NEWTOWN ESTATES - UNIT II
SCHOOL SITE SUBDIVISION
PRELIMINARY SOIL REPORT

WAIMALU, EWA, OAHU, HAWAII
TAX MAP KEY: 9-8-57: 28

To:
COMMUNITY PLANNING, INC.

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

NOVEMBER 11, 1975
November 11, 1975

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

Dear Mr. Houghtailing:

Subject: Newtown Estates - Unit II  
School Site Subdivision  
Preliminary Soil Report  
(for site grading design for single-family  
residential subdivision)  
Waimalu, Ewa, Oahu, Hawaii  
Tax Map Key: 9-8-57: 28

Transmitted herewith is our preliminary soil report for general site grading design for single-family residential subdivision for the proposed Newtown Estates - Unit II, School Site Subdivision at Waimalu, Ewa, Oahu, Hawaii.

This report includes a Boring Location Sketch, boring logs, laboratory test results, general site grading design guidelines and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By [Signature]  
Ezra Koike

CR/EK:v1
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SCOPE OF EXPLORATION

The purpose of this exploration was to evaluate general soil conditions for general site grading design for single-family residential subdivision for the proposed Newtown Estates - Unit II, School Site Subdivision at Waimalu, Ewa, Oahu, Hawaii.

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

FIELD EXPLORATION

Three exploratory borings and one probing were made at the site. The approximate locations of these borings and probing are shown on the Boring Location Sketch.

Borings were made with 4-in. diameter augers using drag type bits. Soil samples were recovered with 3-in. thin-wall tube samplers and a 2-in. standard split spoon sampler driven with a 140-lb hammer falling 30 inches.

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

Also attached are logs of borings previously made for "Newtown Estates - Unit II," August 21, 1972.
LABORATORY TESTS

Laboratory tests included: natural water content and density, unconfined compression, Atterberg limit, specific gravity, ASTM D-1557-70 density and CBR.

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

SOIL DESCRIPTIONS BY OTHERS

From a review of the U. S. Soil Conservation Service maps of the area, the soils are generally described by others as follows:


LaB - Lahaina silty clay, 3 to 7% slopes,
Erosion hazard - moderate to severe
Unified Soil Classification - CL-ML

SOIL CLASSIFICATION SYSTEM

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

GENERAL SITE CONDITIONS

The proposed site is located along the northwest corner of Piki and Kupukupu Streets, Newtown Estates in Waimalu, Ewa, Oahu, Hawaii.
Portions of this site were rough graded during the mass grading work for the bordering Newtown Estates - Unit II. Slopes of about 2 horizontal to 1 vertical and varying in heights from little to about 20 ft were excavated for the perimeter roads and lots surrounding the site.

The northern portion of the site was being used as a contractor's storage yard. An existing silting basin was noted near the southeast corner of the site.

The southern portion is covered with tall grass, brush and some trees.

The site generally slopes down toward the southwest with gradients varying from about 10 to 20% with localized variations.

INTERPRETATION OF SOIL CONDITIONS

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

Stiff, reddish-brown clayey silts and silty clays (MH soils) with decomposed rock from the surface to about 15 to 25 ft, the depths drilled.

Layers of clay (CH soils) were noted from about 6 to 19-ft depths in Boring No. 3.

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

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

DISCUSSION AND RECOMMENDATIONS

In general, the present plan is to clear and grade the site for single-family residential subdivision lots. Preliminary plans indicate that cuts and fills generally less than about 10 ft are contemplated for the site grading.

Because a portion of the site is being used as a contractor's storage yard, remnants of old structures, abandoned utility lines, miscellaneous fills, etc., may be encountered during the grading work and may require field adjustments for removal or backfilling.

Loose soils located within the area of the existing silting basin should be removed down to stiff natural ground prior to placing of fills.

 Foundations

Preliminary grading plans indicated that some house lots are located partly on fill and partly on cut. Some differential settlements may occur where a structure is placed partly on compacted fill and partly on cut areas. To lessen differential settlements, the construction of houses in these areas should be delayed as long as practicable.
The soils at the site may vary from slightly expansive to moderately expansive. The red soils with natural water contents that are close to the plastic limit, in general, may be slightly expansive. The gray soils (CH clays), in general, may be expansive.

The occurrence of clayey soil pockets on the site may be spotty, but a large deposit is suspected around Boring No. 3.

After site grading, the exposed soils should be visually classified for expansive properties to aid the designer of the foundation system.

In general, light, 1 and 2-story masonry and wood-frame residential structures are planned.

Where the soils are slightly expansive, (mostly reddish-brown soils), slab-on-ground construction may be considered on lots that are fairly level and the house will be 15 ft or more from the tops of slopes.

To lessen the expansive effects of the soils, the surface soils should be scarified to a depth of 12 in., moistened to the wet side of optimum and recompacted with light equipment prior to pouring of the slab-on-ground.

Where the surface soils are moderately expansive or expansive, post-and-beam construction may be preferred.
Footing foundations should extend about 2 ft below finish grade. The superstructure should be flexible.

If slab-on-ground construction is contemplated in the moderately expansive soils, the top 2 to 3 ft of surface soils should be removed and replaced with non-expansive soils.

To minimize the wavy surface effects at the ground floor level due to differential settlements or heaving, partitions, doors, cabinets, etc., should be flexible, designed with loose fits and other precautions taken to allow for some future adjustments or maintenance.

To reduce the effects of slope creep, buildings should generally be set back a distance of about 15 ft from the tops of slopes.

Other general guidelines for foundation design are as follows:

1. In fill areas where slab on ground is considered over non-expansive soils, house construction should be delayed as long as practicable to allow the subsoils to settle and adjust to the new loads.
2. Bearing values for a given soil usually vary with the size and depths of footings. For light residential structures, bearing values of about 2000 p.s.f. may be used for footings 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.

4. Concrete slabs on ground should be placed over a base course of 4 in. of well-graded gravel less than 3/4-in. in size or some other form of capillary break should be provided. The subgrade should be compacted and shaped to a level surface or to drain, if practicable, and generally should be kept slightly higher than the finish grade.

5. Superstructures with slip joints should be considered for post and beam structures as well as for slabs on ground to accommodate some up and down movements of the ground surface resulting from environmental or weather changes.
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.

Site Grading

Some decomposed rocks were encountered at about 5 to 20-ft depths in some borings. Some boulders may 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 fills at the toes of slopes and away from building locations.

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

1. The area should be cleared and grubbed.

   Vegetation, rubbish and miscellaneous debris should be cleared and removed from the site prior to grading operations.

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

3. Localized hard and soft pockets encountered during the site preparations should be excavated and replaced with select soils compacted in thin lifts.

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

5. The bottoms and sides of the existing silting basin should be stripped to stiff natural ground before the placement of fills.

6. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level condition. As the fill is brought up, it should continually be keyed into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.
7. If boulders are proposed to be used in the construction of fills, they should be generally placed along the toe sections of fill slopes and as much as practicable 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.

8. In general, fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the ASTM D-1557-70 test method. In roadway and parking areas, the top 2 ft of fill should be compacted to about 95% of the maximum density.

9. 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.

To lessen erosion, the runoff from rainstorms should be diverted by berms or ditches away from slopes whenever practicable. Slope planting is recommended on cut and fill slopes.

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

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

Rock Wall

A rock wall about 5 ft high is proposed along the low side of proposed Lot No. 30.

Fairly well-graded granular material should be used for backfilling behind the wall. Subdrains should be placed behind the walls below the foundation level and daylighted to drain.

For lateral earth pressures, assuming select well-drained backfill, the following equivalent fluid pressure may be used:

- 45 p.c.f. for retaining walls unrestrained at the top.
- 60 p.c.f. for retaining walls restrained at the top.
In addition, lateral earth pressures should be added for anticipated vehicular and building loads. The center of pressure should be considered to act somewhat above the lower third of the triangular fluid pressure diagram, assuming that subdrainage and drainage of the backfill are provided.

Bearing values of about 3000 p.s.f. may be used for wall foundations resting on stiff natural ground or on rocky material.

Roadways

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. Subbase course - 6-in. subbase course over a prepared subgrade.

Provisions should be made in the contract documents to allow for local adjustments regarding select borrow subbase and borrow requirements. Additional laboratory testing may be considered after the site grading in the pavement areas is near the finish pavement subgrade. 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, weep holes should be placed at subgrade levels thru the walls of the catch basins.

**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 should be daylighted to drain wherever practicable, particularly where the soils may be expansive.

**Unforeseen Conditions**

Because of the variability of soil deposits, site improvements, designs and construction techniques, existing or changed conditions may be encountered that cannot be foreseen with even the most exhaustive studies of site and project conditions. These unforeseen conditions should be recognized when encountered and then evaluated so that the designs or the construction methods may be modified accordingly, if necessary.

Unforeseen or changed or undetected conditions such as soft spots, existing utility trenches, underground structures, pipes, voids or cavities, boulders, expansive soil pockets, seepage water or water level changes with weather, etc., may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.
Site Regrading

After mass grading work is done and cuts and fills are made according to the grading plans, regrading at some future date should be avoided unless done under the guidance of a soils engineer.
PROPOSED SPECIFICATION FOR EARTHWORK

NEWTOWN ESTATES - UNIT II
SCHOOL SITE SUBDIVISION

I. GENERAL GRADING REQUIREMENTS

Grading work shall conform to Chapter 23 of Revised Ordinances of Honolulu, 1969, as amended.

II. SPECIFICATIONS FOR ON-SITE EARTHWORK

A. Scope of Work

The work to be performed under these specifications includes the furnishing of labor, materials, tools, and equipment for the earthwork at Newtown Estates - Unit II, School Site Subdivision. The work includes the preparation of the site, the excavation of materials, and the placement of fill materials in accordance with the specifications and applicable plans, together with guidelines included in the preliminary soil report for this project.

B. Soils Engineer

The services of a soil testing firm shall be used. A soil technician shall be present at the site on an intermittent basis to observe grading progress and to take density tests.

A reasonable time shall be allotted to perform field and laboratory tests prior to the placement of additional fill.

The density test results will be transmitted to the Contractor and to Community Planning, Inc. Where low density test results are noted, the area shall be reroled by the Contractor and retested by the Soils Engineer if, in his opinion, a test is necessary.

If the field observations and test results, in the opinion of the Soils Engineer, indicate that the earthwork is not in general conformance to the intent of the plans and soil report, the discrepancy will be reported to the Contractor and the project representative from Community Planning, Inc. for corrective action.
C. **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, stockpiled soils and localized soft pockets 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 such as access roadway, cane haul roads, etc., shall be scarified to a depth of about 12 in. and recompacted to approximately match the density of the surrounding soils.

Silting basins shall be drained and loose and soft soils shall be stripped down to stiff ground and the backfill shall be compacted in accordance with Section II-E, "Placing, Spreading and Compacting Fill Material."

Where fills are constructed on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill shall be benched to a generally level condition. As the fill is constructed in approximately level layers, it shall continually be keyed into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

D. **Materials**

Fill material shall consist of 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 selected soils generally less than 6-in. maximum size, with more than about 30% fines and a plasticity index generally less than 20.

Fill material placed in the top 2 ft of fills shall generally be less than about 3-in. maximum size with more than about 30% fines.

E. **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 or on the wet side of optimum for clay soils.

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 wet side of optimum.

After each layer has been placed, mixed and spread evenly, it shall be compacted to 90% of maximum density in accordance with ASTM D 1557-70 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 or other acceptable rollers which shall be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is at the specified water content. The rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to obtain the desired density.

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

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

For lots partly on fill and partly on cut or existing ground, the cut or existing ground shall be excavated to a depth of about 2 ft and recompacted near the wet side of optimum water content and to generally match the density of the surrounding fill.
F. **Excess Boulders**

Excess boulders not to be used for construction shall be the property of the Contractor and shall be removed from the project site by the Contractor.

G. **Boulder Fills**

If boulders are used for the construction of fills, they shall be generally placed along the toe sections of slopes and outside of probable building sites. The subgrade shall be stripped to stiff natural ground, shaped to drain and a transition layer of select granular material (maximum 6-in. to dust sizes) shall be placed on it. Smaller granular materials shall be used in the void spaces between boulders. A transition layer of select granular material shall be placed against the boulder fill before construction of fills.

H. **Excavation**

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

I. **Unforeseen Conditions**

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

J. **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 grain-size analysis test results.
# Boring Log

**NEWTOWN ESTATES - UNIT II**  
**SCHOOL SITE SUBDIVISION**

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

**TMK:** 9-8-57: 28

## BORING LOG DATA

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**ELEVATION:** 430' + x

**UNIFIED SOIL CLASSIFICATION:**

- **(MH)**  
  - STIFF, REDDISH BROWN Silty clay
- **(MH)**  
  - STIFF, REDDISH BROWN Silty clay
- **(MH)**  
  - STIFF, REDDISH BROWN Silty clay traces of decomposed rock
- **(MH-C)**  
  - STIFF, REDDISH BROWN Silty clay gray clay streaks

**END OF BORING & 16.5'**  
10-28-75

*ELEVATION ESTIMATED FROM PREM. GRADING PLAN REC'D. 10-17-75*
Boring Log

LOCATION: Waimalu, Ewa, Oahu, Hawaii

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

SAMPLER:
- 2.55 - 3" Standard Split Spoon
- 6" - 8" O.D. Thin Wall Tube

LOCATION: Waimalu, Ewa, Oahu, Hawaii

Boring No. 1

Site: School Site Subdivision

Driller: W. Lum

Date: Oct 23, 1975

Field Party: Kaku, Akita, Shigenaga

Type of Boring: Hoist (roll)

Diam: 4"

Evel: 92.12'

Drill Bit: T.C. Drag

Water Level: N/A

Time: N/A

Date: 10-23-75

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<td>MH</td>
<td>2-G</td>
<td>48</td>
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<tr>
<td>2.66</td>
<td>99.75</td>
<td>MH</td>
<td>2-H</td>
<td>14</td>
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</tbody>
</table>

* Elevation Estimated from Prelim. Grading Plan Rec'd 10-17-75

** Note:** PL = Plastic Limit

LL = Liquid Limit

END OF BORING 25.3'

10-23-75

Hammer Bounces
# Boring Log

**PROJECT**
NEWTON ESTATES - UNIT II
SCHOOL SITE SUBDIVISION

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

**TMK**
9-8-57: 28

---

**HAMMER:**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>140 lb</td>
<td>30 ft</td>
</tr>
</tbody>
</table>

**SAMPLER:**

| 2 1/2" - 2" STANDARD SPLIT-SPOON |
| 3" - 3" O.D. THIN WALL TUBE |

---

**Boring Log Data**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Standard Penetration Test (B's)</th>
<th>N (Blows per ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>25</td>
<td>46</td>
<td>28</td>
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<td>24</td>
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<tr>
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<td>3.0</td>
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<td>0.5</td>
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**Penetration Data**

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<tr>
<th>ELEV: 361.7'</th>
<th>361.7'</th>
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</thead>
</table>

---

**End of Boring @ 25.5' 10-24-75**

---

*Elevation estimated from prelim. grading plan rec'd 10-17-75*
**Boring Log**

**PROJECT:** NEWTOWN ESTATES - UNIT II

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

**PROBING**

**Sheet No.** of **Driller:** WALTER LUM ASSOCIATES, INC.

**Sheet No.** of **Date:** OCT 24, 1975

**Field Party:** KAKU, SHIGENAGA

**Type of Boring:** CONTINUOUS PENETRATION

**Diam.:** 2"

**Datum:** 377 ft

**Time:** —

**Date:** 10-24-75

**HAMMER:**

**Weight:** 140 lbs

**Drop:** 30"

**SAMPLER:** 2" DIAM. BLUNT POINT

---

**UNITED SOIL CLASSIFICATION**

<table>
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<th>Description</th>
<th>Penetration Test</th>
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<tr>
<td>ELEV. = 377 + 2' Q</td>
<td>N (Blows per foot)</td>
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<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>0</td>
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<td>20</td>
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---

**END OF PENETRATION G.G.9**

10-24-75

---

*ELEVATION ESTIMATED FROM PRELIM. GRADING PLAN REC'D. 10-17-75*
# 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>
<th>GRAIN-SIZE ANALYSIS</th>
<th>ATTERBERG LIMITS</th>
<th>UNIFIED SOIL CLASSIFICATION</th>
<th>MOISTURE-DENSITY RELATIONS OF SOILS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sieve</td>
<td>Air Dried or Natural</td>
<td>CBR TEST</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1-1/2&quot;</td>
<td>NATURAL</td>
<td>(Surcharge - 51 P.S.F.)</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td>1&quot;</td>
<td>62</td>
<td>Molding Moisture, %</td>
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<tr>
<td></td>
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<td>1/2&quot;</td>
<td>82</td>
<td>Molding Dry Density, P.C.F.</td>
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<td>#10</td>
<td>41</td>
<td>Swell upon saturation, %</td>
<td>92</td>
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<td>#20</td>
<td>41</td>
<td>CBR at 0.1&quot; Penetration</td>
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<td></td>
<td></td>
<td>#40</td>
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**REMARKS:**

Date 11-16-75 By
### TABLE I

**- SUMMARY OF LABORATORY TEST RESULTS**

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<td>DEPTH BELOW SURFACE</td>
<td>10'-11.5'</td>
<td>15'-16.5'</td>
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<tr>
<td>DESCRIPTION</td>
<td>D</td>
<td>R</td>
<td>M</td>
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<td>GRAIN-SIZE ANALYSIS</td>
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<td>(% Passing)</td>
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<td>Sieve</td>
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<td>1-1/2&quot;</td>
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<td>1&quot;</td>
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<td>1/2&quot;</td>
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<td>Dilatancy</td>
<td>RAPID</td>
<td>SLOW</td>
<td>SLOW - NONE</td>
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<td>Toughness</td>
<td>MED STIFF</td>
<td>MED STIFF</td>
<td>MED STIFF</td>
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<td>Dry Strength</td>
<td>MEDIUM</td>
<td>VERY HIGH</td>
<td>VERY HIGH</td>
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<td>CH</td>
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<td>APPARENT SPECIFIC GRAVITY</td>
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<td>CBR TEST</td>
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<td>(Surcharge - 51 P.S.F.)</td>
<td>27.5</td>
<td>95.1</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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<td>Swell upon saturation, %</td>
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<td>CBR at 0.1&quot; Penetration</td>
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<td>MOISTURE-DENSITY RELATIONS OF SOILS</td>
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<tr>
<td>(ASTM D-1557-70, Method)</td>
<td>△</td>
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<tr>
<td>Dry to Wet or Wet to Dry</td>
<td>DRY TO WET</td>
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<td>Max. Dry Density (P.C.F.)</td>
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<td>REMARKS:</td>
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Date 11-6-75  By 07
MOISTURE-DENSITY CURVE (ASTM D-1557-70, METHOD A)

PROJECT: NEWTOWN ESTATES-UNIT II
       SCHOOL SITE SUPREME
LOCATION: WAIMAU, EWA, OAHU, HAWAII
SAMPLE NO.: 2 SURFACE
SAMPLE DESCRIPTION: DARK REDDISH-BROWN SILT CLAY WITH ROOTS

AGGREGATE: 1/4" MINUS
MOLD SIZE: 10x10x8" HIGH
HAMMER: 10 LBS, 18" DEEP
LAYERS: 5
BLOWS: 25/LAYER

WATER CONTENT (%)

DRY DENSITY (P.C.F.)

0 10 20 30 40 50 60

60 70 80 90 100

OPT. MOIST. = 28%
107.5 - W = 29.2 %
85.8 - W = 39.2 %

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

DATE 10-30-75  BY  R.H.
MOISTURE-DENSITY CURVE (ASTM D-1557-70, METHOD A)

PROJECT: NEWTOWN ESTATES - UNIT II
SCHOOL SITE SUBDIVISION

LOCATION: WAIMALU, EWA, OAHU, HAWAII

SAMPLE NO.: 2. SURFACE
SAMPLE DESCRIPTION: DARK REDDISH-BROWN CLAYEY SILT

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4.5" x 4.5" x 4.5" HIGH
HAMMER: 10 LBS., 18" HIGH
LAYERS: 5
BLOWS: 25/LAYER

DATE 10-29-75 BY R.I.
CBR TEST

PROJECT: NEWTOWN ESTATES - UNIT II SCHOOL SITE SUBDIVISION

LOCATION: WAINALU, EWA, OAHU, HAWAII

SAMPLE NO: 2 SURFACE

SAMPLE DESCRIPTION: DARK REDDISH-BROWN SILTY CLAY W/ROOTS

TEST RESULTS:

MOLDING MOISTURE, %: 28.3
MOLDING DRY DENSITY, P.C.F.: 93.5
CBR @ 0.1" PENETRATION: 12.5
DAYS SOAKED: 5

DATE 11-3-75 BY E.M.
DATE 11-4-75 BY R.H.

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

PROJECT: NEWTOWN ESTATES - UNIT II
SCHOOL SITE SUBDIVISION

LOCATION: WAIMALU, EWA, OAHU, HAWAII

SAMPLE NO: 5 SURFACE
SAMPLE DESCRIPTION: DARK REDDISH - BROWN CLAYEY SILT

TEST RESULTS:

MOLDING MOISTURE, %: 27.5
MOLDING DRY DENSITY, P.C.F.: 98.1
CBR @ 0.1" PENETRATION: 15.7
DAYS SOAKED: 5

CBR PENETRATION DATA

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<th>PENETRATION (INCHES)</th>
<th>LOAD (LBS)</th>
<th>LOAD (PSI)</th>
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<td>0.050</td>
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<td>0.175</td>
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<td>0.500</td>
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<td>553</td>
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AGGREGATE 3/4" MINUS
HAMMER WEIGHT 16 LBS.
HAMMER DROP 18 INS.
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

DATE 11-3-75 BY E.M.
DATE 11-4-75 BY P.H.
SELECTED

LOGS OF BORINGS

FROM

NEWTOWN ESTATES - UNIT II

(DATED AUGUST 21, 1972)
### Boring Log

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

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

**SAMPLER**: 2" STANDARD SPLIT SPOON

<table>
<thead>
<tr>
<th>Unit Soil Classification</th>
<th>Description</th>
<th>ELEV = 401'</th>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Wet P.C.</th>
<th>Dry P.C.</th>
<th>Unconf. Comp.</th>
<th>P.S.F.</th>
<th>Penetration Test</th>
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<tbody>
<tr>
<td>(MH)</td>
<td>STIFF, DARK REDDISH BROWN Silty Clay w/ROOTS</td>
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<tr>
<td>(MH)</td>
<td>STIFF, REDDISH BROWN CLAY-CLAYY SILT</td>
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<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED RED Silty Clay w/GRAY CLAY STREAKS</td>
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<td>MH</td>
<td>STIFF, MOTTLED GRAY &amp; RED Silty Clay</td>
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<td>(MH)</td>
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**END OF BORING @ 21.5'**

*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 lbs  
- **Drop**: 30°

**SAMPLER**: 2" STANDARD SPLIT SPON

**BORING NO.**: 14  
**Driller**: W. LUM ASSOC. INC.  
**Field Party**: RADOVICH, SETO, FANG  
**Type of Boring**: AUGER (MIXED)  
**Diam.**: 4"

**Elev.**: 346.5′  
**Datum**:  
**Drill Bit**: T.C. DRAG  
**Water Level**: NOT NOTICED  
**Date**: 7-3-72

<table>
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<tr>
<th>UNITED STATES CLASSIFICATION</th>
<th>DESCRIPTION</th>
<th>ELEV. = 346.5′</th>
<th>Depth (Ft.)</th>
<th>Sampler</th>
<th>Sample No.</th>
<th>Wet Density</th>
<th>P.C.F.</th>
<th>Water Cont.</th>
<th>Dry Density</th>
<th>Unconf. Comp.</th>
<th>Vane Shear</th>
<th>P.S.F.</th>
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</thead>
<tbody>
<tr>
<td><strong>(MH)</strong></td>
<td>STIFF, REDDISH BROWN CLAYEY SILT &amp; ROOTS</td>
<td></td>
<td></td>
<td>14-A</td>
<td></td>
<td>25</td>
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<td><strong>(MH)</strong></td>
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<td></td>
<td>14-B</td>
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*ELEVATION ESTIMATED FROM TOPO MAP DATED SEPT. 22, 1970*
**Boring Log**

**PROJECT:** NEWTON ESTATES UNIT II  
**LOCATION:** Waimalu, Ewa, Oahu, Hawaii  
**Tax Map Key:** 9-8-02: 2  
**Driller:** W. LUM ASSOC., INC.  
**Date:** JUNE 30, 1974  
**Field Party:** KAKU, RADOVICH, FANG  
**Type of Boring:** AUGER (MOBILE)  
**Diam.:** 4"  
**Elev.:** 375' ± 2  
**Datum:**  

**HAMMER:**  
- **Weight:** 140#  
- **Drop:** 30"  
- **2.5" - 2" O.D. THIN WALL TUBE**  
- **2.5" - 2" STANDARD SPLIT SKNUN**

**SAMPLER:**

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<tbody>
<tr>
<td><strong>(MH)</strong> MEDIUM, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK &amp; ROOTS</td>
<td>2.5</td>
<td>15-A</td>
<td>92</td>
<td>25</td>
<td>74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>0.5</td>
<td>0.5</td>
<td>4</td>
</tr>
<tr>
<td><strong>(MH)</strong> STIFF, REDISH BROWN CLAYEY SILT</td>
<td>2</td>
<td>15-B</td>
<td>-</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>4</td>
</tr>
<tr>
<td><strong>(MH)</strong> MEDIUM, MOTTLED RED &amp; OPA CLAYEY SILT &amp; DECOMPOSED ROCK</td>
<td>15</td>
<td>15-C</td>
<td>115</td>
<td>39</td>
<td>63</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>0.5</td>
<td>0.5</td>
<td>4</td>
</tr>
<tr>
<td>END OF BORING @ 16.5'</td>
<td></td>
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</tr>
</tbody>
</table>

*ELEVATION ESTIMATED FROM TOPO MAP*  
**DATED:** SEPT. 22, 1974

**Notes:**
- Water Level: Not recorded  
- Time: Not recorded  
- Date: 6.30.74
SECTION
NOT TO SCALE

FIGURE 1
SUGGESTED BOULDER FILL
NEWTOWN ESTATES - UNIT II
SCHOOL SITE SUBDIVISION
WAIMALU, EWA, OAHU, HAWAII
TAX MAP KEY: 9-8-57:28
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 between borings, at other locations, or at other dates. Soil conditions and water levels may change with the passage of time, 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.

This report was prepared only for the indicated use of the site. If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes, plan changes, or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the recommendations considering the time lapse, changed conditions, and changes in the state of the art of soil engineering.

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

Contract documents and specifications often prescribe supervision by the soil engineer. It should be understood by all parties that the soil engineer's actual scope of work is very limited. We as the soil engineer do not assume the day to day physical direction of the works, nor minute examination of the elements, nor do we assume the responsibility for the safety of the contractor's workmen. Supervision, inspection, control, etc., by the soil engineer generally mean taking of soil tests and making visual observations, sometimes on only an intermittent basis relating to earthwork or foundations for the project. The soil engineer does not guarantee the contractors' performance, but rather looks for general conformance to the intent of the plans and soil report. Any discrepancy noted by the soil engineer regarding earthwork or foundations will be referred to the project engineer or architect or contractor for action.

Although the soil report may comment or discuss construction techniques or procedures for the design engineer's guidance, the report should not be interpreted to prescribe or dictate construction procedures or to relieve the contractor in anyway of his responsibility for the construction.