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DAVID Y. IGE
GOVERNOR

DR. CHRISTINA M. KISHIMOTO
SUPERINTENDENT

MAR 23 2018

STATE OF HAWAI`I

DEPARTMENT OF EDUCATION

P.O. BOX 2360

HONOLULU, HAWAI`I 96804

OFFICE OF SCHOOL FACILITIES AND SUPPORT SERVICES

March 1, 2018

Mr. Scott Glenn
Director, Office of Environmental Quality Control
Department of Health
235 S. Beretania Street, Room 702
Honolulu, Hawaii 96813

RECEIVED
'18 MAR -8 P1:47
OFC. OF ENVIRONMENTAL QUALITY CONTROL

Re: Draft Environmental Assessment and Anticipated Finding of No Significant Impact
Aiea Intermediate School; Applied Technology Center
Tax Map Key: 9-9-005: 001
Honolulu District on the Island of Oahu

Dear Mr. Glenn:

The Department of Education hereby transmits the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI) for the Aiea Intermediate School Applied Technology Center project situated at TMK: 9-9-005: 001 in the Honolulu District on the island of Oahu for publication in the next available edition of the Environmental Notice.

Enclosed is a completed OEQC Publication Form, one hard copy of the DEA-AFONSI, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word.

If there are any questions, please contact Dean Mizumura, Project Coordinator of the Facilities Development Branch, Project Management Section, at 748-5123.

Sincerely,

John C. H. Chung
Acting Public Works Administrator
Facilities Development Branch

JCHC:lm
Enclosures

c: Environmental Communications, Inc.
Facilities Development Branch

18-426

AGENCY
PUBLICATION FORM

Project Name:	Aiea Intermediate School Applied Technology Center
Project Short Name:	(please use no more than five succinct words; count not to include document status, e.g., EA)
HRS §343-5 Trigger(s):	Use of State of Hawaii Lands and Funds
Island(s):	Oahu
Judicial District(s):	Honolulu
TMK(s):	9-9-005: 001
Permit(s)/Approval(s):	City and County of Honolulu Building Permits
Proposing/Determining Agency:	Department of Education
Contact Name, Email, Telephone, Address	Dean Mizumura, dean_mizumura@notes.K12.hi.us 808-784-5123, 3633 Waialae Ave. Honolulu, HI 96816
Accepting Authority:	(for EIS submittals only)
Contact Name, Email, Telephone, Address	
Consultant:	Environmental Communications, Inc.
Contact Name, Email, Telephone, Address	Taeyong Kim, tkim@environcom.com 808-528-4661, P.O. Box 236097 Honolulu, HI 96823

Status (select one)	**Submittal Requirements**
__X_ DEA-AFNSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
____ FEA-FONSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the proposing agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
____ DEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
____ FEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.
____ FEIS Acceptance Determination	The accepting authority simultaneously transmits to both the OEQC and the proposing agency a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
FEIS Statutory Acceptance	Timely statutory acceptance of the FEIS under Section 343-5(c), HRS, is not applicable to agency actions.
____ Supplemental EIS Determination	The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.

____ Withdrawal Identify the specific document(s) to withdraw and explain in the project summary section.

____ Other Contact the OEQC if your action is not one of the above items.

Project Summary
Provide a description of the proposed action and purpose and need in 200 words or less.

The project site presently consists of a portion of the level grassed playfield area on the Aiea Intermediate School campus. The project site is located due west of the the Aiea Stream. The play field area and basketball courts lie to the east of the project site, and the classrooms and administrations buildings lie to the south.

The proposed action consists of a freestanding structure that will be used to house Aiea Intermediate School's vocational and technology programs (AppliedTechnology Center or ATC). The single-story structure of 3,105 square feet will include a large clean workshop / classroom area, an secured open air shop tool work area, male and female restrooms, and a driveway extension with a turnaround hammerhead for vehicular access to the building.

Program projects that will be conducted in the new facility include solar cars, robotics and other STEM based learning initiatives. It is expected that student will gain experience in fabrication activities, heavy tools, shop equipment and industrial trade skills.

Aiea Intermediate School
Applied Technology Center

DOE Job Number Q71000-17
Honolulu District, Island of Oahu
Tax Map Key: 9-9-005: 001

Draft Environmental Assessment

State of Hawaii
Department of Department of Education

March 2018

Aiea Intermediate School Applied Technology Center

DOE Job Number Q71000-17
Honolulu District, Island of Oahu
Tax Map Key: 9-9-005: 001

Draft Environmental Assessment

Prepared pursuant to Chapter 343, Hawaii Revised Statutes (HRS) for review by the State of Hawaii Department of Education

For additional information concerning this document please contact:

Mr. Taeyong Kim
Environmental Communications, Inc.
P.O. Box 236097
Honolulu, HI 96823
Phone: (808) 528-4661
Email: tkim@envirocom.com

A copy of any comments or requests should be made to:

State of Hawaii
Department of Education
Attn: Dean Mizumura
3633 Waialae Avenue
Honolulu, HI 96816
Phone: (808) 784-5123
Email: dean_mizumura@notes.K12.hi.us

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ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
AGL	Above Ground Level
ANSI	American National Standards Institute
ATC	Applied Technology Center
BLNR	Board of Land and Natural Resources
BMPs	Best Management Practices
BWS	Board of Water Supply
CDUP	Conservation District Use Permit
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
City	City and County of Honolulu
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CT	Census Tract
CWA	Clean Water Act of 1977
CZMA	Coastal Zone Management Act
DA	Department of the Army
DAR	Division of Aquatic Resources (State of Hawaii)
dB	Decibel
dBA	Decibels A-Weighted Scale
DBEDT	Dept. of Business, Economic Development and Tourism
DHS	U.S. Department of Homeland Security
DLNR	Department of Land and Natural Resources
DNL	Day-night sound level
DOA	Department of Agriculture (State of Hawaii)
DOD	U.S. Department of Defense
DOE	Department of Education (State of Hawaii)
DOH	Department of Health (State of Hawaii)
DOT-A	Department of Transportation, Airports Division (State of Hawaii)
DOT-H	Department of Transportation, Harbors Division (State of Hawaii)
DPP	Department of Planning and Permitting (City and County of Honolulu)
DU	Decision Units
EA	Environmental Assessment
EFH	Essential Fish Habitats
EHE	Environmental Health Evaluation
EHMP	Environmental Hazard Management Plan
EIS	Environmental Impact Statement
EISPN	Environmental Impact Statement Preparation Notice
EMS	Emergency Medical Services (City and County of Honolulu)
EO	Executive Order(s)

EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973
ESA	Environmental Site Assessment
F	Fahrenheit
FAA	Federal Aviation Administration
FAQ	Frequently Asked Questions
FAR	Federal Aviation Regulations
FEMA	Federal Emergency Management Agency
FHA	Federal Housing Administration
FIRM	Flood Insurance Rate Map(s)
FONSI	Finding of No Significant Impact
FR	Federal Register
FWCA	Fish and Wildlife Coordination Act
GHG	Greenhouse gas
GHGRP	Greenhouse Gas Reporting Program
GWP	Global warming potential
H_2S	Hydrogen Sulfide
HAR	Hawai‘i Administrative Rules
HART	Honolulu Authority for Rapid Transit
HCC	Honolulu Community College
HCDA	Hawaii Community Development Authority
HCM	Highway Capacity Manual
HECO	Hawaiian Electric Company
HEER	Hazard Evaluation and Emergency Response Office (State of Hawaii)
HEPA	Hawaii Environmental Policy Act
HFD	Honolulu Fire Department
HISC	Hawaii Invasive Species Council
HRS	Hawaii Revised Statutes
HTCO	Hawaiian Telcom
HUD	U.S. Department of Housing and Urban Development
IBC	International Building Code
IPCC	Intergovernmental Panel on Climate Change
kV	Kilovolt
LED	Light emitting diode
Leq	Equivalent sound level
LOS	Level of Service
LUC	Land Use Commission (State of Hawaii)
LUO	Land Use Ordinance
MHHW	Mean higher high water
MLLW	Mean lower low water
MS4	Municipal Separate Storm Sewer System
MSL	Mean sea level
MUS	Management Unit Species
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act

NMFS	National Marine Fisheries Service (National Oceanic and Atmospheric Administration)
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O_3	Ozone
OCCL	Office of Conservation and Coastal Lands (State of Hawaii)
OEQC	Office of Environmental Quality Control
OHA	Office of Hawaiian Affairs (State of Hawaii)
OMPO	Oahu Metropolitan Planning Organization
ORMP	Ocean Resources Management Plan (State of Hawaii)
OU1C	Operating Unit 1C
Pb	Lead
PCB	Polychlorinated biphenyl
PET	Polyethylene terephthalate
PUC	Public Utilities Commission
PVC	Polyvinyl chloride
ROI	Region of influence
ROW	Right of way
SB	Senate Bill
SHPD	State Historic Preservation Division
SLUC	State Land Use Commission
SMA	Special Management Area
SOEST	School of Ocean and Earth Science and Technology (University of Hawaii)
SO_2	Sulfur dioxide
SPS	Sewage Pump Station
State	State of Hawaii
SVOC	Semi-volatile organic compounds
SWMP	Storm Water Management Plan
TMDL	Total Maximum Daily Load(s)
TMK	Tax Map Key
UH	University of Hawaii
US	United States
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground storage tanks
VA	U.S. Department of Veterans Affairs
VOC	Volatile organic compound
VPH	Vehicles per hour
WQC	Water Quality Certification

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I. PROJECT SUMMARY

SUBMITTING AGENCY:	State of Hawaii Department of Education Facilities Development Branch 3633 Waialae Avenue Honolulu, Hawaii 96816
APPROVING AGENCY:	State of Hawaii Department of Education Facilities Development Branch 3633 Waialae Avenue Honolulu, Hawaii 96816
ENVIRONMENTAL CONSULTANT:	Environmental Communications, Inc. P.O. Box 236097 Honolulu, Hawaii 96823
PROJECT NAME:	Aiea Intermediate Applied Technology Center DOE Job No. Q71000-17
PROJECT LOCATION:	99-600 Kulawea Street Aiea, Hawaii 96701
TAXMAPKEY/ OWNERSHIP:	9-9-005: 001 State of Hawaii
TAX MAP AREA:	1,345,524 square feet / 31 acres (por.)
ZONING:	R-5 Residential
SPECIAL DISTRICT:	Not in Special Management Area
STATE LAND USE:	Urban District
FLOOD ZONE:	Zone AEF and Zone X
CURRENT LAND USE:	The project site presently consists of level grassed playfield area and two storage trailer containers used for general storage. All activities on the project site are related to the primary Aiea Intermediate School functions. A chain link fence secures the school property from the Aiea Stream which is located immediately due west of the project site. Play field area and basketball courts lie

to the east of the project site, and the classrooms and administrations buildings lie to the south.

PROJECT SCOPE: The proposed action consists of a freestanding structure that will be used to house Aiea Intermediate School's vocational and technology programs (AppliedTechnology Center or ATC). The single-story structure of 3,105 square feet will include a large clean workshop / classroom area, an secured open air shop tool work area, male and female restrooms, and a driveway extension with a turnaround hammerhead for vehicular access to the building.

PROJECT COST/PHASING The total project construction cost is approximately $2,000,0000.

The proposed project will be conducted in a single continuous phase with a projected commencement date during the last quarter of 2018. The improvements should be completed in approximately 6 to 8 months.

PERMITS AND APPROVALS City and County of Honolulu Building Permit
City and County of Honolulu Electrical Permit
City and County of Honolulu Plumbing Permit

II. PURPOSE AND NEED

A. Project Description

The proposed action consists of the construction of a new freestanding building to house Aiea Intermediate Schools Applied Technology programs that include vocational and technology skills. These programs are project based and utilized "hands-on" learning. Program projects that will be conducted in the new facility include solar cars, robotics and other STEM based learning initiatives. It is expected that student will gain experience in fabrication activities, heavy tools, shop equipment and industrial trade skills.

The program for the single story building consists of the following:

Enclosed Technology Clean Workshop/Classroom	1,650 square feet
Open Air Shop Tool Work Area	700 square feet
Covered Lanai Area	500 square feet
Restrooms	205 square feet
Total	3,105 square feet

The building will be constructed with a concrete slab on-grade, metal framed walls and roof, concrete block for the restroom area, and chain link fencing around the heavy equipment open air workshop area. Aluminum windows and industrial garage doors will provide daylight and and access to the interior space. The building will feature operable window to allow natural ventilation but an air conditioning system will also serve the workshop classroom which is intended to serve as a clean work space.

The chain link enclosed heavy equipment work area is separated from the main workshop classroom for noise attenuation and dust and odor control. The restrooms will be accessible from the outside to allow dual use for both the ATC and for playfield use.

A 20-foot wide access road extension is included as part of the proposed improvements. This paved roadway will extend beyond the existing single-loaded parking area and access road that dead-ends at the existing classroom building. The proposed roadway will terminate just north of the ATC with a hammerhead turn around area. The roadway is required for both fire equipment access and for delivery of heavy materials to the ATC. An ADA compliant walkway will be constructed to connect the ATC to the lower campus classroom buildings.

Security and Parking

The building will be self secured with metal doors, steel roll gates and chain link fencing, The project will not increase parking demand and no additional parking

stalls will be provided as part of the project.

Operations

The facility will be in operation during normal school hours, possibly with some extended hours of operation based upon the project activities occurring at the ATC. While indoor activities in the workshop / classroom are not expected to generate any significant noise, the open-air workshop will create noise from the operation of heavy machinery and shop tools. Noise impacts will be monitored by the school to ensure that noise impacts do not affect other classroom activities and the surrounding neighborhood.

B. Project Location

The proposed project is located on a portion of the Aiea Intermediate School campus owned by the State of Hawaii. The school address is 99-600 Kulawea Street, Aiea, Oahu, Hawaii and is identified as TMK 9-9-005: 001.

Aiea Intermediate School is located along the slopes of Aiea and is bounded by Aiea Stream to the north west and a sloping undeveloped hill area to the east. The school site is surrounded by residential and community uses. The Aiea Public Library and a park are located further to the west, and the H-1 freeway lies further to the southwest.

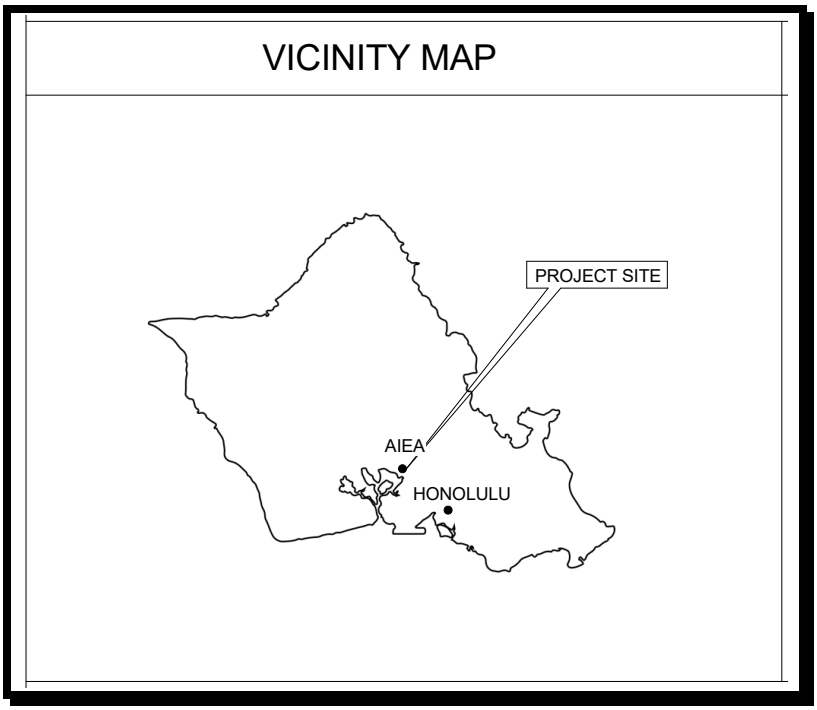
The project site is presently occupied by two shipping storage trailers that will be relocated in favor of the proposed improvements. The proposed site for the ACT is located along the chain link secured western boundary immediately north of the classroom building and parking lot. Basketball courts are located on the opposing side of the playfield. Single-family dwellings are located immediately west of the Aiea Stream running along the entire length of the school's western nad northern boundaries.

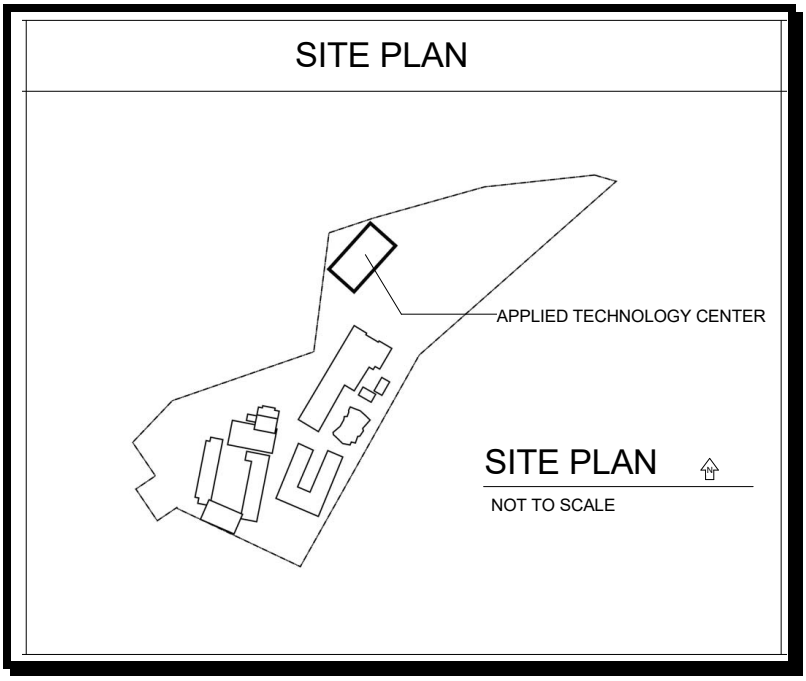
C. Project Objective and Purpose of this Document

The objective of the proposed action is to develop an Applied Technology Center (ATC) for the Aiea Intermediate School to support its programs in STEM and vocational training. This metal and concrete structure is intended to house hands on learning programs that will used both advanced technologies as well as vocational fabrication skills. As a purpose driven classroom and work area, charrettes and meetings with teacher and administrative staff determined that the ATC should be constructed as a freestanding building separated from existing classrooms.

The subject Environmental Assessment is prepared in conformance with Chapter

343 Hawaii Revised Statutes, as the project will involve the use of State lands and funds. The property is owned in fee by the State of Hawaii. The State Department of Education will serve as the submitting and approving agency on behalf of the Department of Education for the subject Environmental Assessment.





Location and Vicinity Map **Figure 1**

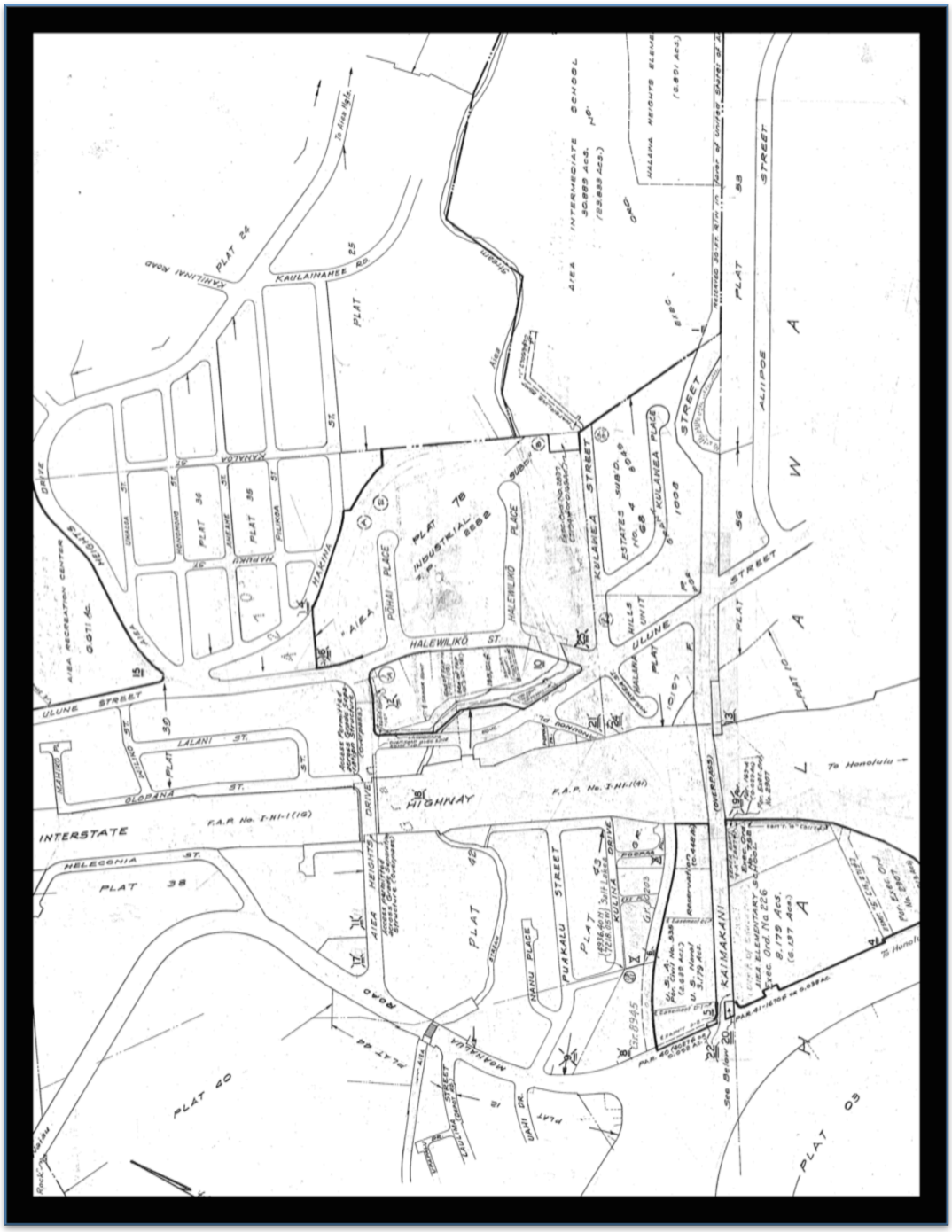
Source: AM Partners, Inc. **Aiea Intermediate School ATC**

Environmental Assessment **Aiea, Hawaii**

Location Aerial Map — **Figure 2**

Source: Google Earth — Aiea Intermediate School ATC

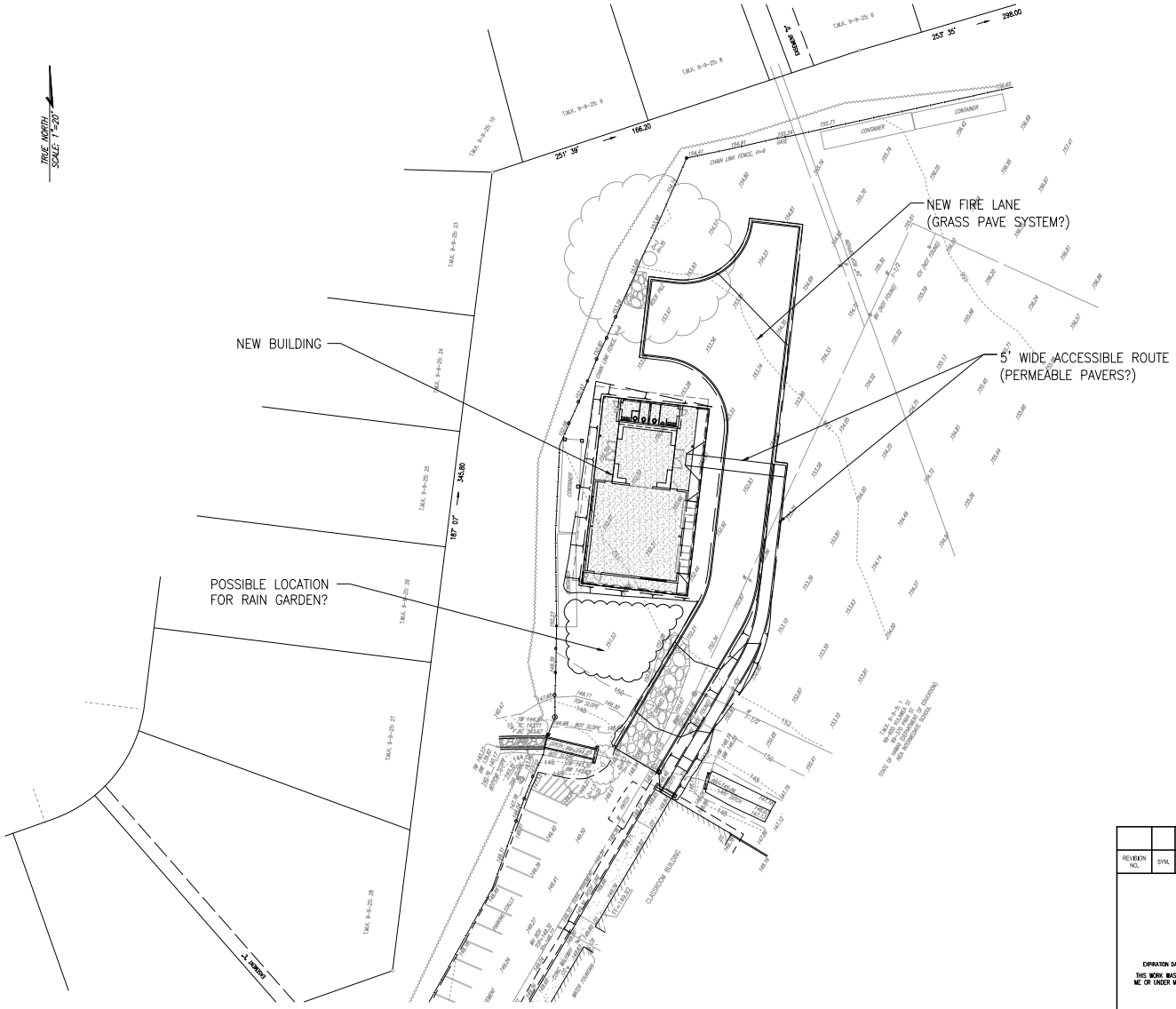
Environmental Assessment — Aiea, Hawaii



Tax Map **Figure 3**

Source: City and County of Honolul Aiea Intermediate School ATC

Environmental Assessment Aiea, Hawaii



REVISION NO.	SYM.	DESCRIPTION	SHT. OF	DATE	APPROVED:

DEPARTMENT OF EDUCATION
STATE OF HAWAII

AIEA INTERMEDIATE SCHOOL
NEW APPLIED TECHNOLOGY CENTER
99-600 KULAMEA STREET
AIEA, OAHU, HAWAII
T.M.K. 9-9-05: 01

PRELIMINARY SITE PLAN

EXPIRATION DATE: 4/30/18

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SHIMABUKURO, ENDO & YOSHIZAWA, INC.
1126 12th Avenue
Honolulu, Hawaii 96816

SEY ENGINEERS

DESIGNED BY	CHECKED BY	JOB NO.	ENVIRONMENTAL
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DRAWN BY	APPROVED BY	DATE	SHEET
BPL	HKE	10/23/2017	OF X SHTS.
SCALE			

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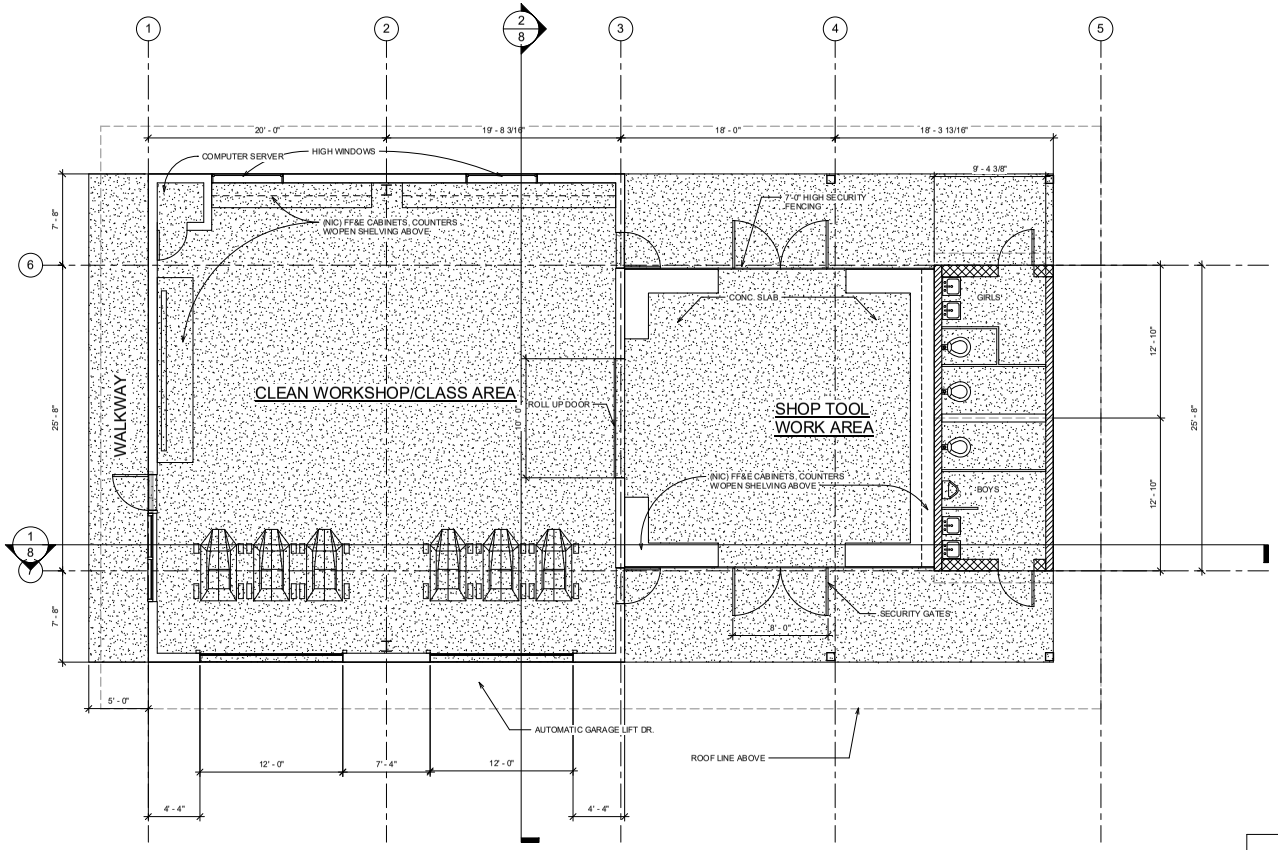

1 GROUND FLOOR
1/4" = 1'-0"

REVISION NO.	BY	DESCRIPTION	SHT OF	DATE	APPROVED

DEPARTMENT OF EDUCATION
STATE OF HAWAII

AIEA INTERMEDIATE APPLIED TECHNOLOGY CENTER
MISC R&M FY17
AIEA, OAHU, HAWAII
9-9405.004

AM PARTNERS, INC.		DOE JOB NO.	DWG ANNO. NO.
DESIGNED BY:	CHK DESIGN'R:	Q71000-17	A-2
DRAWN BY:	APPROVED BY:	DATE: 10/24/17	SHEET: 5 OF 8 SHTS.
SCALE: AS NOTED			

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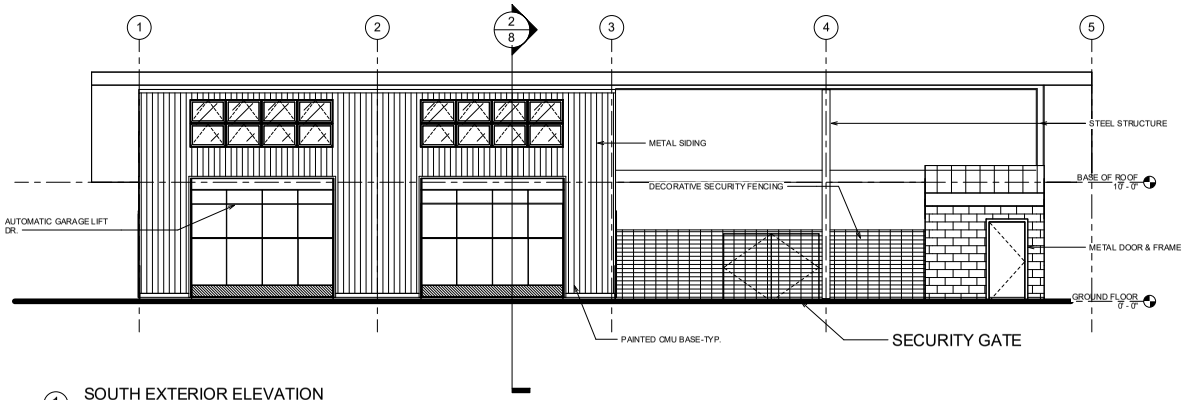
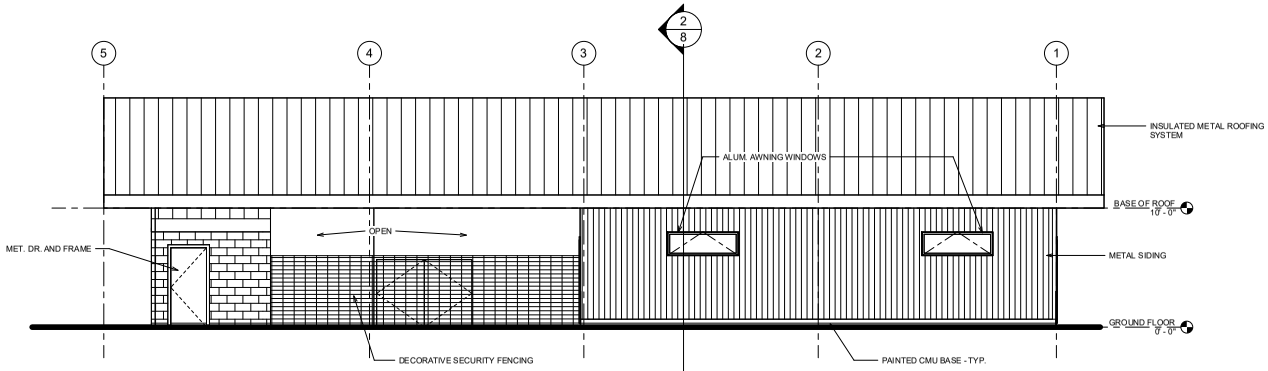


1 SOUTH EXTERIOR ELEVATION
1/4" = 1'-0"



2 NORTH EXTERIOR ELEVATION
1/4" = 1'-0"

REVISION NO.	BY	DESCRIPTION	SHT. OF	DATE	APPROVED

DEPARTMENT OF EDUCATION
STATE OF HAWAII

AIEA INTERMEDIATE APPLIED TECHNOLOGY CENTER
MISC R&M FY17
AIEA, OAHU, HAWAII
9-9-05.004

AM PARTNERS, INC.		DOE JOB NO.	DWG ANG. NO.
DESIGNED BY:	CHECKED BY:	Q71000-17	A-3
DRAWN BY:	APPROVED BY:	DATE 10/24/17	SHEET 6 OF 8 SHTS.
SCALE: AS NOTED			

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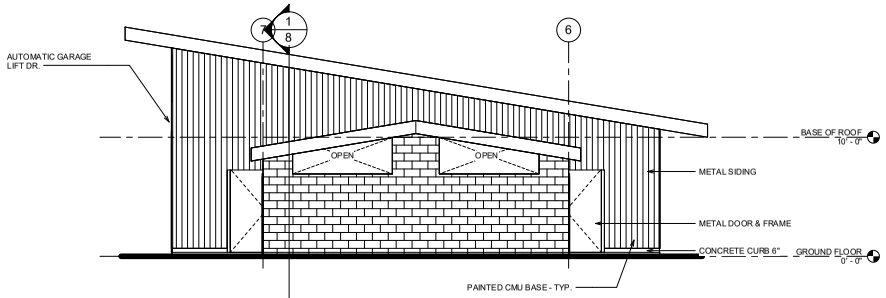
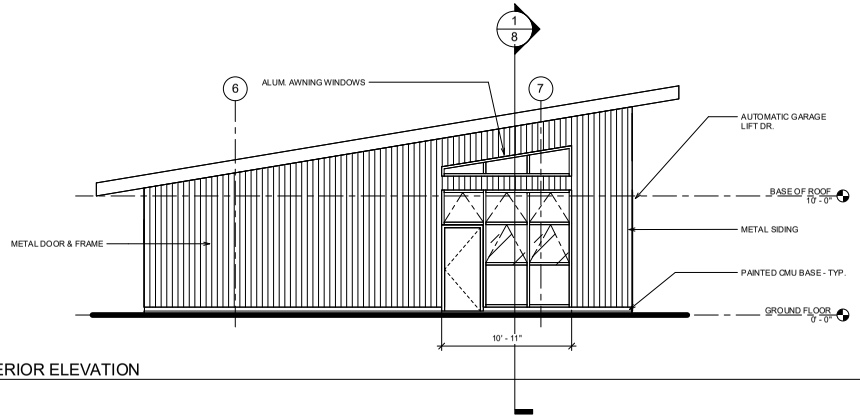


1 EAST EXTERIOR ELEVATION
1/4" = 1'-0"



2 WEST EXTERIOR ELEVATION
1/4" = 1'-0"

REVISION NO.	BY	DESCRIPTION	SHT. OF	DATE	APPROVED

DEPARTMENT OF EDUCATION
STATE OF HAWAII

AIEA INTERMEDIATE APPLIED TECHNOLOGY CENTER
MISC R&M FY17
AIEA, OAHU, HAWAII
B-0405.004

AM PARTNERS, INC.		DOE JOB NO.	DWG NO.
DESIGNED BY:	CHECKED BY:	Q71000-17	A-4
DRAWN BY:	APPROVED BY:	DATE 10/24/17	SHEET 7 OF 8
SCALE: AS NOTED			

FILE _____ DRAWN BY _____ FOLDER # _____

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III. AFFECTED ENVIRONMENT AND POTENTIAL CONSEQUENCES

A. Environmental Setting

The project site consists 1,345,524 square feet located on a single parcel of Residential (R-5) zoned lands located mauka of the H-1 Freeway and immediately east of Aiea Stream. The area is characterized by its single-family residential uses and low-density environment. While urbanized, the Aiea Intermediate School campus is contained by geographical features to the west, north and south with the Aiea Stream bounding the western side and undeveloped heavily vegetated slopes to the north and east. A single point of ingress and egress is located at the southern most portion of the campus and is accessed through a residential neighborhood.

The project site is not a scenic resource nor does it serve as a natural resource. The area is typical of moderate level suburban development and the site is not subject to heavy traffic or use beyond the educational activities of the school.

B. Surrounding Uses

The area surrounding the ATC consists of a perimeter fence and the Aiea Stream to the immediate west, grassed playfield to the north and east, and the campus classrooms, offices and support facilities to the south.

Outside of the campus proper, typical residential community uses surround the campus. The Aiea Public Library, a park and single-family dwellings are located to the west of Aiea Stream, single-family dwelling are found further north of the campus, the Gustav H. Webling Elementary School is found immediate east and uphill of the undeveloped eastern boundary of the campus, and more single-family residential dwelling are found the south.

C. Environmental Conditions and Impacts

1. Site Characteristics

<u>Topography</u>

The project area is flat and open, as it had been previously cleared, graded and grassed. The playfield area is open and devoid of any tress or natural geographic features.

A minimal amount of grading (less than 2-feet) will be required for the ACT building's slab foundation and internal infrastructure. All utilities are presently available to the campus but do not presently serve the ATC site. Utility connections will be required to the main campus. No topographical changes outside of the project boundaries will occur.

Views

The proposed ATC improvements will result in a minimal loss of open space and it will not result in the loss of any scenic views from public access points. The existing open space areas did not serve as a visual resource.

Climate

The Honolulu District is typically warm and dry in climate. Prevailing trade winds arrive from the northeast. According to the National Weather Service Honolulu Office, over a period of 30 years, normal monthly high temperatures range from 80 degrees in January to a high of 89 degrees in August for an average of 84 degrees. Normal month low temperatures range from a low of 65 degrees in February and a high of 74 degrees in August for a monthly average of 70 degrees. Precipitation typically ranges from 0.44 inches in August to a high of 3.8 inches in December. The annual average rainfall in Honolulu is 70 inches per year.

USDA Soil Survey Report and Foundation Recommendations

According to panel 53 of the *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii* by the US Department of Agriculture Soil Conservation Service, the project site is located primarily on soils classified as Hanalei silty clay, 2 to 6 percent slopes (HnB). This land type occurs primarily near Pearl Harbor and consists of soils with slow runoff and slight erosion hazard.

Geolabs, Inc. was retained to conduct a geotechnical engineering exploration for the ATC and provided the following summary and recommendations. The entire report can be found as Appendix B of the subject Environmental Assessment and should be evaluated for detailed findings.

Our field exploration generally encountered very stiff silty clays overlying basaltic cobbles in a clayey matrix extending to the maximum depth explored of approximately 26.5 feet below the existing ground surface. We did not encounter groundwater in the drilled borings at the time of our field exploration. Due to the proximity of the project site to Aiea Stream, water levels are expected to vary with the water level in the stream channel.

Based on the subsurface conditions encountered and the anticipated design finished grades for the new facility, we recommend supporting the new building on shallow foundations consisting of spread and/or continuous footings. Alternatively, slabs-on-grade with thickened-edge footings may be used for

buildings with lightly-loaded bearing walls. An allowable bearing pressure of up to 3,000 psf may be used to design the shallow foundations bearing on the

recompacted on-site soils and/or new compacted fills needed to achieve the finished grades. The bottom of footings should be embedded a minimum of 24 inches below the lowest adjacent finished grades.

Based on our laboratory tests, the on-site clayey soils exhibit moderate to high shrink/swell characteristics when subjected to fluctuations in the soil moisture contents. Therefore, we recommend providing at least 18 inches of non-expansive select granular fill materials below the building slabs, sidewalk slabs, and pavement areas due to the expansive nature of the on-site clayey soils.

Hazardous Materials

The project site primarily consists of open space that has been grassed and is in active playfield use. Two storage trailers are located along the western portion of the ATC site but are not used to store hazardous materials. No hazardous materials were observed onsite.

Air Quality

The ambient air quality of the project site is typical of low-density residential areas in Honolulu. No point source pollution sources have been identified in the general area and typical trade winds ensure that air quality remains within acceptable standards as recorded by the Department of Health air quality monitors. No odors were noted on site and the site is well ventilated and well exposed to prevailing winds.

Air quality impacts from the construction and operation of the facility are expected to be insignificant to non-existent as no major grading will be required. During the construction period, gasoline or diesel powered heavy equipment will be required to transport and erect portions of the building.

Air quality degradation from the operation of this equipment will be negligible and temporary. In the long-term, the ATC facility will not be a point source generator. The open-air shop equipment area may generate some dust from the use of heavy shop equipment. This dust is not considered to be a hazard but can be a nuisance therefore diligent clean-up of the work area should be encouraged. No long-term air quality impacts should occur from the operation of the facility.

Noise Environment

The noise environment will be minimally affected by the ATC. The majority of the facility is within an air conditioned classroom space but the heavy shop equipment work area is located in an open-air space located between the clean

workshop and the restrooms. The classroom and restroom will attenuate noise in the northern and southern directions but some noise impact from the operation of heavy equipment can be expected in the western direction for the residences located across Aiea Stream. The playfield and hilly undeveloped area to the east should not be affected by the equipment noise. Applicable community noise standards from the Department of Health must be adhered to and it is expected that most noise generation will occur during normal school and business hours.

Construction activities will generate noise however construction related noise impacts will be short-term in nature and will not include any atypical construction noises. All construction related activities will continue to adhere to State Department of Health community noise standards.

2. Water Resources

Hydrologic Hazards and Resources

According to the Department of Land and Natural Resource Flood Hazard Assessment Tool, the is primarily located in Zone X, an area where flood hazards are undetermined. A small sliver of the project site is located in Zone AEF, an area located within the 100-year floodway where base elevations have been determined. The project is located above the base flood elevation.

Rising sea levels for the State of Hawaii will not affect the project site.

Tsunami Inundation Area

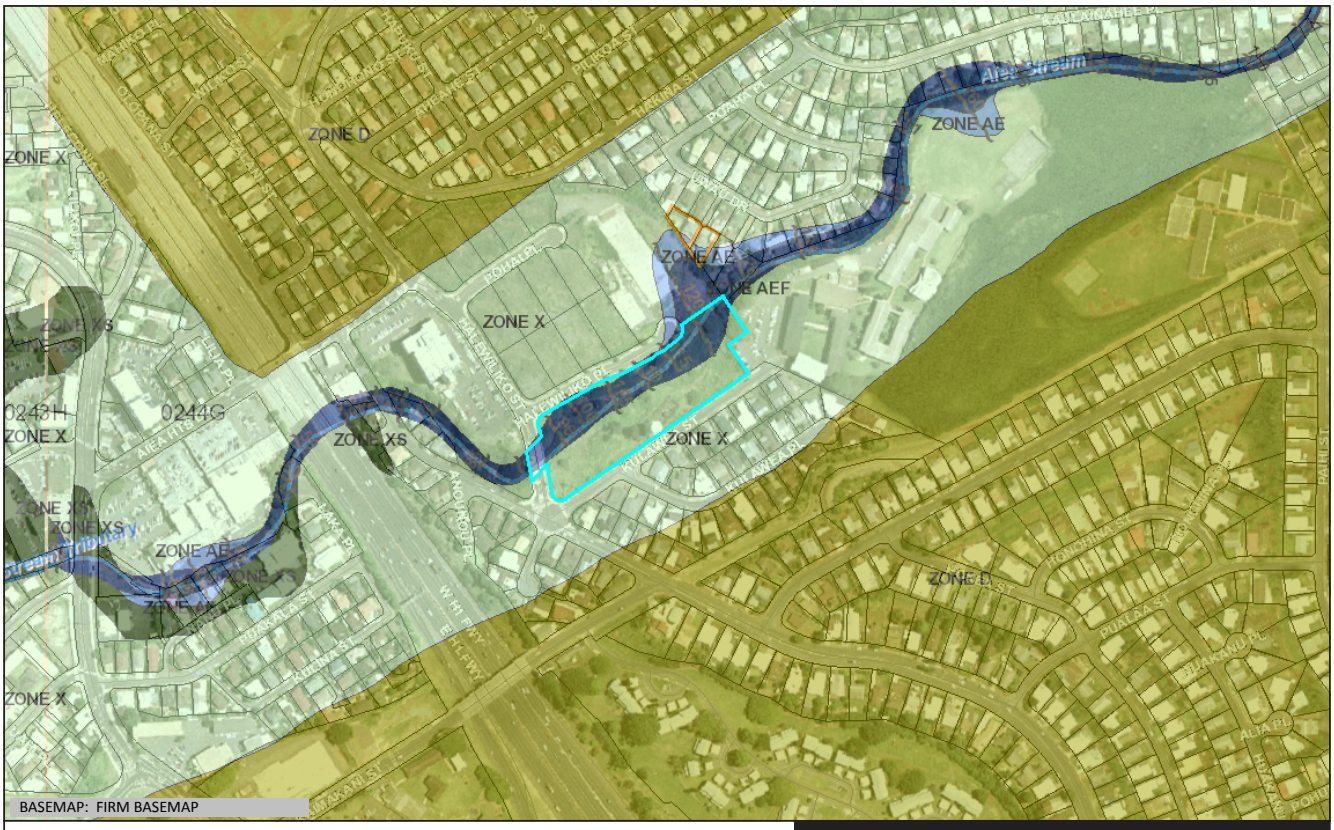
According to Map 20, Inset 2 of the City and County of Honolulu Department of Emergency Management Tsunami Map, the project site is not located in a Tsunami Evacuation Zone.

Special Management Area

The project site is not located within the Special Management Area (SMA).

Water Quality

The project will not adversely affect surface water quality. Presently the site is naturally drained. The proposed ATC building and roadway / fire lane extension will increase non-permeable surfaces but runoff is expected to be retained by the extensive grassed playfield or directed to the Aiea Stream which serves as a regional drainage receptor. No hazardous materials will be stored in the outside of the warehouse. Any surface water generated from the project site is expected to be limited to rainfall.



Flood Hazard Assessment Report

www.hawaiinfip.org

ATC Flood Hazard Map

Property Information

COUNTY:	HONOLULU
TMK NO:	(1) 9-9-078:015
WATERSHED:	AIEA
PARCEL ADDRESS:	99-550 KULAWEA ST AIEA, HI 96701

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 05, 2014
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	15003C0244G
PANEL EFFECTIVE DATE:	JANUARY 19, 2011

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 400 800 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL*)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

3. Archaeological, Historical, Cultural, Botanical and Faunal Resources

Archaeological Resources

The site is not known to be a historic or archaeological site. As such no archaeological or historic materials are expected to exist on the project site. The State Historic Preservation Division will be contacted when foundation plans for the structure are completed.

In the unlikely event that any archaeological artifacts are uncovered, all work will cease and the Department of Land and Natural Resources State Historic Preservation Division (SHPD) will be notified for appropriate action.

Cultural Resources

The project site is not known to be a cultural resource or area used for native gathering practices. The school has been in existence since the early 1960's.

Flora

The entire surface of the project site is covered with playfield grass. The site is completely devoid of any other flora and subsequently, no rare, threatened or endangered species of flora were observed within the project site. Invasive species from flora or fauna are not expected to have any impact on the site.

Fauna

The site does not serve as an endangered wildlife habitat. No land-based fauna was observed during site visits and no rare or endangered species of avifauna were identified.

4. Infrastructure and Utilities

The proposed improvements are not expected to have a significant impact on existing infrastructure and utilities. Water and electrical power is presently available on campus and future operations can be serviced by the local utilities.

Vehicular Access and Traffic Conditions

The roadway that extends north of the existing parking lot is 20-feet wide and is required for fire protection equipment purposes. The hammerhead turn around located immediately north of the ATC will allow fire apparatus to turn around and exit the site in a forward manner. The roadway will also allow heavy equipment and materials to be delivered or removed from the ATC shop area. No additional parking will be provided and no increase in vehicular traffic will result from the

construction of the ATC.

Water

The proposed project will have only minimal impact on water use. Water will be available within the classroom but most water usage will be from the men's and women's toilets and sinks located at the northern end of the ATC building.

Wastewater

Wastewater for the project site will be accommodated by the existing municipal wastewater system. The facility will have men's' and women's' toilets which will generate a nominal amount of wastewater.

Drainage

The site is grassed and is flat with a very gentle slope form east to west and north to south. The proposed action will result in the loss of permeable surfaces as the ATC and appurtenant roadway will decrease the natural drainage area. Stormwater collected will be diverted into the playfield area or will be directed to west were the Aiea Stream is located. A large culvert entering Aiea Stream is located immediately north of the existing roadway and parking lot, and south of the proposed ATC. Aiea Stream serves as a regional drainage receptor. The ATC building will not produce any hazardous surface drainage both in volume and in content.

Solid Waste

Solid waste disposal will be collected by a private hauler and disposed of at an approved County refuse site.

Telephone and Electrical Services

Telephone and electrical services are available for the project via mainlines located within the campus.

5. Public Facilities

The proposed project will not have any significant impact on public facilities including schools, police, and fire or emergency medical services as the project continues an industrial use of an existing industrial building. The project will not increase population in the area. Police, fire protection and emergency medical services are already available in the area but the project is not expected to increase demand for any of these emergency services.

Aiea Fire Station Number 10 provides fire protection and first response emergency and rescue service to the project area. The station is located at 98-1225 Ulune Street, approximately 4,000 from the project site. Response time to the site is approximately 5 minutes. An engine company serves this station.

Ambulance service for the project vicinity is provided by a City and County of Honolulu Emergency Medical Service Unit located at Pali Momi Medical Center. Response time to the project area is approximately 5 to 10 minutes.

Police service in the project area is part of the Honolulu Police Department's District 3, Sector 3. Police service available by beat patrols and anticipated response times are anticipated to be within 5 minutes.

D. Social and Economic Characteristics

The proposed action will not have significant social impact to the surrounding area. The project will provide additional educational opportunities for the students of Aiea Intermediate School so this will provide an indirect benefit to the area for which the school serves.

The project will have beneficial economic impacts. The construction of the facility will create short-term employment, the purchase of goods and services, the generation of excise and income taxes, and other secondary and tertiary effects as a result of the project expenditures.

The long-term operations of the facility will enhance employment opportunities, by providing opportunities to learn new technology and vocational skills that will better prepare students for future learning or as preparation to enter the job market upon completion of high school.

E. Relationship to Plans, Codes and Ordinances

The project site is zoned R-5 residential use as specified under the City and County of Honolulu Zoning Map. According to Table 21-3, Revised Ordinances of Honolulu, the intermediate schools are allowed by Conditional Use Permit (Minor). The proposed ATC is entirely located within the boundaries of the Aiea Intermediate School and is not subject to an independent CUP.

The proposed action is consistent with sections of the City and County of Honolulu General Plan. Notable are Section IX. Health and Education Objective B to provide a wide range of educational opportunities for the people of Oahu. While the project conforms with all of the policies under Objective B, the project is particularly applicable to Policy 1, which supports educational programs that encourages the development of employable skills. The ATC is intended to support

STEM and vocational skills through a hands-on project based learning method. It is anticipated that this exposure will provide exposure to different paths for continued learning and future employment.

Under the City's Primary Urban Center Development Plan, the project is generally consistent with all aspects of the plan but most applicable is Section 4.7 Schools and Libraries. Particularly applicable is Policy 4.7.2 which supports the development of high quality educational system of schools and post-secondary institutions that increase the attractiveness of the Primary Urban Center as a place to live and work. The ATC and its learning programs are a new concept that is expected to be a featured learning opportunity.

The State Land Use Boundary Maps show the project location to be in Urban use. The project is not located within the Special Management Area (SMA).

The project is also consistent with the objectives of the Hawaii State Plan particularly with respect to the objectives and policies regarding socio-cultural advancement. In the State Plan an emphasis is placed on quality education. The proposed ATC will be on the leading edge of middle school education by supporting expanded and enhanced learning in both STEM and vocational activities.

The proposed improvements will require City and County of Honolulu Building, Electrical and Plumbing Permits.

Work on the proposed improvements will not commence until building permits and the environmental assessment process are completed.

F. Impacts on the Environment

The proposed improvements will result in a more intensive use of the existing unused space. While the proposed use will have more physical impact than its current non-use, the mission of the school is to provide quality learning opportunities that will benefit the student immediately, and the County and State in the long term.

The project will have negligible environmental impact but will provide significant benefit to students and the community through the expanded learning opportunities afforded by the ATC.

Minor impacts related to the site and building improvements may occur during the construction period. Other offsetting construction related impacts are the creation of short-term employment both on property and off-property, the generation of additional tax revenues to the State of Hawaii, and the resultant secondary and

tertiary spending and tax collections that will likely be experienced in the community.

Secondary impacts include the use of resources that are not expected to be recovered in short-term. This would include the use of local construction materials, impacts associated with the operation such as electrical demand that would have some minor impacts at the point of power generation, and air quality impacts resulting from the operation of construction equipment and building functions. The minor physical environmental impacts of the project are offset by the significant economic benefits received by the school's students and the community at large.

Cumulative impact to Aiea Intermediate School and the surrounding community is not anticipated to be significant in that the proposed will not general any traffic, and does not create any conditions that should affect adjacent uses. The project is clean and non-intrusive.

G. Adverse Impacts Which Cannot be Avoided

Adverse impacts that cannot be avoided are generally related to short-term construction activities. These impacts can be minimized by sound construction practices, adherence to applicable construction regulations as prescribed by the Department of Health, and coordination with applicable State and County agencies. Best Management Practices (BMPs) will be incorporated wherever practicable to ensure that the local environment is minimally affected by construction activities.

Only minor grading work will be required for the construction of the project improvements. Exterior construction work may create some dust, noise and a minor traffic nuisance during the course of construction. A small amount of paving will be required for the access road extension but this improvement will not affect exiting internal circulation. Heavy vehicles will be required for the installation of heavy machinery but no traffic control measures will be required during the construction period.

H. Alternatives to the Proposed Action

Alternatives locations were considered in within the campus but the proposed location was deemed to have the least amount of impact to other school activities and use of the playfield. The selected location is also best suited for the access road / fire lane. Alternative locations would require use of the playfield that would significantly reduce the amount of area available for recreational activities, would introduce more paving than the current plan, would be less efficient, and would be higher in cost.

The no-action alternative not considered as the proposed project is a core objective of the Department of Education's current learning programs. If the ATC is not built, students would be deprived of educational experiences that are now considered necessary and forward looking. No ATC would result in no creation of additional educational opportunities that are expected to be of the highest priority.

I. Mitigation Measures

Long-term impacts resulting from the proposed improvements are expected to be minimal or non-existent based upon the subject environmental assessment. Long-term air and noise impacts are not expected to change significantly after improvements are completed. Traffic conditions will not be affected. Short-term construction-related noise and air quality impact mitigation measures include general good housekeeping practices and keeping the construction period as short as possible. The contractor will be directed to use best management practices (BMP) wherever applicable.

Examples of BMPs that may be implemented include watering during any dust generating activities and the containment of any runoff during the construction period. All waste materials will be securely contained and appropriately disposed.

J. Irreversible and Irretrievable Commitment of Resources

Implementation of the proposed project will result in the irreversible and irretrievable commitment of resources in the use of non-recyclable energy expenditure and labor. Materials used for new construction may have salvage value; however, it is unlikely that such efforts will be cost-effective. The expenditure of these resources is offset by gains in construction-related wages, increased tax base and tertiary spending.

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IV. REASONS SUPPORTING FINDING OF NO SIGNIFICANT IMPACT

As stated in Section 11-200-12, EIS Rules, Significance Criteria: in determining whether an action may have a significant impact on the environment, every phase of a proposed action shall be considered. The expected consequences of an action, both primary and secondary, and the cumulative as well as the short-term and long-term effects must be assessed in determining if an action shall have significant effect on the environment. Each of the significance criteria is listed below and is followed by the means of compliance or conflict (if extant).

- Involves the loss or destruction of any natural or cultural resource.

The proposed action will not involve the loss or destruction of any natural or cultural resource. The project site is vacant and is devoid of any natural or cultural resources.

- Curtails the range of beneficial uses of the environment.

The proposed installation will not curtail any beneficial uses of the environment. The project area is not generally used by the public. Public access to the site is, in fact, restricted during school hours and the campus is closed when school is not in session.

- Conflicts with the State's long-term goals or guidelines as expressed in Chapter 344, Hawaii Revised Statutes.

The proposed action is consistent with the goals and guidelines expressed in Chapter 344, Hawaii Revised Statutes. The proposed action is triggered by the use of State of Hawaii lands and the use of State of Hawaii funds.

- Substantially affects the economic or social welfare of the community or state.

The proposed action will make a positive contribution to the welfare of the County and State by creating employment during the construction period and will also benefit the State through increased tax revenue.

- Substantially affects public health.

The proposed improvements will not have a significant effect on public health. Safety is a primary concern of all schools and the ATC will be subject to close supervision by DOE staff.

- Involves substantial or adverse secondary impacts, such as population changes or effect on public facilities.

The proposed action will not produce substantial secondary impacts resulting in population changes or significantly increase use of public facilities.

- Involves substantial degradation of environmental quality.

The proposed improvements will not involve the substantial degradation of environmental quality. The improvements proposed will have short-term impact on the environment; however, this is temporary in nature.

- Cumulatively have a considerable effect upon the environment or involve a commitment for larger actions.

The proposed action is not a first phase of any larger action nor will it have a considerable effect on the environment. The project is expected to remain for the long-term and is not designed for larger expansion or other related development.

- Affect rare, threatened or endangered species, or their habitats.

The proposed action will not affect any rare, threatened or endangered species of flora or fauna. The project site is not located near any wildlife refuge or sensitive environmental area.

- Detrimentally affect air or water quality or ambient noise levels.

The proposed action is not expected to impact air or water quality. Long-term noise levels may increase slightly due to the increased level of activity on the site. This impact is expected to be within acceptable levels and will be limited to school hours.

Minimal impacts on air quality and noise are anticipated during construction. These impacts will be limited by normal construction practices and compliance with Department of Health construction mitigation standards.

Water quality will not be affected by the proposed action.

- Affect scenic vistas and view planes identified in County or State plans or studies.

The proposed action will not affect any scenic vistas or view planes identified by the County or State.

- Require substantial energy consumption.

The project will increase energy consumption over non-construction of the building. Energy utilization during the construction phase will increase through the use of fossil fuels used by construction vehicles. Operations of the facility will have energy consumption for the operation of the bottling plant. Natural lighting will provide lighting for the building and operable windows for natural ventilation will be used when weather permits.

- Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

The project is located near the Aiea Stream which serves as a regional drainage resource. No hazardous runoff will be generated by the ATC building. The proposed project will not create any erosion however construction related activities will use BMPs to mitigate and potential runoff impacts.

Anticipated Finding of No Significant Impact

Based on the above stated criteria, it is anticipated that proposed project will not have any significant adverse environmental impacts and that an Environmental Impact Statement will not be required for the proposed action. This Draft Environmental Assessment will be subject to public review and prescribed by Chapter 343 Hawaii Revised Statutes.

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V. LIST OF PARTIES CONSULTED PRIOR TO DEVELOPMENT OF THE DRAFT ENVIRONMENTAL ASSESSMENT

Agencies with ministerial or specific interests regarding the proposed project were contacted for their comments by telephone regarding the proposed project. The agencies consulted have provided information that is referenced in this document or were reserved until the Draft Environmental Assessment is provided for review.

Department of Accounting and General Services
State of Hawaii

Department of Education

Department of Planning and Permitting
City and County of Honolulu

Honolulu Fire Department
City and County of Honolulu

Honolulu Police Department
City and County of Honolulu

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VI. LIST OF AGENCIES, ORGANIZATIONS AND INDIVIDUALS TO BE CONSULTED DURING THE DRAFT ENVIRONMENTAL ASSESSMENT PROCESS

Federal

1. Department of the Army, Corps of Engineers
2. Environmental Protection Agency
3. National Ocean and Atmospheric Administration, National Marine Fisheries Service
4. US Fish and Wildlife Service

State of Hawaii Agencies

1. Dept. of Agriculture
2. Dept. of Business, Economic Development and Tourism, Office of Planning
3. Dept. of Health, Environmental Planning Office
4. Dept. of Health, Clean Air Branch
5. Dept. of Health, Clean Water Branch
6. Dept. of Health, Noise, Radiation and Indoor Noise Branch
7. Dept. of Health, Office of Hazard Evaluation and Emergency Response
8. Dept. of Land and Natural Resources Historic Preservation Division
9. Dept. of Land and Natural Resources Division of Aquatic Resources
10. Dept. of Land and Natural Resources District Land Office
11. Dept. of Land and Natural Resources Office of Conservation and Coastal Lands
12. Dept. of Transportation, Highways Division
13. Office of Environmental Quality Control
14. Office of Hawaiian Affairs
15. University of Hawaii, Environmental Center

City and County of Honolulu Agencies

1. Board of Water Supply
2. Department of Environmental Services
3. Department of Planning and Permitting
4. Department of Transportation Services
5. Fire Department
6. Police Department

Libraries

1. Hawaii State Library
2. Kalihi Public Library

Other Parties

1. Harbors Police
2. Hawaii Harbors Users Group (HHUGS)
2. Iwilei District Participating Parties LLC
3. Kalihi Palama Neighborhood Board, No. 15

REFERENCES

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APPENDIX A
Project Plans

AIEA INTERMEDIATE APPLIED TECHNOLOGY CENTER

MISCELLANEOUS R&M FY17

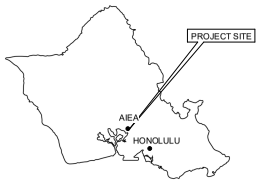
AIEA, OAHU, HAWAII

FOR

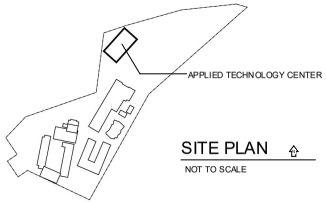
DEPARTMENT OF EDUCATION

DOE JOB NO. P18000-17

VICINITY MAP



SITE PLAN



FOB, PUBLIC WORKS ADMINISTRATOR
DEPARTMENT OF EDUCATION
STATE OF HAWAII

DATE

ED XXXXXX (FOR R&M PROJECTS)

PROJECT TEAM

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REVISION NO.	BY M.	DESCRIPTION	SHT OF	DATE	APPROVED

DEPARTMENT OF EDUCATION
STATE OF HAWAII

AIEA INTERMEDIATE APPLIED TECHNOLOGY CENTER
MISC R&M FY17
AIEA, OAHU, HAWAII
(2) 3-8-030:009

TITLE SHEET

AM PARTNERS, INC.		DOE JOB NO.	DRAWING NO.
DESIGNED BY:	CHECKED BY:	P55003-14	T-1
DRAWN BY:	APPROVED BY:	DATE 12/09/2016	SHEET 1 OF 15 SHTS
SCALE: AS NOTED			

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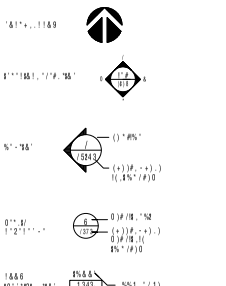
DRAWING SYMBOLS



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KITCHEN	1088 SF	11	1 (3'-0"WIDE)	1 (3'-0"WIDE)
SERVING AREA	715 SF	7	1 (3'-0"WIDE)	1 (3'-0"WIDE)
LAUNDRY AREA	136 SF	1	1 (3'-0"WIDE)	1 (3'-0"WIDE)

DEMOLITION NOTES

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ABBREVIATIONS

GENERAL NOTE

INDEX OF DRAWINGS		
SHT	SHEET DESCRIPTION	Sheet Number
T-1	TITLE SHEET	1
T-2	GENERAL NOTES, ABBREVIATIONS, INDEX TO DRAWINGS	2
C-1	PRELIMINARY SITE PLAN	3
		0
A-1	SITE PLAN	4
A-2	FLOOR PLAN	5
A-3	BUILDING ELEVATIONS	6
A-4	BUILDING ELEVATIONS cont.	7
A-5	BUILDING SECTION	8

REVISION NO.	BY	DESCRIPTION	SHT OF	DATE	APPROVED

DEPARTMENT OF EDUCATION
STATE OF HAWAII

AIEA INTERMEDIATE APPLIED TECHNOLOGY CENTER
MISC R&M FY17
AIEA, OAHU, HAWAII
9-9-05001

AM PARTNERS, INC.		DOE JOB NO.	DRAWING NO.
DESIGNED BY:	CHECKED BY:	Q71000-17	T-2
DRAWN BY:	APPROVED BY:	DATE	SHEET
SCALE: AS NOTED		10/24/17	2 OF 8 SHTS

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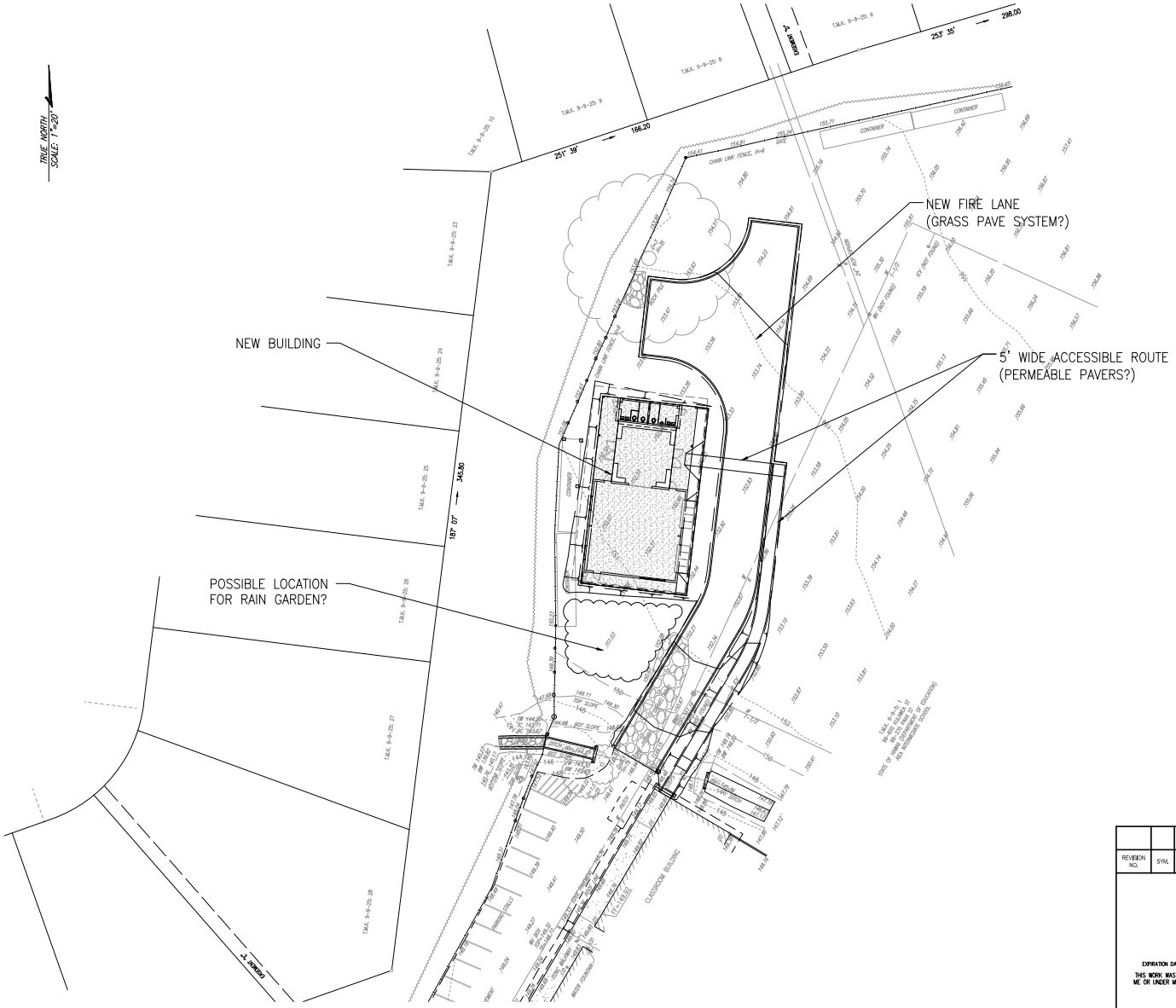

REVISION NO.	SYM.	DESCRIPTION	SHT. OF	DATE	APPROVED:

EXPIRATION DATE: 4/30/18

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SHIMABUKURO, ENDO & YOSHIZAKI, INC.
1126 12th Avenue
Honolulu, Hawaii 96816

DEPARTMENT OF EDUCATION
STATE OF HAWAII

AIEA INTERMEDIATE SCHOOL
NEW APPLIED TECHNOLOGY CENTER
99-600 KULAWEA STREET
AIEA, OAHU, HAWAII
T.M.K. 9-9-05: 01

PRELIMINARY SITE PLAN

SEY ENGINEERS

DESIGNED BY: BPL	CHECKED BY: HKE	JOB NO.: Q76000-17	DRAWING NO.:
DRAWN BY: BPL	APPROVED BY: HKE	DATE: 10/23/2017	SHEET: X OF X SHTS.
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User: BPL Plot Date: Oct-25 2017
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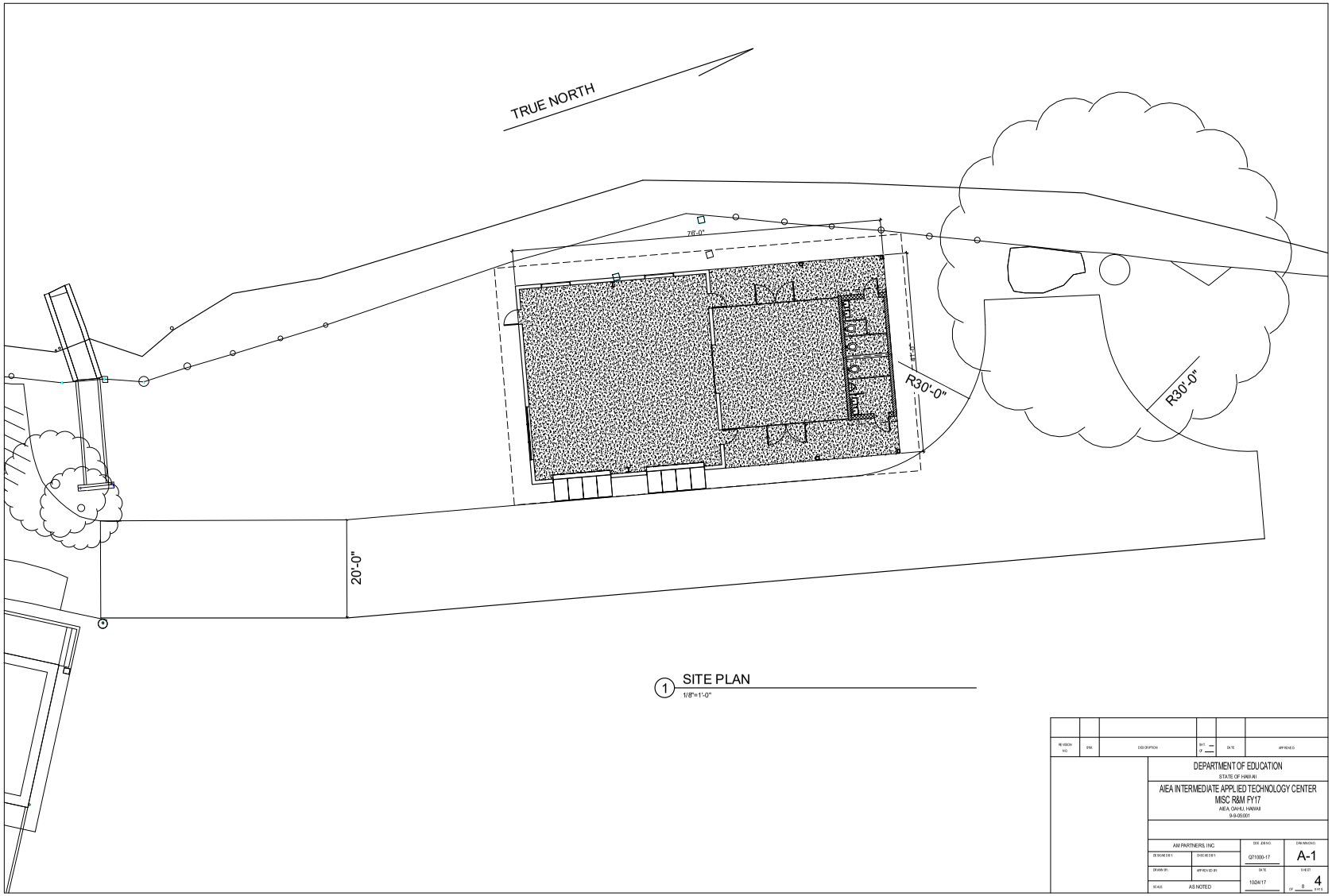

1 SITE PLAN
1/8"=1'-0"

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9-9-05/001

AM PARTNERS, INC		DOE JOB NO. Q71000-17	DRAWING NO. A-1
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SCALE AS NOTED			

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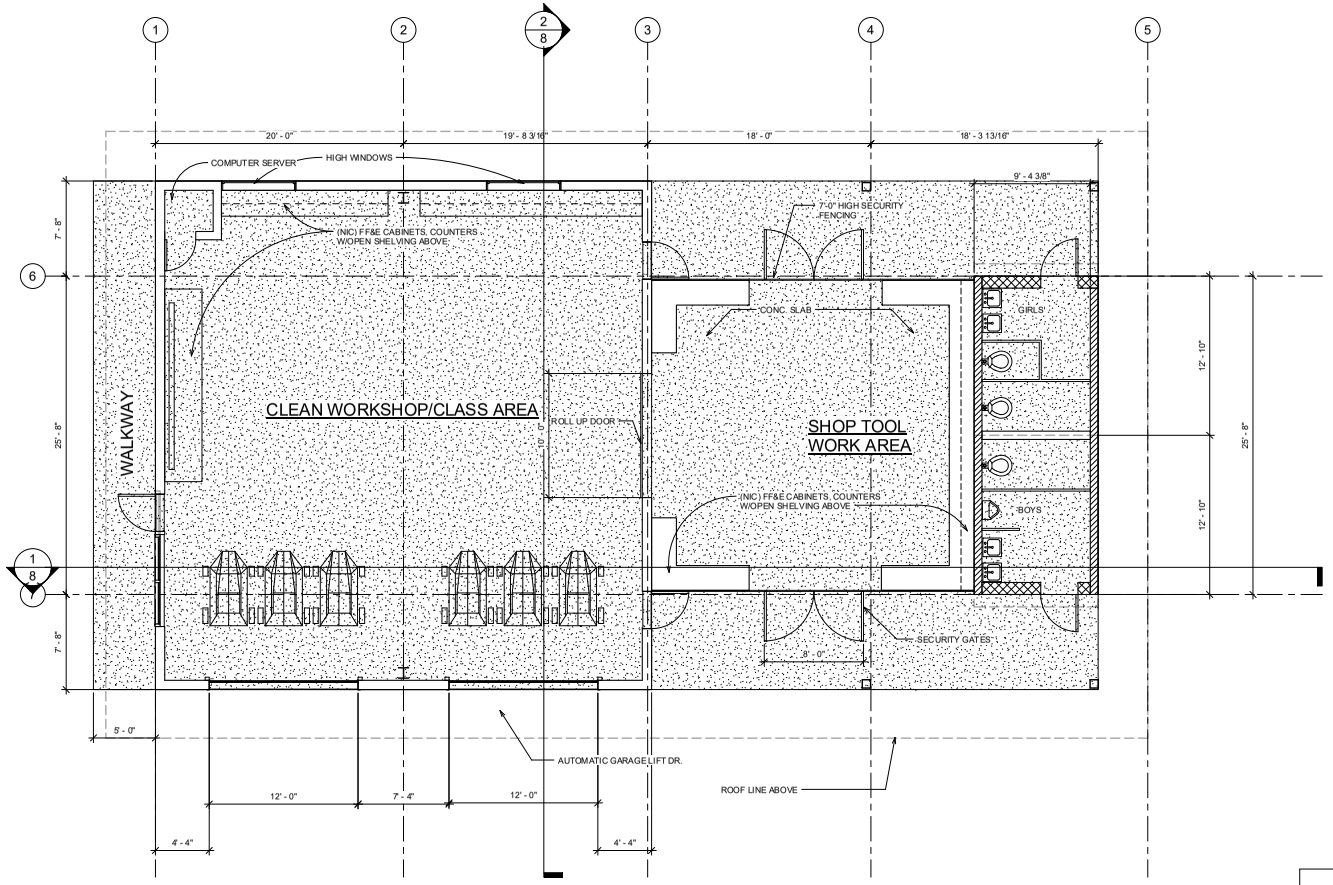

1 GROUND FLOOR
1/4" = 1'-0"

REVISION NO.	BY M.	DESCRIPTION	SHT OF	DATE	APPROVED

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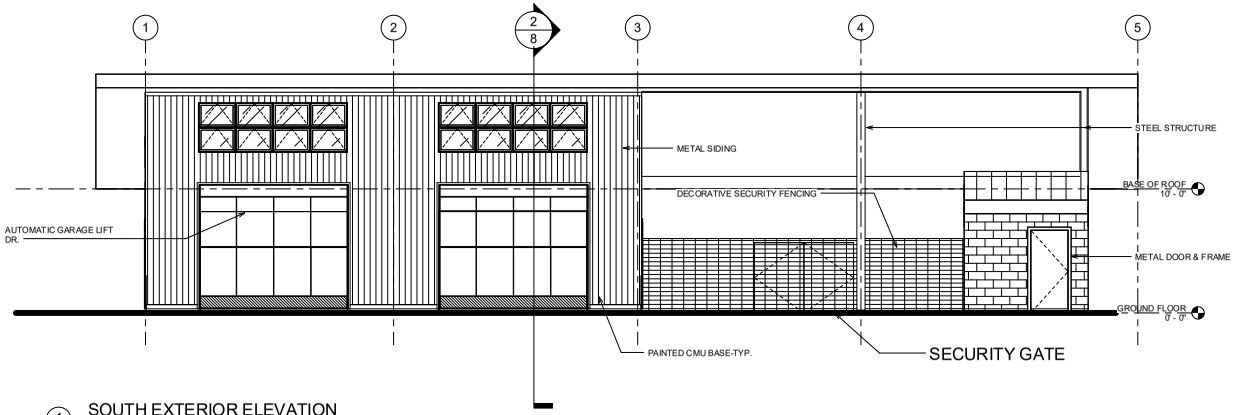
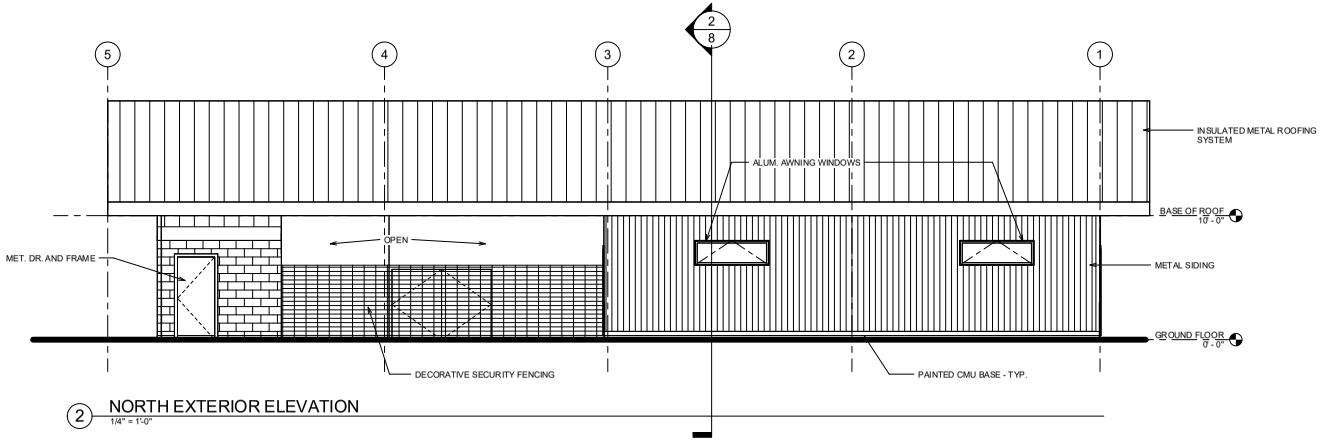


1 SOUTH EXTERIOR ELEVATION
1/4" = 1'-0"



2 NORTH EXTERIOR ELEVATION
1/4" = 1'-0"

REVISION NO.	BY	DESCRIPTION	SHT OF	DATE	APPROVED

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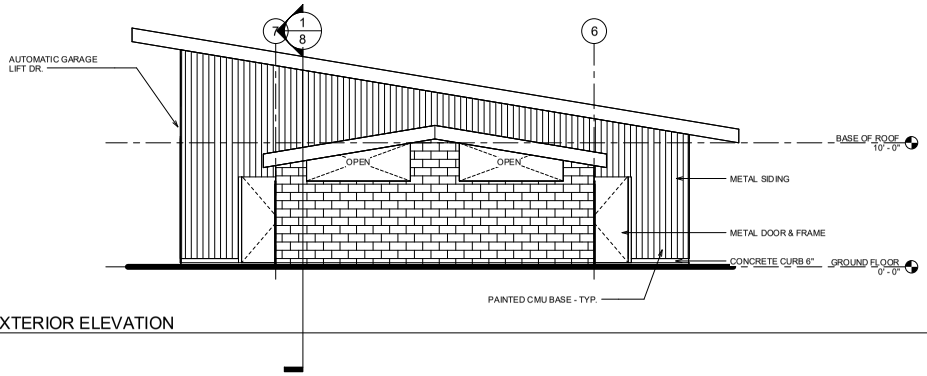
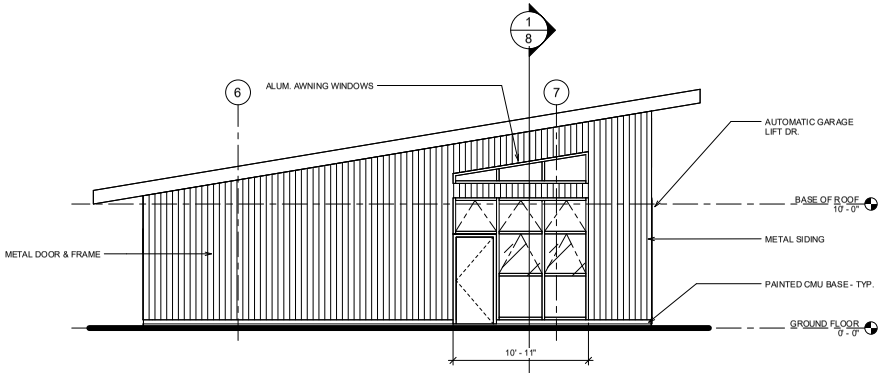


1 EAST EXTERIOR ELEVATION
1/4" = 1'-0"



2 WEST EXTERIOR ELEVATION
1/4" = 1'-0"

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AIEA, OAHU, HAWAII
9-9-05001

AM PARTNERS, INC.		DOE JOB NO.	DRAWING NO.
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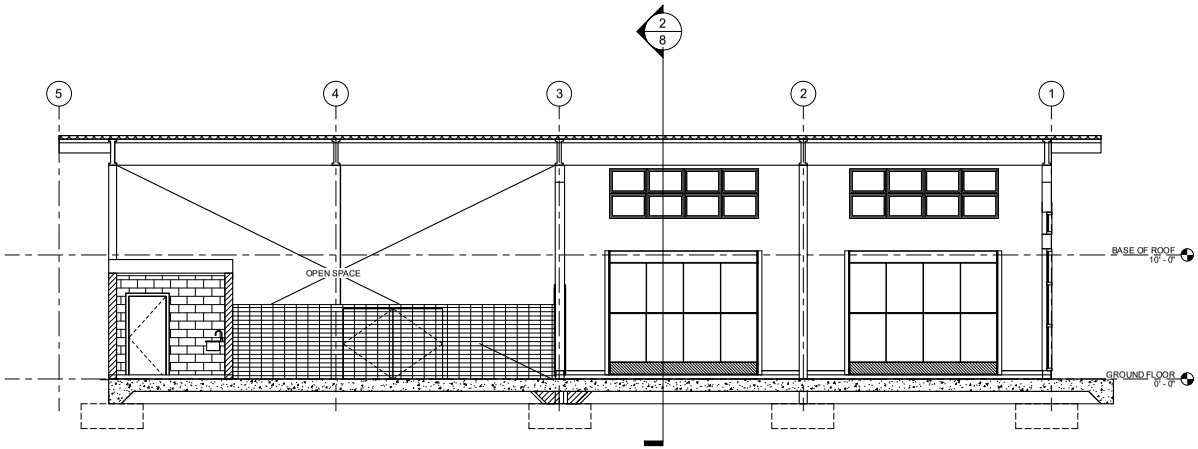
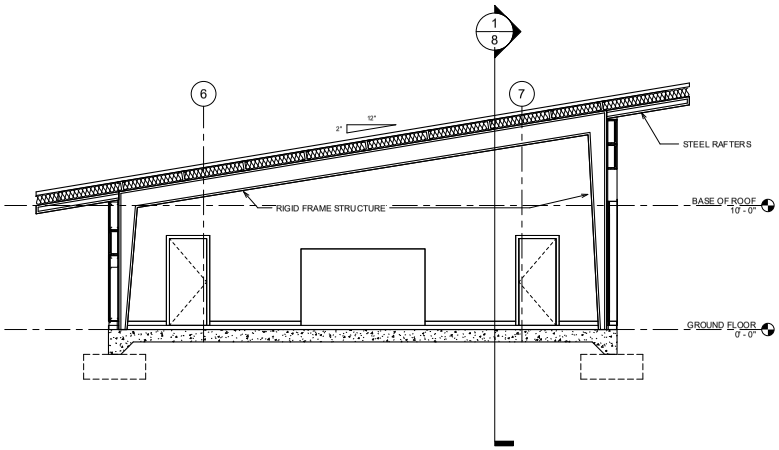


1 BUILDING CROSS SECTION
1/4" = 1'-0"



2 BUILDING SECTION
1/4" = 1'-0"

REVISION NO.	BY M.	DESCRIPTION	SHT OF	DATE	APPROVED

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STATE OF HAWAII

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APPENDIX B
Geotechnical Study

GEOTECHNICAL ENGINEERING EXPLORATION

NEW APPLIED TECHNOLOGY CENTER

AIEA INTERMEDIATE SCHOOL

AIEA, OAHU, HAWAII

W.O. 7559-00 OCTOBER 20, 2017

Prepared for

AM PARTNERS, INC.

and

FACILITIES DEVELOPMENT BRANCH
DEPARTMENT OF EDUCATION
STATE OF HAWAII

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

GEOTECHNICAL ENGINEERING EXPLORATION
NEW APPLIED TECHNOLOGY CENTER
AIEA INTERMEDIATE SCHOOL
AIEA, OAHU, HAWAII

W.O. 7559-00 OCTOBER 20, 2017

Prepared for

AM PARTNERS, INC.

and

FACILITIES DEVELOPMENT BRANCH
DEPARTMENT OF EDUCATION
STATE OF HAWAII

TEDDY S. T. KWOK
LICENSED PROFESSIONAL ENGINEER
No. 7951-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

Teddy S T Kwok 4-30-18
SIGNATURE EXPIRATION DATE OF THE LICENSE

GEOLABS, INC.
Geotechnical Engineering and Drilling Services
2006 Kalihi Street • Honolulu, HI 96819

Hawaii • California

GEOLABS, INC.

Geotechnical Engineering and Drilling Services

October 20, 2017
W.O. 7559-00

Mr. Carl K. Akai, AIA
AM Partners, Inc.
1210 Ward Avenue, Suite 202
Honolulu, HI 96814

Dear **Mr. Akai:**

Geolabs, Inc. is pleased to submit our report entitled "Geotechnical Engineering Exploration, New Applied Technology Center, Aiea Intermediate School, Aiea, Oahu, Hawaii," prepared for the design of the new building project.

Our work was performed in general accordance with the scope of services outlined in our fee proposal dated March 10, 2017.

Please note that the soil and rock samples recovered during our field exploration (remaining after testing) will be stored for a period of two months from the date of this report. The samples will be discarded after that date unless arrangements are made for a longer sample storage period. Please contact our office for alternative sample storage requirements, if appropriate.

Detailed discussion and specific recommendations for design are contained in the body of this report. If there is any point that is not clear, please contact our office.

Very truly yours,

GEOLABS, INC.

Teddy S.T. Kwok

Teddy S.T. Kwok, P.E.
Vice President

TK:mj

2006 Kalihi Street • Honolulu, Hawaii 96819
Phone: (808) 841-5064 • Facsimile: (808) 847-1749 • E-mail: hawaii@geolabs.net

Hawaii • California

GEOTECHNICAL ENGINEERING EXPLORATION
NEW APPLIED TECHNOLOGY CENTER
AIEA INTERMEDIATE SCHOOL
AIEA, OAHU, HAWAII

W.O. 7559-00 OCTOBER 20, 2017

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GEOTECHNICAL ENGINEERING EXPLORATION

NEW APPLIED TECHNOLOGY CENTER

AIEA INTERMEDIATE SCHOOL

AIEA, OAHU, HAWAII

W.O. 7559-00 OCTOBER 20, 2017

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Our field exploration generally encountered very stiff silty clays overlying basaltic cobbles in a clayey matrix extending to the maximum depth explored of approximately 26.5 feet below the existing ground surface. We did not encounter groundwater in the drilled borings at the time of our field exploration. Due to the proximity of the project site to Aiea Stream, water levels are expected to vary with the water level in the stream channel.

Based on the subsurface conditions encountered and the anticipated design finished grades for the new facility, we recommend supporting the new building on shallow foundations consisting of spread and/or continuous footings. Alternatively, slabs-on-grade with thickened-edge footings may be used for buildings with lightly-loaded bearing walls. An allowable bearing pressure of up to 3,000 psf may be used to design the shallow foundations bearing on the recompacted on-site soils and/or new compacted fills needed to achieve the finished grades. The bottom of footings should be embedded a minimum of 24 inches below the lowest adjacent finished grades.

Based on our laboratory tests, the on-site clayey soils exhibit moderate to high shrink/swell characteristics when subjected to fluctuations in the soil moisture contents. Therefore, we recommend providing at least 18 inches of non-expansive select granular fill materials below the building slabs, sidewalk slabs, and pavement areas due to the expansive nature of the on-site clayey soils.

The text of this report should be referred to for detailed discussion and specific recommendations for the design of the project.

END OF SUMMARY OF FINDINGS AND RECOMMENDATIONS

SECTION 1. GENERAL

1.1 Introduction

This report presents the results of our geotechnical engineering exploration performed for the *New Applied Technology Center* project at Aiea Intermediate School in the Aiea area of Honolulu on the Island of Oahu, Hawaii. The project location and general vicinity are shown on the Project Location Map, Plate 1.

This report summarizes the findings and geotechnical recommendations derived from our field exploration, laboratory testing, and engineering analyses for the project. The recommendations presented herein are intended for design of foundations, slabs-on-grade, retaining structures, site grading, and pavements only. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

1.2 Project Considerations

The project site is located at the existing Aiea Intermediate School at the end of Kulawea Street in the Aiea area of Honolulu on the Island of Oahu, Hawaii. Based on the information provided, it is desired to construct a new Applied Technology Center facility for project-based, hands-on learning to expand the school's program with solar cars, robotics, and other STEM-based learning initiatives.

We understand the new building will be located along the west fence line adjacent to the athletics field as shown on the Site Plan, Plate 2. The new building will likely be a pre-engineered structure providing approximately 3,500 to 4,000 square feet of floor area. Further details were not available at the time this report was prepared.

Based on the existing topography at the site and the anticipated finished floor elevation for the new building, we envision site grading work consisting of minor cuts and fills on the order of less than about 2 feet thick may be required to achieve the design finished grades.

As part of the field exploration program, two infiltration tests were performed to evaluate the infiltration characteristics of the subsurface materials for the design of the

storm water runoff disposal system to meet the drainage requirements for Low Impact Development (LID).

Based on our experience in the area, we envision the project site is underlain by moderately to highly expansive clayey soils. Therefore, special attention was given to the expansive nature of the on-site soils and to the design of concrete slabs-on-grade. Key considerations for our geotechnical engineering exploration included the following:

- Development of slabs-on-grade design recommendations with respect to the anticipated expansive soil conditions.
- Development of site preparation procedures for use during the site grading work.
- Development of pavement design recommendations considering the expansive nature of the on-site soils.

1.3 Purpose and Scope

The purpose of our exploration was to obtain an overview of the surface and subsurface conditions to develop an idealized soil and/or rock data set to formulate geotechnical recommendations for the design of the *New Applied Technology Center* project. The work was performed in general accordance with the scope of services outlined in our fee proposal dated March 10, 2017. The scope of work for this exploration included the following tasks and work efforts:

1. Research and review of available in-house soils and geologic information pertinent to the project site and its vicinity.
2. Stakeout of the boring locations and coordination of the utility toning and clearances of the boring locations by our geologist.
3. Mobilization and demobilization of a truck-mounted drill rig and operators to and from the project site.
4. Drilling and sampling of five borings extending to depths of about 5 to 26.5 feet below the existing ground surface for a total of about 82.6 lineal feet of field exploration.
5. Coordination of the field exploration and logging of the borings by our geologist.

6. Performance of two infiltration tests to evaluate the infiltration characteristics of the subsurface materials for the design of storm water runoff disposal system.

7. Laboratory testing of selected soil samples obtained during the field exploration as an aid in classifying the materials and evaluating their engineering properties.

8. Engineering analyses of the field and laboratory data to develop geotechnical recommendations for design of foundations, slabs-on-grade, retaining structures, site grading, and pavements.

9. Preparation of this report summarizing our work on the project and presenting our findings and recommendations.

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

11. Quality assurance of our work and client/design team consultation by our principal engineer.

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

Detailed descriptions of our field exploration methodology and the Logs of Borings are presented in Appendix A. Results of the laboratory tests performed on selected soil samples obtained from our field exploration are presented in Appendix B. Infiltration test results are presented in Appendix C. Photographs of the core samples are presented in Appendix D.

END OF GENERAL

SECTION 2. SITE CHARACTERIZATION

2.1 Regional Geology

The Island of Oahu was built by the extrusion of basalt and basaltic lavas from the Waianae and Koolau shield volcanoes. The older Waianae Volcano is estimated to be middle to late Pliocene in age, and the Koolau Volcano is estimated to be late Pliocene to early Pleistocene in age. After a long period of volcanic inactivity, during which time erosion incised deep valleys into the Koolau Shield, volcanic activity returned with a series of lava flows followed by cinder and tuff cone formations. These series are referred to as the Honolulu Volcanic Series.

During the Pleistocene Epoch (Ice Age), sea levels fluctuated in response to the cycles of continental glaciation. As the glaciers grew and advanced, less water was available to fill the oceanic basins such that sea levels fell below the present stands of the sea. When the glaciers melted and receded, an excess of water became available such that the sea levels rose to above the present sea level.

The processes of erosion and deposition were affected by these glacio-eustatic sea level fluctuations. When the sea level was low, the erosional base level was correspondingly lower, and valleys were carved to depths below the present sea level. When the sea level was high, the erosional base level was raised such that sediments accumulated at higher elevations.

In the mountainous regions of Hawaii, the erosional processes are dominated by detachment of soil and rock masses from the valley walls and are transported downslope toward the axis of a valley, primarily by gravity, as colluvium. Once these materials reach the stream in the central portion of a valley, alluvial processes become dominant, and the sediments are transported and deposited as alluvium.

In general, stream flows in Hawaii are intermittent and flashy, such that the stream flows transmit large volumes of water for very short durations. Because of this, the transport of sediments is intermittent, and the bulk of the stream's hydraulic load

consists of a poorly-sorted mixture of boulders, cobbles, gravel, sands, and fines. When the erosional base levels change, these sediment loads are left as deposits.

When deposits are left in place for long periods of time, chemical processes begin to alter the materials simultaneously causing a breakdown or weathering of the material. Chemical processes also cause induration, or cementation, of the coarse-grained portion of the sediment into a poorly consolidated sedimentary rock, or conglomerate. Simultaneously, erosion continues in the areas above the valley floors and upstream in headwaters. This continued erosion generates material that is transported downslope covering the older alluvial deposits.

The project site is on the southwestern flank of the Koolau Range. The Koolau Range is composed of basaltic rock built by the extrusion of lava from the Koolau Volcanic Series. At the project site, the basaltic rock has been overlain with alluvial deposits transported along Aiea Stream.

2.2 Existing Site Conditions

The project site is located within the existing Aiea Intermediate School at the end of Kulawea Street in the Aiea area of Honolulu on the Island of Oahu, Hawaii. The new building will be situated alongside the fence line on the west side of an open grassy field.

To the west of the fence line is Aiea Stream, a narrow boulder lined water channel way that meanders from the Ko'olau Range in the northeast to Pearl Harbor to the southwest. It appears that the project site lies on a man-made leveled tract built over a natural boulder laden stream terrace.

Based on our field observations and the drawing provided, the topography at the project site is relatively flat with existing ground surface elevations ranging from about Elevation +150 feet Mean Sea Level (MSL) on the south to approximately Elevation +155 feet MSL to the north.

2.3 Subsurface Conditions

The subsurface conditions at the project site were explored by drilling and sampling five borings, designated as Boring Nos. 1 through 5, extending to depths of about 5 to 26.5 feet below the existing ground surface. The approximate boring locations are shown on the Site Plan, Plate 2.

The borings generally encountered a surface fill layer, consisting of very stiff silty clays, extending to depths of about 5 to 6.5 feet below the existing ground surface. The surface fills were generally underlain by older alluvial and river channel deposits extending to the maximum depth explored of about 26.5 feet below the existing ground surface. The older alluvial deposit generally consists of very stiff clayey silts and silty clays. The river channel deposit generally consists of very dense basaltic cobbles in a clayey matrix with some boulders.

We did not encounter groundwater in the drilled borings at the time of our field exploration. Due to the proximity of the project site to Aiea Stream, water levels are expected to vary with the water level in the stream channel. In addition, water levels may vary with storm water runoff, seasonal rainfall, time of the year, and other factors.

Detailed descriptions of the materials encountered in the drilled borings are presented on the Logs of Borings in Appendix A. The results of the laboratory tests performed on selected soil samples are presented in Appendix B. Field infiltration test results are presented in Appendix C. Photographs of the recovered core samples are provided in Appendix D.

2.4 Seismic Design Considerations

Based on the International Building Code (2006 Edition), the project site may be subject to seismic activity, and seismic design considerations will need to be addressed. The following sections provide discussions on the seismicity, soil profile type for seismic design, and the potential for liquefaction at the project site.

2.4.1 Earthquakes and Seismicity

In general, earthquakes throughout the world are caused by shifts in the tectonic plates. In contrast, earthquake activity in Hawaii is linked primarily to volcanic

activity; therefore, earthquake activity in Hawaii generally occurs before or during volcanic eruptions. In addition, earthquakes may result from the underground movement of magma that comes close to the surface but does not erupt. The Island of Hawaii experiences thousands of earthquakes each year, but most are so small that they can be detected only by sensitive instruments. However, some of the earthquakes are strong enough to be felt, and a few cause minor to moderate damage.

In general, earthquakes associated with volcanic activity are most common on the Island of Hawaii. Earthquakes that are directly associated with the movement of magma are concentrated beneath the active Kilauea and Mauna Loa Volcanoes on the Island of Hawaii. Because majority of the earthquakes in Hawaii (over 90 percent) are related to volcanic activity, the risk of seismic activity and degree of ground shaking diminishes with increased distance from the Island of Hawaii. The Island of Hawaii has experienced numerous earthquakes greater than Magnitude 5 (M5+); however, earthquakes are not confined only to the Island of Hawaii.

To a lesser degree, the Island of Maui has experienced several earthquakes greater than Magnitude 5. Therefore, moderate to strong earthquakes have occurred in the County of Maui. The effects of earthquakes occurring on the Islands of Hawaii and Maui may be felt on the Island of Oahu. For example, small landslides occurred on the Island of Oahu as a result of the Maui Earthquake of 1938 (M6.8). Some houses on the Island of Oahu were reportedly damaged as a result of the Lanai Earthquake of 1871 (M7+).

In the last 150 years of recorded history, we are not aware of earthquakes greater than Magnitude 6 that have occurred on the Island of Oahu. An earthquake of Magnitude 4.8 to 5.0 occurred along the Diamond Head Fault in 1948 on the Island of Oahu. The moderate tremor resulted in broken store windows, ruptured building walls, and broken underground water mains.

2.4.2 Soil Profile Type for Seismic Design

Based on the subsurface materials anticipated 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 Profile". Therefore, we believe the seismic design of the building structure may be designed based on a Site Class D soil profile based on the International Building Code (Table No. 1613.5.2), 2006 Edition. Based on a Site Class D soil profile, the following seismic design parameters were estimated and may be used for the seismic analysis of the project site.

SEISMIC DESIGN PARAMETERS INTERNATIONAL BUILDING CODE 2006 EDITION	
Parameter	**Value**
Peak Bedrock Acceleration, PBA (Site Class B)	0.264
Spectral Response Acceleration (Site Class B), S_S	0.610
Spectral Response Acceleration (Site Class B), S_1	0.176
Site Class	"D"
Site Coefficient, F_a	1.312
Site Coefficient, F_v	2.097
Design Peak Ground Acceleration, PGA (Site Class D)	0.224
Design Spectral Response Acceleration, S_{DS}	0.533
Design Spectral Response Acceleration, S_{D1}	0.246

2.4.3 Liquefaction Potential

Based on the International Building Code (2006 Edition), the project site should be evaluated for the potential of soil liquefaction. Soil liquefaction is a condition where saturated cohesionless soils near the ground surface undergo a substantial loss of strength due to the build-up of excess pore water pressures resulting from cyclic stress applications induced by earthquakes. In this process, when the loose saturated sand deposit is subjected to vibration (such as during an earthquake), the soil tends to densify and decrease in volume causing an increase in pore water pressure. If drainage is unable to occur rapidly enough to

dissipate the build-up of pore water pressure, the effective stress (internal strength) of the soil is reduced. Under sustained vibrations, the pore water pressure build-up could equal the overburden pressure, essentially reducing the soil shear strength to zero and causing it to behave as a viscous fluid. During liquefaction, the soil acquires a mobility sufficient to permit both horizontal and vertical movements. If not confined, it will result in significant deformations.

Soils most susceptible to liquefaction are loose, uniformly graded, fine-grained sands and loose silts with little cohesion. The major factors affecting the liquefaction characteristics of a soil deposit are as follows:

FACTORS	LIQUEFACTION SUSCEPTIBILITY
Grain Size Distribution	Fine and uniform sands and silts are more susceptible to liquefaction than coarse or well-graded sands.
Initial Relative Density	Loose sands and silts are most susceptible to liquefaction. Liquefaction potential is inversely proportional to relative density.
Magnitude and Duration of Vibration	Liquefaction potential is directly proportional to the magnitude and duration of the earthquake.

Based on the subsurface conditions encountered, the phenomenon of soil liquefaction is not a design consideration for this project site. The risk for potential liquefaction is non-existent at this project site based on the subsurface conditions encountered (very stiff clayey soils in the absence of groundwater within the depths of the borings).

END OF SITE CHARACTERIZATION

SECTION 3. DISCUSSION AND RECOMMENDATIONS

Our field exploration generally encountered very stiff silty clays overlying basaltic cobbles in a clayey matrix extending to the maximum depth explored of approximately 26.5 feet below the existing ground surface. We did not encounter groundwater in the drilled borings at the time of our field exploration. Due to the proximity of the project site to Aiea Stream, water levels are expected to vary with the water level in the stream channel.

Based on the subsurface conditions encountered and the anticipated design finished grades for the new facility, we recommend supporting the new building on shallow foundations consisting of spread and/or continuous footings. Alternatively, slabs-on-grade with thickened-edge footings may be used for buildings with lightly-loaded bearing walls. An allowable bearing pressure of up to 3,000 pounds per square foot (psf) may be used to design the shallow foundations bearing on the recompacted on-site soils and/or new compacted fills needed to achieve the finished grades. The bottom of footings should be embedded a minimum of 24 inches below the lowest adjacent finished grades.

Based on our laboratory tests, the on-site clayey soils exhibit moderate to high shrink/swell characteristics when subjected to fluctuations in the soil moisture contents. Therefore, we recommend providing at least 18 inches of non-expansive select granular fill materials below the building slabs, sidewalk slabs, and pavement areas due to the expansive nature of the on-site clayey soils. A detailed discussion of these items and our geotechnical engineering recommendations for design are presented in the following sections.

3.1 Building Foundations

In general, we recommend supporting the proposed new building on a shallow foundation support system bearing on the recompacted on-site soils and/or new compacted fills needed to achieve the finished grades at the project site. Based on the anticipated grading concept and the generally stiff subsurface conditions encountered, we believe shallow spread and/or continuous footings may be used to support the new

building construction. Alternatively, slabs-on-grade with thickened-edge footings may be used for buildings with lightly-loaded bearing walls. We recommend using an allowable bearing pressure of up to 3,000 psf to design the shallow foundations bearing on the recompacted on-site soils and/or new compacted fills needed to achieve the finished grades. This bearing value is for sizing the footings based on dead-plus-live loads and may be increased by one-third (⅓) for transient loads, such as those caused by wind or seismic forces.

The bottom of footing excavations should be recompacted to at least 90 percent relative compaction to provide a relatively firm and smooth bearing surface prior to placing reinforcing steel and/or concrete. Soft and/or loose materials encountered at the bottom of footing excavations should be over-excavated to expose the underlying firm materials. The over-excavation may be backfilled with the on-site soils compacted to a minimum of 90 percent relative compaction, or the bottom of footing may be extended down to bear directly on the underlying competent materials.

In general, the bottom of footings should be embedded a minimum of 24 inches below the lowest adjacent finished grades. Footings constructed near tops of slopes or on sloping ground conditions should be embedded deep enough to provide a minimum horizontal setback distance of 6 feet measured from the outside edge of the footings to the face of the slope. Footings adjacent to planned (or existing) retaining walls should be embedded deep enough to avoid surcharging the retaining wall foundations, or the planned retaining walls should be designed to resist the additional structural loads.

Foundations next to utility trenches or easements should be embedded below a 45-degree imaginary plane extending upward from the bottom edge of the utility trench or the footing should be embedded 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 structure foundations are designed and constructed in strict accordance with our recommendations, we estimate total settlements of footings supported on the

recompacted on-site soils and/or new compacted fills to be on the order of about 1 inch or less. We estimate that differential settlements between adjacent footings supported on similar materials to be on the order of about 0.5 inches.

Lateral loads acting on the structures may be resisted by friction developed between the bottom of the foundation and the bearing soil and by passive earth pressure acting against the near-vertical faces of the foundation system. A coefficient of friction of 0.35 may be used for footings bearing on the recompacted on-site soils and/or new compacted fills. Resistance due to passive earth pressure may be estimated using an equivalent fluid pressure of 350 pounds per square foot per foot of depth (pcf). This assumes the soils around the footings are well-compacted. Unless covered by slabs or pavements, the passive pressure resistance in the upper 12 inches of soil should be neglected. In addition, the passive pressure resistance for foundations on slopes should be reduced.

A Geolabs representative should observe the footing excavations prior to placing the reinforcing steel and/or concrete to confirm the foundation bearing conditions and the required embedment depths. Due to the expansive nature of the on-site soils below the foundations, observation of the foundation excavations and preparation operations should be designated as a “Special Inspection” item in accordance with Section 1704 of the International Building Code (2006).

3.2 Slabs-On-Grade

Our field exploration indicates the near-surface clayey soils exhibit moderate to high shrink/swell characteristics when subjected to fluctuations in the soil moisture contents. Unless slabs-on-grade constructed above these expansive soils are properly designed, there is a potential for future distress to the lightly loaded slabs-on-grade resulting from shrinking and swelling of the clayey soils due to changes in the moisture content. To reduce the potential for appreciable structural distress resulting from swelling of the subgrade soils, we recommend preparing the subgrade soils properly prior to fill placement. In addition, we recommend providing a minimum 18 inches of non-expansive select granular fill materials below the slab cushion to support the concrete slabs-on-grades.

We also recommend lightly reinforcing the building slabs-on-grades, as a minimum, with No. 3 reinforcing bars spaced at 12 inches in each direction, in lieu of the standard welded wire fabric. This is to reduce the potential for appreciable structural distress resulting from differential movements of the slabs due to the nature of the on-site soils.

For interior building slabs (not subjected to vehicular traffic or machinery vibration), we recommend placing a minimum 4-inch thick layer of cushion fill consisting of open-graded gravel (ASTM C33, No. 67 gradation) below the slabs. The open-graded gravel cushion fill would provide uniform support of the slabs and would serve as a capillary moisture break. To reduce the potential for appreciable future moisture infiltration through the slab and subsequent damage to floor coverings, an impervious moisture barrier, such as a plastic membrane, is recommended on top of the gravel cushion fill layer. Flexible floor coverings, such as carpet or sheet vinyl, should be considered because they can better mask minor slab cracking. In addition, we recommend designing interior walls to incorporate some flexibility in accommodating a small amount of possible ground movements.

Where the slabs will be subjected to vehicular traffic or machinery vibration, such as trucks and/or forklifts, we recommend providing a 6-inch layer of aggregate subbase below the slabs in lieu of the 4-inch thick gravel cushion fill layer. The moisture barrier also may be omitted for these slabs. The aggregate subbase should consist of crushed basaltic aggregates compacted to a minimum of 95 percent relative compaction.

For the design of structural slabs supported on aggregate subbase, a modulus of subgrade reaction of about 200 pounds per square inch per inch of deflection (pci) may be used for the compacted aggregate subbase. Where slabs are intended to function as rigid pavements for trucks, a minimum slab thickness of 6 inches may be used for preliminary design purposes. Provisions should be made for proper load transfer across the slab joints that will be subject to vehicular traffic. The thickened edges of slabs adjacent to unpaved areas should be embedded at least 12 inches below the lowest adjacent grade.

In order to reduce the potential for appreciable distress due to differential movements between the heavier footings and the lighter building slab, we recommend using free-floating slabs-on-grade with no structural connections to the wall and column foundations. Joint filler and sealant may be used to fill the openings between the edges of the slab and other structural elements. To further reduce the potential for appreciable distress to the building slabs-on-grade and foundations resulting from water infiltration into the subsurface from areas immediately adjacent to the building foundations, we recommend providing a concrete sidewalk (or pavement) around the perimeter of the new buildings. Construction joints should be provided at intervals equal to the width of the sidewalk with expansion joints at right-angle intersections.

Based on our experience, minor differential slab movements between the building slab and the abutting sidewalk slabs have been observed on several occasions. We believe this situation may be attributed to the lack of maintenance of the sidewalk subgrade moisture content after the initial subgrade preparation. It should be noted that the moisture content requirement of the clayey subgrades (at least 2 percent above the optimum moisture) is an important requirement considering the expansive nature of the on-site clayey soils. Therefore, the subgrade soils below the sidewalks should be properly moisture-conditioned and kept moist until placement of the select granular fill and concrete. In addition, consideration may be given to structurally connecting the two abutting slabs with dowels or other structural connections, especially at the entrances to the building and other openings in the walls.

It should be emphasized that the areas adjacent to the slabs should be backfilled tightly against the slab edges with low expansion, relatively impervious soils. These areas also should be graded to divert water away from the slabs and to reduce the potential for water ponding around the slabs and foundations.

3.3 Retaining Structures

Retaining structures may be required for the project construction. Based on the subsurface conditions encountered, the following guidelines may be used to design the retaining structures.

3.3.1 Wall Foundations

In general, we believe retaining wall foundations may be designed in accordance with the recommendations and parameters presented in the "Building Foundations" section. In addition, retaining wall foundations should be at least 18 inches wide and the bottom should be embedded a minimum of 24 inches below the lowest adjacent finished grades. For sloping ground conditions, the footing should extend deeper to obtain a minimum 6-foot setback distance measured horizontally from the outside edge of the footing to the face of the slope. Wall footings oriented parallel to the direction of the slope should be constructed in stepped footings.

3.3.2 Lateral Earth Pressures

Retaining structures should be designed to resist the lateral earth pressures due to the adjacent soils and surcharge effects. The recommended lateral earth pressures for design of retaining walls, expressed in equivalent fluid pressures of pounds per square foot per foot of depth (pcf), are presented in the following table for retaining wall backfills consisting of on-site clayey soils. These lateral earth pressures do not include hydrostatic pressures that might be caused by groundwater trapped behind the structures.

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 2H:1V Sloping Backfill	Horizontal	58	76
	Vertical	29	38

We recommend compacting the backfill behind retaining structures to between 90 and 95 percent relative compaction. Over-compaction of the retaining structure backfill should be avoided. The backfill materials should be moisture-conditioned to above the optimum moisture content prior to being utilized as backfill materials.

In general, the at-rest condition should be used for retaining structures where the top of the structure is restrained from movement prior to backfilling of the wall. The active condition should be used only for gravity retaining walls and retaining structures that are free to deflect by as much as 0.5 percent of the wall height.

Surcharge stresses due to areal surcharges, line loads, and point loads within a horizontal distance equal to the depth of the retaining structures should be considered in the design. For uniform surcharge stresses imposed on the loaded side of the retaining structure, a rectangular distribution with a uniform pressure equal to 50 percent of the vertical surcharge pressure acting on the entire height of the structure, which is restrained, may be used in the design. For retaining structures that are free to deflect (cantilever), a rectangular distribution equal to 33 percent of the vertical surcharge pressure acting over the entire height of the structure may be used for design. The on-site clayey soils may be re-used as a source of backfill behind the retaining structures.

3.3.3 Drainage

Retaining walls should be well drained to reduce the build-up of hydrostatic pressures. A typical drainage system would consist of a 12-inch wide zone of permeable material, such as open-graded 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 weepholes. As an alternative, a prefabricated drainage product, such as MiraDrain or EnkaDrain, may be used instead of the drainage material. The prefabricated drainage product also should be connected hydraulically to a perforated pipe at the base of the wall.

Backfill behind the permeable drainage zone may consist of compacted on-site materials or free-draining compacted fills, where specified by the designer. Unless covered by concrete slabs, the upper 12 inches of backfill should consist of low-expansion, relatively impervious materials to reduce the potential for excessive water infiltration behind the walls.

3.4 Site Grading

Based on the existing topography and the anticipated finished grades for the new building structure, we anticipate the site grading work will consist of minor cuts and fills on the order of less than about 2 feet in height. The following grading items are addressed in the succeeding subsections:

1. Site Preparation
2. Fill Materials
3. Fill Placement and Compaction Requirements

It should be noted that moisture-conditioning and compaction of the clayey subgrade soils and the fill materials are critical elements of the earthwork. Therefore, a Geolabs representative should observe the site grading operations to evaluate whether undesirable materials are encountered during the excavation and scarification process and whether the exposed soil conditions are similar to those encountered in our field exploration.

3.4.1 Site Preparation

At the on-set of earthwork, the area within the contract grading limits should be thoroughly cleared. Vegetation, debris, deleterious materials, and other unsuitable materials should be removed and disposed of properly off-site. Soft and/or yielding areas encountered during clearing below areas designated to receive fill should be over-excavated to expose firm materials, and the resulting excavation should be backfilled with well-compacted fills. The excavated soft and/or organic soils should be disposed of properly off-site and/or used in landscape areas, where appropriate. Contract documents should include additive and deductive unit prices for over-excavation and compacted fill placement to account for variations in the over-excavation quantities.

After clearing, the cut subgrades or areas designated to receive fills should be scarified to a minimum depth of 12 inches, moisture-conditioned to at least 2 percent above the optimum moisture content, and compacted to a minimum of 90 percent relative compaction. Compaction requirement for subgrades subject to vehicular traffic should be increased 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. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

Where shrinkage cracks develop in the subgrade soil after compaction, we recommend preparing the subgrade soil again as recommended above. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft areas and replacement with well-compacted fill. The need for over-excavation due to soft subgrade soil conditions should be evaluated in the field by a Geolabs representative.

3.4.2 Fill Materials

Based on the existing topography at the project site, minor fills may be required to raise the existing ground surface to the design finished grades. In general, we envision two types of fill materials will be required. We recommend the upper 18 inches of fills below the building slabs (below the cushion fill layer), sidewalk slabs, and pavement sections consist of non-expansive, select granular fill materials. Fills below the 18-inch thick non-expansive, select granular fill may consist of general fill. In addition to the two types of fill materials above, we envision that aggregate base course and aggregate subbase materials will be required for earthwork construction.

Based on the anticipated grading concept, we envision the excavated on-site soils may be re-used as a source of general fill materials provided that the materials are free of vegetation, deleterious materials, and clay lumps and rock fragments greater than 3 inches in maximum dimension. Imported general fill materials (if needed) may consist of materials with a low to moderate expansion potential. Imported general fill materials should consist of soil materials with a maximum particle size of 3 inches or less with sufficient fines (between 10 and 60 percent particles passing the No. 200 sieve) to prevent the occurrence of voids in the compacted mass. In addition, general fill materials should have a CBR value of 8 or greater and a swell of 2 percent or less when tested in accordance with ASTM D1883. It should be

noted that the general fill requirements presented herein are intended as guidelines only and may be modified based on additional laboratory testing and field observations on the available fill materials conducted by Geolabs.

The 18-inch thick non-expansive, select granular fill required below the building slabs, sidewalk slabs, and pavement areas should consist of non-expansive select granular materials, such as crushed coral or basalt. The material should be well-graded from coarse to fine with particles no larger than 3 inches in largest dimension. The material also should contain between 10 and 30 percent particles passing the No. 200 sieve. In addition, the material should have a laboratory CBR value of 20 or more and should have a maximum swell of 1 percent or less when tested in accordance with ASTM D1883.

Aggregate base course and aggregate subbase materials required for the flexible and rigid pavement sections should consist of crushed basaltic aggregates and should conform to Subsections 703.06 and 703.17 of the State of Hawaii Standard Specifications for Road and Bridge Construction (2005). Geolabs should test the imported fill materials for conformance with these recommendations prior to delivery to the project site for the intended use.

3.4.3 Fill Placement and Compaction Requirements

General fill materials should be moisture-conditioned to at least 2 percent above the optimum moisture, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 90 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. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

The non-expansive, select granular fill materials recommended below the building slabs, sidewalk slabs, and pavement areas should be moisture-conditioned to above the optimum moisture, placed in level lifts of about 8 inches in loose thickness, and compacted to at least 90 percent relative compaction. Aggregate

base course and subbase 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.

Because moisture-conditioning and compaction of the clayey subgrade soils and general fill materials are critical elements of the earthwork, Geolabs should conduct observations and perform soil density tests during the site grading operations to assist the contractor in obtaining the required degree of compaction and the proper moisture content on the subgrade soils and each fill lift. Where compaction is less than required, additional compactive effort should be applied with adjustment in the moisture content, as necessary, to obtain the specified compaction. It should be noted that the moisture content requirement of the general fills and subgrades (at least 2 percent above the optimum moisture for the clayey soils) is an important requirement considering the moderately to highly expansive nature of the clayey soils.

3.5 Field Infiltration Testing

In accordance with the City's new storm water requirements, infiltration tests and test pits/borings are required to support the on-site disposal design. To provide information for the design of the detention/filtration system, we advanced two boreholes to a depth of about 5 feet below the existing ground surface and installed temporary casing in the boreholes. The infiltration tests were conducted through the bottom of the cased boreholes in general accordance with the procedures described in the Maryland Stormwater Management Manual.

Each boring was pre-soaked with water for approximately 2 hours prior to testing. Water was introduced into the boring to a depth of about 2 feet above the bottom of the boring; and, the drop of the water level in the boring was measured with respect to time for a falling head test consisting of four individual one hour trials per test. The water level was refilled, as necessary, for each trial.

The tests were carried out in several increments until achieving a steady-state with a relatively constant water infiltration rate. Results of the final infiltration rates are presented in the following table.

SUMMARY OF BOREHOLE INFILTRATION TESTING		
Boring No.	**Depth** (feet)	**Final Infiltration Rate** (inches/hour)
B-4	5	0.2
B-5	5	2.35

The infilitration test results indicated that the infiltration rates at the test locations are at about 0.2 and 2.35 inches per hour. It should be noted that each infiltration test was conducted through a 4-inch borehole, which may not represent the actual infiltration condition within a typical infiltration chamber footprint or an open basin. Due to the variability of the subsurface conditions, the actual infiltration rates could also vary considerably from those obtained in our percolation testing. It should be further noted that these tests were conducted on a preliminary basis and their locations were selected based on accessibility rather than the final locations of the storm water management systems.

3.6 Pavement Design

We understand both asphalt concrete and grasscrete pavements are planned to serve the new development. In general, we anticipate the vehicle loading for the new pavements will consist of primarily emergency vehicles such as fire trucks. Based on the moderately to highly expansive soil conditions, we recommend placing the pavement structural sections on non-expansive, select granular fill in lieu of an aggregate subbase course. Based on the above assumptions, we recommend using the following pavement sections for preliminary design purposes:

Fire Lane with Asphalt Concrete Pavements

2.0-Inch Asphaltic Concrete
6.0-Inch Aggregate Base Course (95 Percent Relative Compaction)
8.0-Inch Total Pavement Thickness over 18-Inch Non-Expansive, Select Granular Fill

Fire Lane with Grasscrete Pavements

Grasscrete Pavers over 12-Inch Non-Expansive, Select Granular Fill

The pavement subgrades should be scarified to a depth of about 8 inches, moisture-conditioned to above the optimum moisture, and compacted to a minimum of 95 percent relative compaction. The aggregate base course materials should consist of crushed basaltic aggregates compacted to no less than 95 percent relative compaction. CBR and field density tests should be performed on the actual subgrade soils encountered during construction to confirm the adequacy of the above sections.

In addition, paved areas should be sloped, and drainage gradients should be maintained to carry surface water off-site. Surface water ponding should not be allowed on-site during or after construction. Where concrete curbs are used to isolate landscaping in or adjacent to the pavement areas, we recommend extending the curbs a minimum of 2 inches into the soils below the aggregate base course (for flexible pavements) to reduce the potential for migration of appreciable landscape water into the pavement section. Alternatively, a subdrain system could be constructed to collect the excess water from landscaping irrigation. For long-term performance, we recommend constructing a subdrain system adjacent to the paved/landscaped areas.

3.7 Utility Trenches

We anticipate the utilities for the new building facility will consist of primarily water, sewer, and drain lines. In general, good construction practices should be utilized for the installation and backfilling of the trenches for the new underground utilities. The method and equipment to be used for trench excavation should be determined by the contractor, 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.

In general, we recommend providing granular bedding consisting of 6 inches of open-graded gravel (ASTM C33, No. 67 gradation) under the pipes for uniform support. Free-draining granular materials, such as No. 3B Fine gravel (ASTM C33, No. 67

gradation), also 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 this free-draining material 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.

The upper portion of the trench backfill from a level of 12 inches above the pipes to the top of the subgrade or finished grade should consist of on-site soils (with a maximum particle size of 6 inches) or select granular 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. Where trenches are below pavement areas, the upper 3 feet of the trench backfill below the pavement finished grade should be compacted to a minimum of 95 percent relative compaction.

3.8 Drainage

We wish to emphasize that surface and subsurface drainage are especially critical considering the expansive nature of the on-site soils. Therefore, the finished grades outside the new building should be sloped adequately to shed water away from the foundations and slabs and to reduce the potential for ponding around the structure. In addition, we recommend installing gutter system around the building and diverting the discharge away from the foundation and slab areas. Excessive landscape watering near the foundations and slabs also should be avoided. Planters next to foundations should be avoided or have concrete bottoms and drains to reduce the potential for excessive water infiltration into the subsurface.

These drainage requirements are essential for the proper performance of the above foundation recommendations because ponded water could cause subsurface soil saturation and subsequent heaving or loss of strength. The foundation excavations should be properly backfilled against the walls or slab edges immediately after setting of the concrete to reduce the potential for excessive water infiltration into the subsurface. Drainage swales should be provided as soon as possible and should be maintained to drain surface water runoff away from the foundations and slabs.

3.9 Design Review

Preliminary and final drawings and specifications for the project should be forwarded to Geolabs for review and written comments prior to bid solicitation for construction. This review is necessary to evaluate conformance of the plans and specifications with the intent of the foundation and earthwork recommendations provided herein. If this review is not made, Geolabs cannot be responsible for misinterpretation of our recommendations.

3.10 Post-Design Services/Services During Construction

Geolabs should be retained to provide geotechnical engineering services during construction. The critical items of construction monitoring that require "Special Inspections" include the following:

- Observation of subgrade preparation
- Observation of general fill placement and compaction
- Observation of select granular fill placement and compaction
- Observation of the shallow foundation excavations

A Geolabs representative also should observe the other aspects of earthwork construction. This is to observe compliance with the design concepts, specifications, or recommendations and to expedite suggestions for design changes that may be required in the event that subsurface conditions differ from those anticipated at the time this report was prepared. Geolabs should be accorded the opportunity to provide geotechnical engineering services during construction to confirm our assumptions in providing the recommendations presented herein.

If the actual exposed subsurface conditions encountered during construction differ from those assumed or considered herein, Geolabs should be contacted to review and/or revise the geotechnical recommendations presented herein.

END OF DISCUSSION AND RECOMMENDATIONS

SECTION 4. LIMITATIONS

The analyses and recommendations submitted in this report are based, in part, upon information obtained from field borings. Variations of subsurface conditions between and beyond the borings may occur, and the nature and extent of these variations may not become evident until construction is underway. If variations then appear evident, it will be necessary to re-evaluate the recommendations provided in this report.

The field borings locations indicated in this report are approximate, having been taped from features shown on the Site Layout Plan transmitted by SEY Engineers, Inc. on October 17, 2017. Elevations shown on the boring logs were obtained by interpolating between the spot elevations shown on the same plan. The physical locations and elevations of the borings should be considered accurate only to the degree implied by the methods used.

The stratification lines shown on the graphic representations of the borings depict the approximate boundaries between soil/rock types and, as such, may denote a gradual transition. Water level data from the borings were measured at the times shown on the graphic representations and/or presented in the text of this report. These data have been reviewed and interpretations made in the formulation of this report. However, it must be noted that fluctuation may occur due to variation in tides, rainfall, temperature, and other factors.

This report has been prepared for the exclusive use of AM Partners, Inc. and their client, Facilities Development Branch, Department of Education, State of Hawaii for specific application to the proposed *New Applied Technology Center* project at Aiea Intermediate School in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied.

This report has been prepared solely for the purpose of assisting the engineer in the design of the proposed project. Therefore, this report may not contain sufficient data, or the proper information, to serve as the basis for preparation of construction cost estimates. A contractor wishing to bid on this project is urged to retain a competent

geotechnical engineer to assist in the interpretation of this report and/or in the performance of additional site-specific exploration for bid estimating purposes.

The owner/client should be aware that unanticipated soil/rock conditions are commonly encountered. Unforeseen soil 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.

This geotechnical exploration report was not intended to investigate the potential presence of hazardous materials existing at the site. The equipment, techniques, and personnel used to make 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:

Project Location Map ..... Plate 1

Site Plan ..... Plate 2

Field Exploration ..... Appendix A

Laboratory Tests ..... Appendix B

Infiltration Tests ..... Appendix C

Photograph of Core Samples ..... Appendix D

-ΩΩΩΩΩΩΩΩΩ -

Respectfully submitted,

GEOLABS, INC.

By Teddy S T Kwok

Teddy S.T. Kwok, P.E.
Vice President

TK:mj

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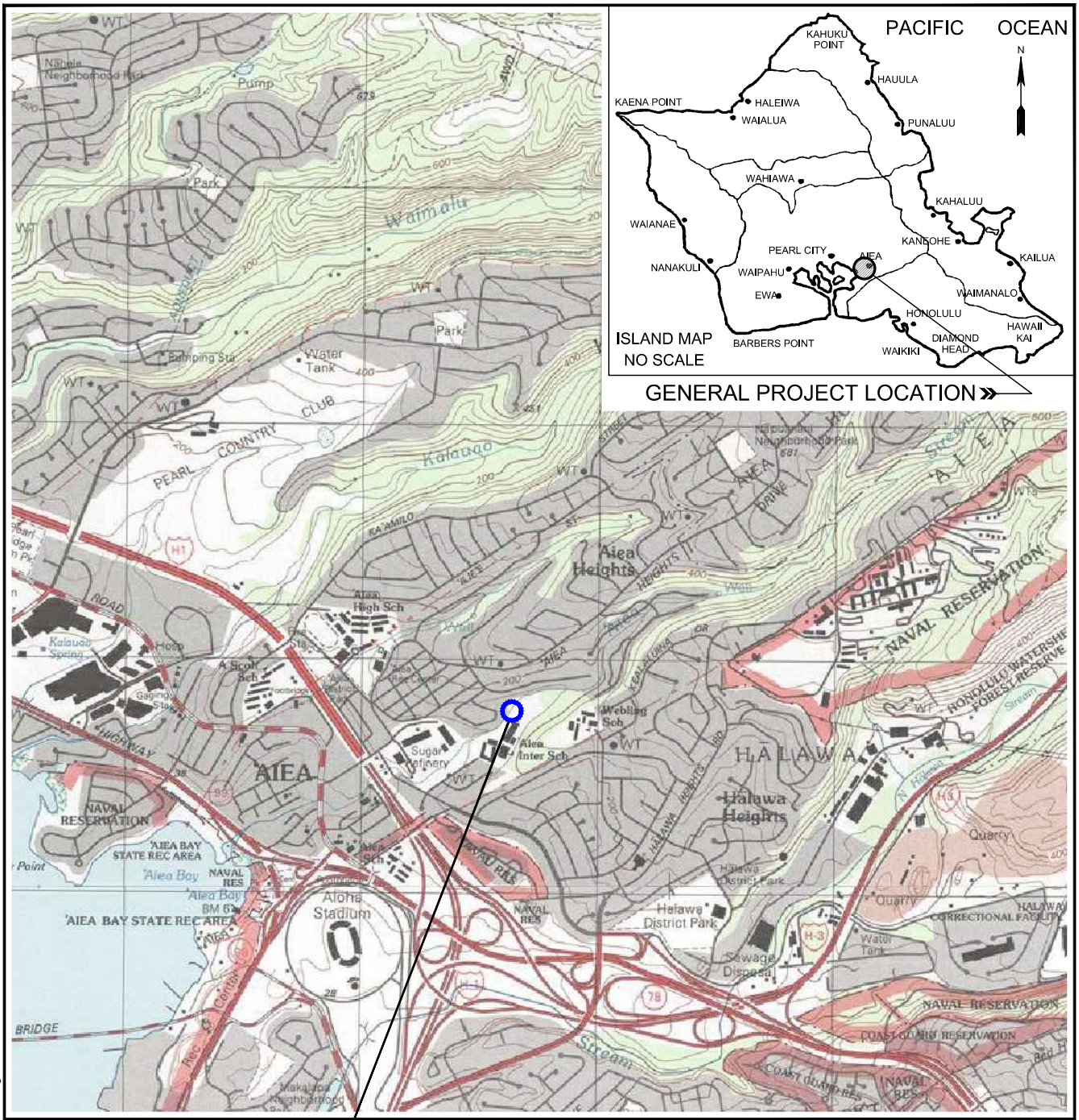
PLATES



PROJECT LOCATION MAP

NEW APPLIED TECHNOLOGY CENTER
AIEA INTERMEDIATE SCHOOL
AIEA, OAHU, HAWAII

2000 1000 0 2000 FT.

GRAPHIC SCALE

N

REFERENCE: MAP CREATED WITH TOPO!® ©2010 NATIONAL GEOGRAPHIC; ©2007 TELE ATLAS, REL. 1/2007.

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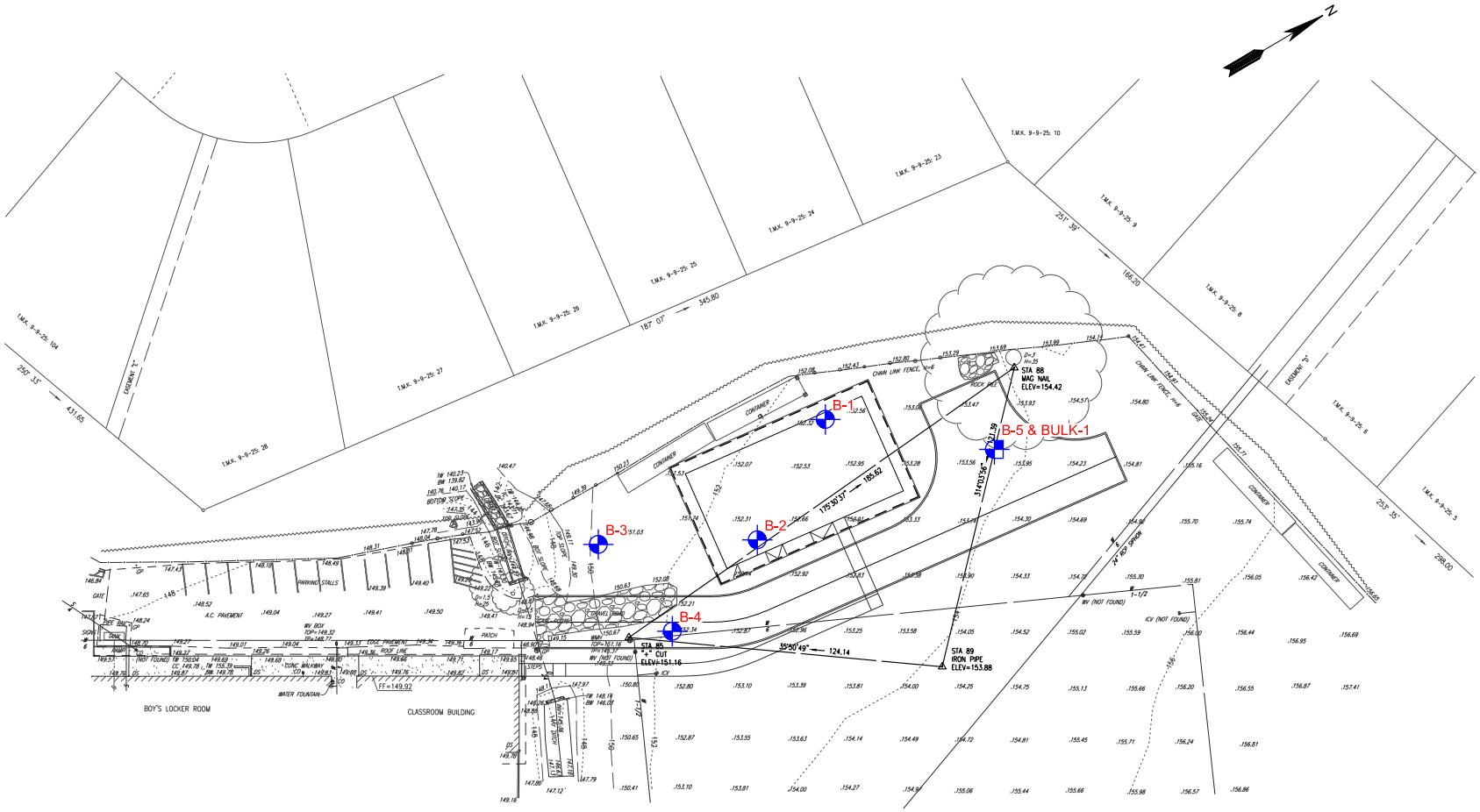
DATE	DRAWN BY	PLATE
AUGUST 2017	HYC	1
SCALE	W.O.	
1" = 2,000'	7559-00	

CAD User: HENRY File Last Updated: August 28, 2017 4:10:41pm Plot Date: August 28, 2017 - 4:11:29pm
File: T:\Drafting\Working\7559-00AieaIntermediateSchoolTechCenter\7559-00PLM.dwg\PLM
Plotter: DWG To PDF-GEO.pc3 Plotstyle: GEO-No-Dithering-Blue-Boring.ctb



SITE PLAN

NEW APPLIED TECHNOLOGY CENTER
AIEA INTERMEDIATE SCHOOL
AIEA, OAHU, HAWAII

LEGEND:

- APPROXIMATE BORING LOCATION
- APPROXIMATE BULK SAMPLE LOCATION

REFERENCE: SITE LAYOUT PLAN TRANSMITTED BY SEY ENGINEERS, INC. ON OCTOBER 17, 2017.

0 20 40 80 120 FT.
GRAPHIC SCALE

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
OCTOBER 2017	HYC	2
SCALE 1" = 40'	W.O. 7559-00	

CAD User: HENRY; File Last Updated: October 19, 2017 9:02:52am; Plot Date: October 19, 2017 - 9:09:33am
File: T:\Projects\7559-00\Aiea Intermediate School\7559-00-Aiea-Intermediate-School-Site-Plan.dwg<SP
Plotter: DWG To PDF-GEO.pc3; Plotstyle: GEO-No-Dithering-Blue-Boring.ctb

APPENDIX A

APPENDIX A

Field Exploration

We explored the subsurface conditions at the project site by drilling and sampling five borings, designated as Boring Nos. 1 through 5, extending to depths ranging from about 5 to 26.5 feet below the existing ground surface. The approximate boring locations are shown on the Site Plan, Plate 2. The borings were drilled using a truck-mounted drill rig equipped with continuous flight augers and coring tools.

Our geologist 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), as shown on the Soil Log Legend, Plate A-0.1. Deviations made to the soil classification in accordance with ASTM D2487 are described on the Soil Classification Log Key, Plate A-0.2. Graphic representations of the materials encountered are presented on the Logs of Borings, Plates A-1 through A-5.

Relatively “undisturbed” soil samples were obtained in general accordance with ASTM D3550, Ring-Lined Barrel Sampling of Soils, by driving a 3-inch OD Modified California sampler with a 140-pound hammer falling 30 inches. In addition, some 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 using the same hammer and drop. 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. The penetration resistance shown on the Logs of Borings indicates the number of blows required for the specific sampler type used. The blow counts may need to be factored to obtain the Standard Penetration Test (SPT) blow counts.

Core samples of the rock materials encountered at the project site were obtained by using diamond core drilling techniques in general accordance with ASTM D2113, Diamond Core Drilling for Site Investigation. Core drilling is a rotary drilling method that uses a hollow bit to cut into the rock formation. The rock material left in the hollow core of the bit is mechanically recovered for examination and description. Rock cores were described in general accordance with the Rock Description System, as shown on the Rock Log Legend, Plate A-0.3. The Rock Description System is based on the publication “Suggested Methods for the Quantitative Description of Discontinuities in Rock Masses” by the International Society for Rock Mechanics (March 1977).

Recovery (REC) may be used as a subjective guide to the interpretation of the relative quality of rock masses, where appropriate. Recovery is defined as the actual length of material recovered from a coring attempt versus the length of the core attempt.

For example, if 3.7 feet of material is recovered from a 5.0-foot core run, the recovery would be 74 percent and would be shown on the Logs of Borings as REC = 74%.

The Rock Quality Designation (RQD) is also a subjective guide to the relative quality of rock masses. RQD is defined as the percentage of the core run in rock that is sound material in excess of 4 inches in length without any discontinuities, discounting any drilling, mechanical, and handling induced fractures or breaks. If 2.5 feet of sound material is recovered from a 5.0-foot core run in rock, the RQD would be 50 percent and would be shown on the Logs of Borings as RQD = 50%. Generally, the following is used to describe the relative quality of the rock based on the "Practical Handbook of Physical Properties of Rocks and Minerals" by Robert S. Carmichael (1989).

Rock Quality	**RQD** (%)
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

The excavation characteristic of a rock mass is a function of the relative hardness of the rock, its relative quality, brittleness, and fissile characteristics. A dense rock formation with a high RQD value would be very difficult to excavate and probably would require more arduous methods of excavation.

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Soil Log Legend

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL RETAINED ON NO. 200 SIEVE	GRAVELS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS LESS THAN 5% FINES	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES MORE THAN 12% FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS 50% OR MORE OF COARSE FRACTION PASSING THROUGH NO. 4 SIEVE	CLEAN SANDS LESS THAN 5% FINES	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES MORE THAN 12% FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS 50% OR MORE OF MATERIAL PASSING THROUGH NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT 50 OR MORE	MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND

- (2-INCH) O.D. STANDARD PENETRATION TEST
- (3-INCH) O.D. MODIFIED CALIFORNIA SAMPLE
- SHELBY TUBE SAMPLE
- GRAB SAMPLE
- CORE SAMPLE
- WATER LEVEL OBSERVED IN BORING AT TIME OF DRILLING
- WATER LEVEL OBSERVED IN BORING AFTER DRILLING
- WATER LEVEL OBSERVED IN BORING OVERNIGHT

LL	LIQUID LIMIT (NP=NON-PLASTIC)
PI	PLASTICITY INDEX (NP=NON-PLASTIC)
TV	TORVANE SHEAR (tsf)
UC	UNCONFINED COMPRESSION OR UNIAXIAL COMPRESSIVE STRENGTH
TXUU	UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (ksf)

Plate

A-0.1

GEOLABS, INC.

Geotechnical Engineering

Soil Classification Log Key

(with deviations from ASTM D2488)

GEOLABS, INC. CLASSIFICATION*

GRANULAR SOIL (- #200 <50%)

- **PRIMARY** constituents are composed of the largest percent of the soil mass. Primary constituents are capitalized and bold (i.e., **GRAVEL, SAND**)
- **SECONDARY** constituents are composed of a percentage less than the primary constituent. If the soil mass consists of 12 percent or more fines content, a cohesive constituent is used (**SILTY** or **CLAYEY**); otherwise, a granular constituent is used (**GRAVELLY** or **SANDY**) provided that the secondary constituent consists of 20 percent or more of the soil mass. Secondary constituents are capitalized and bold (i.e., **SANDY** GRAVEL, **CLAYEY** SAND) and precede the primary constituent.
- **accessory descriptions** compose of the following:
  with some: >12%
  with a little: 5 - 12%
  with traces of: <5%
  accessory descriptions are lower cased and follow the Primary and Secondary Constituents
  (i.e., SILTY GRAVEL **with a little sand**)

COHESIVE SOIL (- #200 ≥50%)

- **PRIMARY** constituents are based on plasticity. Primary constituents are capitalized and bold (i.e., **CLAY, SILT**)
- **SECONDARY** constituents are composed of a percentage less than the primary constituent, but more than 20 percent of the soil mass. Secondary constituents are capitalized and bold (i.e., **SANDY** CLAY, **SILTY** CLAY, **CLAYEY** SILT) and precede the primary constituent.
- **accessory descriptions** compose of the following:
  with some: >12%
  with a little: 5 - 12%
  with traces of: <5%
  accessory descriptions are lower cased and follow the Primary and Secondary Constituents
  (i.e., SILTY CLAY **with some sand**)

EXAMPLE: Soil Containing 60% Gravel, 25% Sand, 15% Fines. Described as: **SILTY GRAVEL** with some sand

RELATIVE DENSITY / CONSISTENCY

Granular Soils			Cohesive Soils			
N-Value (Blows/Foot)		Relative Density	N-Value (Blows/Foot)		PP Readings (tsf)	Consistency
SPT	MCS		SPT	MCS		
0 - 4	0 - 7	Very Loose	0 - 2	0 - 4		Very Soft
4 - 10	7 - 18	Loose	2 - 4	4 - 7	< 0.5	Soft
10 - 30	18 - 55	Medium Dense	4 - 8	7 - 15	0.5 - 1.0	Medium Stiff
30 - 50	55 - 91	Dense	8 - 15	15 - 27	1.0 - 2.0	Stiff
> 50	> 91	Very Dense	15 - 30	27 - 55	2.0 - 4.0	Very Stiff
			> 30	> 55	> 4.0	Hard

MOISTURE CONTENT DEFINITIONS

Dry: Absence of moisture, dry to the touch

Moist: Damp but no visible water

Wet: Visible free water, usually soil is below water table

ABBREVIATIONS

WOH: Weight of Hammer

WOR: Weight of Drill Rods

SPT: Standard Penetration Test Split-Spoon Sampler

MCS: Modified California Sampler

PP: Pocket Penetrometer

GRAIN SIZE DEFINITION

Description	Sieve Number and / or Size
Boulders	> 12 inches (305-mm)
Cobbles	3 to 12 inches (75-mm to 305-mm)
Gravel	3-inch to #4 (75-mm to 4.75-mm)
Coarse Gravel	3-inch to 3/4-inch (75-mm to 19-mm)
Fine Gravel	3/4-inch to #4 (19-mm to 4.75-mm)
Sand	#4 to #200 (4.75-mm to 0.075-mm)
Coarse Sand	#4 to #10 (4.75-mm to 2-mm)
Medium Sand	#10 to #40 (2-mm to 0.425-mm)
Fine Sand	#40 to #200 (0.425-mm to 0.075-mm)

**Soil descriptions are based on ASTM D2488-09a, Visual-Manual Procedure, with the above modifications by Geolabs, Inc. to the Unified Soil Classification System (USCS).*

Plate

A-0.2

GEOLABS, INC.

Geotechnical Engineering

Rock Log Legend

ROCK DESCRIPTIONS

	BASALT		**CONGLOMERATE**
	BOULDERS		**LIMESTONE**
	BRECCIA		**SANDSTONE**
	CLINKER		**SILTSTONE**
	COBBLES		**TUFF**
	CORAL		**VOID/CAVITY**

ROCK DESCRIPTION SYSTEM

ROCK FRACTURE CHARACTERISTICS

The following terms describe general fracture spacing of a rock:

Massive: Greater than 24 inches apart

Slightly Fractured: 12 to 24 inches apart

Moderately Fractured: 6 to 12 inches apart

Closely Fractured: 3 to 6 inches apart

Severely Fractured: Less than 3 inches apart

DEGREE OF WEATHERING

The following terms describe the chemical weathering of a rock:

Unweathered: Rock shows no sign of discoloration or loss of strength.

Slightly Weathered: Slight discoloration inwards from open fractures.

Moderately Weathered: Discoloration throughout and noticeably weakened though not able to break by hand.

Highly Weathered: Most minerals decomposed with some corestones present in residual soil mass. Can be broken by hand.

Extremely Weathered: Saprolite. Mineral residue completely decomposed to soil but fabric and structure preserved.

HARDNESS

The following terms describe the resistance of a rock to indentation or scratching:

Very Hard: Specimen breaks with difficulty after several "pinging" hammer blows.
Example: Dense, fine grain volcanic rock

Hard: Specimen breaks with some difficulty after several hammer blows.
Example: Vesicular, vugular, coarse-grained rock

Medium Hard: Specimen can be broked by one hammer blow. Cannot be scraped by knife. SPT may penetrate by ~25 blows per inch with bounce.
Example: Porous rock such as clinker, cinder, and coral reef

Soft: Can be indented by one hammer blow. Can be scraped or peeled by knife. SPT can penetrate by ~100 blows per foot.
Example: Weathered rock, chalk-like coral reef

Very Soft: Crumbles under hammer blow. Can be peeled and carved by knife. Can be indented by finger pressure.
Example: Saprolite

Plate
A-0.3

GEOLABS, INC. Geotechnical Engineering	NEW APPLIED TECHNOLOGY CENTER AIEA INTERMEDIATE SCHOOL AIEA, OAHU, HAWAII	Log of Boring 1

Approximate Ground Surface Elevation (feet): 152.5 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Density (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								CH	Brown **SILTY CLAY** with a little gravel (basaltic), very stiff, moist (fill)
	19	96			27				
LL=64 PI=39	22				23				
TXUU S_u=1.1 ksf	24	73			36		5		
								MH	Brown **CLAYEY SILT** with some gravel (basaltic) and a little cobbles, very stiff, moist (older alluvium)
	23				39/6" +25/1"		10		Brownish gray to gray subrounded **COBBLES (BASALTIC)** in a clayey matrix, very dense, moist (river channel deposit)
			65		50/3"		15		Brownish gray subrounded **COBBLES (BASALTIC)** in a clayey matrix, very dense, moist (river channel deposit)
	22		78		20/0" Ref.		20		
							25		
							30		Boring terminated at 26 feet * Elevations estimated from Site Layout Plan transmitted by SEY Engineers, Inc. on October 17, 2017.

Date Started:	August 3, 2017	Water Level: ▼	Not Encountered	Plate
Date Completed:	August 3, 2017			
Logged By:	S. Latronic	Drill Rig:	CME-75DG2 *(Energy Transfer Ratio = 81%)*	
Total Depth:	26 feet	Drilling Method:	4" Solid Stem Auger & HQ Coring	A - 1
Work Order:	7559-00	Driving Energy:	140 lb. wt., 30 in. drop	

GEOLABS, INC. Geotechnical Engineering	NEW APPLIED TECHNOLOGY CENTER AIEA INTERMEDIATE SCHOOL AIEA, OAHU, HAWAII	Log of Boring 2

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Approximate Ground Surface Elevation (feet): 152.5 * Description
										CH	Brown **SILTY CLAY** with some gravel (basaltic), very stiff, moist (fill)
	23	90			65						
	21				38						grades with cobbles (basaltic)
TXUU S_u=2.1 ksf	25	78			45		5			MH	Grayish brown **CLAYEY SILT** with some gravel (basaltic) and a little cobbles, very stiff, moist (older alluvium)
											grades with more cobbles
	21				51		10				
											Brownish gray subrounded **COBBLES (BASALTIC)** in a silty matrix with some boulders, very dense, moist (river channel deposit)
					25/1"		15				Brownish gray **BOULDERS (BASALTIC)** in a clayey matrix, very dense, moist (river channel deposit)
					25/1"		20				Boring terminated at 20.1 feet
							25				
							30				

Date Started:	August 3, 2017	Water Level: ▼	Not Encountered	Plate
Date Completed:	August 3, 2017			
Logged By:	S. Latronic	Drill Rig:	CME-75DG2 *(Energy Transfer Ratio = 81%)*	
Total Depth:	20.1 feet	Drilling Method:	4" Solid Stem Auger	A - 2
Work Order:	7559-00	Driving Energy:	140 lb. wt., 30 in. drop	

GEOLABS, INC. Geotechnical Engineering	NEW APPLIED TECHNOLOGY CENTER AIEA INTERMEDIATE SCHOOL AIEA, OAHU, HAWAII	Log of Boring 3

Approximate Ground Surface Elevation (feet): 150 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Density (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								CH	Grayish brown **SILTY CLAY** with some gravel (basaltic) and a little cobbles, very stiff, moist (fill)
	19	101			15/6" +20/1"				
LL=58 PI=32	17				21				
	12	104			39		5		
								CH	Grayish brown **SILTY CLAY** with some cobbles (basaltic), very stiff, moist (older alluvium)
	10				30/3"		10		Brownish gray to gray subrounded **COBBLES (BASALTIC)** in a clayey matrix, very dense, moist (river channel deposit)
								CH	Brownish gray **SILTY CLAY** with some gravel (basaltic), very stiff, moist (older alluvium)
	31	80			20/6" +25/3"		15		
									Brownish gray to gray subrounded **COBBLES (BASALTIC)** in a clayey matrix with some boulders, very dense, moist (river channel deposit)
	28				25/1"		20		
								CH	Brownish gray **SILTY CLAY** with some gravel (basaltic), very stiff, moist (older alluvium)
	25				57		25		
									Boring terminated at 26.5 feet
							30		

Date Started:	August 3, 2017	Water Level:	Not Encountered
Date Completed:	August 3, 2017		
Logged By:	S. Latronic	Drill Rig:	CME-75DG2 *(Energy Transfer Ratio = 81%)*
Total Depth:	26.5 feet	Drilling Method:	4" Solid Stem Auger
Work Order:	7559-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate A - 3

GEOLABS, INC. Geotechnical Engineering	NEW APPLIED TECHNOLOGY CENTER AIEA INTERMEDIATE SCHOOL AIEA, OAHU, HAWAII	Log of Boring 4

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Approximate Ground Surface Elevation (feet): 152 * Description
										CH	Brown with traces of gray mottling **SILTY CLAY** with some gravel (basaltic), very stiff, moist (fill)
	24	79			39						
	23				19						
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				
							30				

Date Started:	August 3, 2017	Water Level:	Not Encountered	Plate
Date Completed:	August 3, 2017			
Logged By:	S. Latronic	Drill Rig:	CME-75DG2 *(Energy Transfer Ratio = 81%)*	
Total Depth:	5 feet	Drilling Method:	4" Solid Stem Auger	A - 4
Work Order:	7559-00	Driving Energy:	140 lb. wt., 30 in. drop	

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Log of Boring

5

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Approximate Ground Surface Elevation (feet): 153.5 * **Description**
	22	78			27					CH	Brown with traces of gray mottling **SILTY CLAY** with a little gravel (basaltic), very stiff, moist (fill)
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				
							30				

Date Started:	August 3, 2017	Water Level: ▼	Not Encountered	Plate
Date Completed:	August 3, 2017			
Logged By:	S. Latronic	Drill Rig:	CME-75DG2 *(Energy Transfer Ratio = 81%)*	
Total Depth:	5 feet	Drilling Method:	4" Solid Stem Auger	A - 5
Work Order:	7559-00	Driving Energy:	140 lb. wt., 30 in. drop	

APPENDIX B

APPENDIX B

Laboratory Tests

Moisture Content (ASTM D2216) and Unit Weight (ASTM D2937) determinations were performed on selected soil 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 one-inch Ring Swell tests were performed on relatively undisturbed and remolded samples to evaluate the swelling potential of the on-site soils. The test results are summarized on Plate B-1.

Two Atterberg Limits tests (ASTM D4318) were performed on selected soil samples to evaluate the liquid and plastic limits. The test results are presented on the Logs of Borings at the appropriate sample depth. Graphic presentation of the test results is provided on Plate B-2.

Two Unconsolidated Undrained Triaxial Compression tests (ASTM D2850) were performed on selected in-situ soil samples to evaluate the undrained shear strengths of the alluvial soils. The approximate in-situ effective overburden pressures were used as the applied confining pressures for the relatively “undisturbed” soil samples. The test results and the stress-strain curves are presented on Plates B-3 and B-4.

One laboratory California Bearing Ratio test (ASTM D1883) was performed on a bulk sample of the near-surface soils to evaluate the pavement support characteristics of the soils. The test results are presented on Plate B-5.

Location	Depth (feet)	Soil Description	Dry Density (pcf)	Moisture Contents Initial (%)	Air-Dried (%)	Final (%)	Ring Swell (%)
B-1*	1.0 - 2.5	Brown silty clay with a little gravel	75.8	24.6	19.9	45.5	1.3
B-2*	1.5 - 3.0	Brown silty clay with some gravel	78.0	24.1	20.1	43.3	6.0
B-3*	1.0 - 2.6	Grayish brown silty clay with some gravel	70.2	24.5	19.1	51.7	4.0
BULK-1**	0.0 - 2.0	Brown silty clay with some sand	101.8	22.8	17.8	31.7	12.2

NOTE: Samples tested were either relatively undisturbed or remolded in 2.4-inch diameter by 1-inch high rings. They were air-dried overnight and then saturated for 24 hours under a surcharge pressure of 55 psf.

* Relatively Undisturbed

** Remolded

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SUMMARY OF RING SWELL TESTS

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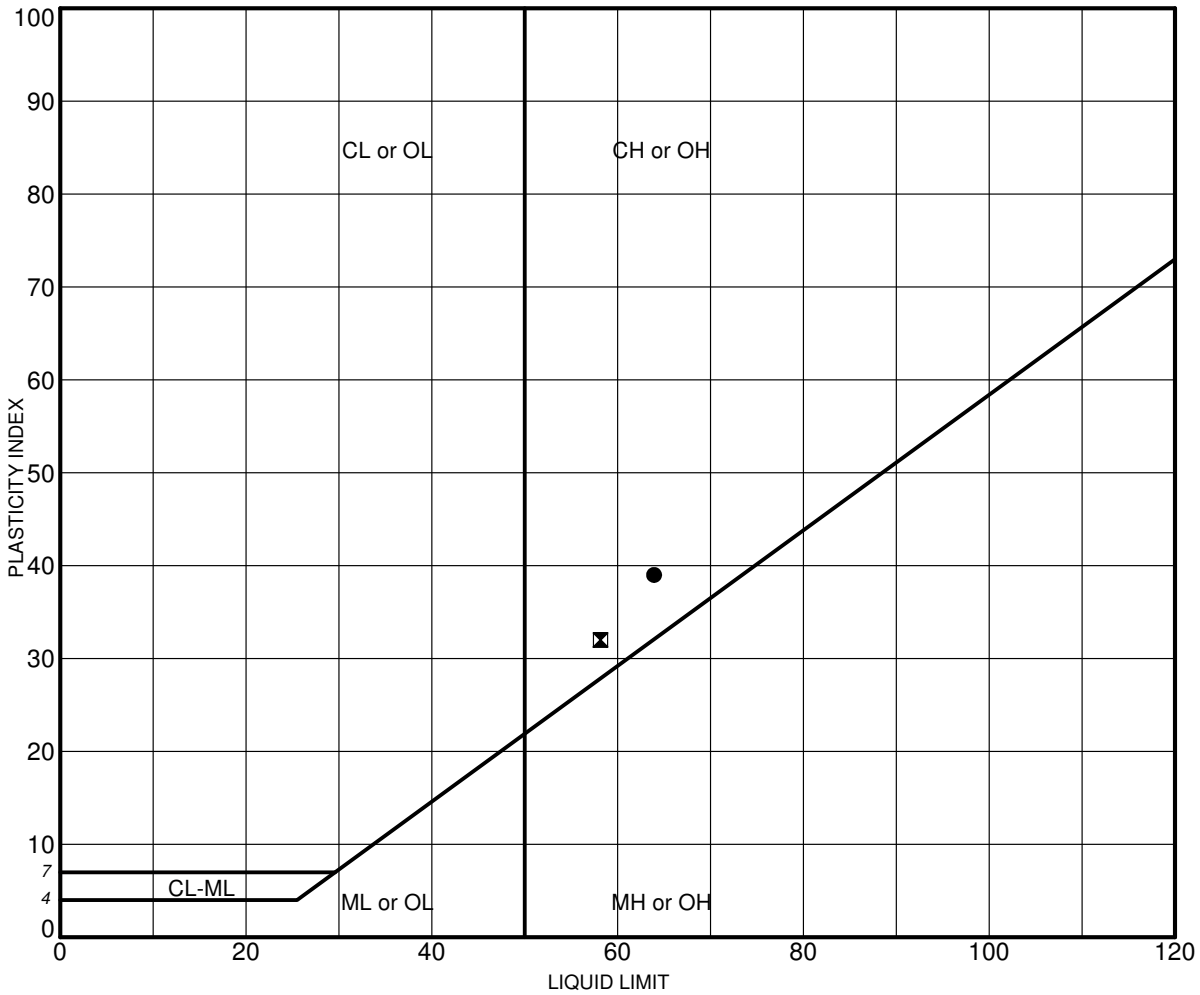
Plate
B - 1

G_RING_SWELL_TEST 7559-00.GPJ GEOLABS.GDT 8/28/17



	Sample	Depth (ft)	LL	PL	PI	Description
●	B-1	3.0-4.5	64	25	39	Brown silty clay (CH) with a little gravel
⊠	B-3	3.5-5.0	58	26	32	Grayish brown silty clay (CH) with some gravel

NP = NON-PLASTIC

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ATTERBERG LIMITS TEST RESULTS - ASTM D4318

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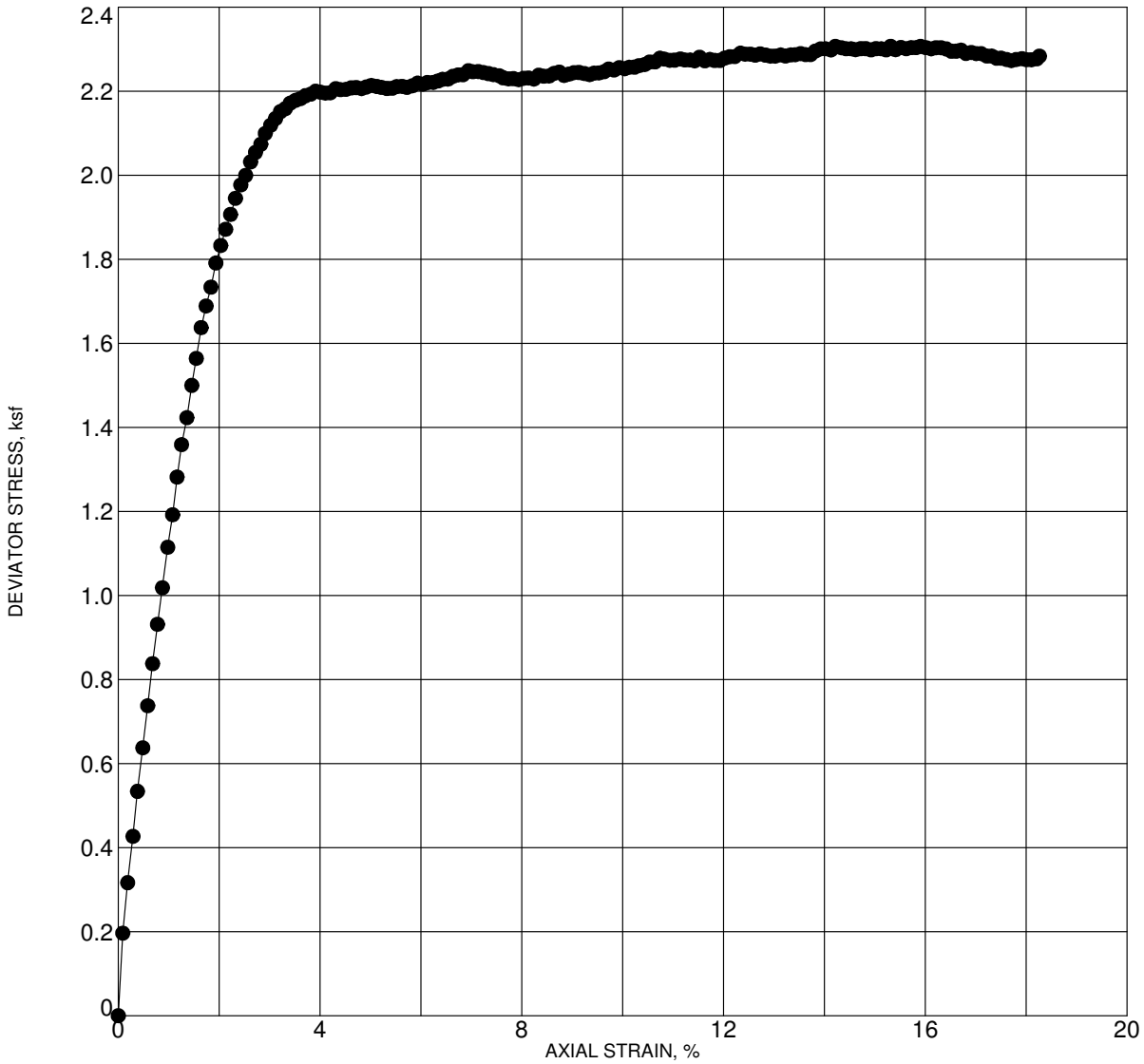
AIEA, OAHU, HAWAII

Plate
B - 2

G ATTERBERG PI-100 LL-120 7559-00.GPJ GEOLABS.GDT 8/28/17



Max. Deviator Stress (ksf):	2.3
Confining Stress (ksf):	0.5

Location: B-1
Depth: 5.0 - 6.5 feet
Description: Brown silty clay with a little gravel
Test Date: 8/9/2017

Dry Density (pcf)	73.1	Sample Diameter (inches)	2.400
Moisture (%)	24.1	Sample Height (inches)	4.977
Axial Strain at Failure (%)	15.0	Strain Rate (% / minute)	1.01

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TRIAXIAL UU COMPRESSION TEST - ASTM D2850

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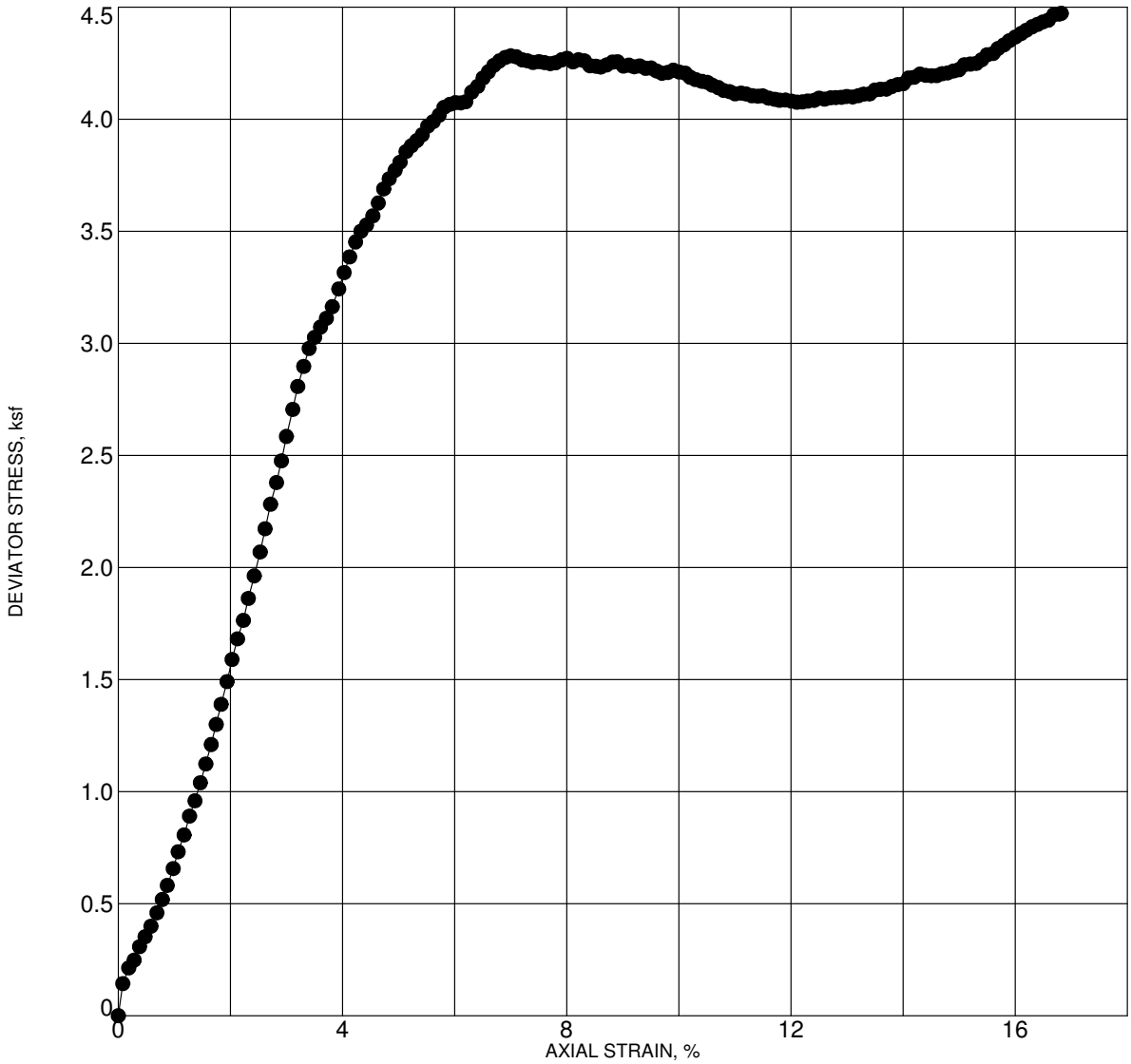
Plate
B - 3

G_TXUU_7559-00.GPJ GEOLABS.GDT 8/28/17



Max. Deviator Stress (ksf):	4.2
Confining Stress (ksf):	0.5

Location: B-2
Depth: 5.0 - 6.5 feet
Description: Grayish brown clayey silt with some gravel
Test Date: 8/11/2017

Dry Density (pcf)	78.0	Sample Diameter (inches)	2.399
Moisture (%)	25.3	Sample Height (inches)	4.995
Axial Strain at Failure (%)	15.0	Strain Rate (% / minute)	1.01

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TRIAXIAL UU COMPRESSION TEST - ASTM D2850

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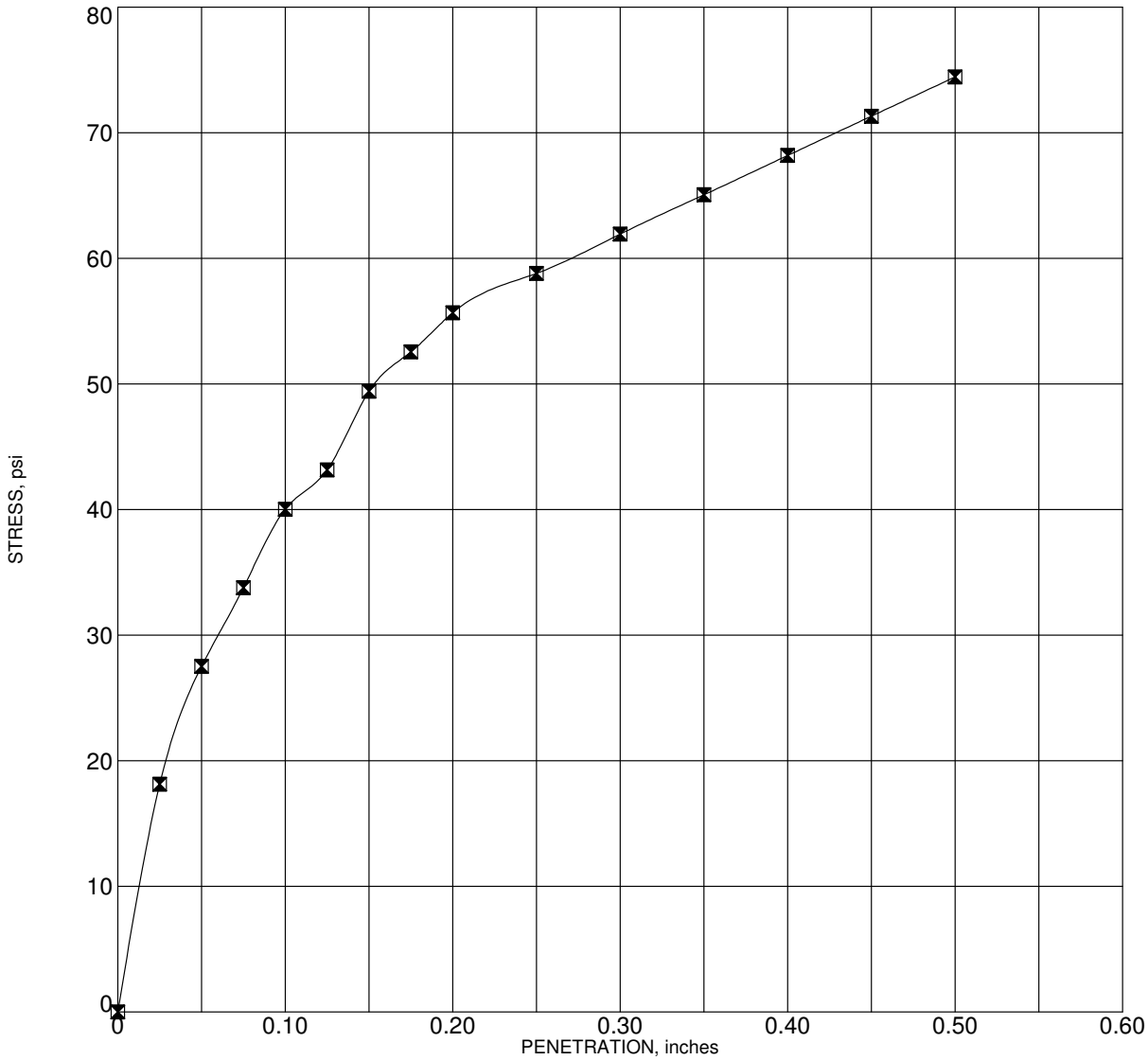
AIEA, OAHU, HAWAII

Plate
B - 4

G_TXUU_7559-00.GPJ GEOLABS.GDT 8/28/17



Corr. CBR @ 0.1"	3.7
Corr. CBR @ 0.2"	3.6
Swell (%)	7.59

Sample: BULK-1
Depth: 0.0 - 2.0 feet
Description: Brown silty clay with some sand

Molding Dry Density (pcf)	108.6	Hammer Wt. (lbs)	10
Molding Moisture (%)	18.8	Hammer Drop (inches)	18
Days Soaked	5	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

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CALIFORNIA BEARING RATIO - ASTM D1883

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Plate
B - 5

G_CBR 7559-00.GPJ GEOLABS.GDT 8/28/17

APPENDIX C

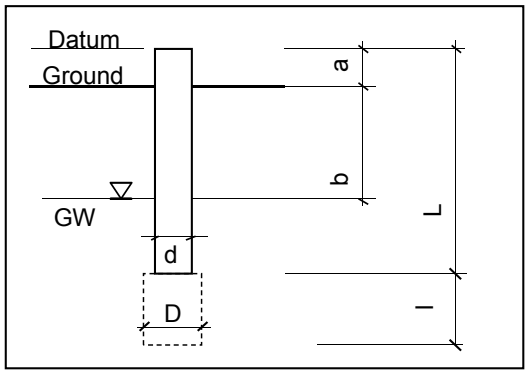
APPENDIX C

Infiltration Tests

Two infiltration tests were conducted at the site to evaluate the infiltration characteristics of the subsurface materials encountered at the boring locations. The infiltration tests were performed in Boring Nos. 4 and 5 at the approximate boring locations shown on the Site Plan, Plate 2. These tests were performed in general 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 states' procedures and may generally be considered as an industry standard.

The field infiltration tests were performed by augering a boring to the selected test depth of about 5 feet below the existing ground surface. Upon reaching the test depth, a 4-inch diameter PVC solid casing was set to the bottom of the drilled hole to allow infiltration only through the soil exposed on the bottom of the boring. Falling head infiltration tests were performed to determine the average infiltration rates of the underlying subsurface materials. Each test consisted of four trials of filling the casing with 24 inches of water and taking periodic readings over a one-hour trial period. The infiltration rates are then calculated based on the result of the fourth and last trial for each test location. The test results are presented on Plates C-1 and C-2.

INFILTRATION TEST RECORD



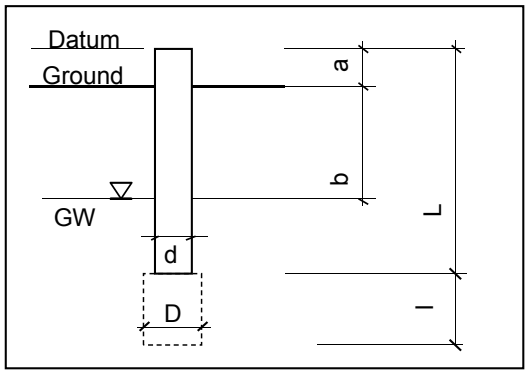
Depth (feet) Generalized Soil/Rock Description

Refer to Log of Boring of B-4

Project:	Applied Technology Center	
	Aiea Intermediate School	
W.O.:	7559-00	
Boring No.:	**B-4**	
Date of Testing:	8/4/2017	
Method of Testing:	Falling Head - LID Method	
Source of Water:	Bucket	
Existing Ground Surface Elev.	+152	feet, MSL
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	0.5	feet
Depth of Boring (from ground):	5.0	feet
Length, L (from datum):	5.5	feet
Open Hole Length, l:	0.0	feet
Test Depth Elevation:	+147	feet, MSL
Diameter of Open Hole, D:	4.5	inches
Diameter of Casing, d (I.D.):	4.0	inches

Trial	Elapsed Time (min)	Pumping Rate (gpm)	Depth to Water (measured from datum) (inches)	Infiltration Rate (inches per hour)
Trial 1				
	0	N/A	41.75	
	15		41.75	
	30		41.75	
	45		41.75	
	60		41.75	0.00
Trial 2				
	0	N/A	41.70	
	15		41.70	
	30		41.75	
	45		41.75	
	60		41.75	0.05
Trial 3				
	0	N/A	41.75	
	15		41.75	
	30		41.80	
	45		41.85	
	60		41.90	0.15
Trial 4				
	0	N/A	41.90	
	15		41.95	
	30		42.00	
	45		42.05	
	60		42.10	0.20

INFILTRATION TEST RECORD



Depth (feet) Generalized Soil/Rock Description

Refer to Log of Boring of B-5

Project:	Applied Technology Center	
	Aiea Intermediate School	
W.O.:	7559-00	
Boring No.:	**B-5**	
Date of Testing:	8/4/2017	
Method of Testing:	Falling Head - LID Method	
Source of Water:	Bucket	
Existing Ground Surface Elev.	+153.5	feet, MSL
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	0.0	feet
Depth of Boring (from ground):	5.0	feet
Length, L (from datum):	5.0	feet
Open Hole Length, l:	0.0	feet
Test Depth Elevation:	+148.5	feet, MSL
Diameter of Open Hole, D:	4.5	inches
Diameter of Casing, d (I.D.):	4.0	inches

Trial	Elapsed Time (min)	Pumping Rate (gpm)	Depth to Water (measured from datum) (inches)	Infiltration Rate (inches per hour)
Trial 1				
	0	N/A	42.25	
	15		42.75	
	30		43.35	
	45		44.00	
	60		44.50	2.25
Trial 2				
	0	N/A	42.25	
	15		42.80	
	30		43.25	
	45		43.85	
	60		44.35	2.10
Trial 3				
	0	N/A	42.10	
	15		42.70	
	30		43.25	
	45		43.80	
	60		44.50	2.40
Trial 4				
	0	N/A	42.40	
	15		42.95	
	30		43.60	
	45		44.25	
	60		44.75	2.35

APPENDIX D

B-1 16.0' TO 26.0'