FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-22(002)	2019	20	94

GEOLABS, INC.
Geotechnical Engineering

Soil Log Legend

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS	GRAVELS	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	LESS THAN 5% FINES	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
		MORE THAN 12% FINES	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
MORE THAN 50% OF MATERIAL RETAINED ON NO. 200 SIEVE	SANDS	CLEAN SANDS	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	50% OR MORE OF COARSE FRACTION PASSING THROUGH NO. 4 SIEVE	LESS THAN 5% FINES	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
		MORE THAN 12% FINES	SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	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, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
50% OR MORE OF MATERIAL PASSING THROUGH NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT 50 OR MORE	MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND

	(2-INCH) O.D. STANDARD PENETRATION TEST	LL	LIQUID LIMIT (NP=NON-PLASTIC)
	(3-INCH) O.D. MODIFIED CALIFORNIA SAMPLE	PI	PLASTICITY INDEX (NP=NON-PLASTIC)
	SHELBY TUBE SAMPLE	TV	TORVANE SHEAR (tsf)
	GRAB SAMPLE	PEN	POCKET PENETROMETER (tsf)
	CORE SAMPLE	UC	UNCONFINED COMPRESSION (psi)
	WATER LEVEL OBSERVED IN BORING AT TIME OF DRILLING	TXUU	UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (ksf)
	WATER LEVEL OBSERVED IN BORING AFTER DRILLING		
	WATER LEVEL OBSERVED IN BORING OVERNIGHT		

Plate
A-0.1

LOG LEGEND FOR SOIL 7864-10.GPJ GEOLABS.GDT 5/1/19

SURVEY PLOTTED BY: DATE:
DRAWN BY:
TRACED BY:
DESIGNED BY:
QUANTITIES BY:
CHECKED BY:
NOTE BOOK No.
ORIGINAL PLAN

GEOLABS, INC.
Geotechnical Engineering

Soil Classification Log Key
(with deviations from ASTM D2488)

GEOLABS, INC. CLASSIFICATION*

GRANULAR SOIL (- #200 <50%)	COHESIVE SOIL (- #200 ≥ 50%)
• PRIMARY constituents are composed of the largest percent of the soil mass. Primary constituents are capitalized and bold (i.e., GRAVEL, SAND)	• PRIMARY constituents are based on plasticity. Primary constituents are capitalized and bold (i.e., CLAY, SILT)
• SECONDARY constituents are composed of a percentage less than the primary constituent. If the soil mass consists of 12 percent or more fines content, a cohesive constituent is used (SILTY or CLAYEY); otherwise, a granular constituent is used (GRAVELLY or SANDY) provided that the secondary constituent consists of 20 percent or more of the soil mass. Secondary constituents are capitalized and bold (i.e., SANDY GRAVEL, CLAYEY SAND) and precede the primary constituent.	• SECONDARY constituents are composed of a percentage less than the primary constituent, but more than 20 percent of the soil mass. Secondary constituents are capitalized and bold (i.e., SANDY CLAY, SILTY CLAY, CLAYEY SILT) and precede the primary constituent.
• accessory descriptions compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY GRAVEL with a little sand)	• accessory descriptions compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY CLAY with some sand)

EXAMPLE: Soil Containing 60% Gravel, 25% Sand, 15% Fines. Described as: SILTY GRAVEL with some sand

RELATIVE DENSITY / CONSISTENCY

Granular Soils			Cohesive Soils			
N-Value (Blows/Foot)		Relative Density	N-Value (Blows/Foot)		PP Readings (tsf)	Consistency
SPT	MCS		SPT	MCS		
0 - 4	0 - 7	Very Loose	0 - 2	0 - 4		Very Soft
4 - 10	7 - 18	Loose	2 - 4	4 - 7	< 0.5	Soft
10 - 30	18 - 55	Medium Dense	4 - 8	7 - 15	0.5 - 1.0	Medium Stiff
30 - 50	55 - 91	Dense	8 - 15	15 - 27	1.0 - 2.0	Stiff
> 50	> 91	Very Dense	15 - 30	27 - 55	2.0 - 4.0	Very Stiff
			> 30	> 55	> 4.0	Hard

MOISTURE CONTENT DEFINITIONS

Dry: Absence of moisture, dry to the touch

Moist: Damp but no visible water

Wet: Visible free water

ABBREVIATIONS

WOH: Weight of Hammer

WOR: Weight of Drill Rods

SPT: Standard Penetration Test Split-Spoon Sampler

MCS: Modified California Sampler

PP: Pocket Penetrometer

GRAIN SIZE DEFINITION

Description	Sieve Number and / or Size
Boulders	> 12 inches (305-mm)
Cobbles	3 to 12 inches (75-mm to 305-mm)
Gravel	3-inch to #4 (75-mm to 4.75-mm)
Coarse Gravel	3-inch to 3/4-inch (75-mm to 19-mm)
Fine Gravel	3/4-inch to #4 (19-mm to 4.75-mm)
Sand	#4 to #200 (4.75-mm to 0.075-mm)
Coarse Sand	#4 to #10 (4.75-mm to 2-mm)
Medium Sand	#10 to #40 (2-mm to 0.425-mm)
Fine Sand	#40 to #200 (0.425-mm to 0.075-mm)

**Soil descriptions are based on ASTM D2488-09a, Visual-Manual Procedure, with the above modifications by Geolabs, Inc. to the Unified Soil Classification System (USCS).*

Plate
A-0.2

SOIL_CLASS_LOG-KEY 7864-10.GPJ GEOLABS.GDT 5/1/19

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THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

GEOLABS, INC.
LICENSE EXPIRES 4-30-20

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BORING LOG LEGENDS

PALI HIGHWAY
LANDSLIDE MITIGATION PROJECT
FAP No. ER-22(002)

Scale: None Date: May 6, 2019

SHEET No. B-1 OF 4 SHEETS

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-22(002)	2019	21	94

GEOLABS, INC.

Geotechnical Engineering

Rock Log Legend

ROCK DESCRIPTIONS

	BASALT		FINGER CORAL
	BOULDERS		LIMESTONE
	BRECCIA		SANDSTONE
	CLINKER		SILTSTONE
	COBBLES		TUFF
	CORAL		VOID/CAVITY

ROCK DESCRIPTION SYSTEM

ROCK FRACTURE CHARACTERISTICS

The following terms describe general fracture spacing of a rock:

Massive:	Greater than 24 inches apart
Slightly Fractured:	12 to 24 inches apart
Moderately Fractured:	6 to 12 inches apart
Closely Fractured:	3 to 6 inches apart
Severely Fractured:	Less than 3 inches apart

DEGREE OF WEATHERING

The following terms describe the chemical weathering of a rock:

Unweathered:	Rock shows no sign of discoloration or loss of strength.
Slightly Weathered:	Slight discoloration inwards from open fractures.
Moderately Weathered:	Discoloration throughout and noticeably weakened though not able to break by hand.
Highly Weathered:	Most minerals decomposed with some corestones present in residual soil mass. Can be broken by hand.
Extremely Weathered:	Saprolite. Mineral residue completely decomposed to soil but fabric and structure preserved.

HARDNESS

The following terms describe the resistance of a rock to indentation or scratching:

Very Hard:	Specimen breaks with difficulty after several "pinging" hammer blows. Example: Dense, fine grain volcanic rock
Hard:	Specimen breaks with some difficulty after several hammer blows. Example: Vesicular, vugular, coarse-grained rock
Medium Hard:	Specimen can be broked by one hammer blow. Cannot be scraped by knife. SPT may penetrate by ~25 blows per inch with bounce. Example: Porous rock such as clinker, cinder, and coral reef
Soft:	Can be indented by one hammer blow. Can be scraped or peeled by knife. SPT can penetrate by ~100 blows per foot. Example: Weathered rock, chalk-like coral reef
Very Soft:	Crumbles under hammer blow. Can be peeled and carved by knife. Can be indented by finger pressure. Example: Saprolite

Plate

A-0.3

LOG LEGEND FOR ROCK 7864-10.GPJ GEOLABS.GDT 5/1/19

ORIGINAL PLAN
SURVEY PLOTTED BY ____ DATE
DRAWN BY ____ . . . .
TRACED BY ____
DESIGNED BY ____
QUANTITIES BY ____
CHECKED BY ____
NOTE BOOK ____
No. ____

GEOTECHNICAL NOTES:

1. *For boring locations, see Sheet R-1.*
2. *The information presented in the logs of borings depict the subsurface conditions encountered at that specified location and at the time of the field exploration only. Variations of subsoil conditions from those depicted in the logs of borings may occur between and beyond the borings.*
2. *The penetration resistance shown on the logs of borings indicate the number of blows required for the specific sampler type used. The blow counts may need to be factored to obtain the Standard Penetration Test (SPT) blow counts.*
4. *The data given is for general information only. Bidders shall examine the site and the boring data and draw their own conclusions therefrom as to the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or conditions other than at the boring locations shown and at the time the borings were taken.*

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROCK LOG LEGEND AND NOTES

PALI HIGHWAY
LANDSLIDE MITIGATION PROJECT
FAP No. ER-22(002)

Scale: None Date: May 6, 2019

SHEET No. B-2 OF 4 SHEETS

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-22(002)	2019	22	94

GEOLABS, INC.
Geotechnical Engineering

PALI HIGHWAY EMERGENCY REPAIRS
ROCK SHED STRUCTURE
HONOLULU, OAHU, HAWAII

Log of Boring 101

Approximate Ground Surface Elevation (feet): 987 *

Other Tests	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Depth (feet)	USCS	Description
	77		6	0	GW	7-inch ASPHALTIC CONCRETE
						Gray SANDY GRAVEL (BASALTIC), dense, moist (fill)
				5	SM	24-inch CONCRETE
						Brown with some gray SILTY SAND with a little gravel (basaltic), loose to medium dense, moist (fill)
UC= 1090 psi	92	50		10		Gray with some multi-color mottling vesicular BASALT, moderately fractured, slightly weathered, hard (basalt formation)
UC= 1770 psi	95	55				
UC= 6280 psi	100	73		15		grades to moderately weathered, medium hard locally
UC= 590 psi	90	33		20		
	97	33		25		6-inch VOID
						grades to vugular locally
UC= 1900 psi	100	68		30		
	100	77		35		
UC= 1750 psi	100	70		40		
	100	60		45		
				50		Boring terminated at 50 feet
						* Elevations estimated from Topographic Survey Map transmitted by Controlpoint Surveying, Inc. on April 3, 2019.
				55		
				60		
				65		
				70		
				75		

Date Started:	March 23, 2019	Water Level: ▼	Not Encountered
Date Completed:	March 23, 2019		
Logged By:	S. Latronic	Drill Rig:	CME-75DG2
Total Depth:	50 feet	Drilling Method:	4" Solid Stem Auger & PQ Coring
Work Order:	7864-10	Driving Energy:	140 lb. wt., 30 in. drop

BORING_LOG_DOT.DWF 7864-10.GPJ GEOLABS.GDT 5/1/19

GEOLABS, INC.
Geotechnical Engineering

PALI HIGHWAY EMERGENCY REPAIRS
ROCK SHED STRUCTURE
HONOLULU, OAHU, HAWAII

Log of Boring 102

Approximate Ground Surface Elevation (feet): 987.5 *

Other Tests	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Depth (feet)	Sample	Graphic	USCS	Description
			65	0			SM	8-inch ASPHALTIC CONCRETE
			11				SP-SM	Tan SILTY SAND (CORALLINE) with some gravel (coralline), dense, moist (fill)
			25/1"	5			CH	Gray SILTY SAND (BASALTIC) with some gravel (basaltic), dense, moist (fill)
								Brown SANDY CLAY with some gravel, stiff, moist (fill)
UC= 2780 psi	92	82	50/4"	10				Gray vesicular BASALT, moderately to slightly fractured, highly weathered, medium hard (basalt formation)
UC= 2480 psi	100	100		15				grades to very hard
								grades to slightly weathered
UC= 1270 psi	100	40		20				
UC= 1090 psi	100	37		25				
	100	77		30				
UC= 4280 psi	100	100		35				
	100	90		40				grades to slightly vugular
UC= 3760 psi	100	83		45				
				50				Boring terminated at 50 feet
				55				
				60				
				65				
				70				
				75				

Date Started:	March 22, 2019	Water Level: ▼	Not Encountered
Date Completed:			
Logged By:	B. Aiu	Drill Rig:	CME-75DR
Total Depth:	50 feet	Drilling Method:	4" Solid Stem Auger & PQ Coring
Work Order:	7864-10	Driving Energy:	140 lb. wt., 30 in. drop

BORING_LOG_DOT.DWF 7864-10.GPJ GEOLABS.GDT 5/1/19

ORIGINAL PLAT
SURVEY PLOTTED BY ____ DATE
DRAWN BY " "
TRACED BY " "
DESIGNED BY " "
NOTE BOOK QUANTITIES BY " "
CHECKED BY " "
No. ____

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BORING LOGS - 1

PALI HIGHWAY
LANDSLIDE MITIGATION PROJECT
FAP No. ER-22(002)

Scale: None Date: May 6, 2019

SHEET No. B-3 OF 4 SHEETS

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-22(002)	2019	23	94

GEOLABS, INC.
Geotechnical Engineering

PALI HIGHWAY EMERGENCY REPAIRS
ROCK SHED STRUCTURE
HONOLULU, OAHU, HAWAII

Log of Boring 103

Approximate Ground Surface Elevation (feet): 983.5 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
							0				7-inch ASPHALTIC CONCRETE
											7-inch CONCRETE
				67	8		5	X		GP-GM	VOID (Gap between bottom of bridge and top of ground surface)
			100	0							Brown GRAVEL (BASALTIC) with some silt and clay, loose, damp (weathered basalt formation)
UC= 13680 psi			88	57			10				Gray BASALT, severely fractured, highly to moderately weathered, medium hard (basalt formation)
UC= 78230 psi			100	57			15				grades to severely to moderately fractured, moderately weathered, hard
UC= 12650 psi			100	48			20				
UC= 2860 psi			100	63			25				
UC= 990 psi			100	100			30				grades with some vesicles, moderately to slightly fractured
			100	100			35				grades with traces of vugs
UC= 5400 psi			100	100			40				grades to highly to moderately weathered, medium hard
			100	100			45				
							50				Boring terminated at 50 feet
							55				
							60				
							65				
							70				
							75				

Date Started:	March 23, 2019	Water Level: ▼	N/A
Date Completed:	March 23, 2019		
Logged By:	D. Gremminger	Drill Rig:	CME-45C TRUCK
Total Depth:	50 feet	Drilling Method:	4" Solid Stem Auger & PQ Coring
Work Order:	7864-10	Driving Energy:	140 lb. wt., 30 in. drop

BORING_LOG_DOT.DGF 7864-10.GPJ GEOLABS.GDT 5/1/19

GEOLABS, INC.
Geotechnical Engineering

PALI HIGHWAY EMERGENCY REPAIRS
ROCK SHED STRUCTURE
HONOLULU, OAHU, HAWAII

Log of Boring 104

Approximate Ground Surface Elevation (feet): 983 *

Other Tests	Moisture Content (%)	Dry Unit Weight (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
							0			SM	6-inch ASPHALTIC CONCRETE
										ML	Tan SILTY SAND (CORALLINE) with a little gravel, dense, moist (fill)
UC= 2240 psi			100	19	50/5"						Brown SANDY SILT with a little gravel (basaltic), very stiff, moist (fill)
UC= 2320 psi			100	92			5				Gray with traces of multi-color mottling vesicular BASALT, slightly to moderately fractured, slightly weathered, hard to very hard (basalt formation)
UC= 2440 psi			100	83			10				
UC= 1950 psi			100	73			15				grades to vugular locally
UC= 1790 psi			100	65			20				
			100	60			25				
UC= 1370 psi			100	73			30				
			98	77			35				
UC= 1090 psi			100	68			40				
			98	89			45				
							50				Brownish gray cemented BASALT, slightly fractured, moderately weathered, medium hard to hard (welded clinker)
											Boring terminated at 50 feet
							55				
							60				
							65				
							70				
							75				

Date Started:	March 22, 2019	Water Level: ▼	Not Encountered
Date Completed:	March 23, 2019		
Logged By:	S. Latronic	Drill Rig:	CME-75DG2
Total Depth:	50 feet	Drilling Method:	4" Solid Stem Auger & PQ Coring
Work Order:	7864-10	Driving Energy:	140 lb. wt., 30 in. drop

BORING_LOG_DOT.DGF 7864-10.GPJ GEOLABS.GDT 5/1/19

ORIGINAL PLAN
SURVEY PLOTTED BY ..... DATE
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
NOTE BOOK
No.

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BORING LOGS - 2

PALI HIGHWAY
LANDSLIDE MITIGATION PROJECT
FAP No. ER-22(002)

Scale: None Date: May 6, 2019

SHEET No. B-4 OF 4 SHEETS