradient no steeper than 2.5H:1V (horizontal to vertical). For slopes subjected to flowing water, some form of erosion protection, such as concrete paving or riprap over geotextile fabric should be considered to protect the erodable native silty clays and silty sands. For slopes with erosion protection, we recommend a gradient no steeper than 2.0H:1V. To reduce the potential for surface erosion, a berm or "V" ditch should be located at the top of slopes subject to significant overland water flows in order to intercept and redirect surface runoff. To minimize erosion of the slope face due to precipitation, vegetation or gravel surfacing should be considered. Consultation with a landscape architect is recommended to establish the design slope for vegetated slopes, and slopes as flat as 3H:1V, or flatter, may be desirable to aid in establishing and maintaining plant growth.

5.4.3 Temporary Excavations

Soils encountered at the boring locations consisted predominately silty clays with zones of silty sands throughout the depths drilled. Due to the presence of the silty sand soils, site soils should conservatively be considered Type C soils when applying the OSHA slope regulations. For these soil types, OSHA recommends a maximum slope inclination of 1.5H:1V or flatter. Steeper cut slopes may be utilized for excavations less than five feet deep depending on the strength, moisture content, and homogeneity of the soils as observed in the field.

The Contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced and, if they are

not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

5.4.4 Construction Considerations

Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within 1/3 the slope height from the top of any excavation steeper than 3H:1V. Where the stability of adjoining walls or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. A professional engineer registered in the State of Arizona should design shoring, bracing, or underpinning required for the project (if any).

Earthen berms or other methods should be used to prevent runoff water from entering all excavations. All runoff water should be collected and disposed of outside the construction limits.

5.5 Corrosion Potential

Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. As soil's resistivity decreases, its corrosivity increases. A commonly accepted correlation between soil resistivity and corrosivity towards ferrous metals is provided below:

Resistivity in ohm-centimeters	**Corrosivity Category**
0 to1,000	Severely Corrosive
1,000 to 2,000	Corrosive
2,000 to 10,000	Moderately Corrosive
Over 10,000	Mildly Corrosive

Results of the laboratory testing for pH, resistivity, soluble sulfates, and soluble chlorides are presented in the following table:

Location	Depth (ft)	pH	Resistivity (ohm-cm)	Soluble Sulfates (ppm)	Soluble Chlorides (ppm)
B-25	0-10	8.2	1,563	8	8
B-26	0-10	8.2	2,503	9	10
B-26	0-10	8.0	3,335	19	36

Based on laboratory testing, minimum resistivities of between 1,563 and 3,335 ohm-cm indicate that on-site soils would be categorized as corrosive to moderately corrosive toward ferrous metals.

Arizona Department of Transportation has established design criteria based on soil resistivity and pH for determining the service life of corrugated steel pipe. Based on the resistivity of 1563 ohms-cm and a pH of 8.2, a service life of 60 years for 18-gage corrugated galvanized steel pipe (CGSP) for dry soil conditions is predicted by the ADOT design criteria.

Protection from corrosion may be necessary for metallic conduits. While in dry field conditions of our arid environment, these soils may not contribute to significant corrosion; however, increases in soil moisture may result in reduced resistivities, and thus, could increase the potential for corrosion. According to ADOT's MPE&D Manual the following types of culvert pipe may be used for various resistivity ranges:

- For resistivities greater than 2000 ohm-cm, galvanized-coated steel AASHTO M-36, aluminum coated steel AASHTO M-36, aluminum alloy AASHTO M-196 or bituminous-coated AASHTO M-190 pipe should be used.
- For resistivities between 500 and 1999 ohm-cm, aluminum alloy AASHTO M-196 or bituminous-coated AASHTO M-190 pipe should be used.
- For resistivities less than 500 ohm-cm, bituminous coated AASHTO M-190 pipe should be used.

- The above-recommended culvert types are applicable for soils with a pH in the range of 5.0 to 9.0. For any value of pH greater than 7.2, bituminous-coated AASHTO M-190 pipe may be used, regardless of resistivity.

Laboratory tests indicate pH values vary between 8.0 and 8.2. Laboratory tests show chloride contents between 8 ppm and 36 ppm, indicating a negligible corrosion potential to concrete reinforcing steel.

Based on laboratory results, sulfate (SO_4) contents vary between 8 ppm and 19 ppm. Therefore, special precautions are not expected to be necessary to protect concrete, and Type II cement may be used for concrete in contact with soil.

6.0 CLOSURE

6.1 Limitations

The recommendations contained in this report are based on our field explorations, laboratory tests, and our understanding of the proposed construction. The subsurface data used in the preparation of this report were obtained from the borings drilled during the field study. It is anticipated that some variations in the soil conditions will exist between the points explored. The nature and extent of variations may not be evident until construction occurs. If any conditions are encountered at this site that are different from those described in this report, our firm should be immediately notified so that we may make any necessary revisions to the recommendations contained in this report. In addition, if the scope of the proposed construction changes from that described in this report, our firm should also be notified. This report was prepared in accordance with the generally accepted standard of practice in Arizona at the time the report was written. No warranty, expressed or implied, is made. It is the Client's responsibility to see that all parties to the project including the Designer, Contractor, Subcontractors, etc. are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the Contractor's option and risk.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on- and off-site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

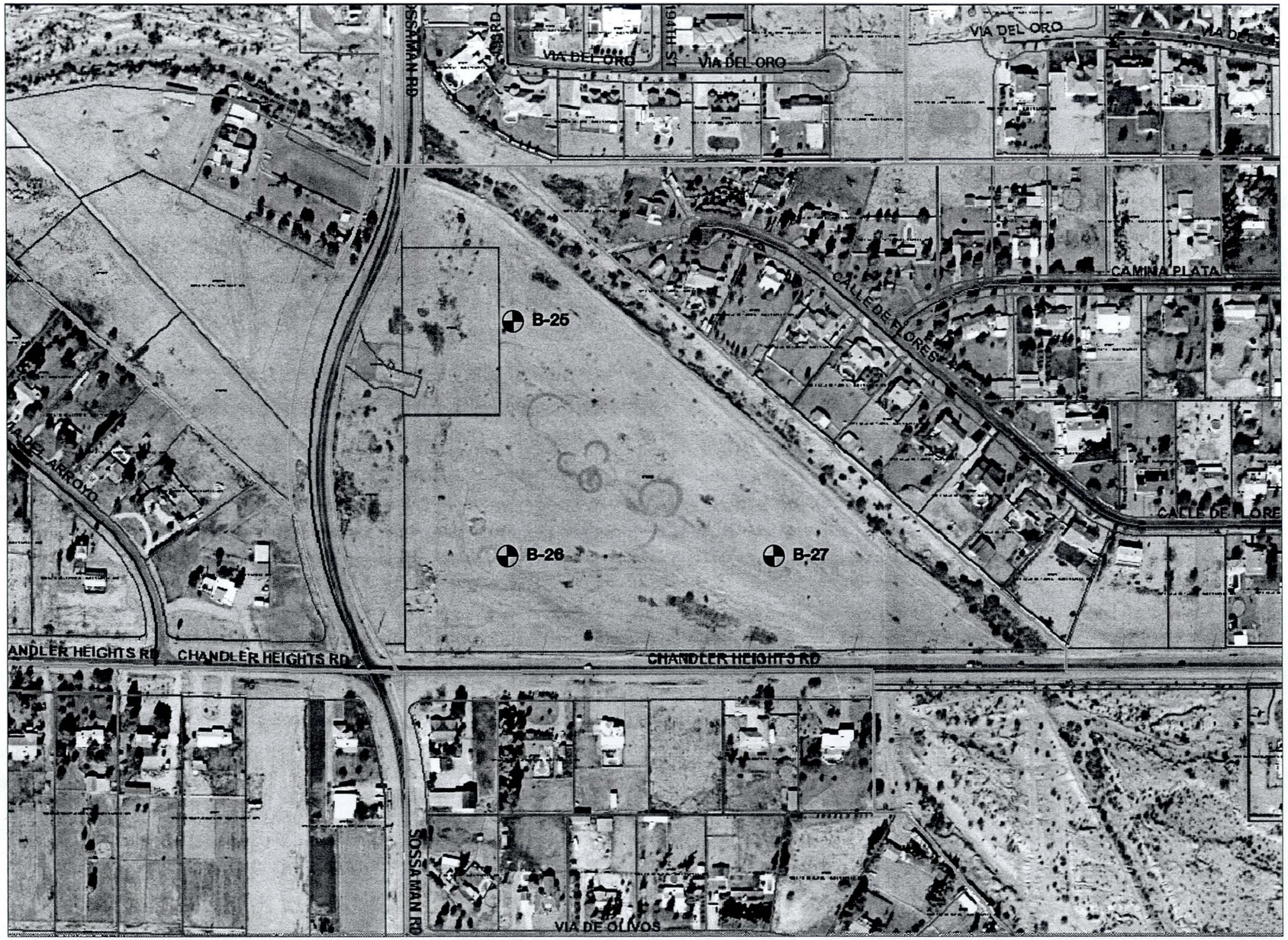
6.2 Additional Services

The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be performed during the construction to verify compliance with these recommendations. These tests and observations should include, but are not necessarily limited to observations and testing during site preparation and earthwork and consultation as may be required during construction.

We also recommend that we review project plans and specifications to verify compatibility with our conclusions and recommendations. Additional information concerning the scope and cost of these services can be obtained from our office.

FIGURES

N



LEGEND

B-1 ⊕ TEST BORING LOCATION

APPROXIMATE SCALE
1IN. = 300 FT.

Flood Control District of Maricopa County
Sonoqui Wash Basin
NEC Chandler Heights Road & Sossaman Road
Queen Creek, Arizona

BORING LOCATION PLAN

FIGURE
1

KLEINFELDER
ENVIRONMENTAL, GEOTECHNICAL,
AND CONSTRUCTION SERVICES

PROJECT NUMBER 57321

June 2005

APPENDIX A

Field Study

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			USCS SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	GRAVELS (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH LESS THAN 5% PASSING NO. 200 SIEVE	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH OVER 12% PASSING NO. 200 SIEVE	GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH LESS THAN 5% PASSING NO. 200 SIEVE	SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH OVER 12% PASSING NO. 200 SIEVE	SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid limit less than 50)		ML	INORGANIC SILTS & VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid limit greater than 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

Note: Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing No. 200 sieve require dual USCS symbols. (See KEY A-3 if provided)

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Drafted By:	SH	Project Number:
Date:	June, 2005	57321

UNIFIED SOIL CLASSIFICATION SYSTEM

Flood Control District of Maricopa County
Sonoqui Wash Basin
Queen Creek, Arizona

KEY

A-1

GEO-KEY_A1_SOIL 57321.GPJ 6/17/2005

LOG SYMBOLS


BULK / GRAB SAMPLE


MODIFIED CALIFORNIA SAMPLER
(2 inch inside diameter)


RING (PORTER) SAMPLER
(2.4 - inch inside diameter)


STANDARD PENETRATION
SPLIT SPOON SAMPLER
(2.0-inch O.D. X 1.4-inch I.D.)


SHELBY TUBE
(3 inch outside diameter)


NON-STANDARD PENETRATION
SPLIT SPOON SAMPLER
(1.5-inch O.D. X 0.9-inch I.D.)


BDBGM SIZE CORE BARREL
(1.65-inch I.D.)


BW44 SIZE CORE BARREL
(1.75-inch I.D.)


HQ-3 SIZE CORE BARREL
(2.4-inch I.D.)


NON-STANDARD PENETRATION
SPLIT SPOON SAMPLER
(2.5-inch O.D. X 2.0-inch I.D.)


WATER LEVEL
(level after completion)


WATER LEVEL
(level where first encountered)

GENERAL NOTES

1. Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.
2. No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
3. Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
4. In general, the Unified Soil Classification designations presented on the logs were based on visual classification in the field, modified where appropriate by visual classifications in the office, and/or laboratory gradation and index testing.
5. NA = Not Analyzed

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LOG KEY

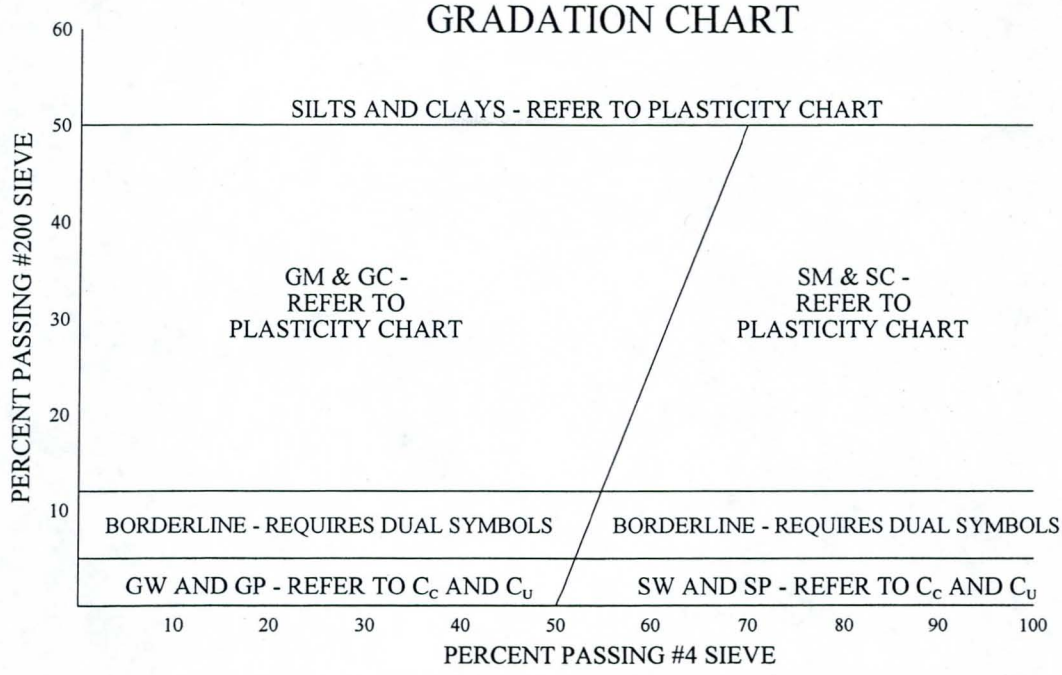
Flood Control District of Maricopa County
Sonoqui Wash Basin
Queen Creek, Arizona

KEY

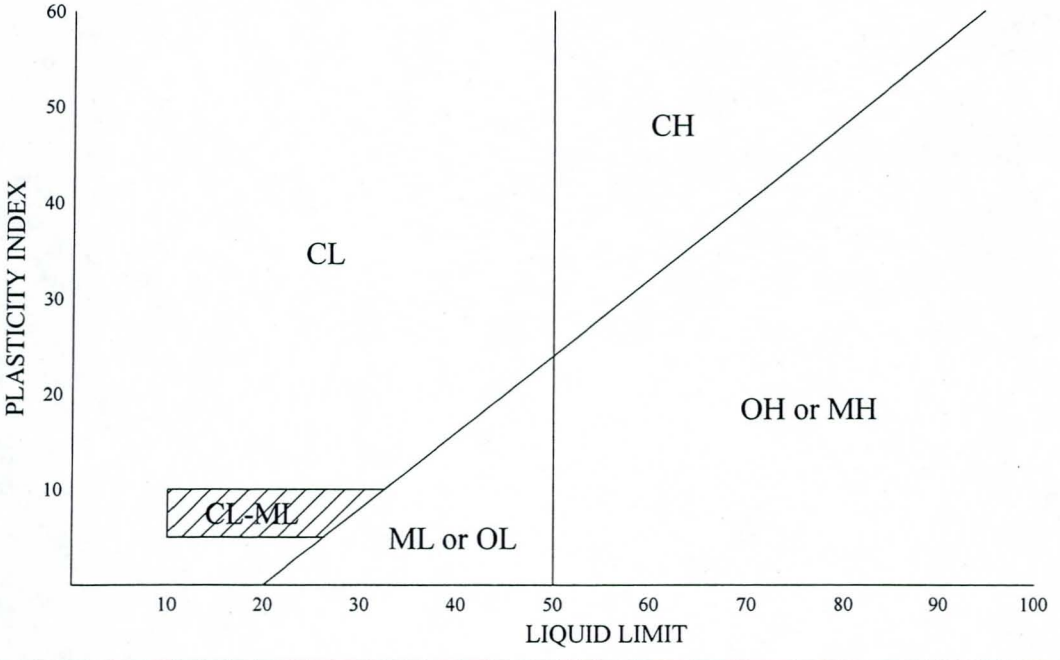
A-2

GEO-KEY_A2_LOG 57321.GPJ 6/17/2005

GRADATION CHART



PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL FRACTION	PARTICLE SIZE RANGE
Boulders	Greater than 300mm (12in.)
Cobbles	300mm to 75mm (12in. to 3in.)
Coarse Gravel	75mm to 19mm (3in. to 3/4in.)
Fine Gravel	19mm (3/4in.) to No. 4 sieve
Coarse Sand	No. 4 sieve to No. 10 sieve
Medium Sand	No. 10 sieve to No. 40 sieve
Fine Sand	No. 40 sieve to No. 200 sieve
Fines	less than No. 200 sieve

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Project Number: 57321

CHARTS & DEFINITIONS

Flood Control District of Maricopa County
Sonoqui Wash Basin
Queen Creek, Arizona

KEY

A-3

GEO-KEY_A3_CHART 57321.GPJ 6/17/2005

TERMINOLOGY USED ON THE BORING LOGS TO DESCRIBE THE FIRMNESS, DENSITY, OR CONSISTENCY OF SOILS

The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586 procedure using 2" O.D., 1 3/8" I.D. samplers.

1. Terms for description of partially saturated and/or cemented soils including clays, cemented granular materials, silts and silty and clayey granular soils.

N	Relative Firmness
0 - 4	Very soft
5 - 8	soft
9 - 15	Moderately firm
16 - 30	Firm
31 - 50	Very firm
51+	Hard

2. Terms for description of cohesionless, uncemented sands and sand-gravel mixtures.

N	Relative Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium dense
31 - 50	Dense
51+	Very dense

3. Terms for description of clays which are saturated or near saturation.

N	Relative Consistency
0 - 2	Very soft
3 - 4	soft
5 - 8	Moderately stiff
9 - 15	Stiff
16 - 30	Very Stiff
31+	Hard

GEO-KEY_A4_SOIL-TERMINOLOGY 57321.GPJ 6/17/2005

KLEINFELDER

Drafted By: SH
Date: June, 2005

Project Number: 57321

TERMINOLOGY USED TO DESCRIBE SOILS

Flood Control District of Maricopa County
Sonoqui Wash Basin
Queen Creek, Arizona

KEY

A-4

Northing and Easting:	N 813,815 E 776,140			Date Started:	5/25/2005
Groundwater (ft):	No Free Groundwater Encountered			Date Completed:	5/25/2005
Drilling Company:	GSI	Equipment:	CME-75	Logged By:	David Neidigh
Hole Diameter (in):	6 5/8	Drilling Method:	Hollow Stem Auger		
Hammer Type:	Automatic			Total Depth (ft):	16.5

ELEVATION (ft)	DEPTH (ft)	FIELD: Sample Interval	FIELD: Blow Counts per 6" Interval	FIELD: Continuous Pen. Resistance (bpf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphical Log	USCS Classification	DESCRIPTION
														0.0 to 16.5 feet Appx. Surface Elevation (ft): 1370.20 Surface Condition: Sparse vegetation
			7/12		85	5.7					0-10': pH Resistivity Chlorides Sulfates		CL-ML	**SANDY SILTY CLAY**, brown, slightly moist, soft to firm, low plasticity, predominantly fine sand size, occasional lenses of silty sand with some gravel
1365	5		4 6 8											
1360	10		13/12				21	4	100	58				
1355	15		5 4 5											Boring terminated at 16.5 feet Sampling stopped at 16.5 feet
1350	20													
1345	25													
1340	30													
	35													

GEO_ADOT_EWEL 57321.GPJ 6/17/2005

KLEINFELDER

Drafted By:	SH
Date:	June, 2005
Project Number:	57321

LOG OF BORING B-25

Flood Control District of Maricopa County
Sonoqui Wash Basin
Queen Creek, Arizona

BORING

B-25

Northing and Easting:	N 813,235 E 776,135			Date Started:	5/25/2005
Groundwater (ft):	No Free Groundwater Encountered			Date Completed:	5/25/2005
Drilling Company:	GSI	Equipment:	CME-75	Logged By:	David Neidigh
Hole Diameter (in):	6 5/8	Drilling Method:	Hollow Stem Auger		
Hammer Type:	Automatic			Total Depth (ft):	16.0

ELEVATION (ft)	DEPTH (ft)	FIELD: Sample Interval	FIELD: Blow Counts per 6" Interval	FIELD: Continuous Pen. Resistance (bpf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphical Log	USCS Classification	DESCRIPTION
														0.0 to 16.0 feet Appx. Surface Elevation (ft): 1363.20 Surface Condition: Sparse vegetation
1360	0		5 4 2				25	7	100	67	0-10': pH Resistivity Chlorides Sulfates Moisture-Density Relationship		CL-ML	**SANDY SILTY CLAY**, brown, slightly moist, soft to firm, low plasticity, predominantly fine sand size, occasional lenses of silty sand with some gravel
1355	5		2 3 4											
1350	10		26/12		100	5.5							SM	**SILTY SAND**, fine to coarse, light grey, slightly moist, very firm, non-plastic to low plasticity, some gravel to 1/2" recovered
1345	15		32/12		118	2.1								Boring terminated at 16.0 feet Sampling stopped at 16.0 feet
1340	20													
1335	25													
1330	30													
	35													

KLEINFELDER

Drafted By:	SH
Date:	June, 2005
Project Number:	57321

LOG OF BORING B-26

Flood Control District of Maricopa County
Sonoqui Wash Basin
Queen Creek, Arizona

BORING

B-26

GEO_ADOT_EW/EL 57321.GPJ 6/17/2005

Northing and Easting:	N 813,210 E 776,800			Date Started:	5/25/2005
Groundwater (ft):	No Free Groundwater Encountered			Date Completed:	5/25/2005
Drilling Company:	GSI	Equipment:	CME-75	Logged By:	David Neidigh
Hole Diameter (in):	6 5/8	Drilling Method:	Hollow Stem Auger		
Hammer Type:	Automatic			Total Depth (ft):	16.0

ELEVATION (ft)	DEPTH (ft)	FIELD: Sample Interval	FIELD: Blow Counts per 6" Interval	FIELD: Continuous Pen. Resistance (bpf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphical Log	USCS Classification	DESCRIPTION
														0.0 to 16.0 feet
														Appx. Surface Elevation (ft): 1371.30 Surface Condition: Sparse vegetation
1370	0		4 4 4								0-10': pH Resistivity Chlorides Sulfates		CL-ML	**SANDY SILTY CLAY**, brown, slightly moist, soft to firm, low plasticity, predominantly fine sand size, occasional lenses of silty sand with some gravel
	5		13/12		104	1.7	NV	NP	99	24	Direct Shear		SM	**SILTY SAND**, fine to coarse, light grey, slightly moist, moderately firm, non-plastic to low plasticity, trace gravel recovered
1365														
	10		5 5 6										CL-ML	**SANDY SILTY CLAY**, brown, slightly moist, moderately firm to firm, low plasticity, predominantly fine sand size, occasional lenses of silty sand with some gravel
1360														
	15		24/12		105	2.7								Boring terminated at 16.0 feet Sampling stopped at 16.0 feet
1355														
	20													
1350														
	25													
1345														
	30													
1340														
	35													

KLEINFELDER

Drafted By:	SH
Date:	June, 2005
Project Number:	57321

LOG OF BORING B-27

Flood Control District of Maricopa County
Sonoqui Wash Basin
Queen Creek, Arizona

BORING

B-27

GEO_ADOT_EW/EL 57321.GPJ 6/17/2005

APPENDIX B

Laboratory Testing

APPENDIX B
LABORATORY TESTING

LABORATORY TESTS

Laboratory tests were performed on selected samples to aid in soil classification and to evaluate physical properties of the soils, which may affect the geotechnical aspects of project design and construction. A description of the geotechnical laboratory testing program is presented below.

Moisture Content and Dry Unit Weight

Moisture content and dry unit weight tests were performed to evaluate moisture-conditioning requirements during site preparation and earthwork grading; soil overburden, and active and passive earth pressures; and relative soil strength and compressibility. Moisture content was evaluated in general accordance with ASTM Test Method D 2216; dry unit weight was evaluated using procedures similar to ASTM Test Method D 2937.

Sieve Analysis

Sieve analyses were performed to evaluate the gradational characteristics of the material and to aid in soil classification. Tests were performed in general accordance with ARIZ 201b.

Atterberg Limits

Atterberg Limits tests were performed to aid in soil classification and to evaluate the plasticity characteristics of the material. Additionally, test results were correlated to published data to evaluate the shrink/swell potential of near-surface site soils. Tests were performed in general accordance with AASHTO T 90.

Moisture/Density Relationship

Standard proctor tests were performed on bulk soil samples to evaluate maximum compacted dry density and optimum moisture content. Test procedures were in general accordance with ARIZ 225.

Resistivity and pH

Resistivity and pH tests were performed to evaluate the corrosive potential of the site soils. Tests were performed in general accordance with ADOT Test Method 236.

Sulfate and Chloride

Sulfate and Chloride tests were performed to evaluate the corrosive potential of site soils toward Portland cement concrete. Tests were performed in general accordance with California Test Methods 417 and 422 (sulfate and chloride, respectively).

Direct Shear

Direct shear tests were performed on selected undisturbed soil samples to evaluate the strength parameters of the site soils. These parameters are often used for slope stability, earth pressure calculation, and/or bearing capacity analyses.

KLEINFELDER

PROJECT: SONOQUI WASH BASIN
LOCATION: QUEEN CREEK, ARIZONA
REVIEWED BY: M. CONNOLLY

PROJECT NO: 57321
WORK ORDER NO: 05229
DATE SAMPLED: 5/25/2005

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

SIEVE SIZES

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

PERCENT PASSING BY WEIGHT

B-25 @ 10-11'	CL-ML	21	17	4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	97	93	78	58	2
B-26 @ 0-10'	CL-ML	25	18	7	100	100	100	100	100	100	100	100	100	100	100	100	100	99	98	96	93	82	67	6
B-27 @ 5-6'	SM	NV	NP	NP	100	100	100	100	100	100	100	100	100	99	99	98	97	95	86	78	64	35	24	7

KLEINFELDER

PROJECT: SONOQUI WASH BASIN
LOCATION: QUEEN CREEK, ARIZONA
MATERIAL: SEE BELOW
SAMPLE SOURCE: SEE BELOW

PROJECT NO: 57321
WORK ORDER NO: 05229
LAB NO: SEE BELOW
DATE SAMPLED: 5/25/2005
REVIEWED BY: M. CONNOLLY

DENSITY OF SOIL IN PLACE BY THE DRIVE-CYLINDER METHOD(ASTM D2937)

LAB #	BORING	USCS	MOISTURE			NUMBER OF RINGS	WET WGT. + RINGS (g)	WEIGHT OF RINGS (g)	DRY DENSITY (pcf)
			WET WT. (g)	DRY WT. (g)	MOISTURE CONTENT				
1	B-25 @ 0-1'	SOIL SAMPLE	658.5	623.1	5.7%	5.0	761.2	220.6	84.7
2	B-25 @ 10-11'	CL-ML	371.8	371.8	0.0%	6.0	1,005.2	271.9	101.2
4	B-26 @ 10-11'	SOIL SAMPLE	750.1	710.9	5.5%	5.0	868.1	229.4	100.2
5	B-26 @ 15-16'	SOIL SAMPLE	858.0	840.1	2.1%	5.0	952.8	227.5	117.6
7	B-27 @ 5-6'	SM	376.1	369.7	1.7%	5.0	865.5	226.8	104.0
8	B-27 @ 15-16'	SOIL SAMPLE	796.9	776.1	2.7%	6.0	1,054.1	270.5	105.3

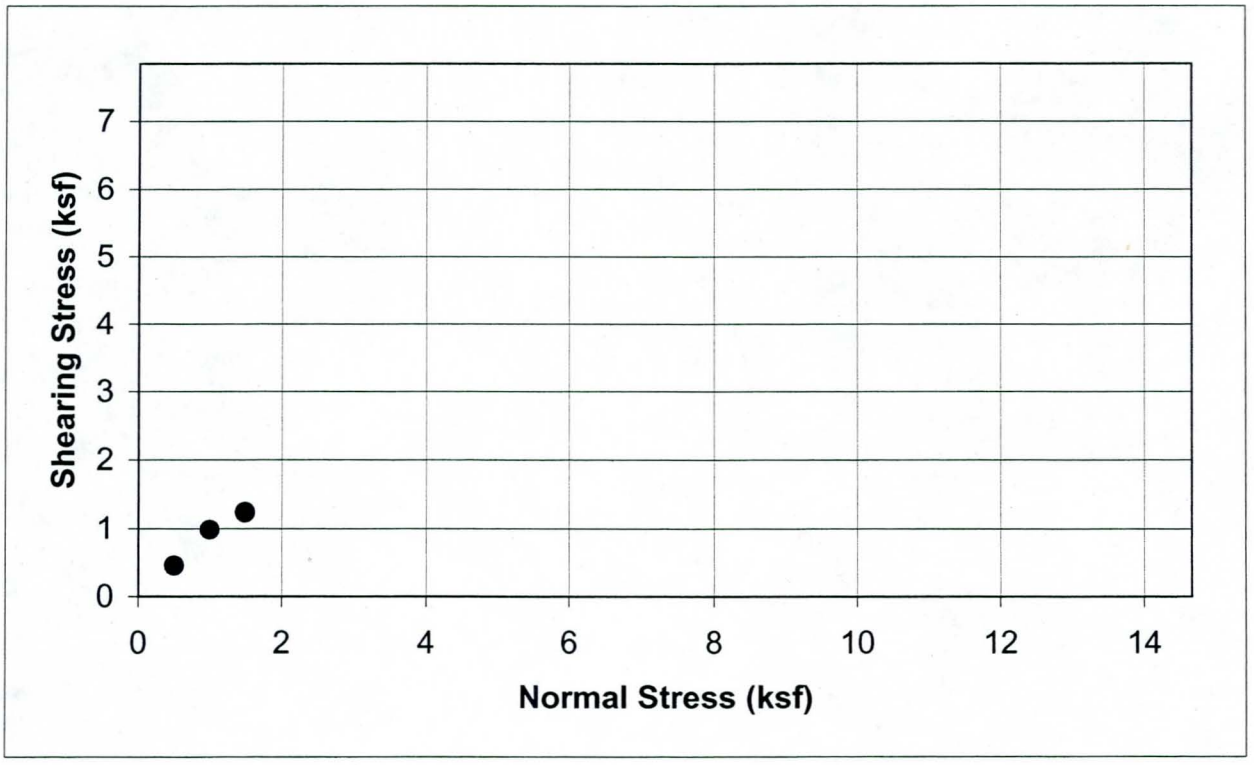
1335 WEST AUTO DRIVE, TEMPE, ARIZONA PHONE: (480) 763-1200 FAX: (480) 763-1212
ISSUED: 6/8/2005

KLEINFELDER

PROJECT:	SONOQUI WASH BASIN	**JOB NO:**	57321
LOCATION:	QUEEN CREEK, ARIZONA	**W.O. NUMBER:**	05229
MATERIAL:	SM	**LAB NO:**	7
SAMPLE SOURCE:	B-27 @ 5-6'	**DATE SAMPLED:**	5/25/2005
SAMPLE PREP.:	SATURATED		
TARGET:	N/A		

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:	Created by DigiShear Version 1.2; Copyright 2000, GEOTAC		
Rate of deformation (in/min):	0.016		
Direct shear point:	1	2	3
Dry mass of specimen (g):	120.8	126.2	127.5
Initial Moisture Content:	2.8%	3.1%	3.3%
Initial Wet Density (lb per cu.ft):	102.8	107.7	109.0
Initial Dry Density (lb per cu.ft):	100.0	104.5	105.6
Final Moisture Content:	23.3%	20.2%	21.9%
Final Wet Density (lb per cu.ft):	118.9	122.4	125.4
Final Dry Density (lb per cu.ft):	96.5	100.8	101.9
Normal Stress (kips per sq. ft):	0.50	1.00	1.50
Maximum Shearing Stress (kips per sq. ft):	0.45	0.98	1.23
Vertical Deformation @ Max Shear (in):	0.036	0.026	0.027
Horizontal Deformation @ Max Shear (in):	0.455	0.491	0.488



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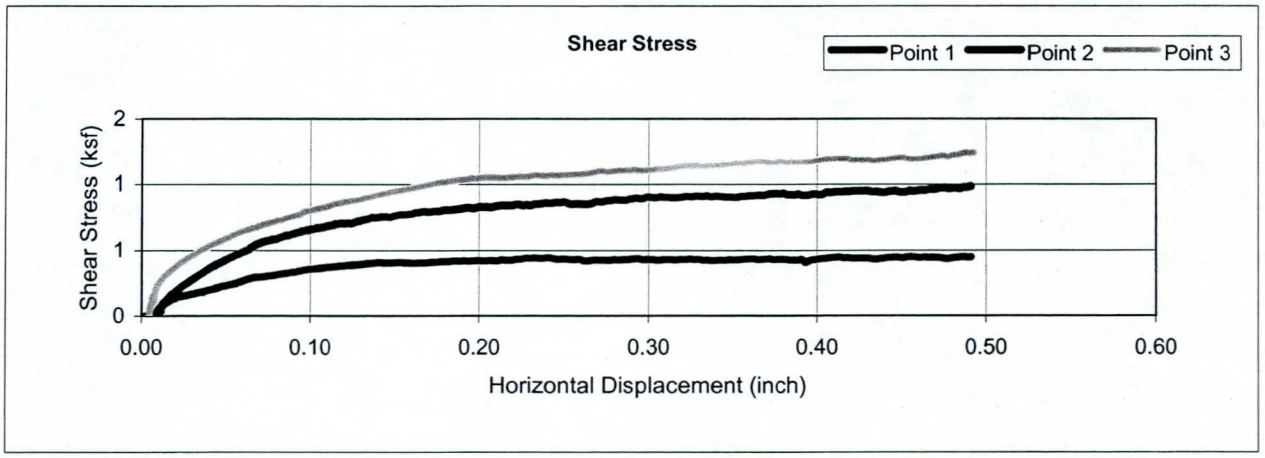
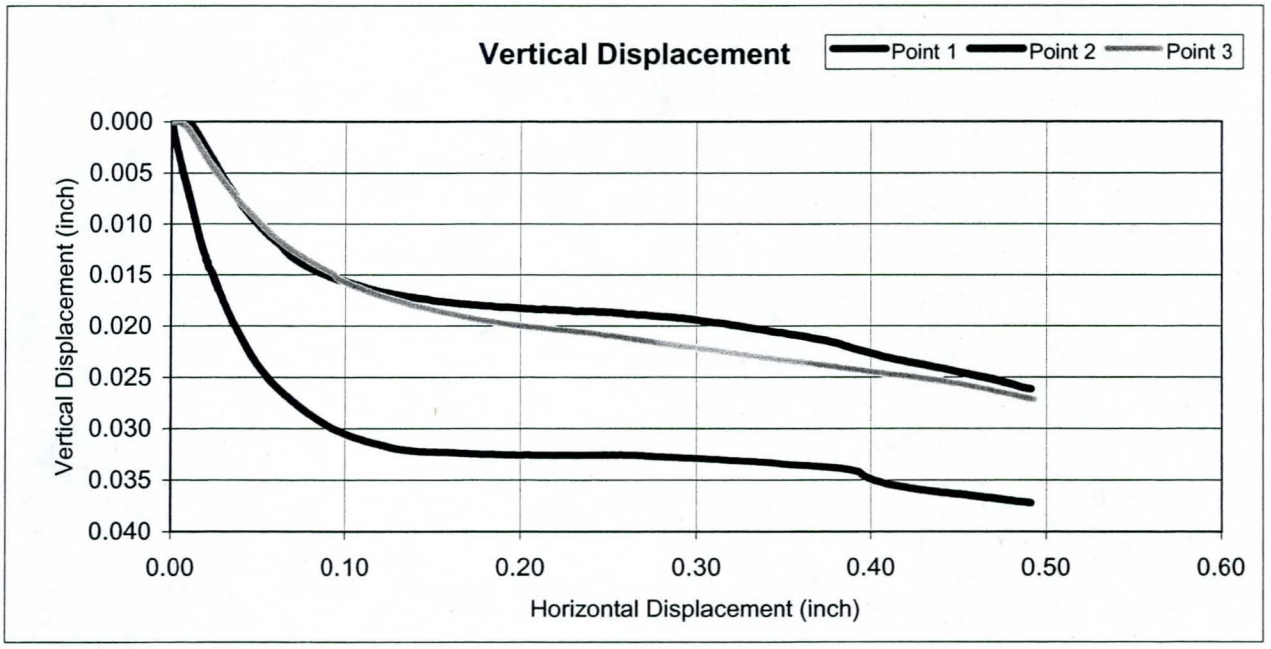
ISSUED: 6/8/2005

KLEINFELDER

PROJECT:	SONOQUI WASH BASIN	**JOB NO:**	57321
LOCATION:	QUEEN CREEK, ARIZONA	**WORK ORDER NO:**	05229
MATERIAL:	SM	**LAB NO:**	7
SAMPLE SOURCE:	B-27 @ 5-6'	**DATE SAMPLED:**	5/25/2005
SAMPLE PREP.:	SATURATED		
NORMAL LOADS (ksf):	0.5 1 1.5		

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)





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ISSUED: 6/8/2005

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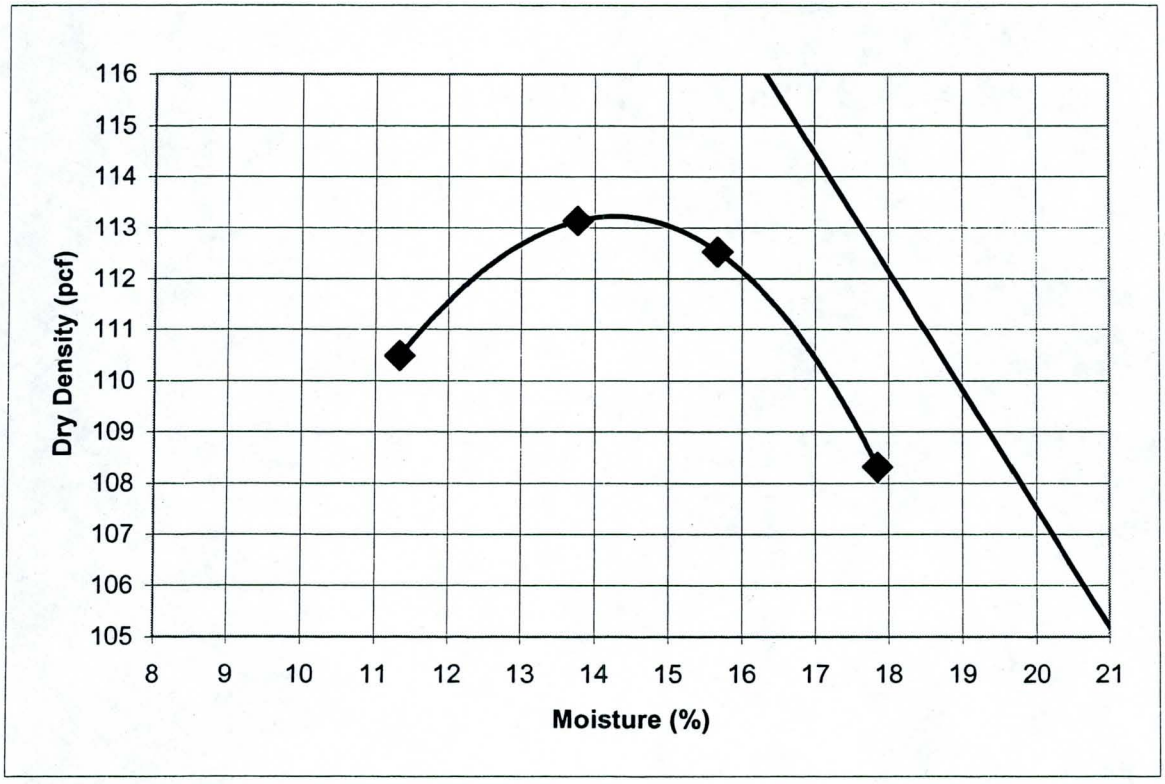
PROJECT:	SONOQUI WASH BASIN	**JOB NO:**	57321
LOCATION:	QUEEN CREEK, ARIZONA	**WORK ORDER NO:**	05229
MATERIAL:	CL-ML	**LAB NO:**	6
SAMPLE SOURCE:	B-26 @ 0-10'	**SAMPLE DATE:**	5/25/2005

LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)

CURVE: 05229-1

	English (pcf)	Metric (kg/ cu.m.)
Maximum dry density:	113.2	1814
Optimum moisture (%):	14.3	14.3



NOTES:

- The zero air void curve represents a specific gravity of: 2.65 (assumed).
- This is a summarized report of the referenced procedures and does not include all reporting requirements. Additional data can be provided at clients request.

Reviewed by: _____

Kleinfelder 1335 West Auto Drive, Tempe, Arizona, 85284 (480) 763-1200 (480) 763-1212 fax

KLEINFELDER

PROJECT:	SONOQUI WASH BASIN	**PROJECT NO:**	57321
LOCATION:	QUEEN CREEK, ARIZONA	**WORK ORDER NO:**	05229
MATERIAL:	SEE BELOW	**LAB NO:**	SEE BELOW
SAMPLE SOURCE:	SEE BELOW	**DATE SAMPLED:**	5/25/2005
		REVIEWED BY:	M. CONNOLLY

PH & RESISTIVITY (AZ 236)

LAB NO	SAMPLE SOURCE	MATERIAL	RESISTIVITY (Ohm-cm)	pH
3	B-25 @ 0-10'	SOIL SAMPLES	1,563	8.2
6	B-26 @ 0-10'	CL-ML	2,503	8.2
9	B-27 @ 0-10'	SOIL SAMPLES	3,335	8.0

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ISSUED: 6/8/2005

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PROJECT:	SONOQUI WASH BASIN	**JOB NO:**	57321
LOCATION:	QUEEN CREEK, ARIZONA	**WORK ORDER NO:**	05229
MATERIAL:	SOIL SAMPLES	**LAB NO:**	3
SAMPLE SOURCE:	B-25 **DEPTH:** 0-10'	**TESTED BY:**	MOTZZ LABORATORIES

ANALYSES RESULTS

ANALYSIS	RESULTS	UNITS
SULFATE	7.5	ppm
CHLORIDE	8.4	ppm

KLEINFELDER

PROJECT:	SONOQUI WASH BASIN			**JOB NO:**	57321
LOCATION:	QUEEN CREEK, ARIZONA			**WORK ORDER NO:**	05229
MATERIAL:	CL-ML			**LAB NO:**	6
SAMPLE SOURCE:	B-26	**DEPTH:**	0-10'	**TESTED BY:**	MOTZZ LABORATORIES

ANALYSES RESULTS

ANALYSIS	RESULTS	UNITS
SULFATE	9.3	ppm
CHLORIDE	9.9	ppm

KLEINFELDER

PROJECT:	SONOQUI WASH BASIN	**JOB NO:**	57321
LOCATION:	QUEEN CREEK, ARIZONA	**WORK ORDER NO:**	05229
MATERIAL:	SOIL SAMPLES	**LAB NO:**	7
SAMPLE SOURCE:	B-27 **DEPTH:** 0-10'	**TESTED BY:**	MOTZZ LABORATORIES

ANALYSES RESULTS

ANALYSIS	RESULTS	UNITS
SULFATE	19	ppm
CHLORIDE	36	ppm