B9905057

MAY 14 1999

TA710.3
H3
H64
No. 525A

PRELIMINARY SOILS AND GEOLOGY INVESTIGATION

PUU ALII RESIDENTIAL PUD

HEEIA, OAHU, HAWAII

TAX MAP KEY: 4-6-02

W. O. 436-00 DECEMBER 13, 1972

FOR

BRIAN GRAY AND ASSOCIATES

GEOLABS-HAWAII, INC.

1553 COLBURN STREET, SUITE 203

HONOLULU, HAWAII 96817

WITHDRAWN

MUNICIPAL REFERENCE & RECORDS CENTER
City & County of Honolulu
City Hall Annex, 558 S. King Street
Honolulu, Hawaii 96813

TABLE OF CONTENTS

TABLE OF CONTENTS

(continued)

GEOLABS-HAWAII, Inc.
Soils and Foundation Engineering, Geology
1553 Colburn Street, Suite 203 • Honolulu, Hawaii 96817 • (808) 841-5064

December 13, 1972

W. O. 436-00

Brian Gray & Associates
116 South King Street, Room 508
Honolulu, Hawaii 96813

Attention: Mr. Brian Gray

Subject: Preliminary Soils & Geology Investigation
Puu Alii Residential PUD
Heeia, Oahu, Hawaii
Tax Map Key: 4-6-02

Gentlemen:

Submitted herein are the results of our preliminary soils and geology investigation of the proposed Puu Alii Development site as requested and authorized by your company (November 30, 1972, W. O. 436-00). This report summarizes our work and presents our preliminary general recommendations for determining the feasibility and for planning the project's site development. More detailed investigation is recommended prior to construction when more detailed development plans are prepared. Items needing additional investigations are delineated in the recommendations of this report.

SITE DESCRIPTION

The approximately 23 acre site is located adjacent to Lilipuna Road, and to the rear of the Safeway and Long's Drug Stores in Heeia, Oahu, Hawaii. The property generally slopes towards Lilipuna Road and Kamehameha Highway. The top of the ridge, forming a portion of the property, has been excavated, resulting in a surface depression. Further cutting of the ridge top is planned to provide fill for existing low areas.

The presently unexcavated area is sparsely vegetated with ornamental banana, pine, guava, plum, mango and other trees. Open grassed areas are also present on the hillside portions of the property.

Piles of trash consisting of logs, tin cans, tin roofing sheets, bottles, reinforcing rods and other debris were located in the lower portions of the property and have been noted on the map, included with this report as Plate 1.

PROPOSED DEVELOPMENT

According to the plot plan supplied by Brian Gray and Associates, the proposed development will consist of 588 units in two,

three, and four story structures. Considerable grading and retaining wall construction will be required to provide level pads for construction.

FIELD EXPLORATION

Five test pits were excavated with a backhoe, in the lowlying swampy area in the western portion of the site. The logs of the test pits are presented on Table A, Appendix A. Bulk samples were taken of the major soil types.

Four borings (15' to 20' deep) were drilled with a B-40, truck mounted, drill rig utilizing a 9-inch diameter, hollow stem flight auger.

In all borings, Standard Penetration Tests were taken at selected depth intervals. The Standard Penetration Test consists of driving a 2-inch O.D. split spoon sampler 18 inches with a 140-pound hammer free-falling a distance of 30 inches. The number of blows required to drive the sampler the last 12-inches is termed the "Standard Penetration Resistance" (N) and is an approximate measure of the relative density or consistency of a soil. These resistance values are plotted on the boring logs. Samples obtained were visually

classified in the field and representative material was placed in air-tight containers and returned to our laboratory for inspection and testing. In addition, undisturbed ring samples were obtained for the selective laboratory testing included with this report as Appendix B.

The test pit and borehole information were supplemented by geologic reconnaissance. The results of the reconnaissance have been plotted on the map and are reported herein.

SUBSURFACE CONDITIONS

A. Geology

During the late Tertiary Period, Koolau Volcanic series basalts covered the Pohakea Peninsula. These basalts were subsequently injected by basalt dikes.

A prolonged period of weathering, erosion and deposition followed, resulting in the deposition of mottled, brown, clayey silts and very weathered basalt boulders ("Older Alluvium") disconformably over the Koolau basalts.

A Post-Pleistocene (Recent) Period of sub-tropical weathering, erosion and deposition has resulted in the formation

of a residual weathering crust (red clayey silts) over the basalts and transported alluvium (loosely consolidated) in the lower portion of the property.

B. Soils

The onsite soils consist of the following general types:

1) Fill-Trash Piles: The lower portions of the property contain considerable amounts of uncompacted fill, wood, glass, paper, tin cans, sheet metal, and pipes in piles (see map - Plate 1).

2) Brown SILT (Older Alluvium): Red, yellow and predominantly brown, very stiff, silts found on the lower slopes of the hillside.

3) Red Clayey SILT to silty CLAY: Very stiff to hard, red, clayey silt to silty CLAY, covering the hilltop portion of the property to depths of at least 21.5 feet (Boring No. 4).

4) Very Loose, Very Wet, Clay and Silty Clay with sand and gravel: These materials exist in the lower

portion of the property adjacent to Lilipuna Road (Test Pit No. 5).

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the field investigation, laboratory testing and engineering analyses, the following preliminary conclusions and recommendations are presented:

A. General

The subsurface conditions encountered during the investigation indicate that development of the property by means of cuts and fills is feasible from a geology and soils engineering standpoint provided that the recommendations given below are followed.

B. Grading

1) Clearing and Grubbing

All deleterious material, i.e. vegetation topsoil, trash, etc., should be removed from borrow and fill areas and wasted from the site. This must include the sizeable old fill and trash piles encountered in

the western and southern portions of the site and indicated on Plate 1.

2) Preparation

Prior to placement of compacted fill in the flat, low-lying western and southern portions of the site, it will also be necessary to remove all unsatisfactory soft, wet swampy material. In this area, investigated with a backhoe, test pits indicated that the depth of this unsatisfactory material is at least 5 feet deep in certain areas. When more definite plans are developed, this area should be further investigated to determine actual limits and depths of removal. The excavated natural materials should be approved by the soils engineer prior to recompaction as structural fill. Materials of high organic content should not be used.

Local soft spots encountered anywhere on the site, in areas to receive fill, should be removed and replaced with compacted structural fill. Our general specifications for fill placements, compaction and supervision

are contained in the grading specifications, included with this report as Appendix C. Recommended construction procedures for fill above cut slope and fill above natural slope are included as Plates GS-2 and GS-3.

3) Slopes

For preliminary planning purposes, cut and fill slopes should not be designed steeper than 2 : 1. It is recommended that additional specific subsurface boring data be obtained from large proposed cut and fill areas to determine the overall stability of these slopes at planned slope gradients. This data should be obtained in conjunction with a design level investigation and grading plan review of the project, prior to construction.

Compaction of any fill slopes should be performed progressively after each three-foot increment of fill has been placed by backrolling with the compaction equipment, or should be overbuilt and subsequently cut back to the compacted core.

Slopes higher than 15 feet in vertical height should contain 6 feet (minimum) wide benches every 15 feet of vertical height. All slopes should be planted immediately after construction to minimize erosion.

4) Drainage

Provisions for site drainage, both during and after construction, must be considered. If springs are encountered during excavation, subdrains may be required.

5) Inspection and Testing

Inspection and testing during grading should be performed under the supervision of a soils engineer to ensure that the recommendations are followed.

C. Retaining Walls (if planned)

Any unsurcharged basement and retaining walls less than 10 feet high should be designed for an equivalent fluid pressure of 35 pounds per cubic foot, provided only moderate compaction of backfill is required. If a high degree of backfill compaction is required or the walls cannot yield even slightly, an equivalent fluid pressure of 60

pounds per cubic foot should be used.

Surcharges due to adjacent footings, hydrostatic pressure, construction equipment, slopes, etc. must be added to the above values.

Retaining walls greater than 10 feet high should be evaluated on an individual basis during the design level phase of the investigation to determine the earth pressure distribution. The recommended analyses should be performed after final grading plans are completed and more detailed information concerning the walls is available.

D. Foundations

Spread or continuous footings on cut and fill areas, acceptably prepared, can be utilized. Recommended bearing values, footing depths and reinforcement will be included in the design level foundation report, when more definite development plans are available. Preliminary data indicates that the onsite materials are moderately expansive.

The opportunity to be of service is appreciated. If you have any questions, please call.

Very truly yours,

GEOLABS-HAWAII, INC.

Brooks D. Anderson II
Geologist

John J. Heneghan, P. E.

BDA/JJH:hlg

xc: (2) Addressee

(1) Mike McCormick Realty

Attn: Mr. Duncan MacNaughton

A P P E N D I X A

Boring Logs

USC	SOIL DESCRIPTION Surface Elevation	Depth (feet)	Samples	Dry Density (pcf)
CH-MH	FILL red-brown mottled boulder, clayey silt, hard		1	74.9
	FILL stiff brown silty clay with roots, wood, glass, ceramics	5	2	63.4
	Stiff black weathered basalt	10	3	
	End boring at 13' Boring Completed 12-6-72	15 20		

STANDARD PENETRATION RESISTANCE
(140 lb. weight, 30" drop)
▼ Blows per foot
10 30 50

10 30 50
● % Water Content

LEGEND

I 2.0" O.D. split-spoon sample
II 2.5" O.D. ring sample
III Core sample
* Sample not recovered
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
Sampler pushed
USC Unified Soil Classification

Puu Alii Residential PUD

LOG OF BORING NO. 1

W. O. 436 DECEMBER 1972

GEOLABS-HAWAII, INC

SOIL MECHANICS & FOUNDATION ENGINEERS

USC	SOIL DESCRIPTION Surface Elevation	Depth (feet)	Samples	Dry Density (p.c.f.)
CL	Hard, dark red to multicolored, mottled, silty clay		1	79.8
		5	2	
ML	Hard, dark brown to multi-colored, mottled silt (older Alluvium)	10	3	
	End boring at 12' Boring Completed 12-6-72	15		

STANDARD PENETRATION RESISTANCE
(140 lb. weight, 30" drop)
▼ Blows per foot
10 30 50

10 30 50
● % Water Content

LEGEND

I 2.0" O.D. split-spoon sample
II 2.5" O.D. ring sample
III Core sample
☆ Sample not recovered
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
Sampler pushed
USC Unified Soil Classification

Puu Alii Residential Pud

LOG OF BORING NO. 2

W. O. 436 DECEMBER 1972

GEOLABS-HAWAII, INC

SOIL MECHANICS & FOUNDATION ENGINEERS

USC	SOIL DESCRIPTION Surface Elevation	Depth (feet)	Samples	Dry Density (pcf)
CL	Very Stiff to hard, dark brown to multicolored, mottled, silty clay (older Alluvium)		1	66.9
		5	2	
	Refusal on rock, may be boulder, moved off hole and redrilled to same depth.	10		
	Borings Completed 12-6-72	15		

STANDARD PENETRATION RESISTANCE
(140 lb. weight, 30" drop)
▽ Blows per foot
10 30 50

10 30 50
● % Water Content

LEGEND

I 2.0" O.D. split-spoon sample
II 2.5" O.D. ring sample
Core sample
* Sample not recovered
Liquid limit
Natural water content
Plastic limit
Impervious seal
Water level
Piezometer tip
Sampler pushed
USC Unified Soil Classification

Puu Alii Residential PUD

LOG OF BORING NO. 3

W. O. 436 DECEMBER 1972

GEOLABS-HAWAII, INC

SOIL MECHANICS & FOUNDATION ENGINEERS

USC	SOIL DESCRIPTION Surface Elevation	Depth (feet)	Samples	Dry Density (pcf)
CL	Hard red silty clay		1	69.5
		5	2	
CL	Very Stiff to stiff, red, mottled clay (weathered basalt)	10	3	
		15	4	
		20	5	
	End boring at 21.5 feet Boring Completed 12-6-72	25		

STANDARD PENETRATION RESISTANCE
(140 lb. weight, 30" drop)
▼ Blows per foot
10 30 50

10 30 50
● % Water Content

LEGEND

- I 2.0" O.D. split-spoon sample
- II 2.5" O.D. ring sample
- III Core sample
- * Sample not recovered
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- Sampler pushed
- USC Unified Soil Classification

Puu Alii Residential PUD

LOG OF BORING NO. 4

W. O. 436 DECEMBER 1972

GEOLABS-HAWAII, INC

SOIL MECHANICS & FOUNDATION ENGINEERS

TABLE A

Test Pit Logs

Test Pit Number	Depth (ft)	Soil Description
1	0 - 4	Stiff, brown clayey SILT (CH-MH)
	4 - 5.5	Soft to stiff, gray mottled clay (CH)
	5.5 - 6.0	Slightly weathered to weathered basalt boulders
2	0 - 1	(Fill) Reddish yellow, stiff, mottled silt (MH)
	1 - 3	(Fill) Brown, stiff, silty clay with boulders (CL)
	3 - 5	(Fill) Boulders, with yellow-brown clayey silt matrix
3	0 - 1	(Fill) Stiff, red brown silt (MH) with trash, glass, iron and wood
	1 - 3	(Fill) Boulders with brown, clayey silt matrix (MH-CH) with paper, wood, and glass
	3 - 4	Boulders with yellow brown clayey silt matrix
4	0 - 0.8	Red, stiff, clayey silt (MH-CH)
	0.8 - 4.5	Stiff to hard, yellow silt (MH) with boulders
5	0 - 1	Soft red clay (CH)
	1 - 4	Very soft, brownish red, silty clay (CL) with cobbles. Water seepage estimated gpm.

A P P E N D I X B

Laboratory Testing

LABORATORY TESTING

The laboratory testing program was developed to establish the engineering properties of the soils and rocks encountered at the project site.

1. Classification Tests

a) Visual Classification. All soil samples obtained from the borings were brought to our laboratory where they were visually reclassified to confirm or modify the field classification prior to finalizing the Logs of Borings.

b) Water Content Determinations. In addition to visual classification, typical samples were tested for natural water content as an aid in soil classification and in evaluating soil properties. The water content values are based upon the dry weight of the soil.

c) Atterberg Limits. Atterberg limit tests were performed on selected clay and silt samples obtained from the borings for the purposes of identification and correlation of soils. Standard procedures (ASTM D 424 for the plastic limit and ASTM D 423 for the liquid limit) were used in the performance of these tests.

d) Grain Size Analysis. Sieve analysis were performed on granular soils. For fine-grained soils, the hydrometer

test was performed to determine the distribution of the grain sizes beyond the No. 200 sieve.

2. Shear Strength Tests

a) Unconfined Compression Tests. Intact core and split-spoon soil samples which apparently exhibited high plasticity were tested for unconfined strength. Length to diameter ratio of 2 was maintained throughout the tests to avoid scatter of test results and to facilitate evaluation of shear strength values for design purposes.

b) Direct Shear Test. In general, soil samples were tested for shear strength using a 2.41 I.D. direct shear box. Each set consisted of at least two tests, each test run under different normal loads. The results are plotted as Normal Stress vs Shear Strength with a failure envelope drawn to determine values of cohesion (c) and angle of frictional resistance (ϕ).

c) Consolidation Tests. Consolidation tests were performed on selected "undisturbed" ring samples of the compressible soils to provide basic data for making settlement calculations. Porous stones were placed on the top and bottom of the samples to allow drainage. Vertical loads were applied in increments with each load increment being allowed to consolidate prior to adding the next increment. Measurements of the time and consolidation were obtained during each load increment and

rebound was measured during the unloading portion. Consolidation test results are plotted in terms of percent settlement versus applied loads.

d) Swell Tests. The ring sample was placed between porous stones and a 100 psf load was applied to the sample for a 24-hour period. The difference between the initial and final sample heights is the amount of swell which is expressed as a percentage of the initial height of the sample.

e) Maximum Density Test. Samples of soil are compacted in a mold of given size with a 10-pound rammer dropped 18 inches to determine the relationship between moisture content and density of the soil. At least three trial points at different moisture content are run to determine the maximum density and optimum moisture content. The test is run in accordance with ASTM D-1557-70.

GEOLABS—HAWAII, INC.

DATE DECEMBER 1972

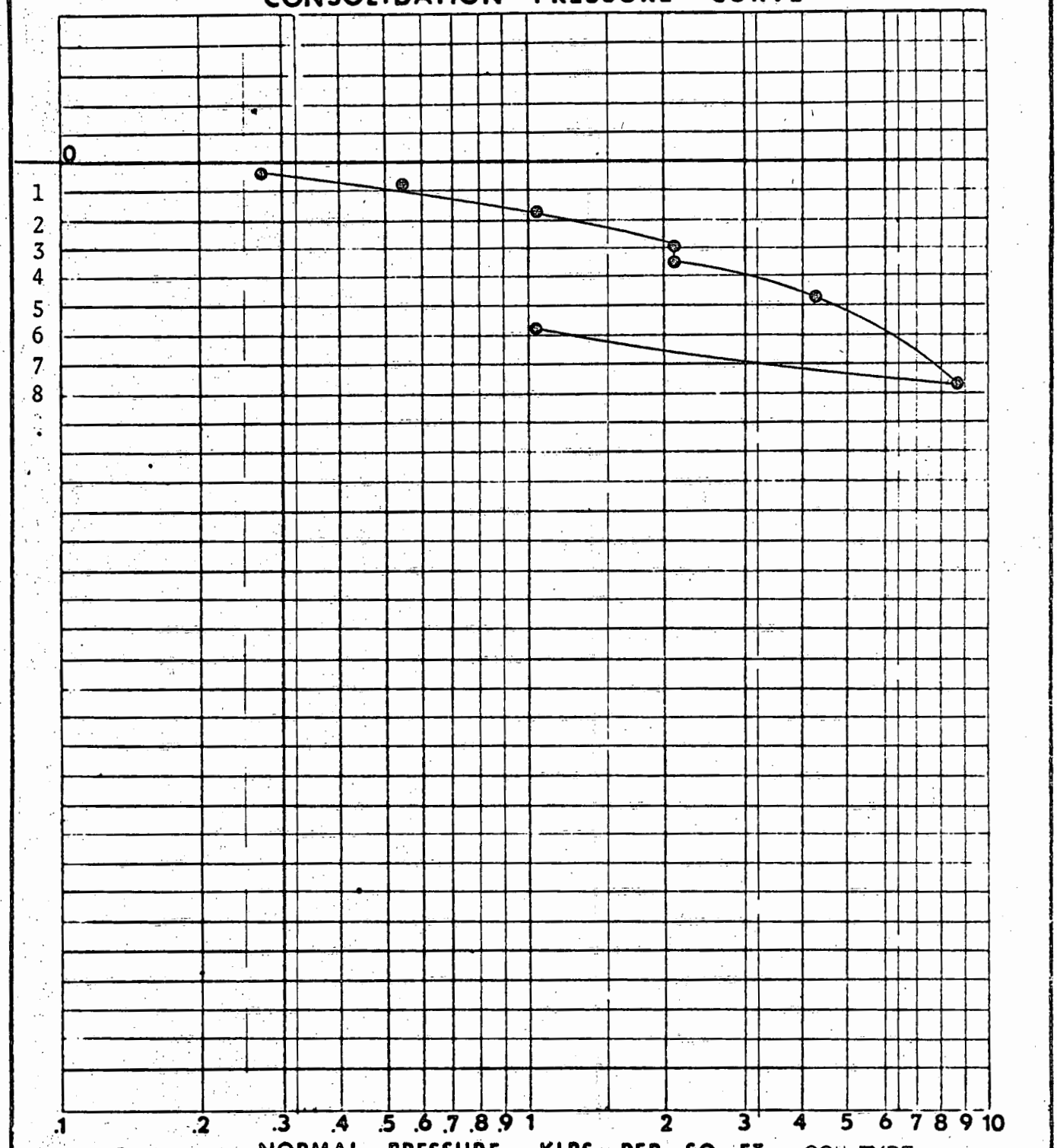
W.O. 436-00

JOB Puu Alii Residential PUD, Heeia, Oahu, Hawaii

BORING NO. 1, S-1

DEPTH 0 - 2 feet

CONSOLIDATION - PRESSURE CURVE



SOIL TYPE

DRY UNIT WT. 74.9 PCF

LIQUID LIMIT %

PLASTIC LIMIT %

PLASTIC INDEX %

PLATE B-1

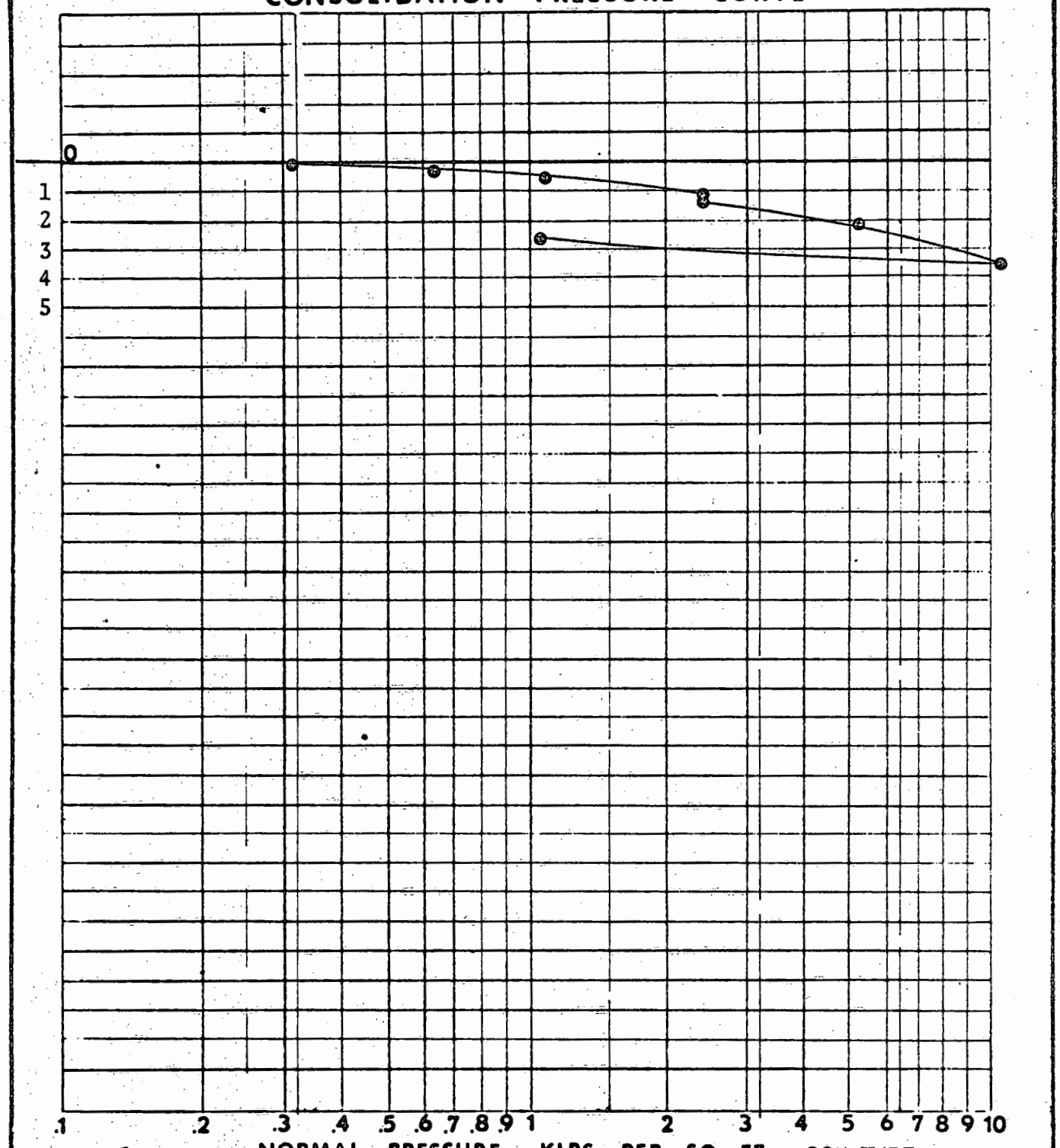
GEOLABS—HAWAII, INC.

DATE DECEMBER 1972 W.O. 436-00

JOB PUU ALII RESIDENTIAL PUD, HEEIA, OAHU, HAWAII BORING NO. 2, S-1

DEPTH 0 - 2 feet

CONSOLIDATION - PRESSURE CURVE



SOIL TYPE
DRY UNIT WT 79.8 PCF
LIQUID LIMIT 77 %
PLASTIC LIMIT 39 %
PLASTIC INDEX 38 %

PLATE B-2

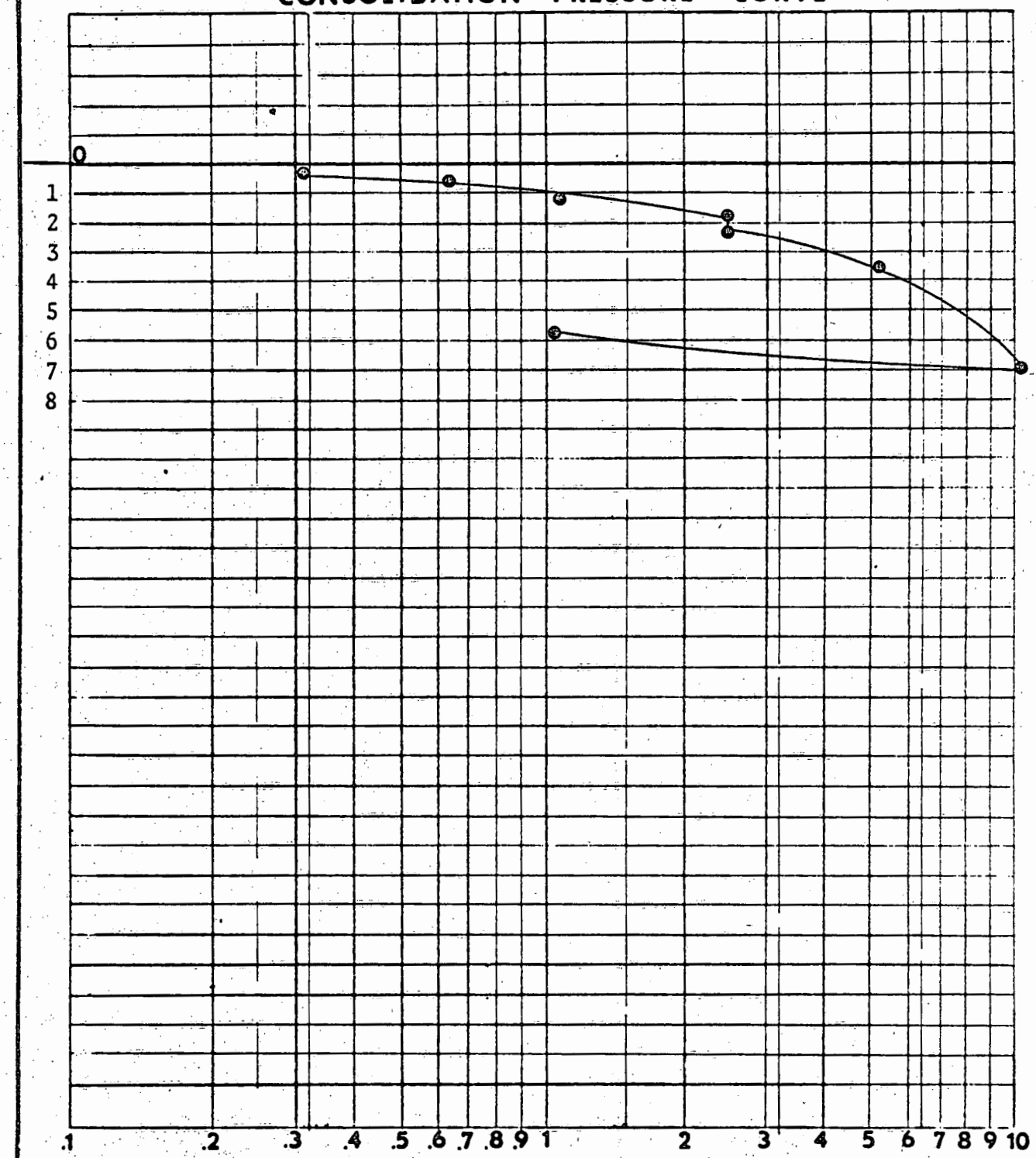
GEOLABS—HAWAII, INC.

DATE DECEMBER 1972 W.O. 436-00

JOB Puu Alii Residential PUD, Heeia, Oahu, Hawaii BORING NO. 3, S-1

DEPTH 0 - 2 feet

CONSOLIDATION - PRESSURE CURVE



SOIL TYPE

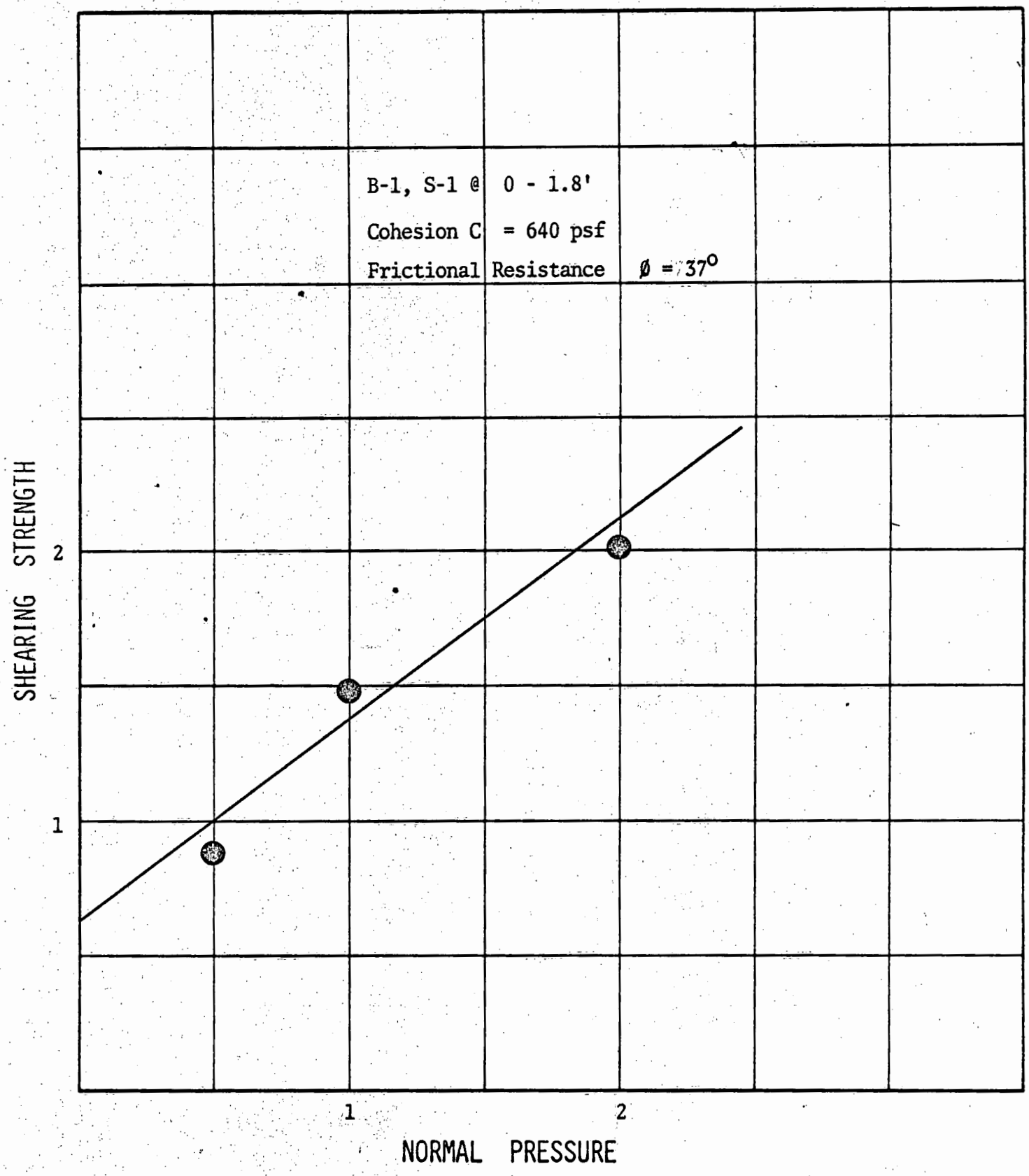
DRY UNIT WT. 66.9 PCF

LIQUID LIMIT %

PLASTIC LIMIT %

PLASTIC INDEX %

PLATE B-3

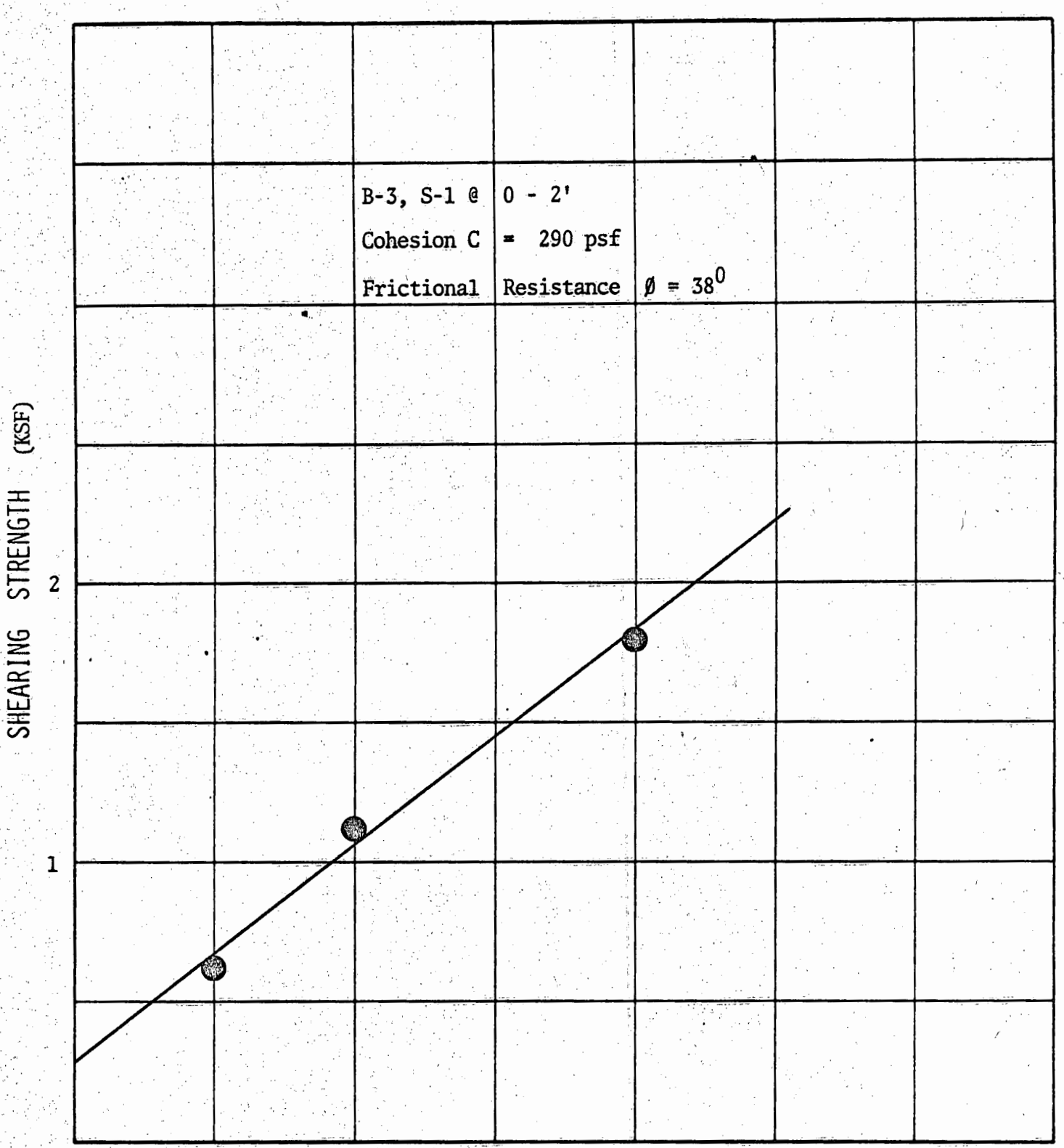


DIRECT SHEAR TEST

GEOLABS-HAWAII, INC.
Foundation & Soil Engineering · Geology

DATE	W.O.
DECEMBER 1972	436-00

PLATE B-4

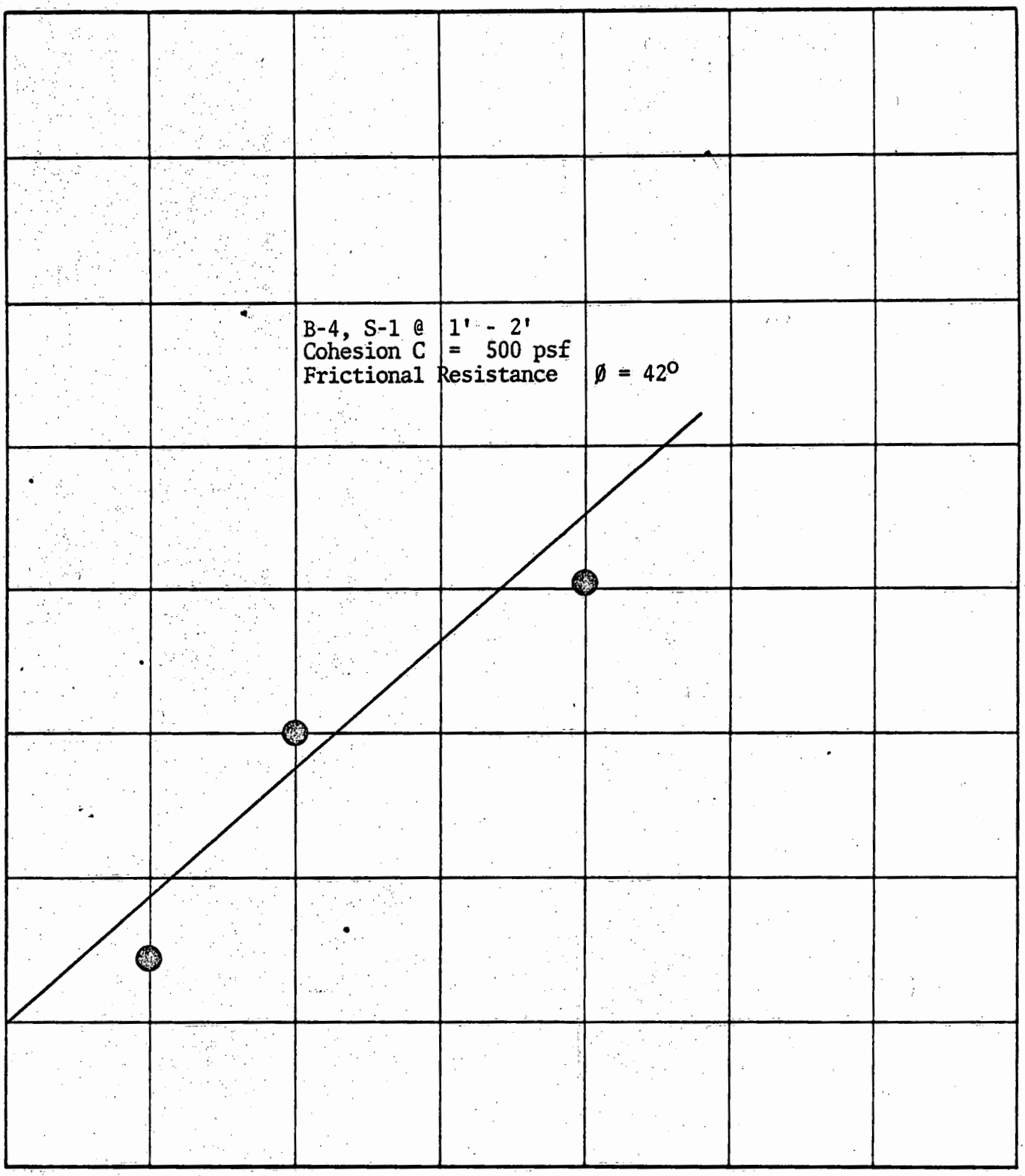


DIRECT SHEAR TEST

GEOLABS-HAWAII, INC.
Foundation & Soil Engineering · Geology

DATE	W.O.
DECEMBER 1972	436-00

PLATE B-5



DIRECT SHEAR TEST

GEOLABS-HAWAII, INC.
Foundation & Soil Engineering · Geology

DATE	W.O.
DECEMBER 1972	436-00

PLATE B-6

A P P E N D I X C

Grading Specifications

GRADING SPECIFICATIONS
PUU ALII RESIDENTIAL PUD
HEEIA, OAHU, HAWAII

The work under this section includes:

1. Clearing and grubbing of site
2. Preparation of natural ground
3. Preparation of fill areas
4. Placement and control of fill operations
5. Compaction equipment
6. Removal and backfill of underground structures
7. Supervision of earthwork
8. Seasonal requirements

1. Clearing

All areas within contract limit lines shall be cleared of trash, debris and organic matter, and such material shall be burned and removed from the site.

2. Preparation of Natural Ground

In areas where the bottom of footings are designed on or below existing natural ground, the soils shall be scarified to a depth as determined by the soils engineer until the material is free of all uneven features and shall be precompacted as outlined in the following Section #4b.

3. Preparation of Fill Areas

All areas upon which fill is to be placed after clearing, as outlined in Section #1 of these specifications, shall be scarified until free of uneven features to a depth as determined by the soils engineer, and watered and compacted according to Section #4 of these specifications.

4. Placement of Fill

a. Material for fill shall consist of onsite soils. Fill material shall be free of all organic matter and other deleterious material, and shall not contain rocks or lumps in excess of four inches (4") in diameter.

b. Compaction of Fill

After the base for the fill has been prepared as described above, it shall be brought to the proper moisture content and compacted to not less than 90% of maximum density in accordance with Test ASTM D-1557-70.

c. Depth of Fill

Fill shall be placed in horizontal layers which,

when compacted, will not exceed six inches (6").

5. Compaction Equipment

The soils engineer shall determine the type of compacting equipment which will attain the specified results in the most efficient manner. Sheepsfoot, vibratory, or pneumatic tire rollers may be used in the test section and the equipment which produces the specified results in the most expedient manner as determined by the soils engineer shall be employed by the contractor. The equipment used in rolling shall be in good working condition, fully ballasted, and self cleaning. Fill material placed in an unsatisfactory condition and not within the enclosed specifications shall be rejected by the soils engineer and the contractor shall rework the fill placed such that the specifications are followed.

6. Removal and Backfill of Underground Structures

Any underground structures such as cesspools, cisterns, septic tanks, wells, pipe lines, etc. shall be removed under the direction of the soils engineer. Backfill of the excavation shall be in accordance with these specifications.

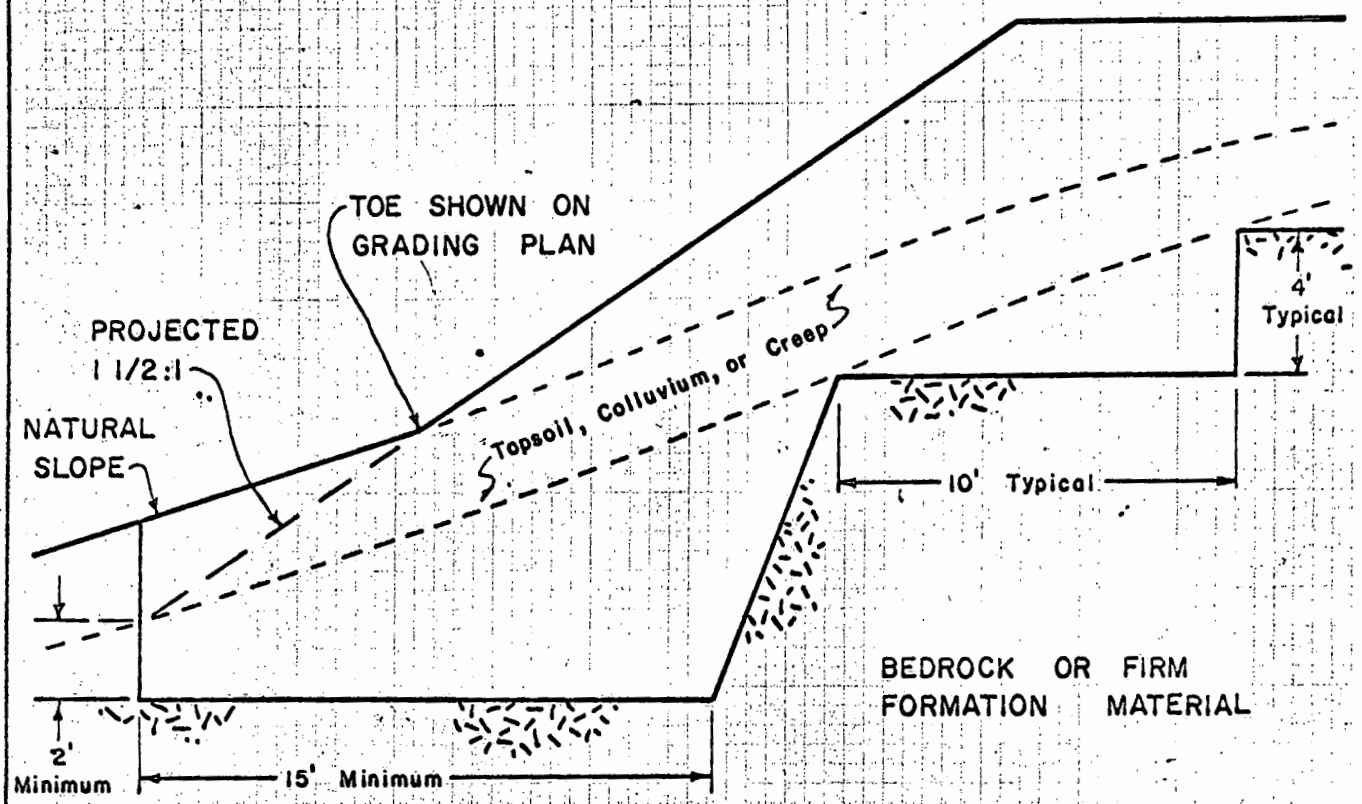
7. Supervision of Earthwork

Field density tests shall be made by the soils engineer during the earthwork operation such that he may certify that the fill was placed according to accepted specifications. In the event that field density tests of a layer or any portion thereof is less than the required density, the particular layer or portion shall be reworked until the required density is obtained.

8. Seasonal Requirements

No fill shall be placed during unfavorable weather conditions as determined by the soils engineer. After interruption of work due to heavy rain, the soils engineer shall approve previously placed fill before resumption of earthmoving operations.

TYPICAL FILL OVER NATURAL SLOPE



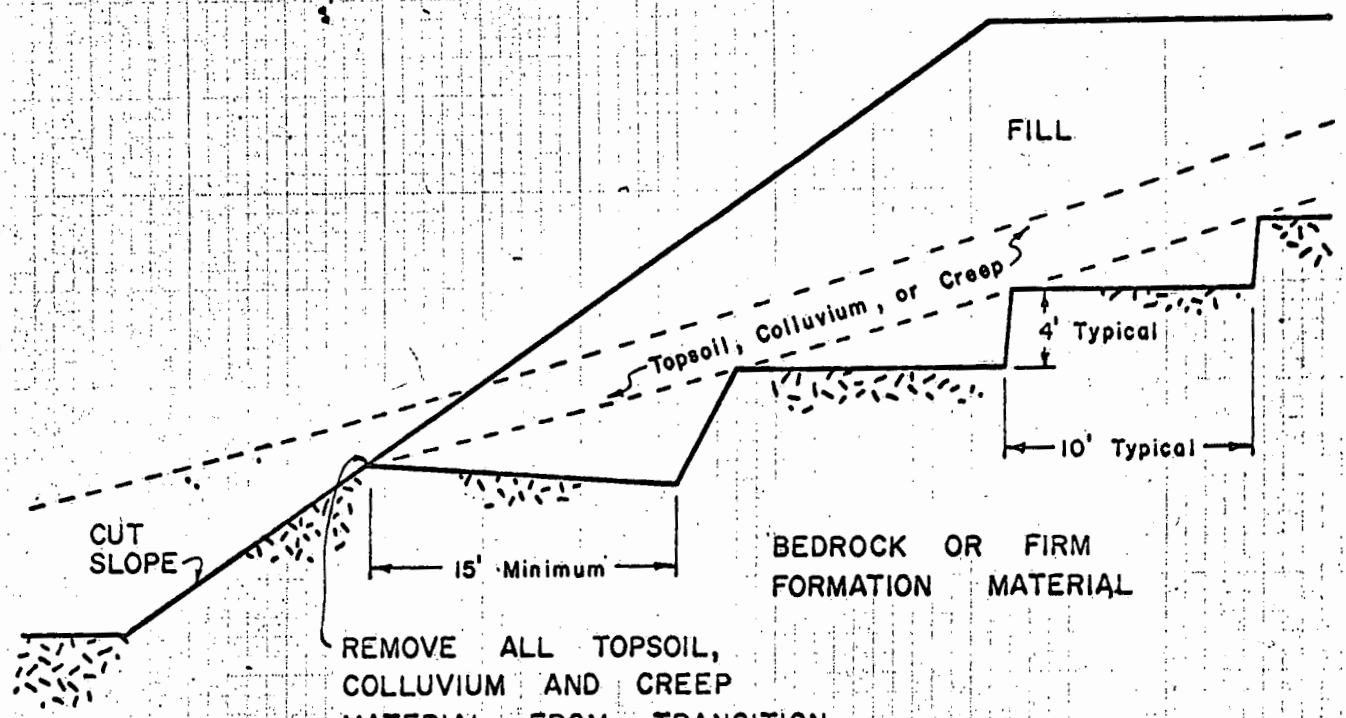
NOTE: WHERE NATURAL SLOPE GRADIENT IS 5:1 OR LESS BENCHING IS NOT NECESSARY, UNLESS STRIPPING DID NOT REMOVE ALL COMPRESSIBLE MATERIAL.

GEOLABS-HAWAII, INC.
Foundation & Soil Engineering • Geology

DATE	DRAWN BY
DECEMBER 1972	
SCALE NONE	W.O. 436-00

PLATE GS-2

TYPICAL FILL OVER CUT SLOPE



GEOLABS-HAWAII, INC.
Foundation & Soil Engineering · Geology

DATE	DRAWN BY
DECEMBER 1972	
SCALE NONE	W.O. 436-00

PLATE GS-3