Kalama Valley Subdivision Units 2, 3 & 5  
Preliminary Soil Report  
Maunalua, Honolulu, Oahu, Hawaii  
TAX MAP KEY: 3-9-10: 15 & 18

For Reference  
Not to be taken from this room

To:  
Kaiser-Aetna

Walter Lum Associates, Inc.  
Civil, Structural, Soils Engineers

June 23, 1972

Municipal Reference & Records Center  
City & County of Honolulu  
City Hall Annex, 505 S. King Street  
Honolulu, Hawaii 96813
June 23, 1972

KAISER-AETNA
P. O. Box 7534
Honolulu, Hawaii 96825

Gentlemen:

Subject: Kalama Valley Subdivision Units 2, 3 & 5
Preliminary Soil Report
(for residential development)
Maunalua, Honolulu, Oahu, Hawaii
Tax Map Key: 3-9-10: 15 & 18

In accordance with your request, soil explorations were made to determine general soil conditions at the proposed residential development site for Kalama Valley Subdivision Units 2, 3 & 5 at Maunalua, Honolulu, Oahu, Hawaii.

Surface soils at the site may be generally described as "CH" clays underlain by silty sand or lava rock. The surface clay layers were generally deeper in the eastern boundary and valley floor north of Kalama cinder cone.

Cuts along the eastern boundary of the site will be made partially thru "CH" clays with cobbles and boulders and partially thru lava rock. Slope adjustments may be required depending upon the type of material encountered out in the field.

For light residential structures, conventional slab-on-ground construction may be used where low expansion soils are within the top 2 ft of finish grade, and modified foundation designs will be required where expansive soils are encountered near the finish grades.

Earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

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

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Ezra Koike
Professional Engineer
Hawaii No. 1450

EK:rmf
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SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions for residential development for the proposed Kalama Valley Subdivision Units 2, 3 & 5 at Maunalua, Honolulu, Oahu, Hawaii.

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

PRELIMINARY FIELD EXPLORATION

Twenty-six exploratory borings and nine open pits were made at the site. The locations of these borings and open pits are shown on the Boring Location Plan. Descriptions of the underlying soils encountered are shown on the boring logs. Also attached are logs of borings previously made for "Kalama Valley Off-Site Improvements," "Two Bridge Foundation Sites" and "Kalama Valley Subdivision Unit 2-A."

Borings were made with 3 and 4-in. diameter augers using carbide drag bits. Open pits were made with a caterpillar D-9 dozer with a ripper. Soil samples were recovered with 2 and 3-in. thin wall tube and 2-in. standard split spoon samplers driven with a 140-lb hammer falling 30 inches.
LABORATORY TESTS
Laboratory tests included: natural density, water content, unconfined compression, torvane shear, grain-size analysis, Atterberg limit, AASHO T-180-57 density, expansion and CBR.

A list of the standard field and laboratory test methods used for this project is given in the Appendix.

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

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

GENERAL SITE CONDITIONS
The project site is located on the eastern side of the floor of Kalama Valley, from about 1,200 ft south to about 2,000 ft north of Kalama cinder cone. The existing ground of the valley floor is generally flat and slopes upward from Kalama Stream west to east toward the foot of Kalama Ridge that forms the east boundary of Kalama Valley.

Prior to the field exploration, trees and brush were removed along the east and south sides of Kalama cinder cone.

Trees, brush, access roads and animal pens were noted on the site north of Kalama cinder cone.
INTERPRETATION OF SOIL CONDITIONS

From the field exploration and laboratory test results, the soils encountered in the borings can be generally described as follows:

**Valley Floor South of Kalama Cinder Cone**

The borings south of the cinder cone generally indicated dark-brown clay ("CH" soils) with cobbles and gravels to about 3 to 10 ft underlain by silty sand or lava rock to about 6.5 to 14 ft, the depths drilled.

**Eastern Boundary**

The open pits and borings along the eastern boundary or lower slopes of Kalama Ridge generally indicated talus material, "CH" soils, with cobbles and boulders to about 8 to 24 ft underlain by silty sand and rock to about 30 to 41 ft, the depths drilled.

**Valley Floor North of Kalama Cinder Cone**

The borings in the floor of the valley generally indicated a surface layer of brown clay ("CH" soils) to about 11 to 21 ft underlain with lava rock.

Gypsum crystals were noted in some of the soil samples recovered.

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

The proposed plan is to grade the site for residential subdivision development.

Fills up to about 15 ft in height are proposed along the central portion of the development.

Along the eastern boundary, cut slopes are proposed along the lower slopes of the ridge. At the lower end of natural drainage paths from the upper slopes, deep deposits of expansive "CH" clays may be encountered. Slope adjustments, buttress fills, and subdrains may be required in these deposits.

The site should be cleared and grubbed, drained and localized soft spots removed prior to construction of fills.

Site Grading

The on-site surface soils are generally clayey, adobe or "CH" soils, and should generally be placed in fills away from the face of slopes and preferably outside of building pads. Silty or sandy soils and decomposed rocks or select borrow soils should be used to construct the outer sections of the slopes and, if practicable, the upper 2 to 3 ft of fills for roadways, parking areas and building pads.
If boulders are to be used to construct fills, they should generally be placed at the toe of slopes and outside the building areas.

The construction of fills should be done in accordance with Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein. The following may be used as a guide:

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 and stockpiled soils should be stripped to stiff natural ground before the placement of fills.

Loose or nested boulders should be removed.

Soft pockets and pockets of unsuitable material should be excavated and the excavation backfilled with compacted select on-site soils.

3. Hard surfaces along existing access roads should be scarified and recompacted to match the density of the surrounding soils.
4. Low spots in dips or natural drainageways should be drained and soft spots removed. Subdrains should be placed in a herringbone pattern along the bottom before the placement of fills.

The lower 2+ ft of fill over drainageways should be constructed with fairly well-graded granular material, 6-in. maximum size with less than about 15% passing the No. 200 sieve.

5. Where fills are proposed on sidehill areas, the ground at the toe of the slope should be benched to a generally level condition. As the fill is brought up, it should be continually keyed into the stiff natural ground by cutting steps into the slopes and compacting the fills into these steps.

6. Fills should be constructed in approximately level layers starting at the lower end and working upward.

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

8. If boulders are used in the construction of fills, they should be placed along the toe of the fill.
slopes. The subgrade should be shaped to drain and covered with a layer of filter material. Boulders may then be placed on the filter layer. The void spaces between boulders should be filled with granular material. A blanket of filter material should be placed against the boulder fill before placing earth fills behind the boulders. See sketch on Figure 5.

Slopes

Where plastic clays, "CH" soils, are encountered, slope ratios generally about 3 horizontal to 1 vertical or flatter should be used; otherwise, reconstruction of the outer portions of the slope with less expansive soils should be considered. See Figure 1.

For slopes in expansive clays (adobe), the following guidelines may be used:

Cut slopes along eastern boundary
3 to 1 slopes up to 15 ft, top to toe, where rock outcrops may be found within a short distance from the top slope. See Figure 2.

Cut and fill slopes between house lots
3 to 1 slopes less than 8 ft in height.

Cut and fill slopes next to the concrete-lined drainage channel
Replace face of slope with select material.
Limit height of cut or fill to 15 ft. See Figure 3.
In silty or granular soils, slopes of about 2 horizontal to 1 vertical or flatter may be used.

Where lava rock with clinker pockets are encountered, slope ratios of about 1-1/2 horizontal to 1 vertical may be used.

For low cuts in fairly continuous lava rock formations, slope ratios of about 1 horizontal to 1 vertical may be used.

The cuts along the eastern boundary will be made partially thru "CH" clays with cobbles and boulders and partially thru lava rock. Allowances should be made for slope adjustments in this section depending on the type of material encountered and particularly if seepage zones, soft spots or expansive soil pockets are encountered in localized areas.

For protection against erosion, water should be diverted away from slopes by berms or ditches whenever practicable.

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

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

**Foundations**

If earthwork is carried out as recommended, the stiff natural ground and well-constructed fills should develop adequate bearing values to support the proposed light, short-span residential structures.
Slab-on-ground construction and post-and-beam construction may be used where silty or granular soils, or select borrow soils occur within the top 2 ft of finish grade.

If slab-on-ground construction is used on clay ("CH" soils), the footing excavations around the perimeter of the building should extend 18 in. below the bottom of the footing and should be backfilled with compacted, select coral or an equivalent water-tight non-expansive material. The base course should be placed and wetted down 48 hours before the placement of slab on ground. See Figure 4.

Post-and-beam construction may be used where clayey soils, "CH", are near finish grade. To minimize the effects of heave and shrinkage of "CH" soils, excavations for the foot blocks should be made about 2 ft deep and about 1 ft 6 in. square or round and backfilled with compacted, select coral or an equivalent material. The foot blocks may be placed on top of the coral. See Figure 4.

The select coral should be well graded from 3/4-in. to dust sizes with about 20 to 25% passing the No. 200 sieve.

The following may be used as a guide for foundation design:

1. Bearing values for a given soil vary with the size and depth of footings. For light residential structures, bearing values of about 1500
p.s.f. on compacted fill and 2000 p.s.f. on stiff natural ground may be used.

2. Soft spots or pockets of loose material encountered in footing excavations or below a building area should be excavated and replaced with compacted select on-site soils or select borrow materials.

3. Concrete slab 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. If practicable, the subgrade should be kept higher than the lot or general finish grade. The subgrade should be compacted and shaped to a level surface or to drain.

4. Buildings and structures should be placed about 15 ft from the tops of slopes. This distance may be reduced for lower slope heights, e.g., 10 ft for 10-ft high slopes, but in no case closer than 5 ft from the top of a slope.

5. Construction of retaining wall on slopes should generally be avoided.
6. Good surface drainage away from building foundations should be maintained and the site should be graded to prevent the ponding of water.

**Underground Utilities**

Underground utilities should be placed after the fills are constructed.

Utility line trenches should be daylighted to drain water, particularly in the upper (eastern) sections.

Flexible connections should be used.

**Roadway**

In general, a rough estimate of the roadway pavement thickness for the light automobile traffic anticipated is as follows:

2. Base course - 6-in. base course.
3. Select borrow - 6-in. select borrow.
   - (0 in. over rocky ground)
4. Borrow - 24-in. borrow over clay,
   - "CH" soils (CBR < 2, Expansion > 7).
Provisions should be made in the contract documents to allow for local adjustments regarding subbase requirements in the field as ground conditions are exposed at subgrade levels.

In fill areas, the use of select soils within the top 3 ft of finish grade may be considered to reduce the thickness or eliminate the select borrow or borrow courses.

It is recommended that the pavement subgrade 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 through the walls of catch basins.

**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 plans, regrading at some future date should be avoided unless done under the guidance of a Soils Engineer.
PROPOSED SPECIFICATION FOR EARTHWORK

KALAMA VALLEY SUBDIVISION - UNITS 2, 3 & 5

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 and rubbish 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.

Stockpiled, nested and loose boulders shall be removed and the area stripped to stiff ground or scarified and recompacted to a fairly level condition before the placement of fills.

Hard surfaces along the existing access roads shall be scarified down to stiff soils and recompacted to match the density of the surrounding soil before the placement of fills.

Where fills are proposed in sidehill areas and gullies, loose material along the bottom and the sides shall be stripped down to stiff natural ground before the placement of fills. New fills shall be keyed into the stiff natural ground.
Subdrains shall be placed along the bottom of natural drainageways before the construction of fills. The final locations of subdrains shall be determined in the field after clearing and grubbing.

Where fills are made on sloping areas steeper than 5 horizontal to 1 vertical, the ground at the toe of the slope shall be benched to a generally level condition. As the fill is brought up, it shall be continually keyed into the stiff natural ground by the cutting of steps into the hillside and compacting the fill into these steps. Ground slopes which are flatter than 5 horizontal to 1 vertical shall be benched when considered necessary by the Soil Engineer.

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.

Adobe or "CH" clay soils shall generally be placed in fills away from the face of slopes and outside of building pads.

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 insure uniformity of material and water content within each layer.

Rocks or cobbles shall not be allowed to nest and voids between rocks shall be carefully 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 assures a thorough bonding during the compacting process.

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

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

**KALAMA VALLEY SUBDIVISION**

**PROJECT**
Kalama Valley, Maunalua, Oahu

**LOCATION**
Tax Map Key: 3-9-10, 15 & 18

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

**SAMPLER:** 2" STANDARD SPLIT SPOON

**BORING NO.** 32  
**Driller** W. LUM ASSOC., INC.  
**Date** JAN. 18, 1972  
**Field Party** GLORY TSUKAZAKI, RADOVICH

**Type of Boring** AUGER (MOBILE)  4"

**Datum**

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**UNITED SOIL CLASSIFICATION**

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**DESCRIPTION**

- **BROWN, CLAY (ADobe)** W/Rock Fragments & Sand
- **Medium Dark Brown Clay (Adobe)** W/Traces of Sand
- **Stiff, Light Brown Clayey Silt W/Sand**
- **Tan Clayey Silt W/Traces of Sand, Gravel & Roots**
- **Dense Dark Gray Silty Sand**
- **Dense Mottled Gray Silty Sand W/Rock Fragments**
- **Rock**
- **End of Boring @ 20'**

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* Elevation estimated from survey stake by PARK ENGINEERING, INC.
**Boring Log**

**Kalama Valley Subdivision**

**Project**
UNITS 2, 3 AND 5

**Location**
Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

**Hammer:**
Weight: 10\(^{a}\) Sledge Hammer
Drop: -

**Sampler:** 2" O.D. Thin Wall Tube

**Open Pit**

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**Penetration Data**

- **Standard Penetration Test**
- **10^a Sledge Hammer**

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**Driller:** Kaiser H-Kai Dev. Co.
**Date:** Jan. 11, 1972

**Field Party:** Meyer (W. Lum Assoc., Inc.)

*Elevation Estimated From Survey Stake By Park Engineering, Inc.*

*Walter Lum Associates, Inc.*

*3030 Waialae Avenue * Honolulu, Hawaii 96816 * Phone 737-7931*
Boring Log

**Location**: Kalama Valley, Maunalua, Oahu

**Tax Map Key**: 3-9-10, 15 & 18

**Hammer**:
- Weight: 140 lbs
- Drop: 20 ft

**Sampler**: 2.5' x 2' O.D. Thin Wall Tube

**Standard Penetration Test**: 91/2', 31/2'

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| Hammer Bounces | 49% |

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**End of Drilling @ G.B**

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**Notes**: Elevation estimated from topo map by Park Engineering, Inc.
# Boring Log

**Kalama Valley Subdivision**

**Project:** Kalama Valley, Maunalua, Oahu

**Location:** Tax Map Key: 3-9-10, 15 & 18

**Hammer:**
- **Weight:** 140*
- **Drop:** 30'
- **Sampler:** 2.56 - 2" Standard Split Spoon

**Drill Bit:** T.C. Drak

**Tax Map Key:** 3-9-10, 15 & 18

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**Location:** Kalama Valley, Maunalua, Oahu

**Type of Boring:** Auger (Lager) Diam. 4"  
**Elevation:** 80'  
**Datum:**  
**Driller:** W. Lum Associates, Inc.

---

Elevation estimated from Topo Map by Park Engineering, Inc.
## Boring Log

**Kalama Valley Subdivision**

**Project:** Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

### Hammer:
- **Weight:** 140 lbs
- **Drop:** 30"

### Sampler:
- **7" Standard Split Spoon**

### Field Party:
- **GLORY TSUKAZAKI-RAPOVICH**

### Boring Log Details:

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<td>SM</td>
<td>Brown &amp; Gray Decomposed Rock Frag. / Roots</td>
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*Elevation Estimated from Survey Stake by W.M. Engineering, Inc.*
# Boring Log

**KALAMA VALLEY SUBDIVISION**

**PROJECT**  UNITS 2, 3 AND 5  

**LOCATION**  Kalamalua, Oahu  

**Tax Map Key:**  3-9-10, 15 & 18  

**HAMMER:**  10# SLEDGE HAMMER  

**SAMPLER:**  2" O.D. THIN WALL TUBE  

<table>
<thead>
<tr>
<th>Unit Classification</th>
<th>Description</th>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Water Cont.</th>
<th>Dry Dens.</th>
<th>P.C.F.</th>
<th>Unconf. Comp.</th>
<th>P.S.F.</th>
<th>Water Level</th>
<th>Time</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>BROWN CLAY W/ TRACES OF GYPSUM</td>
<td>9.5</td>
<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>STIFF PASTE CLAY W/ GYPSUM</td>
<td>11.5</td>
<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>TAN, ORANGE &amp; RED SILTY SAND</td>
<td>10</td>
<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>BLACK SILTY SAND</td>
<td>14.5</td>
<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>BOTTOM OF PIT @ 12.0'</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
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**ELEVATION. ESTIMATED FROM SURVEY STAKES BY PARR ENGINEERING, INC.**

**PENETRATION DATA**

<table>
<thead>
<tr>
<th>Standard Penetration Test</th>
<th>10# SLEDGE HAMMER</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (Blows per foot)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

**Type of Boring:** OPEN PIT  
**Diam.:** 15' WIDE  
**Driller:** KAIER H-KAI DEV.CO.  
**Date:** JAN. 18, 1972  
**Field Party:** WALTER LUM ASSOCIATES, INC.  
**Location:** Kalamalua, Oahu  
**Elev.:** 92.2'  
**Datum:**  
**Drill Bit:**  
**Water Level:** N/A  
**Time:**  
**Date:** 1-18-72
## Boring Log

**Kalama Valley Subdivision**

**Units 2, 3 and 5**

**Location:** Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

---

**Boring No.:** 3.4

**Weight:** 140 lbs

**Drop:** 70 ft.

**Sampler:** 2.5" 2" Standard Split Spoon

---

### Soil Classification

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEV. = 90'</td>
<td>9.4.4</td>
</tr>
</tbody>
</table>

### Penetration Data

<table>
<thead>
<tr>
<th>Standard Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (Blows per foot)</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1.5', 21.5'</td>
</tr>
</tbody>
</table>

---

**End of Boring @ 90'**

---

*Elevation estimated from top map by Park Engineering, Inc.*
Boring Log

KALAMA VALLEY SUBDIVISION

PROJECT: UNITS 2, 3 AND 5

LOCATION: Kalama Valley, Maunalua, Oahu

Tax Map Key: 3-9-10, 15 & 18

HAMMER:

- Weight: 140 lbs
- Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

**Boring Log Details**

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>37-A</td>
<td>49</td>
<td>20</td>
<td>38</td>
<td>39</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>37-B</td>
<td>11</td>
<td>0</td>
<td>10</td>
<td>20</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Description**

- **ELEV. = 95 ± 2**
- **BROWN BLOTTED BROWN CLAY W/ SAND**
- **MEDIUM BROWN CLAY W/ SAND**
- **STIFF MOTTLED BROWN SILTY CLAY W/ SAND**
- **LAVA ROCK**
- **GRAY GYPSUM CRYSTALS**
- **END OF BORING @ 17.0'**

- **ELEVATION** (Estimated from survey stake by Park Engineering, Inc.)

---

**Notes:**

- **Water Level:** Noted
- **Time:**
- **Date:** 1-19-72

---

**Penetration Data**

<table>
<thead>
<tr>
<th>Standard Penetration Test</th>
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<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>N (Blows per foot)</td>
</tr>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

---

**Additional Details:**

- **BORE NO.: 37**
- **Driller: W. LUM ASSOCIATES, INC.**
- **Drill Date:** JAN. 19, 1972
- **Field Party:** GLOREY, KADOVICH
**Boring Log**

**KALAMA VALLEY SUBDIVISION**

**PROJECT**

UNITS 2, 3 AND 5

**LOCATION**

Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

---

**HAMMER:**

Weight 10* SLEDGE HAMMER

Drop —

**SAMPLER:** 2" O.D. THIN WALL TUBE

---

### PENETRATION DATA

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>2'6</td>
<td>MT 97-1</td>
<td>114</td>
<td>97</td>
<td>63</td>
<td>6030</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3'2</td>
<td>MH 99</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td>6/5</td>
</tr>
</tbody>
</table>

---

*ELEVATION ESTIMATED FROM SURVEY STAKE BY PARX ENGINEERING, INC.*
Boring Log  
**KALANA VALLEY SUBDIVISION**  
**PROJECT**  UNITS 2, 3 AND 5  
**LOCATION**  Kalana Valley, Maunaiua, Oahu  
Tax Map Key:  3-9-10, 15 & 18  

**HAMMER:**  
- **Weight**: 10*  
- **Drop**: —  

**SAMPLER:**  2" O.D. THIN WALL TUBE

<table>
<thead>
<tr>
<th>Soil Classification</th>
<th>Description</th>
<th>Depth (ft.)</th>
<th>Sample No.</th>
<th>Wet Density (p.c.f.)</th>
<th>Water Content %</th>
<th>Dry Density (p.c.f.)</th>
<th>Unconf. Comp. (p.s.f.)</th>
<th>Penetration Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>ELEV. = 100' ±</em> 2</td>
<td>BROWN CLAY &amp; BOULDERS</td>
<td>6</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>CLAY POCKETS</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>STIFF DARK BROWN CLAY</td>
<td>2'6</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>LIGHT BROWN CLAYY Silt w/ SAND</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>BOTTOM OF PIT @ 120'</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**PENETRATION DATA**  
- **ELEVATION ESTIMATED FROM SURVEY STAKE BY PARK ENGINEERING, INC.**  
- **Driller**: KAIK ETAL. DEV.C0.  
- **Date**: JAN. 11, 1972  
- **Field Party**: METER (W. LUM ASSOC., INC.)  
- **Type of Boring**: OPEN PIT  
- **Diam.**: 18' x 18'  
- **Elev.**: 100' ±*  
- **Datum**: —  
- **Drill Site**: —  
- **Water Level**: NOT NOTICED  
- **Time**: —  
- **Date**: 1-11-72

---
**Boring Log**

**Kalama Valley Subdivision**

**Project:** Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

**Hammer:**
- Weight: 140 lbs
- Drop: 50'

**Sampler:** 2" Standard Split Spoon

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>Description</th>
<th>Depth (ft)</th>
<th>ELEV.</th>
<th>Penetration Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>(MH)</td>
<td>Stiff Tan Clayey Silt (w) Sand &amp; Roots (SOME CEMENTATION)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gray Cinders, Sand &amp; Rock Fragments</td>
<td>6</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dark Gray Cinders</td>
<td>13</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lava Rock</td>
<td>15</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>END OF BORING @ 15.0' E.</td>
<td>30</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

*Elevation estimated from Topo Map by Park Engineering, Inc.*
Boring Log

Kalama Valley Subdivision

Units 2, 3 and 5

Kalama Valley, Maunalua, Oahu

Tax Map Key: 3-9-10, 15 & 18

Hammer:
- Weight: 10 lb Sledge Hammer
- Drop: --

Sampler:
- 2 1/2 O.D. Thin Wall Tube

Location:
- Kalama Valley, Maunalua, Oahu

PROJECT:
- Location:

Driller:
- Name: Kaiser H-Kal Dev. Co.
- Date: Jan. 12, 1972

Field Party:
- Name: Meyer (W. Lum Associates, Inc.)

Type of Boring:
- Type: Open Pit
- Diameter: 18' x 15'

Penetration Data

Standard Penetration Test

<table>
<thead>
<tr>
<th>N (Blows per foot)</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>Blows/0.5'</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Elevation Estimated from Survey Stake by Park Engineering, Inc.
### Boring Log: Kalama Valley Subdivision

**Project:** Units 2, 3 and 5

**Location:** Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

**Hammer:**
- **Weight:** 10# sledge hammer
- **Drop:**

**Sampler:** 2" OD thinwall tube

---

**Penetration Data**

<table>
<thead>
<tr>
<th>Soil Classification</th>
<th>Description</th>
<th>Penetration Test</th>
<th>Standard Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEV. = 85' ± 2'</td>
<td>BROWN CLAY</td>
<td>PENETRATION</td>
<td>N (Blows per foot)</td>
</tr>
<tr>
<td>14</td>
<td>CLAY, POCKET W/BOULDERS</td>
<td>PENETRATION</td>
<td>1200</td>
</tr>
<tr>
<td>17</td>
<td>STIFF, GRAY BROWN, CLAY W/BOULDERS</td>
<td>PENETRATION</td>
<td>47</td>
</tr>
<tr>
<td>19</td>
<td>BROWN W/LIGHT BROWN SANDY SILT W/DECOMPOSED ROCK</td>
<td>PENETRATION</td>
<td>725</td>
</tr>
<tr>
<td>21</td>
<td>BROWN CLAYEY SILT &amp; DECOMPOSED ROCK, BOTTOM OF PIT @ C. 15.0'</td>
<td>PENETRATION</td>
<td>21</td>
</tr>
</tbody>
</table>

---

*Penetration test data and elevations are estimated from survey stakes by Park Engineering, Inc.*

---

**Open Pit:**
- **Diam.:** 20' ± 14' ±
- **Elev.:** 85' ±
- **Datum:**
- **Drill Bit:**
- **Water Level:**
- **Time:**

**Driller:** Kaiser H. KAI Dev. Co.
**Date:** Jan 12, 1972

**Field Party:** Meyer (Walter Lum Associates, Inc.)
**Boring Log**  
**KALAMA VALLEY SUBDIVISION**  

**PROJECT**  
UNIT 2, 3 AND 5  

**LOCATION**  
Kalama Valley, Kaumalua, Oahu  

**Tax Map Key:** 3-9-10, 15 & 18  

**HAMMER:**  
(*information not fully legible*)  

**PROJECT UNITS**  
2, 3 AND 5  

**Driller**  
W. LUM ASSOC., INC.  

**Date**  
JAN 6, 1972  

**Field Party**  
MAESHIRO, RADOVICH  

**Type of Boring**  
ALGER (ACKER)  

**Elev.**  
72' + 2  

**Datum**  
( *information not fully legible*)  

**Drill Bit**  
T.C. DRAG  

**Tax Map Key:** 3-9-10, 15 & 18  

---

**DESCRIPTION**  

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>2'5</td>
<td>40</td>
<td>10</td>
<td>105</td>
<td>31</td>
<td>80</td>
<td>10,880</td>
<td>-</td>
<td>2/5</td>
<td>3/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'9</td>
<td>40A</td>
<td>105</td>
<td>31</td>
<td>80</td>
<td>10,880</td>
<td>-</td>
<td>-</td>
<td>2/5</td>
<td>3/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'5</td>
<td>40B</td>
<td>107</td>
<td>50</td>
<td>79</td>
<td>3470</td>
<td>1600</td>
<td>-</td>
<td>2/5</td>
<td>3/5</td>
<td></td>
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</tr>
<tr>
<td>2'9</td>
<td>40C</td>
<td>110</td>
<td>50</td>
<td>73</td>
<td>430</td>
<td>72000</td>
<td>-</td>
<td>4/5</td>
<td>10/4</td>
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<tr>
<td>2'55</td>
<td>40-D</td>
<td>NO RECOVERY</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>24/1</td>
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* ELEVATION ESTIMATED FROM TOPO MAP BY PARK ENGINEERING, INC.
Boring Log

**KALAMA VALLEY SUBDIVISION**

**PROJECT**
UNIT 2, 3 AND 5

**LOCATION**
Kalama Valley, Maunalua, Oahu

**Tax Map Key**
3-9-10, 15 & 18

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

**SAMPLER:** 2" STANDARD-split spoon

---

### PENETRATION DATA

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>2’55</td>
<td>41-A</td>
<td>-</td>
<td>46</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3’55</td>
<td>41-B</td>
<td>-</td>
<td>52</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>4’55</td>
<td>41-C</td>
<td>-</td>
<td>53</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>5’55</td>
<td>41-D</td>
<td>ROCK FRAGMENTS</td>
<td>30</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
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<tr>
<td>6’55</td>
<td>41-E</td>
<td>NO RECOVERY</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**ELEVATION ESTIMATED FROM TOPO MAP BY PARK ENGINEERING, INC.**

---

**BORING NO.** 41
**Sheet No:**
**Driller:** WALTER LUM ASSOCIATES, INC.
**Field Party:** MAESHIKO, RADOVICH
**Type of Boring:** AUGER
**Diam:** 4"
**Elev:** 72' ±
**Datum:**
**Date:** 1-5-72
Boring Log

KALAMA VALLEY SUBDIVISION

PROJECT

UNITS 2, 3 AND 5

LOCATION

Kalama Valley, Maunalua, Oahu

Tax Map Key: 3-9-10, 15 & 18

HAMMER:

Weight 140 lbs

Drop 70" x 2

SAMPLER:

2" STANDARD SPRUT SPOON

---

Unified Soil Classification: CLAY (ADobe) w/ COBBLES & BOULDERS

DESCRIPTION

ELEV. = 78' + 2

CLAY (ADobe) w/ COBBLES & BOULDERS

STIFF GRAY BROWN CLAY w/ GYPSUM

STIFF BROWN CLAY w/ REDDISH BROWN SANDY SILT SEAMS

STIFF REDDISH BROWN SANDY SILT

LAVA ROCK

END OF BORING @ 22.0'

---

ELEVATION ESTIMATED FROM SURVEY STAKES BY PARK. ENGINEERING INC.
**Boring Log**

**KALAMA VALLEY SUBDIVISION**

**PROJECT** UNITS 2, 3 AND 5

**LOCATION** Kalama Valley, Maunalua, Oahu

Tax Map Key: 3-9-10, 15 & 18

**HAMMER:**
- Weight: **10# SLEDGE HAMMER**
- Drop: __

**SAMPLER:** 2" O.D. THIN WALL TUBE

---

**PENETRATION DATA**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CLAY &amp; BOULDERS</td>
<td></td>
<td>86.5'</td>
<td>0</td>
<td></td>
<td>42-A</td>
<td>100</td>
<td>44</td>
<td>76</td>
<td>42</td>
<td>100</td>
<td>510</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CH) BROWN CLAY W/ GYPSUM</td>
<td></td>
<td></td>
<td>5'</td>
<td></td>
<td>42-B</td>
<td>100</td>
<td>44</td>
<td>76</td>
<td>42</td>
<td>100</td>
<td>510</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CH) BROWN CLAY</td>
<td></td>
<td></td>
<td>10'</td>
<td></td>
<td>42-C</td>
<td>100</td>
<td>44</td>
<td>76</td>
<td>42</td>
<td>100</td>
<td>510</td>
<td>2.0</td>
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</tr>
<tr>
<td>BOULDERS W/BROWN CLAY</td>
<td></td>
<td></td>
<td>15'</td>
<td></td>
<td>42-D</td>
<td>100</td>
<td>44</td>
<td>76</td>
<td>42</td>
<td>100</td>
<td>510</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>BOTTOM OF PIT @ 16.0'</td>
<td></td>
<td></td>
<td>16.0'</td>
<td></td>
<td>42-E</td>
<td>100</td>
<td>44</td>
<td>76</td>
<td>42</td>
<td>100</td>
<td>510</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

*ELEVATION ESTIMATED FROM SURVEY STAKES BY PARK ENGINEERING, INC.*
**Boring Log**

**LOCATION**
Kalama Valley, Maunalua, Oahu

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

**TAX MAP KEY**
3-9-10, 15 & 18

**PENETRATION DATA**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<tr>
<td>2.5</td>
<td>&quot;</td>
<td>43-A</td>
<td>112</td>
<td>37</td>
<td>82</td>
<td>5340</td>
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<td>2.6</td>
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<td>43-B</td>
<td>107</td>
<td>54</td>
<td>69</td>
<td>1860</td>
<td>1050</td>
<td>2/3</td>
<td>4.5</td>
<td></td>
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<tr>
<td>2.7</td>
<td>&quot;</td>
<td>43-C</td>
<td>109</td>
<td>53</td>
<td>11</td>
<td>1220</td>
<td>1350</td>
<td>2/3</td>
<td>4.5</td>
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<tr>
<td>2.8</td>
<td>&quot;</td>
<td>43-D</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DESCRIPTION**
- MEDIUM GRAY CLAY with traces of gypsum crystals
- ROCK END OF BORING @ 15.5'
### Boring Log

**Kalama Valley Subdivision**

**Project:** Units 2, 3 and 5

**Location:** Kalama Valley, Maunalua, Cahu

**Tax Map Key:** 3-9-10, 15 & 18

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

**Sampler:** 2.5" Thin Wall Tube

**Driller:** W. Lum Associates, Inc.
**Date:** Jan. 5, 1972

**Field Party:** Masahiro Radovich

**Type of Boring:** Auger (Picker) Diam. 4"

**Elevation:** 73' 0"

**Drill Bit:** T.C. Drag

**Water Level:** NSRCD

**Date:** 1-5-72

### PENETRATION DATA

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<tr>
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<tr>
<td><strong>CH</strong></td>
<td>Medium Dark Brown Gray Clay w/ Roots</td>
<td>2.95</td>
<td>44-A</td>
<td>10</td>
<td>30</td>
<td>60</td>
<td>35</td>
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<tr>
<td><strong>CH</strong></td>
<td>Medium Light Gray Clay w/ Traces of Gypsum</td>
<td>2.95</td>
<td>44-B</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
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<tr>
<td><strong>CH</strong></td>
<td>Medium Gray Clay</td>
<td>2.95</td>
<td>44-C</td>
<td>51</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>CH</strong></td>
<td>Mottled Brown Decomposed Rock w/ Clayey Sand</td>
<td>2.95</td>
<td>44-D</td>
<td>56</td>
<td>-</td>
<td>-</td>
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<td></td>
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<tr>
<td><strong>CH</strong></td>
<td>End of Boring @ 20.3'</td>
<td>3.05</td>
<td>44-E</td>
<td>44</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
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</table>

**Penetration Test:**
- Blows/ft:
  - 0: 0
  - 10: 0
  - 20: 0
  - 30: 0
  - 40: 0

**Elevation Estimated from Topo Map by Park Engineering Inc.**
# Boring Log

**Kalama Valley Subdivision**

**Units 2, 3 and 5**

**Location:** Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

**Hammer:**
- **Weight:** 10° Sledge Hammer
- **Drop:** -

**Sampler:** 2" O.D. Thin Wall Tube

---

## Penetration Data

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<tr>
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<tbody>
<tr>
<td>CH</td>
<td>Dark Brown Clay w/ Roots</td>
<td>0.0</td>
<td>PIT</td>
<td>45-4</td>
<td>0.0</td>
<td>41.70</td>
<td>3470</td>
<td>1550</td>
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<tr>
<td></td>
<td></td>
<td>2.5</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH</td>
<td>Brown Clay w/ Boulder &amp; Gypsum</td>
<td>10.0</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5</td>
<td>PIT</td>
<td>45-3</td>
<td>-</td>
<td>42.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>6.0</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom of Pit @ 19.0</td>
<td></td>
<td>10.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
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</table>

*Elevation estimated from survey stake by Park Engineering, Inc.
# Boring Log

## Kalama Valley Subdivision

### Project

- **Units:** 2, 3, and 5

### Location

- **Kalama Valley, Maunalua, Oahu**

### Tax Map Key:

- 3-9-10, 15 & 18

### Hammer

- **Weight:** 140 lbs
- **Drop:** 20 ft
- **Type of Boring:** Airger (AC) Diam. 4"

### Field Party

- **Kaku Tsukazaki**

### Driller

- **Kaku Lum Assoc., Inc.**

### Date

- **Jan. 19, 1972**

### PENETRATION DATA

<table>
<thead>
<tr>
<th>ELEV. = 75' ± 2</th>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Water Level</th>
<th>Bore Cont.</th>
<th>Hand Comp.</th>
<th>Pipe Penetration</th>
<th>Standard Penetration Test</th>
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<tbody>
<tr>
<td>1.5'</td>
<td>1.5</td>
<td>46A</td>
<td>105</td>
<td>4</td>
<td>14</td>
<td>630</td>
<td>1130</td>
<td>1'/5', 1'/5'</td>
</tr>
<tr>
<td>2.5'</td>
<td>2.5</td>
<td>46B</td>
<td>106</td>
<td>56</td>
<td>48</td>
<td>1830</td>
<td>2130</td>
<td>1'/3', 1'/3'</td>
</tr>
<tr>
<td>2.5'</td>
<td>2.5</td>
<td>46C</td>
<td>106</td>
<td>56</td>
<td>48</td>
<td>1830</td>
<td>2130</td>
<td>1'/3', 1'/3'</td>
</tr>
<tr>
<td>3.5'</td>
<td>3.5</td>
<td>46D</td>
<td>106</td>
<td>56</td>
<td>48</td>
<td>1830</td>
<td>2130</td>
<td>1'/3', 1'/3'</td>
</tr>
</tbody>
</table>

### Notes

- **Elevation Estimated from Topo Map by Parker Engineering Inc.**
**WALTER LUM ASSOCIATES, INC.**

3030 WAIKAAEA AVENUE • HONOLULU, HAWAII 96816 • PHONE 723-7931

---

**Boring Log**

**KALAMA VALLEY SUBDIVISION**

**PROJECT**

UNITS 2, 3 AND 5

**LOCATION**

Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

**HAMMER:**

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

**SAMPLER:**

- 2"-6" OD THIN WALL TUBE
- 2.65 - 2" STANDARD SPLIT SPOON

---

**Penetration Data**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Classification</th>
<th>Description</th>
<th>Depth (ft.)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Wet Density</th>
<th>P.C.F.</th>
<th>Water Content</th>
<th>P.C.F.</th>
<th>Dry Density</th>
<th>Penetration Test</th>
<th>Standard Penetration Test</th>
<th>BLOWs/ft</th>
<th>2&quot; OD THIN WALL TUBE SAMPLER</th>
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</thead>
<tbody>
<tr>
<td>(CH)</td>
<td>MEDIUM GRAY CLAY</td>
<td>w/ ROOTS</td>
<td>2.5</td>
<td>47-A</td>
<td>103</td>
<td>43</td>
<td>12</td>
<td>2720</td>
<td>1390</td>
<td>1900</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(CH)</td>
<td>MEDIUM TO STIFF GRAY CLAY</td>
<td></td>
<td>2.5</td>
<td>47-B</td>
<td>110</td>
<td>52</td>
<td>12</td>
<td>3050</td>
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<tr>
<td>(CH)</td>
<td>STIFF GRAY CLAY</td>
<td>w/ GYPSUM</td>
<td>2.5</td>
<td>47-C</td>
<td>110</td>
<td>51</td>
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<td>3140</td>
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<tr>
<td></td>
<td>BROWN, CEMENTED SAND</td>
<td>END OF BORING @ 20.5'</td>
<td>2.5</td>
<td>47-D</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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*ELEVATION ESTIMATED FROM TOPO MAP BY PARK ENGINEERING INC.*
## Boring Log

**PROJECT**  
Kalama Valley Subdivision, Units 2, 3 and 5

**LOCATION**  
Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

---

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

**SAMPLER:**
- 2.5' - 2' O.D. Thin Wall Tube
- 2.65' - 2' Standard Split Spoon

---

### PENETRATION DATA

<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>Sample No.</th>
<th>Water Cont. (%)</th>
<th>Water Test P.C.F.</th>
<th>Void Char. P.E.</th>
<th>Penetration Test (Blows per foot)</th>
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<tr>
<td>2.5</td>
<td>48-A</td>
<td>50</td>
<td>0</td>
<td>10</td>
<td>1600 1700</td>
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<tr>
<td>2.5</td>
<td>48-A</td>
<td>50</td>
<td>0</td>
<td>10</td>
<td>1600 1700</td>
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---

**ELEV. > 74' + 2**

- **Medium, Gray, Clay**
- **Medium Gray Clay w/ Traces of Gypsum**
- **Brown Cemented Sand**  
  End of Drilling @ 20.5'  

---

*Elevation Estimated from Topo Map by WALTER LUM ASSOCIATES, INC.*
WALTER LUM ASSOCIATES, INC.

Boring Log

KALAMA VALLEY SUBDIVISION

UNITs 2, 3 AND 5

PROJECT

Kalama Valley, Maunalua, Oahu

LOCATION

Tax Map Key: 3-9-10, 15 & 18

HAMILER:

Weight 140 lbs

Drop 70 ft

SAMPLER:

3'-6" OD THIN WALL TUBE

STANDARD SPIT SPOON

LOCATION

Field Party

Type of Boring

Driller W. LUM ASSOCIATES, INC.

Date JAN. 15, 1972

WALTER LUM ASSOCIATES, INC.

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

BORING NO. 47

Sheet No. of

Driller W. LUM ASSOCIATES, INC.

Date JAN. 15, 1972

Field Party

Type of Boring AUGER (MOPHIS) Diam. 3/4" ELEV. 84' +/- *

Drill Bit T.C. DRAG

WATER LEVEL

Time -

ELEVATION ESTIMATED FROM SURVEY STAKE BY PARK ENGINEERING, INC.
**Boring Log**

**KALAMA VALLEY SUBDIVISION**

**PROJECT**

UNITS 2, 3 AND 5

**LOCATION**

Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

**HAMMER:**

Weight: 12" SLEDGE HAMMER

Drop: —

**SAMPER:** 2" O.D. THIN WALL TUBE

**PROJECT UNITS**

2, 3 AND 5

**OPEN PIT**

Sheet No. __ of __

Driller: KAISER H. KAI DEV. CO.

Date: JAN. 13, 1972

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

Type of Boring:

OPEN PIT

Diam.: 3.5" x 14" ±

Elev.: 89 ±

Datum: —

Drill Bit: —

Water Level: —

Time: —

Date: 1-13-72

---

**PENETRATION DATA**

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>DESCRIPTION</th>
<th>Penetration Test</th>
<th>Water Cont.</th>
<th>Dry Dens.</th>
<th>Unconf. Comp.</th>
<th>Penetration (Blows per foot)</th>
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<tr>
<td><strong>ELEV. = 89 ±</strong></td>
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<tr>
<td>(CH)</td>
<td>BROWN, CLAY</td>
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<tr>
<td>9.0'-5.0'</td>
<td>W/COTTLES, BOULDERS &amp; GYPSUM</td>
<td></td>
<td>37</td>
<td>70</td>
<td>9500</td>
<td>1800</td>
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<tr>
<td>(CH)</td>
<td>GRAY BROWN, CLAY &amp; COBBLES</td>
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<td></td>
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<tr>
<td>2'-5'</td>
<td></td>
<td>44</td>
<td>70</td>
<td>9500</td>
<td>1800</td>
<td></td>
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<tr>
<td>(CH)</td>
<td>GRAY BROWN CLAY</td>
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<td></td>
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<tr>
<td>10</td>
<td>W/COTTLES, BOULDERS &amp; GYPSUM</td>
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<td></td>
<td></td>
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<td>2'-5'</td>
<td></td>
<td>44</td>
<td>70</td>
<td>9500</td>
<td>2000</td>
<td></td>
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<tr>
<td><strong>BOTTOM OF PIT @ 12.0'</strong></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

* ELEVATION ESTIMATED FROM SURVEY STAKE BY PARK ENGINEERING, INC.
### Boring Log

**PROJECT**
Kalama Valley Subdivision

**LOCATION**
Kalama Valley, Maunalua, Oahu

**Tax Map Key:**
3-9-10, 15 & 18

---

**Boring No:** 50

**Sheet No:**

**Sheet of:**

**Date:**
Feb. 8, 1972

**Driller:**
W. Lum ASSOC., INC.

**Field Party:**
Maeshiro Meyer Radovich

**Type of Boring:**
Auger (minuteman, 7"

**Elev.*:**

**Datum:**

**Drill Bit:**
T.C. Drag

**Water Level:**

**Time:**

**Date:**
2-8-72

---

**Hammer:**

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

**Sampler:**
2" O.D. Thin Wall Tube

---

**Penetration Data**

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<tbody>
<tr>
<td>50-A</td>
<td>104</td>
<td>39</td>
<td>16</td>
<td>9740</td>
<td>2000+</td>
<td>3/5' 5/5'</td>
</tr>
<tr>
<td>50-B</td>
<td>108</td>
<td>51</td>
<td>12</td>
<td>4410</td>
<td>1000+</td>
<td>2/5' 2/5'</td>
</tr>
<tr>
<td>50-C</td>
<td>108</td>
<td>49</td>
<td>13</td>
<td>5250</td>
<td>2000+</td>
<td>4/5' 6/5'</td>
</tr>
<tr>
<td>50-D</td>
<td>101</td>
<td>49</td>
<td>10</td>
<td>4050</td>
<td>1800</td>
<td>4/5' 4/5'</td>
</tr>
<tr>
<td>50-E</td>
<td>102</td>
<td>46</td>
<td>10</td>
<td>4220</td>
<td>2520</td>
<td>4/5' 4/5'</td>
</tr>
</tbody>
</table>

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**Unified Soil Classification**

- (CH) Medium to Stiff Gray Clay

---

**Elevation Estimated from topo map by Park Engineering, Inc.**
**Boring Log**

**Kalama Valley Subdivision**

**Units 2, 3 and 5**

**Project:** Kalama Valley, Maunalua, Oahu

**Location:** Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

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

**Sampler:** 2" Standard Split Spoon

**Datum:** 101 ± *

**Penetration Data**

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>Description</th>
<th>Depth (Ft)</th>
<th>Sampler</th>
<th>Water Dist. %</th>
<th>P.C.F.</th>
<th>Water Cont. %</th>
<th>Undist. Comp.</th>
<th>Vane Shear</th>
<th>Penetration Test</th>
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<tbody>
<tr>
<td></td>
<td>Clay W/ Cobbles and Boulders</td>
<td>101 ± 2.0</td>
<td>51-A</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Standard Penetration Test</td>
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<td></td>
<td>Cobbles or Boulder W/ 15 Traces of Brown Clay</td>
<td>102.6</td>
<td>51-B</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>HAMMER BOUNCES</td>
</tr>
</tbody>
</table>

**Note:** Elevation estimated from survey stake by Park Engineering Inc.
### Boring Log

**Project:** Kalama Valley Subdivision, Units 2, 3, and 5  
**Location:** Kalama Valley, Maunalua, Oahu  
**Tax Map Key:** 3-9-10, 15 & 18

**Hammer:**
- Weight: 10 lbs
- Type: Sledge Hammer
- Drop: __

**Sampler:** 2’ OD Thin Wall Type

**Type of Boring:** OPEN PIT
- **Diam.** 13’ x 14’
- **Elev.** 101’ ±
- **Datum** __
- **Date** 1-14-72

**Driller:** KAISER HIKAI DEV. CO.
**Date:** Jan, 14, 1972

**Field Party:** MEYER (W. LUM ASSOC., INC.)

### Standard Penetration Test

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>N (Blows per foot)</th>
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</thead>
<tbody>
<tr>
<td>10</td>
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<tr>
<td>12.0</td>
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**Soil Classification**

- **Elevation:** 101’ ±
- **Brown Clay w/gypsum & Boulders**
- **Gray Brown Clay**
- **Brown Clay w/gypsum & Boulders**

---

*Elevation estimated from survey stake by Park Engineering, Inc.*
**Boring Log**

**Project:** Kalama Valley Subdivision  
**Unit:** Units 2, 3 and 5  
**Location:** Kalama Valley, Maunalua, Oahu  
**Tax Map Key:** 3-9-10, 15 & 18  

**Hammer:**
- Weight: 140 lbs.  
- Drop: 20”

**Sampler:** 2.5” 2” Standard Split Spoon

---

**Penetration Data**

- **Depth:** Depth in feet
- **Sampler:** Type of sampler used
- **Sample No:** Sample number
- **Wet Bulk:** Weight per unit volume
- **Dry Bulk:** Weight per unit volume
- **Water Cont:** Water content
- **Unit Comp:** Unit compressibility
- **Vane Shear:** Vane shear strength
- **Penetration Test:** Standard penetration test
- **COD Thin Wall Tube Sampler:** C.O.D. thin wall tube sampler

---

**Elevation Estimated from Topo Map by Park Engineering Inc.**
**Boring Log**

**KALANA VALLEY SUBDIVISION**

**PROJECT**: Kalama Valley, Maunalua, Oahu

**LOCATION**: Kalama Valley, Maunalua, Oahu

**Tax Map Key**: 3-9-10, 15 & 18

**HAMMER**: 140#

**Weight**: 30"

**Drop**: 30"

**SAMPLER**: 2" O.D. THIN WALL TUBE

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<td>53-C</td>
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<td>16</td>
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*Elevation Estimated from TDPO Map by Park Engineering, Inc.*
**Boring Log**

**KALAMA VALLEY SUBDIVISION**

**PROJECT**
UNITS 2, 3 AND 5

**LOCATION**
Kalama Valley, Maunalua, Oahu

**Tax Map Key:** 3-9-10, 15 & 18

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

**SAMPLER:** 2" STANDARD SPLIT SPOON

---

**Penetration Data**

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<tr>
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<th>Description</th>
<th>Depth (ft)</th>
<th>Sampler No.</th>
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<th>Water Cont. %</th>
<th>Dry Density (P.C.F.)</th>
<th>Penetrometer Test</th>
<th>Standard Penetration Test</th>
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<td>(CH)</td>
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*Elevation estimated from top map by Park Engineering, Inc.*
**Boring Log**  
**KALAMA VALLEY SUBDIVISION**

**PROJECT**  
UNITS 2, 3 AND 5

**LOCATION**  
Kalama Valley, Maunalua, Oahu  
Tax Map Key: 3-9-10, 15 & 18

**HAMMER:**  
Weight: 140 lbs  
Drop: 30'

**SAMPLER:**  
7" 65-7" STANDARD SPLIT SPOON

**BORING NO. 55**  
Driller: W. LUM ASSOC., INC.  
Field Party: MABSHIRO, ASATO  
Type of Boring: "AUGER (MOBILE)" Diameter: 3"

**ELEVATION:** 86' 7" * 0

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<th>Water Cont.</th>
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* ELEVATION ESTIMATED FROM TOPO MAP BY PARK ENGINEERING, INC.

**PENETRATION DATA**

<table>
<thead>
<tr>
<th>N (Blows per foot)</th>
<th>Standard Penetration Test</th>
<th>2&quot; O.D. TUBE SAMPLER</th>
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**END OF BORING @ 22.1'**
**Boring Log**

**PROJECT:** KALAMA VALLEY SUBDIVISION
**UNIT 2, 3 AND 5**

**LOCATION:** Kalama Valley, Maunalua, Oahu
**Tax Map Key:** 3-9-10, 15 & 18

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

**SAMPLER:** 2" STANDARD SPLIT SPOON

---

### PENETRATION DATA

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>Description</th>
<th>Elevation</th>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Wet Density (pcf)</th>
<th>Water Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Unconsolidated Compression (p.s.f)</th>
<th>Penetration Test (Blows per foot)</th>
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<tr>
<td>BROWN CLAY w/ COBBLES &amp; BOULDERS</td>
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<td>BOULDER</td>
<td>END OF BORING @ 17.0'</td>
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* ELEVATION ESTIMATED FROM SURVEY STAKES BY PARK ENGINEERING INC.

---

**BORING NO:** 56
**Sheet No:** of

**Driller:** W. LUM ASSOCIATES, INC.
**Date:** JAN 21, 1972

**Field Party:** MEYER, MAESHIRO, RADOVICH

**Type of Boring:** AUGER (ACER) **Diam.:** 4"**
**Elev.:** 124' + X
**Datum:**

**Drill Bit:** T.E. DRAG

**Water Level:** Not Honced

**Time:**

**Date:** 1-21-72

---

**Standard Penetration Test:**

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**HAMMER BOUNCES**
# Boring Log

**Kalama Valley Subdivision**

**Project:** Units 2, 3 and 5  
**Location:** Kalama Valley, Maunalua, Oahu  
**Tax Map Key:** 3-9-10, 15 & 18

**Hammer:**  
Weight: 10#  
Drop:  
**Sampler:** 2" OD Thin Wall Tube

**Type of Boring:** Open Pit  
**Diam.:** 12" x 14"  
**Datum:** 124 ±  
**Elev.:**  
**Drill Bit:**  
**Water Level:** Noted  
**Time:**  
**Date:** 1-14-72

### PENETRATION DATA

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<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Water Cont. (%)</th>
<th>Dry Dam. P.C.F.</th>
<th>Unconf. Comp. P.C.F.</th>
<th>Penetration Test</th>
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**Elevation Estimated from Survey Stake by Park Engineering, Inc.**
# TABLE I.A - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<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>EXPANSION AND CBR TESTS</th>
<th>MOISTURE-DENSITY RELATIONS OF SOILS</th>
<th>REMARKS:</th>
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<tbody>
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<td>OPEN PIT 32</td>
<td>OPEN PIT 35</td>
<td>OPEN PIT 35</td>
<td>BOTTOM</td>
<td>A</td>
<td>SURFACE</td>
<td>8.4'</td>
<td>12'</td>
<td>1'-2'</td>
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<td>TAN, ORANGE</td>
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<td>BORING NO.</td>
<td>SAMPLE NO.</td>
<td>DEPTH BELOW SURFACE</td>
<td>DESCRIPTION</td>
<td>GRAIN-SIZE ANALYSIS (% Passing)</td>
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<td>12'</td>
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**WALTER LUM ASSOCIATES, INC.**

CIVIL, STRUCTURAL, SOILS ENGINEERS.
### TABLE 1B - SUMMARY OF LABORATORY TEST RESULTS

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<th>DEPTH BELOW SURFACE</th>
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#### GRAIN-SIZE ANALYSIS

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#### ATTERBERG LIMITS

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#### APPARENT SPECIFIC GRAVITY

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<tr>
<th>EXPANSION AND CBR TESTS</th>
<th>OPEN PT 37</th>
<th>OPEN PT 38</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Surcharge-51 P.S.F.)</td>
<td></td>
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</tr>
<tr>
<td>Molding Moisture, %</td>
<td>20.3</td>
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<tr>
<td>Molding Dry Density, P.C.F.</td>
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<td>Swell upon saturation, %</td>
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<td>CBR at 0.1&quot; Penetration</td>
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#### MOISTURE-DENSITY RELATIONS OF SOILS

<table>
<thead>
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<th>MOISTURE-DENSITY RELATIONS OF SOILS</th>
<th>OPEN PT 37</th>
<th>OPEN PT 38</th>
</tr>
</thead>
<tbody>
<tr>
<td>(AASHO T-180-57 Method)</td>
<td></td>
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<tr>
<td>Dry to Wet or Wet to Dry</td>
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<tr>
<td>Max. Dry Density (P.C.F.)</td>
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<tr>
<td>Optimum Moisture (%)</td>
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#### REMARKS:

Date 3-20-72  By CT

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
KALAMA VALLEY SUBDIVISION - UNITS 2.3.5

TABLE I-C - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
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<td></td>
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<td>1'-6' 18'-19.5'</td>
<td>BROWN CLAY W/REDDISH-BROWN BROWN CLAY SANDY SALT</td>
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<td>GRAY CLAY W/TRACES OF GYPSUM</td>
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GRAIN-SIZE ANALYSIS (% Passing)

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ATTERBERG LIMITS

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<thead>
<tr>
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<th>NATURAL</th>
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<tr>
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<td>NONE</td>
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<tr>
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<td>HIGH</td>
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<tr>
<td>Dry Strength</td>
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UNIFIED SOIL CLASSIFICATION

| CH | CH | CH |

APPARENT SPECIFIC GRAVITY

| 2.95 |

EXPANSION AND CBR TESTS

<table>
<thead>
<tr>
<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>
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<tr>
<td>209</td>
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MOISTURE-DENSITY RELATIONS OF SOILS

<table>
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<tr>
<th>(AASHO T-180-57 Method)</th>
<th>D</th>
<th>DRY TO WET</th>
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<tr>
<td>Dry to Wet or Wet to Dry</td>
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<td>Max. Dry Density (P.C.F.)</td>
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<tr>
<td>Optimum Moisture (%)</td>
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REMARKS:

Date: 3-20-77  By: DJ

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

<table>
<thead>
<tr>
<th>BORING NO.</th>
<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>EXPANSION AND CBR TESTS</th>
<th>MOISTURE-DENSITY RELATIONS OF SOILS</th>
<th>REMARKS</th>
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</thead>
<tbody>
<tr>
<td>43</td>
<td>43-A</td>
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<td>GRAY CLAY WITRACES OF GYPSUM CLAY</td>
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<td></td>
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<td>5'-6'</td>
<td>10'-11'</td>
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**BORING NO.**

**SAMPLE NO.**

**DEPTH BELOW SURFACE**

**DESCRIPTION**

**GRAIN-SIZE ANALYSIS (\% Passing)**

- Sieve 1"
- Sieve 1/2"
- Sieve #4
- Sieve #10
- Sieve #20
- Sieve #40
- Sieve #100
- Sieve #200

**ATTERBERG LIMITS**

- Air Dried or Natural
- Liquid Limit
- Plastic Limit
- Plasticity Index
- Dilatancy
- Toughness
- Dry Strength

**UNIFIED SOIL CLASSIFICATION**

**APPARENT SPECIFIC GRAVITY**

**EXPANSION AND 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 3-10-72 By P.T.
<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
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<th>GRAIN-SIZE ANALYSIS (% Passing)</th>
<th>ATTERBERG LIMITS</th>
<th>UNIFIED SOIL CLASSIFICATION</th>
<th>APPARENT SPECIFIC GRAVITY</th>
<th>EXPANSION AND CBR TESTS</th>
<th>MOISTURE-DENSITY RELATIONS OF SOILS</th>
<th>REMARKS:</th>
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<tr>
<td>L (TOP)</td>
<td>C (BOTTOM)</td>
<td>20'-21.5'</td>
<td>BROWN CLAY</td>
<td>WEDMOUTH</td>
<td>Natural</td>
<td>CH</td>
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<tr>
<td>L (TOP)</td>
<td>C (BOTTOM)</td>
<td>20'-21.5'</td>
<td>REDDISH BROWN</td>
<td>WISAND</td>
<td>Natural</td>
<td>MH</td>
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<tr>
<td>L (TOP)</td>
<td>C (BOTTOM)</td>
<td>10'-11'</td>
<td>GRAY CLAY</td>
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**Remarks:**

Date: 3-20-71

By: POT.
### TABLE I: SUMMARY OF LABORATORY TEST RESULTS

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#### ATTERBERG LIMITS
- Air Dried or Natural
- Liquid Limit
- Plastic Limit
- Plasticity Index

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#### UNIFIED SOIL CLASSIFICATION
| CH | CH | MH |

#### APPARENT SPECIFIC GRAVITY
| | | |

#### EXPANSION AND 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 (%)
# TABLE I-G - SUMMARY OF LABORATORY TEST RESULTS

<table>
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<th>BORING NO.</th>
<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>EXPANSION AND CBR TESTS</th>
<th>MOISTURE-DENSITY RELATIONS OF SOILS</th>
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Date 3-20-72  By PT
# TABLE I
## SUMMARY OF LABORATORY TEST RESULTS

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## DESCRIPTION

### GRAIN-SIZE ANALYSIS (% Passing)

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<th>Sieve</th>
<th>1&quot;</th>
<th>1/2&quot;</th>
<th>#4</th>
<th>#10</th>
<th>#20</th>
<th>#40</th>
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<td>% Passing</td>
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### ATTERBERG LIMITS

- Air Dried or Natural
- Liquid Limit
- Plastic Limit
- Plasticity Index
- Dilatancy
- Toughness
- Dry Strength

<table>
<thead>
<tr>
<th>NATURAL</th>
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<td>34</td>
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<td>57</td>
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<td>MED-HIGH</td>
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<tr>
<td>HIGH</td>
<td>MED-HIGH</td>
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## UNIFIED SOIL CLASSIFICATION

| CH | CH |

## APPARENT SPECIFIC GRAVITY

| 2.68 |

## EXPANSION AND CBR TESTS

- (Surcharge-51 P.S.F.)
- Molding Moisture, %
- Molding Dry Density, P.C.F.
- Swell upon saturation, %
- CBR at 0.1" Penetration

| 26.8 | 96.5 | 11.9 | 2.6 |

## 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 (%)

| DRY TO WET | 87.0 | 32.0 |

## REMARKS:

Date: 3.20.72  By: [Sign]
PLASTICITY CHART

PROJECT: KALAMA VALLEY SUBDIVISION - UNITS 2, 3, 5
LOCATION: MAUNALUA, OAHU, HAWAII

![Plasticity Chart Diagram]

NOTE:
O.P. = INDICATES OPEN PIT NOS.

DATE 3.20.72 BY [signature]
PLASTICITY CHART

PROJECT: KALAMA VALLEY SUBDIVISION - UNITS 2, 3, 5
LOCATION: MAUNALUA, OAHU, HAWAII

NOTE:
OP = INDICATES OPEN PIT NO.

DATE 3.20.72  BY  WJ

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

PROJECT: KALAMA VALLEY SUBDIVISION - UNITS 2, 3, 5
LOCATION: MAUNALUA, OAHU, HAWAII

NOTE:
- O.P. INDICATES OPEN PIT NO.

DATE 3-20-72 BY W.T.
GRAIN-SIZE ANALYSIS CURVE

PROJECT: KALAMA VALLEY SUBDIVISION - UNIT 235

LOCATION: KALAMA VALLEY, MAUNALUA, OAHU

GRAIN SIZE IN MILLIMETERS

<table>
<thead>
<tr>
<th>COBBLE</th>
<th>GRAVEL</th>
<th>SAND</th>
<th>SILT OR CLAY</th>
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<td>COARSE</td>
<td>FINE</td>
<td>COARSE</td>
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DATE 2-4-72  BY SK
MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD 2)

PROJECT: KALAMA VALLEY SUBDIVISION - UNITS 2, 3, 5

LOCATION: KALAMA VALLEY, MAUNALUA, OAHU

SAMPLE NO.: 43 SURFACE

SAMPLE DESCRIPTION: GRAY CLAY WITH TRACES OF GYPSUM

AGGREGATE: 3/4" MINUS

MOLD SIZE: 6" X 6" X 6" HIGH

HAMMER: 1000 G, 15" DIA.

LAYERS: 5

BLOWS: 54 LAYER

WEED AIR VOID CURVE

SPECIFIC GRAVITY = 2.95

MAXIMUM DRY DENSITY = 101.9 P.C.F.

OPTIMUM MOISTURE CONTENT = 24.3 P.C.

DATE: 1-17-72

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

PROJECT: KALAMA VALLEY SUBDIVISION
UNITS 2, 3 AND 5

LOCATION: KALAMA VALLEY, MAUNALUA, OAHU

SAMPLE NO.: 50 SURFACE
SAMPLE DESCRIPTION: GRAY CLAY

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4" x 4.5" HIGH
HAMMER: 16 LBS, 18" DROP
LAYERS: 5
BLOWS: 25/LAYER

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD D)

PROJECT: KALAMA VALLEY SUBDIVISION
UNITS 2, 3 AND 5

LOCATION: KALAMA VALLEY, MAUNALUA, OAHU

SAMPLE NO.: 55 SURFACE
SAMPLE DESCRIPTION: GRAY-BROWN CLAY

AGGREGATE: 3/4" MINUS
MOLD SIZE: 6" DIA. X 8" HIGH
HAMMER: 10LBS., 18" DROP
LAYERS: 6
BLOWS: 60/layer

DIEY DENSITY (P.C.F.)

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

WATER CONTENT (%)

DATE 2-16-72 BY SK

MAXIMUM DRY DENSITY = 94.5 P.C.F.
OPTIMUM MOISTURE CONTENT = 1.1%
MOISTURE–DENSITY CURVE (AASHTO T-180-57, METHOD 2)

PROJECT: KALAMA VALLEY SUBDIVISION - UNITS 2, 3, 5
LOCATION: KALAMA VALLEY, MAUNALUA, OAHU
SAMPLE NO.: OPEN PIT 56 SURFACE
SAMPLE DESCRIPTION: GRAY–BROWN CLAY

AGGREGATE: 3/4" MINUS
MOLD SIZE: 10" F 451" HIGH
HAMMER: 10 LBS. 18" DROP
LAYERS: 5
BLOWS: 56 LAYER

WATER CONTENT (%)
0 10 20 30 40 50 60

MAXIMUM DRY DENSITY: 81.0 P.C.F.
OPTIMUM MOISTURE CONTENT = 3.0 %
ZERO AIR VOID CURVE
SPECIFIC GRAVITY: 2.68

DATE 1-31-72  BY SK.
CBR TEST

PROJECT: KALAMA VALLEY SUBDIVISION - UNITS 2, 3, 5

LOCATION: KALAMA VALLEY, MAUNALUA, OAHU

SAMPLE NO: OPEN PIT 3' SURFACE

SAMPLE DESCRIPTION: BROWN CLAY WITH SOME GYPSUM

CBR PENETRATION DATA

<table>
<thead>
<tr>
<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
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<tr>
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</table>

AGGREGATE 3/4" MINS
HAMMER WEIGHT 10 LBS
HAMMER DROP 18"-
No. OF BLOWS 50 LAYER
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %: 25.2
MOLDING DRY DENSITY, P.C.F: 94.1
CBR @ 0.1" PENETRATION: 13
DAYS SOAKED: 5

DATE 1/19/72 BY MO
DATE 1/25/72 BY SK

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

PROJECT: KALAMA VALLEY SUBDIVISION - UNITS 2, 3, & 5

LOCATION: KALAMA VALLEY, MAUNALUA, OAHU

SAMPLE NO: OPEN AT 31 SURFACE

SAMPLE DESCRIPTION: BROWN CLAY W/BOULDERS

CBR PENETRATION DATA

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<th>PENETRATION (INCHES)</th>
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<th>LOAD (PSI)</th>
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<tr>
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AGGREGATE 1/4" MINUS
HAMMER WEIGHT 10 LBS.
HAMMER DROP 15"
No. OF BLOWS 5
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %: 30.3
MOLDING DRY DENSITY, P.C.F.: 94.5
CBR @ 0.1" PENETRATION: 1.0
DAYS SOAKED: 5

DATE 1-19-72 BY BS
DATE 1-25-72 BY CK

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

PROJECT: KALAMA VALLEY SUBDIVISION - UNIT 2, 3, 5

LOCATION: KALAMA VALLEY, MAUNALUA, OAHU

SAMPLE NO: 45 SURFACE

SAMPLE DESCRIPTION: GRAY CLAY W/TRACES OF GYPSUM

TEST RESULTS:

MOLDING MOISTURE, %: 20.9
MOLDING DRY DENSITY, P.C.F.: 102.9
CBR @ 0.1" PENETRATION: 1.6
DAYS SOAKED: 5

DATE 1-12-72 BY BC

DATE 1-18-72 BY SK

AGGREGATE 3/4" MINUS
HAMMER WEIGHT: 110 LBS.
HAMMER DROP: 18"
No. OF BLOWS: 5
No. OF LAYERS: 5

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

PROJECT: KALAMA VALLEY SUBDIVISION - UNITS 2, 3, 5

LOCATION: KALAMA VALLEY, MAUNALUA, OAHU

SAMPLE NO: OPEN PIT 45 SURFACE

SAMPLE DESCRIPTION: DARK BROWN CLAY W/ROOTS

---

CBR PENETRATION DATA

<table>
<thead>
<tr>
<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
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<tr>
<td>0.500</td>
<td>81</td>
<td>19</td>
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</table>

AGGREGATE 3/4" MINUS
HAMMER WEIGHT 10 LBS.
HAMMER DROP 18" WILSON
No. OF BLOWS 50
No. OF LAYERS 5

---

TEST RESULTS:

MOLDING MOISTURE, %: 22.7
MOLDING DRY DENSITY, P.C.F: 101.8
CBR @ 0.1" PENETRATION: 1.2
CBR @ 0.2" PENETRATION: 1.6

DATE 1-21-72 BY M0
DATE 1-20-72 BY M0
CBR TEST

PROJECT:  KALAMA VALLEY SUBDIVISION
            UNITS 2, 3 AND 5
LOCATION:  KALAMA VALLEY, MAUNALUA, OAHU
SAMPLE NO:  55 SURFACE
SAMPLE DESCRIPTION:  GRAY-BROWN CLAY

TEST RESULTS:

MOLDING MOISTURE, %  18.3
MOLDING DRY DENSITY, P.C.F.  950
CBR @ 0.1" PENETRATION  2.1
DAYS SOAKED  10

DATE  2-16-72  BY  MD
DATE  2-23-72  BY  SK

CBR PENETRATION DATA

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<th>LOAD (PSI)</th>
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<tr>
<td>0.050</td>
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<td>75</td>
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</tbody>
</table>

AGGREGATE  3/8" 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:** KALAMA VALLEY SUBDIVISION - UNITS 2, 3, 5

**LOCATION:** KALAMA VALLEY, MAUNALUA, OAHU

**SAMPLE NO:** OPEN PIT 54 SURFACE

**SAMPLE DESCRIPTION:** GRAY-BROWN CLAY

---

**TEST RESULTS:**

- MOLDING MOISTURE, %: 20.0
- MOLDING DRY DENSITY, P.C.F.: 9.05
- CBR @ 0.1" PENETRATION: 2.0
- DAYS SOAKED: 4

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<tr>
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<th>LOAD (PSI)</th>
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<td>34</td>
</tr>
<tr>
<td>0.500</td>
<td>101</td>
<td>34</td>
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</tbody>
</table>

AGGREGATE: 3/4" MINUS
HAMMER WEIGHT: 10 LBS.
HAMMER DROP: 10".
No. OF BLOWS: 50 LAYER.
No. OF LAYERS: 6.

---

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
LOGS OF BORINGS

FROM

"KALAMA VALLEY OFF-SITE IMPROVEMENTS,"

"TWO BRIDGE FOUNDATION SITES"

AND

"KALAMA VALLEY SUBDIVISION UNIT 2-A"
Boring Log

PROJECT  KALAMA VALLEY OFFSITE IMPROVEMENTS
LOCATION  Mauanalua, Oahu, Hawaii

Tax Map Key: 3-9- Por. 10, 15 & 18

HAMMER:
Weight: 140#
Drop: 30"

2" 5-5 2" STANDARD SPLIT SPOON
"AX" - AX DOUBLE TUBE CORE BARREL

ELEVATIONS:
(ML)
STIFF, REDDISH BROWN
CLAYET SILT &
DECOMPOSED ROCK

(CM)
COBBLE OR BOLDER
MEDIUM DENSITY, TAN
SILTY SAND & CORAL

LAVA ROCK (JUKA PIKA RHA)
CLINKERS & CINDERS

END OF BORING @ 16'

*ELEVATION ESTIMATED
FROM QUEEN'S BEACH
DEVELOPMENT TOPO MAP

---

**Table:**

<table>
<thead>
<tr>
<th></th>
<th></th>
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<td>-</td>
<td>-</td>
<td>-</td>
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<td></td>
</tr>
</tbody>
</table>

**Notes:**
- CORED: 5.0', RECOVERY: 2.0'
- CORED: 1.0', RECOVERY: 0.3'
- NOTE: AT 16'; LOSS OF WATER

---
**Boring Log**

**PROJECT:** KALAMA VALLEY OFFSITE IMPROVEMENTS  
**LOCATION:** Maunalua, Oahu, Hawaii  
**Tax Map Key:** 3-9- Por. 10, 15 & 18

**HAMMER:**  
- Weight: 140 lbs  
- Drop: 30"  
- Sampler: 2" 4" 2" O.D. THIN WALL TUBE  
- 2" 3" 2" STANDARD SPLIT SPOON

---

**DESCRIPTION**  
<table>
<thead>
<tr>
<th>ELEV. = 74' 2&quot;</th>
<th>Sampled</th>
<th>Plastic Limit</th>
<th>Liquid Limit</th>
<th>Unconfined Comp.</th>
<th>P.S.F.</th>
<th>Vane Shear</th>
<th>Penetration Test</th>
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<tbody>
<tr>
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<td>2' 3/4&quot;</td>
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<tr>
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<td>-</td>
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<td>2.5' 3/5 4/5</td>
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**SOIL CLASSIFICATION**  
- STIFF BROWN CLAYET SILT W/ FUKA FUKA ROCK, DECOMPOSED ROCK & ROOTS  
- MOTTLED BROWN & BLACK DECOMPOSED ROCK W/ TRACES OF BROWN CLAY  
- LOOSE, MOTTLED BROWN SILT SAND W/ DECOMPOSED ROCK & CLAY POCKETS  
- END OF BORING E 21.5

---

**ELEVATION ESTIMATED FROM QUEEN'S BEACH DEVELOPMENT TOPO MAP**

---

**CORRECTIONS**

---

**WALTER LUM ASSOCIATES, INC.**

---

**ADDR.:** 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

---

**BORING NO. 10**  
**Sheet No.**  
**Date Aug. 2, 1971**  
**Driller W. LUM ASSOC., INC.**  
**Field Party GLORY, TSUKAZAKI**  
**Type of Boring AUGER**  
**Diam. 4"**  
**Datum**

---

**Drill Bit T.C. DRAG**  
**Water Level 8-2-71**

---

**Elev:**

---

**PENETRATION DATA**

---

**N (Blows per foot):**

---

**2' O.D. THIN WALL TUBE SAMPLER**
Boring Log

PROJECT: KALANA VALLEY OFFSITE IMPROVEMENTS

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9- Por. 10, 15 & 18

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

SAMPLER: 2" STANDARD SPLIT SPOON

---

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</tbody>
</table>

**DESCRIPTION**
- LOOSE, CINDERS W/ REDDISH BROWN SANDY SILT
- END OF BORING @ 11.5'

---

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Plastic Limit</th>
<th>Water Cont.</th>
<th>Hand Limit</th>
<th>Unconfined Comp.</th>
<th>P.S.F.</th>
<th>Penetration Test</th>
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**ELEVATION ESTIMATED FROM QUEEN'S BEACH DEVELOPMENT TOPO MAP**
**Boring Log**

**PROJECT:** KALAMA VALLEY OFFSITE IMPROVEMENTS
**LOCATION:** Maualua, Oahu, Hawaii
**Tax Map Key:** 3-9- Por. 10, 15 & 18

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

**SAMPLER:**
- 2" 5/8" O.D. THIN WALL TUBE
- 2" 5/8" 2" STANDARD SPLIT SPOON

**BORING NO. 16**
- **Sheet No.** of
- **Driller:** W. LUM ASSOC. INC.
- **Field Party:** MAEHIRO, MEYER
- **Type of Boring:** AUGER (MOBILE)
- **Diam.:** 4"
- **Elev.:** 72' ±
- **Datum:**
- **Drill Bit:** T.C. DRAG
- **Time:**
- **Date:** 7-28-71
- **Water Level:** NOT NOTICED

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<tr>
<th>Unified Soil Classification</th>
<th>DESCRIPTION</th>
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<th>Depth (Ft.)</th>
<th>Sample</th>
<th>Sample No.</th>
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<th>Liquid Limit</th>
<th>Unconf. Comp.</th>
<th>P.S.F.</th>
<th>Vane Shear Test</th>
<th>Penetration Test</th>
<th>2&quot; O.D. THIN WALL TUBE SAMPLER</th>
</tr>
</thead>
<tbody>
<tr>
<td>(CH)</td>
<td>MEDIUM TO STIFF, PARK BROWN CLAY (ADobe)</td>
<td>2'5&quot;</td>
<td>IG-A</td>
<td>33</td>
<td>9720</td>
<td>3.5 / 4.5</td>
<td>3.5 / 4.5</td>
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</tr>
<tr>
<td>(CH)</td>
<td>MEDIUM TO STIFF, GRAY CLAY W/TRACES OF GYPSUM</td>
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<td>45</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>(CH)</td>
<td>MEDIUM TO STIFF, LIGHT CLAY, CLAY</td>
<td>10'0&quot;</td>
<td>IG-C</td>
<td>51</td>
<td>2800</td>
<td>1900</td>
<td>-</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ROCK OR BOULDER</td>
<td>15'0&quot;</td>
<td>IG-D</td>
<td>NO RECOVERY</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

*ELEVATION ESTIMATED FROM QUEEN'S BEACH DEVELOPMENT TOPS MAP*
**Boring Log**

**PROJECT:** KALAMA VALLEY OFFSITE IMPROVEMENTS

**LOCATION:** Maunalua, Oahu, Hawaii

**Tax Map Key:** 3-9- For. 10, 15 & 18

---

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

**SAMPLER:** 2" D.P. THIN WALL TUBE

---

**UNIFIED SOIL CLASSIFICATION**

**DESCRIPTION**

**ELEV. = 74' 7"**

---

**SOFT TO MEDIUM GRAY, CLAY (ADOBED)**

---

END OF BORING @ 16'

---

**ELEVATION ESTIMATED FROM QUEEN'S BEACH DEVELOPMENT TOPO MAP**

---
**Boring Log**

**PROJECT:** KALAMA VALLEY OFFSITE IMPROVEMENTS

**LOCATION:** Maunalua, Oahu, Hawaii

**Tax Map Key:** 3-9 Por. 10, 15 & 18

**HAMMER:**
- **Weight:** 140 lbs
- **Drop:** 30" - 2" 5/8" O.D. THIN WALL TUBE
- **2" 5/8" STANDARD SPLIT SPOON**

**SAMPLER:**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Plastic Limit</th>
<th>Water Content</th>
<th>Liquid Limit</th>
<th>Undrained Compressibility</th>
<th>Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>18-A</td>
<td>43</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>18-B</td>
<td>50</td>
<td>-</td>
<td>2340</td>
<td>1300</td>
<td>1400</td>
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<tr>
<td>10</td>
<td>18-C</td>
<td>31</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>HYDRAULIC PUSH/1.0'</td>
</tr>
<tr>
<td>15</td>
<td>18-D</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4/5' 5/5'</td>
</tr>
</tbody>
</table>

**Penetration Data**

- Standard Penetration Test
- 2" O.D. THIN WALL TUBE SAMPLER
- N (blows per foot)

**Notes:**
- *Elevation estimated from Queen's Beach Development Topo Map*
Boring Log

PROJECT: KALAMA VALLEY OFFSITE IMPROVEMENTS
LOCATION: Maunalua, Oahu, Hawaii
Tax Map Key: 3-9- Por. 10, 15 & 18

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

SAMPLER:
- 2" 5/8" O.D. THIN WALL TUBE
- 2" 45/64" 2" STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Soil Classification</th>
<th>DESCRIPTION</th>
<th>Depth (Ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Plastic Limit</th>
<th>Water Content</th>
<th>Liquid Limit</th>
<th>Unusual Comp.</th>
<th>Penetration Test</th>
<th>Standard Penetration Test</th>
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<tbody>
<tr>
<td>(CH)</td>
<td>STIFF, DARK BROWN CLAY W/ROOTS &amp; SAND.</td>
<td>2'45&quot;</td>
<td>18A/A</td>
<td>24</td>
<td>23</td>
<td>99</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>(CH)</td>
<td>COTTLES</td>
<td>2'5</td>
<td>18A/B</td>
<td>-</td>
<td>37</td>
<td>8320</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(CH)</td>
<td>STIFF, GRAY CLAY (APPLE) W/ROOTS &amp; GYPSUM</td>
<td>2'5</td>
<td>18A/B</td>
<td>-</td>
<td>37</td>
<td>8320</td>
<td>-</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>(CH)</td>
<td>STIFF, DARK BROWN SILTY CLAY W/GYPSUM &amp; TRACES OF DECOMPOSED ROCK &amp; ROOTS</td>
<td>2'35</td>
<td>18A/C</td>
<td>-</td>
<td>36</td>
<td>-</td>
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<tr>
<td></td>
<td>ROCK OR BOULDER</td>
<td>2'4</td>
<td>18B/5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>END OF BORING &amp; 18'</td>
<td>2'35</td>
<td>18B/3</td>
<td>-</td>
<td>40</td>
<td>RECOVERY</td>
<td>-</td>
<td>-</td>
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</table>

ELEVATION ESTIMATED FROM QUEEN'S BEACH DEVELOPMENT TOPO MAP

PENETRATION DATA

Standard Penetration Test: 2" O.D. THIN WALL TUBE SAMPLER

Date: 9-2-71

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

BORING NO. 18-A
Driller: W. LUM ASSOC. INC. Date: AUG. 4, 1971
Field Party: MAESHIRO, TSUKAZAKI
Type of Boring: AUGER/AUGER
Diam: 4"
# Boring Log

**PROJECT**  
KALAMA VALLEY OFFSITE IMPROVEMENTS

**LOCATION**  
Maunalua, Oahu, Hawaii

**Tax Map Key:** 3-9 Por. 10, 15, 18

**Boring No.:** 5  
**Sheet No. of**  

**PROJECT:**  
WALTER LUM ASSOCIATES, INC.  
3030 WAIKALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

**Driller:**  
H. LUM ASSOC., INC.

**Date:** NOV. 27, 29, & 30, 1971

**Field Party:**  
MADSHIRO, MAKISHI, MATTES

**Type of Boring:**  
DRILLING (AASHTO), Diam. 4", BX & AX

**Elev. per foot:** 69.5'  
**Datum:** T.C. DRAG & DIAMOND CORING

**Date:**  
Nov. 27, 29, & 30, 1971

---

## Penetration Data

<table>
<thead>
<tr>
<th>Depth (ft.)</th>
<th>Sample</th>
<th>Plastic Limit</th>
<th>Water Cont.</th>
<th>Liquid Limit</th>
<th>Unconfined</th>
<th>Vane Shear</th>
<th>Standard Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N (Blows per foot)</td>
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<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>20</td>
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<tr>
<td>30</td>
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<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>40</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

**END OF BORING @ 30'**

---

*ELEVATION ESTIMATED FROM SURVEY STAKE BY PARK ENGINEERING, INC.*
Boring Log

PROJECT: KALAMA VALLEY OFFSITE IMPROVEMENTS

LOCATION: Mauanua, Oahu, Hawaii

Tax Map Key: 3-9-Por. 10, 15 & 18

Type of Boring: PENETRATION (AXE), Diam. A', BX, & AX

Driller: W. LUM ASSOC., INC.
Date: NOV 24, 1971

Field Party: M.M. MATL, I. HADDOCH

ELEV. 47.7' NS
Datum: I.C. DRAG & DIAMOND CORING

Drill Bit: 2" O.D. THIN WALL TUBE PENETRATION

ELEVATION ESTIMATED FROM SURVEY STAKE BY
PARK ENGINEERING, INC.
## Boring Log

**Project:** Kalama Valley Offsite Improvements  
**Location:** Maunalua, Oahu, Hawaii  
**Tax Map Key:** 3-9- Por. 10,15 & 18

### Hammer
- **Weight:** 140 lbs  
- **Drop:** 20 ft  
- **Sampler:** 2.55" - 9" Standard Split Spoon  
- **AXM - AXM Core Barrel**

### Penetration Data

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Plastic Limit</th>
<th>Water Content</th>
<th>Unconfined Compressibility</th>
<th>Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.55</td>
<td>1-A</td>
<td>14</td>
<td>-</td>
<td>-</td>
<td>Cored Recovery</td>
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<tr>
<td>5</td>
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<td>10</td>
<td>AXM</td>
<td>3.0</td>
<td>4.0</td>
<td>3.4</td>
<td>Standard Test</td>
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<tr>
<td>15</td>
<td>AXM</td>
<td>1.0</td>
<td>0.8</td>
<td>0.9</td>
<td>Standard Test</td>
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<td>20</td>
<td>AXM</td>
<td>5.0</td>
<td>2.5</td>
<td>2.5</td>
<td>Cored Recovery</td>
</tr>
<tr>
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<td>AXM</td>
<td>5.0</td>
<td>2.5</td>
<td>2.5</td>
<td>Cored Recovery</td>
</tr>
<tr>
<td>30</td>
<td>AXM</td>
<td>3.0</td>
<td>1.5</td>
<td>1.5</td>
<td>Cored Recovery</td>
</tr>
</tbody>
</table>

### Notes
- **Estimated FG Depth:** APPROX. INVERT (5-13-71)
- **End of Boring @ 28 ft**

*Elevation estimated from survey stake by Park Engineering, Inc.*
# Boring Log

**PROJECT:** KALAMA VALLEY OFFSITE IMPROVEMENTS  
**LOCATION:** Maunalua, Oahu, Hawaii  
**Tax Map Key:** 3-9- Por. 10, 15 & 18

---

## HAMMER:

- **Weight:** 140 lb  
- **Drop:** 20'  
- **Sampler:** 2½" - 2" STANDARD SPLIT SPOON  
  - BX - BX DOUBLE TUBE CORE BARREL

## BRIDGE SITE NO. 1

- **BORING NO. 8**

---

## PENETRATION DATA

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<td>5</td>
<td>10</td>
<td>20</td>
<td>-</td>
<td>30</td>
<td></td>
<td></td>
<td>15/3/2 25/1/2</td>
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</table>

- **DATE:** 11-30-71  
- **ESTIMATED FIG. DEPTH APPROX. INVERT:** 9-13-71

---

**END OF BORING @ 30'**

---

*ELEVATION ESTIMATED FROM SURVEY STAKE BY PARK ENGINEERING, INC.*
Boring Log

PROJECT: KALAMA VALLEY OFFSITE IMPROVEMENTS

LOCATION: Naunalua, Oahu, Hawaii

Tax Map Key: 3-9- Por. 10, 15 & 18

HAMMER:
- Weight: 140 lbs
- Drop: 30°

SAMPLER: 2" DIA. BLUNT POINT

PENETRATION DATA

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Plastic Limit</th>
<th>Water Content</th>
<th>Liquid Limit</th>
<th>Unconfined</th>
<th>Vane Shear</th>
<th>N (Blows per foot)</th>
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<tbody>
<tr>
<td>0</td>
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</table>

ELEV. + 70.8'

MEDIUM, BROWN SILTY CLAY (AD066)

MEDIUM, BROWN SILTY CLAY (AD036)

LAVA ROCK OR PUNA PIUCA ROCK

CLAY POCKET?

LAVA ROCK

END OF BORING E 25'

*ELEVATION ESTIMATED FROM SURVEY STAKE BY PARK ENGINEERING, INC.

CONTINUOUS PENETRATION TEST BY SUZUKI & KUKI, NOV. 20, 1971

APPROX. INVERT 5-15-71

ESTIMATED FIG. DEPTH

WALTER LUM ASSOCIATES, INC.
3030 WAI'ALE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931
**Boring Log**

**PROJECT**
KALUA VALLEY OFFICE IMPROVEMENTS

**LOCATION**
Mountain, Oahu, Hawaii

**PROJ**
3-9, 10, 15 & 18

**HAMMER**
140

**Weight**
5.2

**Drop**
3-9, 10, 15 & 18

**SAMPLE**
5-9, 10 STANDARD SPLIT SHANK

<table>
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<tr>
<th>DESCRIPTION</th>
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| STIFF, DARK BROWN 
TRACER TO ORGANIC MAT. |

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>MEDIUM, GRAY CLAY (ADZING)</td>
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</table>

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
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<td>MEDIUM, BROWN GRAY CLAY</td>
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<table>
<thead>
<tr>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>MEDIUM, BROWN GRAY CLAY &amp; BOULDERS OR ROCK</td>
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<table>
<thead>
<tr>
<th>DESCRIPTION</th>
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<td>MEDIUM, BROWN GRAY CLAY</td>
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<table>
<thead>
<tr>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>END OF BOARING 0 40.1</td>
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**PENETRATION DATA**

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<th>ELEV. (FT)</th>
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<td>71.3</td>
<td>STIFF, DARK BROWN CLAY (ADZING) TRACER TO ORGANIC MAT.</td>
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<td>2</td>
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<td>15</td>
<td>MEDIUM, BROWN GRAY CLAY &amp; BOULDERS OR ROCK</td>
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<td>MEDIUM, BROWN GRAY CLAY</td>
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<tr>
<td>40</td>
<td>END OF BOARING 0 40.1</td>
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**STANDARD PENETRATION TEST**

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<tbody>
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<td>STIFF, DARK BROWN CLAY (ADZING) TRACER TO ORGANIC MAT.</td>
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<td>MEDIUM, GRAY CLAY (ADZING)</td>
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<td>30</td>
<td>MEDIUM, BROWN GRAY CLAY</td>
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<tr>
<td>40</td>
<td>MEDIUM, BROWN GRAY CLAY &amp; BOULDERS OR ROCK</td>
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<td>MEDIUM, BROWN GRAY CLAY</td>
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<tr>
<td>60</td>
<td>END OF BOARING 0 40.1</td>
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</table>

**DIAGRAM**

[Diagram showing boring log results, with elevation and depth measurements marked.]
**Boring Log**

**Bridge Site No. 2**

**Location:** Kalama Valley Offsite Improvements, Kauai, Hawaii

**Hammertime:** 14.07

**Drop:** 80°

**Tax Map Key:** 3-9-10, 10-15, 18

**Sampler:** 4-9, 6-10 standard cast goods

---

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Description</th>
<th>Sample No.</th>
<th>Hammer Bounces</th>
<th>Core Core</th>
<th>Core Core</th>
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<th>Core Core</th>
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<td>150</td>
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<tr>
<td></td>
<td>MEDIUM, GRAY CLAY (ADOPED)</td>
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<td>LAVA ROCK</td>
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<tr>
<td></td>
<td>END OF BORING 50.1'</td>
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**Penetration Data**

<table>
<thead>
<tr>
<th>Test</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>Blow/10&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-A</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>B-C</td>
<td>25</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>B-G</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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*Elevation Estimated From Survey Stakes By Park Engineering, Inc.*
## Boring Log

**PROJECT:** Kalana Valley Offset Improvements

**LOCATION:** Mauna Loa, Oahu, Hawaii

**DATE:** Nov. 22, 1971

**HAMMER:** Weight 140 lbs

**DROP:** 2 ft - 6 in. thin wall tube

**SAMPLER:** 2 in. 3 in. standard split spoon

### PENETRATION DATA

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Standard Penetration Test (N)</th>
<th>Diameter of Thin Wall Tube (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
<td>1/8 in. 4/8 in.</td>
</tr>
<tr>
<td>5.0</td>
<td></td>
<td>4/8 in. 5/8 in.</td>
</tr>
<tr>
<td>15.0</td>
<td></td>
<td>5/8 in.</td>
</tr>
<tr>
<td>30.0</td>
<td></td>
<td>5/8 in.</td>
</tr>
<tr>
<td>40.0</td>
<td></td>
<td>3/8 in.</td>
</tr>
<tr>
<td>40.0</td>
<td></td>
<td>1/2 in.</td>
</tr>
<tr>
<td>40.0</td>
<td></td>
<td>3/16 in.</td>
</tr>
</tbody>
</table>

### DESCRIPTION

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>stiff brown clay</td>
</tr>
<tr>
<td>15.0</td>
<td>medium gray brown clay</td>
</tr>
<tr>
<td>20.0</td>
<td>stiff gray clay</td>
</tr>
<tr>
<td>40.0</td>
<td>lava rock</td>
</tr>
</tbody>
</table>

**ELEVATION:** 71.1 ft.
SECTION
NOT TO SCALE

FIGURE 1
PROPOSED SLOPE TREATMENT
FOR CUTS & FILLS IN CLAY ('CH' SOILS)
GREATER THAN 8' IN HEIGHT

KALAMA VALLEY SUBDIVISION: UNITS 2, 3 & 5
MAUNALUA, HONOLULU, HAWAII

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
Figure 2
Proposed slope along east boundary for cuts in clay ("CH" soils) less than 15' in height.

Kalama Valley Subdivision - Units 2, 3 & 5
Maunalua, Honolulu, Hawaii

Walter Lum Associates, Inc.
Civil, Structural, Soils Engineers
FIGURE 3
PROPOSED SLOPE ALONG DRAINAGE CHANNEL FOR CUTS & FILLS IN CLAY ("CH" SOILS)
KALAMA VALLEY SUBDIVISION· UNITS 2, 3 & 5
MAUNALUA, HONOLULU, HAWAII
NOTE:

THE BASE COURSE SHOULD BE PLACED AND WETTED DOWN FOR 2 DAYS BEFORE POURING SLAB.

SCARIFY AND RECOMPACT SUBGRADE AT ABOVE OPTIMUM WATER CONTENT AND SHAPE TO DRAIN PRIOR TO PLACING BASE COURSE.

COMPACTED SELECT CORAL OR AN EQUIVALENT MATERIAL.
(WELL-GRADED 3/4" TO DUST SIZES 25% OR MORE PASSING NO. 200 SIEVE)

PROPOSED FOOTING FOR SLAB-ON-GROUND ON EXPANSIVE SOIL

NOT TO SCALE

PROPOSED FOOTING FOR POST-AND-BEAM ON EXPANSIVE SOIL

NOT TO SCALE

FIGURE 4

PROPOSED FOOTING DETAILS FOR LIGHT RESIDENTIAL STRUCTURES ON EXPANSIVE SOILS

KALAMA VALLEY SUBDIVISION UNITS 2, 3 & 5
MAUNALUA, HONOLULU, HAWAII

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
FIGURE 5
PROPOSED BOULDER FILL
KALAMA VALLEY SUBDIVISION UNITS 2,3 & 5
MAUNALUA, OAHU, HAWAII
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.