WAIKALUA ROAD SUBDIVISION
PRELIMINARY SOIL REPORT

KANEOHE, OAHU, HAWAII
TAX MAP KEY: 4-5-07: 1
4-5-08: 1, 4, 38

To:
COMMUNITY PLANNING, INCORPORATED

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

MAY 9, 1973

PW-DE-40 (REV.)
1/71

CITY AND COUNTY OF HONOLULU
DEPARTMENT OF PUBLIC WORKS
DIVISION OF ENGINEERING

DATE _____ 19__

FROM: H. J. YOUNG, CHIEF

TO:

- ☐ CHIEF
- ☑ CHIEF PLANNING & DESIGN ENGR.
- ☐ CHIEF ADMINISTRATIVE ENGR.
- ☑ CHIEF CONTROL ENGINEER
- ☐ CHIEF DRAINAGE ENGINEER
- ☐ CHIEF HIGHWAY ENGINEER
- ☐ CHIEF STRUCTURAL ENGINEER
- ☐ INVESTIGATOR
- ☐ _____
- ☐ CHIEF CONSTRUCTION ENGINEER
- ☑ DISTRICT CONSTR. ENGR.–EAST
- ☐ DISTRICT CONSTR. ENGR.–WEST
- ☐ SERVICE ENGINEER
- ☐ FIELD SURVEY
- ☑ TESTING LAB
- ☑ SECRETARY
- ☐ _____

FOR:

- ☑ APPROPRIATE ATTENTION AND ACTION
- ☐ DRAFT REPLY
- ☐ COMMENTS & RECOMMENDATIONS
- ☐ SEE ME
- ☐ WORK ORDER
- ☐ ARRANGE MEETING
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LOG. NO. 7377 SUSPENSE _____

4-506
1377

Transmittal Form

RECEIVED
DIV. OF ENGINEERING
JUL 16 3 38 PM '73

RECEIVED
DEPT. OF PUBLIC WORKS
JUL 16 2 41 PM '73

COMMUNITY PLANNING, INC.
CONSULTANT PLANNERS • CIVIL ENGINEERS • SURVEYORS
700 BISHOP STREET, SUITE 608
HONOLULU, HAWAII 96813
PHONE 531-4252

TO Engg

TO: Mr. Edward Hirata
Dept. of Public Works
City and County of Honolulu
Honolulu, Hawaii

DATE: July 16, 1973

☐ Mail
☒ Deliver
☐ Pick-up

Gentlemen:

RE: Waikalua Road Subdivision
Kaneohe, Koolaupoko, Oahu, Hawaii

We are sending you herewith ☒ Under separate cover ☐

No. of Copies	Description or Remarks
1	Revised sheet 7 of preliminary soils report
1 ea.	Revised sheets 2 and 3 of proposed grading specification

General Remarks:

As requested by your letter of July 5, 1973.

Very truly yours,

COMMUNITY PLANNING, INC.

By George K. Houghtailing
George K. Houghtailing

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

8. Fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the AASHO T-180-57 test method. The top 2-ft layer in roadway fills should be compacted to 95% of the maximum density.

9. Provisions should be included to drain the site during and after filling operations.

Slopes

In general, slope heights less than 4 to 5 ft should be considered. Cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

To minimize erosion, the runoff from rainstorms should be diverted away from slopes by berms or ditches whenever practicable. If drainage is down the face of slope, lined ditches should be considered.

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.

Borrow soils shall be select soils generally less than 6-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 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 the 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 AASHO Test No. T-180-57 or other comparable density tests. The top 2-ft layer in roadway fills shall be compacted to 95% of the maximum density. Compaction shall be with sheepsfoot 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 sheepsfoot 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 a 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.

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, seepage water or expansive soil pockets are encountered, corrective measures shall be made in the field as they are detected.

45-07:1
SD

ECR 73-429

July 5, 1973

Mr. George K. Houghtailing
Community Planning, Inc.
700 Bishop Street, Suite 608
Honolulu, Hawaii 96813

Dear Mr. Houghtailing:

RE: WAIKALUA ROAD SUBDIVISION SOILS REPORT

The subject soils report has been reviewed and is acceptable. However, to avoid any misunderstanding in the future, we request that the following requirement be included in the report.

Ref.: Proposed Specification for Earthwork; Placing, Spreading and Compacting Fill Material

Add: The top 2-ft. layer in roadway fills shall be compacted to at least 95% of the maximum dry density of the soil.

Please resubmit the applicable revised sheet(s) so that we may attach it to the report that was previously submitted.

Very truly yours,

EDWARD Y. HIRATA
Director and Chief Engineer

VAY:jy

cc: Dist. Engineer
Control Section
Walter Lum Assoc., Inc.

PW-DE-40 (REV.)
1/71

CITY AND COUNTY OF HONOLULU
DEPARTMENT OF PUBLIC WORKS
DIVISION OF ENGINEERING

DATE MAY 25 1973

FROM: H. J. YOUNG, CHIEF

TO:

- ☐ CHIEF
- ☐ CHIEF PLANNING & DESIGN ENGR.
- ☐ CHIEF ADMINISTRATIVE ENGR.
- ☐ CHIEF CONTROL ENGINEER
- ☐ CHIEF DRAINAGE ENGINEER
- ☐ CHIEF HIGHWAY ENGINEER
- ☐ CHIEF STRUCTURAL ENGINEER
- ☐ INVESTIGATOR
- ☐ _____

- ☐ CHIEF CONSTRUCTION ENGINEER
- ☑ DISTRICT CONSTR. ENGR.–EAST
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- ☐ SERVICE ENGINEER
- ☐ FIELD SURVEY
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- ☐ SECRETARY
- ☐ _____

FOR:

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LOG. NO. 665 SUSPENSE _____

Plans are under review.
5-30-73 HJY

3 - E

Transmittal Form

C65

RECEIVED DEPT. OF PUBLIC WORKS MAY 25 2 14 PM '73

TO Engrg

COMMUNITY PLANNING, INC.

CONSULTANT PLANNERS • CIVIL ENGINEERS • SURVEYORS

700 BISHOP ST., SUITE 608
HONOLULU, HAWAII 96813
PHONE 531-4252

TO: Mr. Edward Hirata
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
Honolulu, Hawaii

DATE: May 24, 1973

☐ Mail
☒ Deliver
☐ Pick-up

RECEIVED COMMUNITY PLANNING MAY 25 PM '73

Gentlemen:

RE: Waikalua Road Subdivision
Kaneohe, Koolaupoko, Oahu

We are sending you herewith ☒ **Under separate cover** ☐

No. of Copies	Description or Remarks
1 set	Construction Plan Tracings (2 sheets)
2	Check set with hydrologic map
1	Structural calculations for retaining walls
1	Soils Report
1	Revised Hydrologic Map with calculations

General Remarks:
For review and approval.

As suggested, the carports have been raised and A.C. curb and walkway proposed to accommodate the future widening of Waikalua Road.

The carport and homes will be of wooden construction on pier and post to conform to the natural terrain of each lot.

The sewer check set was returned to the Sewer Division earlier.

Very truly yours,

COMMUNITY PLANNING, INC.

By Bernard P. Kea
George K. Houghtailing

for

CEO-10 (REV. 2/73)

CITY AND COUNTY OF HONOLULU
DEPARTMENT OF PUBLIC WORKS

DATE JUL 5 1973 19

FROM: J. Yamamoto

TO:

- ☐ DIRECTOR
- ☐ DEPUTY DIRECTOR
- ☐ ADMINISTRATIVE SERVICES
- ☐ ENVIRONMENTAL ENGINEER
- ☐ PLANNING COORDINATOR
- ☐ PROGRAM COORDINATOR
- ☐ PUBLIC WORKS FISCAL
- ☐ PUBLIC WORKS PERSONNEL
- ☐ CHIEF – AUTO. EQUIPMENT SERVICES
- ☐ CHIEF – ENGINEERING
- ☐ CHIEF – LAND SURVEY & ACQUISITION
- ☐ CHIEF – REFUSE COLLECTION & DISPOSAL
- ☐ CHIEF – ROAD MAINTENANCE
- ☐ CHIEF – SEWERS
- ☑ G. Tanaka
- ☐

FOR:

- ☐ APPROPRIATE ATTENTION AND ACTION
- ☐ PREPARE REPLY
- ☐ COMMENTS & RECOMMENDATIONS
- ☐ SEE ME
- ☐ ARRANGE MEETING
- ☑ SIGNATURE
- ☐ INFORMATION
- ☐ FILE

LOG. NO. 664

SUSPENSE

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

May 9, 1973

MR. GEORGE HOUGHTAILING
Community Planning, Inc.
700 Bishop Street, Suite 608
Honolulu, Hawaii 96813

Dear Mr. Houghtailing:

Subject: Waikalua Road Subdivision
Preliminary Soil Report
(for residential development)
Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-07: 1
4-5-08: 1, 4, 38

Transmitted herewith is our preliminary soil exploration report for the proposed Waikalua Road Subdivision at Kaneohe, Oahu, Hawaii.

The site is located on the slopes that border the flood plain of Kaneohe Stream. Along the top and face of the slope, the soils may be described as stiff clayey silts (MH soils) with decomposed rocks about 7 to 20 ft thick. Along the toe of slope, the stiff soils are underlain by loose organic silts (OH soils). A "CH" clay layer was noted in the boring at the toe of slope at the west end of the site.

Fills along the top of the sloping terrace should be kept down to a minimum. In general, whenever practicable, the upper areas of the slope should be cut and the lower areas should be filled.

Post and beam foundations are recommended for light residential house construction on the site.

Some grading of the site is contemplated. The earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1969, As Amended and the recommendations contained herein.

This report includes a Boring Location Sketch, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Ezra Koike
Ezra Koike

CR/EK:rmf

C O N T E N T S

WAIKALUA ROAD SUBDIVISION
PRELIMINARY SOIL REPORT

KANEOHE OAHU, HAWAII
TAX MAP KEY: 4-5-07: 1
4-5-08: 1, 4, 38

SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions for residential development for the proposed Waikalua Road Subdivision, Kaneohe, Oahu, Hawaii.

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

FIELD EXPLORATION

Four borings and 1 probing were made at the site. The locations of the borings and probing are shown on the Boring Location Sketch. Descriptions of the underlying soils encountered are shown on the boring logs.

Borings were made with 3-in. diameter augers using a finger type bit. Soil samples were recovered with 2-in. thin-wall tube samplers and a standard split spoon sampler driven with a 140-lb hammer falling 30 inches.

The probing was made with a 2-in. diameter blunt point attached to "A" rods and driven with a 140-lb hammer falling 30 inches.

LABORATORY TESTS

Laboratory tests included: natural water content and density, unconfined compression, laboratory vane shear, Atterberg limit, grain-size analysis, specific gravity, AASHO T-180-57 density, expansion and CBR.

A summary of the laboratory test results is given in Tables IA and IB.

SOIL DESCRIPTIONS BY OTHERS

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

p. 38: Hanalei silty clay (MH soils on stream bottoms and flood plains)

p. 83: Lolekaa silty clay (MH, ML-MH soils on terraces and fans)

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."

GENERAL SITE CONDITIONS

The proposed residential site is located in Kaneohe along the south side of Waikalua Road about 0.7 mile east of Kamehameha Highway.

The existing ground slopes down away from Waikalua Road toward the flood plain of Kaneohe Stream at about 20 to 30% gradients with variations in localized areas. Trees, haole koa, utility poles, rubbish piles and abandoned autos were noted on the site.

Levees or dikes are located along the southern toe of the sloping terrace and in other areas in the stream flood plain. The dikes vary in height from little to about 5 ft above the existing ground surface.

INTERPRETATION OF SOIL CONDITIONS

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

In Boring Nos. 1 and 2 along the top of slope, a surface layer varying in thickness from about 7 to 20 ft of clayey silts (MH soils) with decomposed rocks.

In Boring No. 3 near the bottom of slope at the west edge, the "MH" surface soils were underlain by stiff "CH" clays from about the 11-ft depth.

In Boring No. 4 near the lower section along the southern boundary, the surface crust of about 7 ft was underlain by soft organic silts (OH soils) to about 20-ft depths.

Water was noted in Boring No. 4 at about 10.5-ft depth during the field explorations. Water was not noted in the other borings.

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

DISCUSSION AND RECOMMENDATIONS

In general, the present plan is to widen and improve the existing Waikalua Road alongside the subdivision and provide driveways from the roadway to about the building setback line in the lots. Little to no grading is proposed in the lots.

The site is generally located on ground that slopes downward from the side of the existing Waikalua Road. Because surface soils on a slope tend to creep, fills should generally be avoided. However for road widening and access driveway work, low fills may be unavoidable. In such instances, fills should be kept down to a minimum and generally less than about 4 to 5 ft in height. The fills should be constructed with fairly well-graded granular materials.

Clay "CH" soils were noted in Boring No. 3. Cut and fill slopes and foundations may require adjustments or repairs when clay pockets are encountered.

A shallow (3 to 4-ft depth) sewer line is proposed along a portion of the southern boundary near the toe of slope. The sewer line should be

constructed in short segments as practicable and backfilled with select, fairly well-graded material tamped into place. This would minimize removal of the support for the sloping terrace.

Site Grading

In general, selected on-site soils may be used for the construction of low fills. Grading work should be done as required by the Revised Ordinances of Honolulu, 1969, As Amended and as recommended below:

1. The area should be cleared and grubbed. Surface vegetation, miscellaneous debris and rubbish piles should be cleared and removed prior to site development.

2. Loose surface soils and stockpiled soils should be stripped to stiff natural ground before the placement of low fills. Loose surface soils at finish grades should be scarified and recompacted.

3. Localized soft spots or "CH" clay pockets encountered during site preparations should be excavated and replaced with select material compacted in thin lifts.

4. Hard surfaces of existing utility maintenance or access roads should be scarified down to stiff soils and recompacted to match the density of the surrounding soil.

5. Where low fills are proposed in depressions or drainageways, loose material at the bottom and sides should be stripped down to stiff natural ground before the placement of fills. Subdrains or drainage blanket of filter material should be placed along low points to provide drainage paths. New fills should be keyed into the stiff natural ground.

6. Thin sidehill fills (sliver fills) on the sloping terrace should be avoided.

7. The low 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 be continually keyed

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

8. Fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the AASHO T-180-57 test method.

9. Provisions should be included to drain the site during and after filling operations.

Slopes

In general, slope heights less than 4 to 5 ft should be considered. Cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

To minimize erosion, the runoff from rainstorms should be diverted away from slopes by berms or ditches whenever practicable. If drainage is down the face of slope, lined ditches should be considered.

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 "CH" clay pockets or soft spots are encountered in localized areas. In general, when "CH" clay pockets are encountered in slopes, they should be removed and replaced with a buttress fill constructed with select material.

Foundations

In general, light 2-story wood-frame residential structures are proposed.

The preliminary grading plan indicates that the structures will be located over the sloping lots.

Because of soft soils encountered near the toe of slope, house foundations should be kept as high as practicable up the slope near Waikalua Road.

Structures should be designed to tolerate and resist some settlements. Structures should be designed as small units on floating platforms or decks resting on post and beams that will allow the floors to be releveled should settlements occur. Odd shapes and split level structures should be minimized or designed to float as a unit.

To minimize the effects of slope creep, the foot blocks should be supported on short pipe piles that extend below

an imaginary plane drawn upward at a 4 to 1 ratio from the toe of the slope. Pipe piles should be about 8 ft or more in depth. The foot blocks should be tied together up and down the slope. See Figure 1.

Loads of about 4000 pounds per pipe pile may be considered.

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

Low Retaining Walls

In general, retaining walls should be avoided on the sloping lots.

For the short entry driveways along Waikalua Road, use of low flexible, gravity walls would probably minimize load increase. In general, the walls should be designed carefully with fairly deep, reinforced foundations and good drainage provisions along the back and base of the wall. The backfill of the walls should be constructed with fairly well-graded granular soils.

Lateral earth pressures of about 40 p.c.f. equivalent fluid may be considered assuming a drained backfill.

Where the garage platform meets the driveway retaining wall, a sliding joint should be considered to minimize the transfer of lateral movement from the retaining wall against the garage or residential structure.

Roadway

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

1. Wearing course - 2-in. asphaltic concrete.
2. Base course - 6-in. base course.
3. Subbase - 12-in. select borrow over a prepared subgrade.

Clay pockets will probably be encountered in localized areas.

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 should be placed at subgrade levels thru the walls of the catch basins which are placed in these low areas.

Underground Utilities

Underground utilities should be placed after the fills are constructed.

The bottom of utility trenches should be daylighted and graded to shed water. The backfill and drainage of these utility trenches should be carefully designed.

Flexible connections should be used.

Sewer Main

A sewer main is proposed along a portion of the toe of the sloping terrace.

To minimize removal of support of the slope at the toe due to excavations for the sewer main, construction should proceed in small increments or segments as practicable. The excavations should be backfilled with select, fairly well-graded material tamped into place.

Unforeseen Conditions

Unforeseen or undetected conditions such as soft spots, seepage water or expansive soil pockets 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 plan, regrading at some future date should be avoided unless done under the guidance of a Soils Engineer.

PROPOSED SPECIFICATION FOR EARTHWORK

WAIKALUA ROAD SUBDIVISION

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 necessary 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.

Loose surface soils 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 access roads shall be scarified down to stiff soils and recompacted to match the density of the surrounding soil.

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

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 6-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 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 the 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 AASHO Test No. T-180-57 or other comparable density tests. Compaction shall be with sheepsfoot 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 sheepsfoot 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 90% 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.

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 critical soil conditions such as soft spots, seepage water or expansive soil pockets 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.

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

Boring Log

PROJECT: WAIKALUA ROAD SUBDIVISION
LOCATION: Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-08: 1, 4, 38 & 4-5-07: 1

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

BORING NO. 1 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date MARCH 30, 1973
Field Party SETO, RADOVICH, KAU
Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
Elev. 40'±* Datum ____
Drill Bit FINGER TYPE

Water Level	NOT NOTICED				
Time	____				
Date	3/30/73				

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	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV.= 40'±*?	0									
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT W/TRACES OF SAND & ROOTS		2"SS	1-A	-	42	-	-	-		42
		5	2"S	1-B	109	37	80	33,300	-		6/0.5' 10/0.5' 11/0.5'
(MH)	STIFF MOTTLED BROWN & GRAY CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	10	2"SS	1-C	-	42	-	-	-		
(MH)	STIFF MOTTLED BROWN & GRAY CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	15	2"S	1-D	105	50	70	5990	-		5/0.5' 7/0.5'
MH	STIFF MOTTLED BROWN & GRAY CLAYEY SILT W/DECOMPOSED ROCK	20	2"SS	1-E	-	50	-	-	-		
						LL= 92					
						PL= 51					
	END OF BORING @ 21.5'										
	NOTE: LL= LIQUID LIMIT, % PL= PLASTIC LIMIT, %										
	*ELEVATION ESTIMATED FROM EXIST. TOPO MAP										

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

Boring Log

PROJECT: WAIKALUA ROAD SUBDIVISION
LOCATION: Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-08: 1, 4, 38 & 4-5-07: 1

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

BORING NO. 2 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date APRIL 2, 1973
Field Party RADOVICH, KAU
Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
Elev. 29'± * Datum —
Drill Bit FINGER TYPE

Water Level	NOT NOTICED				
Time	—				
Date	4-2-73				

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	2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 29'±*	0									
			2"SS	2-A	-	32	-	-	-		
MH	STIFF, MOTTLED BROWN CLAYEY SILT W/GRAY DECOMPOSED ROCK	5	2"S	2-B	96	34	72	15,160	-		5/0.5' 5/0.5'
		10	2"SS	2-C	-	37	-	-	-		
(MH)	HARD, BROWN CLAYEY SILT W/TRACES OF SAND	15	2"SS	2-D	-	23	-	-	-		40/0.3'

END OF BORING @ 15.3'

* ELEVATION ESTIMATED FROM EXIST. TOPO MAP

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

Boring Log

PROJECT: WAIKALUA ROAD SUBDIVISION
LOCATION: Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-08: 1, 4, 38 & 4-5-07: 1

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

BORING NO. 3 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date MARCH 30, 1973
Field Party SETO, RADOVICH, KAU
Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
Elev. 26'± * Datum —
Drill Bit FINGER TYPE
Water Level NOT NOTICED
Time —
Date 3/30/73

PENETRATION DATA
Standard Penetration Test — N (Blows per foot) 0 10 20 30 40
2" O.D. THIN WALL TUBE SAMPLER — BLOWS/0.5'

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.	BLOWS/0.5'
	ELEV.= 26'± *	0								
	MISC. FILL: CORAL & ROCK FRAGMENTS & SILTY SAND		2"SS	3-A	-	9 25	-	-	-	
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	5								
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT W/GRAY, DECOMPOSED ROCK		2"S	3-B	103	36	76	26,510	-	5/0.5' 10/0.5'
MH	STIFF, MOTTLED TAN GRAY CLAYEY SILT W/GRAY CLAY	10				LL= 133 PL= 56				
(CH)	STIFF, GRAY CLAY W/MOTTLED BROWN CLAYEY SILT		2"SS	3-C	-	45 38	-	-	-	
CH	STIFF, GRAY & BROWN CLAY	15								
			2"S	3-D	113	41 LL= 105 PL= 40	80	15,060	-	5/0.5' 11/0.5'
	END OF BORING @ 16'									

NOTE:
LL= LIQUID LIMIT, %
PL= PLASTIC LIMIT, %

* ELEVATION ESTIMATED FROM EXIST. TOPO MAP

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

Boring Log

PROJECT: WAIKALUA ROAD SUBDIVISION
LOCATION: Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-08: 1, 4, 38 & 4-5-07: 1

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

BORING NO. 4 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date APRIL 2, 1973
Field Party RADOVICH, KAU
Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
Elev. 10'±* Datum ____
Drill Bit FINGER TYPE

Water Level	10.5'				
Time	____				
Date	4-2-73				

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) / 2" O.D. THIN WALL TUBE SAMPLER (BLOWS/0.5')
	ELEV. = 10'±*	0								
(MH)	STIFF, DARK BROWN SILTY CLAY W/TRACES OF ROOTS		2"SS	4-A	-	41	-	-	-	
MH	STIFF, GRAY & BROWN SILTY CLAY	5	2"S	4-B	103	50	69	2490	-	2/0.5' 2/0.5' 2/0.5'
						LL= 85				
						PL= 40				
	WATER 4-2-73	10								
OH	SOFT, BLACK ORGANIC SILT W/SHELLS		2"S	4-C	112	73	64	-	300	1-MAN PUSH/1.0'
						LL= 67				
						PL= 46				
		15								
			2"S	4-D	108	58	68	-	300	1-MAN PUSH/1.0'
						LL= 68				
OH	SOFT, BLACK ORGANIC SILT W/SAND					PL= 40				
		20								
(MH)	MEDIUM, MOTTLED GRAY & BROWN SILTY CLAY W/SAND, GRAVEL & DEC. ROCK		2"S	4-E	-	62	-	-	-	3/0.5' 16/0.5'
					NOTE:					
					LL= LIQUID LIMIT, %					
					PL= PLASTIC LIMIT, %					
	END OF BORING @ 21'									

*ELEVATION ESTIMATED FROM EXIST. TOPO MAP

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

Boring Log

PROJECT: WAIKALUA ROAD SUBDIVISION
LOCATION: Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-08: 1, 4, 38 & 4-5-07: 1
HAMMER:
Weight: 140*
Drop: 30"
SAMPLER: 2" DIA. BLUNT POINT

PROBING ~~BORING~~ NO. 2A Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date APRIL 2, 1973
Field Party RADOVICH, KAU
Type of Boring CONTINUOUS PENETRATION TEST Diam. 2"
Elev. 25' ± * Datum —
Drill Bit —

Water Level	NOT READABLE				
Time	—				
Date	4-2-73				

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~~ CONTINUOUS Penetration Test N (Blows per foot) 0 10 20 30 40
	ELEV. = 25' ± *	0								
		5								
	END OF PROBING @ 8.2'	10								31/0.5' 72/0.5' 50/0.2'

* ELEVATION ESTIMATED FROM EXIST. TOPO MAP

WAIKALUA ROAD SUBDIVISION

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	1	1	3	3
SAMPLE NO.		E	C (TOP)	D
DEPTH BELOW SURFACE	SURFACE	20'-21.5'	10'-11.5'	15'-16'
DESCRIPTION	MOTTLED BROWN CLAYEY SILT W/TRACES OF SAND & ROOTS	MOTTLED BROWN & GRAY CLAYEY SILT W/DECOMP. ROCK	MOTTLED TAN-GRAY CLAYEY SILT W/GRAY CLAY	GRAY & BROWN CLAY
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"	100			
1/2"	100			
#4	99.7			
#10	98.4			
#20	97.7			
#40	97.3			
#100	96.7			
#200	96.3			
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	118	92	133	105
Plastic Limit	62	51	56	40
Plasticity Index	56	41	77	65
Dilatancy	MED.-QUICK	MED.-QUICK	MEDIUM	NONE
Toughness	SLIGHT-MED.	MEDIUM	SLIGHT-MED.	MED.-HIGH
Dry Strength	MED.-HIGH	MEDIUM	HIGH	HIGH
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	CH
APPARENT SPECIFIC GRAVITY	2.65			
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	45.8			
Molding Dry Density, P.C.F.	72.8			
Swell upon saturation, %	3.4			
CBR at 0.1" Penetration	4.7			
MOISTURE-DENSITY RELATIONS OF SOILS				
(AASHO T-180-57 Method ___)	A			
Dry to Wet or Wet to Dry	WET TO DRY			
Max. Dry Density (P.C.F.)	73.9			
Optimum Moisture (%)	44.4			

REMARKS:

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

Date 4-17-73 By BT

WAIKALUA ROAD SUBDIVISION

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	4	4	4	4
SAMPLE NO.	B	B	C	D
DEPTH BELOW SURFACE	SURFACE	5'-6.5'	10'-11'	15'-16'
DESCRIPTION	DARK BROWN SILTY CLAY W/TRACES OF ROOTS	GRAY & BROWN SILTY CLAY	BLACK ORGANIC SILT W/SHELLS	BLACK ORGANIC SILT W/SAND
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	84	85	67	68
Plastic Limit	42	40	46	40
Plasticity Index	42	45	21	28
Dilatancy	SLOW	NONE	QUICK	NONE-SLOW
Toughness	MED.-HIGH	MED.-HIGH	SLIGHT	MED.-HIGH
Dry Strength	HIGH	HIGH	SLIGHT-MED.	MEDIUM
UNIFIED SOIL CLASSIFICATION	MH	MH	OH	OH
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	37.9			
Molding Dry Density, P.C.F.	82.4			
Swell upon saturation, %	1.2			
CBR at 0.1" Penetration	8.0			
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 (%)				

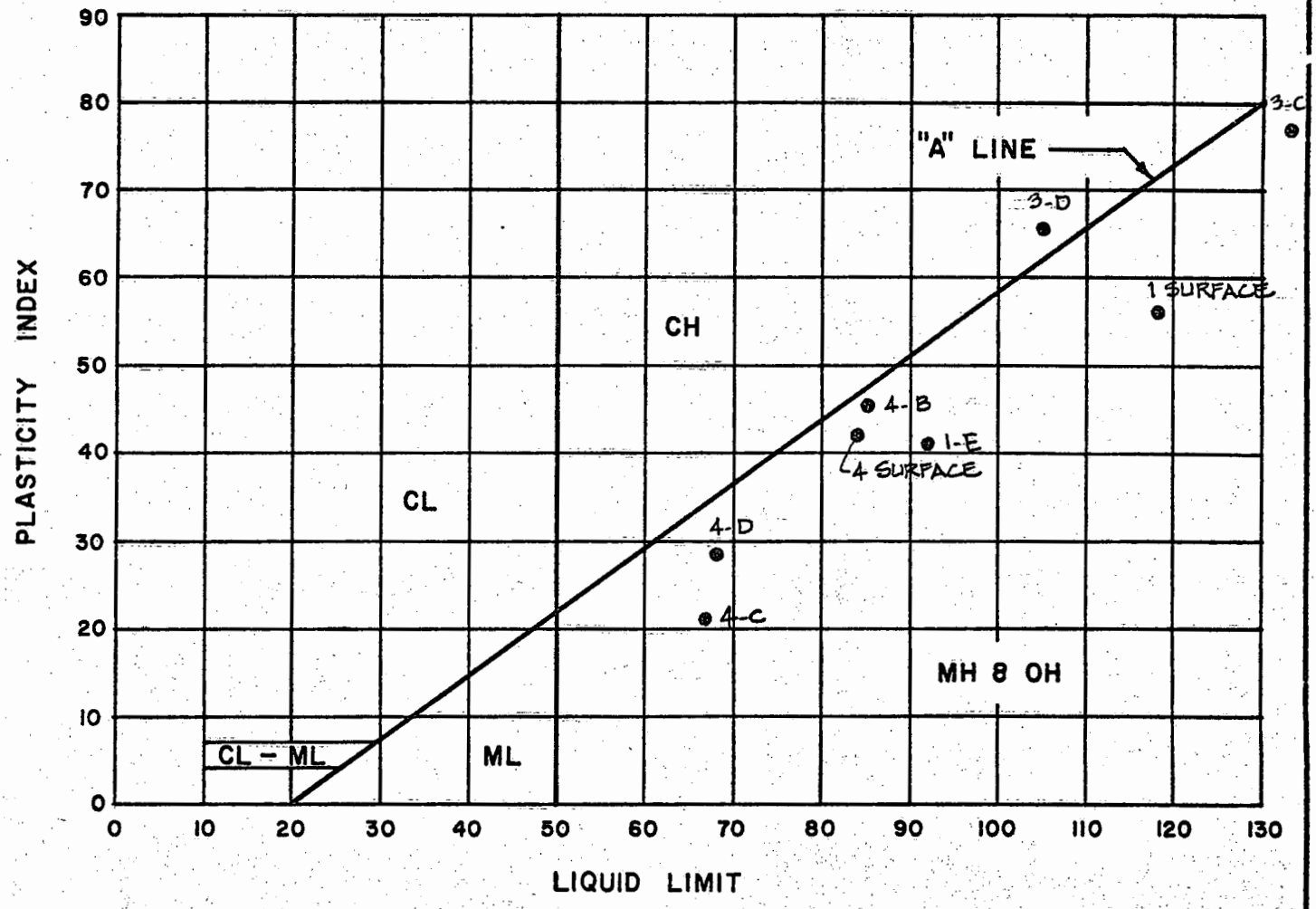
REMARKS:

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

Date 4-17-73 By BT

PLASTICITY CHART

PROJECT: WAIKALUA ROAD SUBDIVISION
LOCATION: KANEOHE, OAHU, HAWAII



DATE APRIL 11, 1973 BY C. RACUYA

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

8-872

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

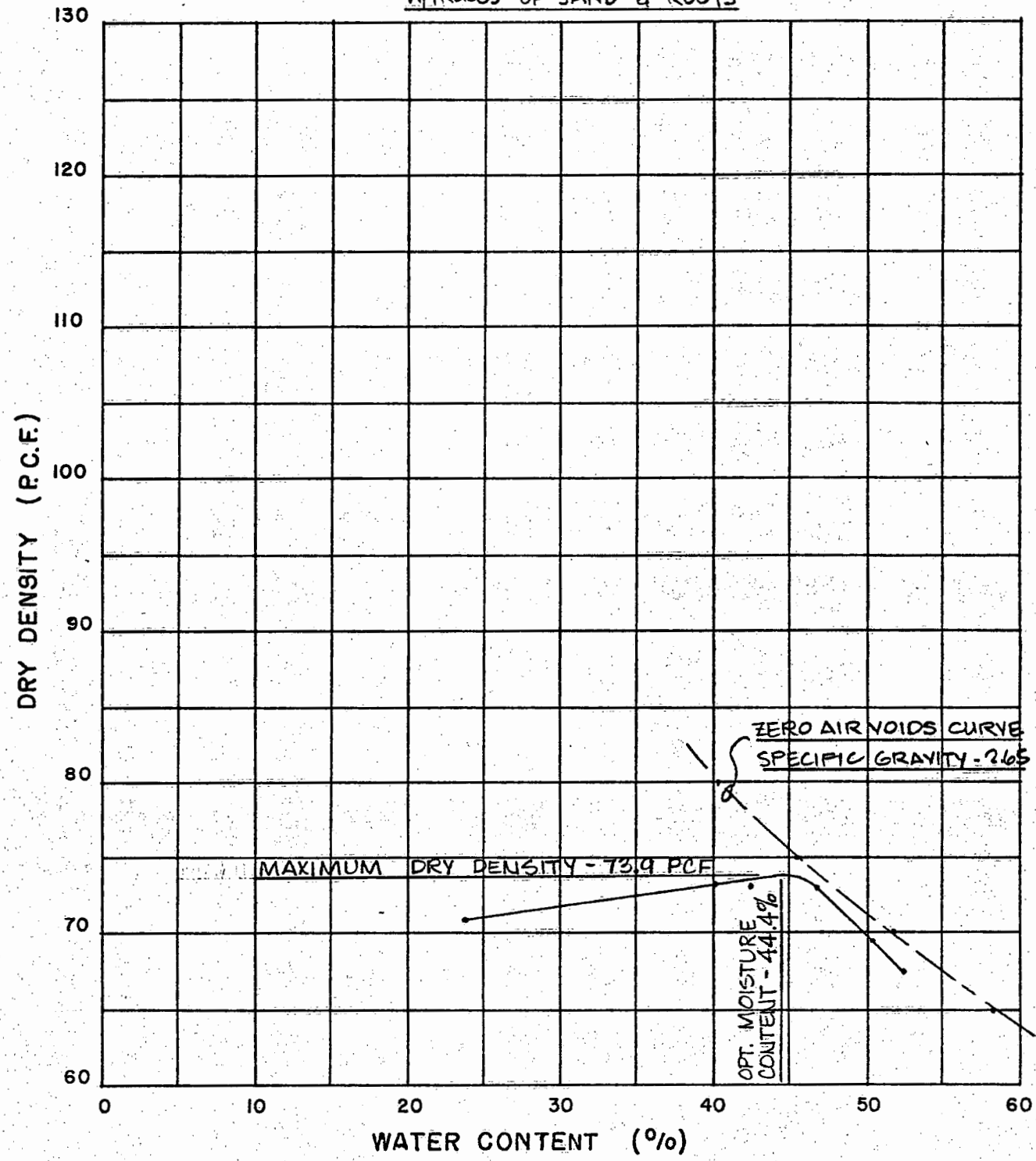
PROJECT: WAIKALUA ROAD SUBDIVISION

LOCATION: KANEOHE, OAHU, HAWAII

SAMPLE NO.: 1 SURFACE

SAMPLE DESCRIPTION: MOTTLED BROWN CLAYEY SILT W/TRACES OF SAND & ROOTS

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 4-17-73 BY BT

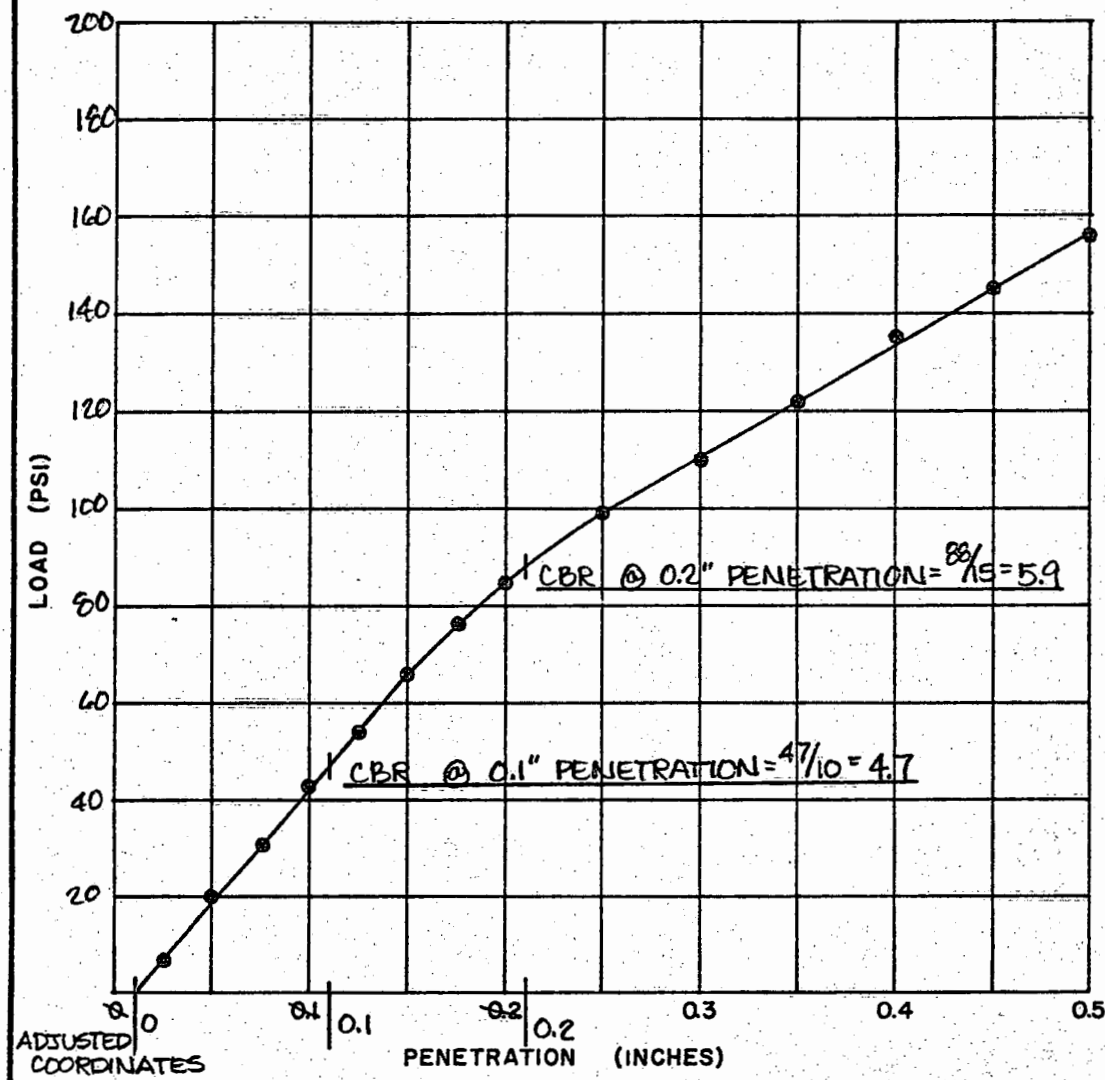
CBR TEST

PROJECT: WAIKALUA ROAD SUBDIVISION

LOCATION: KANEOHE, OAHU, HAWAII

SAMPLE NO: 1 SURFACE

SAMPLE DESCRIPTION: MOTTLED BROWN CLAYEY SILT W/TRACES OF SAND & ROOTS



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	21	7
0.050	59	20
0.075	94	31
0.100	128	43
0.125	163	54
0.150	197	66
0.175	227	76
0.200	255	85
0.250	298	99
0.300	330	110
0.350	365	122
0.400	406	135
0.450	435	145
0.500	468	156

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 45.8

MOLDING DRY DENSITY, P.C.F. 72.8

CBR @ 0.1" PENETRATION 4.7

DAYS SOAKED 6

DATE 4-9-73 BY BS

DATE 4-10-73 BY NI

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

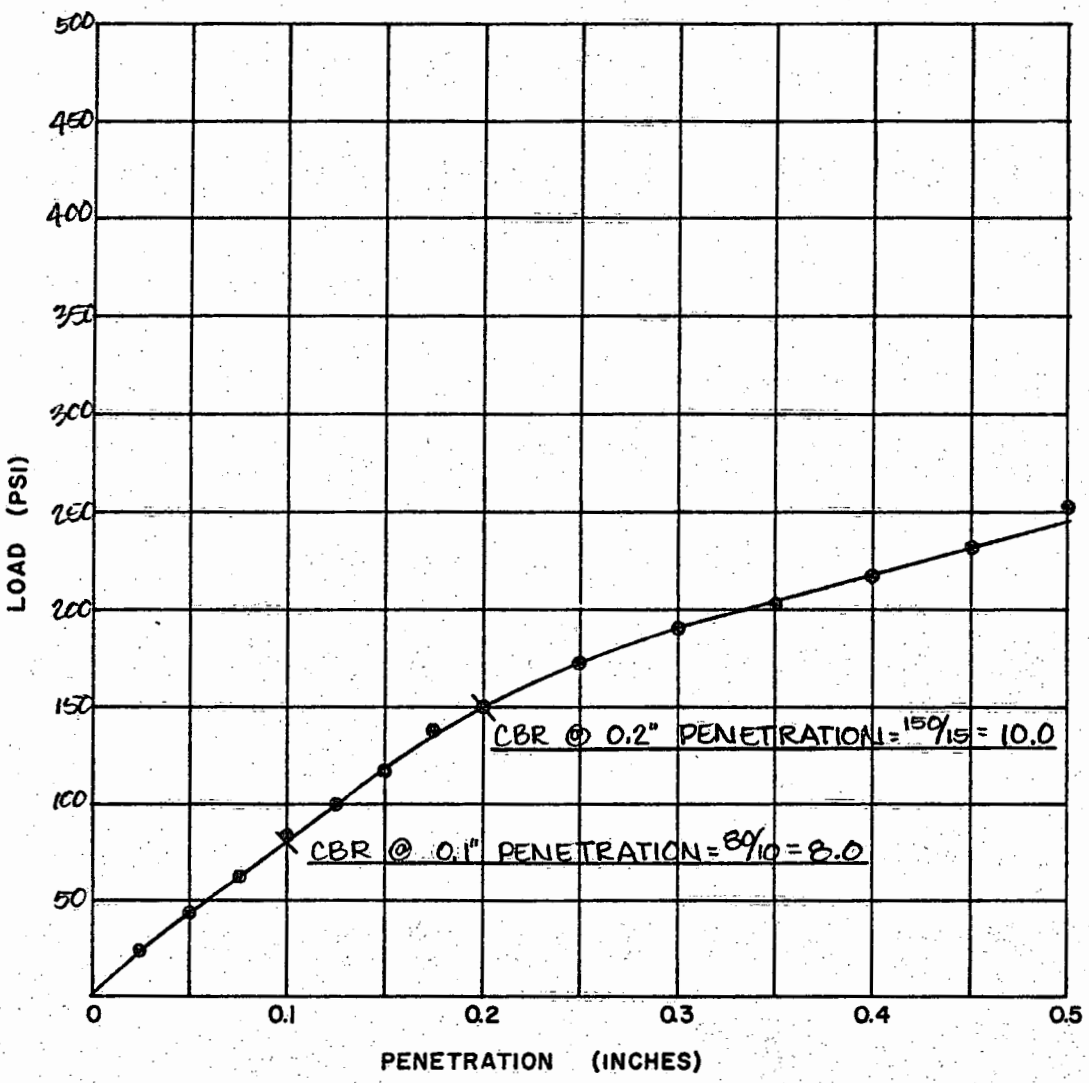
CBR TEST

PROJECT: WAIKALUA ROAD SUBDIVISION

LOCATION: KANEOHE, OAHU, HAWAII

SAMPLE NO: 4 SURFACE

SAMPLE DESCRIPTION: DARK BROWN SILTY CLAY W/TRACES OF SAND



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	65	22
0.050	130	43
0.075	190	63
0.100	250	83
0.125	300	100
0.150	350	117
0.175	410	137
0.200	450	150
0.250	517	172
0.300	570	190
0.350	610	203
0.400	655	218
0.450	695	232
0.500	760	253

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 37.9

MOLDING DRY DENSITY, P.C.F. 82.4

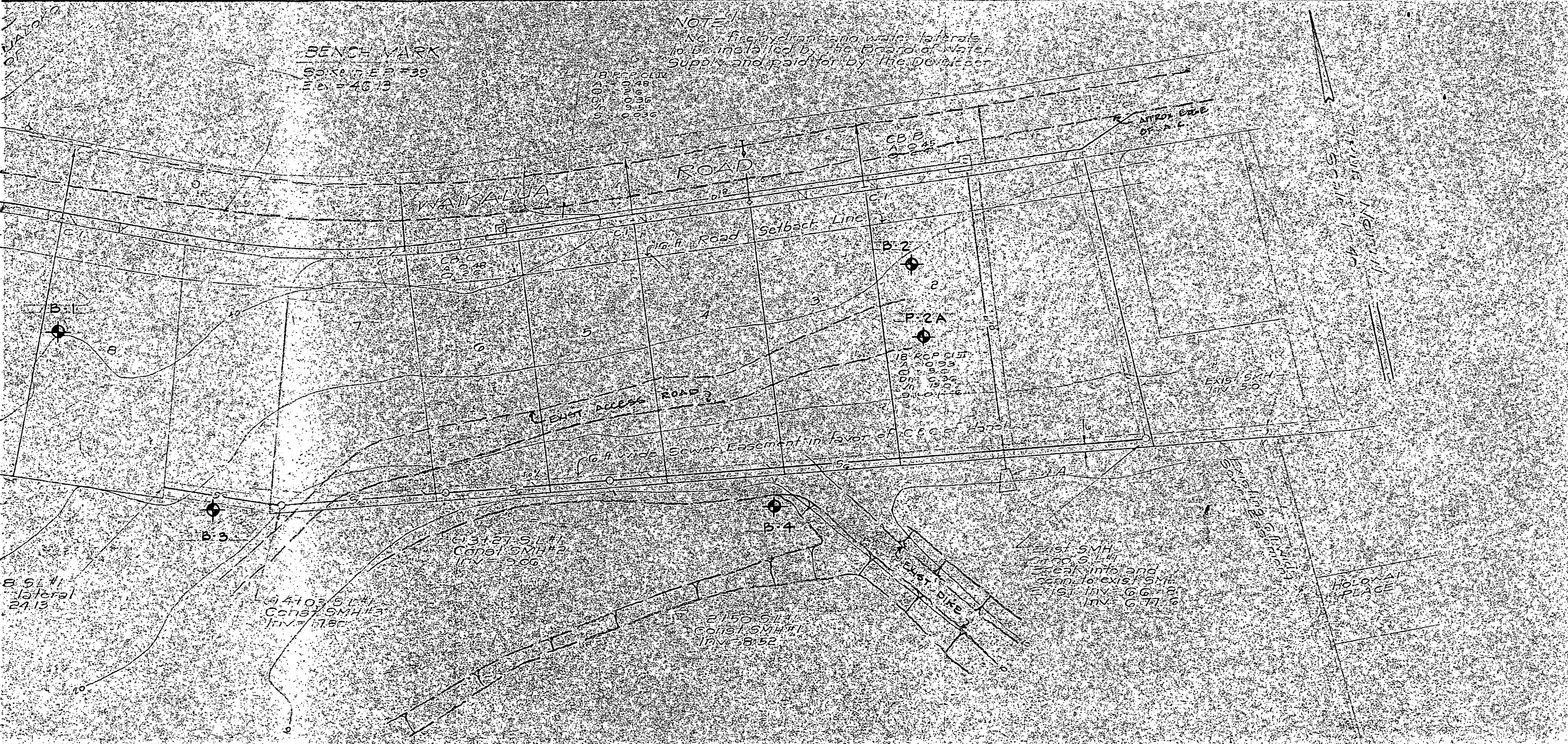
CBR @ 0.1" PENETRATION 8.0

DAYS SOAKED 6

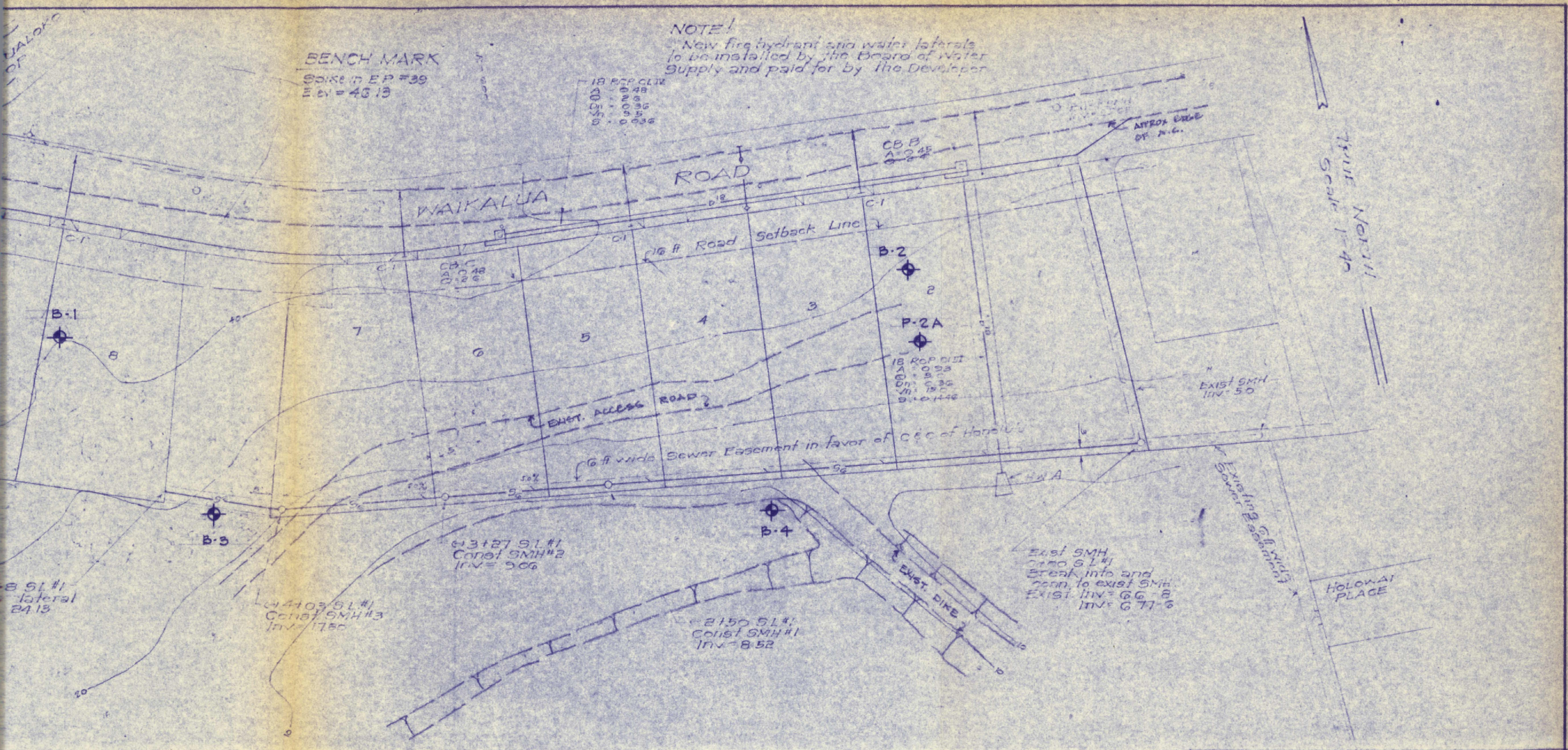
DATE 4-9-73 BY TK & BS

DATE 4-10-73 BY NI

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

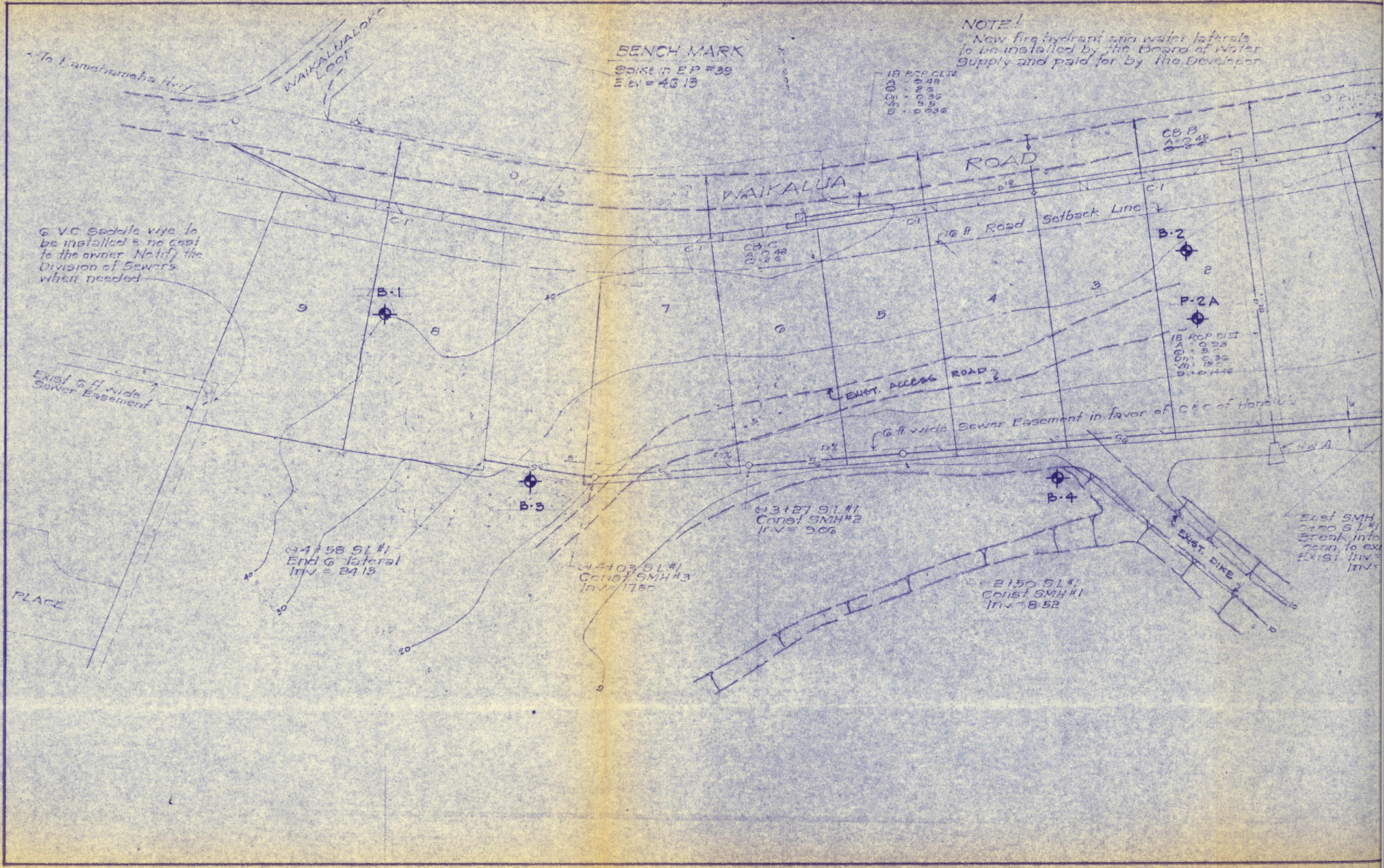


BORING LOCATION SKETCH	
WAIKALUA ROAD SUBDIVISION	
KANEOHE, OAHU, HAWAII	
TMK: 4-5-08: 14, 38 & 4-5-07: 1	
Dr. CR	WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVE.
Date 5/73	CIVIL ENGINEERS PHONE 737-7931
Rev.	Sheet ___ of ___

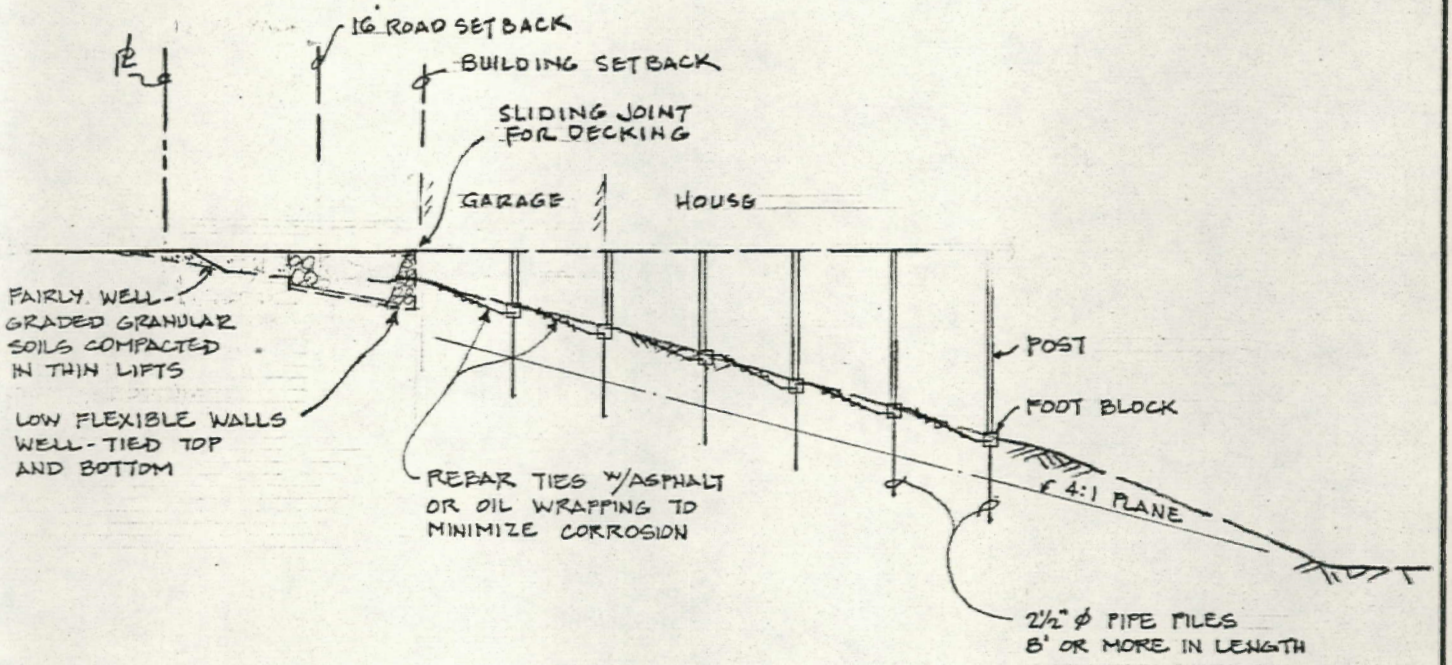


BORING LOCATION SKETCH
WAIKALUA ROAD SUBDIVISION
KANEOHE, OAHU, HAWAII
TMK: 4-5-08: 1, 4, 38 & 4-5-07: 1

Dr. CR Date 5/73 Rev.	WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVE. CIVIL ENGINEERS PHONE 737-7931	Sheet of



NOTE!
New fire hydrant and water laterals to be installed by the Board of Water Supply and paid for by The Developer
BENCH MARK
Spike in E.P. #39
Elev = 43.13
To Kamehameha Hwy
WAIKALUALOKO LOOP
WAIKALUA ROAD
16 ft Road Setback Line
6 V.C. Saddle wye to be installed @ no cost to the owner. Notify the Division of Sewers when needed
Exist 6 ft wide Sewer Easement
EXIST. ACCESS ROAD
6 ft wide Sewer Easement in favor of C & C of Honolulu
B-1
B-2
B-3
B-4
P-2A
CB-B
CB-C
9
8
7
6
5
4
3
2
@ 4+58 S.L. #1 End 6 lateral Inv = 24.13
@ 4+03 S.L. #1 Const. SMH #3 Inv = 17.50
@ 3+27 S.L. #1 Const. SMH #2 Inv = 9.06
@ 2+50 S.L. #1 Const. SMH #1 Inv = 8.52
EXIST. DIKE
PLACE



NOT TO SCALE

FIGURE 1
SUGGESTED FOUNDATIONS
WAIKALUA ROAD SUBDIVISION
KANEOHE, OAHU, HAWAII
TMK: 4-5-08: 1, 4, 38 & 4-5-07: 1

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

MAY, 1973

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 and the changed conditions.

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.