

**GEOTECHNICAL INVESTIGATION REPORT
RETAINING WALL AT SAWMILL ROAD
SOUTH LAKE TAHOE, EL DORADO COUNTY, CALIFORNIA
SAWMILL 2B BIKE PATH AND EROSION CONTROL PROJECT
(COUNTY CIP NO. 95192)**

NOVEMBER 28, 2011



November 23, 2011

File: 122793

Mr. Donaldo Palaroan, P.E.
County of El Dorado Department of Transportation
Tahoe Engineering Unit
924 B Emerald Bay Road
South Lake Tahoe, California 96150

**Subject: Geotechnical Investigation Report
Retaining Wall at Sawmill Road
South Lake Tahoe, El Dorado County, California**

Dear Mr. Palaroan:

Kleinfelder is pleased to present the attached geotechnical investigation report for the proposed retaining wall at Sawmill Road, South Lake Tahoe, El Dorado County, California. The proposed wall is part of the Sawmill 2B Bike Path and Erosion control project (County CIP No. 95192).

We performed the work according to your contract #08-52559, task order #10.

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 us at 916-366-1701.

Sincerely,

KLEINFELDER WEST, INC.

Don Adams, P.E. (C74990)
Project Engineer

M. Zia Islam, P.E. (71199)
Program Manager

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1.0 SCOPE OF WORK

The scope of work for this project was to provide the results of a geotechnical investigation including geotechnical engineering analysis and design recommendations for proposed retaining wall at Sawmill Road in South Lake Tahoe. The location of the proposed retaining wall site is shown on Plate 1.

2.0 PROJECT DESCRIPTION

The Sawmill 2B Bike Path and Erosion Control Project is intended to provide a critical link in the Regional bicycle path network and to stabilize soil and improve storm water quality within the Project area. The Project supports the Tahoe Regional Planning Agency (TRPA) and the Tahoe Metropolitan Planning Organization's (TMPO) "Lake Tahoe Region Bicycle and Pedestrian Plan" by installing a Class I bicycle facility along Sawmill Road between U.S. Highway 50 and Echo View Drive. The purpose of TRPA's Lake Tahoe Region Bicycle and Pedestrian Plan is to provide access to local businesses, schools, and offices for bicyclists and pedestrians, to reduce vehicular transportation, and to enhance recreational opportunities within the basin. The Project also supports TRPA's Environmental Improvement Program and the California Tahoe Conservancy's (CTC) March 1987 Report on Soil Erosion Control Needs and Projects in the Lake Tahoe Basin (Basin) by installing low impact Best Management Practices (BMPs).

3.0 WALL DESCRIPTION

Information about the proposed retaining wall was obtained from the preliminary drawings provided by County of El Dorado. The proposed retaining wall is located between Stations 93+90.00, 6.96' RT and 99+36.89, 6.87' RT (Construction Centerline) approximately. The wall will retain new fills along the eastbound lane of Sawmill Road. The existing ground surface elevation along the proposed wall ranges from approximately elevation 6,264 to 6,267 feet above mean sea level (MSL), based on the project datum established by County of El Dorado Department of Transportation (EDOT). The top of the proposed retaining wall varies between Elevation 6,273 and 6,274 feet above MSL.

4.0 GEOTECHNICAL INVESTIGATION

Subsurface conditions at the site were explored by drilling three soil borings at the site on October 25, 2011. The soil borings were drilled by Andresen Exploration of Reno using a Mobile CME-75 truck-mounted drill rig equipped with 8-inch-diameter hollow stem augers. The borings were drilled to an approximate depth of 20 feet below the existing ground surface.

The locations of borings and boring logs are shown on Plate 2. Locations of the explorations shown on Plate 2 were established by measuring distances from existing site features. Borings locations were recorded in the field using a hand held GPS unit with an accuracy of ± 10 feet. These locations should be considered accurate only to the degree implied by the method used.

A Kleinfelder engineer logged the borings by visually identifying and classifying soils encountered in general accordance with Unified Soil Classification System presented in ASTM D2488. Upon completion of laboratory testing, soil classifications were re-evaluated in general accordance with ASTM D2487. Boring logs are presented in Appendix A. Our engineer also performed on-site testing at selected locations in order to evaluate soil strength and consistency. On-site testing included undrained shear strength measurements using a pocket penetrometer. The results of the on-site testing are presented on the soil boring logs.

Disturbed and relatively undisturbed soil samples were obtained during drilling. Soil samples were obtained from the borings using a California sampler (3-inch outer diameter and 2 1/2-inch inner diameter) or a Standard Penetration Test (SPT) split spoon sampler (2-inch outer diameter and 1.4 inch inside diameter) and driven 18 inches (unless otherwise noted) into undisturbed soil using a 30-inch drop of a 140-pound calibrated automatic hammer. Soil samples obtained from the borings were packaged and sealed in the field to reduce moisture loss and disturbance, and returned to our laboratory for testing. After completion of field work, photographs of the sampled soil were taken and are included in Appendix B.

Upon completion, the soil borings were grouted to the surface with lean cement grout in accordance with County of El Dorado requirements.

5.0 LABORATORY TESTS

Kleinfelder performed laboratory tests on selected samples recovered from the borings to evaluate their physical characteristics. Testing performed consisted of the following:

- Moisture Content (ASTM D2216)
- Atterberg Limits (ASTM D 4318)
- Sieve Analysis (ASTM C136)
- Direct Shear (ASTM D3080)

In addition, the following analytical tests were performed at Western Environmental Testing (WET) Laboratory of Reno:

- pH (SW846 9045B)
- Resistivity (SM 2510B)
- Soluble sulfates (EPA 300.0)
- Soluble chloride (EPA 300.0)

Laboratory test results are included in Appendix C.

6.0 REGIONAL GEOLOGY AND FAULTING

The site is located near the eastern edge of the Sierra Nevada geomorphic province. The mountain ridges surrounding the site primarily consist of volcanic rocks of Tertiary age, with Cretaceous age granitic rocks forming the Sierra Crest west of the site. The volcanic rocks range from basaltic to andesitic in composition and are underlain by the older granitic rock, which form the Sierra Nevada batholith.

The features of the eastern Sierra Nevada Mountains were formed by large scale faulting during Tertiary times. Most of the larger faults are no longer active, although many of the smaller faults in the area are still considered active or potentially active. Numerous volcanic vents are also located in the region. Although not currently active, these features have shown activity within the last 7 million years.

Based on a review of the "Geologic Map of the Lake Tahoe Basin, California and Nevada," (Saucedo, 2005) no mapped faults cross or trend toward the project site. The project site also lies within the zone of influence of numerous other fault systems in the Tahoe Basin, western Nevada, and eastern California.

7.0 SUBSURFACE CONDITIONS

Saucedo, 2005 indicates the project site is underlain by Holocene Flood-plain Deposits (map symbol Qfp). These deposits typically consist of gravelly to silty sand and sandy to clayey silt. Locally includes lacustrine and delta deposits.

The following paragraphs summarize the results of our field exploration. The boring logs should be reviewed for a more detailed description of the subsurface conditions at the locations explored.

During the field investigation, the borings generally encountered about 7 feet of fill material consisting of poorly graded sand with silt and gravel. Cobbles and boulders are likely present in the fill material based on observations of drill rig performance and refusal encountered in Boring B-3. Native soils were encountered near Elevation 6,265 and consisted of medium dense silty and poorly graded sands. The maximum particle size and gravel content generally increased in with depth in this soil layer. Underlying the native sands was a relatively thin (estimated to be about 2 feet thick), firm silt layer. The silt layer was not encountered in Boring B-2. However, it is assumed the layer was present between sample intervals of about 10 to 15 feet deep. Underlying the silt was poorly graded sand with silt to the maximum depths explored of about 20 feet.

During the field exploration, groundwater was encountered in all three borings. In Boring B-1 groundwater was first encountered at elevation 6,258. After completion of Boring B-1, the hollow stem augers were removed from the bore hole. When the augers were removed, the soil collapsed to a depth of 7 feet below the ground surface. Therefore, a stabilized groundwater elevation was not able to be recorded. Groundwater was first encountered in Borings B-2 and B-3 at elevations of 6,256 and 6,252 feet above MSL, respectively. After completion of these borings, and prior to removing the hollow stem auger from the bore hole, the groundwater level was recorded in Borings B-2 and B-3 at elevations of 6,260 and 6,257 feet above MSL, respectively. Fluctuations in the level of groundwater and soil moisture noted in this report may occur

due to variations in precipitation, land use, irrigation, and other factors. A design groundwater level of 6,260 feet is recommended.

8.0 CORROSION EVALUATION

Chemical analyses were performed on soil samples recovered from Borings to evaluate the corrosion potential of the site soils. The results are presented in Table 1 below.

Table 1: Soil Corrosion Test Results

Location	Depth (ft)	Minimum Resistivity (Ohm-cm)	pH	Chloride Content (ppm)	Sulfate Content (ppm)
B-1	1-5 ft	25,000	6.17	23	< 15
B-2	10 ft	4,900	6.03	< 15	< 15

Based on the Caltrans Corrosion Guidelines (2003 version 1.0), a site is considered corrosive if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is 500 ppm or greater
- Sulfate concentration is 2,000 ppm or greater
- The pH is 5.5 or less

Moreover, a minimum resistivity value for soil and/or water less than 1,000 ohm-cm indicates the presence of high quantities of soluble salts and a higher propensity for corrosion. Based on Caltrans guidelines and laboratory test results, the site may be considered as non-corrosive to steel and concrete.

Kleinfelder does not practice corrosion engineering and therefore does not provide recommendations regarding corrosion potential mitigation. The above information is provided to help facilitate the understanding of corrosion potential at a site.

9.0 WALL TYPES

The proposed wall is a 'fill' type wall. Based on the geotechnical considerations, we recommend that either cast-in-place concrete cantilever wall or prefabricated modular wall be used for the proposed wall. Wall design should follow the guidelines of AASHTO Standard Specifications for Highway Bridges and be performed by a registered professional engineer practicing in the State of California.

The Contractor may be allowed to propose alternate wall type for the approval by County of El Dorado by submitting engineering analysis and design certified by a professional engineer practicing in the state of California.

10.0 DESIGN RECOMMENDATIONS

The following recommendations are provided for wall design:

Soil parameters: The soil parameters recommended for design are:

Structural Backfill, Unit Weight = 120 pcf, Friction Angle (ϕ) = 30°, Cohesion = 0 psf
(Structural backfill meeting the requirements of Caltrans Standard Specifications (2006), Section 19-3.06)

Foundation Soil, Unit Weight = 120 pcf, Friction Angle (ϕ) = 32°, Cohesion = 0 psf

Friction factor: A friction factor of 0.35 is recommended for concrete footing and bearing soil interface.

Earth Pressures: The table below presents the recommended earth pressures for cast-in-place concrete cantilever retaining wall.

Table 2: Summary of Recommended Earth Pressures

Condition	Active Pressure (Equivalent Fluid Weight) pcf	Passive Pressure (Equivalent Fluid Weight) pcf	Seismic Surcharge psf	Surcharge Lateral (active) Pressure psf
Level Backslope	40	312 ^a	15H ^b	0.33q ^{c,d}

^a Neglect passive pressure above the top of footing

^b Seismic surcharge according to inverted triangular pressure distribution, where H is the wall height in feet.

^c The surcharge pressure, q, is equivalent to the applied pressure from loads (such as traffic load) located within a lateral distance equivalent to H.

^d Distributed uniformly (rectangular load distribution)

11.0 CONSTRUCTION CONSIDERATIONS

- Follow Caltrans Standard Specifications for clearing and grubbing (Section 16), and structure excavation and backfill (Section 19).
- Follow current OSHA requirements for temporary excavation.
- Employ a registered Geotechnical Engineer or Professional Engineer with at least 10-year experience with earthwork to supervise structure excavation and backfill operation.
- Prepare wall subgrade in accordance with current Caltrans Standard Specifications, Section 19 and/or applicable Standard Special Provisions. Over-excavation may be required if soil encountered at the subgrade deviates from what was encountered in the referenced borings or if during construction, loose or unsuitable soils are encountered at the subgrade elevation.
- Do not allow heavy compaction equipment or other loads in close proximity to the wall.
- Groundwater was encountered at Elevation 6,260 feet MSL during test boring investigation. Therefore, control and removal of water should be anticipated during construction. Follow Caltrans Standard Specification, Section 19-3.04 (Water Control and Foundation Treatment).
- Mark and protect existing utilities.

- During and after construction, positive drainage should be provided to direct surface water away from structures and all excavations toward suitable, non-erosive drainage devices.

12.0 LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the service is provided. Our conclusions, opinions and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This report may be used only by the Client and registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance.

The work performed was based on project information provided by Client. Kleinfelder may need to revise the recommendations if there is change in the project information provided.

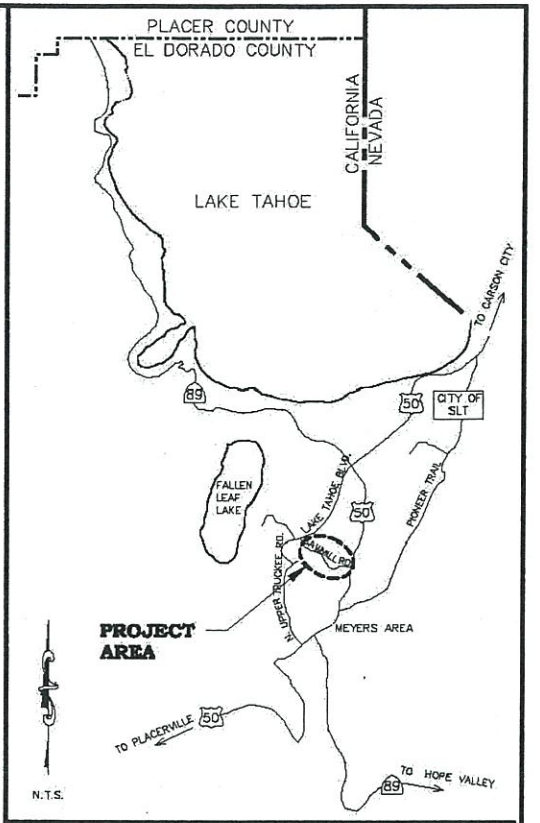
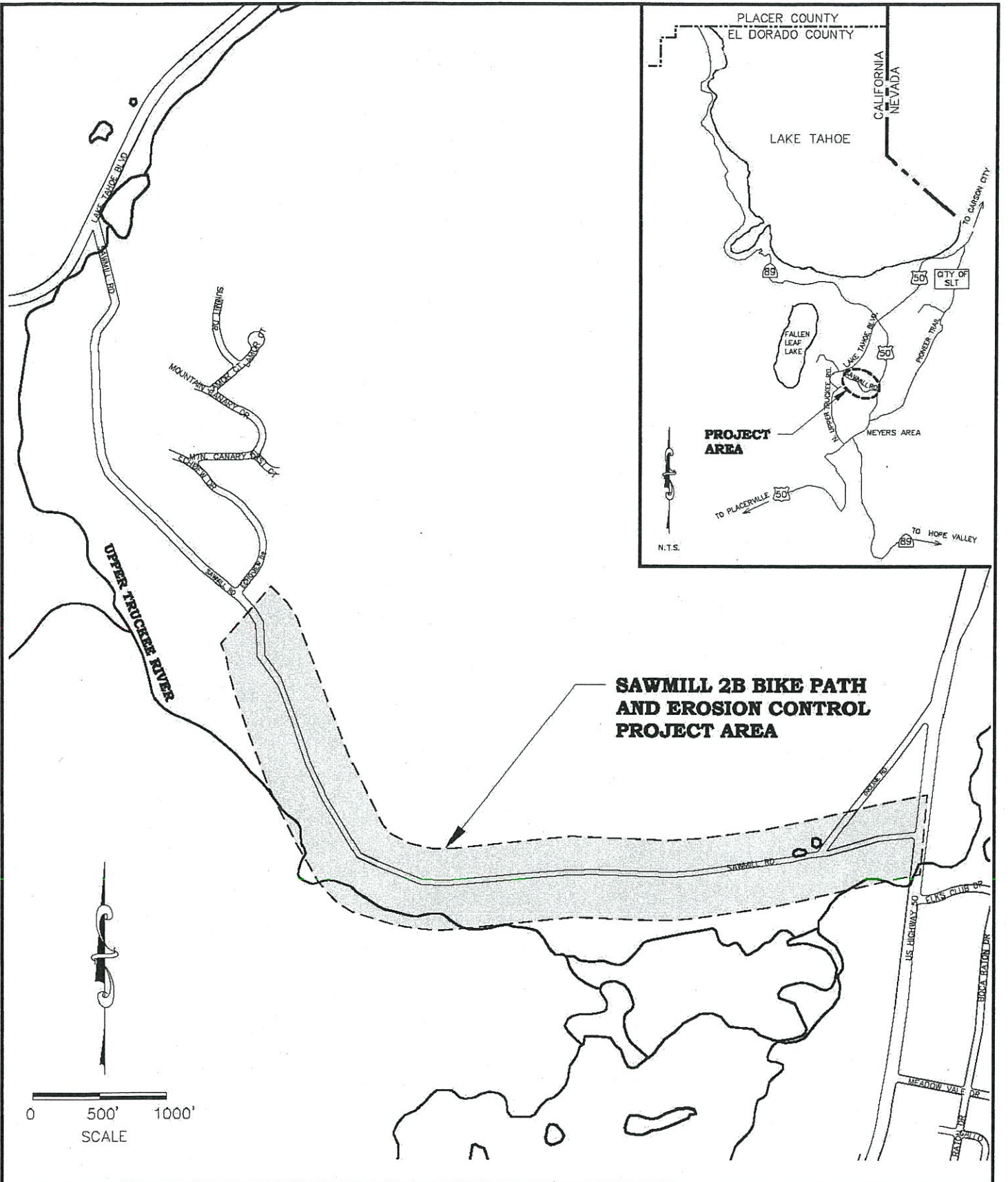
Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. It is possible that soil, rock, or groundwater conditions could vary between or beyond the points explored. If soil, rock, or groundwater conditions are encountered during construction that differ from those described herein, the client is responsible for ensuring that Kleinfelder is notified immediately so that we may reevaluate the recommendations of this report. If the scope of the proposed construction, including the estimated building loads, and the design depths or locations of the foundations changes from that described in this report, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions of this report are modified or approved in writing, by Kleinfelder.

The scope of our geotechnical services did not include any environmental site assessment for the presence or absence of hazardous/toxic materials in the soil, surface water, groundwater, or atmosphere, or the presence of wetlands.

13.0 REFERENCES

Saucedo, G.J., *Geologic Map of the Lake Tahoe Basin, California and Nevada*. California Department of Conservation, California Geological Survey, 2005.

Caltrans Standard Specification, 2006



**SAWMILL 2B BIKE PATH
AND EROSION CONTROL
PROJECT AREA**

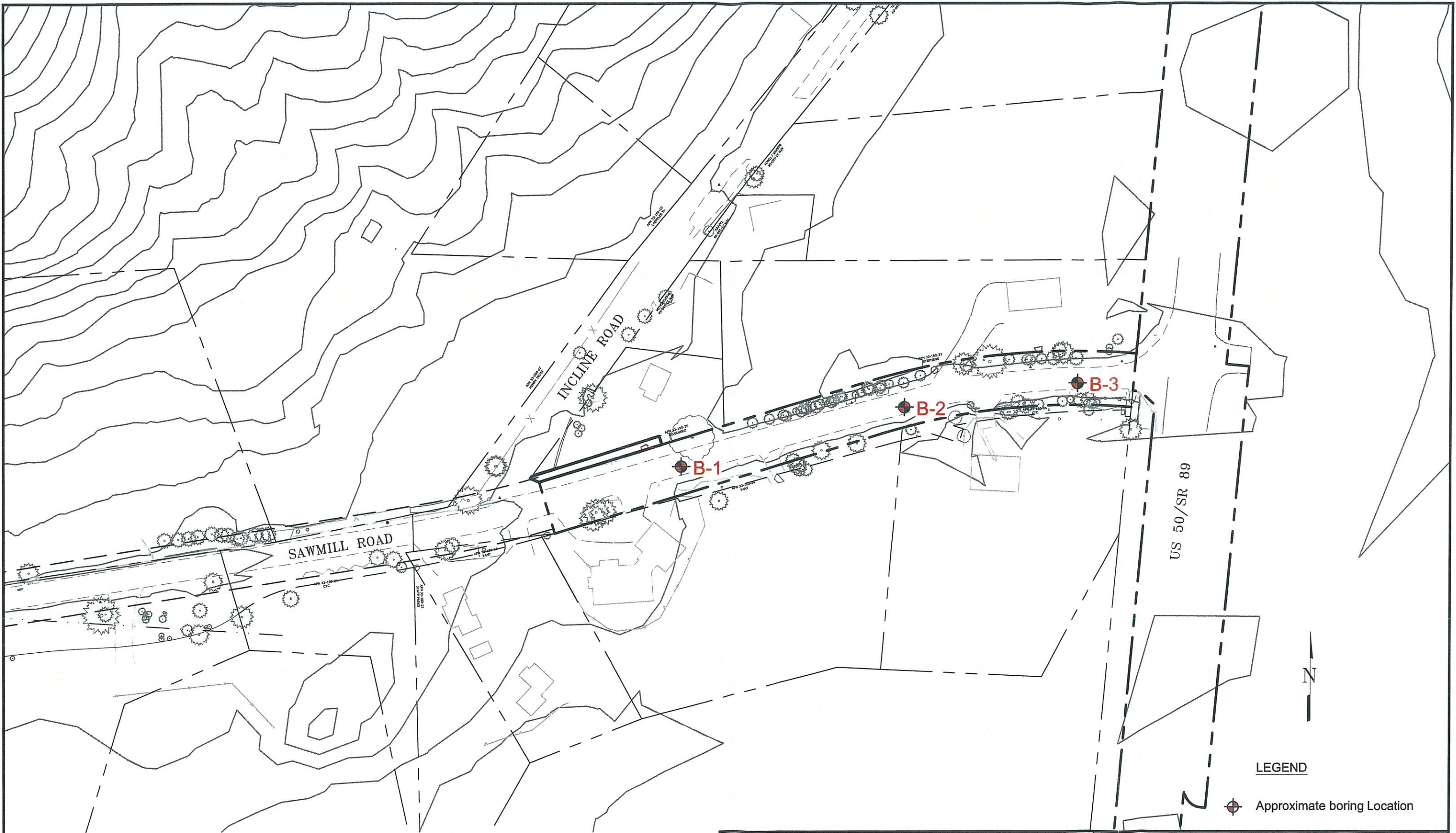
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DRAWN:	11/04/2011
DRAWN BY:	D. Ross
CHECKED BY:	D. Adams
FILE NAME:	plate 1a.dwg

VICINITY MAP

SAWMILL BIKE PATH
EL DORADO COUNTY, CALIFORNIA

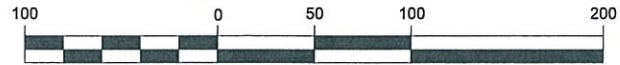
PLATE
1



LEGEND

 Approximate boring Location

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APPROXIMATE SCALE: 1 inch = 100 feet



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BORING LOCATION PLAN

SAWMILL BIKE PATH
EL DORADO COUNTY, CALIFORNIA

PLATE

2

APPENDIX A

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

MAJOR DIVISIONS	GRAPHIC LOG	TYPICAL DESCRIPTIONS			
GRAVELS (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH <5% FINES $Cu \geq 4$ and $1 \leq Cc \leq 3$		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 5 to 12% FINES $Cu \geq 4$ and $1 \leq Cc \leq 3$		GW-GM	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES	
			GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES	
			GP-GM	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES	
			GP-GC	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES	
	GRAVELS WITH >12% FINES		GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES	
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	
			GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES	
	SANDS (More than half of material is larger than the #200 sieve)	CLEAN SANDS WITH <5% FINES $Cu \geq 6$ and $1 \leq Cc \leq 3$		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 5 to 12% FINES $Cu \geq 6$ and $1 \leq Cc \leq 3$		SW-SM	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
				SP-SM	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
			SP-SC	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES	
SANDS WITH >12% FINES			SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES	
			SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES	
			SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES	
		SILTS AND CLAYS (Liquid limit less than 50)		ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY,
	CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS		
	CL-ML		INORGANIC CLAYS-SILTS OF LOW 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		

USCS (D2487) KA CORPORATE STD.-092011.GLB 122793.GPJ 11/2/11



Project Number: 122793
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 Checked By: D. Adams
 File Name: 122793

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

SAWMILL BIKE PATH
 EL DORADO COUNTY, CALIFORNIA

Plate
A-1

SOIL DESCRIPTION KEY

MOISTURE CONTENT

DESCRIPTION	ABBR	FIELD TEST
Dry	D	Absence of moisture, dusty, dry to the touch
Moist	M	Damp but no visible water
Wet	W	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

PLASTICITY

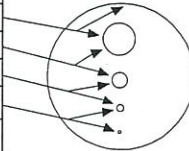
DESCRIPTION	ABBR	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm) thread cannot be rolled at any water content.
Low (L)	LP	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	MP	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit
High (H)	HP	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit

GRAIN SIZE

DESCRIPTION	SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders	>12"	>12"	Larger than basketball-sized
Cobbles	3 - 12"	3 - 12"	Fist-sized to basketball-sized
Gravel	coarse	3/4 - 3"	Thumb-sized to fist-sized
	fine	#4 - 3/4"	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	Rock salt-sized to pea-sized
	medium	#40 - #10	Sugar-sized to rock salt-sized
	fine	#200 - #10	Flour-sized to sugar-sized
Fines	Passing #200	<0.0029	Flour-sized and smaller

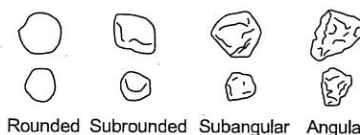
REACTION WITH HCL

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately



ANGULARITY

DESCRIPTION	ABBR	CRITERIA
Angular	A	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	SA	Particles are similar to angular description but have rounded edges
Subrounded	SR	Particles have nearly plane sides but have well-rounded corners and edges
Rounded	R	Particles have smoothly curved sides and no edges



APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	ABBR	SPT (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
Very Loose	VL	<4	<4	<5	0 - 15	Easily penetrated with 1/2-inch reinforcing rod by hand
Loose	L	4 - 10	5 - 12	5 - 15	15 - 35	Difficult to penetrate with 1/2-inch reinforcing rod pushed by hand
Medium Dense	MD	10 - 30	12 - 35	15 - 40	35 - 65	Easily penetrated a foot with 1/2-inch reinforcing rod driven with 5-lb. hammer
Dense	D	30 - 50	35 - 60	40 - 70	65 - 85	Difficult to penetrate a foot with 1/2-inch reinforcing rod driven with 5-lb. hammer
Very Dense	VD	>50	>60	>70	85 - 100	Penetrated only a few inches with 1/2-inch reinforcing rod driven with 5-lb. hammer



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
SOIL DESCRIPTION KEY

SAWMILL BIKE PATH
 EL DORADO COUNTY, CALIFORNIA

Plate

A-2

LOG SYMBOLS

	BULK / BAG SAMPLE	-4	PERCENT FINER THAN THE NO. 4 SIEVE (ASTM Test Method C 136)
	MODIFIED CALIFORNIA SAMPLER (2-1/2 inch outside diameter)	-200	PERCENT FINER THAN THE NO. 200 SIEVE (ASTM Test Method C 117)
	CALIFORNIA SAMPLER (3 inch outside diameter)	LL	LIQUID LIMIT (ASTM Test Method D 4318)
	STANDARD PENETRATION SPLIT SPOON SAMPLER (2 inch outside diameter)	PI	PLASTICITY INDEX (ASTM Test Method D 4318)
	CONTINUOUS CORE	TXUU	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (EM 1110-1-1906)/ASTM TEST METHOD D2850
	SHELBY TUBE	EI	EXPANSION INDEX (UBC STANDARD 18-2)
	ROCK CORE	COL	COLLAPSE POTENTIAL
	GROUNDWATER LEVEL (encountered at time of drilling)	UC	UNCONFINED COMPRESSION (ASTM Test Method D 2166)
	GROUNDWATER LEVEL (measured after drilling)		
	SEEPAGE	MC	MOISTURE CONTENT (ASTM Test Method D 2216)

GENERAL NOTES

Boring log data represents a data snapshot.

This data represents subsurface characteristics only to the extent encountered at the location of the boring.

The data inherently cannot accurately predict the entire subsurface conditions to be encountered at the project site relative to construction or other subsurface activities.

Lines between soil layers and/or rock units are approximate and may be gradual transitions.

The information provided should be used only for the purposes intended as described in the accompanying documents.

In general, Unified Soil Classification System designations presented on the logs were evaluated by visual methods.

Where laboratory tests were performed, the designations reflect the laboratory test results.



Project Number: 122793

Date: 10-28-11

Entry By: D. Ross

Checked By: D. Adams

File Name: 122793

LOG KEY

**SAWMILL BIKE PATH
EL DORADO COUNTY, CALIFORNIA**

Plate

A-3

Boring Number: B-1	Location: Western most, 7' from E.O.P.	Drilling Method: Hollow-stem auger
Boring Total Depth: 20.5 ft	Coordinates (X/Y, Lat/Long): 7129009.764 ft / 2086888.332 ft	Drilling Equipment: Mobile B-57
Depth to Rock: No Rock was Encountered	Datum/Coordinate System: NAD83 Zone 2	Drilling Company: Andresen
Date Begin/End: 10-25-11 / 10-25-11	Top of Boring Elevation: 6271.0 ft	Bit Size/Type: Hollow Stem Auger
Surface Conditions: Asphalt roadway	Coordinate Data Source: Handheld GPS	Hammer Type/Method: Cathead
Groundwater Meas. Pt. Ground Surface	Depth to Groundwater Initial/Time:	Hammer Drop/Weight: 30 in. / 140 lbs.
Logged By: D. Adams	Depth to Groundwater Final/Time: 13.4 ft / 10:16 am	Angle From Horizontal/Bearing: -90°

Depth (ft) Elevation (ft)	Sample Type Symbol	Sample Number	Blows per 6 in.	Pocket Pen. (tsf)	Graphic Log	ASTM Symbol	Field Soil Description & Classification		Laboratory						Other Tests and Field Notes		
							Description	Consistency / Apparent Density	Plasticity	Plasticity Index	Liquid Limit	Water Content (%)	Dry Unit Weight (pcf)	Passing #4 Sieve (%)		Passing #200 Sieve (%)	
							8 inches of ASPHALT CONCRETE										
							5 inches of AGGREGATE BASE										
		Bag	8			SP-SM	Fill: Poorly Graded SAND With Silt And Gravel (SP-SM): 20% gravel, 70% sand, 10% fines, yellowish brown, dry to moist, fine to coarse sand, fine to coarse gravel up to 1-1/2 inches in diameter	Np			5	76	11		Grinding on cobbles or possible boulders at 1 ft.		
56266.0		Bag B Bag A	8			SM	Silty SAND (SM): 80% sand, 20% fines, olive brown, moist, fine to medium sand, trace organics	MD	Np								
		Bag B Bag A	3			SP	Poorly Graded SAND (SP): 5% gravel, 90% sand, 5% fines, brown, dry to moist, fine to coarse sand, fine gravel up to 1/2 inch in diameter, oxidation at 8.5 feet	D	Np								
106261.0		Bag	14			SP	Poorly Graded SAND With Gravel (SP): 30% gravel, 65% sand, 5% fines, brown, dry to moist, fine to coarse sand, fine to coarse gravel up to 1-1/2 inches in diameter	D	Np								
			23			ML	Drill rig cahtter from 11 to 12 feet (possible gravel)	F	Lp-Mp								
			24				SILT (ML): 5% sand, 95% fines, light brownish gray, wet, moderate dilatancy, no dry strength, trace fine sand										
156256.0		Bag	3	0.75		SP-SM	Poorly Graded SAND With Silt (SP-SM): 90% sand, 10% fines, wet, fine sand	MD	Np								
			6			ML	SILT (ML): 5% sand, 95% fines, light brownish gray, wet, moderate dilatancy, no dry strength, trace fine sand	F	Lp-Mp								
206251.0		Bag B Bag A	12	1.75													
			15														
							Boring completed at a depth of 20.5 ft below existing site grade										
							Hole caved to 6'-9" after completion.										
							Approx. 1 ft. of sand heave after drilling to 20 ft. Attempt to redrill prior to sampling but not successful.										

SOIL BORING LOG KA CORPORATE STD.GDT KA CORPORATE STD - 092011.GLB 122793.GPJ 11/28/11



Project Number: 122793
 Date: 10-28-11
 Entry By: D. Ross
 Checked By: D. Adams
 File Name: 122793

BORING LOG B-1

SAWMILL BIKE PATH
 EL DORADO COUNTY, CALIFORNIA

Plate
 1 of 1
A-4

Boring Number: B-2	Location: Middle location, 7' from E.O.P.	Drilling Method: Hollow-stem auger
Boring Total Depth: 20.0 ft	Coordinates (X/Y, Lat/Long): 7129142.57353 ft / 2086934.95834 ft	Drilling Equipment: Mobile B-57
Depth to Rock: No Rock was Encountered	Datum/Coordinate System: NAD83 Zone 2	Drilling Company: Andresen
Date Begin/End: 10-25-11 / 10-25-11	Top of Boring Elevation: 6271.0 ft	Bit Size/Type: Hollow Stem Auger
Surface Conditions: Asphalt roadway	Coordinate Data Source: Handheld GPS	Hammer Type/Method: Cathead
Groundwater Meas. Pt. Ground Surface	Depth to Groundwater Initial/Time: 14.5 ft / 12:00 pm	Hammer Drop/Weight: 30 in. / 140 lbs.
Logged By: D. Adams	Depth to Groundwater Final/Time: 11.1 ft / 12:20 pm	Angle From Horizontal/Bearing: -90°

Depth (ft)	Elevation (ft)	Sample Type Symbol	Sample Number	Blows per 6 in.	Pocket Pen. (tsf)	Graphic Log	ASTM Symbol	Field Soil Description & Classification		Laboratory						Other Tests and Field Notes	
								Description	Consistency / Apparent Density	Plasticity	Plasticity Index	Liquid Limit	Water Content (%)	Dry Unit Weight (pcf)	Passing #4 Sieve (%)		Passing #200 Sieve (%)
								7 inches of ASPHALT CONCRETE									
								5 inches of AGGREGATE BASE									
			Bag	14 25 23			SP-SM	Fill: Poorly Graded SAND With Silt And Gravel (SP-SM): 20% gravel, 70% sand, 10% fines, yellowish brown, dry to moist, fine to coarse sand, fine to coarse gravel up to 1 inch in diameter	Np								
56266.0			Bag	11 22 24			SP	Poorly Graded SAND (SP): 95% sand, 5% fines, olive yellow, dry to moist, fine to coarse sand	MD	Np							
			Bag	7 9 9			SW	Well Graded SAND With Gravel (SW): 40% gravel, 55% sand, 5% fines, reddish brown, dry to moist, fine to coarse sand, fine gravel up to 1 inch in diameter	MD	Np		4	60	3			
106261.0			Bag	6 9 7			SP-SM	Poorly Graded SAND With Silt (SP-SM): 90% sand, 10% fines, gray, wet	D	Np							
156256.0			Tube Tube	6 18 26								24	100				Direct Shear Test; see Appendix C
206251.0				1 8 11													2 feet of sand heave at 20 feet, attempt to redrill before sample, redrill and added water, still 2 feet on heave
								Boring completed at a depth of 20.0 ft below existing site grade									
								Hole caved to 7 ft.-5 in.									

SOIL BORING LOG - KA CORPORATE STD.GDT - 092011.GLB - 122793.GPJ - 11/28/11



Project Number: 122793
 Date: 10-28-11
 Entry By: D. Ross
 Checked By: D. Adams
 File Name: 122793

BORING LOG B-2

SAWMILL BIKE PATH
 EL DORADO COUNTY, CALIFORNIA

Plate
 1 of 1
A-5

Boring Number: B-3	Location: East most, 7' from E.O.P.	Drilling Method: Hollow-stem auger
Boring Total Depth: 21.5 ft	Coordinates (X/Y, Lat/Long): 7129332.38483 ft / 2086979.19381 ft	Drilling Equipment: Mobile B-57
Depth to Rock: No Rock was Encountered	Datum/Coordinate System: NAD83 Zone 2	Drilling Company: Andresen
Date Begin/End: 10-25-11 / 10-25-11	Top of Boring Elevation: 6272.0 ft	Bit Size/Type: Hollow Stem Auger
Surface Conditions: Asphalt roadway	Coordinate Data Source: Handheld GPS	Hammer Type/Method: Cathead
Groundwater Meas. Pt. Ground Surface	Depth to Groundwater Initial/Time: 20.0 ft	Hammer Drop/Weight: 30 in. / 140 lbs.
Logged By: D. Adams	Depth to Groundwater Final/Time: 15.4 ft / 02:17 am	Angle From Horizontal/Bearing: -90°

Depth (ft)	Elevation (ft)	Sample Type Symbol	Sample Number	Blows per 6 in.	Pocket Pen. (tsf)	Graphic Log	ASTM Symbol	Field Soil Description & Classification		Laboratory						Other Tests and Field Notes	
								Description	Consistency / Apparent Density	Plasticity	Plasticity Index	Liquid Limit	Water Content (%)	Dry Unit Weight (pcf)	Passing #4 Sieve (%)		Passing #200 Sieve (%)
								6 inches of ASPHALT CONCRETE									
							SP-SM	4 inches of AGGREGATE BASE									
								Fill: Poorly Graded SAND With Silt (SP-SM): 5% gravel, 85% sand, 10% fines, yellowish brown to reddish brown, dry to moist, trace fine gravel up to 1 inch in diameter		Np							Grinding on cobbles or possible boulders.
			8														
			12														
			16														
56267.0			16					10% gravel up to 1-1/2 inches in diameter									
			21														
			23														
							SP	Poorly Graded SAND (SP): 95% sand, 5% fines, brown, dry, fine sand	L	Np							
			3														
			4														
			5														
106262.0			4				SP	Poorly Graded SAND With Gravel (SP): 20% gravel, 75% sand, 5% fines, olive yellow, dry, fine to coarse sand, fine gravel up to 3/4 inch in diameter	MD	Np							Corrosion Test; see Appendix C
			8														
			16														
							ML	SILT (ML): 5% sand, 95% fines, light brownish gray, moist, fine sand	F	Lp-Mp							
156257.0			2		0.5							6	33	38	100	98	
			4														
			7														
							SP-SM	Poorly Graded SAND With Silt (SP-SM): 90% sand, 10% fines, gray, wet, fine sand	MD	Np							
			6														
			12														
209252.0			15														
								Boring completed at a depth of 21.5 ft below existing site grade									

SOIL BORING LOG KA CORPORATE STD.GDT KA CORPORATE STD - 092011.GLB 122793.GPJ 11/28/11

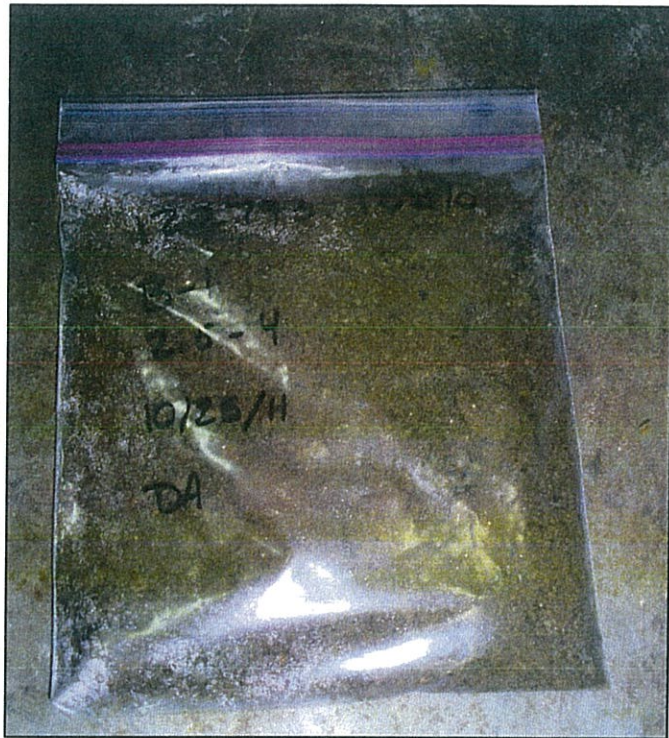


Project Number: 122793
Date: 10-28-11
Entry By: D. Ross
Checked By: D. Adams
File Name: 122793

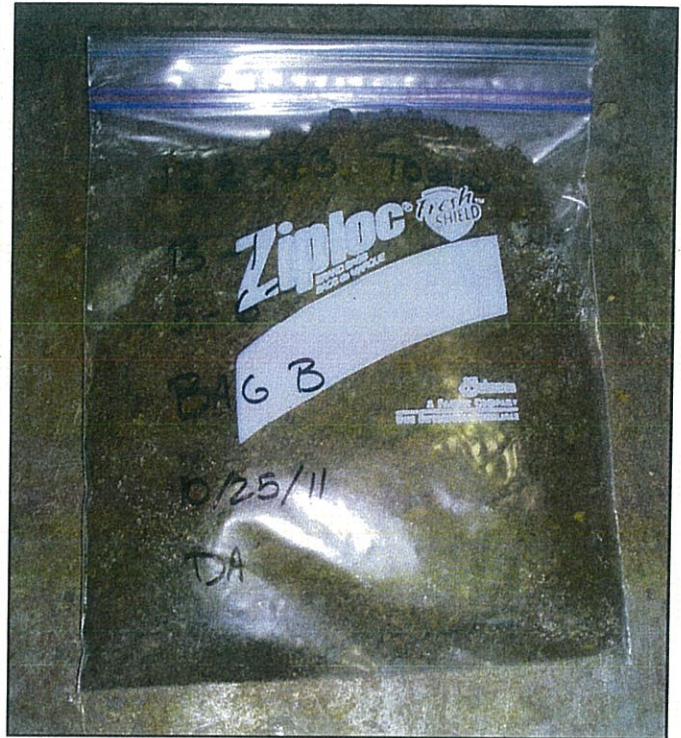
BORING LOG B-3
SAWMILL BIKE PATH EL DORADO COUNTY, CALIFORNIA

Plate 1 of 1 A-6

APPENDIX B



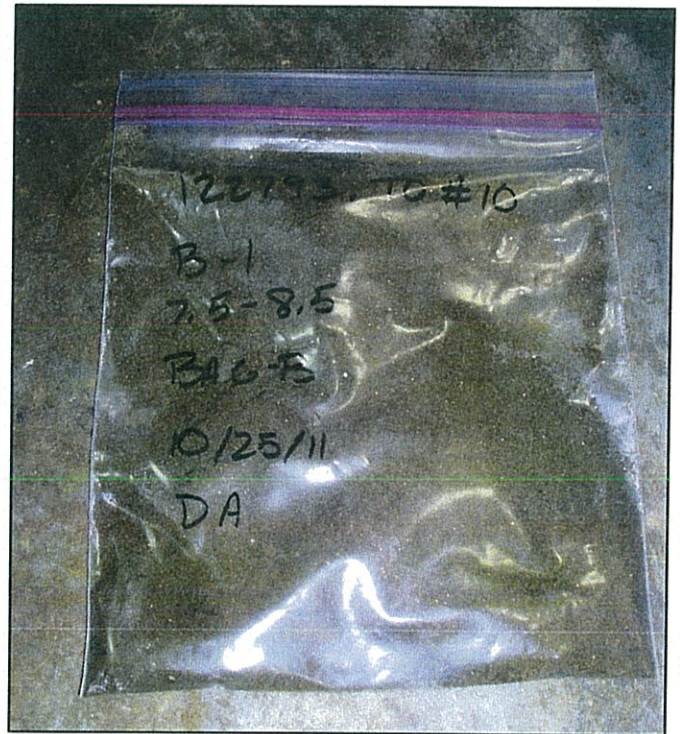
B-1, 2.5-4 ft



B-1, 5-6 ft, Bag B



B-1, 6-6.5 ft, Bag A



B-1, 7.5-8.5 ft, Bag B

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DRAWN BY: D. Adams

CHECKED BY: Z. Islam

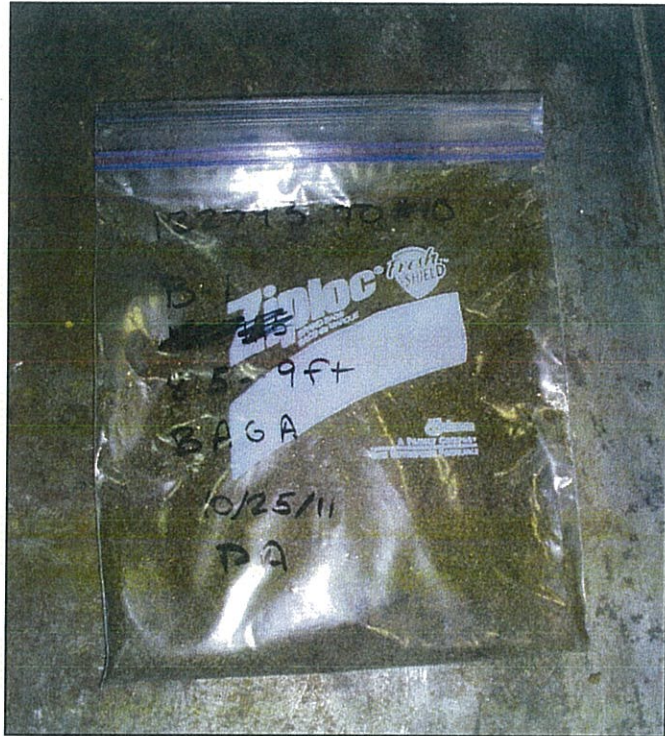
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SAMPLE PHOTOGRAPHS

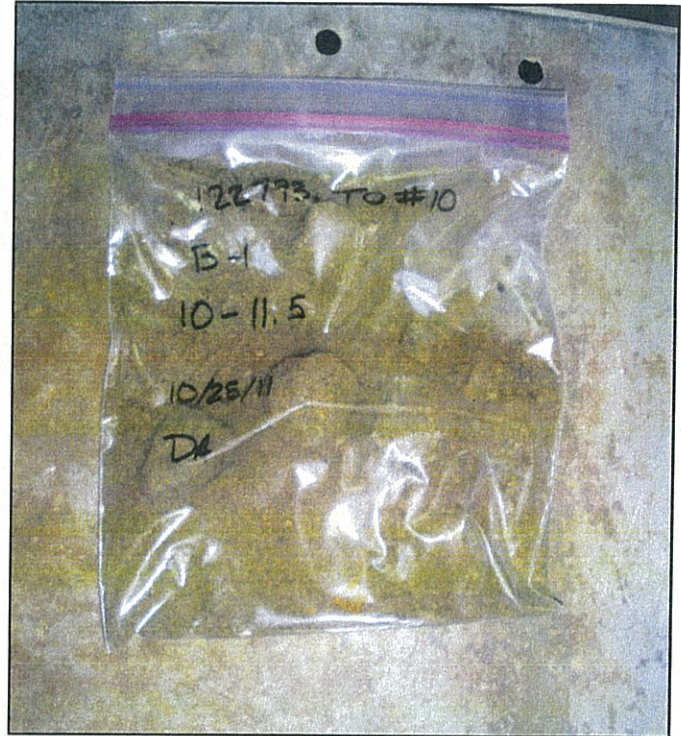
FIGURE

B-1

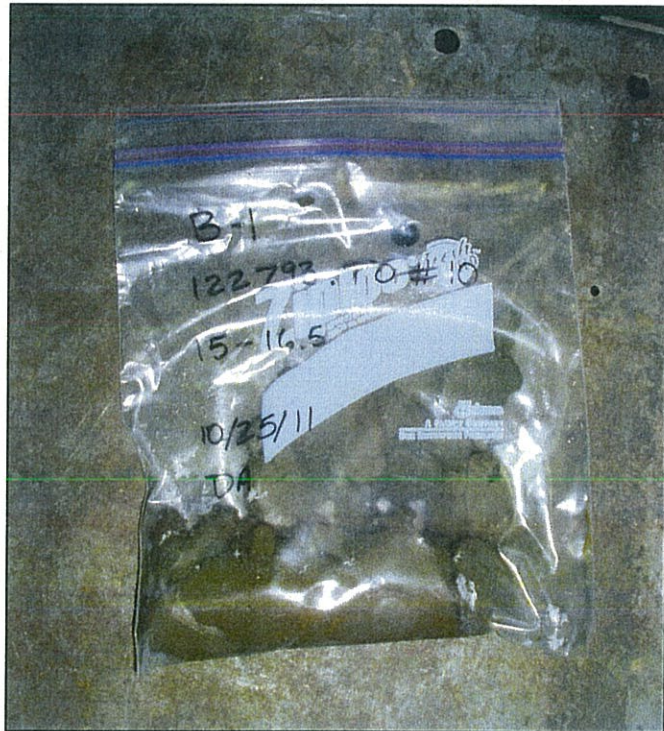
SAWMILL BIKE PATH
EL DORADO COUNTY, CALIFORNIA



B-1, 8.5-9 ft, Bag A



B-1, 10-11.5 ft



B-1, 15-16.5 ft,



B-1, 19-20 ft, Bag B

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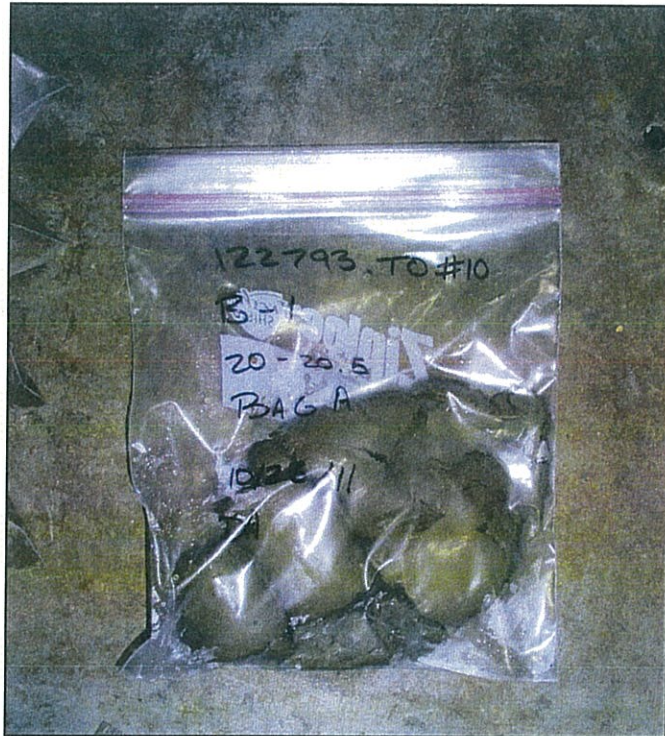
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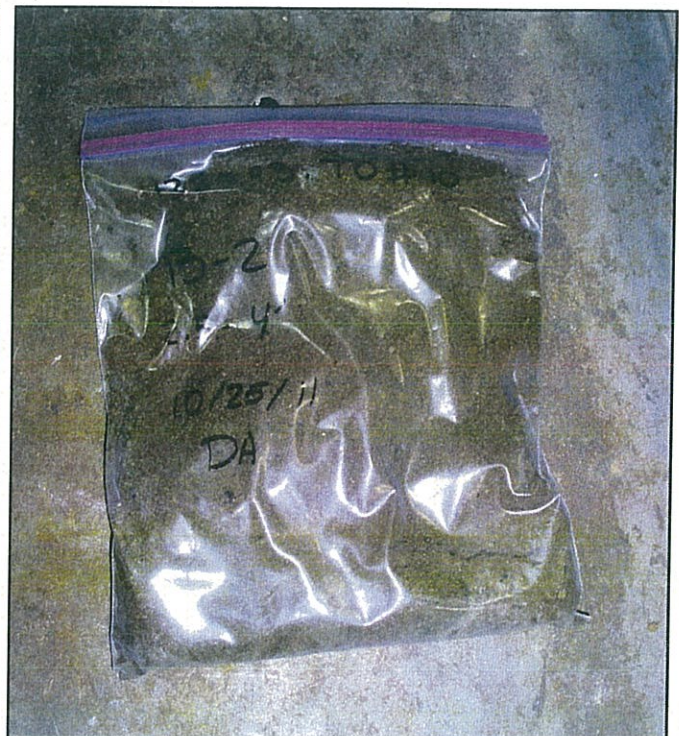
SAWMILL BIKE PATH
EL DORADO COUNTY, CALIFORNIA

FIGURE

B-2



B-1, 20-20.5 ft, Bag A



B-2, 2.5-4 ft



B-2, 5-6.5 ft



B-2, 7.5-9 ft

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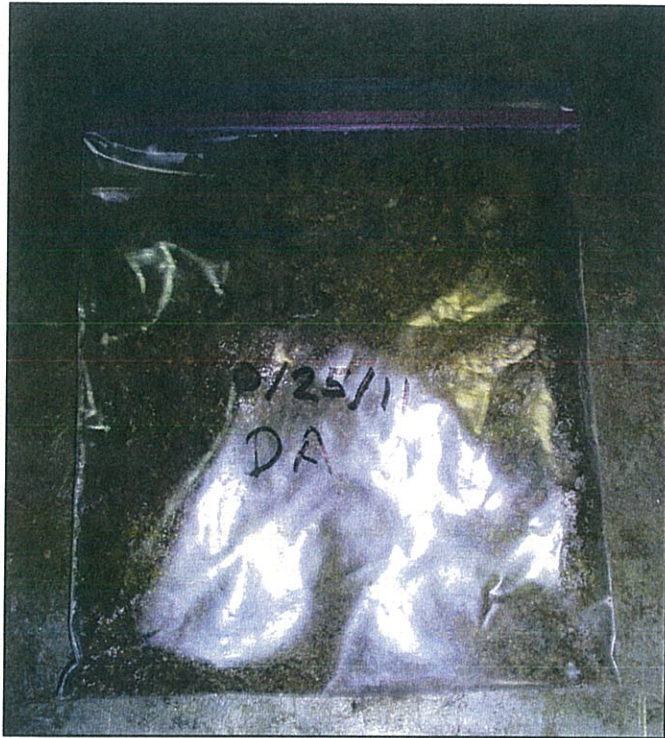
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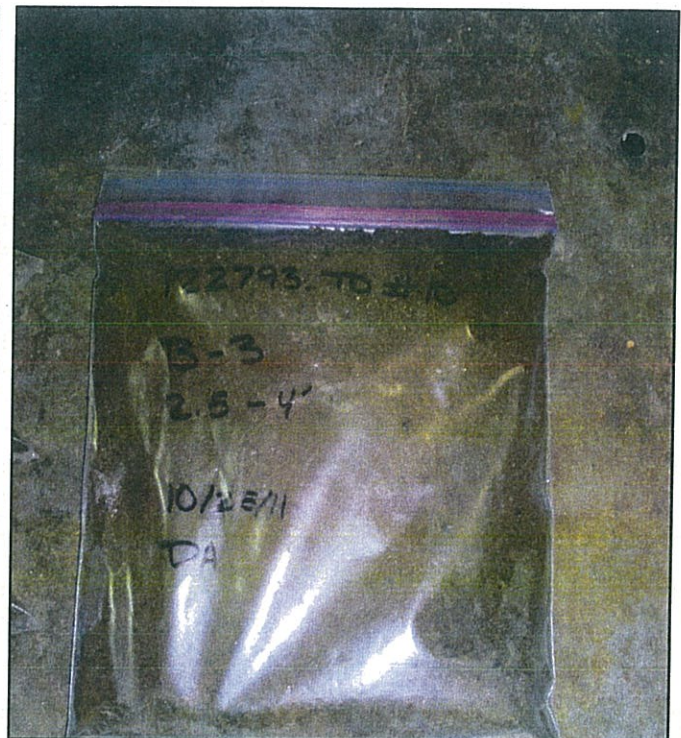
FIGURE

B-3

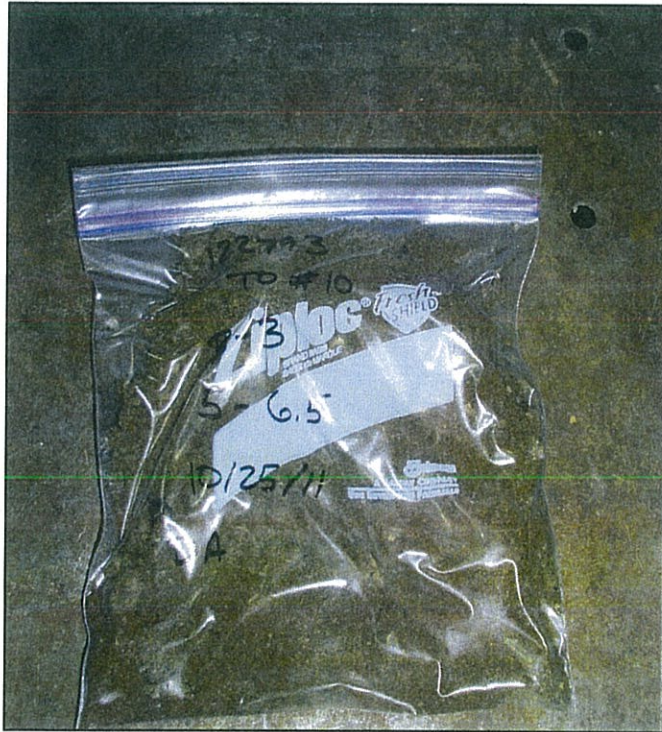
SAWMILL BIKE PATH
EL DORADO COUNTY, CALIFORNIA



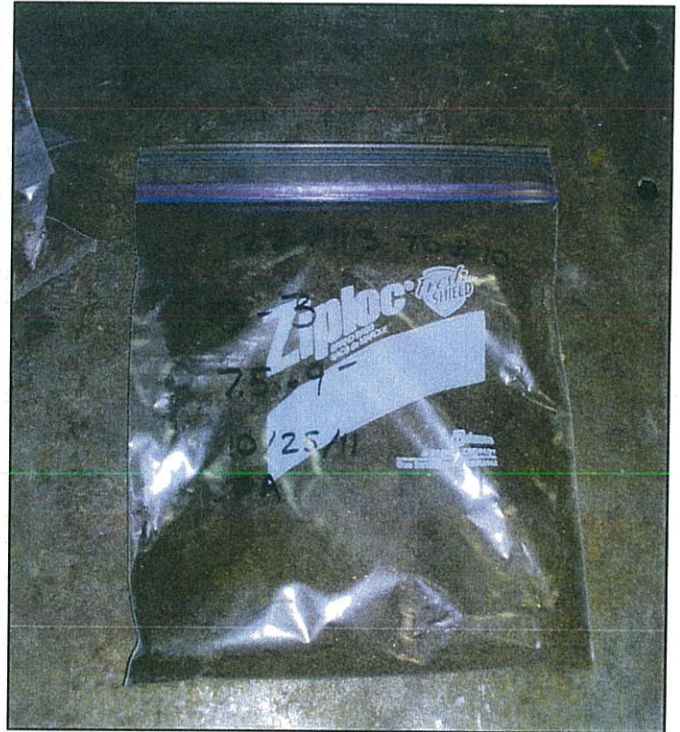
B-2, 10-11.5 ft



B-3, 2.5-4 ft



B-3, 5-6.5 ft



B-3, 7.5-9 ft

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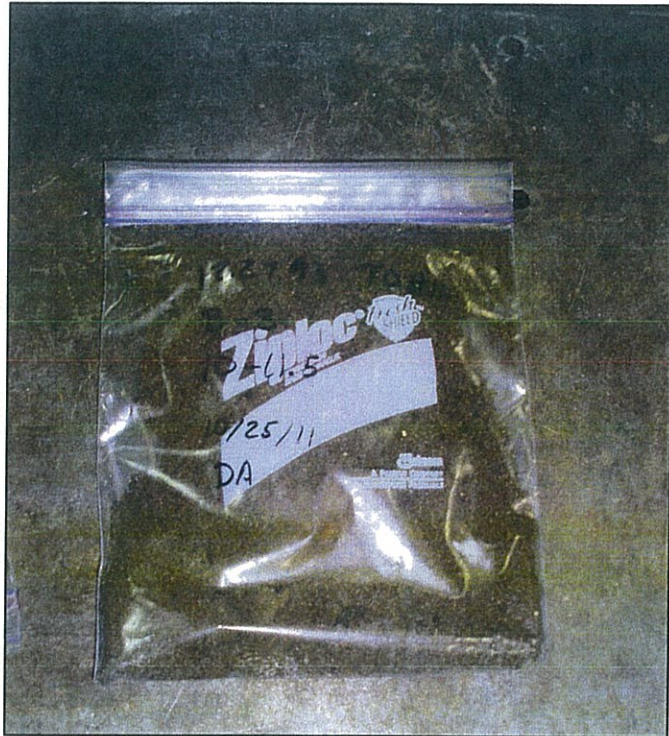
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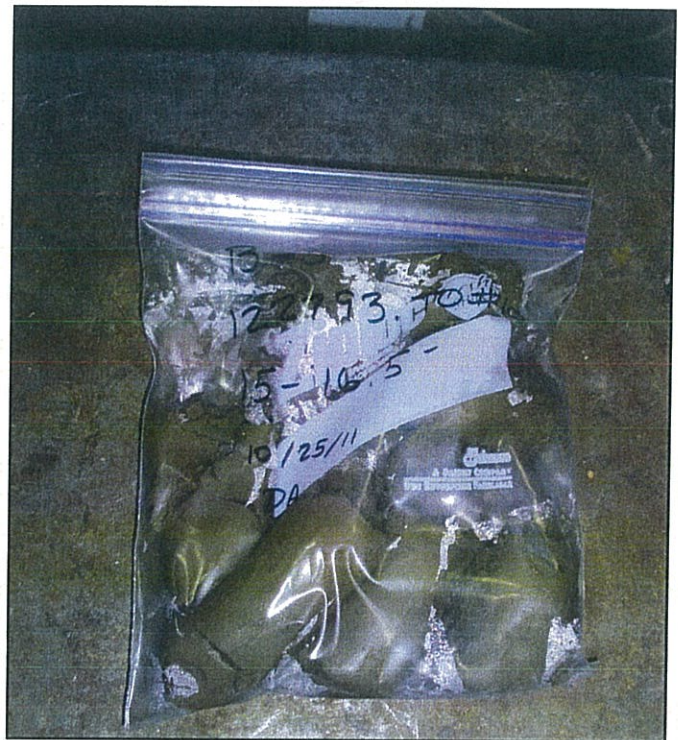
SAWMILL BIKE PATH
 EL DORADO COUNTY, CALIFORNIA

FIGURE

B-4



B-3, 10-11.5 ft



B-3, 15-16.5 ft



B-3, 20-21.5 ft

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SAWMILL BIKE PATH
EL DORADO COUNTY, CALIFORNIA

FIGURE

B-5

APPENDIX C

BORING NO.	SAMPLE DEPTH (ft)	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (% of dry weight)	PARTICLE SIZE SIEVE SIZE (percent passing)						ATTEBERG LIMITS		OTHER TESTS
				6"	3"	3/4"	#4	#10	#200	L.L.	P.I.	
B-1	1.5		5			96	76	62	11			
B-1	2.5											Corrosion Test; see Appendix C
B-2	10.0		4			98	60	42	3			
B-2	16.0											Direct Shear Test; see Appendix C
B-3	10.0											Corrosion Test; see Appendix C
B-3	15.0		38				100	100	98	33	6	

KA LAB SUMMARY KA CORPORATE STD.GDT KA CORPORATE STD.-092011.GLB 122793.GPJ 11/15/11



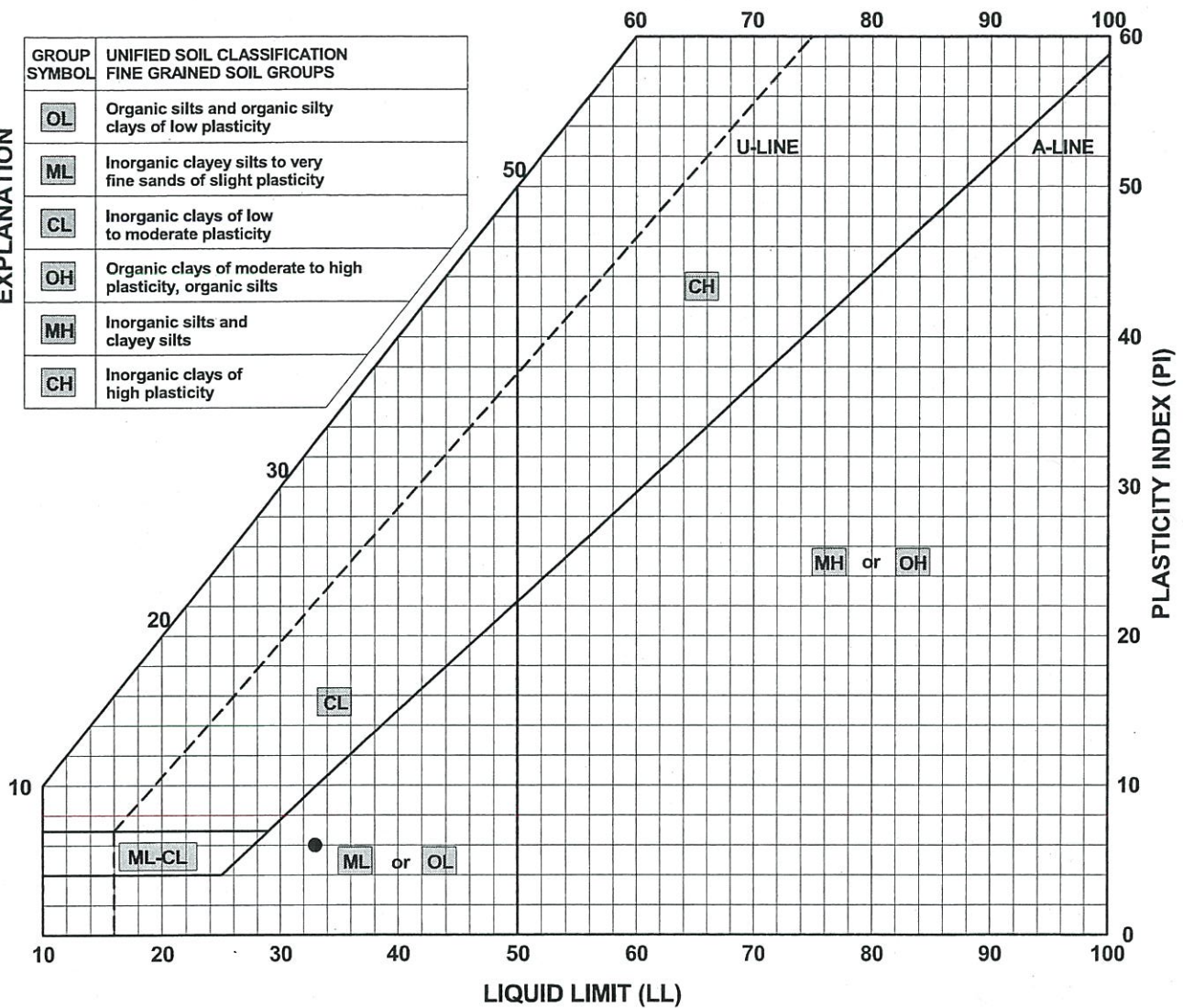
Project Number:	122793
Date:	10-28-11
Entry By:	D. Ross
Checked By:	D. Adams
File Name:	122793

SUMMARY OF LABORATORY TESTS
SAWMILL BIKE PATH EL DORADO COUNTY, CALIFORNIA

Plate
1 of 1
C-1

EXPLANATION

GROUP SYMBOL	UNIFIED SOIL CLASSIFICATION FINE GRAINED SOIL GROUPS
OL	Organic silts and organic silty clays of low plasticity
ML	Inorganic clayey silts to very fine sands of slight plasticity
CL	Inorganic clays of low to moderate plasticity
OH	Organic clays of moderate to high plasticity, organic silts
MH	Inorganic silts and clayey silts
CH	Inorganic clays of high plasticity



LEGEND:	SOURCE	DEPTH (ft)	LL	PL	PI	DESCRIPTION
●	B-3	15.0	33	27	6	SILT (ML)

KA ATTERBERG KA CORPORATE STD.GDT KA CORPORATE STD.-092011.GLB 122793.GPJ 11/15/11



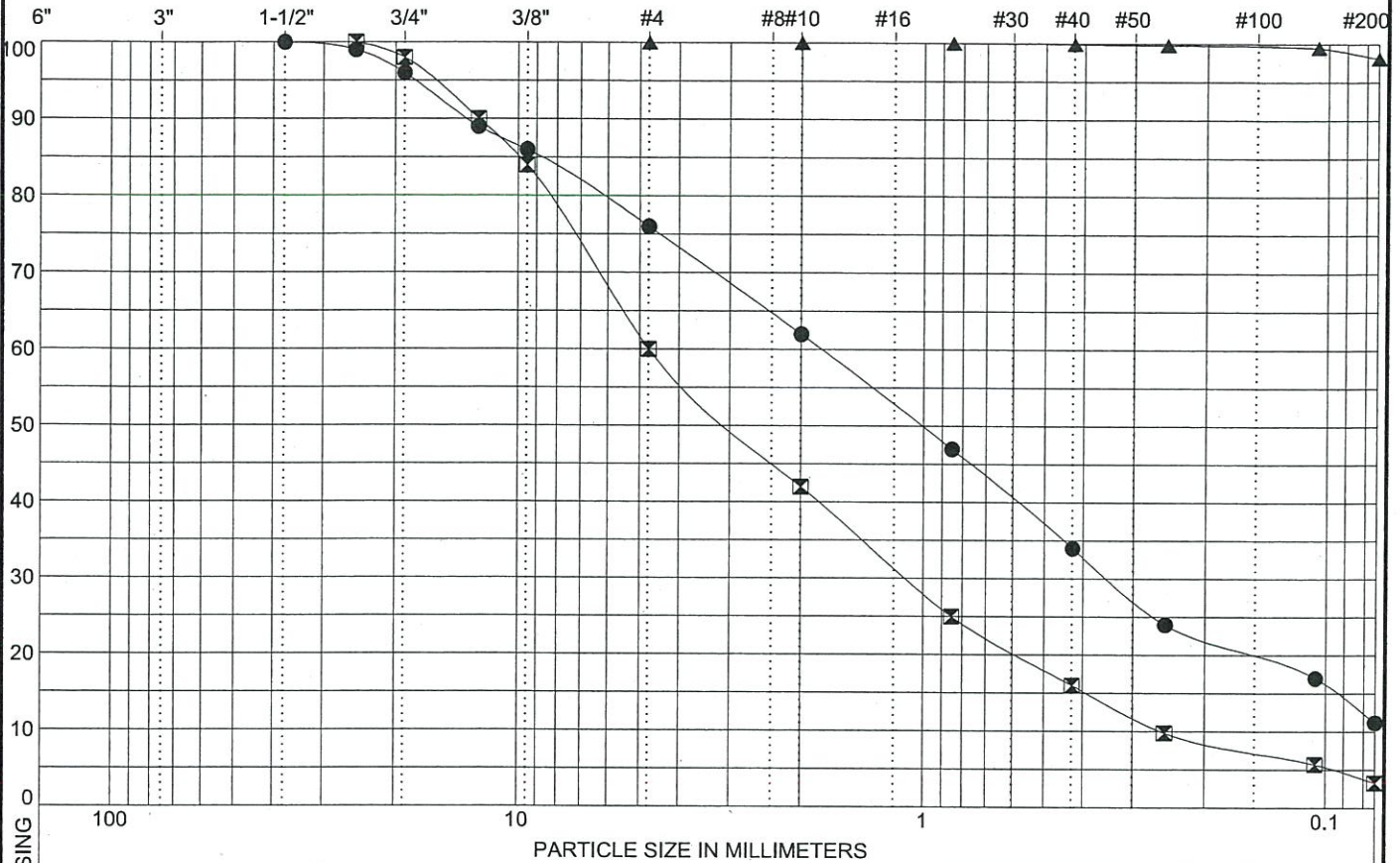
Project Number: 122793
 Date: 10-28-11
 Entry By: D. Ross
 Checked By: D. Adams
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PLASTICITY CHART

 SAWMILL BIKE PATH
 EL DORADO COUNTY, CALIFORNIA

Plate
 1 of 1
C-2

SIEVE SIZE



% PASSING	COBBLE	GRAVEL		SAND		
		coarse	fine	coarse	medium	fine

LEGEND:	SOURCE	DEPTH (ft)	COBBLE (%)	GRAVEL (%)	SAND (%)	FINES (%)	D60 (mm)	D10 (mm)	Cu	Cc	DESCRIPTION
●	B-1	1.5	0	24	65	11	1.78		25.6	0.9	Fill: Poorly Graded SAND With Silt And Gravel (SP-SM)
☒	B-2	10.0	0	40	57	3	4.75	0.25	18.7	1	Well Graded SAND With Gravel (SW)
▲	B-3	15.0	0	0	2	98					SILT (ML)

KA_SIEVE KA CORPORATE STD.GDT_KA CORPORATE STD.-092011.GLB 122793.GPJ 11/15/11



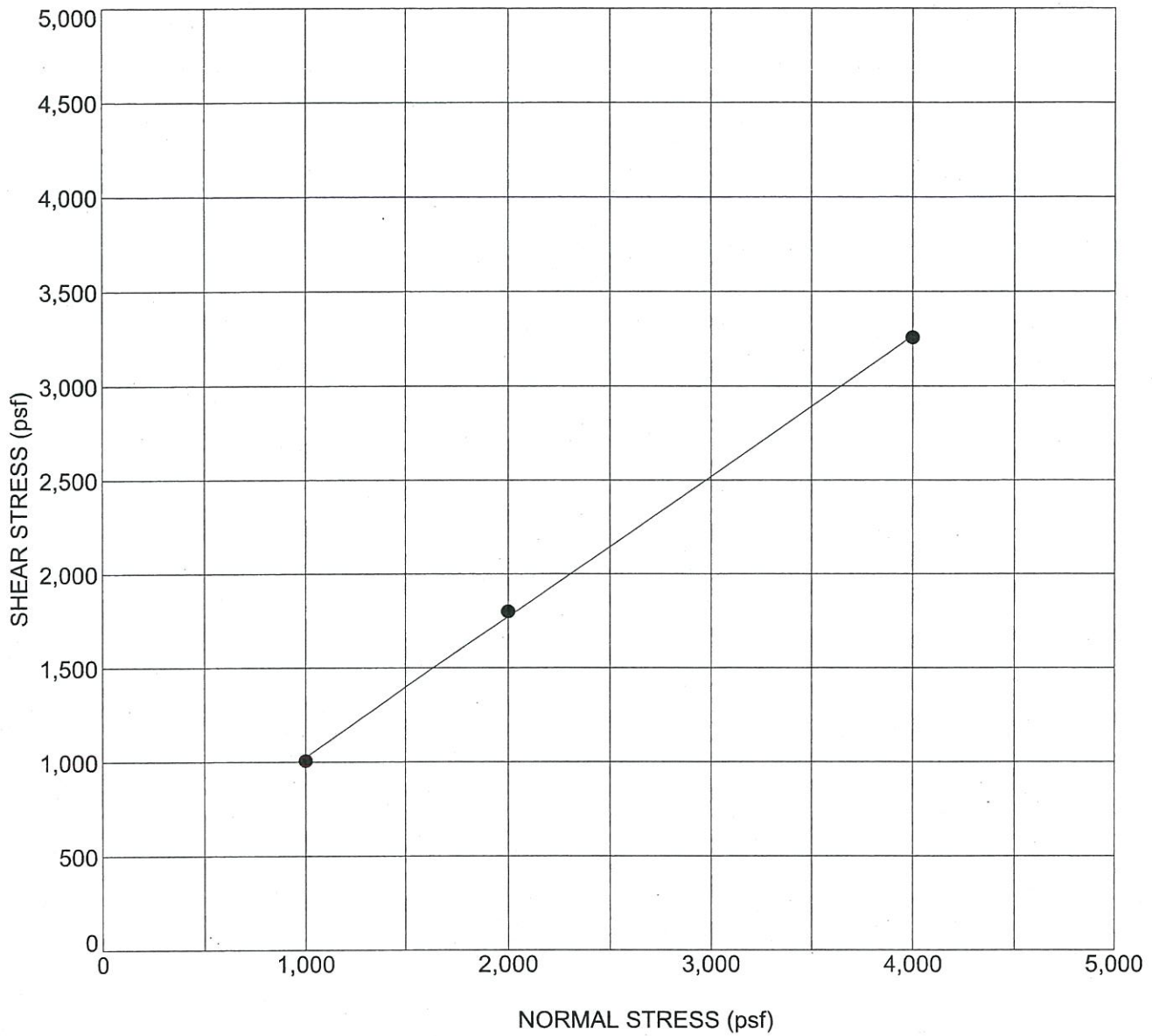
Project Number: 122793
 Date: 10-28-11
 Entry By: D. Ross
 Checked By: D. Adams
 File Name: 122793

GRAIN SIZE ANALYSIS

SAWMILL BIKE PATH
 EL DORADO COUNTY, CALIFORNIA

Plate
 1 of 1
C-3

KA DIRECT SHEAR KA CORPORATE STD.GDT KA CORPORATE STD. - 092011.GLB 122793.GPJ 11/15/11



SOURCE: B-2
 DEPTH: 16 ft
 SOIL DESCRIPTION: Poorly Graded SAND With Silt (SP-SM)

FRICITION ANGLE = 37 deg
 COHESION = 279 psf

FINAL DRY DENSITY (pcf)	99.5	99.6	101.9
INITIAL WATER CONTENT (%)	23.7	23.7	23.7
FINAL WATER CONTENT (%)	24.8	25.4	23.2
NORMAL STRESS (psf)	1000	2000	4000
MAXIMUM SHEAR (psf)	1007	1801	3258



Project Number: 122793
 Date: 10-28-11
 Entry By: D. Ross
 Checked By: D. Adams
 File Name: 122793

DIRECT SHEAR

 SAWMILL BIKE PATH
 EL DORADO COUNTY, CALIFORNIA

Plate

C-4

11/10/2011

Kleinfelder, Inc.
4835 Longley Lane
Reno, NV 89502
Attn: Don Adams

OrderID: 1110462

Dear: Don Adams

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, 18th & 19th editions, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WETLAB-Western Environmental Testing Laboratory in good condition on 10/27/2011. Additional comments are located on page 2 of this report.

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,



Andy Smith
QA Manager

Western Environmental Testing Laboratory

Report Comments

Kleinfelder, Inc. - 1110462

General Comments

The analyses for Paste pH and Resistivity were run off of a saturated paste.

Specific Comments

None

Data Qualifier Legend

- B -- Blank contamination; Analyte detected above the method reporting limit in an associated blank
- HT -- Sample held beyond the accepted holding time
- J -- The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit
- M -- Reported value is estimated; The sample matrix interfered with the analysis
- N -- There was insufficient sample available to perform a spike and/or duplicate on this analytical batch.
- NC -- Not calculated due to matrix interference
- Q -- Reported value is estimated; The value failed to meet QC criteria for either precision or accuracy
- SC -- Spike recovery not calculated. Sample concentration >4X the spike amount; therefore, the spike could not be adequately recovered.

Western Environmental Testing Laboratory Analytical Report

Kleinfelder, Inc.
4835 Longley Lane
Reno, NV 89502

Attn: Don Adams

Phone: (775) 689-7800 Fax: (775) 689-7810

PO\Project: 122793.TO#10

Date Printed: 11/10/2011

OrderID: 1110462

Customer Sample ID: B-1 1-5 Ft.

Collect Date/Time: 10/25/2011

WETLAB Sample ID: 1110462-001

Receive Date: 10/27/2011 17:00

Parameter	Method	Results	Units	Reporting Limit	Date Analyzed
Chloride	EPA 300.0	23	mg/kg	15	11/3/2011
Sulfate	EPA 300.0	<15	mg/kg	15	11/3/2011
Paste pH	SW846 9045B	6.17	pH Units		11/1/2011
Resistivity	SM 2510B	25000	ohms.cm	1.0	11/1/2011

Customer Sample ID: B-3 10-11.5 Ft.

Collect Date/Time: 10/25/2011

WETLAB Sample ID: 1110462-002

Receive Date: 10/27/2011 17:00

Parameter	Method	Results	Units	Reporting Limit	Date Analyzed
Chloride	EPA 300.0	<15	mg/kg	15	11/3/2011
Sulfate	EPA 300.0	<15	mg/kg	15	11/3/2011
Paste pH	SW846 9045B	6.03	pH Units		11/1/2011
Resistivity	SM 2510B	4900	ohms.cm	1.0	11/1/2011

Western Environmental Testing Laboratory QC Report

QCBatchID	QCType	Parameter	Method	Result	Units
C11110048	Blank 1	Resistivity	SM 2510B	<1.0	ohms.cm
C11110143	Blank 1	Chloride	EPA 300.0	<1.0	mg/L
QC11110143	Blank 2	Chloride	EPA 300.0	<1.0	mg/L
C11110143	Blank 3	Chloride	EPA 300.0	<1.0	mg/L
C11110147	Blank 1	Sulfate	EPA 300.0	<1.0	mg/L
QC11110147	Blank 2	Sulfate	EPA 300.0	<1.0	mg/L
QC11110147	Blank 3	Sulfate	EPA 300.0	<1.0	mg/L

CBatchID	QCType	Parameter	Method	Result	Actual	% Recovery	Units
QC11110048	LCS 1	Resistivity	SM 2510B	1420	1412	101	ohms.cm
C11110050	LCS 1	Paste pH	SW846 9045B	7.03	7.00	100	ph Units
C11110143	LCS 1	Chloride	EPA 300.0	10.2	10.0	102	mg/L
QC11110147	LCS 1	Sulfate	EPA 300.0	25.1	25.0	100	mg/L

CBatchID	QCType	Parameter	Method	Duplicate Sample	Sample Result	Duplicate Result	Units	RPD
QC11110048	Duplicate	Resistivity	SM 2510B	1110462-001	25381	24938	ohms.cm	2 %
C11110050	Duplicate	Paste pH	SW846 9045B	1110462-001	6.17	6.16	pH Units	<1%

QCBatchID	QCType	Parameter	Method	Spike Sample	Sample Result	MS Result	MSD Result	Spike Value	Units	MS % Rec.	MSD % Rec.	RPD
C11110143	MS 1	Chloride	EPA 300.0	1111047-002	<1.000	5.11	5.34	5.00	mg/L	101	106	4 %
QC11110143	MS 2	Chloride	EPA 300.0	1111049-001	65.0	69.4	69.5	5.00	mg/L	89	90	<1%
QC11110147	MS 1	Sulfate	EPA 300.0	1111047-002	19.6	29.6	30.0	10.0	mg/L	100	104	1 %
C11110147	MS 2	Sulfate	EPA 300.0	1111049-001	109	118	117	10.0	mg/L	89	77	1 %