March 27, 1978
W.O. 738-00(B)

Civic Development
Room A, 1305 South King Street
Honolulu, Hawaii 96814

Attention: Mr. George H. Sakoda

Subject: Field Observation and
Foundation Recommendations
Momilani Villa, Unit I
Lots 11-12, 13-14, 15-16, 17-18, 23-24,
29-30, 33-34, 57-58, 59-60, 61-62,
63-64 & 65-66

Gentlemen:

As requested, the site conditions at the above referenced
lots were evaluated for foundation design purposes. As
stated in our proposal, it is not the purpose of this
investigation to check the compaction quality of the
already completed grading work.

Our findings and recommendations are presented in this letter.

The soil report and site grading observations for the above
project were made by others. The site grading plan by Park
Engineering Inc. dated September 13, 1976 was used to deter-
mine the grading that had taken place at the site.
FIELD EXPLORATION AND LABORATORY TESTING

One boring was drilled at Lot 45-46 to evaluate the subsurface conditions for the design of the proposed retaining walls. Detailed descriptions of the soils encountered are presented on the logs. The approximate location of the boring is shown on each of the attached plot plans.

2.4-Inch diameter ring samples of the top 1.5 feet below the existing building pads were obtained for visual inspection and laboratory testing to evaluate the expansive properties of the existing surface materials. Water contents and swell tests on 1 inch thick undisturbed ring samples with 55 p.s.f. surcharge loads were utilized in the evaluation of the soil properties.

The results of the laboratory tests are summarized in Table 1.

Portions of the building slabs for Lots 57-58, 59-60 & 61-62 are located within about 15 feet from the top of the stream lining. Problings were made in these lots to evaluate the condition of the fill that was placed in this area. The problings were made by driving a 2-inch diameter conical point with a 140-pound hammer falling 30 inches. The number of blows to drive the conical point was recorded and is presented on the logs. The approximate locations of the problings are shown on the attached plot plans.
Visual observations of the cuts at the retaining wall locations for Lots 11 through 18 and 23-24 were made for retaining wall design purposes.

DISCUSSION AND RECOMMENDATIONS

Based on the field exploration and laboratory test results, our recommendations are as follows:

Expansive Soil Conditions
Where expansive soil conditions are encountered, deep perimeter footings are recommended around the house slabs to reduce the shrink-swell effects of these soils. The perimeter footings should extend a minimum of 2 feet below the outside ground elevation and have a minimum thickness of 9 inches. A #5 bar should be placed at the top and bottom of this cut-off wall footing.

The 6-inch base course layer should be compacted wet of optimum moisture content to a minimum of 90% maximum density. Prior to pouring the slab, the subgrade and base course layer should be kept continuously moist by flooding or sprinkling. The soils engineer should inspect the subgrade preparation, check the moisture contents of the underlying soils, and test compaction of the cushion layer prior to pouring of the slab and perimeter footing.
Expansive Soil Conditions (cont'd)

The bottom of the footing excavation should be neat and free of loose soils.

The concreting of footing and slab should be coordinated in such a way that the time period between the initial excavation and final concrete placement at each lot is kept to a minimum. Continual flooding of the exposed subgrade is required to saturate the underlying expansive soils.

Drainage and gutter water should be diverted far away from the perimeter footings and walkways.

Lot 33-34

The laboratory tests and field observations indicated slightly expansive soils in these lots. The recommendations for expansive soil conditions given above should be used except a 1 foot deep perimeter footing may be used.

Lots 63-64 & 65-66

The laboratory tests indicated expansive soils in these lots. The recommendations for expansive soil conditions given above should be used for these lots.
Lots 57-58, 59-60 & 61-62

The rear portion of these units are located within about 12 to 16 feet from the top of the stream lining. The probings in this area generally indicated stiff underlying material.

It is anticipated that surface fill within 10 feet behind the top of the lined channel bank will experience some long-term settlement. Future additions should be avoided within the 10-foot set-back area behind the top of the lined channel or be designed by a soils engineer.

The laboratory tests indicated expansive soils in these lots. The recommendations for expansive soil conditions given above should be used for these lots.

Lots 11-12, 13-14, 15-16, 17-18, 23-24 & 29-30

The laboratory tests indicated expansive to critically expansive soils in these lots. The recommendations for expansive soil conditions given above should be used for these lots.
For Lots 11 to 16, the perimeter footings should be deepened and extended down to a depth of 3 feet below outside finish grade. Interior footings should be founded 18 inches below the top of slab. All footings should be reinforced with two #5 bars placed at the top and bottom of the footings.

Basement walls are planned for portions of three units. Field observations indicate that the material behind these proposed wall consists primarily of silty clay with cobbles and gravel with pockets of clay. For these units, the following recommendations may be used for retaining wall design:

1. Well-graded granular material, such as base course rock, should be used as backfill material behind the walls.

2. The bottoms of footings should be a minimum of 2 feet below the finish grades.

3. Allowable bearing values of 3000 p.s.f. may be used for footings resting on stiff soil.
4. For lateral earth pressure, the following can be used:
   a) Walls unrestrained at the top - 45 p.c.f. equivalent fluid pressure.
   b) Walls restrained at the top - 60 p.c.f. equivalent fluid pressure.

   Additional load due to sloping surcharge should be included where applicable.

5. A friction factor of 0.40 can be utilized to determine the sliding resistance of the wall foundation.

6. A subsurface drainage system should be used to prevent the build-up of hydrostatic pressure behind the walls.

Footings, slabs and sidewalks located near the tops of slopes will be subject to slope creep effects. To reduce these effects of slope movements, the foundations of these structures should be embedded such that the outer edge of the foundation has a minimum horizontal set-back distance of 5 feet from the slope face.
Lot 45-46
The boring indicated about 2 feet of stiff clay over stiff silty clay over boulderly or rock formation at about 5 ft. depths.

The wall footing should extend through the silty clay and rest on the rocky materials. Other retaining wall recommendations given above should be followed.

To reduce surface slope creep effects, short pier type foundations extending through the upper clay layer should be used for this structure. Loose backfill around the pier should be used to reduce lateral loads on the pier.

The foundation excavations should be observed by a soils engineer to see that the intent of our recommendations is carried out.

Should you have any questions concerning the contents of this report, please feel free to call us.

Respectfully submitted,

C.W. ASSOCIATES, INC.
dba GEOLABS-HAWAII

By Bob Y.K. Wong, P.E.
| Lot No. | Sample Depth | Moisture Content (%) | | | |
|---------|--------------|----------------------|------|------|
|         |              | Before | After | Swell (%) |
| 11      | 6"           | 25     | 49    | 5.7    |
|         | 18"          | 26     |       |        |
| 12      | 6"           | 32     | 38    | 4.4    |
|         | 18"          | 27     |       |        |
| 13      | 6"           | 32     | 48    | 13.9   |
|         | 18"          | 30     |       |        |
| 14      | 18"          | 28     | 38    | 9.1    |
| 15      | 6"           | 28     |       |        |
|         | 12"          | 32     |       |        |
|         | 18"          | 35     | 48    | 9.3    |
| 16      | 18"          | 30     | 37    | 6.8    |
| 17      | 6"           | 32     |       |        |
|         | 12"          | 36     |       |        |
|         | 18"          | 39     | 44    | 4.6    |
| 18      | 18"          | 9.7    | 27    | 4.2    |
| 23      | 18"          | 32     | 43    | 4.3    |
| 24      | 18"          | 39     | 42    | 3.7    |
| 28/29   | 18"          | 32     | 47    | 5.3    |
| 33/34   | 18"          | 42     | 53    | Nil    |
| 57      | 12"          | 32     | 34    | 2.2    |
| 58      | 12"          | 26     | 36    | 7.2    |
| 59      | 6"           | 27     | 34    | 6.9    |
| 60      | 6"           | 28     | 37    | 7.5    |
| 61      | 6"           | 28     |       |        |
|         | 12"          | 29     |       |        |
|         | 18"          | 34     | 39    | 4.6    |
| 62      | 6"           | 26     |       |        |
|         | 12"          | 29     |       |        |
|         | 18"          | 24     | 34    | 7.5    |
### TABLE I (cont'd)

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<th>Lot No.</th>
<th>Sample Depth</th>
<th>Moisture Content (%)</th>
<th>Swell (%)</th>
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**BORING 8**

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<th>Blows per foot</th>
<th>Sample</th>
<th>Dry density (pcf)</th>
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**Surface elevation 143'± (ESTIMATED FROM PLOT PLAN)**

**SOIL DESCRIPTION**

- **STIFF MOTTLED BROWN CLAY**
  - MH
  - CH

- **BOULDER**
  - MH

- **STIFF REDDISH BROWN SILTY CLAY**
  - MH

- **ROCK OR BOULDER AT 4 TO 5 FEET, MOVED HOLE 3 FEET**

- **ROCK OR BOULDER AT 5 TO 6.5 FEET**

- **END OF BORING AT 6.5 FEET ON 3-10-78**

- **NO GROUNDWATER ENCOUNTERED**

**MOISTURE CONTENT**

- **Plastic limit**
- **Liquid limit**
- **Natural water content**

**LOG OF BORING**

**CIVIC DEVELOPMENT**

**MOMILANI VILLA - UNIT I**

**DRIVING ENERGY:** 140 lb. wt., 30' drop

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CONTINUOUS PENETRATION WITH A 2-INCH CONICAL POINT.

PENETRATION TEST TERMINATED AT 11.5 FEET ON 3-3-78
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<th>Dry density (pcf)</th>
<th>Blows per foot</th>
<th>Depth (feet)</th>
<th>Surface elevation 143′± (ESTIMATED FROM PLOT PLAN)</th>
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<td>50 40 30 20 10 0</td>
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**LEGEND**

- Moisture content
- Plastic limit
- Liquid limit
- Natural water content
- 2.0″ O.D. split-spoon sample
- Undisturbed ring sample
- Disturbed ring sample
- Core sample
- Sampler pushed

CONTINUOUS PENETRATION WITH A 2-INCH CONICAL POINT

PENETRATION TEST TERMINATED AT 10.1 FEET ON 3-3-78

MOMILANI VILLA - UNIT I

LOG OF BORING

CIVIC DEVELOPMENT

GEOLABS-HAWAII

Driving energy: 140 lb. wt., 30″ drop W.O. 738-00(B) MARCH 1978

PLATE
LEGEND

1437 FINISHED GRADE OF GROUND

LOT NUMBER

MODEL NUMBER

LOT DIMENSIONS

APPROXIMATE LOCATION OF BORING

PLOT PLAN
HOMILANI VILLA

LANK ENGINEERING, INC.

AREA: LOT 57 = 5724. S.F.
LOT 58 = 5481. S.F.
TMK: 0-6-04 PAR. 10

George Yokota
REGISTERED PROFESSIONAL ENGINEER
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

DATE: MAY 23, 1977

PARK ENGINEERING, INC.
LEGEND

1457 FINISHED GRADE OF GROUND

(C) LOT NUMBER

(S.5.G) LOT DIMENSIONS

APPROXIMATE LOCATION OF BORING

AREA: LOT 59 = 5404 S.F.
LOT 60 = 5449 S.F.
THK: 0-6-04: POR.10

PLOT PLAN
MOMILANI VILLA
1" = 20'

GEORGE YOKOTA
REGISTERED PROFESSIONAL ENGINEER
HAWAII, U.S.A.
No. 1156

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

PARK ENGINEERING, INC.

DATE: MAY 29, 1977
LEGEND

1472 FINISHED GRADE OF GROUND

G1 = LOT NUMBER

A = MODEL NUMBER

(52.02) LOT DIMENSIONS

APPROXIMATE LOCATION OF BORING

PLOT PLAN
MOMILANI VILLA

1" = 20'

AREA: LOT G1 = 5464 S.F.
LOT G2 = 6064 S.F.
TNK: G-0-04: FOR 10

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

PARK ENGINEERING, INC.

DATE: MAY 23, 1977