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**GEOLABS-HAWAII, Inc.**

Geology, Soils and Foundation Engineering  
1553 Colburn Street, Suite 203 • Honolulu, Hawaii 96817 • (808) 815-064

November 20, 1969

W. O. 160

Mr. Wilbert Choi  
Makiki Nursery  
2179 Makiki Heights Drive  
Honolulu, Hawaii 96822

Subject: Slope Stability Analysis - Makiki Nursery  
in Kalihi Valley, Honolulu, Hawaii

Dear Mr. Choi:

In accordance with your request, Geolabs-Hawaii, Inc. has conducted field and laboratory tests and site reconnaissance at the area of the proposed cut slopes to be made at the Makiki Nursery site located in the Kalihi Valley, Honolulu, Hawaii.

It is proposed to cut or excavate the slopes of the subject ridge to provide level bench areas and also soil material to be used in landscaping. The area presently is in use as a nursery site and it is not proposed to place homes or other structures on the slopes at this time.

MUNICIPAL REFERENCE RECORDS CENTER  
City & County of Honolulu  
City Hall Annex, 553 S. King Street  
Honolulu, Hawaii 96813

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SITE DESCRIPTION AND GEOLOGY

The existing nursery site is located in Kalihi Valley approximately 2.6 miles northeast of School Street and 1,500 feet southeast of Kalihi Stream at or near Elevation 700 feet above sea level. The site is situated at the transition from valley slopes to steep ridge slopes. Geologically, the valley slopes are composed of alluvial soils consisting of Clayey SILT mixed with fragments of decomposed rock. These soils overlie decomposed basalt which is exposed in the existing cuts at the base of the ridges at the nursery site.

We understand that the base of the ridge near the existing steel shed is the one to be excavated. At the present time, the base of this ridge has already been excavated leaving a nearly vertical slope approximately 15 feet high composed of highly decomposed basalt with a thin mantle of loose soil. About 20 feet behind this slope, the ground surface drops into a shallow drainage ditch several feet wide and then rises almost vertically 8 feet where it then continues up slope at approximately 1:1 for more than several hundred feet. Sample No. 1 was taken of the highly decomposed basalt near the base of the recent excavation.

The first ridge downstream, or about 500 feet from the subject ridge, has been excavated approximately 60 feet high with a bench two-thirds the way up the slope. The lower 40 feet of this excavation is standing at an average 1:1 slope and is composed of fairly firm decomposed basalt. The upper 20 feet is standing somewhat steeper than 1:1 with a slight overhang at the top where 3 to 4 feet of top soil appears to have moved down slope.

Sample No. 2 was taken of the decomposed basalt near the base of this excavation where the original rock structure is much better preserved than that exposed in the subject ridge. It represents more nearly what we believe the formation will be like in the subject ridge when it is excavated to a comparable depth.

#### FIELD AND LABORATORY TESTS

A site inspection was made on the morning of November 17, 1969 to determine the scope of the proposed excavation and also to familiarize our office with potential problems that may exist on the site. It was noted that previous cuts had been made in the slopes throughout the area and these slopes vary from 45 degrees or 1 horizontal to 1 vertical to steeper angles. No noticeable sloughing or failing of these slopes has occurred in

the past four or five years. Our geologist visited the site on the afternoon of November 17, 1969 and made a reconnaissance of the area, and also obtained representative samples for laboratory testing. The sample test results as included in this report are referred to as Sample No. 1 which was obtained directly to the rear of the existing shed in the proposed cut slope area, and Sample No. 2 from a previously cut slope which is located downstream from the proposed cut area. Undisturbed samples were obtained from these locations and returned to the laboratory for shear tests and slope stability analysis. Also the cut slopes that were visible were classified visually in the field, the classification of which is included in the previous section of this report. The soil material as sampled does not necessarily represent subsurface conditions further into the slope; however, sampling procedures are believed to be representative of what will be excavated during the slope construction.

#### RECOMMENDATIONS

1. Laboratory test results indicate that the soil material when cut on a 1 horizontal to 1 vertical slope will be in a relatively stable condition.
2. Using a slope angle of 45 degrees (1H:1V) with a maximum

vertical height of a slope equal to 20 feet, a safety factor equal to 1.43 will be realized.

3. It is recommended, therefore, that the maximum vertical height of each slope be 20 feet with an approximate 10-foot wide bench at the top of each interval. The slope should not exceed 1 horizontal to 1 vertical from each horizontal bench.

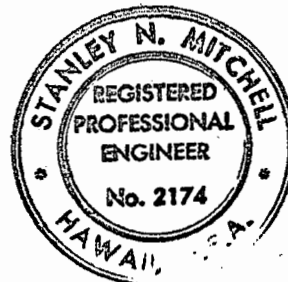
4. Based on the laboratory tests included with this report and experience in this area, it is our opinion that the slopes if constructed per above will be stable with regard to the proposed use of the land.

5. The constructed slope should be planted as soon as possible after completion to reduce erosional effects due to runoff. Also drainage swales should be placed on the benches such that the excess runoff water will be diverted from subsequent lower slopes.

This opportunity to be of service is appreciated.

Very truly yours,  
GEOLABS-HAWAII, INC.

*Stanley N. Mitchell*  
Stanley N. Mitchell, P.E.

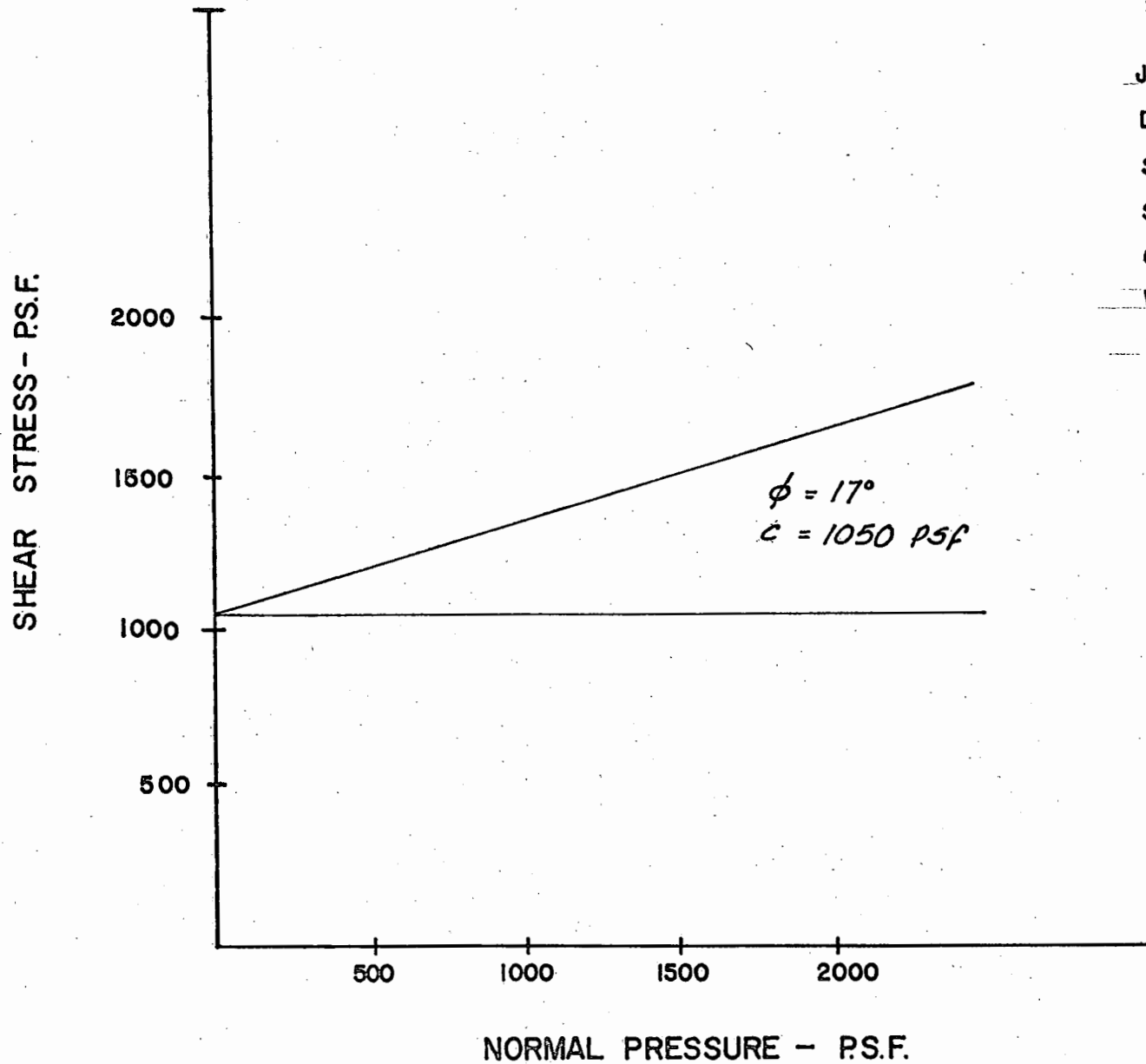


*Ronald A. Pickering*  
Ronald A. Pickering

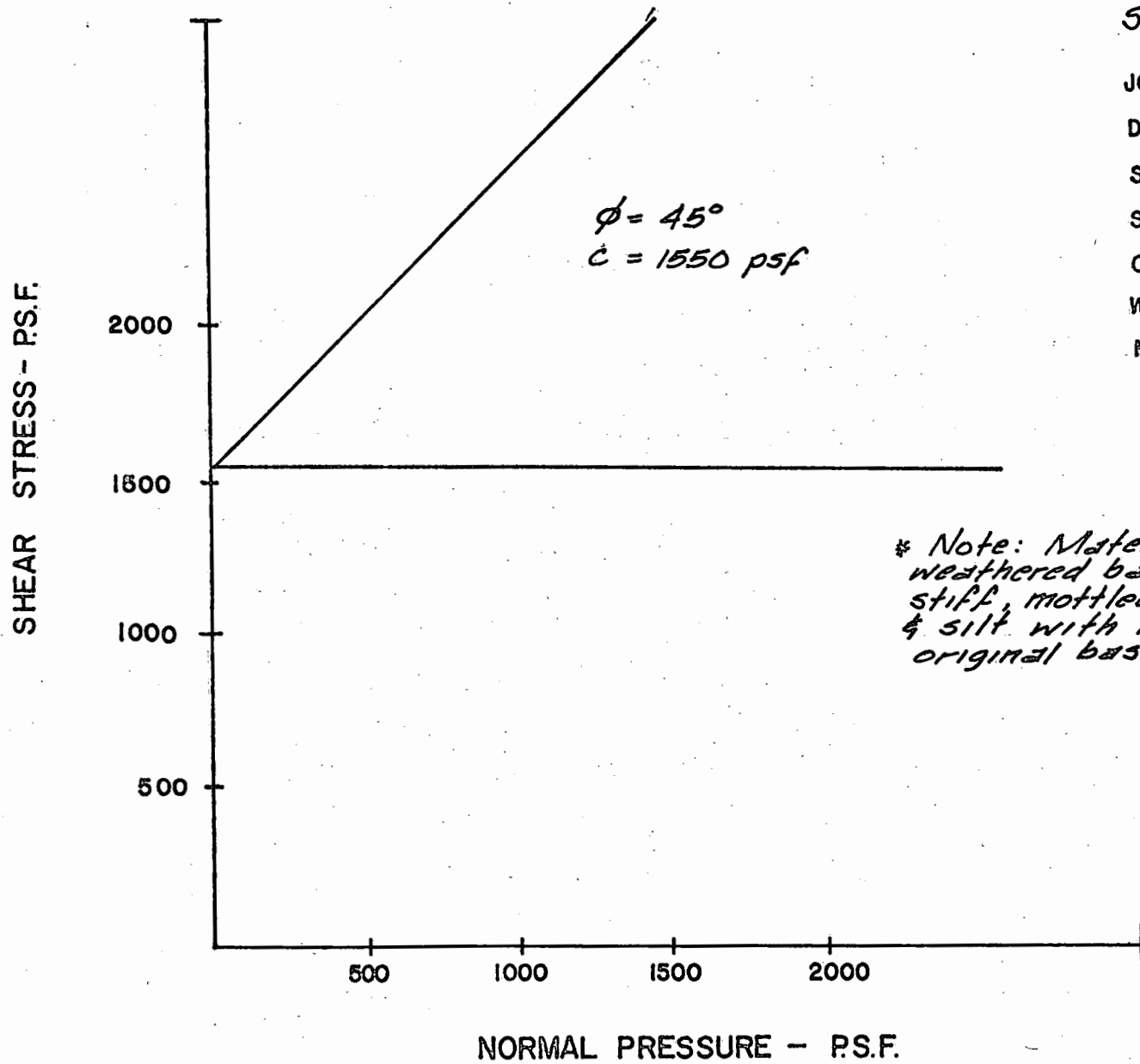
# DIRECT SHEAR TEST

Sample No 1

JOB No. 160  
DH/TP No. Rear of Shed  
SAMPLE DEPTH slope  
SOIL TYPE CL  
CONDITION Undisturbed  
WET UNIT WT. 89.5 pcf  
MOISTURE 81.4 %



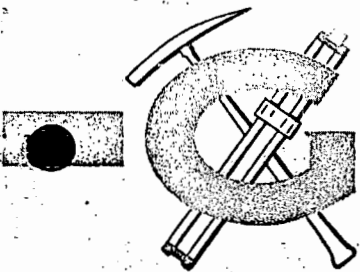
# DIRECT SHEAR TEST



Sample No 2

JOB No. 160  
DH/TP No. Center Ridge  
SAMPLE DEPTH Slope  
SOIL TYPE CL <sup>1/2</sup> (note)  
CONDITION Undisturbed  
WET UNIT WT. 98.5 pcf  
MOISTURE 68.7 %

\* Note: Material is in-place weathered basalt consisting of stiff, mottled red & gray clay & silt with in-place voids from original basalt formations.



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January 19, 1970

W. O. 160

Mr. Wilbert Choi  
Makiki Nursery  
2170 Makiki Heights Drive  
Honolulu, Hawaii 96822

Subject: Addendum Soils Report-II  
Slope Gradient Change Makiki Nursery in  
Kalihi Valley, Honolulu

In accordance with Mr. Yasuo Arakaki's request as stated in his letter dated January 6, 1970, we have reviewed the new grading plan and change in cut slopes for the above-referenced project.

Reference is made to Geolabs-Hawaii, Inc. report dated November 30, 1969 and also for reference purposes the first addendum soils report dated December 15, 1969.

Laboratory tests and analyses as shown in the original soils report indicate that the cut slopes will be stable at a 50% gradient as requested in Mr. Arakaki's letter dated January 6, 1970. The factor of safety for slope stability will be



Mr. Wilbert Choi

January 19, 1970

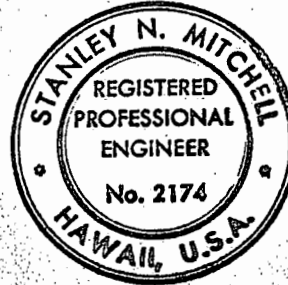
approximately the same as shown in the original soils report. Also, benches will not be required within the cut slope area; however, it is recommended that a drainage ditch be constructed at the top of the 50% slope paralleling in the direction of the ridge line such that surface drainage water will be intercepted and transmitted in the lateral direction to the natural drainage swales.

This addendum report is to serve as certification that the proposed cut slope to the lateral extent shown on the revised grading plan will be stable if excavated on a 50% gradient.

Very truly yours,

GEOLABS-HAWAII, INC.

*Stanley N. Mitchell*  
Stanley N. Mitchell, P.E.



xc: Mr. Yasuo Arakaki