Appendix A

Preliminary Geotechnical Investigation
Kīhei High School
Kīhei, Maui, Hawai'i

Hirata & Associates, Inc. – October 2009

PRELIMINARY GEOTECHNICAL INVESTIGATION
KIHEI HIGH SCHOOL
KIHEI, MAUI, HAWAII

for

GROUP 70 INTERNATIONAL, INC.

HIRATA & ASSOCIATES, INC.
W.O. 09-4797
October 16, 2009

October 16, 2009
W.O. 09-4797

Hirata & Associates
Geotechnical Engineering
Hirata & Associates, Inc.
99-1433 Koaha Pl
Aiea, HI 96701
tel 808.486.0787
fax 808.486.0870

Mr. Rodney Lee
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813

Dear Mr. Lee:

Our report, "Preliminary Geotechnical Investigation, Kihei High School, Kihei, Maui, Hawaii," dated October 16, 2009, our Work Order 09-4797 is enclosed. This investigation was conducted in general conformance with the scope of services presented in our proposal dated May 8, 2008.

This preliminary geotechnical investigation report was prepared in support of the preparation of Design-Build RFP documents for the proposed Kihei High School Campus in Kihei, Maui, Hawaii. A more detailed investigation of the site, including additional exploratory test borings, laboratory testing, and analyses, should be performed by the Design-Build team's Geotechnical Engineer for design.

Slightly to highly weathered basalt was encountered in all of our borings at relatively shallow depths. Based on the Initial Concept Plan and the preliminary topographic survey, it appears that grading will primarily consist of cuts, with isolated shallow fill sections. Maximum cut depths on the order of 15 to 20 feet are expected in the northern portion of the site. As a result, we expect that building excavations will generally expose medium hard to hard weathered basalt. Conventional shallow foundations bearing directly on the weathered basalt may be used for support of the proposed structures. For buildings located in fill areas, footings should extend through the fill material and bear on the underlying weathered basalt.

The following is a summary of our geotechnical recommendations. This summary is not intended to be a substitute for our report which includes more detailed explanations of our recommendations, as well as additional requirements.

- Allowable bearing value = 6,000 psf
- Coefficient of friction = 0.5
- Passive earth pressure = 500 pcf

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.

Paul S. Morimoto

Paul S. Morimoto President

PSM:RIKY:ph

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Hirata & Associates, Inc. W.O. 09-4797

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PRELIMINARY GEOTECHNICAL INVESTIGATION
KIHEI HIGH SCHOOL
KIHEI, MAUI, HAWAII

INTRODUCTION

This report presents the results of our preliminary geotechnical investigation performed for the proposed Kihei High School in Kihei, Maui, Hawaii. We understand that the project will be developed using the Design-Build procurement process, and this report was prepared in support of the Design-Build RFP documents being prepared by your office.

Our scope of services for this study included the following:

- A visual reconnaissance of the site 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 19 exploratory borings to depths ranging from about 15 to 50 feet. A description of our field investigation is summarized on Plates A1.1 and A1.2. The approximate exploratory boring locations are shown on the enclosed Boring Location Plan, Plate A2.2, and the soils encountered in the borings are described on the Boring Logs, Plates A4.1 through A4.24.
- Performing percolation tests in three of the borings at depths of about 20 feet. Test results are presented on Department of Health Site Evaluation/ Percolation Test forms, Plates A5.1 through A5.3.
- Laboratory testing of selected soil samples. Testing procedures are presented in the Description of Laboratory Testing, Plates B1.1 and B1.2. Test results are presented on the Boring Logs (Plates A4.1 through A4.24), Consolidation Test report (Plate B2.1), Direct Shear Test reports (Plates B3.1 and B3.2), Modified Proctor Test reports (Plates B4.1 through B4.4), and Gradation Test report (Plate B5.1).

- Engineering analyses of the field and laboratory data.
- Preparation of this report presenting preliminary geotechnical recommendations for the design of foundations, seismic considerations, resistance to lateral pressures, slabs-on-grade, flexible pavement, and site grading.

PROJECT CONSIDERATIONS

The proposed high school campus will encompass approximately 50 acres of land. The project will include about 200,000 square feet of enclosed educational space. In addition, the Initial Conceptual Site Plan shows a football field with track and field facilities, baseball and softball fields, a soccer field, and a practice field. We assume that the football, baseball, and softball fields will be lighted. The school grounds will also include paved parking and driveway areas.

SITE CONDITIONS

The project site is located on existing ranch land on the east side of Piilani Highway, east of its intersection with Kulanihakoi Street in Kihei, Maui. The northern portion of the site is owned by Kaonoulu Ranch, while the southern portion of the site is owned by Haleakala Ranch Company. The site is bordered on the north by Kulanihakoi Gulch and on the south by Waipuilani Gulch. Land from both ranches border the site on the east. A wire fence extending in an approximate east-west alignment, about midway through the project site, separates the two ranches.

The subject property is vacant of structures and is covered with moderate vegetation. Occasional basalt outcrops were observed at ground surface throughout the site. The site generally slopes downward toward the west and southwest, with ground elevations ranging from about +110 in the northeast to about +40 in the southwest.

SOIL CONDITIONS

Cobbles, boulders, and basalt outcrops were observed at ground surface throughout much of the site. Weathered basalt was encountered in all of the borings at depths

of about 0.5 to 6.5 feet below existing grade, extending to the maximum depths drilled. With the exception of boring B19, the basalt was covered by reddish brown sandy silt in a medium stiff condition. Boring B19 encountered surface soil consisting of grayish brown silty sand in a medium dense condition to a depth of about 4.5 feet. Underlying the silty sand was reddish brown clayey silt to a depth of about 6.5 feet. Occasional boulders were encountered within the surface sandy silt stratum.

Underlying the surface soils was weathered basalt ranging from a highly to slightly weathered condition, with occasional moderately weathered sections. In general, the highly weathered basalt ranged from a dense to medium hard condition with sampling resulting in over 50 blows for 6 inches of penetration during sampling, or refusal. The moderately and slightly weathered basalt ranged from a medium hard to hard condition, with NX coring typically resulting in high core recovery and RQD percentages. Lower core recovery and RQD percentages were generally recorded while drilling in highly fractured sections of the basalt.

Neither groundwater nor seepage water was encountered in our borings.

CONCLUSIONS AND RECOMMENDATIONS

Based on our exploratory fieldwork and laboratory testing, we believe that from a geotechnical viewpoint, the site can generally be developed as planned. Conventional shallow foundations may be used to support the proposed structures.

The Initial Concept Plan, prepared by Group 70 International, Inc., and the preliminary topographic survey indicate that site grading for the project will primarily consist of cuts, with isolated shallow fill sections. Maximum cut depths on the order of 15 to 20 feet are expected in the northern portion of the site. As a result, we expect that building excavations will generally expose medium hard to hard, moderately and slightly weathered basalt. Therefore, conventional shallow foundations bearing directly on the weathered basalt may be used for support of the proposed structures. For buildings located in fill areas, footings should extend through the new fill material and be founded directly on the underlying weathered basalt.

Building Foundations

Conventional shallow foundations founded directly on the medium hard to hard weathered basalt may be used for support of the proposed buildings. Foundations founded on the medium hard to hard weathered basalt may be designed for an allowable bearing value of 6,000 pounds per square foot. The allowable bearing value is for the total of dead and frequently applied live loads, and may be increased by one-third for short duration loading which includes the effect of wind and seismic forces.

The bottom of all footing excavations should be cleaned of loose or deleterious material prior to placement of reinforcing steel and concrete. Footings located on, or near the top of slopes, should be embedded such that a minimum horizontal distance of 5 feet is maintained between the bottom edge of footing and slope face.

Lightpole Foundations

Drilled pier foundations embedded into the medium hard to hard weathered basalt may be used for support of light poles. The drilled piers may be designed using an allowable end bearing value of 6,000 pounds per square foot. Additional vertical load bearing capacity and uplift capacity may be determined using an adhesion value of 2,000 pounds per square foot between the basalt and drilled pier. The minimum diameter of the drilled piers is usually governed by the size of the base plate of the light pole. The final diameter and length of the drilled pier foundations should be determined by the Structural Engineer.

Based on our past experience, we believe that temporary casing will not be required for drilled pier excavations extending into the weathered basalt. If casing is required during construction, temporary, non-corrugated steel casing should be used. The use of permanent casing should not be allowed.

Seismic Design

Based on the borings drilled as part of this study and our knowledge of the deep soil conditions in the area, the subsurface soils can be characterized as a rock soil profile. Therefore, based on the 2003 International Building Code, Site Class B is recommended for this site.

Lateral Design

Resistance to lateral loading may be provided by friction acting at the base of foundations and by passive earth pressure acting on the buried portions of foundations.

A coefficient of friction of 0.5 may be used with the dead load forces. Passive earth pressure may be computed as equivalent fluids having densities of 300 and 500 pounds per cubic foot, with maximum earth pressures of 3,000 and 5,000 pounds per

square foot, for new granular fill and basalt, respectively. Unless covered by pavement or concrete slabs, the upper 12 inches of soil should not be considered in computing lateral resistance.

Retaining Walls

Retaining wall foundations may be designed using recommendations in the *Foundations, Seismic Design,* and *Lateral Design* sections of this report. For active earth pressure considerations, the following equivalent fluid pressures may be used:

Soil Type	Level Backfill Condition	Sloping Backfill Condition	Restrained/ At-rest Condition
Highly weathered basalt	25 pcf	30 pcf	35 pcf
Granular structural fill	35 pcf	45 pcf	50 pcf

To prevent the buildup of hydrostatic pressures, retaining structures should be well-drained. The standard of practice consists of placing a minimum 12-inch thick layer of free-draining gravel at the back of the wall. The gravel should extend from the base of the wall, around subdrains and/or weepholes, and up to within 12 inches of finish grade. Alternatively, prefabricated drainage geocomposites, such as Miradrain or J-drain, may be used in lieu of the free-draining gravel. As with the free-draining gravel, the drainage geocomposites should be placed at the back of the wall, be connected with the weepholes and/or subdrains (in accordance with manufacturer's specifications), and extend to within 12 inches of finish grade.

For freestanding walls, the drainage system should be covered by at least 12 inches of low permeability soil, such as the onsite sandy silt. If the backfill is covered by interior or exterior concrete slabs, the gravel fill should extend to the bottom of slab cushion elevation.

Foundation Settlement

Structural loads were not available at the time of this report. However, neither excessive total nor differential settlement is anticipated for foundations bearing on the medium hard to hard weathered basalt.

Slabs-on-Grade

To provide uniform support, all building slabs-on-grade should be underlain by a 4-inch cushion of clean gravel, such as #3 Fine (ASTM C33 Size No. 67), and protected by a vapor barrier placed over the cushion material.

Slabs-on-grade which will receive floor covering, especially "hard" floor covering such as slate or marble, should include control joints saw-cut into the concrete slab. The purpose of this is to help reduce the potential for reflective cracking of the floor covering due to shrinkage cracks in the concrete slab. Proper curing of the concrete slabs will help reduce shrinkage cracking.

Exterior slabs-on-grade and concrete walkways should be underlain by at least 4 inches of aggregate base course in lieu of the gravel cushion.

Pavement Design

Pavement subgrade throughout most of the project site is expected to generally expose the weathered basalt. Flexible pavement for driveways and parking areas may be designed based on the following section:

2.0"	Asphaltic Concrete
6.0"	Base Course (minimum CBR = 85)
8.0"	Total Thickness

Site Grading

Site Preparation - The project site should be cleared of all vegetation and other deleterious material. We expect that most of the relatively thin surface layer of

clayey silt will be removed during clearing and grubbing operations, as well as during mass grading.

Onsite Fill Materials - The onsite sandy silt will not be acceptable for reuse in structural fills, however, the soil may be reused in general or yard fill areas. Excavated basalt may be reused in structural fills and backfills provided the material is crushed to a well-graded consistency, with a maximum particle size of 3 inches.

Imported Fill Materials - 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. Granular structural fill should also have a minimum CBR value of 15 and a CBR expansion value less than 1.0 percent when tested in accordance with ASTM D 1883.

Compaction - Granular structural fill and backfill should be placed in horizontal lifts restricted to eight inches in loose thickness and compacted to a minimum 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. Fill placed on slopes should be keyed and benched into the existing slope to provide stability for the new fill against sliding. Filling the slope with sliver fills should be avoided.

Structural Excavations - Based on our exploratory borings, we believe that excavations into the weathered basalt layer will require pneumatic equipment. Temporary cuts into the weathered basalt should stand a near vertical gradient. However, it should be the Contractor's responsibility to conform to all OSHA safety standards for excavations.

Slope Gradients - Cut slopes into the weathered basalt may be designed for gradients of 1H:1V or flatter. Fill slopes may be designed for gradients of 2H:1V or flatter. Fill slopes should be planted as soon as practical upon completion of grading to reduce the effects of erosion and weathering.

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 preliminary geotechnical investigation report was prepared specifically for Group 70 International, Inc. and their sub-consultants in support of the preparation of Design-Build RFP documents for the proposed Kihei High School Campus in Kihei, Maui, Hawaii. The boring logs, laboratory test results, and preliminary recommendations presented in this report are for planning and preliminary design purposes only, and are not intended for use in the final design or for developing cost estimates by the contractor.

A more detailed investigation of the site, including additional exploratory test borings, laboratory testing, and analyses, should be performed by the Design-Build team's Geotechnical Engineer.

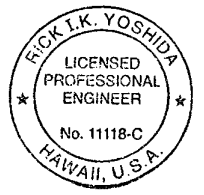
Our preliminary recommendations and conclusions are based upon the site materials observed, the preliminary design information made available, the data obtained from our site exploration, our engineering analyses, and our experience and engineering judgement. The conclusions and preliminary recommendations 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. We will be responsible

for those preliminary 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 under this agreement, either express or implied.

Respectfully submitted,

HIRATA & ASSOCIATES, INC.

Rick Yoshida, P.E.



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Expiration Date of License:
April 30, 2010

APPENDIX A

FIELD INVESTIGATION

DESCRIPTION OF FIELD INVESTIGATION

GENERAL

The site was explored from July 15 to August 6, 2009, by performing a visual site reconnaissance and drilling 19 exploratory test borings to depths ranging from between 15 and 50 feet with a truck-mounted Mobile B-53 truck mounted drill rig. In addition, three percolation tests were performed in borings B19 (P1), B16 (P3), and B18 (P2). P1 was tested at a depth of 20 feet prior to advancing boring B19 to the maximum depth drilled of 50 feet.

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 A4.24.

Boring locations were located in the field by measuring/taping offsets from existing site features shown on the site plan. Ground surface elevations at boring locations were estimated using the Topographic Plan provided by Group 70 International, Inc. The accuracy of the boring locations shown on Plate A2.2 and the surface elevations shown on the boring logs are therefore approximate, in accordance with the field methods used.

SOIL SAMPLING

Representative and bulk soil samples, as well as core samples of rock, 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. The number of blows required to drive the sampler the final 12 inches are recorded at the appropriate depths on the boring logs.

Core samples were obtained by drilling with an NX core barrel having an inside diameter of 2.1 inches. Recovery percentages for each core run are shown on the enclosed Boring Log. The rock quality designation (RQD) for the core run is also shown on the Boring Log. 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.

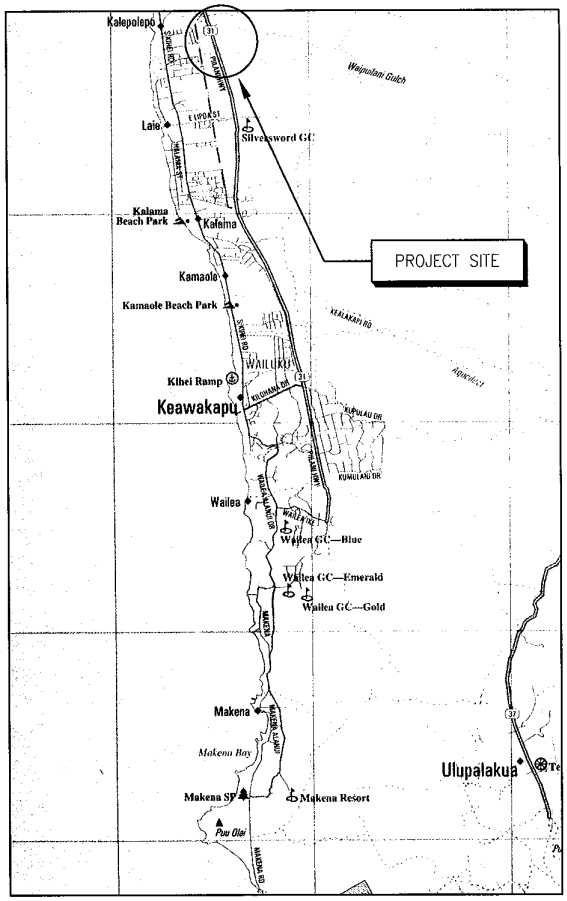
The following is a general correlation between RQD percentages and rock quality.

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.

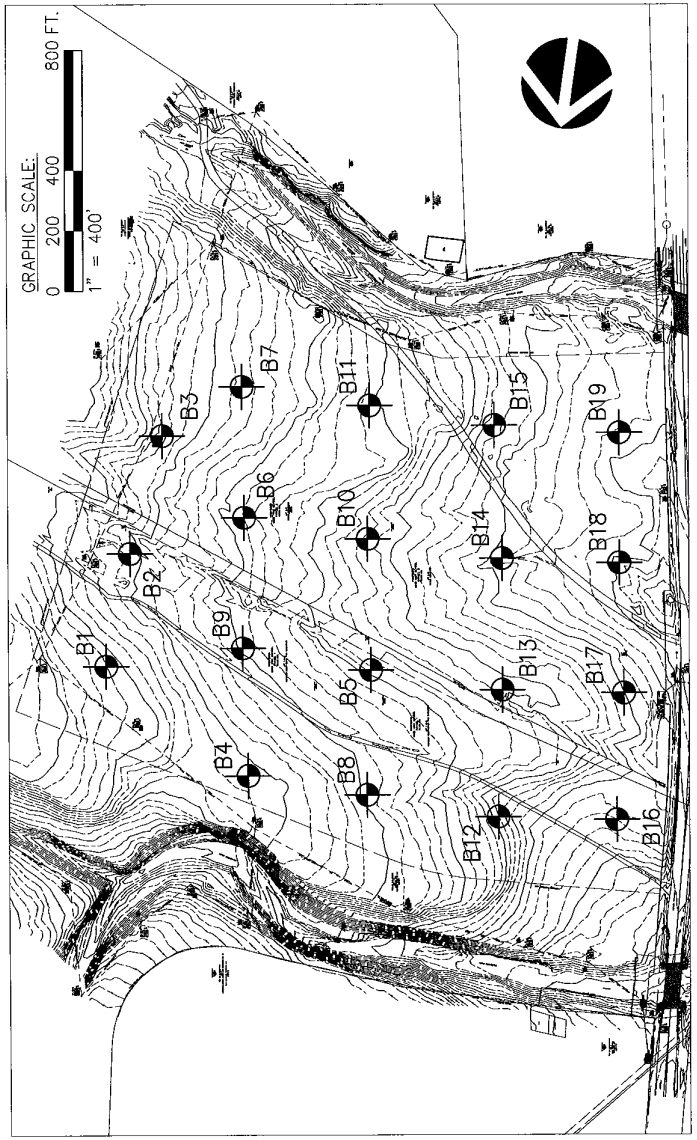
PERCOLATION TESTING

Percolation tests were performed in general accordance with State Department of Health guidelines. The approximate test hole locations are shown on Plate A2.2, and the test results are shown on Plates A5.1 through A5.3.



Reference: Hawaii Atlas & Gazetteer, Topo Maps of the Entire State by DeLorme (1999)

W.O. 09-4797	Kihei High School
Hirata & Associates, Inc.	LOCATION MAP Plate A2.1



BORING LOCATION PLAN

Plate A2.2

Kihei High School

W.O. 09-4797

Hirata & Associates, Inc.

LEGEND:

Approximate location of borings

Reference: Topographic Map provided by Group 70 International, Inc.

MAJOR DIVISIONS			GROUP SYMBOLS		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 low to medium plasticity, gravelly clays, sandy clays, silty clays, 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 soils.
					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	NX / 4" Coring	Water Level

W.O. 09-4784

Kihei High School

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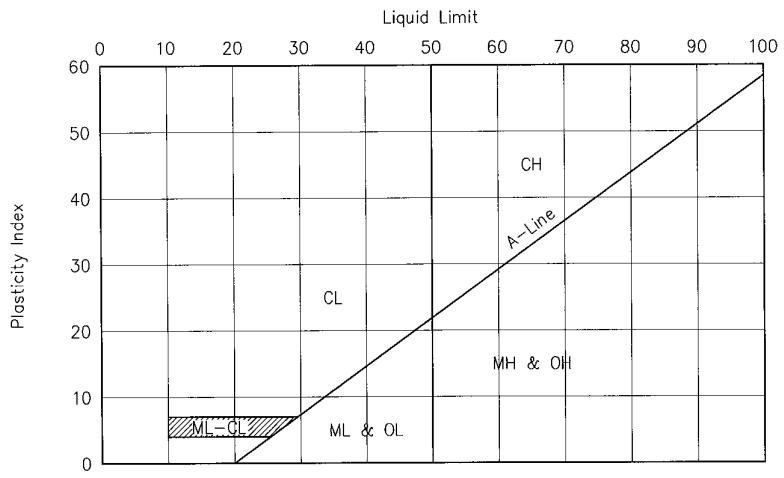
BORING LOG LEGEND

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 gravel 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 (0.074 mm) 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)

W.O. 09-4797	Kihei High School
Hirata & Associates, Inc.	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	Advanced state of decomposition resulting in plastic soils. Rock fabric and structure completely destroyed. Large volume change.

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

W.O. 09-4797	Kihei High School
Hirata & Associates, Inc.	ROCK WEATHERING CLASSIFICATION SYSTEM Plate A3.3

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B1 DRIVING WT. 140 lb. START DATE 08/04/09
SURFACE ELEV. 102±* DROP 30 in. END DATE 08/04/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			10/No Penetration			Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
			10/No Penetration			HIGHLY WEATHERED BASALT (WH) – Light brown, dense to medium hard.
5						SLIGHTLY WEATHERED BASALT (WS) – Gray, fractured, hard. Begin NX coring at 5 feet. 93% Recovery from 5 to 10 feet. RQD = 50%
10						100% Recovery from 10 to 15 feet. RQD = 51% Slightly vesicular from 10 feet.
15						88% Recovery from 15 to 20 feet. RQD = 38% Clinker from 17 to 18 feet.
20						End boring at 20 feet. Neither groundwater nor seepage water encountered. * Elevations based on Topographic Survey provided by Group 70 International, Inc.
25						
30						

Plate B4.1

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B2 DRIVING WT. 140 lb. START DATE 08/03/09
SURFACE ELEV. 91± DROP 30 in. END DATE 08/03/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			10/No Penetration			Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
5						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, fractured, hard. Begin NX coring at 2.5 feet. 87% Recovery from 2.5 to 7.5 feet. RQD = 83% 96% Recovery from 7.5 to 12.5 feet. RQD = 91% 97% Recovery from 12.5 to 17.5 feet. RQD = 44%
10						
15						HIGHLY WEATHERED BASALT (WH) – Grayish to reddish brown, vesicular, fractured, medium hard. 0% Recovery from 17.5 to 20 feet. RQD = 0%
20						End boring at 20 feet. Neither groundwater nor seepage water encountered.
25						
30						

Plate B4.2

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B3 DRIVING WT. 140 lb. START DATE 07/22/09
SURFACE ELEV. 95± DROP 30 in. END DATE 07/22/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			100/8"	67	14	Sandy SILT (ML) – Reddish brown, moist, stiff, with cobbles and boulders.
			10/No Penetration			SLIGHTLY WEATHERED BASALT (WS) – Gray, hard. Begin NX coring at 3 feet. 100% Recovery from 3 to 8 feet RQD = 100%
5						
						100% Recovery from 8 to 13 feet RQD = 100%
10						
						100% Recovery from 13 to 18 feet RQD = 98%
15						
						End boring at 18 feet.
20						Neither groundwater nor seepage water encountered.
25						
30						Plate B4.3

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B4 DRIVING WT. 140 lb. START DATE 08/05/09
SURFACE ELEV. 91± DROP 30 in. END DATE 08/05/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			10/No Penetration			Sandy SILT (ML) – Reddish brown, moist, stiff, with cobbles and boulders.
						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, slightly fractured, hard. Begin NX coring at 3 feet. 100% Recovery from 3 to 8 feet RQD = 100%
5						
						100% Recovery from 8 to 13 feet RQD = 88%
10						
						100% Recovery from 13 to 15 feet RQD = 100%
15						End boring at 15 feet.
20						Neither groundwater nor seepage water encountered.
25						
30						Plate B4.4

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B5 DRIVING WT. 140 lb. START DATE 08/04/09

SURFACE ELEV. 68± DROP 30 in. END DATE 08/04/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Sandy SILT (ML) – Reddish brown, moist, stiff, with cobbles.
			64/6"		12	HIGHLY WEATHERED BASALT (WH) – Brown, dense to medium hard.
5						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, fractured, hard. Begin NX coring at 3 feet. 95% Recovery from 3 to 8 feet RQD = 45% 100% Recovery from 8 to 13 feet RQD = 70%
10						
15						100% Recovery from 13 to 18 feet RQD = 70%
						HIGHLY WEATHERED BASALT (WH) – Brown, dense to medium hard. 58% Recovery from 18 to 20 feet RQD = 50%
20						End boring at 20 feet.
25						Neither groundwater nor seepage water encountered.
30						

Plate B4.5

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B6 DRIVING WT. 140 lb. START DATE 07/22/09

SURFACE ELEV. 78± DROP 30 in. END DATE 07/22/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
			57/6"	70	11	HIGHLY WEATHERED BASALT (WH) – Brown, dense to medium hard.
			50/3"	No Recovery		
5						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, slightly fractured, hard. Begin NX coring at 5 feet. 100% Recovery from 5 to 10 feet RQD = 95%
10						27% Recovery from 10 to 15 feet RQD = 27%
						HIGHLY WEATHERED BASALT (WH) – Reddish brown, moist, dense.
15			78		48	
20			86			
						End boring at 21 feet.
25						Neither groundwater nor seepage water encountered.
30						

Plate B4.6

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B7 DRIVING WT. 140 lb. START DATE 07/22/09
SURFACE ELEV. 87± DROP 30 in. END DATE 07/22/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
			81/10"	67	11	HIGHLY WEATHERED BASALT (WH) – Light brown, dense to medium hard.
5						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly fractured, hard. Begin NIX coring at 5 feet. 100% Recovery from 5 to 10 feet RD = 100%
10						100% Recovery from 10 to 15 feet RD = 98%
15						100% Recovery from 15 to 20 feet RD = 100%
20						End boring at 20 feet.
25						Neither groundwater nor seepage water encountered.
30						

Plate B4.7

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B8 DRIVING WT. 140 lb. START DATE 08/05/09
SURFACE ELEV. 79± DROP 30 in. END DATE 08/05/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
			50/6"	67	13	HIGHLY WEATHERED BASALT (WH) – Light brown, dense to medium hard.
5						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly fractured, hard. Begin NX coring at 4 feet. 98% Recovery from 4 to 8 feet RQD = 98%
10						100% Recovery from 8 to 13 feet RQD = 70%
15						100% Recovery from 13 to 15 feet RQD = 100%
20						End boring at 15 feet.
25						Neither groundwater nor seepage water encountered.
30						

Plate B4.8

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B9 DRIVING WT. 140 lb. START DATE 08/04/09
SURFACE ELEV. 80± DROP 30 in. END DATE 08/04/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
			50/3"		12	HIGHLY WEATHERED BASALT (WH) – Light brown, fractured, dense to medium hard.
5						Begin NX coring at 4 feet. 81% Recovery from 4 to 8 feet. RQD = 56%
						SLIGHTLY WEATHERED BASALT (WS) – Gray, fractured, hard. 88% Recovery from 8 to 13 feet RQD = 80%
10						
						MODERATELY WEATHERED BASALT (WM) – Grayish brown, vesicular, highly fractured, medium hard.
15						53% Recovery from 13 to 18 feet RQD = 0%
						75% Recovery from 18 to 20 feet. RQD = 0%
20						End boring at 20 feet.
25						Neither groundwater nor seepage water encountered.
30						

Plate B4.9

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B10 DRIVING WT. 140 lb. START DATE 07/30/09
SURFACE ELEV. 64± DROP 30 in. END DATE 07/31/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles.
			10/No Penetration			SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, highly fractured, hard. Begin NX coring at 2 feet. 97% Recovery from 2 to 7 feet RQD = 48%
5						
						HIGHLY WEATHERED BASALT (WH) – Brown, vesicular, fractured, medium hard. 13% Recovery from 7 to 12 feet RQD = 10%
10						
						42% Recovery from 12 to 17 feet RQD = 0%
15						
						0% Recovery from 17 to 22 feet RQD = 0%
20			63		10	
						78% Recovery from 23.5 to 28.5 feet RQD = 38%
25						
						MODERATELY WEATHERED BASALT (WM) – Gray, vesicular, fractured, medium hard to hard. 98% Recovery from 28.5 to 33.5 feet. RQD = 47%
30						

Plate B4.10

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B10 (continued) DRIVING WT. 140 lb. START DATE 07/30/09
SURFACE ELEV. 64± DROP 30 in. END DATE 07/31/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						60% Recovery from 33.5 to 38.5 feet. RQD = 10% Highly fractured from 33.5 feet.
35						
40						End boring at 38.5 feet.
45						Neither groundwater nor seepage water encountered.
50						
55						
60						

Plate B4.11

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B11 DRIVING WT. 140 lb. START DATE 07/22/09
SURFACE ELEV. 72± DROP 30 in. END DATE 07/23/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
5						HIGHLY WEATHERED BASALT (WH) – Brown, highly fractured, medium hard. Begin NX coring at 2 feet. 94% Recovery from 2 to 5 feet. RQD = 0%
10						SLIGHTLY WEATHERED BASALT (WS) – Gray, slighty fractured, hard. 100% Recovery from 5 to 10 feet. RQD = 95% 88% Recovery from 10 to 15 feet. RQD = 73% Fractured from 13 feet. 100% Recovery from 15 to 19 feet. RQD = 54%
15						
20						End boring at 19 feet.
25						Neither groundwater nor seepage water encountered.
30						

Plate B4.12

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B12 DRIVING WT. 140 lb. START DATE 08/06/09
SURFACE ELEV. 58± DROP 30 in. END DATE 08/06/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			80/11"	73	15	Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, slightly fractured, hard. Begin NX coring at 2 feet. 95% Recovery from 2 to 7.5 feet. RQD = 94%
5						100% Recovery from 7.5 to 12.5 feet. RQD = 100%
10						90% Recovery from 12.5 to 15 feet. RQD = 63%
15						End boring at 15 feet.
20						Neither groundwater nor seepage water encountered.
25						
30						

Plate B4.13

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B13 DRIVING WT. 140 lb. START DATE 07/30/09
SURFACE ELEV. 60± DROP 30 in. END DATE 07/30/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
			50/4"		13	HIGHLY WEATHERED BASALT (WH) – Brown, dense to medium hard.
						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, slightly fractured, hard. Begin NX coring at 4 feet. 100% Recovery from 4 to 8 feet. RQD = 100%
5						100% Recovery from 8 to 13 feet. RQD = 88%
10						88% Recovery from 13 to 18 feet. RQD = 58%
15						MODERATELY WEATHERED BASALT (WM) – Grayish brown, vesicular, highly fractured, medium hard to hard.
20						77% Recovery from 18 to 23 feet. RQD = 12%
						Reddish brown color from 21.5 to 25.5 feet.
25						87% Recovery from 23 to 28 feet. RQD = 12%
30						87% Recovery from 28 to 33 feet. RQD = 18%

Plate B4.14

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B13 (continued) DRIVING WT. 140 lb. START DATE 07/30/09
SURFACE ELEV. 60± DROP 30 in. END DATE 07/30/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						
						End boring at 33 feet.
35						Neither groundwater nor seepage water encountered.
40						
45						
50						
55						
60						

Plate B4.15

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B14 DRIVING WT. 140 lb. START DATE 07/20/09
SURFACE ELEV. 48± DROP 30 in. END DATE 07/21/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
5						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, fractured, hard. Begin NX coring at 2 feet. 88% Recovery from 2 to 7 feet. RQD = 54% 100% Recovery from 7 to 10 feet. RQD = 82%
10			48		36	HIGHLY WEATHERED BASALT (WH) – Reddish brown, moist, dense to medium hard.
15			50/3"		23	
20						MODERATELY WEATHERED BASALT (WM) – Gray, vesicular, fractured, hard. 94% Recovery from 15.5 to 20.5 feet. RQD = 72% 100% Recovery from 20.5 to 25.5 feet. RQD = 92%
25						100% Recovery from 25.5 to 30.5 feet. RQD = 93%
30						

Plate B4.16

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B14 (continued) DRIVING WT. 140 lb. START DATE 07/20/09
SURFACE ELEV. 48± DROP 30 in. END DATE 07/21/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						25% Recovery from 30.5 to 35.5 feet. RQD = 25%
35			88		25	HIGHLY WEATHERED BASALT (WH) – Gray, moist, dense to medium hard. 47% Recovery from 38 to 43 feet. RQD = 20%
40						
45						MODERATELY WEATHERED BASALT (WM) – Gray, slightly vesicular, fractured, medium hard to hard. 93% Recovery from 43 to 48 feet. RQD = 51%
50						End boring at 48 feet. Neither groundwater nor seepage water encountered.
55						
60						

Plate B4.17

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B15 DRIVING WT. 140 lb. START DATE 07/29/09
SURFACE ELEV. 55± DROP 30 in. END DATE 07/29/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			56/6"			Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
5						SLIGHTLY WEATHERED BASALT (WS) – Gray, fractured, hard. Begin NX coring at 2 feet. 100% Recovery from 2 to 7 feet. RQD = 68% 88% Recovery from 7 to 12 feet. RQD = 72%
10						
15						95% Recovery from 12 to 17 feet. RQD = 72% 25% Recovery from 17 to 22 feet. RQD = 72%
20						HIGHLY WEATHERED BASALT (WH) – Grayish brown, highly vesicular, highly fractured, medium hard to hard. 0% Recovery from 22 to 27 feet.
25						
30						20% Recovery from 27 to 32 feet. RQD = 7%

Plate B4.18

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B15 (continued) DRIVING WT. 140 lb. START DATE 07/29/09
SURFACE ELEV. 55± DROP 30 in. END DATE 07/29/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						53% Recovery from 32 to 37 feet. RQD = 30%
35						MODERATELY WEATHERED BASALT (WM) – Gray, vesicular, fractured, medium hard to hard. 85% Recovery from 37 to 42 feet. RQD = 45%
40						98% Recovery from 42 to 47 feet. RQD = 98%
45						
50						End boring at 47 feet. Neither groundwater nor seepage water encountered.
55						
60						

Plate B4.19

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B16 DRIVING WT. 140 lb. START DATE 08/06/09
SURFACE ELEV. 46± DROP 30 in. END DATE 08/06/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			27	63	18	Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
			35	67	20	
5			10/No Penetration			HIGHLY WEATHERED BASALT (WH) – Brown to reddish brown, moist, dense to medium hard.
10			93	Lost Recovery		
15			98/9"	87	12	
			50/2"		18	
20						End boring at 20 feet. Neither groundwater nor seepage water encountered.
25						
30						

Plate B4.20

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B17 DRIVING WT. 140 lb. START DATE 07/23/09
SURFACE ELEV. 50± DROP 30 in. END DATE 07/23/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			10/No Penetration			Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
5						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly fractured, hard. Begin NX coring at 3 feet. 98% Recovery from 3 to 8 feet. RQD = 98%
10						93% Recovery from 8 to 13 feet. RQD = 85%
15						100% Recovery from 13 to 18 feet. RQD = 100%
20						End boring at 18 feet.
25						Neither groundwater nor seepage water encountered.
30						

Plate B4.21

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B18 DRIVING WT. 140 lb. START DATE 07/15/09
SURFACE ELEV. 40± DROP 30 in. END DATE 07/15/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			10/No Penetration			Sandy SILT (ML) – Reddish brown, moist, medium stiff, with cobbles and boulders.
5			60/4"	Lost Recovery		HIGHLY WEATHERED BASALT (WH) – Gray, medium hard.
10						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, slightly fractured, hard. Begin NX coring at 6 feet. 100% Recovery from 6 to 10 feet. RQD = 88% 92% Recovery from 10 to 15 feet. RQD = 88%
15						HIGHLY WEATHERED BASALT (WH) – Grayish brown, vesicular, highly fractured, dense to medium hard. 5% Recovery from 15 to 20 feet. RQD = 0%
20						End boring at 20 feet.
25						Neither groundwater nor seepage water encountered.
30						

Plate B4.22

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B19 DRIVING WT. 140 lb. START DATE 07/16/09
SURFACE ELEV. 42± DROP 30 in. END DATE 07/20/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			15	98	3	Silty SAND (SM) – Grayish brown, slightly moist, medium dense, with cobbles.
			16	103	3	
5			50/6"	80	16	Clayey SILT (ML) – Reddish brown, moist, medium stiff.
10						SLIGHTLY WEATHERED BASALT (WS) – Gray, slightly vesicular, fractured, hard. Begin NX coring at 7 feet. 45% Recovery from 7 to 12 feet. RQD = 36% Highly fractured from 10 to 12 feet. 100% Recovery from 12 to 17 feet. RQD = 98% 100% Recovery from 17 to 22 feet. RQD = 69%
15						
20						
25			99/8"			HIGHLY WEATHERED BASALT (WH) – Reddish brown, vesicular, highly fractured, medium hard. 17% Recovery from 22 to 25 feet. RQD = 0%
30						

Plate B4.23

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 09-4797

BORING NO. B19 (continued) DRIVING WT. 140 lb. START DATE 07/29/09
SURFACE ELEV. 42± DROP 30 in. END DATE 07/29/09

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
30						MODERATELY WEATHERED BASALT (WM) – Gray, vesicular, fractured, hard. 77% Recovery from 30 to 35 feet. RQD = 13%
35						70% Recovery from 35 to 40 feet. RQD = 20%
40						100% Recovery from 40 to 45 feet. RQD = 58%
45						100% Recovery from 45 to 50 feet. RQD = 88%
50						End boring at 50 feet.
55						Neither groundwater nor seepage water encountered.
60						

Plate B4.24

SITE EVALUATION/PERCOLATION TEST

Date/Time: August 3, 2009
Test performed by: Hirata & Associates, Inc.
Owner:
Tax Map Key:
Test Number: P1 (boring B19)

Elevation: ~42± ft.
Depth to Groundwater Table: 50 ft. below grade (based on final depth of boring)
Depth to Bedrock (if observed): 6.5 ft. below grade
Diameter of Hole: 3 in.
Depth to Hole Bottom: 20 ft. below grade

Depth (inches)	Soil Profile (Color, texture, other)
0 - 54	Grayish brown silty sand
54 - 78	Reddish brown clayey silt
78 - 240	Gray slightly weathered basalt

PERCOLATION READINGS

Time 12 inches of water to seep away: <30 min.
Time 12 inches of water to seep away: <30 min.

✓ For percolation tests in sandy soils, record time intervals and water drops every 10 minutes for at least 1 hour.

___ For percolation tests in non-sandy soils, presoak the test hole for at least 4 hours. Record time intervals and water drops at least every 10 minutes for 1 hour; or if the time for the first 6 inches to seep away is greater than 30 minutes, record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

Time interval	Drop in inches	Time interval	Drop in inches
10 min.	11-1/16	10 min.	7-1/2
10 min.	8-1/4	10 min.	7-3/4
10 min.	8	10 min.	7-1/2
10 min.	7-3/4	10 min.	7-9/16

Percolation Rate (time/final water level drop): 1.32 min/in

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable.

RICK I.K. YOSHIDA
LICENSED PROFESSIONAL ENGINEER
No. 11118-C
HAWAII, U.S.A.

Engineer's Signature/Stamp

SITE EVALUATION/PERCOLATION TEST

Date/Time: August 3, 2009
Test performed by: Hirata & Associates, Inc.
Owner:
Tax Map Key:
Test Number: P2 (Boring B18)

Elevation: ~40± ft.
Depth to Groundwater Table: >20 ft. below grade
Depth to Bedrock (if observed): 3 ft. below grade
Diameter of Hole: 3 in.
Depth to Hole Bottom: 20 ft. below grade

Depth (inches)	Soil Profile (Color, texture, other)
0 - 36	Reddish brown sandy silt
36 - 174	Gray slightly weathered basalt.
174 - 240	Grayish brown highly weathered basalt

PERCOLATION READINGS

Time 12 inches of water to seep away: <30 min.
Time 12 inches of water to seep away: <30 min.

___ For percolation tests in sandy soils, record time intervals and water drops every 10 minutes for at least 1 hour.

___ For percolation tests in non-sandy soils, presoak the test hole for at least 4 hours. Record time intervals and water drops at least every 10 minutes for 1 hour; or if the time for the first 6 inches to seep away is greater than 30 minutes, record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

Time interval	Drop in inches	Time interval	Drop in inches
* See note below			

Percolation Rate (time/final water level drop): NA min/in

* Water was pumped into the test hole at a rate of approximately 4.4 gallons per minute for a period of about 30 minutes. A measurable head could not be maintained.

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable.

RICK I.K. YOSHIDA
LICENSED PROFESSIONAL ENGINEER
No. 11118-C
HAWAII, U.S.A.

Engineer's Signature/Stamp

SITE EVALUATION/PERCOLATION TEST

Date/Time: August 6, 2009
Test performed by: Hirata & Associates, Inc.
Owner:
Tax Map Key:
Test Number: P3 (boring B16)

Elevation: ~46± ft.
Depth to Groundwater Table: >20 ft. below grade
Depth to Bedrock (if observed): 4.5 ft. below grade
Diameter of Hole: 3 in.
Depth to Hole Bottom: 20 ft. below grade

Depth (inches)	Soil Profile (Color, texture, other)
0 - 54	Reddish brown sandy silt
54 - 240	Brown to reddish brown highly weathered basalt

PERCOLATION READINGS

Time 12 inches of water to seep away: <30 min.
Time 12 inches of water to seep away: <30 min.

✓ For percolation tests in sandy soils, record time intervals and water drops every 10 minutes for at least 1 hour.

___ For percolation tests in non-sandy soils, presoak the test hole for at least 4 hours. Record time intervals and water drops at least every 10 minutes for 1 hour; or if the time for the first 6 inches to seep away is greater than 30 minutes, record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

Time interval	Drop in inches	Time interval	Drop in inches
10 min.	7-3/4	10 min.	7-1/4
10 min.	8	10 min.	7-3/4
10 min.	8-1/4	10 min.	7-1/2
10 min.	7-3/4	10 min.	7-9/16

Percolation Rate (time/final water level drop): 1.32 min/in

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable.

RICK I.K. YOSHIDA
LICENSED PROFESSIONAL ENGINEER
No. 11118-C
HAWAII, U.S.A.

Engineer's Signature/Stamp

Plate A5.3

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 and sieve analysis testing. The final classifications are shown at the appropriate locations on the Boring Logs, Plates A4.1 through A4.24.

MOISTURE-DENSITY

Representative samples were tested for field moisture content and dry unit weight. The dry unit weight was determined in pounds per cubic foot while the moisture content was determined as a percentage of dry weight. Samples were obtained using a 3-inch O.D. split tube sampler. Test results are shown at the appropriate depths on the Boring Logs, Plates A4.1 through A4.24.

CONSOLIDATION

A representative samples was tested for its consolidation characteristics. The test sample was 2.42 inches in diameter and 1 inch high. Porous stones were placed in contact with the top and bottom of the test sample to permit addition and release of pore fluid. Loads were then applied in several increments in a geometric progression, and the resulting deformations recorded at selected time intervals. Test results are plotted on the Consolidation Test Report, Plate B2.1.

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 B3.1 and B3.2.

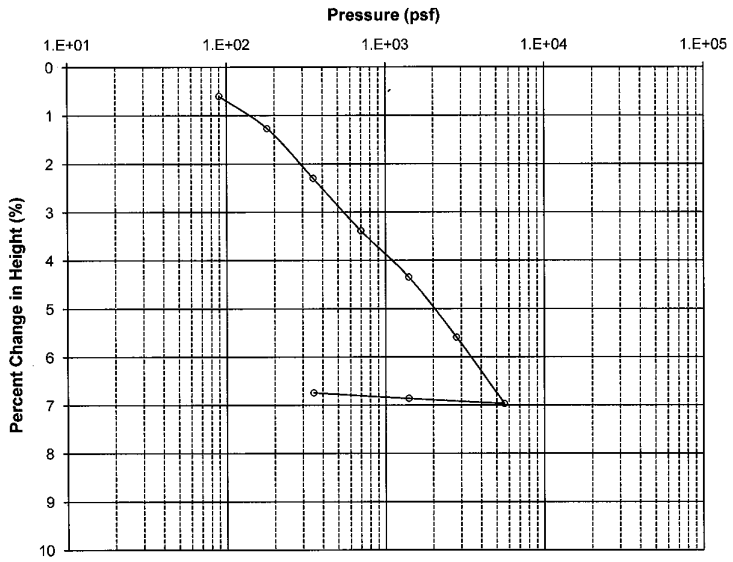
PROCTOR TEST

Modified Proctor tests were performed on bulk samples in general accordance with ASTM D 1557. The test is used to determine the optimum moisture content at which the soil compacts to 100 percent density. Results are shown on Plates B4.1 through B4.4.

SIEVE ANALYSIS

Sieve analysis tests were conducted on bulk samples in general accordance with ASTM D 422. The test is used to classify granular soils. Test results are presented on Plate B5.1.

Consolidation Test Results



Sample Description

Boring No.: B19 Depth (ft): 3

Soil Description: Grayish brown silty sand

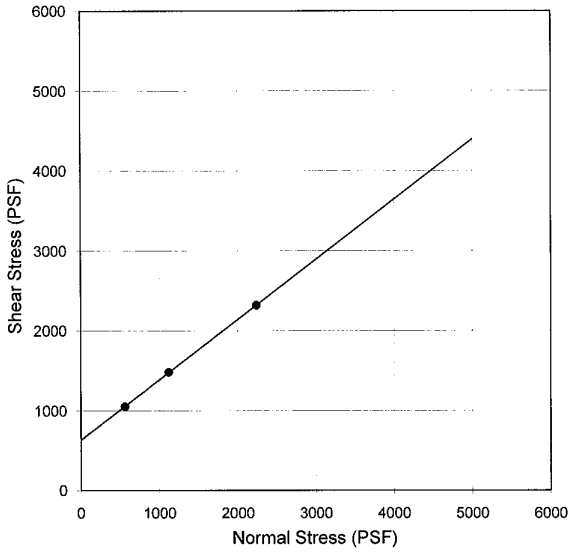
	Moisture Content (%)	Dry Density (pcf)
Initial	3.1	102.5
Final	2.0	109.9

Remark: 8/6/09

W.O. 09-4797	Kihei High School
Hirata & Associates, Inc.	CONSOLIDATION TEST

Plate B2.1

Direct Shear Test Results



Sample Description

Boring No.: B3 Depth (ft): 1

Soil Description: Reddish brown sandy silt

Strength Intercept (C): 633.6 PSF (Peak Strength)

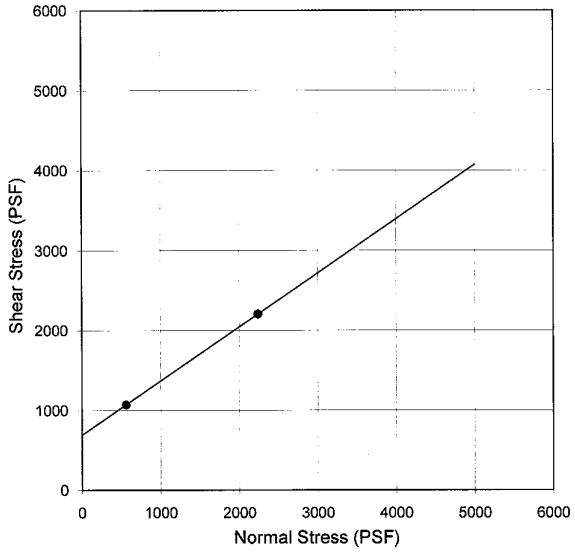
Friction Angle (ϕ): 37.0 DEG (Peak Strength)

Remark: 08/06/09

W.O. 09-4797	Kihei High School
Hirata & Associates, Inc.	DIRECT SHEAR TEST

Plate B3.1

Direct Shear Test Results



Sample Description

Boring No.: B5 Depth (ft): 1
Soil Description: Brown highly weathered basalt
Strength Intercept (C): 692.2 PSF (Peak Strength)
Friction Angle (ϕ): 34.0 DEG (Peak Strength)

Remark: 8/14/09

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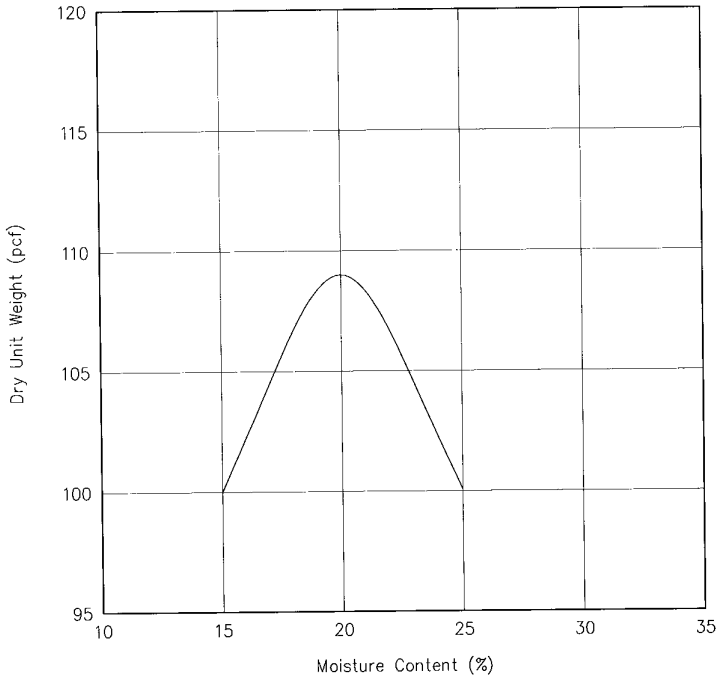

Soil Data
Location: Boring B4 at 0.5 feet.
Description: Reddish brown sandy silt

Test Results
Maximum Dry Density: 109 pcf
Optimum Moisture Content: 20%

W.O. 09-4797	Kihei High School
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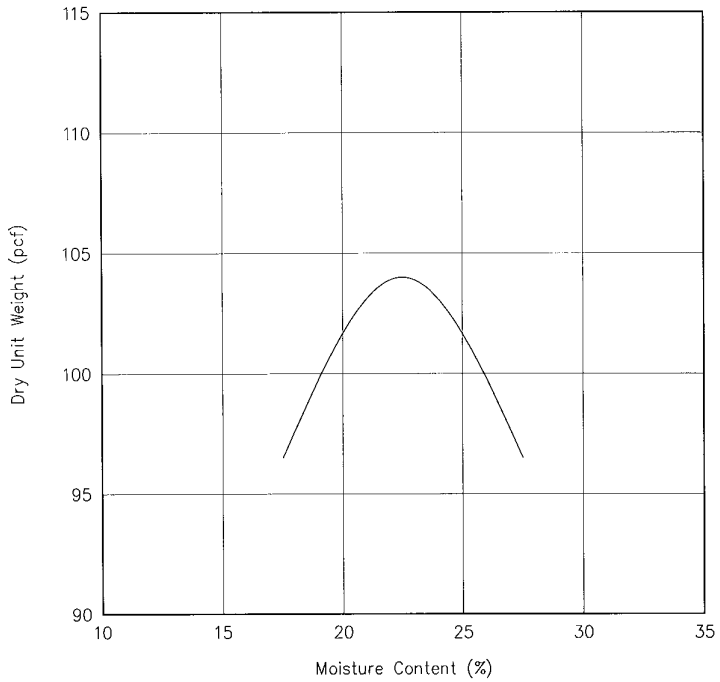


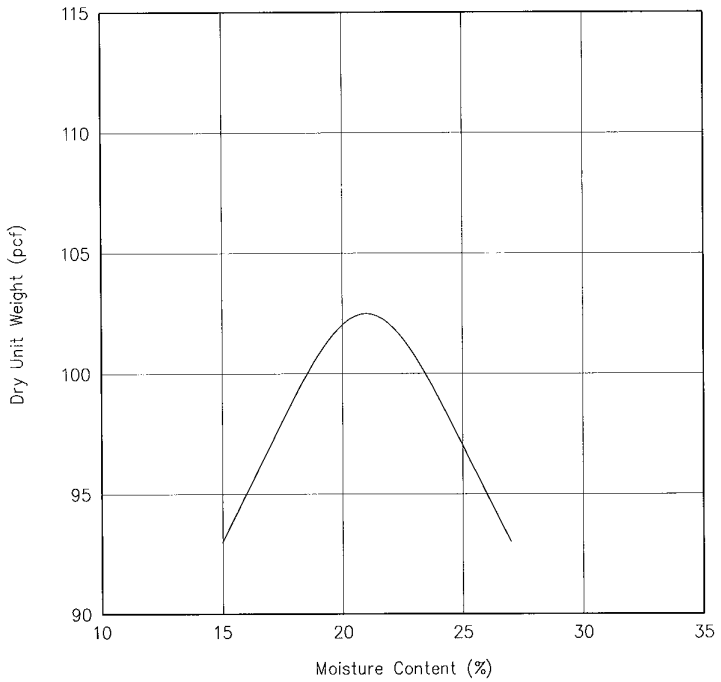
Soil Data

Location: Boring B6 at 0.5 feet.
Description: Reddish brown sandy silt

Test Results

Maximum Dry Density: 104 pcf
Optimum Moisture Content: 22.5%

W.O. 09-4797	Kihei High School
Hirata & Associates, Inc.	MODIFIED PROCTOR CURVE Plate B4.2



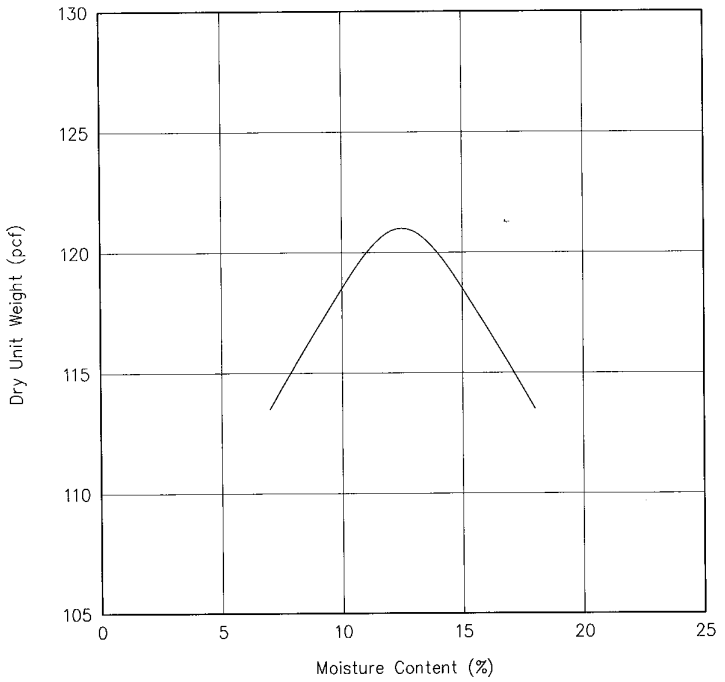
Soil Data

Location: Boring B17 at 0.5 feet.
Description: Reddish brown sandy silt

Test Results

Maximum Dry Density: 102.5 pcf
Optimum Moisture Content: 21%

W.O. 09-4797	Kihei High School
Hirata & Associates, Inc.	MODIFIED PROCTOR CURVE Plate B4.3



Soil Data

Location: Boring B19 at 0.5 feet.

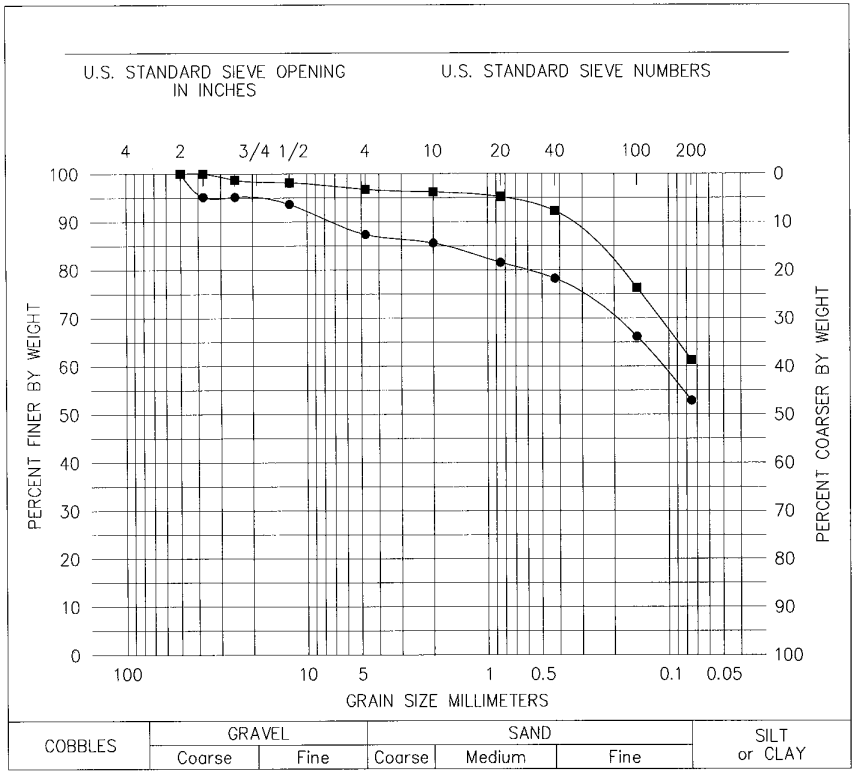
Description: Grayish brown silty sand

Test Results

Maximum Dry Density: 121 pcf

Optimum Moisture Content: 12.5%

W.O. 09-4797	Kihei High School
Hirata & Associates, Inc.	MODIFIED PROCTOR CURVE Plate B4.4



● Sample #1	Location:	Boring B4 at 0.5 feet
	Description:	Reddish brown sandy silt
■ Sample #2	Location:	Boring B11 at 1 foot
	Description:	Reddish brown sandy silt

W.O. 09-4797	Kihei High School
Hirata & Associates, Inc.	GRADATION CURVES Plate B5.1