Attachment A
Permanent BMP Design Report

PERMANENT BMP DESIGN REPORT

Interstate Route H-1, Kapolei Interchange Complex, Phase 2

Addition and Modification of Freeway Access

Federal-Aid Project No. IM-H1-1(261)

Kapolei, Island of Oahu, Hawaii

Prepared For

State of Hawaii Department of Transportation

Highways Division

October 2012

WILSON OKAMOTO CORPORATION

CIVIL ENGINEERS STRUCTURAL ENGINEERS TRAFFIC ENGINEERS PLANNERS

PERMANENT BMP DESIGN REPORT

FOR

INTERSTATE ROUTE H-1 KAPOLEI INTERCHANGE COMPLEX, PHASE 2 ADDITION AND MODIFICATION OF FREEWAY ACCESS

KAPOLEI, OAHU, HAWAII

Expiration Date: April 2014

Prepared for:

State of Hawaii
Department of Transportation
Highways Division

Prepared by:

Wilson Okamoto Corporation

October 2012

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I. INTRODUCTION

A. Purpose

This engineering report is conducted to:

1. Address potential pollution linked to storm water runoff collected within the project site. See "Permanent BMP Checklist and Project Records" in Appendix A.

2. Select site specific permanent Best Management Practices (BMPs) to control the water quality of stormwater runoff by capturing or trapping pollution on-site. This effort would reduce the potential for pollutants originating from State highways to adversely contribute to water quality decline and degradation of State Waters.

B. Proposed Project Location and Description

The project site is located on the Island of Oahu, in the vicinity of Kapolei, between Makakilo Drive and Kalaeloa Boulevard. The site is bounded by the Hawaiian Waters Adventure Park and Farrington Highway to the west and the H-1 freeway to east and south. (See Figure 1)

Proposed improvements of the project includes: the construction of Ramp KA (2-lane roadway) and KA-2 (4-lane roadway) which connects Interstate Route H-1 to Wakea Street, the construction of Ramp KA-1 (2- lane roadway) which connects Ramp KA-2 to Farrington Highway, and an access road which connects Ramp KA-2 to a future proposed road.

C. Existing Topography

The project site generally decreases in elevation from north to south and east to west. Existing elevations range from approximately 176 feet above mean sea level (MSL) at the northern boundary of the project to 72 feet at the intersection of Kamokila Boulevard and Wakea Street.

D. Soils

Soil series and mapping units are found in The U. S. Department of Agriculture Soil Conservation Service's "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii", August 1972. The soil within the project limits consists of:

Ewa silty clay loam, 3 to 6 percent slopes (EaB), and Ewa stony silty clay, 0 to 2 percent slopes (EwA). The Ewa series consists of well-drained soils in basins and on alluvial fans, developed in alluvium derived from basic igneous rock. The EaB soil type occurs on alluvial fans and terraces, with a surface layer of dark reddish-brown silty clay loam (about 18 inches thick) and dark reddish-brown and dark red silty clay loam subangular blocky structure subsoil (about 42 inches thick). Permeability is moderate, runoff is slow and the erosion hazard is slight. The EwA soil type has a similar profile, except that the depth to coral limestone is 20 to 50 inches. Runoff is very slow and the erosion hazard is very slight.

Honouliuli clay, 0 to 2 percent slopes (HxA). The Honouliuli series consists of well-drained soil in coastal plains, developed in alluvium derived from the basic igneous material. The HxA soil type occurs in the lowlands along coastal plains. The Soil Survey described a representative profile of HxA as dark reddish-brown, very sticky and very plastic clay throughout. Permeability is moderately slow, runoff is slow, and the erosion hazard is no more than slight.

Kawaihapai clay loam, 0 to 2 percent slopes (KIA). The Kawaihapai series consists of well-drained soils in drainageways and on alluvial fans on coastal plains, formed in alluvium derived from igneous rock in humid uplands. The KIA soil type occupies smooth slopes. The surface layer is dark brown clay loam (about 22 inches thick) underlain with dark brown stratified sandy loam (32 inches thick). Permeability is moderate, runoff is slow, and the erosion hazard is no more than slight.

Mamala stony silty clay loam, 0 to 12 percent slopes (MnC). The Mamala series consists of shallow, well-drained soils along coastal plains formed in alluvium deposited over coral limestone and consolidated calcareous sand. The MnC soil type has a dark reddish-brown stony silty clay loam surface layer about 11 inches thick. Stones, mostly coral fragments, are common throughout the representative profile. Permeability is moderate, runoff is very slow to medium, and the erosion hazard is slight to moderate.

Molokai silty clay loam, 3 to 7 percent slopes (MuB), 7 to 15 percent slopes (MuC), and 15 to 25 slopes (MuD). The Molokai series consists of well-drained upland soils, developed in material weathered from basic igneous rock. Conditions may be nearly level to moderate steep, with elevations ranging from near sea level to 1,000 feet. Characteristics of the MuB soil type is slow to medium runoff potential and slight to moderate erosion hazard. The MuC soil type occurs on knolls and sharp slope breaks. Runoff is medium and the erosion hazard is moderate.

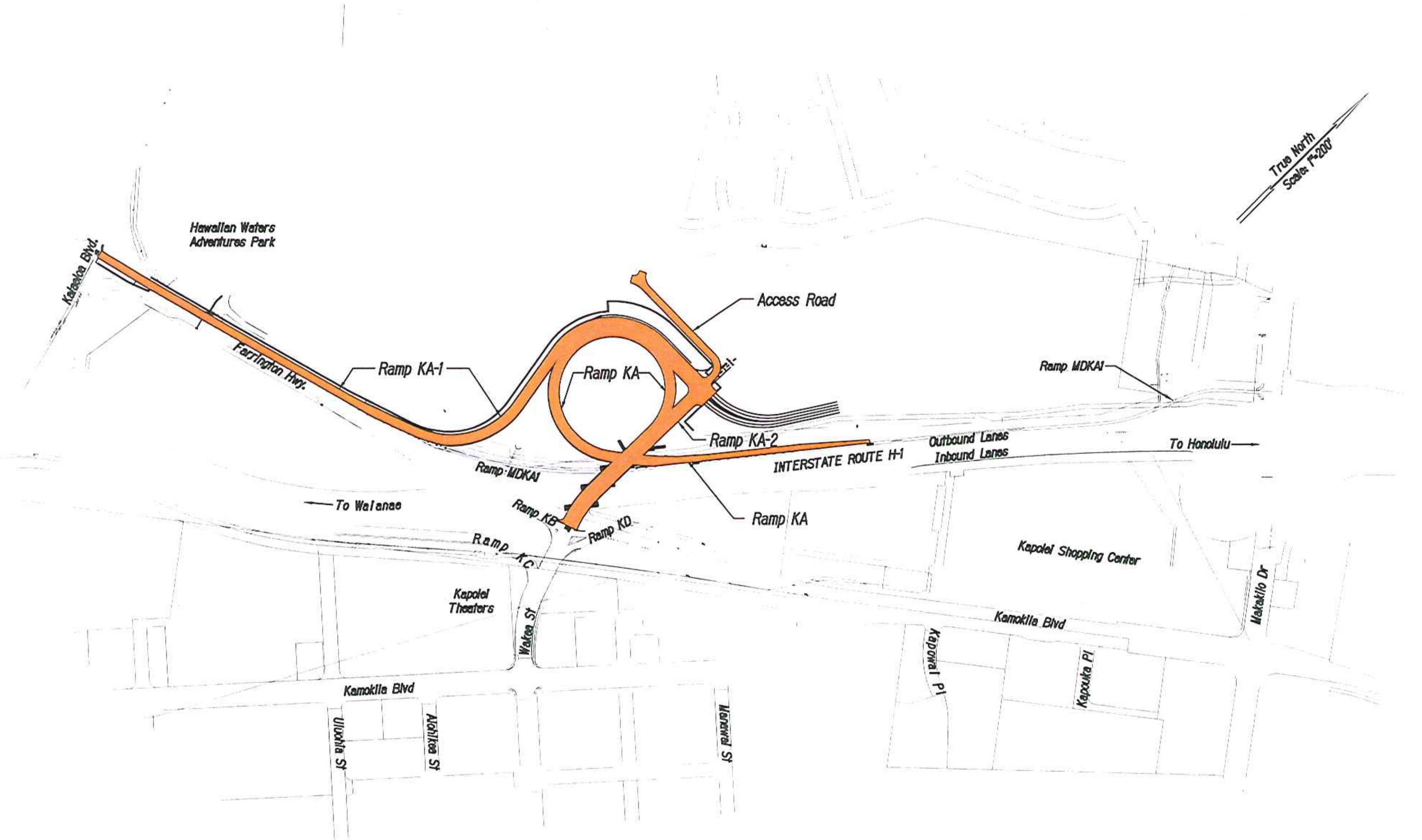
Waialua stony silty clay, 3 to 8 percent slopes (WIB). The Waialua series consists of moderately well-drained soils on alluvial fans, developed in alluvium weathered from basic igneous rock. For the WIB soil type, runoff is slow and the erosion hazard is slight.

E. Land Use

The existing land use of the project site includes undeveloped land covered in weeds, grass, and scattered shrubs and existing segments of the Interstate H-1 Freeway and Farrington Highway at connection points to the proposed interchange. In an agreement between the owners of the undeveloped land and DOT, an equal area land swap occurred which gave DOT a portion of the undeveloped land to be used as a DOT right-of-way for the proposed interchange and primary arterial roadway use. In exchange, the owners of the undeveloped land will receive a portion of the existing DOT right of way located west of the proposed project site.

II. ENVIRONMENTAL RESOURCES

Based on the Flood Insurance Rate Map (FIRM) prepared by the Federal Emergency Management Agency (FEMA), Community Panel 15003C0310G dated January 1, 2011, the proposed project site is determined to be within Zone D, areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted for this area. (See Figure 3)



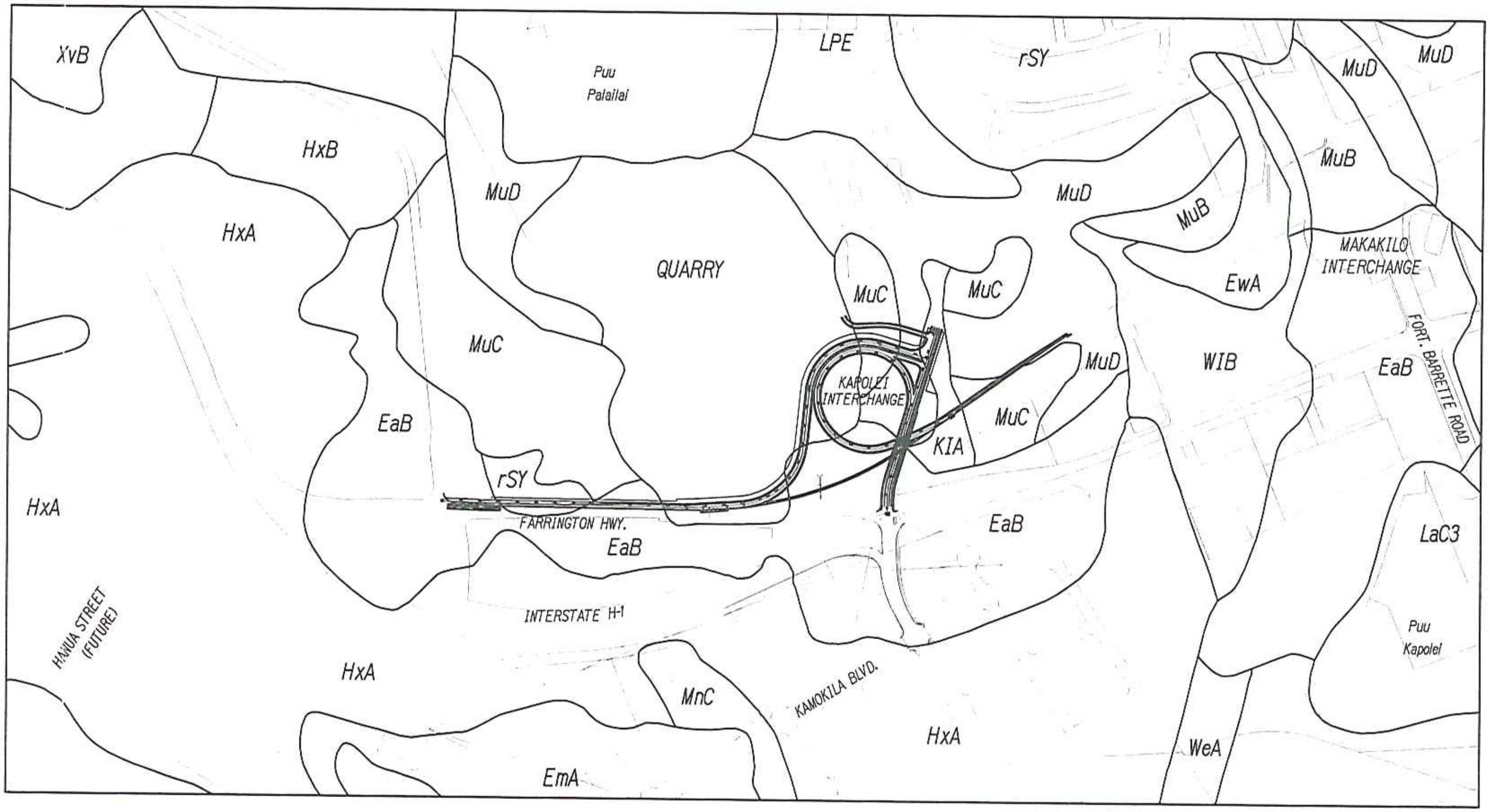
LEGEND:

PROPOSED IMPROVEMENTS

INTERSTATE ROUTE H-1, ADDITION AND MODIFICATION OF FREEWAY ACCESS
Palailai Interchange to Makakilo Interchange (Kapolei Interchange Complex)
Phase 2

PHASE 2 IMPROVEMENTS

FIGURE 1



HxA	HONOULIULI CLAY, 0-2% SLOPES
EaB	EWA SILTY CLAY LOAM, 3-6% SLOPES
MnC	MAMALA STONY SILTY CLAY LOAM, 0-12% SLOPES
MuD	MOLOKAI SILTY CLAY LOAM, 15-25%
KIA	KAWAIHAPAI CLAY LOAM, 0-2% SLOPES
MuC	MOLOKAI SILTY CLAY LOAM, 7-15%
WIB	WAIALUA STONY SILTY CLAY, 3-8% SLOPES
EwA	EWA STONY SILTY CLAY, 0-2% SLOPES
MuB	MOLOKAI SILTY CLAY LOAM, 3-7% SLOPES
rSY	STONY STEEP LAND

Reference: Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (http://www.ctahr.hawaii.edu/soilsurvey/5is/oahu.htm)

INTERSTATE ROUTE H-1, ADDITION AND MODIFICATION OF FREEWAY ACCESS
Palailai Interchange to Makakilo Interchange (Kapolei Interchange Complex)
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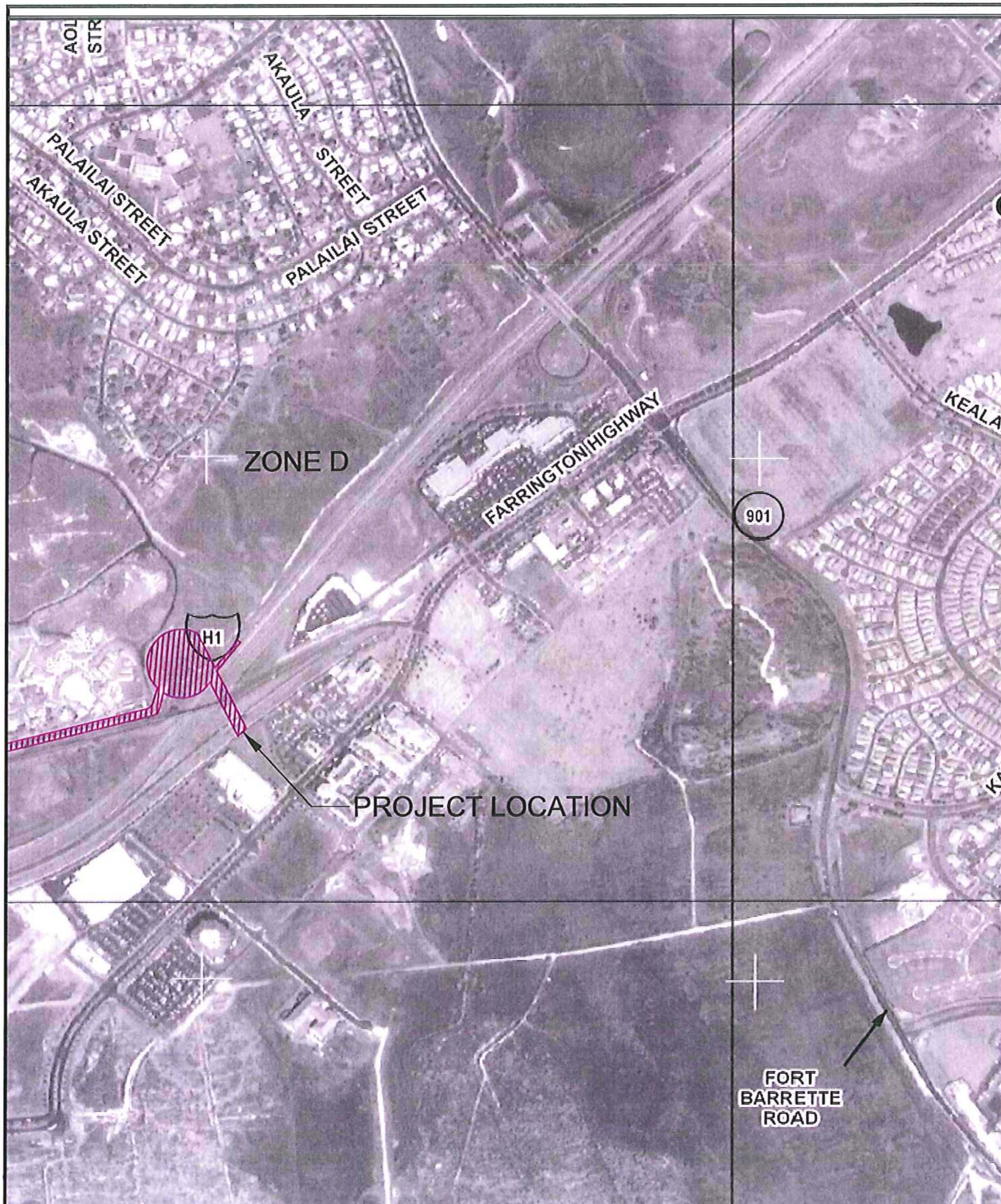
SOIL MAP

FIGURE 2



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PALAILAI INTERCHANGE TO MAKAKILO INTERCHANGE (KAPOLEI INTERCHANGE COMPLEX) PHASE 2

FLOOD INSURANCE RATE MAP

FIGURE 3

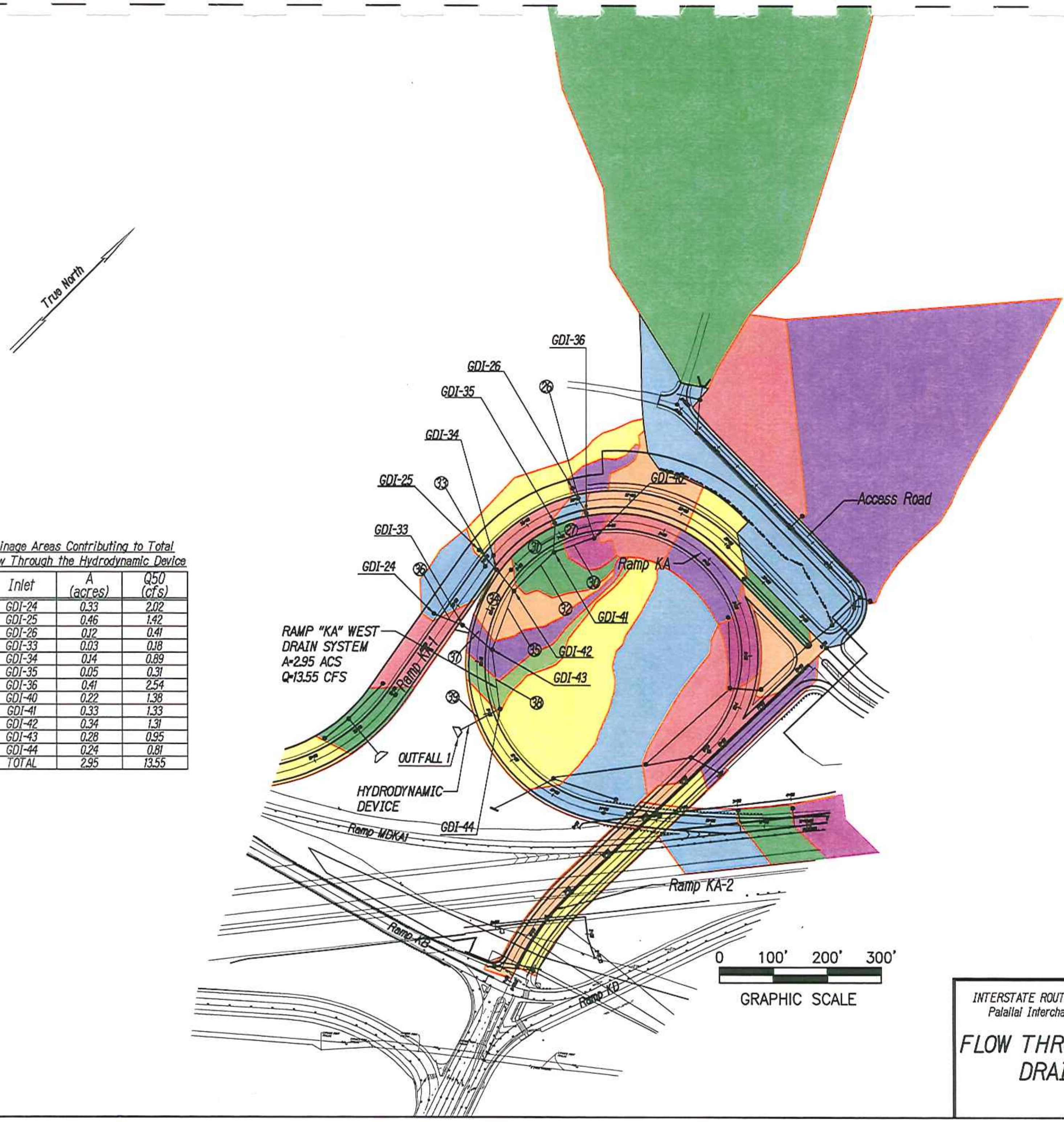
III. OUTFALL IDENTIFICATION

A. Existing Drainage Conditions

The existing drainage conditions of the project site can be divided into two major areas – storm water runoff from the undeveloped land and H-1 Freeway and surface runoff from the existing Farrington Highway. Storm water runoff from the undeveloped land and majority of the H-1 freeway collects at a low point immediately north of the freeway where it enters an existing underground 6' x 3' box culvert which conveys the runoff south across the freeway to a concrete channel that discharges into the Pacific Ocean. The surface runoff from the portions of Farrington Highway that are in the project area is collected in drain inlets located at low spots along highway shoulder and conveyed underground through pipes to the opposite side of the highway where it surface flows through undeveloped land to an earth ditch that connects to the concrete channel that discharges into the Pacific Ocean. (See Figure 5 – Existing Drainage Conditions Map)

B. Proposed Drainage Conditions

Proposed drainage improvements consist of swales, catch basins, drainage pipes, grated inlets, a hydrodynamic device and culverts. A majority of the runoff from the new interchange will sheet flow into grass swales and collect in drain inlets and conveyed through underground drainage pipes that will connect to the existing system that services the area. The existing system will transport the storm water to the Pacific Ocean. (See Figure 4 - Flow Through Based Water Quality Drainage System Outfall and Figure 6, 7, and 8 – Overall Proposed Drainage Conditions Map)



Drainage Areas Contributing to Total Flow Through the Hydrodynamic Device

Inlet	A (acres)	Q50 (cfs)
GDI-24	0.33	2.02
GDI-25	0.46	1.42
GDI-26	0.12	0.41
GDI-33	0.03	0.18
GDI-34	0.14	0.89
GDI-35	0.05	0.31
GDI-36	0.41	2.54
GDI-40	0.22	1.38
GDI-41	0.33	1.33
GDI-42	0.34	1.31
GDI-43	0.28	0.95
GDI-44	0.24	0.81
TOTAL	2.95	13.55

INTERSTATE ROUTE H-1, ADDITION AND MODIFICATION OF FREEWAY ACCESS
Palailai Interchange to Makakilo Interchange (Kapolei Interchange Complex)
Phase 2

FLOW THROUGH BASED WATER QUALITY DRAINAGE SYSTEM OUTFALL

FIGURE 4

IV. REGULATORY REQUIREMENTS

As stated in the Consent Decree filed on January 30, 2006 (Case 1:05-cv-00636-HG-KSC):

"(2) Upon approval of the criteria established under Paragraph 9.f.(1), above, HDOT shall not advertise any construction project or award any construction contract unless and until the project design has been reviewed to ensure that appropriate permanent post-construction BMPs have been included in the project design and are included in the bid package. No project shall proceed without the inclusion of appropriate permanent post-construction BMPs unless there is specific documentation demonstrating that such post-construction BMPs are not practicable."

Under the unified criteria set forth by the Department of Transportation, Highways Division, any project (new or redevelopment) is required to install permanent BMP(s) for storm water management if it generates equal to or greater than one (1) acre of new permanent impervious surface.

V. PERMANENT BMPS

A. Storm Water Pollution

Typical pollutants contained in highway storm water runoff may include, but are not limited to, pesticides, fertilizers, transmission fluid, antifreeze, debris, litter, phosphorus, nitrogen, sediment, heavy metals, oil and grease. Site specific permanent BMPs will control storm water runoff from the project site to protect Hawaii receiving waters from water quality degradation and decline.

B. BMP Selection

Unlike erosion control BMPs for construction activities, storm water permanent BMPs are designed to manage the water quality of stormwater runoff by remaining a part of the projects features after construction is completed. For this project a hydrodynamic device is proposed to provide water quality control for on-site storm water runoff. The hydrodynamic device is a proprietary flow-through based water quality control facility.

1. Hydrodynamic Device: Inline Stormceptor, by Stormceptor

The Hydrodynamic Device is a manufactured structural BMP flow-through based stormwater treatment system designed to mechanically remove first flush pollutants and sediments by slowing incoming stormwater to create a non-turbulent treatment environment which allows oils to rise and sedimemt to settle. The Hydrodynamic Device is a prefabricated structure installed near the outlet of a drain system and is used to remove pollutants such as oil, grease, fine sediments, and trash. The Hydrodynamic Device is sized and designed to remove a minimum of 80% of total suspended solids (of the size fraction typical for urban runoff) from the required water quality flow rate while allowing the design storm peak flow to pass the structure. General maintenance of the hydrodynamic device includes periodic inspections to determine oil and sediment accumulation rate and cleaning and removal of oil and sediment build up from the unit. A maintenance plan should be developed to schedule the periodic inspections and cleanings. The manufacturer cautions that a licensed waste management company should remove the oil and sediment and handling and disposal of oil and sediment should comply with hazardous material regulations of the Department of Health.

The Hydrodynamic Device will be installed as a separate structure on Ramp "KA" west drain system near the outlet headwall structure.

VI. WATER QUALITY DESIGN STANDARDS

Water quality flow rate will be estimated based on the criteria set forth in Chapter 6 of HDOT Highways' "Storm Water Permanent Best Management Practices Manual" March 2007.

A. Flow-Through Based (Hydrodynamic Device)

The required water quality flow rate is:

WQRF = C x 0.4" x A

where:

WQRF = Water Quality Flow Rate in Cubic Feet per Second (cfs)
C = weighted runoff coefficient
0.4" = design storm size, 0.4 inches per hour

A = area of the site in acres

See Appendix B for the calculations

The Hydrodynamic Device treatment flow rate is based on the required water quality flow rate and is designed to pass the design storm peak runoff rate. The filter/device targets removal of a minimum of 80% of the total suspended solids (of the size fractions typical for urban runoff) from the design flow rate. Since 'typical size fraction' is not defined and appears to be subject to interpretation, the Hydrodynamic Device presents a range of total suspended solids removal. The values presented are consistent with values that the City and County of Honolulu has accepted for use within their water quality program.

See Appendix C for technical specification of the Hydrodynamic Device.

VII. RIGHT-OF-WAY

Proposed permanent BMPs will be located within the highway right-of-way.

VIII. CONSTRUCTION COST

A summary of the preliminary unit cost for the proposed permanent BMPs can be seen in the table below.

	Hydrodynamic Device
Quantity	1
Unit	Each
Unit Price	$42,000
Subtotal	$42,000

Installation Cost: $25,000
Include 10% Contingency: ($67,000) (1.10) = $73,700
Total Construction Cost Estimate = $73,700

An associated material maintenance cost for the Hydrodynamic Device is the cost to inspect sediment and oil levels and properly remove and dispose of built up sediment and oil.

IX. CONCLUSION

The permanent BMP proposed for the Interstate Route H-1, Kapolei Interchange Complex Phase 2, Addition and Modification of Freeway Access project will reduce potential pollutant loadings into Hawaii's receiving waters. Given the layout of the proposed drain features and systems, the hydrodynamic device should work well to effectively remove and reduce the amount of pollutants discharged into State waters. The hydrodynamic device was chosen as the primary treatment system to minimize the maintenance time and cost as compared to other permanent BMP measures such as catch basin inserts.

After construction, the hydrodynamic device should be inspected at least semi annually to determine the oil and sediment accumulation rate. Cleaning of the device should occur once the sediment depth reaches 15% of storage capacity. A maintenance schedule should be developed for the life of the hydrodynamic device and records of all inspections and follow-up maintenance, repair, and replacement should be kept for a minimum of five years.