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IN REPLY REFER TO:
SWQ17-142 (D)

September 26, 2017

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

Dear Mr. Glenn:

Subject: Draft Environmental Assessment
Salt Lake Debris Basins (TMK: 1-1-063: 013 and 018)

With this letter, the Department of Facility Maintenance hereby transmits the Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFONSI) for the Salt Lake Debris Basins project situated at TMK: 1-1-063: 013 and 018 in the Honolulu District on the island of Oahu for publication in the next available edition of the Environmental Notice.

Enclosed is a completed Office of Enviromental Quality Control Publication Form, two (2) copies of the DEA-AFONSI, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word. Simultaneous with this letter, we have submitted the summary of the action in a text file by electronic mail to your office.

If you have any questions, please call Mr. Randall R. Wakumoto, P.E., Branch Head of the Storm Water Quality Branch at 768-3242.

Sincerely,

Ross S. Sasamura, P.E.
Director and Chief Engineer

Enclosures

18-181

AGENCY
PUBLICATION FORM

Project Name:	Salt Lake Debris Basins
Project Short Name:	Salt Lake Debris Basins
HRS §343-5 Trigger(s):	Use of State or County lands and use of State or County funds
Island(s):	O`ahu
Judicial District(s):	Honolulu
TMK(s):	1-1-063:018
Permit(s)/Approval(s):	NPDES, Grading, Grubbing, Stockpiling, Building, CZM, NWP, 401-WQC, Street Usage, HPR, ADA
Proposing/Determining Agency:	City & County of Honolulu, Department of Facility Maintenance
Contact Name, Email, Telephone, Address	Randall Wakumoto, rwakumoto@honolulu.gov (808)768-3242, 1000 Uluohia Street, Suite 212, Kapolei, HI 96707
Accepting Authority:	(for EIS submittals only)
Contact Name, Email, Telephone, Address	
Consultant:	Oceanit
Contact Name, Email, Telephone, Address	Jeremy Michelson, jmichelson@oceanit.com (808)531-3017, 828 Fort Street Mall, Suite 600, Honolulu, HI 96813

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

This project is located in Salt Lake on the island of O`ahu in the upper reaches of an existing drainage channel along Likini Street, at the base of the southern-facing exterior slopes of Aliamanu Crater. The purpose of this proposed project is to improve water quality of Salt Lake by constructing two grass-lined debris basins in the upper watershed which will intercept rocks, course sediment, trash and debris and prevent those pollutants from depositing into Salt Lake. The Salt Lake waterways are 303(d) listed by the EPA as impaired waters for the parameters of turbidity and trash. By intercepting the pollutants before they reach the receiving waterways, the proposed debris basins will help to improve the water quality of Salt Lake. Decreasing the sediment and sediment-bound nutrients in Salt Lake will help reduce the growth of algae and other vegetation in the waterways which can contribute to an improvement in the current odor problem.

SALT LAKE DEBRIS BASINS PROJECT

DRAFT ENVIRONMENTAL ASSESSMENT

SALT LAKE, O‘AHU, HAWAI ‘I

APRIL 2017

Prepared For

City and County of Honolulu

Department of Facility Maintenance

Prepared By

Oceanit Laboratories Inc.

COVER SHEET

Proposed action:	Salt Lake Debris Basins Project, Salt Lake, Island of Oʻahu, Hawaiʻi.
Type of Document:	Draft Environmental Assessment
Applicant:	City and County of Honolulu Department of Facility Maintenance 1000 Uluohia Street, Suite 215 Kapolei, Hawaiʻi 96707
Owner:	City and County of Honolulu Department of Facility Maintenance
Consultant/Preparer:	Oceanit 828 Fort Street Mall Suite 600 Honolulu, Hawaiʻi 96813
Approving Agency:	City and County of Honolulu Department of Facility Maintenance 1000 Uluohia Street, Suite 215 Kapolei, Hawaiʻi 96707
Proposed action:	The City and County of Honolulu, Department of Facility Maintenance proposes to construct two debris basins that would intercept and capture rocks, course sediment and debris originating from the outer wall of Āliamanu Crater, before it enters the City-owned storm drain channel. The debris basins would reduce the amount of rocks, sediment and debris that is deposited in the Salt Lake waterways via the drainage channel. The debris basins would also help prevent blockages and downstream damage to the concrete drainage channel. The proposed two debris basins (Basin "A" and Basin "B") would be located in the upper portion of the existing storm drainage channels along Likini Street. Each basin would be equipped with a concrete slotted weir spillway and stilling basin transitioning into their respective reaches of the existing channel. The basins would be served by a new asphalt access road from Likini Street. Access to the basins is designed for maintenance equipment to enter the basins to collect accumulated sediment and debris.
Anticipated Determination:	Finding of No Significant Impact (FONSI)

ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
AE	Archaeological Evaluation
BMPs	Best Management Practices
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CIA	Cultural Impact Assessment
CM	Construction Manager
CWA	Clean Water Act
CZM	Coastal Zone Management
DA	Department of the Army
DEA	Draft Environmental Assessment
DPP	Department of Planning & Permitting
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
ft	Foot or feet
HAR	Hawaiʻi Administrative Rules
HEPA	Hawaiʻi Environmental Protection Act
HDOH	Hawaiʻi Department of Health
HRS	Hawaiʻi Revised Statutes
m	Meter
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NPDES	National Pollution Discharge Elimination System
NRCS	National Resources Conservation Service
NWP	Nationwide Permit
OEQC	Office of Environmental Quality Council
OHA	Office of Hawaiʻian Affairs
NRHP	National Register of Historic Places
PM2.5	Suspended particulate matter ≤ microns aerodynamic diameter
PM10	Suspended particulate matter ≤ 10 microns aerodynamic diameter
SHPD	State Historic Preservation Division
TMDL	Total Maximum Daily Loads
TMK	Tax Map Key
TRM	Turf Reinforced Matting
μg/m3	Micrograms per cubic meter
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WQC	Water Quality Certification

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1 INTRODUCTION AND PROJECT DESCRIPTION

1.1 INTRODUCTION

The City and County of Honolulu (City), Department of Facility Maintenance (DFM) proposes the implementation of stormwater pollution control structures within the City-owned lot, a part of Hoaloha Salt Lake Regional Park in Salt Lake on the Island of Oʻahu, Hawai ʻi. The project location is at the upper reaches of an existing concrete drainage channel along Likini Street, at the base of the southern-facing exterior slopes of Āliamanu Crater.

Presently, rocks, sediment, trash and debris originating from the exterior wall of Āliamanu Crater are intercepted by the existing storm drainage channel and deposited into Salt Lake. These pollutants, in conjunction with pollutants originating throughout the Salt Lake watershed have degraded the water quality of Salt Lake.

The tax map key number for the project parcel is (1) 1-1-063:018. The City-owned parcel is under the jurisdiction of the Department of Parks and Recreation. Other than drainage improvements, the parcel is undeveloped and is not an active recreational park.

Special environmental studies conducted for this DEA include: 1) Archaeological Evaluation Survey; 2) Cultural Impact Assessment; 3) Biological Resources Survey (Flora/Fauna); and 4) Wetland Determination. A summary of these studies are provided in this DEA and a copy of the detailed reports are included in the Appendices.

Photos displaying the upper reaches of the existing concrete channel are shown in Figure 1-3 to Figure 1-7.

1.2 BACKGROUND

The Salt Lake Watershed is located in Moanalua, O‘ahu, just east of Pearl Harbor, approximately two miles inland of the Honolulu International Airport. This 1,200 acre watershed has changed dramatically over the last 100 years. What was once an undeveloped area has now become highly urbanized, comprising residential and commercial areas, together with four schools, a golf course, and military housing. Historically, the Salt Lake water body was approximately 260 acres in size. However, in the early 1970’s a large portion of the lake was drained and filled in to construct the Honolulu Country Club golf course. What remains is a body of water approximately 42 acres in size, comprised of smaller ponds connected by drainage canals. A ring shaped drainage canal surrounds most of the golf course with the exception of the northeast corner. There are 18 stormwater drainage outfalls that discharge to the exterior drainage canal and ponds. The weir outlet of the drainage canal is located at the southeast corner of the golf course. It discharges to the ocean via Moanalua Stream. The Salt Lake waterways are at an elevation of about 3.5 feet mean sea level (MSL) and are not tidally influenced.

As a result of the urbanization throughout the Salt Lake watershed, the volume of stormwater runoff has increased. Over time the drainage canals have filled up with sediment and trash. The decreased water depth has reduced water circulation. Combined with added soil and nutrients this has led to over-growth of vegetation and algae blooms. The decaying vegetation and resultant depletion of the oxygen in the water is likely a primary cause of noxious odors sporadically emanating from the ponds and canals. The City has received complaints of these odors from residents living near the golf course. In addition to the sediment, trash and debris, there are other harmful chemicals, fertilizers, oil and grease that end up in the canals and adversely affect the water quality. The lake and drainage canals were dredged by the City between 2003 and 2005. The dredging temporarily eased the odor problem, but it eventually returned.

1.3 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of this proposed project is to improve water quality of Salt Lake by constructing stormwater pollution control structures in the upper watershed which will intercept rocks, course sediment, trash and debris and prevent those pollutants from depositing into Salt Lake. The Salt Lake waterways are 303(d) listed by the EPA as impaired waters for the parameters of turbidity and trash. By intercepting the pollutants before they reach the receiving waterways, the proposed stormwater pollution control structures will help to improve the water quality of Salt Lake. Decreasing the sediment and sediment-bound nutrients in Salt Lake will help reduce the growth of algae and other vegetation in the waterways which can contribute to an improvement in the odor problem.

Previous studies (Oceanit, 2006) have shown that the proposed project site is an area of high erosion. The high erosion potential and availability of an undeveloped open area make the project site an ideal location to construct a facility to capture rocks, sediment and debris. Previous studies have indicated that debris basins or similar devices would be effective stormwater treatment structures in trapping targeted pollutants from the watershed.

The proposed action is to construct physical improvements that would intercept sediment and debris from the hillside. Specifically, two debris basins (Basin "A" & Basin "B") at the upstream end of the existing concrete drainage channel are proposed. These basins would intercept and capture rocks, coarse sediment, trash and debris before it reaches Salt Lake. An added benefit of the installation of debris basins is that they will help protect the storm drainage system by preventing blockages and decreasing surface wear on the concrete channel. This DEA discloses the foreseeable environmental impacts that could result from the proposed project's implementation and commits to the employment of specific measures to avoid, minimize, or mitigate impacts to the environment. Additionally, this DEA contains a record of the consultation activities that have been conducted to date as part of the project planning.

1.4 PROJECT SITE DESCRIPTION

1.4.1 Project Location and Site Characteristics

The proposed project site is approximately 1.8 acres in area and lies within an 84.3 acre parcel of land owned by the City, located within the Salt Lake watershed, in Moanalua, O'ahu on the southern exterior slopes of Āliamanu crater, on the leeward side of the Ko ' olau Mountain Range. The crater rises prominently behind the project area to the north and east. The project site ranges in elevation between 53-ft and 70-ft above MSL. Likini Street forms the project's south-western boundary. A private residence borders the westernmost extent of the project site.

Depending on available construction monies, two additive items of work will be constructed in addition to the debris basins. The two additive items are: 1) Planting of a low maintenance groundcover to replace the existing grass groundcover and 2) Installation of a 6' high chain-link fence to replace the old existing 4' high chain-link fence. The additive item work is fronting the nearby Salt Lake Elementary School along Ala Lilikoi Street. The additive item work has received an Exemption Declaration from preparing an environmental assessment from the City and County of Honolulu because it will have minimal or no significant impact on the environment. See Appendix G for a copy of the Exemption Declaration for the additive items of work.

1.4.1.1 TRIBUTARY DRAINAGE AREAS

The drainage channel branches into two separate channels in the upper reaches to intercept storm water from natural flow paths defined by two distinct sub-watersheds. Storm runoff is conveyed to the drainage channel through gully flow and overland flow as well as additional flows from a series of residential storm drain outlets below the project site. The natural gullies that drain into the tops of the concrete channels flow only during storm events.

1.4.1.2 EXISTING DRAINAGE SYSTEM

The existing storm drainage system in the vicinity of project site consists of an open trapezoidal concrete drainage channel which branches into two smaller open trapezoidal concrete channels at the upper end of the channel. The channel runs parallel to Likini Street and discharges into Salt Lake below the Salt Lake Elementary School about 2100 feet downstream of the project site.

Figure 1-1. Vicinity Map

Figure 1-2. Location Map of the Salt Lake Debris Basins Project

Figure 1-3. View of the proposed location for Basin "A", looking up-channel

Figure 1-4. View of the proposed location for Basin "A", looking up-channel

Figure 1-5. View of the proposed location for Basin “A”, looking down-channel

Figure 1-6. View of Proposed location for Basin “B”, looking up-channel

Figure 1-7. View of the proposed location of Basin "B", looking down-channel

1.5 REGULATORY OVERVIEW

1.5.1 Laws Relevant to Proposed Project

- Hawaiʻi Environmental Policy Act

The State of Hawaiʻi created the Hawaiʻi Environmental Policy Act (HEPA), Chapter 343, Hawaiʻi Revised Statutes (HRS), to be a review system to ensure that environmental, social and economic impacts of proposed projects are given appropriate consideration in the approvals and permitting process.

- Coastal Zone Management Act

The State of Hawaii in response to the Federal Coastal Zone management Act in 1972 adopted its Coastal Zone Management Program in 1977 to protect, preserve and restore coastal resources including recreation, historic, scenic and open space, ecosystems, economic uses, public use and recreation and marine, while protecting against coastal hazards and managing development.

1.5.2 Environmental Assessment Process

The Environmental Assessment (EA) process is being conducted in accordance with Chapter 343 of the Hawai ʻ i Revised Statutes (HRS). This law, along with its implementing regulations, Title 11, Chapter 200, Hawai ʻ i Administrative Rules (HAR), is the basis for the environmental impact process in the State of Hawai ʻ i. According to Chapter 343, an EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to 13 specific criteria. Section 5.1 of this document states the finding (anticipated, in DEA) that no significant impacts are expected to occur; Section 5.2 lists each criterion and presents the findings for each made by the proposing Agency. If after considering comments to the DEA, the proposing Agency confirms that no significant impacts are anticipated from the proposed action, then the Agency will issue a Finding of No Significant Impact (FONSI), and the action will be permitted to occur. If the Agency concludes that significant impacts are anticipated from the proposed action then an Environmental Impact Statement (EIS) will be prepared.

1.5.3 Permits and Approvals Required for the Project

This section lists the anticipated permits and approvals that would be required to construct two debris basins at the top of the existing concrete channel that runs parallel to Likini Street, in Salt Lake, Oʻahu.

Permit/Approval	Agency Approval
National Pollutant Discharge Elimination System (NDPES)	State of Hawai‘i Department of Health, Clean Water Branch (CWB)
Grading, Grubbing & Stockpiling Permit	City & County of Honolulu, Department of Planning and Permitting (DPP)
Building Permit	City & County of Honolulu, Department of Planning and Permitting (DPP)
Coastal Zone Management (CZM) Certification	State of Hawai‘i Office of Planning, Department of Business & Economic Development & Tourism (DBEDT)
Nationwide (NWP) Permit	U.S. Army Corps of Engineers (USACE)
CWA Section 401 Water Quality Certification (WQC)	State of Hawai‘i Department of Health, Clean Water Branch (CWB)
Street Usage Permit (if a temporary lane closure is required)	City & County of Honolulu, Department of Transportation Services (DTS)
Historic Preservation Review	State of Hawai‘i Department of Land and Natural Resources, Historic Preservation Division (SHPD)
ADA Accessibility Review	State of Hawai‘i Department of Health, Disablity and Communication Access Board (DCAB)

Table 1-1. Required Permits and Approvals

1.6 EXISTING LAND USE CLASSIFICATIONS

There are two land use classifications, State and City & County.

The State Land Use Law, Chapter 205, HRS, is intended to preserve, protect and encourage the development of lands in the State for uses that are best suited to the public health and welfare of Hawai‘i’s people. The footprint of the proposed project falls entirely within the State Urban District (Figure 1-8) but the project parcel (TMK (1) 1-1-063:018) is located on both Urban and Conservation District.

The City has also promulgated land use zoning ordinances (Chapter 21, Revised Ordinances of Honolulu). The footprint of the proposed project falls entirely within the City P-2 General Preservation Zone (Figure 1-9) but the project parcel is located on lands designated P-1 Restricted Preservation and P-2 General Preservation.

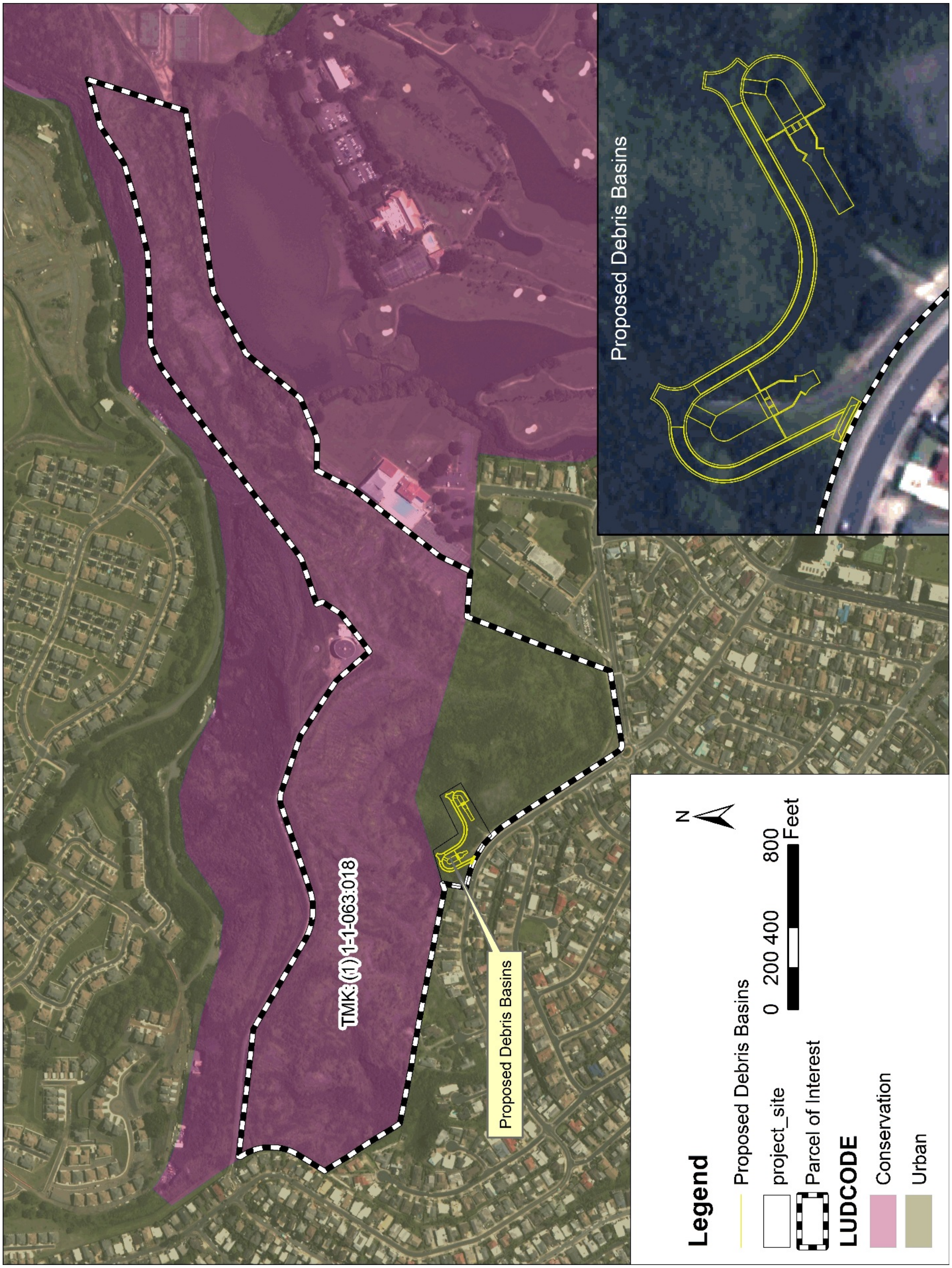

Figure 1-8. State Land Use Districts (SLUD)

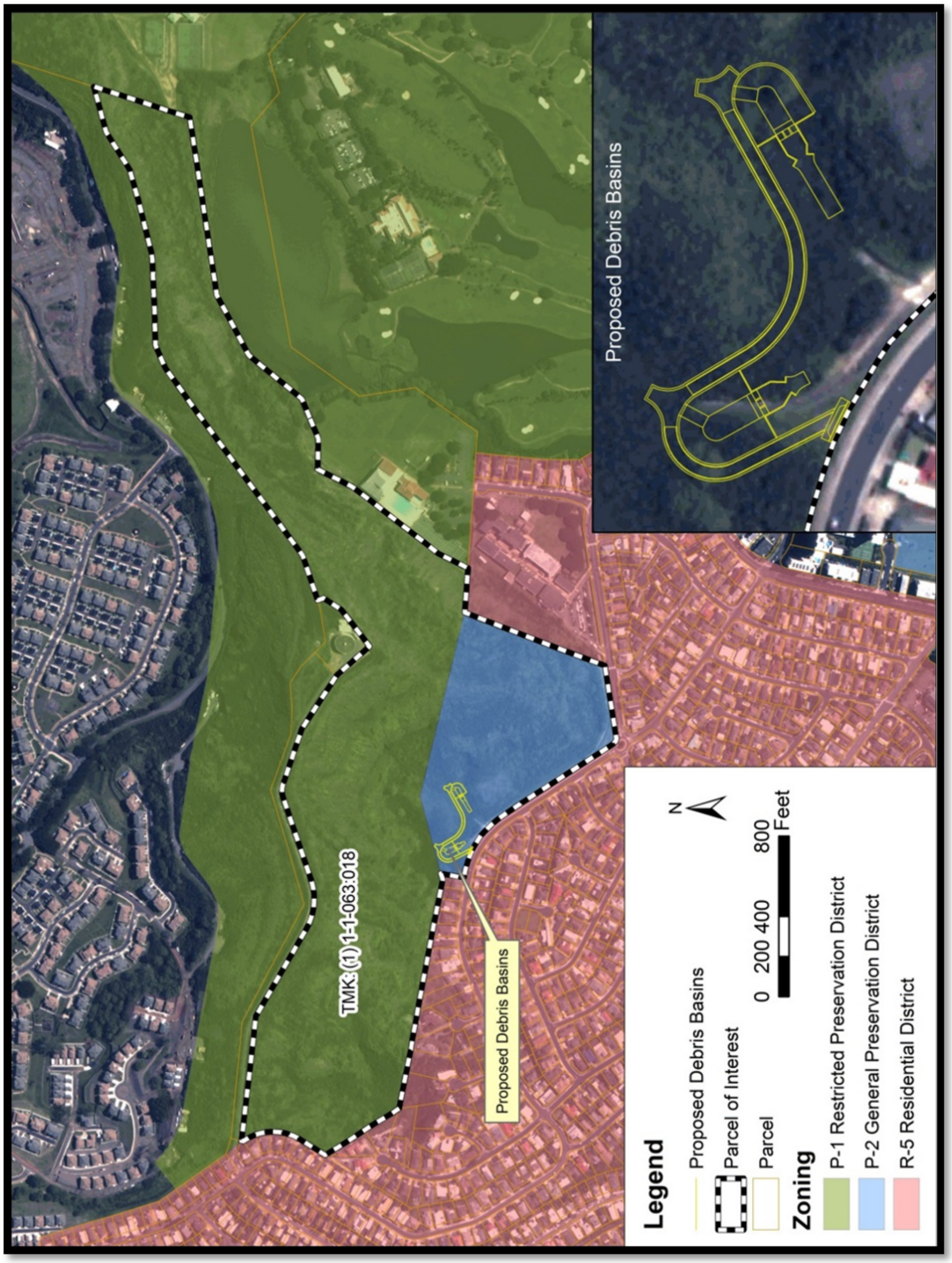

Figure 1-9. City and County Zoning Map in Vicinity of Proposed Debris Basins

2 ALTERNATIVES ANALYSIS

2.1 NO ACTION

2.1.1 Description of No Action Alternative

The no action alternative would mean nothing is done to capture the rocks, coarse sediment, trash and debris that is transported via stormwater from the outer wall of Āliamanu Crater into Salt Lake. Without the installation of debris basins or other structural stormwater BMPs to capture the pollutants before they are deposited into Salt Lake, the water quality of the water body will remain at the current degraded level. Additionally, there will be no protection of the storm drainage channel from blockages and surface wear caused by debris in the stormwater flows. The siltation will continue and more frequent dredging will be needed to maintain Salt Lake.

Figure 2-1. Sediment and Debris Impact upon Salt Lake

2.2 TWO GRASS LINED DEBRIS BASINS (PROPOSED ACTION)

2.2.1 Description of Proposed Alternative

This alternative would involve the construction of two grass lined debris basins, Basin A and Basin B (Figure 2-2), in the upper reaches of the existing City-owned storm drainage channel. Each basin would be equipped with a slotted weir spillway and stilling basin transitioning into their respective reach of the existing channel. The basins would be served by a new access road off of Likini Street.

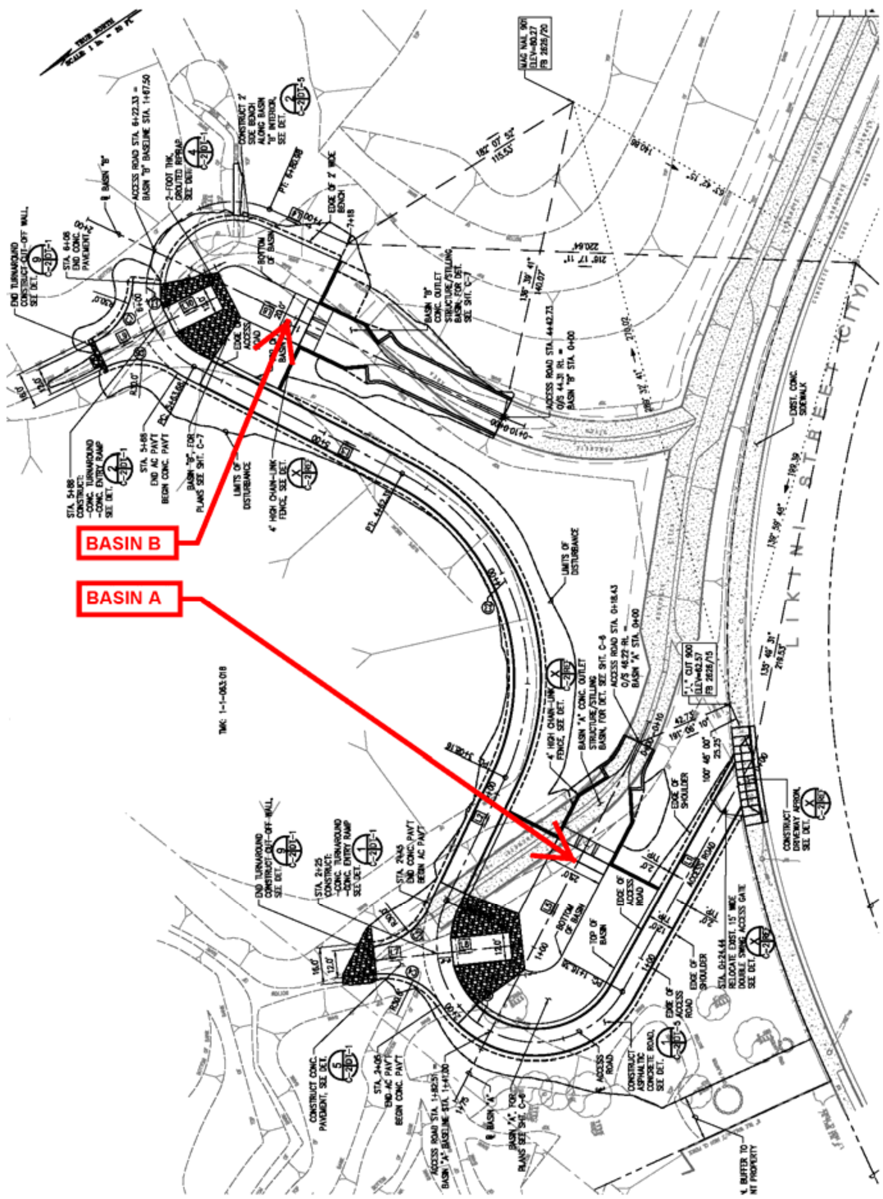

Figure 2-2. Basin “A” & Basin “B” Layout

Basin A would be 80-ft. long by 75-ft. wide with a maximum depth of 6-ft. Basin B would be 65-ft. long by 65-ft. wide with a maximum depth of 6-ft.

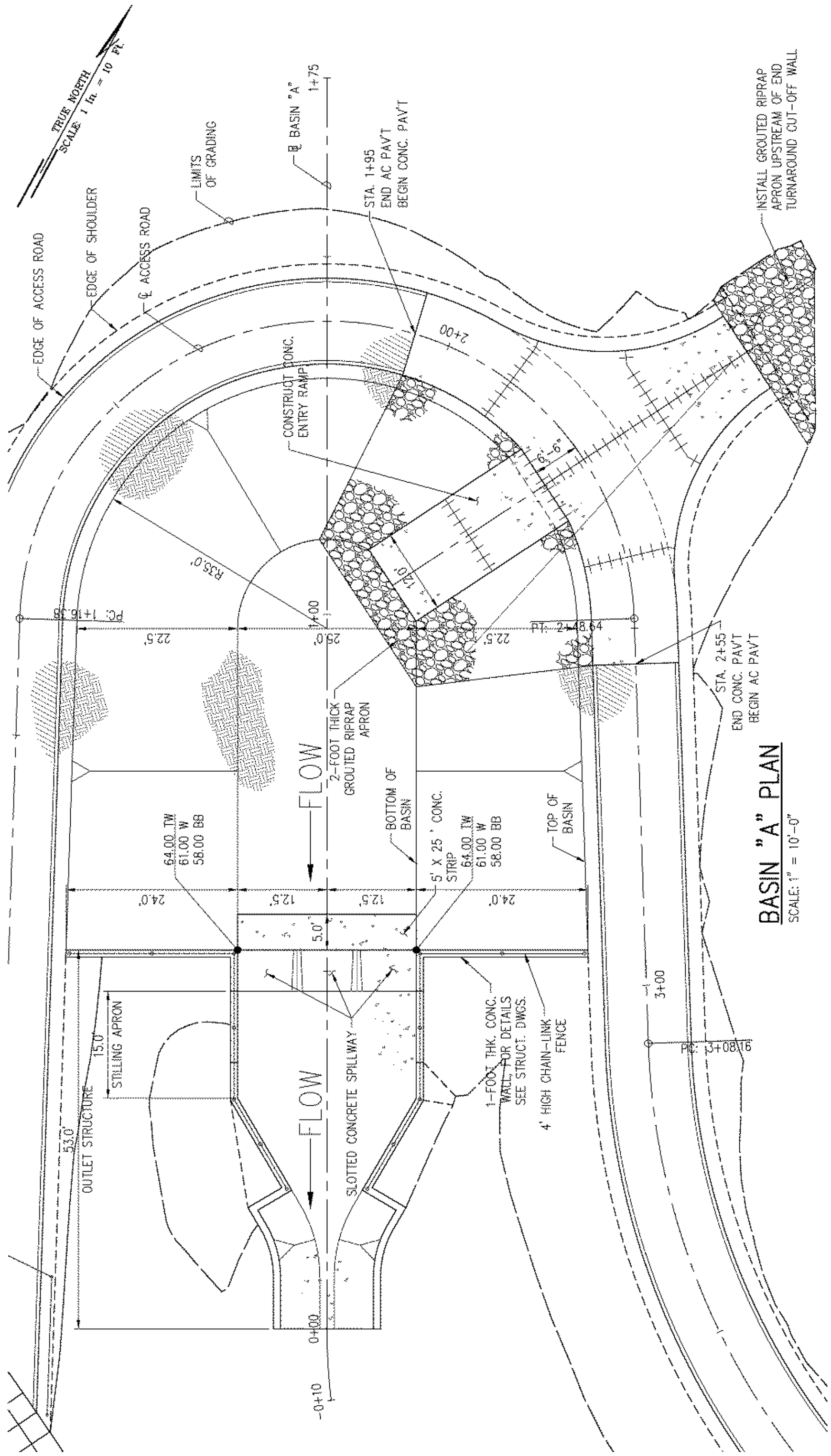

Figure 2-3. Plan View of Debris Basin "A"

The basins are generally constructed of grassed earth bottom and side slopes with a reinforced concrete vehicle ramp and turnaround for ease of maintenance. The side slopes of the basins would be constructed at a maximum slope of 4H:1V (horizontal:vertical) for Basin A and 3.5H:1V for Basin B. Turf Reinforcement Mats (TRM) will be used with the grassing on the side slopes to prevent erosion. Temporary Erosion Control Blankets (ECB) will be used on the basin bottoms while the grass is being established. The bottom of each basin would have a minimum length to width ratio of 2:1 and a maximum slope of approximately 1% to allow for drainage and to prevent ponding of water in the basin. The grassed bottoms of the basins would aid sediment retention and would allow for infiltration of stormwater into the ground. In order to limit erosion of slopes immediately above the debris basin, the slopes will be seeded with grass.

At the downstream terminus of the sedimentation basins, a slotted ogee weir spillway provides for a slowing of storm water flow through the sedimentation basin during small to moderate storm events, while allowing relatively unimpeded passage of storm water during large storm events. The basins are adequately sized to convey flows from a 10-year storm event and the heights of the spillways are set at three feet above the basin bottom. A minimum of one foot of freeboard shall be provided as required by design standards. Slots in the spillway are a minimum of one foot wide at the spillway crest and angle out to become 1.5 feet wide in the downstream direction for safety concerns and to prevent wedging of debris in the slots. The slots allow water to drain from the basins so that the basins will not have standing water. Directly downstream of the spillway is a stilling basin that transitions to the existing drainage channel cross section. The length of the stilling basin is set to provide a natural hydraulic jump in the stilling basin at peak flows, without the need for energy dissipation measures such as chute blocks. The stilling basin has a reinforced concrete slab bottom and reinforced concrete retaining walls on the sides that transition into the existing concrete drainage channel. Fencing will be installed along the top of the concrete retaining walls of the stilling apron and basin for safety concerns.

Sediment loadings to the basins were calculated to ensure that the capacity of the basin is adequate with respect to the amount of sediment expected to be captured. The basins volumes will accommodate over one year’s worth of sediment loading. The basin will be inspected on a monthly basis and regular maintenance cleaning will ensure that adequate sediment capture capacity is maintained.

The access road and associated appurtenances for the basins will be periodically accessed by maintenance vehicles and equipment. To accommodate heavy vehicle loading, the access road will be constructed of asphaltic concrete with compacted base course and subgrade material. The ramp into the basin and the turnaround will be constructed of reinforced concrete rated for heavy equipment loading. The access road size and geometry is designed to accommodate these vehicles as well. To provide positive drainage up to and across the roadway, depressions above the maintenance roadway are to be filled and the roadway will have a ford at each basin to allow water passage.

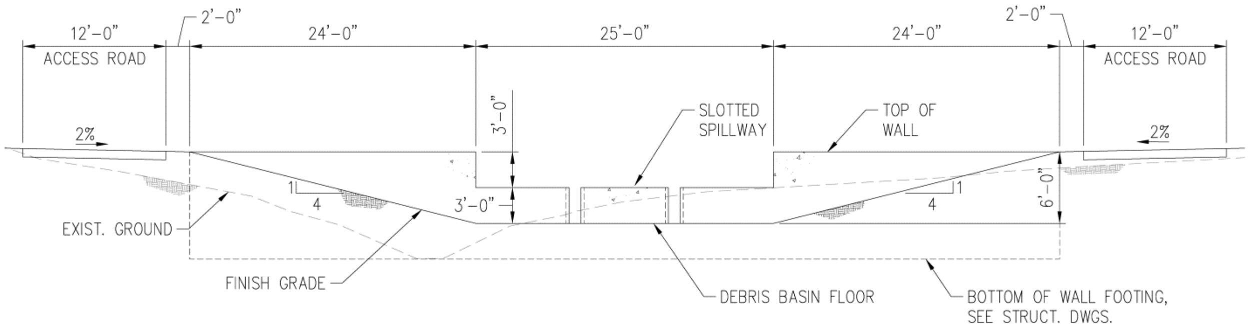

Figure 2-4. Section View of Debris Basin "A" Looking Downstream

2.2.2 Cost of Proposed Alternative

The two grass lined debris basins alternative has an estimated conceptual construction cost of \$900,000. The construction of the basins will be funded entirely by the City DFM, Storm Water Quality Branch.

The proposed action is scheduled for construction in 2018 and would take approximately nine months to complete.

2.3 ONE GRASS LINED DEBRIS BASIN

2.3.1 Description of Alternative

This alternative would involve the construction of one grass lined debris basin (Basin A; Figure 2-3. Plan View of Debris Basin "A") in the upper reaches of the existing City-owned storm drainage channel. The alternative would be similar to the proposed "Two Grass Lined Debris Basins" alternative except Basin A would remain while Basin B would be eliminated. With the elimination of Basin B, the asphalt access roadway would be shortened and the second concrete turnaround and access ramp would also be eliminated.

The principal difference between this alternative and the proposed "Two Grass Lined Debris Basins" alternative is that only one subwatershed would have its stormwater pollutants captured instead of two subwatersheds. The annual sediment and debris captured would only be 58% as much as the two grass lined basins alternative. However, the construction cost of this alternative would be less because of the elimination of Basin B and a portion of the access road.

This alternative is not currently considered because it did not provide the same level of sediment and debris capture as the proposed alternative. However, this alternative could be a recommended alternative if the City needed to reduce the construction budget for the project, or if Contractor bids came in too high for the proposed action.

2.3.2 Cost of Alternative

The one grass lined debris basin alternative has an estimated conceptual construction cost of \$550,000.00.

2.4 TWO CONCRETE LINED DEBRIS BASINS

2.4.1 Description of Alternative

This alternative would involve the construction of two concrete lined debris basins (Basin A & Basin B) in the upper reaches of the existing City-owned storm drainage channel. The alternative would be similar to the proposed "Two Grass Lined Debris Basins" alternative except that the basins would be lined with concrete instead of grass.

The principal difference between this alternative and the proposed "Two Grass Lined Debris Basins" alternative is that the two debris basins would be lined with concrete instead of grass. The construction cost of two concrete lined basins would be higher than grass lined basins. The concrete lining would not be as efficient as grass lining in trapping the sediment in the stormwater flows. Additionally the concrete lining would not allow for the infiltration of stormwater through the basin floor. This would create slightly higher flow rates discharging into the existing storm drainage channel. The concrete lining may also contribute to the occurrence of ponding in the event of blockages or debris buildup, which could lead to vector issues. The maintenance of the basins would be marginally easier with concrete lining.

This alternative was rejected because it would provide roughly the same level of sediment and debris capture as the proposed alternative, while costing more and being less environmentally friendly than the proposed action.

2.4.2 Cost of Alternative

The two concrete lined debris basins alternative has an estimated conceptual construction cost of $1,000,000.00.

3 AFFECTED ENVIRONMENT, POTENTIAL IMPACTS AND PROPOSED MITIGATION

3.1 ENVIRONMENTAL CONSEQUENCES

This section addresses the potential consequences associated with the proposed action. The following parameters are used to evaluate the duration and extent of potential environmental impacts associated with the proposed action

Short-term or long term. These characteristics are determined on a case-by-case basis and do not refer to any particular time period. In general, short-term effects are those that would occur only with respect to a particular activity or for a finite period or only during the time required for construction activities. Long-term effects are those that are more likely to be persistent and chronic.

Direct or indirect. A direct effect is caused by and occurs contemporaneously at or near the location of the action. An indirect effect is caused by a proposed action and might occur later in time or be farther removed in the distance but still be a reasonably foreseeable outcome of the action.

Negligible, minor, moderate, or major. Those relative terms are used to characterize the magnitude or intensity of an impact. Negligible effects are generally those that might be perceptible but are at the lower level of detection. A minor effect is slight, but detectable. A moderate effect is readily apparent. A major effect is one that is severely adverse or exceptionally beneficial.

Adverse or beneficial. An adverse effect is one having adverse, unfavorable outcomes on the man-made or natural environment. A single act might result in adverse effects on one environmental resource and beneficial effects on another resource or could result in both adverse and beneficial impacts to a single resource.

Significance. Significant effects are those that, in their contest and due to their intensity (severity), meet the thresholds for significance set forth in CEQ regulations (40 CFR 1508.27).

Context. The context of an effect can be localized or more widespread (e.g., regional).

Intensity. The intensity of an effect is determined through consideration of several factors, including whether an alternative might have an adverse impact on the unique characteristics of an area (e.g., historical resources, ecologically critical areas), public health and safety, or endangered or threatened species or designated critical habitat. Effects are also considered in terms of their potential for violation of Federal, state, or local environmental law; their controversial nature; the degree of uncertainty or unknown effects, or unique or unknown risks; if there are precedent-setting effects; and their cumulative effects.

3.2 CLIMATE AND TOPOGRAPHY

O‘ahu, similar to the other Hawaiian Islands, has a mild semi-tropical climate that varies across the terrain. The proposed project site is located within a climate region known as the leeward lowlands. Dry weather prevails except for light trade wind showers originating from the windward side of the island and during periods of major storm events.

Average high temperatures range from about 88 degrees Fahrenheit (°F) in the summer months to about 80°F in the winter months. Lows vary from about 66 °F in the winter months to 75 °F in the summer months. In the proposed project area, average rainfall monthly varies between 1 to 2 inches per month during the summer to 3 or 4 inches per month during the winter. Mean annual rainfall at the site is approximately 30 inches (Giambelluca and others 2013). The prevailing winds are trade winds which primarily originate from the northeast.

The topography of the Salt Lake Basin project area slopes downward from about 80 feet MSL on the southern slopes of Āliamanu to about 60 feet MSL near Likini Drive. The drainage in the area flows to the east toward Salt Lake.

3.2.1 Potential Impacts

Under the proposed action, no adverse impacts to climate and topography would occur.

3.2.2 Mitigation Measures

No mitigation measures are necessary because no adverse effects would occur.

3.3 NATURAL HAZARDS

3.3.1 Flooding

The proposed project site is located within Flood Zone D (Figure 3-1). The D Zone is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined but possible.

3.3.2 Tsunami

The proposed project site’s lowest elevation ranges from 60 to 80 feet mean sea level. The project site is located outside of the Tsunami Evacuation Zone (NOAA 2015).

3.3.3 Seismic Activity

The Uniform Building Code (UBC) provides minimum design criteria to address potential for damages due to seismic disturbances. The UBC scale is rated from Seismic Zone 0 through Zone 4, with 0 the lowest level for potential seismic induced ground movement. The entire Island of O‘ahu lies in a seismic zone designated as Zone 2A.

3.3.4 Potential Impacts

Under the Proposed action, no adverse impacts to natural hazards impacts would occur. The proposed debris basins are intended to intercept debris and would not significantly affect flooding. The basins will be designed to safely conduct the flows from a 10-year design storm while maintaining the minimum required freeboard. The proposed project improvements will be designed and constructed in full compliance with the City's storm drainage standards.

3.3.5 Mitigation Measures

No mitigation measures are necessary because no adverse impacts are anticipated.

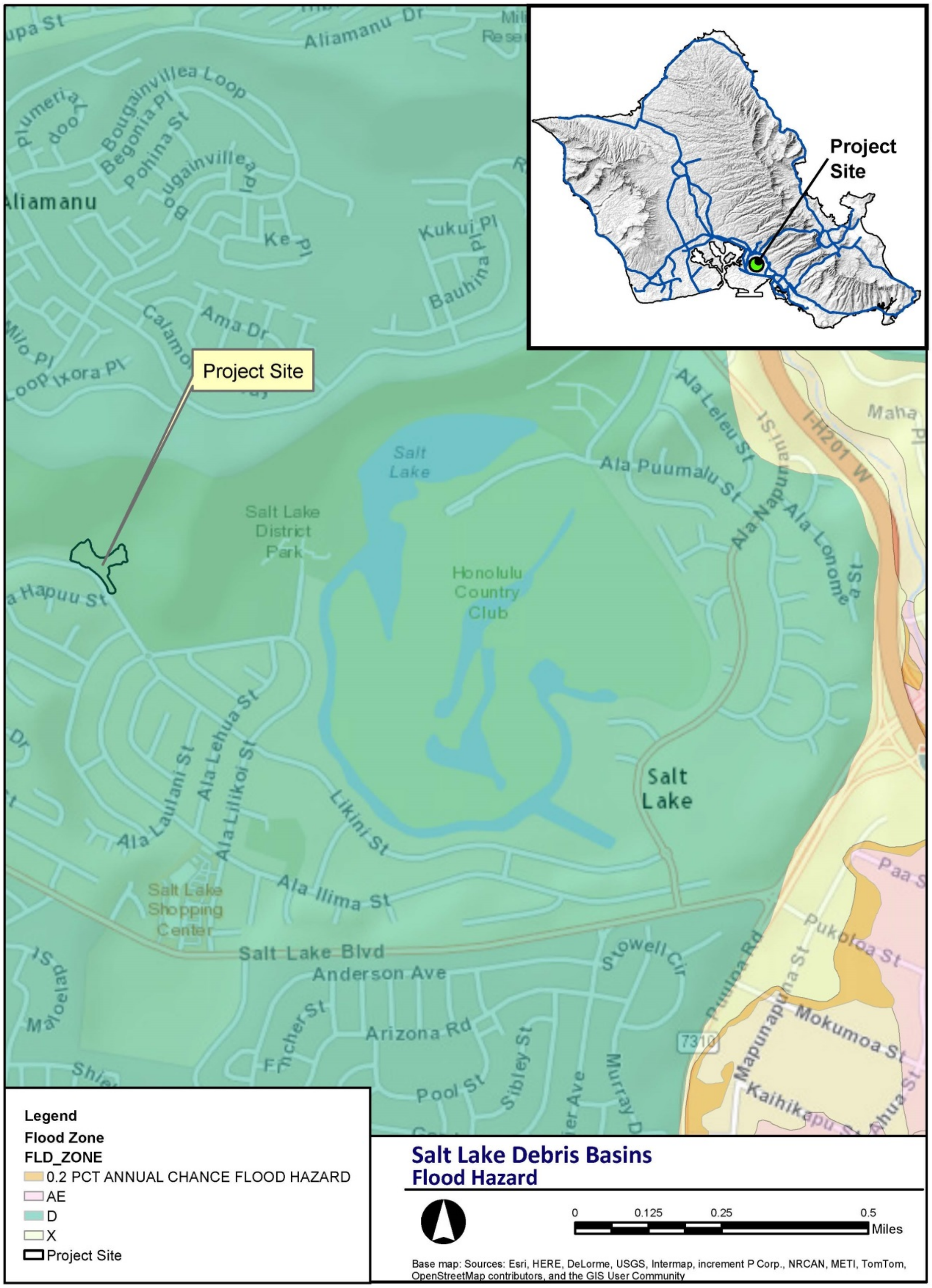

Figure 3-1. Flood Zone Map

3.4 SOILS AND GEOLOGY

3.4.1 Soils

The proposed project site is situated in an area consisting of two soil series which the U.S. Natural Resources Conservation Service (NRCS) categorizes as Makalapa Clay (MdC) and Rock Land (rRK). The Makalapa soil series typically occurs on slopes between 6 to 12 percent. This soil has a clay surface layer, about 8 inches thick, underlain by a subsurface layer, approximately 18 to 38 inches thick, of clay to silty clay loam with a subangular blocky structure underlain by weathered volcanic tuff. The soil has slow runoff and permeability, and the erosion hazard is slight to moderate. The Rock Land series is made up of areas of exposed rock. In the Salt Lake area the exposed rock is tuff, a soft rock formed from volcanic ash. The soil, in the region, is typically dry and non-expansive with rapid runoff characteristics.

A geotechnical soil exploration of the proposed debris basin site was conducted by Yogi Kwong Engineers (YKE). The geotechnical investigation contains a more detailed description of the soils and is intended to augment the NRCS data and provide more precise information for the civil engineering design. YKE conducted a total of 16 dynamic cone penetration probes, two test pits and collected soil samples for laboratory analysis. YKE identified probable fill material in the upper ten feet of soil as measured from ground surface. The soils from 10 feet to 33 feet below ground surface were identified as alluvium. From 33 feet to 40 feet below ground surface, YKE found lake sediments.

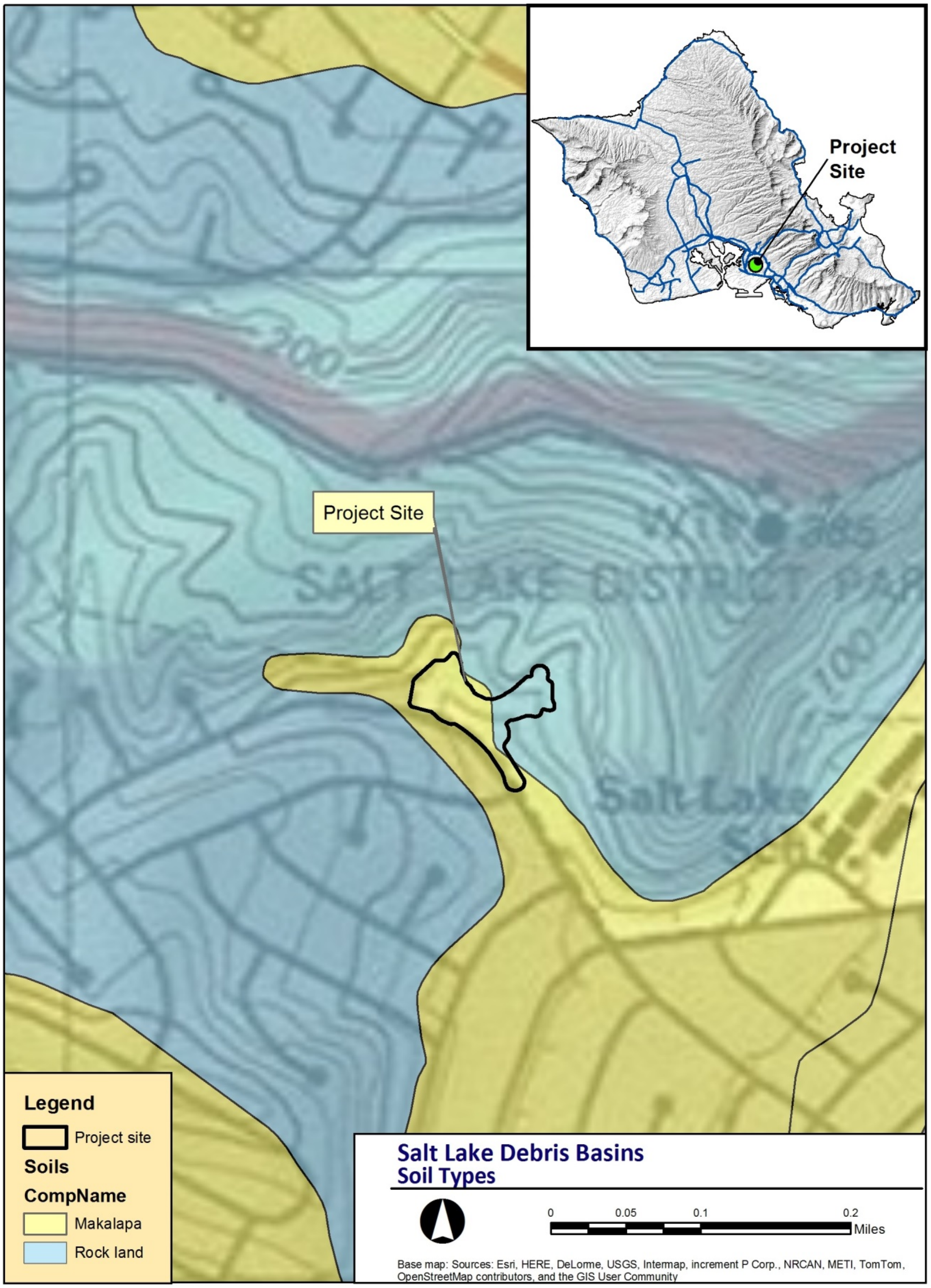

Figure 3-2 Soil Types Map

3.4.2 Geology

Geologically, the proposed project is located in Salt Lake which is situated on the leeward side of the Koʻolau Volcano. The Koʻolau lavas are divided into the Koʻolau Basalt and the Honolulu Volcanics. The study area is directly underlain by the Honolulu Volcanics (Figure 3-3). The Koʻolau Basalt primarily consists of Pliocene aged shield stage tholeiitic basalt. The Honolulu Volcanics are composed of Quaternary and Pleistocene aged alkalic basalt, basanite, and nephelinite (Lagenheim and Clague, 1987).

The rocks of the Honolulu Volcanics and Koʻolau Basalt can be divided into three groups: lava flows (aʻa and pahoehoe), pyroclastic deposits (ash), and dikes. The lava flows of the Koʻolau basalt are usually thin bedded with an average thickness of approximately ten feet (Wentworth and MacDonald, 1953). These beds are composed of aʻa, pahoehoe flows and pyroclastic deposits. Aʻa contains a solid central core between two gravely clinker layers. Pahoehoe flows are usually characterized by a smooth ropy texture. Pyroclastic deposits originate from explosive volcanism. They are composed of friable sand-like ash and indurated tuff deposits. Dikes are thin near vertical sheets of rock that intruded or squeezed into existing lava flows or pyroclastic deposits.

The Honolulu Volcanics erupted much later than the Koʻolau Basalt and overlay the deeply eroded Koʻolau Volcano and its associated alluvial deposits. In the Salt Lake area, they are composed mostly of tuff deposits of approximately 0.4 to 0.8 million years old (Sherrod and others, 2007). Tuff is an igneous or volcanic rock that forms from an explosive volcanic eruption. A volcano blasts ash and rock into the air and the material falls back to the surface surrounding the volcano. Over time the ejected material is compacted and cemented into a material call tuff. Tuff is a relatively soft rock that erodes easily.

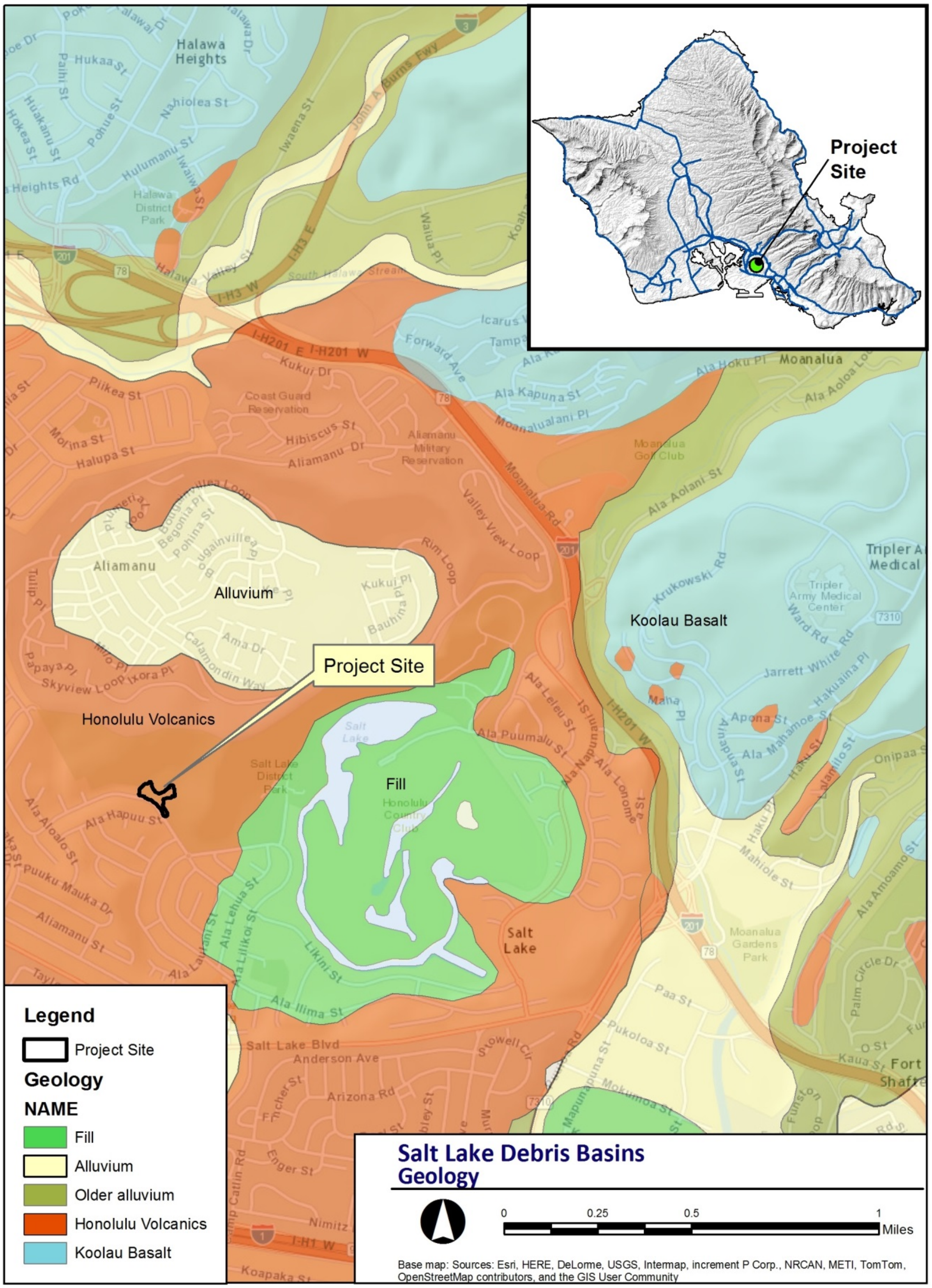

Figure 3-3 Geologic Map

3.4.3 Potential Impacts

Under the proposed action, it is anticipated that there would be no significant cumulative impacts on soils expected. During the construction, land disturbing activities such as excavation could result in temporary soil loss from erosion and sedimentation, particularly during heavy rain.

3.4.4 Mitigation Measures

Application of required construction site best management practices (BMPs) would minimize the potential soil loss. During construction, the contractor would implement standard construction site BMPs and adhere to NPDES permit conditions so that there would be no significant cumulative impacts on soils and therefore no additional mitigation is required.

3.5 WATER RESOURCES

3.5.1 Surface Water

The proposed project site is located within the Salt Lake watershed in Moanalua on the southern exterior slope of Āliamanu Crater. There is no perennial surface water at the proposed project site but perennial Salt Lake is located about 600 yards to the east. The purpose of the proposed project is to intercept debris originating from two natural gulches with intermittent stormwater flow.

The Salt Lake Watershed is located in Moanalua, Oʻahu, east of Pearl Harbor, approximately two miles inland of the Honolulu International Airport. This 1,200 acre watershed has changed dramatically over the last 100 years. What was once an undeveloped watershed has now become highly urbanized, comprising residential and commercial areas, together with four schools, a golf course, and military housing. Historically, the Salt Lake water body was approximately 260 acres in size. However, in the early 1970's a large portion of the lake was drained and filled in to construct the Honolulu International Country Club golf course. What remains is a body of water approximately 42 acres in size, comprised of smaller ponds connected by drainage canals. A drainage canal surrounds most of the golf course with the exception of the northeast corner. There are 18 stormwater drainage outfalls that discharge to the exterior drainage canal and ponds. The outlet of the drainage canal is located at the southeast corner of the golf course. It discharges to the ocean via Moanalua Stream. The Salt Lake bodies of water are at an elevation of about 3.5 feet and are not tidally influenced.

As a result of the urbanization occurring throughout the Salt Lake watershed area, the amount of stormwater runoff has increased. Over time, the drainage canals have filled up with sediment and trash. This abundance of trash has lessened the area available for water and reduced water circulation. Combined with added soil and nutrients this has led to over-growth of vegetation and algae blooms. The resultant depletion of the oxygen supply from the canals was likely a primary cause of noxious odors emanating from the pond in the 1990's. The City has received complaints of these odors from residents living near the golf course. In addition to the sediment and trash, there are other harmful chemicals, fertilizers, oil and grease that end up in the canals and negatively affect the water quality. The drainage canals were dredged by the City between 2003 and 2005, which temporarily eased the odor problem.

The intent of the debris basin project is to reduce the amount of sediment and debris that discharges into Salt Lake, thus reducing the possibility of odor and water quality problems. The proposed project would have a beneficial impact on surface water resources by improving water quality, water circulation and lowering sedimentation and turbidity.

3.5.2 Groundwater

The proposed project site is located in the Moanalua Aquifer System of the Honolulu Sector of the Island of O‘ahu. The aquifers of O‘ahu are generally divided into four general categories; caprock, perched, high-level and basal. Caprock water is found in alluvium, sediment and limestone. It is usually found near the coast and is non-potable. Perched groundwater is water impounded by an impermeable geologic layer such as a bed of ash or clay. These are commonly found in areas where the Honolulu volcanic series, a set of monogenetic volcanic events occurred, which created several notable features including Salt Lake. There are small permanent and perched groundwater bodies in the Salt Lake Area. High-level water is water that is impounded by geologic structures such as dikes. High-level groundwater resources in the Ko'olau Range and Waianae mountains produce large amounts of high quality water. There is not any known high-level dike impounded water in the Salt Lake area. Basal groundwater is the largest category of aquifer on O‘ahu. This water is composed of freshwater ‘floating” on saltwater. Most of the potable and significant amounts of non-potable water of the island is pumped from basal aquifers. Basal water underlies the proposed project area. There is a basal golf course irrigation well owned by the Honolulu Country Club located approximately 0.9 miles to the east of the proposed project area. In addition, the Honolulu Board of Water Supply’s Moanalua Wells are located approximately 1.3 miles to the east of the proposed project area.

3.5.3 Potential Impacts

Potential short-term adverse impacts on the quality of the surface water at Salt Lake are possible during construction of the project. Earthworks operations including grading, excavation and stockpiling will be conducted during the construction of the project. Construction equipment could include excavators, backhoes, loaders and dump trucks.

It is anticipated that the proposed action would have minimal long-term adverse effects on the quality or quantity of the surface water at Salt Lake. The only time period of potential impacts to the quality of surface water would be during the annual maintenance of the debris basins. The proposed action would have a long term beneficial impact on the quality of surface water, by reducing the amount of sediment and debris in Salt Lake.

The proposed action would have no short-term or long-term adverse impacts on the groundwater at Salt Lake. Dewatering may be necessary during the construction phase but this would not result in any long-term adverse impacts on groundwater resources.

3.5.4 Mitigation Measures

Potential short-term adverse impacts on the quality of surface water will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the HDOH will likely be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and check dams, and minimizing time of exposure between construction and re-vegetation.

Potential surface water quality impacts resulting from annual maintenance of the debris basins will be mitigated with the use of appropriate storm water BMPs. The DFM would use appropriate structural and non-structural BMPs such as check dams, erosion control blankets, and grassing to prevent sediment and debris from being transported to Salt Lake during storm events. Typically maintenance would be conducted under dry conditions and the material collected would be taken directly to a landfill facility.

3.6 WETLANDS

Figure 3-4 is a map of wetlands as delineated by the U.S. Fish and Wildlife Service National Wetlands Inventory. This data set represents the extent, approximate location and type of wetlands and deepwater habitats in the United States and its Territories. These data delineate the areal extent of wetlands and surface waters as defined by Cowardin et al. (1979). A wetland determination survey (Appendix F) was conducted by Oceanit on November 6, 2015. The determination survey confirmed the absence of wetland conditions at the project site. The proposed debris basins will intercept debris that would otherwise discharge into the water bodies and wetlands shown in Figure 3-4.

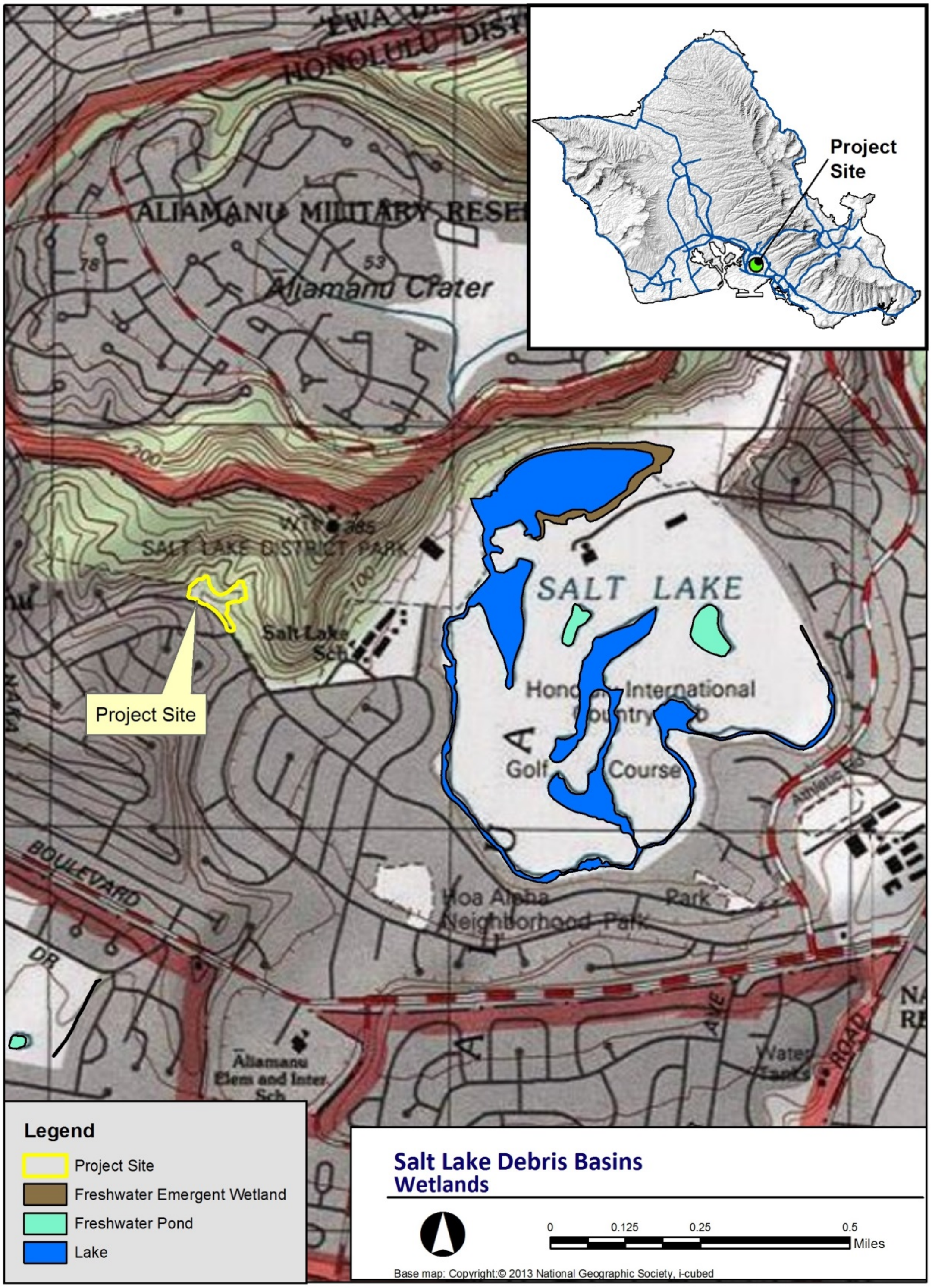

Figure 3-4 Wetlands in the proposed action area

3.6.1 Potential Impacts

The proposed action will not have a significant adverse impact on wetlands. It would have a beneficial impact on the wetland by reducing pollutant discharge into the wetlands.

3.6.2 Mitigation Measures

No mitigation measures will be required.

3.7 BIOLOGICAL RESOURCES

3.7.1 Biological Resources

A Biological Resources Survey was completed for the project by Koehler Enterprises, LLC. The survey was prepared in September 2014 and it is included as Appendix C. The following section provides a description of the Biological Resources Survey and findings for the proposed project site.

Both a Flora Survey and a Fauna Survey were conducted on August 30, 2014 covering an area larger than the footprint of the proposed project area, including the lower portions of the toe of the slopes, drainage ditches and turf areas. The pedestrian surveys examined all areas of potential impact from the proposed action.

3.7.2 Flora Survey

The proposed project area is dominated by Guinea grass (Megathyrus maximus) & haole koa (Leucaena leucocephala) shrubland, where the tree canopy is approximately 15 feet, and the grass/shrub layer is 2 feet in height. The occasional Kiawe trees (*Prosopis pallida*) range from approximately 15-30 feet in height. Following the vegetation of classification of Gagne and Cuddihy (1999), the vegetation community is a lowland dry shrubland; characterized by open shrublands, under which grow herbaceous species adapted for winter rainfall and summer droughts. Appendix C: Biological Resources Survey has a list of the plant species observed at the project area.

Overall, the vegetation at the proposed project site is dominated by invasive plant species adapted to lowland leeward habitats. No ferns or fern allies were observed during the survey. Only three indigenous Hawaiian plant species were observed (*Abutilon incanum (*Ma‘o*), Sida fallax (*‘Ilima*), Waltheria indica (*'Uhaloa). The survey did not reveal any botanical resources of notable value or worthy of consideration for conservation or protective measures.

3.7.3 Mammals

One mammal species, an Indian Mongoose (Herpesties a. auropunctatus), a non-native species, was encountered during the site visit. No other mammals were observed at the proposed project site during the survey. Given the habitat characteristics and surrounding urban environment, cats (*Felis catus*), roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), Polynesian rats

(*Rattus exculans*), and mice (*Mus musculus domesticus*) are likely abundant. However no observations, direct or indirect, of these species were made during the survey.

The endangered Hawaiian Hoary Bat (Lasiurus ceneruc semotus) was not detected during the survey, though a remote possibility exists that the species could make very limited, seasonal use of the proposed project area for foraging. The urbanized, degraded habitat of the proposed site area, is not optimal pupping and roosting habitat.

3.7.4 Birds

During the avian survey, twenty-four individual birds of seven different species were encountered during the site visit. Of these, 21 individuals, representing six species were observed during the two point counts. Six families of birds were represented at the site (Table 3-1). The Pacific golden plover or kolea (Pluvialis fulva), encountered in the mowed area near the entrance gate, was the only native species detected. The Pacific Golden Plover arrives in Hawaii in August and departs in May for arctic breeding grounds. It does not nest in Hawai'i. Zebra doves (Geopelia striata) and Red-vented bulbuls (Pycnonotus cafer) were the most common species observed at the proposed project site.

The threatened Newell's Shearwater (Puffins auricularis newelli) was not detected in this survey, nor was suitable nesting habitat observed in or around the project site. It is a pelagic seabird species exceptionally unlikely to over-fly the project area, and if so, only between the months of May and early December.

Table 3-1. Bird species observed during the biological resources survey.

Common Name	Scientific name	Status	Count
Charadriiformes			
Pacific golden plover (kolea)	*Pluvialis fulva*	Native	n/a
Columbiformes			
Rock pigeon	*Columba livia*	Alien	1
Zebra dove	*Geopelia striata*	Alien	5
Passeriformes			
Red-vented bulbul	*Pycnonotus safer*	Alien	5
Zosteropidae			
Japanese white-eye	*Zosterops japonicus*	Alien	4
Cardinalidae			
Northern cardinal	*Cardinalis cardinalis*	Alien	4
Passeridae			
House sparrow	*Passer domesticus*	Alien	2

3.7.5 Potential Impacts

The proposed action is not anticipated to have a significant impact on botanical, mammalian or avian resources.

There is a remote chance that the endangered Hawaiian Hoary Bat could make use of the proposed project area for foraging. The potential impact that construction of the proposed project would have on the Hawaiian Hoary Bat is during the clearing of the larger trees on site.

The potential impact to the Pacific Golden Plover, which is protected under the Migratory Bird Treaty Act, would be during the commencement of construction activities.

The potential impact to the Newell's Shearwater would be disorientation as a result of the nocturnally flying bird encountering exterior lighting associated with construction activities.

3.7.6 Mitigation Measures

The survey did not reveal any botanical, mammalian or avian resources of notable value or worthy of consideration for conservation.

To avoid potential impacts to the Hawaiian Hoary Bat, it is recommended to refrain from clearing trees greater than 15 feet in height between June 1 and September 15, which is the period when a slight possibility exists that Hawaiian Hoary Bat juveniles may occur in the area, and may not be able to escape a tree being felled.

The native Pacific Golden Plover was encountered during the site visit. Efforts will be made to minimize/avoid actions that may harass or injure the birds. It is recommended that construction commence while the species is away at its arctic breeding grounds during the months of June and July.

To minimize the possibility for interactions between the nocturnally flying Newell's Shearwater, it is recommended that there should be no night-time construction and any lighting used during construction should have fixtures that are shielded and downward-angled.

3.8 EXISTING ARCHAEOLOGICAL AND CULTURAL RESOURCES

A Cultural Impact Assessment (CIA) was prepared for the project area by Scientific Consultant Services, Inc (SCS). An Archaeological Evaluation (See Appendix D) was also prepared by SCS for the project. The CIA (See Appendix E) was prepared in June 2016. The field work for the archaeological evaluation was conducted on October 27, 2014 and June 17, 2016 and the report was finalized in June 2016.

3.8.1 Archaeological Evaluation

The proposed project area is located within the Salt Lake District Park, in the southern portion of Moanalua Ahupua`a, Honolulu (Kona) District, O`ahu Island, Hawai`i [TMK: (1) 1-1-063:018 por.]. The complete Archaeological Evaluation report is attached in Appendix D. The scope of work for this investigation included:

- Historical and previous archaeological background research including previous archaeological reports, Land Commission Awards, and historic maps in order to determine if archaeological sites have been recorded on or near this property, and to document the history of land use in and around the project area.
- Field inspection of the project area to identify surface archaeological sites or features and to investigate and assess the potential for impacts to such sites or features.

The coastal plain of Moanalua was traditionally utilized for aquaculture. Six fishponds, subsequently destroyed or filled-in, were located in the coastal plain. Lo`i were found above what is now Moanalua Park and along Moanalua Stream. Several heiau were located in the ahupua'a, mostly in Moanalua Valley.

No previous archaeological work has been conducted in the immediate project area. Eleven studies were conducted in the region of the proposed action and three studies were conducted in Salt Lake District Park. The proposed action is in Salt Lake District Park, but the park area is large and the areas studied were between 700-feet and 5,000-feet away from the proposed action. The previous studies in the park were conducted in 1979 and 1980 (pp 24–25, Appendix D Archaeological Evaluation). Barrera (1979) conducted an archaeological reconnaissance of portions of the area. During the survey, Barrera located one site, which he thought might be State Site 50-80-13-500, a habitation cave. Connolly (1980) conducted an archaeological reconnaissance survey of the Salt Lake District Park Site which included the current project area. The survey resulted in the identification of a previously unidentified rock shelter. Based on the finding of oyster shell and fragmented human skeletal material, the cave was interpreted as a temporary habitation and burial site. Connolly's (1980) findings also included the re-location of the habitation cave (State Site 50-80-13-500/Bishop Museum Site Oa-A7-20) initially investigated by Soehren, and indicated that extensive bull dozing had "probably" destroyed Bishop Museum Site Oa-A7-21 (State Site 50-80-13-3992). No additional historic properties were identified.

The Archaeological Evaluation included a field inspection. The ground surface of the project area was found to have been subject to land altering activities. A review of aerial photographs and as-built plans indicated that the current existing drainage structures were constructed in 1967 and are not considered historic properties. Modern cultural material, including various modern rubbish, was found on site. No historic properties were identified during the field inspection and no further archaeological work is recommended.

3.8.2 Cultural Impact Assessment

A CIA was also prepared by SCS (Appendix E, Cultural Impact Assessment). The CIA was prepared, as much as possible, in accordance with the suggested methodology and content protocol in the Guidelines for Assessing Cultural Impacts of the Guide to Implementation and Practice of the Hawai'i Environmental Policy Act (OEQC 2012). The guidelines suggest the use of archival research as well as consultation with knowledgeable people.

Consultation was conducted via the U.S. Postal Service. Consultation was sought from Dr. Kamana`opono M. Crabbe, Chief Executive Officer, OHA; Vincent Hinano Rodrigues, SHPD Culture and History Branch Chief; William Ho`ohuli, community member; the Hawaiian Civic

Club of Honolulu; and David Yomes, Chairperson of the Āliamanu, Salt Lake, Foster Village Neighborhood Board. In addition, SCS published CIA notices in the Honolulu Star-Advertiser and the Ka Wai Ola (OHA newspaper). During the consultation process, SCS received no responses to the inquiries pertaining to any information that individuals or organizations may have which might contribute to the knowledge of traditional cultural activities that were, or are currently, conducted in the vicinity of the proposed Salt Lake Basin Debris project area.

Based on the lack of responses from those organizations and individuals contacted, it appears that the proposed project area has not been used for traditional cultural purposes within recent times. Based on historical research and the lack of responses from those organizations and individuals contacted, it is reasonable to conclude that Hawaiian rights related to gathering, access or other customary activities within the project area will not be affected and there will be no adverse effect upon cultural practices or beliefs.

3.8.3 Potential Impacts

No significant impacts to archaeological or cultural resources are anticipated.

3.8.4 Mitigation Measures

No mitigation measures are proposed. Should any previously unidentified burial, archeological or historic sites be found during the course of construction of the proposed project, the Applicant will stop work in the immediate vicinity and the SHPD will be notified immediately. The significance of these finds will then be determined and appropriate mitigation measures will be approved by the SHPD. Subsequent work will proceed after SHPD authorization has been received and mitigation measures have been implemented.

3.9 SCENIC AND VISUAL RESOURCES

3.9.1 Existing Scenic and Visual Resources

Visual resources are the various elements of the landscape that contribute to the visual character of a place. These elements can either be natural or human-made and the elements include objects, vistas and view-sheds.

The Salt Lake debris basins are proposed to be built at the base of the eastern side of Āliamanu Crater. The current view from the neighborhood at Likini Street looking from east to west is of the rocky, semi-vegetated slopes of Āliamanu Crater (Figure 3-5; debris basins are shown in light blue). The vegetation flushes green subsequent to rainfall but is generally brownish in color. Āliamanu Crater is listed in the City & County of Honolulu, Primary Urban Center Development Plan as a Significant Panoramic View with the view direction looking from east to west (Ewa direction; Figure 3-6).

Figure 3-5 Proposed project area with the debris basins superimposed (GoogleEarth).

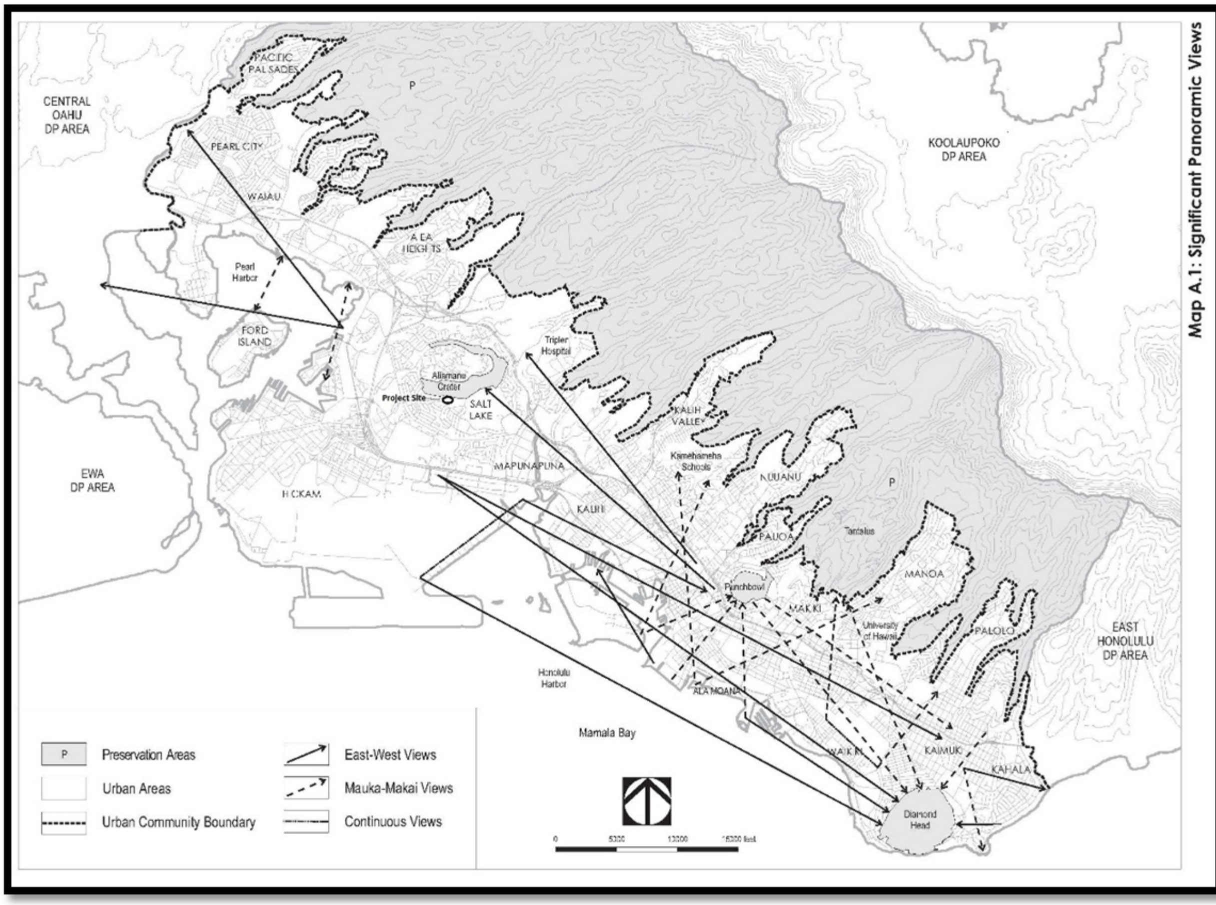

Figure 3-6 Significant panoramic views (C&C Primary Urban Center Development Plan)

3.9.2 Potential Impacts

It is anticipated that the construction of the proposed debris basins would result in long-term, minimal and/or negligible impact on the panoramic view planes. The basins would not be visible from a distance because they would be constructed below grade (below ground level). In addition the proposed project area would be re-vegetated in an effort to minimize their impact on the visual plane in the immediate vicinity. The majority of the structure would not be visible from Likini Street (for a street map see Figure 1-2).

3.9.3 Mitigation Measures

The impacts to visual and scenic resources would be minimal therefore no additional mitigation beyond revegetation of the constructed area is proposed.

3.10 AIR QUALITY

3.10.1 Existing Air Quality

The State Department of Health, Clean Air Branch, monitors ambient air on O‘ahu using five air quality monitoring stations which are located in Kapolei (2 stations), Sand Island, Pearl City and Honolulu. The Sand Island and Pearl City Stations are roughly equidistant from the proposed project site. Environmental Protection Agency has set standards for seven pollutants. These standards are called National Ambient Air Quality Standards or NAAQS. The parameters covered by the NAAQS include PM10, PM2.5, carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide and lead. PM refers to particulate matter and the number after PM refers to the size in microns (thousandths of a millimeter). The air quality at the Sand Island and Pearl City monitoring stations were in compliance with NAAQS goals. According to the 2013 Annual Summary (DOH 2014), Hawai‘i achieved the NAAQS goals.

3.10.2 Potential Impacts

Short-term impacts to air quality could potentially result from the proposed construction activity. Heavy equipment would be used to excavate the basins and construct the access road. Possible emissions include exhaust from diesel engines and fugitive dust from earth moving operations. In terms of NAAQS, it is possible that dust will increase particulate matter (PM10) and engine exhaust will contribute to particulate matter, carbon monoxide, nitrogen dioxide, ozone and sulfur dioxide.

Single family residences are located immediately adjacent to the proposed construction activity (Figure 3-7). There are single family homes across the street to the south and a home immediately to the west. Some of the proposed work will take place within 100 feet from the nearest residence. The nearest school is separated from the proposed project area by a ridge and is also 1000 feet away and is not expected to be impacted by air emissions from construction activity. With the use of appropriate BMPs, air emissions from the proposed work are expected to cause minimal impacts to neighboring homes during the construction of the proposed project.

Minimal long-term air emission adverse impacts would be produced from on-going debris basin maintenance. The Department of Facility Maintenance has an existing program to check all debris and sedimentation basins multiple times per year. The basins would be checked after large area storm events but it is expected that the basins would require sediment and debris collection no more than once a year. When the basins are in need of servicing and emptying, the servicing will be accomplished through use of heavy equipment, including backhoes, wheel loaders, dump trucks, and/or bulldozers with blade-type attachments. Each maintenance operation will take less than eight hours. Minimal impacts from dust and equipment exhaust emissions would result from maintenance operations.

The proposed construction activity may have a positive impact on the Salt Lake air quality by decreasing the sediment and nutrients in Salt Lake that contribute to the decaying vegetation, algal blooms, resultant depletion of the oxygen in the water bodies, and noxious odors.

3.10.3 Mitigation Measures

Potential air quality impacts resulting from construction activities will be mitigated by complying with the HDOH Administrative Rules, Title 11, Chapter 60, Air Pollution Control. The construction contractor(s) will be responsible for complying with the HDOH regulations that prohibit visible dust emissions at property boundaries. Thus an effective dust control plan would be implemented during construction to ensure compliance with State regulations. Fugitive dust emissions would be controlled to a large extent by watering of active work areas, utilizing dust screens, keeping adjacent paved roads clean of dirt and mud, and covering of open-bodied trucks. Other dust control measures would include limiting the area of disturbance at any given time, and grassing of project areas early in the construction schedule. In addition, all construction equipment will be required to be well maintained and compliant with air pollution regulations.

The Contractor would deliver a Public Notice to the residences immediately adjacent to the proposed project site prior to starting construction. The notice shall include at a minimum:

- Contractor contact information;
- Planned weekly hours of construction;
- Planned overall construction schedule;
- Brief description of construction activity; and
- Any planned hindrances to the public.

Potential air quality impacts resulting from annual maintenance of the debris basins will be mitigated with the use of appropriate dust control BMPs. The DFM would use appropriate measures to mitigate dust associated with the maintenance of the basins, and equipment exhaust emissions. Dust would be controlled by watering of the sediment prior to collection, as required. All vehicles and heavy equipment would be properly maintained to minimize pollutant emissions.

Sediment and debris collected at the site will be hauled off-site. Typically, maintenance would be done under dry conditions, and the material collected would be taken directly to a landfill facility. Dump trucks used to transport sediment and debris would be properly covered.

Figure 3-7. Homes and schools in the immediate vicinity to the proposed project

3.11 NOISE

3.11.1 Existing Noise Environment

Noise pollution is regulated by the HDOH, which has set specific decibel levels into three classes based on land use. The Hawai‘i Administrative Rules Title 11, Chapter 46, Community Noise Control contains the specific sound levels in dBA and is shown in Table 3-2.

Table 3-2. Maximum permissible sound levels in dBA

Zoning District	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Class A	55	45
Class B	60	50
Class C	70	70

Class A zoning districts are lands zoned residential, conservation, preservation, public space, open space, or similar type. Class B lands are zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar. Class C includes lands zoned agriculture, country, industrial, or similar types. The debris basins are located in a preservation zoned area. In addition the proposed basins would be adjacent to a residential area. Therefore the construction should comply with Class A noise level standards.

Noise levels cannot exceed the dBA identified above for more than 10 percent of the time within any twenty-minute period, except by permit or variance. Impulsive noise can be 10 dBA above the maximum permissible sound levels. Impulsive noise includes activities such as hammering, pile driving, and explosion.

3.11.2 Potential Impacts

The proposed action would not result in cumulative significant noise impacts. Construction related noise impacts would be temporary and short-term. Heavy equipment would be used to excavate the basins and construct the access road. Single family residences are located immediately adjacent to the proposed construction activity (Figure 3-7). Some of the proposed project work would take place within 100 feet from the nearest residence. There are single family homes across the street to the south and a home immediately to the west. The nearest school is separated from the project area by a ridge and is also 1000 feet away and is not expected to be impacted by noise. Excess noise is expected to cause some adverse impacts to neighboring homes during the construction of the proposed project.

Long term noise impacts would be produced from debris basin maintenance. The DFM has an existing program to check all sedimentation basins multiple times per year. The basins would also be checked after large area storm events but it is expected that the basins will require sediment and debris collection once a year. When the basins are in need of servicing, the servicing would be accomplished through use of heavy equipment, including backhoes, wheel loaders, dump trucks, and/or bulldozers with blade-type attachments. The access roads, turnabouts, and ramps have been designed with consideration for this equipment. Sediment and debris collected at the site will be hauled off-site

3.11.3 Mitigation Measures

Noise impacts would be generated by construction equipment. Due to the close proximity to residences, curfew times for construction will be established and mufflers will be used on equipment to minimize noise from construction equipment. A Department of Health Community Noise Permit would be required for this project and if work is to be done outside the hours of 7:00 am to 6:00 pm, Monday through Friday and 9:00 am to 6:00 pm Saturdays then a Community Noise Variance will also be required. The City would designate a Construction Manager (CM) who will oversee the project.

The Contractor would also deliver a Public Notice to the residences immediately adjacent to the proposed project site prior to starting construction. The notice shall include at a minimum:

- Contractor contact information;
- Planned weekly hours of construction;
- Planned overall construction schedule;
- Brief description of construction activity; and
- Any planned hindrances to the public.

In order to minimize noise impacts from heavy equipment operation, maintenance would only take place during regular work hours, Monday through Friday.

When the basins are being serviced noise will be generated from the use of heavy construction equipment. The DFM would use appropriate measures to minimize noise. In addition, maintenance activities would only take place during normal work hours and each maintenance operation will take less than 8 hours. Noise pollution would be addressed through work practice controls and, if necessary, engineering controls.

3.12 SOCIOECONOMICS

This section describes the social and economic environment of the Āliamanu/Salt Lake/Foster Village neighborhood area where the proposed action would occur. Factors such as demographic characteristics and economic context are described below.

3.12.1 Social and Economic Factors

According to the U.S. Census Bureau, the population of the City and County of Honolulu in 2010 was 953,207. This represents approximately 68 percent of the total population of the State of Hawaiʻi. In 2010 the Honolulu District (Primary Urban Center) had a population of 390,738 people (41 percent of Oʻahu's population) and the Āliamanu/Salt Lake/Foster Village Neighborhood area had a population of 35,969. The average number of people per household in Honolulu in 2010 was 2.89 people.

Salt Lake is part of the Urban Honolulu census designated place. The largest ethnic population of Urban Honolulu is Asian with 54.8% of the population, followed by people reporting as white with 17.9%. The third largest is people reporting as two or more races at 16.3%. Native Hawaiian and Pacific Islander are the fourth largest ethnic population 8.4%. These numbers were obtained from the 2010 U.S. Census.

Housing units in the Āliamanu/Salt Lake/Foster Village Neighborhood area in year 2010 totaled 13,208 compared to 340,906 units in Oʻahu. In 2000 the owner occupied units totaled 5,687 units and renter occupied units totaled 6,045 units.

The civilian labor force for Honolulu County in 2010 was estimated at 483,480 people. The labor force is comprised of persons 16 years of age and over. Honolulu has the largest labor force compared to the other three counties. The unemployment rate is 3.8 percent. The median household income from 2008-2012 was $72,292 in the City and County of Honolulu compared to $67,492 for the State of Hawaiʻi.

In the City and County of Honolulu, government (federal, state and local) has the highest number of civilian jobs at 98,500. Trade, transportation and utilities accounts for 83,500 jobs. Leisure and hospitality accounts for 67,700 jobs. The third highest employment category is Professional and business services which accounts for 66,300 jobs. The job count for educational and health services is 62,200.

In 2013, there were 57,357 military personnel stationed in the State of Hawai'i with the majority of those located in Honolulu County. Eleven of the state's fourteen major military installations are located on Island of Oʻahu. Joint Base Pearl Harbor-Hickam and Fort Shafter along with military housing are located within two miles of the proposed action.

3.12.2 Potential Impacts and Mitigation

The Salt Lake Debris Basins project is located adjacent to residential neighborhoods. Noise and dust due to construction activities, and interruption of local traffic are potential adverse impacts to the local social environment. A weekly limitation of work hours as deemed practical is recommended in order to minimize these social impacts. Refer to Section 3.11 for noise impacts and proposed mitigation measures and Section 3.10 for air quality impacts and proposed mitigation measures.

The proposed action would intercept and capture debris and course sediment, originating from the outer wall of Āliamanu Crater, before it enters the storm drain system and help to reduce adverse impacts to water quality in Salt Lake. Landowners and tenants occupying properties near or adjacent to the Lake and drainage canals would benefit from higher water quality. They would also benefit from an improvement to the drainage canals' odor problem. No further mitigation is proposed for social impacts.

Long-term adverse impacts on the economy are not anticipated from the proposed action. Short-term beneficial impacts are anticipated from direct and indirect employment and purchases required for construction.

No mitigation is required regarding the economic environment associated with the proposed project since the proposed action is not anticipated to have adverse impacts on the economy and would result in short and long-term positive impacts.

3.13 INFRASTRUCTURE, PUBLIC FACILITIES AND SERVICES

The public infrastructure and services in the proposed project area will be discussed in this section. Except for potential minor impacts during construction, there will be few impacts on infrastructure, public services and facilities. There will be a beneficial impact on stormwater drainage.

3.13.1 Drainage, Water, Wastewater, & Solid Waste

3.13.1.1 Drainage & Stormwater

The proposed Salt Lake Debris Basins would be a part of the City stormwater system. The neighborhood in the project area is already served by the City stormwater system. Stormwater from the homes and streets fronting the project flows into an open channel stormwater conduit (concrete lined ditch) that follows the north or mauka side of Likini Street and Ala Lilikoi Street and discharges into Salt Lake (Figure 3-8). Other pipe or culvert stormwater conduits serving adjoining streets also discharge into the open channel from the south (makai). In addition, stormwater runoff from the natural shrub land on the side of Āliamanu Crater also discharges into this open channel conduit. Currently this stormwater runoff from the sides of the crater conveys soil and debris into the City stormwater system and ultimately into Salt Lake.

The purpose of the proposed project is to construct two stormwater debris basins located in the upper reaches of the existing City storm drainage channel. These basins would intercept debris and sediment before it gets into the stormwater system and increases sedimentation in Salt Lake. No adverse impact on the existing stormwater and drainage system is expected. A decrease in sedimentation in Salt Lake would have the beneficial impact of less frequently required maintenance dredging of the lake and canals. A beneficial impact on the stormwater system would occur if the debris basins are constructed because of the decrease in debris and sediment in the storm drainage channel. Sediment and debris in the storm drainage channel could lead to blockages and surface wear on the channel.

3.13.1.2 Water

The neighborhood in the vicinity of the proposed debris basin project receives potable water service from the Honolulu Board of Water Supply (HBWS). HBWS has a potable water reservoir (tank) on Āliamanu Crater approximately 800 feet to the northeast of the site. The reservoir will not be affected by construction or operation of the debris basin. No significant adverse or beneficial impacts are expected on water supply.

3.13.1.3 Wastewater

The neighborhood in the vicinity of the proposed debris basin project receives wastewater (sewer) service from the City. Likini Street is served by an 8-inch vitrified clay wastewater pipe. No impacts on the wastewater system are expected. The 8-inch wastewater pipe under Likini Street will not be impacted.

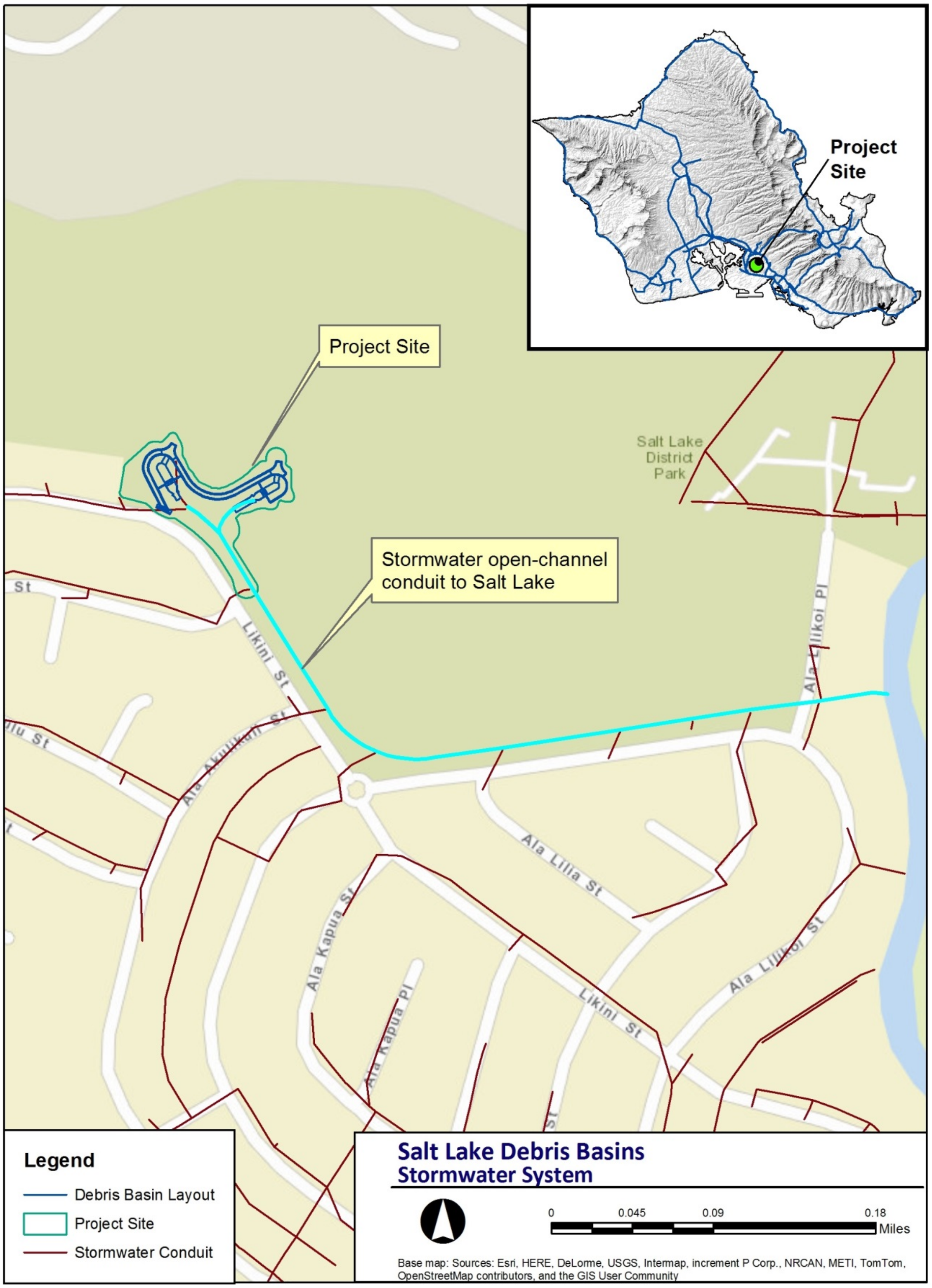

Figure 3-8. Location of the proposed debris basins relative to the existing stormwater system

3.13.1.4 Solid Waste

The City DFM provides solid waste collection in the residential areas adjacent to the proposed project site. The proposed action would generate some solid waste from clearing and construction activities at the site. This waste would be properly disposed of by the construction contractor in accordance with City and State law.

3.13.1.5 Potential Impacts and Mitigation

No significant adverse or beneficial impacts are expected on water supply, wastewater, & solid waste related to the proposed action. The long-term impacts to the drainage system would be beneficial because of the decrease in sediment and debris in the system. There would be short-term impacts on the drainage system during construction. Soil would be exposed for short periods during the grading and construction of the debris basins. Erosion and sedimentation controls would be installed as required by site conditions, construction activities, and project scheduling. Mitigation measures would conform to the required NDPES permit and State of Hawai‘i, Department of Health (DOH) regulations pursuant to the Hawai‘i Administrative Rules, Title 11, Chapter 55, Water Pollution Control.

3.13.2 Transportation

Likini Street is a significant neighborhood street in the Salt Lake area. The highest traffic volumes occur on weekday mornings and afternoons. In the immediate vicinity of the project area, Likini Street provides access to the residents of Ala Akulikuli Street, Ala Hapuu Street, Ala Awaphui Place, Ala Aupaka Place and Ala Aloalo Place. In addition, The Bus Route 3 follows Likini Street. Please see Figure 3-9.

The proposed project includes a driveway upgrade to provide access to the debris basins. Short-term closures of one lane of traffic would be necessary to upgrade the driveway. The duration of time for the closures is expected to last no more than two days. In addition there would be a temporary increase in the amount of traffic during construction. The disruption of traffic will be temporary and minor.

3.13.2.1 Potential Impacts and Mitigation

There may be temporary and minor disruptions to traffic during construction related to the proposed action. One lane of traffic adjacent to the proposed project driveway would be closed for up to two days. A Street Usage Permit will be obtained from DTS. Driveway work will be limited to two days to minimize the disruption of traffic. After construction is completed, no long-term impacts on transportation are anticipated. The impact will be mitigated by strictly limiting the time of lane closure to two days. In order to minimize traffic disruption from the movement of construction materials and equipment, this work will be done during off-peak traffic hours (8:30 AM to 3:30 PM). In order to mitigate potential traffic impacts on children going to or leaving Salt Lake Elementary School, the Contractor’s vehicles would not be driven or parked on Ala Lilikoi Street adjacent to Salt Lake Elementary School during drop-off and pickup times for students. Drop-off times are 7:00 a.m. to 8:00 a.m., Monday through Friday. Pickup time on Monday, Tuesday, Thursday and Friday is 1:30 pm to 2:30 pm. The pick-up time on Wednesday is 1:00 pm to 2:00 pm.

Figure 3-9. Local streets and bus route adjacent to proposed project area

3.13.3 Power and Communications

The community is served by Hawaiian Electric Company (HECO), Oceanit Time Warner and Hawaiian Telecom for electrical and communication services. Construction of the proposed debris basins will not have significant impact on these utilities.

3.13.3.1 Potential Impacts and Mitigation

No impacts would result to power and communication so no mitigation is planned.

3.13.4 Medical, Schools, Police, and Fire

Kaiser Moanalua Medical Center is the nearest hospital to the proposed project area. It is located about three miles away from the proposed debris basins. There would be no impacts on medical services or emergency medical services. In the event of a medical emergency, Kaiser Moanalua would be the nearest emergency room.

Salt Lake Elementary School is the nearest school to the project and is about 1000 feet away. The neighborhood is also served by Moanalua High School and Āliamanu Middle and Elementary Schools. Kama‘āina Kids and the St. Philomena Early Learning Center are also located in the neighborhood. Pedestrian and vehicle school traffic will be higher during morning and afternoon hours.

The nearest police station is the Kalihi Police Station on Kamehameha IV Road about four miles from the proposed project site. No impacts are anticipated on police services in the area. Police staff may be needed to assist in directing traffic during construction activities. There is also a possibility that noise or dust complaints will be directed to the police. Construction will not impact emergency police vehicle access.

The nearest fire station is the Moanalua Station (Station No. 30) located on Salt Lake Boulevard near Ala Napuani Street, about 1 mile from the proposed project site. No impacts are anticipated on firefighting services. Construction will not impact emergency fire fighting vehicle access.

3.13.4.1 Potential Impacts and Mitigation

The proposed action is expected to result in minor or no cumulative impacts or short-term adverse impacts to medical, school, police or fire service. In order to mitigate potential traffic impacts on children going to or leaving Salt Lake Elementary School, the Contractor’s vehicles would not be driven or parked on Ala Lilikoi Street adjacent to Salt Lake Elementary School during drop-off and pickup times for students. Drop-off times are 7:00 a.m. to 8:00 a.m. Monday through Friday. Pickup time on Monday, Tuesday, Thursday and Friday is 1:30 pm to 2:30 pm. The pick-up time on Wednesday is 1:00 pm to 2:00 pm.

4 COMPATIBILITY OF THE PROPOSED ACTION WITH STATE & LOCAL USE PLANS & POLICIES

4.1 HAWAIʻI STATE PLANS AND FUNCTIONAL PLANS

4.1.1 Hawaiʻi 2050 Sustainability Plan

The Hawaiʻi 2050 Sustainability Plan, January 2008 (Hawaiʻi State Plan), serves as a guide for the future long-range development of the State. The State Plan promotes the growth and diversification of the State's economy, the protection of the physical environment, the provision of public facilities, and the promotion of and assistance to socio-cultural advancement.

Goal Three of the plan addresses the environment and natural resources. One of the strategic actions under goal three is Strategic Action #4: Provide greater protection for air, and land-, fresh water- and ocean-based habitats. The proposed action is intended to reduce the input of debris and sediment in Salt Lake in order to improve water quality. The proposed action is consistent with the Hawaiʻi 2050 Sustainability Plan.

4.1.2 Hawaiʻi Watershed Guidance

The Hawaiʻi Coastal Zone Management (CZM) Program and Hawaiʻi Department of Health developed the Watershed Guidance (State of Hawaiʻi, 2010) to help people managing watersheds develop and implement management plans that have the greatest potential for achieving water quality goals. Section 5.0 of the Watershed Guidance proposes management measures to help reduce nonpoint source pollution. Management measures are defined as, "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives." Page 122 of the guidance includes measures for existing developments. These measures include:

1. Develop and implement watershed management programs to reduce runoff pollutant concentrations and volumes from existing development:
2. Identify priority local and/or regional watershed pollutant reduction opportunities, e.g., improvements to existing urban runoff control structures;
3. Contain a schedule for implementing appropriate controls;
4. Limit destruction of natural conveyance systems; and
5. Where appropriate, preserve, enhance, or establish buffers along surface waterbodies and their tributaries.

The purpose of this project is to reduce the amount of debris and sediment into a waterbody. This is consistent with these measures of the Hawaiʻi Watershed Guidance.

4.1.3 Hawai‘i State Land Use Controls

The State Land Use Commission (SLUC), under the authority granted in HRS Chapter 205, regulates land use through land classification into four districts: Urban, Agriculture, Conservation, and Rural. The intent of the land classification is to accommodate growth and development while retaining the natural and agricultural resources of the State. Each district has specific land use objectives and development constraints. The proposed action is located within the Urban District (Figure 1-8). The Urban District generally includes lands characterized by “city-like” concentrations of people, structures and services. This District also includes vacant areas for future development. Jurisdiction of this district lies primarily with the respective counties. Generally, lot sizes and uses permitted in the district area are established by the respective county through ordinances or rules. The proposed action is consistent with uses of the Urban District. The proposed action would not change any existing land uses.

4.1.4 Coastal Zone Management Program §205A-2

The Coastal Zone Management (CZM) Area is defined as, “all lands of the State and the area extending seaward from the shoreline to the limit of the State’s police power and management authority, including the territorial sea”. This project may fall under the jurisdiction of the Coastal Zone Management Program. The CZM program covers the following areas; recreational resources, historic resources, scenic and open space resources, coastal ecosystems, economic uses, coastal hazards, managing development, public participation, beach protection and marine resources. The objectives and policies for these areas and the project’s impacts on these areas are described below.

4.1.4.1 Recreational Resources

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

(A) Improve coordination and funding of coastal recreational planning and management

(B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

- (i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas.
- (ii) Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources would be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable.
- (iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value.
- (iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation.

(v) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources.

(vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters.

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing.

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.

The proposed project is located on a dry waterway that discharges into Salt Lake and is approximately two miles inland (mauka) of the coastline. The proposed project would not provide any new coastal recreation opportunities. It also would not affect any currently existing coastal recreational opportunities. The intent of the proposed action is to reduce the debris and sediment load discharging into Salt Lake. Salt Lake discharges into Moanalua Stream which flows into Mamala Bay via Ke'ehi Lagoon. Mamala Bay and Ke'ehi Lagoon are Class A waters. The proposed action would result in a subsequent reduction of debris and sediment reaching Moanalua Stream and Ke'ehi Lagoon.

Potential water quality impacts to coastal waters during construction of the project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the HDOH will likely be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and check dams, and minimizing time of exposure between construction and re-vegetation.

4.1.4.2 Historic Resources

Objective: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:
(A) Identify and analyze significant archaeological resources;

An Archaeological Evaluation (AE) has been conducted to identify and analyze archaeological resources. The scope of work was:

- Historical and previous archaeological background research including previous archaeological reports, Land Commission Awards, and historic maps in order to determine if archaeological sites have been recorded on or near this property, and to document the history of land use in and around the project area.

- Field inspection of the project area to identify surface archaeological sites or features and to investigate and assess the potential for impact to such sites or features.

No significant archaeological resources were identified.

(B) Maximize information retention through preservation of remains and artifacts or salvage operations

If historic resources, including human skeletal remains, cultural layers, cultural deposits, features, artifacts, sinkholes, lava tubes or lava blisters/bubbles are identified during construction, all work would be stopped in the immediate vicinity of the find, the site would be protected from additional disturbance and the State Historic Preservation Division would be contacted. This directive would also be included in applicable project permits.

(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

If significant archaeological or historic resources are discovered, they would be treated in a manner that complies with state goals.

4.1.4.3 Scenic and Open Space Resources

Objective: Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

(A) Identify valued scenic resources in the coastal zone management area;

(B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

(C) Preserve, maintains, and, where desirable, improve and restore shoreline open space and scenic resources.

(D) Encourage those developments that are not coastal dependent to locate in inland areas.

The proposed project is located approximately two miles inland (mauka) of the coastline and, therefore, would not affect coastal scenic resources. It is anticipated that the proposed debris basins would result in minimal and/or negligible long-term impacts on the panoramic view planes and open space resources. The basins would not be visible from a distance because they would be constructed below grade. In addition the proposed project area would be re-vegetated in an effort to minimize their impact on the visual plane in the immediate vicinity.

4.1.4.4 Coastal Ecosystems

Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

(B) Improve the technical basis for natural resource management;

(C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

(D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

The intent of the proposed project is to reduce sediment and debris load discharging into Salt Lake. Salt Lake discharges into Moanalua Stream which flows into Mamala Bay via Ke'ehi Lagoon. It is expected that the decrease in sediment and debris will have a beneficial impact on coastal ecosystems.

Potential water quality impacts to coastal waters during construction of the project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A NPDES General Permit for Storm Water Associated with Construction Activity administered by the HDOH will likely be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as silt fences and check dams, and minimizing time of exposure between construction and re-vegetation.

4.1.4.5 Economic Uses

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

(A) Concentrate coastal dependent development in appropriate areas;

(B) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area;

(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

(i) Use of presently designated locations is not feasible;

(ii) Adverse environmental effects are minimized; and

(iii) The development is important to the State's economy.

The proposed project is not located along the coast. The Economic use objective and policies listed above would not be adversely affected by project improvements.

4.1.4.6 Coastal Hazards

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.

Policies:

(A) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;

(B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;

(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

(D) Prevent coastal flooding from inland projects.

The proposed project is not located along the coast and is not expected to have any adverse effects on coastal hazards.

4.1.4.7 Managing Development

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

(A) Use, implements, and enforces existing law effectively to the maximum extent possible in managing present and future coastal zone development;

(B) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements

(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

The proposed project area is not located along the coast and would not have any effect on this policy. Every effort will be made to facilitate timely processing of permits. The EA process includes a public meeting which would disclose any potential impacts as a result of the proposed action.

4.1.4.8 Public Participation

Objective: Stimulate public awareness, education, and participation in coastal management.

Policies:

(A) Promote public involvement in coastal zone management processes;

(B) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and

(C) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

The environmental assessment and permits would be available for public review. Comments would be encouraged and addressed. The contractor would coordinate with the community and stakeholders before and during construction.

4.1.4.9 Beach Protection

Objective: Protect beaches for public use and recreation.

Policies:

(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;

(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

The proposed project is not located near or on a beach and would have no effect on beaches.

4.1.4.10 Marine Resources

Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

(B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;

(C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

(D) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

(E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

The proposed action is not anticipated to result in long-term adverse impacts on marine and coastal resources.

4.2 CITY AND COUNTY OF HONOLULU

4.2.1 General Plan

The General Plan for the City is a written commitment by the City government to a future for the Island of O‘ahu which it considers desirable and attainable. The Plan is a statement of the long-range social, economic, environmental, and design objectives for the general welfare and prosperity of the people of O‘ahu. These objectives contain both statements of desirable conditions to be sought over the long run and statements of desirable conditions which can be achieved within an approximate 20-year time horizon. In addition, the General Plan is a statement of broad policies which facilitate the attainment of the objectives of the Plan.

The General Plan is a guide for all levels of government, private enterprise, neighborhood and citizen groups, organizations, and individual citizens in eleven areas of concern:

1. population;
2. economic activity;
3. the natural environment;
4. housing,
5. transportation and utilities;
6. energy;
7. physical development and urban design;
8. public safety;
9. health and education;
10. culture and recreation; and
11. government operations and fiscal management.

Chapter 3 of the plan addresses the Natural Environment. Objective A of this chapter is to protect and preserve the natural environment. There are eleven policies to guide in protecting the natural environment. Policy 6 is: Design surface drainage and flood-control systems in a manner which will help preserve their natural settings. The proposed action is intended to preserve the natural setting. It will be soil lined and vegetated and will also help reduce the inflow of pollutants into the Salt Lake waterways. The proposed action is consistent with the Honolulu General Plan.

4.2.2 Primary Urban Center Development Plan

Section 4.6 of the Primary Urban Center Development Plan addresses stormwater systems. There are three policies outlined concerning stormwater.

- Require methods of retaining or detaining stormwater for gradual release into the ground as the preferred strategy for the management of stormwater. Where feasible, utilize open spaces including parking lots, landscaped areas, parks, and golf courses to detain or infiltrate stormwater flows to reduce their volume and runoff rates. (City Council Resolution No. 94-296).
- Manage stormwater flows through best management practices to minimize stormwater runoff and peak discharge rates.
- Preserve stream and estuarine habitats.

The proposed action is consistent with these policies. The intention of the proposed action is to detain stormwater and to retain debris and sediment, thereby increasing infiltration and decreasing debris and sediment discharge into surface waters.

5 FINDINGS SUPPORTING ANTICIPATED DETERMINATION

5.1 ANTICIPATED DETERMINATION

After reviewing the significance criteria outlined in Chapter 343, Hawai‘i Revised Statutes (HRS), and Section 11-200-12, State Administrative Rules, Contents of Environmental Assessment, the proposed action has been determined to not result in significant adverse effects on the natural and human environment. In accordance with HRS Chapter 343 and the Hawai‘i Administrative Rules (HAR) Sections 11-200-9 and 11-200-11.2, DFM anticipates rendering a Finding of No Significant Impact (FONSI).

5.2 REASONS SUPPORTING THE ANTICIPATED DETERMINATION

The potential impacts of the proposed action have been fully examined and discussed in this Draft Environmental Assessment. As aforementioned, there are no significant environmental impacts expected to result from the proposed action. The determination is based upon the assessments below for criteria 1 through 13.

1. *Involves an irrevocable commitment to loss or destruction of any natural and cultural resource*.

   The archaeological and cultural landscapes have been documented in studies conducted specifically for the proposed project site. An archaeological evaluation was prepared and no historic properties were identified during the field inspection and no further archaeological work is recommended. The proposed action under this project would not result in irrevocable commitment to loss or destruction of a cultural resource.

   There is also not an irrevocable commitment to loss or destruction of a natural resource.

2. *Curtails the beneficial uses of the environment.*

   The proposed action entails reducing the amount of debris and sediment in Salt Lake. It will not curtail beneficial uses of the environment. The proposed project is meant to enhance the water quality of Salt Lake.

3. *Conflicts with the State’s long-term environmental policies or goals and guidelines expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders*.

   The proposed project would not conflict with the State’s long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS. Evaluation of the construction activity described in this EA shows that the proposed project would not have long-term adverse impacts. Short-term adverse impacts would occur during construction from noise, dust, erosion and increased traffic. However, these minor impacts would be mitigated by the use of required best management practices.

4. *Substantially affects the economic or social welfare of the community or State*

   The proposed project would have a short-term positive effect on the economy from the creation of new jobs and increased revenue during construction. After project completion, the improvements would not directly affect the economy. Additionally, the proposed project would affect the social welfare of the community and the State by lessening the pollutant input into Salt Lake from the upland areas and would help enhance a natural aesthetic feature.

5. *Substantially affects public health*

   The proposed project would not substantially affect public health. It is possible that there will be beneficial effects from the higher water quality and decreased odor. Chain link fence will be located between Likini Street and the debris basins to restrict access to the basins. Additionally chain link fence will be located at the top of concrete walls that are part of the debris basins structures for the health and safety of the public.

6. *Involves substantial secondary impacts.*

   The proposed action is not anticipated to result in any substantial secondary impacts. The proposed action is the construction of two debris basins to intercept debris and sediment entering the City's stormwater system. Potential secondary impacts related to this small construction project could include the environmental impact related to changes in land use, population, and related effects on environmental quality. This project would have no or negligible secondary impacts of this nature.

7. *Involves a substantial degradation of environmental quality.*

   The debris basins proposed for this project would not degrade environmental quality. These improvements would improve the environmental quality of Salt Lake and could potentially improve the environmental quality of Moanalua Stream and Ke'ehi Lagoon.

8. *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.*

   The proposed project does not involve a commitment to larger actions and would not have a considerable adverse effect on the environment. If the debris basins are constructed, periodic cleaning and maintenance would be required, likely on an annual basis.

9. *Substantially affects a rare, threatened or endangered species, or its habitat.*

There were no species currently listed or proposed for listing under the Federal or State governments observed during the course of the biological resources survey. In addition, habitat for rare, threatened or endangered species will not be affected.

10. Detrimentally affects air and water quality or ambient noise levels.

Short-term minor impacts on air quality and noise levels would occur during construction. However, when the construction is completed, no long-term adverse effects on air quality and noise level are expected.

General temporary impacts associated with construction have been identified in this DEA. Mitigation measures outlined in this DEA would be applied during the on-going construction activity. BMPs would be adhered to during construction to minimize environmental pollution and damage. No detrimental long-term adverse impacts to air, water, or acoustic quality are anticipated with the proposed action.

Positive long-term impacts to the water quality at Salt Lake are anticipated as a result of this proposed action. In the long-term, air quality could improve due to possible odor reduction.

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

The proposed action is not located in an environmentally sensitive area.

12. Substantially affects scenic vistas and view-planes identified in county or state plans or studies.

The proposed action would result in minimal or negligible long-term, impact on panoramic view planes identified in county or state plans. The basins would not be visible from a distance because they would be constructed below grade. In addition the proposed project area would be re-vegetated in an effort to minimize their impact on the visual plane in the immediate vicinity.

13. Requires substantial energy consumption.

The proposed action would not require substantial energy consumption.

6 AGENCIES AND PUBLIC CONSULTATION

Prior to preparing the DEA, pre-consultation was conducted with Federal, State and City agencies, legislators and community organizations to obtain their initial comments and concerns associated with the proposed action. Table 6-1 shows the organizations contacted. The response letters are attached in Appendix A.

Table 6-1. Agencies and others consulted during pre-consultation

Agency	Response (Yes or No)
State Agencies	
Department of Agriculture	No
Department of Accounting and General Services	Yes
Department of Business, Economic Development, and Tourism	No
State Department of Education	No
State Department of Hawaiian Home Lands	Yes
Department of Health	Yes
Dept. of Land and Natural Resources	No
Dept. of Land and Natural Resources, State Historic Preservation Division	Yes
Dept. of Transportation	No
Office of Hawaiian Affairs	Yes
University of Hawai‘i Environmental Center	No
City and County of Honolulu	
Department of Community Services	No
Department of Design and Construction	Yes
Department of Transportation Services	Yes
Department of Planning and Permitting	Yes
Department of Facility Maintenance	No
Department of Parks and Recreation	Yes
Honolulu Fire Department	Yes
Honolulu Police Department	Yes
Chairperson Larry Baird, Āliamanu/Salt Lake/Foster Village N.B. No. 18	No
Federal Agencies	
USACE - Honolulu District, Regulatory Office	Yes
U.S. Department of the Interior, U.S. Fish and Wildlife Service	No
USDA-Natural Resources Conservation Service	No
U.S. EPA-Pacific Islands Office	No
Legislators	
Senator Glen Wakai	Yes
Representative Linda Ichiyama	Yes
Council Member Joey Manahan	No

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Appendix A. Comments from Initial Consultation

Sample Consultation Letter for Environmental Assessment

DEPARTMENT OF FACILITY MAINTENANCE

CITY AND COUNTY OF HONOLULU

1000 Ulu`ohia Street, Suite 215, Kapolei, Hawaii 96707
Phone: (808) 768-3343 • Fax: (808) 768-3381
Website: www.honolulu.gov

KIRK CALDWELL
MAYOR

ROSS S. SASAMURA, P.E.
DIRECTOR AND CHIEF ENGINEER

EDUARDO P. MANGLALLAN
DEPUTY DIRECTOR

IN REPLY REFER TO:
15-201

August 31, 2015

Chief Michelle R. Lynch
USACE- Honolulu District
Building 230
Fort Shafter, Hawaii 96858

Dear Ms. Lynch:

Subject: Consultation Letter for Environmental Assessment
Salt Lake Debris Basins Project
Salt Lake, Oahu, Hawaii
TMK: (1) 1-1-063:018

The City and County of Honolulu, Department of Facility Maintenance (DFM) is proposing the construction of two (2) debris basins within the drainage area upslope of Salt Lake Elementary School on the Island of Oahu, Hawaii. Oceanit Laboratories, Inc. has been contracted to prepare a Hawaii Environmental Policy Act (HEPA) Environmental Assessment (EA) in accordance with Chapter 343 Hawaii Revised Statutes (HRS). This document is being prepared to evaluate and document the possible environmental, social, and economic consequences associated with the project.

The objective of the project is to construct two (2) debris basins that will intercept and capture debris and course sediment originating from the outer wall of Aliamanu Crater. The debris basins will limit the amount of debris, rocks, and sediment that enter the City's concrete drainage channel and are ultimately deposited in the Salt Lake waterways. This will result in an improvement of the water quality at Salt Lake, and will decrease the frequency of required dredging of the waterways. The debris basins will help protect the storm drainage system by preventing blockages and decreasing surface wear on the concrete channel. The proposed two (2) debris basins (Basin "A" and Basin "B") would be located in the upper portion of the existing City-owned storm drainage channels along Likini Street. Photos of the project site are attached for your review (Photos 1 through 5). Each basin will be equipped with a concrete slotted weir spillway and stilling basin transitioning into their respective reach of the existing channel. The basins would be served by a new asphalt access road originating from Likini Street.

The TMK lot (1) 1-063:018 is owned by the City and County of Honolulu and is divided into two (2) different City zoning designations and two (2) different State Land Use designations. The two (2) City Zoning designations are P-1 Restricted Preservation and P-2 General Preservation. The two (2) State Land Use Commission designations are Urban District and Conservation District.

The footprint of the proposed project falls within the State Urban District and the City P-2 General Preservation Zone. Please refer to Figure 3 for clarification.

Thank you in advance for your cooperation as we move forward with this important debris basins project, which will help improve water quality within the Salt Lake area, and preserve and protect the storm drainage system. We would appreciate any comments or concerns you may have regarding the EA for this project and request that you identify any permits that you may require should this project be approved. Please submit your comments to the DFM no later than 30 days after you receive this letter.

If you have any questions, please call Mr. Randall Wakumoto, Branch Chief of the Storm Water Quality Branch, at 768-3242 or via email at rwakumoto@honolulu.gov.

Sincerely,

Ross S. Sasamura, P.E.
Director and Chief Engineer

Attachments: Salt Lake Basins Project Maps and Project Site Photos

cc. Oceanit
Attention: Jeremy Michelson, P.E., Project Manager

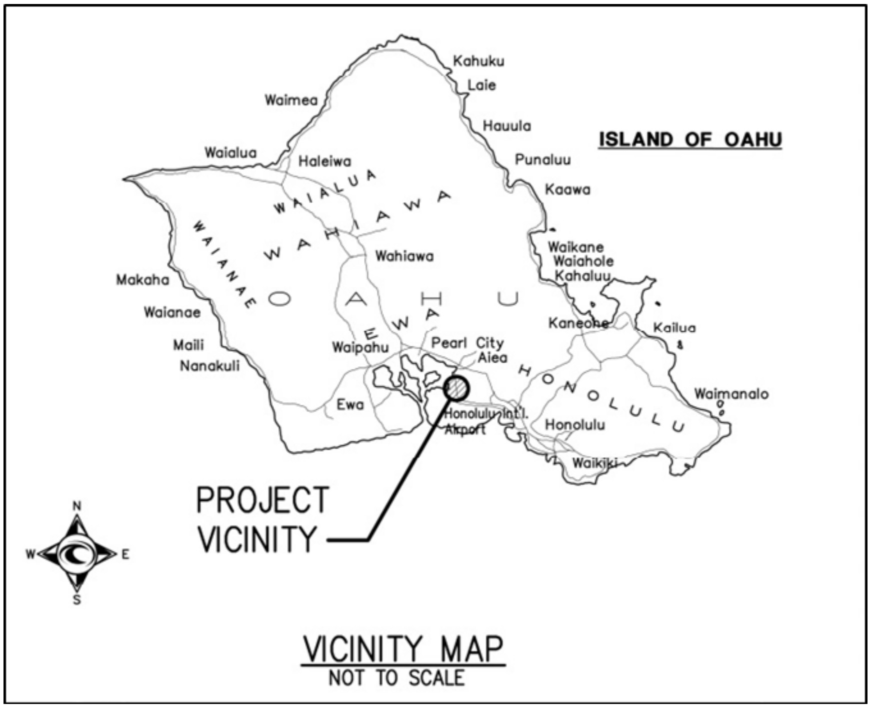

Figure 1. Vicinity Map

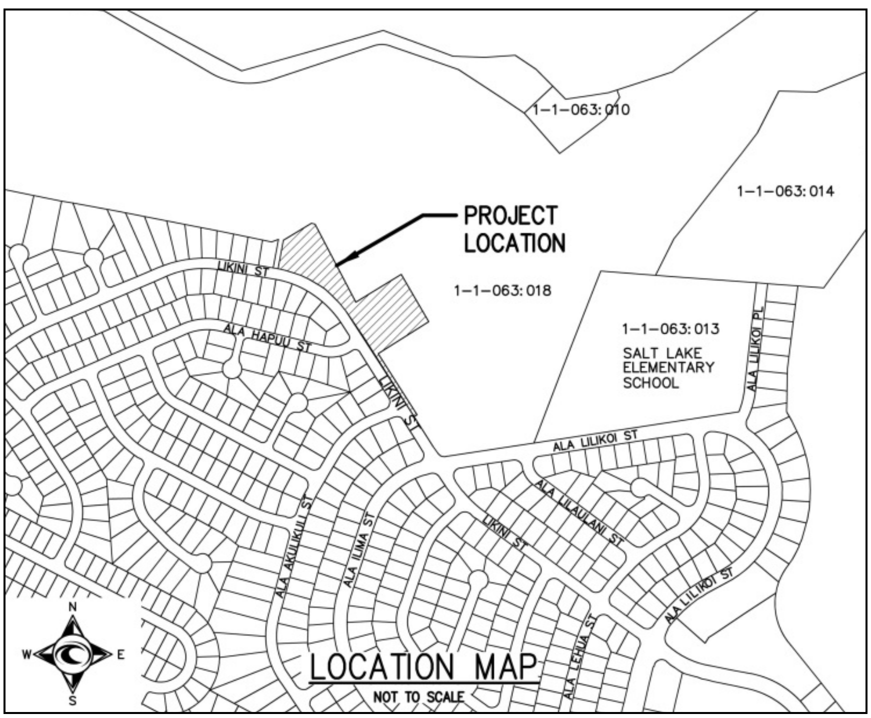

Figure 2. Location of Project

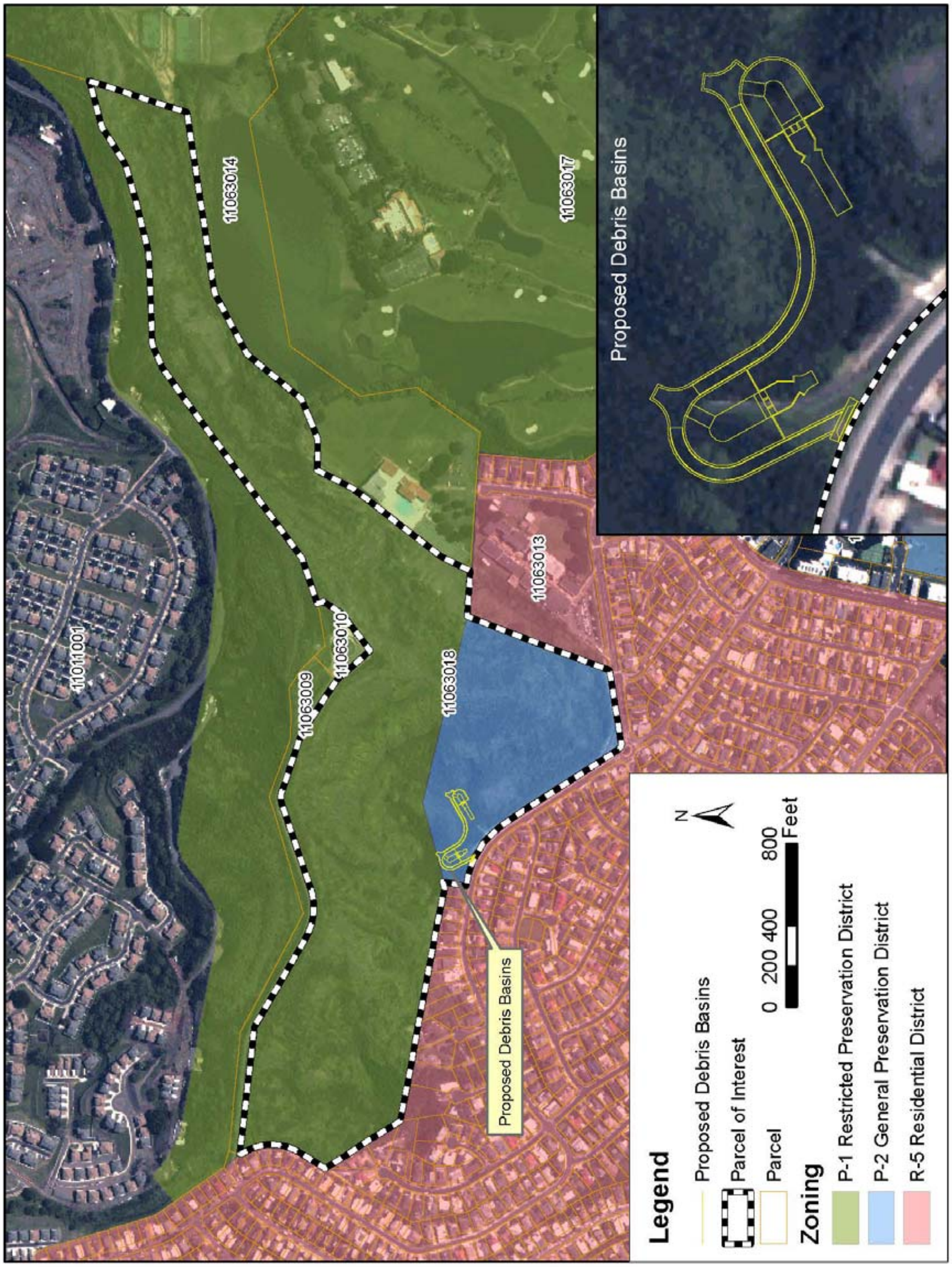

Figure 3. Zoning Map in Vicinity of Proposed Debris Basins

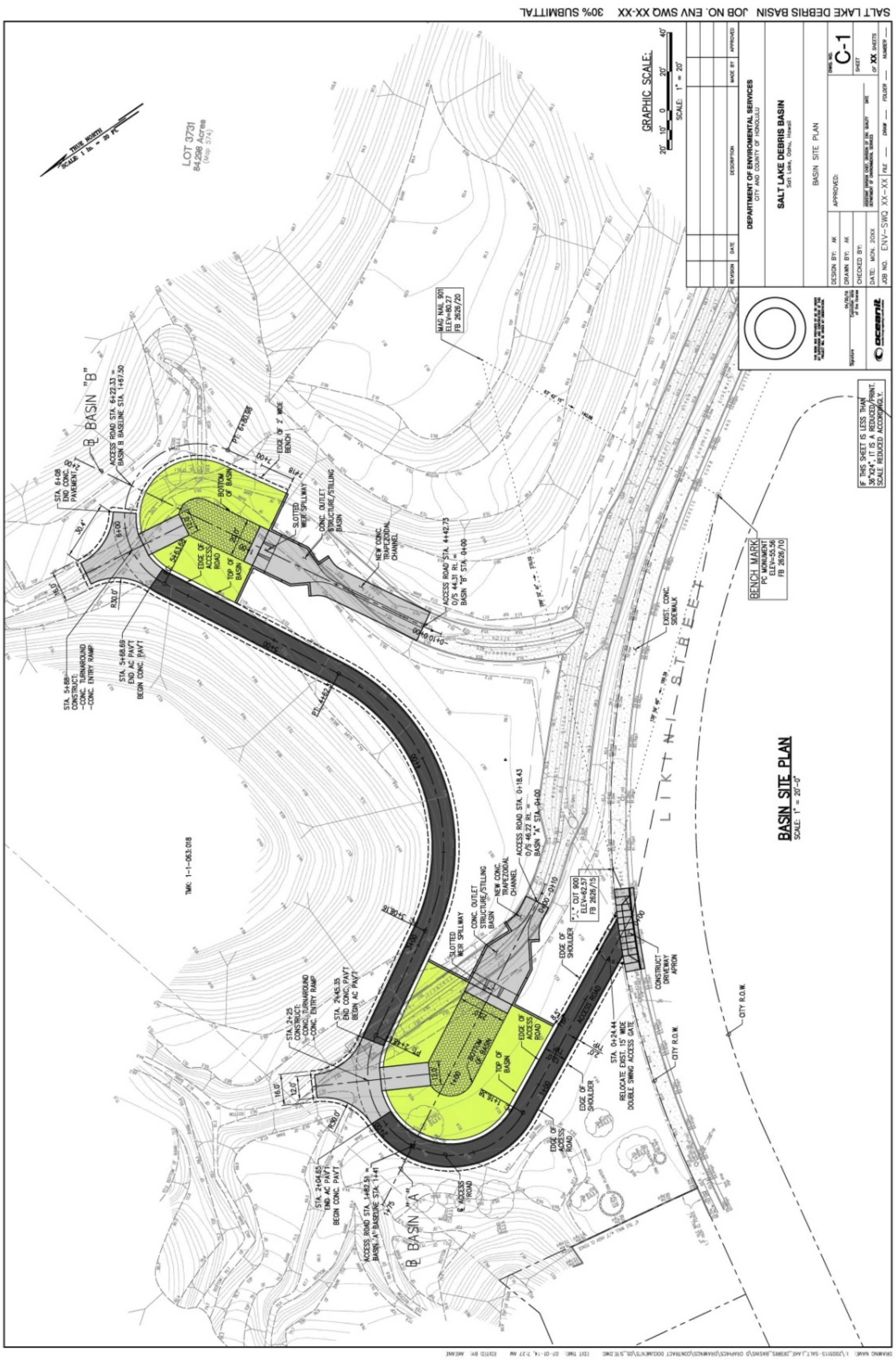

Figure 4. Salt Lake Debris Basins Conceptual Site Plan


Photo 1. Proposed location for Basin “A”, looking up-channel


Photo 2. Proposed location for Basin “A”, looking up-channel


Photo 3. Proposed location for Basin “A”, looking down-channel


Photo 4. Proposed location for Basin “B”, looking down-channel


Photo 5. Proposed location of Basin “B”, looking up-channel

Comments from Initial Consultation

626785
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SWQ

DAVID Y. IGE
GOVERNOR

DOUGLAS MURDOCK
Comptroller

AUDREY HIDANO
Deputy Comptroller

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

SEP 25 2015

(P)1244.5

RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE
2015 SEP 30 P 2:28

Mr. Ross S. Sasamura, Director
Department of Facility Maintenance
City and County of Honolulu
1000 Ulu`ohia Street, Suite 215
Kapolei, Hawaii 96707

Dear Mr. Sasamura:

Subject: Consultation for Environmental Assessment
Salt Lake Debris Basins Project
Salt Lake, Oahu, Hawaii
TMK: (1) 1-1-063:018

This is in response to your letter dated September 4, 2015 regarding the subject project. The proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

If there are any questions, your staff may call Mr. David DePonte of the Public Works Division at 586-0492.

Sincerely,

FOR DOUGLAS MURDOCK
Comptroller

627082
DIR
DRM

OFFICE OF PLANNING
STATE OF HAWAII

DAVID Y. IGE
GOVERNOR

LEO R. ASUNCION
ACTING DIRECTOR
OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: http://planning.hawaii.gov/

RECEIVED
ROAD DIVISION
2015 OCT 6 PM

Ref. No. P-14916

September 30, 2015

2015 OCT -2 P 4:27
RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE

Mr. Ross Sasamura, P.E.
Director and Chief Engineer
Department of Facility Maintenance
City and County of Honolulu
1000 Ulu`ohia Street, Suite 215
Kapolei, Hawaii 96707

Dear Mr. Sasamura:

Subject: Pre-Assessment Consultation for an Environmental Assessment Regarding the Salt Lake Debris Basin Project; TMK: (1) 1-1-063:018

Thank you for the opportunity to provide comments on the pre-assessment consultation request for the Salt Lake Debris Basin project. The pre-consultation review material was transmitted to our office by letter dated September 4, 2015.

It is our understanding that this project calls for the construction of two debris basins that will intercept and capture debris and course sediment originating from the outer wall of Aliamanu Crater. The debris basins will limit the amount of debris, rocks, and sediment that enter the City's concrete drainage channel. The runoff is ultimately deposited in the Salt Lake waterways. The debris basin will help protect the storm drainage system by preventing blockages and decreasing surface wear on the channel.

The debris basins (Basins A and B) will be located in the upper portion of the existing storm drainage channels along Likini Street. Each basin will be equipped with a concrete slotted weir spillway and stilling basin transitioning into their respective reach of the channel. A new asphalt access road will be built as well connecting it to Likini Street to the debris basin.

The Office of Planning (OP) has reviewed the transmitted material and has the following comments to offer:

1. Pursuant to the HAR § 11-200-17(h) – land use plans, policies, and controls – this project must demonstrate that it is consistent with a number of state environmental, social, and economic goals and policies for land-use and housing development. OP provides technical assistance to state and county agencies in administering the statewide planning system in Hawaii Revised Statutes (HRS) Chapter 226, the Hawaii State Plan. The Hawaii State Plan provides goals, objectives, policies, and priority

guidelines for growth, development, and the allocation of resources throughout the State. The Hawaii State Plan includes diverse objectives and policies of state interest including but not limited to the economy, agriculture, the visitor industry, federal expenditure, the physical environment, facility systems, socio-cultural advancement, climate change adaptation, and sustainability.

The Draft Environmental Assessment (Draft EA) should include an analysis that addresses whether the proposed project conforms or is in conflict with the goals, objectives, policies, and priority guidelines listed in the Hawaii State Plan.

2. The coastal zone management area is defined as "all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the U.S. territorial sea" see HRS § 205A-1 (definition of "coastal zone management area").

   HRS Chapter 205A requires all State and county agencies to enforce the coastal zone management (CZM) objectives and policies. The Draft EA should include an assessment as to how the proposed project conforms to the CZM objectives and its supporting policies set forth in HRS § 205A-2. The assessment on compliance with HRS Chapter 205A is an important component for satisfying the requirements of HRS Chapter 343. These objectives and policies include recreational resources, historic resources, scenic and open space resources, coastal ecosystems, economic uses, coastal hazards, managing development, public participation, beach protection, and marine resources.

3. Based on the information available to our office, this debris basin site is outside the area designated as a Special Management Area by the City and County of Honolulu; the project is within the State Land Use Conservation and Urban Districts; within the Salt Lake watershed; and adjacent to the nearby water resources such as the Salt Lake waterway and Manaiki Stream. The stormwater channel, that this project seeks to protect, ultimately connects the project site to the nearshore waters of the south shore of Oahu.

   In order to ensure that the natural resources of the south shore of Oahu remain protected, the negative effects of stormwater runoff and a wide range of human activities should be considered and mitigated. The Draft EA should summarize the area's relation to the State Land Use District Conservation and Urban classification and nearshore marine resources; City and County of Honolulu zoning as it relates to density and erosion controls; and this project's relation to wetlands, perennial streams, tsunami evacuation zone, and flood zone. These items, as well as the near shore water quality classification, should be considered when developing mitigation measures to protect the coastal ecosystem.

OP has a number of resources available to assist in the development of projects which ensure sediment and stormwater control on land, thus protecting the nearshore environment. OP recommends consulting these guidance documents and stormwater evaluative tools when developing strategies to address polluted runoff. They offer useful techniques to keep soil and sediment in place and prevent contaminating nearshore waters, while considering the practices best suited for each project. These three evaluative tools that should be used during the design process include:

- Hawaii Watershed Guidance provides direction on site-appropriate methods to safeguard Hawaii's watersheds and implement watershed plans http://files.hawaii.gov/dbedt/op/czm/initiative/nonpoint/HI Watershed Guidance Final.pdf

- Stormwater Impact Assessments can be used to identify and evaluate information on hydrology, stressors, sensitivity of aquatic and riparian resources, and management measures to control runoff, as well as consider secondary and cumulative impacts to the area http://files.hawaii.gov/dbedt/op/czm/initiative/stomwater_imapct/final_stormwater_impact_assessments_guidance.pdf

- Low Impact Development (LID), A Practitioners Guide covers a range of structural best management practices (BMP's) for stormwater control management, roadway development, and urban layout that minimizes negative environmental impacts http://files.hawaii.gov/dbedt/op/czm/initiative/lid/lid_guide_2006.pdf

If you have any questions regarding this comment letter, please contact Josh Hekekia of our office at (808) 587-2845.

Sincerely,

Leo R. Asuncion
Acting Director

627716
DIR
SWQ

DAVID Y. IGE
GOVERNOR
STATE OF HAWAII

SHAN S. TSUTSUI
LT. GOVERNOR
STATE OF HAWAII

JOBIE M. K. MASAGATANI
CHAIRMAN
HAWAIIAN HOMES COMMISSION

WILLIAM J. AILA, JR.
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS

P. O. BOX 1879
HONOLULU, HAWAII 96805

2015 OCT -8 P 2:58

RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE

October 5, 2015

Ross S. Sasamura, Director
City and County of Honolulu
Department of Facilities Maintenance
1000 Ulu'ohia Street, Suite 215
Kapolei, Hawaii 96707

Dear Director Sasamura:

Subject: Consultation Comments for Environmental Assessment
Salt Lake Debris Basins Project
Salt Lake, O'ahu, Hawaii
TMK: (1) 1-1-063:018

The Department of Hawaiian Home Lands acknowledges receiving the request for comments on the above-cited project. After reviewing the materials submitted, due to its lack of proximity to Hawaiian Home Lands, we do not anticipate any impacts to our lands or beneficiaries from the project.

However, we highly encourage all agencies to consult with Hawaiian Homestead community associations and other (N)native Hawaiian organizations when preparing environmental assessments in order to better assess potential impacts to cultural and natural resources, access and other rights of Native Hawaiians.

Mahalo for the opportunity to provide comments. If you have any questions, please call Nancy McPherson, Planner at 620-9519 or contact via email at nancy.m.mcpherson@hawaii.gov.

Sincerely,

Kaleo L. Manuel
Acting Planning Program Manager

15 004

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
EMD/CWB

09039PJF.15

September 21, 2015

Mr. Randall Wakumoto
Branch Chief
Department of Facility Maintenance
City and County of Honolulu
1000 Uluohia Street, Suite 215
Kapolei, Hawaii 96707

RECEIVED
DEPARTMENT OF FACILITY MAINTENANCE
2015 SEP 24 P 5: 08

Dear Mr. Wakumoto:

SUBJECT: Consultation Letter for Environmental Assessment (EA) for Salt Lake Debris Basins Project Salt Lake, Island of Oahu, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated August 24, 2015, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/05/Clean-Water-Branch-Std-Comments.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You may be required to obtain National Pollutant Discharge Elimination System (NPDES) permit coverage for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55).

For NPDES general permit coverage, a Notice of Intent (NOI) form must be submitted at least 30 calendar days before the commencement of the discharge. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. To request NPDES permit coverage, you must submit the applicable form ("CWB Individual NPDES Form" or "CWB NOI Form") through the e-Permitting Portal and the hard copy certification statement with the respective filing fee ($1,000 for an individual NPDES permit or $500 for a Notice of General Permit Coverage). Please open the e-Permitting Portal website located at: https://eha-cloud.doh.hawaii.gov/epermit/. You will be asked to do a one-time registration to obtain your login and password. After you register, click on the Application Finder tool and locate the appropriate form. Follow the instructions to complete and submit the form.

3. If your project involves work in, over, or under waters of the United States, it is highly recommended that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 835-4303) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and HAR, Chapter 11-54.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

5. It is the State's position that all projects must reduce, reuse, and recycle to protect, restore, and sustain water quality and beneficial uses of State waters. Project planning should:

   a. Treat storm water as a resource to be protected by integrating it into project planning and permitting. Storm water has long been recognized as a source of irrigation that will not deplete potable water resources. What is often overlooked is that storm water recharges ground water supplies and feeds streams and estuaries; to ensure that these water cycles are not disrupted, storm water cannot be relegated as a waste product of impervious surfaces. Any project planning must recognize storm water as an asset that sustains and protects natural ecosystems and traditional beneficial uses of State waters, like community beautification, beach going, swimming, and fishing. The approaches necessary to do so, including low impact development methods or ecological bio-engineering of drainage ways must be identified in the planning stages to allow designers opportunity to include those approaches up front, prior to seeking zoning, construction, or building permits.

b. Clearly articulate the State's position on water quality and the beneficial uses of State waters. The plan should include statements regarding the implementation of methods to conserve natural resources (e.g., minimizing potable water for irrigation, gray water re-use options, energy conservation through smart design) and improve water quality.

c. Consider storm water Best Management Practice (BMP) approaches that minimize the use of potable water for irrigation through storm water storage and reuse, percolate storm water to recharge groundwater to revitalize natural hydrology, and treat storm water which is to be discharged.

d. Consider the use of green building practices, such as pervious pavement and landscaping with native vegetation, to improve water quality by reducing excessive runoff and the need for excessive fertilization, respectively.

e. Identify opportunities for retrofitting or bio-engineering existing storm water infrastructure to restore ecological function while maintaining, or even enhancing, hydraulic capacity. Particular consideration should be given to areas prone to flooding, or where the infrastructure is aged and will need to be rehabilitated.

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb/, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

Darryl Lum TA for

ALEC WONG, P.E., CHIEF
Clean Water Branch

JF:ay

150130
629763
DIR
SWQ

PHONE (808) 594-1888

FAX (808) 594-1938

STATE OF HAWAIʻI
OFFICE OF HAWAIIAN AFFAIRS
560 N. NIMITZ HWY., SUITE 200
HONOLULU, HAWAIʻI 96817

HRD15-7241B

October 19, 2015

2015 OCT 26 A 11:55
RECEIVED DEPARTMENT OF FACILITY MAINTENANCE

Ross S. Sasamura P.E.
Director and Chief Engineer
City and County of Honolulu
Department of Facility Maintenance
1000 Uluʻohia St., Suite 215
Kapolei, HI, 96813

Re: Consultation for the Preparation of an Environmental Assessment for the Salt Lake Debris Basins Project
Moanalua Ahupuaʻa, Kona Moku, Island of Oʻahu, Hawaiʻi
TMK: (1) 1-1-063:018

Aloha e Mr. Sasamura:

The Office of Hawaiian Affairs (OHA) is in receipt of your September 4, 2015 request for comments on the preparation of an Environmental Assessment (EA) for the Salt Lake Debris Basins project. Oceanit Laboratories has been contracted to prepare a Hawaiʻi Environmental Policy Act (HEPA) EA in accordance with Hawaiʻi Revised Statutes Chapter 343, for the proposed project in order to evaluate and document the possible environmental, social, and economic consequences associated with the project. The parcel, TMK: (1) 1-1-063:018, is owned by the City and County of Honolulu and is divided into two City Zoning designations, P-1 Restricted Preservation and P-2 General Preservation, and two State Land Use Commission designations, Urban District and Conservation District. The footprint of the proposed project falls within the State Urban District and the City P-2 General Preservation Zone.

The project objective is to construct two debris basins that will intercept and capture debris and course sediment originating from the outer wall of Aliamanu Crater. Each basin will be equipped with a concrete slotted weir spillway and stilling basin transitioning into their respective reach of the existing channel. A new asphalt access road will be constructed to facilitate access to the basins from Likini Street.

A search of our records indicates that a historic site exists within TMK: (1) 1-1-063:018. The site was designated as State Inventory of Historic Properties (SIHP) 50-80-13-03992, a multi-use cave shelter, and was identified in 1993. The site is located at some distance from the proposed project and can likely be avoided during construction.

As the parcel is known to contain at least one historic property, we recommend that an Archaeological Inventory Survey (AIS) that meets the standards of Hawai'i Administrative Rules (HAR) §13-276 be completed and accepted by the State Historic Preservation Division (SHPD) prior to the project's commencement. We request to review the Draft EA upon its completion and may provide additional comments and recommendations at that time.

Thank you for initiating consultation on this important project. We look forward to receiving the Draft EA regarding the proposed project. Please note we have provided a more specific address below, to which you can address the Draft EA. Should you have any questions please contact Lauren Morawski, Compliance Archaeologist in our Kia'i Kānāwai division, at (808) 594-1997 or laurenm@oha.org.

'O wau iho nō me ka 'oia 'i 'o,

Kamana'opono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer

KC:lm

CC: Susan Lebo SHPD Branch Chief Archaeology (*via email*)

**Please address replies and similar, future correspondence to our agency:*
Dr. Kamana'opono Crabbe
Attn: OHA Compliance Enforcement
560 N. Nimitz Hwy., Ste. 200
Honolulu, Hawai'i 96817

624823
R012
SWQ

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

KIRK CALDWELL
MAYOR

ROBERT J. KRONING, P.E.
DIRECTOR

MARK YONAMINE, P.E.
DEPUTY DIRECTOR

September 14, 2015

RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE
2015 SEP 16 P 12:22

MEMORANDUM

TO: Ross S. Sasamura, P.E., Director
Department of Facility Maintenance

FROM: Robert J. Kroning, P.E.
Director

SUBJECT: Consultation Letter for Environmental Assessment
Salt Lake Debris Basins Project
Salt Lake, Oahu, Hawaii
TMK: (1) 1-1-063:018

The Department of Design and Construction does not have comments to offer on the consultation letter.

Thank you for the opportunity to review and comment. Should there be any questions, please contact me at 768-8480.

RJK: cf (621982)

RECEIVED
ROAD DIVISION
2015 SEP 21 AM 11:48

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8305 • Fax: (808) 768-4730 • Internet: www.honolulu.gov

U255'99
R-Director
- SWQ

KIRK CALDWELL
MAYOR

MICHAEL D. FORMBY
DIRECTOR

MARK N. GARRITY, AICP
DEPUTY DIRECTOR

TP8/15-622304R

September 23, 2015

RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE
2015 SEP 22 P 12:35

MEMORANDUM

TO: Ross S. Sasamura, P.E., Director
Department of Facility Maintenance

FROM: Michael D. Formby, Director
Department of Transportation Services

SUBJECT: Consultation Letter for Environmental Assessment, Salt Lake Debris Basins Project, Salt Lake, Oahu, Hawaii, Tax Map Key: (1) 1-1-063:018

This responds to your memo dated August 24, 2015, requesting our review and comments for the subject inquiry.

The Department of Transportation Services (DTS) has the following comments:

1. The Aliamanu/Salt Lake/Foster Village Neighborhood Board No. 18, as well as the area residents, businesses, nearby Salt Lake Elementary School, etc., should be kept apprised of the details of the proposed project and the impacts, particularly during construction, the project may have on the adjoining local street area network.

2. A street usage permit from the City's DTS shall be obtained for any construction-related work that may require the temporary closure of any traffic lane on a City street.

3. Any construction materials and equipment should be transferred to and from the project site during off-peak traffic hours (8:30 a.m. to 3:30 p.m.) to minimize any possible disruption to traffic on the local streets. The project is located near the Salt Lake Elementary School. Materials and

equipment movements should also be during school hours (8:00 a.m. to 2:05 p.m.), not when children are going to or leaving from the school.

We reserve further comment pending submission of the Draft Environmental Assessment.

Thank you for the opportunity to review this matter. Should you have any questions, please contact Michael Murphy of my staff at 768-8359.

U24124
150009
Director
SWQ
RW

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
PHONE: (808) 768-8000 • FAX: (808) 768-6041
DEPT. WEB SITE: www.honoluludpp.org • CITY WEB SITE: www.honolulu.gov

KIRK CALDWELL
MAYOR

GEORGE I. ATTA, FAICP
DIRECTOR

ARTHUR D. CHALLACOMBE
DEPUTY DIRECTOR

September 8, 2015

2015/ELOG-1756 (df)

RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE
2015 SEP 10 P 3:11

MEMORANDUM

TO: Ross S. Sasamura, P.E., Director and Chief Engineer
Department of Facility Maintenance

FROM: George I. Atta, FAICP, Director
Department of Planning and Permitting

SUBJECT: Salt Lake Debris Basins Project, TMK: 1-1-063: 018

This is in response to your August 24, 2015 memorandum (15-202), requesting comments to the Draft Environmental Assessment (DEA) for the subject project.

1. In addition to the required minimum content as prescribed in Section 11-200-10, Hawaii Administrative Rules, the DEA should discuss the project's consistency with the Oahu General Plan and the Primary Urban Center Development Plan.

2. The project may require grading and building permits.

Should you have any questions, please contact Don Fujii of the Site Development Division at extension 88107.

cc: Planning Division

623663
DIRR
~~DRM~~
SWQ

DEPARTMENT OF PARKS & RECREATION

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 309, Kapolei, Hawaii 96707
Phone: (808) 768-3003 • Fax: (808) 768-3053
Website: www.honolulu.gov

KIRK CALDWELL
MAYOR

MICHELE K. NEKOTA
DIRECTOR

JEANNE C. ISHIKAWA
DEPUTY DIRECTOR

September 1, 2015

RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE
2015 SEP -8 P 12: 26

MEMORANDUM

TO: Ross S. Sasamura, P.E., Director
Department of Facility Maintenance

FROM: Michele K. Nekota
Director

SUBJECT: Consultation Letter for Environmental Assessment
Salt Lake Debris Basins Project Salt Lake, Oahu, Hawaii
TMK: (1) 1-1-063:018

Thank you for the opportunity to review and comment on the proposed Salt Lake Debris Basin Project.

The debris basin which is proposed to be constructed on a portion of TMK: (1) 1-1-063:018 is under the jurisdiction of the Department of Parks and Recreation (DPR). Currently the large property is not used as a park and is not proposed for park improvements or recreation purposes.

Salt Lake District Park and Ala Puumalu Community Park are entirely on TMK: 1-1-063:014 that is owned by the State and under the DPR's jurisdiction pursuant to a Governors Executive Order.

The DPR respectfully requests your concurrence to transfer jurisdiction of TMK: (1) 1-1-063:018 to the Department of Facilities Maintenance.

Should you have any questions, please contact Mr. John Reid, Planner, at 768-3017.

CC: Craig Mayeda, PMRS Administrator

U25019
Director
— SWQ

HONOLULU FIRE DEPARTMENT

CITY AND COUNTY OF HONOLULU

636 South Street
Honolulu, Hawaii 96813-5007
Phone: 808-723-7139 Fax: 808-723-7111 Internet: www.honolulu.gov/hfd

KIRK CALDWELL
MAYOR

MANUEL P. NEVES
FIRE CHIEF

LIONEL CAMARA JR.
DEPUTY FIRE CHIEF

2015 SEP 17 P 12:49

RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE

September 15, 2015

TO: ROSS SASAMURA, P.E., DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF FACILITY MAINTENANCE

FROM: SOCRATES D. BRATAKOS, ASSISTANT CHIEF

SUBJECT: CONSULTATION LETTER FOR ENVIRONMENTAL ASSESSMENT
SALT LAKE DEBRIS BASINS PROJECT
SALT LAKE, OAHU, HAWAII
TAX MAP KEY: 1-1-063: 018

In response to your memorandum dated August 24, 2015, regarding the above-mentioned subject, the Honolulu Fire Department determined that there will be no significant impact to fire department services.

Should you have questions, please contact Battalion Chief Terry Seelig of our Fire Prevention Bureau at 723-7151 or tseelig@honolulu.gov.

Socrates D. Bratakos

SOCRATES D. BRATAKOS
Assistant Chief

SDB/SY:bh

622992
R-Director
-SWQ

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

KIRK CALDWELL
MAYOR

LOUIS M. KEALOHA
CHIEF

DAVE M. KAJIHIRO
MARIE A. McCAULEY
DEPUTY CHIEFS

OUR REFERENCE MT-DK

August 31, 2015

RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE
2015 SEP -1 P 3:29

MEMORANDUM

TO: Ross S. Sasamura, P.E., Director and Chief Engineer
Department of Facility Maintenance

FROM: Louis M. Kealoha, Chief of Police

SUBJECT: Consultation Letter for Environmental Assessment
Salt Lake Debris Basins Project
TMK: (1) 1-1-063:018

This is in response to your memorandum of August 24, 2015, concerning the subject above.

Based on the information provided, this project should have no significant impact on the service or operations of the Honolulu Police Department.

If there are any questions, please call Major Crizalmer Caraang of District 5 (Kalihi) at 723-8202.

Thank you for the opportunity to review this project.

Louis M. Kealoha
Chief of Police

By Mark Tsuyemura

Mark Tsuyemura
Management Analyst VI
Office of the Chief

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

October 5, 2015

SUBJECT: Response to Consultation letter for the Salt Lake Debris Basins Project Environmental Assessment, Salt Lake, Island of Oahu, Hawaii, DA File No. POH-2015-00175

Ross S. Sasamura, P.E.
City and County of Honolulu, Storm Water Branch
1000 Ulu ohia Street, Suite 215
Kapolei, HI 96707

Dear Mr. Sasamura:

The U.S. Army Corps of Engineers, Honolulu District (Corps), is in receipt of your letter dated September 4, 2015 requesting consultation regarding the Salt Lake Debris Basins Project Environmental Assessment. The proposed project is located in Salt Lake, Island of Oahu, Hawaii. Your project has been assigned Department of the Army (DA) file number # POH-2015-00175. Please reference this number in all future correspondence concerning this determination.

We have completed review of the information provided pursuant to Section 404 of the Clean Water Act (Section 404) and Section 10 of the Rivers and Harbors Act of 1899 (Section 10). Section 404 requires authorization prior to the discharge and/or placement of dredged or fill material into waters of the U.S., including adjacent wetlands. Section 10 requires authorization prior to installing structures or conducting work in, over, under, and affecting navigable waters.

Based on our review, we have preliminarily determined that the unnamed channel shown in photographs 1-5 submitted with your letter to the Corps may be a water of the U.S. under the regulatory jurisdiction of the Corps. In accordance with Section 404, a Department of the Army (DA) permit may be required for any activity resulting in the discharge and/or placement of dredged of fill material into this channel.

Thank you for your cooperation with the Honolulu District Regulatory Program. Should you have any questions related to this determination, please contact Becca Frager of my staff at 808-835-4307 or via e-mail at Rebecca.M.Frager@usace.army.mil. You are encouraged to provide comments on your experience with the Honolulu District Regulatory Office by accessing our web-based customer survey form at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Sincerely,

Michelle R. Lynch
Chief, Regulatory Office

Cc:
Randall Wakumoto

150147

HAWAII STATE LEGISLATURE
STATE OF HAWAII
STATE CAPITOL
415 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813

RECEIVED
DEPARTMENT OF
FACILITY MAINTENANCE
2015 NOV -2 A 7:55

October 26, 2015

Mr. Randall R. Wakumoto, P.E.
Branch Head, Storm Water Quality Branch
City and County of Honolulu
Department of Facility and Maintenance
1000 Uluohia Street, Suite 212
Kapolei, HI 96707

Dear Mr. Wakumoto,

This letter is in strong support of the City and County of Honolulu, Department of Facility Maintenance's proposal to construct two debris basins within the drainage area upslope of Likini Street, near the intersection of Likini and Ala Hapuu Streets.

For many years the residents of our Salt Lake community have experienced the ill effects of rotting vegetation, stagnant water, and clogged drainage along the Salt Lake waterway. The debris basins will limit the amount of debris, rocks and sediment entering the City's concrete drainage channels and ultimately deposited in the waterway. This will improve the water quality that runs through the Salt Lake waterway and will decrease the frequency of dredging the waterway. The debris basins will also help protect the storm drainage system by preventing blockages and decreasing surface wear on the concrete channel.

The condition of the Salt Lake waterway has been a contentious issue in our community with significant detrimental effects on our residents' quality of life. We wholeheartedly support the proposed debris basin project to provide much needed relief to our Salt Lake community.

Should you have questions or if we may be of assistance in any way, please do not hesitate to contact our offices.

Sincerely,

Linda Ichiyama
State Representative, District 32

Glenn Wakai
State Senator, District 15

Representative Linda Ichiyama
District 32 – Moanalua, Salt Lake & Aliamanu
State Capitol – Honolulu, Hawaii 96813
Phone: 586-6220 - Fax: 586-6221
E-Mail: repichiyama@capitol.hawaii.gov

Senator Glenn Wakai
District 15 – Kalihi Mapunapuna,Airport, Salt Lake, Aliamanu,Foster Village, Hickam & Pearl Harbor
State Capitol – Honolulu, Hawaii 96813
Phone: 586-8585 - Fax: 586-8588
E-Mail: senwakai@capitol.hawaii.gov

Appendix B. Preliminary Engineering Report

Preliminary Engineering Report
Salt Lake Debris Basins

Salt Lake, Oahu, Hawaii

Prepared for:
City and County of Honolulu
Department of Environmental Services

Prepared by:
Oceanit Laboratories, Inc.
828 Fort Street Mall, Suite 600
Honolulu, Hawaii 96813

March 2016

TABLE OF CONTENTS

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1. GENERAL DESCRIPTION

This Preliminary Engineering Report is prepared for the City & County of Honolulu, Department of Environmental Services to evaluate the implementation of structural storm drain pollution control devices within the drainage area upslope of Salt Lake Elementary School on the Island of Oahu, Hawaii. The project consists of construction of two debris basins at the upper reaches of an existing concrete drainage channel.

1.1 Project Location

The project site is located within the Salt Lake watershed in Moanalua, Oahu on the southern exterior slopes of Aliamanu Crater. The proposed site is located on an 84.3 acre parcel of land identified by Tax Map Key (TMK): 1-1-063:018 - owned by the City & County of Honolulu. The proposed debris basins are situated at the beginning of the City-owned storm drainage channels along the mauka side of Likini Street. Maps depicting the project vicinity and location are provided in Figure 1-1.

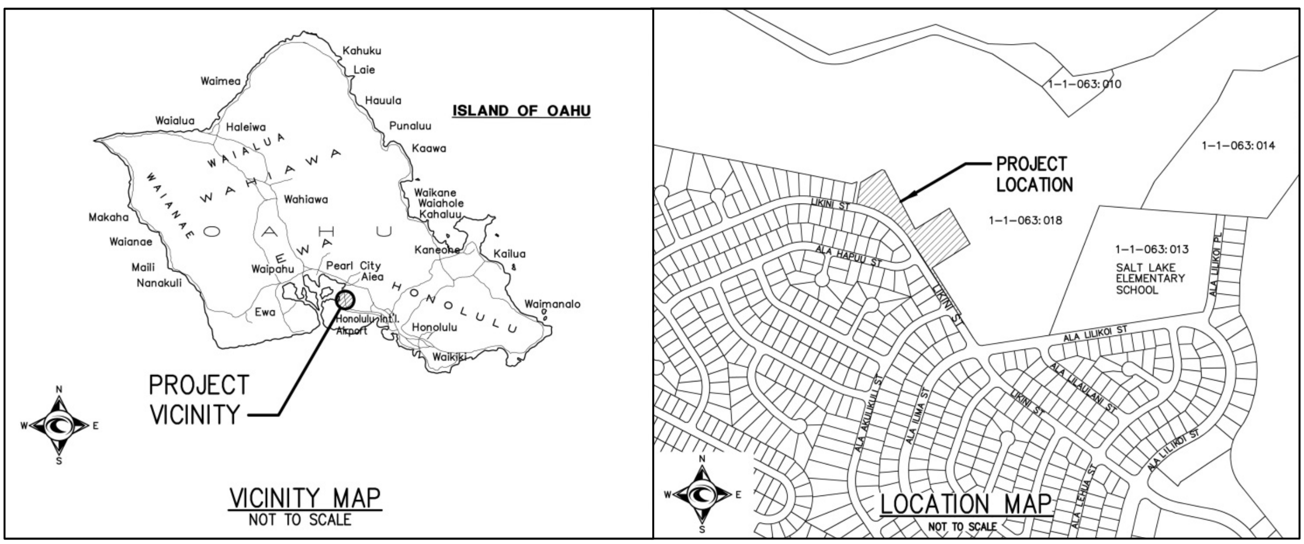


Figure 1-1. Area Maps

1.2 Project Description

The objective of this project is to design a structural storm drain pollution control device which intercepts and captures trash, debris, and sediment (mainly rocks and sand) before it flows into Salt Lake. The design must also consider accessibility of maintenance equipment during the operational life of the control devices. Each of the primary devices will consist of a storage basin with a slotted overflow spillway structure and stilling basin which transitions to the existing drainage channel. The devices are designed to have a functional life of 50 years.

2. DESCRIPTION OF EXISTING CONDITIONS

2.1 Topography

The project site is located along the foot of the southern exterior slopes of Aliamanu Crater in an undeveloped preservation district. A topographic survey of the surrounding area was performed by ParEn, Inc. which covered the upslope regions denoting the defined natural waterways, the existing trapezoidal drainage channels and the sidewalk along the southern boundary of the property. The topography of the surrounding area ranges from mild slopes of about 2 percent to steep grades exceeding 60 percent along the crater side slopes. The only graded development at the site is the existing concrete trapezoidal drainage channels leading to Salt Lake. Refer to Figure 2-1 for the topographic survey map.

2.2 Soils

The project site is situated in an area consisting of two (2) soil series which the U.S. Natural Resources Conservation Service (NRCS) categorizes as Makalapa Clay (MdC) and Rock Land (rRK). The MdC soil series typically occurs on slopes between 6 to 12 percent. This soil has a surface layer, about 8 inches thick, of clay underlain by a subsurface layer, approximately 18 to 38 inches thick, of clay to silty clay loam with a subangular blocky structure underlain by weathered volcanic tuff. The soil has slow runoff and permeability, and the erosion hazard is slight to moderate. The rRK series is made up of areas of exposed rock – primarily basalt and andesite. The soil, in the region, is typically dry and non-expansive with little clay content and rapid runoff characteristics.

A geotechnical exploration of the proposed debris basin site was conducted by Yogi Kwong Engineers (YKE). YKE conducted a total of 16 dynamic cone penetration probes, two test pits and collected soil samples for laboratory analysis. A full geotechnical investigation report is included in Appendix A.

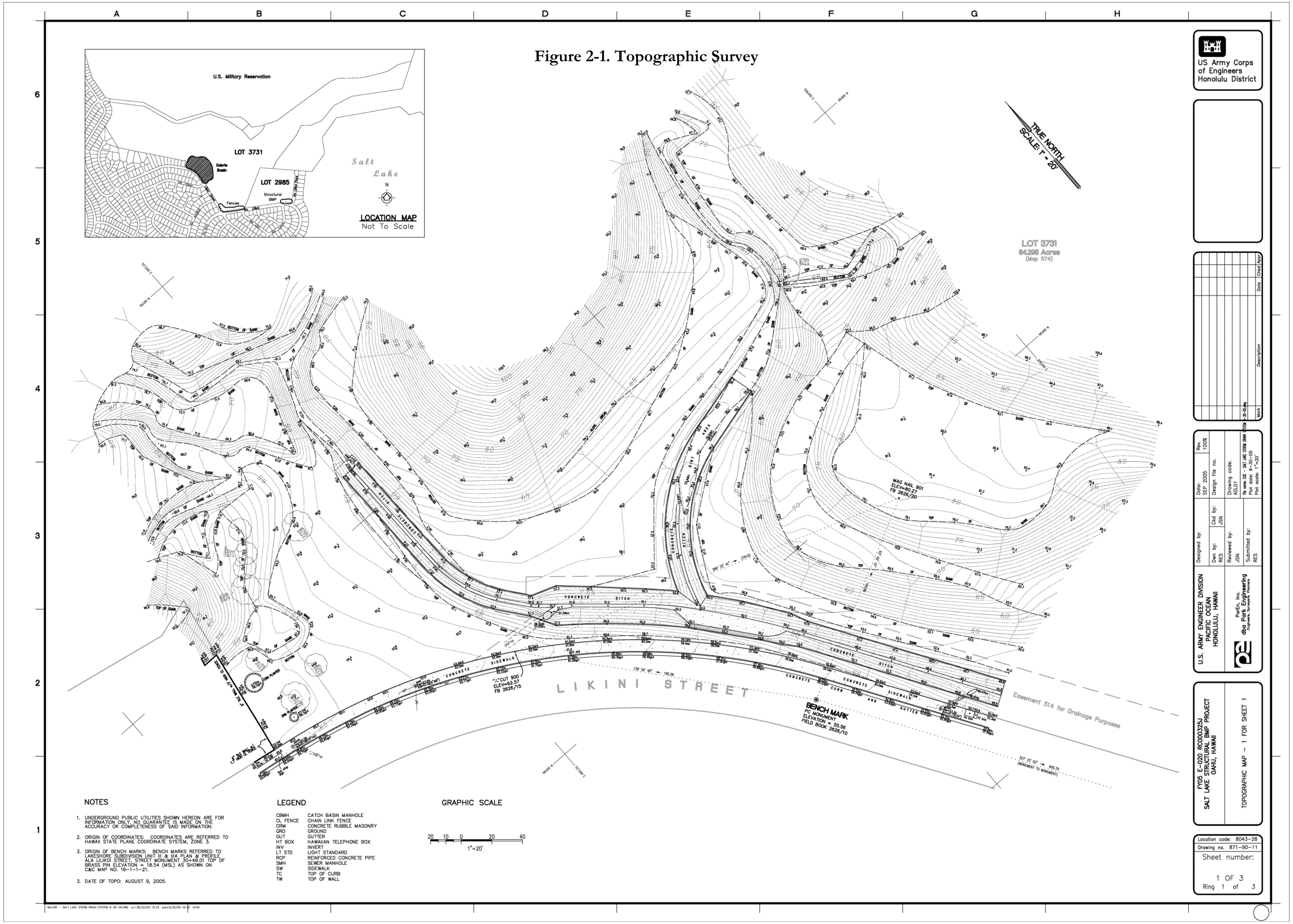
2.3 Vegetation

A Biological Resource Survey was conducted at the project site by Koehler Enterprises, LLC on August 30, 2014. According to the report, the site of the debris basins and access road is undeveloped scrub land along the outer slopes below the ridge of Aliamanu Crater. Nonnative weedy plant species dominate the proposed debris basin site. Vegetation surrounding the existing drainage channel reaches consists of Guinea grass and haole koa shrubland. Slightly upslope of this region, vegetation also includes occasional herbaceous weeds and Kiawe Trees.

2.4 Climate

The site is situated in an area which experiences a mild tropical climate. Average annual precipitation in the area of the project is 35 inches, with the largest percentage occurring during the winter months of December through March. The average median temperature is

Figure 2-1. Topographic Survey



approximately 70º Fahrenheit. The prevailing winds are trades coming in from the north east.

2.5 Existing Drainage System

The existing storm drainage system in the vicinity of project site consists of an open trapezoidal concrete drainage channel which runs parallel to Likini Street and discharges to Salt Lake near the neighboring elementary school. The drainage channel branches into two separate channels in the upper reaches to intercept storm water from natural flow paths defined from two distinct sub-watersheds. Storm drainage is conveyed to the drainage channel through overland flow as well as additional flows from a series of residential storm drain outlets.

3. DESIGN REQUIREMENTS AND PROVISIONS

3.1 Civil

3.1.1 General Parameters

The proposed project will construct two debris basins (Basin "A" & Basin "B") in the upper reaches of the existing City-owned storm drainage channel. Each basin will be equipped with a slotted spillway and stilling basin transitioning into their respective reach of the existing channel. The basins will be served by a new access road off of Likini Street.

The site of the debris basins and access road is undeveloped scrub land below the ridge of Aliamanu Crater. The proposed Project boundaries for the debris basins are shown in detail in Figure 3-1. The total site area including a proposed staging area to the left of the proposed construction site is 1.1 acres. The site is adjacent to Likini Street, which has existing curb, gutter, and sidewalk. The existing City-owned storm drainage channel is offset from the side walk by several feet and there is a 6-foot tall chain-link fence bordering the sidewalk. Access to the site will be through an existing gateway and new drop driveway to be constructed across the existing sidewalk.

3.1.2 Functional and Technical Requirements

Reference is made to the following documents that were used to provide civil design standards and criteria for the project:

- Rules Relating to Storm Drainage Standards, January 2000, Amended December 2013, Department of Planning and Permitting, City and County of Honolulu, Honolulu, Hawaii.
- Rules Relating to Soil Erosion Standards and Guidelines, April 1999, Department of Planning and Permitting, City and County of Honolulu, Honolulu, Hawaii.
- Storm Water BMP Guide, December 2012, Department of Planning and Permitting, City and County of Honolulu, Honolulu, Hawaii.
- Best Management Practices Manual for Construction Sites in Honolulu, July 2011, Department of Environmental Services, City and County of Honolulu, Honolulu, Hawaii.
- Hydraulic Design of Stilling Basins and Energy Dissipators, May 1984, US Department of the Interior, Bureau of Reclamation.

The overall function of the improvements is to reduce the amount of debris and sediment from entering the existing drainage channel, and subsequently discharging to Salt Lake.

The storm drain pollution control devices are debris basins to be installed in the upper reaches of the existing drainage channel. The basins are sized for a target water quality design volume based on associated drainage area and runoff characteristics. Calculations are provided in Appendix B. The basins are generally constructed of a grassed earth bottom and side slopes

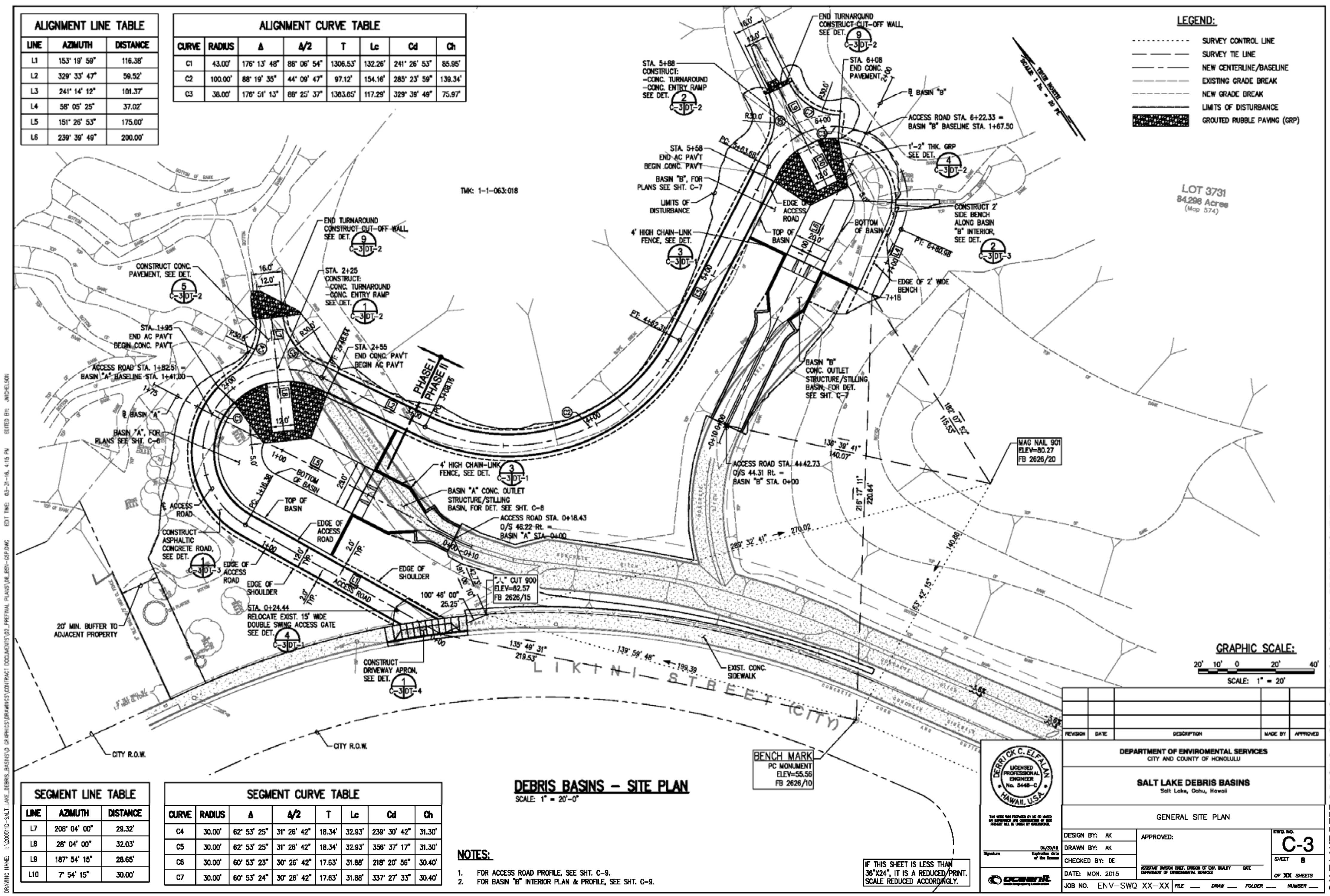


Figure 3-1. Basin Site Plan

with a reinforced concrete vehicle ramp for ease of maintenance. The side slopes of the basins will be constructed at a maximum slope of 4H:1V (horizontal:vertical) for Basin "A" and 3.5H:1V for Basin "B". The basin floors and side slopes will be earthen with a grassed cover to be established thereby increasing sediment retention. The bottom of each basin shall have a length to width ratio of 2:1 and a maximum slope of about 1% to allow for drainage and prevent ponding of water in the basin. The maximum depth of the basins, at the interface with the spillway structure, will be 6-feet.

At the terminus of each debris basin, a slotted Ogee weir spillway provides for a slowing of storm water flow through the debris basin during small to moderate storm events, while allowing relatively unimpeded passage of storm water during large storm events. The height of the spillway is set at three feet for reasons of safety. A minimum of one foot of freeboard shall be provided as required by design standards. Slots in the spillway are a minimum of one (1) foot wide at the spillway crest and angle out to 1.5 feet wide in the downstream direction for reasons of safety and to prevent wedging of debris in the slots. The slots allow water to drain from the basins so that the basins will not have standing water. Sizing calculations for the spillway lengths are provided in Appendix B, along with associated storm flow calculations for 2-, 10-, and 50-year storm events for Basin "A" and Basin "B". Directly downstream of each spillway is a hydraulic stilling basin that transitions to the respective existing drainage channel reach cross section. The length of the stilling basin is set to provide a natural hydraulic jump in the stilling basin at peak flows, without the need for energy dissipation measures such as chute blocks. Stilling basin sizing calculations are provided in Appendix B.

Sediment loading to the basin was calculated to ensure that the capacity of the basin is adequate with respect to the amount of sediment expected to be captured. The basin volumes will each accommodate over one year's worth of sediment loading. The new basins will be inspected several times per year under the City's existing maintenance program. Regular maintenance cleaning will ensure that adequate sediment capture capacity is maintained. Sediment loading calculations are provided in Appendix B.

The access road and associated appurtenance for the basins will be periodically utilized by maintenance vehicles and equipment. To accommodate this vehicle loading, the access road will be constructed of asphaltic concrete with compacted base course and subgrades. The ramps into the basins and the turnaround areas will be constructed of reinforced concrete rated for heavy equipment loading. The access road geometrics are designed to accommodate these vehicles as well. The turnaround provided and roadway curves are designed to accommodate the turning radii of heavy equipment. Roadway grades were limited to accommodate for maintenance vehicle access. Additionally, the roadways were designed to minimize the cut and fill of the grading by following the existing contours as best as possible. Grade returns from the roadway will consist be constructed at a maximum slope of 3H:1V in fill and 1.5H:1V in cut Longitudinal slopes (including access ramps into the basin) are limited to a maximum of 15%. Cross slopes of the roadway are limited to two percent to prevent vehicle tipping and promote sheet flow of stormwater runoff. To provide positive drainage up to and across roadways, depressions above the maintenance roadway are to be filled and the roadway at Basin "A" and Basin "B" will have a ford to allow water passage. In order to limit erosion of slopes immediately above the debris basin, the slopes will be seeded with grass.

3.1.3 Design Objectives and Provisions

The design objectives are to provide storm water Best Management Practices (BMPs) that will meet the functional requirements of the project in an economical manner. The debris basins are designed with the objective of removing debris items and coarse sediment (sand, gravel, and rocks) from flows that pass through the basin

The project also has the design objective of delivering the end user storm water BMPs that are easy and economical to maintain. The access road is designed to easily accommodate the maintenance vehicles and equipment anticipated to be used for debris basin cleaning.

To achieve the design objectives in an economical manner, cut and fill volumes of the debris basins and access road are minimized and balanced as best as possible. Material selection is also designed to meet the functional objectives of the project in an economical manner.

3.1.4 Civil Calculations

Civil calculations were performed to determine the physical design requirements of the debris basins. A tabulated analysis was conducted of regional hydrology, spillway flow hydraulics and estimated sediment loading which are summarized in Table 3-1. The full copy of the civil calculations is provided in Appendix B.

Table 3-1. Civil Design Calculation Summary

	Basin "A"	Basin "B"
2-year Storm Flow	45.64 ft^3/sec	28.34 ft^3/sec
10-year Storm Flow	99.30 ft^3/sec	61.66 ft^3/sec
50-year Storm Flow	147.03 ft^3/sec	91.30 ft^3/sec
Debris Basin Volume	6,488 ft^3	4,569 ft^3
Basin Spillway Width	25 ft.	20 ft.
Stilling Basin Length	15 ft.	15 ft.
1-foot Depth Sediment Capacity	1,154 ft^3	821 ft^3
Est. Maintenance Schedule	1.33 years	1.31 Years

3.2 Environmental

3.2.1 General Parameters

The project will require preparation of an environmental assessment (EA) pursuant to Chapter 343, Hawaii Revised Statutes (HRS) and Title 11, Chapter 200, Hawaii Administrative Rules (HAR), Department of Health, State of Hawaii.

BMPs will be employed as pollution prevention and control measures during construction activities at the site. These measures include, but are not limited to:

- Stabilized construction entrance
- Dust control measures
- Sediment control
- Establishment of ground cover once final grades are achieved.

The anticipated disturbed area is over one acre (1.1 acres) consequently it is anticipated that the project will require a National Pollutant Discharge Elimination System (NPDES) General Permit.

The project will also require review and approval by the City and County of Honolulu Department of Planning and Permitting to ensure compliance with drainage and erosion standards. A grading permit will also be required.

3.3 Structural

3.3.1 General Description of Work

The basin and headwall for each basin with consist of a concrete retaining wall on either side of the concrete spillway. The water which crosses the spillway then goes into a rectangular concrete channel stilling basin which then narrows and transitions to the existing trapezoidal channel cross section. The stilling basin channel is comprised of vertical concrete retaining walls along the sides and reinforced concrete slab on the bottom.

The debris basins will each have an apron near the spillway constructed as a concrete slab. A reinforced concrete turnaround and access ramp will also be constructed at the rear of each basin.

3.3.2 Foundation Design

Soil values and recommendations are from soil report by Yogi Kwong Engineers, LLC. titled "Geotechnical Report: Structural Storm Drain Pollution Control Device and Concrete Spillway Debris Basins in the Vicinity of Salt lake Elementary School" dated September, 2005. This report is included as Appendix A. Recommendations from the report regarding structure foundation design are provided on the following page:

- All retaining wall footings and concrete weir structure shall be embedded a minimum of 36 inches below the lowest adjacent grade on the competent in-situ moderately weathered tuff material or on better rock mass.
- Slabs-on-grade shall be underlain by at least 12 inches of compacted Select Borrow. The Select Borrow shall be granular, well graded material shall be compacted to at least 98% relative compaction. The material beneath the Select Borrow shall be 8" of recompacted subgrade compacted to 95% relative compaction.
- All compacted fills and compacted subgrades shall be tested and approved by the geotechnical engineer before any structural concrete work is placed on this foundation material.
- Minor cut slope made in highly to slightly weathered volcanic tuff should not exceed 1.5 horizontal to 1 vertical. Fill slopes should not be steeper than 3 horizontal to 1 vertical.
- The excavated on site cohesive soils and oversized gravel, cobbles and boulders should not be used for fill or backfill. It should be properly disposed off site. Imported Select Borrow should be used for fill instead. Select Borrow shall consist of well-graded, non-expansive granular material which is free of organics, debris and expansive soil. The material shall not have particles greater than 3 inches in maximum dimension. Select Borrow shall be non-expansive with less than 15% passing the No. 200 mesh sieve (refer to Section 30 of the Standard Specifications for Public Works Construction 1986, Department of Public Works,

City & County of Honolulu). Select Borrow shall have a CBR value of at least 25, a liquid limit of 25% or less, and a plasticity index of 10 or less. Imported material shall be inspected and tested by a qualified geotechnical laboratory prior to use in backfill at the site to determine that it meets the requirements stated above.

- Fill shall be placed in lifts not exceeding 8 inches in loose thickness and shall be compacted to 90% of relative compaction up to a depth of at least two feet below the pavement and slab subgrade. The upper two feet of fill below pavement and slab subgrade shall be compacted to at least 95% relative compaction. Relative compaction in this report is defined as the dry density of the compacted material expressed as a percentage of the maximum dry density of the same material based on ASTM D-1557 test procedures.
- Allowable Soil Bearing Pressure = 3000 psf
  - Coefficient of Base Friction = 0.60
  - Passive Equivalent Fluid Pressure = 300 psf
  - Active Equivalent Fluid Pressure (Level Backfill) = 40 psf/foot of depth
- The access road flexible and rigid pavement and the basin spillway apron slab will be able to accommodate low traffic conditions and maximum single axle load of 24,000 pounds. The following pavement sections shall be used:

  - **Rigid Pavement:** 6 inches concrete
    12 inches select borrow sub-base (98% relative compaction)
    8 inches recompacted subgrade (95% relative compaction)

  - **Flexible pavement:** 2.5 inches asphaltic concrete
    6 inches untreated base course (98% relative compaction)
    12 inches select borrow sub-base (98% relative compaction)
    8 inches recompacted subgrade (95% relative compaction)

4. OPERATION AND MAINTENANCE

4.1 Debris Basins

Access to the sedimentation debris basins will be via a driveway across the sidewalk adjacent to Likini Street near the basins site. Access will be through a locked 15-foot wide gate in the chain-link fencing. The City and County of Honolulu, Department of Facility Maintenance (DFM) will maintain control over the gate lock and provide facility signage restricting access.

DFM has an existing program to check all sedimentation basins multiple times per year. The basins should also be checked after large area storm events. When the basins are in need of servicing, the servicing will be accomplished through use of heavy equipment, including backhoes, wheel loaders, dump trucks, and/or bulldozers with blade-type attachments. The access roads, turnabouts, and ramps have been designed with consideration for this equipment.

Sediment and debris collected at the site will be hauled off-site. Typically, maintenance will be done under dry conditions, and the material collected will be taken directly to a landfill facility. If wet material is collected at the site, the material may need to be taken to a dewatering facility prior to landfilling.

Appendix A

Geotechnical Report

Final Submittal

GEOTECHNICAL REPORT

Structural Storm Drain Pollution Control Device and Concrete Spillway Debris Basins In the Vicinity of Salt Lake Elementary School

Salt Lake, Oahu, Hawaii

Prepared for:

The United States Army Corps of Engineers, Honolulu District

and:

Oceanit Laboratories, Inc.
1001 Bishop Street, ASB Tower, Suite 2970
Honolulu, Hawaii, 96813

September 2005

Prepared by:

YKE

Yogi Kwong Engineers, LLC
615 Piikoi Street, Suite 1605
Honolulu, Hawaii 96814-3141

Project No. 05022

YKE

September 14, 2005

Mr. Jay Stone, P.E.
Oceanit Laboratories, Inc
1001 Bishop Street, ASB Tower, Suite 2970
Honolulu, HI 96813

Subject: **Final Submittal**
Geotechnical Report
Structural Storm Drain Pollution Control Device and Concrete Spillway Debris Basins
In the Vicinity of Salt Lake Elementary School
Salt Lake, Oahu, Hawaii

Dear Mr. Stone:

Yogi Kwong Engineers, LLC is pleased to submit this "Geotechnical Report, Structural Storm Drain Pollution Control Device and Concrete Spillway Debris Basins, in the Vicinity of Salt Lake Elementary School for your use. Our geotechnical engineering services were performed in general accordance with our Consultant Engagement Agreement dated July 14, 2005 and amendment No. 1 dated August 1, 2005 with Oceanit Laboratories, Inc.

Project team's comments on our August 16, 2005 draft geotechnical report are addressed in this report.

We appreciate the opportunity to provide these services to Oceanit Laboratories, Inc. If you have any questions regarding this letter and the attached Geotechnical Report, please do not hesitate to contact us.

Yours truly,
Yogi Kwong Engineers, LLC

James Kwong

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This report presents the results of our geotechnical investigation and recommendations for the proposed Structural Storm Drain Pollution Control Device and Concrete Spillway Debris Basins, in the Vicinity of Salt Lake Elementary School in Salt Lake, Oahu, Hawaii.

1.1 PROJECT DESCRIPTION

As part of the best management program (BMP) improvements, the U. S. Army Corps of Engineers plans to construct a new structural pollution control storm drain device and concrete spillway structures. The general locations of the study sites are shown in the Project Location Map, Figure 1.

The proposed structural storm drain pollution control device is located near the Salt Lake Elementary School at Salt Lake, Oahu, Hawaii. Based on information provided by Oceanit Laboratories, Inc., the structural storm drain BMP device will be composed of a concrete storm drain box manhole measuring approximately 16 feet by 16 feet by 16 feet in size, and the invert of the box manhole will be located at approximately 17 feet below existing ground surface. The approximate structural BMP location is shown in Figure 2. We understand that due to budget constraint, this earlier proposed structural BMP or structural storm drain pollution control device will not be constructed at this time.

Two concrete spillway structures were proposed during the planning and exploration phase (approximately 3 feet high, possibly 15 to 20 feet long), these are located at or near two upstream debris basins at the head of two existing open storm drain channels. The preliminary concrete spillway locations are shown on Figure 3. Also due to budget constraint, we understand that only one concrete spillway debris basin will be proposed for construction at this time.

Other site improvements will likely include paved roads for city maintenance vehicles and equipment to access the concrete spillway structures for maintenance and debris removal.

The proposed project scope for construction is being refined at the time this geotechnical report is due, please refer to the final contract drawings for all proposed facilities locations and other pertinent details. All proposed facilities locations shown in this report may be superseded.

1.2 PURPOSE AND SCOPE OF WORK

The purpose of this geotechnical investigation is to explore the subsurface conditions at or near the structural pollution control storm drain device and the debris basin locations, evaluate the engineering characteristics of the materials encountered, and develop appropriate geotechnical recommendations for the proposed structural BMP improvements. The scope of our services presented herein was limited to a conventional geotechnical investigation and did not include any environmental/hazardous waste or civil engineering/hydrological assessment or evaluation.

The following scope of services was provided in general accordance with Oceanit Laboratories Inc.'s Consultant Engagement Agreement and Amendment No. 1 dated July 14 and August 1, 2005.

1. Conduct planning, utility toning, and other necessary permitting for geotechnical drilling;
2. Drill, log, and sample one (1) geotechnical exploratory boring to 40 feet depth at the Structural BMP location;
3. Perform dynamic cone penetration probes at or near the earlier proposed debris basin A and B and along the proposed access road;
4. Hand excavation of two test pits in the vicinity of the two earlier proposed concrete spillway structures at Debris Basins A and B;
5. Hand sampling of near surface soils along proposed debris basin access road;
6. Perform geotechnical laboratory testing on selected soil and rock samples from all sampled sites;
7. Perform geotechnical engineering analyses on the data obtained from the field exploration and laboratory testing; and
8. Prepare this geotechnical report to summarize our findings, conclusions, and geotechnical recommendations.

2.1 FIELD EXPLORATION

One exploratory boring (B-1) was drilled on July 16, 2005. The exploratory boring was drilled and sampled to a depth of 42 feet below existing ground surface. The boring location is shown on Figure 2. Between August 2 through 4, 2005 a total of 16 dynamic cone penetration probes were performed, 6 in the Debris Basin A area, 5 in the Debris Basin B area, and 5 along the probable access road alignment along the west bank of "Inlet A". The test pits and DCP locations are shown on Figure 3. A detailed description of the field exploration, Log of Boring, log of Test Pits and dynamic cone penetration (DCP) probe test results are presented in Appendix A.

2.2 LABORATORY TESTING

A laboratory testing program was performed to verify visual field classifications and to determine pertinent geotechnical engineering properties of the soil material encountered in the borings. Geotechnical laboratory testing of the soil samples obtained from the borings were performed by Construction Engineering Labs Inc., Pearl City, Hawaii, and by Advanced Terra Testing Inc., Lake Wood, Colorado. A description of the laboratory test procedures and the results of the laboratory testing are presented in the Appendix. The tests performed included in-situ moisture and dry density determinations; Atterberg limits tests, mechanical sieve analyses, and a consolidation test.

3.1 SURFACE CONDITIONS

3.1.1 Structural BMP Manhole

The proposed structural pollution control storm drain manhole is located in a city right-of-way south of a partially concrete-lined open storm drain channel running parallel to Ala Lilikoi Street near the Ala Lilikoi Street – Ala Lilikoi Place intersection. Based on the available topographic information provided by Oceanit, Inc., the storm drain manhole site is relatively level at approximately elevation 20 feet above mean sea level (MSL). Immediately north of the storm drain manhole site is a 35-foot wide storm drain easement, consisting mostly of an approximately 10 feet deep open channel, with unprotected concrete at and near the base.

On the open channel wall, signs of surface erosion were observed in localized areas, and sandy debris appeared washed from the weep holes on the concrete-lined portion of the wall.

At the eastern end of the open channel, near the entrance to the existing 11-foot by 7-foot box culvert, groundwater was observed constantly flowing out of weep holes within the box culvert, from CRM walls on both sides of the culvert entrance, and from the channel floor. High water stain on the existing culvert wall indicated groundwater level was at least 5 feet higher than the level observed during field exploration.

3.1.2 Concrete Spillway Debris Basins

The proposed concrete spillways are located at Debris Basins A and B. We understand that only Debris Basin A is proposed for construction at this time. Debris Basin A is located at approximately 60 feet above mean sea level (MSL), all elevations in this report refer to this datum. Refer to contract drawings for locations and details.

During field exploration, the walls and bottom of the existing gulches at the explored locations are covered primarily by colluvial cobbles, gravel, sand, silt, and boulders, and are sparsely vegetated. DCP testing and hand excavation indicates that 2 to 3 feet of loose colluvial deposits and tuff rock boulders are found at the surface of the adjacent hillsides, at the locations explored.

3.2 SUBSURFACE CONDITIONS

A map of the regional geology of the project area is shown in Figure 4. The Island of Oahu was formed by the coalescing of two separate volcanic islands formed by the Waianae and Koolau

Volcanoes. The Waianae Volcano, in northwest Oahu, moved away from a crustal "hot spot" and ceased eruptions first. The Koolau Volcano, in the southeast, actively erupted until the Koolau Basalts filled the sea between the two islands, lapping over the older Waianae Basalts, and forming the present Schofield Plateau in the center of Oahu.

After the Koolau eruptions ceased, no further volcanic activity occurred on Oahu for about two million years. The island slowly sank some 1,200 feet due to its own weight, spreading laterally in the soft seabed. About 50,000 years ago, a new series of volcanic eruptions called the Honolulu Volcanic Series began (MacDonald et al., 1983), which were much more volatile than the older Koolau lava flows. The eruptions and consisted of about 30 separate events, and were scattered over a period of hundreds of thousands of years.

Salt Lake crater was formed as part of the Honolulu Volcanic Series of eruptions. During its eruption, Salt Lake crater erupted hot cinder and ash that deposited layers of tuff rock that formed the crater walls and plain deposits around the crater. The resulting general geology in the project area as seen in Figure 4 is consolidated gray, brown and lavender, slightly permeable deposits of basaltic vitric-crystal-lithic tuff. Over the years wind and rain has eroded the steep tuff walls of the crater as colluvial deposits have formed at the base of the crater walls.

The explored depths of the colluvial deposits differ between the proposed structural pollution control storm drain manhole and the proposed concrete spillway locations. The site-specific anticipated subsurface conditions at the different locations are described in Sections 3.2.1 and 3.2.2.

3.2.1 Proposed Structural Pollution Control Storm Drain Manhole Location

In general, the anticipated subsurface conditions at this site include three main geologic deposits, based on Boring No. B-1:

Fill: A surface layer of probably fill material extends from surface grade to approximately 10 feet below existing ground surface (bgs). The upper fill deposit consists primarily of a stiff, brown, sandy, gravelly silt layer at the surface and grades to medium-dense silty, sandy gravel with cobbles and boulders. The lower portion of this deposit may contain colluvium (slope wash) materials. The on site surface and near surface fills and colluvial silts and clays are expected to have a slight to moderate shrink/swell potential.

Alluvium: Alluvial deposits consisting primarily of moist to saturated, interbedded layers of clays, sands, silty sand, silty gravel, and sandy gravels underlying the fill layers. Very stiff brown fat clay (with high shrink and swell potential) was encountered at approximately 10 to 12 feet depth. From approximately 12 to 33 feet bgs, interbedded seams and layers of silts, sands and gravels with volcanic cobbles and boulders were encountered.

Lacustrine (lake) Sediments: Lake sediments consisting primarily of very stiff brown clay with rounded gravel was encountered in Boring B-1 from approximately 33 to 40.5 feet bgs. At about 40.5 feet depth, the lacustrine deposit grades to a stiff to very stiff light brown varved clay, and probably contain friable water laid tuff. This clay deposit was encountered from approximately 40.5 feet bgs through the final depth of exploration at approximately 42.0 feet bgs.

Groundwater was encountered at approximately 14.5 feet bgs at the time of the geotechnical exploration. Based upon observed high water mark in the adjacent storm drain channel, it is anticipated that groundwater level may rise to at least 5 feet above the level measured during the geotechnical exploration.

3.2.2 Proposed Concrete Spillway Debris Basin Locations

As part of an amended scope, two test pits were hand excavated at each of the two proposed upstream debris basin locations on August 2 and 3, 2005. Test pit #1 was excavated at the head of the existing concrete line "Inlet A". Test pit #2 was excavated at the head of adjacent "Inlet B". Each test pit was excavated adjacent to the beginning (upstream end) of the concrete lined channel. Several DCP probe tests were also performed at and around each test pit to estimate approximate depth to bedrock. The DCP and test pit locations are shown plotted on Figure 3.

In each test pits, loose colluvial deposits are found at the existing ground surface. In Test pit #1 dry to damp, loose brown silty gravel with sand (GM) and cobbles and boulders was encountered to a depth of approximately 19 inches below the invert of the adjacent storm drain channel. The test pit then encountered approximately 6 inches of probably extremely weathered tuff. A DCP probe performed at the base of the test pit encountered practical penetration refusal (possibly weathered tuff or boulders) at about 6 inches below the bottom of the pit, or about 3 feet below the adjacent concrete lined channel invert.

Gradation tests on samples obtained from test pit #2 indicate that brown silty sand with gravel (SM) was encountered to a depth of approximately 6 inches below the invert of the lower debris basin storm drain channel. Beneath the surface colluvial soil and rocky debris (cobbles and boulders), closely fractured, friable to moderately hard, extremely to moderately weathered volcanic tuff was encountered in test pit #2.

The on site surface and near surface silts and clays (fills or colluvium) are expected to have a slight to moderate shrink and swell potential.

Based on the 90% submittal drawings (dated September 2005), the areas of proposed roadways, earthworks and spillway debris basins were larger than shown on the initial plans and explored areas. It should be recognized that the actual conditions encountered in the field will be more variable and complex than those indicated in this report. If better exploration coverage of the proposed construction areas is desired, for example to better estimate soil and rock quantities, supplemental geotechnical exploration must be performed.

Based on the available geotechnical information, discussions, important geotechnical considerations, and geotechnical recommendations for the proposed BMP structure and debris basins A and B are provided below. In general, sections 4.1 through 4.8 pertain primarily to the BMP structure near Salt Lake Elementary School (not proposed for construction at this time), and sections 4.9 through 4.11 pertain primarily to the proposed concrete spillway debris basins.

4.1 ANTICIPATED OPEN EXCAVATION CONDITIONS AT BMP STRUCTURE

Based on the available preliminary drawings, the inverts of the approximately 16-foot by 16-foot wide new BMP box structure are expected to be approximately 17 feet below existing ground surface. This will require open excavations ranging from roughly 19 to 21 feet below the existing ground surface. The average groundwater level is expected to be at 13 to 15 feet below the existing ground surface or higher, a minimum design groundwater level of 10 feet below existing ground surface is recommended, adequate contingency should be considered and include in design for higher groundwater level due to extreme storm events. Open excavations to construct the BMP structure will require installation of excavation support and groundwater cut-off to sufficient depths to reduce potential occurrence of running or flowing ground, and bottom heave or boiling conditions. Draw down of groundwater level due to dewatering in the area will cause potential excessive settlements to the structures and utilities in the immediate vicinity of the site, and beyond.

Bottom heave is a form of bearing capacity failure in cohesive soils, which is a function of the excavation depth and the soil shear strength adjacent to and below the bottom of the excavation. Boiling is an upward movement of groundwater into the excavation. Ground movements associated with bottom heave or boiling could damage adjacent structures, utilities, and streets. The potential for bottom heave and boiling at the base of trench excavations is high unless appropriate groundwater control measures are implemented and the open excavations are properly shored. The excavation support system to be designed by the Contractor should be designed to penetrate a sufficient depth below the planned excavation to provide a minimum factor of safety of at least 1.5 against bottom instability.

Full perimeter shoring and sheeting or other suitable excavation support systems will be required along the entire BMP structure and associated intake and discharge pipelines because of the relatively close proximity of the excavations to existing slopes, channel, utilities, structures, vehicular traffic, and the depths of trenches and large open excavations required for the installations. Underpinning may be required for utilities and associated structures traversing the open excavations.

Temporary sheet piles or other excavation support may encounter dense zones, hard volcanic gravel to boulders. Pre-excavation such as by thorough pre-drilling will be needed to allow the excavation support system to be installed to sufficient depths. Excessive vibration generated during sheet pile driving will cause structural damage to nearby structures or utilities and slope instability. Use of vibratory hammers to install sheet piles in granular or compressible soils have caused excessive ground settlement of over 1 foot in at least two projects on Oahu. Therefore, vibratory hammers should not be used in driving sheet piles for this project.

The excavation support systems shall be adequately and properly supported with internal bracing to minimize movement of the shoring wall and potential damage to adjacent existing utilities and nearby structures. The first level of bracing should be installed no more than about 4 to 5 feet below the existing ground surface.

Potential geotechnical concerns associated with the BMP structure excavation and construction can include:

- The invert of the proposed BMP structure excavation is 6 to 10 feet below the average groundwater level in the area.
- The presence of significant groundwater level condition requires positive groundwater control to minimize dewatering discharges.
- Significant and widespread ground deformations and movements in the vicinity of the open excavations are expected due to dewatering unless appropriate groundwater control and excavation support system are installed.
- Potential widespread ground settlements and movements due to sheet pile driving. Extreme care should be exercised by the Contractor in pulling sheet piles to minimize potential excessive vibration. It will be prudent to require the contractor to leave the sheet piles in place and only cut off and remove the top 4 feet.
- Potential for bottom heave and boiling in the dewatered excavations.
- Existing underground utilities are present in the project area.

Based on the above considerations and concerns, the excavation support systems and groundwater control must be designed and installed by a qualified contractor or subcontractors who have successfully installed similar excavation support systems and groundwater control for other competed projects.

4.2 SITE PREPARATION AND EXCAVATION CONDITIONS

The proposed BMP structure site should be prepared by stripping off all topsoil material and debris. All stripped-off material and old concrete debris should be hauled to an approved disposal site.

Temporary excavations, groundwater control and dewatering that are required for construction of the proposed BMP structure and related appurtenances are the Contractor's responsibility. All construction excavations should be performed and supported in accordance with applicable Federal, State, and local safety regulations, including but not limited to current OSHA trench excavation safety standards.

Excavations to the depths required for the installation of the proposed structure, and inlet and outlet pipelines, are generally expected to encounter various types of soils, cobbles and boulders ranging from fill materials consisting of sands, gravel, silts and clays and some hard volcanic cobbles and boulders to very stiff fat clays to saturated silty sand, sand, silty sandy gravel, gravels mixed with hard cobbles and boulders. We anticipate that the soil material can generally be excavated with conventional earthwork equipment. Excavation and removal of hard volcanic cobbles and boulders in the excavations will require special handling and a hydraulic hoe ram, or other special excavation equipment.

4.3 OPEN EXCAVATION AND GROUNDWATER CONTROL CONSIDERATIONS

We understand that invert depths of the new BMP structure will be from approximately 17 feet below existing ground surface. Average groundwater level expected to be approximately 14.5 feet below ground surface and will higher during and after rainy periods. It is expected that the construction excavation will require excavation depths ranging from roughly 3 to 8 feet below groundwater level.

Where BMP structure and pipeline installation must be performed in the dry, such as at manhole locations and along the gravity pipe alignments, the open excavations will require dewatering and positive groundwater control involving full perimeter, water tight excavation support, and a bottom seal including a sufficiently thick tremie concrete plug or jet grouted zone to resist buoyancy uplift is required. The excavation support and/or groundwater cut-off should be installed to sufficient depths below the excavations to reduce the potential for boiling and/or bottom heave. The Contractor is required to select, design, and implement adequate groundwater control for all excavations. Drawdown of the groundwater level outside of the trench excavations should be prohibited.

Appropriate pre-drilling may be required to properly install sheet piles or other appropriate excavation support through the fills and driven into adequate embedment. Appropriate pre-grouting may be required for groundwater control where existing utilities cannot be relocated and a continuous sheet pile trench wall cannot be installed.

The dewatering effluent will be murky and will not likely satisfy State Department of Health (DOH) discharge requirements for disposal into storm drains. The Contractor is responsible for obtaining all applicable permits relating to dewatering and discharges.

4.4 DESIGN GUIDELINES FOR EXCAVATION SUPPORT SYSTEMS

Based on anticipated soil conditions encountered in the boring, minimum guidelines for lateral earth pressures have been developed for design of temporary excavation support systems. The Contractor must retain a qualified and experienced structural engineer licensed in the State of Hawaii to design and stamp all temporary excavation supports. The actual soil pressures are dependent on the actual soil conditions encountered, depth of the excavation, shoring design and installation procedures, and the magnitude of any surcharge loads on the ground surface adjacent to the wall. Lateral earth pressures minimum guidelines for design of temporary trench support systems are provided in Figure 5. The pressures are based on the assumption that the support system is constructed without raising the grade adjacent to the excavations, and that there are no surcharge loads acting above a 1:1 plane extending up and back from the base of the wall. As a minimum, for light vehicular traffic on the roads, such as automobiles and pickup truck traffic, a uniform lateral pressure of 100 psf should be included in the design pressures. For construction equipment loads or surcharge loads, it is recommended that the specific loading condition be evaluated individually when developed.

For passive resistance beneath the base of the excavation, the allowable equivalent fluid weights provided in Figure 5 should be used. As a minimum, the top 2 feet below the base of excavation (or any disturbed soil as a result of the excavation process) should not be considered for passive resistance.

The structural elements of the excavation support system should be designed to limit deflections of the excavation to a maximum of 1 inch. However, if any structures or utilities are located immediately adjacent to the open excavation, lower deflection limits may be required to minimize the settlement and potential damage to these facilities.

4.5 EXCAVATION MONITORING

Regardless of the type of the support system that is used, a program to monitor ground movements is recommended to evaluate the impact of construction on adjacent structures and utilities at regular intervals around the excavated shaft area. Such a monitoring program could be developed in conjunction with a detailed preconstruction survey of the condition of structures and other improvements within the zone of influence of construction activities.

Settlement survey markers should be established on the ground surface prior to construction and periodic survey of the monuments should be made before, during, and after construction to measure potential ground movements, in accordance with the Contract requirements. At a minimum, the settlement markers should be surveyed by a surveyor licensed in Hawaii before any excavation, twice weekly when trenching or dewatering within 100 feet of the markers, and one week after backfilling or when all settlements have ceased, whichever is longer.

Prior to the start of construction, we recommend that a photographic and/or video survey be made of existing nearby buildings, structures, landscaping, and pavements. The photographs, videos, and settlement data would provide valuable records in the event that movements and damages arise during the construction. The settlement information would also provide useful reference during construction to alert the Contractor of potential movements, and the possible need to modify their excavation and dewatering operations.

4.6 BACKFILL MATERIALS, PLACEMENT, AND COMPACTION

The excavated silts and clays should not be reused for excavation and trench backfill. The excavated cohesive soils should be properly disposed off site. Imported select borrow should be used instead.

If encountered, soils determined to be contaminated by the Owner should be handled in accordance with all applicable government standards. Excavated material that is contaminated may not be used as backfill material within 2 feet of final ground surface.

Imported select borrow material should consist of a granular, well-graded material, free of organic matter, debris, other substances, and particles greater than 3 inches in maximum dimension. Select borrow should be non-expansive with less than 15 percent of passing the No. 200 mesh sieve (refer to Section 30 of the standard Specifications for Public Works Construction 1986, Department of Public Works City and County of Honolulu). It should have a CBR value of at least 25, a liquid limit of 25 percent or less, and a plasticity index of 10 or les.

Imported material should be inspected and tested by a qualified geotechnical laboratory prior to use in backfill at the site to determine that it meets the requirements stated above.

The trench backfill materials above the pipe bedding should be placed in not more than 8-inch thick loose lifts, moisture conditioned to slightly wet of optimum moisture content for the material being placed, and compacted to at least 90 percent relative compaction up to a depth of at least 2 feet below pavement and slab subgrades. Where applicable, the upper 2 feet of the backfill below pavement sand slab subgrades should spread in lifts not to exceed 6 inches in compacted thickness and compacted to at least 95 percent relative compaction. Relative compaction in this report is defined as the dry density of the compacted material expressed as a percentage of the maximum dry density of the same material based on ASTM D 1557 test procedures.

4.7 REMOVAL OF SUPPORT SYSTEMS

The bracing system should be removed as soon as the excavation backfill has been placed and compacted to a level adequate to support the wall of the excavation. Backfill compaction should continue throughout the shoring removal process, in order to minimize the voids between excavation walls and compacted backfill. In order to avoid damage to existing utilities when the sheet piles are pulled, sheet piles may be left in place as long as the sheet piling is removed to a depth of at least 5 feet below finished grade.

4.8 BMP STRUCTURE FOUNDATION

Based on the groundwater control requirements prescribed above, it is expected that the base of the BMP structure excavation will consist of and underlain by a minimum 3 feet thick tremie concrete slab (or equivalent jet grouted zone) with minimum 30 days unconfined compressive strength of at least 1,000 pound per square inch (psi). The tremie concrete is expected to bear on medium dense to very dense silty sandy gravel to silty sand.

The exposed concrete or jet grout surface should be cleared of all debris, and a maximum 8-inch loose lift of compacted select borrow (leveling course) should be placed prior to placement or construction of the box structure or slab. Alternatively, due to potential presence of some standing water at the base of the excavation, a minimum 6-inch layer of clean free draining crushed rock wrapped in geo-fabric should be used to provide uniform support for the BMP structure slab.

For foundations designed and constructed as noted above, we recommend an allowable bearing pressure of 2,000 pounds per square foot (psf) for the box slab bearing over properly compacted select borrow or clean gravel, over tremie concrete or equivalent. Estimated resultant total and differential settlements should be less than half inch. Removal of sheet piles can cause significantly larger settlement of the completed structure and backfill. If sheet pile removal is permitted, it must be performed with extreme care and minimum vibration.

The structure designers must consider the potential buoyancy forces against the box structure based on the anticipated groundwater conditions during the design life of the structure.

A coefficient of base friction of 0.5 between the box slab base and gravel layer or properly compacted shaft backfill material may be used to develop lateral resistance.

Where sheet piles or other retrievable excavation support systems will be used to brace the excavations, passive resistance recommendations will not be valid, as the sheet piles or support system will prevent direct contact between the structure and the bearing material. As the support system is removed, the structure may not have direct, full contact with the in-situ ground, due to voids created by the driving or pre-drilling operations prior to sheet pile installation.

4.9 EARTHWORKS AT DEBRIS BASINS AND ROADWAY AREAS

Excavations

We understand that minor cuts of less than 10 feet high will be necessary to construct the proposed debris basins A and B. Based on the results of the geotechnical exploration, the proposed cuts into the existing hillside is anticipated to be made primarily in very loose to loose silty sandy gravel with cobbles and boulders (colluvium) and extremely to slightly weathered volcanic tuff. Minor cut slope made in such colluvium should not exceed 2 horizontal to 1 vertical (2H:1V) and must be protected by proper surface drainage and vegetation against future erosion. Minor cut slope made in highly to slightly weathered volcanic tuff should not exceed 1.5 horizontal to 1 vertical (1.5H:1V).

The proposed up to 10 feet high 1.5H:1V road cuts shown on the 90% submittal drawings are expected to encounter both colluvial soils, boulders and volcanic tuff rocks. Long term maintenance and localized slope repair will likely be necessary due to the anticipated presence of erosion prone soils on relatively steeper cut slopes. Reducing the cut slopes to 2H:1V would provide more favorable condition for vegetation growth on soil slope areas.

We anticipate that the soil materials can generally be excavated with conventional earthwork equipment. Excavation and removal of hard volcanic cobbles, boulders and rocks in the excavations will require special handling and a hydraulic hoe ram, or other special excavation equipment. Extremely weathered tuff is expected to be primarily soil-like, and will be prone to erosion. Highly weathered tuff may be friable, soil to rock like materials. Moderately to slightly weathered tuff is expected to range from weak rock to hard rock, and range from locally closely fractured to widely fractured, and bedded (long, persistent bedding planes in some horizons). Although a sample of volcanic tuff tested yield unconfined compressive strength of 2,573 psi, from past experience, hard slightly weathered volcanic tuff can have unconfined compressive strength of 20,000 pounds per square inch (psi) or higher.

The presence of cobbles and boulders and the potential presence of friable tuff layers interbedded with harder, less weathered tuff layers may result in potential over-excavation and overhang on the cut slopes. Therefore, special care should be exercised during site grading excavation. Overhang areas on cut slopes should be backfilled with concrete (7 days unconfined compressive strength of at least 1,000 psi) to prevent potential dislodgement of overhanging friable rocks.

Subgrade Preparation

The site should be cleared of all abandoned subsurface structures, abandoned utility lines, pavements, concrete walkways, top soils, highly expansive soils pockets, and other miscellaneous debris and deleterious materials prior to commencement of construction. A vibratory smooth-wheeled roller with an equivalent dynamic weight of 20 tons should compact the exposed roadway and all structural areas soil subgrade accessible by the roller, with proper moisture conditioning, to a minimum of 95 percent of the maximum dry density as determined by ASTM D1557 test method. If any soft soils, depressions, voids, etc. are encountered during construction or compaction, local over-excavation must be performed to remove the soft subgrade soils or to expose the voids/cavities, such as due to nesting of boulders. If construction debris or organic materials are encountered, the materials should be replaced with a compacted selected borrow material. Similarly, in cobbly and bouldery subgrade, the oversized materials should be over-excavated, to a maximum of 2 feet below the base of the on-grade slab or pavement concrete, and replace with compacted select borrow material.

To reduce the potential for excessive ground shrinkage or expansion causing potential cracking of the constructed concrete slabs, or excessive differential movements of structures, the exposed soil subgrade must be kept moisture conditioned to slightly above the optimum moisture content at all time.

Fills and Compaction

Fill slopes should not be steeper than 3H:1V and must be protected from potential erosion, such as by grouted rip rap and/or appropriate erosion control mats, and proper surface drainage provisions. Prior to fill placement, the existing slopes must be keyed and benched, individual bench height should not exceed 4 feet. All fill embankment should be constructed using free draining granular fills, locally available select borrow materials would be suitable.

The excavated on site cohesive soils (silts and clays) and oversized gravel, cobbles and boulders should not be reused for fill or backfill. The excavated cohesive soils and other unsuitable materials should be properly disposed off site. Imported select borrow should be used instead.

If encountered, soils determined to be contaminated by the Owner should be handled in accordance with all applicable government standards. Excavated material that is contaminated may not be used as backfill material within 2 feet of final ground surface.

Imported select borrow material should consist of a granular, well-graded material, free of organic matter, debris, other substances, and particles greater than 3 inches in maximum dimension. Select borrow should be non-expansive with less than 15 percent of passing the No. 200 mesh sieve (refer to Section 30 of the standard Specifications for Public Works Construction 1986, Department of Public Works City and County of Honolulu). It should have a CBR value of at least 25, a liquid limit of 25 percent or less, and a plasticity index of 10 or less. Imported material should be inspected and tested by a qualified geotechnical laboratory prior to use in backfill at the site to determine that it meets the requirements stated above.

Fills and backfill materials should be placed in not more than 8-inch thick loose lifts, moisture conditioned to slightly wet of optimum moisture content for the material being placed, and compacted to at least 90 percent relative compaction up to a depth of at least 2 feet below pavement and slab subgrade. Where applicable, the upper 2 feet of fill below pavement and slab subgrade should be spread in lifts not to exceed 6 inches in compacted thickness and compacted to at least 95 percent relative compaction. Relative compaction in this report is defined as the dry density of the compacted material expressed as a percentage of the maximum dry density of the same material based on ASTM D 1557 test procedures.

4.10 CONCRETE STRUCTURES FOUNDATIONS

The available geotechnical information indicated that the debris basin area may be underlain by approximately 1 foot (or less) to 4 feet of colluvial soils and boulders, over variously weathered volcanic tuff. The soil to rock interface is expected to be highly variable and erratic.

Concrete Barriers

To reduce the potential of storm water scour or erosion beneath and around the proposed concrete pavements, basin slabs and retaining structures, below grade concrete barriers are strongly recommended to be designed and constructed to cutoff storm water flows beneath the pavement and debris basin reinforced concrete slabs located in storm water flow paths.

The proposed concrete barriers foundations and abutments must be keyed and embedded at least 3 feet into competent in-situ moderately weathered tuff or better rock mass. Adequate grouted rip-rap protection against scour must be provided upstream and downstream of the barriers. The exposed subgrade for barrier construction must be cleared of all debris.

For foundations designed and constructed as noted above, we recommend an allowable bearing pressure of 3,000 pounds per square foot (psf) for the concrete barrier bearing on competent moderately weathered or stronger volcanic tuff. Estimated resultant total and differential settlements should be less than half inch.

A coefficient of base friction of 0.6 for properly placed concrete over competent volcanic tuff can be used to provide lateral resistance. An equivalent fluid pressure of 300 pounds per square foot (pcf) can be used to compute passive resistance for portions of the concrete barrier embedded into competent volcanic tuff.

Retaining Walls

We understand that retaining walls (2 feet to 8 feet high) will be required in a transition outlet structure area between the reinforced concrete lined debris basin and the concrete-lined open channel. Non-restrained retaining walls with level, granular backfills (3B fine gravel wrapped in appropriate filter fabrics), and free-draining sub-drainage behind the walls (to discharge at appropriate outlets) can be designed using an active equivalent fluid pressure of 40 pounds per square foot (psf) per foot of depth. Retaining wall footings must be keyed entirely into competent moderately or less weathered volcanic tuff rocks. A coefficient of base friction of 0.6 for properly placed concrete over competent in-situ volcanic tuff rock mass can be used to provide lateral resistance. An equivalent fluid pressure of 300 pounds per square foot (pcf) can be used to compute passive resistance for portions of the concrete footing entirely embedded into competent volcanic tuff rock mass.

For foundations designed and constructed as noted above, we recommend an allowable bearing pressure of 3,000 pounds per square foot (psf) for the concrete footing bearing directly on competent moderately weathered or stronger volcanic tuff rock mass. Estimated resultant total and differential settlements should be less than half inch.

On-Grade Slabs

We understand a structural slab will be constructed on grade at the base of the debris basin. A compacted layer of select borrow, minimum 12-inch thick, placed in maximum 8-inch loose lifts, should be placed to provide uniform support beneath the slabs.

4.11 ACCESS ROAD PAVEMENT

The existing topsoil and at least the top one foot of the existing surface soils (with slight to moderate shrink/swell potential) containing cobbles and boulders should be removed from this site and properly disposed. Additional subgrade preparation considerations and recommendations are presented in section 4.9 above.

If construction debris, large boulders protruding into the pavement section, or organic materials are encountered, the materials should be replaced with a granular fill material. The select borrow backfill should be placed in 6-inch layers and compacted to 95 percent of the maximum density as determined by the ASTM test D-1557. The base course and sub-base should be compacted to a minimum of 98 percent of the maximum density as determined by the ASTM test D-1557.

Based on the available geotechnical data, low traffic conditions and maximum single axle load of 24,000 pounds, the recommended pavement section thicknesses are as follows:

Rigid Pavements:	6 inches concrete
	12 inches select borrow (sub-base)
	8 inches recompacted subgrade
Flexible Pavements:	2.5 inches asphaltic concrete
	6 inches untreated base course
	12 inches select borrow (sub-base)
	8 inches recompacted subgrade

During the design, we plan to review the geotechnical related sections of the pre-final plans and specifications to verify that the intent of our recommendations and design considerations are properly reflected in the design.

If design changes occur or if any unanticipated variations or undesirable conditions are encountered during construction, YKE should be notified by written letter so that supplemental data can be obtained and recommendations can be made if appropriate. During construction, we recommend that YKE or a qualified geotechnical engineer be retained to periodically observe site preparation, subgrade cleaning and preparation, excavation conditions, fill placement, and compaction operations. The project's geotechnical engineer-of-record should evaluate the suitability of the subgrade materials encountered, proper subgrade preparation, if necessary over-excavation of unsuitable subgrade materials, and base course placement and compaction.

Samples of proposed fill materials should be examined, and if appropriate, tested by the geotechnical engineer-of-record prior to placement. The geotechnical engineer-of-record or their designated representative should observe fill placement and compaction procedures and perform tests to evaluate the actual degree of compaction achieved.

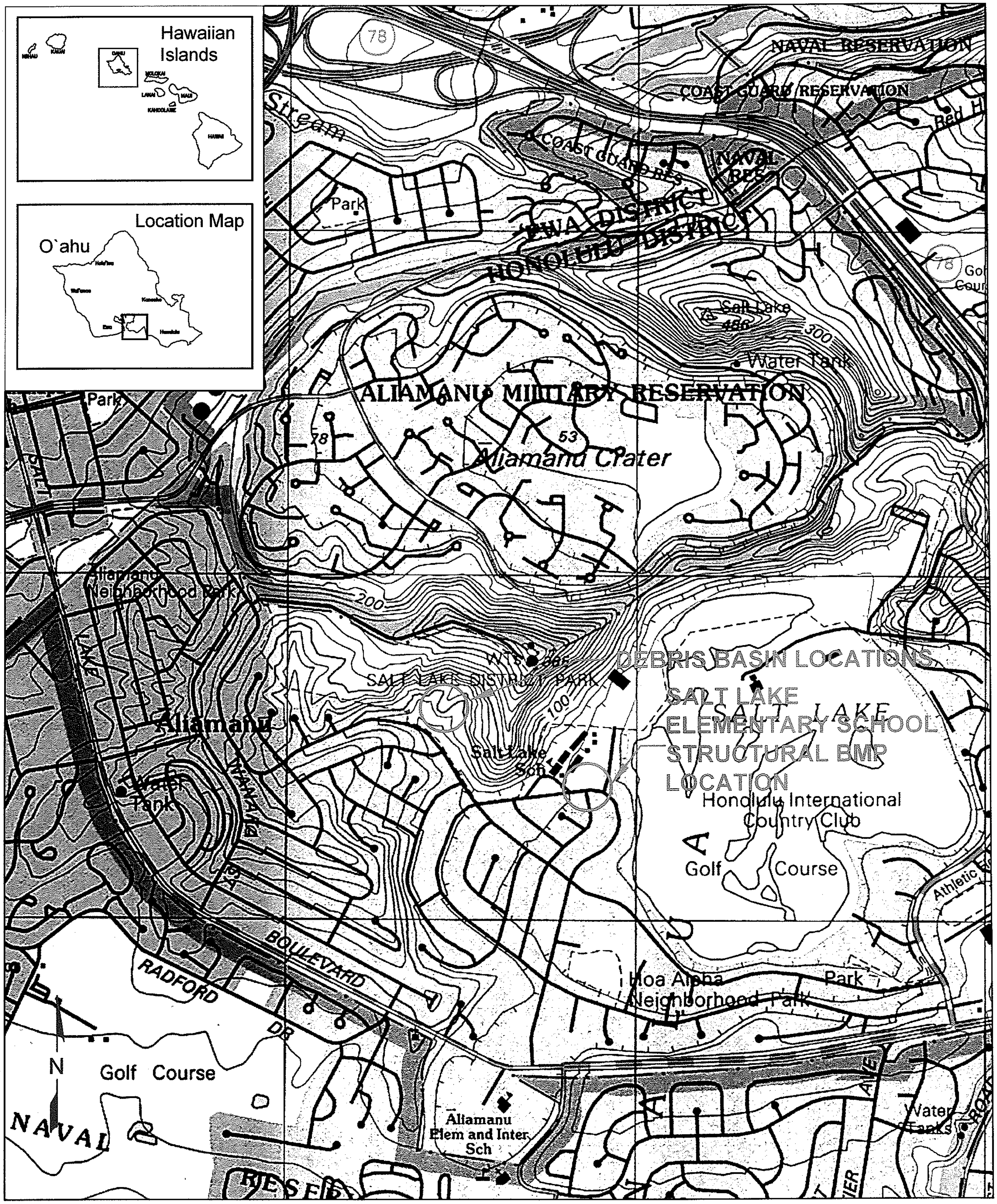
The geotechnical recommendations and conclusions presented in this report are based on the assumption that the scope of the constructed project, as described, does not change appreciably and that significant variations in soil properties from those encountered by our exploration do not occur. The boring and probes are widely spaced; therefore, large variations in soil properties between the borings are likely. If any conditions notably different from those described here are encountered during excavation and construction, we should be immediately notified.

This report was prepared for use by the U.S. Army Corps of Engineers, and Oceanit Laboratories, Inc., their designated design consultants, and prospective bidders in accordance with generally accepted geotechnical engineering practices. The geotechnical opinions and recommendations given in this report are based on our evaluation of the data collected for this project. Additional conclusions or recommendations made from this data by others are their responsibility.

Our study is based on the data obtained from the boring, test pits and DCP probes made at the locations indicated on the location plan. If project plans or requirements change, the conclusions and recommendations by YKE may need to be revised. The nature and extent of variations between the borings may become evident during construction and will likely differ from those discussed in this report. No warranty is included, either expressed or implied; that the actual conditions encountered will conform exactly to the conditions described herein. Qualified geotechnical engineers should be retained to observe exposed conditions.

Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

MacDonald, G.A., A.T. Abbott, and F.L. Peterson, 1983. Volcanoes in the Sea: The Geology of Hawaii, 2nd Edition, University of Hawaii Press, Honolulu, Hawaii.



NO SCALE

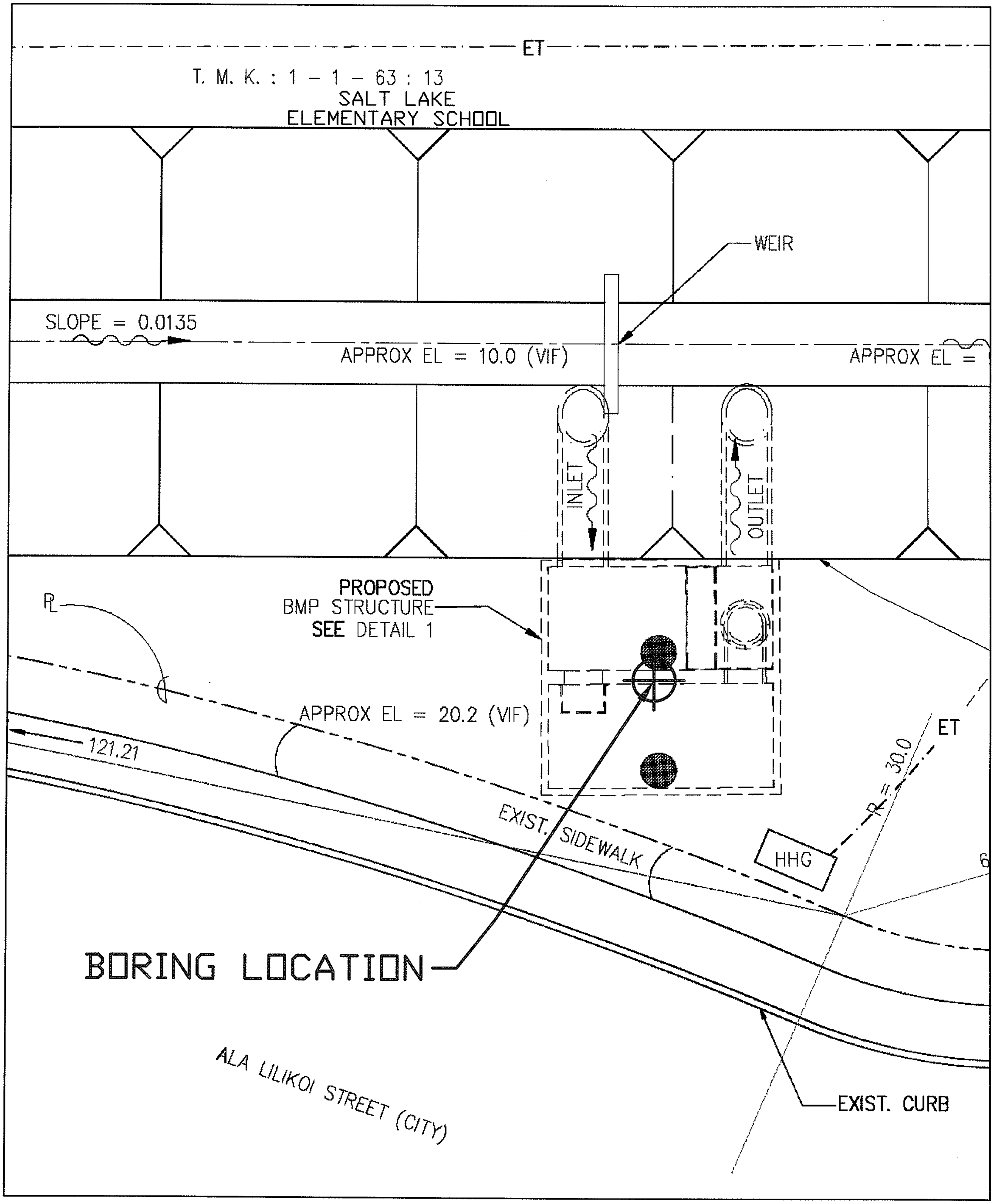
Project Locations Map

In the Vicinity of Salt Lake Elementary School

Structural Storm Drain Pollution Control Device

Honolulu. Oahu, Hawaii

FIGURE 1



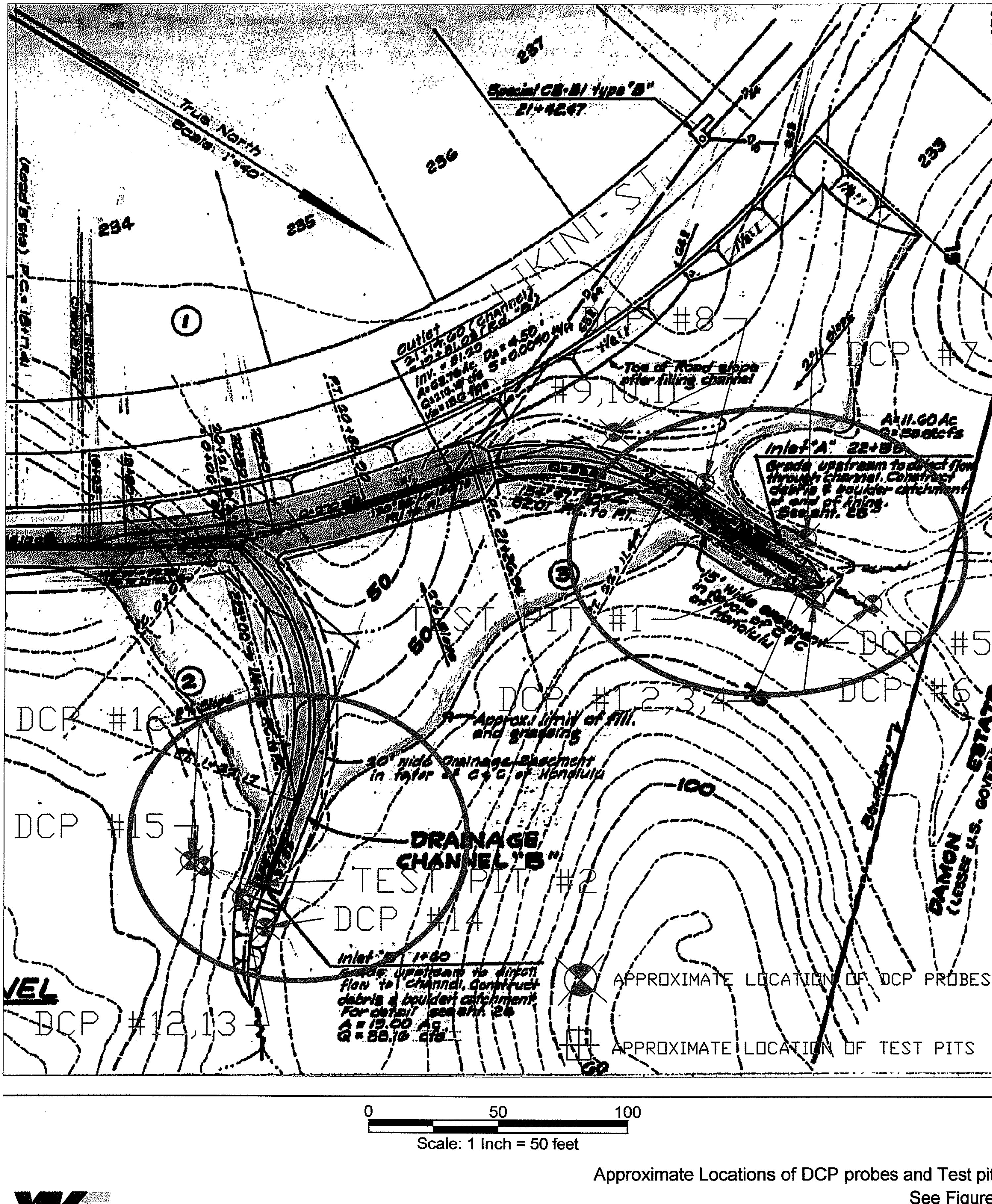
Approximate location of boring

Salt Lake Elementary School Structural BMP

YKE

Honolulu. Oahu, Hawaii

FIGURE 2

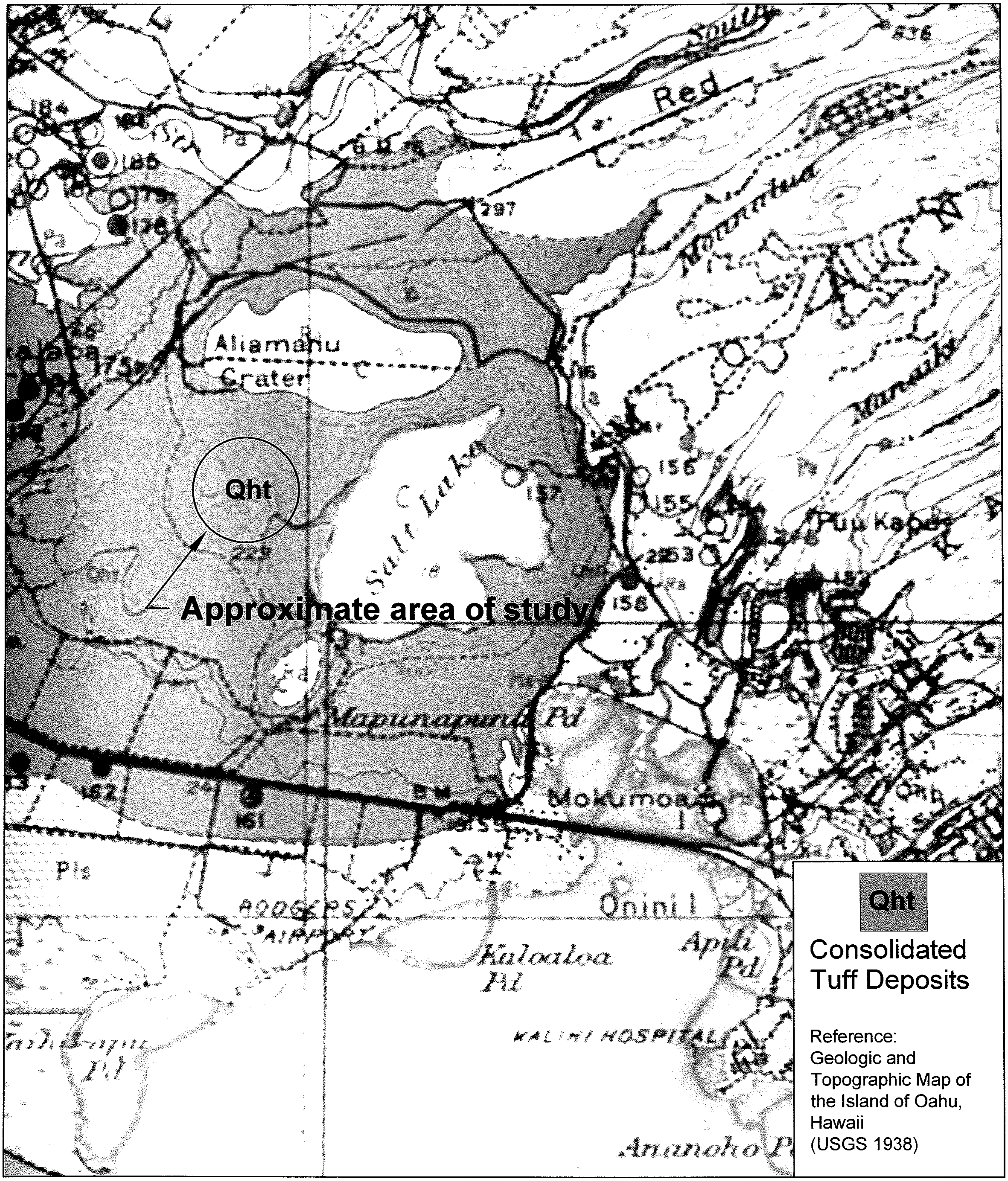


Approximate Locations of DCP probes and Test pits

See Figure 1

Honolulu, Oahu, Hawaii

FIGURE 3

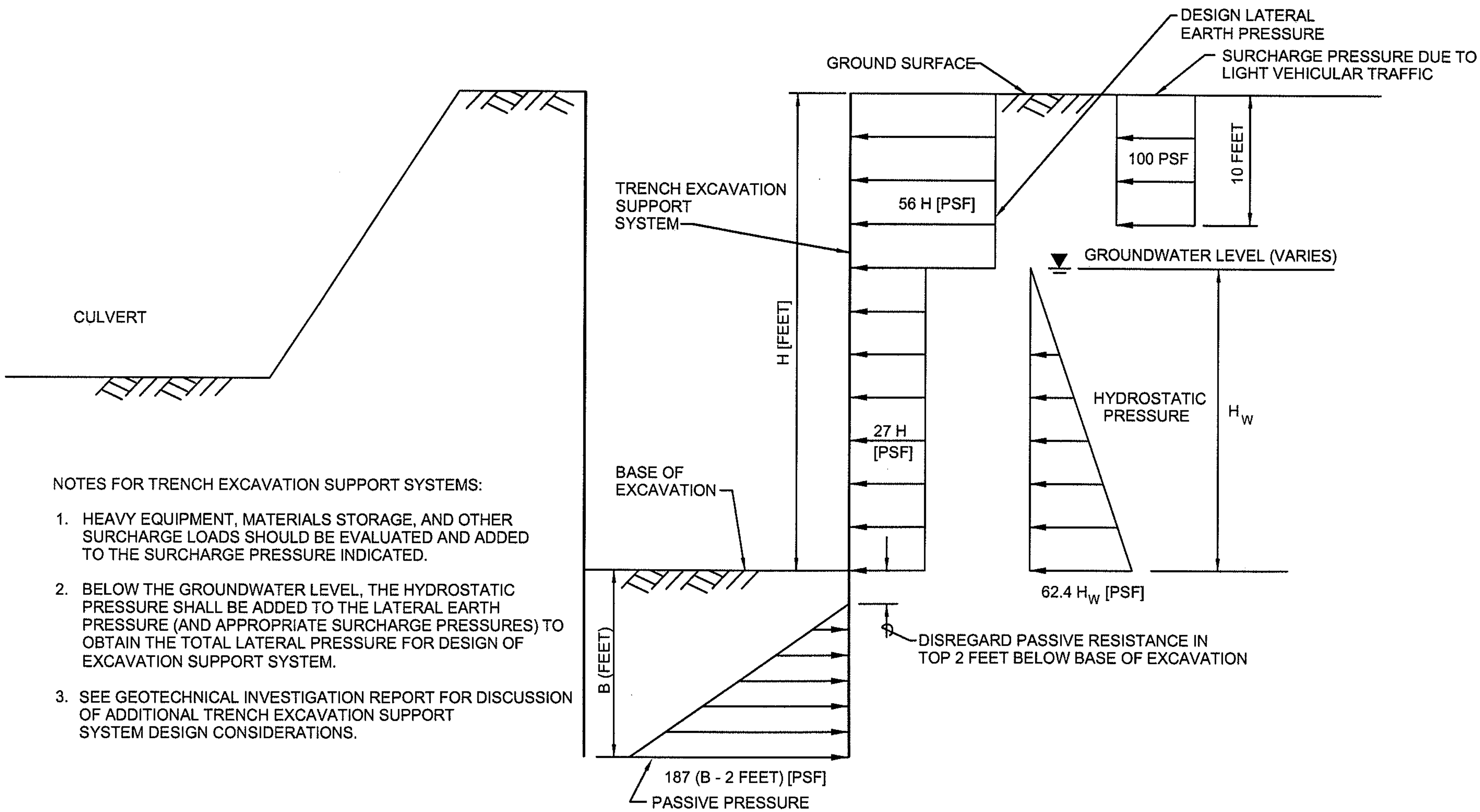


Scale: No Scale

Regional Geological Map of Near Surface Materials
See Figure 1

YK

Honolulu, Oahu, Hawaii
FIGURE 4



NOTES FOR TRENCH EXCAVATION SUPPORT SYSTEMS:

1. HEAVY EQUIPMENT, MATERIALS STORAGE, AND OTHER SURCHARGE LOADS SHOULD BE EVALUATED AND ADDED TO THE SURCHARGE PRESSURE INDICATED.
2. BELOW THE GROUNDWATER LEVEL, THE HYDROSTATIC PRESSURE SHALL BE ADDED TO THE LATERAL EARTH PRESSURE (AND APPROPRIATE SURCHARGE PRESSURES) TO OBTAIN THE TOTAL LATERAL PRESSURE FOR DESIGN OF EXCAVATION SUPPORT SYSTEM.
3. SEE GEOTECHNICAL INVESTIGATION REPORT FOR DISCUSSION OF ADDITIONAL TRENCH EXCAVATION SUPPORT SYSTEM DESIGN CONSIDERATIONS.

LATERAL EARTH PRESSURE GUIDELINES FOR SHAFT EXCAVATION SUPPORT SYSTEM DESIGN

Salt Lake Elementary School Structural BMP
Salt Lake, Oahu, Hawaii

Project No. 05022

FIGURE 5

LIST OF APPENDIX FIGURES

LIST OF APPENDIX TABLES

This appendix summarizes the results of field explorations, soil sampling, and field permeability testing, performed by YKE for the Salt lake Elementary School Structural BMP and Debris Basins project. Refer to Section 3 of report for anticipated subsurface conditions for this project.

The location of the project site is indicated on Figure 1. The approximate locations of borings performed by YKE for this project are shown on Figure 2.

A.1 EXPLORATORY BORING AND TEST PITS

Field explorations for the replacement sewer line consisted of completing a total of one (1) exploratory boring (B-1) and two (2) test pits (TP-1 and TP-2). The approximate location of the boring is shown on Figure 2.

The boring was drilled by Hawaii Test Borings using a Mobile Drill B-53 drill rig. In general, the borings were drilled using solid-stem, continuous, flight-augers and PQ-size steel casing. The drilling bit used is noted on the Log of Boring Key and Logs of Borings, which are presented on Figures A-3 through A-4.

Test pits were hand-excavated using shovels and electric spades to depths of 35 inches and 24 inches below the existing ground surface. Soil stratigraphy was logged by YKE engineering personnel.

A.2 SOIL SAMPLING

Soil sampling was conducted under the observation of YKE engineering personnel, who logged the materials encountered in each boring, and obtained samples for further examination and laboratory testing.

Relatively undisturbed and disturbed soil samples were obtained using either a Standard Penetration Test (SPT) sampler or a Dames & Moore type "U" sampler. The SPT and Dames & Moore samplers were driven into the ground by successive blows of a 140-pound hammer falling 30 inches. The sampler was driven for a total distance of 18 inches, and blow counts for each 6 inches of penetration were recorded. Where the SPT sampler was used, this procedure followed the ASTM D3441 standard for determining the standard penetration resistance of soil. Blow counts for the last 12 inches of penetration are noted on the Log of Borings.

Soil samples recovered from the field were initially classified according to the American Society of Testing and Materials (ASTM) D4288 standards and the Unified Soil Classification System, shown on Figure A-1. These classifications were later refined according to ASTM D2487 based on the results of laboratory tests performed on selected samples. Samples recovered during the field exploration program were transported to our office in Honolulu for further examination and laboratory testing. The borings were backfilled using a combination of soil cuttings and imported backfill.

A.3 DYNAMIC CONE PENETROMETER TESTS

Sixteen (16) Dynamic Cone Penetrometer (DCP) tests were completed by YKE personnel, to depths ranging from 0.5 inches to 56 inches below the existing ground surface. The DCP test consists of driving a cone tip into the ground by successive blows of a 17.6-pound hammer falling 22.6 inches. The number of blows and penetration were recorded, and the resulting penetration rate can be related to the in-situ California Bearing Ratio. In general, the DCP was driven starting from the existing ground surface. The DCP logs are presented on Figures D-1 through D-18.

SOIL CLASSIFICATION CHART

	Major Divisions		Symbol	Typical Names	Other Criteria
COARSE GRAINED SOILS More than 50% of material larger than No. 200 sieve size	**Gravels** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravel** Little or no fines (<5%)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Cu>4 and 1<=Cc=3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting Cu and Cc criteria for GW
		Gravels with Fines Appreciable amount of fines (>12%)	GM	Silty gravels, gravel-sand-silt mixtures	Atterberg limit below A-line or PI<4
			GC	Clayey gravels, gravel-sand-silt mixtures	Atterberg limit above A-line with PI>7
	Sands More than 50% of coarse fraction passing No. 4 sieve	**Clean Sands** Little or no fines (<5%)	SW	Well-graded sands, gravelly sands, little or no fines	Cu>6 and 1<=Cc=3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting Cu and Cc criteria for SW
		Sands with Fines Appreciable amount of fines (>12%)	SM	Silty sands, sand-silt mixture	Atterberg limit below A-line or PI<4
			SC	Clayey sands, sand-clay mixture	Atterberg limit above A-line with PI>7
FINE GRAINED SOILS More than 50% of material smaller than No. 200 sieve size	**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	Atterberg limit below A-line
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clay	Atterberg limit above A-line
			OL	Organic silts and organic silty clays flow plasticity	Atterberg limit below A-line
	Silts and Clays Liquid limit larger than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Atterberg limit below A-line
			CH	Inorganic clays of high plasticity, fat clays	Atterberg limit above A-line
			OH	Organic clays of high plasticity, organic silts	Atterberg limit below A-line
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils	

Notes:

1. Cu = D60/D10, Cc = (D30)^2/(D60 x D10) where D60, D30 and D10 are diameters associated with 60%, 30% and 10% smaller in gradation curves.
2. Dual symbols are used to indicate borderline classifications such as GP/SP.

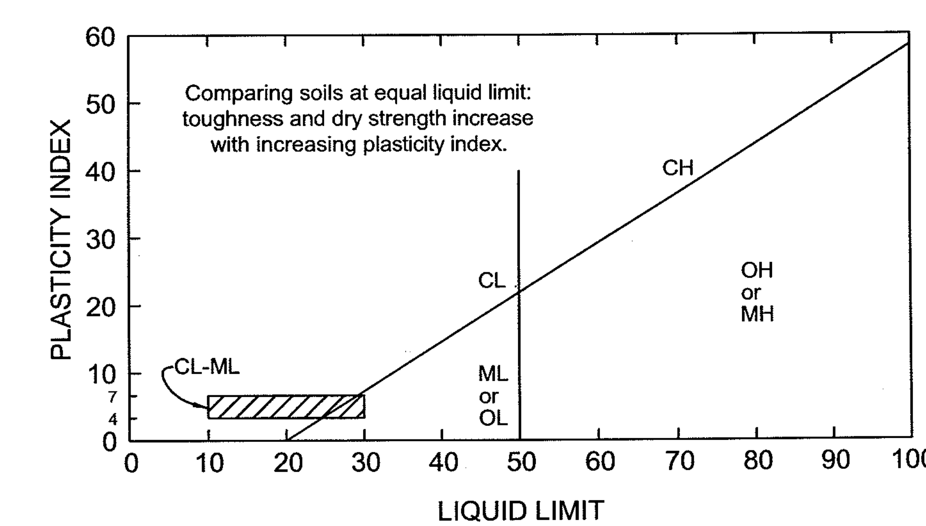
GRADATION CHART

Soil Fraction	Size Range			
	Lower Limit		Upper Limit	
	Millimeters	Sieve	Millimeters	Sieve
Boulders	304.8	12*	914.4	36*
Cobbles	76.2	3*	304.8	12*
Gravel				
Coarse	2	10**	4.76	4**
Medium	0.42	40**	2	10**
Fine	0.074	200**	0.42	40**
Fines			0.074	200**

* U.S. standard sieve opening in inches

** U.S. standard sieve number

PLASTICITY CHART



DESCRIPTION OF ROCK MATERIALS

A. DEGREE OF WEATHERING

The following terms were used to describe the chemical weathering of rock:

Extremely Weathered: The original minerals of the rock have been almost entirely altered to secondary minerals, even though the original fabric may be intact.

Highly Weathered: The rock is weakened to such an extent that a 2-inch diameter core can be broken readily by hand across the rock fabric.

Moderately Weathered: Rock is discolored and noticeably weakened, but a 2-inch diameter core cannot usually be broken by hand, across the rock fabric.

Slightly Weathered: Rock is slightly discolored, but not noticeably lower in strength than fresh rock.

Unweathered: Rock shows no discoloration, loss of strength, or any other effect of weathering.

B. HARDNESS

The following terms were used to describe the hardness of rock and soil:

Soft: Reserved for plastic material.

Friable: Easily crumbled, pulverized, or reduced to powder.

Low Hardness: Can be gouged deeply or carved with pocket knife.

Moderately Hard: Can be readily scratched by a knife blade; scratch leaves heavy trace of dust and scratch is readily visible after the powder has been blown away.

Hard: Can be scratched with difficulty, scratch produces little powder and is often faintly visible.

Very Hard: Cannot be scratched with pocket knife.

C. ROCK FRACTURE CHARACTERISTICS

The general fracture spacing is described in the boring log according to the following criteria:

Crushed: Less than 5 microns (mechanical clay) to 0.1 foot.

Intensely Fractured: 0.05 to 0.1 foot (contain no clay).

Closely Fractured: 0.1 to 0.5 feet.

Moderately Fractured: 1.0 to 3.0 feet.

Very Widely Fractured: Over 3 feet.

SALT LAKE ELEMENTARY SCHOOL STRUCTURAL BMP

LOG OF BORING KEY

DATE BEGAN: **DATE FINISHED:** **LOGGED/CHECKED BY:**

LOCATION: **HAMMER TYPE:**

GROUND SURFACE ELEVATION: **GWL DATE/DEPTH:** **HAMMER WEIGHT/DROP:**

DRILL EQUIP: **DRILLING METHOD:**

CONTRACTOR: **BOREHOLE BACKFILL:**

DEPTH (FT.)	SAMPLE TYPE	SAMPLE NUMBER	SAMPLING RESISTENCE	RECOVERY, %	RQD, %	GRAPHIC LOG	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, pcf	UNCONFINED COMP STRENGTH, psi	LIQUID LIMIT	PLASTIC LIMIT	OTHER TESTS AND REMARKS
0							Silty gravel (GM)						
							Mixture of Poorly graded gravel and silty gravel (GP-GM)						
5							Silty sand (SM)						
							Fat clay (CH)						
10							Silt (ML)						
							SAMPLER SYMBOLS						
15							Standard Penetration Test Sampler						
							Dames & Moore Type "U" Sampler (3.25-inch O.D.)						
							NX-sized Rock Coring Sampler						
20			10				Number of blows to advance sampler 12 inches, or distance traveled						
							ABBREVIATIONS FOR LAB TESTS						
25							Gravel= % of sample passing through 76.2 mm sieve and retained on #4 sieve						
							Sand= % of sample passing through #4 sieve and retained #200 sieve						
30							Fine= % of sample passing through #200 sieve						
							PP= Pocket penetrometer test						

SALT LAKE ELEMENTARY SCHOOL STRUCTURAL BMP

LOG OF BORING B-1

DATE BEGAN: 07-16-05 **DATE FINISHED:** 07-16-05 **LOGGED/CHECKED BY:** K.S / J.K

LOCATION: CORNER OF ALA LILIKOI ST. AND ALA LILIKOI PL. **HAMMER TYPE:** SAFETY

GROUND SURFACE ELEVATION: N.A. **GWL DATE/DEPTH:** 07-16-05 / ~14.5 FT. **HAMMER WEIGHT/DROP:** 140 lb/ 30 in

DRILL EQUIP: MOBILE DRILL B-53 **DRILLING METHOD:** 4" SOLID STEM AUGER / WASH BORING

CONTRACTOR: HAWAII TEST BORING, INC **BOREHOLE BACKFILL:** CUTTINGS AND GRAVEL

DEPTH (FT.)	SAMPLE NUMBER	SAMPLING RESISTENCE	RECOVERY, %	RQD, %	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, pcf	UNCONFINED COMP STRENGTH, psi	LIQUID LIMIT	PLASTIC LIMIT	OTHER TESTS AND REMARKS
0					FILL						Auger to 2 ft. bgs
											Cobbles at surface
	1	25	67		Brown silt with sand and some gravel, very stiff, dry to moist (ML)						
											Auger to 5 ft. bgs
5	2	29	56		Grades to brown silty sandy gravel with cobbles and boulders, medium dense, dry to moist (GM)						Auger chatter
	3	15	56								
											Auger to 10 ft. bgs
					Grades to moist						
10	4A 4B	45	72		ALLUVIUM Brown fat clay with some sand, very stiff, moist (CH)	40.0	79.9	22.8	104.9	28.3	PP=3.8 tsf
	5	33	100		Grades to interbedded layers of sand, silt, and gravel (GM)						Gravel= 32% Sand= 31% Fines= 37%
					Grades to wet						
15	6A 6B	95	72		Brown silty sandy gravel, very dense with cobbles and boulders, wet						Auger grinding Encountered ground water at ~14.5 ft. bgs
	7	34	100		Grades to silty, gravelly sand, medium dense to dense, wet (SM) Brown silty gravelly sand and volcanic cobbles and boulders, dense, wet (SM)						Gravel= 22% Sand= 58% Fines= 20%
20	8A 8B	124	44		Brown, silty sandy gravel, rounded, friable, cemented, contains cobbles and boulders, dense to very dense, (GP-GM)	29.7	92.6				Gravel= 51% Sand= 38% Fines= 11%
											Auger to 25 ft. bgs Driller reports possible gravel conditions. Slight auger chatter

SALT LAKE ELEMENTARY SCHOOL STRUCTURAL BMP

LOG OF BORING B-1

DATE BEGAN: 07-16-05 **DATE FINISHED:** 07-16-05 **LOGGED/CHECKED BY:** K.S / J.K

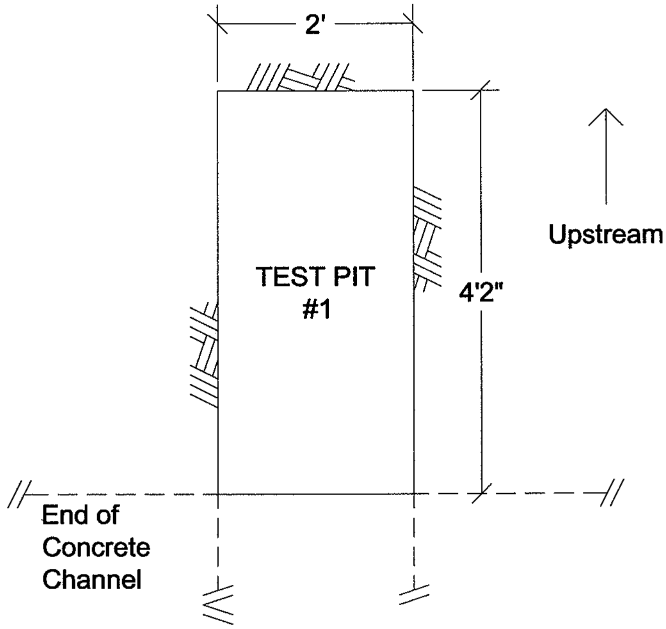
LOCATION: CORNER OF ALA LILIKOI ST. AND ALA LILIKOI PL. **HAMMER TYPE:** SAFETY

GROUND SURFACE ELEVATION: N.A. **GWL DATE/DEPTH:** 07-16-05 / ~14.5 FT. **HAMMER WEIGHT/DROP:** 140 lb/ 30 in

DRILL EQUIP: MOBILE DRILL B-53 **DRILLING METHOD:** 4" SOLID STEM AUGER / WASH BORING

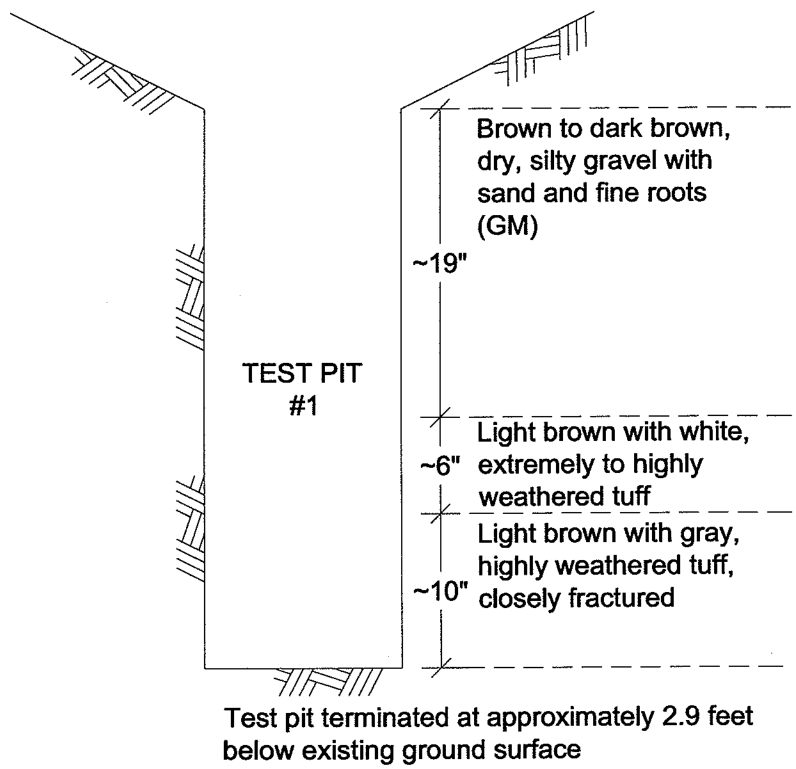
CONTRACTOR: HAWAII TEST BORING, INC **BOREHOLE BACKFILL:** CUTTINGS AND GRAVEL

DEPTH (FT.)	SAMPLE TYPE	SAMPLE NUMBER	SAMPLING RESISTENCE	RECOVERY, %	RQD, %	GRAPHIC LOG	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, pcf	UNCONFINED COMP STRENGTH, psi	LIQUID LIMIT	PLASTIC LIMIT	OTHER TESTS AND REMARKS
25		9A 9B	80 104	0 100			Contains hard cobbles and boulders						Borehole collapses, line hole with Bentonite Sampler refusal at 26' bgs. No sample obtained. Set core barrel to 26' bgs, resample (9B)
		10		20	36		Contains dense, gray, rounded volcanic gravel and occasional cobbles						Possible silt and sand matrix wash out with cuttings during coring
30		11	22	56			Dark brownish gray, gravelly, silty sand, medium dense, wet						Auger to 34 ft. bgs
							LACUSTRINE DEPOSITS Brown, fat clay with rounded gravel, very stiff, wet (CH)(lake sediments)						
35		12A 12B 12C	40	100				61.0	65.2	20.4			PP= 3.3, 4.0, 3.2 tsf
													Auger to 39 ft. bgs
40		13A 13B 13C	30	100			Very stiff, brown, clayey silt with rounded gravel						
		14	15	100			Grades to light brown varved clay (possibly contains some water laid tuff), stiff to very stiff, wet						PP= 4.0, 3.75 tsf
							Boring completed at 42.0 feet below existing ground surface on 07.16.05						
45													



PLAN VIEW WITH LOCATION AND SIZE OF TEST PIT #1
NOT TO SCALE

Date Excavated: 8/2/05
Logged by: Kealohi Sandefur (YKE)
No groundwater encountered



PROFILE VIEW WITH ENCOUNTERED SOIL CONDITIONS
NOT TO SCALE

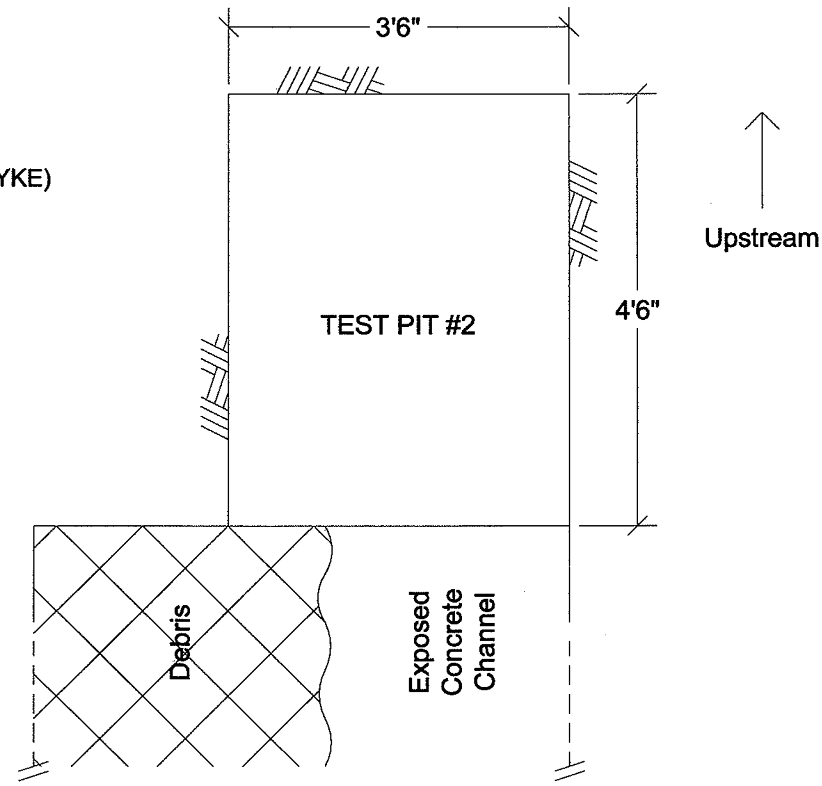
PLAN AND PROFILE VIEW OF TEST PIT #1
UPPER DEBRIS BASIN
Salt Lake Elementary School Structural BMP and Debris Basins A and B
Salt Lake, Oahu, Hawaii

Project No. 05022

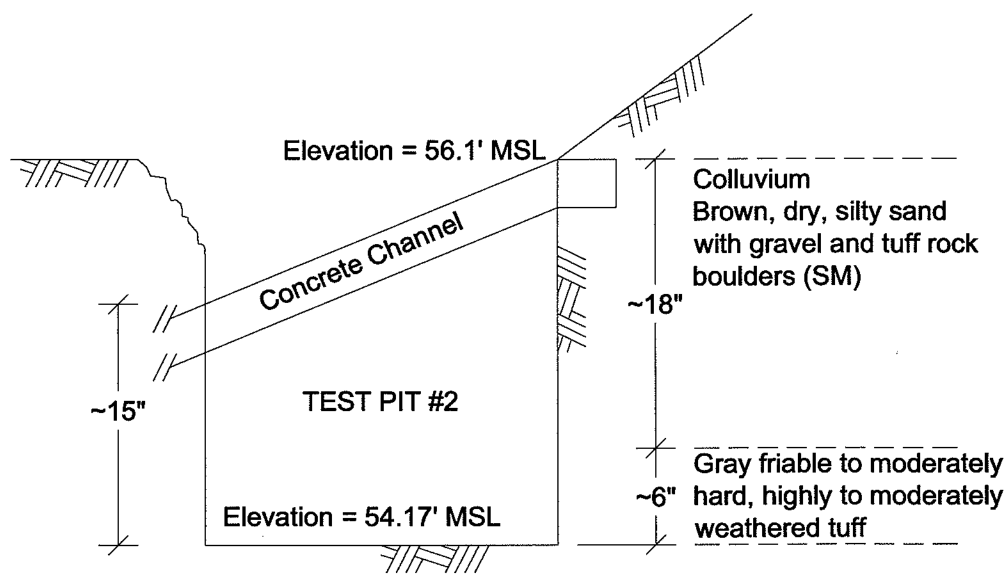
YKE

FIGURE A-5

Date Excavated: 8/3/05
Logged by: Kealohi Sandefur (YKE)
No groundwater encountered



PLAN VIEW WITH LOCATION AND SIZE OF TEST PIT #1
NOT TO SCALE



Test pit terminated at approximately 2 feet below existing ground surface

PROFILE VIEW WITH ENCOUNTERED SOIL CONDITIONS
NOT TO SCALE

PLAN AND PROFILE VIEW OF TEST PIT #2
LOWER DEBRIS BASIN

Salt Lake Elementary School Structural BMP and Debris Basins A and B
Salt Lake, Oahu, Hawaii

Project No. 05022

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FIGURE A-6

To evaluate their engineering properties, selected soil samples obtained during the field exploration were laboratory tested for moisture content, dry density, grain sizes by sieve analyses, plasticity index (Atterberg Limits), unconfined compression strength tests, California Bearing Ratios and consolidation tests. Because of the gravelly nature of the soils sampled, a direct shear test could not be performed. The tests and results are described in the following paragraphs.

B.1 Moisture Content and Dry Density

Selected relatively undisturbed soil samples were tested to measure their moisture contents and dry densities. The tests were performed in accordance with American Society for Testing and Materials (ASTM) Method D2216. Results of the moisture contents and dry densities are presented on the Log of Borings at the appropriate sample depths.

B.2 Gradation Analyses

Gradation analyses (ASTM D422) were performed on selected samples using both the sieve and hydrometer methods to evaluate grain size distribution. Results of sieve tests are presented on Figure B-1.

B.3 Atterberg Limits (Plasticity Index)

To assist in classifying the soils, Plasticity Index tests were performed on selected samples. These tests were performed in accordance with ASTM D4318. The results are presented on Figure B-2, and are also indicated on the Log of Borings.

B.4 Unconfined Compression Strength Tests

Intact rock core and soil samples were tested under unconfined compression (UC) conditions according to ASTM D2938 to evaluate compressive strength. The unconfined compressive strength of the selected rock core and soil samples are presented in Table B-1. The unconfined compressive strengths of the selected soil samples are presented on Figure B-3.

Table B-1
Unconfined Compression Strength Test Results

Boring	Depth * (feet)	Geologic Description	UCS (psi)
B-1	11.0	Alluvium	22.8
B-1	35.0	Lacustrine Deposits	20.4
TP-2	2.0	Volcanic Tuff	2,573

* Depth below existing ground surface

B.5 CALIFORNIA BEARING RATIO TEST

One (1) California Bearing Ratio test was performed on a bulk sample in accordance with ASTM D1883. The results are presented in Table B-2.

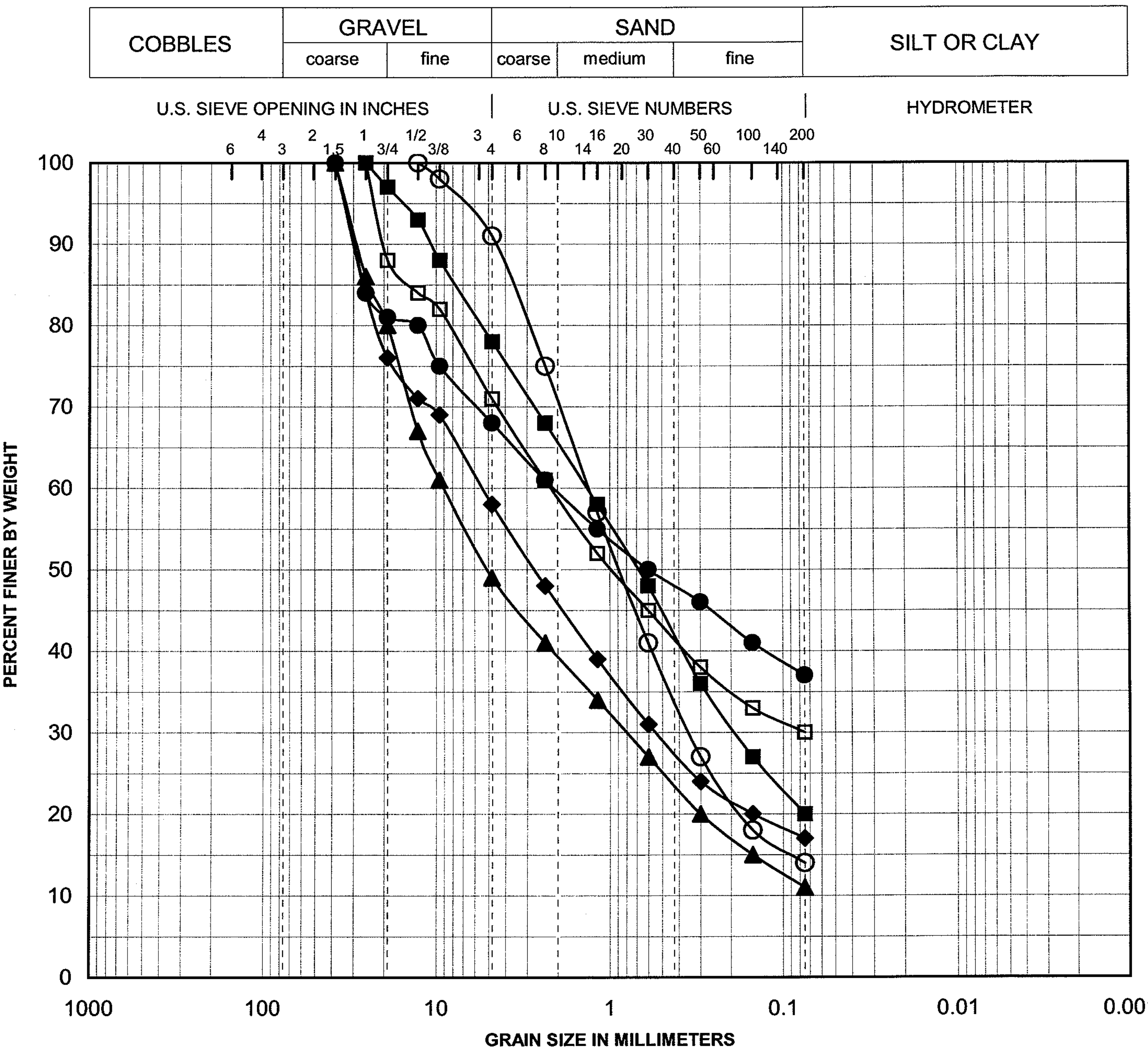
Table B-2
California Bearing Ratio Test Results

Boring	Depth * (feet)	Description	Expansion (%)	CBR @ 0.1"
TP-?	0.5 – 1.0	Silty gravel	2.2	5.4

* Depth below existing ground surface

B.6 ONE-DIMENSIONAL CONSOLIDATION TEST

The compressibility of relatively undisturbed soil samples was determined by the performance of the one-dimensional consolidation test in accordance with ASTM D2435. Results of these tests are presented on Figure B-4.



Symbol	Boring	Depth (ft)	Description	LL %	PI %	Gravel %	Sand %	Fines %
●	B-5	12.5	Silty gravel with sand (GM)			32	31	37
■	B-7	17.5	Silty sand with gravel (SM)			22	58	20
▲	B-8B	21.0	Poorly graded gravel with silt and sand (GP-GM)			51	38	11
◆	TP-1	1.0	Silty gravel with sand (GM)			42	41	17
○	TP-1	3.5	Silty sand (SM)			9	77	14
□	TP-2	1.0	Silty sand with gravel (SM)			29	41	30

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Salt Lake, Oahu, Hawaii

GRAIN SIZE DISTRIBUTION CURVES

Project Number: 05028

FIGURE B-1

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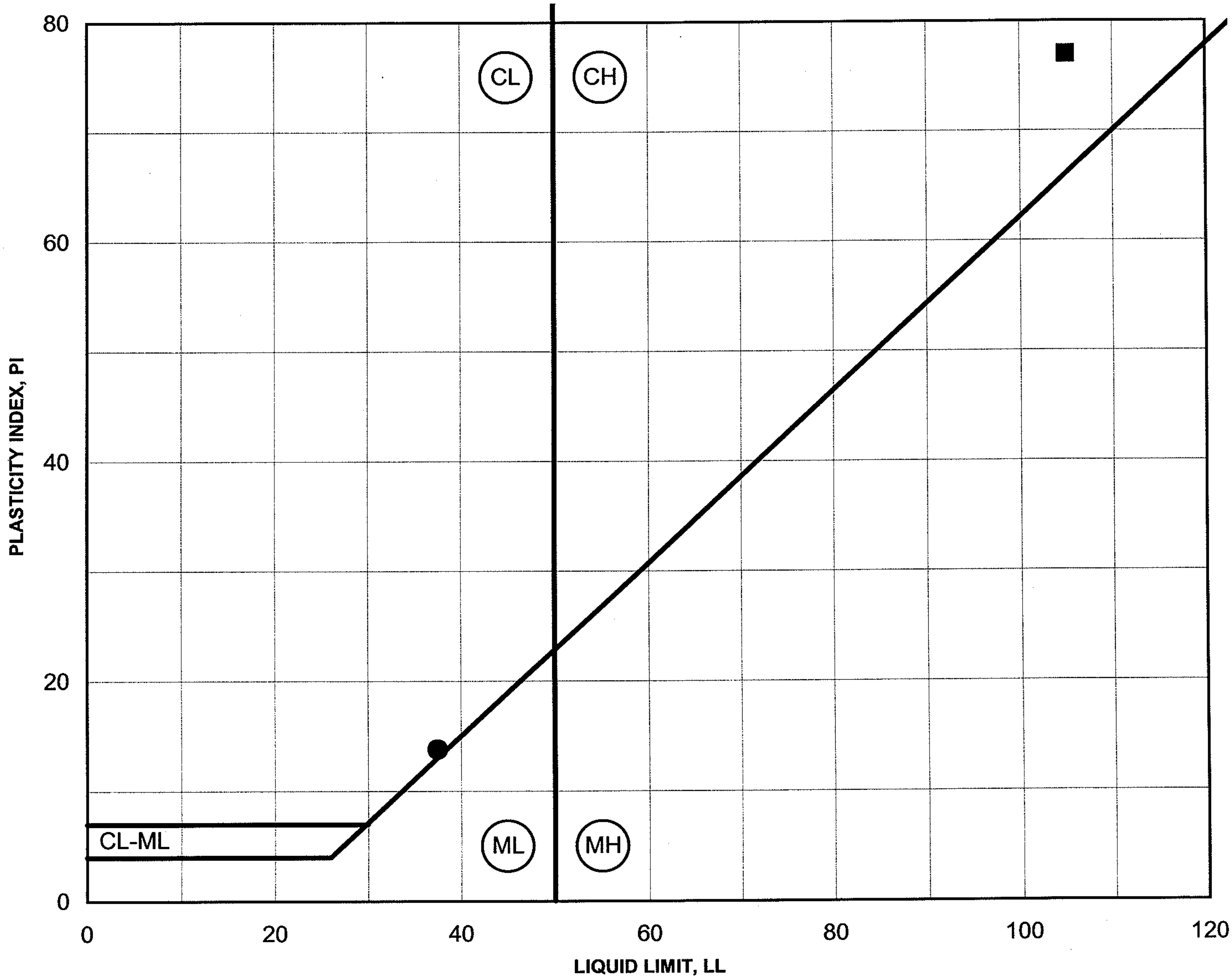

Boring		Depth (ft)	Classification	LL %	PL %	PI %
●	B-1	6.0	Lean clay (CL)	38	24	14
■	B-1	11.0	Fat clay (CH)	105	28	77
▲						0
◆						0
○						
□						
△						
◇						
×						
+						

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Salt Lake, Oahu, Hawaii

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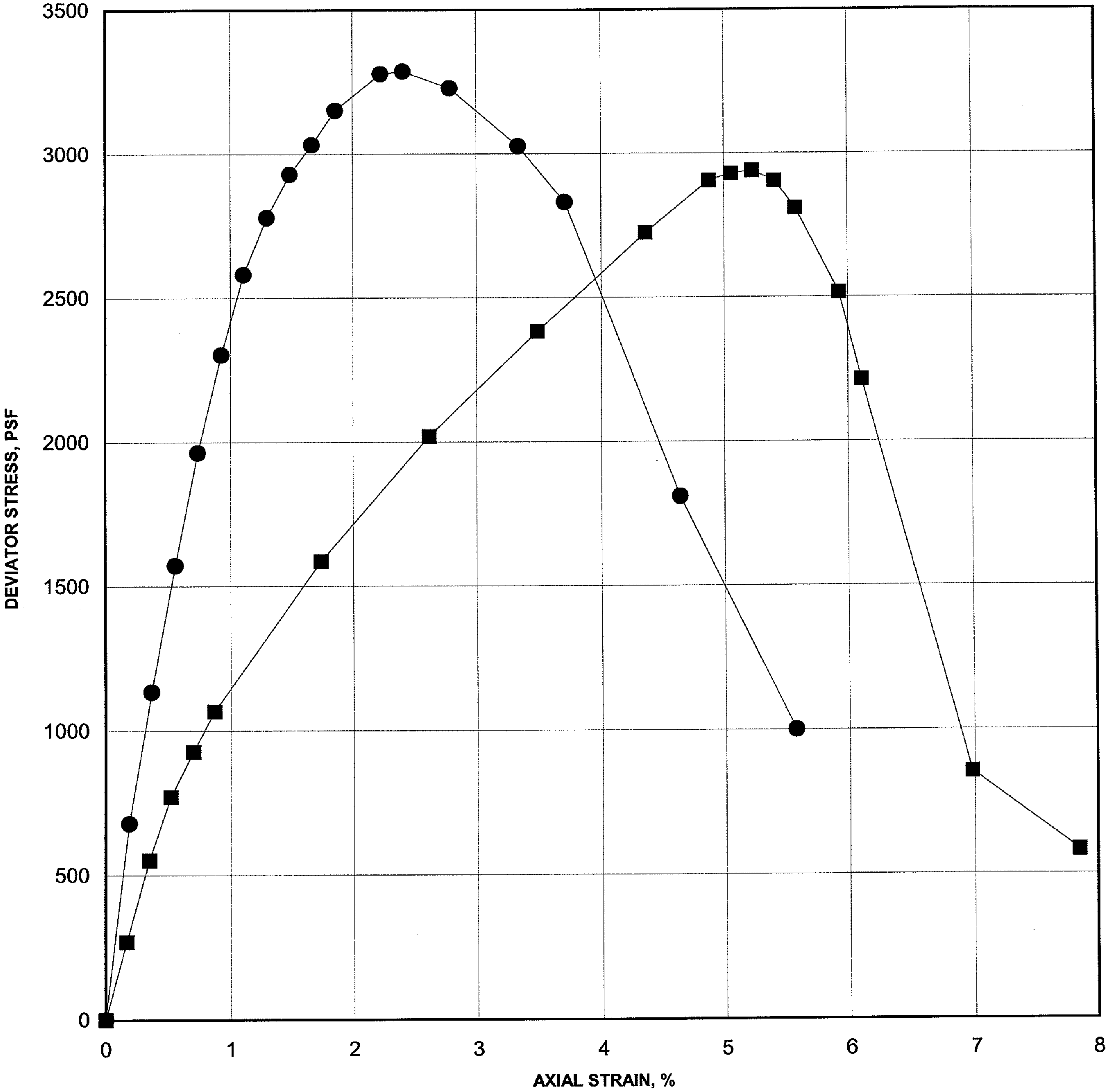
PLASTICITY CHART

FIGURE B-2

YKE



Boring		Depth (ft)	Classification	UCS (psf)	w_o (%)	γ_d (pcf)
●	B-1	11.0	Very stiff, brown, fat clay with some sand (CH), alluvium	3286	40.0	79.9
■	B-1	35.0	Very stiff, brown, fat clay with rounded gravel (CH), lacustrine	2939	61.0	65.2
▲						
◆						

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Salt Lake, Oahu, Hawaii

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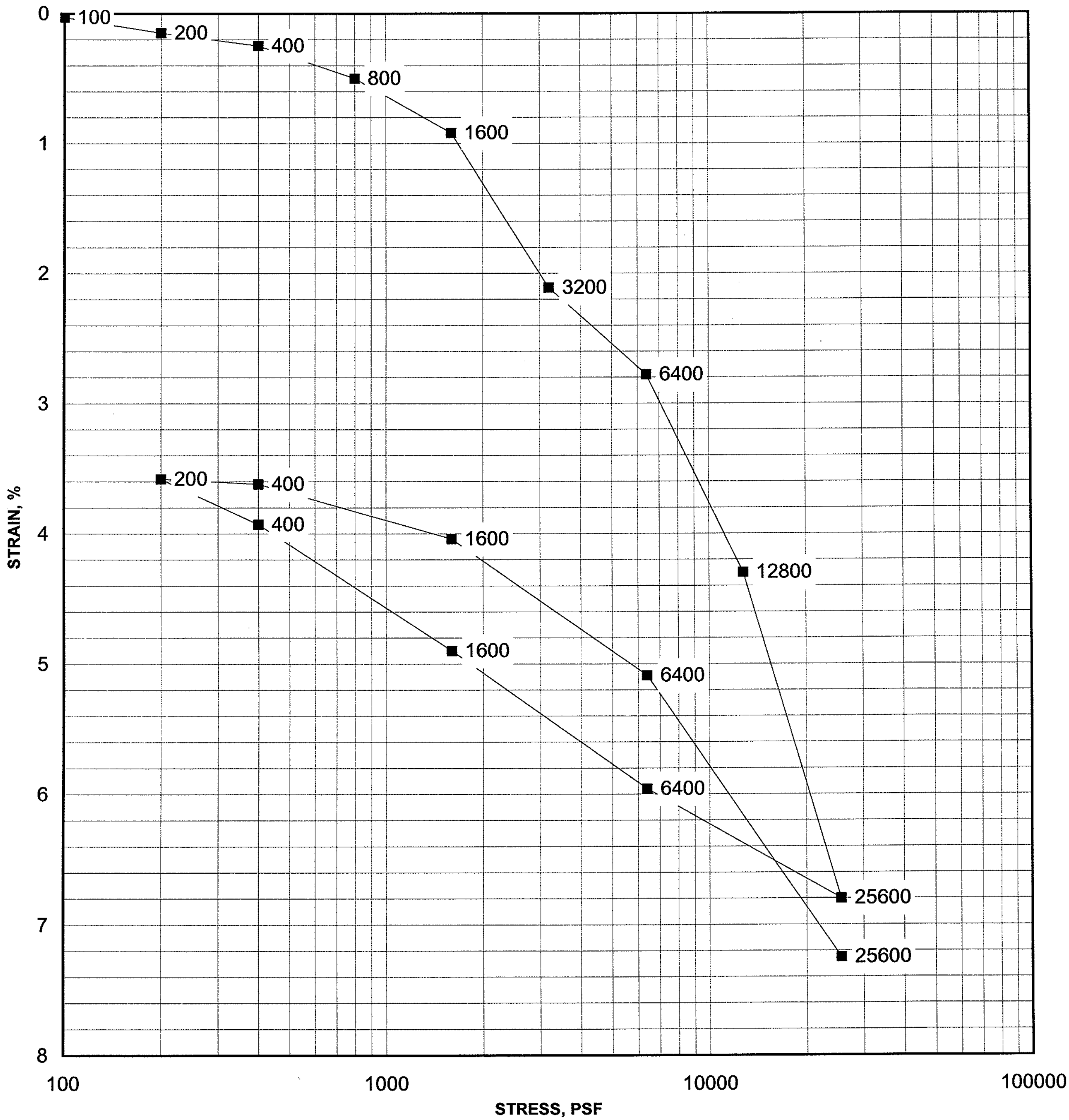
UNCONFINED COMPRESSION STRENGTH TEST

FIGURE B-3

YKE



Boring	Depth (ft)	Description	p_o (psf)	$C_{\varepsilon c}$	$C_{\varepsilon r}$	t_{50} (min)	t_{90} (min)	c_v (in^2/min)	w_o (%)	γ_d (pcf)
B-1	35.0	V. stiff fat clay (CH)	5000	12.56	11.56	<0.1	0.49	1.73	54.7	69.4

Project: Salt Lake Elementary School Structural BMP

Salt Lake, Oahu, Hawaii

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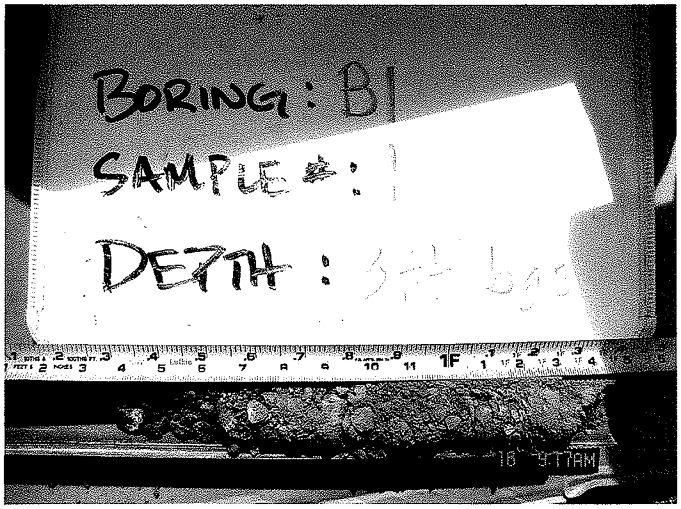
CONSOLIDATION TEST

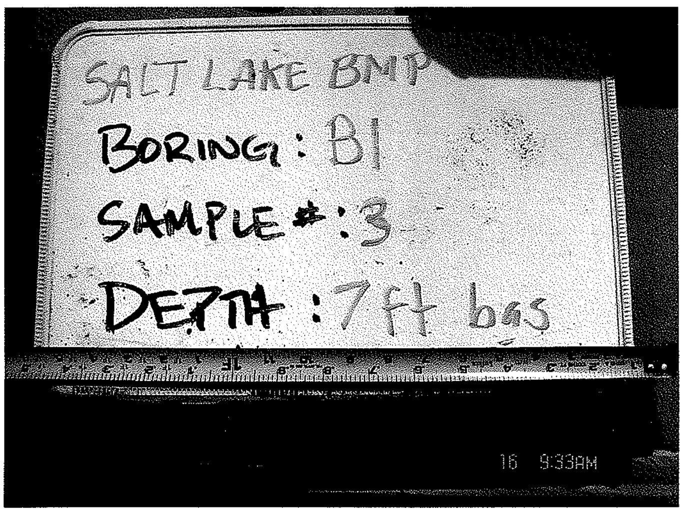
FIGURE B-4

YKE

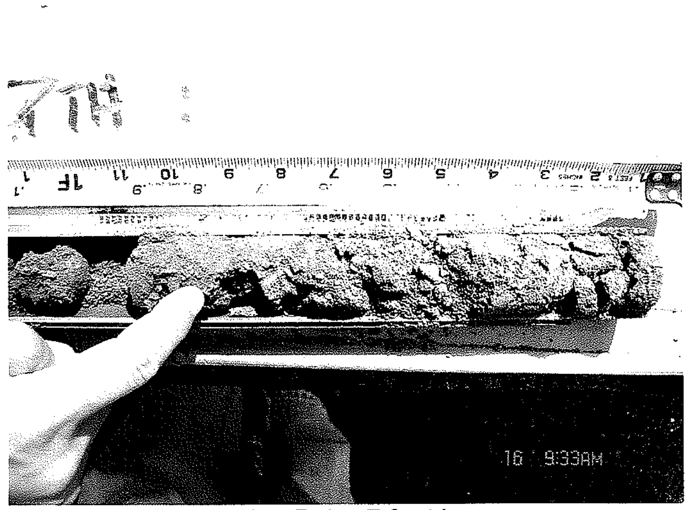


Boring B-1 – 3 feet bgs

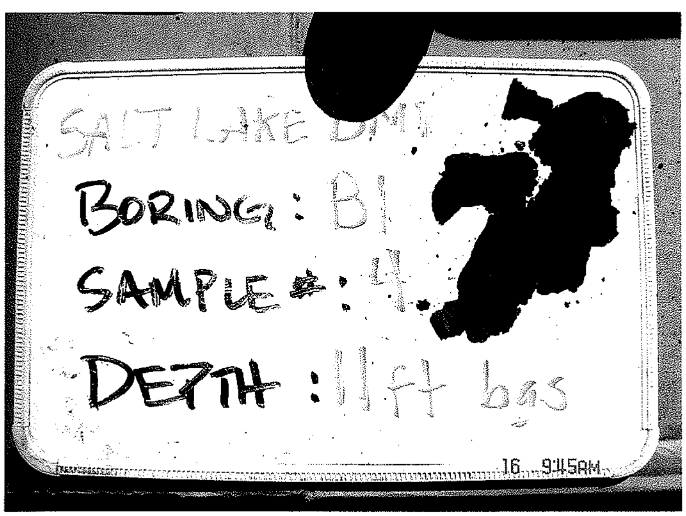
Boring B-1 – 6 feet bgs



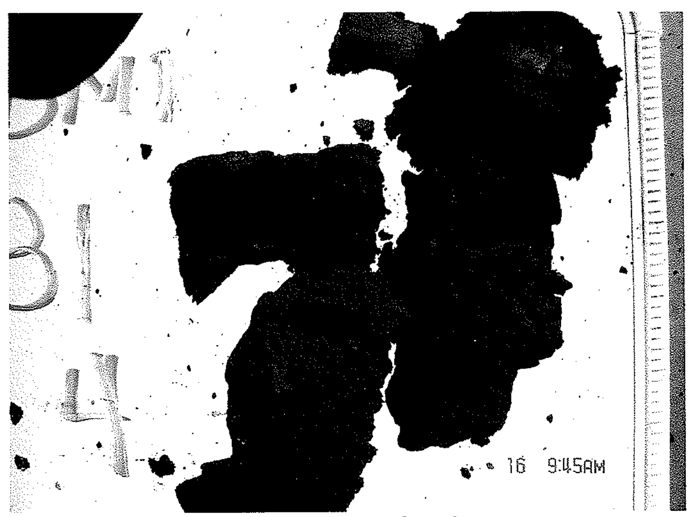
Boring B-1 – 7 feet bgs



Boring B-1 – 7 feet bgs



Boring B-1 – 11 feet bgs



Boring B-1 – 11 feet bgs

PHOTOGRAPHS OF SELECTED SOIL SAMPLES, ROCK CORES, TEST PITS, AND CULVERT

Salt Lake Elementary School Structural BMP and Debris Basins
Salt Lake, Oahu, Hawaii

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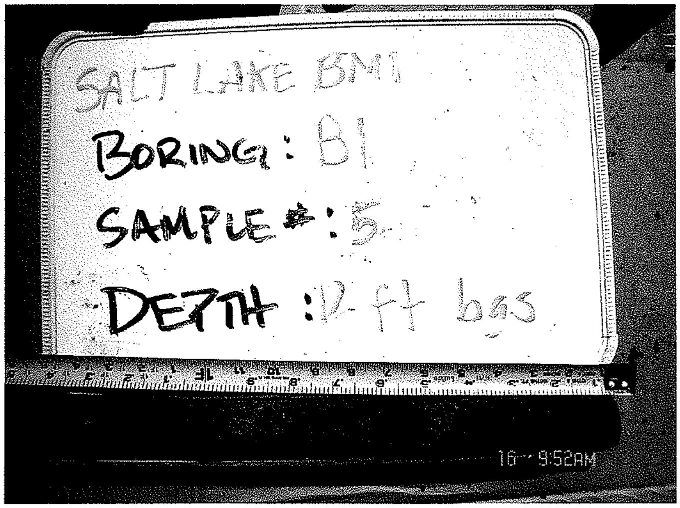
FIGURE C-1

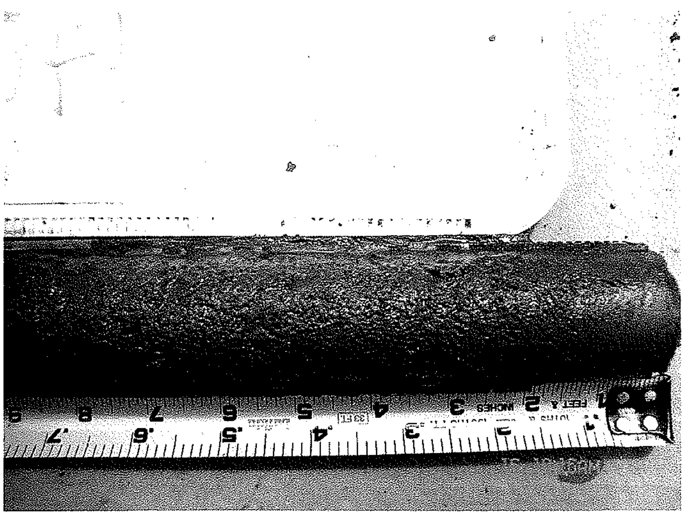


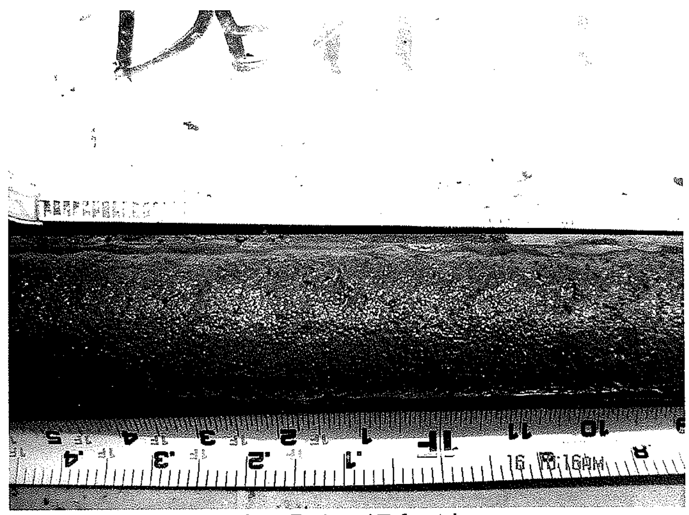
Boring B-1 – 12 feet bgs


Boring B-1 – 12 feet bgs


Boring B-1 – 12 feet bgs

Boring B-1 – 17 feet bgs


Boring B-1 – 17 feet bgs


Boring B-1 – 17 feet bgs

PHOTOGRAPHS OF SELECTED SOIL SAMPLES, ROCK CORES, TEST PITS, AND CULVERT

Salt Lake Elementary School Structural BMP and Debris Basins
Salt Lake, Oahu, Hawaii

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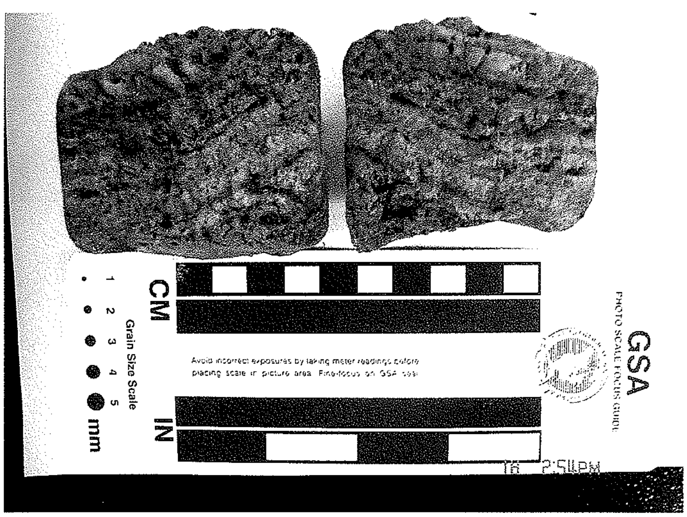
FIGURE C-2

Boring B-1 – 21 feet bgs

Boring B-1 – 21 feet bgs

Boring B-1 – 26 feet bgs

Boring B-1 – 40.5 feet bgs



Boring B-1 – 40.5 feet bgs

Boring B-1 – 35.5 feet bgs

PHOTOGRAPHS OF SELECTED SOIL SAMPLES,
ROCK CORES, TEST PITS, AND CULVERT

Salt Lake Elementary School Structural BMP and Debris Basins
Salt Lake, Oahu, Hawaii

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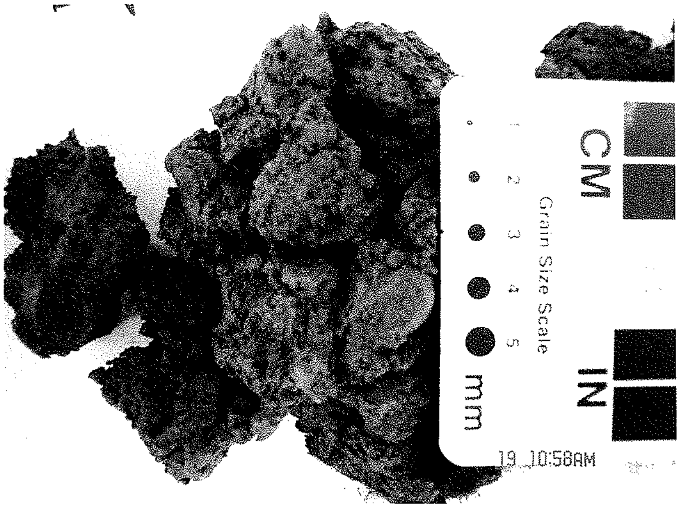
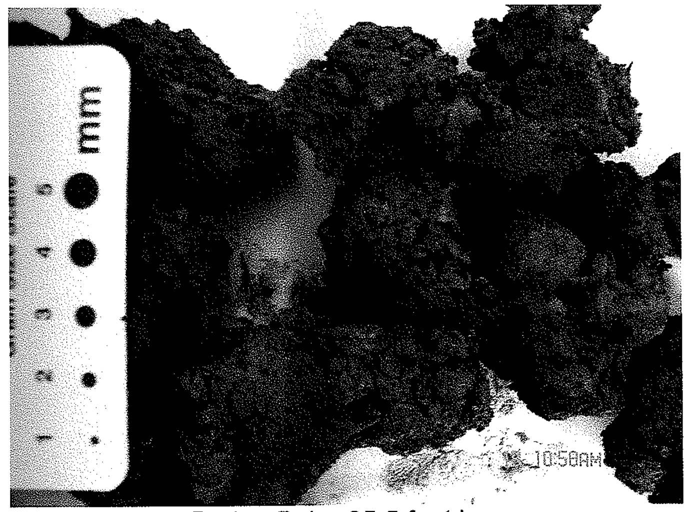
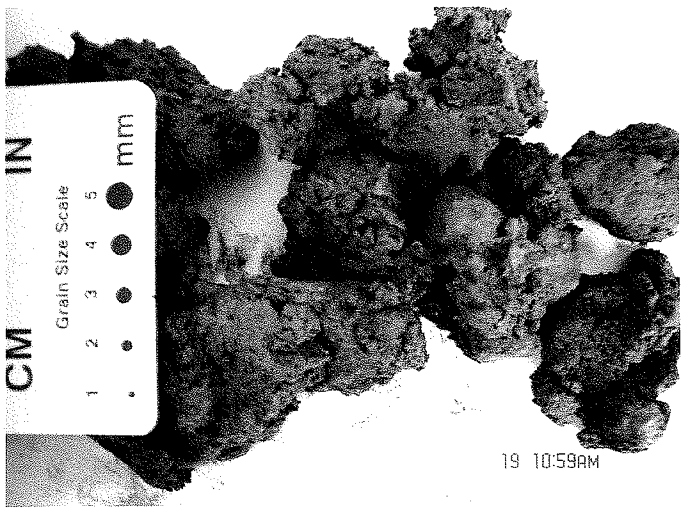
FIGURE C-3



Boring B-1 – 35.5 feet bgs

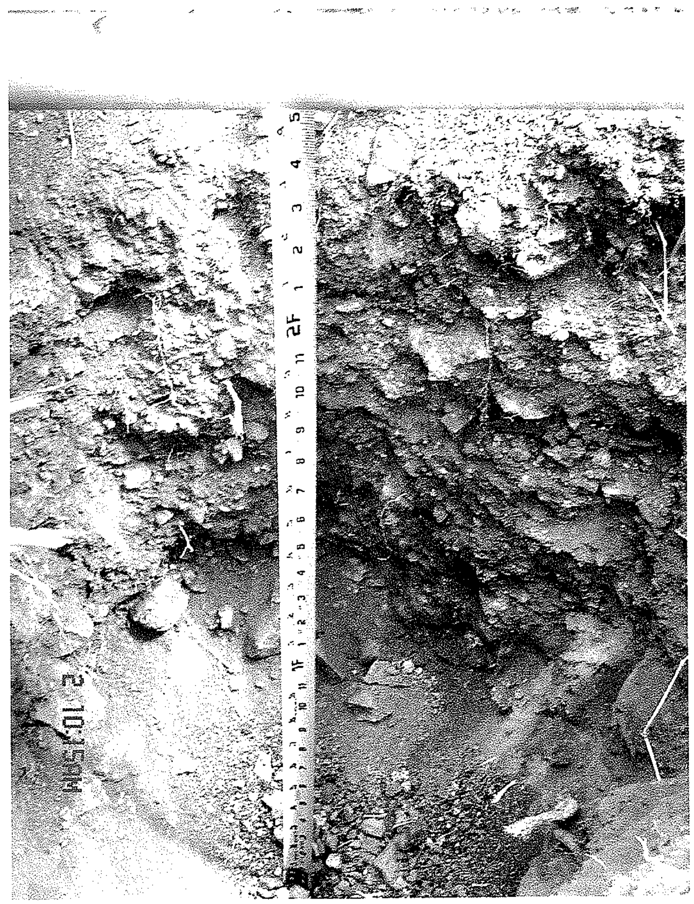


Boring B-1 – 35.5 feet bgs



Boring B-1 – 35.5 feet bgs


Test Pit #2 – Excavated to 24 inches bgs


Test Pit #1 – Excavated to 30 inches bgs

PHOTOGRAPHS OF SELECTED SOIL SAMPLES, ROCK CORES, TEST PITS, AND CULVERT

Salt Lake Elementary School Structural BMP and Debris Basins
Salt Lake, Oahu, Hawaii

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FIGURE C-4

Water infiltration seen at entrance to culvert

Water infiltration seen at entrance to culvert

Water infiltration seen at entrance to culvert

High water line mark in culvert

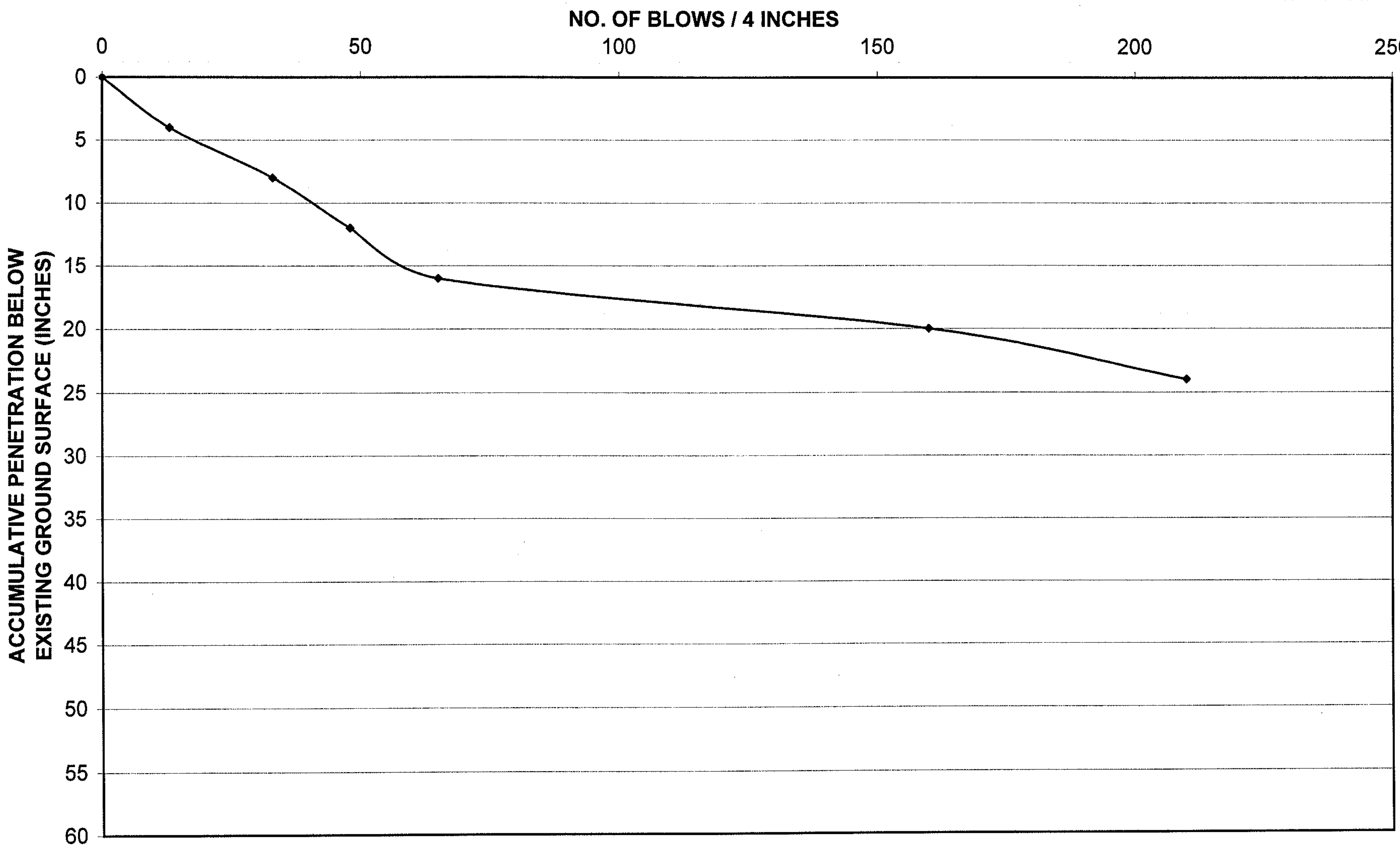
PHOTOGRAPHS OF SELECTED SOIL SAMPLES,
ROCK CORES, TEST PITS, AND CULVERT

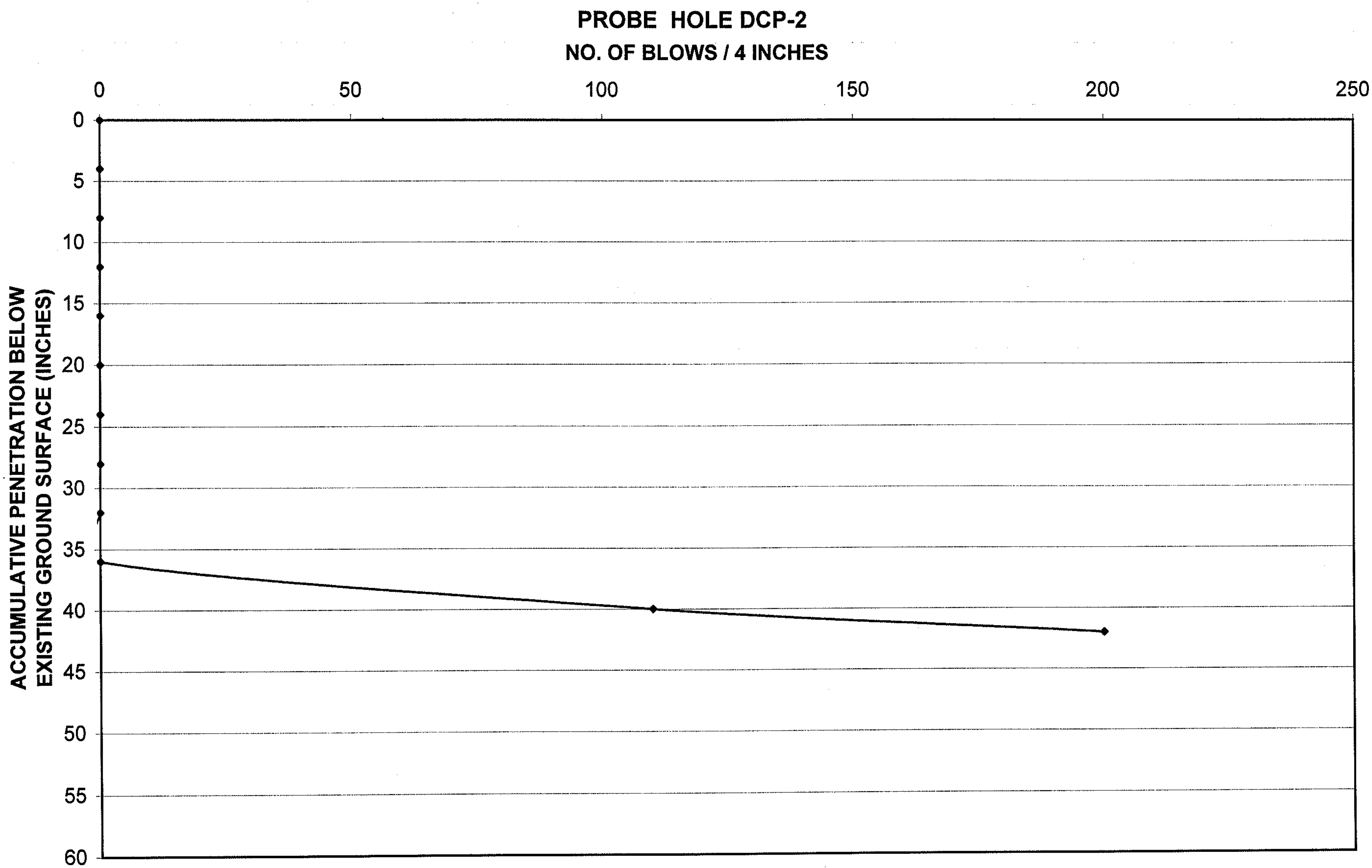
Salt Lake Elementary School Structural BMP and Debris Basins
Salt Lake, Oahu, Hawaii

Project No.

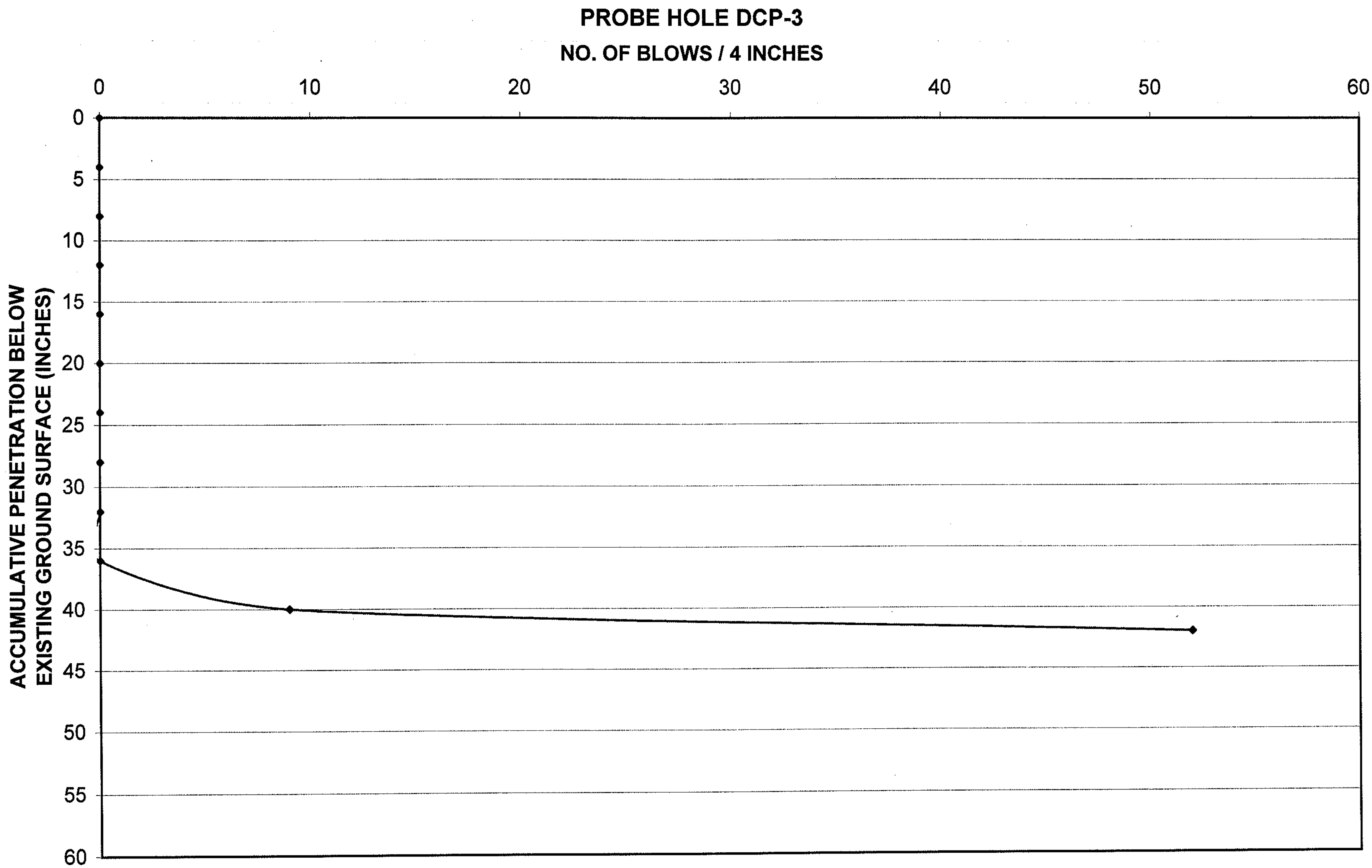
FIGURE C-5

PROBE HOLE DCP-1



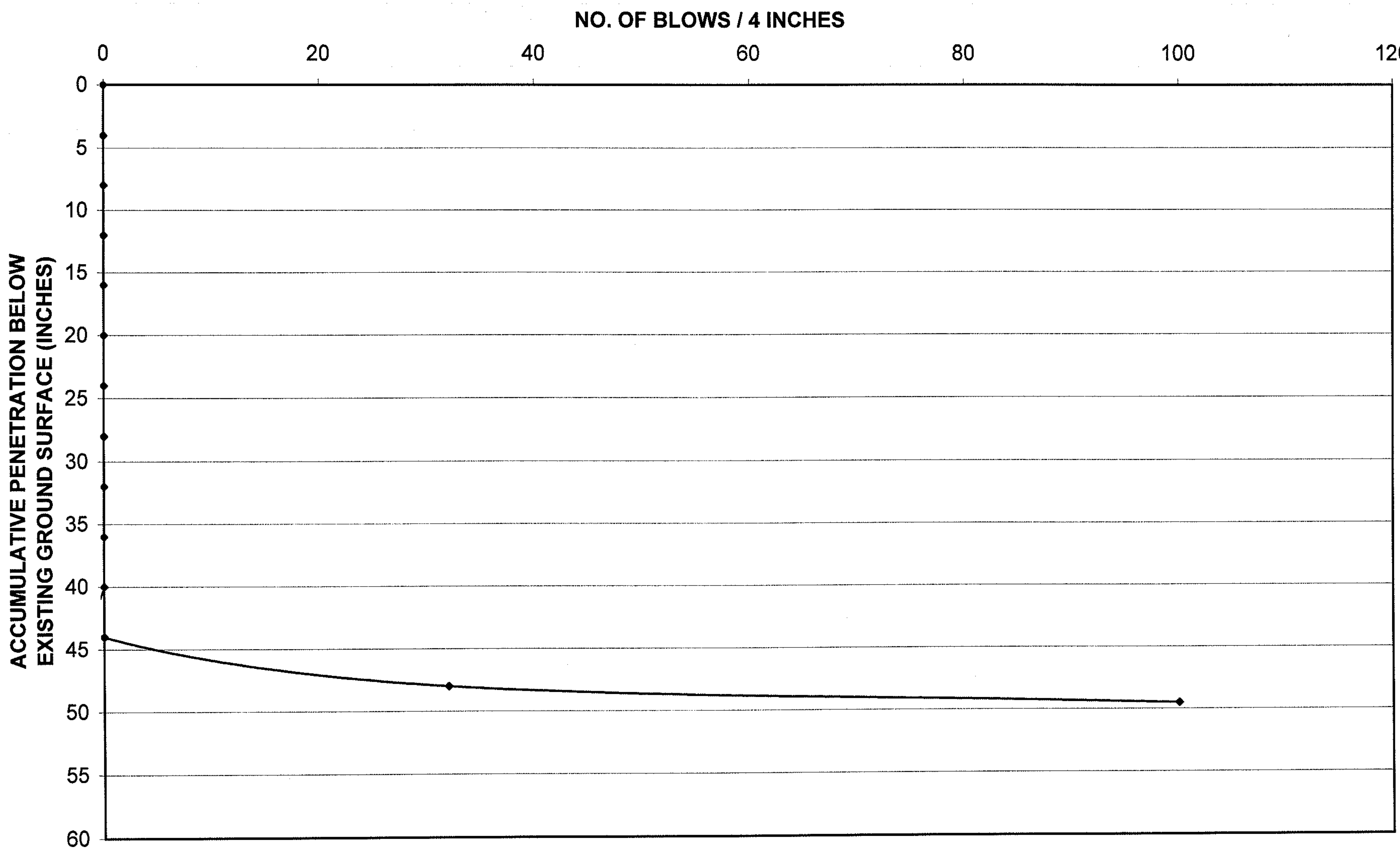


PROBE HOLE DCP-2
NO. OF BLOWS / 4 INCHES
0
50
100
150
200
250
ACCUMULATIVE PENETRATION BELOW EXISTING GROUND SURFACE (INCHES)
0
5
10
15
20
25
30
35
40
45
50
55
60

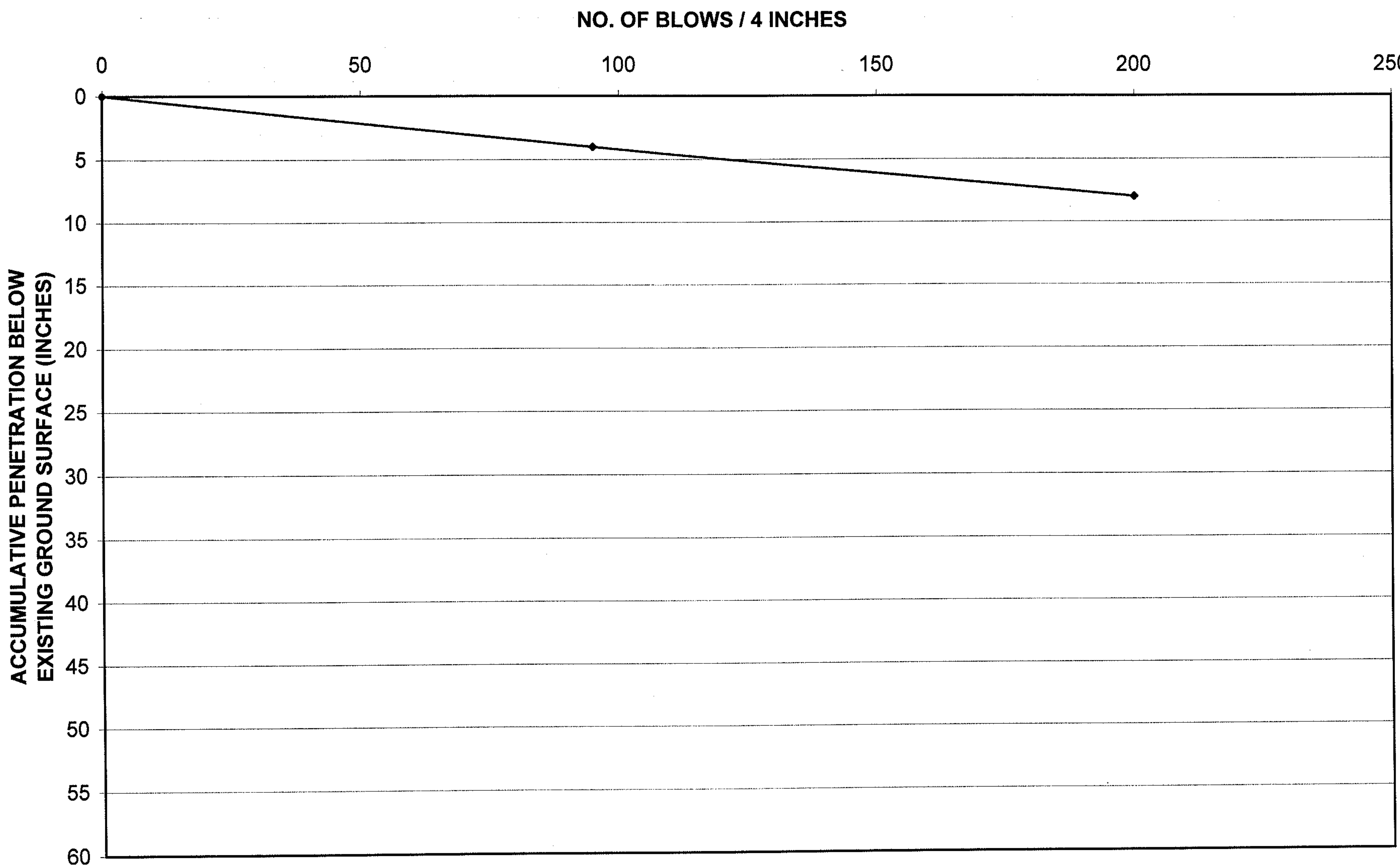


PROBE HOLE DCP-3
NO. OF BLOWS / 4 INCHES
0
10
20
30
40
50
60
ACCUMULATIVE PENETRATION BELOW EXISTING GROUND SURFACE (INCHES)
0
5
10
15
20
25
30
35
40
45
50
55
60

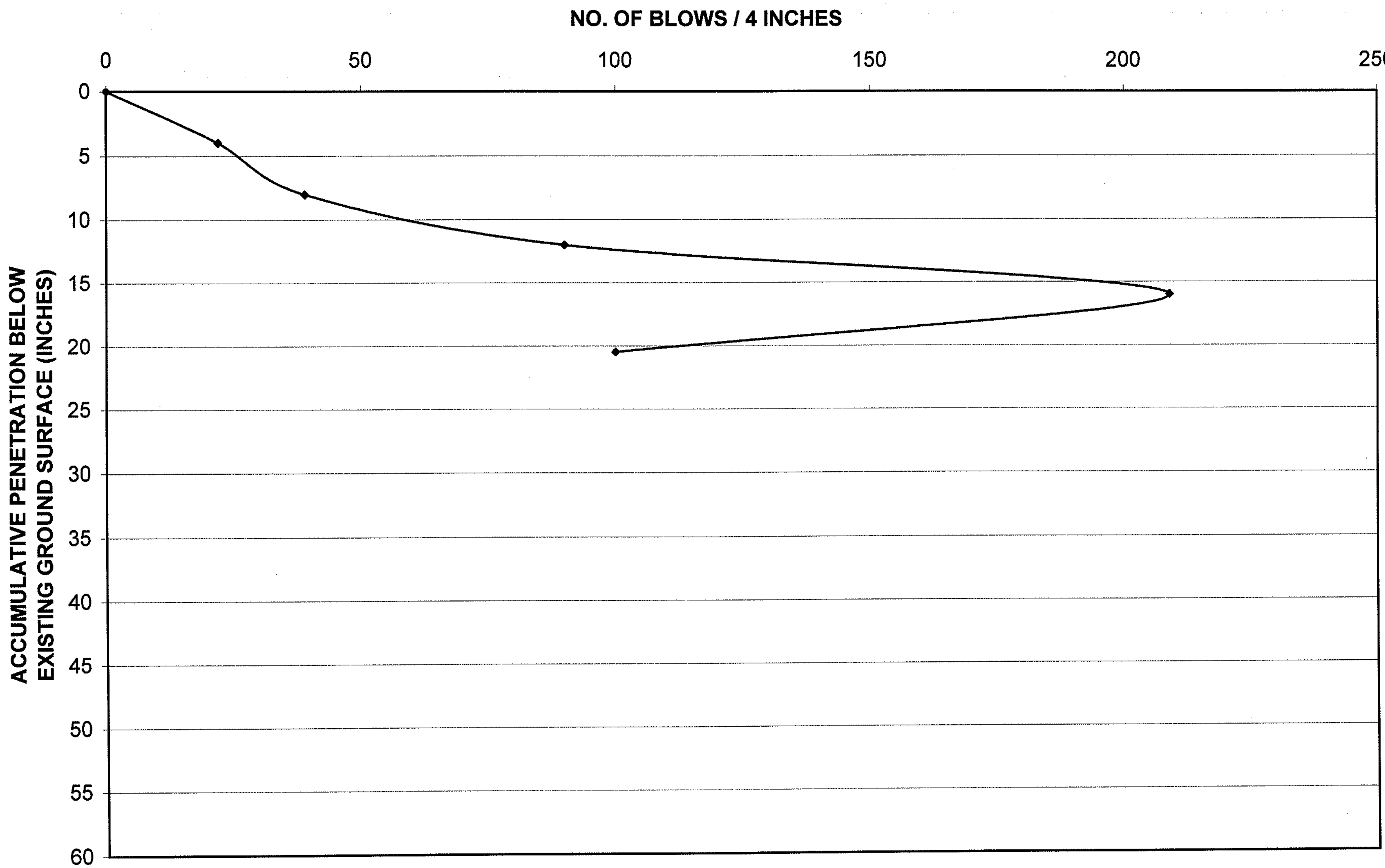
PROBE HOLE DCP-4

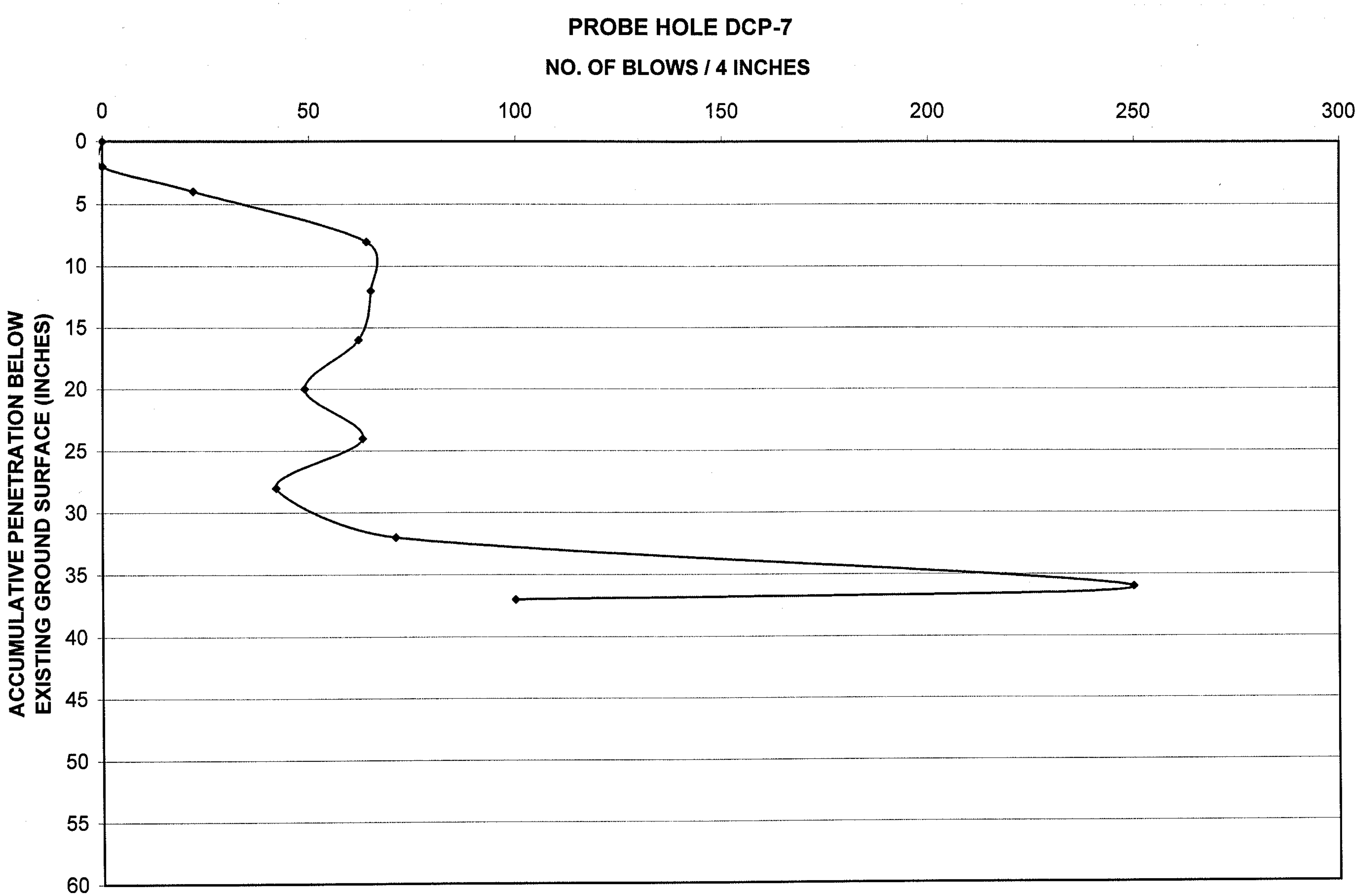


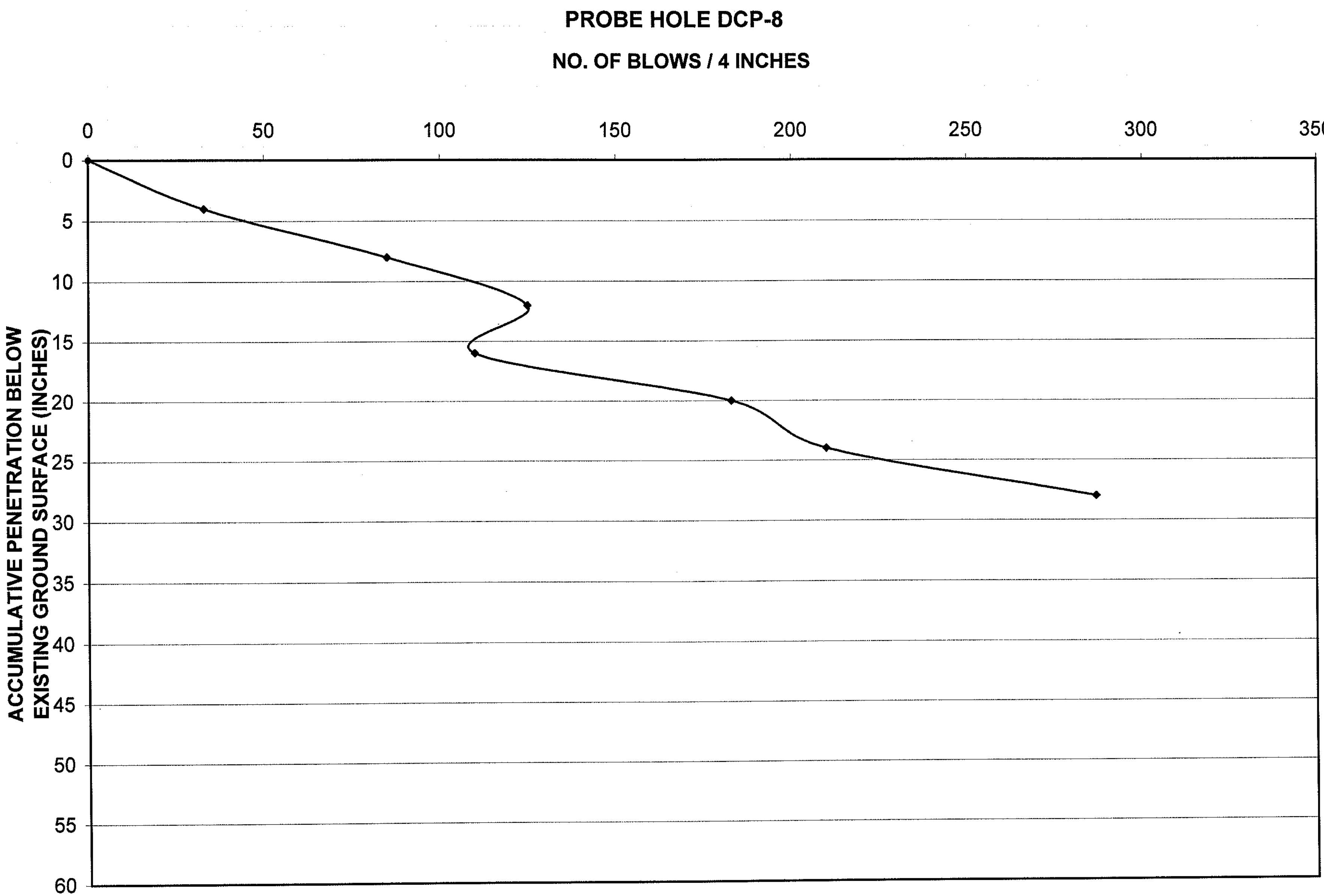
PROBE HOLE DCP-5

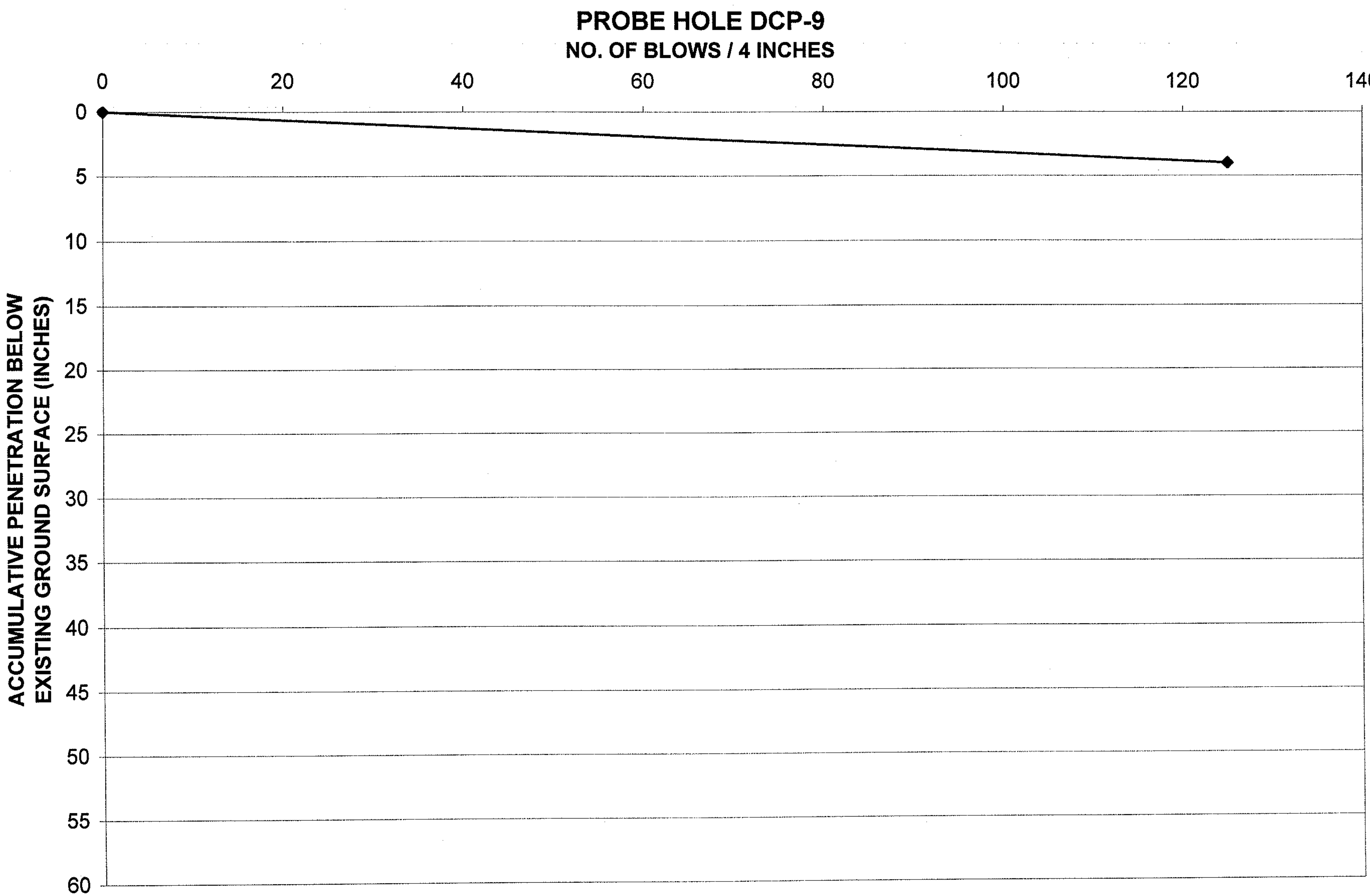


PROBE HOLE DCP-6

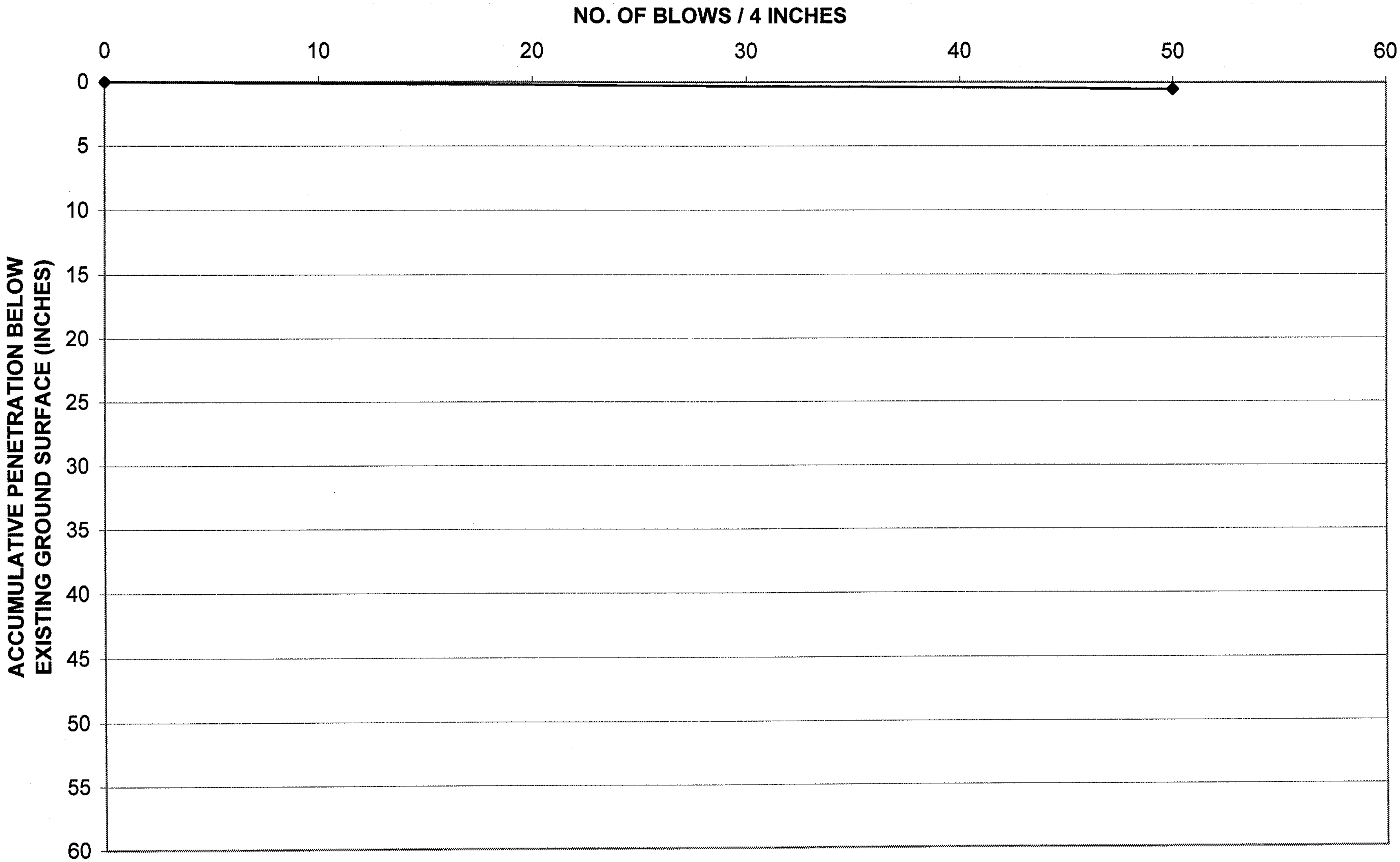


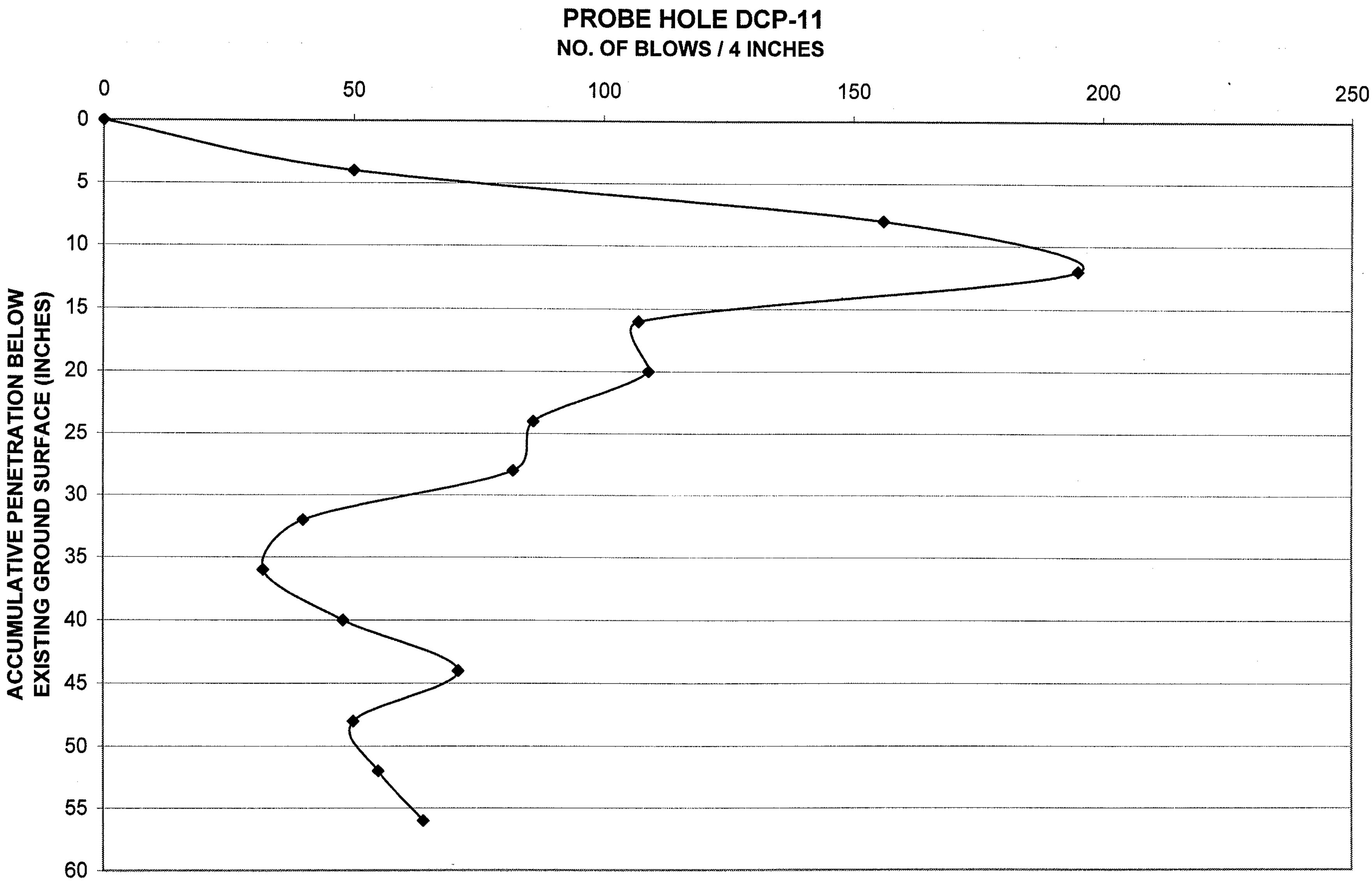

PROBE HOLE DCP-7
NO. OF BLOWS / 4 INCHES
0
50
100
150
200
250
300
ACCUMULATIVE PENETRATION BELOW EXISTING GROUND SURFACE (INCHES)
0
5
10
15
20
25
30
35
40
45
50
55
60


PROBE HOLE DCP-8
NO. OF BLOWS / 4 INCHES
0
50
100
150
200
250
300
350
ACCUMULATIVE PENETRATION BELOW EXISTING GROUND SURFACE (INCHES)
0
5
10
15
20
25
30
35
40
45
50
55
60

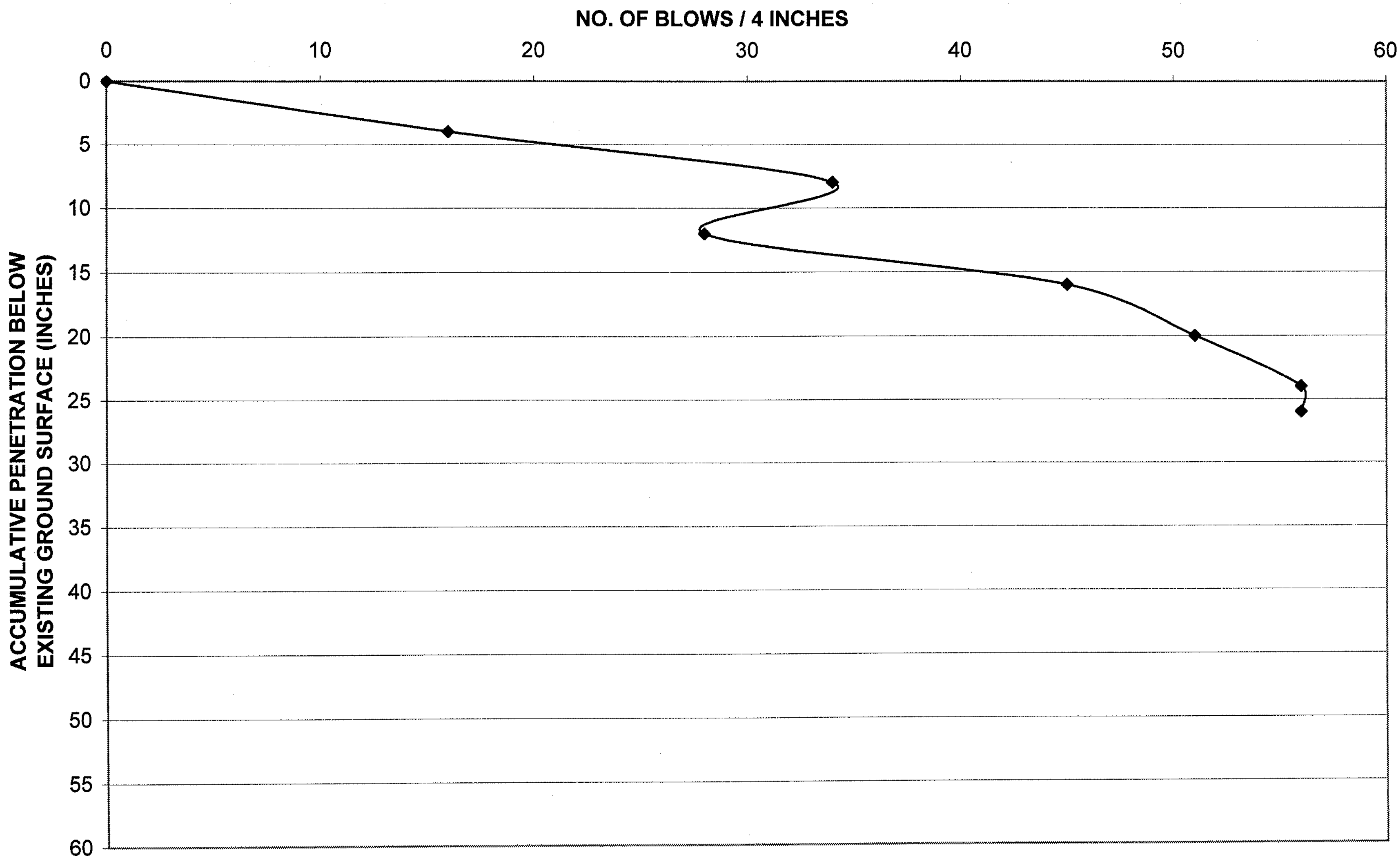

PROBE HOLE DCP-9
NO. OF BLOWS / 4 INCHES
0
20
40
60
80
100
120
140
ACCUMULATIVE PENETRATION BELOW EXISTING GROUND SURFACE (INCHES)
0
5
10
15
20
25
30
35
40
45
50
55
60

PROBE HOLE DCP-10



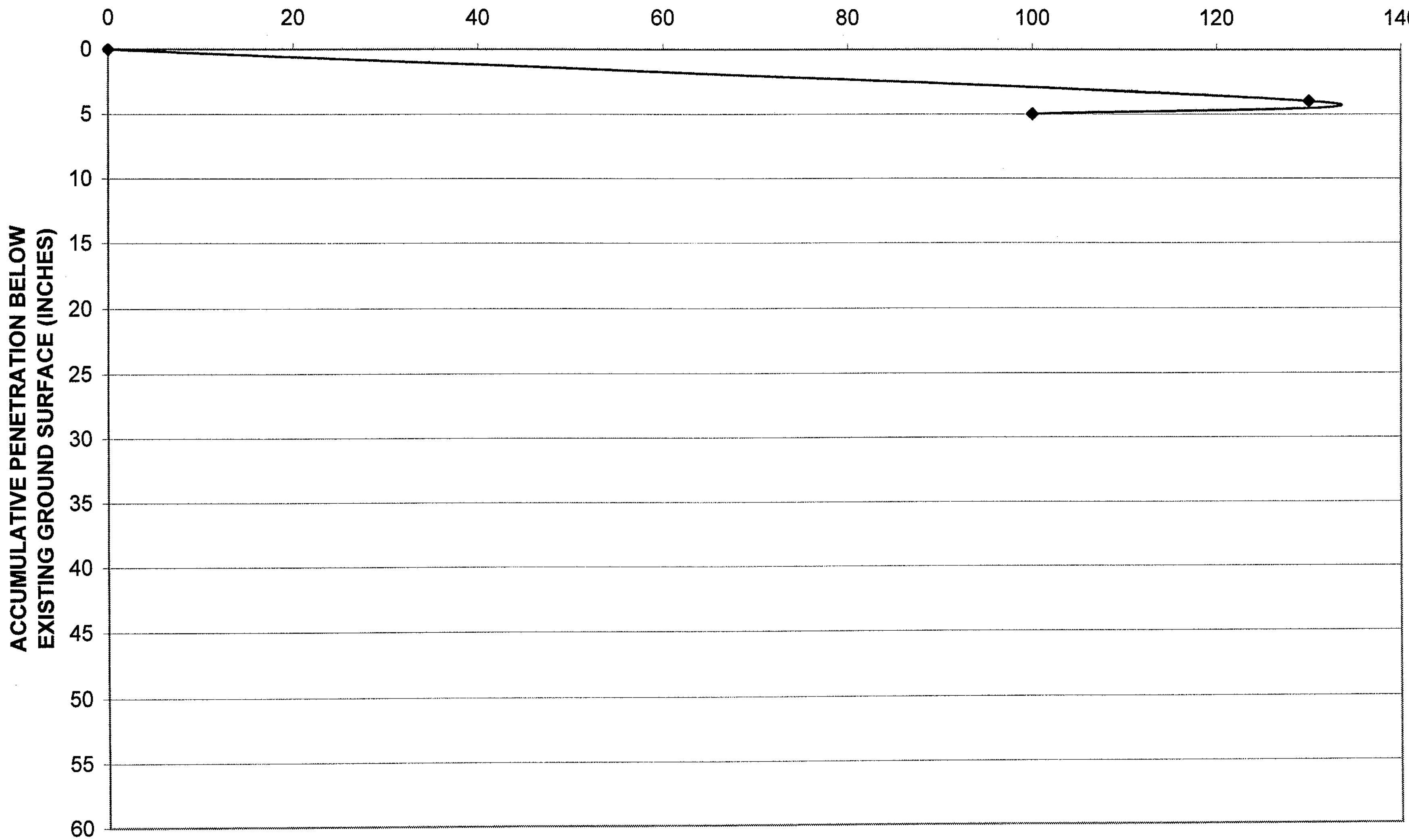

PROBE HOLE DCP-11
NO. OF BLOWS / 4 INCHES
0
50
100
150
200
250
0
5
10
15
20
25
30
35
40
45
50
55
60
ACCUMULATIVE PENETRATION BELOW
EXISTING GROUND SURFACE (INCHES)

PROBE HOLE DCP-12

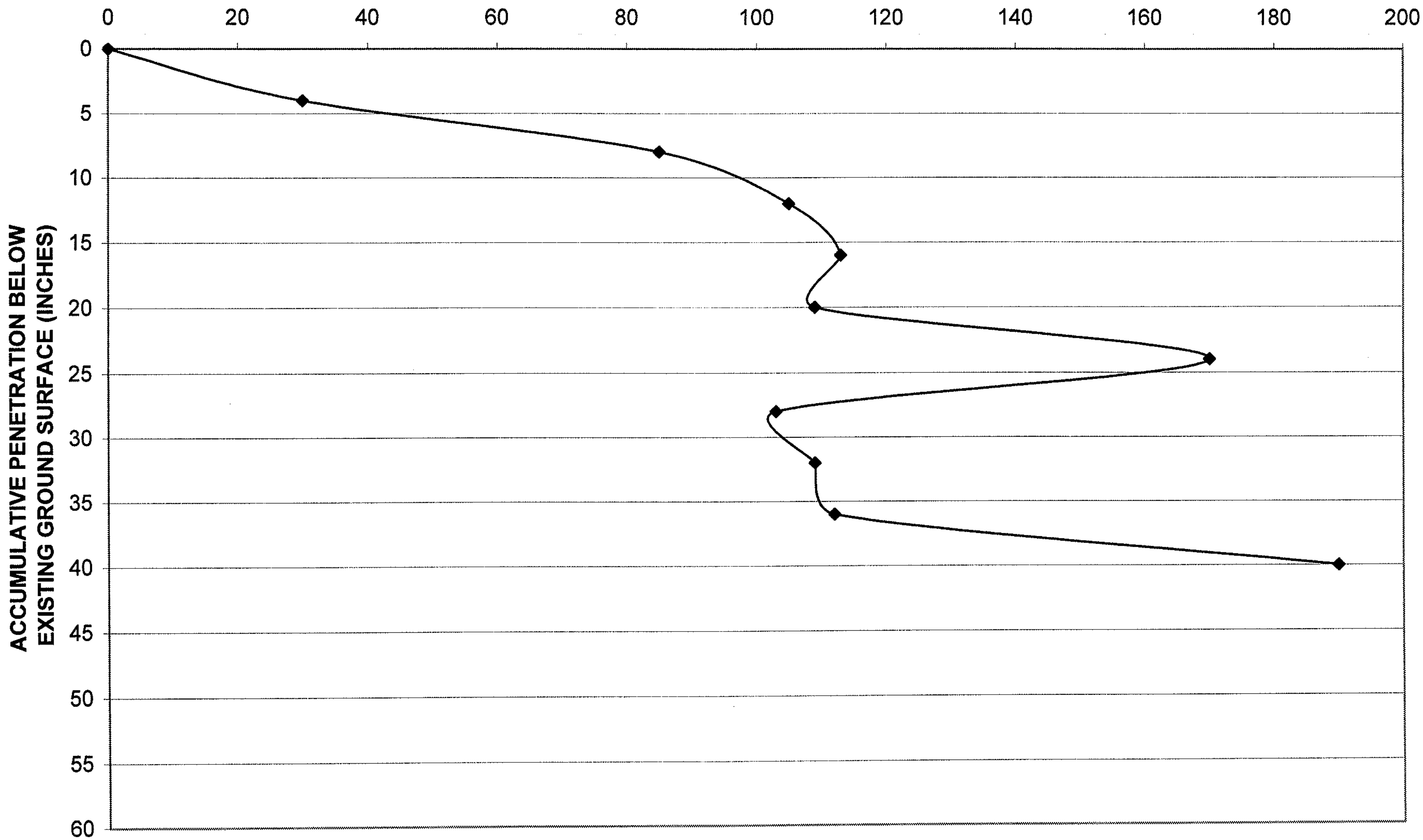


PROBE HOLE DCP-13

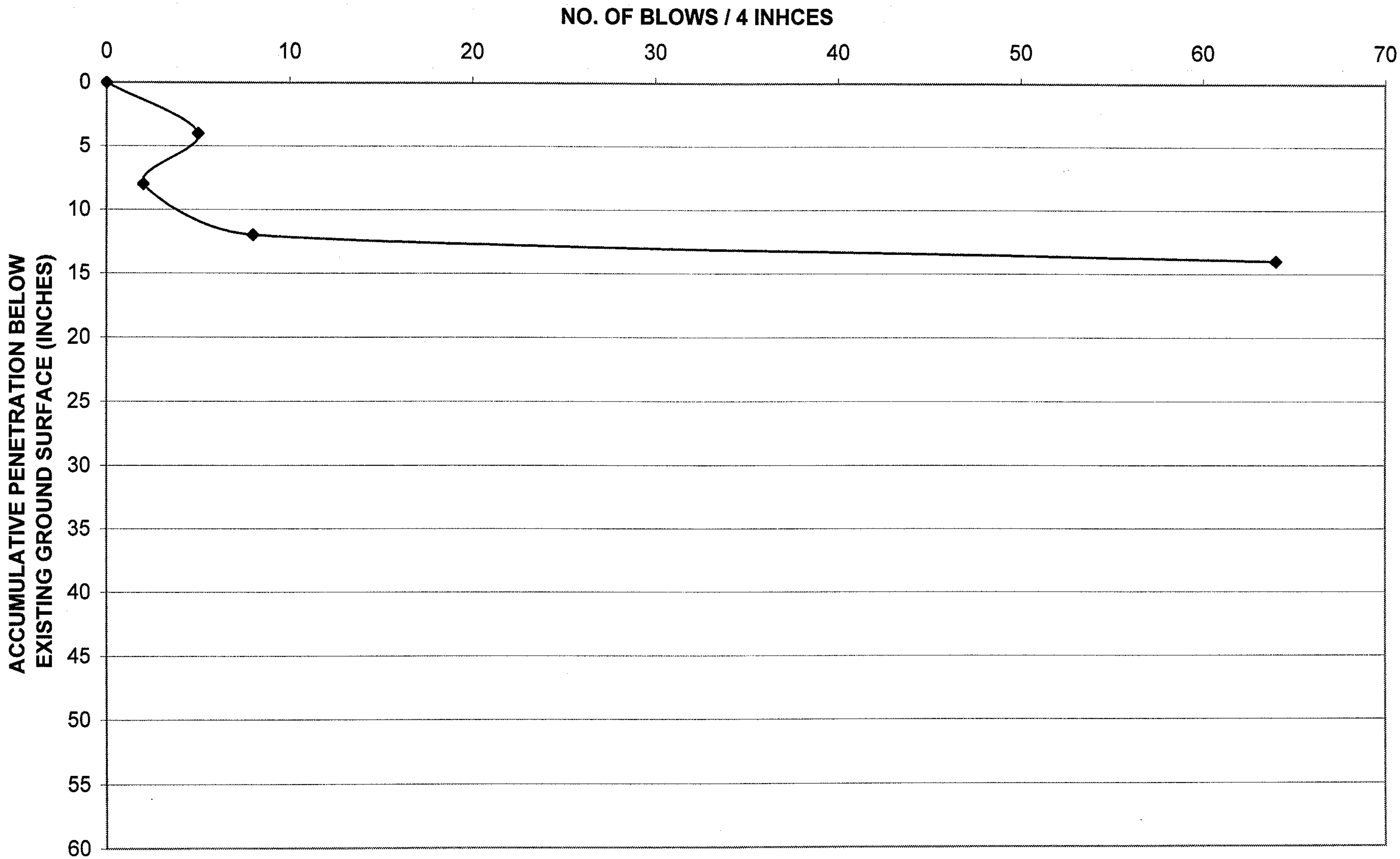
NO. OF BLOWS / 4 INCHES

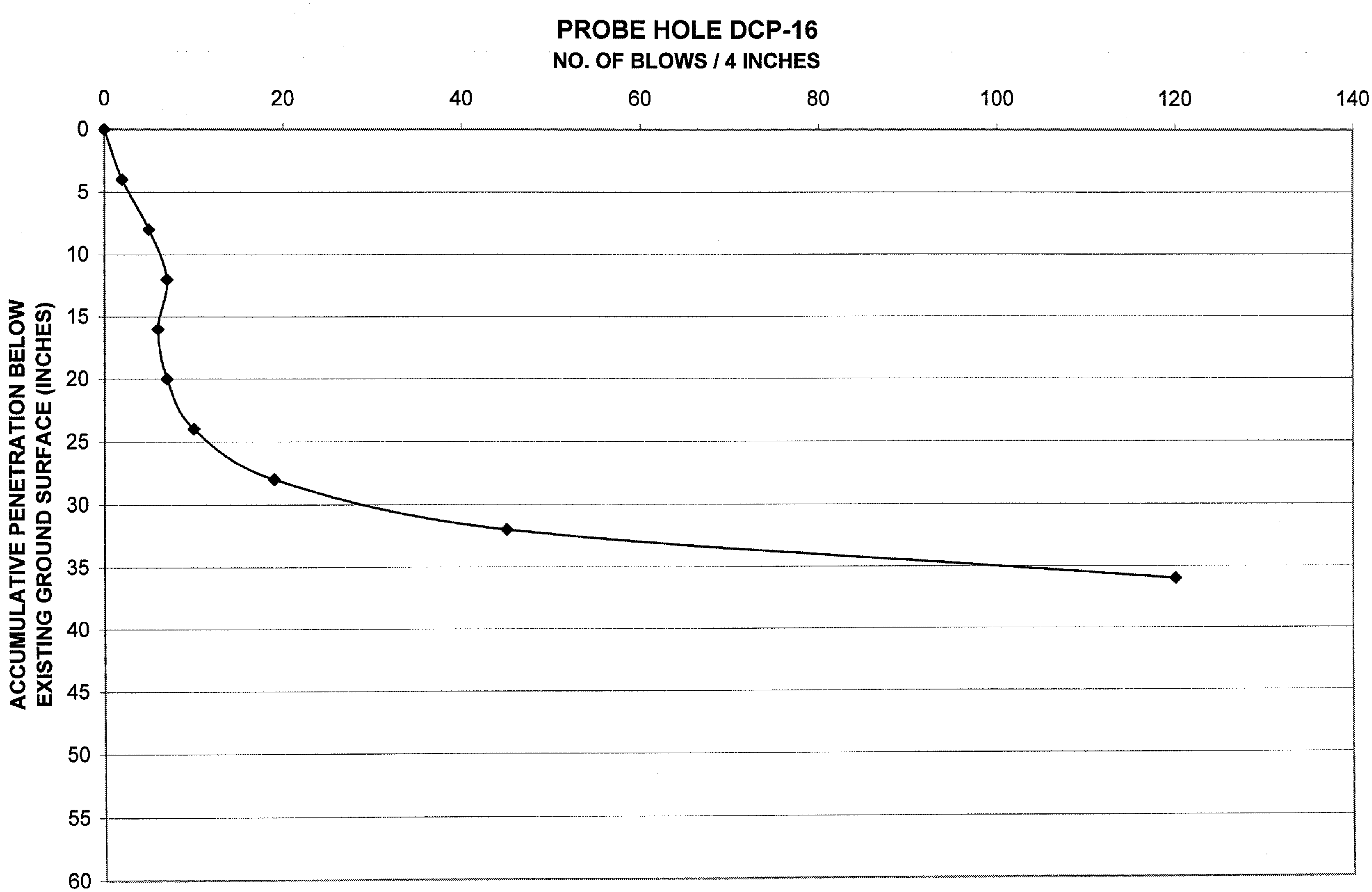


PROBE HOLE DCP-14
NO. OF BLOWS / 4 INCHES



PROBE HOLE DCP-15




PROBE HOLE DCP-16
NO. OF BLOWS / 4 INCHES
0
20
40
60
80
100
120
140
ACCUMULATIVE PENETRATION BELOW EXISTING GROUND SURFACE (INCHES)
0
5
10
15
20
25
30
35
40
45
50
55
60

Salt Lake Elementay School
Structural BMP

DCP-1	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)	DCP-2	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0		0	0	0
	13	4	4		0	4	4
	33	4	8		0	4	8
	48	4	12		0	4	12
	65	4	16		0	4	16
	160	4	20		0	4	20
	210	4	24		0	4	24
					0	4	28
					0	4	32
					0	4	36
					110	4	40
					200	2	42
DCP-3	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)	DCP-4	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0		0	0	0
	0	4	4		0	4	4
	0	4	8		0	4	8
	0	4	12		0	4	12
	0	4	16		0	4	16
	0	4	20		0	4	20
	0	4	24		0	4	24
	0	4	28		0	4	28
	0	4	32		0	4	32
	0	4	36		0	4	36
	9	4	40		0	4	40
	52	2	42		0	4	44
					32	4	48
					100	1.5	49.5
DCP-5	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)	DCP-6	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0		0	0	0
	95	4	4		22	4	4
	200	4	8	12" HOLE	39	4	8
					90	4	12
					209	4	16
					100	4.5	20.5
DCP-7	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)	DCP-8	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0		0	0	0
	0	2	2		33	4	4
	22	2	4		85	4	8
	64	4	8		125	4	12
	65	4	12		110	4	16
	62	4	16		183	4	20
	49	4	20		210	4	24
	63	4	24		287	4	28
	42	4	28				
	71	4	32				
	250	4	36				
	100	1	37				

Salt Lake Elementay School
Structural BMP

DCP-9	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0
	125	4	4

DCP-10	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0
	50	0.5	0.5

DCP-11	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0
	50	4	4
	156	4	8
	195	4	12
	107	4	16
	109	4	20
	86	4	24
	82	4	28
	40	4	32
	32	4	36
	48	4	40
	71	4	44
	50	4	48
	55	4	52
	64	4	56

DCP-12	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0
	16	4	4
	34	4	8
	28	4	12
	45	4	16
	51	4	20
	56	4	24
	56	2	26

DCP-13	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0
	130	4	4
	100	1	5

DCP-14	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0
	30	4	4
	85	4	8
	105	4	12
	113	4	16
	109	4	20
	170	4	24
	103	4	28
	109	4	32
	112	4	36
	190	4	40

DCP-15	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0
	5	4	4
	2	4	8
	8	4	12
	64	2	14

DCP-16	NO. OF BLOWS	INCHES DRIVEN	ACCUMULATIVE PENETRATION (INCHES)
	0	0	0
	2	4	4
	5	4	8
	7	4	12
	6	4	16
	7	4	20
	10	4	24
	19	4	28
	45	4	32
	120	4	36

EFFECTIVE MODULUS OF SUBGRADE REACTION

CBR at 0.1" = 5.4
M_R = 1500 CBR = 1500 x 5.4 = 8,100 psi
From Figure 3.3, with D_{SB} = 12 inches and assuming E_{SB} = 15,000 psi,
k = 450 pci

CONCRETE ELASTIC MODULUS

Assuming f'_C = 4,000 psi
$E_C = 57{,}000 f'_C{}^{0.5} = 57{,}000 \times 4{,}000^{0.5} = 3.6 \times 10^6$ psi

MEAN CONCRETE MODULUS OF RUPTURE

Assume S'_C = 650 psi

LOAD TRANSFER COEFFICIENT

For continuously reinforced concrete pavement without tied shoulders, assume J = 3.2

DRAINAGE COEFFICIENT

Assuming good drainage and wet conditions greater than 25% of the time, C_D = 1.00

DESIGN SERVICEABILITY LOSS

Assume ΔPSI = 2.5

RELIABILITY

Assuming rural local classification, R = 80%

OVERALL STANDARD DEVIATION

Assume S_0 = 0.3

ESTIMATED TOTAL 18-KIP EQUIVALENT SINGLE AXIS LOAD (ESAL) APPLICATIONS

For 1 dump truck and backhoe continuously driving, parking, and loading on the pavement, assume $W_{18} = 1.5 \times 10^6$

DESIGN SLAB THICKNESS

D = 6 inches, with D_{SB} = 12 inches

Reference: *AASHTO Guide for Design of Pavement Structures*, 1993. American Association of State Highway and Transportation Officials

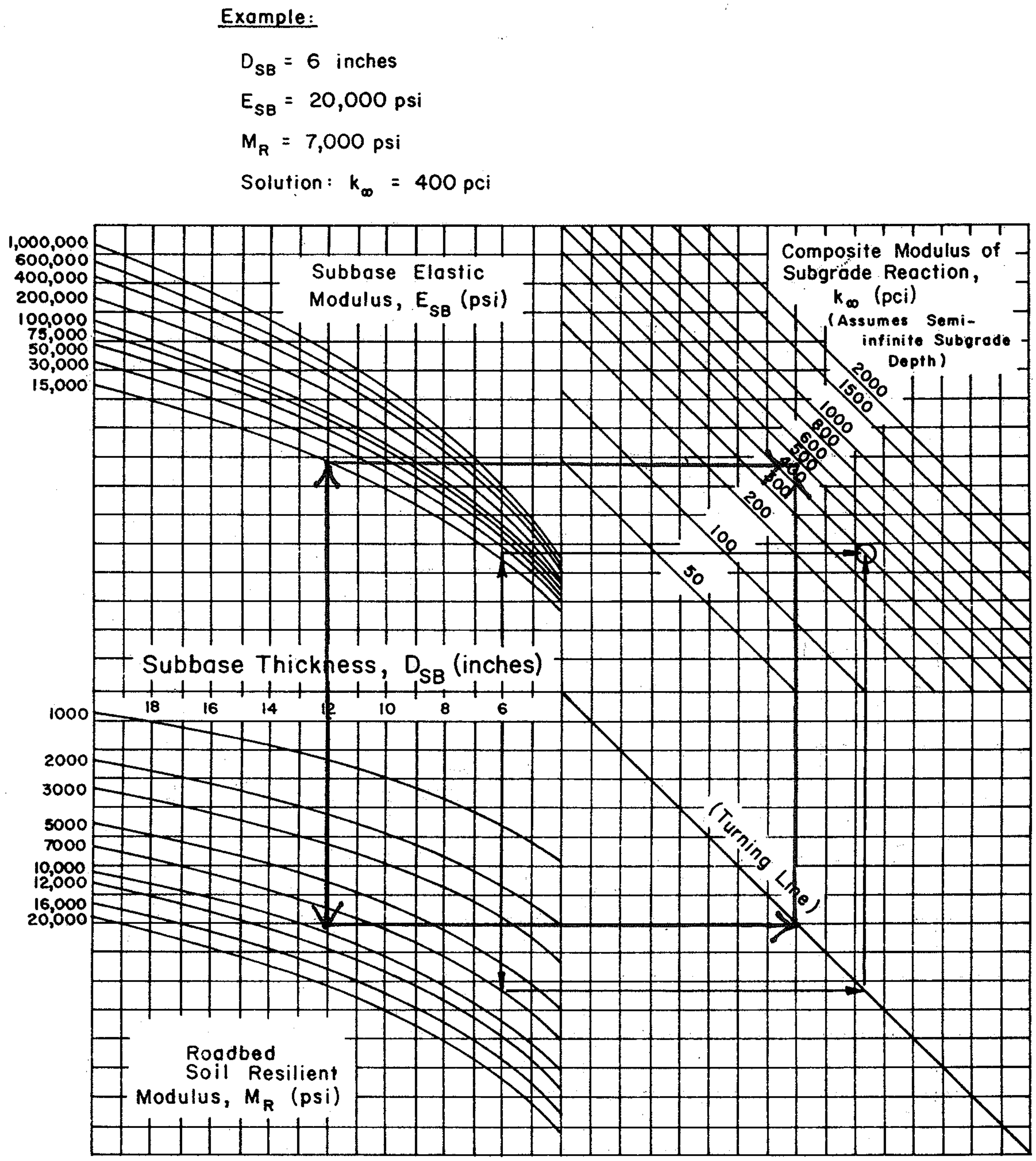
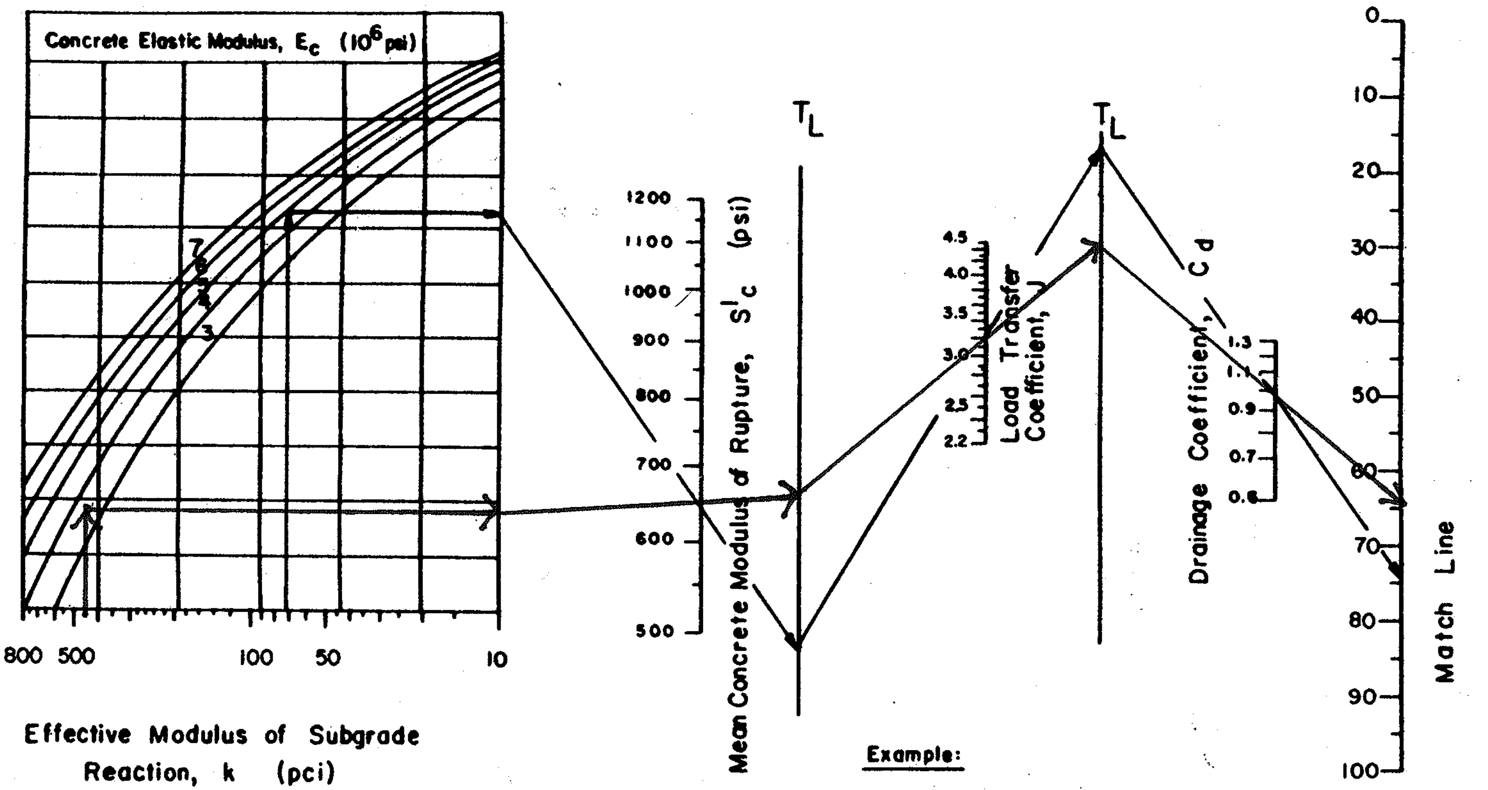


Figure 3.3. Chart for Estimating Composite Modulus of Subgrade Reaction, k_∞, Assuming a Semi-Infinite Subgrade Depth. (For practical purposes, a semi-infinite depth is considered to be greater than 10 feet below the surface of the subgrade.)

NOMOGRAPH SOLVES:

$$\log_{10} W_{18} = Z_R * S_o + 7.35 * \log_{10}(D+1) - 0.06 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.5 - 1.5}\right]}{1 + \frac{1.624*10^7}{(D+1)^{8.46}}} + (4.22 - 0.32 p_t) * \log_{10}\left[\frac{S_c' * C_d \left[D^{0.75} - 1.132\right]}{215.63 * J \left[D^{0.75} - \frac{18.42}{(E_c/k)^{0.25}}\right]}\right]$$



Example:

$k = 72$ pci
$E_c = 5 \times 10^6$ psi
$S'_c = 650$ psi
$J = 3.2$
$C_d = 1.0$

$S_o = 0.29$
$R = 95\%$ ($Z_R = -1.645$)
$\Delta PSI = 4.2 - 2.5 = 1.7$
$W_{18} = 5.1 \times 10^6$ (18 kip ESAL)
Solution: D=10.0 inches (nearest half-inch, from segment 2)

Figure 3.7. Design Chart for Rigid Pavement Based on Using Mean Values for Each Input Variable (Segment 1)

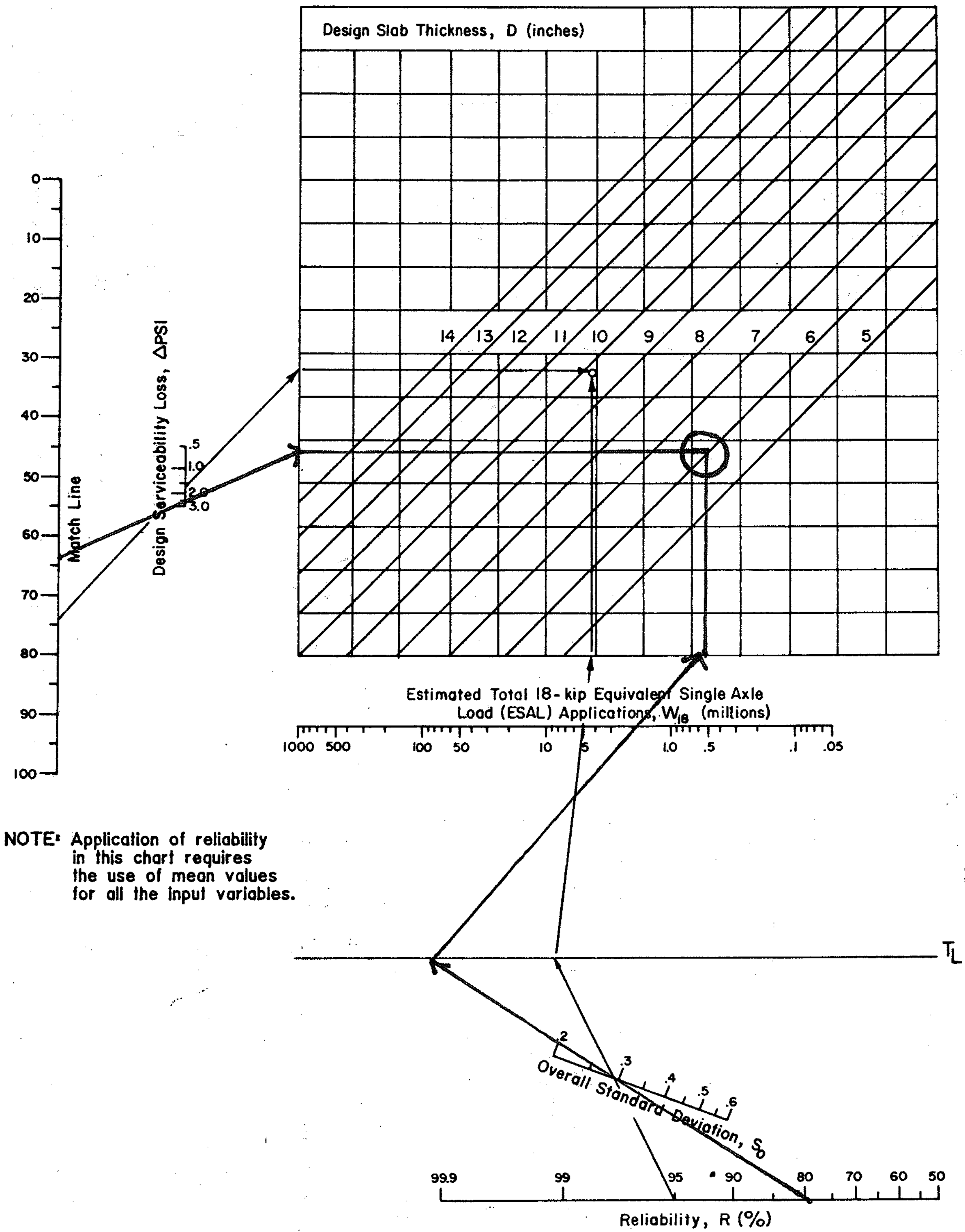
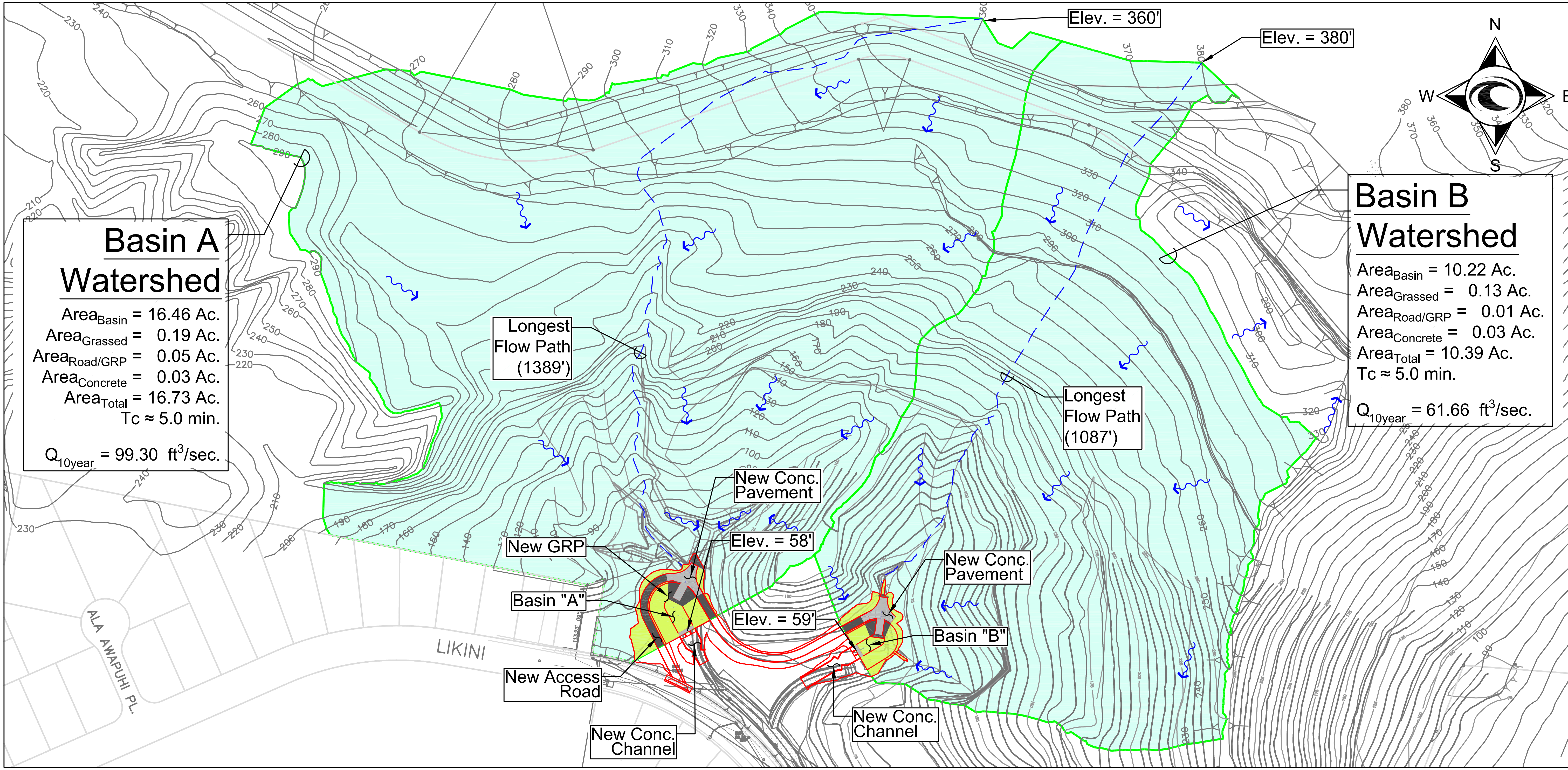


Figure 3.7. Continued—Design Chart for Rigid Pavements Based on Using Mean Values for Each Input Variable (Segment 2)

Appendix B

Civil Calculations



Legend:

- Drainage Direction Flow Arrow
- Drainage Sub-Basin Longest Flow Path
- Contributing Watershed Boundary
- Grassed Drainage Sub-basins
- Access Road/GRP Drainage Sub-basins
- Concrete Drainage Sub-basins

150' 75' 0 150' 300'

SCALE: 1" = 150'

Figure C-1: Finished Condition Drainage Watershed Boundary

Salt Lake Debris Basins

oceanit

March 2016

Debris Basin "A"

Hydrology and Hydraulics

Basin "A" Calculations

Project: Salt Lake Debris Basin, Oahu, Hawaii
Project No.: 200511D
Client: City & County of Honolulu
Subject: 2-yr Stormflow For Basin "A"
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

References:
1. Digitized Topographic Survey
Sept. 7, 1965.
2. City and County of Honolulu, "Rules Relating to Storm Drainage Standards.
January 2000. Amended December 2012
3. State of Hawaii, DLNR, Division of Water and Land Development. "Rainfall Frequency Study For Oahu".
1984.

Determine: Determine 2-yr stormflow for Basin "A".

Solution: Q=CIA

A: Area
Area = 16.73 acres (Ref. 1)

I: Rainfall Intensity
I = i*(CF)

i = 1.25 inches (Ref. 3)
Tm (recurrance interval) = 2 years

Time of Concentration, tc (Ref. 2, pg 26, similar to small agricultural area with little cover)
tc = 0.0078K$^{(0.77)}$
K = SQRT(L^3/H)
L = 1,394 ft
Δ Elev. = 305 ft
K = 2980.192
tc = 3.69 min
Use tc = 5.00 min

CF = 2.80

I = 3.50 in/hr

C: Runoff Coefficient
Land use type: Open space

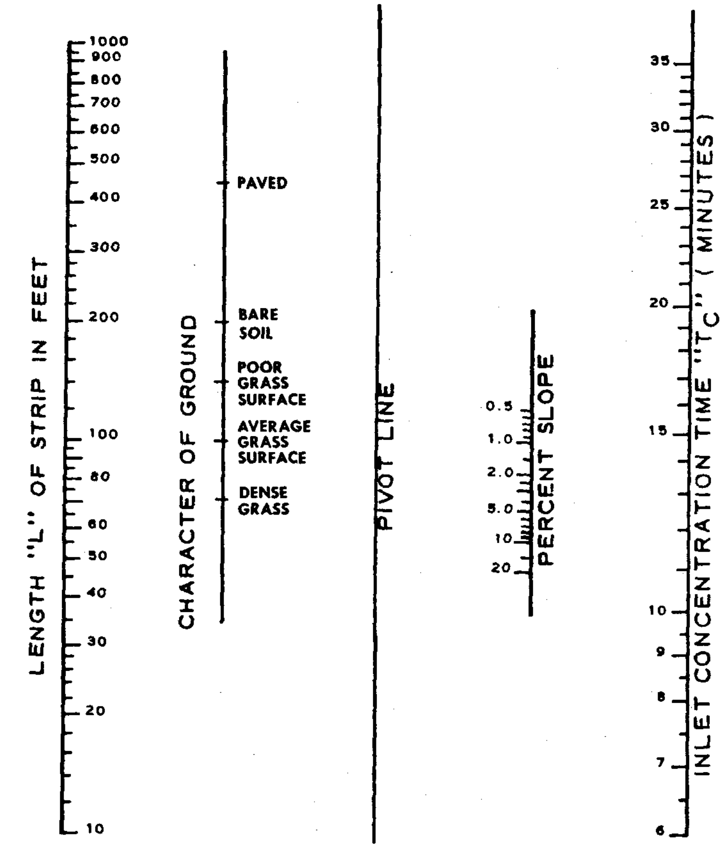
C =	0.78	Contributing Watershed Basin	16.46 acres	(Ref. 2. Table 1, pg 21. Band 2)
C =	0.70	New Graded/Grassed	0.19 acres	(Ref. 3)
C =	0.85	New Access Road/GRP	0.05 acres	(Ref. 3)
C =	0.90	New Conc. Pavement & Channels	0.03 acres	(Ref. 3)
Cw =	**0.7795**		16.73 acres	

$$C_w = \frac{\sum_{j=1}^{n} C_j A_j}{\sum_{j=1}^{n} A_j}$$

Q: 45.64 cfs

Plate 3

Overland Flow Chart



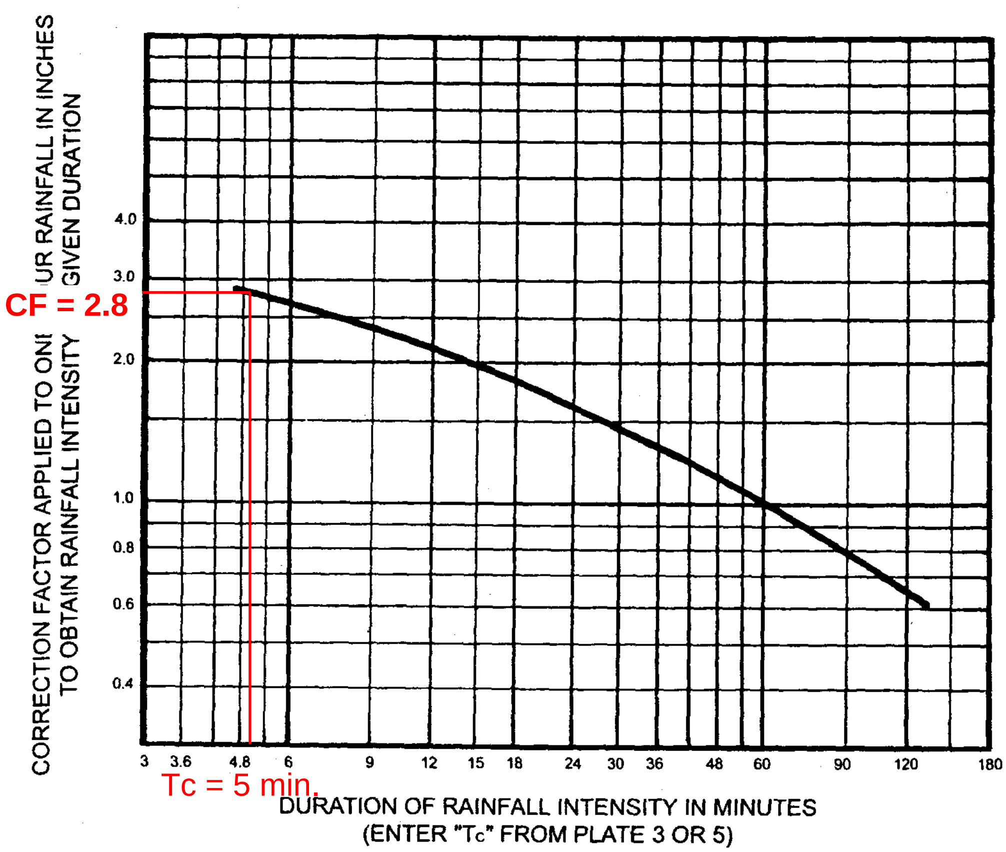


Plate 4

CORRECTION FACTOR

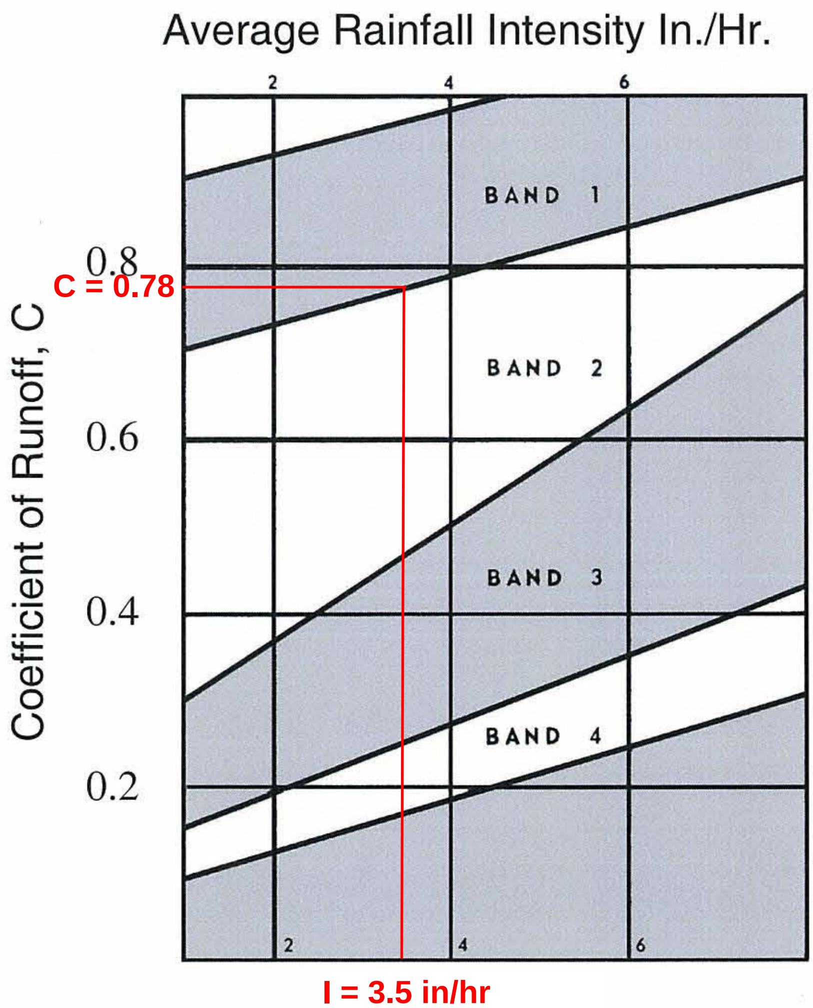
FOR CONVERTING 1 HR. RAINFALL
TO RAINFALL INTENSITY
OF VARIOUS DURATIONS

TO BE USED FOR AREA
LESS THAN 100 ACRES

(See Plate 6 for area
more than 100 acres)

§1-4.3 DESIGN CHARTS

Table 1
RUNOFF COEFFICIENT FOR AGRICULTRUAL AND OPEN AREAS



Band 1	Steep, barren, impervious surfaces
Band 2	Rolling barren in upper band values, flat barren in lower part of band, steep forested and steep grass meadows
Band 3	Timber lands of moderate to steep slopes, mountainous, farming
Band 4	Flat pervious surface, flat farmlands, wooded areas and meadows

Basin "A" Calculations

Project: Salt Lake Debris Basin, Oahu, Hawaii
Project No.: 200511D
Client: City & County of Honolulu
Subject: 10-yr Stormflow For Basin "A"
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

References:
1. Digitized Topographic Survey
Sept. 7, 1965.
2. City and County of Honolulu, "Rules Relating to Storm Drainage Standards.
January 2000. Amended December 2012
3. State of Hawaii, DLNR, Division of Water and Land Development. "Rainfall Frequency Study For Oahu".
1984.

Determine: Determine 10-yr stormflow for Basin "A".

Solution: Q=CIA

A: Area
Area = <u>16.73</u> acres (Ref. 1)

I: Rainfall Intensity
I = i*(CF)

i = 2.47 inches (Ref. 2 Plate 1)
Tm (recurrance interval) = 10 years

Time of Concentration, tc (Ref. 2, pg 26, similar to small agricultural area with little cover)
tc = $0.0078K^{(0.77)}$
K = SQRT(L^3/H)
L = 1,394 ft
Δ Elev. = 305 ft
K = 2980.192
tc = 3.69 min
Use tc = 5.00 min

CF = 2.80

I = <u>6.916</u> in/hr

C: Runoff Coefficient
Land use type: Open space

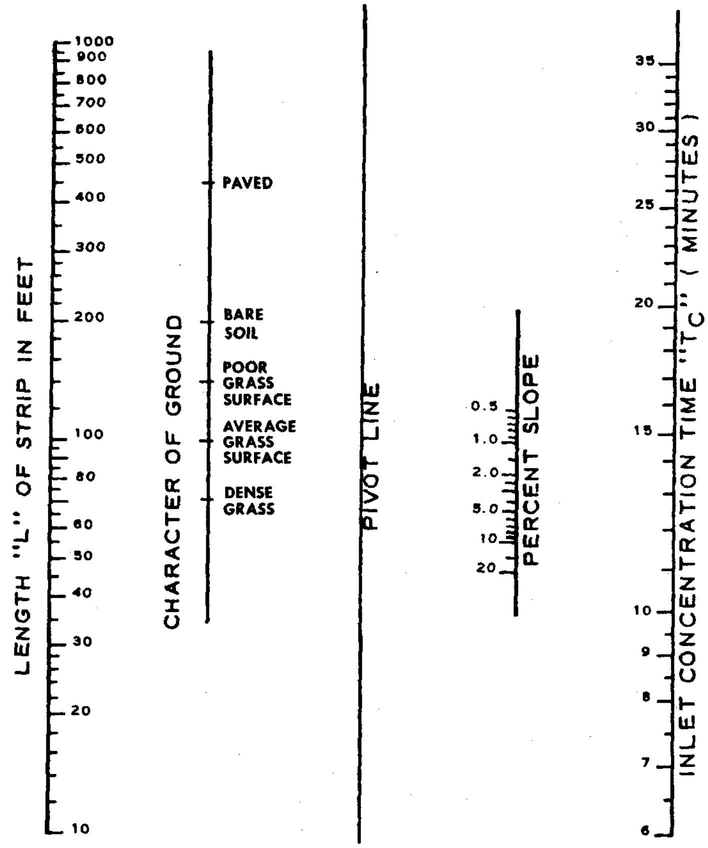
C =	0.86	Contributing Watershed Basin	16.46 acres	(Ref. 2. Table 1, pg 21. Band 2)
C =	0.70	New Graded/Grassed	0.19 acres	(Ref. 3)
C =	0.85	New Access Road/GRP	0.05 acres	(Ref. 3)
C =	0.90	New Conc. Pavement & Channels	0.03 acres	(Ref. 3)
Cw =	**0.8582**		16.73 acres	

$$C_w = \frac{\sum_{j=1}^{n} C_j A_j}{\sum_{j=1}^{n} A_j}$$

Q: 99.30 cfs

Plate 3

Overland Flow Chart



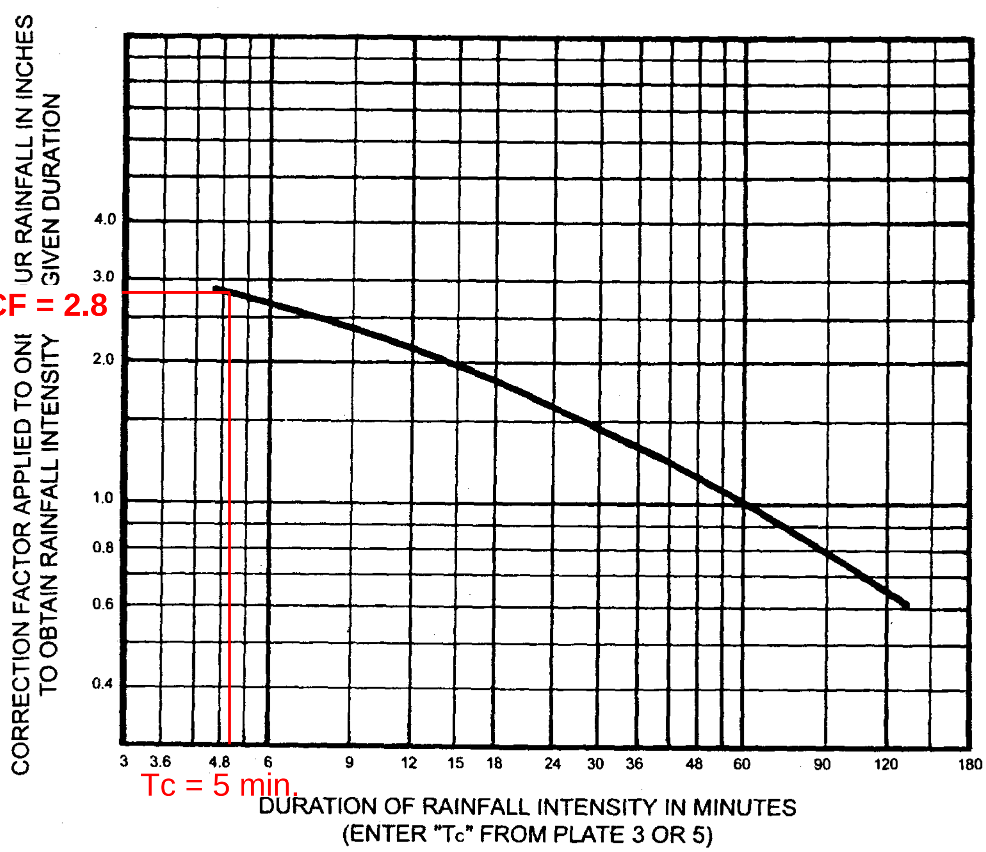


Plate 4

CORRECTION FACTOR

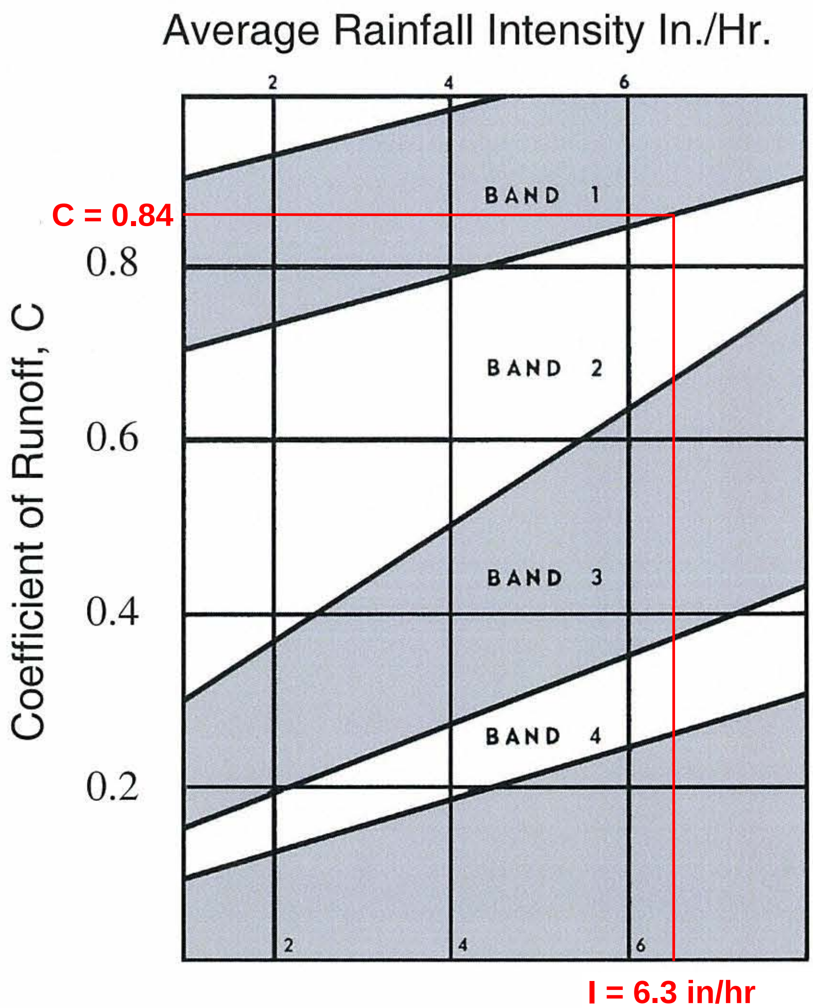
FOR CONVERTING 1 HR. RAINFALL TO RAINFALL INTENSITY OF VARIOUS DURATIONS

TO BE USED FOR AREA LESS THAN 100 ACRES

(See Plate 6 for area more than 100 acres)

§1-4.3 DESIGN CHARTS

Table 1
RUNOFF COEFFICIENT FOR AGRICULTRUAL AND OPEN AREAS



Band 1	Steep, barren, impervious surfaces
Band 2	Rolling barren in upper band values, flat barren in lower part of band, steep forested and steep grass meadows
Band 3	Timber lands of moderate to steep slopes, mountainous, farming
Band 4	Flat pervious surface, flat farmlands, wooded areas and meadows

Basin "A" Calculations

Project: Salt Lake Debris Basin, Oahu, Hawaii
Project No.: 200511D
Client: City & County of Honolulu
Subject: 50-yr Stormflow For Basin "A"
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

References:

1. Digitized Topographic Survey
 Sept. 7, 1965.
2. City and County of Honolulu, "Rules Relating to Storm Drainage Standards.
 January 2000. Amended December 2012
3. State of Hawaii, DLNR, Division of Water and Land Development. "Rainfall Frequency Study For Oahu".
 1984.

Determine: Determine 50-yr stormflow for Basin "A".

Solution: Q=CIA

A: Area
Area = <u>16.73</u> acres (Ref. 1)

I: Rainfall Intensity
I = i*(CF)

i = 3.35 inches (Ref. 2 Plate 2)
Tm (recurrance interval) = 50 years

Time of Concentration, tc (Ref. 2, pg 26, similar to small agricultural area with little cover)
$tc = 0.0078K^{(0.77)}$
K = SQRT(L^3/H)
L = 1,394 ft
Δ Elev. = 305 ft
K = 2980.192
tc = 3.69 min
Use tc = 5.00 min

CF = 2.80

I = <u>9.38</u> in/hr

C: Runoff Coefficient
Land use type: Open space

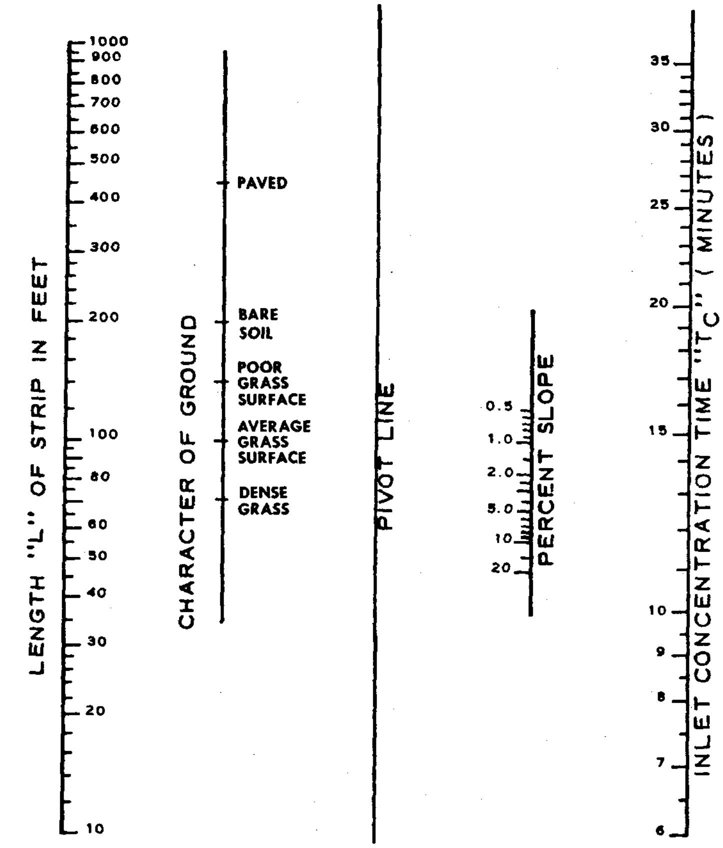
C =	0.94	Contributing Watershed Basin	16.46 acres	(Ref. 2. Table 1, pg 21. Band 2)
C =	0.70	New Graded/Grassed	0.19 acres	(Ref. 3)
C =	0.85	New Access Road/GRP	0.05 acres	(Ref. 3)
C =	0.90	New Conc. Pavement & Channels	0.03 acres	(Ref. 3)
Cw =	**0.937**		16.73 acres	

$$C_w = \frac{\sum_{j=1}^{n} C_j A_j}{\sum_{j=1}^{n} A_j}$$

Q: 147.03 cfs

Plate 3

Overland Flow Chart



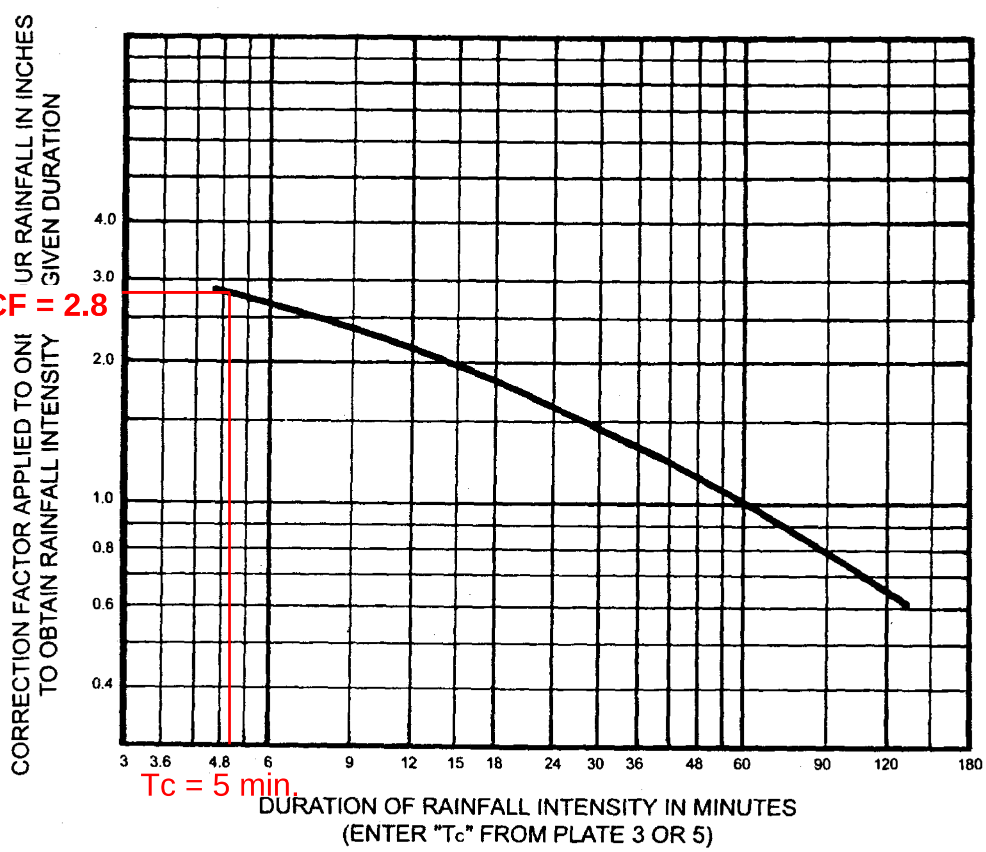


Plate 4

CORRECTION FACTOR

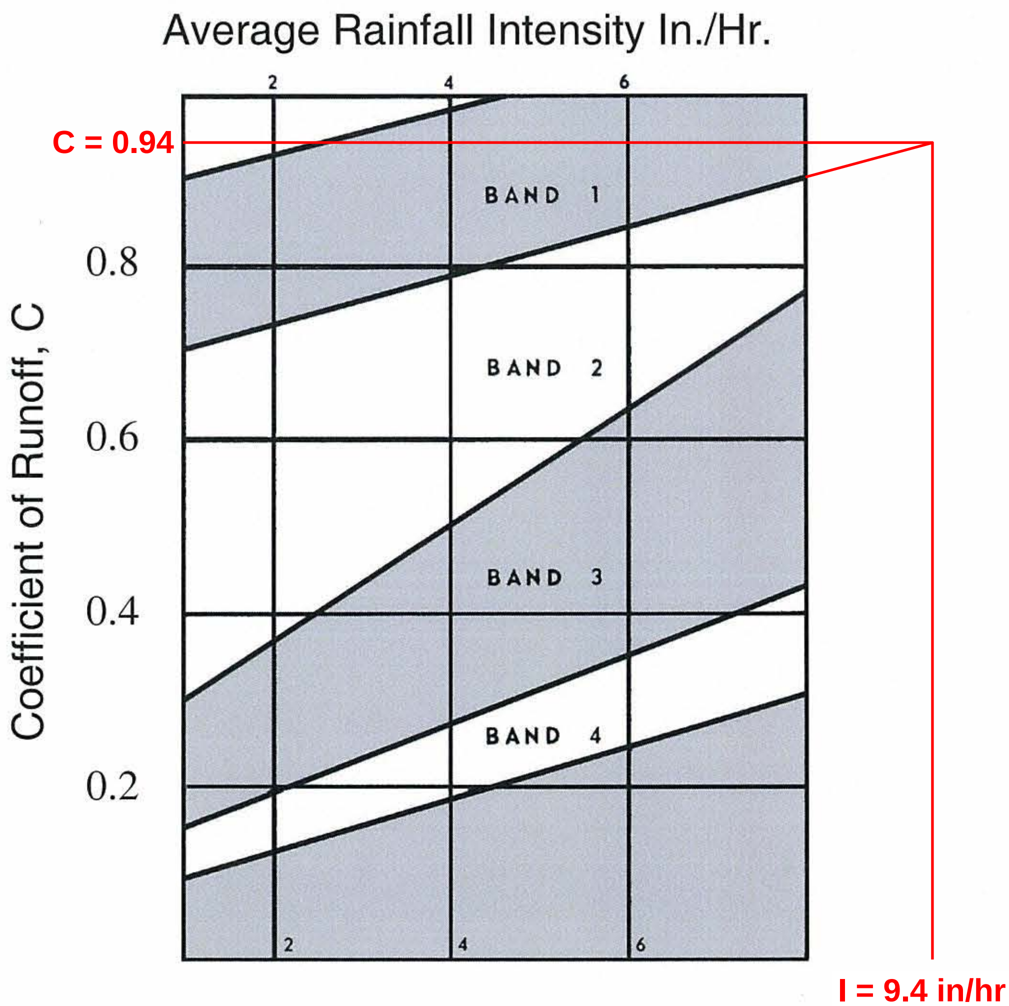
FOR CONVERTING 1 HR. RAINFALL TO RAINFALL INTENSITY OF VARIOUS DURATIONS

TO BE USED FOR AREA LESS THAN 100 ACRES

(See Plate 6 for area more than 100 acres)

§1-4.3 DESIGN CHARTS

Table 1
RUNOFF COEFFICIENT FOR AGRICULTRUAL AND OPEN AREAS



Band 1	Steep, barren, impervious surfaces
Band 2	Rolling barren in upper band values, flat barren in lower part of band, steep forested and steep grass meadows
Band 3	Timber lands of moderate to steep slopes, mountainous, farming
Band 4	Flat pervious surface, flat farmlands, wooded areas and meadows

Basin "A" Calculations

Project:	Salt Lake Debris Basin, Oahu, Hawaii		
Project No.:	200511D		
Client:	City & County of Honolulu		
Subject:	Weir Size Stilling Basin Sizing		
By:	APK	Date:	3/6/2015
Checked by:	JDM	Date:	3/6/2015

References

1. Peterka, A. J. U.S. Dept. of Interior, Bureau of Reclamation. *Hydraulic Design of Stilling Basins and Energy Dissipators.* Engineering Monograph No. 25. Washington: GPO: May 1984.

2. U.S. Dept. of the Interior, Bureau of Reclamation. *Design of Small Dams.* Hydraulics of Control Structures, Third Edition 1987

Basin A

Width of spillway crest	W	25.00
Height of spillway crest	Z	5.75
Weir Coefficient	C	3.95

Assume head is 1', so P/Ho=3, and using Fig 9-23, in Ref. 2, Co=3.95

		2 yr.	10 yr.	50 yr.		
Flow (ft^3/s)	Q	45.64	99.30	147.03		
Depth on sill (ft)	Ho	0.60	1.00	1.30	$H_o = \left(\frac{Q}{C \times W}\right)^{\frac{2}{3}}$	(Ref. 2)
Estimated velocity (Bot. of sill) (ft/ (Use V_T to be conserv.)	V_T	18.74	18.38	18.12	$V_T = \sqrt{2g(Z - \frac{H_o}{2})} = V_1$	(Ref. 1)
Depth at end of chute (ft)	D_1	0.10	0.22	0.32	$D_1 = \frac{Q}{V_T \times W}$	
Froude Number	F_1	10.58	6.97	5.60	$F_1 = \frac{V_1}{\sqrt{gD_1}}$	(Ref. 1)
Depth after jump (ft)	D_2	1.41	2.02	2.42	$D_2 = \frac{D_1}{2}\left(\sqrt{1+8F^2} - 1\right)$	(Ref. 1)
ratio (L/D_2) from fig 12		6.10	6.15	6.10		(Ref. 1)
From figure 12 (Ref. 1) Length of jump (ft)	L	8.60	12.45	14.73		
Design Stilling Basin Length (ft)		**15.00**	**15.00**	**15.00**		

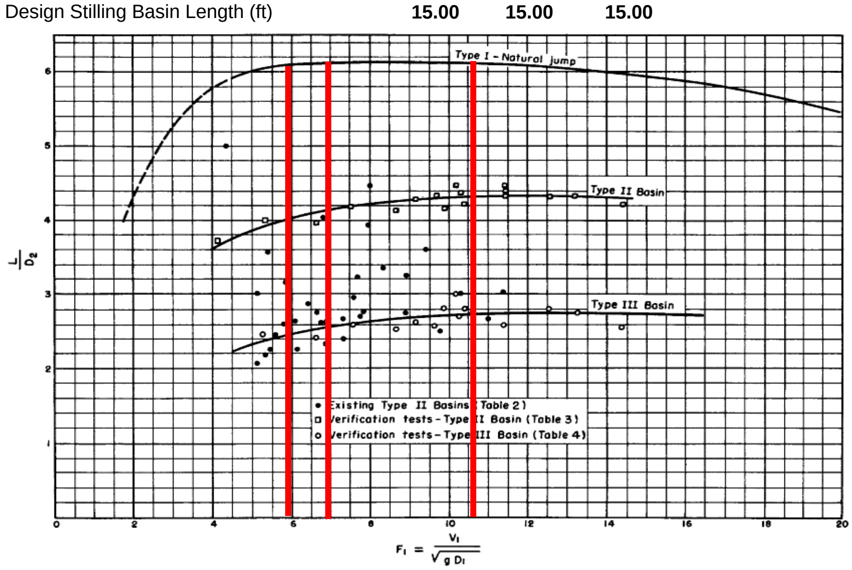


FIGURE 12.—*Length of jump on horizontal floor (Basins I, II, and III).*

Debris Basin "B"

Hydrology and Hydraulics

Basin "B" Calculations

Project: Salt Lake Debris Basin, Oahu, Hawaii
Project No.: 200511D
Client: City & County of Honolulu
Subject: 2-yr Stormflow For Basin "B"
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

References:

1. Digitized Topographic Survey
Sept. 7, 1965.
2. City and County of Honolulu, "Rules Relating to Storm Drainage Standards.
January 2000. Amended December 2012
3. State of Hawaii, DLNR, Division of Water and Land Development. "Rainfall Frequency Study For Oahu".
1984.

Determine: Determine 2-yr stormflow for Basin "B".

Solution: Q=CIA

A: Area

Area = 10.39 acres (Ref. 1)

I: Rainfall Intensity

I = i*(CF)

i = 1.25 inches (Ref. 3)

Tm (recurrance interval) = 2 years

Time of Concentration, tc (Ref. 2, pg 26, similar to small agricultural area with little cover)

$tc = 0.0078K^{(0.77)}$

K = SQRT(L^3/H)

L = 1,208 ft

Δ Elev. = 325 ft

K = 2328.9423

tc = 3.05 min

Use tc = 5.00 min

CF = 2.80

I = 3.50 in/hr

C: Runoff Coefficient

Land use type: Open space

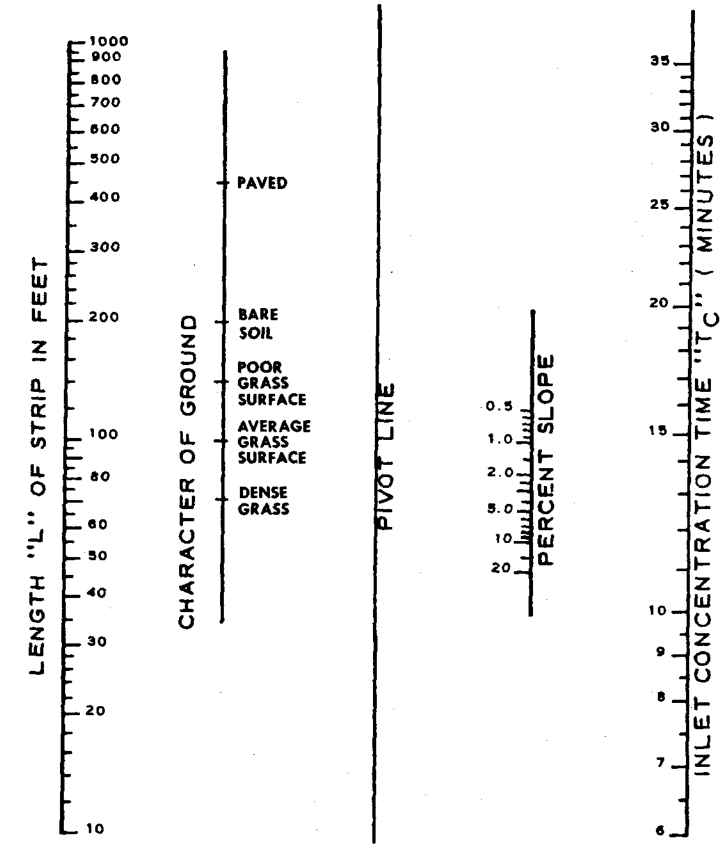
C =	0.78	Contributing Watershed Basin	10.22 acres	(Ref. 2. Table 1, pg 21. Band 2)
C =	0.70	New Graded/Grassed	0.13 acres	(Ref. 3)
C =	0.85	New Access Road/GRP	0.01 acres	(Ref. 3)
C =	0.90	New Conc. Pavement & Channels	0.03 acres	(Ref. 3)
Cw =	**0.7794**		10.39 acres	

$$C_w = \frac{\sum_{j=1}^{n} C_j A_j}{\sum_{j=1}^{n} A_j}$$

Q: 28.34 cfs

Plate 3

Overland Flow Chart



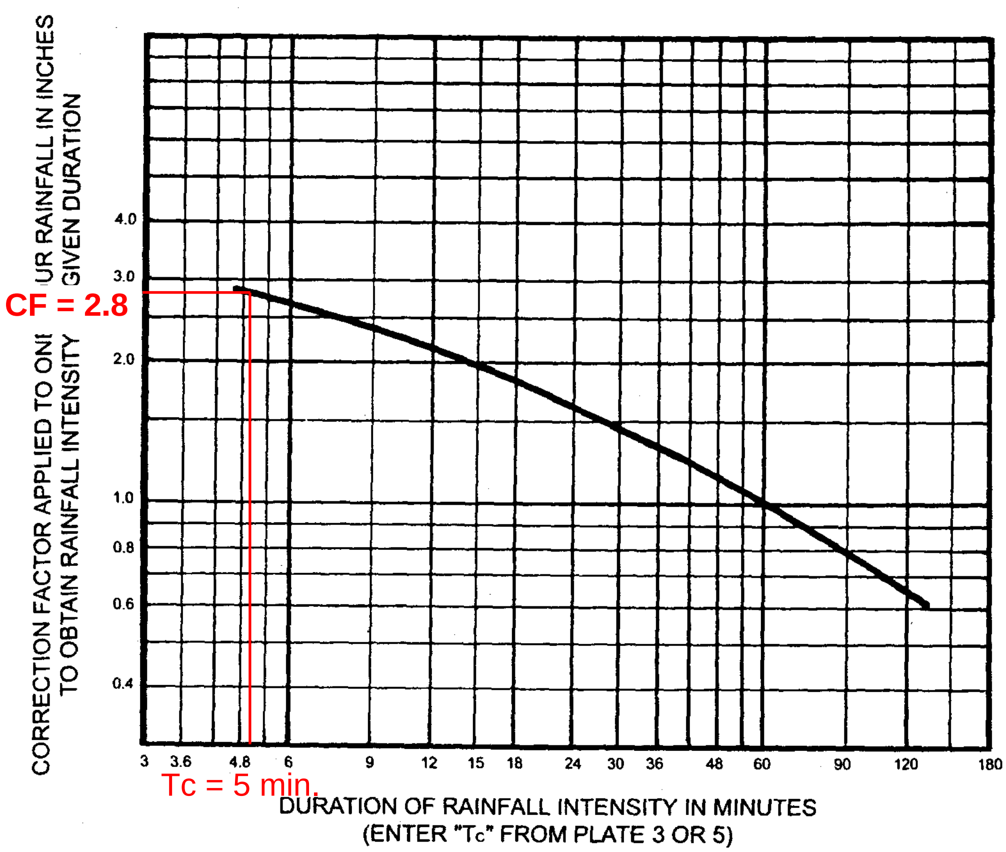


Plate 4

CORRECTION FACTOR

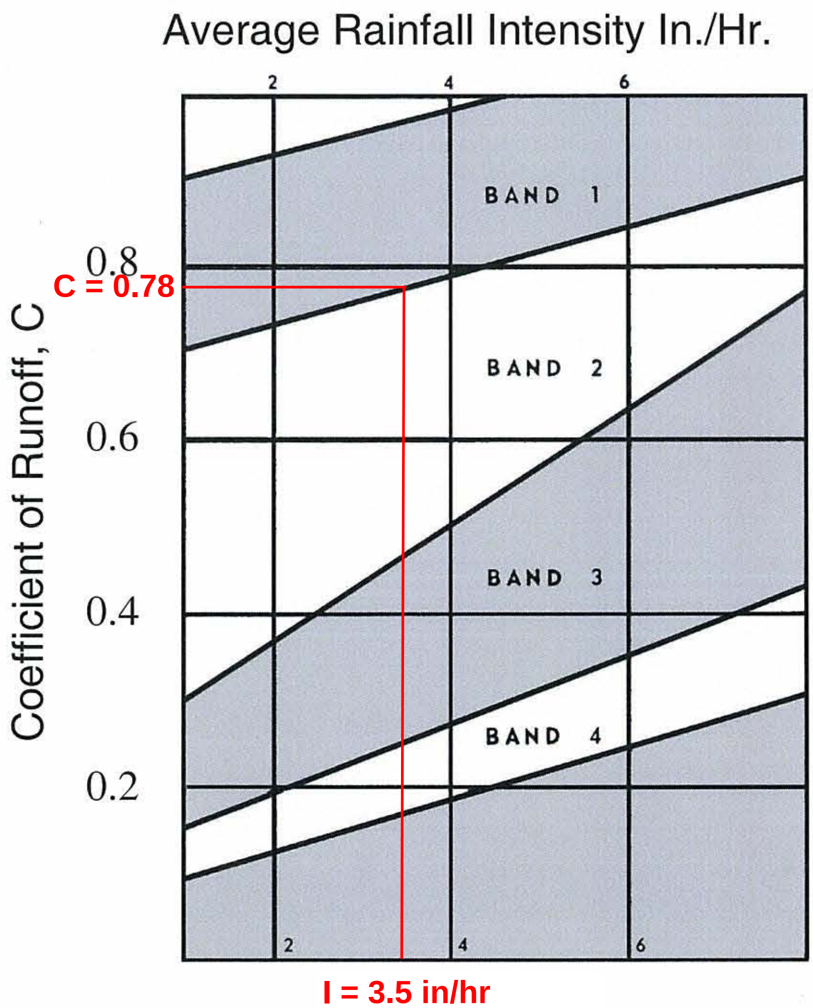
FOR CONVERTING 1 HR. RAINFALL
TO RAINFALL INTENSITY
OF VARIOUS DURATIONS

TO BE USED FOR AREA
LESS THAN 100 ACRES

(See Plate 6 for area
more than 100 acres)

§1-4.3 DESIGN CHARTS

Table 1
RUNOFF COEFFICIENT FOR AGRICULTRUAL AND OPEN AREAS



Band 1	Steep, barren, impervious surfaces
Band 2	Rolling barren in upper band values, flat barren in lower part of band, steep forested and steep grass meadows
Band 3	Timber lands of moderate to steep slopes, mountainous, farming
Band 4	Flat pervious surface, flat farmlands, wooded areas and meadows

Basin "B" Calculations

Project: Salt Lake Debris Basin, Oahu, Hawaii
Project No.: 200511D
Client: City & County of Honolulu
Subject: 10-yr Stormflow For Basin "B"
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

References:
1. Digitized Topographic Survey
Sept. 7, 1965.
2. City and County of Honolulu, "Rules Relating to Storm Drainage Standards.
January 2000. Amended December 2012
3. State of Hawaii, DLNR, Division of Water and Land Development. "Rainfall Frequency Study For Oahu".
1984.

Determine: Determine 10-yr stormflow for Basin "B".

Solution: Q=CIA

A: Area
Area = <u>10.39</u> acres (Ref. 1)

I: Rainfall Intensity
I = i*(CF)

i = 2.47 inches (Ref. 2 Plate 1)
Tm (recurrance interval) = 10 years

Time of Concentration, tc (Ref. 2, pg 26, similar to small agricultural area with little cover)
$tc = 0.0078K^{(0.77)}$
K = SQRT(L^3/H)
L = 1,208 ft
Δ Elev. = 325 ft
K = 2328.9423
tc = 3.05 min
Use tc = 5.00 min

CF = 2.80

I = <u>6.916</u> in/hr

C: Runoff Coefficient
Land use type: Open space

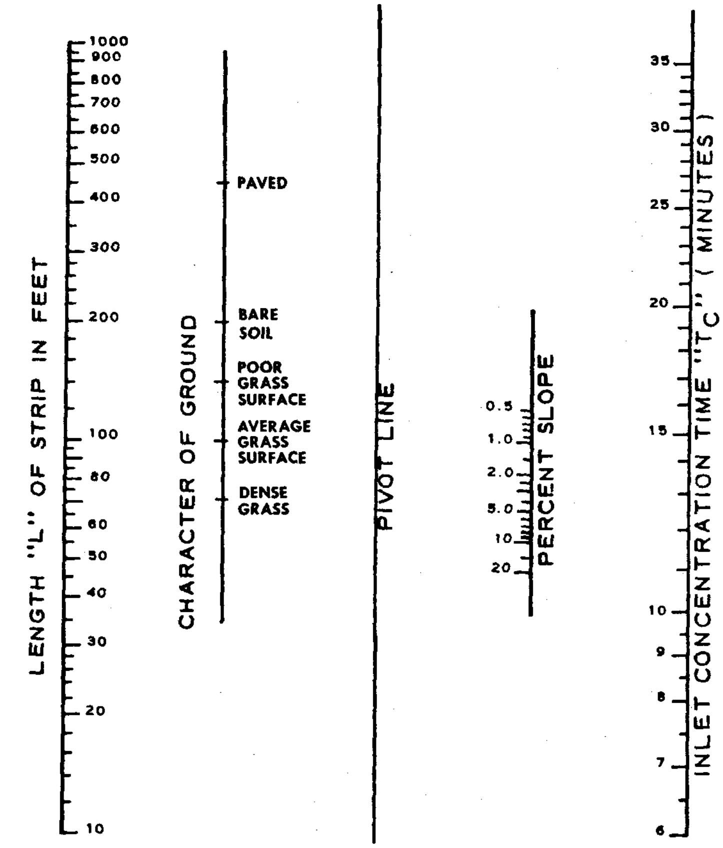
C =	0.86	Contributing Watershed Basin	10.22 acres	(Ref. 2. Table 1, pg 21. Band 2)
C =	0.70	New Graded/Grassed	0.13 acres	(Ref. 3)
C =	0.85	New Access Road/GRP	0.01 acres	(Ref. 3)
C =	0.90	New Conc. Pavement & Channels	0.03 acres	(Ref. 3)
Cw =	**0.8581**		10.39 acres	

$$C_w = \frac{\sum_{j=1}^{n} C_j A_j}{\sum_{j=1}^{n} A_j}$$

Q: 61.66 cfs

Plate 3

Overland Flow Chart



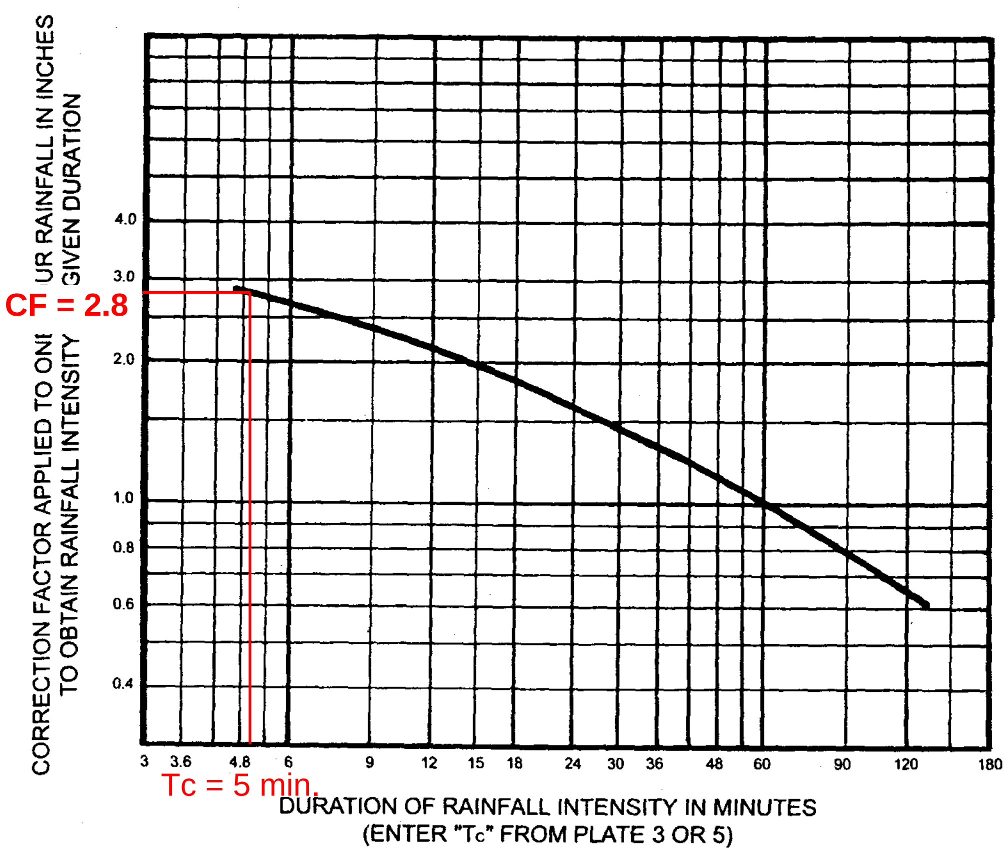


Plate 4

CORRECTION FACTOR

FOR CONVERTING 1 HR. RAINFALL
TO RAINFALL INTENSITY
OF VARIOUS DURATIONS

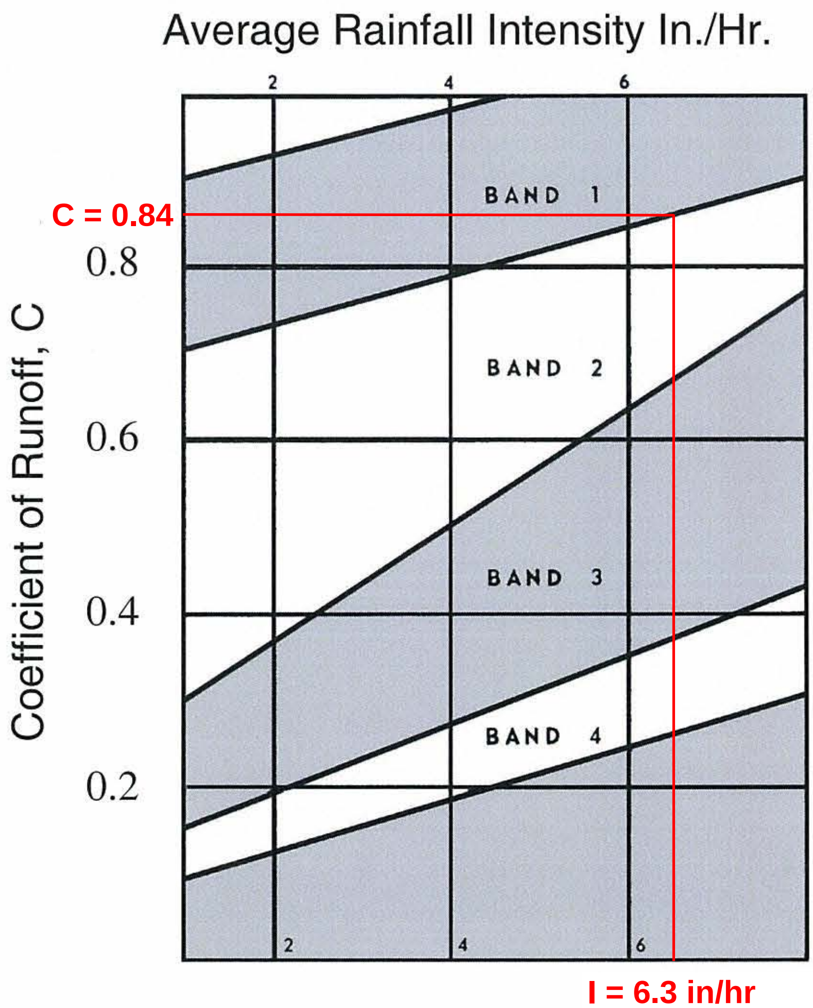
TO BE USED FOR AREA
LESS THAN 100 ACRES

(See Plate 6 for area
more than 100 acres)

§1-4.3 DESIGN CHARTS

Table 1

RUNOFF COEFFICIENT FOR AGRICULTRUAL AND OPEN AREAS



Band 1	Steep, barren, impervious surfaces
Band 2	Rolling barren in upper band values, flat barren in lower part of band, steep forested and steep grass meadows
Band 3	Timber lands of moderate to steep slopes, mountainous, farming
Band 4	Flat pervious surface, flat farmlands, wooded areas and meadows

Basin "B" Calculations

Project: Salt Lake Debris Basin, Oahu, Hawaii
Project No.: 200511D
Client: City & County of Honolulu
Subject: 50-yr Stormflow For Basin "B"
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

References:

1. Digitized Topographic Survey
 Sept. 7, 1965.
2. City and County of Honolulu, "Rules Relating to Storm Drainage Standards.
 January 2000. Amended December 2012
3. State of Hawaii, DLNR, Division of Water and Land Development. "Rainfall Frequency Study For Oahu".
 1984.

Determine: Determine 50-yr stormflow for Basin "B".

Solution: Q=CIA

A: Area

Area = 10.39 acres (Ref. 1)

I: Rainfall Intensity

I = i*(CF)

i = 3.35 inches (Ref. 2 Plate 2)

Tm (recurrance interval) = 50 years

Time of Concentration, tc (Ref. 2, pg 26, similar to small agricultural area with little cover)

tc = $0.0078K^{(0.77)}$

K = SQRT(L^3/H)

L = 1,208 ft

Δ Elev. = 325 ft

K = 2328.9423

tc = 3.05 min

Use tc = 5.00 min

CF = 2.80

I = 9.38 in/hr

C: Runoff Coefficient

Land use type: Open space

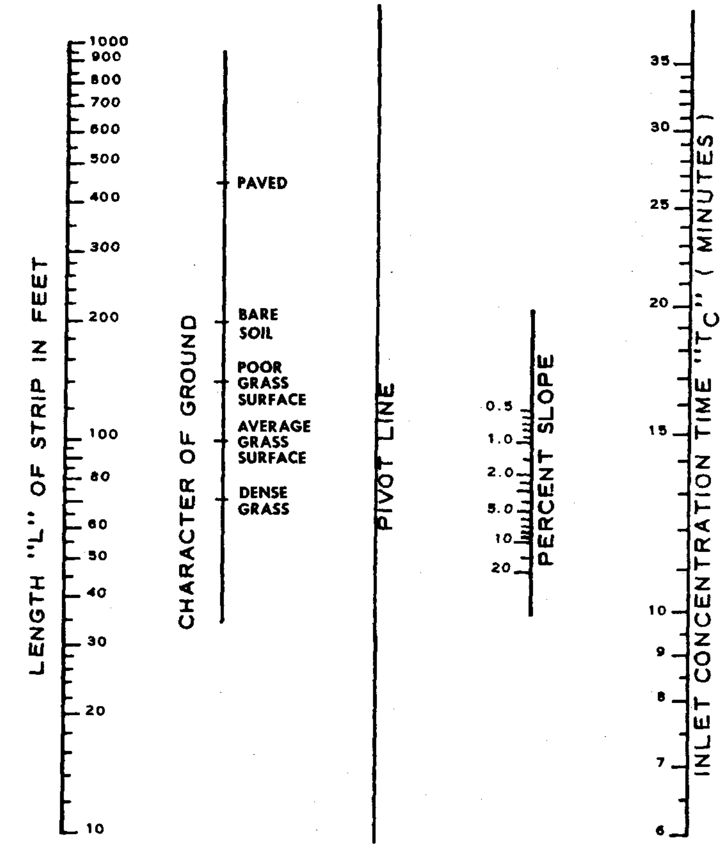
C =	0.94	Contributing Watershed Basin	10.22 acres	(Ref. 2. Table 1, pg 21. Band 2)
C =	0.70	New Graded/Grassed	0.13 acres	(Ref. 3)
C =	0.85	New Access Road/GRP	0.01 acres	(Ref. 3)
C =	0.90	New Conc. Pavement & Channels	0.03 acres	(Ref. 3)
Cw =	**0.9368**		10.39 acres	

$$C_w = \frac{\sum_{j=1}^{n} C_j A_j}{\sum_{j=1}^{n} A_j}$$

Q: 91.30 cfs

Plate 3

Overland Flow Chart



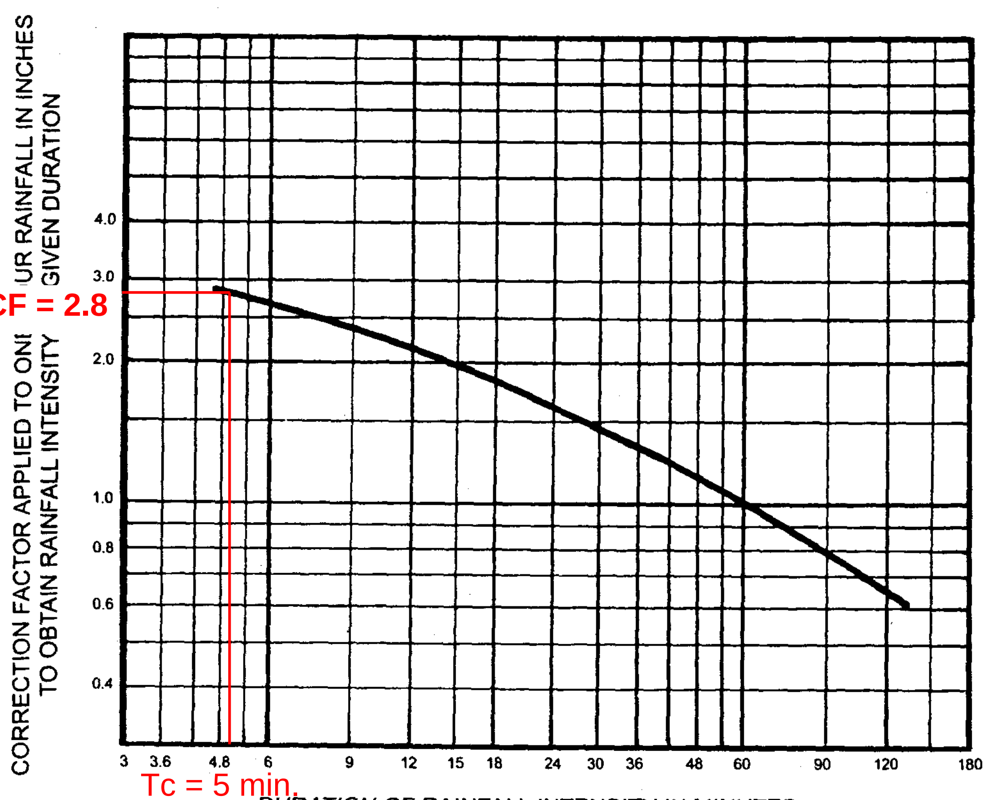


Plate 4

CORRECTION FACTOR

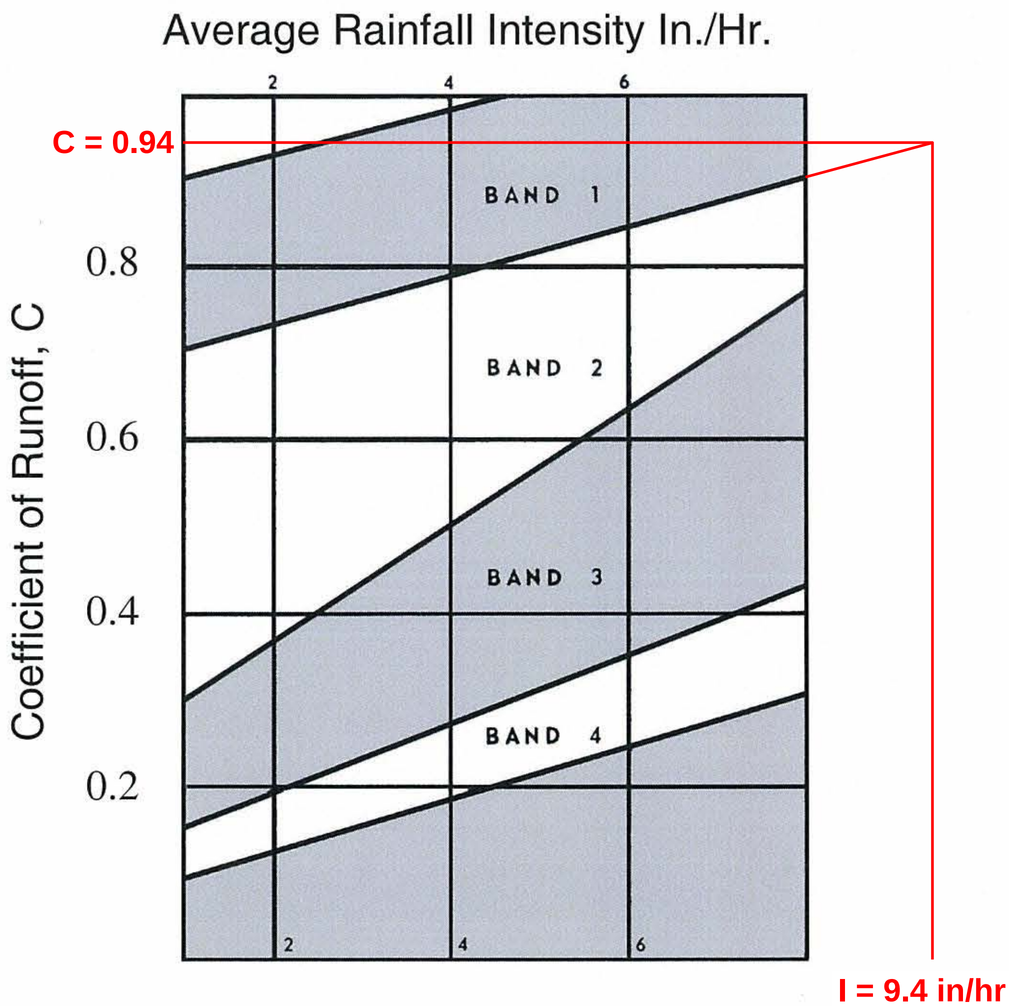
FOR CONVERTING 1 HR. RAINFALL TO RAINFALL INTENSITY OF VARIOUS DURATIONS

TO BE USED FOR AREA LESS THAN 100 ACRES

(See Plate 6 for area more than 100 acres)

§1-4.3 DESIGN CHARTS

Table 1
RUNOFF COEFFICIENT FOR AGRICULTRUAL AND OPEN AREAS



Band 1	Steep, barren, impervious surfaces
Band 2	Rolling barren in upper band values, flat barren in lower part of band, steep forested and steep grass meadows
Band 3	Timber lands of moderate to steep slopes, mountainous, farming
Band 4	Flat pervious surface, flat farmlands, wooded areas and meadows

Basin "B" Calculations

Project:	Salt Lake Debris Basin, Oahu, Hawaii
Project No.:	200511D
Client:	City & County of Honolulu
Subject:	Weir Size Stilling Basin Sizing

By:	APK	Date:	3/6/2015
Checked by:	JDM	Date:	3/6/2015

References

1. Peterka, A. J. U.S. Dept. of Interior, Bureau of Reclamation. *Hydraulic Design of Stilling Basins and Energy Dissipators.* Engineering Monograph No. 25. Washington: GPO: May 1984.

2. U.S. Dept. of the Interior, Bureau of Reclamation. *Design of Small Dams.* Hydraulics of Control Structures, Third Edition 1987

Basin A

Width of spillway crest	W	20.00
Height of spillway crest	Z	8.00
Weir Coefficient	C	3.95

Assume head is 1', so P/Ho=3, and using Fig 9-23, in Ref. 2, Co=3.95
Found head to be 0.85', just under assumed 1', so P/Ho=3.53. Using Fig 9-23, Co=3.95, so Ho to remain 0.85

		2 yr.	10 yr.	50 yr.		
Flow (ft^3/s)	Q	28.34	61.66	91.30		
Depth on sill (ft)	Ho	0.50	0.85	1.10	$H_o = \left(\frac{Q}{C \times W}\right)^{\frac{2}{3}}$	(Ref. 2)
Estimated velocity (Bot. of sill) (ft/s) (Use V_T to be conserv.)	V_T	22.34	22.09	21.90	$V_T = \sqrt{2g(Z - \frac{H_o}{2})} = V_1$	(Ref. 1)
Depth at end of chute (ft)	D_1	0.06	0.14	0.21	$D_1 = \frac{Q}{V_1 \times W}$	
Froude Number	F_1	15.63	10.42	8.45	$F_1 = \frac{V_1}{\sqrt{gD_1}}$	(Ref. 1)
Depth after jump (ft)	D_2	1.37	1.99	2.39	$D_2 = \frac{D_1}{2}\left(\sqrt{1+8F^2} - 1\right)$	(Ref. 1)
ratio (L/D_2) from fig 12		5.95	6.15	6.15		(Ref. 1)
From figure 12 (Ref. 1) Length of jump (ft)	L	8.16	12.23	14.70		
Design Stilling Basin Length (ft)		**15.00**	**15.00**	**15.00**		

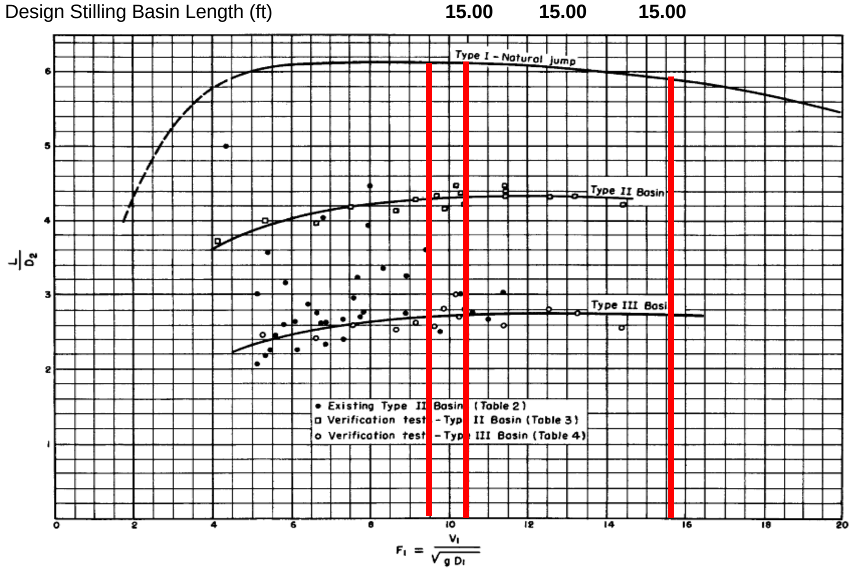


FIGURE 12.—*Length of jump on horizontal floor (Basins I, II, and III).*

Debris Basins

Storage Calculations

Basin "A"
Water Quality Design Volume

Project:	Salt Lake Debris Basin
Project No.:	200511D
Client:	ENV
Subject:	Debris Basin Sizing

By:	APK	Date:	9/28/2017
Checked by:	JDM	Date:	9/28/2017

References:

1. Department of Planning and Permitting, City and County of Honolulu. *Rules Relating to Storm Drainage Standards.* January 2000.
2. Department of Planning and Permitting, City and County of Honolulu, *Storm Water BMP Guide.* December 2012.

Equations:

C = 0.05 + 0.009 x IMP [Ref. 1, pg. 50]
C = Runoff coefficient
IMP = Impervious area

WQV = P x C x A x 3630 [Ref. 1, pg. 50]
WQV = water quality design volume in cubic feet
P = Design storm runoff depth
C = Runoff coefficient
A = Area of site in acres
3630 = conversion factor

Given:

Drainage Area for Channel A = 16.73 ac.

Calculate C for Basin A

Impervious area:

Access Road =	0.05	ac.
Conc. Pavement =	0.03	ac.
Total =	0.08	ac.
IMP =	0.48%	
C =	0.05 + 0.009 x 0.48	
C =	0.054	

Calculate WQDV for Basin A

A =	16.73	ac	
P =	1.5	inch	
WQDV =	1.5 x 0.054 x 16.73 x 3630		
WQDV =	4,947	cf	minimum required by Ref. 1
WQDV=	6,488	cf	(CAD design storage @ ogee weir crest elevation)
FS =	1.31		

Ultimate size of basin is determined by required side slopes and length to width ratio.
Side slopes shall be 4:1 (Basin A) for safety as indicated in Ref. 2.
Length to width ratio shall be 2:1 as indicated in Ref. 2

Basin "B"
Water Quality Design Volume

Project:	Salt Lake Debris Basin		
Project No.:	200511D		
Client:	ENV		
Subject:	Debris Basin Sizing		
By:	APK	Date:	9/28/2017
Checked by:	JDM	Date:	9/28/2017

References:

1. Department of Planning and Permitting, City and County of Honolulu. *Rules Relating to Water Quality. August 16, 2017.*
2. Department of Planning and Permitting, City and County of Honolulu, *Storm Water BMP Guide.* December 2012.

Equations:

C = 0.05 + 0.009 x IMP [Ref. 1, pg. 45]
C = Runoff coefficient
IMP = Impervious area

WQV = P x C x A x 3630 [Ref. 1, pg. 46]
WQV = water quality design volume in cubic feet
P = Design storm runoff depth
C = Runoff coefficient
A = Area of site in acres
3630 = conversion factor

Given:

Drainage Area for Channel B = 10.39 ac.

Calculate C for Basin B

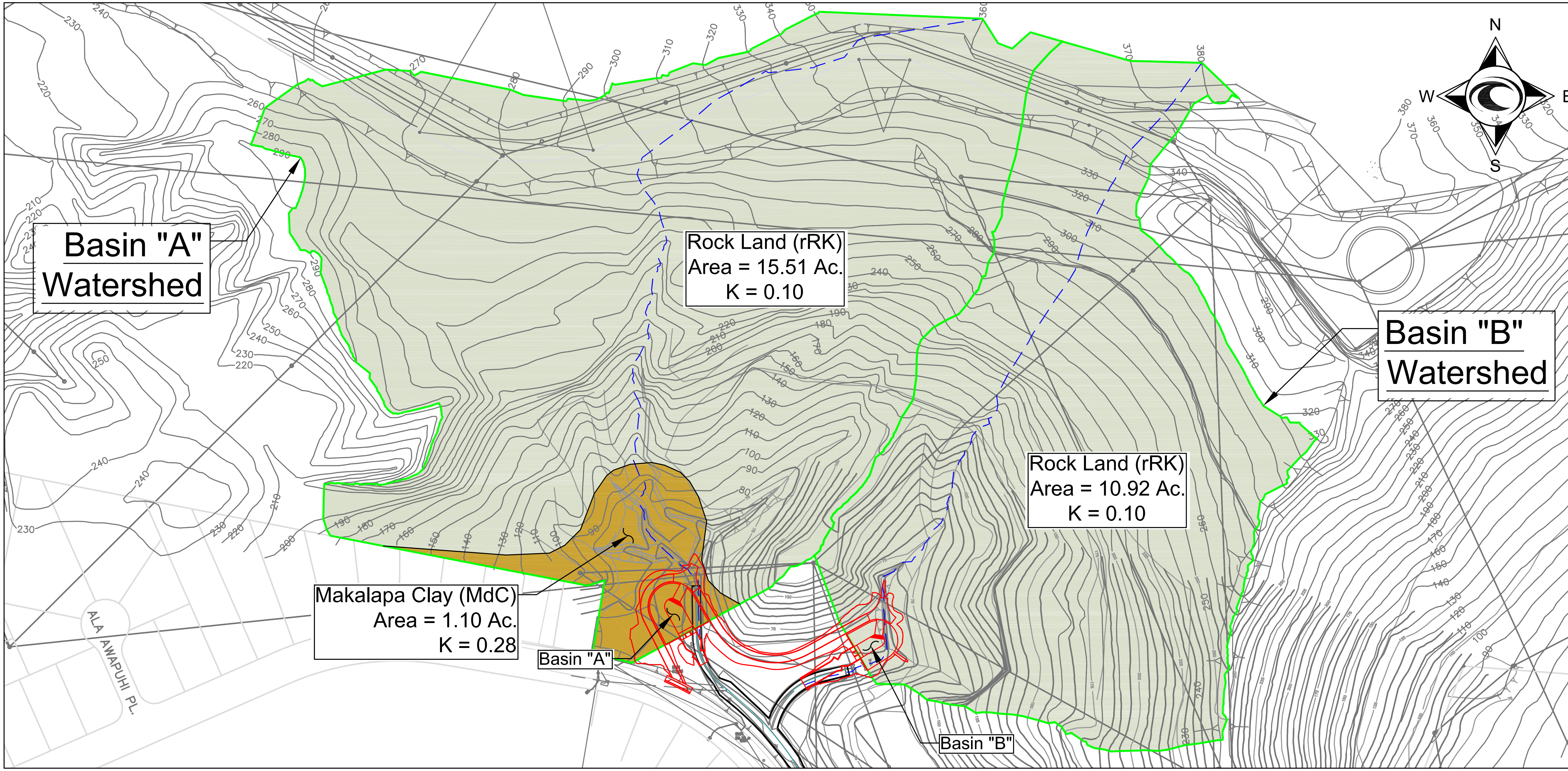
Impervious area:

Access Road =	0.01	ac.
Conc. Pavement =	0.03	ac.
Total =	0.04	ac.
IMP =	0.38%	
C =	0.05 + 0.009 x 0.38	
C =	0.053	

Calculate WQDV for Basin B

A =	10.39	ac	
P =	1.5	inch	
WQDV =	1.5 x 0.053 x 10.39 x 3630		
WQDV =	3,025	cf	minimum required by Ref. 1
WQDV=	4,569	cf	(CAD design storage @ ogee weir crest elevation)
FS =	1.51		

Ultimate size of basin is determined by required side slopes and length to width ratio.
Side slopes shall be 3.5:1 (Basin B) for safety as indicated in Ref. 2.
Length to width ratio shall be 2:1 as indicated in Ref. 2



Legend:

Drainage Sub-Basin Longest Flow Path

Drainage Sub-basin Boundary

150' 75' 0 150' 300'

SCALE: 1" = 150'

Figure B-2: Existing Soils Map

Salt Lake Debris Basin

oceanit

March 2015

Basin "A" USLE

Project:	Salt Lake Sediment Debris Basins		
Project No.:	200511D		
Client:	City & County of Honolulu, Department of Environmental Services		
Subject:	Soil Loss Calculations - Basin "A"		
By:	APK	**Date:**	3/6/2015
Checked by:	JDM	**Date:**	3/6/2015

Reference: 1. Rules Relating to Soil Erosion Standards and Guidelines
Department of Planning and Permitting City and County of Honolulu, Hawaii, April 1999
2. P. King, Water Resources and Environmental Engineering
McGraw-Hill. 1992 pg. 196

Determine: Determine the sedimentation rate.

R, total erosive effect factor for an average year.

R = 190 (Ref. 1, Average Annual Rainfall Factor , R, pg 57)

K, soil erodibility factor.

Soil Symbol = rRK (See Figure 2)
K = 0.10 (Ref. 1, pg 43, table 14)
Area = 15.50 Acres

Soil Symbol = MdC (See Figure 2)
K = 0.28 (Ref. 1, pg 43, table 14)
Area = 1.23 Acres

K (weighted)= $$\frac{\sum_{i=1}^{n} K_i \, Area_i}{\sum_{i=1}^{n} Area_i} = 0.11$$

LS, factor for length and steepness of slope.

LS = $((\lambda/72.6)^m)*(430x^2+30x+.43)/6.57415$
s = 21.9% (Slope of from top of watershed to exist. channel)
m = 0.5
λ = 1457.04
x = 0.2139
LS = 18.074

CP, erosion control factor.
C= 0.011 (Ref. 1, Table 20, tall weeds 95%-100% cover)
P= 1 (No other erosion control measures)
CP = 0.011

A = RK(LS)(CP)
A = 190(0.11)(18.1)(0.011) = 4.28 Ton/Acre/Year

Basin "A" USLE

Project: Salt Lake Sediment Debris Basins
Project No.: 200511D
Client: City & County of Honolulu, Department of Environmental Services
Subject: Soil Loss Calculations - Basin "A"
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

Annual Sediment Loading:

$\mathbf{W_{soil}}$, sediment loss

A=	4.28	Ton/Acre/Year
Area=	16.73	Acre
$\mathbf{W_{soil}}$ **=**	71.56	Ton/Year
	143,123	lbs/Year
SG_{soil}	2.65	(Ref. 2)
ρ_{water} =	62.4	lb/ft^3

$$\rho_{soil} = SG_{soil} \times \rho_{water}$$

ρ_{soil} = 165.36 lb/ft^3

$$V_{soil} = \frac{W_{soil}}{\rho_{soil}} = \frac{143{,}123}{165.36}$$

V_{soil} = **866** ft^3/Year

Basin "B" USLE

Project: Salt Lake Sediment Debris Basins
Project No.: 200511D
Client: City & County of Honolulu, Department of Environmental Services
Subject: Soil Loss Calculations - Basin "B"
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

Reference:
1. Rules Relating to Soil Erosion Standards and Guidelines
   Department of Planning and Permitting City and County of Honolulu, Hawaii, April 1999
2. P. King, Water Resources and Environmental Engineering
   McGraw-Hill. 1992 pg. 196

Determine: Determine the sedimentation rate.

R, total erosive effect factor for an average year.

R = 190 (Ref. 1, Average Annual Rainfall Factor , R, pg 57)

K, soil erodibility factor.

Soil Symbol = rRK (See Figure 2)
K = 0.10 (Ref. 1, pg 43, table 14)

LS, factor for length and steepness of slope.

LS = $((\lambda/72.6)^{m})*(430x^{2}+30x+.43)/6.57415$

s = 26.9% (Slope of from top of watershed to exist. channel)
m = 0.5
λ = 1287.17
x = 0.2602
LS = 23.918

CP, erosion control factor.

C= 0.011 (Ref. 1, Table 20, tall weeds 95%-100% cover)
P= 1 (No other erosion control measures)
CP = 0.011

A = RK(LS)(CP)
A = 190(0.1)(23.9)(0.011) = 5.00 Ton/Acre/Year

Basin "B" USLE

Project: Salt Lake Sediment Debris Basins
Project No.: 200511D
Client: City & County of Honolulu, Department of Environmental Services
Subject: Soil Loss Calculations - Basin "B"
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

Annual Sediment Loading:

W_{soil}, sediment loss

A=	5.00	Ton/Acre/Year
Area=	10.39	Acre
W_{soil} =	51.94	Ton/Year
	103,875	lbs/Year

SG_{soil}	2.65	(Ref. 2)
ρ_{water} =	62.4	lb/ft^3

$$\rho_{soil} = SG_{soil} \times \rho_{water}$$

ρ_{soil} = 165.36 lb/ft^3

$$V_{soil} = \frac{W_{soil}}{\rho_{soil}} = \frac{103{,}875}{165.36}$$

V_{soil} = **628** ft^3/Year

Basin Capacity USLE

Project: Salt Lake Debris Basins
Project No.: 200511D
Client: City & County of Honolulu, Department of Environmental Services
Subject: Sediment Capacity
By: APK **Date:** 3/6/2015
Checked by: JDM **Date:** 3/6/2015

		Basin "A"	Basin "B"
Depth (ft) for sediment capacity		1	1
Volume (CAD Surface) (ft^3)		1154	821
Volume of Sediment annually (ft^3/Year)		866	628
Time to fill up basins	years	1.33	1.31
	days	487	477

Appendix C. Biological Resources Survey

Biological Resources Survey for the Proposed Salt Lake Debris Basins

Salt Lake, Honolulu, Hawaii

TMK: 1-1-063:018 (Portion)

Prepared By:

Koehler Enterprises, LLC
2914A Lauoha Place
Honolulu, HI 96813

Prepared for:

Oceanit Laboratories, Inc.
828 Fort Street Mall, Ste 600
Honolulu, Hawaii

September 9, 2014

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LIST OF TABLES

1.0 INTRODUCTION

The City & County of Honolulu is proposing to construct two debris basins at the upper reaches of existing concrete drainage ditches along Likini Street, at the base of the southern-facing, exterior slopes of the Aliamanu Crater (Figure 1). The 1.02 acre project site lies at between 54 and 80 ft elevation, within the Salt Lake watershed, with the undeveloped rim of the Aliamanu crater rising prominently behind the project area to the north and east. Likini Street forms the project's south-western boundary. A private residence borders westernmost extent of the project site. The proposed project entails excavation, grading, and revegetating two unlined basins, along with other improvements, such as concrete access ramps, spillway construction and weir installation. Access roads around the basins will be paved. The extent of the project area generally follows the topography of the site, with the basins and access roads proposed for the least sloped areas. The purpose of this study is to assess the biological resources present in the project area.

2.0 METHODS

2.1 Botanical Survey

A pedestrian survey of the project area was conducted on August 30, 2014, and consisted of walking the outline of both proposed sediment basins and project boundaries, examining all areas potentially impacted by the project. The survey area is larger than the proposed footprint of the project, including the lower portions of the toe of the slopes, drainage ditches and turf areas. A Garmin *GPSMAP 62S* handheld GPS unit was used to indicate the survey area and important features (Figure 2).

Where possible, plants were identified to species in the field and abundance qualitatively assessed. Samples were collected for unidentified species requiring further analysis and subsequently identified. Plant names follow Gagne and Cuddihy (1999) and Wagner, Herbst and Sohmer (1999).

2.2 Fauna Survey

Owing to the small project area, observations were made at two avian point count stations on August 30, 2014. Data were collected for 8 minutes at each of the two stations. A foot survey was conducted for the remainder of the project site. Observations were made with the assistance of Bausch & Lomb 8 X 24 binoculars and by listening for vocalizations. Avian species present, but not detected during the point count survey were noted and tallied separately.

Direct mammal observation techniques were limited to visual and auditory detection. Indirect observations (scat, tracks and other evidence of presence) were also recorded in a running tally.

Phylogenetic Order and nomenclature for avian species follows the *AOU Check-List of North American Birds* (American Ornithologists' Union 1998), and the 42nd through 54th Supplements (American Ornithologist's Union 2000, Banks et al. 2002,2003,2004,2005,2006,2007,2008; Chesser et al. 2009,2010,2011,2012,2013). Mammal names follow Tomich 1986.

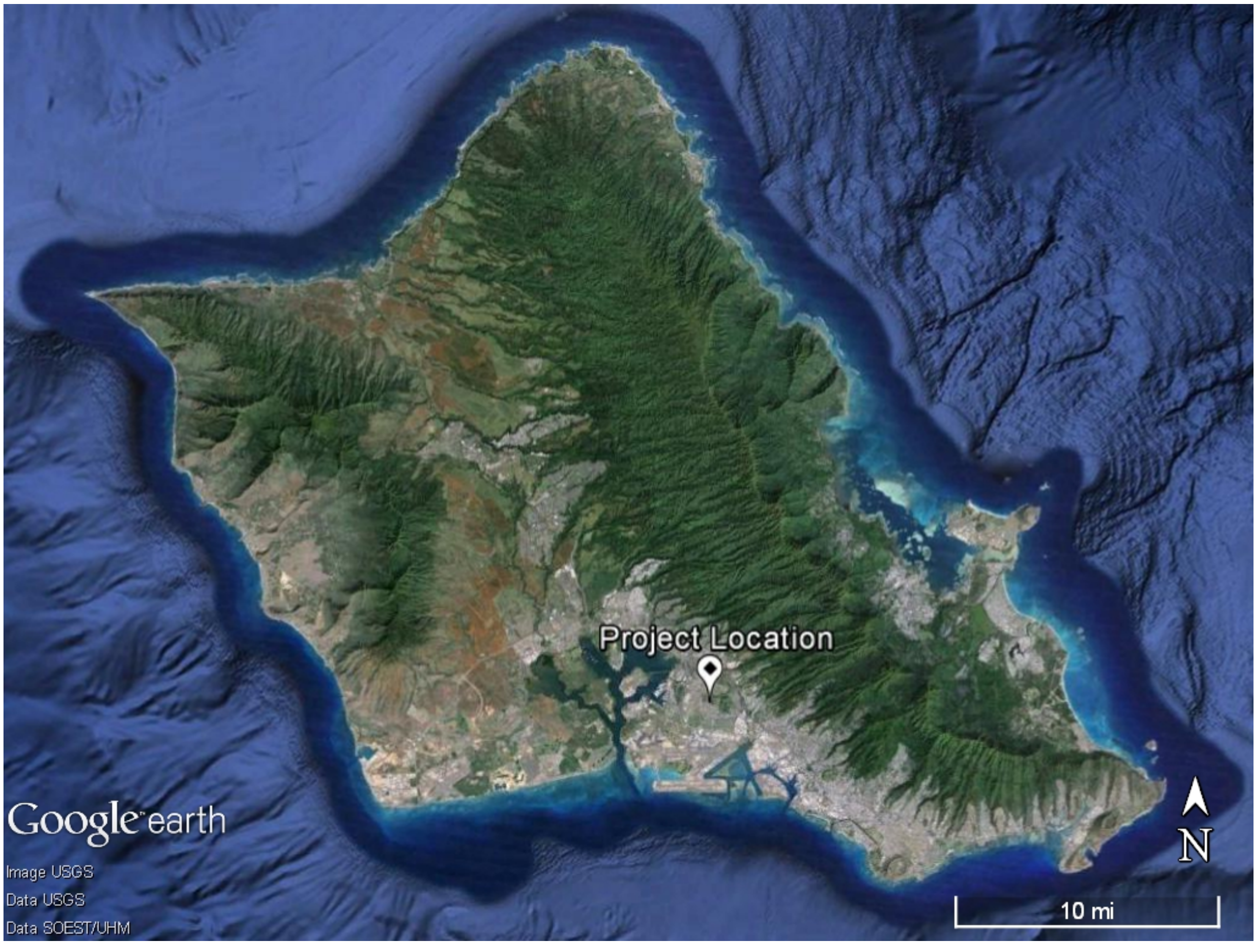

Figure 1. Salt Lake debris basin biological resources survey location.

3.0 RESULTS

3.1 General Habitat Observations

The project area is dominated by a Guinea grass (*Megathyrsus maximus*) & *haole koa* (*Leucaena leucocephala*) shrubland, where the tree canopy is approximately 15 feet, and the grass/shrub layer 2 feet in height. The occasional Kiawe trees (*Prosopis pallida*) range from approximately 15-30 feet in height. Following the vegetation classification of Gagne and Cuddihy (1999), the vegetation community is a lowland dry shrubland; characterized by open shrublands, under which grow herbaceous species adapted for winter rainfall and summer droughts. Estimated annual rainfall for the site is 30.25in (Giambelluca *et al* 2013) with the most recent significant (> 0.1 in/24hr) rainfall event occurring August 8, 2014. In the wet season, the grass/shrub layer is likely taller.

The drainage ditches and dry water courses harbor greater species diversity. Accumulated sediment in the drainage channels supports plant growth. The landscape slopes upward away from Likini St., but especially at the project boundaries. For the most part, the substrate consists of soils, and rocky soils. Occasional rock out-crops were observed further up slope, outside the project area. A 10-15 foot wide

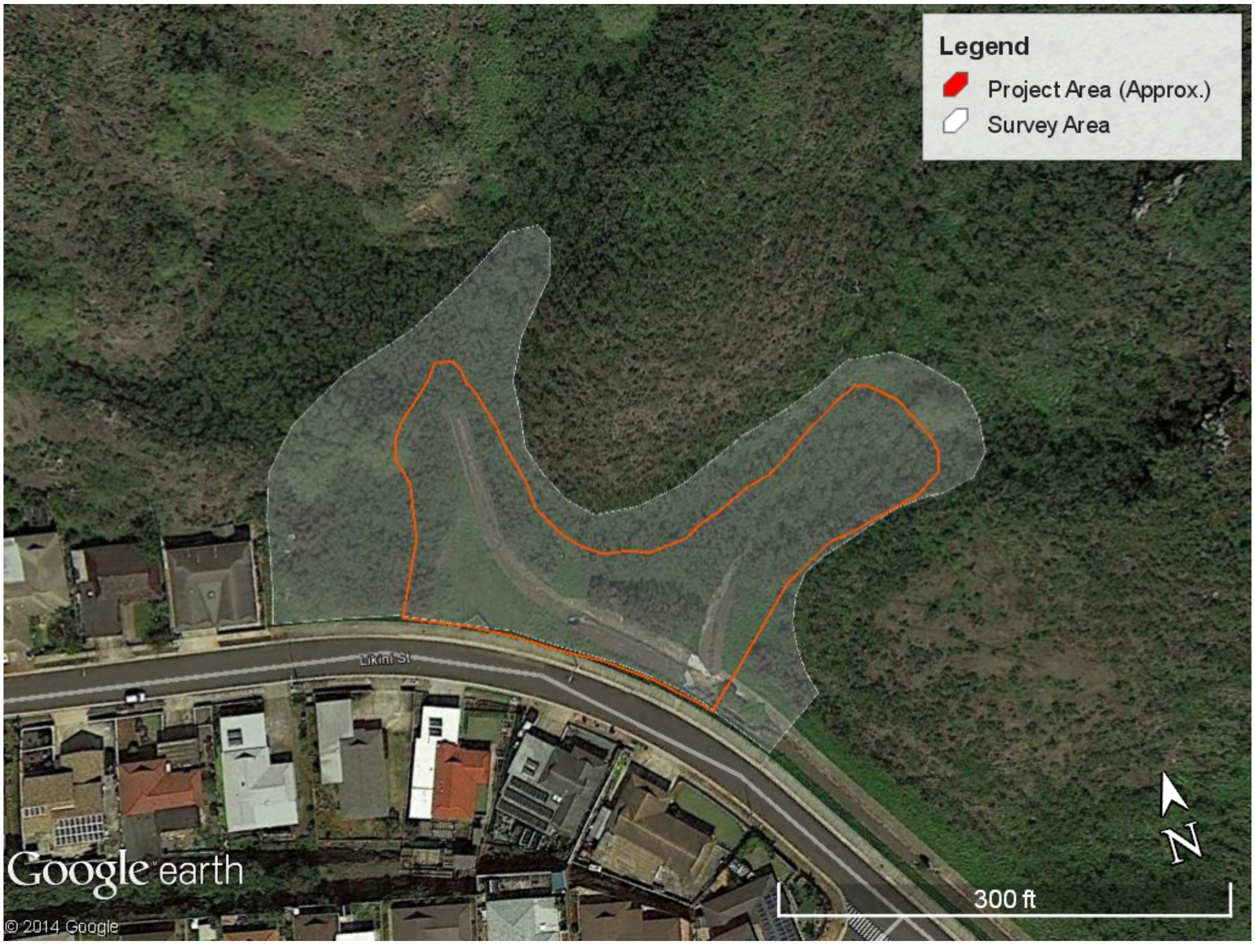

Figure 2. Biological resources survey area for the Salt Lake Debris Basin project.

area around the each side of the concrete-lined ditch was mowed to a height between 2-5 inches. A black tarp-like permeable synthetic erosion control liner was present beneath the mowed area fringing portions of the drainage ditches, flush with the soil.

3.2 Botanical Survey

Overall, the vegetation at the site is dominated by invasive weeds adapted to lowland leeward habitats. Table 1 details the plant species that were recorded at the site. No ferns or fern allies were observed during the survey.

Only three native Hawaiian plant species were recorded (*Abutilon incanum*, *Sida fallax*, *Waltheria indica*).

The vegetation where the proposed activities are to take place can be further divided into three specific plant communities: *Haole koa* shrubland, Drainage swale, Maintained turf

3.2.1 *Haole koa* shrubland

The site is primarily composed of haole koa shrubland. This vegetation community occurs mauka (upslope) and ewa (east) of the existing concrete drainage channels. *Haole koa* is the dominant woody species, which occur up to 15 ft tall, forming an open canopy. Kiawe (*Prosopis pallida*), a tree reaching 30 ft tall and needle bush (*Acacia farnesiana*), a shrub that grows to 6 ft at the site, also occurred sporadically within the shrubland. Guinea grass primarily composes the vegetation below the *haole koa* canopy, through which occur occasional Chinese violet (*Asystasia gangetica*) and comb bushmint (*Hyptis pectinata*). The three native plant species that were recorded occurred near or on rocky outcrops where the Guinea grass was largely absent.

3.2.2 Drainage swale

The drainage swale contained introduced herbaceous plant species that are adapted to higher fertility habitats. Although the swale was dry at the time of the survey, these species appear to be benefiting from periodic rainfall and nutrient runoff. Species that occurred in the swale included: Benghal dayflower (*Commelina benghalensis*); purple bush-bean (*Macroptilium atropurpureum*); hyacinth bean (*Lablab purpureus*); Aiea morning glory (*Ipomoea triloba*) and obscure morning glory (*Ipomoea obscura*).

Figure 3. Representative view of the project site, facing east from the fenceline on the western project boundary.

Table 1. Plant species observed during the Salt Lake Debris Basin Biological Resources Survey.

Common Name	Scientific Name	Status	Occurrence	Note
	DICOTYLEDONES			
	ACANTHACEAE			
Chinese violet	*Asystasia gangetica*	Introduced	Occasional	
	AMARANTHACEAE			
Green amaranth	*Amaranthus viridis*	Introduced	Occasional	
	APOCYNACEAE			
Carrion plant	*Stapelia gigantea*	Introduced	Occasional	
	ASTERACEAE			
Coat buttons	*Tridax procumbens*	Introduced	Occasional	
	CLUSIACEAE			
Autograph tree	*Clusia rosea*	Introduced	Rare	
	CONVOLVULACEAE			
Aiea morning glory	*Ipomoea triloba*	Introduced	Occasional	
Obscure morning glory	*Ipomoea obscura*	Introduced	Occasional	
	CUCURBITACEAE			
Ivy gourd	*Coccinia grandis*	Introduced	Rare	
	EUPHORBIACEAE			
Graceful spurge	*Euphorbia hypericifolia*	Introduced	Occasional	
	FABACEAE			
Haole koa	*Leucaena leucocephala*	Introduced	Abundant	[1]
Kiawe	*Prosopis pallida*	Introduced	Common	
Needlebush	*Acacia farnesiana*	Introduced	Occasional	
Purple bush-bean	*Macroptilium atropurpureum*	Introduced	Rare	
Australian pea	*Lablab purpureus*	Introduced	Occasional	
Creeping indigo	*Indigofera spicata*	Introduced	Occasional	
	LAMIACEAE			
Comb hyptis	*Hyptis pectinata*	Introduced	Occasional	
	MALVACEAE			
Maʻo	*Abutilon incanum*	Indigenous	Rare	
-	*Abutilon grandiforum*	Introduced	Rare	
ʻIlima	*Sida fallax*	Indigenous	Rare	
False mallow	*Malvastrum coromandelianum subsp. coromandelianum*	Introduced	Occasional	
Bracted fanpetals	*Sida ciliaris*	Introduced	Occasional	
	NYCTAGINACEAE			
Hogweed	*Boerhavia coccinea*	Introduced	Occasional	
	RUTACEAE			
Orange jessamine	*Murraya paniculata*	Introduced	Rare	
	STERCULIACEAE			
ʻUhaloa	*Waltheria indica*	Indigenous	Occasional	

Table 1 (Cont'd). Plant species observed during the Salt Lake Debris Basin Biological Resources Survey.

Common Name	Scientific Name	Status	Occurrence	Note
	MONOCOTYLEDONES			
	ASPARAGACEAE			
Mother-in-law's tongue	*Sansevieria trifasciata*	Introduced	Rare	
	COMMELINACEAE			
Benghal dayflower	*Commelina benghalensis*	Introduced	Occasional	
	CYPERACEAE			
Umbrella sedge	*Cyperus rotundus*	Introduced	Occasional	
	POACEAE			
Fingergrass	*Chloris barbata*	Introduced	Occasional	
Lovegrass	*Eragrostis tenella*	Introduced	Abundant	
Guinea grass	*Megathyrsus maximus*	Introduced	Abundant	[1]
Natal Redtop	*Melinus repens*	Introduced	Occasional	
	XANTHORRHOEACEAE			
Aloe	*Aloe vera*	Introduced	Rare	

Notes:
[1] Dominant, vegetation-defining species

3.2.3 Maintained turf

The maintained turf immediately inside the gate and along the makai perimeter fence line is composed of plant species adapted to low fertility and seasonally dry turf communities, including: false mallow (*Malvastrum coromandelianum* subsp. *coromandelianum*); bracted fanpetals (*Sida ciliaris*); creeping indigo (*Indigofera spicata*); coat buttons (*Tridax procumbens*); hogweed (*Boerhavia coccinea*); graceful spurge (*Euphorbia hypericifolia*); lovegrass (*Eragrostis tenella*) and green amaranth (*Amaranthus viridis*).

In addition, abutting the ewa edge of the site, close to the makai perimeter fence, a resident has established, and appears to be maintaining, a vegetable garden containing plants such as pumpkin (*Cucurbita pepo*) and eggpant (*Solanum melongena*). A full botanical inventory of this garden was not deemed an important component of the wider botanical survey. The species included in this garden are therefore not included in Table 1.

3.3 Fauna Survey

3.3.1 Avian Survey

Twenty-four individual birds of seven different species were encountered during the site visit. Of those, 21 individuals, representing six species were observed during the two point counts (Table 2). Six families

Table 2. Avian species detected during the Biological Resources Survey for the Salt Lake Debris Basin survey.

Common Name	Scientific Name	Status*	Count**	Note
	CHARADRIIFORMES			
	CHARADRIIDAE - Plovers, Dotterels, and Lapwings			
Pacific Golden Plover	*Pluvialis fulva*	N	n/a	[1]
	COLUMBIFORMES			
	COLUMBIDAE - Pigeons & Doves			
Rock Pigeon	*Columba livia*	A	1	
Zebra Dove	*Geopelia striata*	A	5	
	PASSERIFORMES			
	PYCNONOTIDAE - Bulbuls			
Red-vented Bulbul	*Pycnonotus cafer*	A	5	
	ZOSTEROPIDAE - White-eyes			
Japanese White-eye	*Zosterops japonicus*	A	4	
	CARDINALIDAE - Cardinals, Saltators, & Allies			
Northern Cardinal	*Cardinalis cardinalis*	A	4	
	PASSERIDAE - Old World Sparrows			
House Sparrow	*Passer domesticus*	A	2	

* Status: A - Alien, I - Indigenous, N - Native, E - Endemic
** Count: Number of individuals encountered at both point count stations
[1] Observed in mowed area adjacent to concrete ditches, not during point count. Protected under the migratory bird treaty act.

of birds were represented at the site. The Pacific Golden Plover (*Pluvialis fulva*), encountered in the mowed area near the entrance gate, was the only native species detected. Zebra Doves (*Geopelia striata*) and Red-vented Bulbuls (*Pycnonotus cafer*) were the most common species observed at the site.

3.3.2 Mammal Survey

One mammal species, an Indian Mongoose (*Herpesties a. auropunctatus*), a non-native species, was encountered during the site visit. No other evidence of mammals was observed during the survey.

4.0 DISCUSSION

4.1 Botanical Resources

The survey did not reveal any botanical resources of notable value or worthy of consideration for conservation or protective measures.

4.2 Faunal Resources

4.2.1 Avian

Avian abundance and diversity appeared comparable within the survey and adjacent developed and undeveloped areas. Of the seven species encountered during this survey, only the Pacific Golden Plover, is native.

A common species, the Pacific Golden Plover arrives in August and spends fall and winter on Pacific Islands, as far south as New Zealand. It departs in May for arctic breeding grounds. In Hawaii, it occurs on all islands, and feeds in fields, lawns, and occasionally mud flats. It does not nest in Hawaii. Individuals establish and defend feeding territories during the day, but at night roost communally in wetlands, beaches and large rooftops. Some individuals are known to return to their same territory each year. (Birdlife International 2012, Denny 2010, Johnson *et al* 1996)

The threatened Newell's Shearwater (*Puffins auricularis newelli*) was not detected in this survey, nor was suitable nesting habitat observed in or around the project site. It is a pelagic seabird species exceptionally unlikely to over-fly the project area, and if so, only between the months of May and early December. This bird nests at high altitudes in the mountains transiting to sea in the evening, and returning to nesting sites early in the morning. The primary threat to this species is believed to be predation by non-native mammals at nesting colonies, with collision with made-made structures the second leading contributor to mortality. Disorientation due to exterior lighting contributes to this nocturnally-flying species' collisions with man-made structures. (Ainley *et al* 2007, Melgar 2002)

4.2.2 Mammals

The mammal species observed during the survey are in keeping with the general project site habitat and surrounding areas. Given the habitat characteristics and surrounding urban environment, in addition to the Indian Mongoose observed, cats (*Felis catus*), roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), Polynesian rats (*Rattus exculans*), and mice (*Mus musculus domesticus*) are likely abundant. However no observations, direct or indirect, of these species were made during the survey. Likewise, no signs other large vertebrates (i.e. dogs, pigs, or goats) were observed, though they may occur.

The endangered Hawaiian hoary bat (*Lasiurus cenerus semotus*) was not detected during the survey, though a remote possibility exists that the species could make very limited, seasonal use of the project area for foraging. The urbanized, degraded habitat in and around the project are not optimal pupping and roosting habitat. The 15 ft haole koa canopy and occasional Kiawe trees likely do not provide sufficient shade for daytime roosting (Pinzari 2014).

4.3 Potential Impacts to Protected Species

4.3.1 Flora

No plant species identified in the survey are currently protected or proposed for protection under Federal or State endangered species programs (DLNR 1997, USFWS 2010a, USFWS 2014a).

4.3.2 Fauna

4.3.2.1 Newell's Shearwater

The Newell's Shearwater is listed as Threatened under the Endangered Species Act (ESA) (DLNR 1998, USFWS 2010, USFWS 2014a). At most, the proposed project may present a potential for disorientation of Newell's Shearwaters caused by exterior lighting associated with construction. To minimize the possibility for interactions between this nocturnal flying species, it is recommended that as little lighting be employed during construction and that all fixtures be shielded and downward-angled.

4.3.2.2 Pacific Golden Plover

The Pacific Golden Plover is protected under the Migratory Bird Treaty Act (MBTA)(USFWS 2013). Impacts, if any, to the species are most likely to occur during construction. Efforts should be made to minimize/avoid actions that may harass or injure birds, for example commencing construction while the species is away at its arctic breeding grounds (June – July).

4.3.2.3 Hawaiian Hoary Bat

The Hawaiian Hoary Bat is listed as Endangered under the ESA (USFWS 2010, USFWS 2014a). Clearing of woody vegetation greater than 15 ft tall is the project's primary potential impact. To avoid impacts, the project should refraining from clearing trees above 15 feet in height for construction between June 1 and September 15, which is the period when a slight possibility exists that Hawaiian hoary bat juveniles may occur in the project area, and may not be able to escape a tree being felled.

4.3.3 Critical Habitat

No critical habitat is present in our in the vicinity of the project site, based on review of data in the United States Fish and Wildlife Service's Critical Habitat Portal (USFWS 2014).

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Appendix D. Archaeological Evaluation

SCS Project No. 1602-2 FI/AE

AN ARCHAEOLOGICAL EVALUATION FOR THE SALT LAKE DEBRIS BASINS PROJECT MOANALUA AHUPUA`A, HONOLULU (KONA) DISTRICT O`AHU ISLAND, HAWAI`I [TMK: (1) 1-1-063:018 POR.]

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INTRODUCTION

At the request of Oceanit Laboratories, Inc., Scientific Consultant Services, Inc. (SCS) has conducted an Archaeological Field Inspection for the proposed Salt Lake Debris Basins Project located in Salt Lake, Moanalua Ahupua`a, Honolulu (Kona) District, O`ahu Island, Hawai`i [TMK: (1) 1-1-063:018 por.]. The approximately 1.8 acre project area is located within the Salt Lake District Park which is owned by the City and County of Honolulu (Figures 1 through 3; Appendix A).

Based on a review of previous archaeological studies in the vicinity, and a field inspection of the project area, this report presents documentation of past land use within the project area and in the surrounding portion of Honolulu.

This report does not meet the requirements of HAR Chapter 13-276 for an archaeological inventory survey; however, through research into the archaeological, historical, and cultural background, and a field inspection of the project area, this investigation is intended to identify cultural resources that may be affected by the project.

The scope of work for this investigation includes:

- Historical and previous archaeological background research including previous archaeological reports, Land Commission Awards, and historic maps in order to determine if archaeological sites have been recorded on or near this property, and to document the history of land use in and around the project area.
- Field inspection of the project area to identify surface archaeological sites or features and to investigate and assess the potential for impact to such sites or features.
- Preparation of a letter report which will include the results of the historical research and the fieldwork and make recommendations as to what additional work, if any, might be required.

ENVIRONMENTAL SETTING

The island of O`ahu ranks third in size of the eight main islands in the Hawaiian Archipelago. The Ko`olau and Wai`anae Mountain ranges (forming the eastern and western portions of the island, respectively), were formed by two volcanoes. Through the millennia the

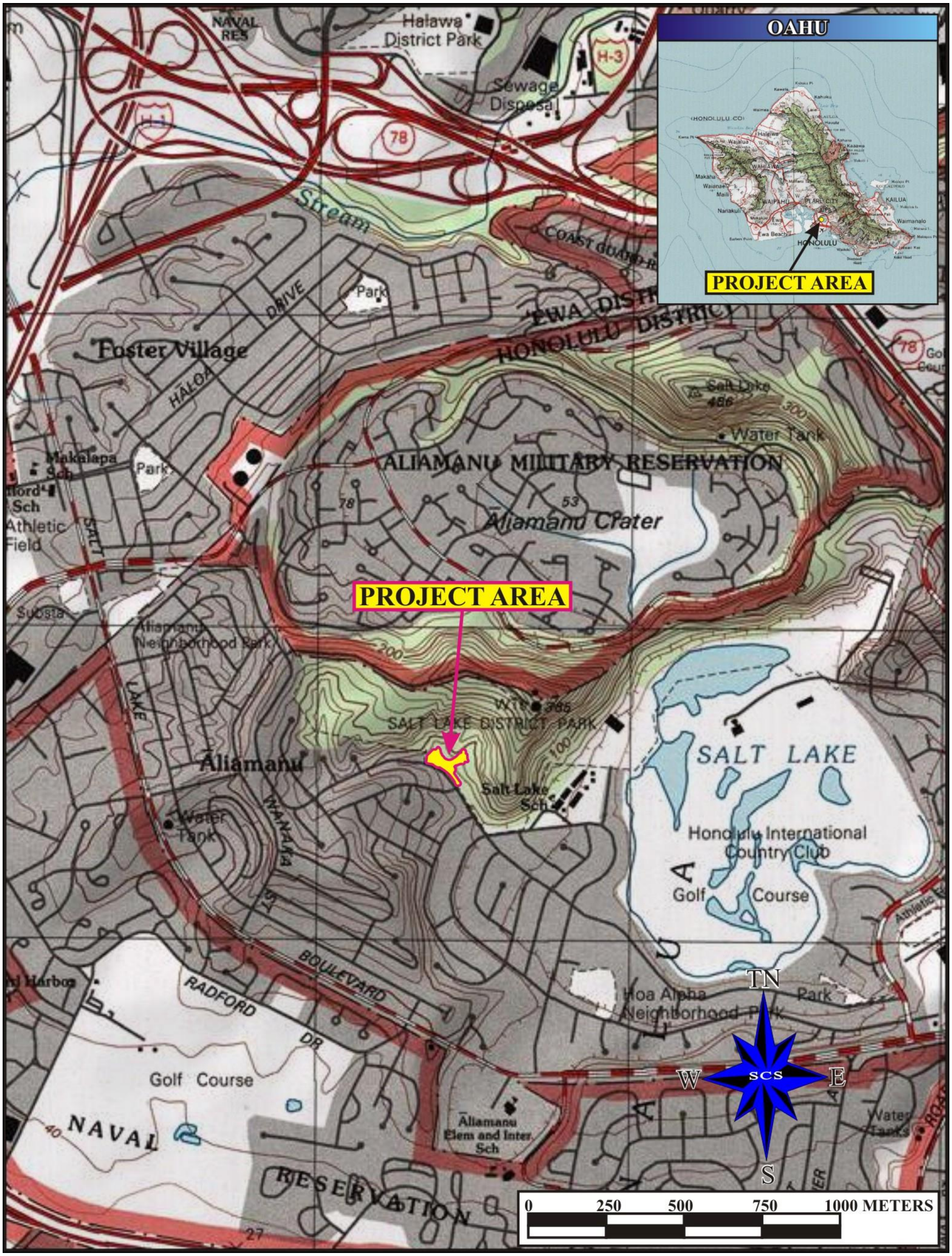

Figure 1: USGS Quadrangle (Pearl Harbor 1999) Map Showing Project Area Location.

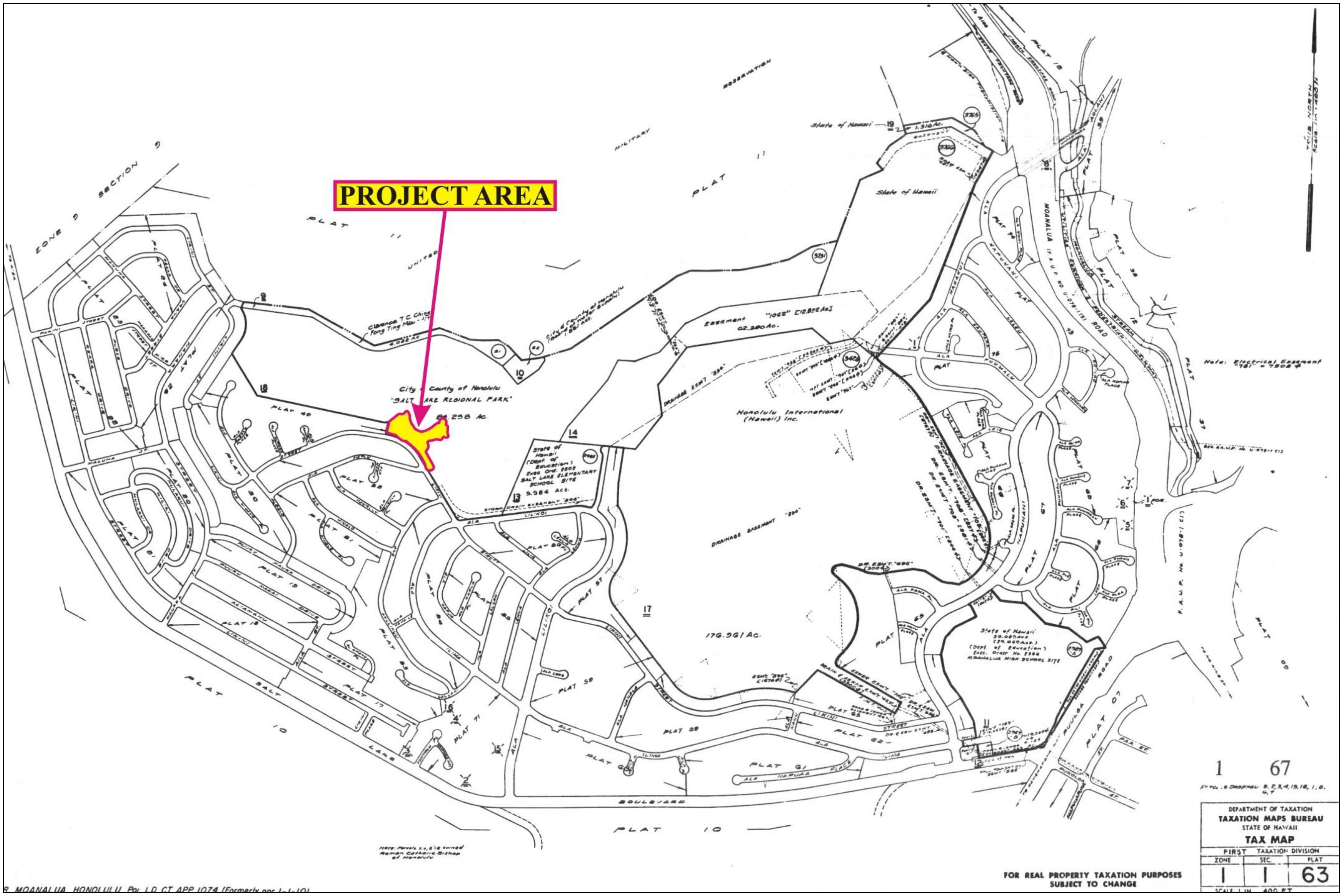

Figure 2: Tax Map Key [TMK: (1) 1-1-063] Showing Project Area Location.

Figure 3: Google Earth Image (Aerial imagery from Google, Digital Globe dated 1/29/2013) Showing Project Area Location.

constant force of water carved fertile amphitheater-headed valleys and rugged passes eroded at lower elevations providing access from one side of the island to another (Macdonald and Abbott 1970).

According to MacDonald and Abbott (1970:366), numerous volcanic eruptions, which occurred over hundreds of thousands of years, created a number of today's well-known landmarks, including: Diamond Head Crater, Koko Head, Hanauma Bay, Punchbowl, and Tantalus. The eruptions also created "broad saucer-shaped tuff cones", including the Salt Lake, Āliamanu (bird salt pond) and Makalapa (Kapūkapī) Craters, located near the project area. These craters comprised a cluster of overlapping tuff cones that blocked the former courses of Moanalua and Halawa Streams and forced the streams to make wide detours to the sea" (MacDonald and Abbott 1970:374-375). In re-routing the course of the streams, the cones also played a large role in shaping Moanalua and Hālawa Valleys. In the recent past, Salt Lake Crater, was filled-in and is currently the site of a golf course (McDonald and Abbott 1970:375).

LOCATION

The Salt Lake Basin project area is situated near the center of the island of O`ahu, on the leeward side of the Ko`olau Mountain Range. The project area is located an estimated 3.5 miles (c. 5,363 m) north of the coastline at an elevation of 20 to 32 feet (6.0 to 9.8 m) above mean sea level (amsl). The proposed project area is located within the Salt Lake District Park, in the southern portion of Moanalua Ahupua`a, Honolulu (Kona) District, O`ahu Island, Hawai`i [TMK: (1) 1-1-063:018 por.]. According to the Honolulu Property Tax website (http://www.honolulupropertytax.com), the project area consists of approximately 1.8acres of land owned by the City and County of Honolulu.

PROJECT AREA

The approximately 1.8-acre project area is within the confines of the Salt Lake District Park, which forms the southeast and northeast project area boundaries of the project area. Residential housing and Salt Lake District Park forms the northwest/west project area boundary and the southwest project area boundary is formed by a concrete sidewalk and the asphalt-paved Likini Street.

Two concrete, v-shaped in cross-section, drainages are located within the project area. Both drainages curve from the north to the south and drain or re-direct runoff water from the southwest exterior slope of Āliamanu Crater to a main v-shaped in-cross section, concrete drainage that is oriented in a general northwest to southeast direction. Also feeding the main concrete drainage is a concrete pipe oriented in a general east/west direction, which is likely to extend beneath Likini Street. Please note that these concrete drainages are below the ground surface of the project area. The north/northwest side of the project area slopes towards the south/southeast. The slopes contain natural drainages which drain into the project area's main concrete drainage. In addition, the project area exhibited evidence of prior land alterations including, multiple mechanically created push piles located at the western end of the project area. The areas adjacent to the three open-air concrete drainages were graded during preparation for the placement of the drainages.

CLIMATE

The outstanding features of Hawai`i's climate includes mild and equable annual temperatures, moderate humidity index recordings, the persistence of northeasterly trade winds, and the infrequency of severe storms. Temperatures within the *ahupua`a* of Moanalua usually range from the high 50s to the high 80s (degrees Fahrenheit), during the winter months. Winter rainfall ranges from 15 to 20 inches (Armstrong 1983:62, 64). Summer temperatures in Moanalua range from the high 60s to the low 90s (degrees Fahrenheit). Summer rainfall in this area ranges from 2 to 7 inches (*ibid*).

SOILS

According to Foote et al. (1972: 119, 87,88, Sheet Map 64; Figure 4), the eastern portion of the project area is located within the Rock Land Soil Series (rRK) and the larger portion of the project area is located in the Makalapa Soil Series, specifically within Makalapa clay soils (MdC). Foote et al. (1972:119) stated that the Rock Land Soil Series is comprised "…of areas where exposed rock covers 25 to 90 percent of the surface" with basalt and andesite rock outcrops and shallow soils deposits the definitive characteristics of the soil series. The rRK Soil Series occurs from around sea level to over 6,000 feet above mean sea level (amsl) in areas receiving 15 to 60 inches of annual rainfall. Rock Land is often utilized as ranchlands, wildlife habitats, and for providing water.

In general, the Makalapa Soil Series is comprised of well-drained soils occurring in the uplands near Salt Lake Crater, on the island of O`ahu, at between 20 to 200 feet amsl in areas receiving 20 to 35 inches of annual rainfall (Foote *et al*. 1972:87). The Makalapa clay soils

Figure 4: USDA Soil Survey Map (Foote et al. 1972: Sheet Map 64) Showing Project Area Location.

exhibit 6 to 12 percent slopes, medium runoff, and a moderate erosion hazard. Typically, the MdC soils are often sites selected for urban development and ranchlands (*ibid*: 88).

VEGETATION

The vegetation within the project area reflects modifications to the landscape and does not reflect the vegetation pattern prior to Contact with Westerners (pre-1778). As stated elsewhere in this document, the project area has been subjected to prior land alterations which are reflected in the vegetation. Thus, the project area is currently an environment dominated by a dense growth of exotic species. Exotic vegetation identified within the project area includes: *koa haole* (*Leucaena leucocephala*); *klu* (*Vachellia farnesiana*); Chinese violet (*Asystasia gangetica*); *alena* (*Boerhavia sp*.); coat buttons (*Tridax procumbens*); mock orange *(Murraya paniculata*); *`uhaloa* (*Waltheria indica*); basil (*Ocimum basilicum*); aloe (*Aloe vera* (*L.*) *Burm.f.*); kiawe (*Prosopis pallida*); garden spurge (*Euphorbia pulcherrina*); slender mimosa *(Desmanthus pernambucanus*); and the autograph tree (*Clusia rosea*). Native plant species observed during the field inspection included: *ilima* (*Sida fallax*) and *kauna`oa* (*Cuscata sandwichiana*).

HISTORICAL AND CULTURAL BACKGROUND

Early settlement and agricultural development was probably first established on the windward side of the Hawaiian Islands and may have begun as early as A.D. 900-1000 on O`ahu during what is known as the Colonization Period (Kirch 2011:22). Most likely arriving from east Polynesia, these early inhabitants brought with them tools, fishing gear, and other artifacts, as well as useful plants and animals. Settling in favorable localities offering both fishing and agricultural opportunities and having near access to inland resources was a priority (Kirch 1985). Although receiving the majority of their protein from fish, Handy and Handy (1972: vi) have stated:

> …for every fisherman's house along the coasts there were hundreds of homesteads of planters in the valleys and on the slopes and plains between the shore and the forests. The Hawaiians, more than any of the other Polynesians, were a people whose means of livelihood, whose work and interests, were centered in the cultivation of the soil. The planter and his life furnish us with the key to his culture.

TRADITIONAL LAND DIVISIONS

Traditionally, the division of O`ahu's land into districts (*moku*) and sub-districts was said to be performed by *Mā`ilikukahi* who was chosen by the chiefs to be the *mō`īho`oponopono o ke aupuni* (administrator of the government; Kamakau 1991:53–55). Cordy (2002) places Mā`ilikukahi at the beginning of the 16th century. Mā`ilikukahi created six districts and six district chiefs (*ali`i `ai moku*). Land was considered the property of the king or *ali`i `ai moku* (the *ali`i* who eats the island/district), which he held in trust for the gods. The title of *ali`i `ai moku* ensured rights and responsibilities to the land, but did not confer absolute ownership. The king kept the parcels he wanted; his higher chiefs received large parcels from him and, in turn, distributed smaller parcels to lesser chiefs. The *maka`āinana* (commoners) worked the individual plots of land. It is said that Mā`ilikukahi gave land to *maka`āinana* (commoners) all over the island of O`ahu (*ibid*).

In general, several terms, such as *moku*, *ahupua`a*, *`ili* or *`ili`* ā*ina* were used to delineate various land sections. A district (*moku*) contained smaller land divisions (*ahupua`a*) that customarily continued inland from the ocean and upland into the mountains. Extended household groups living within the *ahupua`a* were therefore able to harvest from both the land and the sea. Ideally, this situation allowed each *ahupua`a* to be self-sufficient by supplying needed resources from different environmental zones (Lyons 1875:111). The *`ili `āina* or *`ili* were smaller land divisions next to importance to the *ahupua`a* and were administered by the chief who controlled the *ahupua`a* in which it was located (Lyons 1875:33; Lucas 1995:40). The *mo`o`āina* were narrow strips of land within an *`ili*. The land holding of a tenant or *hoa `āina* residing in an *ahupua`a* was called a *kuleana* (Lucas 1995:61). The project area is located in the Moanalua Ahupua`a, which is said to be named "…for two encampments (*moana lua*) at taro patches, where travelers bound for Honolulu from `Ewa rested…" (Pukui *et al*. 1974:152).

The *ahupua`a* of Moanalua extended from the ridge of the Ko`olau Mountains to the coastline, encompasses Moanalua Valley, and includes Moanalua Stream, which empties into Ke`ehi Lagoon, to the east of Hickam Air Force Base (Anderson and Bouthillier 1996). According to Fornander (1918-1919 in Sterling and Summers 1972:257), the Kona District was officially re-named Honolulu, in 1859, which extended from Maunalua Ahupua`a, on the east, to Moanalua Ahupua`a on the west.

TRADITIONAL SETTLEMENT PATTERNS

This section relies heavily on information from several classic references on traditional Native Hawaiian lifeways, traditions, and archaeological sites (e.g., Handy and Handy 1972; Kirch 1985; McAllister 1933; Sterling and Summers 1972) on file at the SCS library, Honolulu.

The Hawaiian economy was based on agricultural production and marine exploitation, as well as raising livestock and collecting wild plants and birds. Extended household groups settled in various *ahupua`a*. During pre-Contact times, there were primarily two types of agriculture, wetland and dry land, both of which were dependent upon geography and physiography. River valleys provided ideal conditions for wetland *kalo* (*Colocasia esculenta*) agriculture that incorporated pond fields and irrigation canals. Other cultigens, such as *kō* (sugar cane, *Saccharum officinaruma*) and *mai`a* (banana, *Musa* sp.), were also grown and, where appropriate, such crops as *`uala* (sweet potato, *Ipomoea batatas*) were produced. This was the typical agricultural pattern seen during traditional times on all the Hawaiian Islands (Kirch and Sahlins 1992, Vol. 1:5, 119; Kirch 1985).

PRE-CONTACT PERIOD (PRE-1778)

During the pre-Contact Period, the District of Kona (now known as Honolulu) extended from Moanalua across the southern expanse of O`ahu to Maunalua (Figure 5). Much of the coastal lands were preferred for chiefly residence. Easily accessible resources such as offshore and onshore fish ponds, the sea with its fishing and surfing—known as the sports of kings, and some of the most extensive and fertile wet taro lands were located in the area (Kirch and Sahlins, 1992 Vol. 1:19). Inland resources necessary for subsistence, could easily be brought to the *ali`i* residences on the coast from nearby inland plantations. The majority of farming was situated in the lower portions of stream valleys where there were broader alluvial flat lands or on bends in the streams where alluvial terraces could be modified to take advantage of the stream flow. Dry land cultivation occurred in colluvial areas at the base of gulch walls or on flat slopes (Kirch 1985; Kirch and Sahlins 1992, Vol. 2:59).

The coastal plain of Moanalua Ahupua`a was traditionally utilized for aquaculture (*i.e.*, fishponds) (Watanabe 1991:9). Several fishponds were developed adjacent to the ancient shoreline (Fornander 1969, II: 270). Kirch (1985:211) notes fishponds were likely to be constructed where broad, shallow reef flats or embayment allowed ponds to extend from the

Figure 5: Kona District Map (Sterling and Summers 1978) Showing Project Area Location.

shoreline in a semi-circle arc and that on O`ahu, "the most suitable localities were Kane`ohe Bay and Pearl Harbor….". Several fishponds were developed adjacent to the ancient shoreline (Fornander 1969, II: 270).

According to Handy and Handy (1972: 474, McAllister 1933:91, 93; Figure 6; see Figure 5), six fishponds were located along the Moanalua coastline: Weli Fishpond (McAlister Site 75), Mapunapuna Fishpond (McAllister Site 78), Awaawaloa Fishpond (McAllister Site 79), Kaloaloa Fishpond (McAllister Site 80), Kaihikapu (Kaikikapu) Fishpond (McAllister Site 81), and Lelepaua Fishpond (McAllister Site 82). These fishponds, once renowned for mullet and crab, now either destroyed or filled-in, are described below.

- **Weli Fishpond (McAllister Site 75) and Kaihikapu (Kaikikapu) Fishpond (McAllister Site 81) (Destroyed)**
  McAllister (1933: 91) described Weli Fishpond (McAllister Site 75) as located between Kahauiki and Mokumoa Island, immediately adjacent to Kaihikapu (Kaikikapu) Fishpond (McAllister Site 81), and covering approximately 30 acres. At the time of McAllister's site visit, "[t]he greater part of its walls appears to be earth embankments, mostly natural. It is now separated from Kaikikapu pond by a roadway." Kaihikapu (Kaikikapu) Fishpond (McAllister Site 81) was described by McAllister (1933:91) as 20 acres in size with a 900 foot long wall that extended from Mokumoa Island to the coastline of Moanalua Ahupua`a.

- **Mapunapuna Fishpond (McAllister Site 78) (Destroyed)**
  McAllister (1933: 93) described Mapunapuna Fishpond (McAllister Site 78) as measuring 40 acres. The fishpond contained four *mākāhā* (sluice gates) and was enclosed by an "almost straight" wall constructed of coral. The wall measured1600 feet long by 10 feet and stood 2.5 feet above the water surface. The fishpond enclosed a small inlet. A small pond, named Keawamalia, located adjacent to the Damon's house, adjoined Mapunapuna Fishpond.

- **Awaawaloa Fishpond (McAllister Site 79) (Destroyed)**
  McAllister (1933:93) described Awaawaloa Fishpond (McAllister Site 79) as "a small 8.8-acre pond with a coral rock wall 900 feet long." At the time of McAllister's site visi, in the early 1930s, the wall had been breached wall that contained two *mākāhā*. Ahua, the adjoining pond, is thought to be of recent construction.

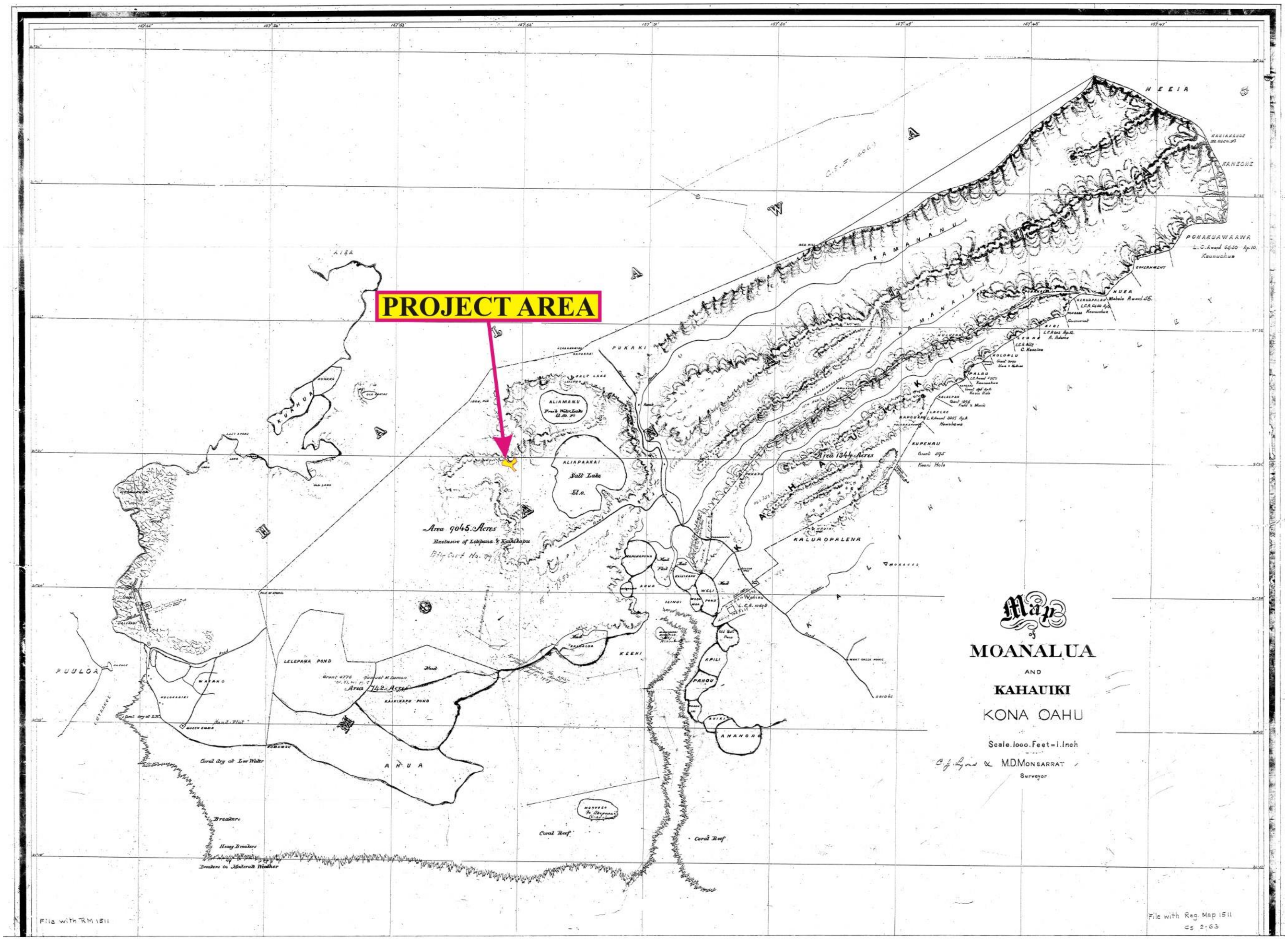

Figure 6: Historic Map of Moanalua and Kahauiki, Kona, Oahu (C.J. Lyons and M.D. Monsarrat n.d.: Registered Map 1126).

- **Kaloaloa Fishpond (McAllister Site 80) (Destroyed)**
  McAllister (1933:93) described Kaloaloa Fishpond (McAllister Site 80) as covering 30 acres enclosed by a 2,700 foot long semi-circular wall constructed of coral. The Kaloaloa Fishpond wall contained two *mākāhā*.

  Kaihikapu Fishpond (McAllister Site 81) (Filled-In)
  Now filled-in, McAllister (1933:93) described Kaihikapu Fishpond (McAllister Site 81) as a 258-acre pond. The pond was enclosed by a coral wall measuring 4,500 ft. long by by 3 to 8 ft. wide by 3 ft. high and containing three *mākāhā*. Kaihikapu Fishpond was built by Kaihikapu-a-Manuia. According to Fornander (1969, Vol.II:267), there once were salt pans in the area. When Captain Brown's ship ran out of salt, Kalanikupule directed Captain Brown "to the saltpans of Kaihikapu." "While the crew was obtaining salt, Captain Brown and Gardener were killed by a party of Hawaiians under Kalanikupule and Kamohomoho" (Fornander 1969, Vol.II:267).

- **Lelepaua Fishpond (McAllister Site 82) (Filled-In)**
  McAllister (1933:93) described Lelepaua Fishpond (McAllister Site 82) as a "large inland pond" which covered 332 acres and was "mostly filled." The walls of Lelepaua Fishpond were constructed of coral and earthen embankments measuring at least 10 feet wide. Lelepaua Fishpond, also, was constructed by Kaihikapu-a-Manuia and according to McAllister's informant (Dibble) Lelepaua was where Captain Brown went to procure salt for his ship.

Temporary habitation also occurred along the coastline, probably to provide day or overnight shelter for those who tended the fishponds or harvested near shore marine resources. Traditionally, early Hawaiians were known to inter the deceased in sand dunes along the shoreline.

According to Handy and Handy (1972:474), there once was a number of *lo`i* (wetland taro) in the interior of Moanalua Valley, including a large inland *lo`i* system that was located in what is now Moanalua Park. This *lo`i* systemn was irrigated from Kalou Stream, a tributary of Moanalua. There was also a large area of *lo`i* plantations located to the southwest of lower portion of Moanalua Stream that extended to the coast. Also cultivated near the coast were groves of coconut, *lo`i*, breadfruit, and bananas. In contrast, the back of Moanalua Valley was conducive to terracing. However, semi-wild taro, yams, *wauke*, and *olona* was grown in quantities along, and above, the stream (Handy and Handy 1972:474).

Several *heiau* (ceremonial center), located in Moanalua Ahupua`a, were documented by McAllister (1933) during his survey of the valley in the early 1930s.

- **Wakaina Heiau (McAllister Site 77-A) (Destroyed)**
  According to McAllister (1933:93), Wakaina Heiau (McAllister Site 77-A) was initially documented by Thrum, in the early 1900s, as the ruins of a *heiau* of *pookanaka* (human sacrifice) class which measured 100 by 70 ft., the sacrificial stone was said to have been located nearby. In the early 1930s, McAllister's informant, Namakahelu, pointed out the former site of the *heiau* "…[o]n the plateau now cultivated, mountain side the Damon home, of which nothing remains" (McAllister 1933:93).

- **Probable Heiau (McAllister Site 86) (Destroyed)**
  McAllister Site 86, a probable *heiau* was described by McAllister (1933:96) as a small *heiau* " [l]ocated on the side of the ridge facing the stream in the valley." The *heiau* was small in size and appeared to consist of "a practically open terrace" as it appeared to consisted of one wall (3.5 feet long by 3.5 feet wide) which delineated the southwest side of the structure. The surface of the terrace was paved and "…toward the center of the back is an area which appears as if it might have been the foundation for some structure with a slight terrace surrounding it. The slope in back is rather steep, with several convenient shelters which bear evidence in the form of bits of mats and broken gurds of having been frequented and probably used as habitations" (McAllister 1933:96). According to Summers (Sterling and Summers 1972: 334) this structure, destroyed in 1958, may have been referred to in "Wai-a-puka" by Mokumaia.

- **Paliuli Heiau (McAllister Site 90) (Destroyed?)**
  According to McAllister (1993: 98), Paliuli Heiau was located "…on the north side of Moanalua Valley about 1 mile above Salt Lake…Only two portions of the heiau are now discernible. One is a small elevated terrace which is divided by a line of flat stones placed upright on their long sides. The back of this area was similarly marked off. No trace of stepping can now be found on the front of the long slope. Some 30 feet back and above this terrace is a bluff 10 to 20 feet high with a cave at its foot. This was formerly used as a place of burial, according to Douglas Damon, but as the contents were gradually being carried away and the bodies subject to the disrespect of curio hunters, the remains were burned some years ago. A wall begins near the upper terrace and continues along the side

of the hill for some distance. It not only has the appearance of recent construction, but does not seem to form a part of the heiau."

"The second portion is a lower terrace; a part of the f rant side still shows evidence of having been evenly faced and stepped. A portion of a tibia was seen imbedded between the rocks about one foot deep. Upon further examination, a crushed skull which was wedged between the rocks 1.5 feet deep was seen a few feet from the tibia…. Both appear to have been placed at the time or before the building of the terrace. It is possible that this terrace suggested a good burial ground to the Hawaiians after the heiau fell into disuse in missionary times, as in [McAllister] Sites 293, 329, 371. If this happened, a large number of stones were removed and then replaced so as to appear undisturbed."

McAllister (1993:99) notes that there may have been additional "…features of the site, for many stones had been removed before Mr. Damon could stop a workman whom he found dislodging stones on the heiau. These stones were not replaced but were evenly piled in circles a few hundred feet below the site." Sterling and Summers (1972: 336) note that Paliuli Heiau could not be relocated by Stell Newman during the 1973 state-wide re-location of McAllister sites project, which was conducted by the State of Hawai`i, suggesting the site may have been destroyed.

- **Koaloa Heiau (McAllister Site 91)**
  Koaloa Heiau (McAllister Site 91) was recorded by McAllister (1933: 99) as "… located on the Honolulu [southest] side of Moanalua Valley, about halfway up the side of the ridge…The entire structure is approximately 93 feet front [sic?] by 50 feet wide, built of the rather rough lava rocks found in the vicinity. It appears to have been but a single main terrace, with steplike ledging in front, two smaller areas on either side, and one or possibly two small terraces, which probably formed the oracle tower site, in the back-center against the steep slope. The large stone just north of the main terrace may or may not have had a connection, though the stone paving which surrounded it, except in front, would indicate that it had a function."

WAHI PANA (LEGENDARY PLACES)

Numerous legends are associated with Moanaua Ahupua`a, from the name of the valley to historical events, including famous battles. It is said that "Moanalua" refers to "two encampments (*moana lua*) at taro patches" where travelers from `Ewa stopped to rest while on their way to Honolulu (Pukui *et al.* 1974: 152). According to legend, Salt Lake, (Āliapa`akai, salt pond) is associated with the goddess Pele, who once lived in the area, formerly known as Āliamanu, with her family. When her family left the area, Pele dropped some salt and the pet bird belonging to her favorite sister (Hi`iaka) was able to escape (Pukui *et al.* 1974: 11).

According to Fornander (1918-19119: Vol. 4, 104) Aliapaakai (Salt Lake; McAllister Site 83), is the place where Pele once thought to make her home:

> Upon their arrival at Oahu, Pele and Hiiaka took up .their abode in Kealiapaakai at Maoanalua, where they dug down into the ground and made a home. On coming from Kauai they brought some red dirt and some salt with them and deposited these things in their new home. Because of this facet these places were given the names of Kealiapaakai and Kealiamanu. Upon the finding that the place was too shallow they went to settle at Leahi.

In a similar legend (Emerson 1915:XII), Pele is also said to have excavated the crater on her first trip around the island of O`ahu, as she and her companions were searching for a place to settle:

> …Once more the captain sails on with the rod,
> To try if Oahu's the wished for land:
> They thrust in the staff at Salt Lake Crater,
> But that proved not the land of their promise.

Moanalua Ahupua`a is also associated with the followers of the various *ali`i* as they fought for control of Oa`hu. According to an article in Ka Hookumu ana o na Paemoku, Ke Au Hau (Nov. 29. 1911 in Sterling and Summers 1972: 6):

> When Kahekili defeated Oahu, Kahahana, his wife and friend fled to Moanalua where he lived with his servant. From there he moved to Kinimakalehua at Aliamanu below Kapukaki, a place facing Leilono. There was a lehua and a hau tree where they stayed for a few days. From there they went to Ke-ana-apuaa and from thence to Kepaakaea, then to Waipio and on to Kahaone. They remained there until they thought it better to go up to Oahunui at Wahiawa and so they went to the forest of Halemano. They were

> there a short time and moved to Leilehua. After
> living there for a time they went to stay at Po'ohilo
> in Honouliuli and there they hid until, weary with
> life in the forest, they showed themselves to the commoners.

After “showing themselves to the commoners” Kahahana was captured at Pu`uloa by Kamehameha’s forces. Kahahana’s body was subsequently taken to Ulukou, in Waikiki, to the same coconut grove where Kaopulupulu was laid, after his death (Ka Hookumu ana o na Paemoku, Ke Au Hau, Nov. 29. 1911 in Sterling and Summers 1972: 7).

There are a variety of accounts relating to McAllister Site 85, the “house of bones” (also known as Kaualua or Kauwalua), that once was located “… on the plateau between Puukapu and Puu a Ma`o, inland of the highway,” in Moanalua Ahupua`a (McAllister 1933: 95).

Fornander (1918-1919: Vol. 6. 29) ties the “house of bones” to the struggle between the *ali`i* for control of O`ahu:

> Fearfully did Kahekili avenge the death of Hueu on the
> revolted Oahu chiefs…It is related that one of the Maui
> chiefs, named Kalaikoa, caused the bones of the' slain
> to be scraped and cleaned, and that the quantity collected
> was so great that he built a house for himself, the walls of
> which were laid up entirely of the skeletons of the slain.
> The skulls of Elani, Konamanu, and Kalakioonui adorned
> the portals of this horrible house. The house was called
> "Kauwalua," and was situated at Lapakea in Moanalua, as
> One passes by the old upper road to Ewa. The site is still
> pointed out, but the bones have received burial.

Namakahelu, McAllister’s informant, provides an account of the “house of bones”. According to Namakahelu (McAllister 1933: 95):

> Kaualua was constructed by Kalalakoa (Kalaikoa) when he was
> chief of Moanalua. He was in the habit of stationing himself at a
> prominent place along the roadway, probably not far from
> Puukapu, and waylaying travelers. After overpowering them
> in hand-to-hand combat, he would kill them and remove the
> long bones with which he was constructing a fence around his
> grass hut. This continued for many years; and the people were
> in great fear of him and would go many miles out of their way,
> frequently traveling by canoe, rather than pass his house. When

> this fence had almost been completed except for one more set of bones, there arose a warrior, by name Kaluaihalawa. He gathered together a large group of people and expressed his intention of attempting to kill Kalalakoa. The people went with him to the foot of Puukapu where they remained while he climbed to the top of the hill where Kalalakoa was watching. As Kaluaihalawa neared the chief, he told him that he had come to fight. "It means death," Kalalakoa replied. "Then let mc rest and get my breath" said Kaluaihalawa to which the other agreed. After an interval, Kalalakoa again warned the warrior that the outcome meant death, but Kaluaihalawa lunged forward and tripped the chief toppling him over and throwing himself upon him and killing him. The people who were watching below sent up a mighty cheer.

John Papa `Ī`ī (1959:95) mentions the "house of bones" in his description of the trail extending from `Ewa District to Kikihale, as the trail passes through Moanalua:

> Let us turn to look at the trail going to Ewa from Kikihale. It led up to Leleo. to Ko`iu`iu and on to Keone`ula. There were no houses there, only a barren plain. It was there that the boy (John Ii) met with his attendants who came from Ewa with the god Ka`ili. He accompanied them on the way to Hoa`ae`ae and when the prostrating kapu was called, they all prostrated themselves on the plain until the others passed along. When they reached a bridge, the trail led along the banks of taro patches, up to the other side of Kapalama, to the plain of Kaiwi-`ula; on to the taro patches of Kalihi; down to a stream; up to the other side; down into Kahauiki; up to the other side: turned left to the houses of the Portuguese people; along the plain to Kauwalua, Kalaikoa's house of bones; down to a cocoanut grove; along the taro patches of Kahohonu; over to the other side and from there to a forded stream and up to Ka-papakolea a resting place for travellers coming this way or going that way. From there the trail went to Ka-leina-ka-`uhane; thence to Kapuka-ki, where one could see the irregular sea of Ewa; then down to the ridge to Napehā, a resting place for the multitude that go diving there, for there is a deep pool here. It was named. Napehā, (lean over) so it was said, because Kualii went and leaned over the pool to drink water.

Subterranean lava tubes, said to connect various locations on the island of O`ahu, are mentioned in numerous legends. One such legend involves a secret cave which belonged to the *ali`i* called Pohukaina Cave. Pohukaina Cave is said to be a place where the chiefs stored their wealth and were often interred there (Kamakau 1870 in Sterling and Summers 1972:176). According to legend, Pohakuaina Cave was located on the east side of O`ahu, at Kāehoalani Hill Kualoa, between Kualoa and Ka`a`awa. According to Ke Au Hou (June 28, 1911 in Sterling and Summers 1972: 176):

> The entrance is believed to be at Kaoio cliff, facing Kaaawa and another entrance is at Kaahuula spring. Hailikulamanu is another entrance a little way below the cave of Koluana in Moanalua (and there are still others) at Kalihi, Puiwa, at Waipahu in Ewa and at Kahuku in Koolauloa. Kauhuhu is the roof of the burial cave "house", that is, the mountain of Konahuanu is sloping down toward Ka huku. It was said that many had gone into it in olden days with kukui nut candles, going in from here in Kona and out at Kahuku. In this cave are many creeks, rivers and streams. Some places are decorated and some places are level.

THE POST CONTACT PERIOD (POST-1778) AND THE MĀHELE

In 1783, Kahekili, a fierce warrior and powerful Maui *ali`i*, conquered O`ahu. As was the custom following such a significant victory, Kahekili re-allocated the lands of O`ahu to his warriors and supporters, and gave Moanalua Ahupua`a to his son, Kalanikūpule (Pukui *et al*. 1974:152). Twelve years later, in 1795, Kamehameha I defeated the forces of Maui at the Battle of Nu`uanu. Kalanikūpule went into hiding, but was eventually captured, killed, and is believed to have been sacrificed at Pu`ukapu, in Moanalua (Pukui *et al*. 1974:152). Kamehamaha I redistributed the lands of O`ahu to his warriors and supporters (Klieger 1995:30). Thus, Kamehameha I gave the *ahupua`a* of Moanalua to Kame`eiamoku, a Hawai`i Island *ali`i* and one of Kamehameha I's revered five Kona "uncles", who later became the Counselor of State to Kamehameha I (Pukui *et al*. 1974:152). Although Kame`eiamoku was referred to as Kamehameha's "uncle", the two were cousins through Kamehameha's mother, Kekuiapoiwa II.

Following the death of Kame`eiamoku, in 1802, Kamehameha I gave Moanalua Ahupua`a to Kame`eiamoku's son, Ulumāheihei Hoapili. After Ulumāheihei Hoapili died in 1840, the *ahupua`a* of Moanalua was passed on to Ulumāheihei Hoapili's *hanai* (adopted) son and heir, Lot Kapuāiwa (Kamehameha V), as Land Commission Award 7715 (Appendix B).

In 1839, "the upland and mountain land" of Moanalua Ahupua`a was leased to William Sumner by Kamehameha III (no author 1849, 1:494-495 in Ayers 1970:62). According to Ayers (1970:62), Sumner, a ship captain, "…arrived in Hawai`i in 1807" and subsequently "…became the master of several vessels for King Kamehameha III and the chiefs." The terms of the lease stipulated that the land would be leased to Sumner and his heirs for fifty-five yeas for $50 per year. The lease agreement stated that at the end of the fifty-five years Sumner and his heirs could continue to live on the land rent free and that the land would be "heritable" by Sumner's heirs who were born in the islands, "provided that William Sumner did not sell said land" (Ayers 1970:63). During the early 1900s, the entire valley was used for grazing cattle (Ayers 1971:4), most likely by Sumner's cattle.

In the 1840s, traditional land tenure shifted drastically with the introduction of private land ownership based on western law. While it is a complex issue, many scholars believe that in order to protect Hawaiian sovereignty from foreign powers, Kauikeaouli (Kamehameha III) was forced to establish laws changing the traditional Hawaiian economy to that of a market economy (Kame`eleihiwa 1992:169-70, 176; Kelly 1983:45, 1998:4; Daws 1962:111; Kuykendall 1938 Vol. I: 145). The Māhele of 1848 divided Hawaiian lands between the king, the chiefs, the government, and began the process of private ownership of lands. The subsequently awarded parcels were called Land Commission Awards (LCAs). Once lands were thus made available and private ownership was instituted, the *maka`āinana* (commoners), if they had been made aware of the procedures, were able to claim the plots on which they had been cultivating and living. These claims did not include any previously cultivated but presently fallow land, *`okipū* (on O`ahu), stream fisheries, or many other resources necessary for traditional survival (Kelly 1983; Kame`eleihiwa 1992:295; Kirch and Sahlins 1992). If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed LCA and issued a Royal Patent after which they could take possession of the property (Chinen 1961:16).

On December 11, 1872, Kamehameha V died intestate. According to Probate 2412 (Ist CC) the half-sister of Kamehameha V, Ruth Ke`elikōlani, daughter of Kīna`u and Kekuanao`a, was declared his heir (see Appendix B). Thus, the lands of Moanalua were passed on to Ruth Ke`elikōlani. On May 15, 1883, Ruth Ke`elikōlani died and her lands, including Moanalua

Ahupua`a, were bequeathed to the last living heir of Kamehameha I, Bernice Pauahi (Pukui *et al.* 1974:152). One of Pauahi's actions, following her inheritance of Moanalua, included the lease of fifteen acres in the lower portion of the valley to Richard Gerke for ten years, "with permission for him [Gerke] to sublet the lands to two Chinese (Abstract 1933, 9:1520 in Ayers 1970:64).

Bernice Pauahi married Charles Reed Bishop, the founder of what is now known as the First Hawaiian Bank. Moanalua Ahupua`a subsequently became part of the Damon Estate. Bernice Pauahi Bishop's willed Moanalua Ahupua`a, in its entirety, to Samuel M. Damon, her husband's business partner following her death in 1884 (Pukui *et al*. 1974:152). According to Ayers (1970:64), in October 1883 Pauahi "added a codicil in her will, bequeathing, 'all of that tract of land known as the ahupua`a of Moanalua… and also the fishery of Kaliawa,' to Samuel Mills Damon. Samuel Damon, subsequently, purchased "…the Sumner heirs' title to the ahupua`a, and began his purchase of 89 of the remaining kuleana titles" (Abstract 1933:106-108 in Ayers 1970:65).

Currently, 24 acres of Moanalua Ahupua`a is a privately owned park containing Kamehameha V's summer cottage, which was built in 1867, and the site of the annual Prince Lot Hula Festival. The remaining suitable portions of the *ahupua`a* have been developed for residences and commercial purposes.

PREVIOUS ARCHAEOLOGICAL STUDIES

A literature search identified two previously conducted archaeological studies (Barrera 1979, Connolly 1980) that included the current project area. The other selected previous archaeological studies are intended to reflect a range of findings in the general Moanalua area. The studies selected for the Previous Archaeology discussion was based on report availability at the State Historic Preservation Division (SHPD), Kapolei, library. The findings of the studies summarized below (Figure 7), and in Table 1, indicate the presence of a fairly substantial pre-Contact settlement, which included fishponds and *lo`i*, in the lower portion of the valley with use and occupation continuing into the Historic Period (post-1778).

One of the earliest archaeological surveys conducted on O`ahu was conducted by J. Gilbert McAllister in the early 1930s, under the auspices of the Bernice P. Bishop Museum (McAllister 1933). During this survey McAllister (1933:90-100) documented eighteen sites within Moanalua Ahupua`a, none of which are located in the project area. In addition to the fishponds, *heiau*, and *wahi pana* described above, McAllister (1933) described petroglyphs

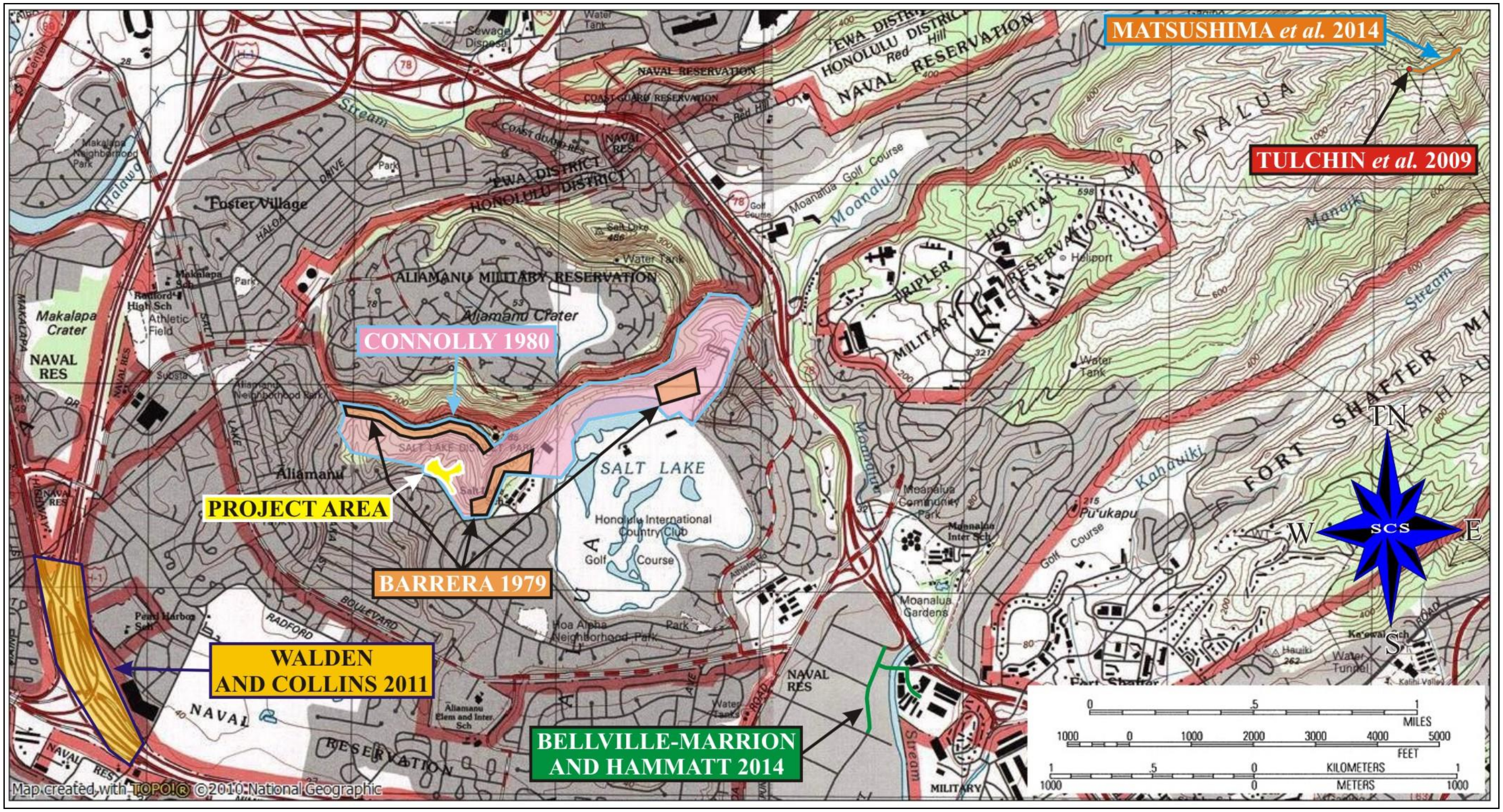

Figure 7: USGS Quadrangle (Pearl Harbor 1999) Map Showing Previous Archaeology in the Vicinity of the Current Project Area.

Table 1: Summary of Previous Archaeology.

Reference	Location of Study	Type of Study	Site Number(s)
McAllister 1933	Island-wide	Island-wide Survey	McAllister Sites 75 through 82, 77-a, 86, 90, 91, 93
Ayers 1970	Moanalua Ahupua`a* and South Hālawa Ahupua`a	Salvage archaeological survey and excavations	Bishop Museum Sites: A7-27, A7-29, A7-30, A7-33, A7-38, A7-40, A7-42 through A7-47, A7-52 through A7-54, A7-59, A7-62, A7-64, A7-67, A7-69, A7-72, A7-24, A7-32, A7-35, A7-37, A7-39, A7-48, A7-49, A7-57, A7-63, A7-65, A7-66, A7-68, A7-23, A7-31, A7-34, A7-51, A7-55, A7-71, A7-36, A7-50, A7-56, A7-1, A7-70, A7-58 through A7-60, A7-73, A7-74 through A7-78, A7-44, A7-41, A7-24, A7-25*
Loyd Soehren	Moanalua Ahupua`a	Limited archaeological excavations	Bishop Museum Site Oa-A7-20
Barrera 1979	Salt Lake District Park (portions of)	Archaeological reconnaissance	State Site 50-80-13-500(?); Bishop Museum Site Oa-A7-20
Connolly 1980	Salt Lake District Park	Archaeological reconnaissance	State Site 50-80-13-3992 (Bishop Museum Site Oa-A7-21), now destroyed; State Site 50-80-13-500 (Bishop Museum Site Oa-A7-20); newly identified habitation cave with human burial
Whitehead and Cleghorn 2003	Biomedical Center, Tripler Army Medical Center	Archaeological surface Survey and subsurface testing	State Site 50-80-14-6523
Tulchin *et al.* 2009	HECO Tripler Ridge Communications Station Upgrade Project	Archaeological assessment	None
Walden and Collins 2011	Freeway management system, Phase 1C, Part 1B:installation of CCTV and communication infrastructure	Archaeological assessment	None
Matsushima *et al.* 2009	HECO Tripler Spur Project	Archaeological inventory survey	State Site 50-80-14-7603
Bellville-Marrion and Hammatt 2014	Māpunapuna Water System Improvements Project	Archaeological monitoring	None
Tome and Spear 2015	Current Project Area	Archaeological field inspection	None

*Only includes sites within Moanalua Ahupua`a

(McAllister Site 93); a burial cave (McAllister Site 87); terrace facings (McAllister Site 88); and Waiola Pool (McAllister Sire 92), which is said to have “medicinal qualities.”

In 1970, the Department of Anthropology, Bernice P. Bishop Museum (Ayres 1970) conducted a salvage archaeological survey and excavations in the *ahupua`a* of Moanalua and South Hālawa. During the survey, fifty-seven sites were identified in Kamana-nui Valley (Moanalua Ahupua`a) and forty-eight sites were identified in South Hālawa Ahupua`a. The functions of the pre-Contact sites identified within Kamana-nui were interpreted as agricultural, habitation, and ceremonial, including one possible shrine and two petroglyph rocks, one of which was McAllister Site 93. The six Historic (post-1778) sites identified in Kamana-nui Valley included a “paved buggy road” which Samuel Damon built in the early 1900s; one bridge abutment dated 1909; and several house sites, including the remains of May Damon’s home and Dougal Damon’s home, which were built in the 1900s. Sites identified within South Hālawa Ahupua`a were interpreted as having agricultural and habitation functions.

In 1974, Loyd Soehren (in Davis and Kaschko 1980:6), under the auspices of Bernice P. Bishop Museum, conducted limited archaeological excavations of a burial cave which was subsequently designated Bishop Museum Site Oa-A7-20 (Figure 8). Davis and Kaschko (1980:7) surmise that the historic burials “were presumably removed by 1964.” However, fragmented human skeletal elements and historic artifacts, including glass beads, iron nails, and a metal button were identified during Soehren’s (1974) excavations. Evidence of pre-Contact habitation was indicated by artifacts, including basalt adzes, bone and pearlshell fishhooks, a bone awl, a dog or pig tooth pendant, a possible abrader, and a grinding stone, recovered during excavation (Davis and Kaschko 1980:7).

On August 3, 1979, Chiniago (Barrera 1979) conducted an archaeological reconnaissance of portions of the area. During the survey, Barrera located one site, which he thought might be State Site 50-80-13-500 (see Figure 8), the above-described a habitation cave. However, the vegetation was extremely dense preventing a conclusive determination.

Connolly (1980) conducted an archaeological reconnaissance survey of the Salt Lake District Park Site [TMK: (1) 1-1-063:9 and 14], which included the current project area. The survey resulted in the identification of a previously unidentified rockshelter (see Figure 8). Based on the finding of oyster shell and fragmented human skeletal material, the cave was interpreted as a temporary habitation and burial site. Connolly’s (1980) findings also included the re-location of the habitaiton cave (State Site 50-80-13-500/Bishop Museum Site Oa-A7-20)

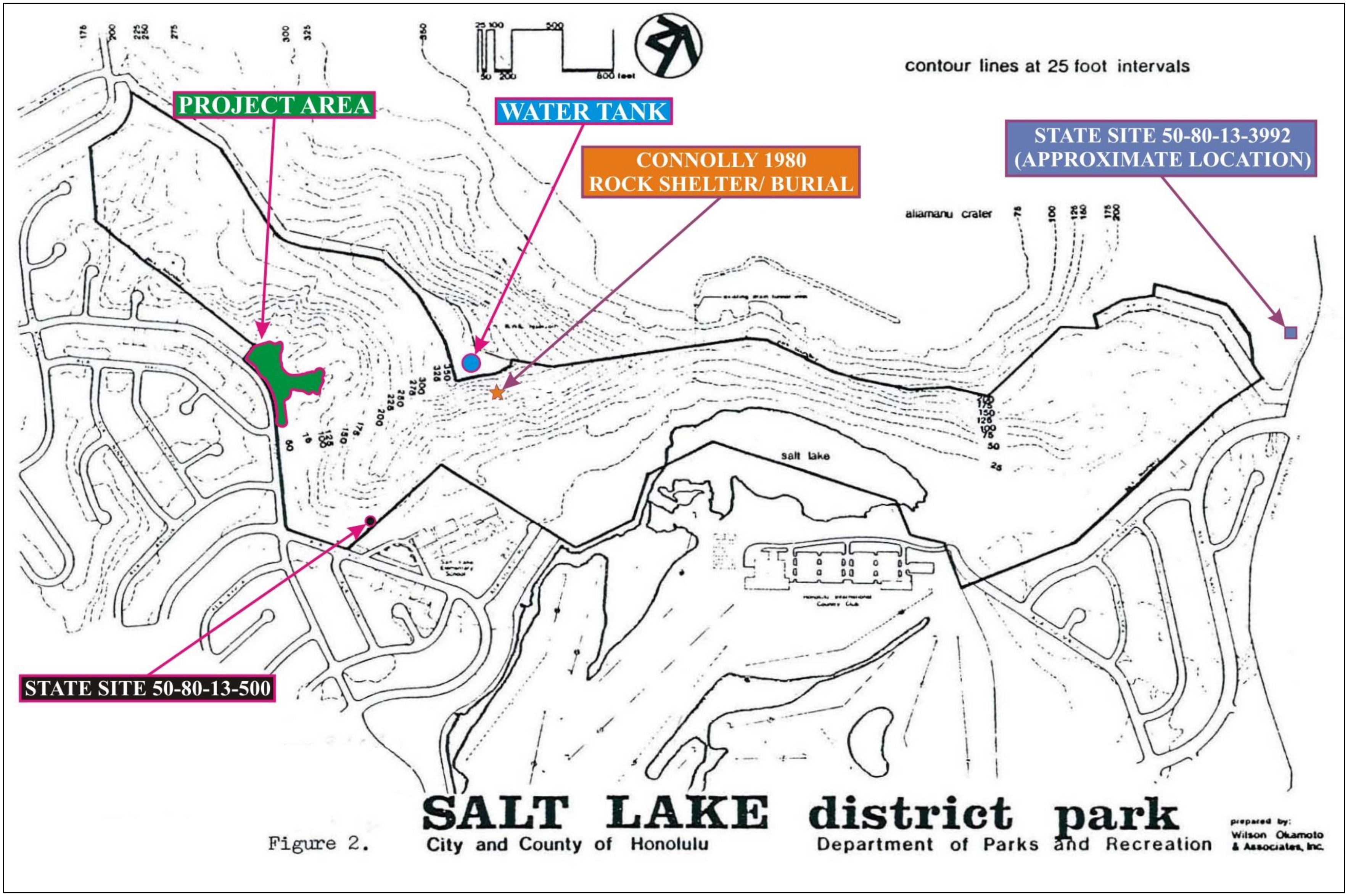

Figure 8: Topographic Map (Adapted From Connolly 1980) Showing the Locations of State Site 50-80-13-500; the Rockshelter/Burial Identified by Connolly (1980); State Site 50-80-13-3992; and the Current Project Area.

initially investigated by Soehren, and indicated that extensive bull dozing had “probably” destroyed Bishop Museum Site Oa-A7-21 (State Site 50-80-13-3992).

In 2003 Pacific Legacy, Inc. (Whitehead and Cleghorn 2003) conducted archaeological investigations for the proposed Biomedical Center, Tripler Army Medical Center [TMK: (1) 1-1-012], which included the manual excavation of 24 shovel probes. The survey resulted in the identification of State Site 50-80-14-6523, a “probable WWII concrete bunker.”

In 2009, Cultural Surveys Hawai`i, Inc. (Tulchin *et al.* 2009) conducted an archaeological inventory survey-level investigation of 0.05 acres for the proposed HECO Tripler Ridge Communications Station Upgrade Project [TMK: (1) 1-1-013:004]. No historic properties were identified.

In 2011, Pacific Consulting Services, Inc. (Walden and Collins 2011) conducted an archaeological inventory survey-level investigation in support of freeway management system, Phase 1C, Part 1B:installation of CCTV and communication infrastructure [TMK: (1) 1-1-010 and 1-1-002. No historic properties were identified.

In 2014, Cultural Surveys Hawai`i, Inc. (Matsushima *et al.* 2009) conducted an archaeological inventory survey of 0.9 acres for the HECO Tripler Spur Project [TMK: (1) 1-1-013:001 por. and 1-1-013001 por. and 004]. During the survey, State Site 50-80-14-7603, a trail alignment, was identified.

In 2014, Cultural Surveys Hawai`i, Inc. Bellville-Marrion and Hammatt 2014) conducted archaeological monitoring during ground altering activities for the Māpunapuna Water System Improvements  project in Moanalua Ahupua`a [TMK: (1) 1-1-007:016-018, 028, 031, 043 and -1-035:004-009, 013-015]. No historic properties were identified.

FIELD INSPECTION

On October 27, 2014 and June 17, 2016, SCS archaeologist, Guerin Tome, B.A., conducted an archaeological field inspection of the Salt Lake Debris Basin project area, under the overall supervision of Robert L. Spear, Principle Investigator.

As stated elsewhere in this document, the ground surface of the project area had been subjected to extensive previous land altering activities. Two concrete v-shaped in cross-section drainages are located within the project area (Figures 9 and 10). Both drainages curve from the north to the south and drain or re-direct runoff water from the southwest exterior slope of Āliamanu Crater to a main, v-shaped, in-cross section, concrete drainage (Figure 11). The main concrete drainage is oriented in a general northwest to southeast direction. Also feeding the main concrete drainage is a concrete pipe oriented in a general east/west direction, which is likely to extend beneath Likini Street (Figure 12). The north/northwest side of the project area slopes towards the south/southeast and contain natural drainages, which drain into the project area's main concrete drainage. Please note that these concrete drainages are below the ground surface of the project area.

The project area exhibited evidence of prior land alterations including, a large mechanically disturbed area and multiple mechanically created push piles located at the western end of the project area (Figure 13). The areas adjacent to the three open-air concrete drainages were graded during preparation for the placement of the drainages.

Modern cultural materials identified on the ground surface included: black plastic pvc pipe; angular basalt construction gravel; rusted ferrous metal buckets; aluminum cans; amber colored bottle glass fragments; one green glass bottle; tennis balls; aluminum foil; imported clam, oyster and *opihi* shell, which originated from adjacent residential area; clear glass bottles; plastic and metal Safeway shopping cart; white golf balls; and green bottle sherds. These materials were not confined to any specific area, but were strewn about the entire project area.

The features designated as Inlets (Drainage Channels) A and B are depicted on as-built drawings (Appendix C) stamped 1967 suggesting the construction of these of drainages was completed in 1967. Thus, the concrete basins are not considered historic properties.

RECOMMENDATIONS

No historic properties were identified during the Archaeological Field Inspection. As shown in Figure 8, the locations of State Site 50-80-13-500 (Bishop Museum Site Oa-A7-20), the rockshelter/burial identified by Connolly (1980), and State Site 50-80-13-3992 (Bishop Museum Oa-A7-21) are clearly well outside of the current project area boundaries. The findings indicated that the project area had been subjected to extensive prior ground disturbance.
Based on the absence of historic properties and the extensive previous ground disturbance to the project area, no further archaeological work is recommended.

Figure 9: Photographic View of Southeast Lateral Concrete Drainage. View to Northeast.

Figure 10: Photographic View of Northwest Lateral Concrete Drainage. View to North.

Figure 11: Photographic View of Main Concrete Drainage. View to Southeast.

Figure 12: Photographic View of Concrete Pipe. View to Southwest.

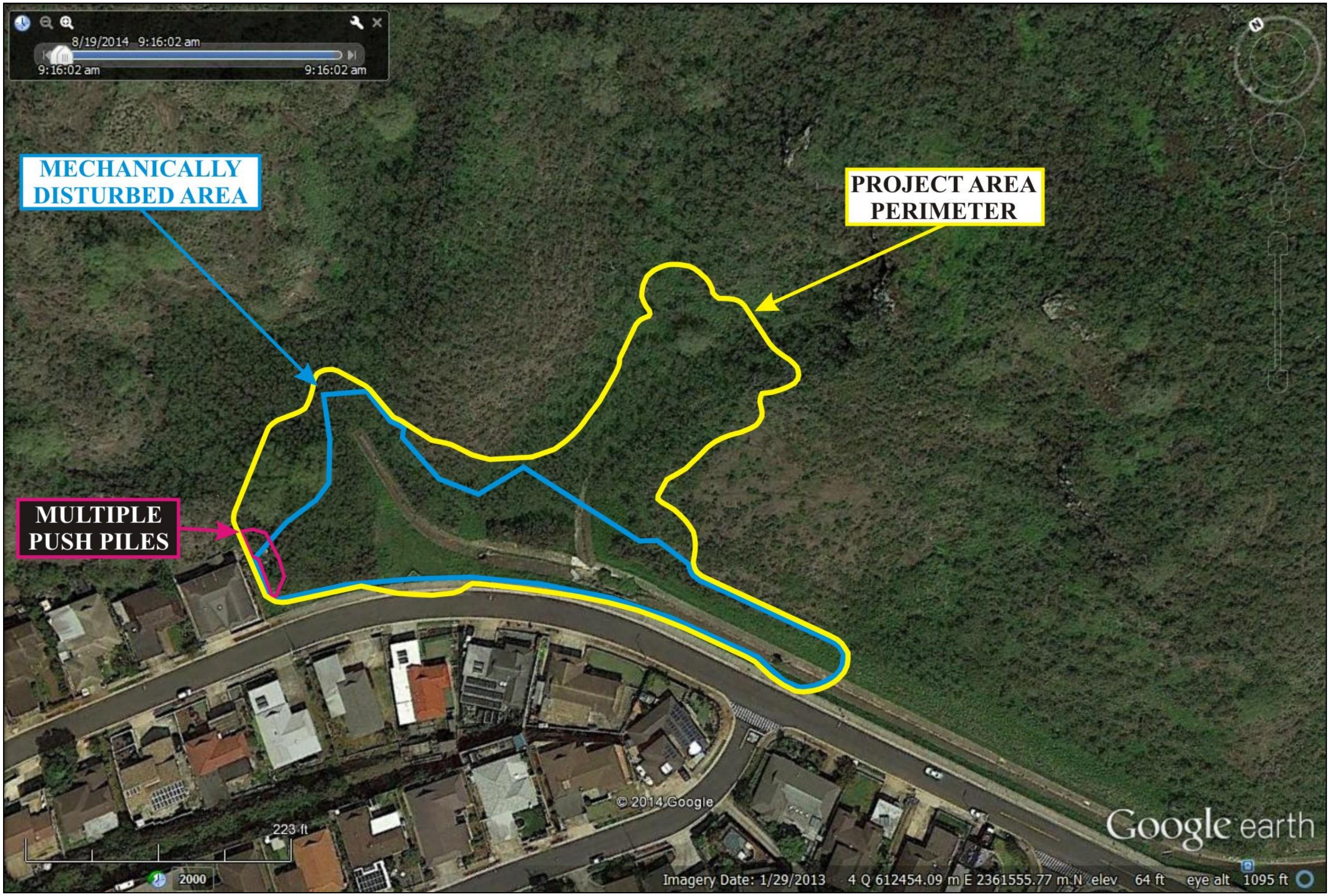

Figure 13: Google Earth Image (Aerial imagery from Google, Digital Globe dated 1/29/2013) Showing Project Findings.

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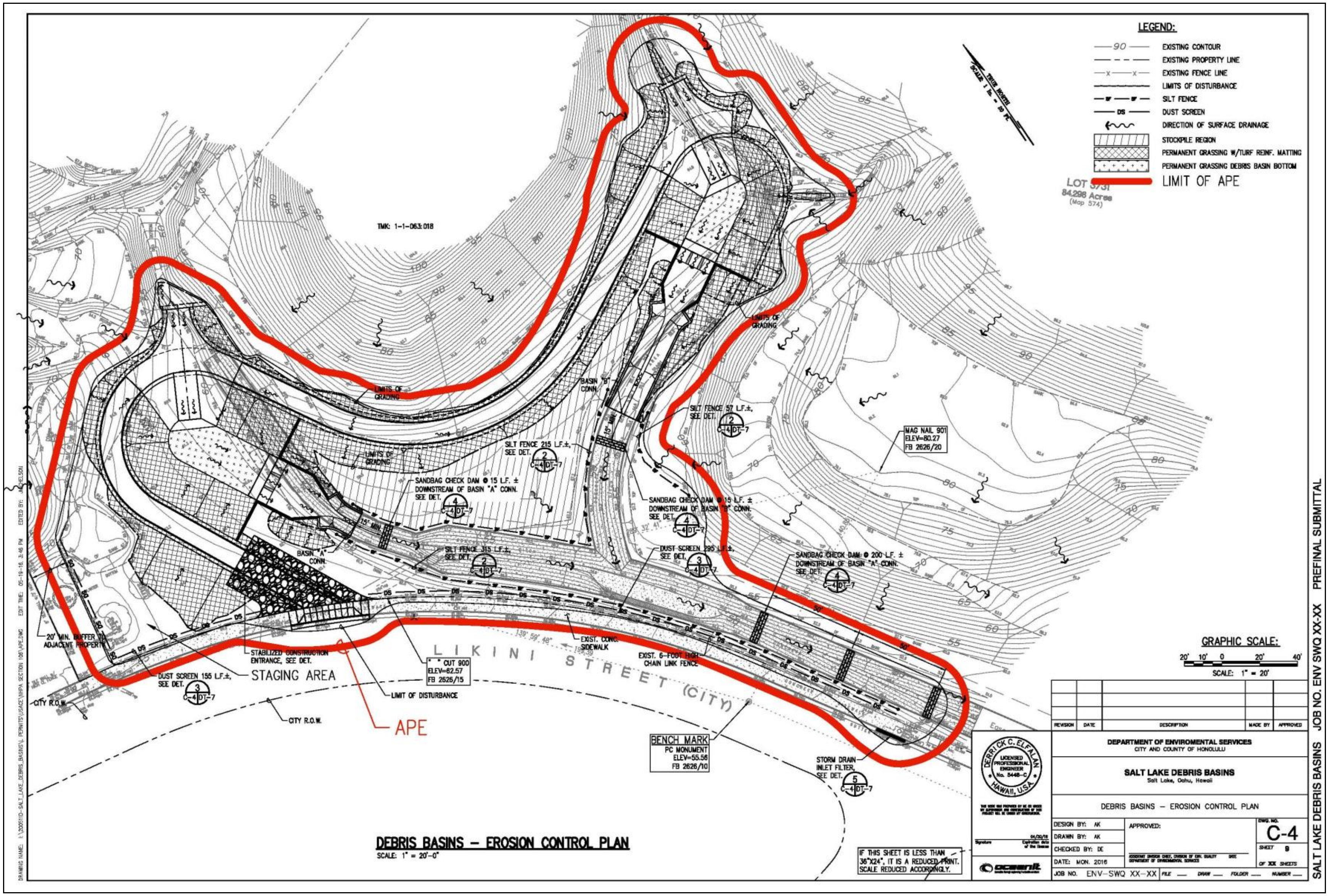
APPENDIX A: CONSTRUCTION PLAN


LEGEND:
EXISTING CONTOUR
EXISTING PROPERTY LINE
EXISTING FENCE LINE
LIMITS OF DISTURBANCE
SILT FENCE
DUST SCREEN
DIRECTION OF SURFACE DRAINAGE
STOCKPILE REGION
PERMANENT GRASSING W/TURF REINF. MATTING
PERMANENT GRASSING DEBRIS BASIN BOTTOM
LIMIT OF APE
TMK: 1-1-063:018
LIMITS OF GRADING
SILT FENCE 215 L.F.±, SEE DET.
SILT FENCE 57 L.F.±, SEE DET.
MAG NAIL 901 ELEV=80.27 FB 2626/20
SANDBAG CHECK DAM @ 15 L.F. ± DOWNSTREAM OF BASIN "A" CONN. SEE DET.
SANDBAG CHECK DAM @ 15 L.F. ± DOWNSTREAM OF BASIN "B" CONN. SEE DET.
SANDBAG CHECK DAM @ 200 L.F. ± DOWNSTREAM OF BASIN "A" CONN. SEE DET.
SILT FENCE 315 L.F.±, SEE DET.
DUST SCREEN 295 L.F.±, SEE DET.
BASIN "A" CONN.
BASIN "B" CONN.
20' MIN. BUFFER TO ADJACENT PROPERTY
STABILIZED CONSTRUCTION ENTRANCE, SEE DET.
CUT 900 ELEV=62.57 FB 2626/15
EXIST. CONC. SIDEWALK
EXIST. 6-FOOT HIGH CHAIN LINK FENCE
LIKINI STREET (CITY)
DUST SCREEN 155 L.F.±, SEE DET.
STAGING AREA
LIMIT OF DISTURBANCE
CITY R.O.W.
APE
BENCH MARK PC MONUMENT ELEV=55.56 FB 2626/10
STORM DRAIN INLET FILTER, SEE DET.
GRAPHIC SCALE:
SCALE: 1" = 20'
DEBRIS BASINS – EROSION CONTROL PLAN
SCALE: 1" = 20'-0"
IF THIS SHEET IS LESS THAN 36"X24", IT IS A REDUCED PRINT. SCALE REDUCED ACCORDINGLY.
DEPARTMENT OF ENVIRONMENTAL SERVICES
CITY AND COUNTY OF HONOLULU
SALT LAKE DEBRIS BASINS
Salt Lake, Oahu, Hawaii
DEBRIS BASINS – EROSION CONTROL PLAN
DESIGN BY: AK
DRAWN BY: AK
CHECKED BY: DE
DATE: MON. 2016
APPROVED:
JOB NO. ENV-SWQ XX-XX
C-4
SALT LAKE DEBRIS BASINS JOB NO. ENV SWQ XX-XX PREFINAL SUBMITTAL

APPENDIX B: LAND COMMISSION AWARD 7715

KAPUAIWA, LOT KAMEHAMEHA Alii AwardLCA 7715

MAHELE BOOK 7-8 (12-13)
Relinquished:
Kukulaeo, ili nui o Waikiki, Kona, Oahu
2 Puehuehu, ahp., Lahaina, Maui
Waiokila, ili o Kahakuloa, Kaanapali, Maui
Wakiu, ahp., Hana, Maui
Poo, ahp., Kohala, Hawaii
Kaoma, ahp., Kohala, Hawaii
Makeanehu, ahp., Kohala, Hawaii
Kaihoa, ahp., Kohala, Hawaii
Puaiki, ahp., Kohala, Hawaii
Lapaki, ahp., Kohala, Hawaii
Keopuka, ahp., Kona, Hawaii
Kahanaiki, ahp., Kona, Hawaii
2 Mokukano 1,2, ahp., Kona, Hawaii
Auhaukeae, ahp., Kona, Hawaii
Keekee, ahp., Kona, Hawaii
Lehuula-iki, ahp., Kona, Hawaii
Kaumoali, ahp., Hamakua, Hawaii
Waawaa, ahp., Puna, Hawaii
Kealakomo me Kilauea, ahp., Puna, Hawaii
By M. Kekuanaoa, father and kahu waiwai (executor)

Received:
Moanalua, ahp., Kona, Oahu
Waiokama, ahp., Lahaina, Maui
Hanakaoo, ahp., Lahaina, Maui
Kahua, ahp., Kohala, Haawaii
2 Hikiaupea, ahp., Kohala, Hawaii
Hawi, ahp., Kohala, Hawaii
Kamano, ahp., Kohala, Hawaii
Hihiu hookahi, ahp., Kohala, Hawaii
Kauapalaoa, ahp., Kohala, Hawaii
Kaupulehu, ahp., Kona, Hawaii
Kaloko, ahp., Kona, Hawaii
Keauhou, kahi i hanau ai ka Moi-place where the King was born, Kona
Puaa, ahp., Puna, Hawaii
Hilea, ahp., Kau, Hawaii
Paukaa, ahp., Hilo, Hawaii
Punaluu, ahp., Kau

Privy Council Records 3:789: Resolution authorizing Minister of Interior to grant Royal Patents to Lot Kamehameha for his lands, 18 in number, without further division or commutation upon the relinquishment of the above land [Kahikinui, Maui] to the Government.
[See also *Indices* pp 64-65]

Claim 7715
NR 444.5 M. Kekuanaoa lists the lands Lot Kamehameha received in the Mahele.

<u>APPENDIX C: AS-BUILT DRAWINGS</u>

CONSTRUCTION PLANS

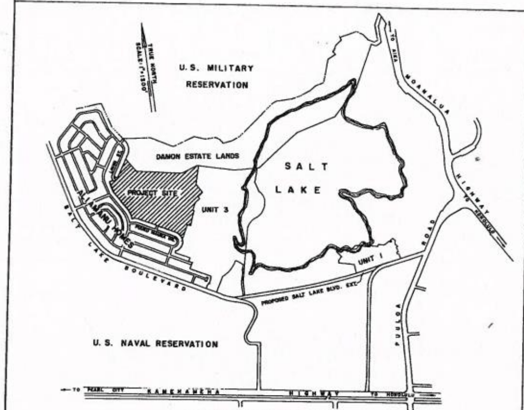
LAKESHORE SUBDIVISION UNIT 2

MOANALUA, HONOLULU, OAHU, HAWAII

OWNER:
INTERNATIONAL DEVELOPMENT CO.

AS BUILT TRACINGS
APPROVED 6/8/67

PLANS PREPARED BY:
SUNN, LOW, TOM & HARA, INC.
CONSULTING ENGINEERS
195 SOUTH KING STREET
HONOLULU, HAWAII.



LOCATION PLAN
SCALE: 1in = 1,200 ft.
T.M.K.: 1-1-10

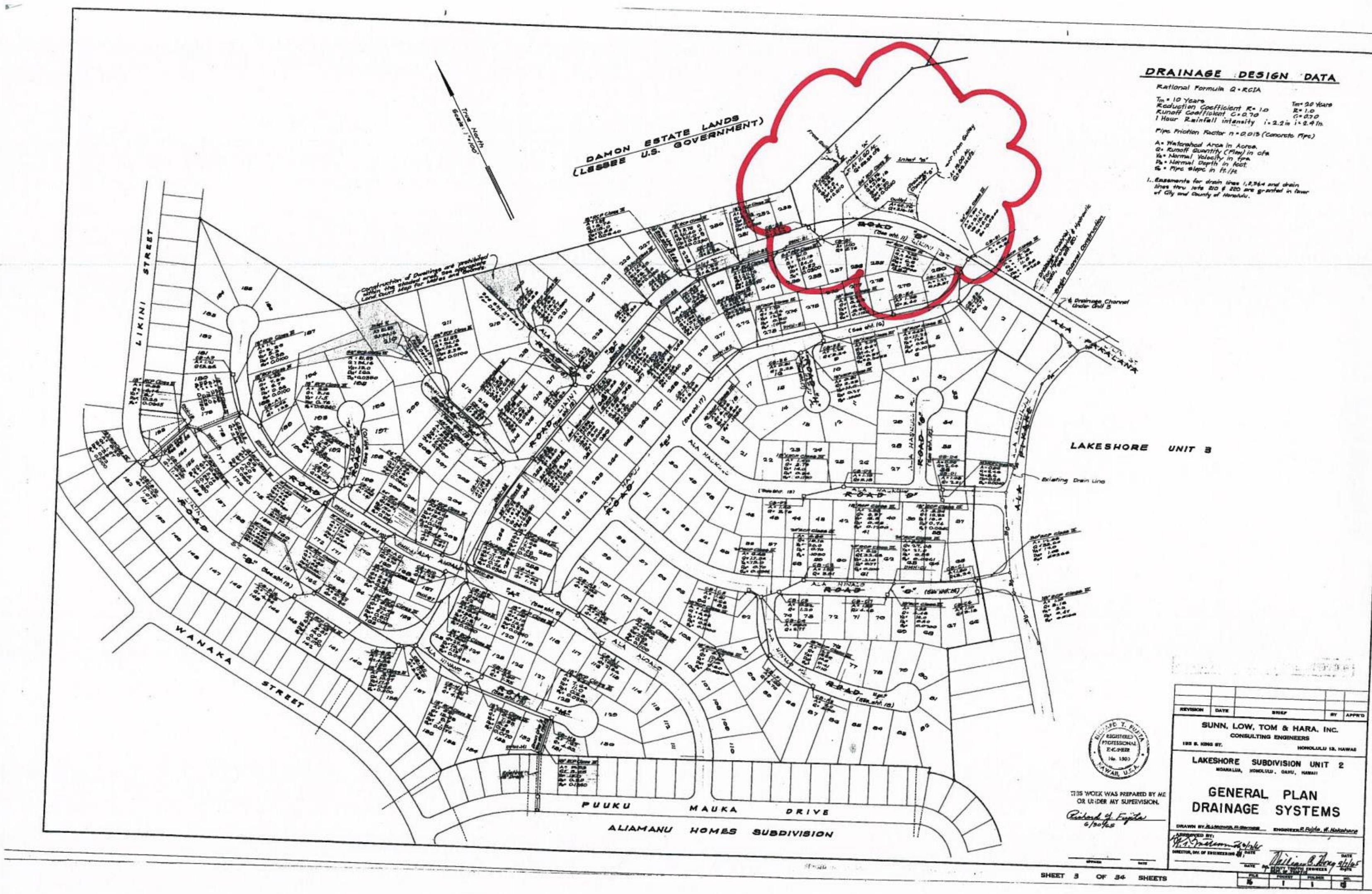
INDEX

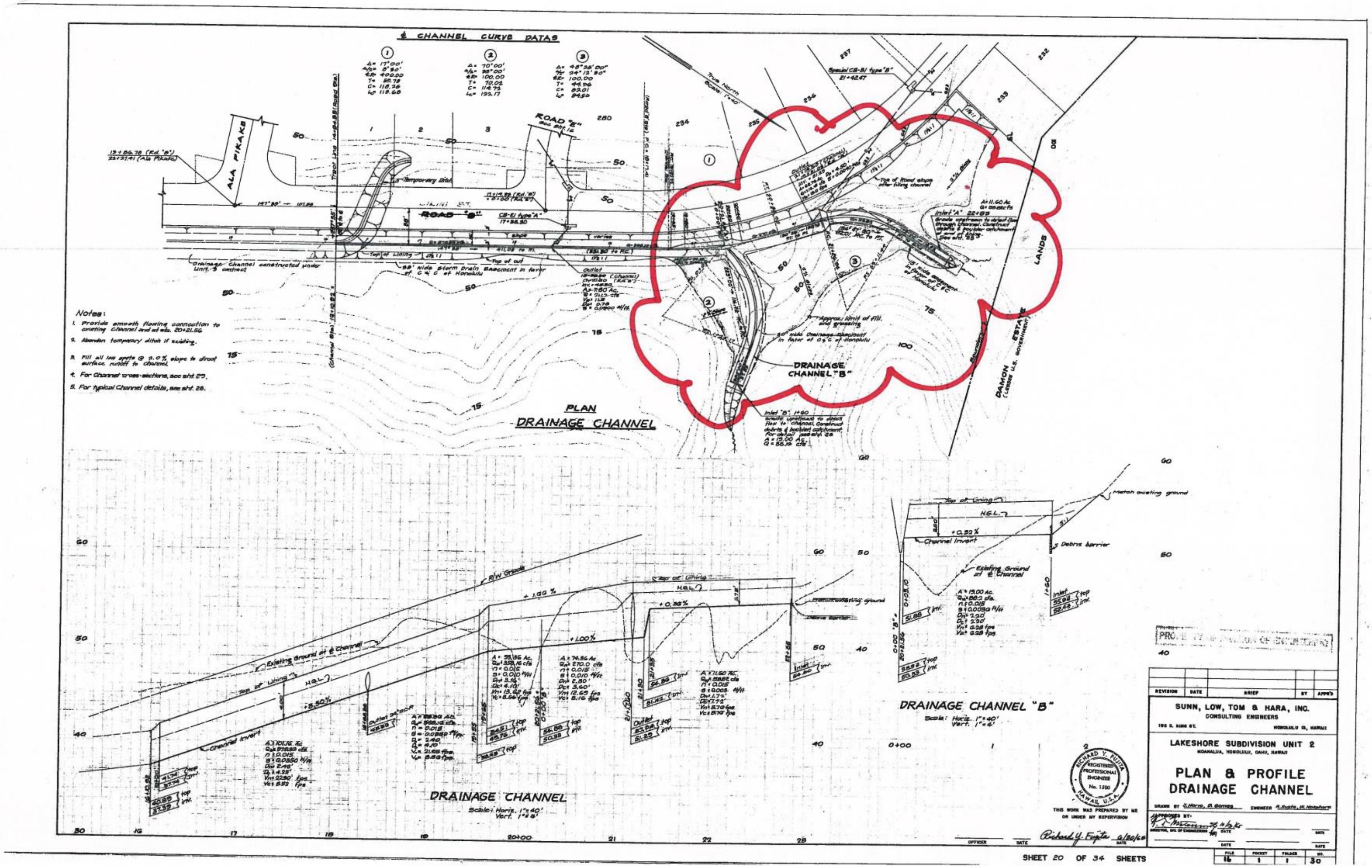
SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	GENERAL PLAN – SEWER AND WATER SYSTEMS
3	GENERAL PLAN – DRAINAGE SYSTEMS
4-8	GRADING PLAN
9	PLAN AND PROFILE – ROAD "A"
10	PLAN AND PROFILE – ROAD "A" & "L"
11-13	PLAN AND PROFILE – ROAD "B"
14	PLAN AND PROFILE – ROAD "C"
15	PLAN AND PROFILE – ROAD "D"
16	PLAN AND PROFILE – ROAD "E" & "H"
17	PLAN AND PROFILE – ROAD "E" & "G"
18	PLAN AND PROFILE – ROAD "F" & "J"
19	PLAN AND PROFILE – ROAD "M" & "K"
20	PLAN AND PROFILE – DRAINAGE CHANNEL
21	PLAN AND PROFILE – SEWER LINES "P," "Q," & "R"
22	PLAN AND PROFILE – SEWER LINES "S" & "T" AND DRAIN LINE 1
23	PROFILES – SEWER LINES "N" & "U" AND DRAIN LINES 2 & 3
24-25	CURB RETURN GRADES
26	TYPICAL ROAD SECTION & DRAINAGE DETAILS
27-28	DRAINAGE AND MISCELLANEOUS DETAILS
29	CROSS SECTIONS – DRAINAGE CHANNEL
30	STANDARD TRAFFIC DETAILS
31-32	STANDARD WATER DETAILS
33-34	STREET LIGHTING DETAILS

APPROVED:

PLANNING DIRECTOR, PLANNING DEPARTMENT	10-15-65 DATE
CHIEF ENGINEER, DEPT. OF PUBLIC WORKS	10/12/65 DATE
for DIRECTOR, DIVISION OF SANITATION	9/8/65 DATE
for TRAFFIC ENGINEER, DEPT. OF TRAFFIC	9/7/65 DATE
MANAGER & CHIEF ENGINEER, B.W.S.	9/17/65 DATE

16-1-1-11 to 39 m


DRAINAGE DESIGN DATA
Rational Formula Q = RCIA
Tm = 10 Years
Reduction Coefficient R = 1.0
Runoff Coefficient C = 0.70
1 Hour Rainfall intensity i = 2.2 in
Tm = 20 Years
R = 1.0
C = 0.70
i = 2.4 in.
Pipe Friction Factor n = 0.013 (Concrete Pipe)
A = Watershed Area in Acres.
Q = Runoff Quantity (Flow) in cfs
Vn = Normal Velocity in fps
Dn = Normal Depth in feet
S = Pipe slope in ft./ft.
1.. Easements for drain lines 1,2,3 & 4 and drain lines thru lots 210 & 220 are granted in favor of City and County of Honolulu.
DAMON ESTATE LANDS
(LESSEE U.S. GOVERNMENT)
LIKINI STREET
WANAKA STREET
PUUKU MAUKA DRIVE
ALIAMANU HOMES SUBDIVISION
LAKESHORE UNIT 3
ALA KAPALANA
Existing Drain Line
Drainage Channel Under Unit 3
REVISION
DATE
BRIEF
BY
APPR'D
SUNN, LOW, TOM & HARA, INC.
CONSULTING ENGINEERS
HONOLULU 13, HAWAII
LAKESHORE SUBDIVISION UNIT 2
MOANALUA, HONOLULU, OAHU, HAWAII
GENERAL PLAN
DRAINAGE SYSTEMS
REGISTERED PROFESSIONAL ENGINEER
HAWAII, U.S.A.
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.
Richard Y. Fujita
6/30/65
DRAWN BY
ENGINEER R. Fujita, H. Nakahara
APPROVED BY:
DIRECTOR, DIV. OF ENGINEERING
DATE
SHEET 3 OF 34 SHEETS



℄ CHANNEL CURVE DATAS
PLAN
DRAINAGE CHANNEL
DRAINAGE CHANNEL "B"
ROAD "B"
ROAD "C"
ALA PIKAKE
DAMON ESTATE
LANDS
Notes:
1. Provide smooth flowing connection to existing Channel and at sta. 20+21.56
2. Abandon temporary ditch if existing.
3. Fill all low spots @ 2.0% slope to direct surface runoff to channel.
4. For Channel cross-sections, see sht. 27.
5. For typical Channel details, see sht. 28.
DRAINAGE CHANNEL
Scale: Horiz. 1"=40' Vert. 1"=8'
DRAINAGE CHANNEL "B"
Scale: Horiz. 1"=40' Vert. 1"=4'
Existing Ground at ℄ Channel
Top of Lining
H.G.L.
Channel Invert
R/W Grade
Debris barrier
Match existing ground
SUNN, LOW, TOM & HARA, INC.
CONSULTING ENGINEERS
LAKESHORE SUBDIVISION UNIT 2
PLAN & PROFILE
DRAINAGE CHANNEL
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
SHEET 20 OF 34 SHEETS

Appendix E. Cultural Impact Assessment

SCS Project Number 1609-1 CIA

A CULTURAL IMPACT ASSESSMENT FOR THE SALT LAKE DEBRIS BASINS PROJECT MOANALUA AHUPUA`A, HONOLULU (KONA) DISTRICT O`AHU ISLAND, HAWAI`I [TMK: (1) 1-1-063:018 POR.]

Prepared by:
Cathleen A. Dagher, B.A.
and
Robert L. Spear, Ph.D.
November 2015
Revised June 2016**DRAFT**

Prepared for:
Oceanit Laboratories, Inc.
828 Fort Street Mall, Suite 600
Honolulu, Hawai`i 96813

SCIENTIFIC CONSULTANT SERVICES Inc.
HAWAII
1347 Kapiolani Blvd., Suite 408 Honolulu Hawai`i 96814

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INTRODUCTION

At the request of Oceanit Laboratories, Inc., Scientific Consultant Services, Inc. (SCS) has prepared a Cultural Impact Assessment (CIA) for the proposed Salt Lake Debris Basins Project located in Salt Lake, Moanalua Ahupua`a, Honolulu (Kona) District, O`ahu Island, Hawai`i [TMK: (1) 1-1-063:018 por.]. The approximately 1.8 acre project area is located within the Salt Lake District Park which is owned by the City and County of Honolulu (Figures 1 through 3).

The Constitution of the State of Hawai`i clearly states the duty of the State and its agencies is to preserve, protect, and prevent interference with the traditional and customary rights of Native Hawaiians. Article XII, Section 7 (2000) requires the State to "protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by *ahupua`a* tenants who are descendants of Native Hawaiians who inhabited the Hawaiian Islands prior to 1778." In spite of the establishment of the foreign concept of private ownership and western-style government, Kamehameha III (Kauikeaouli) preserved the peoples traditional right to subsistence. As a result in 1850, the Hawaiian Government confirmed the traditional access rights to Native Hawaiian *ahupua*`a tenants to gather specific natural resources for customary uses from undeveloped private property and waterways under the Hawaiian Revised Statutes (HRS) 7-1. In 1992, the State of Hawai`i Supreme Court, reaffirmed HRS 7-1 and expanded it to include, "native Hawaiian rights…may extend beyond the *ahupua`a* in which a Native Hawaiian resides where such rights have been customarily and traditionally exercised in this manner" (Pele Defense Fund v. Paty, 73 Haw.578, 1992).

Act 50, enacted by the Legislature of the State of Hawai`i (2000) with House Bill (HB) 2895, relating to Environmental Impact Statements, proposes that:

> …there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawaii's culture, and traditional and customary rights… [H.B. NO. 2895].

Articles IX and XII of the State constitution, other state laws, and the courts of the State impose on government agencies a duty to promote and protect cultural beliefs and practices, and resources of Native Hawaiians as well as other ethnic groups. Act 50 also requires state agencies

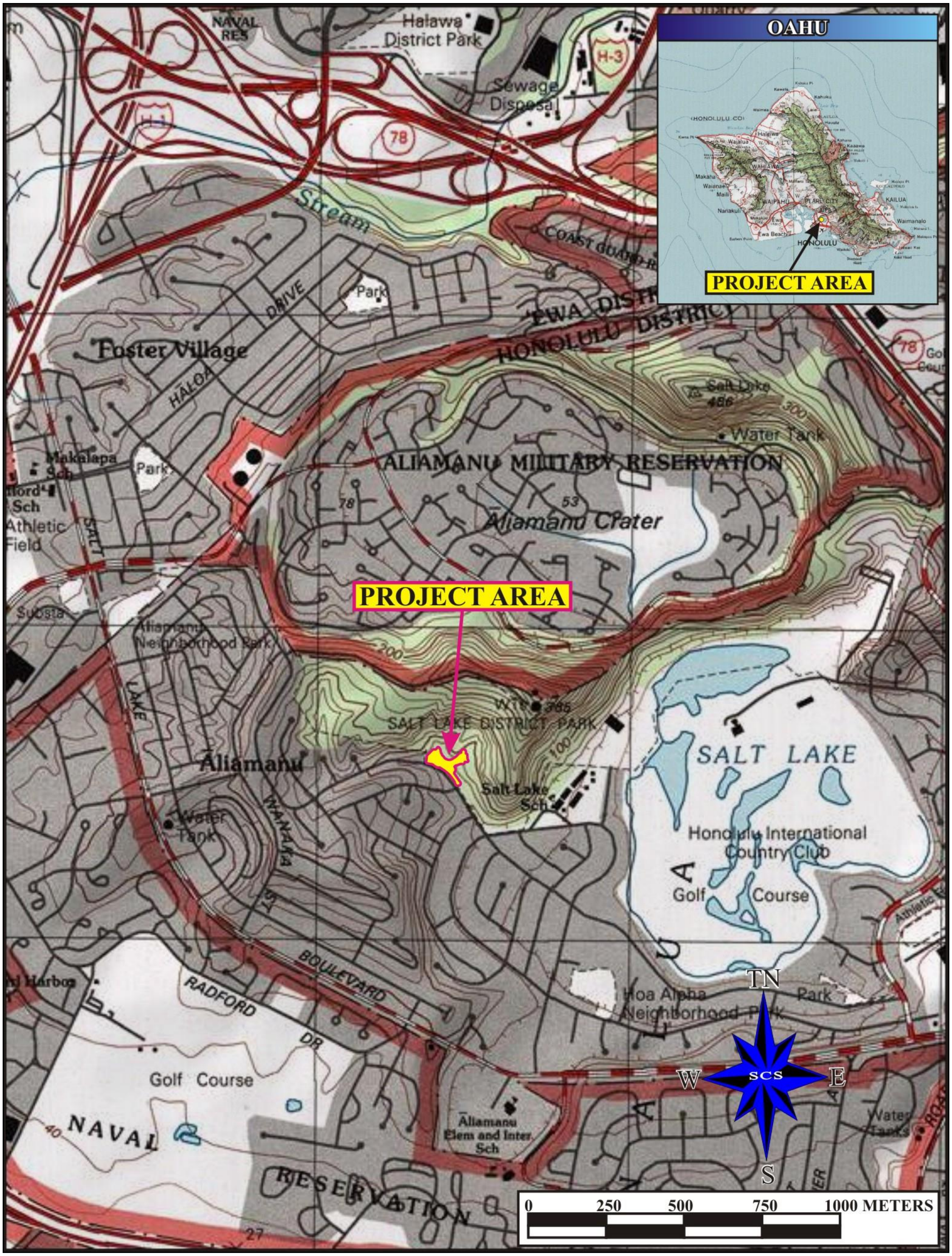

Figure 1: USGS Quadrangle (Pearl Harbor 1999) Map Showing Project Area Location.

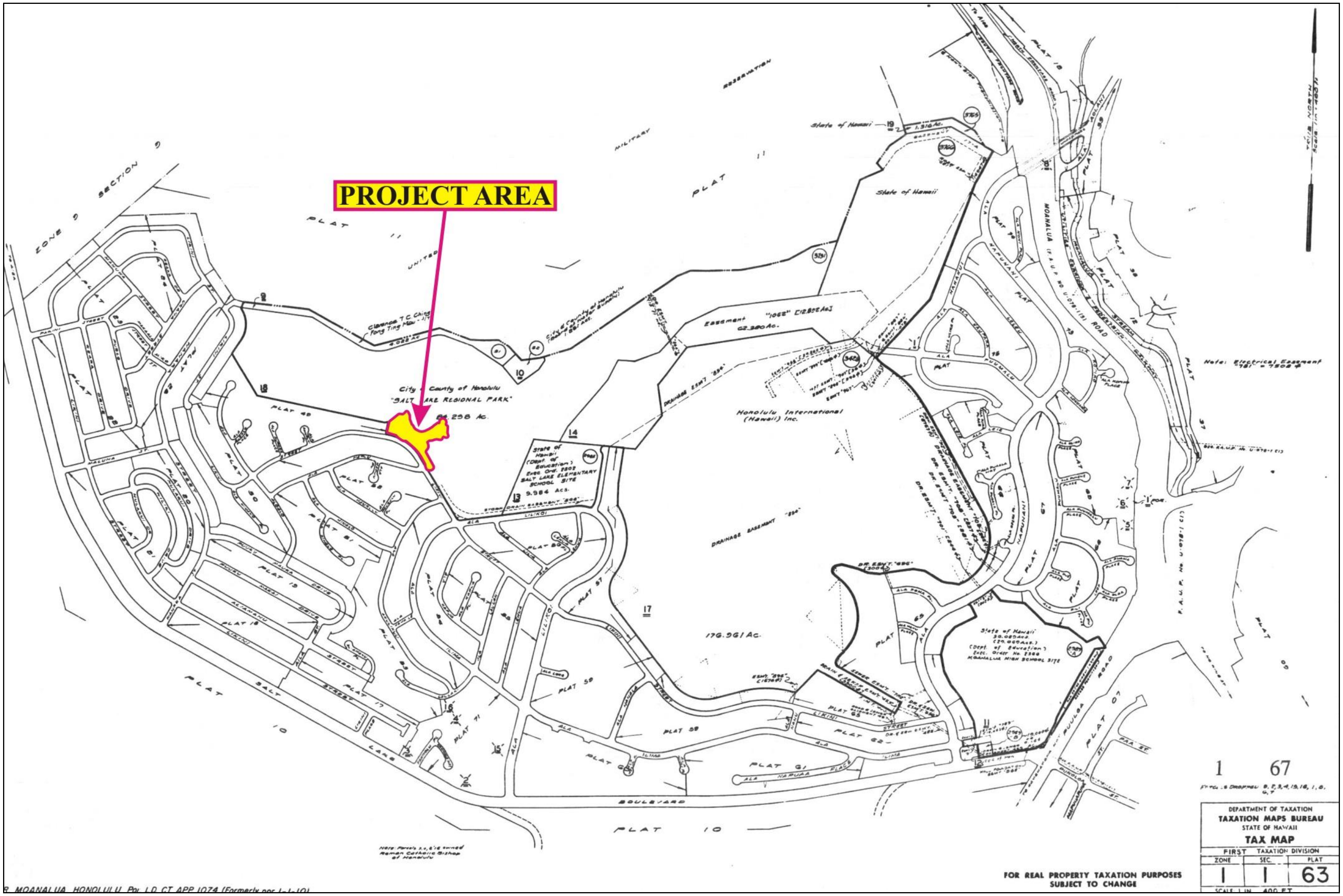

Figure 2: Tax Map Key [TMK: 1) 1-1-063] Showing Project Area Location.

Figure 3: Google Earth Image (Aerial imagery from Google, Digital Globe dated 1/29/2013) Showing Project Area Location.

and other developers to assess the effects of proposed land use or shoreline developments on the "cultural practices of the community and State" as part of the HRS Chapter 343 (2001) environmental review process.

It also redefined the definition of "significant effect" to include "...the sum of effects on the quality of the environment, including actions that irrevocably commit a natural resource, curtail the range of beneficial uses of the environment, are contrary to the State's environmental policies . . . or adversely affect the economic welfare, social welfare or cultural practices of the community and State" (H.B. 2895, Act 50, 2000). Cultural resources can include a broad range of often overlapping categories, including places, behaviors, values, beliefs, objects, records, stories, etc. (H.B. 2895, Act 50, 2000).

Thus, Act 50 requires that an assessment of cultural practices and the possible impacts of a proposed action be included in Environmental Assessments and Environmental Impact Statements, and to be taken into consideration during the planning process. As defined by the Hawaii State Office of Environmental Quality Control (OEQC), the concept of geographical expansion is recognized by using, as an example, "the broad geographical area, e.g. district or *ahupua`a*" (OEQC 2012:12). It was decided that the process should identify 'anthropological' cultural practices, rather than 'social' cultural practices. For example, *limu* (edible seaweed) gathering would be considered an anthropological cultural practice, while a modern-day marathon would be considered a social cultural practice.

Therefore, the purpose of a CIA is to identify the possibility of ongoing cultural activities and resources within a project area, or its vicinity, and then assessing the potential for impacts on these cultural resources. The CIA is not intended to be a document of in-depth archival-historical land research, or a record of oral family histories, unless these records contain information about specific cultural resources that might be impacted by a proposed project.

According to the Guidelines for Assessing Cultural Impacts established by the Hawaii State Office of Environmental Quality Control (OEQC 2012:12):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both manmade and natural, which support such cultural beliefs.

The meaning of “traditional” was explained in *National Register Bulletin*:

> "Traditional” in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice. The traditional cultural significance of a historic property then is significance derived from the role the property plays in a community’s historically rooted beliefs, customs, and practices. . . . [Parker and King 1990:1]

METHODOLOGY

This CIA was prepared as much as possible in accordance with the suggested methodology and content protocol in the Guidelines for Assessing Cultural Impacts (OEQC 2012:11-13). In outlining the “Cultural Impact Assessment Methodology,” the OEQC (2012:11) states that:

> “…information may be obtained through scoping, community meetings, ethnographic interviews and oral histories…”

This report contains archival and documentary research, as well as communication with organizations having knowledge of the project area, its cultural resources, and its practices and beliefs. An example of the letters of inquiry is presented in Appendix A. Copies of the posted legal notice and affidavit are presented in Appendix B. An example of the follow-up letter of inquiry is presented in Appendix C. This CIA was prepared in accordance with the suggested methodology and content protocol provided in the Guidelines for Assessing Cultural Impacts (OEQC 2012:13), whenever possible. The assessment concerning cultural impacts may include, but not be limited to:

A. A discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.

B. A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.

C. Ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained.

D. Biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.

E. A discussion concerning historical and cultural source materials consulted, the institutions and repositories searched and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.

F. A discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

G. A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area affected directly or indirectly by the proposed project.

H. An explanation of confidential information that has been withheld from public disclosure in the assessment.

I. A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.

J. An analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.

K. A bibliography of references, and attached records of interviews which were allowed to be disclosed.

If ongoing cultural activities and/or resources are identified within the project area, assessments of the potential effects on the cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

ARCHIVAL RESEARCH

Archival research focused on a historical documentary study involving both published and unpublished sources. These sources included legendary accounts of native and early foreign writers; early historical journals and narratives; historic maps; land records, such as Land Commission Awards, Royal Patent Grants, and Boundary Commission records; historic accounts; and previous archaeological reports.

INTERVIEW METHODOLOGY

Interviews are conducted in accordance with Federal and State laws and guidelines when knowledgeable individuals are able to identify cultural practices in, or in close proximity to, the project area. If they have knowledge of traditional stories, practices and beliefs associated with a project area or if they know of historical properties within the project area, they are sought out for additional consultation and interviews. Individuals who have particular knowledge of traditions passed down from preceding generations and a personal familiarity with the project area are invited to share their relevant information concerning particular cultural resources. Often people are recommended for their expertise, and indeed, organizations, such as Hawaiian Civic Clubs, the Island Branch of Office of Hawaiian Affairs (OHA), historical societies, Island Trail clubs, and Planning Commissions are depended upon for their recommendations of suitable informants. These groups are invited to contribute their input and suggest further avenues of inquiry, as well as specific individuals to interview. It should be stressed again that this process does not include formal or in-depth ethnographic interviews or oral histories as described in the OEQC's *Guidelines for Assessing Cultural Impacts* (2012). The assessments are intended to identify potential impacts to ongoing cultural practices, or resources, within a project area or in its close vicinity.

If knowledgeable individuals are identified, personal interviews are sometimes taped and then transcribed. These draft transcripts are returned to each of the participants for their review and comments. After corrections are made, each individual signs a release form, making the interview available for this study. When telephone interviews occur, a summary of the information is usually sent for correction and approval, or dictated by the informant and then incorporated into the document. If no cultural resource information is forthcoming and no knowledgeable informants are suggested for further inquiry, interviews are not conducted.

ENVIRONMENTAL SETTING

The island of O`ahu ranks third in size of the eight main islands in the Hawaiian Archipelago. The Ko`olau and Wai`anae Mountain ranges (forming the eastern and western portions of the island, respectively), were formed by two volcanoes. Through the millennia the constant force of water carved fertile amphitheater-headed valleys and rugged passes eroded at lower elevations providing access from one side of the island to another (Macdonald and Abbott 1970).

According to MacDonald and Abbott (1970:366), numerous volcanic eruptions, which occurred over hundreds of thousands of years, created a number of today's well-known landmarks, including: Diamond Head Crater, Koko Head, Hanauma Bay, Punchbowl, and Tantalus. The eruptions also created "broad saucer-shaped tuff cones", including the Salt Lake, Āliamanu (bird salt pond) and Makalapa (Kapūkapī) Craters, located near the project area. These craters comprised a cluster of overlapping tuff cones that blocked the former courses of Moanalua and Hālawa Streams and forced the streams to make wide detours to the sea" (MacDonald and Abbott 1970:374-375). In re-routing the course of the streams, the cones also played a large role in shaping Moanalua and Hālawa Valleys. In the recent past, Salt Lake Crater, was filled-in and is currently the site of a golf course (McDonald and Abbott 1970:375).

LOCATION

The Salt Lake Basin project area is situated near the center of the island of O`ahu, on the leeward side of the Ko`olau Mountain Range. The project area is located an estimated 3.5 miles (c. 5,363 m) north of the coastline at an elevation of 20 to 32 feet (6.0 to 9.8 m) above mean sea level (amsl). The proposed project area is located within the Salt Lake District Park, in the southern portion of Moanalua Ahupua`a, Honolulu (Kona) District, O`ahu Island, Hawai`i [TMK: (1) 1-1-063:018 por.]. According to the Honolulu Property Tax website (http://www.honolulupropertytax.com), the project area consists of approximately 1.8 acres of land owned by the City and County of Honolulu.

PROJECT AREA

The approximately 1.8-acre project area is within the confines of the Salt Lake District Park, which forms the southeast and northeast project area boundaries of the project area. Residential housing and Salt Lake District Park forms the northwest/west project area boundary and the southwest project area boundary is formed by a concrete sidewalk and the asphalt-paved Likini Street.

Two concrete, v-shaped in cross-section, drainages are located within the project area. Both drainages curve from the north to the south and drain or re-direct runoff water from the southwest exterior slope of Āliamanu Crater to a main v-shaped in-cross section, concrete drainage that is oriented in a general northwest to southeast direction. Also feeding the main concrete drainage is a concrete pipe oriented in a general east/west direction, which is likely to extend beneath Likini Street. Please note that these concrete drainages are below the ground surface of the project area. The north/northwest side of the project area slopes towards the south/southeast. The slopes contain natural drainages which drain into the project area's main concrete drainage. In addition, the project area exhibited evidence of prior land alterations including, multiple mechanically created push piles located at the western end of the project area. The areas adjacent to the three open-air concrete drainages were graded during preparation for the placement of the drainages.

CLIMATE

The outstanding features of Hawai`i's climate includes mild and equable annual temperatures, moderate humidity index recordings, the persistence of northeasterly trade winds, and the infrequency of severe storms. Temperatures within the *ahupua`a* of Moanalua usually range from the high 50s to the high 80s (degrees Fahrenheit), during the winter months. Winter rainfall ranges from 15 to 20 inches (Armstrong 1983:62, 64). Summer temperatures in Moanalua range from the high 60s to the low 90s (degrees Fahrenheit). Summer rainfall in this area ranges from 2 to 7 inches (*ibid*).

SOILS

According to Foote *et al*. (1972: 119, 87,88, Sheet Map 64; Figure 4), the eastern portion of the project area is located within the Rock Land Soil Series (rRK) and the larger portion of the project area is located in the Makalapa Soil Series, specifically within Makalapa clay soils (MdC). Foote *et al*. (1972:119) stated that the Rock Land Soil Series is comprised "…of areas where exposed rock covers 25 to 90 percent of the surface" with basalt and andesite rock outcrops and shallow soils deposits the definitive characteristics of the soil series. The rRK Soil Series occurs from around sea level to over 6,000 feet above mean sea level (amsl) in areas receiving 15 to 60 inches of annual rainfall. Rock Land is often utilized as ranchlands, wildlife habitats, and for providing water.

In general, the Makalapa Soil Series is comprised of well-drained soils occurring in the uplands near Salt Lake Crater, on the island of O`ahu, at between 20 to 200 feet amsl in areas receiving 20 to 35 inches of annual rainfall (Foote *et al*. 1972:87). The Makalapa clay soils

Figure 4: USDA Soil Survey Map (Foote et al. 1972) Showing Project Area Location.

exhibit 6 to 12 percent slopes, medium runoff, and a moderate erosion hazard. Typically, the MdC soils are often sites selected for urban development and ranchlands (*ibid*: 88).

VEGETATION

The vegetation within the project area reflects modifications to the landscape and does not reflect the vegetation pattern prior to Contact with Westerners (pre-1778). As stated elsewhere in this document, the project area has been subjected to prior land alterations which are reflected in the vegetation. Thus, the project area is currently an environment dominated by a dense growth of exotic species. Exotic vegetation identified within the project area includes: *koa haole* (*Leucaena leucocephala*); *klu* (*Vachellia farnesiana*); Chinese violet (*Asystasia gangetica*); *alena* (*Boerhavia sp*.); coat buttons (*Tridax procumbens*); mock orange *(Murraya paniculata*); *`uhaloa* (*Waltheria indica*); basil (*Ocimum basilicum*); aloe (*Aloe vera* (*L.*) *Burm.f.*); kiawe (*Prosopis pallida*); garden spurge (*Euphorbia pulcherrina*); slender mimosa *(Desmanthus pernambucanus*); and the autograph tree (*Clusia rosea*). Only one native plant species, *ilima* (*Sida fallax*), was identified within the project area[G1].

HISTORICAL AND CULTURAL BACKGROUND

Early settlement and agricultural development was probably first established on the windward side of the Hawaiian Islands and may have begun as early as A.D. 900-1000 on O`ahu during what is known as the Colonization Period (Kirch 2011:22). Most likely arriving from Polynesia, these early inhabitants brought with them tools, fishing gear, and other artifacts, as well as useful plants and animals. Settling in favorable localities offering both fishing and agricultural opportunities and having near access to inland resources was a priority (Kirch 1985). Although receiving the majority of their protein from fish, Handy and Handy (1972: vi) have stated:

> …for every fisherman's house along the coasts there were hundreds of homesteads of planters in the valleys and on the slopes and plains between the shore and the forests. The Hawaiians, more than any of the other Polynesians, were a people whose means of livelihood, whose work and interests, were centered in the cultivation of the soil. The planter and his life furnish us with the key to his culture.

TRADITIONAL LAND DIVISIONS

Traditionally, the division of O`ahu's land into districts (*moku*) and sub-districts was said to be performed by a *Mā`ilikukahi* who was chosen by the chiefs to be the *mō`īho`oponopono o ke aupuni* (administrator of the government; Kamakau 1991:53–55). Cordy (2002) places Mā`ilikukahi at the beginning of the 16th century. Mā`ilikukahi created six districts and six district chiefs (*ali`i `ai moku*). Land was considered the property of the king or *ali`i `ai moku* (the *ali`i* who eats the island/district), which he held in trust for the gods. The title of *ali`i `ai moku* ensured rights and responsibilities to the land, but did not confer absolute ownership. The king kept the parcels he wanted; his higher chiefs received large parcels from him and, in turn, distributed smaller parcels to lesser chiefs. The *maka`āinana* (commoners) worked the individual plots of land. It is said that Mā`ilikukahi gave land to *maka`āinana* (commoners) all over the island of O`ahu (*ibid*).

In general, several terms, such as *moku*, *ahupua`a*, *`ili* or *`ili` āina* were used to delineate various land sections. A district (*moku*) contained smaller land divisions (*ahupua`a*) that customarily continued inland from the ocean and upland into the mountains. Extended household groups living within the *ahupua`a* were therefore able to harvest from both the land and the sea. Ideally, this situation allowed each *ahupua`a* to be self-sufficient by supplying needed resources from different environmental zones (Lyons 1875:111). The *`ili `āina* or *`ili* were smaller land divisions next to importance to the *ahupua`a* and were administered by the chief who controlled the *ahupua`a* in which it was located (Lyons 1875:33; Lucas 1995:40). The *mo`o`āina* were narrow strips of land within an *`ili*. The land holding of a tenant or *hoa `āina* residing in a *ahupua`a* was called a *kuleana* (Lucas 1995:61). The project area is located in the Moanalua Ahupua`a, which is said to be named "…for two encampments (*moana lua*) at taro patches, where travelers bound for Honolulu from `Ewa rested…" (Pukui *et al*. 1974:152).

The *ahupua`a* of Moanalua extended from the ridge of the Ko`olau Mountains to the coastline, encompasses Moanalua Valley, and includes Moanalua Stream, which empties into Ke`ehi Lagoon, to the east of Hickam Air Force Base (Anderson and Bouthillier 1996). According to Fornander (1918-1919 in Sterling and Summers 1972:257), the Kona District was officially re-named Honolulu, in 1859, which extended from Maunalua Ahupua`a, on the east, to Moanalua Ahupua`a on the west.

TRADITIONAL SETTLEMENT PATTERNS

This section relies heavily on information from several classic references on traditional Native Hawaiian lifeways, traditions, and archaeological sites (e.g., Handy and Handy 1972; Kirch 1985; McAllister 1933; Sterling and Summers 1972) on file at the SCS library, Honolulu.

The Hawaiian economy was based on agricultural production and marine exploitation, as well as raising livestock and collecting wild plants and birds. Extended household groups settled in various *ahupua`a*. During pre-Contact times, there were primarily two types of agriculture, wetland and dry land, both of which were dependent upon geography and physiography. River valleys provided ideal conditions for wetland *kalo* (*Colocasia esculenta*) agriculture that incorporated pond fields and irrigation canals. Other cultigens, such as *kō* (sugar cane, *Saccharum officinaruma*) and *mai`a* (banana, *Musa* sp.), were also grown and, where appropriate, such crops as *`uala* (sweet potato, *Ipomoea batatas*) were produced. This was the typical agricultural pattern seen during traditional times on all the Hawaiian Islands (Kirch and Sahlins 1992, Vol. 1:5, 119; Kirch 1985). Agricultural development on the windward side of O`ahu was likely to have begun early (AD 1100–1300) during what is known as the Expansion Period (Kirch 1985).

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PRE-CONTACT PERIOD (PRE-1778)

During the pre-Contact Period, the District of Kona (now known as Honolulu) extended from Moanalua across the southern expanse of O`ahu to Maunalua (Figure 5). Much of the coastal lands were preferred for chiefly residence. Easily accessible resources such as offshore and onshore fish ponds, the sea with its fishing and surfing—known as the sports of kings, and some of the most extensive and fertile wet taro lands were located in the area (Kirch and Sahlins, 1992 Vol. 1:19). Inland resources necessary for subsistence, could easily be brought to the *ali`i* residences on the coast from nearby inland plantations. The majority of farming was situated in the lower portions of stream valleys where there were broader alluvial flat lands or on bends in the streams where alluvial terraces could be modified to take advantage of the stream flow. Dry land cultivation occurred in colluvial areas at the base of gulch walls or on flat slopes (Kirch 1985; Kirch and Sahlins 1992, Vol. 2:59).

The coastal plain of Moanalua Ahupua`a was traditionally utilized for aquaculture (*i.e.*, fishponds) (Watanabe 1991:9). Several fishponds were developed adjacent to the ancient shoreline (Fornander 1969, II: 270). Kirch (1985:211) notes fishponds were likely to be constructed where broad, shallow reef flats or embayment allowed ponds to extend from the shoreline in a semi-circle arc and that on O`ahu, "the most suitable localities were Kane`ohe Bay and Pearl Harbor….". Several fishponds were developed adjacent to the ancient shoreline (Fornander 1969, II: 270).

According to Handy and Handy (1972: 474, McAllister 1933:91, 93; Figure 6; see Figure 5), six fishponds were located along the Moanalua coastline: Weli Fishpond (McAlister Site 75), Mapunapuna Fishpond (McAllister Site 78), Awaawaloa Fishpond (McAllister Site 79), Kaloaloa Fishpond (McAllister Site 80), Kaihikapu (Kaikikapu) Fishpond (McAllister Site 81), and Lelepaua Fishpond (McAllister Site 82). These fishponds, once renowned for mullet and crab, now either destroyed or filled-in, are described below.

- **Weli Fishpond (McAllister Site 75) and Kaihikapu (Kaikikapu) Fishpond (McAllister Site 81) (Destroyed)**
  McAllister (1933: 91) described Weli Fishpond (McAllister Site 75) as located between Kahauiki and Mokumoa Island, immediately adjacent to Kaihikapu (Kaikikapu) Fishpond (McAllister Site 81), and covering approximately 30 acres. At the time of McAllister's site visit, "[t]he greater part of its walls appears to be earth embankments, mostly natural. It is now separated from Kaikikapu pond by a roadway." Kaihikapu (Kaikikapu)

Figure 5: Kona District Map (Sterling and Summers 1978) Showing Project Area Location.

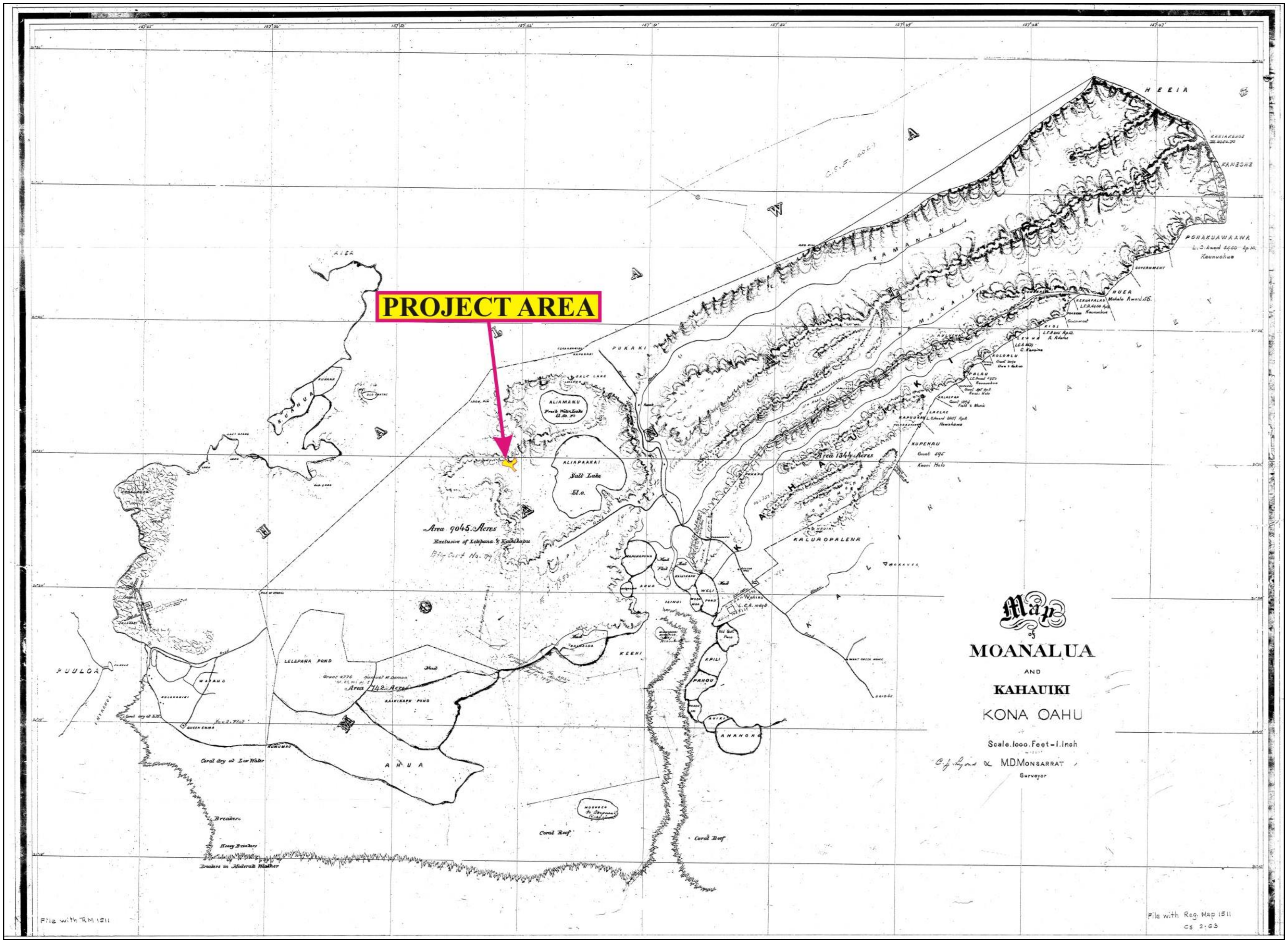

Figure 6: Historic Map of Moanalua and Kahauiki, Kona, Oahu (C.J. Lyons and M.D. Monsarrat n.d.: Registered Map 1126).

Fishpond (McAllister Site 81) was described by McAllister (1933:91) as 20 acres in size with a 900 foot long wall that extended from Mokumoa Island to the coastline of Moanalua Ahupua`a.

- **Mapunapuna Fishpond (McAllister Site 78) (Destroyed)**
  McAllister (1933: 93) described Mapunapuna Fishpond (McAllister Site 78) as measuring 40 acres. The fishpond contained four *mākāhā* (sluice gates) and was enclosed by an “almost straight” wall constructed of coral. The wall measured1600 feet long by 10 feet and stood 2.5 feet above the water surface. The fishpond enclosed a small inlet. A small pond, named Keawamalia, located adjacent to the Damon’s house, adjoined Mapunapuna Fishpond.

- **Awaawaloa Fishpond (McAllister Site 79) (Destroyed)**
  McAllister (1933:93) described Awaawaloa Fishpond (McAllister Site 79) as “a small 8.8-acre pond with a coral rock wall 900 feet long.” At the time of McAllister’s site visi, in the early 1930s, the wall had been breached wall that contained two *mākāhā*. Ahua, the adjoining pond, is thought to be of recent construction.

- **Kaloaloa Fishpond (McAllister Site 80) (Destroyed)**
  McAllister (1933:93) described Kaloaloa Fishpond (McAllister Site 80) as covering 30 acres enclosed by a 2,700 foot long semi-circular wall constructed of coral. The Kaloaloa Fishpond wall contained two *mākāhā*.

  Kaihikapu Fishpond (McAllister Site 81) (Filled-In)
  Now filled-in, McAllister (1933:93) described Kaihikapu Fishpond (McAllister Site 81) as a 258-acre pond. The pond was enclosed by a coral wall measuring 4,500 ft. long by by 3 to 8 ft. wide by 3 ft. high and containing three *mākāhā*. Kaihikapu Fishpond was built by Kaihikapu-a-Manuia. According to Fornander (1969, Vol.II:267), there once were salt pans in the area. When Captain Brown’s ship ran out of salt, Kalanikupule directed Captain Brown “to the saltpans of Kaihikapu.” “While the crew was obtaining salt, Captain Brown and Gardener were killed by a party of Hawaiians under Kalanikupule and Kamohomoho” (Fornander 1969, Vol.II:267).

- **Lelepaua Fishpond (McAllister Site 82) (Filled-In)**
  McAllister (1933:93) described Lelepaua Fishpond (McAllister Site 82) as a “large inland pond” which covered 332 acres and was “mostly filled.” The walls of Lelepaua

Fishpond were constructed of coral and earthen embankments measuring at least 10 feet wide. Lelepaua Fishpond, also, was constructed by Kaihikapu-a-Manuia and according to McAllister's informant (Dibble) Lelepaua was where Captain Brown went to procure salt for his ship.

Temporary habitation also occurred along the coastline, probably to provide day or overnight shelter for those who tended the fishponds or harvested near shore marine resources. Traditionally, early Hawaiians were known to inter the deceased in sand dunes along the shoreline.

According to Handy and Handy (1972:474), there once was a number of *lo`i* (wetland taro) in the interior of Moanalua Valley, including a large inland *lo`i* system that was located in what is now Moanalua Park. This *lo`i* system was irrigated from Kalou Stream, a tributary of Moanalua. There was also a large area of *lo`i* plantations located to the southwest of lower portion of Moanalua Stream that extended to the coast. Also cultivated near the coast were groves of coconut, *lo`i*, breadfruit, and bananas. In contrast, the back of Moanalua Valley was conducive to terracing. However, semi-wild taro, yams, *wauke*, and *olona* was grown in quantities along, and above, the stream (Handy and Handy 1972:474).

Several *heiau* (ceremonial center), located in Moanalua Ahupua`a, were documented by McAllister (1933) during his survey of the valley in the early 1930s.

- **Wakaina Heiau (McAllister Site 77-A) (Destroyed)**
  According to McAllister (1933:93), Wakaina Heiau (McAllister Site 77-A) was initially documented by Thrum, in the early 1900s, as the ruins of a *heiau* of *pookanaka* (human sacrifice) class which measured 100 by 70 ft., the sacrificial stone was said to have been located nearby. In the early 1930s, McAllister's informant, Namakahelu, pointed out the former site of the *heiau* "…[o]n the plateau now cultivated, mountain side the Damon home, of which nothing remains" (McAllister 1933:93).

- **Probable Heiau (McAllister Site 86) (Destroyed)**
  McAllister Site 86, a probable *heiau* was described by McAllister (1933:96) as a small *heiau* " [l]ocated on the side of the ridge facing the stream in the valley." The *heiau* was small in size and appeared to consist of "a practically open terrace" as it appeared to consisted of one wall (3.5 feet long by 3.5 feet wide) which delineated the southwest side of the structure. The surface of the terrace was paved and "…toward the center of the

back is an area which appears as if it might have been the foundation for some structure with a slight terrace surrounding it. The slope in back is rather steep, with several convenient shelters which bear evidence in the form of bits of mats and broken gurds of having been frequented and probably used as habitations" (McAllister 1933:96). According to Summers (in Sterling and Summers 1972: 334) this structure, destroyed in 1958, may have been referred to in "Wai-a-puka" by Mokumaia.

- **Paliuli Heiau (McAllister Site 90) (Destroyed?)**

According to McAllister (1993: 98), Paliuli Heiau was located "…on the north side of Moanalua Valley about 1 mile above Salt Lake…Only two portions of the heiau are now discernible. One is a small elevated terrace which is divided by a line of flat stones placed upright on their long sides. The back of this area was similarly marked off. No trace of stepping can now be found on the front of the long slope. Some 30 feet back and above this terrace is a bluff 10 to 20 feet high with a cave at its foot. This was formerly used as a place of burial, according to Douglas Damon, but as the contents were gradually being carried away and the bodies subject to the disrespect of curio hunters, the remains were burned some years ago. A wall begins near the upper terrace and continues along the side of the hill for some distance. It not only has the appearance of recent construction, but does not seem to form a part of the heiau."

"The second portion is a lower terrace; a part of the f rant side still shows evidence of having been evenly faced and stepped. A portion of a tibia was seen imbedded between the rocks about one foot deep. Upon further examination, a crushed skull which was wedged between the rocks 1.5 feet deep was seen a few feet from the tibia…. Both appear to have been placed at the time or before the building of the terrace. It is possible that this terrace suggested a good burial ground to the Hawaiians after the heiau fell into disuse in missionary times, as in [McAllister] Sites 293, 329, 371. If this happened, a large number of stones were removed and then replaced so as to appear undisturbed."

McAllister (1993:99) notes that there may have been additional "…features of the site, for many stones had been removed before Mr. Damon could stop a workman whom he found dislodging stones on the heiau. These stones were not replaced but were evenly piled in circles a few hundred feet below the site." Sterling and Summers (1972: 336) note that Paliuli Heiau could not be relocated by Stell Newman during the 1973 state-wide re-location of McAllister sites project, which was conducted by the State of Hawai`i, suggesting the site may have been destroyed.

- **Koaloa Heiau (McAllister Site 91)**

  Koaloa Heiau (McAllister Site 91) was recorded by McAllister (1933: 99) as "… located on the Honolulu [southest] side of Moanalua Valley, about halfway up the side of the ridge…The entire structure is approximately 93 feet front [sic?] by 50 feet wide, built of the rather rough lava rocks found in the vicinity. It appears to have been but a single main terrace, with steplike ledging in front, two smaller areas on either side, and one or possibly two small terraces, which probably formed the oracle tower site, in the back-center against the steep slope. The large stone just north of the main terrace may or may not have had a connection, though the stone paving which surrounded it, except in front, would indicate that it had a function."

WAHI PANA (LEGENDARY PLACES)

Numerous legends are associated with Moanaua Ahupua`a, from the name of the valley to historical events, including famous battles. It is said that "Moanalua" refers to "two encampments (*moana lua*) at taro patches" where travelers from `Ewa stopped to rest while on their way to Honolulu (Pukui *et al.* 1974: 152). According to legend, Salt Lake, (Āliapa`akai, salt pond) is associated with the goddess Pele, who once lived in the area, formerly known as Āliamanu, with her family. When her family left the area, Pele dropped some salt and the pet bird belonging to her favorite sister's (Hi`iaka) was able to escape (Pukui *et al.* 1974: 11).

According to Fornander (1918-19119: Vol. 4, 104) Aliapaakai (Salt Lake; McAllister Site 83), is the place where Pele once thought to make her home:

> Upon their arrival at Oahu, Pele and Hiiaka took up .their abode in Kealiapaakai at Maoanalua, where they dug down into the ground and made a home. On coming from Kauai they brought some red dirt and some salt with them and deposited these things in their new home. Because of this facet these places were given the names of Kealiapaakai and Kealiamanu. Upon the finding that the place was too shallow they went to settle at Leahi.

In a similar legend (Emerson 1915:XII), Pele is also said to have excavated the crater on her first trip around the island of O`ahu, as she and her companions were searching for a place to settle:

> …Once more the captain sails on with the rod,
> To try if Oahu’s the wished for land:
> They thrust in the staff at Salt Lake Crater,
> But that proved not the land of their promise.

Moanalua Ahupua`a is also associated with the followers of the various *ali`i* as they fought for control of Oa`hu. According to an article in Ka Hookumu ana o na Paemoku, Ke Au Hau (Nov. 29. 1911 in Sterling and Summers 1972: 6):

> When Kahekili defeated Oahu, Kahahana, his wife and friend fled to Moanalua where he lived with his servant. From there he moved to Kinimakalehua at Aliamanu below Kapukaki, a place facing Leilono. There was a lehua and a hau tree where they stayed for a few days. From there they went to Ke-ana-apuaa and from thence to Kepaakaea, then to Waipio and on to Kahaone. They remained there until they thought it better to go up to Oahunui at Wahiawa and so they went to the forest of Halemano. They were there a short time and moved to Leilehua. After living there for a time they went to stay at Po'ohilo in Honouliuli and there they hid until, weary with life in the forest, they showed themselves to the commoners.

After “showing themselves to the commoners” Kahahana was captured at Pu`uloa by Kamehameha’s forces. Kahahana’s body was subsequently taken to Ulukou, in Waikiki, to the same coconut grove where Kaopulupulu was laid, after his death (Ka Hookumu ana o na Paemoku, Ke Au Hau, Nov. 29. 1911 in Sterling and Summers 1972: 7).

There are a variety of accounts relating to McAllister Site 85, the “house of bones” (also known as Kaualua or Kauwalua), that once was located “… on the plateau between Puukapu and Puu a Ma`o, inland of the highway,” in Moanalua Ahupua`a (McAllister 1933: 95).

Fornander (1918-1919: Vol. 6. 29) ties the “house of bones” to the struggle between the *ali`i* for control of O`ahu:

> Fearfully did Kahekili avenge the death of Hueu on the revolted Oahu chiefs…It is related that one of the Maui chiefs, named Kalaikoa, caused the bones of the' slain

> to be scraped and cleaned, and that the quantity collected was so great that he built a house for himself, the walls of which were laid up entirely of the skeletons of the slain. The skulls of Elani, Konamanu, and Kalakioonui adorned the portals of this horrible house. The house was called "Kauwalua," and was situated at Lapakea in Moanalua, as One passes by the old upper road to Ewa. The site is still pointed out, but the bones have received burial.

Namakahelu, McAllister's informant, provides an account of the "house of bones". According to Namakahelu (McAllister 1933: 95):

> Kaualua was constructed by Kalalakoa (Kalaikoa) when he was chief of Moanalua. He was in the habit of stationing himself at a prominent place along the roadway, probably not far from Puukapu, and waylaying travelers. After overpowering them in hand-to-hand combat, he would kill them and remove the long bones with which he was constructing a fence around his grass hut. This continued for many years; and the people were in great fear of him and would go many miles out of their way, frequently traveling by canoe, rather than pass his house. When this fence had almost been completed except for one more set of bones, there arose a warrior, by name Kaluaihalawa. He gathered together a large group of people and expressed his intention of attempting to kill Kalalakoa. The people went with him to the foot of Puukapu where they remained while he climbed to the top of the hill where Kalalakoa was watching. As Kaluaihalawa neared the chief, he told him that he had come to fight. "It means death," Kalalakoa replied. "Then let mc rest and get my breath" said Kaluaihalawa to which the other agreed. After an interval, Kalalakoa again warned the warrior that the outcome meant death, but Kaluaihalawa lunged forward and tripped the chief toppling him over and throwing himself upon him and killing him. The people who were watching below sent up a mighty cheer.

John Papa `Ī`ī (1959:95) mentions the "house of bones" in his description of the trail extending from `Ewa District to Kikihale, as the trail passes through Moanalua:

> Let us turn to look at the trail going to Ewa from Kikihale. It led up to Leleo. to Ko`iu`iu and on to Keone`ula. There were no houses there, only a barren plain. It was there that the boy (John Ii) met with his attendants who came from Ewa with the

> god Ka`ili. He accompanied them on the way to Hoa`ae`ae and when the prostrating kapu was called, they all prostrated themselves on the plain until the others passed along. When they reached a bridge, the trail led along the banks of taro patches, up to the other side of Kapalama, to the plain of Kaiwi-`ula; on to the taro patches of Kalihi; down to a stream; up to the other side; down into Kahauiki; up to the other side: turned left to the houses of the Portuguese people; along the plain to Kauwalua, Kalaikoa's house of bones; down to a cocoanut grove; along the taro patches of Kahohonu; over to the other side and from there to a forded stream and up to Ka-papakolea a resting place for travellers coming this way or going that way. From there the trail went to Ka-leina-ka-`uhane; thence to Kapuka-ki, where one could see the irregular sea of Ewa; then down to the ridge to Napehā, a resting place for the multitude that go diving there, for there is a deep pool here. It was named. Napehā, (lean over) so it was said, because Kualii went and leaned over the pool to drink water.

Subterranean lava tubes, said to connect various locations on the island of O`ahu, are mentioned in numerous legends. One such legend involves a secret cave which belonged to the *ali`i* called Pohukaina Cave. Pohukaina Cave is said to be a place where the chiefs is their wealth and were often interred there (Kamakau 1870 in Sterling and Summers 1972:176). According to legend, Pohakuaina Cave was located on the east side of O`ahu, at Kāehoalani Hill Kualoa, between Kualoa and Ka`a`awa. According to Ke Au Hou (June 28, 1911 in Sterling and Summers 1972: 176):

> The entrance is believed to be at Kaoio cliff, facing Kaaawa and another entrance is at Kaahuula spring. Hailikulamanu is another entrance a little way below the cave of Koluana in Moanalua (and there are still others) at Kalihi, Puiwa, at Waipahu in Ewa and at Kahuku in Koolauloa. Kauhuhu is the roof of the burial cave "house", that is, the mountain of Konahuanu is sloping down toward Ka huku. It was said that many had gone into it in olden days with kukui nut candles, going in from here in Kona and out at Kahuku. In this

cave are many creeks, rivers and streams.
Some places are decorated and some places are
level.

THE POST-CONTACT PERIOD (POST-1778) AND THE MĀHELE

In 1783, Kahekili, a fierce warrior and powerful Maui *ali`i*, conquered O`ahu. As was the custom following such a significant victory, Kahekili re-allocated the lands of O`ahu to his warriors and supporters, and gave Moanalua Ahupua`a to his son, Kalanikūpule (Pukui *et al*. 1974:152). Twelve years later, in 1795, Kamehameha I defeated the forces of Maui at the Battle of Nu`uanu. Kalanikūpule went into hiding, but was eventually captured, killed, and is believed to have been sacrificed at Pu`ukapu, in Moanalua (Pukui *et al.* 1974:152). Kamehamaha I redistributed the lands of O`ahu to his warriors and supporters (Klieger 1995:30). Thus, Kamehameha I gave the *ahupua`a* of Moanalua to Kame`eiamoku, a Hawai`i Island *ali`i* and one of Kamehameha I's revered five Kona "uncles", who later became the Counselor of State to Kamehameha I (Pukui *et al*. 1974:152). Although Kame`eiamoku was referred to as Kamehameha's "uncle", the two were cousins through Kamehameha's mother, Kekuiapoiwa II.

Following the death of Kame`eiamoku, in 1802, Kamehameha I gave Moanalua Ahupua`a to Kame`eiamoku's son, Ulumāheihei Hoapili. After Ulumāheihei Hoapili died in 1840, the *ahupua`a* of Moanalua was passed on to Ulumāheihei Hoapili's *hanai* (adopted) son and heir, Lot Kapuāiwa (Kamehameha V), as Land Commission Award 7715 (Appendix A).

In the 1840s, traditional land tenure shifted drastically with the introduction of private land ownership based on western law. While it is a complex issue, many scholars believe that in order to protect Hawaiian sovereignty from foreign powers, Kauikeaouli (Kamehameha III) was forced to establish laws changing the traditional Hawaiian economy to that of a market economy (Kame`eleihiwa 1992:169-70, 176; Kelly 1983:45, 1998:4; Daws 1962:111; Kuykendall 1938 Vol. I: 145). The Māhele of 1848 divided Hawaiian lands between the king, the chiefs, the government, and began the process of private ownership of lands. The subsequently awarded parcels were called Land Commission Awards (LCAs). Once lands were thus made available and private ownership was instituted, the *maka`āinana* (commoners), if they had been made aware of the procedures, were able to claim the plots on which they had been cultivating and living. These claims did not include any previously cultivated but presently fallow land, *`okipū* (on O`ahu), stream fisheries, or many other resources necessary for traditional survival (Kelly 1983; Kame`eleihiwa 1992:295; Kirch and Sahlins 1992). If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed LCA and issued a Royal Patent after which they could take possession of the property (Chinen 1961:16).

In 1839, "the upland and mountain land" of Moanalua Ahupua`a was leased to William Sumner by Kamehameha III (no author 1849, 1:494-495 in Ayers 1970:62). According to Ayers (1970:62), Sumner, a ship captain, "…arrived in Hawai`i in 1807" and subsequently "…became the master of several vessels for King Kamehameha III and the chiefs." The terms of the lease stipulated that the land would be leased to Sumner and his heirs for fifty-five yeas for $50 per year. The lease agreement stated that at the end of the fifty-five years Sumner and his heirs could continue to live on the land rent free and that the land would be "heritable" by Sumner's heirs who were born in the islands, "provided that William Sumner did not sell said land" (Ayers 1970:63). During the early 1900s, the entire valley was used for grazing cattle (Ayers 1971:4), most likely by Sumner's cattle.

On December 11, 1872, Kamehameha V died intestate. According to Probate 2412 (Ist CC) the half-sister of Kamehameha V, Ruth Ke`elikōlani, daughter of Kīna`u and Kekuanao`a, was declared his heir (see Appendix A). Thus, the lands of Moanalua were passed on to Ruth Ke`elikōlani. On May 15, 1883, Ruth Ke`elikōlani died and her lands, including Moanalua Ahupua`a, were bequeathed to the last living heir of Kamehameha I, Bernice Pauahi (Pukui *et al.* 1974:152). One of Pauahi's actions, following her inheritance of Moanalua, included the lease of fifteen acres in the lower portion of the valley to Richard Gerke for ten years, "with permission for him [Gerke] to sublet the lands to two Chinese (Abstract 1933, 9:1520 in Ayers 1970:64).

Bernice Pauahi married Charles Reed Bishop, the founder of what is now known as the First Hawaiian Bank. Moanalua Ahupua`a subsequently became part of the Damon Estate. Bernice Pauahi Bishop's willed Moanalua Ahupua`a, in its entirety, to Samuel M. Damon, her husband's business partner following her death in 1884 (Pukui *et al*. 1974:152). According to Ayers (1970:64), in October 1883 Pauahi "added a codicil in her will, bequeathing, 'all of that tract of land k own as the ahupua`a of Moanalua… and also the fishery of Kaliawa,'" to Samuel Mills Damon. Samuel Damon, subsequently, purchased "…the Sumner heirs' title to the ahupua`a, and began his purchase of 89 of the remaining kuleana titles" (Abstract 1933:106-108 in Ayers 1970:65).

Currently, 24 acres of Moanalua Ahupua`a is a privately owned park containing Kamehameha V's summer cottage, which was built in 1867, and the site of the annual Prince Lot Hula Festival. The remaining suitable portions of the *ahupua`a* have been developed for residences and commercial purposes.

PREVIOUS ARCHAEOLOGICAL STUDIES

A literature search identified two previously conducted archaeological studies (Barrera 1979, Connolly 1980) that included the current project area. The other selected previous archaeological studies are intended to reflect a range of findings in the general Moanalua area. The studies selected for the Previous Archaeology discussion was based on report availability at the State Historic Preservation Division (SHPD), Kapolei, library. The findings of the studies summarized below (Figure 7), and in Table 1, indicate the presence of a fairly substantial pre-Contact settlement, which included fishponds and *lo`i*, in the lower portion of the valley with use and occupation continuing into the Historic Period (post-1778).

One of the earliest archaeological surveys conducted on O`ahu was conducted by J. Gilbert McAllister in the early 1930s, under the auspices of the Bernice P. Bishop Museum (McAllister 1933). During this survey McAllister (1933:90-100) documented eighteen sites within Moanalua Ahupua`a, none of which are located in the project area. In addition to the fishponds, *heiau*, and *wahi pana* described above, McAllister (1933) described petroglyphs (McAllister Site 93); a burial cave (McAllister Site 87); terrace facings (McAllister Site 88); and Waiola Pool (McAllister Sire 92), which is said to have "medicinal qualities."

In 1970, the Department of Anthropology, Bernice P. Bishop Museum (Ayres 1970) conducted a salvage archaeological survey and excavations in the *ahupua`a* of Moanalua and South Hālawa. During the survey, fifty-seven sites were identified in Kamana-nui Valley (Moanalua Ahupua`a) and forty-eight sites were identified in South Hālawa Ahupua`a. The functions of the pre-Contact sites identified within Kamana-nui were interpreted as agricultural, habitation, and ceremonial, including one possible shrine and two petroglyph rocks, one of which was McAllister Site 93. The six Historic (post-1778) sites identified in Kamana-nui Valley included a "paved buggy road" which Samuel Damon built in the early 1900s; one bridge abutment dated 1909; and several house sites, including the remains of May Damon's home and Dougal Damon's home, which were built in the 1900s. Sites identified within South Hālawa Ahupua`a were interpreted as having agricultural and habitation functions.

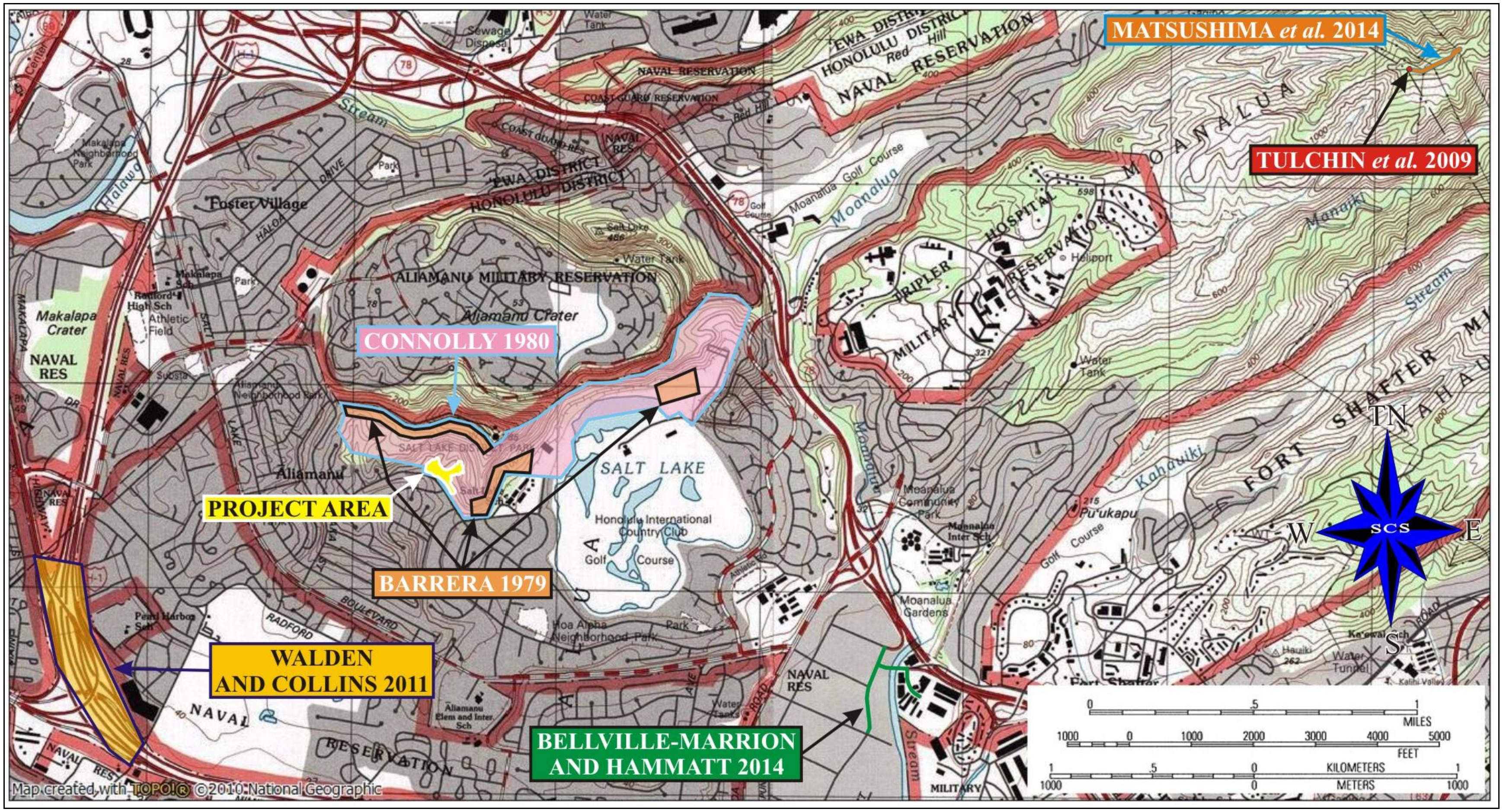

Figure 7: USGS Quadrangle (Pearl Harbor 1999) Map Showing Previous Archaeology in the Vicinity of the Current Project Area.

Table 1: Summary of Previous Archaeology.

Reference	Location of Study	Type of Study	Site Number(s)
McAllister 1933	Island-wide	Island-wide Survey	McAllister Sites 75 through 82, 77-a, 86, 90, 91, 93
Ayers 1970	Moanalua Ahupua`a* and South Hālawa Ahupua`a	Salvage archaeological survey and excavations	Bishop Museum Sites: A7-27, A7-29, A7-30, A7-33, A7-38, A7-40, A7-42 through A7-47, A7-52 through A7-54, A7-59, A7-62, A7-64, A7-67, A7-69, A7-72, A7-24, A7-32, A7-35, A7-37, A7-39, A7-48, A7-49, A7-57, A7-63, A7-65, A7-66, A7-68, A7-23, A7-31, A7-34, A7-51, A7-55, A7-71, A7-36, A7-50, A7-56, A7-1, A7-70, A7-58 through A7-60, A7-73, A7-74 through A7-78, A7-44, A7-41, A7-24, A7-25*
Loyd Soehren	Moanalua Ahupua`a	Limited archaeological excavations	Bishop Museum Site Oa-A7-20
Barrera 1979	Salt Lake District Park (portions of)	Archaeological reconnaissance	State Site 50-80-13-500(?); Bishop Museum Site Oa-A7-20
Connolly 1980	Salt Lake District Park	Archaeological reconnaissance	State Site 50-80-13-3992 (Bishop Museum Site Oa-A7-21), now destroyed; State Site 50-80-13-500 (Bishop Museum Site Oa-A7-20); newly identified habitation cave with human burial
Whitehead and Cleghorn 2003	Biomedical Center, Tripler Army Medical Center	Archaeological surface Survey and subsurface testing	State Site 50-80-14-6523
Tulchin *et al.* 2009	HECO Tripler Ridge Communications Station Upgrade Project	Archaeological assessment	None
Walden and Collins 2011	Freeway management system, Phase 1C, Part 1B:installation of CCTV and communication infrastructure	Archaeological assessment	None
Matsushima *et al.* 2009	HECO Tripler Spur Project	Archaeological inventory survey	State Site 50-80-14-7603
Bellville-Marrion and Hammatt 2014	Māpunapuna Water System Improvements Project	Archaeological monitoring	None
Tome and Spear 2015	Current Project Area	Archaeological field inspection	None

*Only includes sites within Moanalua Ahupua`a

In 1974, Loyd Soehren (in Davis and Kaschko 1980:6), under the auspices of Bernice P. Bishop Museum, conducted limited archaeological excavations of a burial cave which was subsequently designated Bishop Museum Site Oa-A7-20 (Figure 8). Davis and Kaschko (1980:7) surmise that the historic burials “were presumably removed by 1964.” However, fragmented human skeletal elements and historic artifacts, including glass beads, iron nails, and a metal button were identified during Soehren’s (1974) excavations. Evidence of pre-Contact habitation was indicated by artifacts, including basalt adzes, bone and pearlshell fishhooks, a bone awl, a dog or pig tooth pendant, a possible abrader, and a grinding stone, recovered during excavation (Davis and Kaschko 1980:7).

On August 3, 1979, Chiniago (Barrera 1979) conducted an archaeological reconnaissance of portions of the area. During the survey, Barrera located one site, which he thought might be State Site 50-80-13-500 (see Figure 8), the above-described a habitation cave. However, the vegetation was extremely dense preventing a conclusive determination.

Connolly (1980) conducted an archaeological reconnaissance survey of the Salt Lake District Park Site [TMK: (1) 1-1-063:9 and 14], which included the current project area. The survey resulted in the identification of a previously unidentified rockshelter (see Figure 8). Based on the finding of oyster shell and fragmented human skeletal material, the cave was interpreted as a temporary habitation and burial site. Connolly’s (1980) findings also included the re-location of the habitaiton cave (State Site 50-80-13-500/Bishop Museum Site Oa-A7-20) initially investigated by Soehren, and indicated that extensive bull dozing had “probably” destroyed Bishop Museum Site Oa-A7-21 (State Site 50-80-13-3992).

In 2003 Pacific Legacy, Inc. (Whitehead and Cleghorn 2003) conducted archaeological investigations for the proposed Biomedical Center, Tripler Army Medical Center [TMK: (1) 1-1-012], which included the manual excavation of 24 shovel probes. The survey resulted in the identification of State Site 50-80-14-6523, a “probable WWII concrete bunker.”

In 2009, Cultural Surveys Hawai`i, Inc. (Tulchin *et al.* 2009) conducted an archaeological inventory survey-level investigation of 0.05 acres for the proposed HECO Tripler Ridge Communications Station Upgrade Project [TMK: (1) 1-1-013:004]. No historic properties were identified.

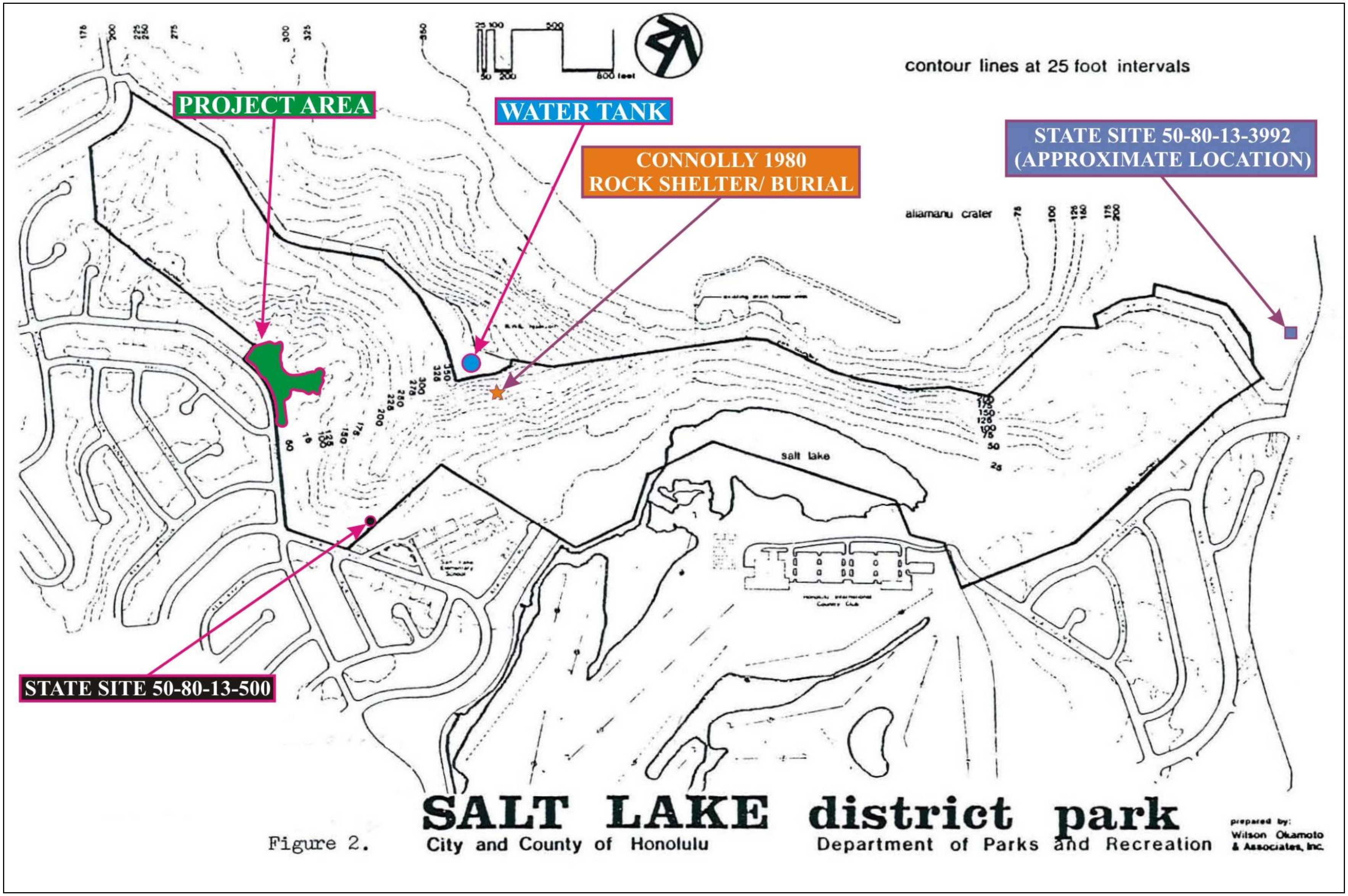

Figure 8: Topographic Map (Adapted From Connolly 1980) Showing the Locations of State Site 50-80-13-500; the Rockshelter/Burial Identified by Connolly (1980); State Site 50-80-13-3992; and the Current Project Area.

In 2011, Pacific Consulting Services, Inc. (Walden and Collins 2011) conducted an archaeological inventory survey-level investigation in support of freeway management system, Phase 1C, Part 1B:installation of CCTV and communication infrastructure [TMK: (1) 1-1-010 and 1-1-002. No historic properties were identified.

In 2014, Cultural Surveys Hawai`i, Inc. (Matsushima *et al.* 2009) conducted an archaeological inventory survey of 0.9 acres for the HECO Tripler Spur Project [TMK: (1) 1-1-013:001 por. and 1-1-013001 por. and 004]. During the survey, State Site 50-80-14-7603, a trail alignment, was identified.

In 2014, Cultural Surveys Hawai`i, Inc. Bellville-Marrion and Hammatt 2014) conducted archaeological monitoring during ground altering activities for the Māpunapuna Water System Improvements project in Moanalua Ahupua`a [TMK: (1) 1-1-007:016-018, 028, 031, 043 and -1-035:004-009, 013-015]. No historic properties were identified.

Scientific Consultant Services, Inc. (Dagher *et al*. Spear 2016) conducted an archaeological field inspection of the 1.8-acre Salt Lake Debris Basin project area. The project area exhibited evidence of prior land alterations including, a large mechanically disturbed area and multiple mechanically created push piles located at the western end of the project area. The areas adjacent to the three open-air concrete drainages were graded during preparation for the placement of the drainages. No historic properties were identified during the field inspection.

CONSULTATION

Consultation was conducted via the U.S. Postal Service. Consultation was sought from Dr. Kamana`opono M. Crabbe, Chief Executive Officer, OHA; Vincent Hinano Rodrigues, SHPD Culture and History Branch Chief; William Ho`ohuli, community member; the Hawaiian Civic Club of Honolulu; and David Yomes, Chairperson of the Aliamanu, Salt Lake, Foster Village Neighborhood Board. The initial letters of inquiry were mailed to the above-named individuals and organizations on August 15, 2014. Follow-up letters were mailed to these same individuals and organizations on September 24, 2014.

In addition, a Cultural Impact Assessment Notice was published on August 3, 6, and 7, 2014, in *The Honolulu Star-Advertiser*, and the September 2014 issue of the OHA newspaper, *Ka Wai Ola* (see Appendix B). These notices requested information of cultural resources or activities in the area of the proposed project, stated the Tax Map Key (TMK) number, and where to respond with pertinent information. Based on the responses, an assessment of the potential effects on cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

CULTURAL IMPACT ASSESSMENT INQUIRY RESPONSES

Analysis of the potential effect of the project on cultural resources, practices or beliefs, the potential to isolate cultural resources, maintain practices or beliefs in their original setting, and the potential of the project to introduce elements that may alter the setting in which cultural practices take place is a requirement of the OEQC (2012:13). As stated earlier, this includes the cultural resources of the different groups comprising the multiethnic community of Hawai`i.

During the consultation process, SCS received no responses to the inquiries pertaining to any information that individuals or organizations may have which might contribute to the knowledge of traditional cultural activities that were, or are currently, conducted in the vicinity of the proposed Salt Lake Basin Debris project area.

SUMMARY

The “level of effort undertaken” to identify potential effect by a project to cultural resources, places or beliefs (OEQC 2012) has not been officially defined and is left up to the investigator. A good faith effort can mean contacting agencies by letter, interviewing people who may be affected by the project or who know its history, researching sensitive areas and previous land use, holding meetings in which the public is invited to testify, notifying the community through the media, and other appropriate strategies based on the type of project being proposed and its impact potential. Sending inquiring letters to organizations concerning development of a piece of property that has already been totally impacted by previous activity and is located in an already developed industrial area may be a “good faith effort.” However, when many factors need to be considered, such as in coastal or mountain development, a good faith effort might mean an entirely different level of research activity.

In the case of the current undertaking, letters of inquiry were sent to individuals and organizations that may have knowledge or information pertaining to the collection of cultural resources and/or practices currently, or previously, conducted in close proximity to the approximately 1.8 acre proposed Salt Lake Debris Basins Project area located in Salt Lake, Moanalua Ahupua`a, Honolulu (Kona) District, O`ahu Island, Hawai`i [TMK: (1) 1-1-063:018 por.].

Historical and cultural source materials were extensively used and can be found listed in the References Cited portion of this report. Such scholars as Samuel Kamakau, Martha Beckwith, Jon J. Chinen, Lilikalā Kame`eleihiwa, R. S. Kuykendall, Marion Kelly, E. S. C. Handy and E.G. Handy, Elspeth P. Sterling, and Mary Kawena Puku`i and Samuel H. Elbert continue to contribute to our knowledge and understanding of Hawai`i, past and present. The works of these and other authors were consulted and incorporated in this report where appropriate. Land use document research was supplied by the Waihona `Aina Database (2014).

CULTURAL ASSESSMENT AND RECOMMENDATIONS

Analysis of the potential effect of the project on cultural resources, practices or beliefs, its potential to isolate cultural resources, practices or beliefs from their setting, and the potential of the project to introduce elements which may alter the setting in which cultural practices take place is a suggested guideline of the OEQC (2012). Based on the lack of responses from those organizations and individuals contacted, it appears that the proposed project area has not been used for traditional cultural purposes within recent times. Based on historical research and the lack of responses from those organizations and individuals contacted, it is reasonable to conclude that Hawaiian rights related to gathering, access or other customary activities within the project area will not be affected and there will be no adverse effect upon cultural practices or beliefs.

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APPENDIX A: EXAMPLE LETTER OF INQUIRY

Dear:

In compliance with the State of Hawai‘i Revised Statute (HRS) Chapter 343 Environmental Impact Statements Law, and in accordance with the State of Hawai`i Department of Health’s Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impacts as adopted by the Environmental Council, State of Hawai`i on November 19, 1997, Scientific Consultant Services, Inc. (SCS) is in the process of preparing a Cultural Impact Assessment (CIA) pertaining to the proposed (Salt Lake Debris Basins Project, Moanalua Ahupua`a, Honolulu (Kona) District, O`ahu Island, Hawai`i [TMK: (1) 1-1-063:018 por.] (Figures 1 through 3).

According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs…The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man-made and natural which support such cultural beliefs…

We are seeking any information that you or other individuals have which might contribute to the knowledge of traditional cultural activities that were, or are currently, conducted in the vicinity of the proposed development. We are, also, seeking any information pertaining to traditional cultural activities or traditional rights which may be impacted by the proposed project. In addition, we are seeking any information pertaining to traditional cultural activities or traditional rights which may be impacted by the proposed project. The results of the cultural impact assessment are dependent on the response and contributions made by individuals, such as yourself.

Enclosed are maps showing the location of the proposed project area. Please contact me at the Scientific Consultant Services, Honolulu, office at (808) 597-1182 or via e-mail (cathy@scshawaii.com) with any information or recommendations concerning this Cultural Impact Assessment.

Sincerely yours,

Cathleen Dagher
Senior Archaeologist
Enclosures (3)

Cc: Dr. Kamana`opono M. Crabbe, Chief Executive Officer Office of Hawaiian Affairs; Vincent H. Rodrigues, Cultural Historian, State Historic Preservation Division; Hawaiian Civic Club of Honolulu; William Ho`ohuli, community member

APPENDIX B: LEGAL NOTICE AND AFFIDAVIT

Scientific Consultant Services, Inc. (SCS) seeking information on cultural resources and traditional, or on-going, cultural activities on or near the proposed Salt Lake Debris Basins Project, Moanalua Ahupua`a, Honolulu (Kona) District, O`ahu Island, Hawai`i [TMK: (1) 1-1-063:018 por.]. Please respond within 30 days to Cathleen Dagher at (808) 597-1182.

(1609)

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
Salt Lake Debris Basins Project CIA (SCS Proj 1609)

STATE OF HAWAII } SS.
City and County of Honolulu

Doc. Date: AUG - 7 2014 **# Pages:** 1
Notary Name: Patricia K. Reese First Judicial **Circuit**
Doc. Description: Affidavit of Publication

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

AUG - 7 2014
Notary Signature Date

Lisa Kaukani being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser and MidWeek, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Advertiser 3 times on:
08/03, 08/06, 08/07/2014

Midweek Wed. 0 times on:

_____ times on:

Scientific Consultant Services, Inc. (SCS) seeking information on cultural resources and traditional, or on-going, cultural activities on or near the proposed Salt Lake Debris Basins Project, Moanalua Ahupua'a, Honolulu (Kona) District, O'ahu Island, Hawai'i [TMK: (1) 1-1-063:018 por.]. Please respond within 30 days to Cathleen Dagher at (808) 597-1182.
(SA654517 8/3, 8/6, 8/7/14)

And that affiant is not a party to or in any way interested in the above entitled matter.

Lisa Kaukani

Subscribed to and sworn before me this 7th day
of August A.D. 2014

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Oct 07 2014

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

Ad # 0000654517 SP.NO.: __________ L.N.

APPENDIX C: EXAMPLE FOLLOW-UP LETTER

Dear Mr:

This is the follow-up to our August 15, 2014 letter, which was in compliance with the statutory requirements of the State of Hawaiʻi Revised Statute (HRS) Chapter 343 Environmental Impact Statements Law, and in accordance with the State of Hawai`i Department of Health's Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impacts as adopted by the Environmental Council, State of Hawai`i, on November 19, 1997.

Scientific Consultant Services, Inc. (SCS) is in the process of preparing a Cultural Impact Assessment (CIA) pertaining to the proposed Salt Lake Debris Basins Project, Moanalua Ahupua`a, Honolulu (Kona) District, O`ahu Island, Hawai`i [TMK: (1) 1-1-063:018 por.].

According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs…The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural which support such cultural beliefs…

We are seeking any information that you or other individuals have which might contribute to the knowledge of traditional cultural activities that were, or are currently, conducted in the vicinity of the proposed project. We are, also, seeking any information pertaining to traditional cultural activities or traditional rights which may be impacted by the proposed undertaking. In addition, we are seeking any information pertaining to traditional cultural activities or traditional rights which may be impacted by the proposed project. The results of the cultural impact assessment are dependent on the response and contributions made by individuals, such as yourself.

Please contact me at the Scientific Consultant Services, Honolulu, office at (808) 597-1182 or via e-mail (cathy@scshawaii.com) with any information or recommendations concerning this Cultural Impact Assessment.

Sincerely yours,

Cathleen Dagher
Senior Archaeologist

Cc:

APPENDIX D: LAND COMMISSION AWARD 7715

KAPUAIWA, LOT KAMEHAMEHA Alii AwardLCA 7715

MAHELE BOOK 7-8 (12-13)
Relinquished:
Kukulaeo, ili nui o Waikiki, Kona, Oahu
2 Puehuehu, ahp., Lahaina, Maui
Waiokila, ili o Kahakuloa, Kaanapali, Maui
Wakiu, ahp., Hana, Maui
Poo, ahp., Kohala, Hawaii
Kaoma, ahp., Kohala, Hawaii
Makeanehu, ahp., Kohala, Hawaii
Kaihoa, ahp., Kohala, Hawaii
Puaiki, ahp., Kohala, Hawaii
Lapaki, ahp., Kohala, Hawaii
Keopuka, ahp., Kona, Hawaii
Kahanaiki, ahp., Kona, Hawaii
2 Mokukano 1,2, ahp., Kona, Hawaii
Auhaukeae, ahp., Kona, Hawaii
Keekee, ahp., Kona, Hawaii
Lehuula-iki, ahp., Kona, Hawaii
Kaumoali, ahp., Hamakua, Hawaii
Waawaa, ahp., Puna, Hawaii
Kealakomo me Kilauea, ahp., Puna, Hawaii
By M. Kekuanaoa, father and kahu waiwai (executor)

Received:
Moanalua, ahp., Kona, Oahu
Waiokama, ahp., Lahaina, Maui
Hanakaoo, ahp., Lahaina, Maui
Kahua, ahp., Kohala, Haawaii
2 Hikiaupea, ahp., Kohala, Hawaii
Hawi, ahp., Kohala, Hawaii
Kamano, ahp., Kohala, Hawaii
Hihiu hookahi, ahp., Kohala, Hawaii
Kauapalaoa, ahp., Kohala, Hawaii
Kaupulehu, ahp., Kona, Hawaii
Kaloko, ahp., Kona, Hawaii
Keauhou, kahi i hanau ai ka Moi-place where the King was born, Kona
Puaa, ahp., Puna, Hawaii
Hilea, ahp., Kau, Hawaii
Paukaa, ahp., Hilo, Hawaii
Punaluu, ahp., Kau

Privy Council Records 3:789: Resolution authorizing Minister of Interior to grant Royal Patents to Lot Kamehameha for his lands, 18 in number, without further division or commutation upon the relinquishment of the above land [Kahikinui, Maui] to the Government.
[See also *Indices* pp 64-65]

Claim 7715
NR 444.5 M. Kekuanaoa lists the lands Lot Kamehameha received in the Mahele.

Appendix F. OHWM Determination & Wetland Determination Field Report

Salt Lake Detention Basin Field Survey
Ordinary High Water Mark and Wetland Determination
Field Report

The site was accessed on foot over a period of about 2 hours on the morning of Friday November 6, 2015. A site map (1"=20'), small shovel, measuring tapes, botanical report, Munsell soil color book, and camera were used to document site conditions. Photograph images were obtained (IMG_0760 through IMG_0800) and saved in the project file (I/2005D-Salt_Lake_Debris_Basins/D Graphics / Photos /11-6-15 OHWM). Weather was typical trade-wind sunny skies, with minimal rainfall at the site (0.26-inches) scattered during the previous week. However, passing hurricanes in the late summer and fall resulted in more precipitation at the site than normal for this time of year. For example, in August during the passage of the first hurricane of the season rainfall at the site was recorded at nearly 2-inches per hour.

The trapezoid concrete storm drain channel is divided into west and east branches. Both channels are concrete lined, with 2:1 side slopes and a bottom width just under 2-feet. The east channel has a top width of 14 feet and the upper 150-feet of the west channel has a top width of 16 feet and both channels have a total depth of about 3-feet. None of the channels contained water at the time of the survey. Where the west channel is joined by a 54-inch pipe culvert it widens to about 23-feet and about 5-feet in depth and this width is maintained until below the junction with the east channel. There was no evidence of flow within either open channel although there was evidence of a very small flow trickling from the 54-inch pipe culvert drain.

West Branch
The upper reach of the west branch of the concrete channelized stream (Image 0761, Figure 1) is about 150-feet in length with a total depth of 3-feet. A flow stain approximately 6-inches up the sidewall (3-inch water flow depth) marks the OHWM. The channel (and OHWM) terminates at a wall of grass and Haole Koa at the top of the channel (Figure 2). Three 4-inch metal pipes set vertically into the concrete lip, bar the entrance of large materials into the channel. Rock, sediment, and foliage is built up behind these bars to a depth of about 1 foot above the bottom of the concrete channel. The swale above the concrete drainage ditch, is overgrown with grasses and haole-koa trees with trunk diameter of several inches. The foliage is similar to that seen above the swale At the bottom of the swale a discontinuous rill approximately a foot wide and a few inches deep is occasionally seen. The rill consists of what appears to be recently eroded loosely packed rough-edged gravel, mixed with foliage debris and is likely the result of the unusual heavy rainfall associated with passing hurricanes earlier in the year. This rill is a temporary feature likely resultant from unusually heavy rainfall during previous months and should not be considered to be within waters of the U.S. (Figure 4). The swale was followed up slope approximately 100 feet, beyond the point where it bifurcates at a friable stone cliff, which is a likely source of the gravel seen in the bottom of the swale.

A wetland determination was conducted by examination of the soils and vegetation present on the site. A 14-inch deep pit was dug within a section of the rill approximately 30-feet above the top end of the west channel. The soil was dust-dry to the bottom of the pit and consisted of loosely packed angular gravel and fine sand mixed with small quantities of vegetation debris. The soil when wetted contained minimal quantities of fines and displayed a lite color (Munsel 5Y3/2) with no hydric soil indicators present. No obligate wetland plants are present on the site. The Haole koa abundant on the site is considered to be an upland plant. The two facultative wetland plants present, Guinea grass and Lovegrass (aka Bunchgrass) are common throughout the islands in both dry and wet habitats. Neither the plants nor soils at this site are consistent with the presence of a wetland.

East Branch

The east branch of the concrete culvert is about 140 feet long, but about half of the channel is filled with sediment covered with tall grass and miscellaneous succulents. Similar to the upper portion of the west branch, the OHWM flow in the unobstructed channel appears to only be about 3-inches deep, extending up either wall about 6-inches. However, this flow widens to encompass the entire width of the sediment deposits within the channel. The edge of the sediment deposit in the channel follows the line as demarcated in the existing site plan Sheet C-1 as surveyed and reaches to within about 3-inches (vertically) from the top of the channel sidewalls. Above the end of the concrete channel the swale is quickly covered with relatively mature Haole koa trees (Figure 10). Although a rill is occasionally apparent at the bottom of the swale, its size, discontinuous nature, and loose gravel consistency does not constitute the bed or bank of a permanent stream. Therefore the OHWM must end at the top of the concrete channel.

A wetland determination was conducted by observing the plants and soils present on the site. Approximately 30 feet above the end of the concrete channel, a shallow pit (12-inches) was dug to gauge the condition of the soils. Soil was dry, powdery down to the bottom of the pit and consisted of sandy loam mixed with angular gravel. The strata was uniform, generally loose (non-compact) and of lite color (Munsell 5Y 3/2) similar to the soil at the end of the west branch. The soil appears to have been recently eroded from the surrounding steep hillsides and was mixed with organic matter from the surrounding landscape. No signs of hydric soils were present. The Haole koa abundant on the site is considered to be an upland plant. The two facultative wetland plants present, Guinea grass and Lovegrass (aka Bunchgrass) are common throughout the islands in both dry and wet habitats. The plants and soils on the site are not consistent with the presence of a wetland at this site.

Respectfully Submitted.

Robert E. Bourke
Environmental Scientist
Oceanit

December 3, 2015

Figure 1. West Branch channel upper segment.

Figure 2. West Branch channel OHWM stains indicate flow width of 36” and depth of 3”.

Figure 3. Top of West Branch channel has three 4-inch metal posts that inhibit the flow of debris into the concrete channel.

Figure 4. Swale immediately above top of West Branch concrete channel contains a small discontinuous rill with loose gravel and leaves in the bottom.

Figure 5. West Branch channel at junction with 54-inch drain pipe.

Figure 6. West Branch channel below junction with drain pipe. OHWM is in line with tape measure.

Figure 7. Outfall of East Branch channel to main channel. Tip of sediment buildup visible in photo.

Figure 8. OHWM reaches depth of 3-inches about 6-inches up either side of East Branch channel to the toe of soil plug within the channel where the OHWM diverge to incorporate the soil plug in the channel.

Figure 9. The OHWM rises above the base of the East Branch concrete channel to encompass the sediment load within the channel up stream to the terminus of the channel.

Figure 10. Above the end of the East Branch concrete channel the natural swale is covered with grasses and Haole koa trees with no discernable stream bed or banks.

WETLAND DETERMINATION DATA FORM – Hawai'i and Pacific Islands Region

Project/Site: Salt Lake Debris Basin W-Branch City: Honolulu Sampling Date: 11-6-15 Time: 0800

Applicant/Owner: Honolulu C&C State/Terr/Comlth.: Hi Island: Oahu Sampling Point: W1

Investigator(s): Robert Bourke TMK/Parcel: 1-1-063:018

Landform (hillslope, coastal plain, etc.): Hill Slope Terminus of Local relief (concave, convex, none): concave

Lat: N21°21'22.33" Long: W157°55'07.84 Datum: HI St Plane NAD 27 Slope (%): 5%

Soil Map Unit Name: Makalapa Clay and Rockland (Fig B2 Hydrol Rpt) NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation NO, Soil NO, or Hydrology NO significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation NO, Soil NO, or Hydrology NO naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____		**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present? Yes ____ No X		
Wetland Hydrology Present? Yes ____ No X		

Remarks:

VEGETATION – Use scientific names of plants. - Site is ~30 ft beyond end of concrete drain channel

Tree Stratum (Plot size: 5m x 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. NONE			
2.			
3.			
4.			
5.			
= Total Cover	0		
Sapling/Shrub Stratum (Plot size: 5m x 10m)			
1. Leucaena leucocephala	100	✓	UPL
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5m x 10m)			
1. Megathyrsus maximus	35	✓	FAC
2. Eragrostis tenella	20		FAC
3. Asystasia gangetica	5		FACU
4.			
5.			
6.			
7.			
8.			
= Total Cover			
Woody Vine Stratum (Plot size: 5m x 10m)			
1. Amaranthus gangetica	25 ✓		FACU
2.			
= Total Cover			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	0	x 2 =
FAC species	55	x 3 = 165
FACU species	30	x 4 = 120
UPL species	100	x 5 = 500
Column Totals:	185 (A)	785 (B)

Prevalence Index = B/A = 4.24

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50% NO
- ✓ 3 - Prevalence Index is ≤3.0[1] NO
- ___ Problematic Hydrophytic Vegetation[1] (Explain in Remarks or in the delineation report)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Not prevalent Yes ✓ No ____

Remarks: Site completely covered w/ Haole koa

by: R.E. Bourke [signature]

SOIL

Sampling Point: ____________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
12	5Y 3/2		NONE				Sandy loam	Dry uniform strata

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Sandy Mucky Mineral (S1)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: NONE
Depth (inches): ____________

Hydric Soil Present? Yes ______ No ✓

Remarks: Soil is erosive sand & gravel from surrounding volcanic tuff rock, mixed with organic material from overlaying haole koa & grasses.

HYDROLOGY

Wetland Hydrology Indicators: (Explain observations in Remarks, if needed.)

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ✓ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) (Guam, CNMI, and American Samoa)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches):
Water Table Present? Yes ____ No ✓ Depth (inches):
Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches):

Wetland Hydrology Present? Yes ______ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil dry, powdery down to at least 12-inches
Some open gravel (in narrow (12x18") "bed", likely from recent erosion, but no readily definable bed or bank
Haole koa & Grass growing across "bed" of swale

WETLAND DETERMINATION DATA FORM – Hawai'i and Pacific Islands Region

Project/Site: Saltlake Debris Basin E-Branch City: Honolulu Sampling Date: 11-6-15 Time: 0845

Applicant/Owner: Honolulu C&C State/Terr/Comlth.: HI Island: Oahu Sampling Point: E1

Investigator(s): Robert Bourke TMK/Parcel: 1-1-063:018

Landform (hillslope, coastal plain, etc.): Hillslope terminus of storm channel Local relief (concave, convex, none): concave

Lat: N21°21'21.04" Long: W157°55'4.98" Datum: NAD27 HI State Plane Slope (%): 5%

Soil Map Unit Name: Rockland (Fig B2, Hydrology Rept) NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____
Hydric Soil Present?	Yes ____	No ✓
Wetland Hydrology Present?	Yes ____	No ✓
Is the Sampled Area within a Wetland?	Yes ____	No ✓

Remarks:

VEGETATION – Use scientific names of plants. – Site is ~ 30 ft beyond top end of concrete chnl

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 5m x 10m)			
1. None			
2.			
3.			
4.			
5.			
= Total Cover	0		
Sapling/Shrub Stratum (Plot size: 5m x 10m)			
1. Leucaena leucocephala	100	✓	upl
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 5m x 10m)			
1. Megathyrsus maximus	35	✓	FAC
2. Eragrostis tenella	20		FAC
3. Asystasia gangetica	5		FACU
4.			
5.			
6.			
7.			
8.			
= Total Cover			
Woody Vine Stratum (Plot size: 5m x 10m)			
1. Amaranthus gangetica	25		FACU
2.			
= Total Cover			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	0	x 2 =
FAC species	55	x 3 = 165
FACU species	30	x 4 = 120
UPL species	100	x 5 = 500
Column Totals:	185 (A)	785 (B)

Prevalence Index = B/A = 4.24

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50% No

___ 3 - Prevalence Index is ≤3.0[1] No

___ Problematic Hydrophytic Vegetation[1] (Explain in Remarks or in the delineation report)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? not prevalent Yes ✓ No ____

Remarks: Site completely covered w/ Haole koa all across width of swale

By: R.E. Bourke [signature]

SOIL

Sampling Point: ______________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
14	5Y 3/2		NONE					Dry sandy loam mixed w/ gravel

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Muck Presence (A8)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Dark Surface (S7)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Stratified Layers (A5)
- ___ Sandy Mucky Mineral (S1)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________

Depth (inches): ______________

Hydric Soil Present? **Yes** ______ **No** ______

Remarks: Soil is sandy loam with plentiful angular gravel. Twigs & leaves of haole koa were found to the depth of the pit indicating typically dry conditions and recent mass erosion.

HYDROLOGY

Wetland Hydrology Indicators: (Explain observations in Remarks, if needed.)

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- X Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Tilapia Nests (B17)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Fiddler Crab Burrows (C10) (Guam, CNMI, and American Samoa)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Salt Deposits (C5)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (inches):

Water Table Present? Yes ______ No X Depth (inches):

Saturation Present? (includes capillary fringe) Yes ______ No X Depth (inches):

Wetland Hydrology Present? **Yes** ______ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil dry, powdery down to 12-inch depth. Appears to be freshly eroded &/deposited.

Appendix G. Exemption Declaration – Salt Lake Debris Basins Additive Items

DEPARTMENT OF FACILITY MAINTENANCE

CITY AND COUNTY OF HONOLULU

1000 Ulu`ohia Street, Suite 215, Kapolei, Hawaii 96707
Phone: (808) 768-3343 • Fax: (808) 768-3381
Website: www.honolulu.gov

KIRK CALDWELL
MAYOR

ROSS S. SASAMURA, P.E.
DIRECTOR AND CHIEF ENGINEER

EDUARDO P. MANGLALLAN
DEPUTY DIRECTOR

IN REPLY REFER TO:
16-298 (D)

November 23, 2016

MEMORANDUM

TO: Mr. Scott Glenn, Director
State of Hawaii, Department of Health
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

FROM: Ross S. Sasamura, P.E.
Director and Chief Engineer
Department of Facility Maintenance

SUBJECT: Exemption Declaration – Salt Lake Debris Basins Additive Items

AGENCY OR APPLICANT ACTION

Check applicable box

☒ This exempted action is an agency action as defined by Section 343-5(b), HRS, and Section 11-200-5, HAR

☐ This exempted action is an applicant action as defined by Section 343-5(c), HRS, and Section 11-200-6, HAR

SPECIFY EXEMPTION CLASS:

Check applicable box

☒ The Exemption Declaration for the action described below is based on the Exemption List for the City and County of Honolulu (City), Department of Environmental Services (ENV), reviewed and concurred to by the Environmental

Council on May 17, 2012. The City's Department of Facility Maintenance, Storm Water Quality Branch was recently an entity of ENV and does not yet have its own Exemption List.

- Exemption List Class #2: Replacement or reconstruction of existing structure and facilities where the new structure will be located generally on the same site and will have substantially the same purpose, capacity, density, height, and dimensions as the structure replaced.
    - Item Number #13: Fencing, curbing, walls and gates
    - Item Number #21: Landscaping

☐ The Exemption Declaration for the action described below is based on the consultation process prescribed by Section 11-200-8(a), Hawai'i Administrative Rules (HAR), Exemption Class ____.

DESCRIPTION OF ACTION

Proposing Agency or Applicant: The City and County of Honolulu, Department of Facility Maintenance

Project Name & Address/Location: Salt Lake Debris Basins – Fencing & Landscaping Additive Items / Fencing & Landscaping Additive Items are located adjacent to Salt Lake Elementary School along Ala Lilikoi Street

Anticipated Start Date: 5/1/2018

Anticipated End Date: 1/31/2019

Island and District: O`ahu and Honolulu

Tax Map Key(s) and Latitude/Longitude Coordinates: (1) 1-1-068:013 & 018 and 21.3542 North, -157.9148 West

All Necessary Permits and Approvals: NPDES Permit, Grading Permit, CZM Permit, and HRS, Chapter 343 Environmental Assessment

NARRATIVE
Describe the action and why it qualifies for the exemption:

Description of the Action:

The fencing and landscaping actions are additive items to the Salt Lake Debris Basins project. The fencing and landscaping have independent utility of the proposed debris basins. They will only be constructed if there are sufficient construction monies available, dependent upon Contractor base bid prices for the debris basins. The construction site for the fencing and landscaping is at a location approximately 800 feet away from the debris basins construction site.

1) The fencing additive item involves replacing an old, rusted 4' high chain link fence with a new 6' high chain link fence. The new fence will be located at the exact same location as the old fence. The length of fence to be replaced is 1708'. The fence is located on both sides of a concrete drainage channel which runs in front of the Salt Lake Elementary School. The work will include demolishing and removing the old chain link fencing, and installing the new chain link fencing and two locked chain link personnel gates. It is intended to use the existing fence post holes for the new fence. Concrete footings will be used in the existing post holes to anchor the fence posts. See attached sheet C-1 from the 90% plans for the location of the proposed fencing.

2) The landscaping additive item involves planting a low-maintenance, drought tolerant native vegetation groundcover in place of the existing grass groundcover that is growing in the strip between the chain link fence and the concrete drainage channel fronting Salt Lake Elementary School. The new groundcover would be planted at the same location of the previous groundcover. The area of groundcover to be planted is approximately 0.3 acres. The work will include applying an herbicide to the grass groundcover and weeds to eradicate the existing vegetation, installing jute mesh matting, planting the new groundcover, and installing a fiber roll between the groundcover and the drainage channel to be used as a sediment control BMP. A temporary drip irrigation system will be used until the new vegetation is established. See attached sheet C-1 from the 90% plans for the location of the proposed landscaping.

Qualification for Exemption:

The subject additive items of the Salt Lake Debris Basins project will be constructed with City funds and will involve work within the City-owned Salt Lake Regional Park and within an easement in favor of the City.

A review of HAR, Chapter 11-200-8A, Exempt Classes of Action, indicates the following exemptions that are applicable to the additive items of the subject project:

(2) Replacement or reconstruction of existing structures and facilities where the new structure will be located generally on the same site and will have substantially the same purpose, capacity, density, height, and dimensions as the structure replaced;

The two additive items are included within the *Comprehensive Exemption List* published by ENV (May 17, 2012) as indicated in the above section "SPECIFY EXEMPTION CLASS" on pages 1 and 2 of this document. The proposed chain link fencing will replace existing chain link fencing and will be located at the same site and will have substantially the same purpose and dimensions. The only difference between the existing and proposed fence being that the proposed fence would be 2' higher. The proposed chain link fencing would fall under *Exemption Class #2, Item Number #13: Fencing, curbing, walls and gates.*

The proposed landscaping work is comprised of replacing an existing invasive groundcover with a proposed native groundcover on the same footprint. The proposed groundcover will have the same purpose and areal dimensions as the existing groundcover, but will likely be more low-lying to the ground. The purpose of the groundcover is to provide erosion control next to a concrete drainage channel and to provide an aesthetic enhancement. The proposed groundcover landscaping would fall under *Exemption Class #2, Items #21: Landscaping.*

RECEIVING ENVIRONMENT
Describe the site, including any impacts on the receiving environment:

The additive items are located within the City-owned Salt Lake Regional Park and within an easement in favor of the City which fronts Salt Lake Elementary School. The areas of the additive items have been grassed in a previous City project and they are currently maintained several times per year by the City Department of Facility Maintenance. The area of the additive item work ranges in elevation from 13-feet to 35-feet above mean sea level (MSL). The additive item project area drains to the trapezoidal concrete drainage channel which fronts Salt Lake Elementary School. The trapezoidal drainage channel is 4-feet wide on the bottom, ranges from 16-feet to 24-feet wide at the top and has a depth between 4-feet and 7-feet deep. The concrete drainage channel discharges stormwater to the canals that surround the Honolulu Country Club, which drain to Moanalua Stream and eventually discharge to the Ocean.

The proposed groundcover should decrease the amount of sediment and other pollutants which flow into the drainage channel from the project area, compared to existing conditions, due to the sparse grass groundcover in some areas. During construction erosion will need to be mitigated in the groundcover establishment area. There are no known historic properties within the project boundaries. The project area has been subjected to extensive prior ground disturbance. Due to this prior extensive ground disturbance and the minimal ground disturbance associated with the construction of the proposed additive items, it is unlikely that historic properties would be encountered.

There are no known rare, threatened, or endangered flora or fauna species located in the project site of the proposed additive items based on the prior development and urbanized nature of the surroundings.

The project site is close to Salt Lake Elementary School. Construction would likely be required to take place during daytime hours due to the nearby residential housing and nighttime noise restrictions. Noise emissions are not expected to cause significant impacts to the students and teachers in the classrooms because it is not anticipated that the construction work will require the use of heavy equipment.

Health and safety impacts to students, teachers, school employees and other passers-by will be required to be addressed by the contractor before the work is initiated.

ENVIRONMENTAL ANALYSIS

I have considered the potential effects of the proposed project and all related activities against the criteria checked below:

Applicable		Not Applicable
☒	Land Use and Zoning Conformance	☐
☒	Traffic (Vehicles, Bicycles, Pedestrian)	☐
☐	Infrastructure (Roads, Buildings, Utilities)	☒
☒	Air Quality Pollutant Emissions	☐
☒	Noise Emissions	☐
☒	Solid, Hazardous, and Liquid Waste Management	☐
☒	Social	☐
☐	Economic	☒
☒	Health and Safety	☐
☐	Recreation	☒
☐	Public Beach Access	☒
☐	Cultural Resources and Practices	☒
☒	Visual/Aesthetic	☐

☐ Environmental Justice	☒
☒ Rare, Threatened, and/or Endangered Species	☐
☒ Surface and Ground Water Resources	☐
☒ Wetlands	☐
☒ Floodplains	☐
☐ Riparian/Coastal Resources	☒
☐ Other	☐

MITIGATION
Describe all mitigation measures and best management practices planned to address impacts during the project activities and after project completion:

Sediment and erosion control best management practices (BMPs) will be used during the construction of the fencing and groundcover establishment. Proposed BMPs to be used are jute mesh in the planting area and a fiber roll between the planting area and the drainage channel. These measures will likely remain in place permanently. See attached sheet C-1 of the 90% plans.

To prevent noise impacts to the school and residences during construction, heavy equipment will not be used at the site to keep construction noise below permissible levels.

To protect against students and passers-by from climbing or falling into the concrete drainage channel during the replacement of the chain-link fencing, temporary barriers and signage will be used by the contractor.

CONSULTATION
The following parties have been consulted about this declaration exemption (Name, affiliation, consultation date):

Mr. Les Segundo
State of Hawaii, Department of Health
Office of Environmental Quality Control
August 1, 2016

Mr. Jack Pobuk, P.E.
City and County of Honolulu
Department of Environmental Services
November 16, 2016

EXEMPT DECLARATION
The direct, cumulative, and potential impacts of the action described above have been considered pursuant to Chapter 343, Hawai'i Revised Statutes and Chapter 11-200, Hawai'i Administrative Rules. I declare that the action described above will have minimal or no significant impact on the environment and is therefore exempt from the preparation of an environmental assessment.

Ross S. Sasamura, P.E. Date

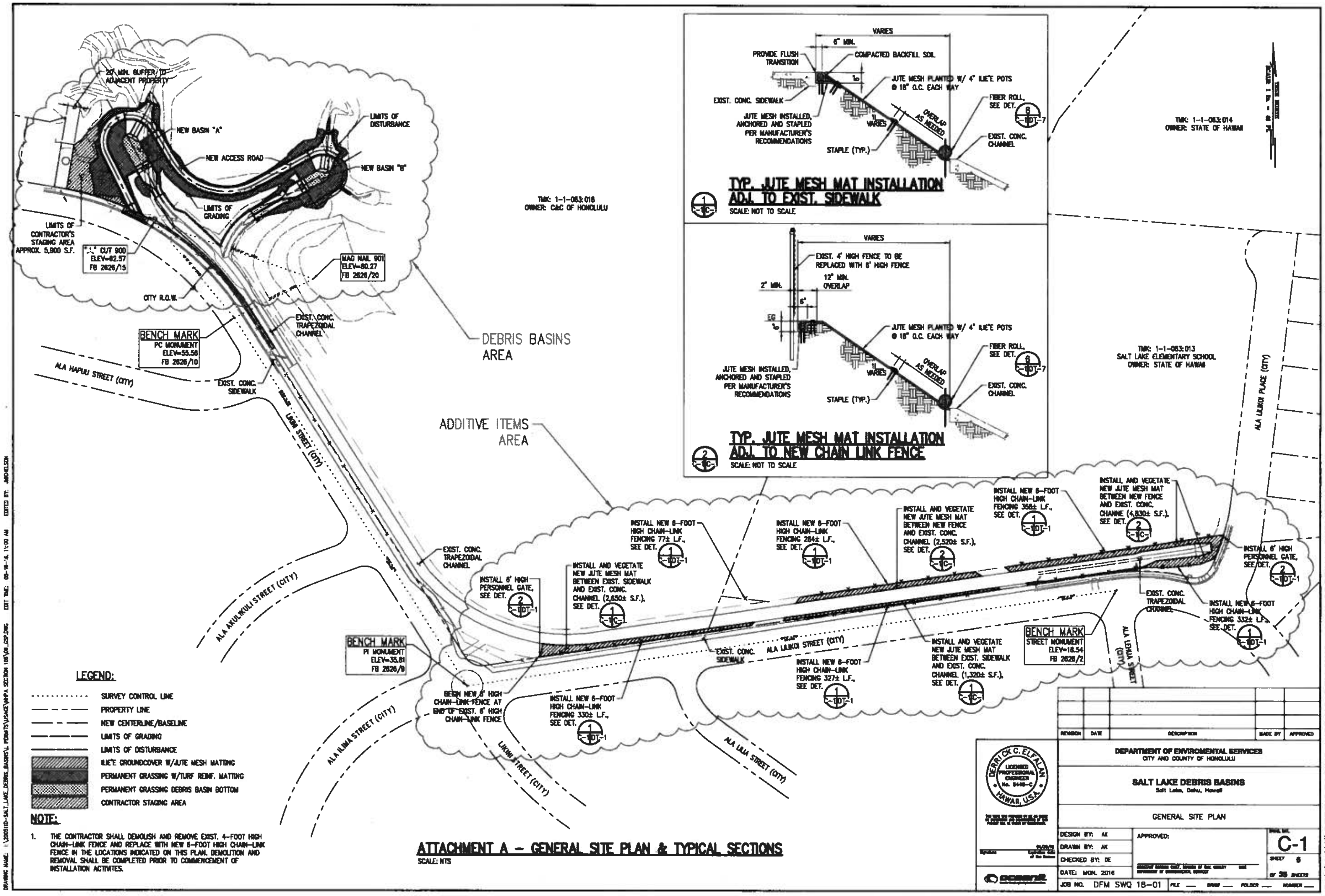
23 Nov 2016

Director and Chief Engineer

☒ This document is on file in our office and is available for public review.

☐ This document has been submitted to the Office of Environmental Quality Control for publication in The Environmental Notice.

Attachments: **Figure 1 – Vicinity Map**
Figure 2 – Location Map
Attachment A – Site Plan & Typical Sections
(Sht. C-1 of 90% Plans)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OWNER: C&C OF HONOLULU
TMK: 1-1-063:014
OWNER: STATE OF HAWAII
TMK: 1-1-063:013
SALT LAKE ELEMENTARY SCHOOL
OWNER: STATE OF HAWAII
20' MIN. BUFFER TO ADJACENT PROPERTY
NEW BASIN "A"
NEW ACCESS ROAD
NEW BASIN "B"
LIMITS OF DISTURBANCE
LIMITS OF GRADING
LIMITS OF CONTRACTOR'S STAGING AREA APPROX. 5,900 S.F.
CUT 900 ELEV=62.57 FB 2626/15
MAG NAIL 901 ELEV=80.27 FB 2626/20
CITY R.O.W.
BENCH MARK PC MONUMENT ELEV=55.56 FB 2626/10
EXIST. CONC. TRAPEZOIDAL CHANNEL
EXIST. CONC. SIDEWALK
DEBRIS BASINS AREA
ADDITIVE ITEMS AREA
ALA HAPUU STREET (CITY)
LIKINI STREET (CITY)
ALA AKULIKULI STREET (CITY)
ALA ILIMA STREET (CITY)
ALA LILIA STREET (CITY)
ALA LILIKOI STREET (CITY)
ALA LEHUA STREET (CITY)
ALA LILIKOI PLACE (CITY)
BENCH MARK PI MONUMENT ELEV=35.81 FB 2626/8
BENCH MARK STREET MONUMENT ELEV=18.54 FB 2626/2
BEGIN NEW 6' HIGH CHAIN-LINK FENCE AT END OF EXIST. 6' HIGH CHAIN-LINK FENCE
INSTALL 6' HIGH PERSONNEL GATE, SEE DET. 2 C-1DT-1
INSTALL NEW 6-FOOT HIGH CHAIN-LINK FENCING 330± L.F., SEE DET. 1 C-1DT-1
INSTALL NEW 6-FOOT HIGH CHAIN-LINK FENCING 77± L.F., SEE DET. 1 C-1DT-1
INSTALL AND VEGETATE NEW JUTE MESH MAT BETWEEN EXIST. SIDEWALK AND EXIST. CONC. CHANNEL (2,650± S.F.), SEE DET. 1 C-1C-1
INSTALL NEW 6-FOOT HIGH CHAIN-LINK FENCING 284± L.F., SEE DET. 1 C-1DT-1
INSTALL NEW 6-FOOT HIGH CHAIN-LINK FENCING 327± L.F., SEE DET. 1 C-1DT-1
INSTALL AND VEGETATE NEW JUTE MESH MAT BETWEEN NEW FENCE AND EXIST. CONC. CHANNEL (2,520± S.F.), SEE DET. 2 C-1C-1
INSTALL AND VEGETATE NEW JUTE MESH MAT BETWEEN EXIST. SIDEWALK AND EXIST. CONC. CHANNEL (1,320± S.F.), SEE DET. 1 C-1C-1
INSTALL NEW 6-FOOT HIGH CHAIN-LINK FENCING 356± L.F., SEE DET. 1 C-1DT-1
INSTALL AND VEGETATE NEW JUTE MESH MAT BETWEEN NEW FENCE AND EXIST. CONC. CHANNE (4,830± S.F.), SEE DET. 2 C-1C-1
INSTALL 6' HIGH PERSONNEL GATE, SEE DET. 2 C-1DT-1
INSTALL NEW 6-FOOT HIGH CHAIN-LINK FENCING 332± L.F., SEE DET. 1 C-1DT-1
VARIES
6" MIN.
PROVIDE FLUSH TRANSITION
COMPACTED BACKFILL SOIL
EXIST. CONC. SIDEWALK
JUTE MESH PLANTED W/ 4" ILIE'E POTS @ 18" O.C. EACH WAY
JUTE MESH INSTALLED, ANCHORED AND STAPLED PER MANUFACTURER'S RECOMMENDATIONS
OVERLAP AS NEEDED
FIBER ROLL, SEE DET. 6 C-1DT-7
EXIST. CONC. CHANNEL
STAPLE (TYP.)
TYP. JUTE MESH MAT INSTALLATION ADJ. TO EXIST. SIDEWALK
SCALE: NOT TO SCALE
EXIST. 4' HIGH FENCE TO BE REPLACED WITH 6' HIGH FENCE
12" MIN. OVERLAP
2" MIN.
TYP. JUTE MESH MAT INSTALLATION ADJ. TO NEW CHAIN LINK FENCE
SCALE: NOT TO SCALE
LEGEND:
SURVEY CONTROL LINE
PROPERTY LINE
NEW CENTERLINE/BASELINE
LIMITS OF GRADING
LIMITS OF DISTURBANCE
ILIE'E GROUNDCOVER W/JUTE MESH MATTING
PERMANENT GRASSING W/TURF REINF. MATTING
PERMANENT GRASSING DEBRIS BASIN BOTTOM
CONTRACTOR STAGING AREA
NOTE:
1. THE CONTRACTOR SHALL DEMOLISH AND REMOVE EXIST. 4-FOOT HIGH CHAIN-LINK FENCE AND REPLACE WITH NEW 6-FOOT HIGH CHAIN-LINK FENCE IN THE LOCATIONS INDICATED ON THIS PLAN. DEMOLITION AND REMOVAL SHALL BE COMPLETED PRIOR TO COMMENCEMENT OF INSTALLATION ACTIVITIES.
ATTACHMENT A - GENERAL SITE PLAN & TYPICAL SECTIONS
SCALE: NTS
DERRICK C. ELFALAN LICENSED PROFESSIONAL ENGINEER No. 5448-C HAWAII, U.S.A.
REVISION DATE DESCRIPTION MADE BY APPROVED
DEPARTMENT OF ENVIRONMENTAL SERVICES
CITY AND COUNTY OF HONOLULU
SALT LAKE DEBRIS BASINS
Salt Lake, Oahu, Hawaii
GENERAL SITE PLAN
DESIGN BY: AK
DRAWN BY: AK
CHECKED BY: DE
DATE: MON. 2016
JOB NO. DFM SWQ 18-01
APPROVED:
C-1
SHEET 6 OF 35 SHEETS

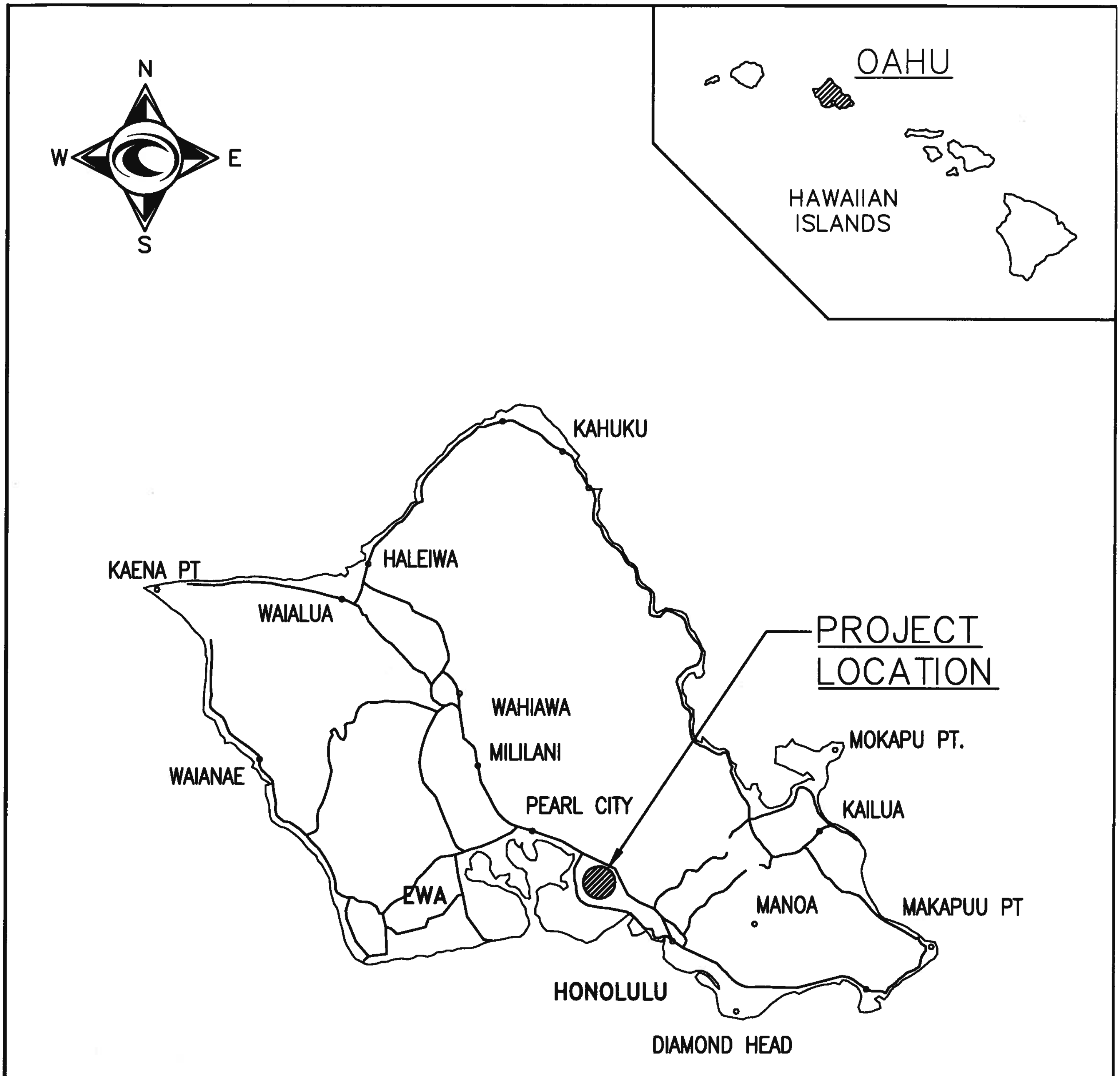

FIGURE 1 – VICINITY MAP
NOT TO SCALE

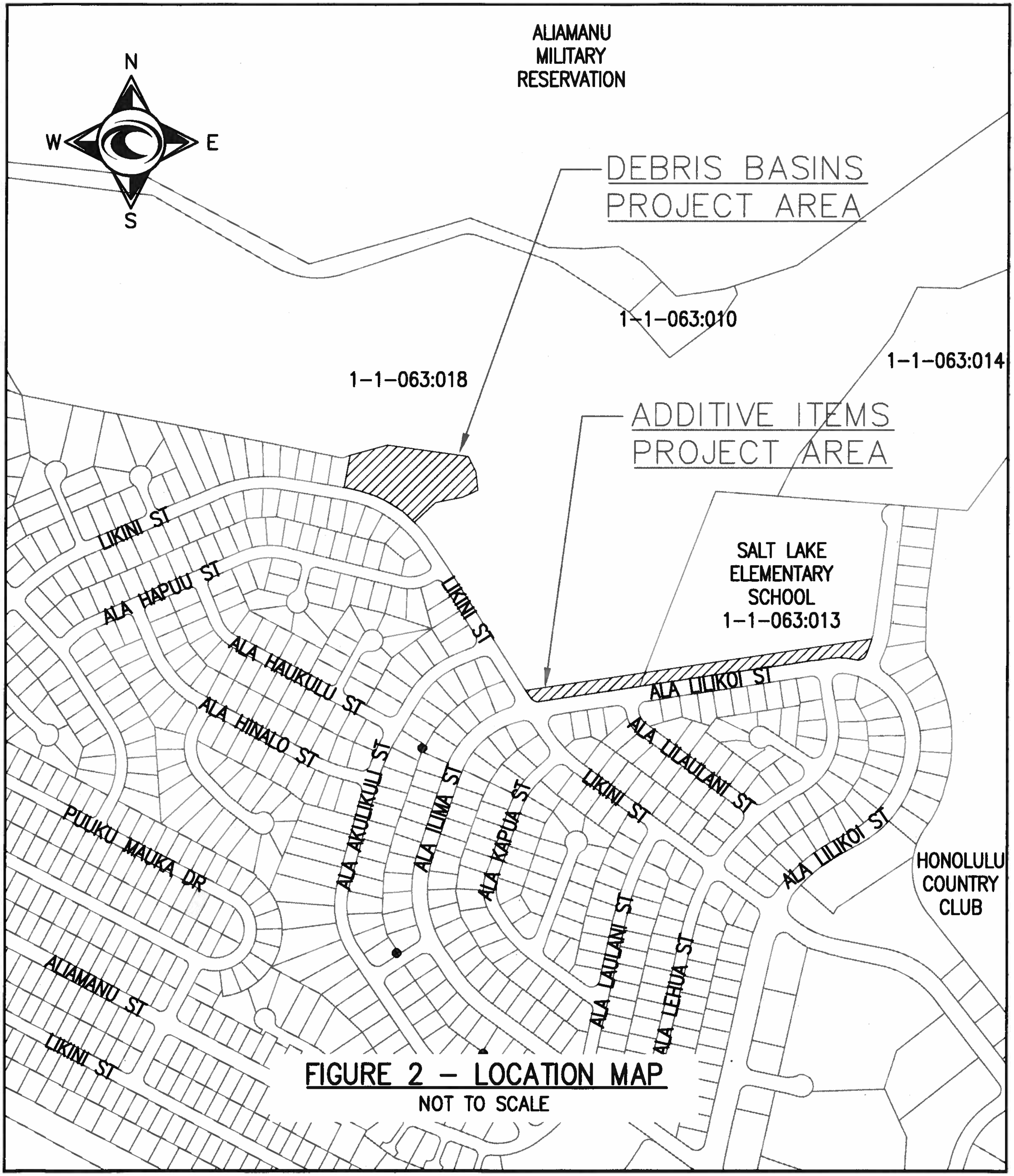

FIGURE 2 – LOCATION MAP

NOT TO SCALE