NEWTOWN ESTATES - UNIT III
PRELIMINARY SOIL REPORT

WAIKALU, OAHU, HAWAII
TAX MAP KEY: 9-8-02: POR. 9

To:
COMMUNITY PLANNING, INC.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
JULY 23, 1973

MUNICIPAL REFERENCE & RECORDS CENTER
City & County of Honolulu
City Hall Annex, 599 South King Street
Honolulu, Hawaii 95813
July 23, 1973

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

Dear Mr. Houghtailing:

Subject: Newtown Estates - Unit III
Preliminary Soil Report
(for site grading for residential development)
Waimalu, Oahu, Hawaii
Tax Map Key: 9-8-02: Por. 9

In accordance with your request, soil explorations were made to evaluate general soil conditions at the proposed residential development site for Newtown Estates - Unit III at Waimalu, Oahu, Hawaii.

The surface soils at the site may be generally described as stiff to hard reddish-brown clayey silts and silty clays (MH soils). Decomposed rock and boulders were encountered in several borings.

The proposed light residential structures, in our opinion, may be supported either directly on the stiff existing ground or on compacted fills constructed from the on-site soils.

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

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

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Ezra Koike

CR/EK:ms
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NEWTOWN ESTATES - UNIT III
PRELIMINARY SOIL REPORT

WAIMALU, OAHU, HAWAII
TAX MAP KEY: 9-8-02: POR. 9

SCOPE OF EXPLORATION

The purpose of this exploration was to evaluate general soil conditions for site grading for residential development for the proposed Newtown Estates - Unit III.

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

FIELD EXPLORATION

Twenty-four borings were made at the site. The locations of these borings are shown on the Boring Location Sketch. Descriptions of the underlying soils encountered are shown on the Boring Logs Nos. 1 thru 24. Also attached are logs of borings made for Newtown Estates - Unit II.

Borings were made with 4-in. diameter augers using a finger type bit. Soil samples were recovered with a 2-in. standard split spoon sampler and 2-in. thin-wall tube samplers driven with a 140-lb hammer falling 30 inches.
LABORATORY TESTS

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

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

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

SOIL CLASSIFICATION SYSTEM

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

SOIL DESCRIPTIONS BY OTHERS


Pg. 94, Manana silty clay loam (MoB, MoC, MoD₂)

Pg. 94-95, Manana silty clay (MpB, MpC)

The Manana soils "consists of well-drained soils on uplands on the Island of Oahu" and are classified as "MH" soils according to the "Unified Soil Classification System."
GENERAL SITE CONDITIONS

The proposed residential site is part of the Newtown development at Waialua, Oahu, Hawaii.

The site is located on a ridge about 1-1/2 miles northeast of the intersection of Moanalua Road and Kaahumanu Street.

The existing ground generally slopes down toward the southwest at about 20 to 30% gradients with variations in localized areas. Steeper slopes of about 50 to 60% gradients were noted along the north boundary of the site.

The site was a former sugarcane field. Haul roads and irrigation ditches were noted on the site during the field explorations.

Stockpiles of soils and boulders are located along the south and west portions of the site. One soil stockpile, about 40 ft in height, is used as a borrow source. Soil was being loaded into trucks and hauled away during the field explorations.

Prior to the field explorations, the access road to the Board of Water Supply reservoir site was cut and graded. The road cut varies from little to about 20 ft in height. The slopes were grassed.

Grading for Newtown Estates - Unit II was also in progress.
INTERPRETATION OF SOIL CONDITIONS

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

Stiff to hard clayey silts and silty clays (MH soil) to about 30 ft, the maximum depth drilled.

Decomposed rock and boulders were encountered in several borings.

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

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

DISCUSSION AND RECOMMENDATIONS

In general, the present plan is to clear and grade the site for residential development. Preliminary plans generally indicate cuts from little to about 30 ft in height in the northern portion and fills from little to about 40 ft in height in the southern portion of the site.

Stockpiles of soil and boulders were noted in the south and west portions of the site. Stockpiles should be stripped to stiff natural ground.
Fills from little to about 40 ft in height are proposed in drainageways. Loose or soft soils should be stripped to firm ground before fills are placed in the drainageways. Trenches should be cut in a herringbone pattern along the bottoms and sides of the drainageways. Subdrains should be placed in the trenches to provide drainage paths. Rock blankets with subdrains and/or buttress fills should be considered at the toe of fills. See Figure 1.

Settlement gages should be installed to monitor the performance of fills over the drainageways. After allowing the ground to consolidate for about 3 months, or when settlement gages show negligible settlements, building construction may proceed over the compacted fills over the natural drainageways.

Decomposed rocks or boulders were encountered at about 8 to 14-ft depths in some borings. Because of the shallow depths to decomposed rocks, boulders will probably be found interspersed over the site. The closer an excavation approaches decomposed rocks, the greater will be the quantity of boulders. Boulders may be used to construct fill slopes outside of house lots. See Figure 1.

From the test data, in general, the on-site soils should have sufficient strength to support the proposed fills and light residential structures, provided the site is cleared and grubbed, drained and localized soft spots are removed.
Site Grading

Surface vegetation and miscellaneous debris should be cleared and removed prior to site filling. Localized hard and soft pockets encountered during the site preparations should be excavated and replaced with select soils compacted in thin lifts.

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

In general, the on-site soils may be used for the construction of the proposed fills. Grading work should be done in accordance with F.H.A. Data Sheet 79-C; Revised Ordinances of Honolulu, 1969 As Amended; and as recommended below:

1. The area should be cleared and grubbed.

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

3. Hard surfaces along existing haul roads should be scarified down to stiff soils and recompacted to match the density of the surrounding soil.
4. Where fills are proposed in gullies, drainageways or irrigation ditches, loose material at the bottom and sides should be stripped down to stiff natural ground. Trenches should be cut in a herringbone pattern along the bottom and sides and subdrains placed in the trenches to provide drainage paths before the placement of fills.

5. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level condition. As the fill is brought up, it should continually be keyed into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

6. If boulders are proposed to be used in the construction of fills, they should be generally placed along the toe sections of fill slopes and outside of probable building sites. Before placing the boulders, the subgrade should be stripped to stiff natural ground and shaped to drain. A layer of select material or low grade concrete should be placed on the subgrade and
the boulders placed on the select material or low grade concrete. The void spaces between boulders should be filled with smaller granular material. A blanket of filter material should be placed against the boulders before earth fills are placed against the boulders. See attached sketch, Figure 1.

7. In general, fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the AASHO T-189-57 test method. In roadway areas, the top 2 ft of fill should be compacted to 95% of the maximum density.

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

Slopes
In general, cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

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

To minimize erosion, the runoff from rainstorms should be diverted by berms or ditches away from slopes whenever practicable.
The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

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

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

**Foundations**

If earthwork is carried out as specified, the stiff natural ground and compacted fills should develop adequate bearing values to support the proposed light residential structures.

If the site is graded and compacted, and foundations constructed as recommended, differential settlements should be relatively negligible and within the settlement tolerances of light residential structures.

**General recommendations for foundation design considerations** are as follows:

1. For the proposed light residential structures, conventional house foundations such as slab-on-ground or post-and-beam construction may be used.
2. Bearing values for a given soil usually vary with the size and depth of footings. For light, wood frame structures, bearing values of about 2000 p.s.f. may be used for footings resting on stiff natural ground or on compacted fill.

3. Soft spots or pockets of loose material encountered in footing excavations or below the building area should be excavated and replaced with well-graded granular material such as S4C or other approved material compacted in thin lifts.

4. Concrete slabs on ground should be placed over a base course of 4 in. of well-graded gravel less than 3/4-in. and greater than-a 1/4-in. in size. The subgrade should be compacted and shaped to a level surface or to drain. If practicable, the subgrade generally should be kept slightly higher than the finish grade outside the building.

5. Because of the downhill creep effect of soils on a slope, some settlements may occur near the tops of slopes. Buildings should generally 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 generally not closer than 5 ft from the top of a slope.

6. Construction of retaining walls on slopes should generally be avoided.

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

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

2. Base course - 6-in. base course.
3. Select borrow subbase - 6-in. select borrow.
4. Borrow - 6-in. borrow over a prepared subgrade.

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

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, weep holes should be placed at subgrade levels thru the walls of catch basins which are placed in these low areas.

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

Utility trenches located near the top of slopes should be daylighted or drained.

Unforeseen Conditions
Unforeseen or undetected conditions such as soft spots, seepage water, expansive soil pockets or abandoned utilities and rubble 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
NEWTOWN ESTATES - UNIT III

General Description

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

Clearing, Grubbing and Preparing Areas to be Filled

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

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

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

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

Trenches shall be cut in a herringbone pattern and subdrains placed in the trenches to provide drainage paths for the bottom and sides of gullies, ditches or dips before the placement of fills.

Materials

Fill material shall consist of selected on-site soils or approved borrow soils. The soils shall contain no more than a trace of organic and deleterious matter.
Borrow soils shall be select soils generally less than 6-in. maximum size, with more than 30% fines and a plasticity index generally less than 20.

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

**Placing, Spreading and Compacting Fill Material**

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

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

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

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

After each layer has been placed, mixed and spread evenly, it shall be compacted to 90% of maximum density in accordance with AASHO Test No. T-180-57 or other comparable density tests. For fills in roadway areas, the top 2 ft of fill shall be compacted to 95% of the maximum density. Compaction shall be with sheepsfoot rollers, multiple-wheel pneumatic-tired rollers or other acceptable rollers which shall be able to compact the fill to the
specified density. Rolling shall be accomplished while the fill material is at the specified water content. The rolling of each layer shall be continuous over the area and the roller shall make sufficient passes to obtain the desired density.

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

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

**Boulder Fills**

If boulders are used for the construction of fills, they shall be generally placed along the toe section of slopes. The subgrade shall be stripped to stiff natural ground, shaped to drain and a layer of select material or low grade concrete shall be placed on it. Voids shall be filled with smaller granular soils. A blanket of filter material shall be placed against the boulder fill before construction of fills against it.
Excavation

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

Unforeseen Conditions

If unforeseen or undetected soil conditions such as soft spots, seepage water or expansive soil pockets are encountered, corrective measures shall be made in the field as they are detected.

Rainy Weather

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

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

Symbols

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

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

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limit or sieve analysis test results.
# Boring Log

**PROJECT:** NEWTOWN ESTATES - UNIT III  
**LOCATION:** Waimalu, Oahu, Hawaii  
**Tax Map Key:** 9-8-02: Por. 9

**HAMMER:**  
- Weight: 140#  
- Drop: 30"  
- Type: 2" 6" - 2" OD, THIN WALL TUBE  
- Type: 2" 8" - 2" STANDARD SPLIT SPOON

## PENETRATION DATA

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<th>Elevation</th>
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<th>Time</th>
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<th>Hammer</th>
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<th>T.O.D. Penetration Test</th>
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<td>5/0.5, 4/0.5'</td>
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**END OF BORING @ 21.5' 6-20-73**

**NOTES:**  
- LL = LIQUID LIMIT  
- PL = PLASTIC LIMIT

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 6.1-73* BY COMMUNITY PLANNING, INC.
### Boring Log

**PROJECT**: NEWTOWN ESTATES - UNIT III  
**LOCATION**: Waimalu, Oahu, Hawaii  
**Tax Map Key**: 9-8-02: Por. 9  
**HARD ROCK**:  
- **Value**: 140#  
- **Drop**: 20"  
- **2" 0.025" THIN WALL TUBE**  
- **2.5" 2" STANDARD SPLIT SPOON**  

**ELEVATION**: 44.5" + 0.28"  
**TIME**:  
**DATE**: 6-19-73  

**HAMMER**:  
- **Weight**: 140#  
- **Diameter**: 2.5"  
- **Thin Wall Tube**: 2.5"  
- **Standard Split Spoon**: 2"  

**PENETRATION DATA**

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<th>N (Blows per foot)</th>
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**END OF BORING @ 21.5'**  
6-19-73
WALTER LUM ASSOCIATES, INC.

Boring Log

PROJECT: NEWTOWN ESTATES - UNIT III
LOCATION: Waimalu, Oahu, Hawaii

Tax Map Key: 9-8-02: Por. 9

LOCATION: Waialae Avenue - Honolulu, Hawaii

BORING NO. 3 Sheet No. _ of __
Driller W. LUM ASSOCIATES, INC. Date JUNE 19, 1973
Field Party: MEYER, OSHIRO
Type of Boring: ALGER (MOBILE) Diam. 4"

Elev. 515 + Datum
Drill Bit: FINGER TYPE
Water Level: NOT NOTICED
Time:

Date 6-19-73

HAMMER:
Weight: 140 lb
Drop: 30"

SAMPLER:
2"-3" O.D. THIN WALL TUBE
2".6" R. STANDARD SPLIT SPOON

Boring Log

ELEV. = 515' + 2

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<td>33</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>83</td>
<td>3710</td>
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<td>B-H /2</td>
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<td>-</td>
<td>-</td>
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<td>1'0&quot;</td>
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END OF BORING @ 21.5' 6-19-73

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.
## Boring Log

**PROJECT**: NEWTON ESTATES - UNIT III  
**LOCATION**: Waimalu, Oahu, Hawaii  
**DATE**: JUNE 19, 1973

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<tr>
<td>(MH) HARD, RED BROWN Silty Clay</td>
<td>17 1/2</td>
</tr>
<tr>
<td>(MH) HARD, MOTTLED, GRAY BROWN CLAYY Silt</td>
<td>17 1/2</td>
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**END OF BORING @ 26.5'**

6-19-73

---

*Elevation estimated from Prelim. Grading Plan dated 5-7-73 by Community Planning, Inc.*
Boring Log

PROJECT: NEWTOWN ESTATES - UNIT III
LOCATION: Waimalu, Oahu, Hawaii
Tax Map Key: 9-8-02: Por. 9

HAMMER:
Weight: 140#
Drop: 30'

SAMPLER: 2" STANDARD SPLIT SPOON

---

LOCATION: Waimalu, Oahu, Hawaii

Elevation: 520' *

---

UNIFIED CLASSIFICATION

**ELEV. 520'**

(MH)

HARD, REDDISH BROWN CLAYEY SILT

(MH)

STIFF, MOTTLED BROWN CLAYEY SILT W/ SOME DECOMPOSED ROCK

(MH)

STIFF, MOTTLED RED BROWN CLAYEY SILT

---

END OF BORING @ 16.5'
6-21-73

---

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.*

---

*BORING NO. 5  Sheet No. __ of __*
Driller: W. LUM ASSOC., INC.  Date: JUNE 21, 1973
Field Party: MEYER, OSURO, KAU
Type of Boring: AUGER (8-50') Diam. 4"x
Elev. 520' *  Datum
Drill Bit: FINGER TYPE

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PENETRATION DATA

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*---*
Boring Log

**PROJECT**
NEWTON ESTATES - UNIT III

**LOCATION**
Waimalu, Oahu, Hawaii

**Tax Map Key:** 9-8-02: Por. 9

**Hammemer:**
Weight: 140 lbs
Drop: 50 ft

**Sampler:** 2" STANDARD SPLIT SPOON

**LOCATION**
Waimalu, Oahu, Hawaii

**Field Party:** RADOVICH, KAU, KUTAKA

**Type of Boring:** AUGER (Subscription) Diam: 4"

**Hammer:**
Weight: 140 lbs
Drop: 50 ft

**Date:** 7-17-75

**Hammer Information:**

**Identification:**

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<th>Sampler</th>
<th>Sample No.</th>
<th>Plastic Limit</th>
<th>Viscous Limit</th>
<th>Liquid Limit</th>
<th>Undisturbed Comp.</th>
<th>Penetration Test</th>
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**Penetration Data:**

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

**End of Boring:** 6-41-5

7-18-75
Boring Log

PROJECT: NEWTOWN ESTATES - UNIT III
LOCATION: Waimalu, Oahu, Hawaii

Tax Map Key: 9-8-02: Por. 9

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

SAMPLER: 2" STANDARD SPLIT SPDOON

LOCATION: Wailalu, Oahu, Hawaii

FIELDPARTY: MEYER, OSHIRO

Type of Boring: AUGER (MOULDED) Diam. 4"

Elev.: 445' ±
Datum: (MH)

Drill Bit: FINGER TYPE

Water Level: NOT NOTICED

Date: 6-19-73

PENETRATION DATA

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<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Wet Density</th>
<th>Water Content</th>
<th>Dry Density</th>
<th>Unconfined Comp.</th>
<th>Permanent Set</th>
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<td>10</td>
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<td>27</td>
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</table>

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-1-73 BY COMMUNITY PLANNING, INC.
# Boring Log

**PROJECT** NEWTOWN ESTATES - UNIT III  
**LOCATION** Waimalu, Oahu, Hawaii  
**Tax Map Key:** 9-8-02: Por. 9

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

**SAMPER:** 2" STANDARD SPLIT SPATON

<table>
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<tbody>
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<td>5</td>
<td>B-B</td>
<td>23</td>
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<td>23</td>
<td>35/0.5</td>
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<td>STIFF, MOTTLED LIGHT REDDISH BROWN CLAYEY SILT (DECOMPOSED ROCK)</td>
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<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
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<td>23</td>
<td>58</td>
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<tr>
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<td>HARD, MOTTLED LIGHT BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK</td>
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<td>38</td>
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<td>40/0.5</td>
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**END OF BORING @ 16'  
6-20-73**

**NOTE:**  
- LL = LIQUID LIMIT  
- PL = PLASTIC LIMIT

* ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.
**Boring Log**

**PROJECT**  
NEWTOWN ESTATES - UNIT III  

**LOCATION**  
Waimalu, Oahu, Hawaii  

**Tax Map Key:**  
9-8-02: Por. 9  

**HAMMER:**  
Weight 140#  
Drop 80"  

**SAMPLER:**  
2" STANDARD SPLIT SPoon  

---

**PROJECT**  
NEWTOWN ESTATES - UNIT III  

**LOCATION**  
Waimalu, Oahu, Hawaii  

**Tax Map Key:**  
9-8-02: Por. 9  

**HARD, REDDISH BROWN CLAYEY SILT**  

---

**SOIL CLASSIFICATION**  

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Water Cont. %</th>
<th>Dry Dens.</th>
<th>Unconf. Comp.</th>
<th>Vane Shear</th>
<th>P.S.F.</th>
<th>N (Blows per foot)</th>
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<tbody>
<tr>
<td>0</td>
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<td>PL= 49</td>
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<td>LL=</td>
<td>PL=</td>
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</table>

---

**END OF BORING @ 2.5**
6-16-73

---

**NOTE:**  
LL= LIQUID LIMIT  
PL= PLASTIC LIMIT

---

**ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.**
# Boring Log

**PROJECT**  
NEWTOWN ESTATES - UNIT III

**LOCATION**  
Waimalu, Oahu, Hawaii

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

**Sampler:**  
2" STANDARD SPLIT SPoon

---

**Penetration Data**

<table>
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<tr>
<th>Depth (ft)</th>
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<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
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**Description**

- **Elev. = 510 + 0.5**
- **MH**: Hard, Brown Clayey Silt
- **MH**: Hard, Brown Clayey Silt
- **MH**: Hard, Mottled Gray Clayey Silt with traces of decomposed rock
- **MH**: Hard, Brown Clayey Silt
- **MH**: Stiff, Light Gray Brown Clayey Silt with decomposed rock
- **MH**: Stiff, Mottled Gray Clayey Silt
- **MH**: Hard Mottled Reddish Gray Clayey Silt
- **MH**: Hard, Mottled Lavender Clayey Silt

---

**Note:**
- Elevations estimated from Prelim. Grading Plan dated 5-7-73 by Community Planning, Inc.
# Boring Log

**PROJECT:** NEWTOWN ESTATES - UNIT III  
**LOCATION:** Waimalu, Oahu, Hawaii  
**Tax Map Key:** 9-8-02: Por. 9

**Driller:** W. LUM ASSOC., INC.  
**Date:** JUNE 18, 1973  
**Field Party:** MEYER, OSHIRO

**Type of Boring:** AUGER  
**Hammer:** ELEV.  
**Drop:** 80"  
**Weight:** 140 lbs  
**Sampler:** 2' S. - 2' O.D. THIN WALL TUBE  
**Sampler:** 2' SS - 2' STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
<th>Sample No.</th>
<th>Water Cont.</th>
<th>Unconf. Comp.</th>
<th>Penetration Test</th>
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<tbody>
<tr>
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<td>11-A</td>
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<tr>
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<td>STIFF MOTTLED DARK BROWN CLAYEY SILT</td>
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<tr>
<td>15</td>
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<td>11-C</td>
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<tr>
<td>16</td>
<td>GRAY BROWN DECOMPOSED TUKA ROCK W/SOMewhat Silty, Sand</td>
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<td>9</td>
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| 20        | END OF BORING @ 20'  
0-18-73    | 11-E       | 12           |             |               |                 |

**Penetration Data**  
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*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-1-73 BY COMMUNITY PLANNING, INC.*
### Boring Log

**PROJECT**  
NEWTOWN ESTATES - UNIT III

**LOCATION**  
Waimalu, Oahu, Hawaii

Tax Map Key: 9-8-02: Por. 9

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

**SAMPLER:**  
2" STANDARD SPLIT SPON:

---

**LOCATION**  
Waimalu, Oahu, Hawaii

- Field Party: MEYER, OSHIRO
- Type of Boring: AUGER (CONE)  
  Diam. 4"
- Datum:  
- Elev.: 567'  
- Drift Bit: FINGER TYPE
- Water Level: NOT NOTICED
- Time:  
- Date: 6-18-73

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<table>
<thead>
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<th>Sample</th>
<th>Depth (ft)</th>
<th>Weights</th>
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**ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.**

---

* END OF BORING @ 16.5'  
  6-18-73
**Boring Log**

**PROJECT:** NEWTOWN ESTATES - UNIT III

**LOCATION:** Waimalu, Oahu, Hawaii

**Tax Map Key:** 9-8-02: Por. 9

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

**SAMPLER:** 2" STANDARD SPAT SPOON

**LOCATION:** Waimalu, Oahu, Hawaii

**Date:** 6-15-73

---

### PENETRATION DATA

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<tr>
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<tr>
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<td>58</td>
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**END OF BORING @ 251.5' 6-15-73**

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.*
Boring Log

PROJECT: NEWTOWN ESTATES - UNIT III
LOCATION: Waimalu, Oahu, Hawaii
Tax Map Key: 9-8-02: Por.-9

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

SAMPLER: 2" STANDARD SPLIT SPOON

<table>
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<td>14-B</td>
<td>3.5</td>
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<tr>
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<td>HARD, RED BROWN CLAYEY SILT</td>
<td>14-C</td>
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**END OF BORING 24.5' 6-16-73**

**ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.**
Boring Log

PROJECT: NEWTOWN ESTATES - UNIT III
LOCATION: Waimalu, Oahu, Hawaii

 Tax Map Key: 9-8-02: Por. 9

HAMMER:
- Weight: 160 lb
- Drop: 30" (2' 6" - 2" O.D. THIN WALL TUBE
- SAMPLER: 2' 6" - 2 STANDARD SPLIT SHOVEL

---

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---

ELEV. = 477 ± 2

STIFF, HARD
REDDISH BROWN
Silty Clay

STIFF, MOTT. REDDISH BROWN CLAYETY SILT WARTICES OF
DECOMPOSED ROCK
DECOMPOSED ROCK
BOULDER (?)

END OF BORING @ 14' 6-26-73

**ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.**
**Boring Log**

**PROJECT:** NEWTOWN ESTATES - UNIT III  
**LOCATION:** Waimalu, Oahu, Hawaii  
**Tax Map Key:** 9-8-02: Por. 9  

**HAMMER:**  
- **Weight:** 140 lbs  
- **Drop:** 25' - 2" O.D. THIN WALL TUBE  
- **Sampler:** 2.66" - 2 STANDARD SPLIT SPOON

<table>
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<tr>
<th>ELEV.: 450' + 2'</th>
<th>Description</th>
<th>Sample</th>
<th>Penetration Test</th>
<th>2&quot; O.D. THIN WALL TUBE</th>
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<tbody>
<tr>
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<td>END OF BORING 8.26'</td>
<td>6-18-73</td>
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**Penetration Data**  
- Standard Penetration Test (SPT): N (Blows per foot)  
- 2" O.D. THIN WALL TUBE:
  - 0 Blow/0.5'
  - 1 Blow/0.5'
  - 2 Blow/0.5'
  - 3 Blow/0.5'
  - 4 Blow/0.5'

**Notes:**  
- Elevation estimated from Prelim. Grading Plan dated 5-7-73 by Community Planning, Inc.
Boring Log

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: Waimalu, Oahu, Hawaii

Tax Map Key: 9-8-02: Por. 9

HAMMER:
- Weight: 140 lbs
- Drop: 80"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 17

ELEV. = 572' + 0"

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<td>END OF BORING @ 16.5'</td>
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<td>31</td>
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N (Blows per foot)

0 10 20 30 40

55
52
47

* ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-78 BY COMMUNITY PLANNING, INC.
**Boring Log**

**PROJECT**  
NEWTOWN ESTATES - UNIT III  

**LOCATION**  
Waimalu, Oahu, Hawaii  

**Tax Map Key:** 9-8-02: Por. 9  

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

**SAMPLER:** 2" STANDARD SPLIT SPOON  

**LOCATION**  
Waimalu, Oahu, Hawaii  

**Field Party:** MEYER, OSHIRO, KAU  

**Type of boring:** AUGER (MOULDED)  

**ELEV.** 505'±  

**Drill Bit:** FINGER TYPE  

**Date:** 6-21-73

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<th>Unit Classification</th>
<th>DESCRIPTION</th>
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<th>Sample No.</th>
<th>Wet Density</th>
<th>P.C.</th>
<th>Water Cont.</th>
<th>Dry Density</th>
<th>Percentage</th>
<th>Unconf. Comp.</th>
<th>Vane Shear</th>
<th>P.S.F.</th>
<th>Standard Penetration Test</th>
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<td>N (Blows per foot)</td>
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<tr>
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<td>18-D</td>
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</tr>
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**END OF BORING @ 16.5' 6-21-73**

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.*
**Boring Log**

**PROJECT:** NEWTOWN ESTATES - UNIT III  
**LOCATION:** Waimalu, Oahu, Hawaii  
**Tax Map Key:** 9-8-02: Por. 9

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

**SAMPLER:** 2" STANDARD SPLIT SPOON

---

<table>
<thead>
<tr>
<th>Unified Classification</th>
<th>Description</th>
<th>Depth (Ft.)</th>
<th>Sampler</th>
<th>Water Cont. P.C.F.</th>
<th>Dry Cont. P.C.F.</th>
<th>Unconf. Comp. P.S.F.</th>
<th>Penetration Test</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>(MH)</td>
<td>BOULDER (?)</td>
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<td>END OF BORING &amp; E. E.</td>
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---

*Elevation estimated from Prelim. Grading Plan dated 5-7-73 by Community Planning, Inc.*

---

**BORING NO.: 19**  
**Driller:** W. LUM ASSOC., INC.  
**Date:** JUNE 19, 1973  
**Field Party:** MEYER, OSHIRO  
**Type of Boring:** AUGER  
**Elev:** 40'-2" MSL  
**Drill Bit:** FINGER TYPE

**Water Level:** NOT NOTICED  
**Time:**  
**Date:** 5-18-73
Boring Log

PROJECT: NEWTOWN ESTATES - UNIT III
LOCATION: Waimalu, Oahu, Hawaii
Tax Map Key: 9-8-02: Por. 9

HAMMER:
Weight: 140 lbs
Drop: 30 ft

SAMPLER: 2" STANDARD SPLIT SPOON

<table>
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<tr>
<th>Unit Soil Classification</th>
<th>DESCRIPTION</th>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Wet Density (pcf)</th>
<th>Dry Density (pcf)</th>
<th>Unconf. Comp. (p.s.f.)</th>
<th>Standard Penetration Test (blows per foot)</th>
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</tbody>
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END OF BORING @ 16.5'
6-15-73

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.
**Boring Log**

**PROJECT:** NEWTOWN ESTATES - UNIT III  
**LOCATION:** Waimalu, Oahu, Hawaii  
**Tax Map Key:** 9-8-02: Por. 9

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

**SAMPLER:** 2" STANDARD SPLIT SPOON

---

**DESCRIPTION**  
- **MH**  
  STIFF TO HARD REDDISH BROWN CLAYEY SILT

- **(MH)**  
  STIFF, MOTT. REDDISH BROWN SILTY CLAY

- **(MH)**  
  STIFF, MOTTLED RED & BROWN-GRAY CLAYEY SILT

**END OF BORING @ 16.5'**  
6-16-73

---

**PENETRATION DATA**

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---

**NOTE:**  
- LL = LIQUID LIMIT  
- PL = PLASTIC LIMIT

---

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73, BY COMMUNITY PLANNING, INC.*
## Boring Log

**PROJECT**  
NEWTOWN ESTATES - UNIT III

**LOCATION**  
Waimalu, Oahu, Hawaii

**Tax Map Key:** 9-8-02: Por. 9

**HAMMER:**
- **Weight:** 140 lbs
- **Drop:** 20".

**SAMPLER:** 2" STANDARD SPLIT SPoon

---

### PENETRATION DATA

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<td>22-C</td>
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**ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-1-73 BY COMMUNITY PLANNING, INC.
## Boring Log

**PROJECT** | NEWTOWN ESTATES - UNIT III
---|---
**LOCATION** | Waimalu, Oahu, Hawaii
**Tax Map Key** | 9-8-02: Por. 9

### HAMMER:
- **Weight**: 140 lbs
- **Drop**: 2.5" - 2" O.D. THIN WALL TUBE
- **Sampler**: 2.66" - 2" STANDARD SPLIT SPOON

### PENETRATION DATA

<table>
<thead>
<tr>
<th>depth (ft)</th>
<th>sampler</th>
<th>sample no.</th>
<th>wet density (pcf)</th>
<th>dry density (pcf)</th>
<th>unconf. comp.</th>
<th>p.f.s.</th>
<th>p.s.e.</th>
<th>n blows per foot</th>
<th>standard penetration test</th>
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<td>23A</td>
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<td>79</td>
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<td>-</td>
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<td>3/0.5'</td>
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**END OF BOREING @ 15.7'**

**6/22-73**

---

**ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.**
**Boring Log**

**PROJECT**
NEWTOWN ESTATES - UNIT III

**LOCATION**
Waimalu, Oahu, Hawaii

**Tax Map Key:** 9-8-02: Por. 9

---

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

**SAMPLER:**
- 2.5" - 2" D.D. THIN WALL TUBE
- 2.5" - 2" STANDARD SPLIT SIDON

---

**Location:** Waimalu, Oahu, Hawaii

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

**Elevation:** 575' 2" km

**Water Level:** NOT NOTICED

**Date:** 6-21-73

---

**Penetration Data**

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<tr>
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**End of Boring at 21.5:** 6-21-73

---

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN DATED 5-7-73 BY COMMUNITY PLANNING, INC.*
# TABLE I - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
<th>DESCRIPTION</th>
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<tbody>
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<td></td>
<td></td>
<td>5.0'-6.0'</td>
<td>6.0'-7.0'</td>
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<td></td>
<td></td>
<td>REDDISH-BROWN</td>
<td>CLAYEY SILT</td>
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<td></td>
<td>MOTTLED REDDISH-BROWN</td>
<td>CLAYEY SILT</td>
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<tr>
<th>GRAIN-SIZE ANALYSIS</th>
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<table>
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<tr>
<th>ATTERBERG LIMITS</th>
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<tbody>
<tr>
<td>Air Dried or Natural</td>
<td>61</td>
<td>91</td>
<td>44</td>
<td>64</td>
</tr>
<tr>
<td>Liquid Limit</td>
<td>37</td>
<td>47</td>
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<td>30</td>
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<tr>
<td>Plastic Limit</td>
<td>24</td>
<td>50</td>
<td>14</td>
<td>28</td>
</tr>
</tbody>
</table>

| DILATANCY | MEDIUM - HIGH | MEDIUM | SLOW | MEDIUM |
| Tougness   | MEDIUM | MEDIUM | MEDIUM | MEDIUM |
| Dry Strength | MEDIUM | MEDIUM | SLIGHT-MEDIUM | MEDIUM |

<table>
<thead>
<tr>
<th>UNIFIED SOIL CLASSIFICATION</th>
<th>MH</th>
<th>MH</th>
<th>ML</th>
<th>MH</th>
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<table>
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<th>APPARENT SPECIFIC GRAVITY</th>
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<table>
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<tr>
<th>EXPANSION AND CBR TESTS</th>
<th>Surcharge-51 P.S.F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molding Moisture, %</td>
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<tr>
<td>Molding Dry Density, P.C.F.</td>
<td>83.4</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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<table>
<thead>
<tr>
<th>MOISTURE-DENSITY RELATIONS OF SOILS</th>
<th>(AASHO T-180-57 Method)</th>
</tr>
</thead>
<tbody>
<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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<td>Optimum Moisture (%)</td>
<td>75.8</td>
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**REMARKS:**

Date 7-10-73  By  PST
# Table I.B - Summary of Laboratory Test Results

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<thead>
<tr>
<th>Boring No.</th>
<th>0-1'</th>
<th>10.0'-11.5'</th>
<th>15.0'-16.5'</th>
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<tr>
<td>Sample No.</td>
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</tr>
<tr>
<td>Depth Below Surface</td>
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**Description**

- Reddish Brown Clayey Silt
- Reddish Brown Clayey Silt
- Mottled Brown Clayey Silt
- Reddish Brown Clayey Silt

**Grain-Size Analysis (Passing)**

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

<table>
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<tbody>
<tr>
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</tr>
<tr>
<td>Liquid Limit</td>
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<td>Plastic Limit</td>
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<td>Plasticity Index</td>
<td>15</td>
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<td>52</td>
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<tr>
<td>Dilatancy</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
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<tr>
<td>Toughness</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>Dry Strength</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
</tr>
</tbody>
</table>

**Unified Soil Classification**

- MH
- MH
- MH

**Apparent Specific Gravity**

- 2.89

**Expansion and CBR Tests**

(Surcharge-51 P.S.F.)

<table>
<thead>
<tr>
<th>Molding Moisture, %</th>
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**Moisture-Density Relations of Soils**

(AASHO T-180-57 Method)

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<thead>
<tr>
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<th>Dry to Wet</th>
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<tr>
<td>Max. Dry Density (P.C.F.)</td>
<td>95.0</td>
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<td>Optimum Moisture (%)</td>
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**Remarks:**

- Date: 7-10-75
- By: W.L.
# TABLE I.C - SUMMARY OF LABORATORY TEST RESULTS

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<thead>
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<th>BORING NO.</th>
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<th>22</th>
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</thead>
<tbody>
<tr>
<td>SAMPLE NO.</td>
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</tr>
<tr>
<td>DEPTH BELOW SURFACE</td>
<td>-</td>
<td>-</td>
<td>5.0' - 6.5'</td>
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<tr>
<td>DESCRIPTION</td>
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<td>REDDISH-BROWN</td>
<td>REDDISH-BROWN</td>
<td>REDDISH-BROWN</td>
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<tr>
<td>GRAIN-SIZE ANALYSIS (%) Passing</td>
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<tr>
<td>Sieve</td>
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<td>99.2</td>
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<td>ATTERBERG LIMITS</td>
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<td>Air Dried or Natural</td>
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<td>Dry Strength</td>
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<td>(Surcharge - 5.1 P.S.F.)</td>
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<td>Molding Moisture, %</td>
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<td>Molding Dry Density, P.C.F.</td>
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<tr>
<td>Swell upon saturation, %</td>
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<tr>
<td>CBR at 0.1&quot; Penetration</td>
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<tr>
<td>MOISTURE-DENSITY RELATIONS OF SOILS</td>
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<tr>
<td>(AASHO T-180-57 Method)</td>
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<tr>
<td>Dry to Wet or Wet to Dry Max. Dry Density (P.C.F.)</td>
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<tr>
<td>Optimum Moisture (%)</td>
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REMARKS:

Date: 1-16-73
By: [Signature]
PLASTICITY CHART

PROJECT: NEWTOWN ESTATES - UNIT III
LOCATION: WAIKALU, OAHU, HAWAII

DATE 7-10-73 BY WAT
MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: WAIMALU, OAHU, HAWAII

SAMPLE NO.: B SURFACE

SAMPLE DESCRIPTION: DARK REDDISH-BROWN CLAYEY SILT

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4" x 4.564" HIGH
HAMMER: 10 LBS, 15" DROP
LAYERS: 5
BLOWS: 25/LAYER

MAX. DRY DENSITY: 102.6 P.C.F.

OPTIMUM MOISTURE CONTENT: 25.3%

ZERO AIR VOIDS CURVE
SPECIFIC GRAVITY: 2.02

DATE: 6-25-73

BY: JL
MOISTURE- DENSITY CURVE (AASHO T-180-, METHOD A)

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: WAIMALU, OAHU, HAWAII

SAMPLE NO: 9 SURFACE

SAMPLE DESCRIPTION: REDDISH BROWN, CLAYEY SILT

WATER CONTENT (%)

DENSITY (P.C.F.)

0 10 20 30 40 50 60

0 60 70 80 90 100 110 120 130

MAXIMUM DRY DENSITY - 95.0 P.C.F.

OPTIMUM MOISTURE CONTENT - 2.85 %.

ZERO AIR VOIDS CURVE

SPECIFIC GRAVITY - 2.89

AGGREGATE: \( \frac{3}{4} \)" MINUS
MOLD SIZE: \( 4" \times 4.584" \) HIGH
HAMMER: 10 LBS 18" DROP
LAYERS: 5
BLOWS: 25/LAYER

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

DATE 7.9.13 BY PST
MOISTURE-DENSITY CURVE (AASHO T-180-1, METHOD A)

PROJECT: NEWTOWN ESTATES - UNIT III
LOCATION: WAILALU, EWA, OAHU, HAWAII
SAMPLE NO.: 17 SURFACE
SAMPLE DESCRIPTION: REDDISH-BROWN, CLAYEY SILT

MOISTURE-DENSITY CURVE

ZERO AVOIDS CURVE
SPECIFIC GRAVITY = 2.72

MAXIMUM DRY DENSITY = 91.9 P.C.F.
OPTIMUM MOISTURE CONTENT = 26.3%
MOISTURE-DENSITY CURVE (AASHO T-180-, METHOD A)

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: WAIMALU, OAHU, HAWAII

SAMPLE NO.: 21 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN, CLAYEY SILT

AGGREGATE: 1/4" MINUS

MOLD SIZE: 4" x 4.5 X 4.5" HIGH

HAMMER: 10 LBS, 18" DROP

LAYERS: 5

SAMPLE BLOWS: 25/LAYERS

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

DATE 6-19-73  BY  NL
MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: WAIMALU, OAHU, HAWAII

SAMPLE NO.: 22 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN, CLAYEY SILT

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4" x 4.564 HIGH
HAMMER: 10 LBS 16" DROP
LAYERS: 5

BLOWS: 25/LAYER

DATE: 9-21-73

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

PROJECT: NEWTOWN ESTATES - UNIT III
LOCATION: WAIMALU, OAHU, HAWAII
SAMPLE NO: B - SURFACE
SAMPLE DESCRIPTION: DARK REDDISH-BROWN, CLAYEY SILT

CBR PENETRATION DATA

<table>
<thead>
<tr>
<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
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<tbody>
<tr>
<td>0.025</td>
<td>2.0</td>
<td>10</td>
</tr>
<tr>
<td>0.050</td>
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<td>0.075</td>
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<td>50</td>
</tr>
<tr>
<td>0.125</td>
<td>175</td>
<td>58</td>
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<tr>
<td>0.150</td>
<td>223</td>
<td>74</td>
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<tr>
<td>0.175</td>
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<td>79</td>
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<td>0.300</td>
<td>345</td>
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<tr>
<td>0.350</td>
<td>385</td>
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<tr>
<td>0.400</td>
<td>406</td>
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<td>410</td>
<td>137</td>
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<tr>
<td>0.500</td>
<td>420</td>
<td>140</td>
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</table>

AGGREGATE 3/8" MISHUS
HAMMER WEIGHT 10 LBS
HAMMER DROP 16"
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

TEST RESULTS:
MOLDING MOISTURE, %: 42.9
MOLDING DRY DENSITY, P.C.F: 93.4
CBR @ 0.1" PENETRATION: 64/10 = 6.4
DAYS SOAKED: 4

DATE 6-22-73 BY JU
DATE 6-23-73 BY MI

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

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: WAIALU, OAHU, HAWAII

SAMPLE NO: 9 SURFACE

SAMPLE DESCRIPTION: REDDISH BROWN, CLAYEY SILT

TEST RESULTS:

MOLDING MOISTURE, %.

MOLDING DRY DENSITY, P.C.F.

CBR @ 0.1" PENETRATION

DAYS SOAKED

DATE 6-20-73 BY JU

DATE 6-21-73 BY NL

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

CIVIL, STRUCTURAL, SOILS ENGINEERS
CBR TEST

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: WAIMALU, OAHU, HAWAII

SAMPLE NO: 1B SURFACE
SAMPLE DESCRIPTION: REDDISH-BROWN, CLAYEY SILT

CBR PENETRATION DATA

<table>
<thead>
<tr>
<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025</td>
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<td>120</td>
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<td>87</td>
</tr>
<tr>
<td>0.125</td>
<td>320</td>
<td>110</td>
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<tr>
<td>0.150</td>
<td>390</td>
<td>130</td>
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<tr>
<td>0.175</td>
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<td>0.200</td>
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<td>300</td>
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<td>0.400</td>
<td>960</td>
<td>310</td>
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<td>0.450</td>
<td>920</td>
<td>300</td>
</tr>
<tr>
<td>0.500</td>
<td>1010</td>
<td>320</td>
</tr>
</tbody>
</table>

AGGREGATE \( \frac{1}{4}" \) MINUS
HAMMER WEIGHT 10 LBS
HAMMER DROP 18"""
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %: 93.2
MOLDING DRY DENSITY, P.C.F.: 61.6
CBR @ 0.1" PENETRATION: 8.7
DAYS SOAKED: 4

DATE 6-23-73 BY EM
DATE 6-25-73 BY NI

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

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: WAIMALU, OAHU, HAWAII

SAMPLE NO: 17 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT

TEST RESULTS:

MOLDING MOISTURE, %: 28.5
MOLDING DRY DENSITY, P.C.F.: 91.0
CBR @ 0.1" PENETRATION: 1.2
DAYS SOAKED: 5

DATE 6-20-73 BY MK
DATE 6-25-73 BY DF

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

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: WAIMALU, OAHU, HAWAII

SAMPLE NO: 21 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN, CLAYEY SILT

CBR PENETRATION DATA

<table>
<thead>
<tr>
<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025</td>
<td>42</td>
<td>14</td>
</tr>
<tr>
<td>0.050</td>
<td>101</td>
<td>34</td>
</tr>
<tr>
<td>0.075</td>
<td>164</td>
<td>55</td>
</tr>
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<td>0.100</td>
<td>189</td>
<td>63</td>
</tr>
<tr>
<td>0.125</td>
<td>256</td>
<td>85</td>
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<tr>
<td>0.150</td>
<td>323</td>
<td>106</td>
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<td>0.175</td>
<td>361</td>
<td>117</td>
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<td>213</td>
</tr>
<tr>
<td>0.500</td>
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AGGREGATE \( \frac{1}{4}'' \) MINUS
HAMMER WEIGHT 10 LBS
HAMMER DROP 18''
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %  26.4
MOLDING DRY DENSITY, P.C.F.  99.6
CBR @ 0.1'' PENETRATION  6.7
DAYS SOAKED  4

DATE  6-22-73  BY  JU
DATE  6-23-72  BY  AI
CBR TEST

PROJECT: NEWTOWN ESTATES - UNIT III

LOCATION: WAIMALU, OAHU, HAWAII

SAMPLE NO: 22 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN, CLAYEY SILT

CBR PENETRATION DATA

<table>
<thead>
<tr>
<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
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<td>0.025</td>
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<td>0.075</td>
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<td>0.100</td>
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<td>0.125</td>
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<td>0.150</td>
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<td>0.175</td>
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AGGREGATE 1/4" MINUS
HAMMER WEIGHT 10 LBS.
HAMMER DROP 18"

No. OF BLOWS 5/6/LAYER
No. OF LAYERS 5

ADJUSTED COORDINATES

TEST RESULTS:

MOLDING MOISTURE, %: 30.3
MOLDING DRY DENSITY, P.C.F: 91.0
CBR @ 0.1" PENETRATION: 5.9
DAYS SOAKED: 5

DATE 6-25-73 BY JU CL
DATE 6-26-73 BY JS

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
GENERAL TESTING METHODS

EXPLORATORY BORINGS AND SAMPLING

Method for soil investigation and sampling by auger borings (Tentative)  
ASTM Designation: D 1452-63T

Method for thin wall tube sampling of soils (Tentative)  
ASTM Designation: D 1587-63T

Method for penetration test and split barrel sampling of soils (Tentative)  
ASTM Designation: D 1586-64T

LABORATORY TESTING

Grading Analysis

Sieve analysis of fine and coarse aggregates  
AASHO Designation: T 27-60

Amount of material finer than No. 200 sieve in aggregate  
AASHO Designation: T 11-60

Atterberg Limits

Determining the liquid limit of soils  
AASHO Designation: T 89-60

Modified as follows: Substitute Casagrande grooving tool. Tests conducted from natural moisture content unless noted otherwise.

Determining the plastic limit of soils  
AASHO Designation: T 90-56

Calculating the plasticity index of soils  
AASHO Designation: T 91-54

Specific Gravity

Specific gravity of soils  
AASHO Designation: T 100-60

Modified as follows: 500 ML Pycnometer

Expansion and CBR Tests

Expansion test and California Bearing Ratio (CBR)  
Section VIII - TM 5-530
"Materials Testing" by Headquarters, Dept. of the Army

Compaction Test

Moisture-Density relations of soils using a 10# rammer and an 18" drop  
AASHO Designation: T 180-57

Unified Soil Classification  
Designation E-3 from "Earth Manual" by the United States Department of the Interior Bureau of Reclamation
AUGUST 21, 1972

DATED

"NEWMOW ESTATES UNIT II"

FROM

LOGS OF BORING
**Boring Log**

**PROJECT**  NEWTOWN ESTATES UNIT II

**LOCATION**  Waimalu, Ewa, Oahu, Hawaii

**Tax Map Key:**  9-8-02: 2

**Driller:**  W. LUM ASSOC., INC.  **Date:**  JULY 3, 1972

**Field Party:**  RADDIVICH, SETO, FANG

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

**Elev.**  44\(1\)2 **Datum:**  ---

**Hammer:**  T.C. DRAC

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

**Sampler:**  2' STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Soil Classification</th>
<th>Description</th>
<th>Sample</th>
<th>D.P.F.</th>
<th>Unconf. Comp.</th>
<th>Vers. Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>(MH)</td>
<td>STIFF, REDDISH BROWN CLAYEY SILT W/ROOTS</td>
<td>5-A</td>
<td>22</td>
<td>-</td>
<td>-</td>
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<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED REDDISH BROWN, CLAYEY SILT</td>
<td>5-B</td>
<td>36</td>
<td>-</td>
<td>-</td>
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<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED RED &amp; GRAY CLAYEY SILT W/TRACE OF DECOMPOSED ROCK</td>
<td>5-C</td>
<td>34</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED BROWN CLAYEY SILT W/TRACE OF DECOMPOSED ROCK</td>
<td>5-D</td>
<td>41</td>
<td>-</td>
<td>-</td>
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<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED RED &amp; GRAY CLAYEY SILT</td>
<td>5-E</td>
<td>45</td>
<td>-</td>
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<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED RED &amp; GRAY CLAYEY SILT</td>
<td>5-F</td>
<td>47</td>
<td>-</td>
<td>-</td>
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</table>

**END OF BORING @ 26.5\(1\)**

---

**Notes:**
- **Standard Penetration Test**
- **Elevation Estimated from Topo Map Dated Sept. 22, 1970**
Boring Log

PROJECT: NEWTOWN ESTATES UNIT II
LOCATION: Waimalu, Ewa, Oahu, Hawaii
Tax Map Key: 9-8-02: 2

HAMMER:
Weight: 140#
Drop: 30" 2.5" D. D. THIN WALL TUBE

SAMPLER:
2.5" . T STANDARD SPLIT SPOON

ELEV.: 437± 3

**ELEVATION ESTIMATED FROM TOPO MAP DATED SEPT. 22, 1970**

*SB*
# Boring Log

**PROJECT:** New Town Estates Unit II  
**LOCATION:** Waimalu, Ewa, Oahu, Hawaii  
**Tax Map Key:** 9-8-02: 2

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

**SAMPLER:** 2" STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Unconf. Comp.</th>
<th>Wet Cone Penetration Test</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>10-A</td>
<td>-</td>
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<td>5</td>
<td>10-B</td>
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<td>10</td>
<td>10-C</td>
<td>-</td>
<td>28</td>
</tr>
<tr>
<td>15</td>
<td>10-D</td>
<td>-</td>
<td>48</td>
</tr>
</tbody>
</table>

**END OF BORING @ 16.5'**

---

*ELEVATION ESTIMATED FROM TOP MAP DATED SEPT. 22, 1972*
# Boring Log

**PROJECT**
NEWTOWN ESTATES UNIT II

**LOCATION**
Waimalu, Ewa, Oahu, Hawaii

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

**Sampler:**
- 2" STANDARD SPLIT SPOON

---

**Penetration Data**

<table>
<thead>
<tr>
<th>Soil Classification</th>
<th>Description</th>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Wet Density</th>
<th>Water Content</th>
<th>Unconfined Comp.</th>
<th>Penetration Test</th>
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</thead>
<tbody>
<tr>
<td>MH</td>
<td>STIFF, DARK REDDISH BROWN SILTY CLAY w/ROOTS</td>
<td>10</td>
<td>B-A</td>
<td>13-B</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>MH</td>
<td>STIFF, REDDISH BROWN CLAYEY SILT</td>
<td></td>
<td>B-B</td>
<td>13-B</td>
<td>32</td>
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<td>-</td>
<td></td>
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<tr>
<td>MH</td>
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<td>15</td>
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<td>13-C</td>
<td>34</td>
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<tr>
<td>MH</td>
<td>STIFF, MOTTLED GRAY &amp; RED SILTY CLAY</td>
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<td>B-D</td>
<td>13-D</td>
<td>-</td>
<td>LL 105</td>
<td>FL 43</td>
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<tr>
<td>MH</td>
<td>STIFF, MOTTLED GRAY CLAYEY SILT W/TRACE OF DECOMPOSED ROCK</td>
<td>20</td>
<td>B-E</td>
<td>13-E</td>
<td>42</td>
<td>-</td>
<td>-</td>
<td></td>
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</table>

**End of Boring @ 21.5'**

---

**Notes:**
- Elevation estimated from topographic map dated Sept. 22, 1970
### Boring Log

**Boring No.** 15  
**Sheet No.** 1 of 1

**Driller:** W. W. LUM ASSOC., INC.  
**Date:** JUNE 30, 1972

**Field Party:** KAKU, RADOVICH, PANG

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

**Elev.:** 375' + *  
**Datum:** __________

**Drill Bit:** FINGER TYPE

**Weight:** 140#  
**Drop:** 30'

**LOCATION:** Waimalu, Ewa, Oahu, Hawaii  
**Tax Map Key:** 9-8-02: 2

---

### PENETRATION DATA

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</tr>
</thead>
<tbody>
<tr>
<td>(MH)</td>
<td>MEDIUM, MOTTLED BROWN CLAYEY SILT &amp; TRACES OF DECOMPOSED ROCK &amp; ROOTS</td>
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<td>15-C</td>
<td>115</td>
<td>69</td>
<td>63</td>
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</tr>
<tr>
<td></td>
<td>END OF BORING @ 16.5'</td>
<td></td>
<td></td>
<td>15-D</td>
<td>47</td>
<td></td>
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</table>

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

<table>
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<th>N (Blows per foot)</th>
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<th>20</th>
<th>30</th>
<th>40</th>
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<tr>
<td>3</td>
<td>9%</td>
<td>0.5'</td>
<td>0.5'</td>
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<tr>
<td>4</td>
<td>4%</td>
<td>0.5'</td>
<td>0.5'</td>
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---

**Elevation Estimated from Topo Map, Dated Sept. 22, 1970**
**Boring Log**

**PROJECT**

NEWTOWN ESTATES UNIT II

**LOCATION**

Waialu, Ewa, Oahu, Hawaii

Tax Map Key: 9-8-02: 2

**HAMMER:**

Weight: 140#

Drop: 30"

**SAMPLER:**

2" STANDARD SPLIT SPOON

---

**Boring Log Details**

- **ELEV. = 437'**

<table>
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</tr>
<tr>
<td>MH</td>
<td>STIFF, MOTTLED BROWN &amp; GRAY, SILTY CLAY w/ DECOMPOSED ROCK</td>
</tr>
<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED BROWN w/ traces of gray clayey silt</td>
</tr>
<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED DARK GRAY &amp; RED CLAYEY SILT w/ traces of decomposed rock</td>
</tr>
<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED GRAY CLAYEY SILT w/ traces of decomposed rock</td>
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<tr>
<td></td>
<td>ROCK OR BOULDER</td>
</tr>
<tr>
<td></td>
<td>END OF BORING @ 25.3'</td>
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**Penetration Data**

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<th>Water Cont.</th>
<th>Dr. Cont.</th>
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<td>17-B</td>
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<td>17-C</td>
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<tr>
<td>17-E</td>
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<td>17-F</td>
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**Notes:**

- **ELEVATION ESTIMATED FROM TOPO MAP DATED SEPT. 22, 1970**

---

**Driller:** W. Lum & Assoc., Inc.

**Date:** July 5, 1972

**Field Party:** Kaihu, Radovich, Fang

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

**PROJECT**  NEWMON ESTATES UNIT II

**LOCATION**  Waimalu, Ewa, Oahu, Hawaii

Tax Map Key:  9-8-02: 2

**HAMMER:**

- Weight: 140 ft
- Drop: 20'

**SAMPLER:**  2' STANDARD SPLIT SPOON

---

**DESCRIPTION**

- **ELEV. = 421.5'**
- **STIFF, REDDISH BROWN CLAYEY SILT W/TRACE OF DECOMPOSED ROCK & ROOTS**

- **MH**
  - **STIFF, MOTTLED BROWN SILTY CLAY**
  - **STIFF, MOTTLED REDDISH BROWN & GRAY CLAY**
  - **STIFF, MOTTLED DARK GRAY & RED SILTY CLAY W/DECOMPOSED ROCK**

- **MH**
  - **STIFF, MOTTLED GRAY-BROWN CLAYEY SILT W/DECOMPOSED ROCK**

**END OF BORING @ 21.5'**

---

**PENETRATION DATA**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<td>1B-E</td>
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<td></td>
<td></td>
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**ELEVATION ESTIMATED FROM TOTAL STATION**

DATED SEPT. 22, 1970
**WALTER LUM ASSOCIATES, INC.**

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7921

**Boring Log**

**PROJECT:** NEWTOWN ESTATES UNIT II  
**LOCATION:** Waimalu, Ewa, Oahu, Hawaii  
**Tax Map Key:** 9-8-02-2  
**Driller:** W. LUM ASSOC., INC.  
**Date:** JULY 7, 1972  
**Field Party:** SUZUKI, RADOVICH  
**Type of Boring:** ANGER (\textit{rotary})  
**Diam.:** 4"  
**Weight:** 140#  
**Drop:** 30"  
**Sampler:** 2" STANDARD SPLIT SPON

<table>
<thead>
<tr>
<th>Unified Classification</th>
<th>DESCRIPTION</th>
<th>Depth (ft.)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Wet Dens. (lb./cu. ft.)</th>
<th>Dry Dens. (lb./cu. ft.)</th>
<th>Unconf. Comp.</th>
<th>P.S.I.</th>
<th>N (Blows per foot)</th>
<th>PENETRATION DATA</th>
<th>STANDARD PENETRATION TEST</th>
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<tr>
<td>(MH)</td>
<td>STIFF, REDDISH BROWN CLAYEY SILT W/ROOTS</td>
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<td>21-A</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED GRAY BROWN &amp; CLAYEY SILT W/DECOMPOSED ROCK</td>
<td>15</td>
<td>21-B</td>
<td>28</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
<td>GRAY, DECOMPOSED ROCK &amp; ROCK</td>
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<td>21-C</td>
<td>24</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
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<tr>
<td></td>
<td>END OF BORING &amp; 15.7'</td>
<td>15</td>
<td>21-D</td>
<td>23</td>
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*ELEVATION ESTIMATED FROM TOP MAP, DATED SEPT. 22, 1970*
SECTION
NOT TO SCALE

FIGURE 1
PROPOSED BOULDER FILL
NEWTOWN ESTATES - UNIT III
WAIMAKU, OAHU, HAWAII
TMK: 9-8-02: 1OR. 9

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

JULY, 1973
LIMITATIONS

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

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

If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes, plan changes, or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the recommendations considering the time lapse and the changed conditions.

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