GEOLABS, INC.
Geotechnical Engineering and Drilling Services

November 4, 2003
W.O. 3917-20

Mr. Timothy E. Steinberger, P.E.
City & County of Honolulu
Department of Design & Construction
650 South King Street, 11th Floor
Honolulu, HI 96813

PROGRESS REPORT NO. 6
PHASE III – ADDITIONAL INSTRUMENT MONITORING
KUAHEA STREET AREA MOVEMENT
PROJECT NO. 97504
PALOLO, OAHU, HAWAII

Dear **Mr. Steinberger:**

This sixth progress report is presented to summarize our work efforts and the results of the additional field instrumentation monitoring conducted for the Kuahea Street Area Movement project located in Palolo Valley on the Island of Oahu, Hawaii. The approximate location of the project site is shown on the Project Location Map, Plate 1.

This report provides summary information pertaining to the recorded earth movements and subsurface water levels detected during the Phase III instrument monitoring effort. The report summarizes the field data and observations that were collected during three site monitoring visits, which were conducted on March 25 and 26, June 9 and 10, and August 14 through 18, 2003. Our work was performed in general accordance with our fee proposal dated February 4, 2002 and Amendment No. 2 for Engineering Services for the Kuahea Street Area Movement Project, Contract No. F-60578, CIP No. 97504.

This report is our second semi-annual progress report covering the additional 12-month instrument monitoring period, which officially commenced in August 2002 and officially expired in July 2003. However, due to some adjustment of our field monitoring schedule, the current instrument monitoring period was extended through the end of August 2003 rather than the projected expiration date of July 2003. As a result of the shift in our instrument monitoring schedule, we anticipate that the next additional 12-month instrument monitoring period actually will span between September 1, 2003 and August 31, 2004 rather than between August 2003 and July 2004 as initially projected.

PHASE II – ADDITIONAL FIELD EXPLORATION

The existing Inclinometer Nos. I-2 through I-10 remain operational; however, evidence of significant casing deformation (difficulty in advancing the probe) at

Inclinometer Nos. I-2 and I-4 was again encountered during recent monitoring, which was conducted in August 2003. We estimate that the instruments may be rendered non-functional within the next few months. The impending loss of function of the instruments was anticipated earlier this year and as a result, two replacement inclinometers were installed recently to replace the soon-to-be non-functional instruments. The replacement inclinometers are identified as Inclinometer Nos. I-11 and I-12, which will supplement the data obtained from Inclinometer Nos. I-2 and I-4 until data can no longer be collected from the instruments at which time Inclinometer Nos. I-11 and I-12 will serve to replace Inclinometer Nos. I-2 and I-4, respectively. Inclinometer Nos. I-11 and I-12 were initialized with baseline readings recorded during our August monitoring site visit. Further, analyses and discussion pertaining to Inclinometer Nos. I-11 and I-12 will be addressed in our next progress report.

The following table presents a complete summary of the borings and operational instrumentation used in our current analyses and reporting for this project. The depths are referenced from the existing ground surface.

SUMMARY OF INSTRUMENT INSTALLATION

BORING NO.	DEPTH DRILLED (feet)	DEPTH OF INCLINOMETER (feet)	PIEZOMETER IDENTIFICATION (and Screen Depth in feet)
I-1*	60	58	N/A
I-2	71	68	N/A
I-3	100	92	N/A
I-4	69	66	N/A
I-5	96	92	N/A
I-6	90	88	N/A
I-7	72	68	N/A
I-8	40	37	N/A
I-9**	62	59	N/A
I-10**	62	59	N/A
I-11**	74	67	N/A
I-12**	72	67	N/A
P-1	43	N/A	P-1A (3-8); P-1B (15-25); P-1C (32-42)
P-2	45	N/A	P-2A (4-14); P-2B (34-44)
P-3	60	N/A	P-3A (12-22); P-3B (30-40); P-3C: (45-55)

SUMMARY OF INSTRUMENT INSTALLATION			
BORING NO.	**DEPTH DRILLED** (feet)	**DEPTH OF INCLINOMETER** (feet)	**PIEZOMETER IDENTIFICATION** (and Screen Depth in feet)
P-4	57	N/A	P-4A (30-40); P-4B (45-55)
P-5	71	N/A	P-5A (39-49); P-5B (59-69)
P-6	50	N/A	P-6A (5-15); P-6B (38-48)
P-7	37	N/A	P-7 (23-38)
* Denotes non-functional instrumentation (decommissioned) due to compounded casing deformation ** Denotes replacement instrumentation			

PHASE III – INSTRUMENT MONITORING

Based on our review of the inclinometer data recorded in the past 6-month monitoring period spanning between March 2003 and August 2003, it appears that the inclinometers installed in Boring Nos. I-2, I-4, I-8, I-9, and I-10 continue to clearly indicate the presence of some subsurface ground movement at their respective instrument locations. The earth movements, indicated by the deflection of the inclinometer casing, show well-defined basal movement boundaries, below which limited earth movement is apparent. Boring Nos. I-2, I-9, and I-10 are located within the documented Waiomao Landslide footprint. Boring No. I-4 is located within the potential zone of earth movement identified as Area "A," and Boring No. I-8 is located within the upslope portion of the potential zone of earth movement identified as Area "B." The locations of the inclinometer instrumentation are shown on the Instrument Location Plan, Plate 2.

Based on our review of the inclinometer data recorded between March 2003 and August 2003, it appears that Boring Nos. I-3 and I-6 continue to indicate the presence of some probable subsurface ground movement at their respective instrument locations. The probable earth movements, indicated by deflection of the inclinometer casing, show relatively weak-defined basal slip surfaces below which more limited earth movement is apparent. Above the weak-defined basal slip surfaces, a variety of complex earth movements (casing deflections) has been recorded. The detected earth movements are considered to be relatively small in magnitude, and the basal slip surfaces appear to be located at depths of less than about 15 to 20 feet below the existing ground surface; however, the cumulative displacements continue to increase slowly. Boring No. I-3 is located within the western portion of the documented Waiomao Landslide footprint, and Boring No. I-6 is located on the downslope portion of the potential zone of earth movement identified as Area "B."

Based on our review of the inclinometer data recorded between March 2003 and August 2003, it appears that Boring No. I-5 continues to indicate the presence of some possible subsurface earth movement at the instrument location. The magnitude of the possible earth movement is very small yet the cumulative displacement recorded by the instrument continues to increase very slowly.

Based on our review of the inclinometer data recorded between March 2003 and August 2003, it appears that Boring No. I-7 continues to indicate that potential subsurface earth movement is not occurring at the instrument location. The following subsections provide a more detailed discussion of our evaluation of the inclinometer data recorded to date. A table showing a summary of our interpretation of the inclinometer readings is provided at the end of the discussion.

Boring No. I-2

Inclinometer No. I-2 is located near the center of the documented Waiomao Landslide as shown on the Instrument Location Plan, Plate 2. Inclinometer No. I-2 continues to record steady earth movement along a basal slip surface located at about 43 to 47 feet below the ground surface. The cumulative displacement measured at Inclinometer No. I-2 is approximately 1.39 inches as of August 14, 2003. Because the inclinometer site and vicinity consists of an undeveloped hillslope vegetated with grass, overt signs of possible ground surface deformation were not observed.

Based on the magnitude of the cumulative deflection experienced by the casing, we anticipate that Inclinometer No. I-2 may be nearing the end of its useful life. Presently, the movement of the recording probe within the casing is slightly encumbered; therefore, we estimate that the instrument may be usable for another 2 to 4 months before being rendered un-usable. A replacement inclinometer identified as Inclinometer No. I-11 was recently constructed and initialized with baseline readings. Discussion pertaining to the new replacement inclinometer will be addressed in the next progress report.

Boring No. I-3

Inclinometer No. I-3 is located near the western end of the documented Waiomao Landslide as shown on the Instrument Location Plan, Plate 2. The magnitude and direction of the probable subsurface earth movement recorded at Inclinometer No. I-3 appear to have stabilized some with a better movement trend having been established. A relatively weak-defined basal slip surface appears to exist at a depth of about 15 to 18 feet below the existing ground surface. Above the probable slip surface, some complex casing deflections have been recorded. The cumulative displacement measured at Inclinometer No. I-3 is approximately 0.93 inches as of August 14, 2003. Because the inclinometer site and vicinity consists of an undeveloped hillslope vegetated with grass, overt signs of possible ground surface deformation were not observed.

It is our opinion that the subsurface earth movements recorded at Inclinometer No. I-3 are complex and may be composed of various directional vectors of earth movement including some slight ground uplift. The complexity also may be related to the close proximity of the western lateral boundary of the Waiomao Landslide.

Boring No. I-4

Inclinometer No. I-4 is located in the upslope region of the area of potential earth movement identified as Area "A" as shown on the Instrument Location Plan, Plate 2. The inclinometer continues to record steady subsurface earth movement with a cumulative displacement of about 1.83 inches as of August 18, 2003. The well-defined basal slip surface is located at about 5 to 7 feet below the existing ground surface. Disturbance to the ground surface in the vicinity of the inclinometer is visibly apparent with pavement cracks and settlement being among the most notable evidence of ground surface deformation.

Based on the cumulative deflection sustained by the inclinometer casing and our observation of some moderate restriction of the probe movement within the casing, we estimate that the inclinometer is nearing the end of its useful life and it may be rendered un-usable within about 1 to 3 months. A replacement inclinometer identified as Inclinometer No. I-12 was recently constructed and initialized with baseline readings. Discussion pertaining to the new replacement inclinometer will be addressed in the next progress report.

Boring No. I-5

Inclinometer No. I-5 is located in the downslope region of the area of potential earth movement identified as Area "A" as shown on the Instrument Location Plan, Plate 2. The inclinometer shows that some very slight possible earth movement may be occurring along a shallow depth, weakly defined slip surface located at approximately 13 to 15 feet below the ground surface. However, the recorded displacement is very small and the inclinometer record minimally suggests a progressive pattern of movement. The cumulative displacement recorded at Inclinometer No. I-5 is approximately 0.30 inches as of August 18, 2003.

The very small magnitude and rate of potential earth movement does not correlate with the larger magnitude and rate of movement recorded by Inclinometer No. I-4 located further upslope. Visible ground surface deformation and disturbance to surface structures located in the vicinity of Inclinometer No. I-5 is not overtly apparent.

Boring No. I-6

Inclinometer No. I-6 is located in the downslope region of the area of potential earth movement identified as Area "B" as shown on the Instrument Location Plan, Plate 2. The inclinometer indicates the presence of some probable subsurface earth movement at the

instrument location; however, the record of movement is erratic and not well defined. A basal slip surface may exist at a depth of about 10 to 13 feet below the ground surface, below which generally limited casing deflection has been recorded. The cumulative displacement recorded at Inclinometer No. I-6 is approximately 0.50 inches as of August 14, 2003.

The probable earth movement recorded at Inclinometer No. I-6 is of a considerably lower rate and magnitude than the probable earth movement recorded further upslope at Inclinometer No. I-3. Therefore, additional monitoring is necessary to evaluate whether there may be a correlation between the probable earth movements detected by the two inclinometers. Because the site is located on an undeveloped grass hillslope, visible signs of ground surface deformation were not overtly visible.

Boring No. I-7

Inclinometer No. I-7 is located in the area of potential earth movement identified as Area "C" as shown on the Instrument Location Plan, Plate 2. The inclinometer indicates that there is no significant earth movement occurring within Area "C."

Boring No. I-8

Inclinometer No. I-8 is located along the upper boundary of the area of potential earth movement identified as Area "B" as shown on the Instrument Location Plan, Plate 2. The inclinometer continues to record steady subsurface earth movement with a cumulative displacement of about 0.62 inches as of August 15, 2003. A well-defined basal slip surface exists at about 7 to 10 feet below the existing ground surface.

Visible signs of earth movement observed at the ground surface include the presence of some longitudinal pavement cracks located along the northern side of Waiomao Road fronting the existing retaining wall. In addition, it appears that the existing concrete curb located along the northern side of Waiomao Road adjacent to the inclinometer (fronting 2318 Waiomao Road) is showing some slight outward (northerly) deflection located in the immediate area of Inclinometer No. I-8. A vertical crack was recently observed on the backside of the retaining wall fronting 2318 Waiomao Road. The crack is located in the vicinity of the aforementioned curb deflection.

Boring No. I-9

Inclinometer No. I-9 is located near the central portion of the head of the documented Waiomao Landslide as shown on the Instrument Location Plan, Plate 2. The inclinometer continues to record steady subsurface earth movement with a cumulative displacement of about 0.58 inches as of August 15, 2003. A well-defined basal slip surface exists at a depth of about 38 to 42 feet below the existing ground surface. Observation of the ground surface within the graded and landscaped slopes located in the vicinity of Inclinometer No. I-9 shows no overt sign of ground surface deformation.

Boring No. I-10

Inclinometer No. I-10 is located near the western side of the head of the documented Waiomao Landslide as shown on the Instrument Location Plan, Plate 2. The inclinometer continues to record steady subsurface earth movement with a cumulative displacement of about 0.46 inches as of August 18, 2003. A well-defined basal slip surface exists at a depth of about 23 to 27 feet below the existing ground surface. Observation of the ground surface within the graded and landscaped slopes located in the vicinity of Inclinometer No. I-10 shows no overt signs of ground surface deformation.

Earth Movement Summary

The following is a generalized summary of the inclinometer data obtained to-date for ease of reference.

INCLINOMETER NO.	OCCURRENCE OF MOVEMENT	MAXIMUM RECORDED LATERAL MOVEMENT (inches/time period)	APPROXIMATE RATE OF LATERAL MOVEMENT (inches/month)	APPROXIMATE BASAL DEPTH OF MOVEMENT (feet)
I-1*	Yes	1.22 / 33 Months	0.037	25 – 29
I-2**	Yes	1.39 / 46 Months	0.030	43 – 47
I-3	Probable	0.93 / 44 Months	0.021	15 – 18
I-4**	Yes	1.83 / 46 Months	0.040	5 – 7
I-5	Possible	0.30 / 46 Months	0.007	13 – 15
I-6	Probable	0.50 / 40 Months	0.013	10 – 13
I-7	No	Nil / 43 Months	N/A	N/A
I-8	Yes	0.62 / 37 Months	0.017	7 – 10
I-9	Yes	0.58 / 11 Months	0.053	38 – 42
I-10	Yes	0.46 / 11 Months	0.042	23 – 27

* Inclinometer decommissioned July 2002
** Inclinometer may be nearing end of useful life due to compounded casing deformation

Rainfall Summary

A review of available National Weather Service (NWS) rainfall information for the Palolo/Kaimuki area between February 2003 and August 2003 was performed. Rainfall information from the NWS Hydronet Gauge No. 25, which is located at the Palolo Fire Station near the mouth of Palolo Valley, was obtained from the National Weather Service Forecast Office Honolulu internet website. The following rainfall information was obtained from the subject gauge. It should be noted that the Hydronet Gauge No. 25 is located down-valley at a lower elevation than the Kuahea Street project site. Therefore, the recorded rainfall totals are anticipated to be significantly lower than the actual rainfall experienced at the project site. However, the gauge provides real-time rainfall information that is readily obtained from the NWS website. The Gauge No. 25

information provides a general approximation of the magnitude of rainfall experienced in the vicinity of the project site.

RAINFALL INFORMATION NWS HYDRONET GAUGE NO. 25	
Month/Year	**Total Rainfall** (inches)
February 2003	3.38
March 2003	3.14
April 2003	1.10
May 2003	0.33
June 2003	0.68
July 2003	0.64
August 2003	0.80

Based on our review of the rainfall information and monthly precipitation summaries for the current monitoring period (February through August 2003), the months of February and March 2003 experienced elevated rainfall totals associated with significant storm events. Based on our review of the inclinometer data, it appears that only Inclinometer Nos. I-3 and I-8 recorded a slight increase in the rate of movement between February and April following the period of elevated rainfall, which occurred from about January through March 2003. The earth movements recorded by the remaining inclinometers do not appear to have been affected by the period of elevated rainfall.

In general, our interpretation of the earth movement response to elevated rainfall is that if a period of increased or above normal rainfall is experienced following a prolonged period of normal or lower than normal rainfall, the earth movement rates at some of the inclinometers tend to increase abruptly following the period of elevated precipitation and then settle back to normal levels. The effect has been noted in the past with Inclinometer Nos. I-1, I-2, I-3, I-4, and I-8. Other inclinometers at the site do not appear to record the earth movement rate response such as described.

Subsurface Water Monitoring

The monitoring of subsurface water levels (groundwater) is accomplished by measuring the level of water (head) contained within the fifteen standpipe piezometers installed in drilled borings at the project site. The fifteen standpipe piezometers are identified as Boring Nos. P-1 through P-7, and the approximate locations of the piezometers are shown on the Instrument Location Plan, Plate 2.

Based on our monitoring of the subsurface water levels recorded from Boring Nos. P-1 through P-7 for the past monitoring period (February through August 2003), the record shows that the piezometers identified as P-2A, P-3B, P-3C, P-4A, P-4B, and P-6B have encountered appreciable measurable volumes of subsurface water seepage at their respective screened well points.

Measurement of the water level encountered at Piezometer No. P-2A, which is screened between 4 and 14 feet below the ground surface, indicates that significant shallow depth water seepage may exist. However, the measured water levels have been on a declining (lowering) trend since about November 2002, despite the elevated rainfall totals experienced between January and March 2003. The head level in the standpipe was measured at about 7 feet in January 2003 and has since consistently lowered to about 3.5 feet as of August 2003.

Measurement of the water level encountered at Piezometer No. P-3B, which is screened between 30 and 40 feet below the ground surface, indicates that some periodic water seepage may be occurring. Typically, only trace amounts of water are detected; however, periodic elevated head levels of about 2 feet and 6 feet of water were measured in the standpipe in August 2003 and June 2003, respectively. The elevated head levels do not appear to correlate with rainfall at the site.

Measurement of the water level encountered at Piezometer No. P-3C, which is screened between 45 and 55 feet below the ground surface, indicates that fairly consistent water seepage may be occurring. The measured water levels typically range on the order of about 5 to 6 feet of head in the standpipe. However, it should be noted that the standpipe was observed to be nearly dry in March 2003.

Measurement of the water level encountered at Piezometer No. P-4A, which is screened between 30 and 40 feet below the ground surface, indicates that some near-continual water seepage may be occurring. The measured water level in the standpipe appears to remain fairly consistent throughout the past monitoring period with an average of about 1.8 feet of head measured in the standpipe.

Measurement of the water level encountered at Piezometer No. P-4B, which is screened between 45 and 55 feet below the ground surface, indicates that some continual water seepage may be occurring. The measured water level in the standpipe appears to be fairly consistent throughout the past monitoring period with an average of about 2.6 feet of head in the standpipe. It should be noted that in February 2003, the measured water level was anomalously high with about 19.5 feet of head in the standpipe. The measured spike in water level may be related to the elevated period of rainfall that was experienced in January 2003.

Measurement of the water level encountered at Piezometer No. P-6B, which is screened between 38 and 48 feet below the ground surface, indicates that continual high

volumes of water seepage may be occurring. The measured water level in the standpipe appears to remain consistent throughout the past monitoring period with an average of about 18 feet of head in the standpipe. Despite the high volume of water seepage measured at Piezometer No. P-6B, subsurface earth movement at the adjacent Inclinometer No. I-7 has not been detected.

In general, the piezometers that encounter measurable subsurface water typically indicate the water presence on a year-round basis with some elevated spikes in the water levels occurring following periods of above average rainfall. In addition, occasionally the measured water levels drop with only trace amounts of subsurface water seepage being detected.

The remaining piezometers (P-1A, P-1B, P-1C, P-2B, P-3A, P-5A, P-5B, P-6A, and P-7) continue to have encountered only trace amounts of subsurface water seepage during the past monitoring period. These piezometers have remained generally dry, or, have indicated a static accumulation of about 0.8 foot or less of water in the standpipes.

The following is a summary of the piezometer data obtained during the last site visit for instrumentation monitoring, which occurred between August 15 and August 18, 2003.

PIEZOMETER NO.	HEIGHT OF WATER LEVEL IN PIEZOMETER	PIEZOMETER NO.	HEIGHT OF WATER LEVEL IN PIEZOMETER
P-1A	NOT ENCOUNTERED	P-4A	1.8 feet
P-1B	0.8 feet	P-4B	2.8 feet
P-1C	0.2 feet	P-5A	NOT ENCOUNTERED
P-2A	3.5 feet	P-5B	0.7
P-2B	0.6 feet	P-6A	NOT ENCOUNTERED
P-3A	0.5 feet	P-6B	16.0 feet
P-3B	1.9 feet	P-7	0.5 feet
P-3C	6.0 feet	-	-

Observations: Pavement & Structural Deformation

A general reconnaissance of the project site was conducted on September 18, 2003 to record observations pertaining to the existing site conditions.

Waiomao Road Area

The existing elongated longitudinal pavement cracks that were sealed previously to reduce surface water infiltration along the northern side of Waiomao Road in the vicinity of Area "B" appear to be in fair condition. The existing arc-shaped pavement cracks that cross Waiomao Road along the western boundary of the Waiomao Landslide also were previously sealed to reduce surface water infiltration.

The continued settlement of the roadway pavement immediately surrounding the existing storm drain manhole fronting 2340 Waiomao Road was observed. The pavement settlement has produced a noticeable bump located along the northern side of the southwest bound travel lane. In addition, the eastern boundary of the Waiomao Landslide that crosses Waiomao Road also was observed to exhibit a noticeable bump when crossing with a vehicle. The existing pavement patch at this location appears to be in fair condition.

Kuahea Street Area

Observation of the area along Kuahea Street at the head of the Waiomao Landslide indicates that the road pavement and northern road shoulder continue to experience some settlement of the ground surfaces. The ground settlements have produced uneven pavement surfaces with significant bumps that traverse the roadway. Large open cracks in the pavement at Kuahea Street were not observed, and the existing asphaltic concrete patches were observed to be in generally fair condition. However, some small fatigue cracks are beginning to appear along the existing pavement patches, which traverse the head scarp boundary of the earth movement.

Observation of the area surrounding the intersection of Kuahea Place and Kuahea Street do not indicate extraordinary signs of new pavement or structural deformation. The concrete driveway located at 2331 Kuahea Street is experiencing on-going distress related to widening cracks and deformation of the concrete pavement surrounding the existing water meter boxes.

The gaps located between the concrete pavement of Kuahea Street and the driveway at 2334 Kuahea Street have been sealed with concrete to reduce the infiltration of surface water along the curb alignment. The pavement gaps were identified previously in our Progress Report No. 5 for the project.

Vacant Graded Hillslopes

The existing graded hillslopes located within the footprint of the Waiomao Landslide as well as most of the area along Kipona Place at the toe of the landslide do not exhibit overt signs of earth movement or ground surface deformation. The exception being a localized area of possible renewed earth slump activity located

opposite of 2340 Kipona Place. The localized area, which measures approximately 10 feet wide and is located on the steeply sloping ground surface adjacent to the street, has exposed some rubbly fill material containing some cobbles and small boulders.

It appears that surface water runoff may have eroded the ground surface or initiated a small earth slump that has deposited a lobe of loose soil and rock material, which encroaches on the road shoulder up to the existing asphalt curb. The ground surface erosion has exposed some once-buried cobbles and small boulders that have the potential to come loose from the slope and roll into the roadway if disturbed further by surface water runoff. The loose rocks should be removed from the site to reduce the potential for the rocks to roll into the roadway. Other than the removal of the loose surface rocks, immediate remedial work does not appear to be warranted. However, if additional erosion or slumping of earth occurs, the situation should be investigated further to determine the possible cause and stabilization alternatives.

CLOSURE

We appreciate the opportunity to provide continued services to you for the above project. If you have questions or need additional information, please contact our office.

Respectfully submitted,

GEOLABS, INC.

By _____
Robin M. Lim, P.E.
Vice President

ROBIN M. LIM
LICENSED PROFESSIONAL ENGINEER
No. 8436-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

_____ 4-30-04
SIGNATURE EXPIRATION DATE OF THE LICENSE

RML:SC:cj

Attachments: Project Location Map, Plate 1
Instrument Location Plan, Plate 2

(4 Copies to Addressee)

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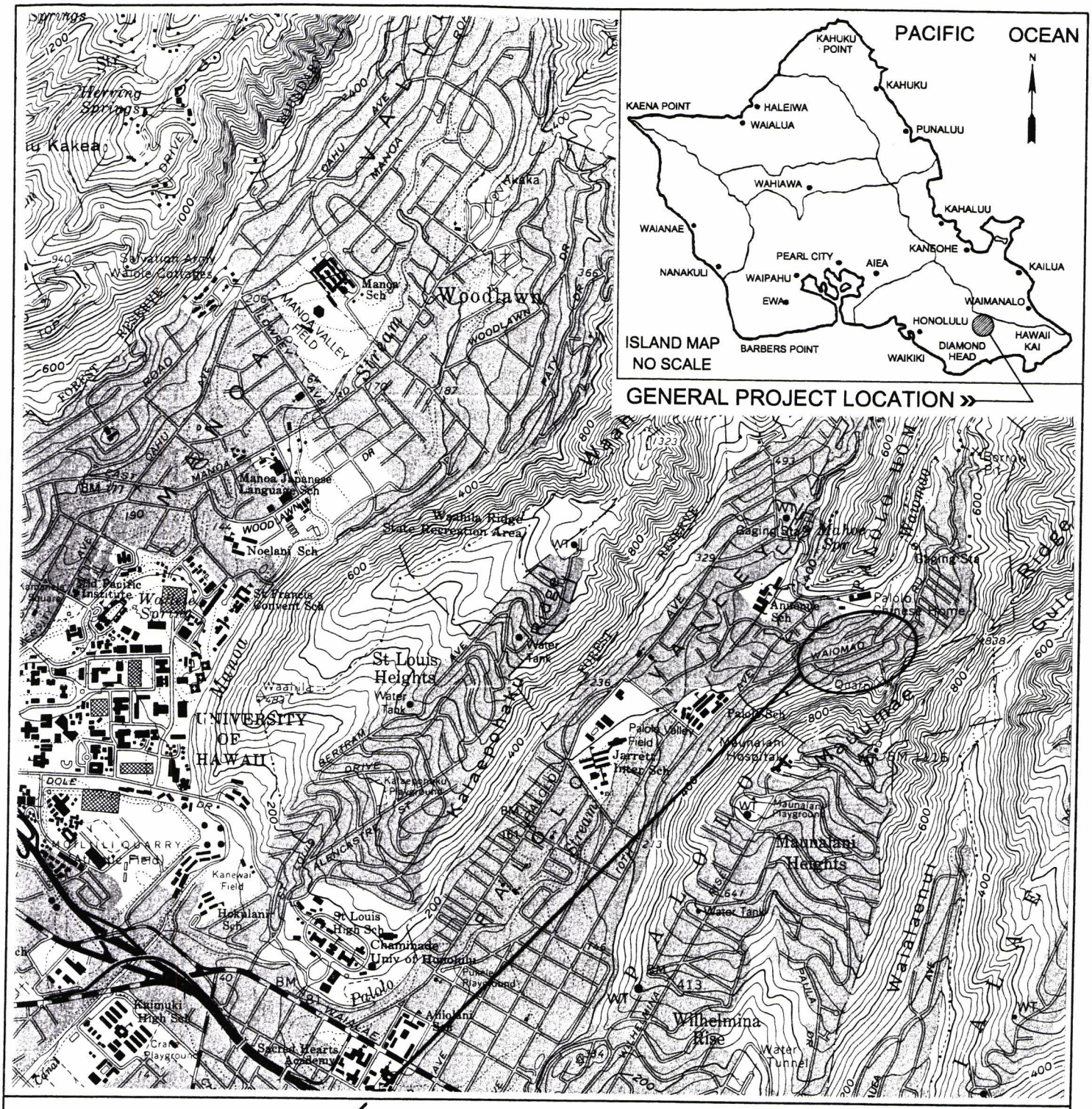

PROJECT LOCATION MAP

KUAHEA STREET AREA MOVEMENT
PALOLO, OAHU, HAWAII

2000 1000 0 2000 FT.

GRAPHIC SCALE

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REFERENCE: U.S.G.S. QUADRANGLE MAP; HONOLULU, OAHU, HAWAII (1983).

GEOLABS, INC.

Geotechnical Engineering

DATE	DRAWN BY	PLATE
FEBRUARY 2003	KHN	1
SCALE	W.O.	
1" = 2,000'	3917-20	

File: 3917-20PLM.dwg Feb 24, 2003 - 10:18am

LEGEND:

- APPROXIMATE LOCATION OF WAIOMAO LANDSLIDE
- APPROXIMATE LIMIT OF STUDY AREA
- APPROXIMATE LOCATION OF PIEZOMETER
- A+ APPROXIMATE LOCATION OF INCLINOMETER WITH DEPTH AND DIRECTION OF "A" POSITIVE AXIS ORIENTATION
- 3 APPROXIMATE LOCATION OF EXISTING SHORT LENGTH SUBDRAIN WITH IDENTIFICATION NUMBER
- APPROXIMATE LOCATION OF SUSPECTED EARTH MOVEMENT
- 6+00 PRE-EXISTING STATION IDENTIFICATION FOR MONITORING BY THE CITY'S STREET SURVEY
- 2265 STREET ADDRESS

REFERENCE: BASE MAP OBTAINED FROM CITY AND COUNTY OF HONOLULU, DEPARTMENT OF DESIGN AND CONSTRUCTION, GEOGRAPHIC INFORMATION SYSTEM DATABASE.

INSTRUMENT LOCATION PLAN

KUAHEA STREET AREA MOVEMENT
PALOLO, OAHU, HAWAII

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
FEBRUARY 2003	KHN	2
SCALE 1" = 150'	W.O. 3917-20	

File: 3917-20InstrumentLocationPlan.dwg Feb 26, 2003 - 12:13pm