GEOTECHNICAL ENGINEERING EXPLORATION

SITE IMPROVEMENTS AT
KAUMAHINA STATE WAYSIDE PARK
HONOMANU, MAUI, HAWAII

DECEMBER 23, 2025

Prepared for:
THE LIMTIACO CONSULTING GROUP, INC.

PROJECT NO. 060925-00

Kokua Geotech LLC
Soil and Foundation Engineering

December 23, 2025
Project No. 060925-00

The Limtiaco Consulting Group, Inc
1622 Kanakanui Street
Honolulu, Hawaii 96817

Attention: Mr. Jason Lau

Subject: **Geotechnical Engineering Exploration**
Site Improvements at Kaumahina State Wayside Park
Honomanu, Maui, Hawaii

Dear **Mr. Lau**:

We are pleased to submit this report entitled "Geotechnical Engineering Exploration, Site Improvements at Kaumahina State Wayside Park, Honomanu, Maui, Hawaii" prepared for the design of the project.

The purpose of our field exploration and this report was to observe and evaluate the general subsurface conditions at accessible locations at the project site to formulate geotechnical recommendations to assist in the design of the project. Our work was performed in general accordance with the scope of services outlined in our fee proposal dated June 10, 2025.

Our findings and recommendations are summarized as follows:

1. Our field exploration generally encountered surface fill materials overlying residual soils extending down to the maximum depth explored of about 16.5 feet below the existing ground surface. The surface fill materials encountered in the borings generally consisted of stiff sandy and clayey silts extending about 3 to 5 feet below the existing ground surface, where encountered. Underlying the surface fill materials, our borings generally encountered residual soils consisting of medium stiff to very stiff clayey silt with varying sand and gravel content. It should be noted that refusal conditions suspected to be boulders were encountered in Boring Nos. 3 and 5 at respective depths 4 feet and 8 feet below the existing ground surface.

2. We did not encounter groundwater in the borings at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

3. Based on the firm subsurface conditions encountered at the project site, we believe the planned picnic tables with covered shelters, retaining structures, and other improvements may be supported on a shallow foundation system consisting of spread and/or continuous footings or concrete slabs on-grade with thickened edge footings. In general, the bottom of the spread and/or continuous footings should be embedded a minimum of 18 inches below the lowest adjacent finished grade. An allowable bearing pressure of up to 2,500 pounds per square foot (psf) may be utilized for the design of shallow foundations bearing on properly recompacted on site soils. This bearing value is for supporting dead plus live loads and may be increased by one third (⅓) for transient loads, such as those caused by wind or seismic forces.

4. We anticipate that concrete slabs-on-grade will be utilized for the new picnic tables and walkways at the project site. We recommend capping the slab subgrade with a minimum 12-inch thick layer of non-expansive structural fill material compacted to a minimum of 90 percent relative compaction to address the low to moderate swell potential of the underlying on-site soils. The on-site soils encountered at the slab subgrade should be scarified to a depth of about 10 inches, moisture-conditioned to above the optimum moisture, and compacted to a minimum of 90 percent relative compaction. Soft and/or loose materials encountered at the bottom of the slab excavations should be over-excavated to expose the underlying firm materials and backfilled with structural fill material compacted to a minimum of 90 percent relative compaction.

5. We understand parking lot improvements for the project includes restriping of the parking stalls, construction of a new concrete swale, and possibly pavement reconstruction. Traffic loading conditions were not available at the time this report was prepared, however we anticipate vehicle loading will consist primarily of passenger vehicles, light pick-up trucks, and occasional heavy vehicular traffic. Based on these assumptions, our field exploration program and our laboratory test results, we recommend using the following pavement sections for preliminary design purposes:

   <u>Flexible Pavement for Parking Lot</u>
   3.0-Inch Asphaltic Concrete
   <u>6.0-Inch Aggregate Base Course (95 Percent Relative Compaction)</u>
   9.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

   <u>Rigid Pavement for Parking Lot</u>
   6.0-Inch Portland Cement Concrete
   <u>6.0-Inch Aggregate Subbase Course (95 Percent Relative Compaction)</u>
   12.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

6. In general, the on-site soils may be re-used as a source of general fill material, provided they are free of vegetation, deleterious materials, and rock fragments greater than 6 inches in maximum dimension. The soil samples collected and tested generally exhibited elevated moisture content; therefore, the in-situ soils may constantly be in a very moist to wet condition. Drying or aerating the excavated materials may be necessary prior to their use as general fill.

7. It should be noted that fills placed on slopes steeper than 5H:1V should be keyed and benched into the existing slope to provide stability of the new fill against sliding. The filling operations should start at the lowest point and continue up in level horizontal compacted layers in accordance with the fill placement recommendations presented in the "Site Grading" section herein.

8. Kokua Geotech LLC should also be retained to monitor the foundation excavations, site grading operations, aggregate base and subbase course placement and testing, and other aspects of earthwork construction to determine whether the recommendations of this report are followed. The recommendations presented herein are contingent upon such observations.

Detailed discussion of our findings and geotechnical engineering recommendations are contained in the body of this report. We appreciate the opportunity to be of service for this project. Should you have any questions concerning this report, please contact our office.

Very truly yours,

Kokua Geotech LLC

DRAFT

____

Xiaobin (Tim) Lin, P.E.
President

TABLE OF CONTENTS

PAGE

PLATES

APPENDIX A

APPENDIX B

APPENDIX C

GEOTECHNICAL ENGINEERING EXPLORATION
SITE IMPROVEMENTS AT KAUMAHINA STATE WAYSIDE PARK
HONOMANU, MAUI, HAWAII

SECTION 1.0 INTRODUCTION

We have performed a geotechnical engineering exploration for the *Site Improvements at Kaumahina State Wayside Park* project in Honomanu on the Island of Maui, Hawaii. The location of the project and general vicinity are shown on the Project Location Map, Plate 1.

The purpose of our exploration was to observe and evaluate the general subsurface conditions at the project site to formulate geotechnical recommendations to assist in the design of the project. This report summarizes the findings and presents our geotechnical recommendations resulting from our site reconnaissance, field exploration, laboratory testing, and engineering analyses for the project. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

1.1 PROJECT CONSIDERATIONS

The project generally involves site improvements at the Kaumahina State Wayside Park in Honomanu on the Island of Maui, Hawaii. The project site is generally located along the mauka side of Hana Highway (Route 360) near mile marker 12.2.

The park is generally located on approximate 7.8-acre parcel consisting of about 1 acre of open lawn and parking space, and the remainder generally occupied by forest area. The site improvements projects is generally limited to the approximate 1-acre area. The project site generally consists of a parking lot at the north connecting to Hana Highway, a comfort station, and a lawn that slopes upwards and south towards the tree line. The lawn area includes an asphaltic concrete (AC) paved walkway connecting the parking lot to three picnic tables. A fourth picnic table is generally located at the east end of the project site near a lookout overseeing Ke'anae Point.

Based on the information provided, we understand it is desired to improve the park visitor experience with new covered picnic areas, drainage improvements, and waterline replacement. The improvements are generally listed below and shown on the Site Plan, Plate 2.

1. Replace three existing picnic tables with five new picnic tables with covered shelters
2. New rain garden near the existing comfort station
3. Replace existing AC walkway with a new concrete walkway
4. Replace approximately 550 linear feet of 2-inch diameter waterline
5. Site grading consisting of cuts of 4 feet or less
6. New retaining walls of up to 2.5 feet high for grade separation
7. Parking lot improvements including restriping and a new concrete swale

1.2 PURPOSE AND SCOPE OF WORK

The purpose of our services was to generally explore and evaluate the subsurface soil conditions at accessible locations at the project site to provide geotechnical recommendations to assist in the design of the project. The work was performed in general accordance with our fee proposal dated June 10, 2025. The scope of work for this exploration included the following items:

1. Coordination of boring stake-out and utility clearances by our engineer.
2. Mobilization and demobilization of a truck-mounted drill rig and two operators from Honolulu to and from the project site.
3. Drilling and sampling of six boreholes extending to depths ranging from about 3 to 16.5 feet below the existing ground surface. A bulk sample of the near-surface soils was collected for California Bearing Ratio (CBR) analysis.
4. Performance of one field infiltration test.
5. Provide a field engineer to observe and log the borings, obtain samples, and perform a general reconnaissance of the project site.
6. Perform laboratory tests of selected soil samples obtained during the field exploration as an aid in classifying the materials and evaluating their engineering properties.

7. Analyses of the field and laboratory data to formulate geotechnical recommendations to assist in the design of the project.

8. Preparation of this report summarizing our findings and presenting our geotechnical recommendations for the project.

9. Coordination of our overall work on the project by our senior engineer.

10. Quality assurance and client/design team consultation by our principal engineer.

11. Miscellaneous work efforts such as drafting, word processing, and clerical support.

Detailed descriptions of our field exploration methodology are presented in the following section, and the Logs of Borings are presented in Appendix A. Results of the laboratory tests performed on selected samples are presented in Appendix B. Results of the infiltration test performed at the site are presented in Appendix C.

END OF INTRODUCTION

SECTION 2.0 SITE CHARACTERIZATION AND FINDINGS

2.1 GENERAL SITE GEOLOGY

The project site is generally located on the northeastern flank of the East Maui Volcano, also known as Haleakala, on the Island of Maui. Based on the geologic maps of the Island of Maui (Sherrod, Sinton, Watkins, and Brunt, 2021), the general area of the project site is underlain by Lava Flows (Tk) of the Kula Volcanic Series.

Haleakala was generally built in three distinguishable series of lava flows. The lower unit, the Honomanu Volcanic Series (late Pliocene to early Pleistocene Epoch) consists of thinly-bedded, basaltic pahoehoe and a'a lavas. These lavas tend to be very permeable and carry water for the basal aquifer. Overlying this unit is the Kula Volcanic Series (early Pleistocene Epoch), composed primarily of thicker alkalic a'a flows, which may contain many inter-stratified, thin residual-soil layers.

A long quiescent period followed, during which time, canyons were carved in the volcano, although a few eruptions may have occurred during this erosion interval in addition to erosion due to eustatic changes (higher and lower stands of the sea level). At the end of the rest period, copious flows erupted along the southwest and east rifts. This is the third and upper rock unit, known as the Hana Volcanic Series (Pleistocene Epoch). The lavas range in composition from ultra-basic olivine porphyries to non-porphyritic, alkalic basalts.

In-situ weathering of these lava flows has occurred, forming a mantle of residual and saprolitic soils overlying the top of the basalt rock formation. In general, saprolite is composed mainly of silty material that may exhibit a relict structure (vesicles, joints, etc.) from its parent rock, while residual soil tends to be more clayey and is usually "structureless." Both residual and saprolitic soils are typical of the tropical weathering of volcanic rocks. The residual and saprolitic soils grade to basaltic rock formation with increased depth.

The subsurface soils underlying the project site are classified as Kailua silty clay (KBID) by the U.S. Soil Conservation Service in their publication "Soil Survey of Islands of Kauai, Maui, Maui, Molokai and Lanai, State of Hawaii" (1972). The Kailua silty clay is generally described to be on low uplands developed in volcanic ash. The subsurface generally consists of silty clay exhibiting more remnant subangular block structure with depth until reaching a substratum of soft, weathered igneous rock. Mass grading and development of the project site and the surrounding Hana Highway have brought the project site to its present form.

2.2 SITE DESCRIPTION

The project site is the Kaumahina State Wayside Park located in Honomanu on the Island of Maui, Hawaii. The project site provides a rest stop along Hana Highway at approximately mile marker 12.2 for visitors traveling to Hana from Kahului. The park generally sits on a bluff at an elevation of approximately +375 feet Mean Sea Level (MSL) which oversees the adjacent Honomanu and Nua'ailua Bays to the east.

As previously mentioned, the mass grading and development of the park and the surrounding Hana Highway have brought the project site to its present form. Based on our site observations and the grading plan provided, the project site generally slopes down from south to north. The project site is steepest along the southern boundary with grades of about three horizontal to one vertical (3H:1V) whereas the central to northern portion of the project site (existing parking lot) is flatter with grades of about 6 to 8 percent. The existing ground surface elevations generally range between about +365 feet MSL at the north and +390 feet MSL at the southeast corner of the project site.

2.3 FIELD EXPLORATION

We explored the subsurface conditions at the project site by drilling and sampling six borings, designated as Boring Nos. 1 through 6, extending to depths ranging from about 3 to 16.5 feet below the existing ground surface. Boring Nos. 1 through 5 were drilled utilizing a truck-mounted drill rig equipped with continuous flight augers. Due to access restrictions, Boring No. 6 was hand augered and sampled to a depth of about 3 feet below the existing ground surface. The approximate boring locations are shown on the Site Plan, Plate 2.

Boring No. 5 was drilled and sampled in the parking lot to explore the subsurface conditions beneath the pavement surface. In addition, a bulk sample of the near-surface soils was obtained at this location – designated herein as Bulk-5 – to perform laboratory testing to determine the engineering properties of the on-site soils.

Our engineer classified the materials encountered in the borings by visual and textural examination in the field in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils, and monitored the drilling operations on a near continuous (full-time) basis. These classifications were further reviewed visually and by testing in the laboratory. Soils were classified in general accordance with ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). Graphic representations of the materials encountered are presented on the Logs of Borings, Appendix A.

Soil samples were obtained from the drilled borings in general accordance with ASTM D1586, Penetration Test and Split-Barrel Sampling of Soils, by driving a 2-inch OD standard penetration sampler with a 140-pound hammer falling 30 inches. The blow counts needed to drive the sampler the second and third 6 inches of an 18-inch drive are shown as the "Penetration Resistance" on the Logs of Borings at the appropriate sample depths.

2.4 LABORATORY TESTING

Moisture Content (ASTM D2216) determinations were performed on selected samples as an aid in the classification and evaluation of soil properties. The test results are presented on the Logs of Borings at the appropriate sample depths.

Four Atterberg Limits tests (ASTM D4318) were performed on selected soil samples to evaluate the liquid and plastic limits. Two of the tested samples exhibited non-plastic properties whereas the other two samples tested exhibited about 48 percent Liquid Limit and about 16 percent Plasticity Index resulting in silty soils. The test results are summarized on the Logs of Borings at the appropriate sample depths. Graphic presentations of the Atterberg Limits test results are provided on Plate B-1.

Three one-inch Ring Swell tests were performed on remolded samples to evaluate the swelling potential of the on-site soils. The swell test results ranged between about 0.3 and 1 percent indicating the tested soils have low swelling potential when subjected to moisture fluctuations. The Ring Swell test results are summarized on Plate B-2.

One laboratory California Bearing Ratio (CBR) test (ASTM D1883) was performed on a bulk sample of the near-surface soils to evaluate the pavement support characteristics of the on-site soils. Results of our laboratory CBR test indicates the on-site soils tested has a CBR value of about 30.5 with a corresponding swell of about 0.2 percent. The CBR test results are presented on Plate B-3.

2.5 SUBSURFACE CONDITIONS

Our borings generally encountered surface fill materials over residual soils extending to the maximum depth explored of about 16.5 feet below the existing ground surface. The surface fill materials generally consisted of stiff sandy and clayey silts extending about 3 to 5 feet below the existing ground surface, where encountered.

Underlying the surface fill materials, our borings generally encountered residual soils extending to the maximum depth explored of about 16.5 feet below the existing ground surface. The residual soils generally consisted of medium stiff to very stiff clayey silt with varying sand and gravel content. It should be noted that refusal conditions suspected to be boulders were encountered in Boring Nos. 3 and 5 at respective depths 4 feet and 8 feet below the existing ground surface.

We did not encounter groundwater in the borings at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

2.6 SEISMIC DESIGN CONSIDERATIONS

Based on the International Building Code, 2018 Edition (IBC 2018) and American Society of Civil Engineers Standard ASCE/SEI 7-16 (ASCE 7-16), the project site may be subject to seismic activity, and seismic design considerations will need to be addressed. Based on the subsurface materials encountered at the project site and the geologic setting of the area, we anticipate the project site may be classified from a seismic analysis standpoint as being a “Stiff Soil” site corresponding to a Site Class D soil profile type based on Chapter 20 of ASCE 7-16.

Based on Site Class D, the following seismic design parameters were estimated and may be used for seismic analysis of the project.

SUMMARY OF SEISMIC DESIGN PARAMETERS	
Mapped MCE Spectral Response Acceleration, S_S	1.058 g
Mapped MCE Spectral Response Acceleration, S_1	0.273g
Site Class	D
Site Coefficient, F_a	1.077
Site Coefficient, F_v	2.054
Design Spectral Response Acceleration, S_{DS}	0.759g
Design Spectral Response Acceleration, S_{D1}	0.374g
Peak Ground Acceleration, PGA	0.379g
Site Modified Peak Ground Acceleration, PGA_M	0.462g

Based on the subsurface conditions encountered, the phenomenon of soil liquefaction is not a design consideration for this project site.

END OF SITE CHARACTERIZATION AND FINDINGS

SECTION 3.0 DISCUSSION AND RECOMMENDATIONS

Based on the results from our field exploration, the project site is generally underlain by surface fill materials overlying residual soils extending down to the maximum depth explored of about 16.5 feet below the existing ground surface. The surface fill materials encountered in the borings generally consisted of stiff sandy and clayey silts extending about 3 to 5 feet below the existing ground surface, where encountered. Underlying the surface fill materials, our borings generally encountered residual soils consisting of medium stiff to very stiff clayey silt with varying sand and gravel content. It should be noted that refusal conditions suspected to be boulders were encountered in Boring Nos. 3 and 5 at respective depths 4 feet and 8 feet below the existing ground surface.

We did not encounter groundwater in the borings at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

Based on the firm subsurface conditions encountered at the project site, we believe the planned picnic tables with covered shelters, retaining structures, and other improvements may be supported on a shallow foundation system consisting of spread and/or continuous footings or concrete slabs-on-grade with thickened edge footings. In general, the bottom of the spread and/or continuous footings should be embedded a minimum of 18 inches below the lowest adjacent finished grade. An allowable bearing pressure of up to 2,500 pounds per square foot (psf) may be utilized for the design of shallow foundations bearing on properly recompacted on site soils. This bearing value is for supporting dead plus live loads and may be increased by one third (⅓) for transient loads, such as those caused by wind or seismic forces.

We anticipate that concrete slabs-on-grade will be utilized for the new picnic tables and walkways at the project site. We anticipate the on-site clayey/silty soils have a low to moderate expansion potential when subjected to moisture fluctuations. To reduce the potential for changes in the moisture content of the slab subgrade clayey soils, we recommend capping the slab subgrade with a minimum 12-inch thick layer of non-expansive structural fill material compacted to a minimum of 90 percent relative compaction. The on-site soils encountered at the slab subgrade should be scarified to a depth of about 10 inches, moisture-conditioned to above the optimum moisture, and compacted to a minimum of 90 percent relative compaction. Soft and/or loose materials encountered at the bottom of the slab excavations should be over-excavated to expose the underlying firm materials and backfilled with structural fill material compacted to a minimum of 90 percent relative compaction.

We understand parking lot improvements for the project includes restriping of the parking stalls, construction of a new concrete swale, and possibly pavement reconstruction. Traffic loading conditions were not available at the time this report was prepared, however we anticipate vehicle loading will consist primarily of passenger vehicles, light pick-up trucks, and occasional heavy vehicular traffic. Based on these assumptions, our field exploration program and our laboratory test results, we recommend using the following pavement sections for preliminary design purposes:

<u>Flexible Pavement for Parking Lot</u>
3.0-Inch Asphaltic Concrete
<u>6.0-Inch Aggregate Base Course (95 Percent Relative Compaction)</u>
9.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

<u>Rigid Pavement for Parking Lot</u>
6.0-Inch Portland Cement Concrete
<u>6.0-Inch Aggregate Subbase Course (95 Percent Relative Compaction)</u>
12.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

In general, the on-site soils may be re-used as a source of general fill material, provided they are free of vegetation, deleterious materials, and rock fragments greater than 6 inches in maximum dimension. The soil samples collected and tested generally exhibited elevated moisture content; therefore, the in-situ soils may constantly be in a very moist to wet condition. Drying or aerating the excavated materials may be necessary prior to their use as general fill.

It should be noted that fills placed on slopes steeper than 5H:1V should be keyed and benched into the existing slope to provide stability of the new fill against sliding. The filling operations should start at the lowest point and continue up in level horizontal compacted layers in accordance with the fill placement recommendations presented in the “Site Grading” section herein.

Detailed discussion of these items and our geotechnical recommendations for design of the new foundations, slabs-on-grade, retaining structures, site grading, pavements, and other geotechnical aspects of the project are further discussed in the following sections.

3.1 SHALLOW FOUNDATIONS

Based on the subsurface conditions encountered at the project site, we believe shallow spread and/or continuous strip footings or concrete slabs-on-grade with thickened edge footings may be used to support the planned picnic tables and covered shelters at the project site. An allowable bearing pressure of up to 2,500 pounds per square foot (psf) may be utilized for the design of shallow foundations bearing on properly recompacted on-site soils. This bearing value is for supporting dead-plus-live loads and may be increased by one-third (⅓) for transient loads, such as those caused by wind or seismic forces.

In general, the bottom of footings should be embedded a minimum of 18 inches below the lowest adjacent finished grades. Footings constructed near tops of slopes or on sloping ground should be embedded deep enough to provide a minimum horizontal set-back distance of 6 feet measured from the outside edge of the footings to the slope face. Loose fill material or topsoil on the slope face should not be included when determining the extent of lateral cover.

Footings located adjacent to planned (or existing) retaining walls should be embedded deep enough to avoid surcharging the retaining wall foundations. Foundations next to utility trenches should be embedded below a one horizontal to one vertical (1H:1V) imaginary plane extending upward from the bottom edge of the utility trench, or the foundation should be extended to a depth as deep as the inverts of the utility lines. This requirement is necessary to avoid surcharging adjacent below-grade structures with additional structural loads and to reduce the potential for appreciable foundation settlement.

If foundations are designed and constructed in strict accordance with the recommendations presented herein, we estimate total settlements of the foundations to be less than 1 inch. Differential settlements between adjacent footings supported on similar materials may be on the order of about 0.5 inch or less.

Lateral loads acting on the structures may be resisted by friction between the base of the foundation and the bearing materials and by passive earth pressure developed against the near-vertical faces of the embedded portion of foundations. A coefficient of friction of 0.4 may be used for footings bearing directly on new compacted fills or the recompacted on-site soils. Resistance due to passive earth pressure may be estimated using an equivalent fluid pressure of 360 pounds per square foot per foot of depth (pcf). This assumes that the backfill around the footings are well-compacted. Unless covered by pavements or slabs, the passive resistance in the upper 12 inches of soil should be neglected.

Resistance to uplift loads may be mobilized by the dead weight of the structure and the footings and/or slabs. In addition, the weight of the soil above the footings may be used to resist uplift loads. Contribution of dead weight from the soil above the footings may be estimated using a unit weight of 110 pounds per cubic foot (pcf).

A Kokua Geotech LLC representative should observe footing excavations prior to placement of the reinforcing steel and concrete to confirm the foundation bearing conditions and the required embedment depths.

3.2 SLABS-ON-GRADE

We anticipate that concrete slabs-on-grade will be utilized for the new picnic tables and walkways at the project site. We anticipate the on-site clayey/silty soils have a low to moderate expansion potential when subjected to moisture fluctuations. To reduce the potential for changes in the moisture content of the slab subgrade clayey soils, we recommend capping the slab subgrade with a minimum 12-inch thick layer of non-expansive structural fill material. The structural fill should be compacted to a minimum of 90 percent relative compaction.

Prior to placement of the structural fill, the on-site soils encountered at the slab subgrade should be scarified to a depth of about 10 inches, moisture-conditioned to above the optimum moisture, and compacted to a minimum of 90 percent relative compaction. Soft and/or loose materials encountered at the bottom of the slab excavations should be over-excavated to expose the underlying firm materials. The over-excavation should be backfilled with structural fill material compacted to a minimum of 90 percent relative compaction.

Where the slabs will be subjected to equipment vibration and/or vehicular traffic, we recommend placing a minimum 6-inch thick layer of aggregate subbase below the slabs and above the structural fill. The aggregate subbase should consist of crushed basaltic aggregates compacted to a minimum of 95 percent relative compaction.

Control joints should be provided along planned walkways at intervals equal to the width of the walkway with expansion joints at right-angle intersections. The thickened edges of slabs adjacent to unpaved areas should be embedded at least 12 inches below the lowest adjacent grade. It should be emphasized that the areas adjacent to the slab edges should be backfilled tightly against the edges of the slabs with relatively impervious soils. These areas should also be graded to divert water away from the slabs and to reduce the potential for water ponding around the slabs.

3.3 RETAINING STRUCTURES

Based on the information provided, we understand retaining walls are planned to provide grade separation at the project site. Therefore, we are providing the following guidelines for the design of retaining structures for the project. Design of foundations for the retaining wall structures should be based on the parameters presented in the "Shallow Foundations" section herein.

3.3.1 STATIC LATERAL EARTH PRESSURES

Retaining structures should be designed to resist lateral earth pressures due to the adjacent soils and surcharge effects caused by loads adjacent to the walls. The recommended lateral earth pressures for the design of the retaining structures, expressed in equivalent fluid pressures of pounds per square foot per foot of depth (pcf), are presented in the following table.

LATERAL EARTH PRESSURES FOR DESIGN OF RETAINING STRUCTURES			
Backfill Condition	**Earth Pressure Component**	**Active** (pcf)	**At-Rest** (pcf)
Level Backfill	Horizontal	40	60
	Vertical	None	None
Maximum 3H:1V Sloping Backfill	Horizontal	45	64
	Vertical	16	23

The values provided above assume that on-site soils will be used to backfill behind the retaining structures. It is assumed that the backfill behind the retaining structures will be compacted to between 90 and 95 percent relative compaction per ASTM D1557. Over-compaction of the retaining structure backfill should be avoided.

In general, an active condition may be used only for gravity walls or walls that are free to deflect by as much as 0.5 percent of the structure height. If the tops of structures are not free to deflect beyond this degree, the structures should be designed for the at-rest condition. These lateral earth pressures do not include hydrostatic pressures that might be caused by groundwater trapped behind the structures.

Surcharge stresses due to areal surcharges, line loads, and point loads within a horizontal distance equal to the depth of the structure should be considered in the design. For uniform surcharge stresses imposed on the loaded side of the structure, a rectangular distribution with a uniform pressure equal to 33 percent of the vertical surcharge pressure acting over the entire height of the wall, which is free to deflect (cantilever), may be used in the design. For walls that are restrained, a rectangular distribution equal to 50 percent of the vertical surcharge pressure acting over the entire height of the structure may be used for design. Additional analyses during design may be needed to evaluate the surcharge effects of point loads and line loads.

3.3.2 DYNAMIC LATERAL EARTH PRESSURES

Dynamic lateral earth forces due to seismic loading will need to be considered in the design of the retaining structures. Seismic loading is used to estimate the dynamic lateral earth pressure based on a peak ground acceleration (PGA or a_{max}) of 0.50g. The table below summarizes the dynamic lateral earth forces acting on the retaining structures in the event of an earthquake versus the estimated wall displacements.

Please note that the values provided in the table only apply to level backfill conditions, where "H" is the height of the wall in feet. The resultant force should be assumed to act through the mid-height of the wall. The dynamic lateral earth forces are in addition to the static lateral earth pressures provided previously.

DYNAMIC LATERAL EARTH FORCES FOR RETAINING STRUCTURES	
Lateral Movement (inches)	Dynamic Lateral Earth Forces (H^2 pounds per linear foot)
0.5	17.7
1.0	13.8
1.5	12.1
2.0	11.0
Note: "H" is the height of the retaining structure in feet.	

3.3.3 RETAINING STRUCTURE DRAINAGE

The retaining structures should be well-drained to reduce the potential for build-up of hydrostatic pressures. A typical drainage system would consist of a 12-inch wide zone of permeable material, such as No. 3 Fine gravel (ASTM C33, No. 67 gradation), placed directly around a perforated pipe (perforations facing down) at the base of the wall discharging to an appropriate outlet or weep holes. As an alternative, a prefabricated drainage product, such as MiraDrain, may be used instead of the drainage material. The prefabricated drainage product also should be hydraulically connected to a perforated pipe at the base of the wall.

The backfill from the bottom of the wall to the bottom of the perforated pipe or weep hole should consist of relatively impervious materials to reduce the potential for significant water infiltration into the subsurface. In addition, the upper 12 inches of the retaining structure backfill should consist of relatively impervious materials to reduce the potential for significant water infiltration behind the retaining structure unless covered by concrete slabs at the surface.

3.4 SITE GRADING

Based on the Grading Plan prepared by The Limtiaco Consulting Group, Inc. dated November 2025, we anticipate grading for the project to generally consist of cuts and fills of up to 4 feet deep/thick and grading related to the foundation construction and infrastructure installation. Site grading items that are addressed in the subsequent subsections include the following:

1. Site and Subgrade Preparation
2. Excavations
3. Fill Materials
4. Fill Compaction Requirements
5. Cut and Fill Slopes

A Kokua Geotech LLC representative should monitor site grading operations to observe whether undesirable materials are encountered during the excavation and scarification process, and to confirm whether the exposed soil conditions are similar to those assumed in this report.

3.4.1 SITE AND SUBGRADE PREPARATION

At the on-set of earthwork, the area within the contract grading limits should be cleared and grubbed thoroughly. Surface vegetation, debris, deleterious materials, and other unsuitable materials should be removed and disposed of properly off-site. After clearing and grubbing, areas to receive fills and finished subgrades in cut areas should be scarified to a depth of 8 inches, moisture-conditioned to above the optimum moisture content, and compacted to a minimum of 90 percent relative compaction.

Soft and yielding areas encountered during clearing should be over-excavated to expose firm material, and the resulting excavation should be backfilled with general fill materials compacted to a minimum of 90 percent relative compaction. The excavated soft soils should be properly disposed of off-site and/or used in landscape areas, where appropriate.

Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavating the soft areas and replacing these areas with well-compacted structural fill. A Kokua Geotech LLC field representative should evaluate the need for over-excavation due to soft subgrade soil conditions.

3.4.2 EXCAVATIONS

All excavations should be made in accordance with applicable Occupational Safety and Health Administration (OSHA) and state regulations. The contractor should determine the method and equipment to be used for the excavations, subject to practical limits and safety considerations. In addition, the excavations should comply with the applicable federal, state, and local safety requirements. The contractor should be responsible for trench shoring design and installation.

Based on the information provided, we envision excavations for the project may consist of cuts of up to 4 feet deep for the proposed improvements. Based on our borings and field observations, these excavations will generally encounter stiff clayey and sandy silts. It should be noted that our borings encountered hard boulders and/or cobbles at relatively shallow depths which may be encountered within the excavation depths.

It is anticipated that most of the material may be excavated with normal heavy excavation equipment. However, excavations encountering large boulders may require the use of hoerams. Contractors should be encouraged to examine the site conditions and the subsurface data to make their own reasonable and prudent interpretation.

3.4.3 FILL MATERIALS

In general, the on-site soils may be re-used as a source of general fill material, provided they are free of vegetation, deleterious materials, and rock fragments greater than 6 inches in maximum dimension.

Imported structural fill materials should consist of imported, non-expansive granular material such as crushed coral or basalt. In addition, the structural fill material should be well-graded from coarse to fine with particles no larger than 3 inches in largest dimension. The material should have a CBR value of 20 or higher and a swell potential of 1 percent or less when tested in accordance with ASTM D1883. The material should also contain between 10 and 30 percent particles passing the No. 200 sieve.

Aggregate base course and select borrow for subbase course should meet the respective material requirements as specified in Sections 31 and 30 of the Standard Specifications for Public Works Construction, County of Maui, September 1986.

3.4.4 FILL COMPACTION REQUIREMENTS

The soil samples collected and tested generally exhibited elevated moisture contents; therefore, the in-situ soils may constantly be in a very moist to wet condition. Drying or aerating the excavated materials may be necessary prior to their use as general fill.

General fill materials should be moisture-conditioned to above the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 90 percent relative compaction. The non-expansive structural fill materials should be placed in level lifts of about 8 inches in loose thickness, moisture-conditioned to above the optimum moisture, and compacted to at least 90 percent relative compaction.

The aggregate base course and subbase course materials should be moisture-conditioned to above the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 95 percent relative compaction.

Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D1557 test procedures. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

3.4.5 CUT AND FILL SLOPES

Based on the results of our field exploration, we recommend cut and fill slopes be designed with a slope inclination of 3H:1V or flatter. We envision the cut slopes at the project site generally will expose the stiff clayey and sandy silts encountered in the borings.

Fills placed on slopes steeper than 5H:1V should be keyed and benched into the existing slope to provide stability of the new fill against sliding, as shown on the Typical Keying and Benching Detail, Plate 3. The filling operations should start at the lowest point and continue up in level horizontal compacted layers in accordance with the above fill placement recommendations.

Fill slopes should be constructed by overfilling and cutting back to the design slope ratio to obtain a well-compacted slope face. Track-rolling of slopes should not be permitted. If over-cutting of a slope occurs, keying and benching requirements should be implemented instead of backfilling the slope to the design grade with sliver fills. Water should be diverted away from the tops of slopes and slope planting should be provided as soon as possible to reduce the potential for erosion of the finished slopes.

3.5 PAVEMENTS

We understand parking lot improvements for the project includes restriping of the parking stalls, construction of a new concrete swale, and possibly pavement reconstruction. Detailed traffic projections and design traffic loading conditions were not available for the parking lot at the time this report was prepared. In general, we anticipate vehicle loading will consist primarily of passenger vehicles, light pick-up trucks, and occasional heavy vehicular traffic.

We anticipate the pavement subgrades within the parking lot generally consist of silty soils with varying amounts of sand and gravel as encountered during our field exploration. Based on the laboratory test results, a design CBR value of 30 with a corresponding CBR swell value of less than 1 percent was adopted in our pavement analyses for the anticipated subgrade conditions in the parking lot. Based on these assumptions, we recommend using the following pavement sections for preliminary design purposes:

Flexible Pavement for Parking Lot
3.0-Inch Asphaltic Concrete
6.0-Inch Aggregate Base Course (95 Percent Relative Compaction)
9.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

Rigid Pavement for Parking Lot
6.0-Inch Portland Cement Concrete
6.0-Inch Aggregate Subbase Course (95 Percent Relative Compaction)
12.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

The pavement subgrade soils should be scarified to a minimum depth of about 8 inches, moisture-conditioned to above the optimum moisture content, and compacted to not less than 95 percent relative compaction prior to placing the aggregate base and subbase course layers.

The subgrade soils should be thoroughly moistened and kept moist until covered by the pavement structural section.

Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D1557 test procedures. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

Soft and yielding areas encountered during subgrade preparation should be over-excavated to expose firm material, and the resulting excavation should be backfilled with well-compacted aggregate base course material. The excavated soft soils should be properly disposed of off-site and/or used in landscape areas, where appropriate.

Aggregate base course and subbase course materials should consist of crushed aggregates compacted to at least 95 percent relative compaction in accordance with ASTM D1557 test procedures. CBR and field density tests should be performed on the actual materials used during construction to confirm the adequacy of the above section. The recommended section also assumes that adequate drainage will be provided for the paved areas.

Paved areas should be sloped, and drainage gradients should be maintained to carry the surface water off the site. Surface water ponding should not be allowed on the site during or after construction.

3.6 UTILITY TRENCHES

We understand that replacement of the underground waterline is required for the project. As discussed above, all excavations should be made in accordance with applicable Occupational Safety and Health Administration (OSHA) and state regulations. The contractor should determine the method and equipment to be used for utility trench excavation, subject to practical limits and safety considerations. In addition, the trench excavations should comply with the applicable federal, state, and local safety requirements. The contractor should be responsible for trench shoring design and installation.

In general, we recommend providing granular bedding consisting of 6 inches of open-graded gravel, such as No. 3 Fine gravel (ASTM C33, No. 67 gradation), under the pipes for uniform support. Where soft and/or loose soils are encountered at or near the invert of the pipes, a stabilization layer consisting of additional 18 inches of open-graded gravel wrapped in a non-woven filter fabric (Mirafi 180N or equivalent) should be provided below the bedding layer for uniform support.

In addition, open-graded gravel (ASTM C33, No. 67 gradation) should be used for the initial trench backfill up to about 12 inches above the pipes to provide adequate support around the pipes. It is critical to use a free-draining material, such as open-graded gravel, to reduce the potential for formation of voids below the haunches of pipes and to provide adequate support for the sides of the pipes. Improper trench backfill could result in backfill settlement and pipe damage.

Trench backfill material above the open-graded gravel may consist of general fill materials (on-site soils) or structural fill material. The backfill should be placed in maximum 8-inch level loose lifts and mechanically compacted to no less than 90 percent relative compaction to reduce the potential for appreciable future ground subsidence. The upper 2 feet below the finished grade in areas subjected to vehicular traffic should be compacted to a minimum of 95 percent relative compaction.

3.7 FIELD INFILTRATION TESTING

We understand that the project will include a new rain garden for Low Impact Development (LID) improvements for the on-site management of stormwater runoff. In order to obtain subsurface infiltration information in support of the planning of the new rain garden, we conducted a falling head infiltration test, designated herein as Infiltration Test No. 1, at a selected location at the project site. The approximate field infiltration test location is shown on the Site Plan, Plate 2.

The field infiltration test was performed generally in accordance with the procedures in Appendix D of the State of Maryland Department of the Environment "Stormwater Design Manual, Volumes I and II" (rev. 2009). These procedures are consistent with other state's procedures and may generally be considered an industry standard.

The field infiltration test was performed by first augering a boring to the selected test depth, generally about 4 feet below the existing ground surface, and then inserting solid PVC casing to the bottom of the borehole. Falling head infiltration tests were then performed in the borehole to determine the average infiltration rates of the underlying subsurface materials. Each test consisted of four trials of filling the borehole with 24 inches of water and taking periodic readings over a 1-hour trial period. The infiltration rates are then calculated based on the results of the fourth and last trial for each test location. The calculated infiltration rate at the test location is summarized in the following table and in Appendix C.

FIELD INFILTRATION TEST RESULTS		
Test Location	**Test Depth** (feet)	**Average Measured Infiltration Rate** (inches/hour)
I-1	4.0	4.0

It should be noted that the infiltration test was conducted through an approximate 4-inch diameter borehole, which may not represent the actual percolation condition within the entire infiltration system footprint. Therefore, it is necessary to require the contractor to verify the actual infiltration rate during construction. A Kokua Geotech LLC representative should observe the excavation for the infiltration systems to confirm the anticipated infiltration substrata conditions.

3.8 DESIGN REVIEW AND CONSTRUCTION OBSERVATION SERVICES

The construction plans and specifications for the project should be forwarded to us for review to determine whether the recommendations contained in this report are adequately reflected in those documents. If this review is not made, Kokua Geotech LLC cannot assume responsibility for misinterpretation of our recommendations.

Kokua Geotech LLC should also be retained to monitor the foundation excavations, site grading operations, aggregate base and subbase course placement and testing, and other aspects of earthwork construction to determine whether the recommendations of this report are followed. The recommendations presented herein are contingent upon such observations.

If the actual exposed subsurface soil conditions encountered during construction differ from those assumed or considered in this report, Kokua Geotech LLC should be contacted to review and/or revise the geotechnical recommendations presented herein.

END OF DISCUSSION AND RECOMMENDATIONS

SECTION 4.0 LIMITATIONS

This report has been prepared for the exclusive use of The Limtiaco Consulting Group, Inc and their project consultants for specific application to the design of the *Site Improvements at Kaumahina State Wayside Park* project in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied. If any part of the project concept is altered or if subsurface conditions differ from those described in this report, then the information presented herein shall be considered invalid, unless the changes are reviewed, and any supplemental or revised recommendations issued in writing by Kokua Geotech LLC.

The analyses and report recommendations are based in part upon information obtained from the field borings and the assumption that subsurface conditions do not vary significantly from those observed in the borings. Variations of the subsurface conditions between and beyond the field borings may occur, and the nature and extent of these variations may not become evident until construction is underway. If variations then appear evident, Kokua Geotech LLC should be notified so that we can re-evaluate the recommendations presented herein.

The owner/client should be aware that unanticipated soil conditions are commonly encountered. Unforeseen subsurface conditions, such as perched groundwater, soft deposits, hard layers or cavities, may occur in localized areas and may require additional probing or corrections in the field (which may result in construction delays) to attain a properly constructed project. Therefore, a sufficient contingency fund is recommended to accommodate these possible extra costs.

The field borehole locations indicated herein are approximate, having been estimated by using a handheld Global Positioning System (GPS) to field locate the selected locations shown on the Grading Plan prepared by The Limtiaco Consulting Group, Inc dated November 2025. Elevations of the borings were estimated from contours shown on the same plan. The field boring locations and elevations should be considered accurate only to the degree implied by the methods used.

The stratification breaks shown on the graphic representations of the boring depict the approximate boundaries between soil types and, as such, may denote a gradual transition. We did not encounter groundwater in the boring at the time of our field exploration. However, it must be noted that fluctuation in groundwater levels may occur due to variation in seasonal rainfall, and other factors. These data have been reviewed and interpretations made in the formulation of this report.

This report has been prepared solely for the purpose of assisting the design engineers in the design of the project. Therefore, this report may not contain sufficient data, or the proper information, to serve as a basis for detailed construction cost estimates.

This geotechnical engineering exploration conducted at the project site was not intended to investigate the potential presence of hazardous materials existing at the project site. It should be noted that the equipment, techniques, and personnel used to conduct a geo-environmental exploration differ substantially from those applied in geotechnical engineering.

END OF LIMITATIONS

CLOSURE

The following plates and appendices are attached and complete this report:

This report concludes our scope of work outlined in our fee proposal dated June 10, 2025. If you have any questions regarding this report or if any part of the report is not clear, please contact our office.

Respectfully submitted,

Kokua Geotech LLC

DRAFT

____

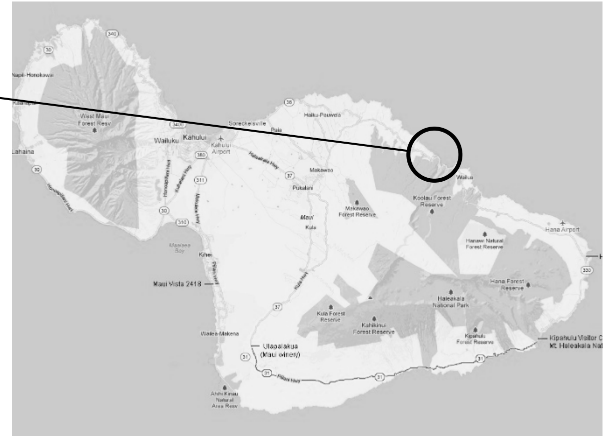
Xiaobin (Tim) Lin, P.E.
President

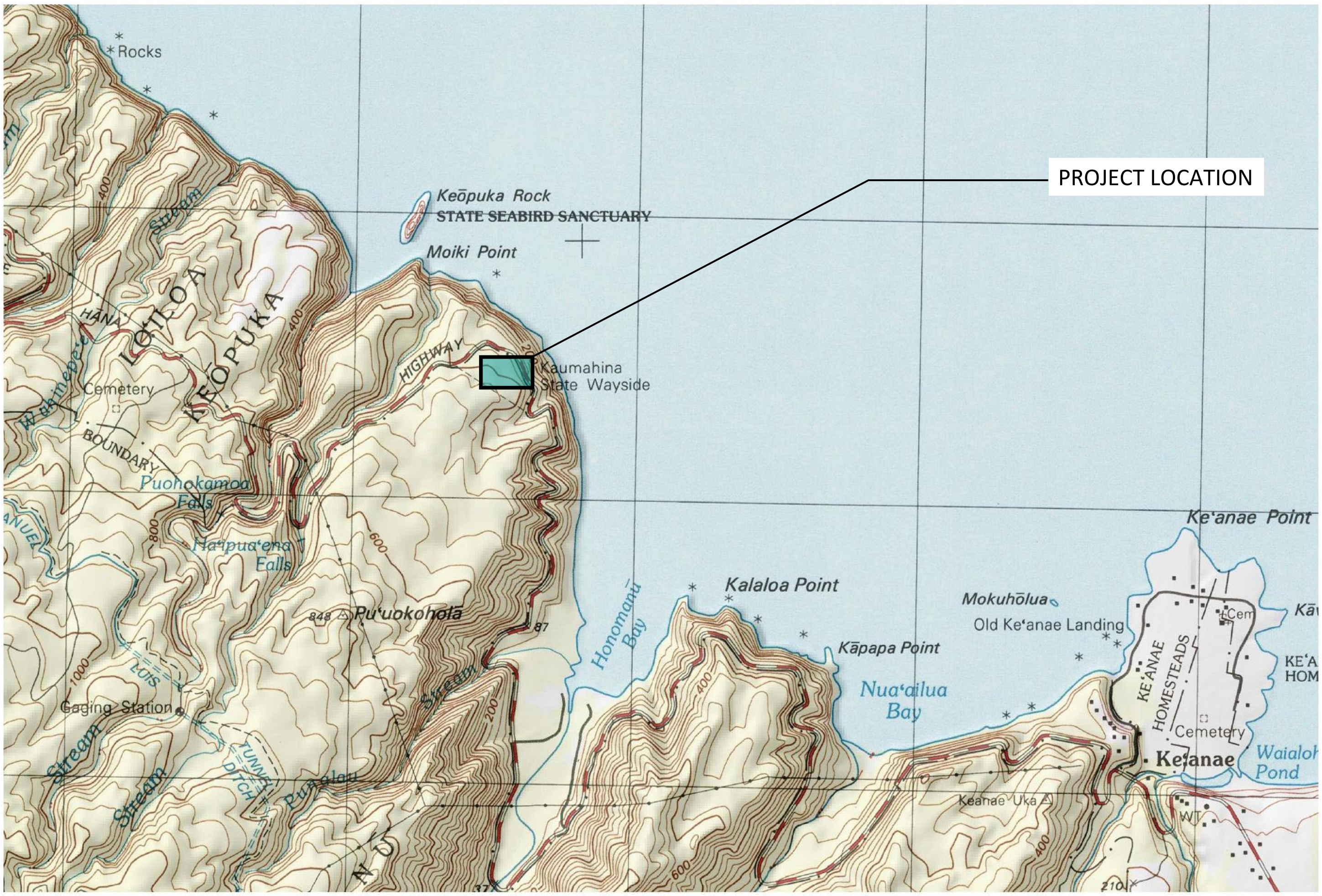
XIAOBIN (TIM) LIN
LICENSED PROFESSIONAL ENGINEER
No. 13982-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.
(MY LICENSE EXPIRES 4/30/2026)

PLATES

GENERAL PROJECT LOCATION





Mercator Projection
WGS84
UTM Zone 4Q
CALTOPO

1 2 3 km
0.5 1.0 1.5 mi
Scale **1:18267** 1 inch = 1522 feet

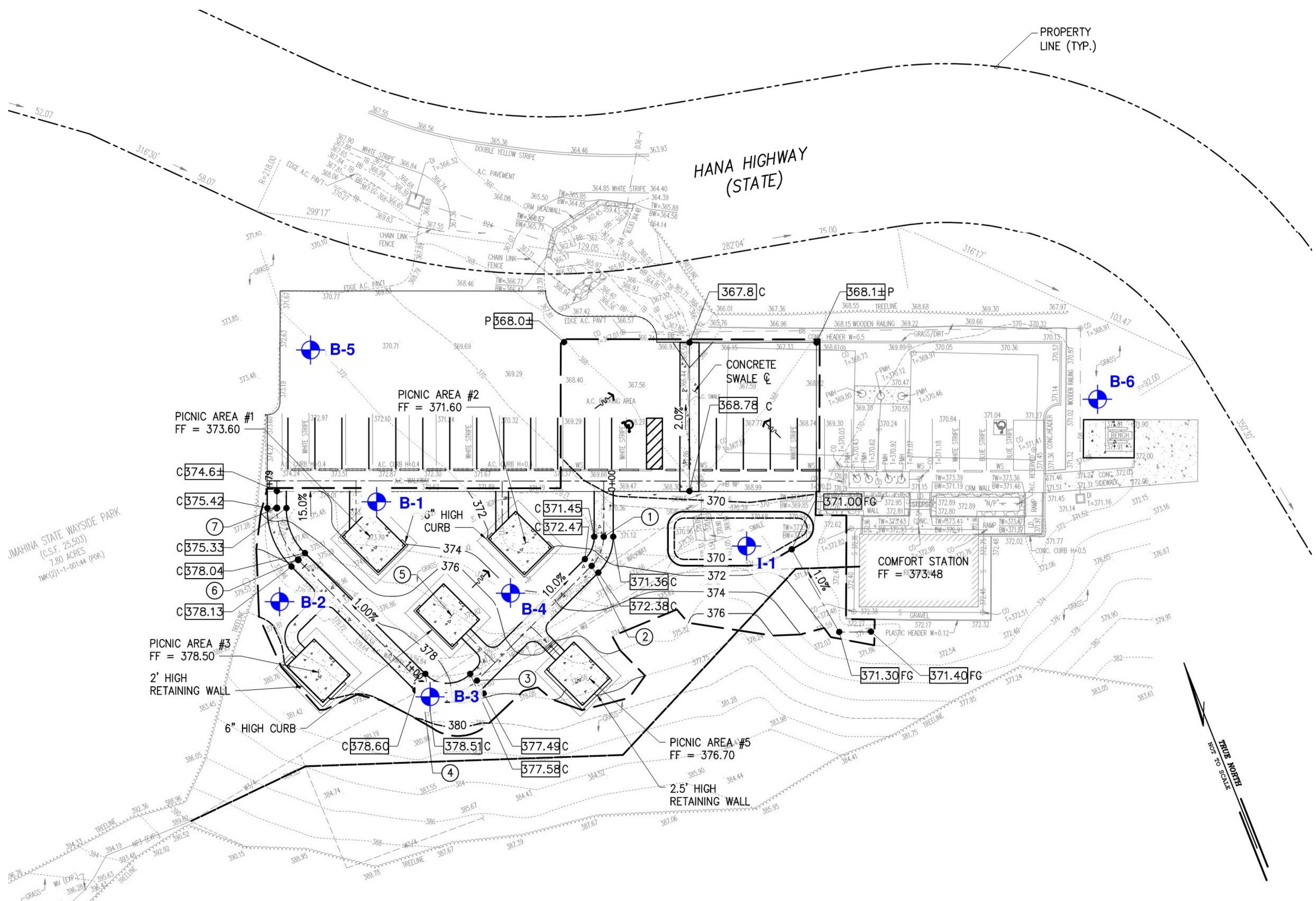
MN 9.4º

PROJECT LOCATION MAP

SITE IMPROVEMENTS AT
KAUMAHINA STATE WAYSIDE PARK
HONOMANU, MAUI, HAWAII

Kokua Geotech LLC
Soil and Foundation Engineering

PROJECT NO.: 060925-00	**PLATE** 1
DATE: DECEMBER 2025	



REFERENCE: GRADING PLAN PREPARED BY THE LIMTIACO CONSULTING GROUP, INC. DATED NOVEMBER 2025

APPROXIMATE BORING (B)/INFILTRATION (I) TEST LOCATION

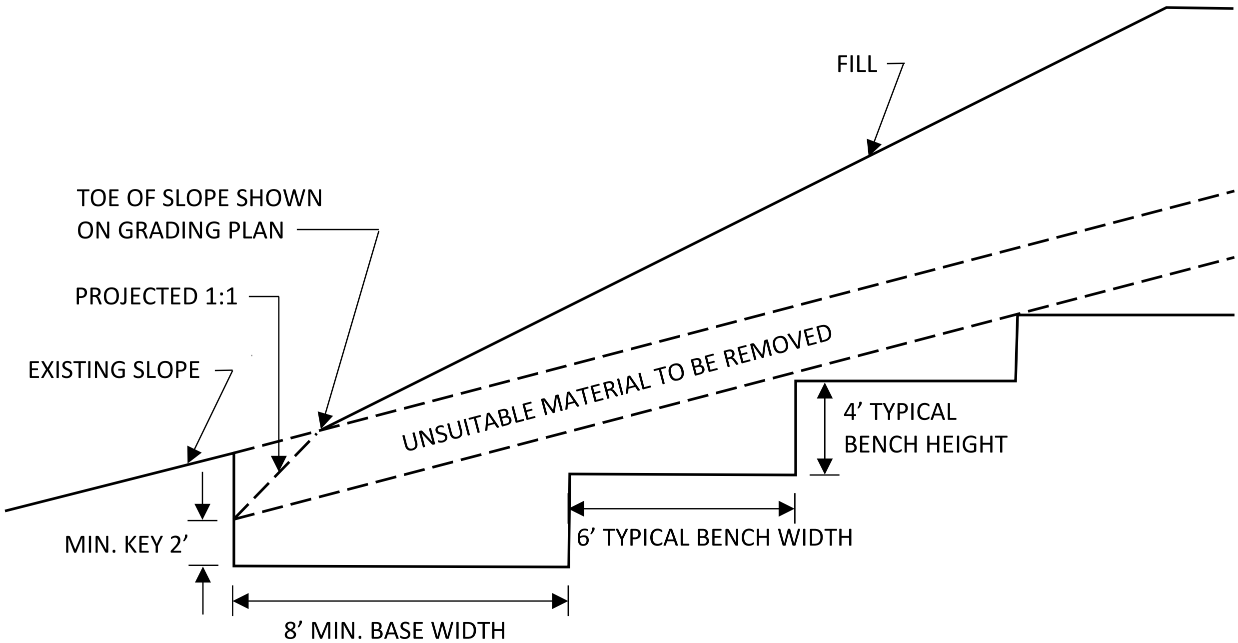
Kokua Geotech LLC
Soil and Foundation Engineering

SITE PLAN

SITE IMPROVEMENTS AT
KAUMAHINA STATE WAYSIDE PARK
HONOMANU, MAUI, HAWAII

PROJECT NO.: 060925-00	**PLATE** 2
DATE: DECEMBER 2025	

GENERAL GRADING RECOMMENDATIONS
TYPICAL FILL ON EXISTING SLOPING GROUND



(NOT TO SCALE)

NOTES:
1. WHERE EXISTING SLOPE IS 5H:1V OR FLATTER, BENCHING IS NOT NECESSARY. HOWEVER, FILL SHOULD NOT BE PLACED ON COMPRESSIBLE OR UNSUITABLE MATERIALS.
2. WHERE FILL SLOPE IS SUSCEPTIBLE TO EROSION, TURF REINFORCEMENT MATTING (TRM) OR GROUTED RIPRAP IS RECOMMENDED TO PROTECT THE TOE AREA OF THE EMBANKMENT.
3. THIS DRAWING IS FOR ILLUSTRATION ONLY; NOT FOR CONSTRUCTION
4. SEE REPORT FOR DISCUSSION AND RECOMMENDATIONS

TYPICAL KEYING AND BENCHING DETAIL

Kokua Geotech LLC Soil and Foundation Engineering	SITE IMPROVEMENTS AT KAUMAHINA STATE WAYSIDE PARK HONOMANU, MAUI, HAWAII
PROJECT NO.: 060925-00	**PLATE** 3
DATE: DECEMBER 2025	

APPENDIX A

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	U.S.C.S	Graphic Log	MATERIAL DESCRIPTION	Pocket Pen./Torvane, tsf	Water Content, %	Dry Unit Weight, pcf	Remarks and Other Tests
1	2	3	4	5	6	7	8	9	10	11	12

COLUMN DESCRIPTIONS

1. Elevation (feet): Elevation (MSL, feet).
2. Depth (feet): Depth in feet below the ground surface.
3. Sample Type: Type of soil sample collected at the depth interval shown.
4. Sample Number: Sample identification number.
5. Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6. U.S.C.S: Type of material encountered.
7. Graphic Log: Graphic depiction of the subsurface material encountered.
8. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9. Pocket Pen./Torvane, tsf: the reading from Poecket Penetrometer or Torvane.
10. Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
11. Dry Unit Weight, pcf: Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.
12. Remarks and Other Tests: Other Tests

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Asphaltic Concrete (AC)

Silty GRAVEL (GM)

SILT, SILT w/SAND, SANDY SILT (ML)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler

Bulk Sample

Grab Sample

HQ Coring

3-inch OD Modified California w/ brass liners

PQ Coring

2-inch OD unlined split spoon (SPT)

Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)

Water level (after waiting)

Minor change in material properties within a stratum

Inferred/gradational contact between strata

? Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Project: **Site Improvements at Kaumahina State Wayside Park** Project Location: **Honomanu, Maui, Hawaii** Project Number: **060925-00**	**Kokua Geotech LLC** 1017 N King Street Honolulu, HI 96817 (808) 214-9339	Log of Boring No. 1 Sheet 1 of 1

Date(s) Drilled **8/28/25**	Logged By **XN**	Checked By **AJF**
Drilling Method **CF Auger**	Drill Bit Size/Type **4-inch Solid Stem Auger**	Total Depth of Borehole **15.5 feet**
Drill Rig Type **Blue Acker**	Drilling Contractor **Kokua Geotech LLC**	Approximate Surface Elevation **+373 feet MSL***
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lbs. with 30-inch drop**
Borehole Backfill **Soil Cuttings, Gravel, and AC Patch**	Location **See Site Plan (Plate 2)**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	U.S.C.S	Graphic Log	MATERIAL DESCRIPTION	Pocket Pen./Torvane, tsf	Water Content, %	Dry Unit Weight, pcf	Remarks and Other Tests
373	0				ML		Brown SANDY SILT with a little gravel, stiff, moist (fill)				
			1	9					44		Sw.= 0.3%
			2	12					35		LL=NP, PI=NP
368	5				ML		Brown CLAYEY SILT with a little sand and gravel, medium stiff, moist (residual soil)				
			3	7					40		
					ML		Brown SANDY SILT with a little gravel, stiff, moist (residual soil)				
363	10										
			4	12					33		
358	15		5	23					41		
							Boring terminated at approximately 15.5 feet below the existing ground surface				
							*Elevations of borings are estimated based on the Grading Plan prepared by the Limtiaco Consulting Group, Inc. dated November 2025				
353	20										
348	25										
343	30										

C:\Users\andre\Dropbox\Andrew H\02 Projects\060925-00.TLCG State Wayside Park Improvements\5 Drafting\12-16-25 Draft Boring Logs and Lab\Kaumahina State Park Boring Logs v1.bg4[KG 2-14-24 20ft pages.tpl]

Project: Site Improvements at Kaumahina State Wayside Park	**Kokua Geotech LLC**	# Log of Boring No. 2
Project Location: **Honomanu, Maui, Hawaii**	1017 N King Street Honolulu, HI 96817 (808) 214-9339	Sheet 1 of 1
Project Number: **060925-00**		

Date(s) Drilled **8/28/25**	Logged By **XN**	Checked By **AJF**
Drilling Method **CF Auger**	Drill Bit Size/Type **4-inch Solid Stem Auger**	Total Depth of Borehole **11.0 feet**
Drill Rig Type **Blue Acker**	Drilling Contractor **Kokua Geotech LLC**	Approximate Surface Elevation **+380 feet MSL***
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lbs. with 30-inch drop**
Borehole Backfill **Soil Cuttings, Gravel, and AC Patch**	Location **See Site Plan (Plate 2)**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	U.S.C.S	Graphic Log	MATERIAL DESCRIPTION	Pocket Pen./Torvane, tsf	Water Content, %	Dry Unit Weight, pcf	Remarks and Other Tests
380	0				ML		Brown with orange mottling SANDY SILT with a little gravel, stiff, moist (fill)				
		SPT	1	10					34		LL=NP, PI=NP
		SPT	2	19					24		
					ML		Brown CLAYEY SILT with some decomposed gravel, very stiff, moist (residual soil)				
375	5	SPT	3	18					32		
							grades with a little sand				
370	10	SPT	4	21					35		
							Boring terminated at approximately 11.0 feet below the existing ground surface				
365	15										
360	20										
355	25										
350	30										

Project: Site Improvements at Kaumahina State Wayside Park Project Location: Honomanu, Maui, Hawaii Project Number: 060925-00	**Kokua Geotech LLC** 1017 N King Street Honolulu, HI 96817 (808) 214-9339	# Log of Boring No. 3 Sheet 1 of 1

Date(s) Drilled **8/28/25**	Logged By **XN**	Checked By **AJF**
Drilling Method **CF Auger**	Drill Bit Size/Type **4-inch Solid Stem Auger**	Total Depth of Borehole **4.0 feet**
Drill Rig Type **Blue Acker**	Drilling Contractor **Kokua Geotech LLC**	Approximate Surface Elevation **+379 feet MSL***
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lbs. with 30-inch drop**
Borehole Backfill **Soil Cuttings, Gravel, and AC Patch**	Location **See Site Plan (Plate 2)**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	U.S.C.S	Graphic Log	MATERIAL DESCRIPTION	Pocket Pen./Torvane, tsf	Water Content, %	Dry Unit Weight, pcf	Remarks and Other Tests
379	0				ML		Brown CLAYEY SILT with a little sand and gravel, stiff, moist (residual soil)				
			1	10					34		Sw.= 0.5%
			2	5 10/0" Ref.			grades with boulders		34		
							Boring terminated at approximately 4.0 feet below the existing ground surface				
374	5										
369	10										
364	15										
359	20										
354	25										
349	30										

Project: Site Improvements at Kaumahina State Wayside Park	**Kokua Geotech LLC**	Log of Boring No. 4
Project Location: **Honomanu, Maui, Hawaii**	1017 N King Street	Sheet 1 of 1
Project Number: **060925-00**	Honolulu, HI 96817	
	(808) 214-9339	

Date(s) Drilled **8/29/25**	Logged By **XN**	Checked By **AJF**
Drilling Method **CF Auger**	Drill Bit Size/Type **4-inch Solid Stem Auger**	Total Depth of Borehole **16.5 feet**
Drill Rig Type **Blue Acker**	Drilling Contractor **Kokua Geotech LLC**	Approximate Surface Elevation **+374 feet MSL***
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lbs. with 30-inch drop**
Borehole Backfill **Soil Cuttings, Gravel, and AC Patch**	Location **See Site Plan (Plate 2)**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	U.S.C.S	Graphic Log	MATERIAL DESCRIPTION	Pocket Pen./Torvane, tsf	Water Content, %	Dry Unit Weight, pcf	Remarks and Other Tests
374	0				ML		Brown CLAYEY SILT with some sand and gravel, stiff, moist (fill)				
		SPT	1	8					32		LL=48, PI=15
		SPT	2	9	ML		Brown CLAYEY SILT with a little sand and gravel, stiff, moist (residual soil)		32		
369	5	SPT	3	5			grades to medium stiff locally		37		
364	10	SPT	4	14					45		
359	15	SPT	5	30			grades to hard		38		
							Boring terminated at approximately 16.5 feet below the existing ground surface				
354	20										
349	25										
344	30										

Project: Site Improvements at Kaumahina State Wayside Park	**Kokua Geotech LLC**	Log of Boring No. 5
Project Location: Honomanu, Maui, Hawaii	1017 N King Street Honolulu, HI 96817 (808) 214-9339	Sheet 1 of 1
Project Number: 060925-00		

Date(s) Drilled **8/29/25**	Logged By **XN**	Checked By **AJF**
Drilling Method **CF Auger**	Drill Bit Size/Type **4-inch Solid Stem Auger**	Total Depth of Borehole **8.0 feet**
Drill Rig Type **Blue Acker**	Drilling Contractor **Kokua Geotech LLC**	Approximate Surface Elevation **+372 feet MSL***
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lbs. with 30-inch drop**
Borehole Backfill **Soil Cuttings, Gravel, and AC Patch**	Location **See Site Plan (Plate 2)**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	U.S.C.S	Graphic Log	MATERIAL DESCRIPTION	Pocket Pen./Torvane, tsf	Water Content, %	Dry Unit Weight, pcf	Remarks and Other Tests
372	0						3-inch ASPHALTIC CONCRETE				
					GM		Brownish gray SILTY GRAVEL with some sand, moist (base material)				
			1	13	ML		Brown CLAYEY SILT with some sand and gravel, stiff, moist (fill)		23		
			2	14	ML		Brown CLAYEY SILT with a little sand and gravel, stiff, moist (residual soil)		34		
367	5		3	14			grades to medium stiff locally		44		
			4	30/0" Ref.			grades with boulders, refusal				
							Boring terminated at approximately 8.0 feet below the existing ground surface				
362	10										
357	15										
352	20										
347	25										
342	30										

C:\Users\andre\Dropbox\Andrew H\02 Projects\060925-00.TLCG State Wayside Park Improvements\5 Drafting\12-16-25 Draft Boring Logs and Lab\Kaumahina State Park Boring Logs v1.bg4[KG 2-14-24 20ft pages.tpl]

Project: Site Improvements at Kaumahina State Wayside Park Project Location: Honomanu, Maui, Hawaii Project Number: 060925-00	**Kokua Geotech LLC** 1017 N King Street Honolulu, HI 96817 (808) 214-9339	Log of Boring No. 6 Sheet 1 of 1

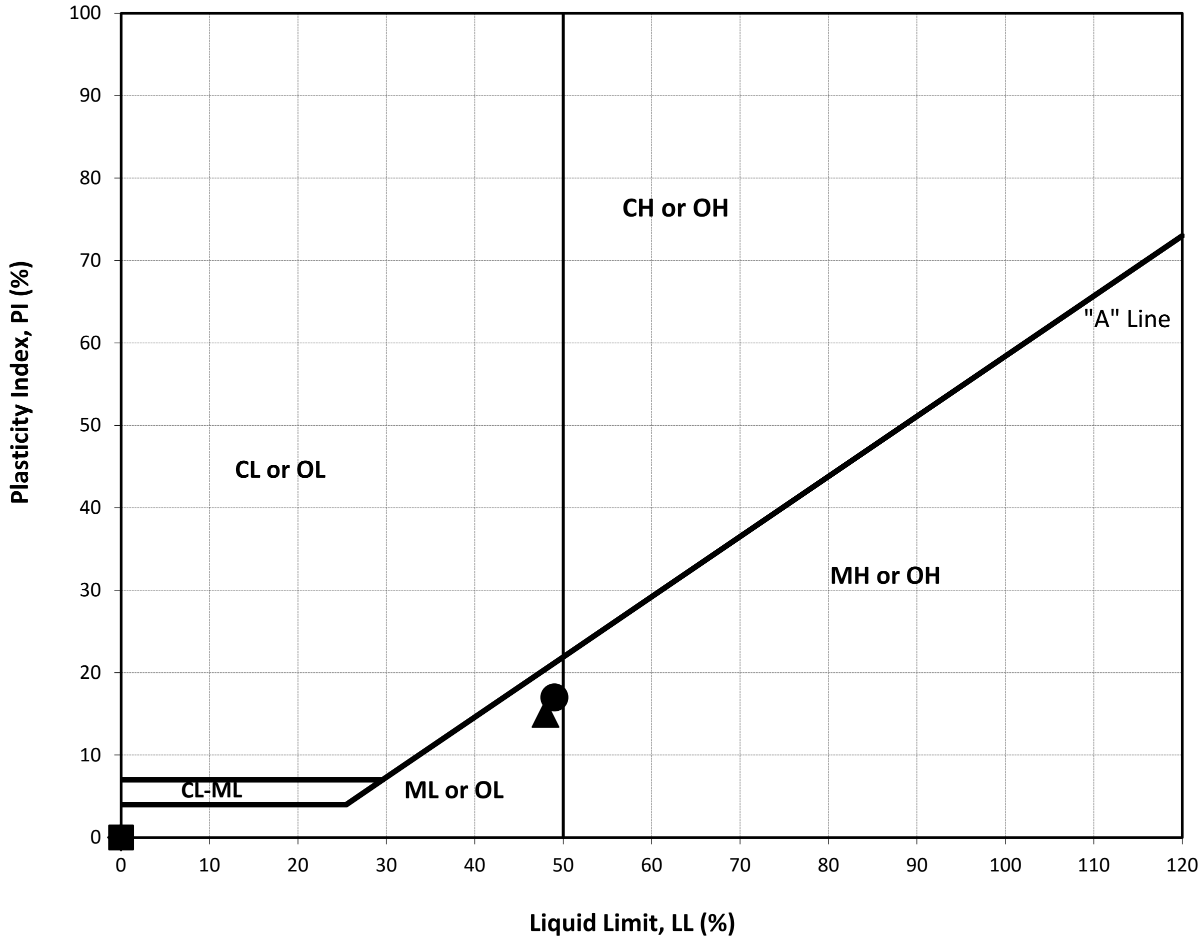
Date(s) Drilled **8/29/25**	Logged By **XN**	Checked By **AJF**
Drilling Method **CF Auger**	Drill Bit Size/Type **4-inch Solid Stem Auger**	Total Depth of Borehole **3.0 feet**
Drill Rig Type **Blue Acker**	Drilling Contractor **Kokua Geotech LLC**	Approximate Surface Elevation **+371 feet MSL***
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lbs. with 30-inch drop**
Borehole Backfill **Soil Cuttings, Gravel, and AC Patch**	Location **See Site Plan (Plate 2)**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	U.S.C.S	Graphic Log	MATERIAL DESCRIPTION	Pocket Pen./Torvane, tsf	Water Content, %	Dry Unit Weight, pcf	Remarks and Other Tests
371	0		1		ML		Brown CLAYEY SILT with a little sand and gravel, moist (fill)		23		Sw.= 1.0%
			2						20		LL=49, PI=17
							Boring terminated at approximately 3.0 feet below the existing ground surface				
366	5										
361	10										
356	15										
351	20										
346	25										
341	30										

C:\Users\andre\Dropbox\Andrew H\02 Projects\060925-00.TLCG State Wayside Park Improvements\5 Drafting\12-16-25 Draft Boring Logs and Lab\Kaumahina State Park Boring Logs v1.bg4[KG 2-14-24 20ft pages.tpl]

APPENDIX B

PLASTICITY CHART



Symbol	Sample	Depth (feet)	Material Description	USCS	LL	PL	PI
■	B-1	3.0 to 4.5	Brown SANDY SILT with a little gravel	ML	NP	NP	NP
◆	B-2	1.0 to 2.5	Brown with orange mottling SANDY SILT with a little gravel	ML	NP	NP	NP
▲	B-4	1.0 to 2.5	Brown CLAYEY SILT with some sand and gravel	ML	48	33	15
●	B-6	3.0 to 4.5	Brown CLAYEY SILT with a little sand and gravel	ML	49	32	17

SUMMARY OF ATTERBERG LIMITS (ASTM D4318) TEST RESULTS

Kokua Geotech LLC
Soil and Foundation Engineering

SITE IMPROVEMENTS AT
KAUMAHINA STATE WAYSIDE PARK
HONOMANU, MAUI, HAWAII

PROJECT NO.: 060925-00

DATE: DECEMBER 2025

PLATE
B-1

Location	Depth (feet)	Test Type	Soil Description	Dry Density (pcf)	Moisture Contents Initial (%)	Moisture Contents Air-Dried (%)	Moisture Contents Final (%)	Ring Swell (%)
B-1	1.0 to 2.5	Remolded	Brown SANDY SILT with a little gravel	111.4	23.2	16.2	24.9	0.3
B-3	1.0 to 2.5	Remolded	Brown CLAYEY SILT with a little sand and gravel	107.0	23.5	16.2	26.8	0.5
B-6	0.0 to 1.0	Remolded	Brown CLAYEY SILT with a little sand and gravel	110.7	15.7	1.5	18.8	1.0

Note: Samples tested were remolded in 2.4-inch diameter by 1-inch high rings. Samples were then air-dried overnight followed by saturating for a minimum of 24 hours under a surcharge pressure of 60 psf.

SUMMARY OF RING SWELL TEST RESULTS

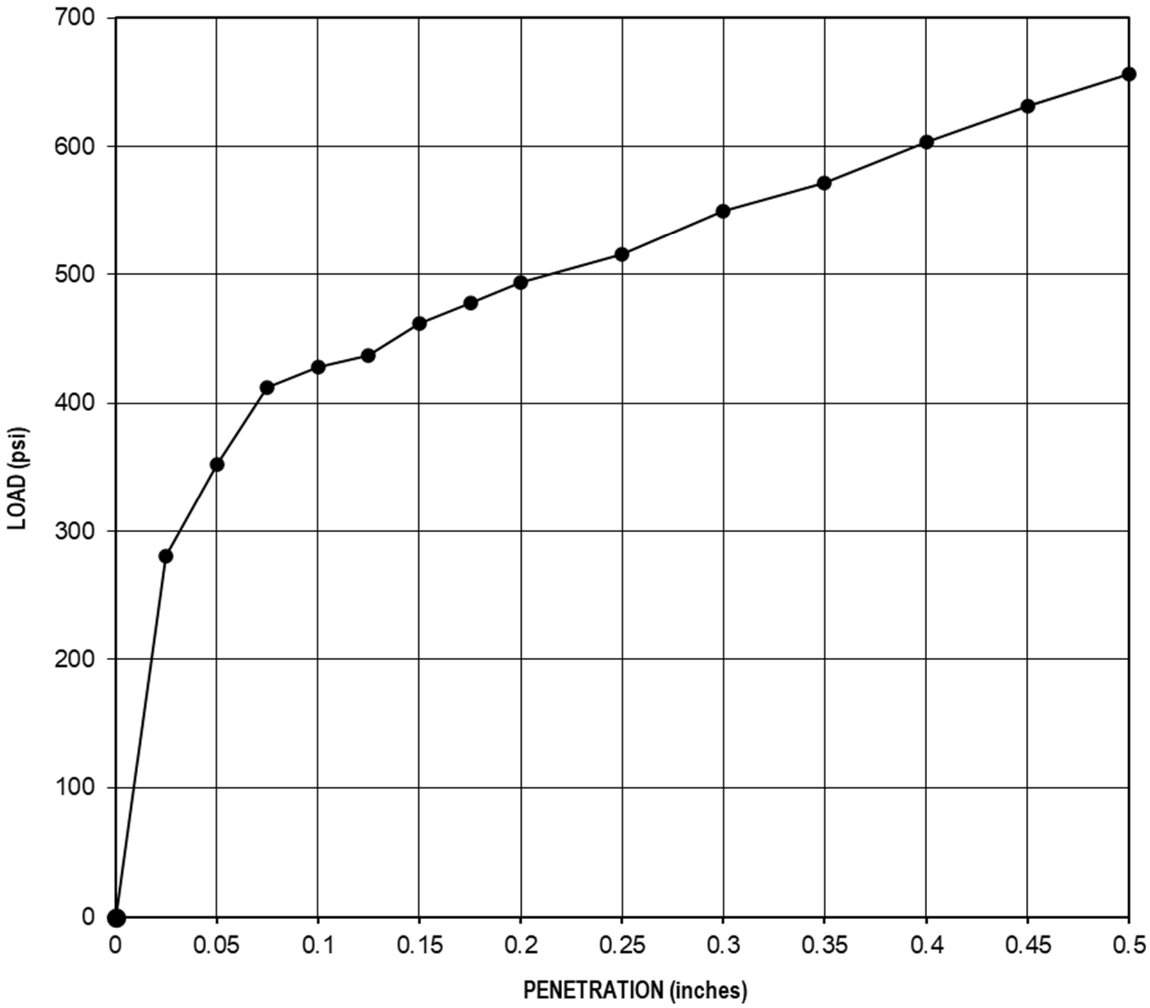
SITE IMPROVEMENTS AT
KAUMAHINA STATE WAYSIDE PARK
HONOMANU, MAUI, HAWAII

Kokua Geotech LLC
Soil and Foundation Engineering

PROJECT NO.: 060925-00

DATE: DECEMBER 2025

PLATE
B-2



Location:	Bulk-5
Depth:	1.0 to 2.5 feet
Description:	Brown CLAYEY SILT with some sand and gravel

Molding Dry Density:	111.5 pcf		
Molding Moisture:	22.3 %	**Corrected CBR @ 0.1”:**	40.1
Days Soaked:	5	**Corrected CBR @ 0.2”:**	30.5
Aggregate:	¾-inch minus	**Swell (%):**	0.20

SUMMARY OF CALIFORNIA BEARING RATIO (ASTM D1883) TEST RESULTS

SITE IMPROVEMENTS AT
KAUMAHINA STATE WAYSIDE PARK
HONOMANU, MAUI, HAWAII

Kokua Geotech LLC
Soil and Foundation Engineering

PROJECT NO.: 060925-00

DATE: DECEMBER 2025

PLATE
B-3

APPENDIX C

FIELD INFILTRATION TEST RECORD

Project Name:	Kaumahina State Wayside Park	Date of Testing:	8/29/2025
Project No.:	060925-00	Infiltration Test No.:	1

Method of Testing:	LID Infiltration Test				
Diameter of Borehole:	4.0	inches	Depth of Borehole:	4.0	feet
Diameter of Casing (ID):	4.0	inches	Length of Casing:	4.0	feet
Datum (above ground):	0.0	feet	Depth of Casing:	4.0	feet
GW level (from ground):	N/A	feet			

Depth (from ground, feet)	Anticipated Subsurface Soil Profile
0 to 2 feet	Brown CLAYEY SILT with some sand and gravel
2 to 4 feet	Brown SANDY SILT with some gravel

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water Level (measured from datum) (inches)	Infiltration Rate (inches per hour)
Trial 1	0	9:55	24.00	
	2	9:57	25.50	
	5	10:00	26.00	
	10	10:05	27.00	
	20	10:15	27.50	
	40	10:35	28.50	
	60	10:55	28.75	4.8
Trial 2	0	11:01	24.00	
	2	11:03	24.50	
	5	11:06	25.00	
	10	11:11	27.00	
	20	11:21	28.00	
	40	11:41	28.06	
	60	12:01	28.06	4.1
Trial 3	0	12:13	24.00	
	2	12:15	24.25	
	5	12:18	25.00	
	10	12:23	26.56	
	20	12:33	27.00	
	40	12:53	27.75	
	60	1:13	28.00	4.0
Trial 4	0	1:29	24.00	
	2	1:31	24.50	
	5	1:34	25.25	
	10	1:39	26.25	
	20	1:49	27.00	
	40	2:09	27.50	
	60	2:29	28.00	4.0