REPORT
GEOTECHNICAL INVESTIGATION

PERMANENT REPAIR
KAPALAMA STREAM CRM WALLS
WORK AREAS 1 & 2
KOHOU STREET
HONOLULU, HAWAII
TMK: (1) 1-6-005

for

BILLS ENGINEERING, INC.

Project No. 23-0046
January 4, 2024

SHINSATO ENGINEERING, INC.
98-747 KUAHAO PLACE, #E
PEARL CITY, HI 96782

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January 4, 2024
Project No. 23-0046

David B. Bills
Bills Engineering, Inc.
1108 Fort Street Mall, Suite 4
Honolulu, Hawaii 96813-2714

Dear Mr. Bills:

The attached report presents the data, conclusions and recommendations for the permanent repairs to the CRM walls located along the Kapalama Stream in Honolulu, Hawaii.

1) The existing stream sidewalls in the work area are supported by CRM walls that are in disrepair. Permanent repairs are planned to stabilize the stream walls.

2) The subsurface condition at the site was explored by drilling four (4) test borings to depths of 9 to 19.5 feet below the existing grade. Borings 1 and 2 were drilled in the Work Area 2 section of the project and Borings 3 and 4 were drilled in the Work Area 1 section of the project.

   The test borings encountered highly plastic CLAY containing varying amounts of gravel and cobbles to depths of 7 to 13.5 feet below the existing grade followed by weathered BASALTIC ROCK to the final depths of the borings. Groundwater was encountered in Borings 2 and 3 at depths of 12.2 to 12.4 feet below the existing grade.

3) Based on the findings and observations made during this investigation, it is concluded that from a geotechnical perspective, the site may be developed for the intended use provided the recommendations contained in this report are included in the design and construction of the project. Relatively shallow spread and continuous footings may be used to support the proposed walls.

4) Special considerations may be required during the construction of the new walls. These included but may not be limited to the following:

   a) The subsurface soil contains numerous cobbles and boulders which will likely hinder excavation work.

   b) The soil is susceptible to caving especially during rainy weather. Special construction methods should be employed to prevent cave-ins of the sides of the excavations.

Details of the findings and recommendations are presented in the attached report.

This investigation was made in accordance with generally accepted engineering procedures and included such field and laboratory tests considered necessary for the project. In the opinion of the undersigned, the accompanying report has been substantiated by mathematical data in conformity with generally accepted engineering principles and presents fairly the design information requested by your organization. No other warranty is either expressed or given.

Respectfully submitted,

SHINSATO ENGINEERING, INC.

Lawrence S. Shinsato, P.E.
President

LSS:ls

This work was prepared by me
or under my supervision.
License Expires 04/30/24

1.0 INTRODUCTION

This investigation was made for the purpose of obtaining information on the subsurface conditions from which to base recommendations for foundation design for the proposed permanent repairs to the Kapalama Stream channel walls located at Kohou Street in Honolulu, Hawaii. The location of the site, relative to the existing streets and landmarks, is shown on the Vicinity Map, Plate A-1.

2.0 SCOPE OF WORK

The services included drilling 4 test borings to depths of 9 to 19.5 feet below the existing grade, obtaining samples of the underlying soils, performing laboratory tests to determine pertinent engineering properties of the representative soil samples, performing an engineering analysis to determine foundation design parameters.

The following information is provided for use by the Architect and/or Engineer:

1. General subsurface conditions, as disclosed by the test borings.
2. Physical characteristics of the soils encountered.
3. Recommendations for foundation design, including bearing values, embedment depth and estimated settlement.
4. Recommendations for placement of fill and backfill.
5. Special design considerations.

3.0 PLANNED DEVELOPMENT

From the information provided, the project will consist of permanent repairs to the Kapalama Stream CRM walls that are in disrepair including areas that have failed.

4.0 SITE CONDITIONS

4.1 Surface

The project work area consists of two sections along the existing Kapalama Stream channel to the east and south of the existing Kapalama Gardens apartments. Area 1 is located along Kohou Street. Area 2 is a section extending from near North School Street to the “Y” intersection of the stream channel with Area 1. See the attached plot plan for the locations.

The CRM walls in Area 1 are approximately 7 to 9 feet high. The walls in Area 2 are approximately 6 to 8 feet high. The existing ground surface beyond the walls rise up to a higher elevation.

4.2 Subsurface

The subsurface condition at the site was explored by drilling four (4) test borings to depths of 9 to 19.5 feet below the existing grade. Borings 1 and 2 were drilled in the Work Area 2 section of the project and Borings 3 and 4 were drilled in the Work Area 1 section of the project.

The locations of the borings are shown on the Plot Plan, Plate A-2.

The test borings encountered highly plastic CLAY containing varying amounts of gravel and cobbles to depths of 7 to 13.5 feet below the existing grade followed by weathered BASALTIC ROCK to the final depths of the borings.

Groundwater was encountered in Borings 2 and 3 at depths of 12.2 to 12.4 feet below the existing grade. Groundwater was not observed in Borings 1 and 4.

4.3 General Soil Description and Geology

4.3.1 General Soil Description

From the USDA Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii", the site is located in an area classified as Kawaihapai stony clay loam, 2 to 6 percent slopes (KlaB).

The Kawaihapai series consists of well-drained soils in drainage ways and on alluvial fans on the coastal plains. These soils formed in alluvium derived from basic igneous rock in humid uplands. In a representative profile, the surface layer is dark-brown clay loam followed by dark-brown stratified sandy loam. The substratum is stony and gravelly.

Estimated soil properties include but may not be limited to:

Permeability is moderate.
Unified Soil Classification - CL (low plasticity clay)
Moderate shrink-swell potential
Low corrosivity to uncoated steel
Low corrosivity to concrete

4.3.2 Geology

The site is located on the southeastern flank of the elongated Koolau Mountain range. The mountain range is believed to have formed during the late Tertiary/early Pleistocene time (between 1 and 12 million years ago). Lavas flowed from rift zones roughly paralleling the existing mountain crest trends to form the main shield of the volcano. After cessation of the main volcanic activity, erosion reduced the height of the volcanic dome by as much as 1,000 feet. Stream activity cut deep valleys into the mountain range. During high stands of sea levels, the valleys were infilled with sediment (alluviated) grading to the high sea level stands (Stearns, 1967).

Late-stage volcanic eruptions occurred on the southeasterly end of the Koolau mountains. These late-stage eruptions, known as the Honolulu Volcanic Series, form familiar landmarks on Oahu such as Diamond Head, Punchbowl, Tantalus, Round Top and Salt Lake craters (Stearns and Vaksvik, 1935).

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 General

Based on the findings of this investigation, it is concluded that from a geotechnical perspective, the site may be developed for the intended use provided the recommendations contained herein are included in the design and construction of the project.

5.2 Special Considerations

Special considerations will be required in the design and construction of the project due to existing soil conditions. These include but may not be limited to the following:

a) The subsurface soil contains numerous cobbles and boulders which will likely hinder excavation work. Also, the underlying BASALTIC ROCK may require powered equipment for removal.

b) The soil is susceptible to caving especially during rainy weather. Special construction methods should be employed to prevent cave-ins of the sides of the excavations.

c) Compaction of fill and backfill material should be done with care due to the close proximity of the neighboring structures.

5.3 Foundation Design

For the design of the permanent channel walls, the recommended foundation design parameters are as follows:

a) Allowable soil bearing value and footing embedment:

i) 2,000 psf for footings bearing on firm on-site soils or properly compacted fill and embedded a minimum of 12-inches below the lowest adjacent finished grade (measured to the bottom of the footing). The bearing value may be increased by 125 psf for each additional foot of embedment below 12-inches to a maximum of 4,000 psf.

ii) 6,000 psf for footings bearing directly on the underlying BASALTIC ROCK.

iii) For sloping ground conditions, the footing embedment shall be increased such that there is a minimum horizontal setback of 5-feet from the outside edge of the footing to the slope face.

iv) The bearing values are for dead plus live loads and may be increased by one-third (1/3) for momentary loads due to wind or seismic forces. If any footing is eccentrically loaded, the maximum edge pressure shall not exceed the bearing pressure for permanent or for momentary loads.

v) For footings located adjacent to utility trenches: the bottom of the footing shall be deepened below a 1 horizontal to 1 vertical plane projected upwards from the edge of the utility trench.

vi) For footings located adjacent to retaining walls or other structural elements which are not designed for surcharge loading, the new footing shall be deepened below a 45-degree plane projected upwards from the adjacent structure.

b) Estimated foundation settlement: less than 1-inch for the wall footings.

c) Earth pressure coefficients:

i) On-site soil:
Kp = 2.50
Ka = 0.45 (unrestrained)
Ko = 0.60 (restrained, at-rest)
soil unit weight: (above groundwater) 110 pcf
(below groundwater) 50 pcf submerged
coefficient of friction: 0.35 x DL
pull-out resistance: 500 pounds per square foot of sidewall contact area

ii) Imported structural fill (minimum 24-inches thick) and the underlying BASALTIC ROCK
Kp = 3.50
Ka = 0.27 (unrestrained)
Ko = 0.42 (restrained, at-rest)
soil unit weight: (above groundwater) 140 pcf
(below groundwater) 80 pcf submerged
coefficient of friction: 0.7 x DL

iii) The above earth pressures apply to level, properly draining backfill. The earth pressure shall be increased for sloping ground conditions and also any surcharge loading.

iv) NOTES:

- The passive, active and at-rest earth pressures are determined by multiplying the respective earth coefficient by the unit weight.
- The allowable passive earth resistance values may be used for structural elements in direct contact with undisturbed material. Where the ground surface adjacent to the resisting element is exposed to the weather, the top 12 inches shall be neglected in calculating the passive earth resistance. This is to allow for soil shrinkage and/or erosion.
- Lateral resistance and friction may be combined.
- The above active earth coefficients do not include surcharge loads such as footings located within a 45-degree plane projected upwards from the heel of the footing, sloping ground and/or from hydrostatic pressures. If such conditions occur, the active earth pressures shall be increased accordingly.
- The active earth pressure coefficient is for unrestrained conditions. Unrestrained walls are defined as walls that are allowed to rotate between 0.005 and 0.01 times the wall height. The rotation of the wall develops the "active earth pressure." If the wall is not allowed to move as in the case of basement walls or walls that are restrained at the top, the soil pressure that will develop is known as an "at-rest" pressure. For restrained walls, the above “at-rest” earth pressures shall be used to design the structure.
- The active earth pressure coefficient for imported structural fill may be used to design retaining walls where the imported structural fill is placed within a 1H:2V plane projected upward and outward from the heel of the wall footing. Where this cannot be accomplished, the active earth pressure for the on-site soil shall be used to design the wall.
- Drainage for the retaining wall backfill shall be accomplished by providing 4-inch diameter weepholes spaced 8-feet on-center or by using a minimum 4-inch diameter perforated PVC footing drain pipe. A 2-foot thick layer of crushed gravel (ASTM No.

67), which is wrapped with geotextile filter fabric, shall be placed above the pipe; the crushed gravel shall be continuous from weephole to weephole, or in the case of a footing drain pipe, laid throughout the full length of the pipe. Geotextile fabric shall be MIRAFI 140N or similar.

- The backfill material for retaining walls shall be properly compacted in accordance with the Site Preparation and Grading section to this report. Also, surface drainage shall be designed to minimize surface water runoff from entering the backfill area. In non-pavement areas, the top 12 inches of backfill material shall be fine-grained, cohesive soil.

d) Site Class and coefficients:

C: very dense soil and soft rock profile (2012 IBC)

e) All loose and disturbed soil at the bottom of footing excavations shall be removed to firm soil or the disturbed soil shall be compacted prior to laying of steel or pouring of concrete.

5.4 Earthwork

It is recommended that the site preparation and grading work be performed in the following manner:

a) Clearing and Grubbing:
In all areas to receive fill and in structural areas, all vegetation, weeds, brush, roots, stumps, rubbish, debris, soft soil and other deleterious material shall be removed and disposed of off-site.

b) Preparation of Ground to Receive Fill:
The exposed surface shall then be scarified to a depth of 6 inches, moisture conditioned to near optimum moisture (ASTM D1557) and then compacted to the degree of compaction specified below. If soft or loose spots are encountered, the loose/soft areas shall be removed to firm material and the resulting depression shall be filled with properly compacted fill.

c) Types of Fill and Backfill Material:
Structural fill and backfill shall be described as material placed beneath structures and extending a horizontal distance of 3 feet beyond the edge of the structural line. Non-structural fill shall be described as material placed beyond 3 feet from the building line.

d) Material Quality:
Fill and backfill material shall consist of soil which is free of organics and debris. The maximum size particle for fill and backfill material shall be as follows:

Top 2 feet below finished subgrade (FSG)	3"
Below 2 feet from FSG	6"

Structural fill shall have a Unified Soil Classification of either GW, GM, SW, or SM. The plasticity index of the fine portion as determined by the ASTM D4318 test shall be less than 15.

e) Placement of Fill and Backfill:

Each layer of fill and backfill material shall be placed in lifts not exceeding the following (loose thickness):

Top 2 feet below finished subgrade (FSG)	8"
Below 2 feet from FSG	12"

*The loose thickness of this layer shall not exceed 1.5 times the largest size particle; this is predicated upon proper compaction of each lift.

Prior to placing of fill and backfill material, the material shall be aerated or moistened to near optimum moisture content (ASTM D1557 test procedure).

Where fill is placed on existing ground that is steeper than 5 horizontal to 1 vertical, the existing ground surface shall be benched into firm soil as the fill is placed.

f) Degree of Compaction:
Each layer of fill and backfill shall be thoroughly compacted from edge to edge using conventional compaction equipment designed for the purpose. The minimum degree of compaction for each layer (as determined by the ASTM D1557 test procedure) shall be as follows:

Structural Fill (under and 3 feet beyond the edge of buildings)	95 %
Non-structural fill	* 90 %

*Where compaction tests are not practical due to the size of the material, each layer shall be compacted by track rolling until it does not weave or creep under the weight of the track rolling equipment (D-8 dozer or larger).

It is particularly important to see that all fill and backfill soils are properly compacted in order for the design parameters to remain applicable.

g) Preparation of Footing Excavations:
Footing excavations shall be cleaned of loose material and soils disturbed by the excavation prior to placing of steel or pouring of concrete. Any soft soil encountered at the bottom of the footing excavation shall be removed to firm material. The resulting depression shall then be backfilled with properly compacted structural fill.

h) Site Drainage:
During construction, drainage shall be provided to minimize ponding of water adjacent to or on foundation and pavement areas. Ponded areas shall be drained immediately. Any subgrade soil that has become soft due to ponding shall be removed to firm material and replaced with compacted structural fill.

6.0 INSPECTION

During the progress of construction, so as to evaluate compliance with the design concepts, specifications and recommendations contained in this report, it is recommended that a representative from Shinsato Engineering be present to observe the following operations:

1) Site preparation and grading including field density tests for soil compaction.
2) Foundation excavations to verify that suitable bearing material has been encountered at the bottom of foundation excavations.
3) Any special inspection services that may apply.

7.0 REMARKS

The conclusions and recommendations contained herein are based on the findings and observations made at the boring locations. If conditions are encountered during construction which appear to differ from those disclosed by the explorations, this office shall be notified so as to consider the need for modifications.

This report has been prepared for the exclusive use of Bills Engineering, Inc. and their respective client and design consultants. It shall not be used by or transferred to any other party or to another project without the consent and/or thorough review by this facility. Should the project be delayed beyond the period of one year from the date of this report, the report shall be reviewed relative to possible changed conditions.

Samples obtained in this investigation will deteriorate with time and will be unsuitable for further laboratory tests within one (1) month from the date of this report. Unless otherwise advised, the samples will be discarded at that time.

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The following are included and complete this report:

Appendix
Field Investigation
Laboratory Testing

Attachments	Plate
Vicinity Map	A-1
Plot Plan	A-2
Logs of Test Borings	B-1 through B-4

APPENDIX
FIELD INVESTIGATION AND LABORATORY TESTING

FIELD INVESTIGATION

Drilling

The subsurface explorations consisted of drilling test borings at the locations shown on the Plot Plan, Plate A-2. The test borings were advanced with a CME 55 drill rig using continuous flight augers.

The augers are 4 inch diameter continuous helical flight augers with the lead auger having a head equipped with changeable cutting teeth. Soil cuttings are brought to the surface by the continuous flights. After the bore hole is advanced to the required depth and cleaned of cuttings by additional rotation of the augers, the augers are retracted for soil sampling or in-situ testing.

Soil Sampling

Samples of the underlying soils were obtained from the boring by driving a soil sampler into the subsurface material using an automatic hammer that has an energy equivalent to a 140 pound safety hammer falling from a height of 30 inches. The sampler was driven approximately 18 inches into the soil (or until refusal is encountered) and the number of blows required to drive the sampler was recorded at 6 inch intervals. The blow count for the last 12 inches of sampling are shown on the boring log.

The sampler is retracted from the bore hole and a section of the retrieved soil is placed in a close fitting waterproof container in order to retain field conditions until completion of the laboratory tests. Samples are then transported to the laboratory for testing.

Soil samples were obtained using a modified California Sampler which is a 3 inch outside diameter, 2.5 inch inside diameter steel sampler with an interior lining of 1 inch long, thin brass rings, or a split spoon sampler which is a 2 inch outside diameter, 1-3/8 inch inside diameter steel sampler.

Field Logging

During the subsurface explorations, continuous logs of the borings were kept. The logs included visual classification of the soils encountered using the Unified Soil Classification System as well as other pertinent information which were gathered during the drilling process. The final boring logs included in this report incorporates engineering analysis and results of the laboratory tests.

Probing

Probing was done to determine soil consistency at deeper depths. The probe consists of a 2 inch diameter steel tip that is attached to AW drilling rods. The probe was driven into the underlying material with a 140 pound safety hammer falling from a height of 30 inches. The number of blows required to drive the sampler at 12 inch interval are shown on the boring logs.

LABORATORY TESTING

General

Laboratory tests are performed on various soil samples to determine their engineering properties. Samples containing over-sized particles were not suitable for testing.

Descriptions of the various tests performed in this investigation are listed below.

Unit Weight and Moisture Content

The in-situ unit weight and moisture content of the samples are used to correlate similar soils at various depths. The sample is weighed, the volume determined, and a portion of the sample is placed in the oven. After oven-drying, the sample is again weighed to determine the moisture loss. The data is used to determine the wet-density, dry-density, and moisture content.

Classification Tests

The terms and symbols used to describe the soil materials are based on the Unified Soil Classification System which provides a basis for classifying soils using either visual methods or laboratory test results. Laboratory tests include sieve and hydrometer analysis for particle size distribution, and Atterberg Limits test for liquid limit, and plasticity index determination.

Grain-size distribution of the soil is determined by passing the soil through a series of sieves. If 50 percent or more of the soil by dry weight passes the #200 sieve, the soil is classified as fine-grained. If more than 50 percent of the soil by dry weight is retained on the #200 sieve, the soil is classified as coarse grained.

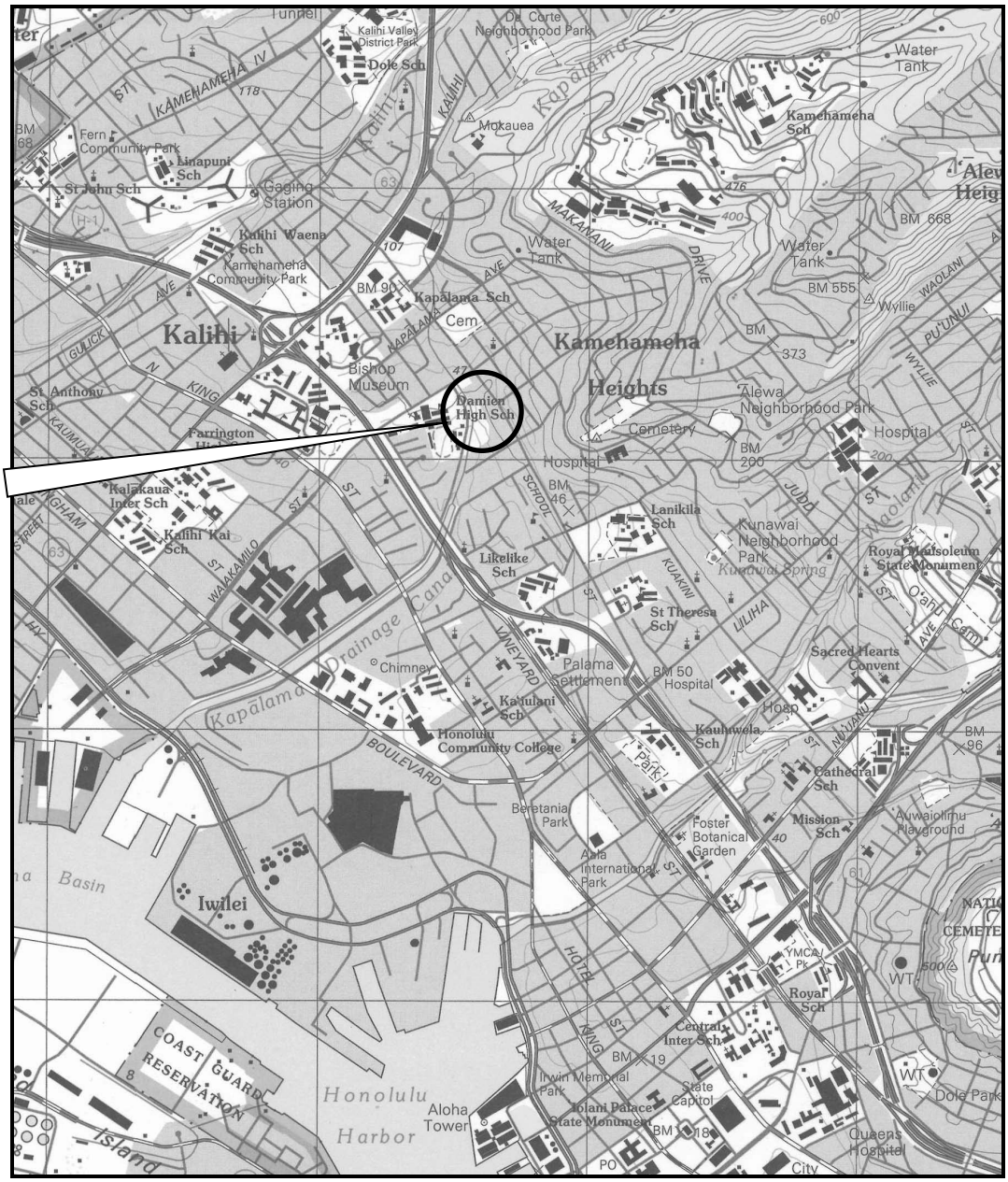
Coarse grained soils are described as follows:

Boulder	Material retained on a 12 inch square sieve
Cobble	Material passing a 12 inch sieve but retained on a 3 inch sieve
Gravel	Material passing a 3 inch sieve but retained on a #4 sieve
Sand	Material passing a #4 sieve but retained on a #200 sieve

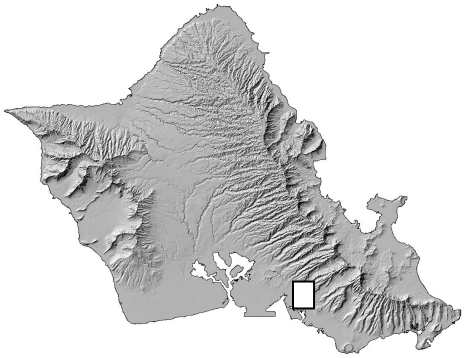
Fine-grained materials are silts and clays. The liquid limit and plastic limit results from an Atterberg Limits test are used to determine if the soil is a silt or clay.

VICINITY MAP

SITE LOCATION



TRUE NORTH



REFERENCE:
USGS TOPOGRAPHIC MAP
HONOLULU QUADRANGLE
DATED 1998
SCALE: 1”=2000’

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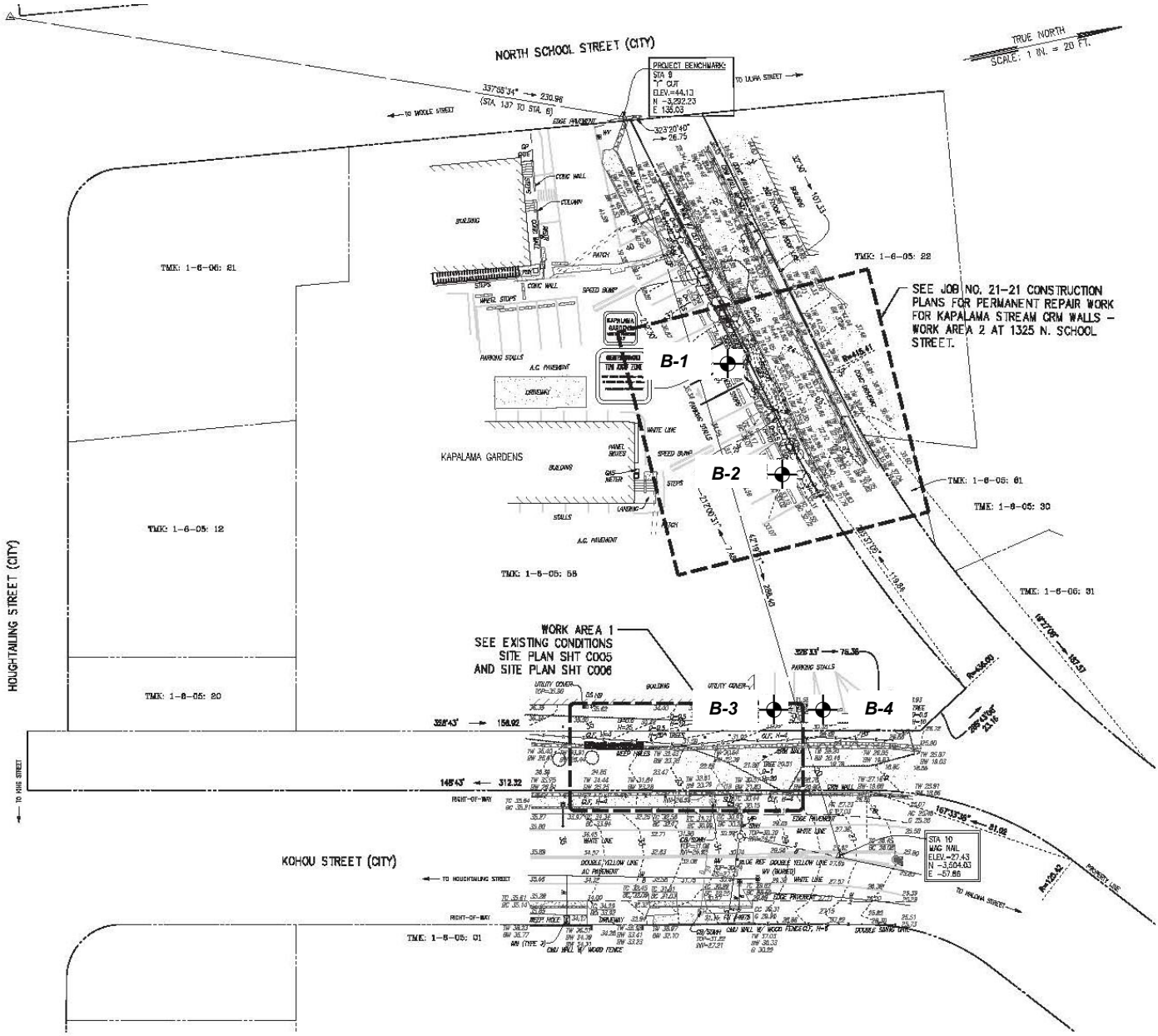

GENERAL PLAN – WORK AREA 1

20 10 0 20 40

LEGEND:

BORING LOCATION

PLOT PLAN

SCALE: 1" = 60'

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LOG OF BORING NO. 1

DRILLING METHOD: **CME Drill Rig**
HAMMER WEIGHT (lbs): **140**
HAMMER DROP (in): **30**

ELEVATION (FT.): **+/-35' (est.)**
DEPTH OF BORING (FT.): **13.92**
DEPTH TO GROUNDWATER (FT.): **NGWE**
DATE DRILLED: **12/27/23**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		**CH**	CLAY; with gravel; trace roots			brown	slightly moist	medium stiff				
2		**GM**	silty GRAVEL; few organics; trace sand		9	brown, gray	moist	loose	62.0	12.8		
4		**CH**	CLAY, trace gravel; trace sand		5	brown	moist	medium stiff	63.1	48.3	0.7	
6												
8					23	light gray	moist	stiff	73.5	42.6	4.0	1.2
10			--with gravel		13/6"	brown, mottled orange and gray			84.6	31.4	6.0	
		(RX)	BASALT, weathered --sampler refusal at 10'; --sample cuttings tested		20/0"			soft to medium hard rock		17.4		
12												
14			--sampler refusal at 13.9'		46/5"					12.5		
			END OF BORING									
16												
18												
20												
22												
24												
26												
28												
30												

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PLATE B-1

LOG OF BORING NO. 2

DRILLING METHOD: **CME Drill Rig**
HAMMER WEIGHT (lbs): **140**
HAMMER DROP (in): **30**

ELEVATION (FT.): **+/-34' (est.)**
DEPTH OF BORING (FT.): **16.58**
DEPTH TO GROUNDWATER (FT.): **12'-5"**
DATE DRILLED: **12/27/23**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		**CH**	CLAY; with gravel			brown	moist	medium stiff				
2					12				67.4	20.1		
			--trace of gravel and organics			gray	very moist	soft				
4			--trace sand		9	gray and orange brown		medium stiff	65.4	56.3	1.0	0.6
6					11				65.7	55.1	1.1	0.4
8												
10					13				64.4	50.4	2.4	0.7
12							▼					
		(RX)	BASALT, weathered --sampler refusal		15/0"	gray brown		soft to medium hard rock				
14												
16			--sampler refusal		38/1"					38.7		
			END OF BORING									
18												
20												
22												
24												
26												
28												
30												

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PLATE B-2

LOG OF BORING NO. 3

DRILLING METHOD: **CME Drill Rig**
HAMMER WEIGHT (lbs): **140**
HAMMER DROP (in): **30**

ELEVATION (FT.): **+/-32' (est.)**
DEPTH OF BORING (FT.): **19.5**
DEPTH TO GROUNDWATER (FT.): **12'-2"**
DATE DRILLED: **12/28/23**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		**CH**	CLAY; few gravel			brown	moist	medium stiff				
2		**SM**	silty SAND; with gravel	■	17	brown, gray, tan	slightly moist	medium dense	98.7	7.1		
		CH	CLAY, with gravel, few sand			gray brown	moist	very stiff				
4				■	37				88.5	22.2		
6		**(BLD)**	BOULDER (18" diameter) --sampler refusal		15/0";			very dense to hard				
8		**CH**	CLAY, with gravel, few sand			brown and gray		very stiff				
			--few gravel; few sand	■	58					25.4		
10			--with gravel	■	78				100.1	23.9		
12							▼					
14		**(RX)**	BASALT; weathered; --sampler refusal at 13.8'	■	45/4"	orange, brown, gray		soft rock	83.2	27.8		
16												
18												
			--highly weathered rock	■	34	gray, tan		very soft rock		57.1		
20			END OF BORING									
22												
24												
26												
28												
30												

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PLATE B-3

LOG OF BORING NO. 4

DRILLING METHOD: **CME Drill Rig**
HAMMER WEIGHT (lbs): **140**
HAMMER DROP (in): **30**

ELEVATION (FT.): **+/-30' (est.)**
DEPTH OF BORING (FT.): **9**
DEPTH TO GROUNDWATER (FT.): **NGWE**
DATE DRILLED: **12/28/23**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		**CH**	CLAY			brown	slightly moist	medium stiff				
			--with gravel; few sand; some roots				moist			14.4		
2					6							
4			--some sand and roots		8	brown, orange				34.0		
6					8					28.0		
8		**(RX)**	BASALT, weathered --sampler refusal at 7.0'		12/0"	brown, gray, orange		soft to medium hard rock				
			--sampler refusal		15/0"							
			END OF BORING									
10												
12												
14												
16												
18												
20												
22												
24												
26												
28												
30												

Project: PERMANENT REPAIR WORK
KAPALAMA STREAM CRM WALLS
Project No.: 23-0046

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PLATE B-4