NANAKULI ELEMENTARY SCHOOL - FIRST INCREMENT
16 CLASSROOMS AND SITEWORK
PRELIMINARY SOIL REPORT

D.A.G.S. JOB NO. 02-16-6809.2
NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

To:
DIVISION OF PUBLIC WORKS
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
STATE OF HAWAII

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

FEBRUARY 3, 1976

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • TEL. 737-7931

WALTER LUM
EDWARD WATANABE
EZRA KOIKE
WALLACE WAKAHIRO

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FILE

March 31, 1976

DIVISION OF PUBLIC WORKS
Department of Accounting and General Services
State of Hawaii
P. O. Box 119
Honolulu, Hawaii 96810

RECEIVED
APR 2 1976
WILSON, OKAMOTO & ASSOCIATES

Gentlemen:

Subject: Addendum #1 to
Nanakuli Elementary School - First Increment
Preliminary Soil Report
Dated February 3, 1976
D.A.G.S. Job No. 02-16-6809.2
Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

As requested by Wilson, Okamoto & Associates, Structural Engineers for the project, additional guidelines for retaining wall design are being submitted as follows:

1. Lateral earth pressures for sloping backfill may be according to earth pressure charts by Terzaghi & Peck or other similar accepted theory.

2. Estimated allowable bearing values of 3,000 p.s.f. may be used for wall foundations resting on dense or hard natural ground or on compacted select fill that extends thru the surface clay (CH-CL) soils. Toe pressures may be increased about 1/3 where a triangular pressure diagram is used along the base of the wall and a lesser increase for a trapezoidal pressure diagram.

3. For sliding resistance between the base and subgrade, a coefficient of friction of 0.40 plus an ultimate cohesion of 400 p.s.f. may be used where the subgrade is sandy-silty material and the base of the wall is well drained.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Edward K. Watanabe
Edward K. Watanabe

EKW:es

cc: Wilson, Okamoto & Associates ✓

O - H.O.
C - Wakano

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

WALTER LUM
EDWARD WATANABE
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3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • TEL. 737-7931

February 3, 1976

DIVISION OF PUBLIC WORKS
Department of Accounting and General Services
State of Hawaii
P. O. Box 119
Honolulu, Hawaii 96810

Gentlemen:

Subject: Nanakuli Elementary School - First Increment
16 Classrooms and Sitework
Preliminary Soil Report
(for site grading and foundation design purposes)
D.A.G.S. Job No. 02-16-6809.2
Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

Transmitted herewith is our soil exploration report for site grading and foundation design considerations for the proposed Nanakuli Elementary School, First Increment, 16 Classrooms and Sitework at Nanakuli, Oahu, Hawaii.

This report includes a Boring Location Sketch, boring logs, laboratory tests results, general site grading and foundation design guidelines and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Edward K. Watanabe
Edward K. Watanabe

CR/EKW:sa

C O N T E N T S

NANAKULI ELEMENTARY SCHOOL - FIRST INCREMENT
16 CLASSROOMS AND SITEWORK
PRELIMINARY SOIL REPORT

D.A.G.S. JOB NO. 02-16-6809.2
NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

SCOPE OF EXPLORATION

The purpose of this exploration was to evaluate general soil conditions for site grading and foundation design considerations for the proposed Nanakuli Elementary School, First Increment, 16 Classrooms and Sitework at Nanakuli, Oahu, Hawaii.

This report includes field exploration, laboratory tests, general design guidelines for site grading and foundations and limitations.

FIELD EXPLORATION

Ten borings were made at the site (B-8 thru B-17). The approximate locations of these borings are shown on the Boring Location Sketch.

The borings were made by MAS Drilling Co. and logged by Walter Lum Associates, Inc.

The borings were made with 3-in. diameter augers using a finger-type bit. Soil samples were recovered with 2-1/2-in. O.D. thin-wall tubes and a 2-in. standard split spoon sampler driven with a 140-lb hammer falling 30 inches.

Also attached are logs of 7 borings (B-1 thru B-7) previously made for "Nanakuli Elementary School - First Increment," September 20, 1975.

LABORATORY TESTS

Laboratory tests included: natural water content and density, unconfined compression, laboratory vane shear, Atterberg limit, grain-size analysis and CBR.

A summary of the laboratory test results is given in Tables 1A thru 1C.

SOIL CLASSIFICATION SYSTEM

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions given on the boring logs are generally made in accordance with the "Unified Soil Classification System."

GEOLOGIC AND SOIL DESCRIPTIONS BY OTHERS

From a review of geologic literature and the U. S. Soil Conservation Service maps of the area, the soils are generally described by others as follows:

Stearns, H. T. and U. S. Geological Survey, "Geologic and Topographic Map of Island of Oahu," 1938:

Pa - Consolidated noncalcareous material, chiefly older alluvium

U. S. Soil Conservation Service, "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii," August 1972:

LPE - Lualualei extremely stony clay (3 to 35% slopes)
High shrink-swell potential
Unified Soil Classification - CH

GENERAL SITE CONDITIONS

The proposed site is located near the end of Haleakala Avenue about 3,000 ft northeasterly of Farrington Highway.

The site is bordered by Nanakuli High School on the east, an existing paved playcourt on the south and residences on the west. The area to the north, across Haleakala Avenue, is presently part cemetery and part vacant.

A stockpile of soil is located in the northern portion of the site.

A drainageway about 5 to 15 ft deep crosses the northerly third of the site in an east-west direction. The upper or eastern end of the site was filled over when Nanakuli High School was constructed. The drainageway was generally dry during the field exploration.

In general, the site is about 10 to 20 ft lower than the Nanakuli High School grounds along the easterly boundary and about 5 to 15 ft higher than the paved playcourt along the southerly boundary.

Except for the drainageway, the rest of the site is on a gradual slope with gradients of about 5 to 10% down toward the west. The elevation at the site generally varies from about 88 to 126 ft.

The site is generally covered with grass. Some trees and boulders were noted in the drainageway. Loose clusters of boulders were also noted scattered over the remainder of the site.

INTERPRETATION OF SOIL CONDITIONS

From the field explorations and laboratory test results, the soils encountered in the borings may be generally approximated as follows:

Proposed Retaining Walls Along East Boundary
(Boring Nos. 8 thru 11)

Existing fill (mostly "CH" clays) about 0 to 17 ft over a layer about 1 to 2 ft thick of clay (CH-CL) soils underlain by hard, sandy silts (ML soils) or dense, silty sands (SM soils) with cobbles or boulders to about 15 to 20 ft, the depths drilled.

Proposed Retaining Wall Along West Boundary And
16 Classroom Building
(Boring Nos. 12 thru 17)

A thin surface layer about 1 to 2 ft of stiff clay (CH-CL) soils over dense silty sand and gravel with cobbles and boulders (SM, GM soils) to about 7 to 15 ft, the depths drilled.

Water was not noted in the borings during the field explorations.

For more detailed descriptions of soils encountered in the drill holes, refer to the boring logs.

Variations to the above soil and water conditions are to be expected between borings and in localized areas.

DISCUSSION AND RECOMMENDATIONS

The proposed plan for the First Increment is to grade the entire school site and construct retaining walls along the east and west boundaries and a 16-classroom building in the southwest portion of the site.

For general grading of the site, fills of little to about 15 ft and cuts of little to about 10 ft are planned.

Along the east boundary, the toe of the existing fill for Nanakuli High School will be cut back and the slope retained with 2 separate, parallel, stepped-up CRM retaining walls. Cuts from little to about 15 to 20 ft in heights are contemplated. The lower retaining wall will be about 5 ft above finish grade, followed by a 10-ft wide bench; the upper retaining wall will be about 5 ft above the bench with a 5-ft wide swale along the top and a 2 horizontal to 1 vertical slope about 6 ft high up to the existing ground. A portion of the proposed top of slope may be close to the existing tennis practice wall. The existing wall may be subject to creep from the construction of the CRM walls. Some maintenance should be expected.

Along the west boundary, a CRM retaining wall about 2 to 11 ft high is proposed. The wall will retain fills from little to about 5 ft in height above the wall with 3 horizontal to 1 vertical slopes from the top of the wall.

In the southwest portion of the site, a 16-classroom building is proposed. The building will be a 2-story reinforced concrete structure about 50 by 195 ft in plan with 250 kip column loads and 7.0 kips/ft wall loads.

Since the thin layer of surface soils may be expansive, the ideal solution would be to strip and waste the expansive soils that are on the site.

Since stripping and wasting the expansive soils may not be economically practicable, an alternative solution would be to strip the surface expansive soils and use the material to fill the bottom of the gully. The expansive soils should be capped with 3 ft of non-expansive material. Also, the outer slopes of expansive soils should be capped with non-expansive soils.

The more granular soils from areas in cut should be used for backfill under the proposed structures and retaining walls.

The existing drainageway will be filled over. After clearing and grubbing, subdrains should be provided at the bottom of the drainageway and daylighted beyond the toe of the retaining wall. The fill should be placed as soon as practicable to allow the fill soils to settle and lessen future settlements.

If cesspools are encountered during grubbing work, they should be backfilled as recommended under "Cesspools."

Site Grading

In general, the borings indicated a surface layer of clay (CH-CL) soils.

The southerly portion of the site will be mostly in cut, and most of the surface clay (CH-CL) soils can be removed. The northwesterly third of the site may be mostly filled. As much as practicable, the surface clay (CH-CL) soils should be stripped and placed near the bottom layers of the fills in the gully.

Grading work should be done in accordance with the Revised Ordinances of Honolulu, 1969 As Amended and as recommended below:

1. The area should be cleared and grubbed.

2. Surface vegetation and miscellaneous debris, boulder stockpiles, boulder clusters and rubbish should be cleared and removed prior to site filling.

3. Topsoil should be stripped to stiff natural ground and stockpiled for finish grading.

4. Soft pockets and clay (CH) soils encountered during site preparations should be excavated and replaced with select soils compacted in thin lifts.

5. Hard surfaces such as along existing unpaved roads should be scarified down to stiff soils and recompacted to match the density of the surrounding soil.

6. Where fills are proposed on sidehill areas, gullies and natural drainageways, soft soils and loose material at the bottoms and sides should be stripped down to firm soils before the placement of fills.

Subdrains should be placed along the bottoms of natural drainageways with laterals in a herringbone pattern along the sides of the drainageways. Subdrains should be daylighted.

7. The materials used for filling the site should be controlled. In general, expansive clay soils and cobbles larger than 3 in. but less than 6 in. should be kept below 3 ft of finish grade.

   Non-expansive soils (P.I. less than 20) should be used to finish the top 3 ft of fill. Gravel size materials in the fill should not be greater than 3 inches.

   The on-site cobbles and boulders larger than 6 in. should be used to construct the outer slopes of fills along the west boundary of the site beyond the retaining wall.

8. Where clay (CH) soils are used for fills, the following guidelines may be considered:

   a. Where fills are to be placed over clay (CH) soils, the existing surface should be scarified and recompacted on the wet side of optimum.

b. Fills should be constructed in thin lifts on the wet side of optimum to lessen the swell potential of the clay.

c. Fills should be compacted to 90% of ASTM D 1557-70.

d. The clay soils should not be allowed to dry out before placing the next lift.

e. Use of clay (CH) soils in fills on sloping areas or the construction of slopes should be avoided. On-site clay soils should generally be placed in the deeper portions of fills in flat areas and away from the faces of slopes.

9. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level

condition. As the fill is brought up, it should continually be keyed into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

10. For construction of the fill at the lower end of the gully at the westerly side of the site behind the retaining wall, the surface adobe soils should be stripped and replaced with select soils before the construction of the fill.

11. Boulders may be placed along the toe sections of fill slopes beyond the retaining walls and outside of probable building sites. Before placing fills or boulders, the subgrade should be stripped to stiff natural ground and shaped to drain. A layer of select granular material should be placed on the subgrade and the fill or boulders placed on the select material. The void spaces between boulders should be filled with smaller granular material. A blanket of filter material should be placed against the boulders before any earth fills are placed against the boulders. See attached sketch, Figure 1.

12. Fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the ASTM D 1557-70 test method. In roadway areas, the top 2 ft of fill should be compacted to 95% of the maximum density.

13. Provisions to drain the site should be included during and after the completion of filling operations.

Slopes

The grading plans indicate slope heights generally less than 10 ft.

In silty and sandy soils, cut and fill slopes of 2 horizontal to 1 vertical or flatter may generally be considered.

Other general guidelines for slope design are as follows:

1. In general, for slope heights greater than 15 ft, 8-ft wide benches should be placed at height intervals of about 15 ft for the higher slopes. Where adobe soils are used as fill materials, the height of the slopes or fill should be less than 8 ft.

2. To lessen erosion, the runoff from rainstorms should be diverted by berms or ditches away from slopes whenever practicable.

3. The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

4. Slope planting is recommended on cut and fill slopes to lessen erosion.

5. Slope adjustments or other precautions may be necessary if seepage zones or expansive clay pockets are encountered in localized areas.

Siting of Buildings

Buildings and retaining walls should not be located directly over the drainageway, if practicable, to lessen the possible differential settlement effects resulting from the consolidation of the fill over the gully.

To reduce the effects of slope creep, buildings and retaining walls should be kept 15 ft or more away from the tops of slopes.

Parking areas and other facilities that can tolerate settlements may be located over the drainageway.

Foundations

For the proposed 16-Classroom Building at the location indicated on the Boring Location Sketch, spread footings bearing on the dense or hard sandy or silty natural ground, or on well-compacted fill extending thru the surface clay (CH-CL) soils may be considered.

Estimated allowable bearing values of 3,000 p.s.f. may be used on dense or hard sandy or silty natural ground or on well-compacted fill extending thru the surface clay (CH-CL) soils.

Footing excavations along utility trenches should be carried below the bottom of trenches or the footings should be designed to bridge the trench.

Other general guidelines for foundation design are as follows:

1. Surface clay (CH-CL) soils below and 5 ft beyond the perimeter of buildings and beneath retaining wall structures should be removed and replaced with non-expansive soils.

2. Soft spots or pockets of loose material encountered in footing excavations or below the building area should be excavated and replaced with well-graded granular material.

3. Footing excavations should be tamped before pouring concrete.

4. Foundations should be well-tied together with deep grade beams, particularly around the perimeter of the structure.

5. Concrete masonry walls should be supported on deep well-reinforced continuous beam type foundations and the tops of walls should be well-reinforced to reduce the effects of differential settlements. Vertical joints or wall openings extending the full height of the walls may be provided to attempt to control possible cracking.

6. Good surface drainage away from the foundations of structures should be maintained and the site should be graded to prevent the ponding of water.

Concrete Slab on Ground

The surface layer of clay (CH-CL) soils should be removed where concrete slabs on ground are being considered. Backfill under slabs should be select, non-expansive borrow or on-site material compacted in thin lifts.

If practicable, concrete slabs on ground should be placed after the superstructure is constructed and should be separated from grade beams, walls and columns.

If a capillary break is required, 4 in. of well-graded gravel less than 3/4-in. and greater than 1/4-in. in size or some other form of capillary break may be used.

The subgrade should be compacted and shaped to a level surface or to drain, if practicable, and generally should be kept slightly higher than the finish grade on the outside of buildings.

Retaining Walls

Along the east boundary, 2 separate, parallel, stepped-up CRM retaining walls are proposed to retain an existing fill that varies in height from little to about 15 to 20 ft. The wall footing should extend thru the clay (CH-CL) soils down to silty or sandy (SM) soils, or bear on compacted select backfill extending thru the surface clay (CH-CL) soils.

To reduce imposing additional lateral loads and disturbances to the lower retaining wall, the toe of the upper retaining wall should be below an imaginary plane extending upward from the heel of the lower retaining wall at a 1-1/2 horizontal to 1 vertical slope ratio assuming that the backfill is granular material extending thru the surface clay (CH-CL) soils and compacted in thin lifts.

Along the west boundary, a single CRM retaining wall about 2 to 11 ft high will retain fills up to about 16 ft in height (5 ft higher than the top of wall). The fill will slope upward at 3 horizontal to 1 vertical ratios behind the wall. The wall should extend thru the surface clay (CH-CL) soils and bear on the dense silty sand or cobble layer.

Subdrains should be placed behind the walls below the footing levels and should be daylighted at low points.

Fairly well-graded granular material or select granular material should be used for backfilling against walls and compacted in thin lifts.

Retaining walls on slopes tend to creep and tilt. Joints should be intermittently spaced and placed at corners of walls to allow for anticipated tilt and movements.

Assuming a well-drained backfill, walls subjected to lateral earth pressures should be designed to resist estimated soil pressures approximating at-rest conditions as follows:

Walls unrestrained at top - 45 p.c.f. equivalent fluid pressure for walls above the water table.

In addition, lateral pressure due to sloping surcharge or live loads should be included.

The center of pressure should be considered to act somewhat above the lower third of the triangular fluid pressure diagram.

Estimated allowable bearing values of 3,000 p.s.f. may be used for wall foundations resting on dense or hard natural ground or on compacted select fill that extends thru the surface clay (CH-CL) soils. Toe pressures may be increased about 1/3 where a triangular pressure diagram is used along the base of the wall.

For sliding resistance between the base and subgrade, a coefficient of friction of 0.40 may be used provided the subgrade is sandy-silty material and the base of the wall is well drained.

Joint and Connection Details

Some differential settlements are to be expected between the building elements. Joints and connections should be detailed to allow some movements or releveling and adjustments at a later date.

To minimize the wavy surface effects at the ground floor level due to differential settlements or heaving, non-bearing partitions, doors, cabinets, etc., should be designed with loose fits and other precautions taken to allow for some future adjustments or maintenance.

Driveways, sidewalks and entry slabs next to the buildings should be supported on hinged seats that would permit some rotation and maintain a smooth transition to the building.

Roadway and Parking Areas

The surface clay (CH) soils within 2 ft of the finish grades should be removed.

For light automobile traffic and drained subgrade conditions, the roadway pavement section for the general soil conditions may be as follows:

1. Wearing course - 2-in. asphaltic concrete.

2. Base course - 6-in. base course.

3. Subbase course - 6-in. subbase course over a prepared subgrade.

Provisions should be made in the contract documents to allow for local adjustments regarding select borrow subbase and borrow requirements in the field in accordance with the design standards of the City and County of Honolulu. In fill areas, the use of select soils within the top 2 to 3 ft of the subgrade may reduce the thickness of or eliminate the need for the select borrow subbase or borrow courses.

The subgrade should be compacted and shaped to drain. To lessen the ponding of water and softening of the subgrade, weep holes should be placed at subgrade levels thru the walls of the catch basins.

Cesspools

Cesspools may be encountered during the site preparation work. When encountered, cesspools should be flagged and located on the plans. Sludge should be removed from the bottom and the cesspool backfilled with fairly well-graded granular materials. The materials should be placed in thin layers and rammed into place or compacted with vibratory equipment. The top 4 ft of fill should be compacted in 6-in. compacted layers.

Building foundations should be designed to bridge the cesspool or extended to the bottoms of the cesspools.

Field Adjustment

Provisions should be made in the contract documents to allow for local adjustments in the field regarding overexcavation, select borrow, etc.

Utilities

Utilities should be placed after the fills are constructed. Utility lines should be designed with flexible joints, particularly where lines are connected to structures.

Utility line trenches should be daylighted with rock drains to drain water.

Unforeseen Conditions

Because of the variability of soil deposits, site improvements, designs and construction techniques, existing or changed conditions may be encountered that cannot be foreseen with even the most exhaustive studies of site and project conditions. These unforeseen conditions should be recognized when encountered and then evaluated so that the designs or the construction methods may be modified accordingly, if necessary.

Unforeseen or changed or undetected conditions such as soft spots, new or existing utility trenches, underground structures, pipes, voids or cavities, boulders, expansive soil pockets, seepage water or water level changes with weather, etc., may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

Site Regrading

After mass grading work is done and cuts and fills are made according to the grading plans, regrading at some future date should be avoided unless done under the guidance of a soils engineer.

BORING LOGS

The stratification lines shown on each of the boring logs represent the approximate boundary between soil types and the transition may be gradual.

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limit or grain-size analysis test results.

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC. [redacted]

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL
FIRST INCREMENT
16 CLASSROOMS AND SITEWORK

LOCATION: Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 8 Sheet No. ____ of ____
Driller: MAS DRILLING CO. Date: JAN. 12, 1976
Field Party: RACUYA (W. LUM ASSOC., INC.)
Type of Boring: AUGER (MOBILE B-40) Diam.: 3"
Elev.: 134'± * Datum: —
Drill Bit: FINGER TYPE

Water Level					
Time	—				
Date	1-12-76				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV.: 134'± *	0								
(ML)	HARD, REDDISH BROWN SANDY SILT W/TRACES OF GRAVEL (FILL)			8-A	-	15	-	-	-	10/0.5' 30/0.3' HAMMER BOUNCES
(CH)	STIFF, REDDISH BROWN CLAY W/TRACES OF GRAVEL (FILL)			8-B	-	18	-	-	-	
	GRAY ROCK FRAGMENTS (FILL) W/CLAY POCKETS	5		8-C	-	14	-	-	-	60/0.5' HAMMER BOUNCES
(SM)	DENSE LIGHT BROWN-GRAY SILTY SAND W/TRACES OF GRAVEL	10		8-D	-	10	-	-	-	55
(ML)	HARD, BROWN SANDY SILT W/TRACES OF GRAVEL	15		8-E	-	16	-	-	-	72
(GM)	DENSE, BROWN SILTY GRAVEL W/SAND	20		8-F	-	21	-	-	-	60/0.5' HAMMER BOUNCES
	END OF BORING @ 20.5' 1-12-76									

*ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN," DECEMBER 10, 1975

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

NANAKULI ELEMENTARY SCHOOL
FIRST INCREMENT

PROJECT 16 CLASSROOMS AND SITEWORK

LOCATION Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2"SS - 2" STANDARD SPLIT SPOON
2½"S - 2" O.D. THIN WALL TUBE

BORING NO. 9 Sheet No. ____ of ____
Driller MAS DRILLING CO. Date JAN. 13, 1976
Field Party RACUYA (W. LUM ASSOC., INC.)
Type of Boring AUGER (MOBILE B-40) Diam. 3"
Elev. 134'± * Datum —
Drill Bit FINGER TYPE

Water Level	NOT NOTICED			
Time	12:45 PM			
Date	1-13-76			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2½" O.D. THIN WALL TUBE BLOWS/0.5'
	ELEV. = 134'± *	0									
CH	STIFF, REDDISH BROWN CLAY W/TRACES OF GRAVEL & ROOTS		2"SS	9-A	22	20	54	-	-		
			2"SS	9-B	-	18	-	-	-		
		5	2½"S	9-C	24	26	64 γ_w=122 γ_D=97	3410	-		HYDRAULIC PRESSURE: 400 PSI / 0.5' 5/0.1'
CH	STIFF, BROWN CLAY W/GRAVEL										
		10	2"SS	9-D	-	16	-	-	-		
			2½"S	9-E	-	24	-	-	-		HYDRAULIC PRESSURE: 350 PSI / 0.8'
	COBBLES OR BOULDERS	15									
	ROCK FRAGMENTS		2"SS	9-F	-	6	-	-	-		
(CH)	STIFF, BROWN CLAY W/DECOMPOSED ROCK					21					
		20	2"SS	9-G	-	22	-	-	-		60/0.3' HAMMER BOUNCES
SM	DENSE, BROWN SILTY SAND W/GRAVEL										
		25	2"SS	9-H	-	17	-	-	-		58
ML	HARD, BROWN SANDY SILT				38	22	41				
	END OF BORING @ 26.5' 1-13-76										

NOTE: γ_w = WET DENSITY, P.C.F. γ_D = DRY DENSITY, P.C.F.

* ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN" DECEMBER 10, 1975

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT 16 CLASSROOMS AND SITEWORK

LOCATION: Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight 140#
Drop 30"
SAMPLER: 2" SS - 2" STANDARD SPLIT SPOON
2½" S - 2" O.D. THIN WALL TUBE

BORING NO. 10 Sheet No. ____ of ____
Driller MAS DRILLING CO. Date JAN. 13, 1976
Field Party RACUYA (W. LUM ASSOC., INC.)
Type of Boring AUGER (MOBILE B-40) Diam. 3"
Elev. 132'± * Datum —
Drill Bit FINGER TYPE

Water Level				
Time	2:30 PM			
Date	1-13-76			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40 / 2½" O.D. THIN WALL TUBE
	ELEV. = 132'± *	0								
(CH)	REDDISH BROWN CLAY W/ROOTS		2"SS	10-A	-	23	-	-	-	40/0.3' HAMMER BOUNCES
	BOULDER									
(CH)	HARD, BROWN CLAY W/ROOTS		2½"S	10-B	-	27	γ_w=	123	>2000	HYDRAULIC PRESSURE: 500 PSI/0.3'
			2"SS	10-C	-	18	γ_D=	96	-	49/0.5' HAMMER BOUNCES
(ML)	HARD, MOTTLED BROWN SANDY SILT W/SOME CLAY (DECOMPOSED ROCK)	5	2"SS	10-D	-	8	-	-	-	19/0.5' HAMMER BOUNCES
(SM)	DENSE, BROWN-GRAY SILTY SAND									
(SM)	DENSE, BROWN SILTY SAND W/TRACES OF GRAVEL	10	2"SS	10-E	-	12	-	-	-	50/0.3' HAMMER BOUNCES
(SM)	DENSE, GRAY SILTY SAND W/GRAVEL (DECOMPOSED ROCK)	15	2"SS	10-F	-	7	-	-	-	50/0.1' HAMMER BOUNCES
(ML)	HARD, BROWN SANDY SILT W/TRACES OF GRAVEL	20	2"SS	10-G	-	15	-	-	-	60/0.4' HAMMER BOUNCES
	END OF BORING @ 20.9' 1-13-76									

NOTE:
γ_w = WET DENSITY, P.C.F.
γ_D = DRY DENSITY, P.C.F.

* ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN" DECEMBER 10, 1975

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

NANAKULI ELEMENTARY SCHOOL
FIRST INCREMENT

PROJECT 16 CLASSROOMS AND SITEWORK

LOCATION Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 11 Sheet No. ____ of ____

Driller MAS DRILLING CO. Date JAN. 13, 1976

Field Party RACUYA (W. LUM ASSOC., INC.)

Type of Boring AUGER (MOBILE B-40) Diam. 3"

Elev. 129'± * Datum —

Drill Bit FINGER TYPE

Water Level					
NOT NOTICED					
Time 10:00 AM					
Date 1-13-76					

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 129'± *	0								
CH	STIFF, BROWN CLAY W/ ROOTS			11-A	23	16	53	–	–	12/0.5' 40/0.3' HAMMER BOUNCES
	COBBLE OR BOULDER?									
(SM)	MOTTLED BROWN DECOMPOSED ROCK W/ROCK FRAGMENTS (CRUSHES TO SILTY SAND)	5		11-B	–	16	–	–	–	50/0.3' HAMMER BOUNCES
				11-C	39	20	46	–	–	60/0.5' 40/0.3' HAMMER BOUNCES
ML	HARD, BROWN SANDY SILT W/ GRAVEL	10		11-D	–	10	–	–	–	60/0.5' 40/0.1' HAMMER BOUNCES
(GM)	GRAY BROWN DECOMPOSED ROCK W/ROCK FRAGMENTS	15		11-E	–	15	–	–	–	82/0.5' HAMMER BOUNCES
	END OF BORING @ 15.0' 1-13-76									

* ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN" DECEMBER 10, 1975

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT 16 CLASSROOMS AND SITEWORK

LOCATION: Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 12 Sheet No. ____ of ____

Driller MAS DRILLING CO. Date JAN. 13, 1976

Field Party RACUYA (W. LUM ASSOC., INC.)

Type of Boring AUGER (MOBILE B-40) Diam. 3"

Elev. 99'± * Datum —

Drill Bit FINGER TYPE

Water Level				
Time	4:25 PM			
Date	1-13-76			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
(SM)	DENSE, MOTTLED BROWN SILTY SAND W/GRAVEL			12-A	–	20	–	–	–	59
		5		12-B	–	9	–	–	–	50/0.2' HAMMER BOUNCES
				12-C	–	9	–	–	–	50/0.3' HAMMER BOUNCES
(SM)	DENSE, GRAY BROWN SILTY SAND & GRAVEL	10		12-D	–	7	–	–	–	47/0.5' 50/0.4' HAMMER BOUNCES
	BOULDER?			12-E	NO	RECOVERY				40/0.1' HAMMER BOUNCES
	NOTE: UNABLE TO AUGER PAST 14'	15								
	END OF BORING @ 14.1' 1-13-76									

* ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN", DECEMBER 10, 1975

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC.

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL
FIRST INCREMENT
16 CLASSROOMS AND SITEWORK

LOCATION: Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 13 Sheet No. ____ of ____
Driller MAS DRILLING CO. Date JAN. 13, 1976
Field Party RACUYA (W. LUM ASSOC., INC.)
Type of Boring AUGER (MOBILE B-40) Diam. 3"
Elev. 92'± * Datum —
Drill Bit - FINGER TYPE

Water Level	NOT NOTICED			
Time	6:30 PM			
Date	1-13-76			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 92'± *	0								
(MH-CH)	BROWN, CLAYEY SILT									
(CH)	MOTTLED BROWN & GRAY CLAY W/GRAVEL			13-A	—	22	—	—	—	13/0.5' 25/0.0' HAMMER BOUNCES
	COBBLES OR BOULDERS? (GRAY SILTY SAND CUTTINGS)	5		13-B	NO RECOVERY					50/0.1' HAMMER BOUNCES
				13-C	—	20	—	—	—	50/0.2' HAMMER BOUNCES
SM	DENSE, MOTTLED BROWN SILTY SAND W/GRAVEL	10								
		15		13-D	32	33	47	—	—	43/0.5' 50/0.3' HAMMER BOUNCES
	END OF BORING @ 16.3' 1-13-76									

* ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN", DECEMBER 10, 1975

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT — 16 CLASSROOMS AND SITEWORK

LOCATION: Nanakuli, Oahu, Hawaii

Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 14 Sheet No. _____ of _____

Driller: MAS DRILLING CO. Date: JAN. 12, 1976

Field Party: RACUYA (W. LUM ASSOC., INC.)

Type of Boring: AUGER (MOBILE B-40) Diam.: 3"

Elev.: 107'± * Datum: —

Drill Bit: FINGER TYPE

Water Level				
Time	2:20 PM			
Date	1-12-76			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 107'± *	0								
(CH)	STIFF, BROWN, CLAY W/ROOTS & COBBLES			14-A	-	21	-	-	-	50/0.5' HAMMER BOUNCES
	BOULDER? (ROCK FRAGMENTS)	5		14-B	-	20	-	-	-	70/0.4' HAMMER BOUNCES
(SM)	DENSE, BROWN SILTY SAND W/TRACES OF GRAVEL	10		14-C	-	23	-	-	-	55/0.5' HAMMER BOUNCES
		15		14-D	-	9	-	-	-	60/0.5' HAMMER BOUNCES
	END OF BORING @ 15.5' 1-12-76									

* ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN", DECEMBER 10, 1975

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC.

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT — 16 CLASSROOMS AND SITEWORK

LOCATION: Nanakuli, Oahu, Hawaii — Tax Map Key: 8-9-07: Por. 3

HAMMER: Weight 140 # — Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 15 — Sheet No. ____ of ____

Driller MAS DRILLING CO. — Date JAN. 12, 1976

Field Party RACUYA (W. LUM ASSOC., INC.)

Type of Boring AUGER (MOBILE B-40) — Diam. 3"

Elev. 118'± * — Datum —

Drill Bit FINGER TYPE

Water Level	NOT NOTICED			
Time	12:10 PM			
Date	1-12-76			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
(CH)	BROWN, CLAY W/ROOTS	0		15-A	-	14	-	-	-	50/0.4'
(SC)	DENSE MOTTLED BROWN CLAYEY SAND W/GRAVEL			15-B	-	17	-	-	-	93
(SM)	DENSE, BROWN SILTY SAND W/GRAVEL	5		15-C	37	24	42	-	-	47
(SM)	DENSE, BROWN SILTY SAND W/GRAVEL	10		15-D	-	8	-	-	-	50/0.3' HAMMER BOUNCES
(ML)	HARD, BROWN SANDY SILT W/TRACES OF GRAVEL	15		15-E	-	11	-	-	-	42/0.5' 50/0.1' HAMMER BOUNCES
	END OF BORING @ 16.1' 1-12-76									

* ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN" DECEMBER 10, 1975

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT — 16 CLASSROOMS AND SITEWORK

LOCATION: Nanakuli, Oahu, Hawaii — Tax Map Key: 8-9-07: Por. 3

HAMMER: Weight 140# Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 16 Sheet No. ____ of ____

Driller MAS DRILLING CO. Date JAN. 12, 1976

Field Party RACUYA (W. LUM ASSOC., INC.)

Type of Boring AUGER (MOBILE B-40) Diam. 3"

Elev. 120'± * Datum —

Drill Bit FINGER TYPE

Water Level				
Time	10:55 AM			
Date	1-12-76			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 120'± *	0								
(GH)	STIFF, BROWN, CLAY W/COBBLES & ROOTS			16-A	–	25	–	–	–	4/0.5'
						19				40/0.3'
(GC)	DENSE, BROWN CLAYEY GRAVEL			16-B	–	14	–	–	–	50/0.3
		5								
				16-C	–	7	–	–	–	82
(SM)	DENSE, MOTTLED BROWN SILTY SAND W/GRAVEL									
		10		16-D	–	9	–	–	–	60/0.5'
										HAMMER BOUNCES
(ML)	HARD, BROWN SANDY SILT W/TRACES OF GRAVEL	15		16-E	–	14	–	–	–	53/0.5'
										50/0.2'
	END OF BORING @ 16.2' 1-12-76									

* ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN", DECEMBER 10, 1975

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT — 16 CLASSROOMS AND SITEWORK

LOCATION: Nanakuli, Oahu, Hawaii — Tax Map Key: 8-9-07: Por. 3

HAMMER: Weight 140# — Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 17 — Sheet No. ____ of ____

Driller MAS DRILLING CO. — Date JAN. 12, 1976

Field Party RACUYA (W. LUM ASSOC., INC.)

Type of Boring AUGER (MOBILE B-40) — Diam. 3"

Elev. 111'± * — Datum ____

Drill Bit FINGER TYPE

Water Level				
Time	9:30 AM			
Date	1-12-76			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
(CH)	ELEV. = 111'± * 0 GRAY-BROWN, CLAY & SILTY SAND W/COBBLES & ROOTS									
(SM)	DENSE, BROWN, SILTY SAND W/GRAVEL			17-A	–	19	–	–	–	24/0.5' 20/0.1'
	BOULDER?									HAMMER BOUNCES
(SM)	DENSE, BROWN, SILTY SAND W/GRAVEL	5		17-B	–	12	–	–	–	30/0.5' 40/0.2'
	BOULDER ?			17-C	NO RECOVERY					50/0.0'
	NOTE: UNABLE TO AUGER PAST 7.0'									HAMMER BOUNCES
	END OF BORING @ 7.0' 1-12-76									

* ELEVATION ESTIMATED FROM "ULTIMATE SITE GRADING PLAN" DECEMBER 10, 1975

NANAKULI ELEMENTARY SCHOOL - 1ST INCREMENT
16 CLASSROOMS & SITEWORK

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	9	9	9	9
SAMPLE NO.	A	C	G	H (BTM.)
DEPTH BELOW SURFACE	1'-2.5'	6'-6.5'	20'-20.3'	25.0'-26.5'
DESCRIPTION	REDDISH-BROWN CLAY W/TRACES OF GRAVEL & ROOTS	BROWN CLAY W/GRAVEL	BROWN SILTY SAND W/GRAVEL	BROWN SANDY SILT
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1-1/2"			100	100
1"			100	100
1/2"			100	100
#4			70.3	100
#10			53.5	99.1
#20			41.5	94.4
#40			34.6	84.7
#100			26.0	71.1
#200			21.1	62.1
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		NATURAL
Liquid Limit	54	64		41
Plastic Limit	22	24		38
Plasticity Index	32	40		3
Dilatancy	SLOW	SLOW		RAPID-SLOW
Toughness	MED. STIFF	MED. STIFF		WEAK-SOFT
Dry Strength	HIGH	HIGH		LOW
UNIFIED SOIL CLASSIFICATION	CH	CH	SM	ML
APPARENT SPECIFIC GRAVITY				
CBR TEST (Surcharge - 51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (ASTM D-1557-70, Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 1-27-76 By BT

NANAKULI ELEMENTARY SCHOOL - 1ST INCREMENT
16 CLASSROOMS & SITEWORK

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	11	11	13	13
SAMPLE NO.	A	C		D
DEPTH BELOW SURFACE	1'-2.3'	5'-6.3'	SURFACE	15'-16.3'
DESCRIPTION	BROWN CLAY W/ROOTS	BROWN SANDY SILT W/GRAVEL	BROWN CLAYEY GRAVEL W/SAND	MOTTLED BROWN SILTY SAND W/GRAVEL
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1-1/2"		100	100	100
1"		100	100	100
1/2"		100	77.8	94.9
#4		97.9	69.1	83.5
#10		93.8	58.4	75.0
#20		84.4	53.4	66.1
#40		73.3	51.2	59.3
#100		59.4	49.0	46.3
#200		52.5	48.3	39.2
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	53	46	50	47
Plastic Limit	23	39	23	32
Plasticity Index	30	7	27	15
Dilatancy	SLOW	RAPID-SLOW	SLOW	SLOW
Toughness	VERY STIFF	WEAK & SOFT	VERY STIFF	MED. STIFF
Dry Strength	HIGH	LOW	HIGH	MEDIUM
UNIFIED SOIL CLASSIFICATION	CH	ML	GC	SM
APPARENT SPECIFIC GRAVITY				
CBR TEST (Surcharge - 51 P.S.F.)				
Molding Moisture, %			15.2	
Molding Dry Density, P.C.F.			119.3	
Swell upon saturation, %			4.0	
CBR at 0.1" Penetration			5.4	
MOISTURE-DENSITY RELATIONS OF SOILS (ASTM D-1557-70, Method)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 1-27-76 By BT

2-775

NANAKULI ELEMENTARY SCHOOL - 1ST INCREMENT
16 CLASSROOMS & SITEWORK

TABLE I C - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	15	15	15	
SAMPLE NO.		B	C	
DEPTH BELOW SURFACE	SURFACE	3'-4.5'	5'-6.5'	
DESCRIPTION	BROWN CLAY W/SOME ROOTS & GRAVEL	BROWN SILTY SAND W/GRAVEL	BROWN SILTY SAND W/GRAVEL	
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1-1/2"		100		
1"		100		
1/2"		90.2		
#4		82.5		
#10		66.0		
#20		42.2		
#40		30.9		
#100		19.6		
#200		15.6		
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL		NATURAL*	
Liquid Limit	54		42	
Plastic Limit	25		37	
Plasticity Index	29		5	
Dilatancy	SLOW		RAPID-SLOW	
Toughness	MED. STIFF		WEAK & SOFT	
Dry Strength	HIGH		LOW	
UNIFIED SOIL CLASSIFICATION	CH	SM	ML (SM)**	
APPARENT SPECIFIC GRAVITY	2.80			
CBR TEST (Surcharge - 51 P.S.F.)				
Molding Moisture, %	19.5			
Molding Dry Density, P.C.F.	107.8			
Swell upon saturation, %	2.4			
CBR at 0.1" Penetration	6.2			
MOISTURE-DENSITY RELATIONS OF SOILS (ASTM D-1557-70, Method ___)	A			
Dry to Wet or Wet to Dry	DRY TO WET			
Max. Dry Density (P.C.F.)	108			
Optimum Moisture (%)	18			

REMARKS:
* SAMPLE TESTED ONLY ON THE PORTION THAT PASSES THE # 40 SIEVE.
** UNIFIED SOILS CLASSIFICATION IN PARENTHESIS BASED ON VISUAL IDENTIFICATION OF TOTAL SAMPLE.

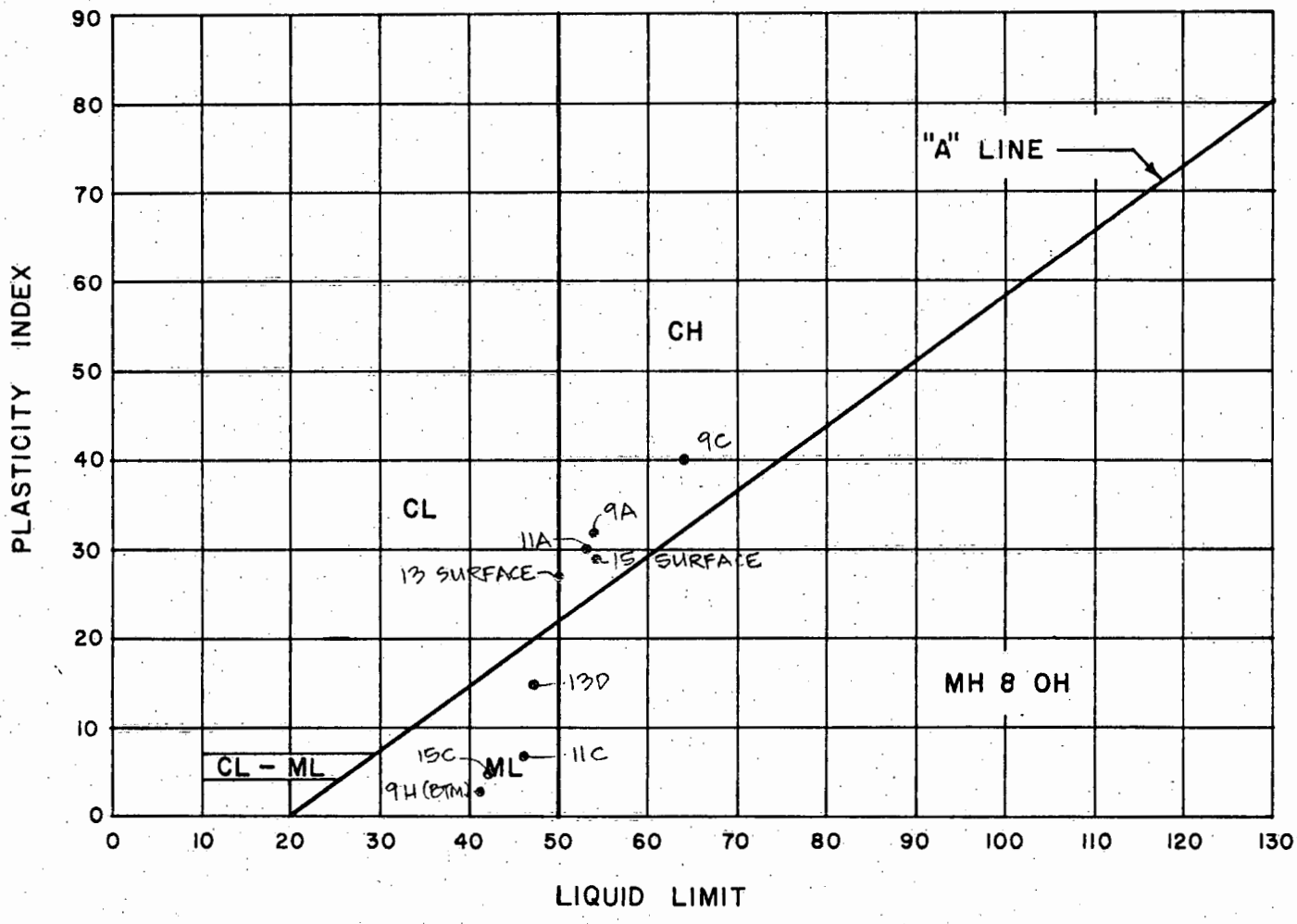
Date 1-27-76 By BT

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

PLASTICITY CHART

PROJECT: NANAKULI ELEMENTARY SCHOOL - 1ST INCREMENT
16 CLASSROOMS & SITEWORK

LOCATION: NANAKULI, OAHU, HAWAII



DATE 1-27-76 BY BT

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

8-872

MOISTURE-DENSITY CURVE (ASTM D-1557-70, METHOD A)

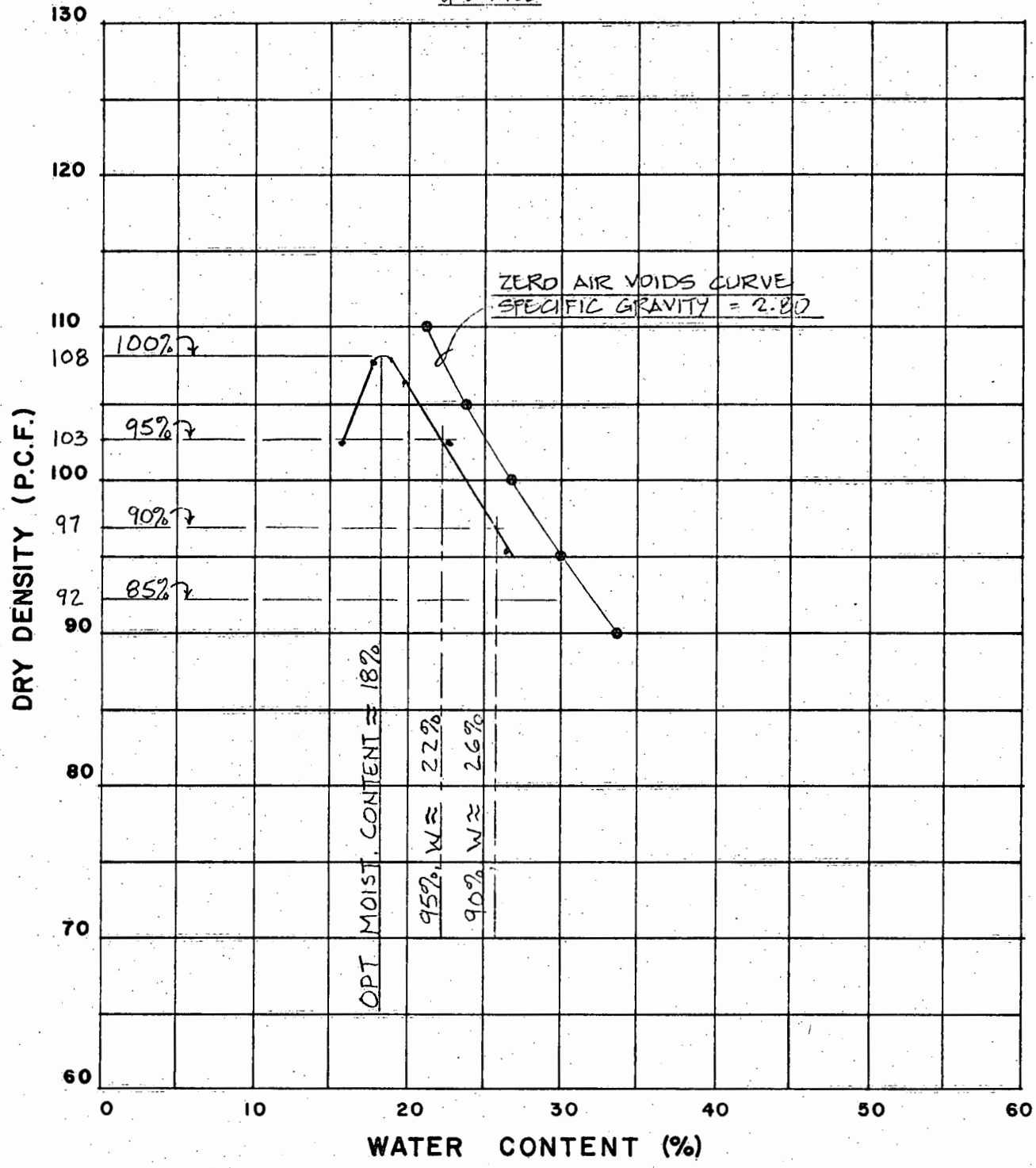
PROJECT: NANAKULI ELEMENTARY SCHOOL - 1ST INCREMENT
16 CLASSROOMS & SITEWORK

LOCATION: NANAKULI, OAHU, HAWAII

SAMPLE NO.: 15 SURFACE

SAMPLE DESCRIPTION: BROWN CLAY W/SOME ROOTS & GRAVEL

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4"ΦX4.584" HIGH
HAMMER: 10 LBS, 18 DROP
LAYERS: 5
BLOWS: 25 /LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 1-16-76 BY R.H.

2-775

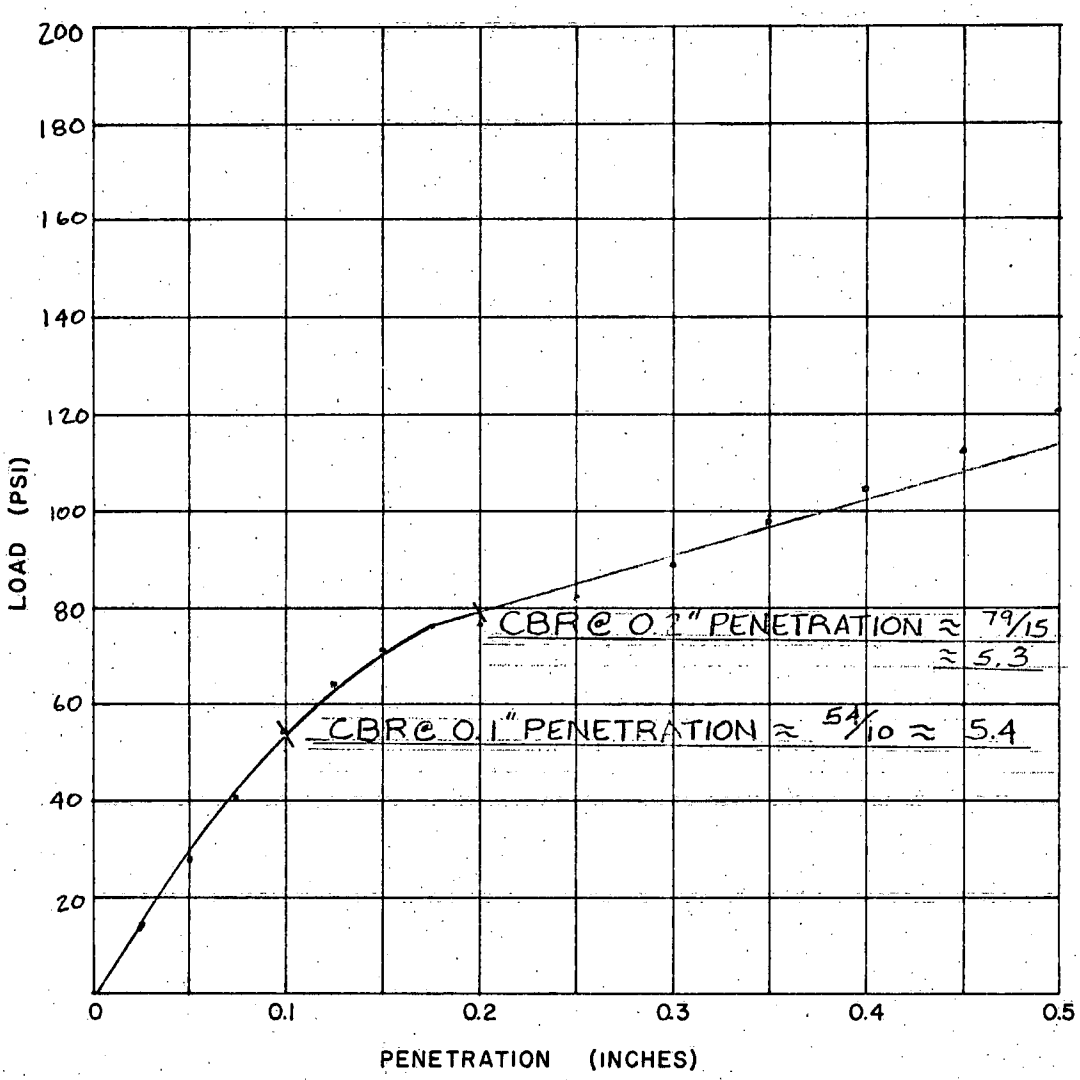
CBR TEST

PROJECT: NANAKULI ELEMENTARY SCHOOL - 1ST INCREMENT
16 CLASSROOMS & SITEWORK

LOCATION: NANAKULI, OAHU, HAWAII

SAMPLE NO: 13 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY GRAVEL W/SAND



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	41	14
0.050	85	28
0.075	124	41
0.100	162	54
0.125	193	64
0.150	213	71
0.175	227	76
0.200	232	77
0.250	246	82
0.300	266	89
0.350	293	98
0.400	316	105
0.450	340	113
0.500	364	121

AGGREGATE 3/4" MINUS
HAMMER WEIGHT 10 LBS.
HAMMER DROP 18 INS.
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 15.2
MOLDING DRY DENSITY, P.C.F. 115.3
CBR @ 0.1" PENETRATION 5.4
DAYS SOAKED 5

DATE 1-19-76 BY G.S.
DATE 1-20-76 BY R.H.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

10-470

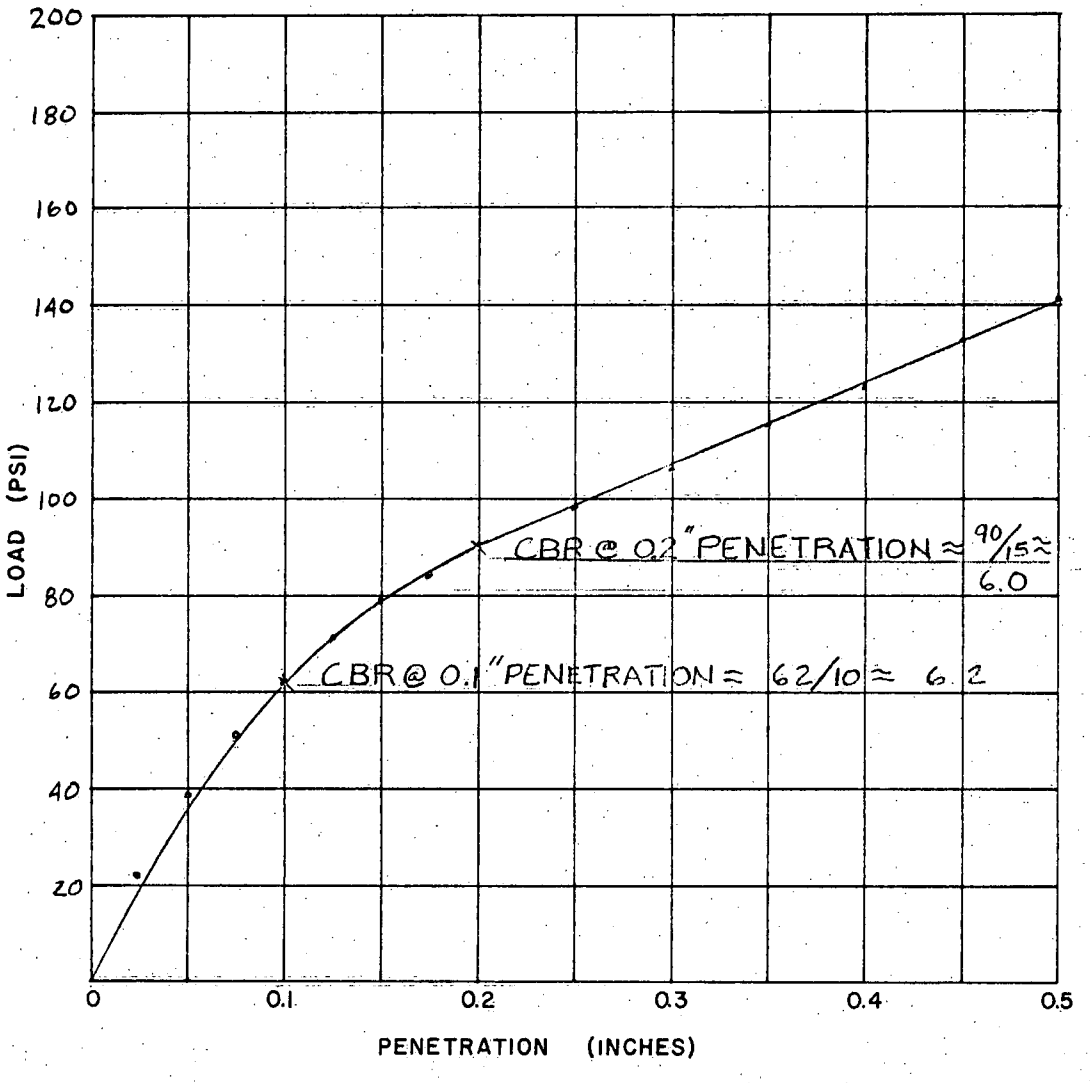
CBR TEST

PROJECT: NANAKULI ELEMENTARY SCHOOL - 1ST INCREMENT
16 CLASSROOMS & SITEWORK

LOCATION: NANAKULI, OAHU, HAWAII

SAMPLE NO: 1S SURFACE

SAMPLE DESCRIPTION: BROWN CLAY W/SOME ROOTS & GRAVEL



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	67	22
0.050	116	39
0.075	154	51
0.100	185	62
0.125	213	71
0.150	238	79
0.175	252	84
0.200	270	90
0.250	294	98
0.300	319	106
0.350	345	115
0.400	370	123
0.450	399	133
0.500	424	141

AGGREGATE 1/4" MINUS
HAMMER WEIGHT 10 LBS.
HAMMER DROP 18 INS
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 19.5
MOLDING DRY DENSITY, P.C.F. 107.8
CBR @ 0.1" PENETRATION 6.2
DAYS SOAKED 5

DATE 1-19-76 BY G.S.
DATE 1-20-76 BY R.H.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

LOGS OF BORINGS

FROM

NANAKULI ELEMENTARY SCHOOL - FIRST INCREMENT

(DATED SEPTEMBER 20, 1975)

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT
LOCATION: Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 1 Sheet No. ____ of ____
Driller: MAS DRILLING CO. Date: AUG. 25, 1975
Field Party: ASATO (W. LUM ASSOC., INC.)
Type of Boring: AUGER (B-40) Diam.: 4"
Elev.: 106'± * Datum: —
Drill Bit: T.C. DRAG
Water Level: NOT NOTICED
Time: —
Date: 8-25-75

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 106'± *	0								
CH	STIFF, BROWN, CLAY W/TRACES OF ROOTS			1-A	24	12	58	–	–	11/0.5 — 10/0.0' HAMMER BOUNCES
				1-B	–	10	–	–	–	50/0.3' HAMMER BOUNCES
		5		1-C	–	7	–	–	–	65/0.4' HAMMER BOUNCES
(SM)	DENSE, BROWN SILTY SAND W/DECOMPOSED ROCK & GRAVEL	10		1-D	–	5	–	–	–	65/0.4' HAMMER BOUNCES
	NOTE: ENCOUNTERED COBBLES & BOULDERS BETWEEN 0-15'	15		1-E	–	9	–	–	–	65/0.4' HAMMER BOUNCES
	END OF BORING @ 15.4' 8-25-75									
	*Elevation estimated from Topo Map									

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC.

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT

LOCATION: Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 2 Sheet No. ____ of ____

Driller: MAS DRILLING CO. Date: AUG. 25, 1975

Field Party: ASATO (W. LUM ASSOC., INC.)

Type of Boring: AUGER (B-40) Diam.: 4"

Elev.: 112'± * Datum: —

Drill Bit: T.C. DRAG

Water Level					
Time	—				
Date	8-25-75				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 112'± *	0								
(CH)	STIFF, BROWN CLAY W/ TRACES OF ROOT & WOOD			2-A	–	22	–	–	–	
CH	STIFF, BROWN CLAY W/ GRAVEL	5		2-B	23	29	60	–	–	
				2-C	–	14	–	–	–	GG
(GC)	STIFF, MOTTLED BROWN CLAY, DECOMPOSED ROCK, SAND & GRAVEL	10		2-D	–	19	–	–	–	50/0.5'
	NOTE: ENCOUNTERED COBBLES & BOULDERS BETWEEN 0'-15'.	15		2-E	ROCK FRAGMENTS					50/0.2' HAMMER BOUNCES
	END OF BORING @ 15.2' 8-25-75									

*Elevation estimated from Topo Map

NANAKULI ELEM. 2001

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT

LOCATION: Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 3 Sheet No. ____ of ____
Driller MAS DRILLING CO. Date AUG. 25, 1975
Field Party ASATO (W. LUM ASSOC., INC.)
Type of Boring AUGER (B-40) Diam. 4"
Elev. 128'± * Datum —
Drill Bit T.C. DRAG

Water Level					
Time	—				
Date	8-25-75				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 128'± *	0								
CL	STIFF, REDDISH BROWN CLAY W/TRACES OF GRAVEL			3-A	22	12	49	—	—	
(ML)	STIFF, MOTTLED BROWN SANDY SILT W/ DECOMPOSED ROCK	5		3-B	—	17	—	—	—	50
(ML)	STIFF, BROWN SANDY SILT			3-C	—	12	—	—	—	40
(SM)	DENSE, BROWN SILTY SAND W/GRAVEL	10		3-D	—	6	—	—	—	50/0.4' HAMMER BOUNCES
(GM)	DENSE, BROWN SILTY GRAVEL W/ SAND	15		3-E	—	5	—	—	—	50/0.2
	NOTE: ENCOUNTERED COBBLES & BOULDERS BETWEEN 0'-15'									
	END OF BORING @ 15.7' 8-25-75									

*Elevation estimated from Topo Map

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC.

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT

LOCATION: Nanakuli, Oahu, Hawaii

Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 4 Sheet No. ____ of ____

Driller: MAS DRILLING CO. Date: AUG. 25, 1975

Field Party: ASATO (W. LUM ASSOC., INC.)

Type of Boring: AUGER (B-40) Diam.: 4"

Elev.: 94'± * Datum: —

Drill Bit: T.C. DRAG

Water Level	NOT NOTICED				
Time	—				
Date	8-25-75				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 94'± *	0								
CH	STIFF BROWN CLAY W/ TRACES OF GRAVEL			4-A	20	17	54	-	-	
	GRAY, PUKA PUKA ROCK W/ MOTTLED BROWN SILTY SAND			4-B	ROCK FRAGMENTS					21/0.5' 25/0.0' HAMMER BOUNCES
(SM)	DENSE, MOTTLED BROWN SILTY SAND W/ TRACES OF GRAVEL	5		4-C	-	18	-	-	-	50/0.4' HAMMER BOUNCES
(SM)	DENSE, BROWN SILTY SAND W/ GRAVEL	10		4-D	-	24	-	-	-	71
(ML)	STIFF, BROWN SANDY SILT	15		4-E	-	29	-	-	-	50/0.5' 50/0.3' HAMMER BOUNCES
	NOTE: ENCOUNTERED COBBLES & BOULDERS BETWEEN 0'-15'									
	END OF BORING @ 16.3' 8-25-75									

*Elevation estimated from Topo Map

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC.

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT

LOCATION: Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 5 Sheet No. ____ of ____

Driller: MAS DRILLING CO. Date: AUG. 25, 1975

Field Party: ASATO (W. LUM ASSOC., INC.)

Type of Boring: AUGER (B-40) Diam.: 4"

Elev.: 122'± * Datum: —

Drill Bit: T.C. DRAG

Water Level					
Time	—				
Date	8-25-75				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 122'± *	0								
CH	STIFF BROWN CLAY W/ GRAVEL			5-A	21	13	63	—	—	10/0.5' ; 30/0.5'
(SM)	DENSE, BROWN SILTY SAND			5-B	—	19	—	—	—	50/0.3' HAMMER BOUNCES
		5								
(ML)	STIFF, BROWN SANDY SILT			5-C	—	21	—	—	—	50/0.5' HAMMER BOUNCES
(GM)	DENSE, BROWN SILTY GRAVEL W/ SAND	10		5-D	—	8	—	—	—	45
(SM)	DENSE, BROWN SILTY SAND	15		5-E	—	12	—	—	—	77

NOTE:
ENCOUNTERED COBBLES & BOULDERS BETWEEN 0'-15'

END OF BORING @ 16.5'
8-25-75

*Elevation estimated from Topo Map

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL — FIRST INCREMENT

LOCATION: Nanakuli, Oahu, Hawaii — Tax Map Key: 8-9-07: Por. 3

HAMMER: Weight 140# — Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 6 — Sheet No. ____ of ____

Driller MAS DRILLING CO. — Date AUG. 25, 1975

Field Party ASATO (W. LUM ASSOC., INC.)

Type of Boring AUGER (B-40) — Diam. 4"

Elev. 114'± * — Datum —

Drill Bit T.C. DRAG

Water Level				
Time	—			
Date	8-25-75			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 114'± *	0								
(CH)	STIFF, BROWN CLAY W/TRACES OF ROOTS & GRAVEL			G-A	–	16	–	–	–	22/0.2'
(ML)	STIFF, MOTTLED BROWN SANDY SILT & DECOMPOSED ROCK			G-B	–	24	–	–	–	47/0.5'
		5								
(GM)	DENSE, BROWN SILTY GRAVEL W/ SAND			G-C	–	9	–	–	–	52/0.4'
(ML)	STIFF, BROWN SANDY SILT W/TRACES OF DECOMPOSED ROCK	10		G-D	–	29	–	–	–	62
(SM)	DENSE, BROWN SILTY SAND W/GRAVEL	15		G-E	–	16	–	–	–	30/0.5' 52/0.2'
	NOTE: ENCOUNTERED COBBLES & BOULDERS BETWEEN 0'-15'									
	END OF BORING @ 16.2' 8-25-75									

*Elevation estimated from Topo Map

NANAKULI ELEM. SCHOOL

WALTER LUM ASSOCIATES, INC.

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI ELEMENTARY SCHOOL FIRST INCREMENT

LOCATION: Nanakuli, Oahu, Hawaii

Tax Map Key: 8-9-07: Por. 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 7 Sheet No. ____ of ____

Driller: MAS DRILLING CO. Date: AUG. 25, 1975

Field Party: ASATO (W. LUM ASSOC., INC.)

Type of Boring: AUGER (B-40) Diam.: 4"

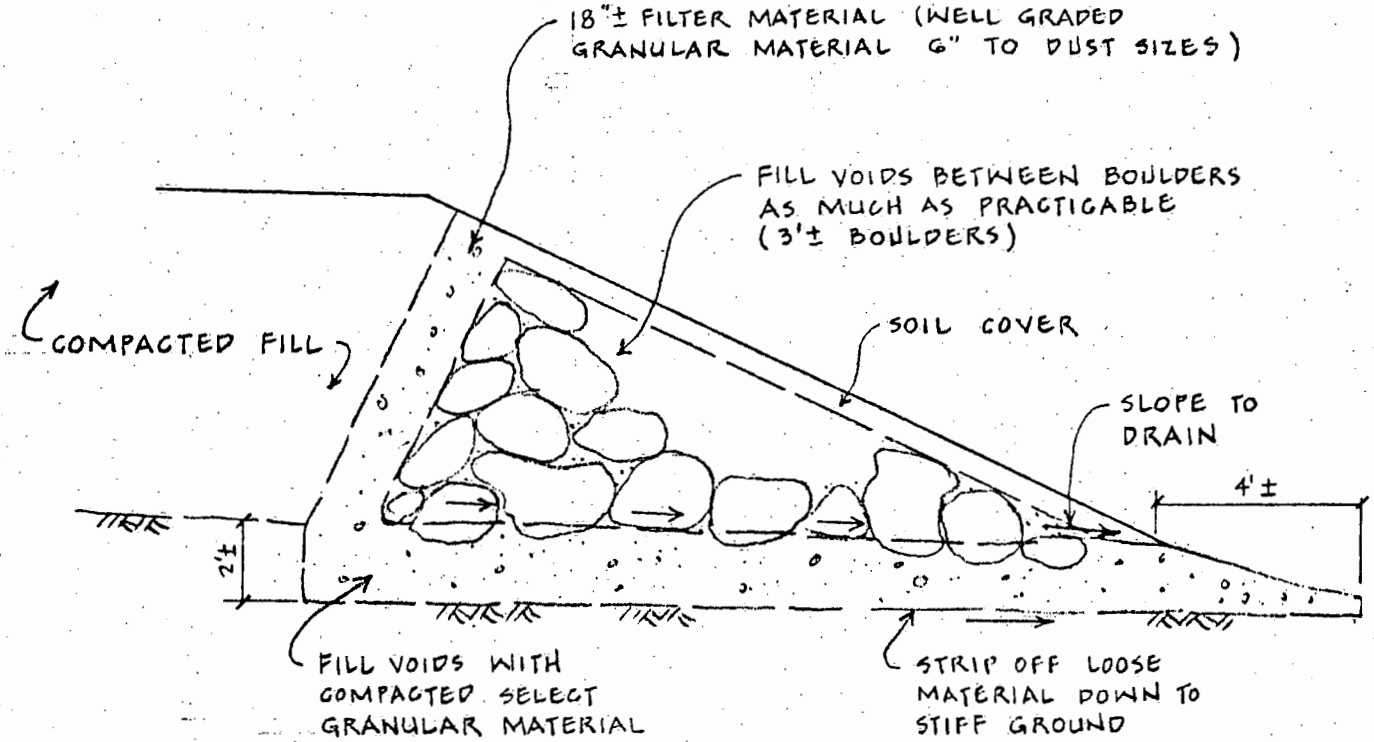
Elev.: 118'± * Datum: —

Drill Bit: T.C. DRAG

Water Level				
Time	—			
Date	8-25-75			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 118'± *	0								
(GM)	DENSE, BROWN SILTY SAND & DECOMPOSED ROCK			7-A	—	16	—	—	—	90
	DENSE, GRAY BROWN CINDER W/ PUKA PUKA ROCK	5		7-B	—	12	—	—	—	50/0.5'
(ML)	STIFF, BROWN CLAYEY SILT	10		7-C	—	25	—	—	—	55
(SM)	DENSE, BROWN SILTY SAND	15		7-D	—	6	—	—	—	52/0.2'
	NOTE: ENCOUNTERED COBBLES & BOULDERS BETWEEN 0'-15'									
	END OF BORING @ 15.7' 8-25-75									

*Elevation estimated from Topo Map



SECTION
NOT TO SCALE

FIGURE 1

SUGGESTED BOULDER FILL

NANAKULI ELEMENTARY SCHOOL
FIRST INCREMENT
16 CLASSROOMS AND SITEWORK
NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions between borings, at other locations, or at other dates. Soil conditions and water levels may change with the passage of time, construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

This report was prepared only for the indicated use of the site. If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes, plan changes, or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the recommendations considering the time lapse, changed conditions, and changes in the state of the art of soil engineering.

Our professional services were performed, findings obtained and recommendations prepared in accordance with generally accepted soil engineering practices. This warranty is in lieu of all other warranties expressed or implied.

LIMITATIONS (cont'd.)

Contract documents and specifications often prescribe supervision by the soil engineer. It should be understood by all parties that the soil engineer's actual scope of work is very limited. We as the soil engineer do not assume the day to day physical direction of the works, nor minute examination of the elements, nor do we assume the responsibility for the safety of the contractor's workmen. Supervision, inspection, control, etc., by the soil engineer generally mean taking of soil tests and making visual observations, sometimes on only an intermittent basis relating to earthwork or foundations for the project. The soil engineer does not guarantee the contractors' performance, but rather looks for general conformance to the intent of the plans and soil report. Any discrepancy noted by the soil engineer regarding earthwork or foundations will be referred to the project engineer or architect or contractor for action.

Although the soil report may comment or discuss construction techniques or procedures for the design engineer's guidance, the report should not be interpreted to prescribe or dictate construction procedures or to relieve the contractor in anyway of his responsibility for the construction.