GEOTECHNICAL INVESTIGATION
DEPARTMENT OF LAND AND NATURAL RESOURCES
STREAM CROSSINGS AT NA PALI KONA FOREST RESERVE
KOKEE, KAUAI, HAWAII
TMK: (4) 1-4-01: 013
(DRAFT)

for

SSFM INTERNATIONAL

HIRATA & ASSOCIATES, INC.
W.O. 25-7132
January 5, 2026

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January 5, 2026
W.O. 25-7132

Mr. Corey Matsuoka
SSFM International
501 Sumner Street, Suite 620
Honolulu, Hawaii 96817

Dear Mr. Matsuoka:

Our report, "Geotechnical Investigation, Department of Land and Natural Resources, Stream Crossings at Na Pali Kona Forest Reserve, Kokee, Kauai, Hawaii, TMK: (4) 1-4-01: 013," dated January 5, 2026, our Work Order 25-7132 is enclosed. This investigation was conducted in general conformance with the scope of services presented in our revised proposal dated July 22, 2025.

The predominant surface soil encountered in the borings drilled at the Waiakoalii Stream crossing consisted of brown weathered gravel with silt, sand, and cobbles. The gravel was in a medium dense condition and extended to depths ranging from about 1 to 9 feet. Underlying the gravel was basalt, extending down to the maximum depths drilled. The basalt varied from medium dense to hard and slightly to completely weathered. Water was encountered in the borings at depths ranging from about 1.9 to 3.3 feet. The depths to groundwater can be expected to fluctuate with the water level in the adjacent stream, as well as with heavy rainfall.

The predominant surface soil encountered in the borings drilled at the Kawaikoi Stream crossing consisted of weathered gravel with silt, sand, and cobbles, as well as cobbles and boulders in a matrix of silt, sand, and weathered gravel. The gravel layer was generally in a loose to medium dense condition while the cobbles and boulders layer was in a dense to very dense condition. Underlying the surface soils at depths ranging from about 1.5 to 5 feet was basalt, extending down to the maximum depths drilled. The basalt varied from medium dense to hard and slightly to completely weathered. Water was encountered in the borings at depths ranging from about 1.8 to 5.3 feet. The depths to groundwater can be expected to fluctuate with the water level in the adjacent stream, as well as with heavy rainfall.

Recommendations for the design of concrete slab fords are presented in the report. We appreciate this opportunity to be of service. Should you have any questions concerning this report, please feel free to call on us.

Very truly yours,

HIRATA & ASSOCIATES, INC.

Rick I.K. Yoshida, P.E. Vice President

RIKY:CCT

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GEOTECHNICAL INVESTIGATION
DEPARTMENT OF LAND AND NATURAL RESOURCES
STREAM CROSSINGS AT NA PALI KONA FOREST RESERVE
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INTRODUCTION

This report presents the results of our geotechnical investigation performed for the proposed two stream crossings at Na Pali Kona Forest Reserve in Kokee, Kauai, Hawaii. Our scope of services for this study included the following:

- A visual reconnaissance of the site and its vicinity to observe existing conditions which may affect the project. The general location of the project site is shown on the enclosed Location Map, Plate A2.1.

- A review of available in-house soils information pertinent to the site and the proposed project.

- Drilling and sampling 8 exploratory borings to depths ranging from about 8 to 20.5 feet. A description of our field investigation is summarized on Plates A1.1 and A1.2. The approximate exploratory boring locations are shown on Plates A2.2 and A2.3, and the soils encountered in the borings are described on the Boring Logs, Plates A4.1 through A4.8.

- Laboratory testing of selected soil samples. Testing procedures are presented in the Description of Laboratory Testing, Plate B1.1. Test results are presented on the Boring Logs (Plates A4.1 through A4.8), Direct Shear Test reports (Plates B2.1 through B2.3), and CBR Test reports (Plates B3.1 and B3.2).

- Engineering analyses of the field and laboratory data.

- Preparation of this report presenting geotechnical recommendations for the design of concrete pavement for the stream crossings and site grading.

PROJECT CONSIDERATIONS

Information regarding the proposed project was provided by your office, and KAI Hawaii, project Structural Engineer.

The project will consist of stream crossings along an existing dirt road at Kawaikoi Stream, located approximately 3.5 miles from Kokee Road, and at Waiakoalii Stream, located about 4 miles from Kokee Road. We understand that concrete slab fords will be used for the proposed stream crossings.

SITE CONDITIONS

The project sites are located along Mohihi-Camp 10 Road within the Na Pali Kona Forest Reserve, in the Kokee area of Kauai. Mohihi–Camp 10 Road is an unpaved road which extends to the east from its junction with State Highway 550 (Kokee Road), approximately 100 yards northeast of Kokee State Park headquarters along the highway. Kawaikoi Stream crosses Mohihi–Camp 10 Road approximately 3.5 miles east of the junction while Waiakoalii Stream crosses the road at approximately 4.4 miles from the junction.

Outcrops of spheroidal weathered basalt and boulders were observed at the ground surface and on the slopes adjacent the dirt road in the vicinity of the stream crossings. Slope gradients in these areas are relatively steep, ranging from approximately 1V:1H to near vertical.

At the time of our fieldwork, water was observed flowing at the Kawaikoi Stream crossing. However, water appeared stagnant at the Waiakoalii Stream crossing. Based on visual observation, the streambeds generally consisted of exposed sand, gravel, cobbles, and boulders. Remnants of concrete slabs were also observed within the stream crossing areas.

SOIL CONDITIONS

Waiakoalii Stream Crossing

The predominant surface soil encountered in the borings consisted of brown weathered gravel with silt, sand, and cobbles. The gravel was in a medium dense condition and extended to depths ranging from about 1 to 9 feet. Underlying the gravel was basalt, extending down to the maximum depths drilled. The basalt varied from medium dense to hard and slightly to completely weathered.

Water was encountered in the borings at depths ranging from about 1.9 to 3.3 feet. The depths to groundwater can be expected to fluctuate with the water level in the adjacent stream, as well as with heavy rainfall.

Kawaikoi Stream Crossing

The predominant surface soil encountered in the borings consisted of weathered gravel with silt, sand, and cobbles, as well as cobbles and boulders in a matrix of silt, sand, and weathered gravel. The gravel layer was generally in a loose to medium dense condition while the cobbles and boulders layer was in a dense to very dense condition.

Underlying the surface soils at depths ranging from about 1.5 to 5 feet was basalt, extending down to the maximum depths drilled. The basalt varied from medium dense to hard and slightly to completely weathered.

Water was encountered in the borings at depths ranging from about 1.8 to 5.3 feet. The depths to groundwater can be expected to fluctuate with the water level in the adjacent stream, as well as with heavy rainfall.

CONCLUSIONS AND RECOMMENDATIONS

Concrete Slab Ford Crossings

Recommendations for the concrete slab fords assume that vehicular traffic will consist primarily of passenger vehicles, light pickup trucks, and only occasional heavy trucks. Based on our test borings and laboratory test results, the following is recommended.

7.0"	Portland Cement Concrete
8.0"	Aggregate Base Course (CBR = 85 minimum)
	Mirafi FW700 geotextile filter fabric (or approved equivalent)
15.0"	Total Thickness

The installation of the geotextile filter fabric should follow the manufacturer's guidelines. The aggregate base course should be compacted to a minimum 95 percent compaction as determined by ASTM D 1557. The subgrade, where practical, should be compacted to a minimum 95 percent compaction prior to placement of the geotextile filter fabric.

Cutoff walls at the upstream and downstream edges of the concrete slab should be provided to protect against undercutting by scour.

Dewatering and temporary diversion of the stream flow using methods such as a cofferdam will be required for construction of concrete fords in a dry environment. It is our opinion that a sheet pile cofferdam is not feasible due to the presence of the cobbles and boulders. Alternatives such as portable cofferdam or sandbags should be considered. The contractor should be responsible for the design, implementation, monitoring, and removal of the construction dewatering.

Site Grading

Site Preparation - The project site should be cleared of all vegetation, concrete slabs, boulders, and other deleterious material. In areas requiring fill placement, the existing ground should first be scarified to a minimum depth of 6 inches and

compacted to a minimum 90 percent compaction as determined by ASTM D 1557. Soft or loose soils indicated by pumping conditions should be removed and replaced with either approved onsite material or imported granular structural fill. The use of woven geotextile filter fabrics and/or geogrids may be needed to help stabilize the subgrade.

Structural Excavations - Based on our exploratory borings, we believe that excavations into the gravel, cobbles, and highly to completely weathered basalt can generally be accomplished using conventional excavating equipment. Difficulty can be expected if boulders are encountered. Hydraulic hoe-ramming type equipment may be required for excavation into hard basalt or to break up large boulders. Considerable sloughing may occur due to the presence of cobbles and boulders in the steam beds. Temporary cuts into the surface soils should be stable at slope gradients of 1.5H:1V or flatter. However, the contractor should be responsible for conforming to OSHA safety standards for all excavations.

Slope Gradients – All fill slopes should be stable at slope gradients of 2H:1V or flatter. If possible, new cut slopes should be constructed at slope gradients of 2H:1V or flatter to reduce the potential for excessive sloughing and erosion. However, due to the relatively steep gradients of existing slopes, new cut with 2H:1V slope gradient may not be feasible. As a result, new cut slopes may be cut to a steeper slope gradient of 1H:1V or match the existing slopes. The steeper cut slope gradients may increase the potential for sloughing and localized shallow slope failures that will require more frequent maintenance.

Fill slopes should be constructed from the bottom up. Filling the slope with sliver fills should be avoided. The fill should be continually benched into existing slopes as the fill is brought up in lifts. The benches should extend into competent material and be wide enough for compaction equipment to work effectively. Fill slopes

should be constructed by overfilling and cutting back to the design slope gradient to obtain a well-compacted slope face.

Where applicable, all slopes should be planted as soon as practical upon completion of grading to reduce the effects of erosion and weathering.

Onsite Fill Material - The onsite clayey silt, weathered gravel, and highly to completely weathered basalt (weathered gravel with silt and sand) may be reused in compacted fills and backfills provided all rock fragments larger than 6 inches in maximum dimension are removed prior to reuse.

Imported Fill Material - Imported structural fill should be well-graded, non-expansive granular material. Specifications for imported granular structural fill should indicate a maximum particle size of 3 inches, and state that between 8 and 20 percent of soil by weight shall pass the #200 sieve. In addition, the plasticity index (P.I.) of that portion of the soil passing the #40 sieve shall not be greater than 10. Imported structural fill should have a CBR expansion value no greater than 1.0 percent and a minimum CBR value of 15 percent, when tested in accordance with ASTM D 1883.

Compaction - In general, fill and backfill consisting of cohesive soils, such as the onsite clayey silt should be placed in horizontal lifts restricted to 8 inches in loose thickness, and compacted to a minimum 90 percent compaction as determined by ASTM D 1557. Granular fill, such as the weathered gravel and imported granular structural fill, should also be placed in 8-inch loose lifts, but compacted to at least 95 percent compaction as determined by ASTM D 1557.

Fill placed in areas which slope steeper than 5H:1V should be continually benched as the fill is brought up in lifts.

ADDITIONAL SERVICES

We recommend that we perform a general review of the final design plans and specifications. This will allow us to verify that the foundation design and earthwork recommendations have been properly interpreted and implemented in the design plans and construction specifications.

For continuity, we recommend that we be retained during construction to (1) observe subgrade conditions prior to fill placement, (2) review and/or perform laboratory testing on import borrow to determine its acceptability for use in compacted fills, (3) observe fill placement and perform compaction testing, and (4) provide geotechnical consultation as required.

Our services during construction will allow us to verify that our recommendations are properly interpreted and included in construction, and if necessary, to make modifications to those recommendations, thereby reducing construction delays in the event subsurface conditions differ from those anticipated.

LIMITATIONS

The boring logs indicate the approximate subsurface soil conditions encountered only at those times and locations where our borings were made, and may not represent conditions at other times and locations.

This report was prepared specifically for SSFM International and their subconsultants for design of the proposed stream crossings at Na Pali Kona Forest Reserve in Kokee, Kauai, Hawaii. The boring logs, laboratory test results, and recommendations presented in this report are for design purposes only, and are not intended for use in developing cost estimates by the contractor.

During construction, should subsurface conditions differ from those encountered in our borings, we should be advised immediately in order to re-evaluate our

recommendations, and to revise or verify them in writing before proceeding with construction.

Our recommendations and conclusions are based upon the site materials observed, the preliminary design information made available, the data obtained from our site exploration, our engineering analyses, and our experience and engineering judgment. The conclusions and recommendations in this report are professional opinions which we have strived to develop in a manner consistent with that level of care, skill, and competence ordinarily exercised by members of the profession in good standing, currently practicing under similar conditions in the same locality. We will be responsible for those recommendations and conclusions, but will not be responsible for the interpretation by others of the information developed. No warranty is made regarding the services performed, either expressed or implied.

Respectfully submitted,

HIRATA & ASSOCIATES, INC.

Con Truong, Project Engineer

This work was prepared by
me or under my supervision.
Expiration Date of License:
April 30, 2026

APPENDIX A

FIELD INVESTIGATION

DESCRIPTION OF FIELD INVESTIGATION

GENERAL

The site was explored between November 5 and 10, 2025, by performing a visual reconnaissance of the site and drilling 8 test borings to depths ranging from about 8 to 20.5 feet with an Acker track-mounted drill rig.

During drilling operations, the soils were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System. The boring logs indicate the depths at which the soils or their characteristics change, although the change could actually be gradual. If the change occurred between sample locations, the depth was interpreted based on field observations. Classifications and sampling intervals are shown on the boring logs. A Boring Log Legend is presented on Plate A3.1. The Unified Soil Classification and Rock Weathering Classification Systems are shown on Plates A3.2 and A3.3, respectively. The soils encountered are logged on Plates A4.1 through A4.8.

Borings were located in the field by measuring/taping offsets from existing site features shown on the plans. Surface elevations at boring locations were estimated based on a preliminary topographic survey map prepared by ControlPoint Surveying, Inc., dated October 28, 2025. The accuracy of the boring locations shown on Plates A2.2 and A2.3, and the boring elevations shown on Plates A4.1 through A4.8 are therefore approximate, in accordance with the field methods used.

SOIL SAMPLING

Representative and disturbed samples, as well as a bulk soil sample, were recovered from the borings for selected laboratory testing and analyses. Representative samples were recovered by driving a 3-inch O.D. split tube sampler a total of 18 inches with a 140-pound hammer dropped from a height of 30 inches. Disturbed samples were obtained by driving a 2-inch O.D. standard split spoon sampler a total of either 18 or 24 inches with a 140-pound hammer dropped from a height of 30

inches. The number of blows required to drive the samplers the final 12 inches are recorded at the appropriate depths on the boring logs, unless noted otherwise.

ROCK SAMPLING

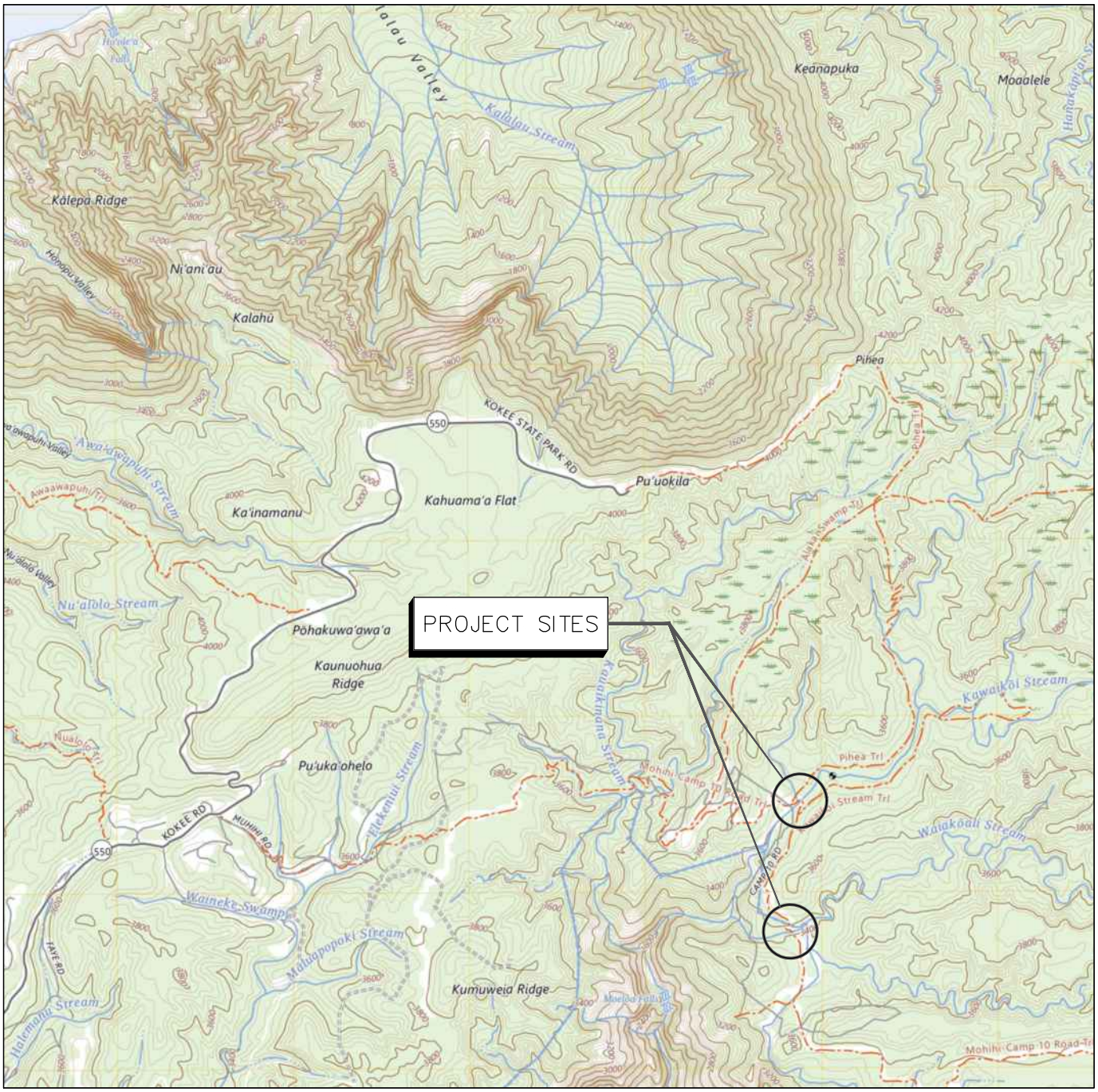
Core samples of rock were obtained by drilling with a HQ core barrel having an inside diameter of 2.5 inches. Recovery percentages for each core run are shown on the enclosed Boring Logs.

The rock quality designation (RQD) for the core runs are also shown on the Boring Logs. This is a modified core recovery percentage which takes into account the number of fractures observed in the core samples. Only pieces of core 4 inches in length or longer, as measured along the centerline, were included in the determination of this modified core recovery percentage. Fractures caused by drilling or handling were ignored.

The following is a general correlation between RQD percentages and rock quality.

RQD (%)	Description of Rock Quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Reference: Tunnel Engineering Handbook, Second Edition, edited by J.O. Bickel, T.R. Kuesel, and E.H. King, 1996.



Reference: Topographic quadrangle map prepared by the United States Department of the Interior Geologic Survey Haena Quadrangle, Kauai County, Hawaii. 2024.

Stream Crossings at Na Pali Kona Reserve, Kauai

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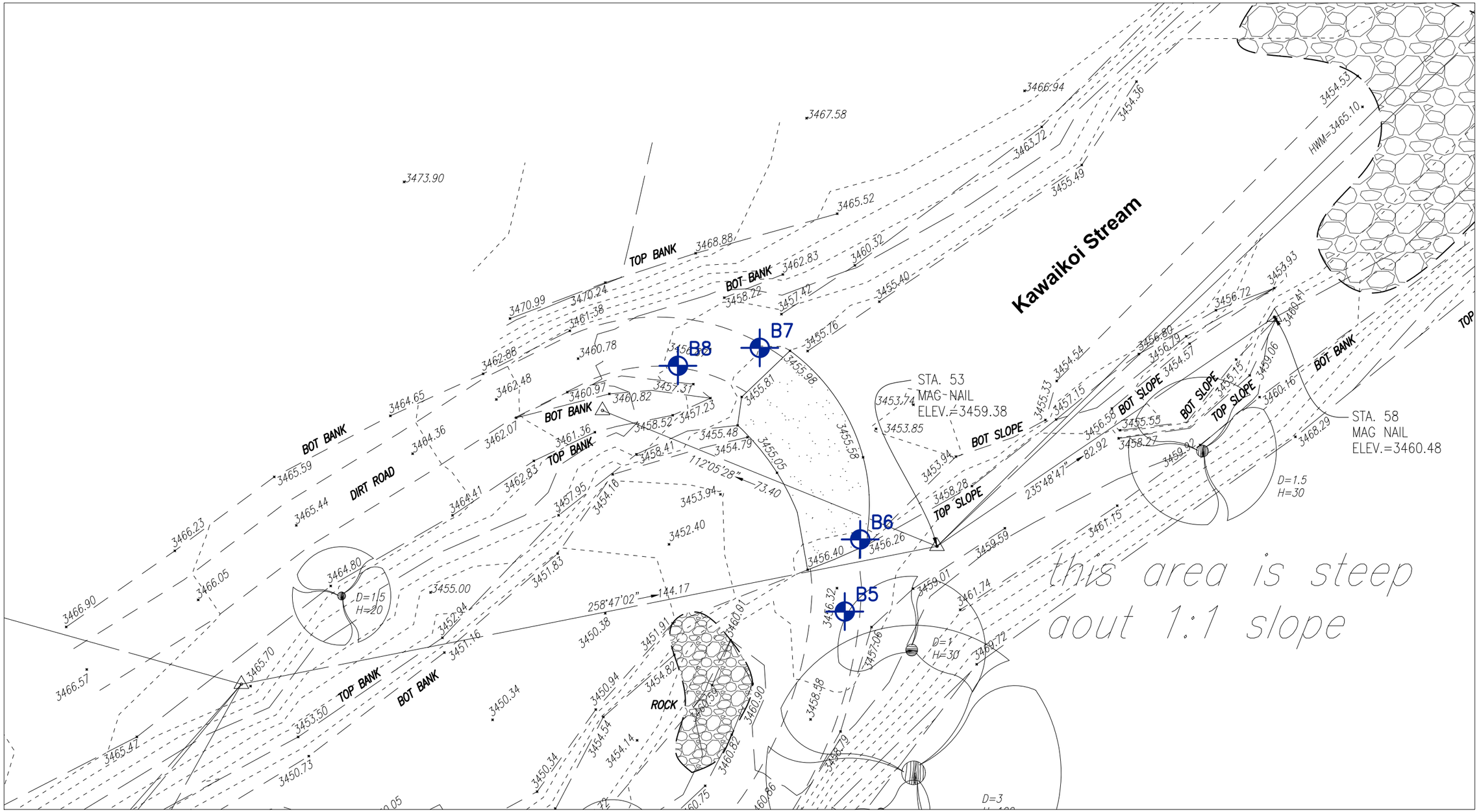
LOCATION MAP

Plate A2.1



LEGEND:

Approximate location of borings

Reference: Preliminary topographic survey map prepared by ControlPoint Surveying, Inc., dated 10/28/25.

GRAPHIC SCALE:

0 10 20 40 FT.

1" = 20'

Stream Crossings at Na Pali Kone Forest Reserve, Kauai

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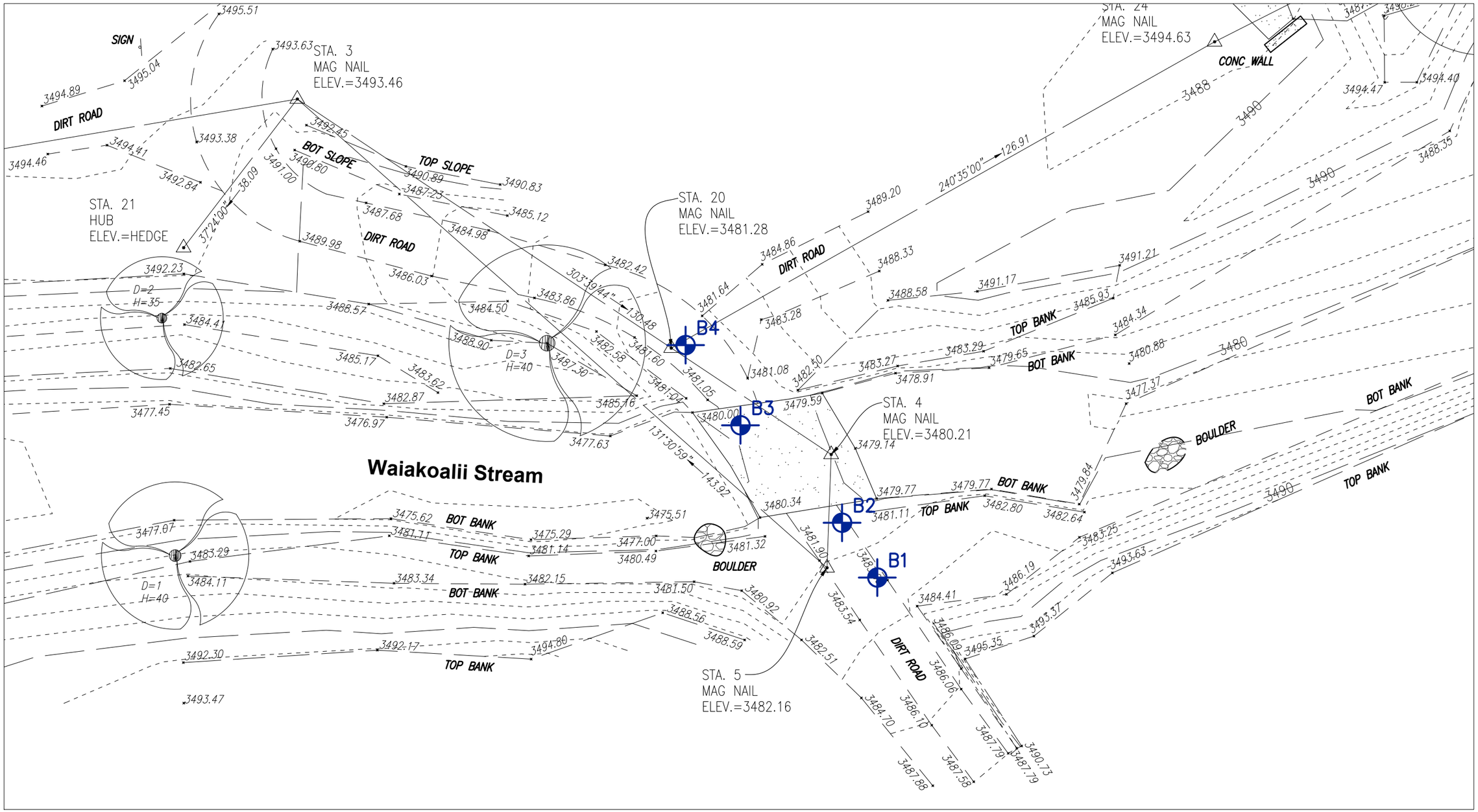
BORING LOCATION PLAN

Plate
A2.2



LEGEND:

Approximate location of borings

Reference: Preliminary topographic survey map prepared by ControlPoint Surveying, Inc., dated 10/28/25.

GRAPHIC SCALE:
0 10 20 40 FT.
1" = 20'

Stream Crossings at Na Pali Kona Forest Reserve, Kauai

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BORING LOCATION PLAN

Plate
A2.3

MAJOR DIVISIONS			GROUP DIVISIONS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of the material is LARGER than No. 200 sieve size.)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines.)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines.)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size.)	CLEAN SANDS (Little or no fines.)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines.)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of the material is SMALLER than No. 200 sieve size.)	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 high plasticity, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50.)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic silts.
FORMATIONS				FRESH TO MODERATELY WEATHERED BASALT
				VOLCANIC TUFF / HIGHLY TO COMPLETELY WEATHERED BASALT
				CORAL

SAMPLE DEFINITION

2" O.D. Standard Split Spoon Sampler	Shelby Tube	RQD: Rock Quality Designation
3" O.D. Split Tube Sampler	Core Sample	Water Table

Stream Crossings at Na Pali Kona Forest Reserve, Kauai

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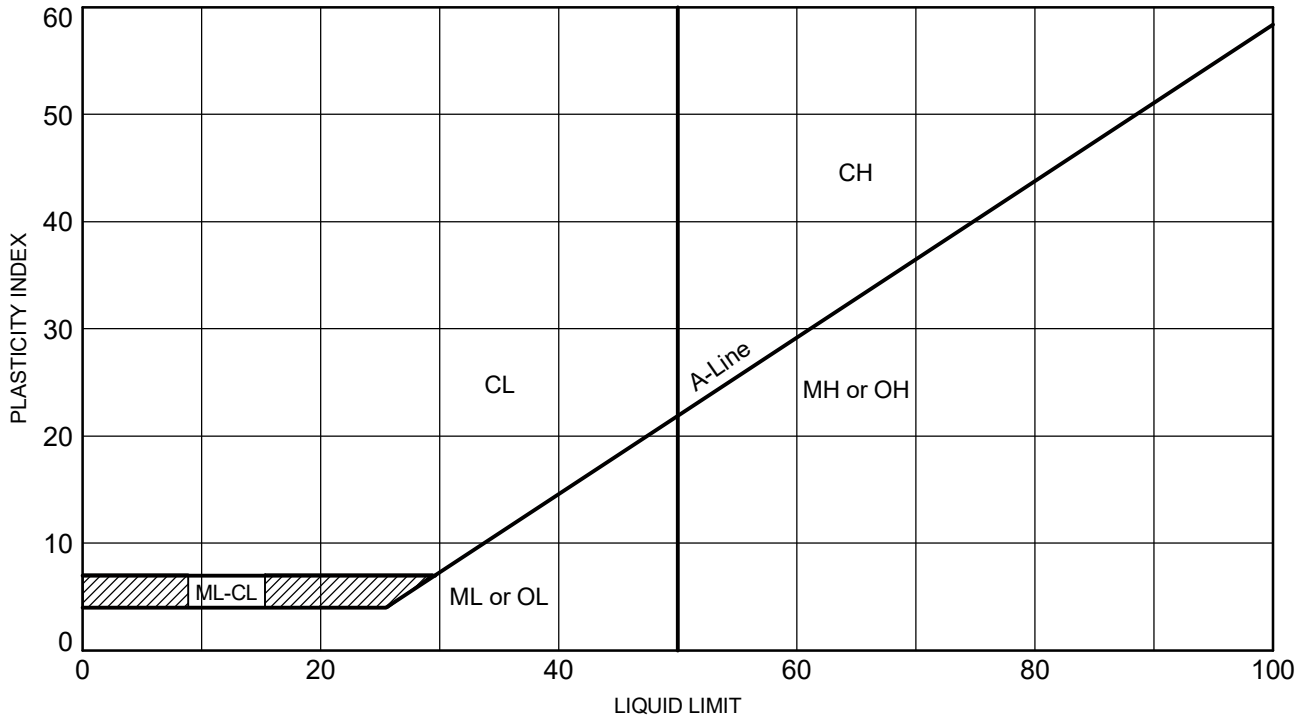
BORING LOG LEGEND

Plate A3.1

PLASTICITY CHART



GRADATION CHART

COMPONENT DEFINITIONS BY GRADATION	
COMPONENT	SIZE RANGE
Boulders	Above 12 in.
Cobbles	3 in. to 12 in.
Gravel Coarse Fine Gravel	3 in. to No. 4 (4.76 mm) 3 in. to 3/4 in. 3/4 in. to No. 4 (4.76 mm)
Sand Coarse Sand Medium Sand Fine Sand	No. 4 (4.76 mm) to No. 200 (0.074mm) No. 4 (4.76 mm) to No. 10 (2.0 mm) No. 10 (2.0 mm) to No. 40 (0.42 mm) No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

Stream Crossings at Na Pali Kona Forest Reserve, Kauai

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UNIFIED SOIL CLASSIFICATION SYSTEM

Plate
A3.2

Grade	Symbol	Description
Fresh	F	No visible signs of decomposition or discoloration. Rings under hammer impact.
Slightly Weathered	WS	Slight discoloration inwards from open fractures, otherwise similar to F.
Moderately Weathered	WM	Discoloration throughout. Weaker minerals such as feldspar decomposed. Strength somewhat less than fresh rock but cores cannot be broken by hand or scraped by knife. Texture preserved.
Highly Weathered	WH	Most minerals somewhat decomposed. Specimens can be broken by hand with effort or shaved with knife. Core stones present in rock mass. Texture becoming indistinct but fabric preserved.
Completely Weathered	WC	Minerals decomposed to soil but fabric and structure preserved (Saprolite). Specimens easily crumbled or penetrated.
Residual Soil	RS	Advance state of decomposition resulting in plastic soils. Rock fabric and structure completely destroyed. Large volume change.

Reference: Soil Mechanics, NAVFAC DM-7.1, Department of the Navy, Naval Facilities Engineering Command, September, 1986.

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Boring No.
B1

BORING LOG

PROJECT NAME Stream Crossings at Na Pali Kona Forest Reserve, Kauai
WORK ORDER NO. 25-7132 DRIVING WT. 140 lb. START DATE 11/5/25
SURFACE ELEV. 3483 ±* DROP 30 in. END DATE 11/6/25

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
									GRAVEL (GW-GM) - Brown, loose to medium dense, with silt, sand, and cobbles.
			21	66	53				WEATHERED BASALT (WH-WC) - Mottled brown, medium dense to dense, highly to completely weathered. (weathered gravel with silt and sand) Groundwater encountered at 3 feet on 11/6/25 at 3:25 pm.
			15	65	55				
			23/5"	62	57	5			
NP = No Penetration Begin HQ coring from 7 feet.	89	71	10/NP 5/NP 10/NP						BASALT (WS) - Gray, hard, slightly weathered.
						10			End boring at 10.0 feet. * Elevations based on preliminary topographic survey map prepared by ControlPoint Surveying, Inc., dated 10/28/25.
						15			
						20			
						25			
						30			

Plate A4.1

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Boring No.
B2

BORING LOG

PROJECT NAME Stream Crossings at Na Pali Kona Forest Reserve, Kauai
WORK ORDER NO. 25-7132 DRIVING WT. 140 lb. START DATE 11/6/25
SURFACE ELEV. 3481 ± DROP 30 in. END DATE 11/6/25

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
Begin HQ coring from 0.5 feet.	20	0	37			0 ▼ 5			WEATHERED GRAVEL (GW-GM) - Mottled brown, very moist to wet, medium dense to very dense, with silt, sand, and cobbles. Groundwater encountered at 1.9 feet on 11/6/25 at 12:40 pm.
NP = No Penetration	94 54 56	22 0 0	5/NP 12 6/6" 10/NP		27	10 15			WEATHERED BASALT (WM-WH) - Mottled brown, dense to medium hard, moderately to highly weathered.
						20 25 30			End boring at 19.0 feet.

Plate A4.2

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Boring No.
B3

BORING LOG

PROJECT NAME Stream Crossings at Na Pali Kona Forest Reserve, Kauai
WORK ORDER NO. 25-7132 DRIVING WT. 140 lb. START DATE 11/7/25
SURFACE ELEV. 3480 ± DROP 30 in. END DATE 11/7/25

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
Begin HQ coring from 6 feet.	0	0	16 19	114 105	10 17	0 5			WEATHERED GRAVEL (GW-GM) - Mottled brown, medium dense, with silt, sand, and cobbles. Groundwater encountered at 2.4 feet on 11/7/25 at 9:43 am.
	57 79	0 0	22 13 20		37 33 17	10 15 20			WEATHERED BASALT (WH) - Mottled brown, dense to medium hard, highly weathered.
						25 30			End boring at 20.5 feet.

Plate A4.3

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Boring No.
B4

BORING LOG

PROJECT NAME Stream Crossings at Na Pali Kona Forest Reserve, Kauai
WORK ORDER NO. 25-7132 DRIVING WT. 140 lb. START DATE 11/7/25
SURFACE ELEV. 3482 ± DROP 30 in. END DATE 11/7/25

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
			12	84	52				Clayey SILT (MH) - Mottled brown, moist, with sand and weathered rock fragments.
			44	72	39				WEATHERED BASALT (WH-WC) - Mottled brown, medium dense to dense, highly to completely weathered. (weathered gravel with silt and sand) Groundwater encountered at 3.3 feet on 11/7/25 at 10:50 am.
			19	56	62	5			
			24	64	65				
			38	65	59	10			
									End boring at 10.5 feet.
						15			
						20			
						25			
						30			

Plate A4.4

Hirata & Associates, Inc.
GEOTECHNICAL ENGINEERING

Boring No.
B5

BORING LOG

PROJECT NAME Stream Crossings at Na Pali Kona Forest Reserve, Kauai
WORK ORDER NO. 25-7132 DRIVING WT. 140 lb. START DATE 11/7/25
SURFACE ELEV. 3456 ± DROP 30 in. END DATE 11/7/25

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
									WEATHERED GRAVEL (GW-GM) - Brown, moist, loose to medium dense, with silt and sand.
NP = No Penetration			10/NP						COBBLES AND BOULDERS - Brown, dense to very dense, in a matrix of silt, sand, and weathered gravel.
Begin HQ coring from 3.5 feet.			10/NP						
	57	47							BASALT (WS) - Gray, hard, slightly weathered. Groundwater encountered at 5.3 feet on 11/7/25 at 1:34 pm.
			10/NP						Brown, highly weathered at 8 feet.
									End boring at 8.5 feet.

10
15
20
25
30

Plate A4.5

Hirata & Associates, Inc.
GEOTECHNICAL ENGINEERING

Boring No.
B6

BORING LOG

PROJECT NAME Stream Crossings at Na Pali Kona Forest Reserve, Kauai
WORK ORDER NO. 25-7132 DRIVING WT. 140 lb. START DATE 11/10/25
SURFACE ELEV. 3454 ± DROP 30 in. END DATE 11/10/25

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
NP = No Penetration Begin HQ coring from 0.5 feet.	63	25	3/NP			▼			COBBLES AND BOULDERS - Brown, dense to very dense, in a matrix of silt, sand, and weathered gravel. Groundwater encountered at 1.8 feet on 11/10/23 at 1:03 pm.
	100	83	7/NP			5			BASALT (WS) - Gray, hard, slightly weathered.
	88	80	2/NP			10			
						15			End boring at 13.5 feet.
						20			
						25			
						30			

Plate A4.6

Hirata & Associates, Inc.
GEOTECHNICAL ENGINEERING

Boring No. B7

BORING LOG

PROJECT NAME Stream Crossings at Na Pali Kona Forest Reserve, Kauai
WORK ORDER NO. 25-7132 DRIVING WT. 140 lb. START DATE 11/10/25
SURFACE ELEV. 3456 ± DROP 30 in. END DATE 11/10/25

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
									WEATHERED GRAVEL (GW-GM) - Brown, moist, loose to medium dense, with silt and sand.
No Recovery			15 17 35 61 30 40 40	64 85 119 80 72 73	47 30 16 46 53 54	5 10 15 20			WEATHERED BASALT (WH) - Mottled reddish brown, dense, highly to completely weathered. Groundwater encountered at 2.2 feet on 11/10/25 at 3:15 pm.
						25 30			End boring at 20.5 feet.

Plate A4.7

Hirata & Associates, Inc.
GEOTECHNICAL ENGINEERING

Boring No.
B8

BORING LOG

PROJECT NAME Stream Crossings at Na Pali Kona Forest Reserve, Kauai
WORK ORDER NO. 25-7132 DRIVING WT. 140 lb. START DATE 11/10/25
SURFACE ELEV. 3458 ± DROP 30 in. END DATE 11/10/25

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
									WEATHERED GRAVEL (GW-GM) - Mottled brown, moist, medium dense, with silt and sand Boulder at 0.5 feet.
			14 27	65 88	46 37	5			WEATHERED BASALT (WH) - Mottled reddish brown, moist, medium dense, highly to completely weathered. (weathered gravel with sand)
			5/NP 5/NP						BASALT (WS) - Gray, hard, slightly weathered.
						10 15 20 25 30			End boring at 8.0 feet. Unable to take groundwater level reading due to caving of bore hole.

Plate A4.8

APPENDIX B

LABORATORY TESTING

DESCRIPTION OF LABORATORY TESTING

CLASSIFICATION

Field classification was verified in the laboratory in accordance with the Unified Soil Classification System. Laboratory classification was determined by visual examination. The final classifications are shown at the appropriate locations on the Boring Logs, Plates A4.1 through A4.8.

MOISTURE-DENSITY

Representative samples were tested for field moisture content and dry unit weight. Disturbed samples were tested for field moisture content. The dry unit weight was determined in pounds per cubic foot while the moisture content was determined as a percentage of dry weight. Representative samples were obtained using a 3-inch O.D. split tube sampler. Disturbed samples were obtained using a 2-inch O.D. standard split spoon sampler. Test results are shown at the appropriate depths on the Boring Logs, Plates A4.1 through A4.8.

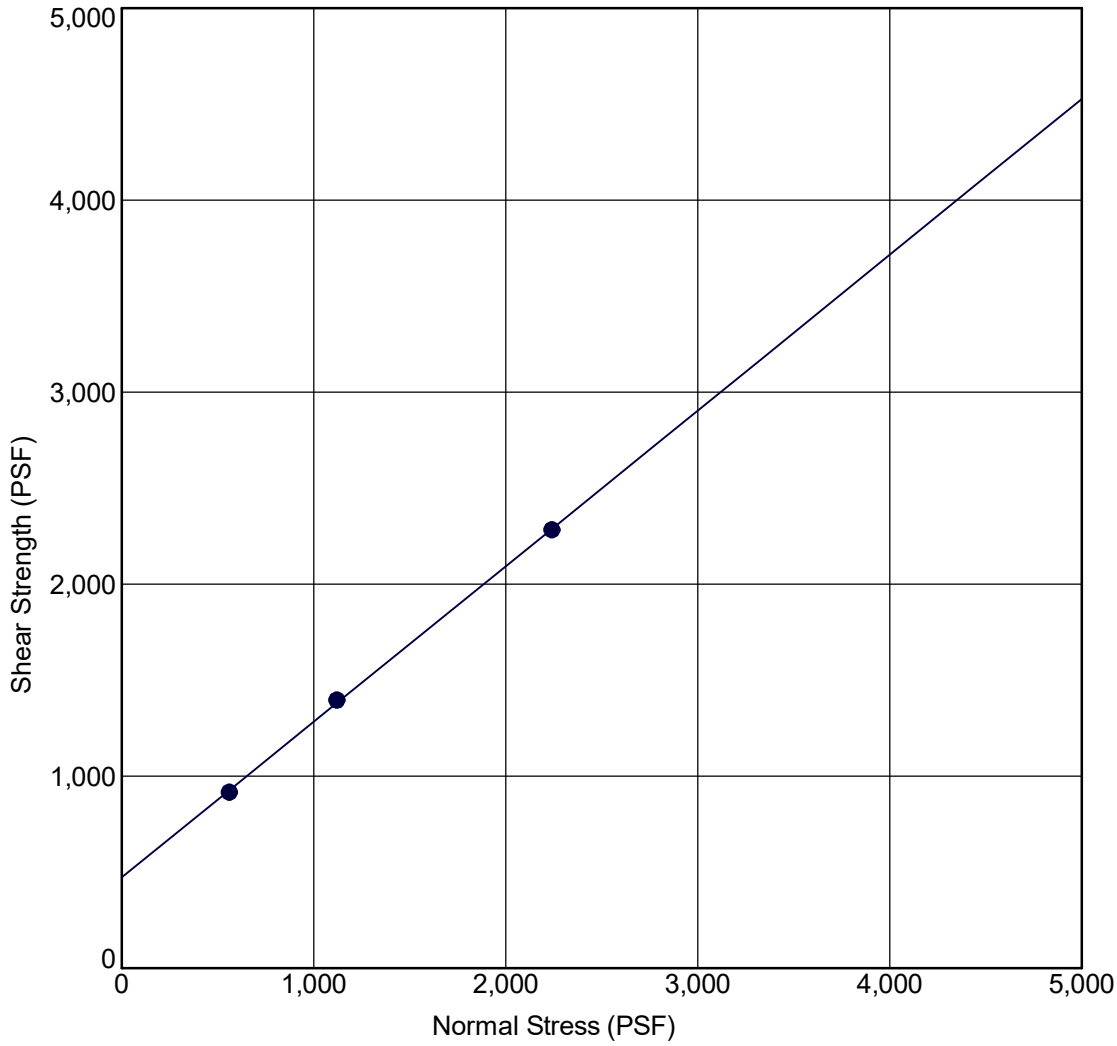
SHEAR TESTS

Shear tests were performed in the Direct Shear Machine which is of the strain control type. Each sample was sheared under varying confining loads in order to determine the Coulomb shear strength parameters, cohesion and angle of internal friction. Test results are presented on Plates B2.1 through B2.3.

CALIFORNIA BEARING RATIO TESTS

CBR tests were performed in general accordance with ASTM D 1883 on bulk samples of near surface soil. Results are shown on Plates B3.1 and B3.2.

Direct Shear Test Results



Soil Data

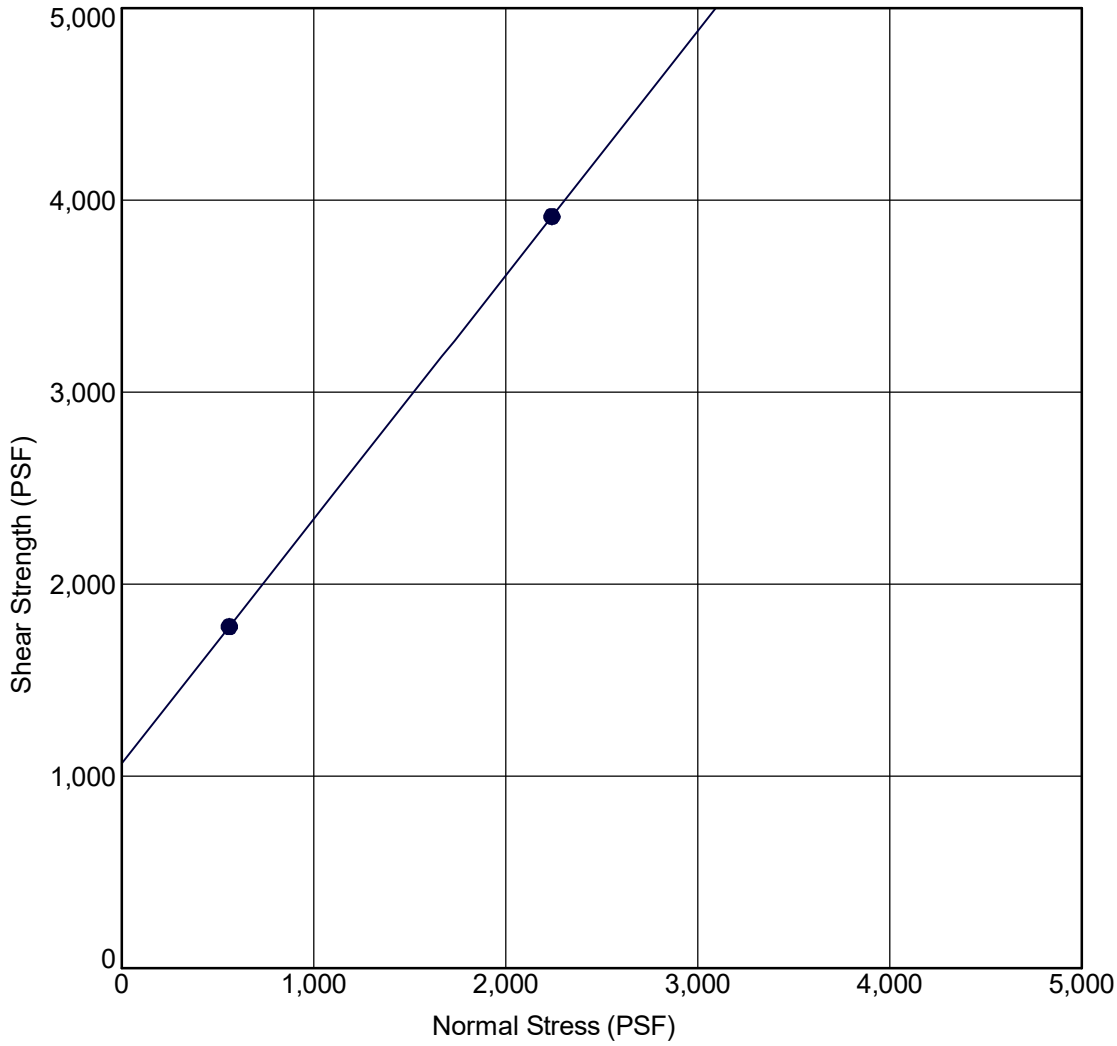
Boring No.: B1 Depth (ft): 3
Soil Description: Mottled brown weathered basalt

Test Results

Strength Intercept (c): 473.0 PSF (Peak Strength)
Friction Angle (phi): 39.0 DEG (Peak Strength)

	Stream Crossings at Na Pali Kona Forest Reserve, Kauai		
	HIRATA & ASSOCIATES, INC. Geotechnical Engineering	**DIRECT SHEAR TEST**	Plate B2.1
	W.O. 25-7132	*ASTM D3080*	

Direct Shear Test Results



Soil Data

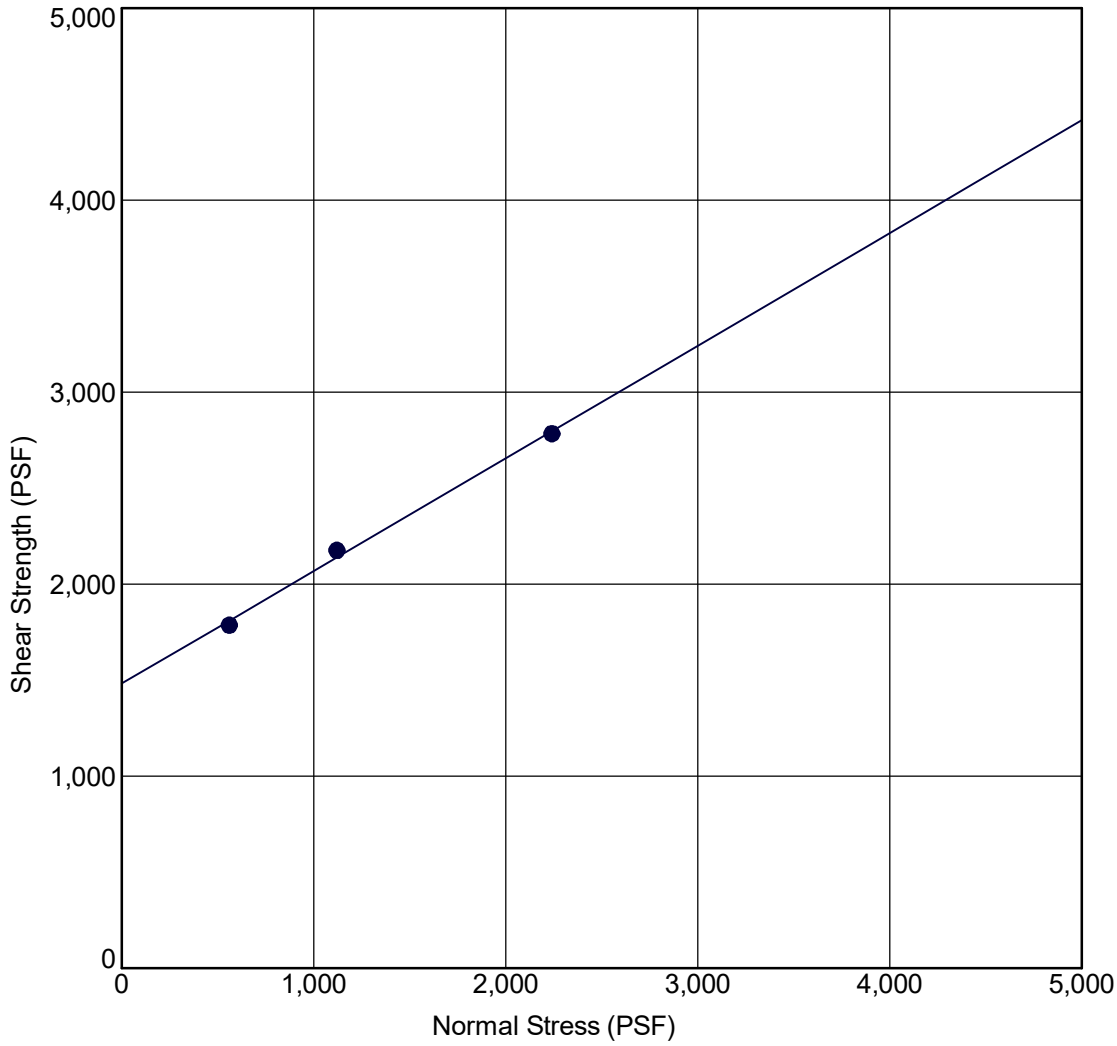
Boring No.: B7 Depth (ft): 7
Soil Description: Mottled reddish brown weathered basalt

Test Results

Strength Intercept (c): 1066.6 PSF (Peak Strength)
Friction Angle (phi): 51.8 DEG (Peak Strength)

	Stream Crossings at Na Pali Kona Forest Reserve, Kauai		
	HIRATA & ASSOCIATES, INC. Geotechnical Engineering	**DIRECT SHEAR TEST**	Plate B2.2
	W.O. 25-7132	*ASTM D3080*	

Direct Shear Test Results



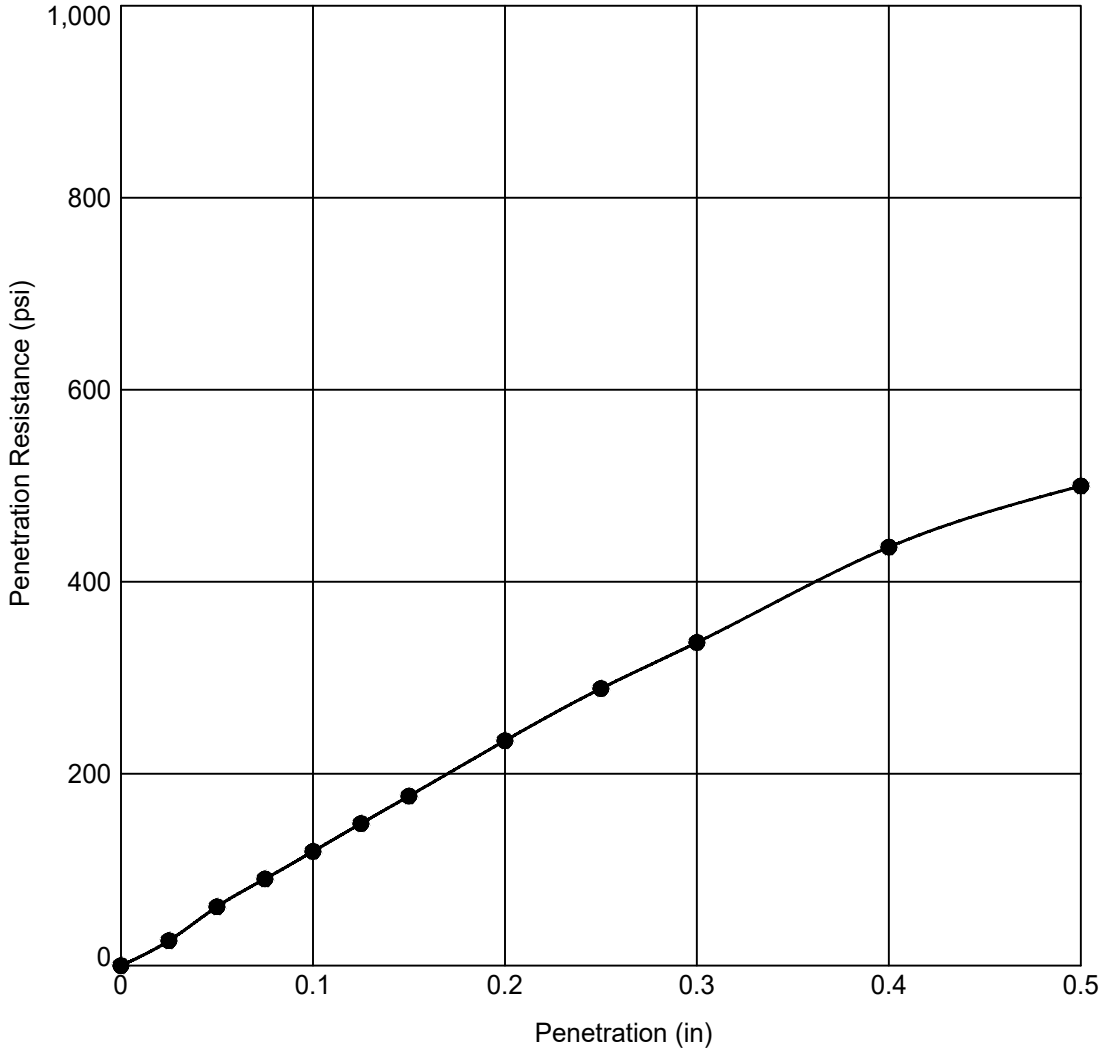
Soil Data

Boring No.: B8 Depth (ft): 4
Soil Description: Mottled reddish brown weathered basalt

Test Results

Strength Intercept (c): 1482.0 PSF (Peak Strength)
Friction Angle (phi): 30.4 DEG (Peak Strength)

	Stream Crossings at Na Pali Kona Forest Reserve, Kauai		
	HIRATA & ASSOCIATES, INC. Geotechnical Engineering	**DIRECT SHEAR TEST**	Plate B2.3
	W.O. 25-7132	*ASTM D3080*	



Soil Data

Location:	Boring B4 at 0 to 2 ft
Description:	Mottled brown clayey silt with weathered sand (Completely weathered basalt)
Sample Dry Density	90.3 pcf
Sample Moisture Content	27.0 %

Test Results

CBR Value:	11.9 %
Expansion:	2.0 %

Stream Crossings at Na Pali Kona Forest Reserve, Kauai

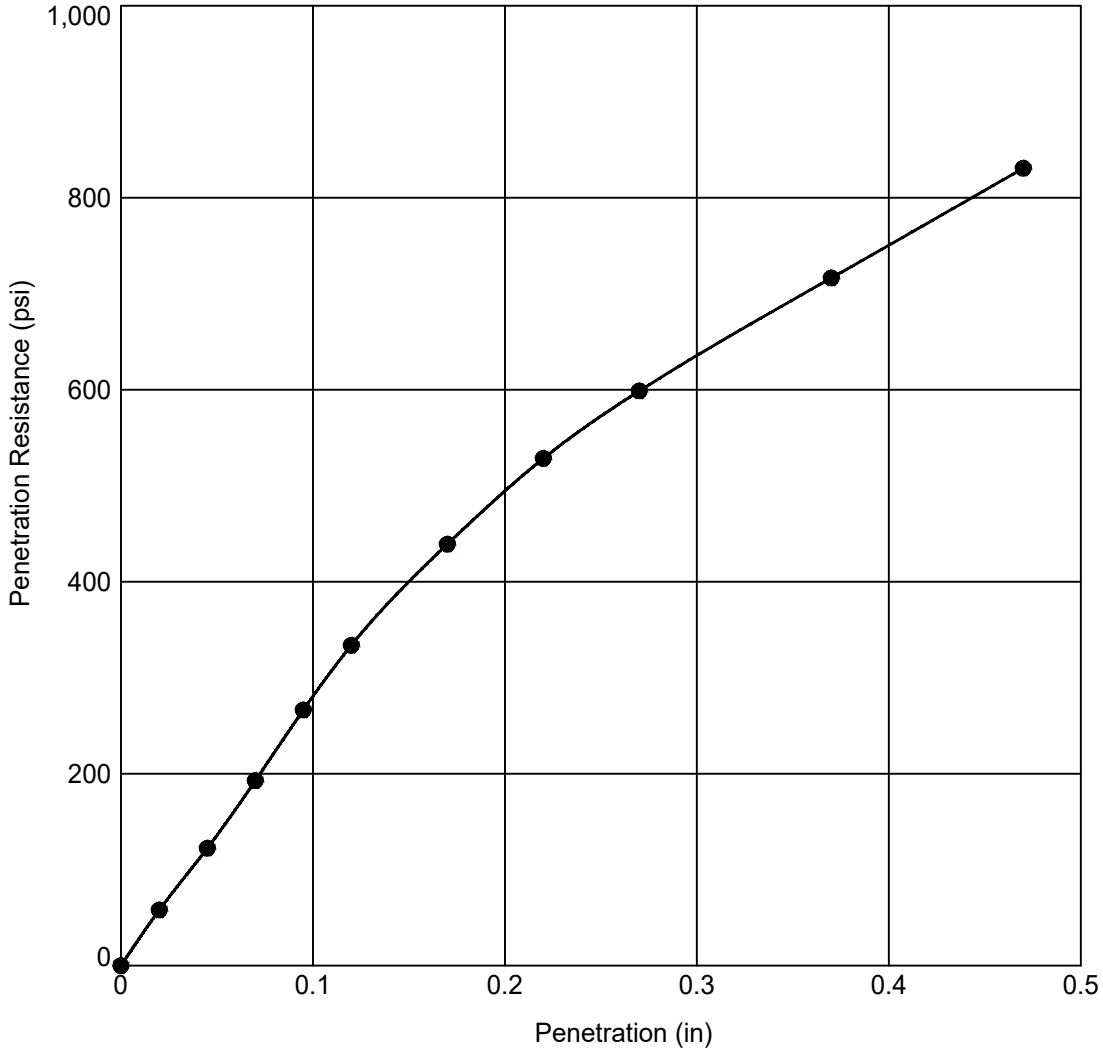
HIRATA & ASSOCIATES, INC.
Geotechnical Engineering

W.O. 25-7132

CBR STRESS PENETRATION TEST

ASTM D1883

Plate B3.1



Soil Data

Location:	Boring B7 at 1 to 3 feet
Description:	Mottled brown weathered gravel with sand (Completely weathered basalt)
Sample Dry Density	94.2 pcf
Sample Moisture Content	32.0 %

Test Results

CBR Value:	28.0 %
Expansion:	0.2 %

Stream Crossings at Na Pali Kona Forest Reserve, Kauai

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W.O. 25-7132

CBR STRESS PENETRATION TEST

ASTM D1883

Plate B3.2