MAKAKILO HALE II
PRELIMINARY SOIL REPORT
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
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

CM/EK:rmf
## CONTENTS

<table>
<thead>
<tr>
<th>Scope</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOPE OF EXPLORATION</td>
<td>1</td>
</tr>
<tr>
<td>FIELD EXPLORATION AND LABORATORY TESTS</td>
<td>1</td>
</tr>
<tr>
<td>SOIL CLASSIFICATION SYSTEM</td>
<td>2</td>
</tr>
<tr>
<td>GEOLOGIC AND SOIL DESCRIPTIONS BY OTHERS</td>
<td>2</td>
</tr>
<tr>
<td>GENERAL SITE CONDITIONS</td>
<td>3</td>
</tr>
<tr>
<td>INTERPRETATION OF SOIL CONDITIONS</td>
<td>4</td>
</tr>
<tr>
<td>DISCUSSION AND RECOMMENDATIONS</td>
<td>5</td>
</tr>
</tbody>
</table>

PROPOSED SPECIFICATION FOR EARTHWORK

**APPENDICES:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>LOGS OF BORINGS - Boring Nos. 1 thru 29</td>
</tr>
<tr>
<td>B</td>
<td>SUMMARY OF LABORATORY TEST RESULTS - Tables IA thru IF</td>
</tr>
<tr>
<td>C</td>
<td>PLASTICITY CHART</td>
</tr>
<tr>
<td>D</td>
<td>MOISTURE-DENSITY CURVES</td>
</tr>
<tr>
<td>E</td>
<td>CBR TESTS</td>
</tr>
<tr>
<td>F</td>
<td>LOGS OF BORINGS FROM &quot;MAKAKILO DEVELOPMENT - KAPOLEI PD-H&quot; REPORT DATED MARCH 5, 1973</td>
</tr>
<tr>
<td>G</td>
<td>BORING LOCATION SKETCH</td>
</tr>
<tr>
<td>H</td>
<td>LIMITATIONS</td>
</tr>
</tbody>
</table>
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, AASHO 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.


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 recompacted.

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 drainageways, 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 recompressed 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:

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 AASHO 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 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 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 Partly 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 recompacted 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  
**LOCATION**  Makakilo, Oahu, Hawaii  
**Hammer:**  Weight 140#  
**Sampler:**  2" STANDARD SPLIT SPOON  

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>Description</th>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Wet Dense.</th>
<th>Dry Dense.</th>
<th>Unconf. Comp.</th>
<th>Penetration Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>(CH)</td>
<td>STIFF, BROWN, CLAY</td>
<td>1-A</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td><strong>4%</strong></td>
</tr>
<tr>
<td></td>
<td>WITH_traceS_of_SAND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>HAMMER</strong></td>
</tr>
<tr>
<td></td>
<td>GRAVEL &amp; ROOTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>BOUNCES</strong></td>
</tr>
<tr>
<td></td>
<td>COBBLE OR BOULDER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MOTTLED BROWN</td>
<td>1-B</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td><strong>72</strong></td>
</tr>
<tr>
<td></td>
<td>DECOMPOSED ROCK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WITH_traceS_of_CLAYEY_SILT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SM)</td>
<td>MEDIUM DENSITY</td>
<td>1-C</td>
<td>38</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td><strong>72</strong></td>
</tr>
<tr>
<td></td>
<td>MOTTLED BROWN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WITH_traceS_of_WHITE_SAND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DECOMPOSED ROCK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(MH)</td>
<td>STIFF</td>
<td>1-D</td>
<td>48</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td><strong>5%</strong></td>
</tr>
<tr>
<td></td>
<td>MOTTLED BROWN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WITH_traceS_of_CLAYEY_SILT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WITH_traceS_of_SAND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DECOMPOSED ROCK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**PROJECT**  
MAKAKIHO HALE II

**LOCATION**  
Makakilo, Oahu, Hawaii

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

---

**HAMMER:**

- **Weight:** 140#
- **Drop:** 90°

**SAMPLER:** 2" STANDARD SPLIT SPOON

---

**ELEVATION DATA**

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>Description</th>
<th>Depth (ft)</th>
<th>Samples</th>
<th>Sample No.</th>
<th>Per Cent.</th>
<th>Weight</th>
<th>Water Cont.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
<td>STIFF, BROWN CLAYEY SILT w/TRACES OF ROOTS</td>
<td>7.9</td>
<td>2-A</td>
<td>16</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ML</td>
<td>STIFF, BROWN CLAYEY SILT</td>
<td>5</td>
<td>2-B</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>COBBLE OR BOULDER</td>
<td>10</td>
<td>2-C</td>
<td>21</td>
<td>LL = 47, PL = 30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MH</td>
<td>HARD, MOTTLED GRAY CLAYEY SILT w/TRACES OF DECOMPOSED ROCK</td>
<td>15</td>
<td>2-D</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>STIFF, MOTTLED GRAY BROWN DECOMPOSED ROCK w/TRACES OF CLAYEY SILT</td>
<td>20</td>
<td>2-E</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**NOTE:**

- LL = LIQUID LIMIT
- PL = PLASTIC LIMIT

**END OF BORING @ 21.9' 7-25-73**

---

*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:
Weight: 140 lbs
Drop: 30'

SAMPER: 2" STANDARD SPLIT SPOON

ELEV. = 737.4' ± 0

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
<td>STIFF, RED</td>
<td>5</td>
<td>3-A</td>
<td>18</td>
<td>LL 41</td>
<td>PL 13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SILTY CLAY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MH</td>
<td>HARD, REDDISH BROWN SILTY CLAY</td>
<td>10</td>
<td>3-B</td>
<td>21</td>
<td>LL 59</td>
<td>PL 34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH</td>
<td>HARD MOTTLED GRAY BROWN CLAY</td>
<td>15</td>
<td>3-C</td>
<td>24</td>
<td>LL 18</td>
<td>PL 32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM</td>
<td>DENSE, GRAY BROWN SILTY SAND w/ TRACES OF DECOMPOSED ROCK</td>
<td>20</td>
<td>3-D</td>
<td>25</td>
<td>LL 17</td>
<td>PL 19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(MH)</td>
<td>STIFF MOTTLED GRAY BROWN SILTY CLAY w/ DECOMPOSED ROCK</td>
<td>30</td>
<td>3-E</td>
<td>41</td>
<td>LL 17</td>
<td>PL 19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF BORING @ 21.5'
9-24-73

NOTE

LLc LIQUID LIMIT
PLc PLASTIC LIMIT

*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'

**SAMPER:** 2" STANDARD SPLIT SPOON

---

**PENETRATION DATA**

<table>
<thead>
<tr>
<th>Unified Classification</th>
<th>Description</th>
<th>Depth (ft.)</th>
<th>Sample No.</th>
<th>Wet Density (p.e.f.)</th>
<th>Water Content (%)</th>
<th>Unconf. Comp. (p.e.f.)</th>
<th>Penetration Test</th>
<th>N (Blows per foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(MH)</td>
<td>STIFF, REDDISH BROWN CLAYEY SILT</td>
<td>0</td>
<td>4-A</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(MH)</td>
<td>STIFF, GRAY BROWN CLAYEY SILT W/ TRACES OF DECOMPOSED ROCK</td>
<td>10</td>
<td>4-B</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MOTTLED GRAY DECOMPOSED ROCK (SOME CRUSHES TO CLAYEY SILT)</td>
<td>15</td>
<td>4-C</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GRAY ROCK FRAGMENTS</td>
<td>18</td>
<td>4-D</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MOTTLED GRAY DECOMPOSED ROCK</td>
<td>20</td>
<td>4-E</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>END OF BORING @ 21.5'</td>
<td>22</td>
<td>4-F</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driller</td>
<td>W. LUM ASSOC., INC.</td>
</tr>
<tr>
<td>Field Party</td>
<td>KAKU ASATO</td>
</tr>
<tr>
<td>Type of Boring</td>
<td>AUGER</td>
</tr>
<tr>
<td>Elev.</td>
<td>744.2</td>
</tr>
</tbody>
</table>

**H Hammer:**
- **Weight:** 40 #
- **Drop:** 30"

**Sampler:** 2" STANDARD SPLIT SPOON

---

**STIFF- BROWN CLAY-BY SILT**

**GRAY ROCK FRAGMENTS**

**END OF BORING & 10.5'**

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

---

**PENETRATION DATA**

<table>
<thead>
<tr>
<th>Penetration Test</th>
<th>PENETRATION DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (Blows per foot)</td>
<td>0 10 20 30 40</td>
</tr>
<tr>
<td>Vane Shear</td>
<td>0</td>
</tr>
<tr>
<td>P.S.F.</td>
<td>0</td>
</tr>
</tbody>
</table>

---

**NOTE:**
- **SECOND ATTEMPT**
- 11' AWAY, DRILL TIME 8.0'-9.5' -- 20 MIN.
**Boring Log**

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

**HAMMER:**  
- **Weight:** 140 lbs  
- **Drop:** 30" 

**SAMPLER:** 2" STANDARD SPLIT SPOON

**BORING NO.** G  
**Sheet No.** of __

**Driller**  
**Field Party:** RADOVICH, KAU, OMORI  
**Type of Boring:** AUGER (MOBILE)  
**Diam.:** 4"  
**Datum:** __

**Elev.:** __

**Hammer:** __

**Drill Bit:** FINGER TYPE  
**Water Level:** __

**Time:** __  
**Date:** 9-24-73

---

**UNITED CLASSIFICATION**  
**DESCRIPTION**  
**Depth (Ft.)**  
**Sample No.**  
**Sample Pec.**  
**Water Cent.**  
**Unconf. Comp.**  
**Silt Pec.**  
**Vein Pec.**  
**Standard Penetration Test**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>G-A</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>G-B</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>15% 0.2'</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*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 lbs
Drop: 30"

**SAMPLER:**
2" STANDARD SPLIT SPOON

---

### PENETRATION DATA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>T-A</td>
<td>17</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>T-B</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>T-C</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>T-D</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20</td>
<td>T-E</td>
<td>17</td>
<td>-</td>
<td>-</td>
<td>-1.10</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20.1</td>
<td>T-F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*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:** 50"

**SAMPLER:** 2" STANDARD SPLIT SPOON

---

**DESCRIPTION**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8-A</td>
<td>18</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>8-B</td>
<td>16</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>8-C</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>8-D</td>
<td>28</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>18.5</td>
<td>8-E</td>
<td>No Recovery</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**END OF BORING @ 18.5' 9-27-73**

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

---

**PENETRATION DATA**

<table>
<thead>
<tr>
<th>N (Blows per foot)</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>PENETRATION DATA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Standard Penetration Test
- Data provided by W. Lum Associates, Inc.
**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

---

**ELEVATION DATA**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample</th>
<th>Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.25 - 10</td>
<td>9-A</td>
<td>15</td>
</tr>
<tr>
<td>10.5</td>
<td>9-B</td>
<td>20</td>
</tr>
<tr>
<td>11.5</td>
<td>9-C</td>
<td>12</td>
</tr>
<tr>
<td>14.5</td>
<td>9-D</td>
<td>16</td>
</tr>
<tr>
<td>20.5</td>
<td>9-E</td>
<td>19</td>
</tr>
</tbody>
</table>

---

**UNIFIED SOIL CLASSIFICATION**

- (ML) HARD, RED CLAY, BROWN SILT W/ TRACES OF ROOTS
- ML HARD MOTTLED GRAY BROWN SILTY CLAY
- ML DENSE, GRAY SILTY SAND W/ DECOMPOSED ROCK
- ML COBBLE
- ML DENSE, GRAY BROWN SILTY SAND W/ DECOMPOSED ROCK

---

**ELEVATION FROM SITE PLAN**

*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

---

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(ML) STIFF, REDDISH BROWN CLAYEY SILT</td>
<td>0</td>
<td>10-A</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CH) STIFF, BROWN CLAY W/ DECOMPOSED ROCK</td>
<td>5</td>
<td>10-B</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ML-CH) STIFF, MOTTLED GRAY SILTY CLAY W/ DECOMPOSED ROCK</td>
<td>10</td>
<td>10-C</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CH-CH) GRAY ROCK FRAGMENTS</td>
<td>15</td>
<td>10-D</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END OF BORING @ 15.5</td>
<td>25 MIN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Date:** 10-8-73  
**Time:** -  
**Water Level:** N/A  
**Datum:** -

---

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

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

HAMMER:  140 #
Weight:  30"
Drop:

SAMPLER:  2" STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>DESCRIPTION</th>
<th>Depth (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ML)</td>
<td>STIFF, BROWN CLAY, Silt w/ TRACES OF Silty Clay</td>
<td>0</td>
</tr>
<tr>
<td>(CH)</td>
<td>STIFF, BROWN CLAY</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>MOTTLED GRAY, DECOMPOSED ROCK</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>CLAYEY SILT</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>COBBLE OR BOULDER</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>END OF BORING @ 12'</td>
<td>10-5-73</td>
</tr>
</tbody>
</table>

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

LOCATION: Makakilo, Oahu, Hawaii

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

Driller: W. Lum Assoc., Inc.
Date: Oct. 6, 1973

Field Party: Asato, Kau, Omori

Type of Boring: Auger (Versa)

Diam.: 4"

Elev.: 739 ft

Datum: M.H.

Drill Bit: T.C. Drag

Water Level: N.F.

Time: 10:5:73

Date: 10-5-75

Hammer:

Weight: 140 lbs.

Drop: 10"

Sampler: 2" Standard Split Spoon

Penetration Data

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Wet Density</th>
<th>Water Content</th>
<th>Dry Density</th>
<th>Unconf. Comp.</th>
<th>Vane Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-A</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-B</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-C</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-D</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-E</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-F</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standard Penetration Test

N (Blows per foot)

0 10 20 30 40

End of Boring, 21.5 ft
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 lb  
- **Drop:** 20"  

**SAMPLER:** 2" STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Unified Classification</th>
<th>Description</th>
<th>Depth (ft.)</th>
<th>Sample No.</th>
<th>Wet Den. (p.c.f.)</th>
<th>Dry Den. (p.c.f.)</th>
<th>Unconf. Comp. (p.s.f.)</th>
<th>Sample P.S.F.</th>
<th>Standard Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML-CL</td>
<td>HAR邦, BROWN</td>
<td>0</td>
<td>13-A</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Silty CLAY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>W/Traces of roots</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BOULDER</td>
<td>5</td>
<td>13-B</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>STIFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MOTTLED GRAY BROWN, CLAY</td>
<td></td>
<td></td>
<td>13-C</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(CH)</td>
<td>W/SAND &amp; GRAVEL</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>STIFF, MOTTLED BROWN</td>
<td></td>
<td></td>
<td>13-D</td>
<td>16</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>CLAY W/Traces of Sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BOULDER</td>
<td>15</td>
<td>13-E</td>
<td>34</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GRAY, DECOMPOSED ROCK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>COBBLES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>STIFF, MOTTLED BROWN</td>
<td></td>
<td></td>
<td>13-F</td>
<td>35</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(CH)</td>
<td>CLAY W/ SAND &amp; GRAVEL</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**END OF BORING @ 21.5'**  
**9.24.73**

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

**PROJECT**: MAKA KiLO HALE II

**LOCATION**: Makakilo, Oahu, Hawaii

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

**Type of Boring**: AUGER (MOBILE) Diam.: 4"

**Elev.**: 710' ± *

**HAMMER**:
- Weight: 140#
- Drop: 30"

**SAMPLER**: 2" STANDARD SPLIT SPOON

---

**UNITED SOIL CLASSIFICATION**

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>STIFF, REDDISH BROWN CLAYEY SILT W/ TRACES OF ROOTS</td>
</tr>
<tr>
<td>5</td>
<td>STIFF, MOTTLED BROWN CLAY W/ SOME SAND &amp; ROOTS</td>
</tr>
<tr>
<td>10</td>
<td>MOTTLED GRAY DECOMPOSED ROCK</td>
</tr>
<tr>
<td>15</td>
<td>COBBLE OR BOULDER</td>
</tr>
</tbody>
</table>

**End of Boring**: 8.15' 9-26-73

---

**PENETRATION DATA**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>14-A</td>
<td>18</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.50</td>
</tr>
<tr>
<td>10</td>
<td>14-D</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.50</td>
</tr>
<tr>
<td>15</td>
<td>14-E</td>
<td>NO RECOVERY</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.50</td>
</tr>
</tbody>
</table>

**Water Level**: NOT NOTICED

**Time**: 00:00 9-26-73

---

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

---

**NOTE**

- LL = LIQUID LIMIT
- PL = PLASTIC LIMIT

---

*HAMMER BOUNCES*
Boring Log

**PROJECT:** MAKAKILO HALE II  
**LOCATION:** Makakilo, Oahu, Hawaii

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

**HAMMER:**
- **Weight:** 140 lbs
- **Drop:** 30 ft

**SAMPER:** 2" STANDARD SPLIT SPOON

**LOCATION:** Makakilo, Oahu, Hawaii

**FIELD PARTY:** RADOVICH, OMORI, KAU

**ELEVATION DATA**

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>Description</th>
<th>Sample No.</th>
<th>Wet Dens.</th>
<th>Dens.</th>
<th>Unit Comp.</th>
<th>Vane Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ML)</td>
<td>HARD, RED CLAYY SILT</td>
<td>15-A</td>
<td>11</td>
<td>-</td>
<td>-</td>
<td>46</td>
</tr>
<tr>
<td>(CH)</td>
<td>STIFF, MOTTLED GRAY BROWN CLAY W/ GRAVEL</td>
<td>15-B</td>
<td>20</td>
<td>LL=88</td>
<td>PL=2B</td>
<td>45</td>
</tr>
<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED GRAY BROWN SANDY SILT W/ DECOMPOSED ROCK &amp; SOME CLAY</td>
<td>15-C</td>
<td>17</td>
<td>-</td>
<td>-</td>
<td>5%/5%</td>
</tr>
<tr>
<td>(MH)</td>
<td>HARD, MOTTLED GRAY CLAYY SILT</td>
<td>15-D</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td>52</td>
</tr>
<tr>
<td>(SM)</td>
<td>DENSE Silty Sand W/ DECOMPOSED ROCK</td>
<td>15-E</td>
<td>11</td>
<td>-</td>
<td>-</td>
<td>5%/5%</td>
</tr>
</tbody>
</table>

**Standard Penetration Test**

- **N (Blows per foot):** 0 10 20 30 40

**NOTE**

- LL: LIQUID LIMIT
- PL: PLASTIC LIMIT

**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

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

**HAMMER:**
- **Weight:** 140#
- **Drop:** 50"

**SAMPLER:** .2" STANDARD SPLIT SPOON

**LOCATION:**
- OSHI O
- Diam. 10" (VERT.)

**Type of Boring:** AUGER (YESTA)

**Elev.:** 696' + x

**Drill Bit:** T.C. DRAG

**Date:** 10-1-73

---

**Penetration Data**

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>Description</th>
<th>Depth (Ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Water Cont.</th>
<th>Dry Density (p.c.f.)</th>
<th>Undrained Comp. (p.s.f.)</th>
<th>Vane Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ML)</td>
<td>STIFF RED BROWN CLAYEY SILT</td>
<td></td>
<td></td>
<td>G16-A</td>
<td>17.</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>G16-B</td>
<td>16</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>COBBLE OR BOULDER</td>
<td>5</td>
<td></td>
<td>G16-C</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>DECOMPOSED ROCK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>END OF BORING &amp; 1'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** SECOND ATTEMPT. ROUGH DRILLING 10'-10'. MOVED HOLE 15' AWAY ON THIRD ATTEMPT. ROUGH DRILLING 40'-50'.

**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:** 0.2" STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>Description</th>
<th>ELEV. = 599.48'</th>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Wet Bulk Dens.</th>
<th>Dry Bulk Dens.</th>
<th>Water Cont.</th>
<th>Vane Shear</th>
<th>Standard Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH</td>
<td>STIFF, BROWN CLAYEY SILT w/ TRACES OF ROOTS</td>
<td>17-A</td>
<td>17</td>
<td>LL: 62</td>
<td>FL: 32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MH</td>
<td>STIFF MOTTLED GRAY BROWN CLAYEY SILT</td>
<td>17-B</td>
<td>16</td>
<td>LL: 56</td>
<td>FL: 34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MH</td>
<td>MOTTLED GRAY DECOMPOSED ROCK (CRUSHED TO SANDY SILT)</td>
<td>17-C</td>
<td>23</td>
<td>LL: 66</td>
<td>FL: 42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| (MH)                       | END OF BORING, 6 20.5'  
10-2-73                      |              |            |            |               |               |             |            |                          |

**NOTE:** MOVED HOLE 13' AWAY. DRILL TIME 11.0' 13.0' 25 MIN.

**END OF BORING, 6 20.5'  
10-2-73**

*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 SPLINT SPOON

---

#### PENETRATION DATA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>18-A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>18-B</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>18-C</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>18-D</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20</td>
<td>18-E</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>25</td>
<td>18-F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

---

**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

ELEV. = 82'+

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HARD RED &amp; DARK BROWN CLAY W/ ROOTS</td>
<td>10</td>
<td>19.A</td>
<td>1.6</td>
<td>LL</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STIFF, GRAY-BROWN SANDY SILT W/SOME GRAVEL</td>
<td>15</td>
<td>19.B</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HARD, MOTTLED GRAY SILT/CLAY</td>
<td>20</td>
<td>19.C</td>
<td>39</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIGHT GRAY DECOMPOSED ROCK</td>
<td>25</td>
<td>19.D</td>
<td>12</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COBBLES</td>
<td>30</td>
<td>19.E</td>
<td>42</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STIFF, MOTTLED GRAY SILT/CLAY W/SAND</td>
<td>35</td>
<td>19.F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF BORING @ 21.5' 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:**
- Weight: 140 lbs.
- Drop: 30"

**Sampler:** 2" STANDARD SPLIT SPOON

**Boring No.** 20
**Date:** Oct. 4, 1973
**Driller:** W. LUM ASSOC., INC.
**Field Party:** ASATO, KAU

**Type of Boring:** AUGER (VERSATILE)
**Diam.:** 4"

**Elev.:** 687 +/ *

**Datum:**

**Drill Bit:** T.C. DRAG

**Date of Notice:**

**Date:** 10-4-73

---

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20-A</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>20-B</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>20-C</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>20-D</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HAMMER</td>
</tr>
</tbody>
</table>

**Note:**
- 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, 1975  
**Field Party:** RADOVICH, KAU, OMORI  
**Type of Boring:** AUGER (MOBILE)  
**Diam.:** 4"  
**Datum:**  
**Hammer:**  
**Weight:** 140*  
**Drop:** 30"  
**Sampler:** 2" STANDARD SPLIT SPOON

---

## PENETRATION DATA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>21-A</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>21-B</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>21-C</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>21-D</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>21-E</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**UNITED STATES GEOLOGICAL SURVEY**  
**UNITED STATES GEOLOGICAL SURVEY**

---

**DESCRIPTION**  
**ELEV.: 994' 3"**

**ML**  
HARD, RED CLAYET SILT

**SM**  
DENSE, GRAY SITY SAND W. DECOMPRESSED ROCK

**BOULDER**  
STIFF, MOTTLED GRAY SITY CLAY & DECOMPOSED ROCK

END OF BORING & 21.5'  
9-25-73

---

*Elevation estimated from Site Plan by G. R. Sutton & Assoc., Inc. (7-30-73)
WALTER LUM ASSOCIATES, INC.

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
Driller W. LUM ASSOCIATES INC.
Date OCT. 5, 1973
Type of Boring AUGER (VERGA)
Diam. 4"

Elev. Datum 706' 4" ±

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

LOCATION:

## Boring Log

**PROJECT**  
MAKAKILO HALE II

**LOCATION**  
Makakilo, Oahu, Hawaii

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

**HAMMER:**  
Weight 140 lbs
Drop 30

**SAMPLER:** 2" STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(ML)</td>
<td>STIFF, BROWN ELAYET SILT</td>
<td></td>
<td>23A</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>STIFF, BROWN ELAYET W/ GRAY</td>
<td>5</td>
<td>23B</td>
<td>18</td>
<td></td>
<td>LL: 52</td>
<td></td>
<td>P.L: 27</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DECOMPOSED ROCK</td>
<td></td>
<td>23C</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COBBLE OR BOULDER**  
END OF BORING @ 9'  
9-28-73

**NOTE:** DRILL TIME  
8:00-9:00 25 MIN.

**EVIDENCE:**  
LL: LIQUID LIMIT  
P.L: PLASTIC LIMIT

*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

**Hamer:**  
Weight: 140#  
Drop: 30"

**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: AUGER (VERSA)

Elev.: 68' - 1'  
Datum:  

Drill Bit: T.C. DRAG  
Water Level: NOT NOTED

**Date:** 10-1-73

---

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N (Blows per foot)</td>
</tr>
<tr>
<td>0 - 10</td>
<td>24-A</td>
<td>16</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>10 - 15</td>
<td>24-B</td>
<td>16</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>15 - 20</td>
<td>24-C</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20 - 25</td>
<td>24-D</td>
<td>9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>57</td>
</tr>
<tr>
<td>25 - 30</td>
<td>24-E</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5%</td>
</tr>
<tr>
<td>30 - 35</td>
<td>24-F</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5%</td>
</tr>
<tr>
<td>35 - 40</td>
<td>24-G</td>
<td>28</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5%</td>
</tr>
</tbody>
</table>

---

*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

<table>
<thead>
<tr>
<th>HAMMER:</th>
<th>140#</th>
<th>Drop: 30</th>
</tr>
</thead>
</table>

**Sampler:** 2" STANDARD SPLIT SPOON

---

**Standard Penetration Test**

<table>
<thead>
<tr>
<th>Penetration Test</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
</table>

---

**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

<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample No.</th>
<th>Penetration (Blows per foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>26-A</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>26-B</td>
<td>18</td>
</tr>
<tr>
<td>10</td>
<td>26-C</td>
<td>23</td>
</tr>
<tr>
<td>15</td>
<td>26-D</td>
<td>23</td>
</tr>
<tr>
<td>20</td>
<td>26-E</td>
<td>27</td>
</tr>
<tr>
<td>25</td>
<td>26-F</td>
<td>32</td>
</tr>
</tbody>
</table>

*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  

### Soil Classification and Description

<table>
<thead>
<tr>
<th>Soil</th>
<th>Description</th>
<th>ELEV.</th>
<th>Depth (ft)</th>
<th>Sampler</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
<td>STIFF BROWN CLAYET SILT W/ DECOMPOSED ROCK</td>
<td>682'</td>
<td>0</td>
<td>21A</td>
</tr>
<tr>
<td></td>
<td>END OF BORING @ 3'</td>
<td>682'</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**:  
ROUGH DRILLING FOR 5 MIN. MOVED HOLE 5', SOUTH, HIT COBBLE OR BOULDER AT 2.0', THIRD ATTEMPT IN NORTH, HIT COBBLE OR BOULDER AT 2'.

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

**PROJECT** MAKAHILO HALE II

**LOCATION** Makakilo, Oahu, Hawaii

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

**HAMMER:**
- **Weight:** 140 lbs
- **Drop:** 30"

**SAMPER:** 2" STANDARD SPLIT SPOON

**BORING NO.** 28

**Date:** 9-28-73

<table>
<thead>
<tr>
<th>Depth (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>30</td>
</tr>
</tbody>
</table>

**STIFF, RED SILT CLAY**

**HARD, MOTTLED BROWN CLAY**

**COBBLES OR BOULDERS**

**END OF BORING, 2.19'**

9-28-73

*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

---

#### Penetration Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(ML)</td>
<td>HARD, MOTTLED RED BROWN CLAYET SILT.</td>
<td>0</td>
<td>29-A</td>
<td>18</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>47</td>
</tr>
<tr>
<td>(MH-CH)</td>
<td>STIFF MOTTLED GRAY BROWN SILTY CLAY WRALES OF SAND</td>
<td>5</td>
<td>29-B</td>
<td>22</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(SM)</td>
<td>BOULDER DENSE, GRAY SILTY SAND</td>
<td>10</td>
<td>29-C</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>COBBLES OR BOULDERS</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

#### TABLE IA - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>C</td>
<td>5'-6.5'</td>
<td>BROWN CLAYY SILT</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>0.5'-1.5'</td>
<td>RED CLAYY</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>5'-6'</td>
<td>RED CLAYY</td>
</tr>
</tbody>
</table>

#### GRAIN-SIZE ANALYSIS (% Passing)

<table>
<thead>
<tr>
<th>Sieve</th>
<th>1&quot;</th>
<th>1/2&quot;</th>
<th>#4</th>
<th>#10</th>
<th>#20</th>
<th>#40</th>
<th>#100</th>
<th>#200</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### ATTERBERG LIMITS

<table>
<thead>
<tr>
<th></th>
<th>Air Dried or Natural</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>Dilatancy</th>
<th>Toughness</th>
<th>Dry Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NATURAL</td>
<td>47</td>
<td>30</td>
<td>17</td>
<td>SLOW-MED.</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
</tr>
<tr>
<td></td>
<td>NATURAL</td>
<td>47</td>
<td>28</td>
<td>19</td>
<td>SLOW</td>
<td>MEDIUM-HIGH</td>
<td>MEDIUM</td>
</tr>
<tr>
<td></td>
<td>NATURAL</td>
<td>59</td>
<td>53</td>
<td>20</td>
<td>NONE-SLOW</td>
<td>MEDIUM</td>
<td>SLIGHT-MED.</td>
</tr>
</tbody>
</table>

#### UNIFIED SOIL CLASSIFICATION

<table>
<thead>
<tr>
<th></th>
<th>ML</th>
<th>ML</th>
<th>MH</th>
</tr>
</thead>
</table>

#### APPARENT SPECIFIC GRAVITY

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
</table>

#### CBR TESTS

<table>
<thead>
<tr>
<th></th>
<th>(Surcharge-51 P.S.F.)</th>
<th>Molding Moisture, %</th>
<th>Molding Dry Density, P.C.F.</th>
<th>Swell upon saturation, %</th>
<th>CBR at 0.1&quot; Penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### MOISTURE-DENSITY RELATIONS OF SOILS

<table>
<thead>
<tr>
<th></th>
<th>(AASHO T-180-57 Method)</th>
<th>Dry to Wet or Wet to Dry</th>
<th>Max. Dry Density (P.C.F.)</th>
<th>Optimum Moisture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### REMARKS:

Date: 10-24-73  By: CT

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
### TABLE I.D - SUMMARY OF LABORATORY TEST RESULTS

| BORING NO. | 3 | 3 |
| SAMPLE NO. | C | D |
| DEPTH BELOW SURFACE | 10'-11.5' | 15'-15.9' |
| DESCRIPTION | MOTTLED GRAY, WET ACES OF BROWN CLAY, DECAY ROCK |

### GRAIN-SIZE ANALYSIS (% Passing)

| Sieve | 3 | 3 |
| 1'' | 100 |
| 1/2'' | 100 |
| #4 | 85.8 |
| #10 | 69.8 |
| #20 | 56.7 |
| #40 | 49.9 |
| #100 | 43.6 |
| #200 | 42.1 |

### ATTERBERG LIMITS

| Air Dried or Natural | NATURAL |
| Liquid Limit | 78 |
| Plastic Limit | 32 |
| Plasticity Index | 46 |

| Dilatancy | SLOW |
| Toughness | MED-HIGH |
| Dry Strength | MED-HIGH |

### UNIFIED SOIL CLASSIFICATION

| CH | SM |

### 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:

Date 10-24-73  By CT
# Table Ic - Summary of Laboratory Test Results

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>9</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample No.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth Below Surface</td>
<td>5'-6.5'</td>
<td>5'-6.5'</td>
<td>5'-6.5'</td>
</tr>
<tr>
<td>Description</td>
<td>MOTTLED GRAY CLAY W/ SOME BROWN CLAY</td>
<td>MOTTLED BROWN CLAY W/SAND &amp; SILT</td>
<td>MOTTLED BROWN SILTY CLAY</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grain-Size Analysis (% Passing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve</td>
</tr>
<tr>
<td>1&quot;</td>
</tr>
<tr>
<td>1/2&quot;</td>
</tr>
<tr>
<td>#4</td>
</tr>
<tr>
<td>#10</td>
</tr>
<tr>
<td>#20</td>
</tr>
<tr>
<td>#40</td>
</tr>
<tr>
<td>#100</td>
</tr>
<tr>
<td>#200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Atterberg Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Dried or Natural</td>
</tr>
<tr>
<td>Liquid Limit</td>
</tr>
<tr>
<td>Plastic Limit</td>
</tr>
<tr>
<td>Plasticity Index</td>
</tr>
<tr>
<td>Dilatancy</td>
</tr>
<tr>
<td>Toughness</td>
</tr>
<tr>
<td>Dry Strength</td>
</tr>
<tr>
<td>Natural</td>
</tr>
<tr>
<td>Natural</td>
</tr>
<tr>
<td>Natural</td>
</tr>
<tr>
<td>MEDIUM</td>
</tr>
<tr>
<td>NONE</td>
</tr>
<tr>
<td>SLIGHT-MED</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Apparent Specific Gravity</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CBR Tests (Surcharge-51 P.S.F.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molding Moisture, %</td>
</tr>
<tr>
<td>Molding Dry Density, P.C.F.</td>
</tr>
<tr>
<td>Swell upon saturation, %</td>
</tr>
<tr>
<td>CBR at 0.1&quot; Penetration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Moisture-Density Relations of Soils (AASHO T-180-57 Method)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry to Wet or Wet to Dry</td>
</tr>
<tr>
<td>Max. Dry Density (P.C.F.)</td>
</tr>
<tr>
<td>Optimum Moisture (%)</td>
</tr>
</tbody>
</table>

**Remarks:**

Date: 0-24-73  By: [Signature]

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
### Table 1D - Summary of Laboratory Test Results

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample No.</th>
<th>Depth Below Surface</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 A</td>
<td>17 B</td>
<td>0'-2'</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/2'</td>
<td>Clayey Silt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2'-10'</td>
<td>Witraces of Roots</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10'-11'</td>
<td>Mottled Gray Decomposed Rock</td>
</tr>
<tr>
<td>17 C</td>
<td>17 D</td>
<td>5'-6.5'</td>
<td>Gray-Brown (Some Crushed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clayey Silt to Sandy Silt</td>
</tr>
</tbody>
</table>

#### Grain-Size Analysis (% Passing)

<table>
<thead>
<tr>
<th>sieve</th>
<th>1</th>
<th>1/2&quot;</th>
<th>#4</th>
<th>#10</th>
<th>#20</th>
<th>#40</th>
<th>#100</th>
<th>#200</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Atterberg Limits

<table>
<thead>
<tr>
<th>Air Dried or Natural</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td>5%</td>
<td>3%</td>
<td>22%</td>
</tr>
<tr>
<td>Natural</td>
<td>5%</td>
<td>3%</td>
<td>22%</td>
</tr>
<tr>
<td>Natural</td>
<td>5%</td>
<td>3%</td>
<td>22%</td>
</tr>
</tbody>
</table>

#### Unified Soil Classification

- MH
- MH
- MH
- MH

#### Apparent Specific Gravity

- MH
- MH
- MH
- MH

#### 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:

Date: 10-24-73  By: P.T.

Walter Lum Associates, Inc.
Civil, Structural, Soils Engineers
## TABLE I.E - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>A</td>
<td>05'-2'</td>
<td>RED &amp; DARK BROWN CLAY W/ROOTS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5'-4'</td>
<td>BROWN CLAY DECOMPOSED ROCK</td>
</tr>
</tbody>
</table>

### GRAIN-SIZE ANALYSIS

<table>
<thead>
<tr>
<th>Sieve</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td></td>
</tr>
<tr>
<td>1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td></td>
</tr>
<tr>
<td>#20</td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td></td>
</tr>
<tr>
<td>#100</td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td></td>
</tr>
</tbody>
</table>

### ATTERBERG LIMITS

<table>
<thead>
<tr>
<th>Property</th>
<th>Natural</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Dried or Natural Liquid Limit</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>Plastic Limit</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>Dilatancy</td>
<td>SLOW-MED.</td>
<td>SLOW-MED.</td>
</tr>
<tr>
<td>Toughness</td>
<td>MED-HIGH</td>
<td>MED-HIGH</td>
</tr>
<tr>
<td>Dry Strength</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
</tr>
</tbody>
</table>

### UNIFIED SOIL CLASSIFICATION

<table>
<thead>
<tr>
<th></th>
<th>CH</th>
<th>CH</th>
</tr>
</thead>
</table>

### APPARENT SPECIFIC GRAVITY

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### CBR TESTS

<table>
<thead>
<tr>
<th>Property</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Surcharge-51 P.S.F.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molding Moisture, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molding Dry Density, P.C.F.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swell upon saturation, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBR at 0.1&quot; Penetration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### MOISTURE-DENSITY RELATIONS OF SOILS

<table>
<thead>
<tr>
<th>Property</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(AASHO T-180-57 Method)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry to Wet or Wet to Dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Dry Density (P.C.F.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimum Moisture (%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### REMARKS:

Date 10-24-73 By BT
### Table I.F - Summary of Laboratory Test Results

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Depth Below Surface</th>
<th>Description</th>
<th>Grain-Size Analysis (% Passing)</th>
<th>Atterberg Limits</th>
<th>Unified Soil Classification</th>
<th>Apparent Specific Gravity</th>
<th>CBR Tests</th>
<th>Moisture-Density Relations of Soils</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Surface</td>
<td>Reddish - Brown Clayey Silt</td>
<td>100</td>
<td>50</td>
<td>Natural</td>
<td>1.86</td>
<td>24.9</td>
<td>101.5</td>
<td>15.7</td>
</tr>
<tr>
<td>B</td>
<td>Surface</td>
<td>Reddish - Brown Clayey Silt</td>
<td>100</td>
<td>40</td>
<td>Natural</td>
<td>2.90</td>
<td>25.9</td>
<td>99.6</td>
<td>105.2</td>
</tr>
<tr>
<td>C</td>
<td>Surface</td>
<td>Reddish - Brown Clayey Silt</td>
<td>100</td>
<td>49</td>
<td>Natural</td>
<td>2.90</td>
<td>22.9</td>
<td>98.8</td>
<td>105.2</td>
</tr>
<tr>
<td>D</td>
<td>Surface</td>
<td>Reddish - Brown Clayey Silt</td>
<td>100</td>
<td>48</td>
<td>Natural</td>
<td>2.90</td>
<td>25.1</td>
<td>98.1</td>
<td>105.2</td>
</tr>
</tbody>
</table>

**Numerical Data**

- Sample A: Reddish Brown Clayey Silt
- Sample B: Reddish Brown Clayey Silt
- Sample C: Reddish Brown Clayey Silt
- Sample D: Reddish Brown Clayey Silt

**Remarks:**

Date: 10-14-73  By  BT

---

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

PROJECT: MAKAKILO HALE II
LOCATION: MAKAKILO, OAHU, HAWAII

DATE 10-24-73  BY  BT
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" x 4.584" HIGH
HAMMER: 10 LBS 18" DROP
LAYERS: 5

BLOWS: 25/LAYER

MAXIMUM DRY DENSITY: 100.5pcf

OPTIMUM DRY DENSITY: 94.8pcf

ZERO AIR HOLES CURVE

SPECIFIC GRAVITY: 2.86

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

DATE 10-9-73  BY JS
MOISTURE-DENSITY CURVE (AASHO T-180-51, METHOD A)

PROJECT: MAKAKILO HALE II
LOCATION: MAKAKILO, OAHU, HAWAII
SAMPLE NO.: "O" SURFACE
SAMPLE DESCRIPTION: BROWN SILTY CLAY
AGGREGATE: ¼" MILUX
MOLD SIZE: 4" Ø X 4.564" HIGH
HAMMER: 10 LBS., 18' DROP
LAYERS: 0
BLOWS: 25/LAYER

DATE 10-6-73 BY N1

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

PROJECT: MAKAKILO HALE II

LOCATION: MAKAKILO, OAHU, HAWAII

SAMPLE NO: "A" SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT

CBR PENETRATION DATA

<table>
<thead>
<tr>
<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025</td>
<td>130</td>
<td>43</td>
</tr>
<tr>
<td>0.050</td>
<td>250</td>
<td>43</td>
</tr>
<tr>
<td>0.075</td>
<td>400</td>
<td>183</td>
</tr>
<tr>
<td>0.100</td>
<td>550</td>
<td>177</td>
</tr>
<tr>
<td>0.125</td>
<td>650</td>
<td>210</td>
</tr>
<tr>
<td>0.150</td>
<td>700</td>
<td>233</td>
</tr>
<tr>
<td>0.175</td>
<td>770</td>
<td>257</td>
</tr>
<tr>
<td>0.200</td>
<td>830</td>
<td>217</td>
</tr>
<tr>
<td>0.250</td>
<td>900</td>
<td>301</td>
</tr>
<tr>
<td>0.300</td>
<td>1000</td>
<td>333</td>
</tr>
<tr>
<td>0.350</td>
<td>1050</td>
<td>360</td>
</tr>
<tr>
<td>0.400</td>
<td>1150</td>
<td>383</td>
</tr>
<tr>
<td>0.450</td>
<td>1220</td>
<td>401</td>
</tr>
<tr>
<td>0.500</td>
<td>1270</td>
<td>423</td>
</tr>
</tbody>
</table>

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 AT 0.1" PENETRATION: 16.3
DAYS SOAKED: 4

DATE 10-10-73 BY RH
DATE 10-11-73 BY NL
CBR TEST

PROJECT: MAKAKILO HALE II
LOCATION: MAKAKILO, OAHU, HAWAII
SAMPLE NO: "O" SURFACE
SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT

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 NH

CBR PENETRATION DATA

<table>
<thead>
<tr>
<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>0.050</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>0.075</td>
<td>140</td>
<td>0</td>
</tr>
<tr>
<td>0.100</td>
<td>180</td>
<td>0</td>
</tr>
<tr>
<td>0.125</td>
<td>220</td>
<td>0</td>
</tr>
<tr>
<td>0.150</td>
<td>260</td>
<td>0</td>
</tr>
<tr>
<td>0.175</td>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>0.200</td>
<td>340</td>
<td>0</td>
</tr>
<tr>
<td>0.225</td>
<td>380</td>
<td>0</td>
</tr>
<tr>
<td>0.250</td>
<td>420</td>
<td>0</td>
</tr>
<tr>
<td>0.300</td>
<td>470</td>
<td>0</td>
</tr>
<tr>
<td>0.350</td>
<td>520</td>
<td>0</td>
</tr>
<tr>
<td>0.400</td>
<td>570</td>
<td>0</td>
</tr>
<tr>
<td>0.450</td>
<td>620</td>
<td>0</td>
</tr>
<tr>
<td>0.500</td>
<td>670</td>
<td>0</td>
</tr>
</tbody>
</table>

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

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

TEST RESULTS:

MOULDING MOISTURE, %: 22.9

MOULDING 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
CBR TEST

PROJECT: MAKAKILO HALE II

LOCATION: MAKAKILO, OAHU, HAWAII

SAMPLE NO: "D" SURFACE

SAMPLE DESCRIPTION: BROWN SILTY CLAY

CBR PENETRATION DATA

<table>
<thead>
<tr>
<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>0.050</td>
<td>62</td>
<td>27</td>
</tr>
<tr>
<td>0.075</td>
<td>130</td>
<td>43</td>
</tr>
<tr>
<td>0.100</td>
<td>183</td>
<td>61</td>
</tr>
<tr>
<td>0.125</td>
<td>237</td>
<td>79</td>
</tr>
<tr>
<td>0.150</td>
<td>250</td>
<td>98</td>
</tr>
<tr>
<td>0.175</td>
<td>244</td>
<td>115</td>
</tr>
<tr>
<td>0.200</td>
<td>225</td>
<td>92</td>
</tr>
<tr>
<td>0.250</td>
<td>464</td>
<td>179</td>
</tr>
<tr>
<td>0.300</td>
<td>520</td>
<td>176</td>
</tr>
<tr>
<td>0.350</td>
<td>538</td>
<td>174</td>
</tr>
<tr>
<td>0.400</td>
<td>646</td>
<td>256</td>
</tr>
<tr>
<td>0.450</td>
<td>705</td>
<td>235</td>
</tr>
<tr>
<td>0.500</td>
<td>767</td>
<td>256</td>
</tr>
</tbody>
</table>

ADJUSTED COORDINATES

TEST RESULTS:

MOLDING MOISTURE, %: 25.1

MOLDING DRY DENSITY, P.C.F.: 95.9

CBR @ 0.1" PENETRATION: 5.7

DAYS SOAKED: 1

DATE 10-10-73 BY RH

DATE 10-11-73 BY JS
LOGS OF BORINGS

FROM

"MAKAKILO DEVELOPMENT - KAPOLEI PD-H"

REPORT DATED MARCH 5, 1973
### Boring Log

**MAKAKILO DEVELOPMENT**

**PROJECT** KAPOLEI P.D.H.

**LOCATION** Makakilo, Oahu, Hawaii

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

---

**HAMMER:**
- **Weight:** 140 lbs
- **Drop:** 30"

**SAMPLER:**
- **2"SS** 2" STANDARD SPLIT SPOON
- **"AX"** AX DOUBLE TUBE CORE BARREL

---

#### PENETRATION DATA

<table>
<thead>
<tr>
<th>Soil Classification</th>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Plastic Limit %</th>
<th>Water Cont.</th>
<th>Liquid Limit</th>
<th>Unconf. Comp.</th>
<th>V.S. N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELEV. = 731.7 ft</strong></td>
<td>0</td>
<td>I-A</td>
<td>24</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>(ML)</strong> STIFF, REDDISH BROWN GLAITEY SILT <strong>W/DECOMPOSED ROCK</strong></td>
<td>2.55</td>
<td>&quot;AX&quot;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LAVA ROCK <strong>W/DECOMPOSED ROCK</strong></td>
<td>5.00</td>
<td>&quot;AX&quot;</td>
<td>-</td>
<td>CORED: 5.0'</td>
<td>RECOV: 5.0'</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BLUE, DENSE LAVA ROCK</td>
<td>10.00</td>
<td>&quot;AX&quot;</td>
<td>-</td>
<td>CORED: 2.0'</td>
<td>RECOV: 2.0'</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>END OF BORING &amp; 9.5'</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

---

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

**MAKAKILO DEVELOPMENT**

**PROJECT**
KAPOLEI P.D.H.

**LOCATION**
Makakilo, Oahu, Hawaii

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

**HAMMER:**
- **Weight:** 140#
- **Drop:** 30°

**SAMPLER:**
2" STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>DESCRIPTION</th>
<th>ELEV = G74' 6&quot;</th>
<th>Depth (Ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Plastic Limit</th>
<th>Water Cont.</th>
<th>Liquid Limit</th>
<th>Unsaturated P.S.F.</th>
<th>Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ML)</td>
<td>MEDIUM, REDDISH BROWN CLAYET SILT</td>
<td></td>
<td></td>
<td>2-A</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>STIFF, REDDISH BROWN CLAYET SILT</td>
<td></td>
<td></td>
<td>2-B</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>STIFF, GRAY &amp; REDDISH BROWN CLAYET SILT</td>
<td></td>
<td></td>
<td>2-C</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>(MLN)</td>
<td>ROCK (BOULDER)</td>
<td></td>
<td></td>
<td>2-D</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DENSE, GRAY SILTY SAND/GRavel</td>
<td></td>
<td></td>
<td>2-E</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>ROCK</td>
<td></td>
<td></td>
<td>2-F</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>END OF BORING @ 13'</td>
<td></td>
<td></td>
<td>2-G</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
</tbody>
</table>

* ELEVATION ESTIMATED FROM EXISTING FEATURES

**PLAN BY C.R. SUITT & ASSOC., INC. (11-6-72)**
**Boring Log**

**PROJECT:** MaakkiLO DEVELOPMENT

**LOCATION:** Makakilo, Oahu, Hawaii

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

**HAMMER:**
- **Weight:** 140#
- **Drop:** 30"

**SAMPLER:**
- 2" S.S. 2" STANDARD SPLIT SPOON
- "AX" AX DOUBLE TUBE CORE BARREL

**LOCATION:**
- Makakilo, Oahu, Hawaii

**Field Party:**
- **Driller:** W. LUM ASSOC. INC.
- **Date:** FEB. 9, 1973

**Type of Boring:**
- **Drill Bit:** T.C. DRAG T.C. CORING

**Depth:**
- 0'

**DESCRIPTION:**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Plastic Limit %</th>
<th>Water Cont. %</th>
<th>Liquid Limit</th>
<th>Unconf. Comp. p.s.f.</th>
<th>Vane Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-A</td>
<td>21</td>
<td>20</td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-B</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-C</td>
<td>22</td>
<td>19</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-D</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

---

**PENETRATION DATA**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Plastic Limit %</th>
<th>Water Cont. %</th>
<th>Liquid Limit</th>
<th>Unconf. Comp. p.s.f.</th>
<th>Vane Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.55</td>
<td>3-A</td>
<td>21</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.55</td>
<td>3-B</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.55</td>
<td>3-C</td>
<td>22</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.55</td>
<td>3-D</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**END OF BORING @ 18'**

---

**RUN 18'**
- **CORROD:** 5.0'
- **RECOV:** 9.2'
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.