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MAKAKILO HALE II
PRELIMINARY SOIL REPORT

FOR REFERENCE
not to be taken from this room

MAKAKILO, OAHU, HAWAII
TAX MAP KEY: 9-2-03: Por. 2

To:
FINANCE REALTY COMPANY, LTD.

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

FEBRUARY 9, 1974

MUNICIPAL REFERENCE & RECORDS CENTER
City & County of Honolulu
City Hall Annex, 505 S. King Street
Honolulu, Hawaii 96813

WITHDRAWN

WALTER LUM ASSOCIATES, INC.

CIVIL, STRUCTURAL, SOILS ENGINEERS

WALTER LUM
EDWARD WATANABE
EZRA KOIKE
WALLACE WAKAHIRO

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

February 9, 1974

MR. R. YOSHIDA
Finance Realty Company, Ltd.
195 South King Street
Honolulu, Hawaii 96813

Dear Mr. Yoshida:

Subject: Makakilo Hale II
Preliminary Soil Report
(for site grading design purposes for
townhouse development)
Makakilo, Oahu, Hawaii
Tax Map Key: 9-2-03: Por. 2

Transmitted herewith is our preliminary soil report for site grading design purposes for Makakilo Hale II, a proposed townhouse development at Makakilo, Oahu, Hawaii.

This report includes a Boring Location Sketch, boring logs, laboratory test results, recommendations for mass site grading design and limitations.

This report does not include swimming pool work or conditions resulting from the pool construction.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Ezra Koike
Ezra Koike

CM/EK:rmf

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MAKAKILO HALE II
PRELIMINARY SOIL REPORT

MAKAKILO, OAHU, HAWAII
TAX MAP KEY: 9-2-03: POR. 2

SCOPE OF EXPLORATION

The purpose of this exploration was to evaluate general soil conditions for site grading design purposes for Makakilo Hale II, a proposed townhouse development at Makakilo, Oahu, Hawaii.

This report includes field explorations, laboratory tests, general site grading design recommendations and limitations.

This report does not include swimming pool work or conditions resulting from pool construction.

FIELD EXPLORATION AND LABORATORY TESTS

Twenty-nine exploratory borings were made at the approximate locations shown on the Boring Location Sketch. Borings were made with 4-in. diameter augers using carbide drag and finger type bits. Soil samples were recovered with a 2-in. standard split spoon sampler driven with a 140-lb hammer falling 30 inches.

Also attached are the logs of borings previously made for the soil reconnaissance report, "Kapolei PD-H", dated March 5, 1973.

Laboratory tests included: natural water content, Atterberg limit, grain-size analysis, specific gravity, AASHTO T-180-73I density and CBR.

A summary of the laboratory test results is given in Tables IA thru IF.

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 may be generally described as follows:

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

Twb - upper, middle and lower basalt.

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

Stony steep land (rSY) p. 121.

GENERAL SITE CONDITIONS

Site Location

The proposed site is located about 6,000 ft north of the intersection of Makakilo Drive and the H-1 Freeway, in Makakilo, Oahu, Hawaii. Makakilo Hale I is located to the southwest of the site and Makakilo-Waena Elementary School grounds to the west.

Size

The proposed area for development is about 16 acres.

Access to Site

At the present time, the site is accessible from Makakilo Drive.

Annual Rainfall

The average rainfall of the proposed site varies from about 20 to 30 inches.

Topography

In general, the site slopes downward toward the east at an overall slope of about 15%. The ground elevation varies from about 670 to 770 ft.

Makakilo Gulch borders the site on the north and east.

An existing sewer line crosses the central portion of the site in a southeasterly direction.

Several natural drainageways cross the site generally sloping downward from west to east in the northern and southern portions of the site. Boulders were noted in these natural drainageways.

Eroded areas were also noted at several locations on the site.

Most of the site is covered with brush and trees.

INTERPRETATION OF SOIL CONDITIONS

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

About 3 to 21 ft of stiff clayey silt or silty clay (MH or ML soils) with decomposed rock for the depths drilled.

Pockets of clay (CH soil), about 2 to 15 ft, were noted at or near the surface in about half of the borings.

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

Variations to the above soil conditions are to be expected in localized areas. For more detailed descriptions of soils encountered in the drill holes, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

In general, the proposed plan is to clear and grade the site for residential townhouse development. In general, cuts and fills of up to about 8 ft are contemplated for the site grading.

The preliminary grading plans indicate that some of the natural drainage gullies on the eastern and western portions of the site will be filled.

Before the construction of fills over drainageways, the natural channels should be drained and stripped of loose soils and subdrains installed along the bottoms and sides. Storm drainage systems should be carefully designed to intercept and channelize the flow that formerly followed the natural gullies.

At several locations of the site, clayey "CH" soils were found at or near the surface. Wherever practicable, these soils should be kept about 2 and preferably 3 ft below finish grade and away from the outer portions of slopes.

In general, buildings should be located about 15 to 20 ft away from the tops of slopes. Buildings should be avoided over old natural drainageways and on sloping areas steeper than about 3 horizontal to 1 vertical ratio.

On fairly level sites, where the buildings are located well back from the tops of slopes, spread footing or narrow beam type foundations without footings may be considered.

On sloping ground and near the tops of slopes, post and beam construction with deep pier type footings are recommended. If practicable, retaining walls should be avoided.

The preliminary grading plan shows a proposed 6-ft high slope in the northeastern portion of the site. The slope will be partly in cut and partly in fill. Such banks are difficult to construct with adequate compaction. The bank should be constructed by overfilling and compacting the slope, then cutting back to the design slope and grade.

Site Grading

In general, the on-site soils may be used for the construction of the proposed fills. The grading of the site, particularly the construction of fills, should be done prior to building construction to allow the underlying soils as much time as practicable to adjust to the new load experience.

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

1. The area should be cleared and grubbed. Surface vegetation and miscellaneous debris should be cleared and removed prior to site filling.
2. Loose surface soils should be stripped to stiff natural ground before the placement of fills. Loose surface soils at finish grade should be scarified and recompactd.
3. Localized soft pockets encountered during the site preparation should be excavated and replaced with compacted select material.
4. Where fills are proposed on sloping areas and natural draingeways, loose material at the bottom and sides should be stripped down to stiff natural ground before the placement of fills.

Subdrains should be placed along the bottom of natural drainageways with laterals in

a herringbone pattern along the sides of the drainageways.

5. 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 stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

6. In general, fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the AASHO T-180-73I test method. In roadway areas, the top 2 ft of fill should be compacted to 95% of the maximum density.

To minimize the expansive effects of soils, the fills should be compacted on the wet side of optimum moisture.

7. If boulders are proposed to be used in the construction of fills, they should be generally

placed along the toe sections of fill slopes and outside of probable building sites. Before placing any boulders, the subgrade should be stripped to stiff natural ground and shaped to drain. A transition layer of select fairly well-graded granular material (6-in. to dust sizes) should be placed on the subgrade and the boulders placed on the select material. Earth fill may be used in the void spaces between boulders. A transition layer of select granular material should also be placed against the boulders before earth fills are placed against the boulders. See attached sketch, Figure 1.

Slopes

The preliminary plans generally indicate cut and fill slopes less than 20 ft in height. For these slopes, 2 horizontal to 1 vertical or flatter ratios may be used in silty or sandy (MH, ML, SM) soils.

Flatter slopes generally less than 12 ft in height or other precautions should be considered where clay (CH) soils are encountered in cut slopes, otherwise, the clay pockets should be removed as they are encountered in the field and replaced with select on-site or borrow materials.

If slope heights (top to toe) of greater than 20 ft are considered, 8-ft-wide benches should be placed at height intervals of about 15 ft.

To minimize erosion, the runoff from rainstorms should be diverted away from slopes by berms or ditches wherever practicable.

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

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

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

Foundations

Because natural water contents of the soils are lower than the plastic limits and "CH" clay pockets were noted in over half of the borings made, the shrink-swell potentials of the soils may be great.

In general, 2-story, wood-frame structures with concrete slabs on ground are contemplated. Care should be taken in

the design of these structures because of the potential shrink-swell properties of the soils.

On sloping ground and near tops of slopes, post and beam construction with deep pier type footings is recommended.

On fairly level sites where buildings are located 15 to 20 ft from the tops of slopes, spread footing or narrow beam type foundations without footings may be considered.

If practicable, irregular-shaped building and mixed split-level foundations should be avoided. Where they are used, some cracking of walls may occur because of differential movements.

Where clay "CH" soil pockets are encountered at building sites, the clay soils should be removed to about 2 ft below slabs and 3 ft below foundations and replaced with select on-site or borrow soils compacted in thin lifts.

Material imported for use within the top 2 ft below floor slabs and foundations should be non-expansive with a plasticity index of less than 15.

Provisions should be made for future maintenance, and adjustments should be made should a structure be damaged by the shrinkage or swelling of the on-site soils.

Other areas that may require careful construction and some maintenance are: foundations near tops of slopes and foundations immediately behind retaining walls.

General guidelines for foundation design considerations are as follows:

1. Bearing values for a given soil usually vary with the size and depths of footings. For light residential structures, bearing values of about 3000 p.s.f. may be used for footings on stiff natural ground or on compacted fill.
2. Piers should extend down to a plane drawn upward at a 6 horizontal to 1 vertical slope from the bottom of the slope. A minimum depth of 4 ft should be used. [Bearing values of about 4000 p.s.f. may be used for piers 4 ft or deeper on stiff natural ground or on compacted fill.] (ADDITION)
3. 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.
4. A few units may be partly on cut and partly on fill. For slab-on-ground construction, to

minimize differential settlements that may occur, the cut area below the unit should be excavated to a depth of about 2 ft and recompactd at above optimum moisture to match the density of the fill area.

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

Retaining Walls

Retaining walls are planned for some units to form a terrace for the ground floor level.

In general, retaining walls on slopes are not recommended. If used, they should be carefully designed for each site condition.

To minimize the heave effects on the wide footing of a conventional type retaining wall, a "crib" type retaining structure without footings should be considered.

Sandy or fairly well-graded granular soils should be used for backfilling against retaining structures.

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

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

Walls restrained at top - 60 p.c.f. equivalent fluid pressure.

Walls unrestrained at top - 45 p.c.f. equivalent fluid pressure.

Allowances should also be made for lateral pressures from floor loads.

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

Concrete Slabs on Ground

To minimize heave effects, pockets of clay "CH" soils encountered below slab-on-ground areas should be removed to about 2 ft below the base course level and replaced with select on-site or borrow soils.

To minimize the capillary rise of water from underlying soils, concrete slabs on ground should be placed over a base course of 4 in. of well-graded gravel less than 3/4-in. and greater than 1/4-in. in size or some other capillary break should be provided.

It is preferable that the subgrade level be higher than the outside finish grade. The subgrade should be compacted and shaped to drain, if practicable.

Some waving of slabs on ground should be expected because of the variations in the on-site soils.

Roadway and Parking Area

In general, for light automobile traffic and drained subgrade conditions, an estimate of the roadway and parking area pavement thickness is as follows:

1. Wearing course - 2-in. asphaltic concrete.
2. Base course - 6-in. select material.
3. Subbase course - 6-in. select material.
4. Borrow - 6-in. borrow over a prepared subgrade.

Clay (CH) soils should be removed about 2 ft below the parking and roadway pavement.

Provisions should be made in the contract documents to allow for local adjustments regarding select borrow subbase and borrow material 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 avoid the ponding of water and softening of the subgrade at low points, weep holes thru the walls of the catch basins or subdrains that daylight should be placed at subgrade levels.

Utilities

Utilities should be placed after the fills are constructed.

The bottoms of utility trenches should be daylighted and graded to shed water, particularly near the tops and toes of slopes.

The backfill of these utility trenches should be carefully designed.

Utility lines should be designed with flexible joints, particularly where lines are connected to structures.

Unforeseen Conditions

Because of the variability of soil deposits, site improvements, designs and construction techniques, 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

and then evaluated so that the designs or the construction methods may be modified accordingly, if necessary.

Unforeseen or undetected conditions such as soft spots, existing utility trenches, structure foundations, voids or cavities, boulders, expansive soil pockets or seepage water, 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.

PROPOSED SPECIFICATION FOR EARTHWORK

MAKAKILO HALE II

General Description

This item shall consist of clearing and grubbing, preparing of land to be filled, excavating and filling of the land, spreading, compacting and testing of the fill, and subsidiary work for grading the site.

Clearing, Grubbing and Preparing Areas to be Filled

Vegetation, rubbish and miscellaneous material shall be removed and disposed of, leaving the disturbed area with a neat, debris-free appearance.

Topsoil and stockpiled soils shall be stripped to stiff natural ground before the placement of fills. Loose surface soils encountered at finish grade shall be scarified and recompacted.

Hard surfaces of existing haul roads shall be scarified down to stiff soils and recompacted to match the density of the surrounding soil.

The bottoms and sides of gullies or natural drainageways shall be stripped down to stiff natural ground before the placement of fills.

Subdrains shall be placed along the bottom of natural drainageways with laterals in a herringbone pattern along the sides of the drainageways.

Materials

Fill material shall consist of selected on-site soils or approved borrow soils. The soils shall contain no more than a trace of organic and deleterious matter.

Borrow soils shall be select soils generally less than 3-in. maximum size, with more than 30% fines and a plasticity index generally less than 20.

Fill material placed in the top 2 ft of fills shall contain less than 30% gravel.

Placing, Spreading and Compacting Fill Material

The selected fill material shall be placed in level layers which, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and thoroughly blade-mixed during the spreading to attain uniformity of material and water content within each layer.

Rocks or cobbles shall not be allowed to nest and voids between rocks shall be filled and compacted with small stones or earth.

When the water content of the fill material is well below the optimum for compacting purposes, water shall be added until the water content is near optimum.

When the water content of the material is well above the optimum for compacting purposes, the fill material shall be aerated by blading or by other satisfactory methods until the water content is near the optimum.

After each layer has been placed, mixed and spread evenly, it shall be compacted to 90% of maximum density in accordance with AASHTO Test No. T-180-73I or other comparable density tests. For fills in roadway areas, the top 2 ft of fill shall be compacted to 95% of the maximum density. Compaction shall be with sheepfoot rollers, multiple-wheel pneumatic-tired

rollers or other acceptable rollers which shall be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is at the specified water content. The rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to obtain the desired density.

Field density tests shall be made to get an indication of the compaction of the fill. Where sheepfoot rollers are used, the soil may be disturbed to a depth of several inches. Density readings shall be taken as often as necessary in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required density, that layer or portion shall be reworked until the required density has been obtained.

The fill operation shall be continued in 6-in. compacted layers, as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

Boulder Fills

If boulders are used for the construction of fills, they shall be generally placed along the toe section of slopes and outside of probable building sites. The subgrade shall be stripped to stiff natural ground, shaped to drain and a transition layer of select fairly well-graded granular material shall be placed on the subgrade and the boulders placed on the select material. Earth fill may be used in the void spaces between boulders. A transition layer of select granular material shall be placed against the boulder fill before construction of fills against it.

Units Partly on Cut and Parly on Fill

For slabs on ground partly on cut and partly on fill, the cut area below the unit shall be overexcavated to a depth of 2 ft and recompactd to match the density of the fill area.

Excavation

Suitable material from excavation shall be used in the fill and unsuitable material from excavation shall be disposed of.

Unforeseen Conditions

If unforeseen or undetected soil conditions such as soft spots, existing utility trenches, structure foundations, voids or cavities, boulders, seepage water or expansive soil pockets, etc., are encountered, corrective measures shall be made in the field as they are detected.

Rainy Weather

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests indicate that the water content and density are as previously specified.

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 sieve analysis test results.

Boring Log

PROJECT MAKAKILO HALE II

BORING NO. 1 Sheet No. of

Driller W. LUM ASSOC., INC. Date SEPT. 24, 1973

LOCATION Makakilo, Oahu, Hawaii

Field Party KAKU, CHOW

Tax Map Key: 9-02-3: Por. 2

Type of Boring ALGER (MOBILE B-30) Diam. 4"

Elev. 714' ± * Datum

HAMMER:

Weight 140#

Drop 30"

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time

SAMPLER: 2" STANDARD SPLIT SPOON

Date 9-24-73

PENETRATION DATA

Standard Penetration Test

N (Blows per foot)

0 10 20 30 40

Unified Soil Classification

DESCRIPTION

Depth (Ft.)

Sampler

Sample No.

Wet Dens. P.C.F.

Water Cont. %

Dry Dens. P.C.F.

Unconf. Comp. P.S.F.

Vane Shear P.S.F.

ELEV. = 714' ± ↓ *

(CH)

STIFF, BROWN CLAY W/TRACES OF SAND, GRAVEL & ROOTS COBBLE OR BOULDER

0



1-A

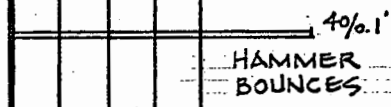
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20

-

-

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(SM)

MOTTLED BROWN DECOMPOSED ROCK W/TRACES OF CLAYEY SILT

5



1-B

-

30

-

-

-



(SM)

MEDIUM DENSITY MOTTLED BROWN W/WHITE SILTY SAND & DECOMPOSED ROCK

10



1-C

-

38

-

-

-



(MH)

STIFF, MOTTLED BROWN W/WHITE CLAYEY SILT W/TRACES OF SAND & DECOMPOSED ROCK

15



1-D

-

48

-

-

-



END OF BORING @ 21' 9-24-73

20



1-E

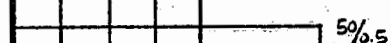
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44

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*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

11-2-73

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2
 HAMMER: 140#
 Weight 30"
 Drop
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 2 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date SEPT. 25, 1973
 Field Party KAKU, ASATO
 Type of Boring AUGER (MOBILE B-30) Diam. 4"
 Elev. 728' ± * Datum _____
 Drill Bit FINGER TYPE
 Water Level NOT NOTICED
 Time _____
 Date 9-25-73

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF, BROWN CLAYEY SILT W/TRACES OF ROOTS	0		2-A	-	16	-	-	-					
				2-B	-	19	-	-	-					
ML	STIFF, BROWN CLAYEY SILT	5		2-C	-	21	-	-	-					
						LL = 47 PL = 30								
	COBBLE OR BOULDER	10		2-D	-	15	-	-	-					
(MH)	HARD, MOTTLED GRAY CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	15		2-E	-	15	-	-	-					65
	STIFF, MOTTLED GRAY BROWN DECOMPOSED ROCK W/TRACES OF CLAYEY SILT	20		2-F	-	28	-	-	-					
	END OF BORING @ 21.5' 9-25-73													
					NOTE									
					LL = LIQUID LIMIT									
					PL = PLASTIC LIMIT									

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2

BORING NO. 3 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date SEPT. 24, 1973
 Field Party RADOVICH, KAU, OMORI
 Type of Boring ALGER (MOBILE P-50) Diam. 4"
 Elev. 737' ± * Datum _____
 Drill Bit FINGER TYPE
 Water Level NOT NOTICED
 Time _____
 Date 9-24-73

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

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	
ML	STIFF, RED SILTY CLAY	0		3-A	-	18	-	-	-						31/0.5'
						LL= 47									
						PL= 28									
MH	HARD, REDDISH BROWN SILTY CLAY	5		3-B	-	21	-	-	-						34/0.5'
						LL= 59									
						PL= 33									
CH	HARD MOTTLED GRAY BROWN CLAY	10		3-C	-	24	-	-	-						62
						LL= 18									
						PL= 32									
SM	DENSE, GRAY BROWN SILTY SAND W/ TRACES OF DECOMPOSED ROCK	15		3-D	-	25	-	-	-						50/10.4'
(MH)	STIFF MOTTLED GRAY BROWN SILTY CLAY W/ DECOMPOSED ROCK	20		3-E	-	41	-	-	-						18
	END OF BORING @ 21.5' 9-24-73														

NOTE
 LL= LIQUID LIMIT
 PL= PLASTIC LIMIT

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

WALTER LUM ASSOCIATES, INC.

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

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2
 HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 4 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date OCT. 6, 1973
 Field Party KAKI, ASATO
 Type of Boring AUGER (VERSA DRILL) Diam. 4"
 Elev. 745' ± * Datum _____
 Drill Bit FINGER TYPE
 Water Level NOT NOTICED
 Time _____
 Date 10-6-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(MH)	STIFF, REDDISH BROWN CLAYEY SILT	0 - 5	[Diagram]	4A	-	20	-	-	-					
(MH)	STIFF, GRAY BROWN CLAYEY SILT W/ TRACES OF DECOMPOSED ROCK	5 - 10	[Diagram]	4B	-	22	-	-	-					
	MOTTLED GRAY DECOMPOSED ROCK (SOME CRUSHES TO CLAYEY SILT)	10 - 15	[Diagram]	4C	-	23	-	-	-					
	GRAY ROCK FRAGMENTS	15 - 20	[Diagram]	4D	-	24	-	-	-					41
	MOTTLED GRAY DECOMPOSED ROCK	20 - 21.5	[Diagram]	4E	-	33	-	-	-					47
	END OF BORING @ 21.5' 10-6-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2
 HAMMER:
 Weight 140 #
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 5 Sheet No. of
 Driller W. LUM ASSOC., INC. Date OCT. 6, 1973
 Field Party KAKU, ASATO
 Type of Boring ALGER (YERSA) DRILL Diam. 4"
 Elev. 764 ± * Datum
 Drill Bit T.C. DRAG
 Water Level NOTICED
 Time
 Date 10-6-73

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
DRILL TIME	ELEV. = 764 ± ↓ *									0	10	20	30	40
(ML)	STIFF, BROWN CLAYEY SILT	0 - 5	5-A	5-A	-	19	-	-	-					
(CH)	STIFF, BROWN CLAY W/GRAY DECOMPOSED ROCK	5 - 7	5-B	5-B	-	21	-	-	-					
		7 - 8	5-C	5-C	-	23	-	-	-				19/0.5'	30/0.3'
	GRAY ROCK FRAGMENTS	8.0 - 10.5	5-D	5-D	-									35/0.0'
	END OF BORING @ 10.5' 10-6-73	10.5												
	NOTE: SECOND ATTEMPT 11' AWAY. DRILL TIME 8.0' - 9.5' 20 MIN.													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II

LOCATION Makakilo, Oahu, Hawaii

Tax Map Key: 9-02-3: Por. 2

HAMMER: _____

Weight 140 #

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 6 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date SEPT. 24, 1973

Field Party RADOVICH, KAU, OMORI

Type of Boring Auger (MOBILE B-50) Diam. 4"

Elev. 707' ± * Datum _____

Drill Bit FINGER TYPE

Water Level NOT NOTICED

Time _____

Date 9-24-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(GH)	STIFF, BROWN CLAY W/ GRAVEL, SAND & ORGANIC MATERIAL	0		G-A	-	10	-	-	-					
	BOULDER	5												
	STIFF, BROWN CLAYEY SILT W/ GRAVEL, DECOMPOSED ROCK & SAND			G-B	-	15	-	-	-					
	BOULDER													
	END OF BORING @ 10'	10												
	9-24-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II

BORING NO. 7 Sheet No. _____ of _____

LOCATION Makakilo, Oahu, Hawaii

Driller W. LUM ASSOC., INC. Date SEPT. 25, 1973

Tax Map Key: 9-02-3: Por. 2

Field Party KAKU, ASATO

HAMMER:

Type of Boring AUGER (MOBILE B-30) Diam. 4"

Weight 140#

Elev. 716' ± * Datum —

Drop 30"

Drill Bit FINGER TYPE

SAMPLER: 2" STANDARD SPLIT SPOON

Water Level NOT NOTICED

Time —

Date 9-25-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF, REDDISH BROWN CLAYEY SILT	0		7-A	-	17	-	-	-					
(ML)	STIFF, REDDISH BROWN CLAYEY SILT w/ DECOMPOSED ROCK	2.5		7-B	-	19	-	-	-					
(MH)	STIFF, MOTTLED GRAY BROWN CLAYEY SILT w/ DECOMPOSED ROCK	5		7-C	-	21	-	-	-					
	COBBLE OR BOULDER	10		7-D	-	NO RECOVERY			-					30/0.0'
	STIFF, MOTTLED GRAY CLAYEY SILT & DECOMPOSED ROCK	15		7-E	-	17	-	-	-				11/1.0'	
	COBBLE OR BOULDER	17.5		7-F	-	NO RECOVERY			-					40/0.1'
	GRAY, DECOMPOSED ROCK	20		7-F	-	NO RECOVERY			-					HAMMER BOUNCES
	END OF BORING @ 20.1'													HAMMER BOUNCES
	9-25-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
Tax Map Key: 9-02-3: Por. 2
 HAMMER: 140#
 Weight 30"
 Drop
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 8 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date SEPT. 27, 1973
 Field Party ASATO, CHOW
 Type of Boring ALGER (VERSA DRILL) Diam. 4"
 Elev. 722 ± X Datum _____
 Drill Bit T.C. DRAG
 Water Level NOTICED
 Time _____
 Date 9-27-73

MAKAKILO HALE II

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF BROWN CLAYEY SILT W/ TRACES OF ROOTS	0		B-A	-	18	-	-	-					
(ML)	STIFF TAN BROWN CLAYEY SILT & DECOMPOSED ROCK	5		B-B	-	16	-	-	-					
	MOTTLED GRAY DECOMPOSED ROCK (SOME CRUSHES TO CLAYEY SILT)	10		B-C	-	21	-	-	-					
	COBBLE OR BOULDER?	15		B-D	-	28	-	-	-					80
	END OF BORING @ 18.5'	18.5		B-E			NO RECOVERY							20/0.0'
	9-27-73													HAMMER BOUNCES

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

Boring Log

PROJECT MAKAKILO HALE II

BORING NO. 9 Sheet No. _____ of _____

LOCATION Makakilo, Oahu, Hawaii

Driller W. LUM ASSOC., INC. Date SEPT. 24, 1973

Tax Map Key: 9-02-3: Por. 2

Field Party RADOVICH, KAU, OMORI

Type of Boring ALGER (MOBILE B-50) Diam. 4"

HAMMER:

Elev. 728' ± * Datum _____

Weight 140#

Drill Bit FINGER TYPE

Drop 30"

Water Level NOT NOTICED

SAMPLER: 2" STANDARD SPLIT SPOON

Time _____

Date 9-24-73

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	HARD, RED CLAYEY SILT W/ TRACES OF ROOTS	0		9-A	-	16	-	-	-					
ML	HARD MOTTLED GRAY BROWN SILTY CLAY	5		9-B	-	20	LL= 47 PL= 29	-	-					
	DENSE, GRAY SILTY SAND W/ DECOMPOSED ROCK COBBLE	10		9-C	-	12	-	-	-					50/0.3
	DENSE, GRAY BROWN SILTY SAND W/ DECOMPOSED ROCK	15		9-D	-	16	-	-	-					50/0.5
	END OF BORING @ 20.5'	20.5		9-E	-	19	-	-	-					45/0.5
	9-25-73													

NOTE

LL= LIQUID LIMIT
PL= PLASTIC LIMIT

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2

BORING NO. 10 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date OCT. 8, 1973
 Field Party ASATO, KAU
 Type of Boring AUGER (VERSA DRILL) Diam. 4"
 Elev. 719' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time _____
 Date 10-8-73

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

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
DRILL RATE	ELEV. = 719' ± *									N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF, REDDISH BROWN CLAYEY SILT	0 - 4	[Diagram]	10-A	-	20	-	-	-					
(CH)	STIFF, BROWN CLAY w/ DECOMPOSED ROCK	4 - 10	[Diagram]	10-B	-	19	-	-	-					
				10-C	-	30	-	-	-					57
(MH-CH)	STIFF, MOTTLED GRAY SILTY CLAY w/ DECOMPOSED ROCK	10 - 13.5	[Diagram]	10-D	-	25	-	-	-					59/0.5
	GRAY ROCK FRAGMENTS	13.5 - 13.5	[Diagram]	10-E		NO RECOVERY								35/0.0
	END OF BORING @ 13.5'													
	10-8-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2
 HAMMER: 140 #
 Weight 30"
 Drop 2" STANDARD SPLIT SPOON
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 11 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date OCT. 5, 1973
 Field Party ASATO, KAU, OMORI
 Type of Boring AUGER (VERSA DRILL) Diam. 4"
 Elev. 724 ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level NOTICED
 Time _____
 Date 10-5-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF, BROWN CLAYEY SILT w/ TRACES OF SILTY CLAY	0		11-A	-	21	-	-	-					
(CH)	STIFF, BROWN CLAY	5		11-B	-	32	-	-	-					
	MOTTLED GRAY DECOMPOSED ROCK & CLAYEY SILT	10		11-C	-	24	-	-	-					
	COBBLE OR BOULDER	10		11-D		ROCK FRAGMENTS								
	END OF BORING @ 12'	10-5-73												

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2
 HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 12 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date OCT. 5, 1973
 Field Party ASATO, KAU, OMORI
 Type of Boring ALGER (VERSA DRILL) Diam. 4"
 Elev. 739 ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time _____
 Date 10-5-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF BROWN CLAYEY SILT	0 - 5		12-A	-	18	-	-	-					
				12-B	-	18	-	-	-					
				12-C	-	19	-	-	-					
(MH)	STIFF, GRAY BROWN SILTY CLAY W/ TRACES OF DECOMPOSED ROCK	5 - 10		12-D	-	21	-	-	-					
	GRAY DECOMPOSED ROCK	10 - 15		12-E	-	26	-	-	-					40 / 10.5
(MH)	STIFF, GRAY BROWN SANDY SILT W/ DECOMPOSED ROCK	15 - 20		12-F	-	46	-	-	-					
	END OF BORING @ 21.5'													
	10-5-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2
 HAMMER:
 Weight 140 #
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 13 Sheet No. of
 Driller W. LUM ASSOC., INC. Date SEPT. 24, 1973
 Field Party RADOVICH, KAU, OMORI
 Type of Boring ALGER (MOBILE) Diam. 4"
 Elev. 705' ± * Datum
 Drill Bit FINGER TYPE
 Water Level NOT NOTICED
 Time
 Date 9-24-73

MAKAKILO HALE II

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML-CL)	HARD, BROWN SILTY CLAY W/TRACES OF ROOTS	0 - 4	4	13-A	-	19	-	-	-					42
	BOULDER	4 - 5												
(CH)	STIFF MOTTLED GRAY BROWN, CLAY W/ SAND & GRAVEL	5 - 10	5	13-B	-	15	-	-	-					42/0.5'
(CH)	STIFF, MOTTLED BROWN CLAY W/ TRACES OF SAND	10 - 13	10	13-C	-	25	-	-	-					47/0.5'
	BOULDER	13 - 15												
	GRAY, DECOMPOSED ROCK COBBLES	15 - 16		13-D	-	16	-	-	-					50/0.5'
(CH)	STIFF, MOTTLED BROWN CLAY W/ SAND & GRAVEL	16 - 21.5	16	13-E	-	34	-	-	-					
	END OF BORING @ 21.5' 9-24-73	21.5												

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

Boring Log

PROJECT MAKAKILO HALE II

LOCATION Makakilo, Oahu, Hawaii

Tax Map Key: 9-02-3: Por. 2

HAMMER:

Weight 140#

Drop 30"

SAMPLER:

2" STANDARD SPLIT SPOON

BORING NO. 15 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date SEPT. 25, 1973

Field Party RADOVICH, OMORI, KAU

Type of Boring ALGER (MOBILE P-50) Diam. 4"

Elev. 702' ± * Datum _____

Drill Bit FINGER TYPE

Water Level NOT NOTICED

Time _____

Date 9-25-73

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	HARD, RED CLAYEY SILT	0		15-A	-	17	-	-	-	46				
GH	STIFF, MOTTLED GRAY & BROWN CLAY W/ GRAVEL	5		15-B	-	20	LL= 88 PL= 28	-	-	45				
(MH)	STIFF, MOTTLED GRAY & BROWN SANDY SILT W/ DECOMPOSED ROCK & SOME CLAY	10		15-C	-	17	-	-	-	50/0.5				
(MH)	HARD, MOTTLED GRAY CLAYEY SILT	15		15-D	-	26	-	-	-	52				
(SM)	DENSE, SILTY SAND W/ DECOMPOSED ROCK	20		15-E	-	11	-	-	-	50/0.5				
END OF BORING @ 20.5'														
9-25-73														
NOTE														
LL= LIQUID LIMIT														
PL= PLASTIC LIMIT														

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II

BORING NO. 16 Sheet No. _____ of _____

LOCATION Makakilo, Oahu, Hawaii

Driller W. LUM ASSOC., INC. Date OCT. 1, 1973

Tax Map Key: 9-02-3: Por. 2

Field Party ASATO, OSHIRO

Type of Boring ALGER (VERSA DRILL) Diam. 4"

HAMMER:

Weight 140#

Elev. 696' ± * Datum _____

Drop 30"

Drill Bit T.C. DRAG

SAMPLER: 2" STANDARD SPLIT SPOON

Water Level NOT NOTICED

Time _____

Date 10-1-73

PENETRATION DATA

Standard Penetration Test
N (Blows per foot)
0 10 20 30 40

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
(ML)	STIFF, RED BROWN CLAYEY SILT	0		16-A	-	17	-	-	-					
	COBBLE OR BOULDER			16-B	-	16	4	-	-					35/0.2'
	GRAY DECOMPOSED ROCK	5		16-C	-	16	-	-	-					40/0.5'
	END OF BORING @ 7' 10-1-73													
	NOTE: SECOND ATTEMPT ROUGH DRILLING 3.0'-4.0' MOVED HOLE 15' AWAY ON THIRD ATTEMPT. ROUGH DRILLING 4.0'-5.0'.													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II

BORING NO. 18 Sheet No. _____ of _____

LOCATION Makakilo, Oahu, Hawaii

Driller W. LUM ASSOC., INC. Date OCT. 2, 1973

Tax Map Key: 9-02-3: Por. 2

Field Party ASATO, OSHIRO

Type of Boring ALGER (VERSA DRILL) Diam. 4"

HAMMER: Weight 140#

Elev. 695 ± X Datum _____

Drop 30"

Drill Bit T.C. DRAG

SAMPLER: 2" STANDARD SPLIT SPOON

Water Level NOT NOTICED

Time _____ Date 10-4-73

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Fr.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF, REDDISH BROWN CLAYEY SILT	0 - 4.5'	[Diagram]	18-A	-	17	-	-	-				4/0.5'	
(MH-GH)	STIFF, REDDISH BROWN SILTY CLAY	4.5' - 5'	[Diagram]	18-B	-	19	-	-	-				9/0.5'	
(GH)	HARD, BROWN CLAY	5' - 10'	[Diagram]	18-C	-	21	-	-	-					
(MH)	STIFF MOTTLED GRAY BROWN SILTY CLAY W/ DECOMPOSED ROCK	10' - 15'	[Diagram]	18-D	-	25	-	-	-					50/0.5'
	MOTTLED GRAY DECOMPOSED ROCK	15' - 20'	[Diagram]	18-E	-	43	-	-	-					50/0.5'
	GRAY BROWN DECOMPOSED ROCK	20' - 21.5'	[Diagram]	18-F	-	34	-	-	-					60

NOTE: AT 5' HAMMER BOUNCES; CONTINUED HOLE 7.5' AWAY FROM 5' DEPTH.

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II

LOCATION Makakilo, Oahu, Hawaii

Tax Map Key: 9-02-3: Por. 2

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 19 Sheet No. of

Driller W. LUM ASSOC., INC Date SEPT. 25, 1973

Field Party KADOVICH, KAU, OMORI

Type of Boring ALGER (MOBILE P-50) Diam. 4"

Elev. 682' ± * Datum

Drill Bit FINGER TYPE

Water Level NOT NOTICED

Time

Date 9-25-73

MAKAKILO HALE II

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	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	HARD RED & DARK BROWN CLAY W/ ROOTS.	0		19-A	-	16	52	-	-					
(MH)	STIFF, GRAY-BROWN SANDY SILT W/SOME GRAVEL	5		19-B	-	21	-	-	-					50/0.4'
(MH)	HARD, MOTTLED GRAY SILTY CLAY	10		19-C	-	39	-	-	-					73
	LIGHT GRAY DECOMPOSED ROCK	15		19-D	-	12	-	-	-					50/0.4'
	COBBLES	18												
(MH)	STIFF, MOTTLED GRAY SILTY CLAY W/SAND	20		19-E	-	42	-	-	-					52
	END OF BORING @ 21.5'	21.5												
	9-25-73													

NOTE
 LL= LIQUID LIMIT
 PL= PLASTIC LIMIT

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2
 HAMMER: 140#
 Weight 30"
 Drop
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 20 Sheet No. of
 Driller W. LUM ASSOC., INC. Date OCT. 4 & 5, 1973
 Field Party ASATO, KAU
 Type of Boring Auger (Versa Drill) Diam. 4"
 Elev. 687' ± * Datum
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time
 Date 10-4-73

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
DRILL RATE	ELEV. = 687' ± ↓ *									N (Blows per foot)				
										0	10	20	30	40
(CH)	STIFF, BROWN CLAY W/TRACES OF DECOMPOSED ROCK			20-A	-	20	-	-	-					
(CH)	HARD, BROWN CLAY			20-B	-	21	-	-	-					
	GRAY BROWN DECOMPOSED ROCK W/CLAYEY SILT	5		20-C	-	14	-	-	-					32/0.5'
	GRAY BROWN DECOMPOSED ROCK	10		20-D	-	13	-	-	-					35/0.5'
11-15' 25 MIN	COBBLE OR BOULDER													32/10.2'
	END OF BORING @ 13'													
	10-5-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2

BORING NO. 21 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date SEPT. 25, 1973
 Field Party RADOVICH, KAU, OMORI
 Type of Boring ALGER (MOBILE B-50) Diam. 4"
 Elev. 694' ± * Datum _____
 Drill Bit FINGER TYPE

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

Water Level	NOT NOTICED			
Time				
Date	9-25-73			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	HARD, RED CLAYEY SILT	0 - 5	[Diagram]	21-A	-	18	-	-	-					
(SM)	DENSE, GRAY SILTY SAND w/ DECOMPOSED ROCK	5 - 10	[Diagram]	21-B	-	18	-	-	-					66
		10 - 15	[Diagram]	21-C	-	29	-	-	-					40/0.5'
		15 - 20	[Diagram]	21-D	-	17	-	-	-					41/0.1'
	BOULDER	20 - 21.5	[Diagram]											
	STIFF, MOTTLED GRAY SILTY CLAY & DECOMPOSED ROCK	21.5 - 21.5'	[Diagram]	21-E	-	19	-	-	-					56
	END OF BORING @ 21.5'													
	9-25-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II

LOCATION Makakilo, Oahu, Hawaii

Tax Map Key: 9-02-3: Por. 2

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 22 Sheet No. _____ of _____

Driller W. LUM ASSOC, INC. Date OCT. 5, 1973

Field Party ASATO, KAU, OMORI

Type of Boring AUGER (VERSA DRILL) Diam. 4"

Elev. 708' ± * Datum _____

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time _____

Date 10-5-73

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	ELEV. = 708' ± * STIFF REDDISH BROWN CLAYEY SILT	19		22-A	-	19	-	-	-					
		21		22-B	-	21	-	-	-					
		25		22-C	-	25	-	-	-					
	GRAY-BROWN DECOMPOSED ROCK W/TRACES OF CLAYEY SILT	23		22-D	-	23	-	-	-					
	GRAY-BROWN DECOMPOSED ROCK	28		22-E	-	28	-	-	-					42/0.5
	GRAY-BROWN DECOMPOSED ROCK W/SILTY CLAY	33		22-F	-	33	-	-	-					80
	END OF BORING @ 21.5' 10-5-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2
 HAMMER: 140#
 Weight 30"
 Drop 2" STANDARD SPLIT SPOON
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 24 Sheet No. of
 Driller W. LUM ASSOC., INC. Date OCT. 1, 1973
 Field Party ASATO, OSHIRO
 Type of Boring ALGER (VERSA DRILL) Diam. 4"
 Elev. 686' ± * Datum
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time
 Date 10-1-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF, BROWN CLAYEY SILT	0		24-A	-	16	-	-	-					
(MH-CH)	STIFF, GRAY BROWN SILTY CLAY W/ DECOMPOSED ROCK & RED BROWN CLAY POCKET	5		24-B	-	16	-	-	-					
				24-C	-	23	-	-	-					57
	GRAY ROCK FRAGMENTS	10		24-D	-	9	-	-	-					50/0.5
	MOTTLED GRAY DECOMPOSED ROCK	15		24-E	-	25	-	-	-					50/0.4
	END OF BORING @ 20.3'	20		24-F	-	26	-	-	-					50/0.3
	10-1-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2

BORING NO. 25 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date OCT. 4, 1973

Field Party ASATO, KAU

Type of Boring ALGER (VERSA DRILL) Diam. 4"

Elev. 688' ± * Datum _____

Drill Bit T.C. DRAG

HAMMER:
 Weight 140#
 Drop 30"

Water Level NOT NOTICED

Time _____

SAMPLER: 2" STANDARD SPLIT SPOON

Date 10-4-73

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
DRILL RATE										N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF, BROWN CLAYEY SILT W/ TRACES OF DECOMPOSED ROCK	0		25-A	-	17	-	-	-					
(MH-GH)	STIFF, REDDISH BROWN SILTY CLAY	5		25-B	-	19	-	-	-					
(CH)	STIFF, BROWN CLAY	5		25-C	-	20	-	-	-					
	GRAY ROCK FRAGMENTS	10		25-D	-	12	-	-	-					50/0.3'
	END OF BORING @ 15'	15		25-E										40/0.0'
														HAMMER BOUNCES

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

MAKAKILO HALE II

WALTER LUM ASSOCIATES, INC.

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

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2

BORING NO. 26 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date OCT 4, 1973
 Field Party ASATO, KAU
 Type of Boring Auger (VERSA DRILL) Diam. 4"
 Elev. 677' ± * Datum _____
 Drill Bit T.C. DRAG

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

Water Level	<u>NOT NOTICED</u>			
Time				
Date	<u>10-4-73</u>			

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(MH)	STIFF, BROWN CLAYEY SILT	0 - 1		26-A	-	15	-	-	-					
(CH)	STIFF, BROWN CLAY	1 - 2		26-B	-	18	-	-	-					
(CH)	STIFF MOTTLED GRAY BROWN CLAY W/ DECOMPOSED ROCK	2 - 5		26-C	-	23	-	-	-					65
	MOTTLED GRAY DECOMPOSED ROCK FRAGMENTS	5 - 10		26-D	-	23	-	-	-					59/0.5
	GRAY BROWN DECOMPOSED ROCK FRAGMENTS	10 - 15		26-E	-	27	-	-	-					40/0.3
	GRAY ROCK FRAGMENTS	15 - 20		26-F	NO RECOVERY								32/0.0	
	END OF BORING @ 20' 10-4-73	20												HAMMER BOUNCES

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

Boring Log

PROJECT MAKAKILO HALE II

LOCATION Makakilo, Oahu, Hawaii

Tax Map Key: 9-02-3: Por. 2

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 27 Sheet No. of

Driller W. LUM ASSOC. INC. Date SEPT. 28, 1973

Field Party ASATO, CHOW

Type of Boring AUGER (VERSA DRILL) Diam. 4"

Elev. 682' ± * Datum

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time

Date 9-28-73

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF BROWN CLAYEY SILT W/ DECOMPOSED ROCK END OF BORING @ 3' 9-28-73 NOTE: ROUGH DRILLING FOR 5 MIN. MOVED HOLE 5' SOUTH. HIT COBBLE OR BOULDER AT 2.0'. THIRD ATTEMPT 19' NORTH. HIT COBBLE OR BOULDER AT 2'.	0 3		21-A	-	18	-	-	-					35/0.3'

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

Boring Log

PROJECT MAKAKILO HALE II
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-02-3: Por. 2

BORING NO. 28 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date SEPT. 25 & 26, 1973
 Field Party RADOVICH KAU, OMORI, OSHIRO
 Type of Boring ALGER (MOBILE B-50) Diam. 4"
 Elev. 669' ± * Datum _____
 Drill Bit FINGER TYPE

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

Water Level	<u>NOT NOTICED</u>			
Time				
Date	<u>9-28-73</u>			

MAKAKILO HALE II

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML-CL)	STIFF, RED SILTY CLAY	0		28-A	-	19	-	-	-					
(GH)	HARD, MOTTLED BROWN CLAY	5		28-B	-	25	-	-	-					19
	COBBLES OR BouldERS	10												
	COBBLES OR BouldERS	15		28-C	-	20	-	-	-					50/0.2
	END OF BORING @ 18'													
	9-26-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

Boring Log

PROJECT MAKAKILO HALE II

BORING NO. 29 Sheet No. _____ of _____

LOCATION Makakilo, Oahu, Hawaii

Driller W. LUM ASSOC. INC. Date SEPT. 25, 1973

Tax Map Key: 9-02-3: Por. 2

Field Party RADOVICH, KALL, OMORI

HAMMER:

Type of Boring AUGER (MOBILE B-50) Diam. 4"

Weight 140#

Elev. 672' ± * Datum _____

Drop 30"

Drill Bit: FINGER TYPE

SAMPLER: 2" STANDARD SPLIT SPOON

Water Level NOT NOTICED

Time _____

Date 9-25-73

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	HARD, MOTTLED RED BROWN CLAYEY SILT	0		29-A	-	18	-	-	-					47
(MH-GH)	STIFF MOTTLED GRAY BROWN SILTY CLAY W/TRACES OF SAND	5		29-B	-	22	-	-	-					
(SM)	BOLDER DENSE, GRAY SILTY SAND	10		29-C	-	4	-	-	-					50.5
	COBBLES OR BOLLERS	15												
	END OF BORING @ 17' 9-25-73													

*Elevation estimated from Site Plan by C. R. Sutton & Assoc., Inc. (7-30-73)

MAKAKILO HALE II

MAKAKILO HALE II

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	<u>2</u>		<u>3</u>	
SAMPLE NO.	<u>C</u>		<u>A</u>	<u>B</u>
DEPTH BELOW SURFACE	<u>5'-6.5'</u>		<u>0.5'-1.5'</u>	<u>5'-6'</u>
DESCRIPTION	<u>BROWN CLAYEY SILT</u>		<u>RED SILTY CLAY</u>	<u>REDDISH- BROWN SILTY CLAY</u>
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	<u>NATURAL</u>		<u>NATURAL</u>	<u>NATURAL</u>
Liquid Limit	<u>47</u>		<u>47</u>	<u>59</u>
Plastic Limit	<u>30</u>		<u>28</u>	<u>33</u>
Plasticity Index	<u>17</u>		<u>19</u>	<u>26</u>
Dilatancy	<u>SLOW-MED.</u>		<u>SLOW</u>	<u>NONE-SLOW</u>
Toughness	<u>MEDIUM</u>		<u>MED-HIGH</u>	<u>MEDIUM</u>
Dry Strength	<u>MEDIUM</u>		<u>SLIGHT-MED.</u>	<u>SLIGHT-MED.</u>
UNIFIED SOIL CLASSIFICATION	<u>ML</u>		<u>ML</u>	<u>MH</u>
APPARENT SPECIFIC GRAVITY				
CBR TESTS				
(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 (AASHTO T-180-57 Method <u> </u>)				
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 10-24-13 By BT

MAKAKILO HALE II

TABLE I D - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	<u>3</u>	<u>3</u>		
SAMPLE NO.	<u>C</u>	<u>D</u>		
DEPTH BELOW SURFACE	<u>10'-11.5'</u>	<u>15'-15.9'</u>		
DESCRIPTION	<u>MOTTLED GRAY BROWN CLAY</u>	<u>GRAY-BROWN SILTY SAND WITH TRACES OF DECOMP. ROCK</u>		
GRAIN-SIZE ANALYSIS				
(% Passing)				
Sieve				
1"		<u>100</u>		
1/2"		<u>100</u>		
#4		<u>85.8</u>		
#10		<u>69.8</u>		
#20		<u>56.7</u>		
#40		<u>49.9</u>		
#100		<u>43.6</u>		
#200		<u>42.1</u>		
ATTERBERG LIMITS				
Air Dried or Natural	<u>NATURAL</u>			
Liquid Limit	<u>78</u>			
Plastic Limit	<u>32</u>			
Plasticity Index	<u>46</u>			
Dilatancy	<u>SLOW</u>			
Toughness	<u>MED-HIGH</u>			
Dry Strength	<u>MED-HIGH</u>			
UNIFIED SOIL CLASSIFICATION				
	<u>CH</u>	<u>SM</u>		
APPARENT SPECIFIC GRAVITY				
CBR TESTS				
(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				
(AASHTO T-180-57 Method <u> </u>)				
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 10-24-73 By BT

MAKAKILO HALE II

TABLE I C - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	9	14	15	
SAMPLE NO.	B	C	B	
DEPTH BELOW SURFACE	5'-6.5'	5'-6.5'	5'-6.5'	
DESCRIPTION	MOTTLED GRAY-BROWN SILTY CLAY	MOTTLED BROWN CLAY W/SOME SAND & ROOTS	MOTTLED GRAY & BROWN CLAY W/GRAVEL	
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	
Liquid Limit	47	89	88	
Plastic Limit	29	30	28	
Plasticity Index	18	59	60	
Dilatancy	MEDIUM	NONE	SLOW-MED.	
Toughness	SLIGHT-MED.	HIGH	HIGH	
Dry Strength	SLIGHT-MED.	MED-HIGH	HIGH	
UNIFIED SOIL CLASSIFICATION	ML	CH	CH	
APPARENT SPECIFIC GRAVITY				
CBR TESTS				
(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 (AASHO T-180-57 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 10-24-73 By BT

MAKAKILO HALE II

TABLE 10 - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	17	17	17	17
SAMPLE NO.	A	B	C	D
DEPTH BELOW SURFACE	0.5'-2'	2.5'-4'	5'-6.5'	10'-11'
DESCRIPTION	BROWN CLAYEY SILT W/ TRACES OF ROOTS	BROWN CLAYEY SILT W/ TRACES OF ROOTS	MOTTLED GRAY-BROWN CLAYEY SILT	MOTTLED GRAY DECOMP. ROCK (SOME CRUSHES TO SANDY SILT)
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				100
1/2"				100
#4				74.6
#10				60.0
#20				55.1
#40				53.6
#100				52.0
#200				51.1
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	
Liquid Limit	52	56	66	
Plastic Limit	32	34	42	
Plasticity Index	20	22	24	
Dilatancy	MEDIUM	SLOW	MEDIUM	
Toughness	MEDIUM	MEDIUM	MEDIUM	
Dry Strength	SLIGHT-MED	SLIGHT-MED	SLIGHT-MED	
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	MH
APPARENT SPECIFIC GRAVITY				
CBR TESTS				
(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 (AASHTO T-180-57 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 10-24-73 By BT

MAKAKILO HALE II

TABLE I E - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	19		23	
SAMPLE NO.	A		B	
DEPTH BELOW SURFACE	0.5'-2'		2.5'-4'	
DESCRIPTION	RED & DARK BROWN CLAY W/ROOTS		BROWN CLAY W/GRAY DECOMP. ROCK	
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL		NATURAL	
Liquid Limit	52		52	
Plastic Limit	25		27	
Plasticity Index	27		25	
Dilatancy	SLOW-MED.		SLOW	
Toughness	MED.-HIGH		MED.-HIGH	
Dry Strength	MEDIUM		MED.-HIGH	
UNIFIED SOIL CLASSIFICATION	CH		CH	
APPARENT SPECIFIC GRAVITY				
CBR TESTS				
(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 (AASHTO T-180-57 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 10-24-73 By BT

MAKAKILO HALE II

TABLE I F - SUMMARY OF LABORATORY TEST RESULTS

PARKING LOT	A	B	C	D
SAMPLE NO.				
DEPTH BELOW SURFACE	SURFACE	SURFACE	SURFACE	SURFACE
DESCRIPTION	REDDISH - BROWN CLAYEY SILT	REDDISH - BROWN CLAYEY SILT	REDDISH - BROWN CLAYEY SILT	BROWN SILTY CLAY
GRAIN-SIZE ANALYSIS				
(% Passing)				
Sieve				
1"	100	100	100	100
1/2"	100	100	100	100
#4	100	100	98.8	100
#10	99.9	99.9	98.7	99.9
#20	99.7	99.7	98.6	99.9
#40	99.4	99.0	98.3	99.8
#100	98.4	97.8	94.5	99.8
#200	97.6	97.3	91.0	99.8
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	50	46	49	48
Plastic Limit	31	31	28	27
Plasticity Index	19	15	21	21
Dilatancy	SLOW	MEDIUM	MEDIUM	MEDIUM
Toughness	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Dry Strength	MEDIUM	SLIGHT-MED.	MEDIUM	MEDIUM
UNIFIED SOIL CLASSIFICATION				
	ML-MH	ML	ML	ML-CL
APPARENT SPECIFIC GRAVITY				
	2.86			2.90
CBR TESTS				
(Surcharge-51 P.S.F.)				
Molding Moisture, %	24.9	25.9	22.9	25.1
Molding Dry Density, P.C.F.	101.5	99.6	105.2	95.9
Swell upon saturation, %	0.2	0.3	0.8	2.1
CBR at 0.1" Penetration	18.3	6.1	12.3	5.7
MOISTURE-DENSITY RELATIONS OF SOILS				
(AASHTO T-180-57 Method)				
Dry to Wet or Wet to Dry	A			A
Max. Dry Density (P.C.F.)	DRY TO WET			DRY TO WET
Optimum Moisture (%)	100.5			102.8
	24.8			22.5

REMARKS:

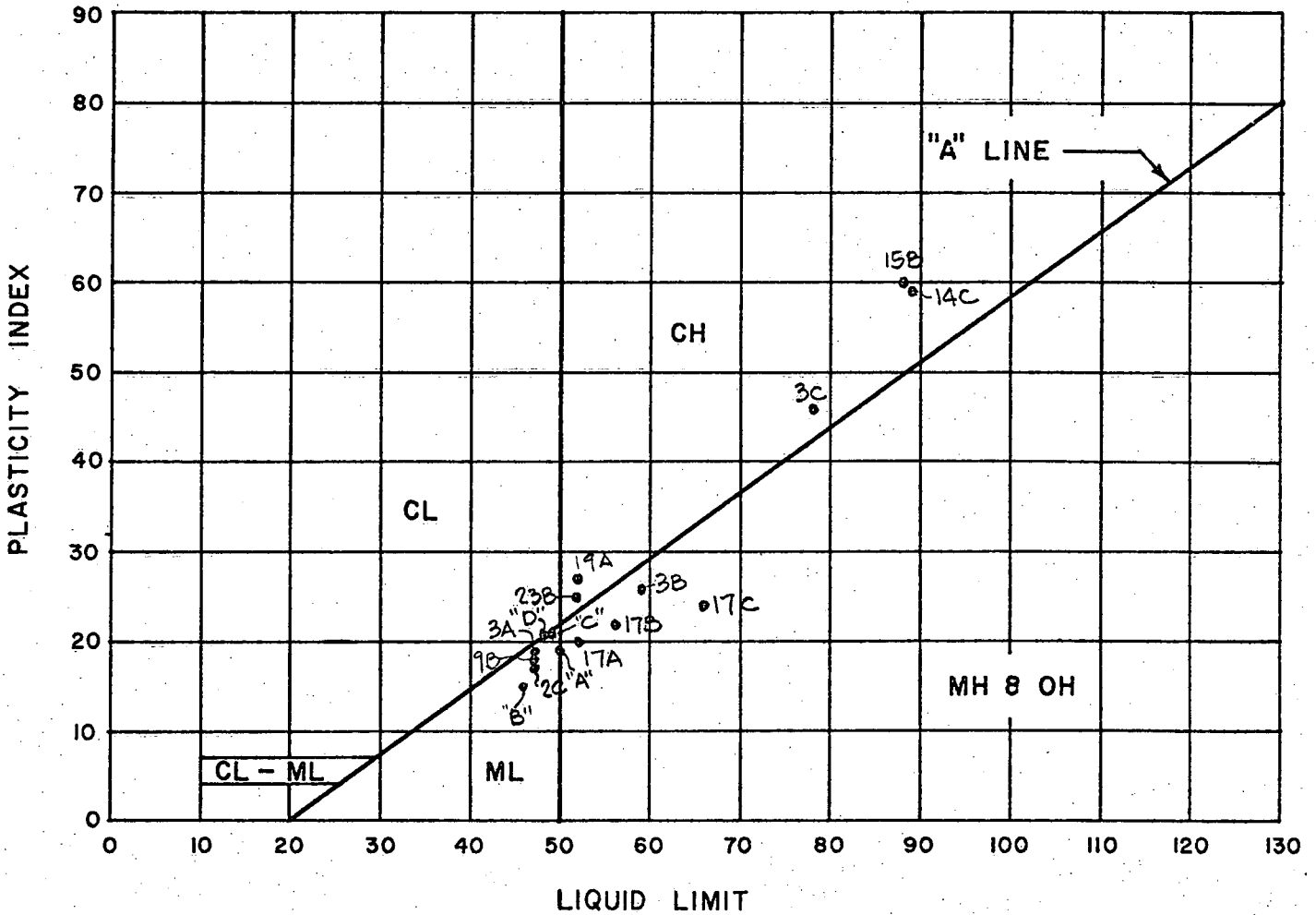
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 10-24-73 By BT

PLASTICITY CHART

PROJECT: MAKAKILO HALE II

LOCATION: MAKAKILO, OAHU, HAWAII



DATE 10-24-73 BY BT

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

MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

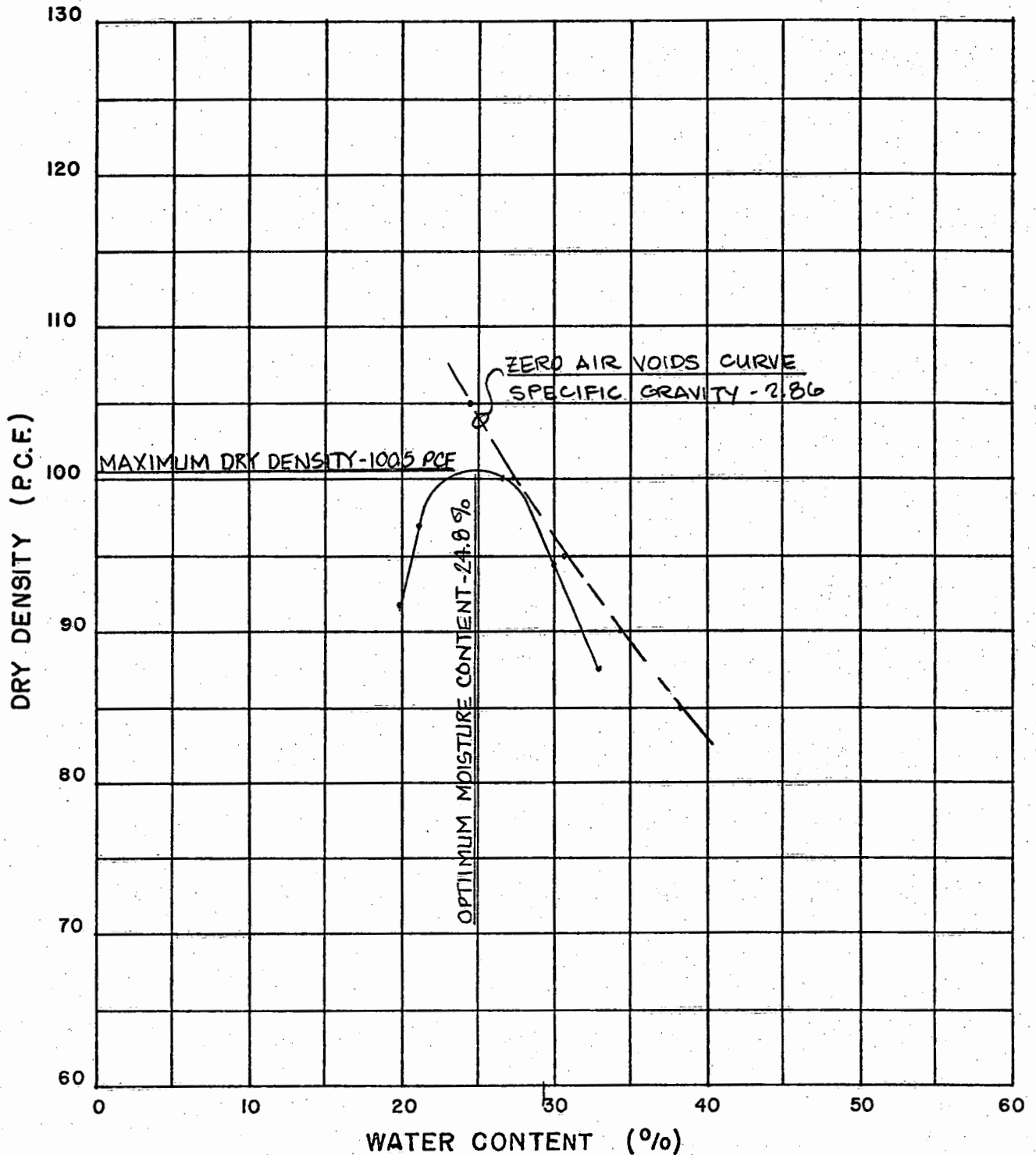
PROJECT: MAKAKILO HALE II

LOCATION: MAKAKILO, OAHU, HAWAII

SAMPLE NO.: "A" SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4" ϕ x 4.584" HIGH
HAMMER: 10 LBS 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



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

DATE 10-9-73 BY JS

MOISTURE-DENSITY CURVE (AASHTO T-180-57, METHOD A)

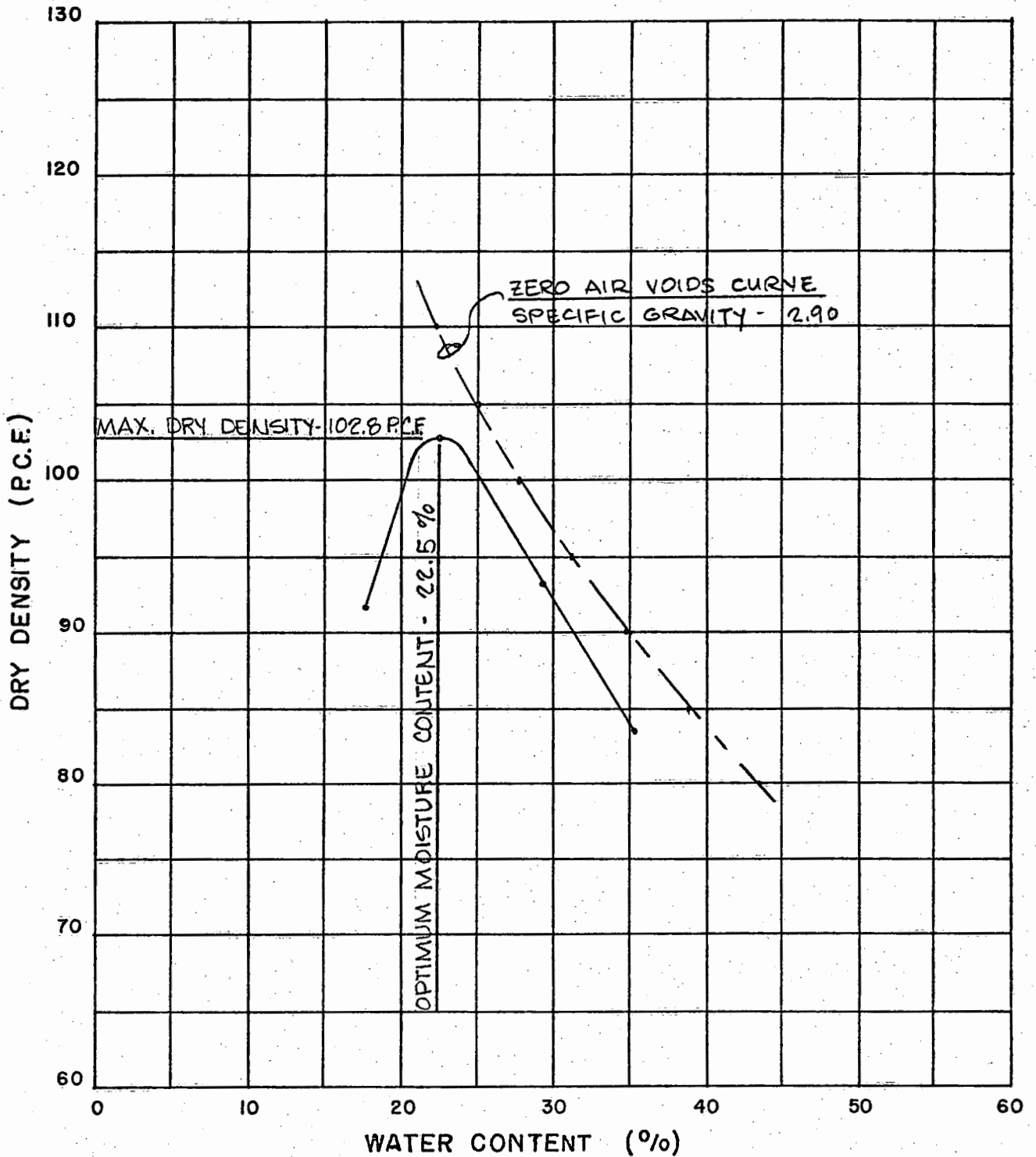
PROJECT: MAKAKILO HALE II

LOCATION: MAKAKILO, OAHU, HAWAII

SAMPLE NO.: "0" SURFACE

SAMPLE DESCRIPTION: BROWN SILTY CLAY

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4" ϕ X 4.584" HIGH
HAMMER: 10 LBS, 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



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

DATE 10-9-73 BY NI

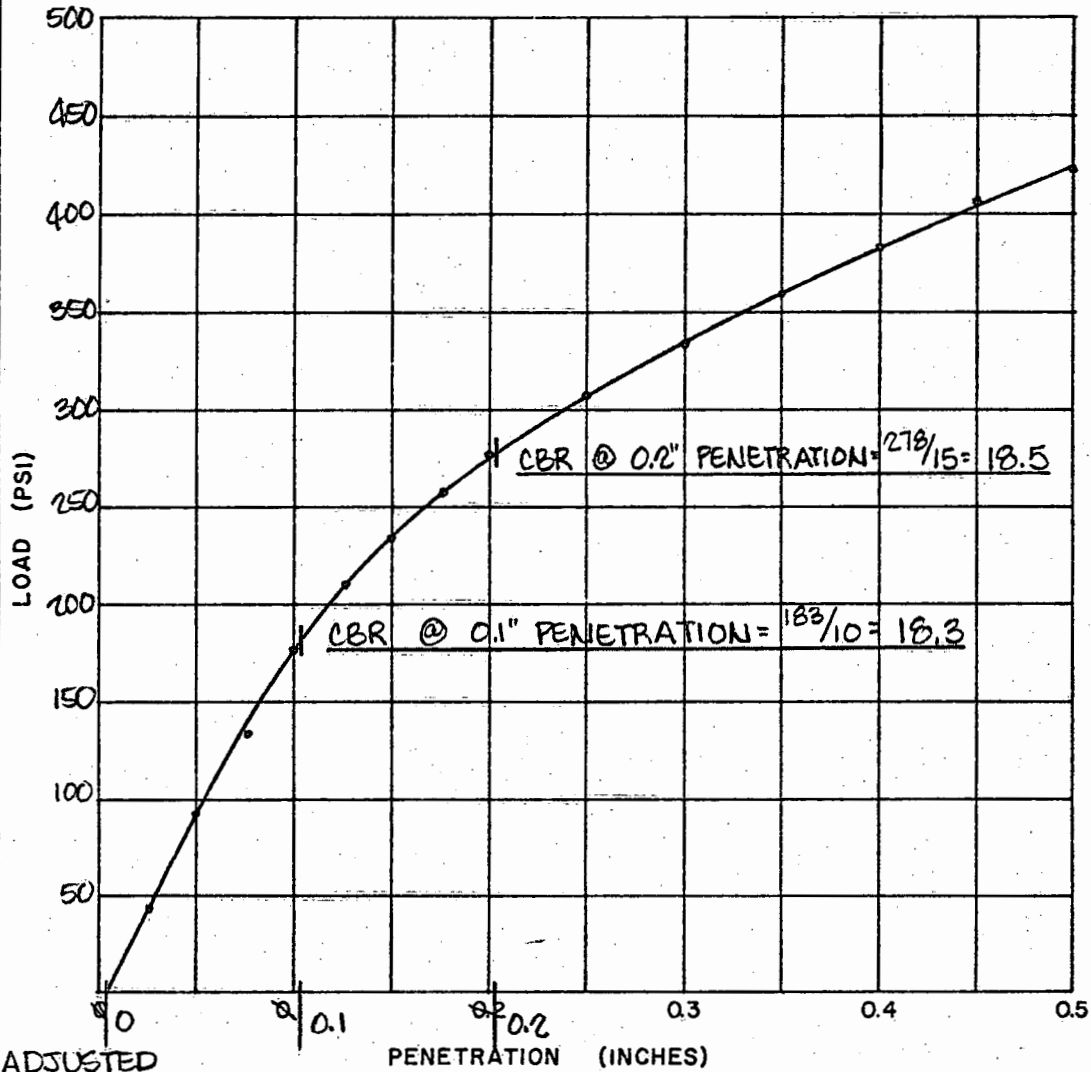
CBR TEST

PROJECT: MAKAKILO HALE II

LOCATION: MAKAKILO, OAHU, HAWAII

SAMPLE NO: "A" SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	130	43
0.050	280	93
0.075	400	133
0.100	530	177
0.125	630	210
0.150	700	233
0.175	770	257
0.200	830	277
0.250	920	307
0.300	1000	333
0.350	1080	360
0.400	1150	383
0.450	1220	407
0.500	1270	423

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

ADJUSTED COORDINATES
TEST RESULTS:

MOLDING MOISTURE, % 24.9
 MOLDING DRY DENSITY, P.C.F. 101.5
 CBR @ 0.1" PENETRATION 18.3
 DAYS SOAKED 4

DATE 10-10-73 BY RH
 DATE 10-11-73 BY NI

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

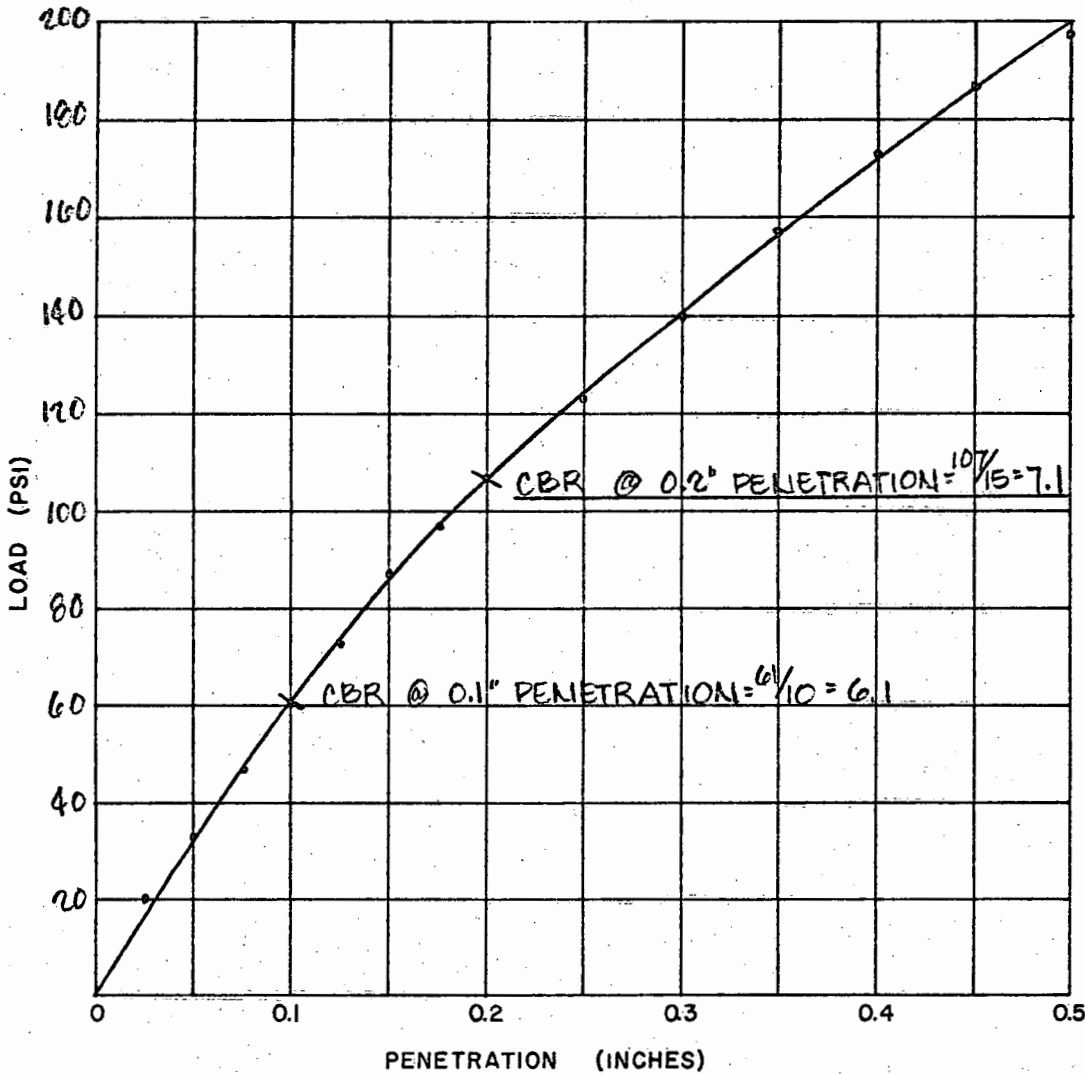
CBR TEST

PROJECT: MAKAKILO HALE II

LOCATION: MAKAKILO, OAHU, HAWAII

SAMPLE NO: "B" SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	60	20
0.050	100	33
0.075	140	47
0.100	180	60
0.125	220	73
0.150	268	87
0.175	290	97
0.200	320	107
0.250	370	123
0.300	420	140
0.350	470	157
0.400	520	173
0.450	560	187
0.500	590	197

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

TEST RESULTS:

MOLDING MOISTURE, % 25.9
 MOLDING DRY DENSITY, P.C.F. 99.6
 CBR @ 0.1" PENETRATION 6.1
 DAYS SOAKED 4

DATE 10-10-73 BY RH
 DATE 10-11-73 BY NI

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

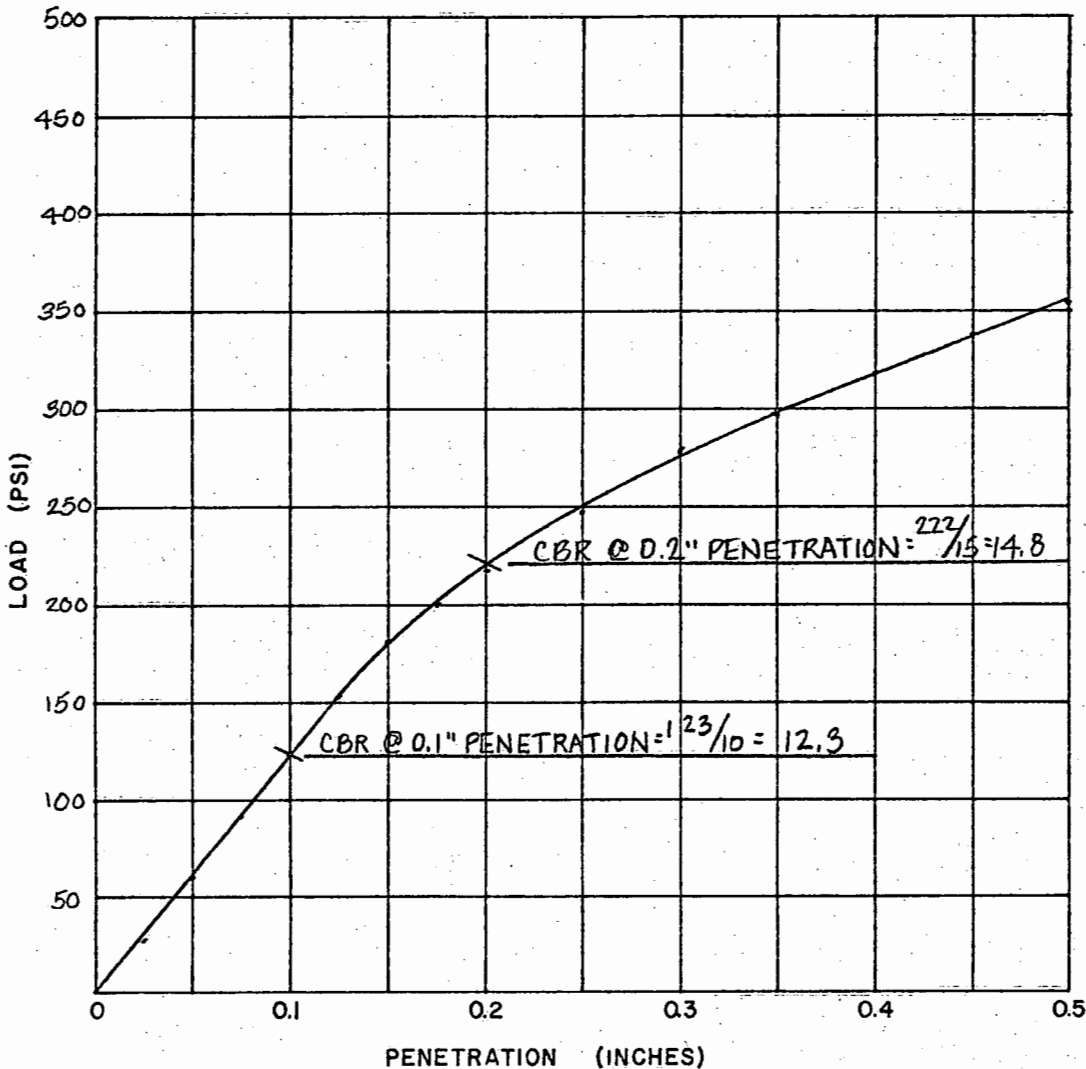
CBR TEST

PROJECT: MAKAKILO HALE II

LOCATION: MAKAKILO, OAHU, HAWAII

SAMPLE NO: "C" SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	80	27
0.050	180	60
0.075	275	92
0.100	370	123
0.125	460	153
0.150	540	180
0.175	600	200
0.200	650	217
0.250	740	247
0.300	830	277
0.350	890	297
0.400	950	317
0.450	1010	337
0.500	1060	353

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

TEST RESULTS:

MOLDING MOISTURE, % 22.9

MOLDING DRY DENSITY, P.C.F. 105.2

CBR @ 0.1" PENETRATION 12.3

DAYS SOAKED 4

DATE 10-12-73 BY CL

DATE 10-15-73 BY JS

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

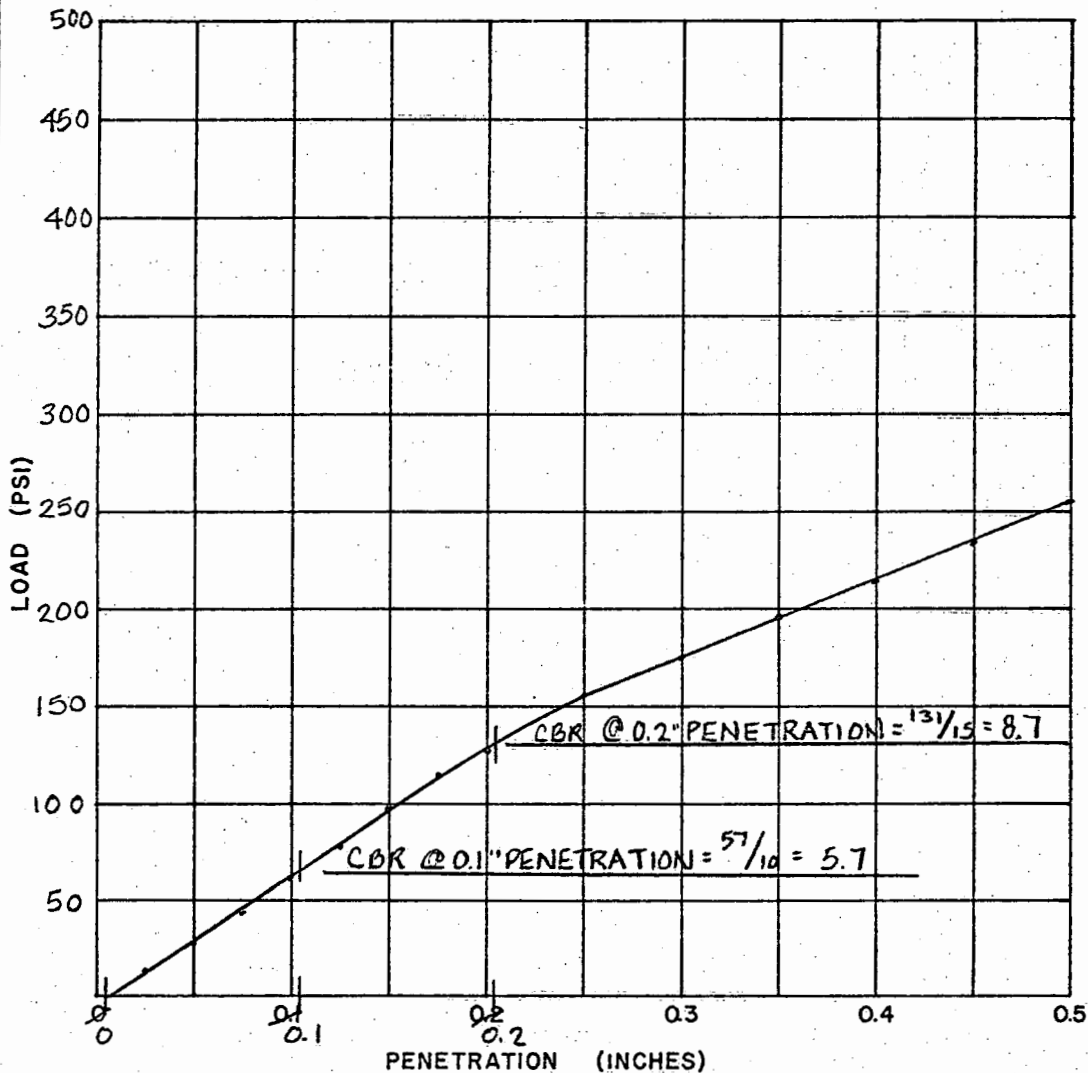
CBR TEST

PROJECT: MAKAKILO HALE II

LOCATION: MAKAKILO, OAHU, HAWAII

SAMPLE NO: "D" SURFACE

SAMPLE DESCRIPTION: BROWN SILTY CLAY



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	38	13
0.050	82	27
0.075	130	43
0.100	183	61
0.125	237	79
0.150	294	98
0.175	344	115
0.200	385	128
0.250	464	155
0.300	528	176
0.350	588	196
0.400	646	215
0.450	705	235
0.500	767	256

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

ADJUSTED COORDINATES
 TEST RESULTS:

MOLDING MOISTURE, % 25.1

MOLDING DRY DENSITY, P.C.F. 95.9

CBR @ 0.1" PENETRATION 5.7

DAYS SOAKED 4

DATE 10-10-73 BY RH

DATE 10-11-73 BY JS

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

LOGS OF BORINGS

FROM

"MAKAKILO DEVELOPMENT - KAPOLEI PD-H"

REPORT DATED MARCH 5, 1973

Boring Log

PROJECT MAKAKILO DEVELOPMENT
KAPOLEI P.D.H.

LOCATION Makakilo, Oahu, Hawaii
Tax Map Key: 9-2-03: Por. 2

HAMMER:
Weight 140 #
Drop 30"
SAMPLER: 2"GS - 2" STANDARD SPLIT SPOON
"AX" - AX DOUBLE TUBE CORE BARREL

BORING NO. 1 Sheet No. _____ of _____

Driller W.L. LUM ASSOC, INC. Date FEB. 13, 1973

Field Party SUZUKI, TAGUCHI, CHOW

Type of Boring ALGERY (CONCORE) (1218) Diam. 3" & "AX"

Elev. 731' ± * Datum _____

Drill Bit T.C. DRAG & T.C. CORING

Water Level	NOT NOTICED				
Time	—				
Date	2-13-73				

KAPOLEI P.D.

PENETRATION DATA

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.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(ML)	STIFF, REDDISH BROWN GLAYEY SILT w/ DECOMPOSED ROCK	0 - 2.55	2"SS	1-A	—	24	—	—	—					
	LAVA ROCK & DECOMPOSED ROCK	2.55 - 5	"AX"	RUN #1										
	BLUE, DENSE LAVA ROCK	5 - 6.5	"AX"	RUN #2										
	NOTE: LOST WATER @ 6.5'	6.5 - 9.5												
	END OF BORING @ 9.5'	9.5												

* ELEVATION ESTIMATED FROM EXISTING FEATURES PLAN BY G.R. SUTTON & ASSOC., INC. (11-6-72)

CM

Boring Log

MAKAKILO DEVELOPMENT
KAPOLEI P.D.H.

BORING NO. 2 Sheet No. _____ of _____

PROJECT _____

Driller W. LUM ASSOC., INC. Date FEB. 8, 1973

LOCATION Makakilo, Oahu, Hawaii

Field Party SUZUKI, CHOW, K. MEYER

Tax Map Key: 9-2-03: Por. 2

Type of Boring AUGER (CONCRETE) Diam. 3" & "AX"

HAMMER: _____

Elev. 674' ± * Datum _____

Weight 140#

Drill Bit T.C. DRAG

Drop 30"

Water Level NOT NOTICED

SAMPLER: 2" STANDARD SPLIT SPOON

Time _____

Date 2-8-73

KAPOLEI P.D.

PENETRATION DATA

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.	Standard Penetration Test					
										N (Blows per foot)					
DRILL RATE										0	10	20	30	40	
	ELEV. = 674' ± * ₀														
(ML)	MEDIUM, REDDISH BROWN CLAYEY SILT			2-A	-	21	-	-	-						
(ML)	STIFF, REDDISH BROWN CLAYEY SILT														
(ML-MH)	STIFF, GRAY & REDDISH BROWN CLAYEY SILT			2-B	-	21	-	-	-						
	ROCK (BOULDER)														
(SM)	DENSE, GRAY SILTY SAND W/ GRAVEL			2-C	-	23	-	-	-						80/0.5'
	ROCK														
	END OF BORING @ 13'														

* ELEVATION ESTIMATED FROM EXISTING FEATURES PLAN BY G.R. SUTTON & ASSOC., INC. (11-6-72)

SM

Boring Log

PROJECT MAKAKILO DEVELOPMENT
KAPOLEI P.D.H.
 LOCATION Makakilo, Oahu, Hawaii
 Tax Map Key: 9-2-03: Por. 2

BORING NO. 3 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date FEB. 9, 1973
 Field Party SUZUKI, CHOW
 Type of Boring AUGER & ROTARY (CORE) 1218 Diam. 3" & "AX"

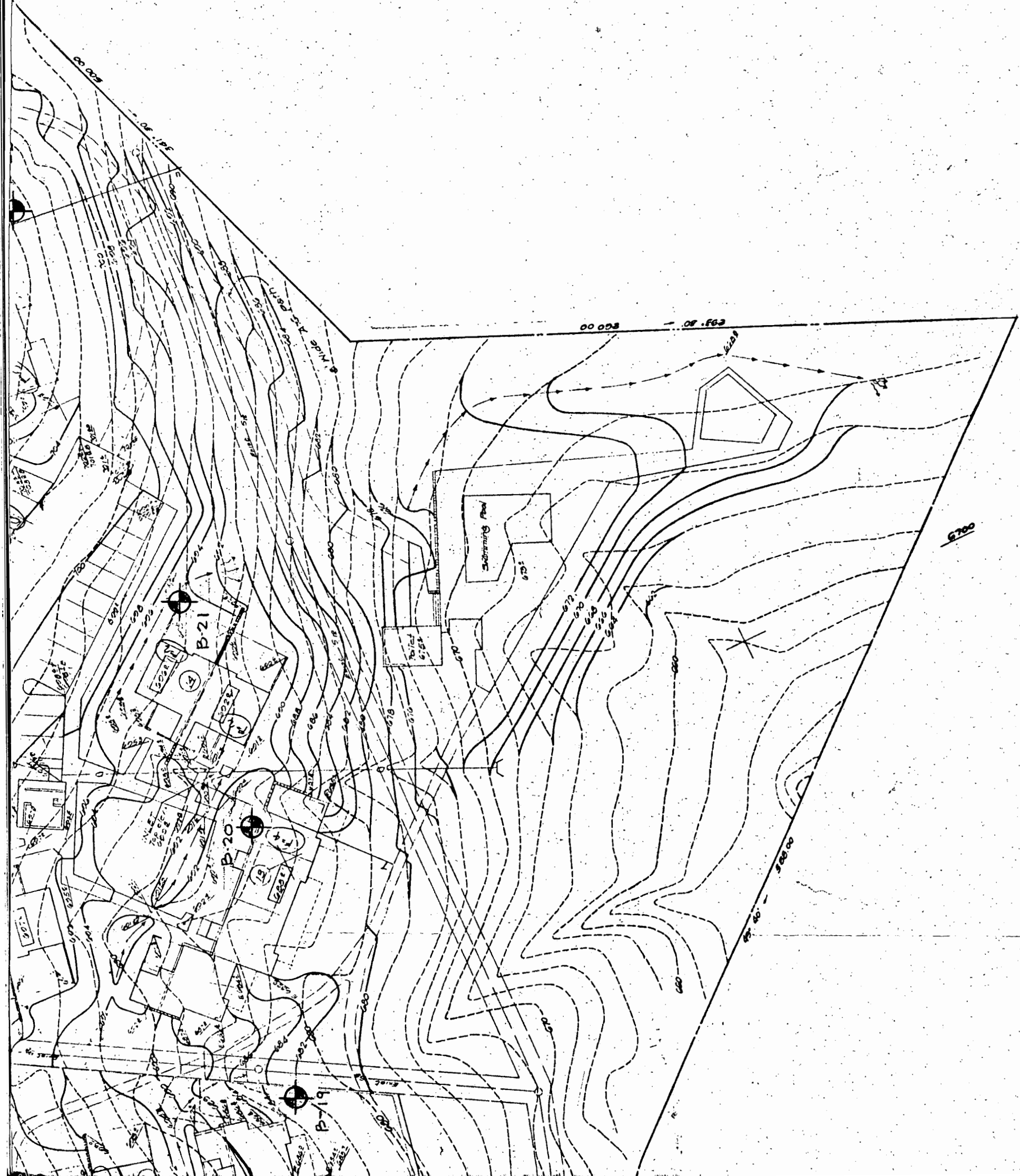
HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" SS - 2" STANDARD SPLIT SPOON
"AX" - AX DOUBLE TUBE CORE BARREL

Elev. _____ Datum _____
 Drill Bit T.C. DRAG & T.C. CORING
 Water Level NOT NOTICED
 Time _____
 Date 2-9-73

KAPOLEI - P.D.

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
ML	STIFF, REDDISH BROWN CLAYEY SILT	0 - 5	2"SS	3-A	29	20	44	-	-					
		5 - 10	2"SS	3-B	-	19	-	-	-					
CH	STIFF, BROWN CLAY	10 - 15	2"SS	3-C	26	22	79	-	-					41
	BLUE, DENSE LAVA ROCK (BOULDER?)	15 - 18'	"AX"	RUN #1										
	STIFF, MOTTLED BROWN CLAYEY SILT													
	END OF BORING @ 18'													
	* ELEVATION ESTIMATED FROM EXISTING FEATURES PLAN BY C.R. SUTTON & ASSOC., INC. (11-6-72)													

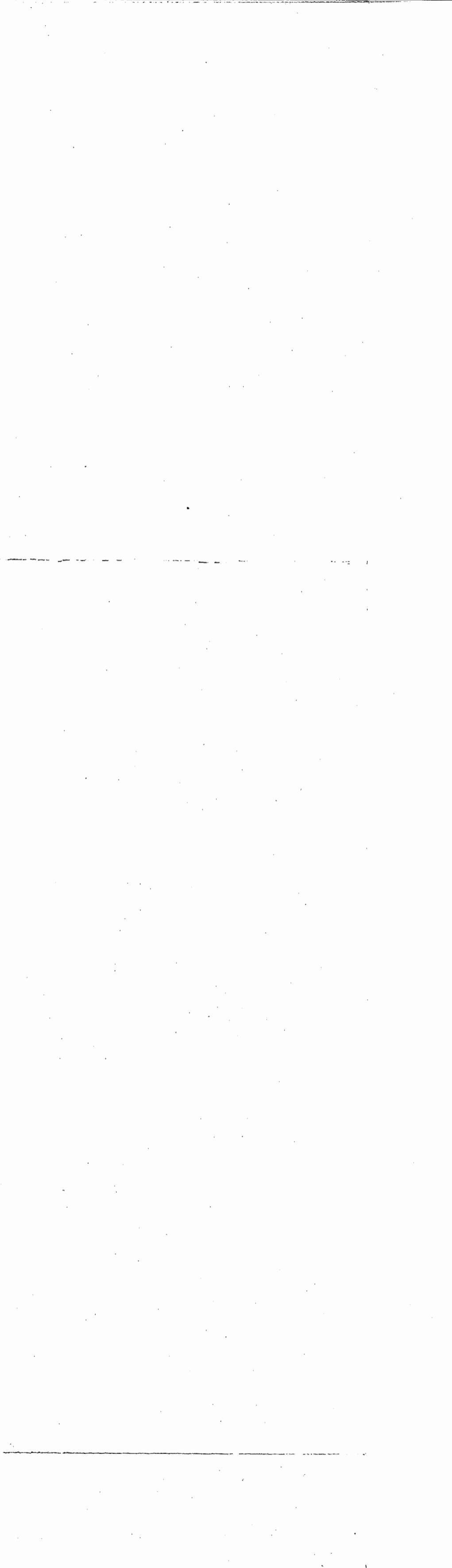
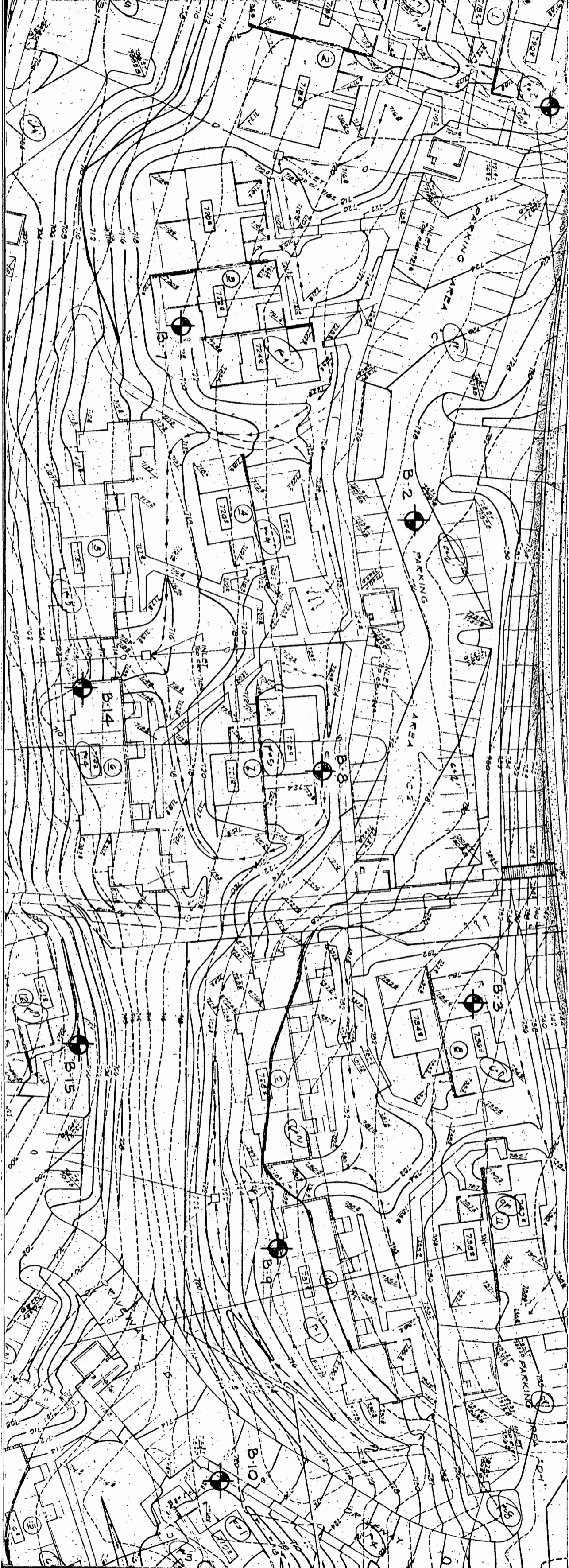
C.M.

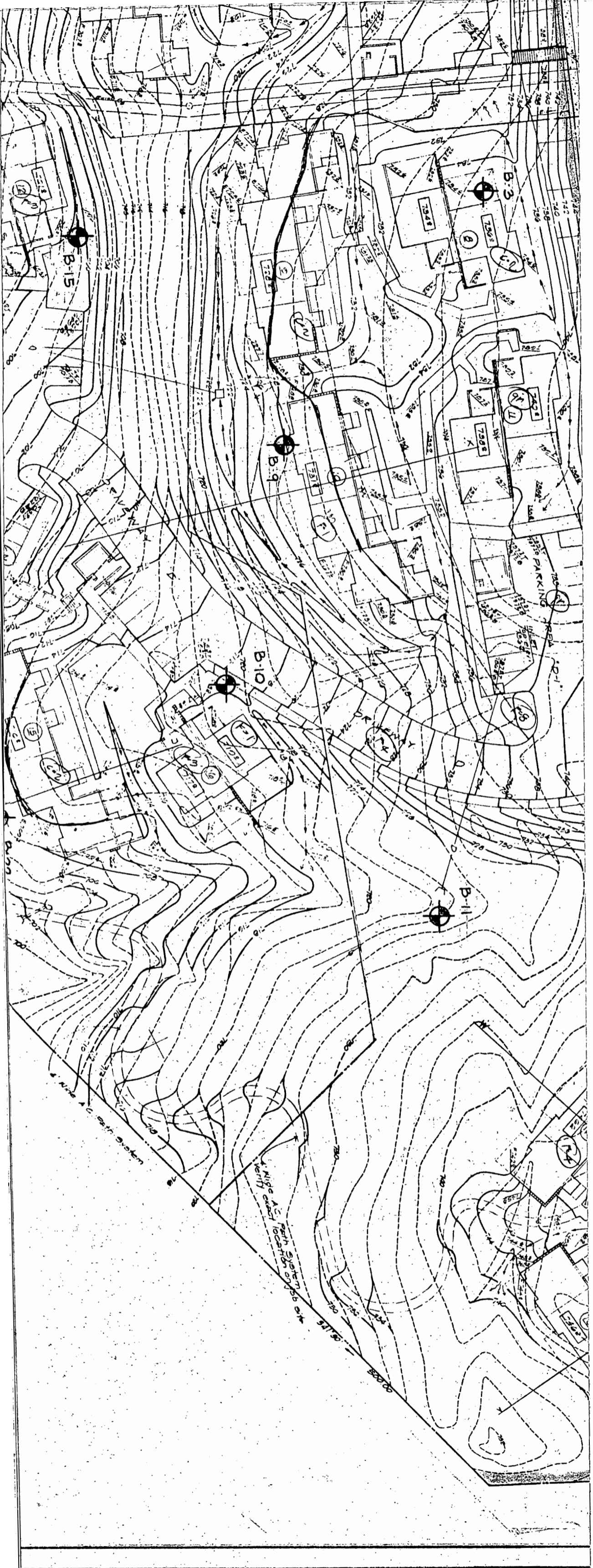


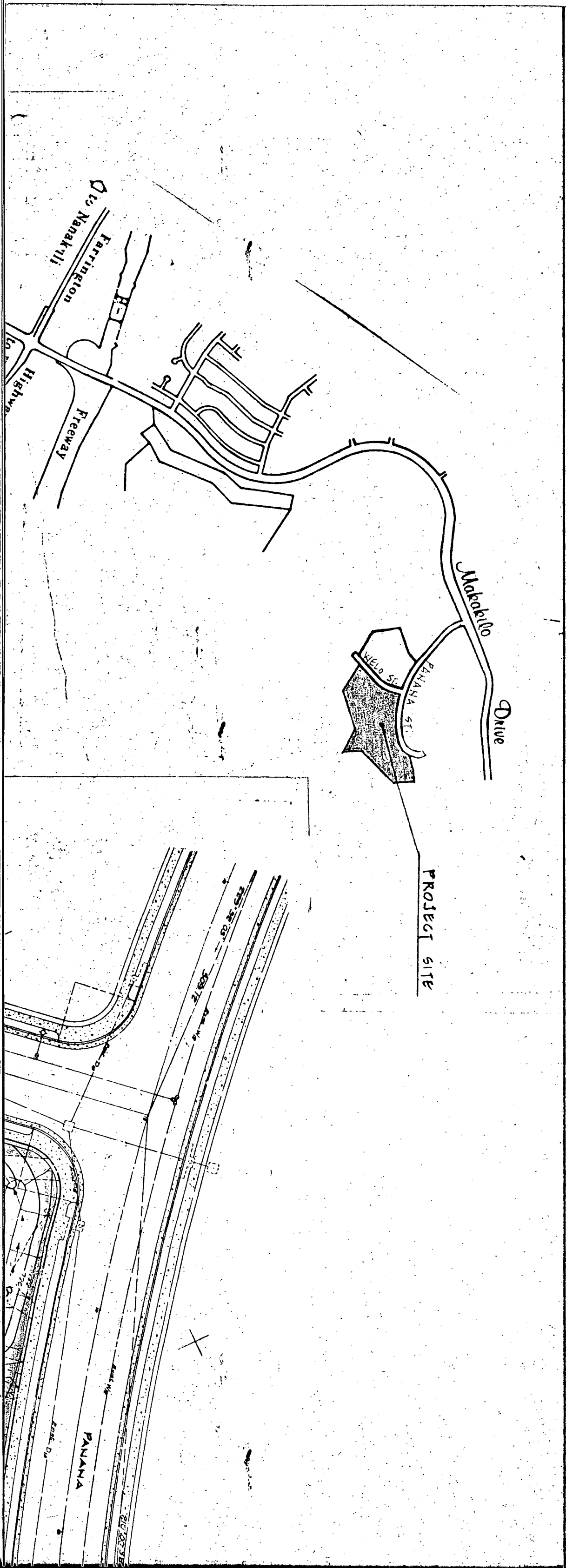
BORING LOCATION SKETCH
MAKAKILO HALE II
 MAKAKILO, OAHU, HAWAII
 TAX MAP KEY: 9-2-03 : POR. 2

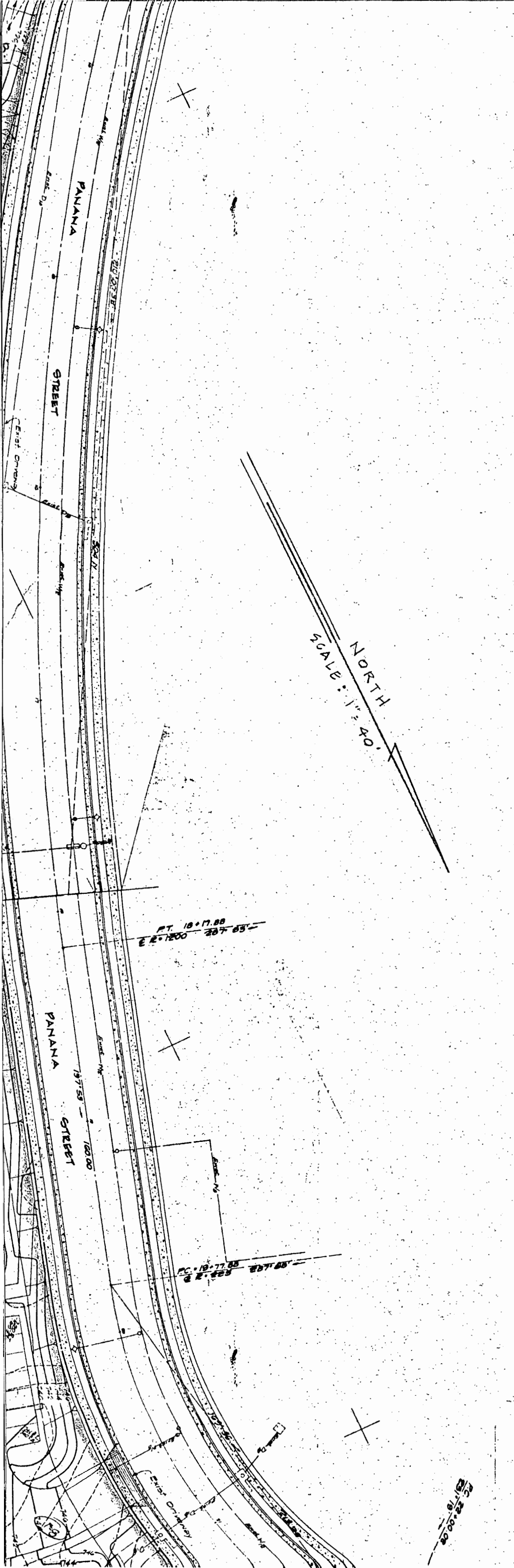
Dr. _____	WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVE. CIVIL ENGINEERS PHONE 737-7931	Sheet _____
Date _____		of _____
Rev. _____		









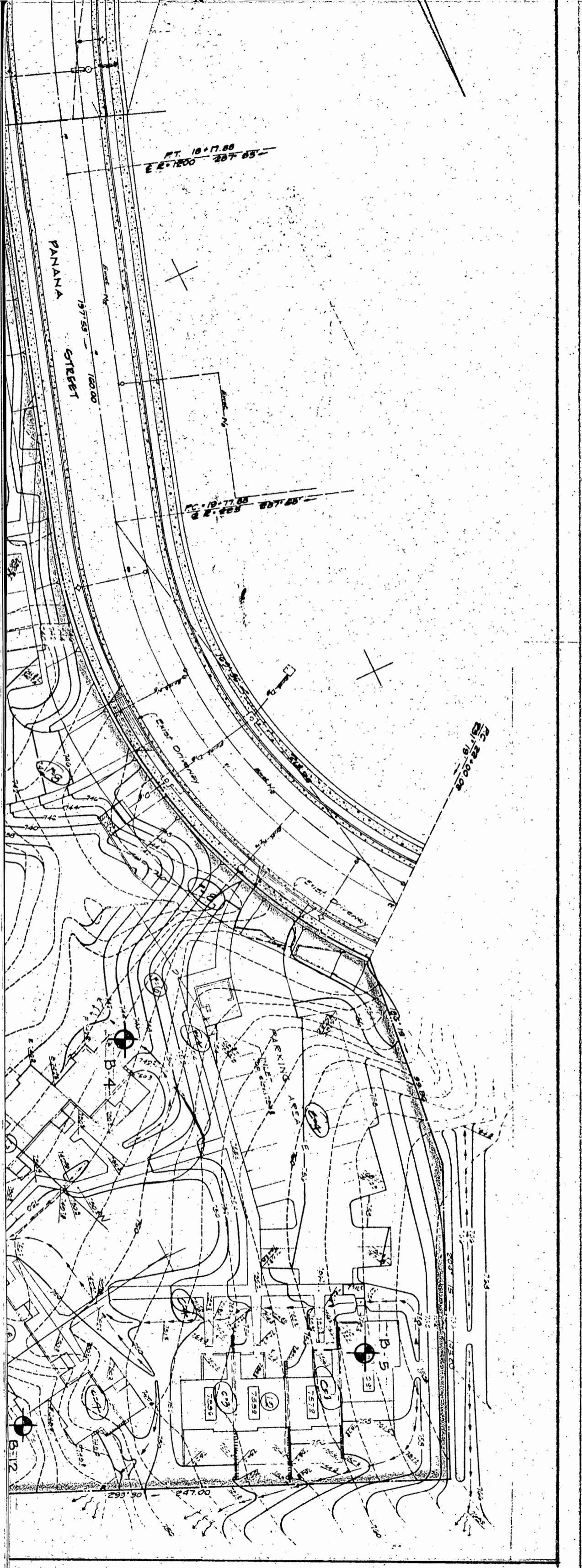


NORTH
SCALE: 1" = 40'

PC 18+77.85
E R=1200

PC 19+77.85
E R=1200

PC 20+77.85
E R=1200



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 at other locations or at other dates. Soil conditions and water levels may change with the passage of time and 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.

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 engineering practices. This warranty is in lieu of all other warranties expressed or implied.