3.3 GEOLOGY AND SOILS

3.3.1 Resource Definition

Terrestrial

Geology and geography encompass surface features such as soils and topography, as well as subsurface features, such as formations and materials that compose the terrestrial contents of the islands. Geologic resources such as groundwater, mineral ore, and liquid hydrocarbons can be found both at the earth's surface and within subsurface geologic structures. Topography describes lateral changes in the shape, height, and depth of the ground surface across a landing site area. Soils are unconsolidated surface material that form from underlying bedrock or other parent materials. Soil drainage, texture, strength, shrink/swell potential, and rates of erosion are used to assess the suitability of surface soil and sediments to support man-made structures and facilities. In combination with other factors (e.g., climate and terrain), these soil traits also substantially affect the suitability of a soil for agricultural development.

Marine

Marine geology as it pertains to the benthic environment along the cable corridors is described and analyzed in Section 3.7 of this document.

3.3.2 Regulatory Setting

Various county, state, and federal (including military) regulatory agencies oversee development, alteration, cultivation, degradation, or extraction of geological resources. For the project types proposed in this document, the following topics will be of primary concern.

Soils and Geology

At the federal level and primarily focused on soils, agriculture and erosion, the Natural Resource Conservation Service (NRCS) under the purview of the U.S. Department of Agriculture (USDA) coordinates with the State Department of Agriculture (DOA) their associated Soil and Water Conservation Districts (SWCDs) and other agricultural and soil groups for research, programming, funding, and education. The U.S. Geological Survey (USGS) operating under the U.S. Department of the Interior (DOI) is a science organization that provides information to describe and understand the earth; minimize loss of life and property from natural disasters; and manage water, biological, energy, and mineral resources. The USGS does not provide a regulatory function, but instead provides background studies, maps, analyses, and recommendations over a full range of interconnected earth science features and processes, including geological functions and descriptions.

These organizations, while working jointly, also coordinate with the OP to implement the Coastal Zone Management (CZM) Program and its soil-related programs primarily focusing on erosion control, water quality, and irrigation. The OP maintains Agricultural Lands of Importance to the State of Hawai‘i (ALISH) maps, which categorize lands in the state based on quality of the soils, and their viability for agricultural use. This categorization influences decisions as to the conversion of these lands for development.

Geotechnical Requirements and Grading

Geotechnical requirements for construction and land alteration (hazard engineering) vary by county. Where required, these studies accompany a County Grading or Grading/Grubbing permit application. Currently, the City and County of Honolulu have the most defined and codified requirements pertaining to development on slopes. *Honolulu Ordinance 04-27* authorizes, under certain conditions, the Director of Planning and Permitting to require the submittal of an engineering slope hazard report with a grading or building permit application. By definition, the Engineering Slope Hazard Report “utilizes the application of engineering and geologic knowledge and principles in the investigation, evaluation and mitigation of hazards posed by potential rock, soil or other slope movement.” Revised Ordinances of Honolulu (ROH) Sections 14-14.2(d) (2) and 14-15.1(n) also pertain to the analysis, engineering, and reporting of development on slopes and unstable soils. Other counties in the state rely on the analyses of architects and engineers as part of the issuance of building permits to ensure the geotechnical integrity of structures and development. Any development in the form of construction, grading, or terrain alteration must address requirements for the geotechnical condition of surface sediment as defined by county governments in the county where the development is to occur (State of Hawai‘i 2006).

Aquifers

As geologic features, aquifers can be affected by physical alteration, depletion, extraction, and pollution both at the site of development and downgradient of development where construction activity and operation can result in topographic or hydrologic impacts to HDOH – Safe Drinking Water Branch, whose mission is to “safeguard public health by protecting Hawai‘i’s drinking water sources (surface water and groundwater) from contamination and assure that owners and operators of public water systems provide safe drinking water to the community.” This mission is facilitated through the administration of the Safe Drinking Water Program, Underground Injection Control Program (UIC), Groundwater Protection Program, and the Drinking Water State Revolving Fund. These programs, through various state and federal agencies, provide enforcement, monitoring, and administration of various applicable federal and state programs and regulations (SDWB 2012).

3.3.3 Region of Influence

The ROI landing site areas on O‘ahu primarily consist of flat nearshore locations where slopes are negligible and surface sediment consists primarily of artificial fill. This is especially true of the Pearl Harbor area. Topography at the larger landing site areas on the west side of both Moloka‘i and Lāna‘i is flat along shoreline and nearshore areas but breaks abruptly into steep, rocky terrain at the landward terminus of beaches at each study site. Landing site areas at Kahului Harbor, and Mokuleia and Oneloa Bays (Kapalua) on the island of Maui are also flat along the shoreline and break to steeper slopes landward of beach areas. Section 3.3.4 below elaborates on unique geologic and topographic features, and soils at each of the landing site areas.

3.3.4 Affected Environment

General

The Hawaiian-Emperor volcanic chain is a northwest-trending chain stretching nearly 6,000 km (3,730 miles) across the northern Pacific Ocean. This system of islands, and associated reefs, banks, and atolls, consists of at least 107 individual volcanoes. The chain is age-progressive with still-active volcanoes at the southeast end. The segment known as the Hawaiian Ridge, which includes the main Hawaiian Islands and a chain of islands, atolls, and seamounts known collectively as the Northwestern Hawaiian Islands, extends approximately 3,000 km (1,865 miles) northwest across the Pacific. Hawaiian volcanoes produce lava of distinct chemical compositions during four major stages in their evolution and growth. After several million years of erosion, alkaline rejuvenated-stage lava erupts from isolated vents. Today, the relief of these islands varies as the once smooth volcanic domes have been weathered and eroded. Older islands like O‘ahu are deeply dissected, and geologic features observed at ground surface include ridges, valleys, and alluvial fans. The younger islands in the landing site area are those of Maui County. They exhibit fewer of these erosional features (Clague et al. 1987).

Maui County-O‘ahu Routing Specific

Maui

The Island of Maui is 465,280 acres (727 square miles) and measures 48 miles by 26 miles. Of its area, 76 percent is within 5 miles of the coast. The island has a wide variety of landscapes resulting from a unique combination of geology, topography, and climate. The island is a type of “volcanic doublet,” formed from two shield volcanoes that overlapped one another to form an isthmus between them. The older, western volcano has been eroded considerably and is cut by numerous drainages, forming the peaks of the West Maui Mountains. The larger, younger volcano to the east, Haleakalā, rises to more than 10,000 feet above sea level. The eastern flanks of both volcanoes are cut by deep valleys with steep-sided ravines that run from high in

the flanks of the volcanoes across slowly declining hillside slopes and down to the rocky, windswept shoreline. The isthmus of Maui that separates the two volcanic masses was formed by sandy erosional deposits. Maui's last volcanic eruption occurred around 1790. Although considered dormant by volcanologists, Haleakalā has erupted during recorded history and is regarded by some as having some potential for a future eruption. ALISH maps identify "prime" agricultural lands throughout the isthmus area and along the Lahaina-Kapalua corridor. Other Important Agricultural Lands are found around the island within the coastal valleys toward the interior, and along the south side of Haleakalā.

Maui-Kahului Harbor

An overview of the geology, USDA-NRCS soils and ALISH areas, and aquifers and watersheds for the Maui-Kahului Harbor landing site area is shown in Figures 3.3-1, 3.3-2, and 3.3-3. Roughly 80 percent of the landing site area at Kahului Harbor is composed of Holocene age surficial alluvium and dune deposits. The alluvium deposits trace from the landing site area west to the trend of valleys that drain the western slope of the West Maui Mountain Range. The older dune deposits underlie the alluvium and are exposed along the coastline across the eastern stretch of the landing site area. Man-made fill serves as the foundation of the two breakwaters that protect Kahului Harbor. Topography is flat across most of the landing site area. Ridgelines from the West Maui Mountains extend partly into the western end of the landing site area where slopes are as steep as 10 percent (USGS 2007).

Table 3.3-1 identifies the soil types occurring within the Maui-Kahului Harbor landing site area.

Maui-Kapalua (West Maui)

An overview of the geology, USDA-NRCS soils and ALISH areas, and aquifers and watersheds for the Maui-Kapalua landing site area is shown in Figures 3.3-4, 3.3-5, and 3.3-6. The Maui-Kapalua landing site area is underlain mostly by Pleistocene age lava flows of the Honolua group. These younger flows overlay an older series of thin-bedded flank flows that exist as the uppermost unit of the Wailuku Basalt formation, the volcanic group that comprises the main mass of West Maui's extinct shield volcano. Ridgelines from this shield volcano flatten considerably as they travel to the coast, and exist more as berms with slopes ranging from 0 to 15 percent within the landing site area (USGS 2007).

Table 3.3-2 identifies the soil types occurring within the Maui-Kapalua landing site area.

Lānaʻi

An overview of the geology, USDA-NRCS soils and ALISH areas, and aquifers and watersheds for the Lānaʻi landing site area is shown in Figures 3.3-7, 3.3-8, and 3.3-9. The island of Lānaʻi was formed by a single volcano and covers a land area of about 90,000 acres (140 square miles). The island is 18 miles by 13 miles at its extremes. Of its area, 100 percent is within 5

miles of the coast. It is a generally hilly island that rises gradually above sea level to the peak of Lānaʻihale, or Mount Palawai. The northwestern extension of the island, where the landing site area occurs, is characterized as having semiarid and subhumid low mountain slopes primarily composed of Pleistocene age basalt lava flows. These volcanic slopes are fronted to the north along the northern edge of the landing site area by younger, Holocene age beach deposits. The island of Lānaʻi contains "important agricultural lands" subcategorized as "unique" under the State's ALISH categorization system. These lands are located on the traditional agricultural plateau extending to the west-southwest of Lānaʻi City. Bluffs that steepen into cliffs off the southeastern side of the central plateau of Lānaʻi make most of the southern half of the landing site area less conducive to substantial development. Topography is steep through much of the east-west-trending northern half of the landing site area with slopes up to 20 percent. Slopes along the northern edge of the landing site area average less than 2 percent for strips of land up to a quarter-mile wide.

Table 3.3-3 identifies the soil types occurring within the Lānaʻi landing site area.

Molokaʻi

Molokaʻi is 166,400 acres (260 square miles) in size, measuring 38 by 10 miles. Of its area, 100 percent is within 5 miles of the coast. Molokaʻi was formed from two distinct shield volcanoes known as Wailau (East Molokaʻi), and Maunaloa (West Molokaʻi). What remains of Wailau is the southern half of the original cone, which now plays host to some of the highest sea cliffs in the world. The northern half of Wailau's original cone collapsed suddenly during a post-shield event approximately 1.5 million years ago, and it now exists as a field of scattered volcanic debris extending north into the Pacific Ocean. Maunaloa in western Molokaʻi retains much of its original form and is notably lower in elevation than even the remaining ridges of the now extinct Wailau. Molokaʻi is generally drier than the other Hawaiian Islands, and soils across the western side of the island are heavily denuded due to grazing by goats and historically poor land management practices. The eastern half of Molokaʻi forms a high plateau rising to an elevation of 4,900 feet to the aforementioned sea cliffs. The ALISH map identifies "prime" agricultural lands in the center of the island extending between Molokaʻi Ranch and the town of Kaunakakai. Other Important Agricultural Lands extend west to Molokaʻi Ranch, north of Kaunakakai town, and within smaller valley areas along the southeastern side of the island.

Molokaʻi-Kaluakoi (West Molokaʻi)

An overview of the geology, USDA-NRCS soils and ALISH areas, and aquifers and watersheds for the Molokaʻi-Kaluakoi landing site area is shown in Figures 3.3-10, 3.3-11, and 3.3-12. Lava flows and vent deposits of the northwest face of Maunaloa occur at the surface across most of the Molokaʻi-Kaluakoi landing site area. Surficial alluvium and beach deposits overlay West Molokaʻi volcanic substrate along the coast of Kepuhi Bay. Eolianite dune fields overlay lava flows that form the peninsula at ʻIlio Point. Where the northern ridge of Maunaloa wraps into the

north end of the landing site area, slopes average 10 percent to 15 percent. Slopes through most of the north-south-trending, central part of the landing site area are flat especially along the coast at Kepuhi Bay, where wave-washed rock land gives way to beaches of coralline sand.

Table 3.3-4 identifies the soil types occurring within the Molokaʻi-Kaluakoi landing site area.

Molokaʻi-Kaunakakai (South Molokaʻi)

An overview of the geology, USDA-NRCS soils and ALISH areas, and aquifers and watersheds for the Molokaʻi-Kaunakakai landing site area is shown in Figures 3.3-13, 3.3-14, and 3.3-15. All but the northwest tip of the Molokaʻi-Kaunakakai landing site area is flat, coastal marshland composed of Holocene age silt and mud deposits. These surficial strata overlie slightly older alluvium deposits derived from the mountains of both west and east Molokaʻi. Where the foothills of Maunaloa extend into the northwest corner of the landing site area, Pleistocene and Pliocene age lava flows back coastal surficial deposits. Slopes average from 2 percent across the coastal surficial deposits to 20 percent in the foothills at the northwest corner of the site (USGS 2007).

Table 3.3-5 identifies the soil types occurring within the Molokaʻi-Kaunakakai landing site area.

<u>Oʻahu</u>

Oʻahu is 381,440 acres (596 square miles) and measures 44 miles by 30 miles. Of the area, 79 percent is within 5 miles of coast. The island of Oʻahu was formed by two shield volcanoes that are now extinct: Waianae Volcano in the west, and Koolau Volcano along the east and southern parts of the island. Ancient lava flows from the two volcanoes merged to form the central plain (saddle) of Oʻahu. The eroded remains of the ancient shield cones of these volcanoes compose the Waianae and Koolau mountain ranges. Features of both mountain ranges include amphitheater-headed valleys and steep cliffs. Eroded materials from the volcanoes form extensive alluvial and colluvial deposits at the terminus of the island's valleys. Shallow soils develop in alluvium derived from eroded sediments and consist primarily of silty clays. Near the coast, eroded sediments are often intermixed with marine sediments in shallow subsurface nearshore deposits (Sterns et al. 1947).

Oʻahu-MCBH at Kāneʻohe Bay

An overview of the geology, USDA-NRCS soils and ALISH areas, and aquifers and watersheds for the Oʻahu-MCBH at Kāneʻohe Bay landing site area is shown in Figures 3.3-16, 3.3-17, and 3.3-18. The MCBH at Kāneʻohe Bay landing site area is composed primarily of Holocene age beach and reef deposits overlying older Pleistocene and Pliocene age volcanic rock. Pleistocene age calcareous reef rock and sediments occur through the northern section of the landing site area with older volcanic rocks of the Koolau mountain range exposed at surface in

the hills inland from the residential community of Lanikai. Slopes range from less than 1 percent for most of the landing site area to 30 percent at Ulupau Crater and in the foothills of the Koolau Mountains. In general, the topography of most of the landing site area is flat (USGS 2007).

Table 3.3-6 identifies the soil types occurring within the Oʻahu-MCBH at Kāneʻohe Bay landing site area.

Oʻahu-Pearl Harbor

An overview of the geology, USDA-NRCS soils and ALISH areas, and aquifers and watersheds for the Oʻahu-Pearl Harbor landing site area is shown in Figures 3.3-19, 3.3-20, and 3.3-21. A majority of this landing site area is composed of built Holocene age fill. This man-made fill predominates in the Honolulu International Airport beach deposit area where the fill was used in the construction of various runways over the years, including the Reef Runway. These man-made and natural sediment layers overlay calcareous reef rock and marine sediment exposed north of the airport and over much of the western portion of the landing site area. North and east of the landing site area, older Pleistocene age Honolulu Volcanic tuff and lava flows form the foothills of the western face of the Koolau mountain range. Slopes within the Pearl Harbor landing site area do not exceed 2 percent (USGS 2007).

Table 3.3-7 identifies the soil types occurring within the Oʻahu-Pearl Harbor landing site area.

3.3.5 Potential Impacts of Cable System Implementation

General Description of Impact Types

All of the sites, regardless of island or location, would likely require clearing, grading, excavating, engineering and recontouring of soils for access roads, cable installation, and converter station construction. These activities have the greatest potential impacts to soils and, to a lesser degree, geology. Alteration of the slope and topographic features for future construction may alter the geologic strata or slope, resulting in possible landslides, failure, or liquefaction. Construction activities may result in the removal of vegetation and exposure of soil, leaving areas vulnerable to erosion. Most of the landing site areas are located in flat coastal plains where the threat of erosion may not be as severe as in areas with greater slopes.

In general, steep, sloped areas (defined here as those exceeding 20 percent) are not traditionally conducive to the placement of structures and/or access roads. Assuming a maximum 6- to 12-acre footprint for the converter station and the complexity of this type of development, slopes substantially less than 20 percent would be optimum for converter station development on any of the islands or landing site areas. The Lānaʻi, Maui-Kapalua, and, to a lesser degree, the Molokaʻi-Kaluakoi landing site areas would require special consideration as

those areas contain little topographically flat or low slope areas of the size needed for converter station development, including access roads to the proposed site.

With alteration and compaction of soils for development, impacts to natural drainage channels, groundwater recharge areas, and by association, impacts to aquifers, may occur. Construction of culverts, drainage conveyance channels, and erosion control structures permanently or temporarily, may occur where access roads are needed to cross ravines. Compaction of sediments and soils would occur in all areas where transportation occurs on nonpaved accessways.

There are numerous federal, state and county regulations defining, rating, and establishing procedures and criteria regarding how, when, and where agricultural lands can be converted for development. Pockets of Important Agricultural Lands/ALISH do occur in certain sections of the landing site areas. Conversion of these lands would require approval by the county and possibly the state, in addition to any general land use approvals required by the zoning code.

3.3.6 General Siting Criteria and Special Conservation and Construction Measures

General Description of Recommendations

A description of recommended conservation and construction measures for potential impacts to geology and soils is presented below (MARFORRES 2011).

GS-1 Avoid the selection of landing sites in areas with steep topography, potential seismic hazards, or other geological hazards (further defined and discussed in Section 3.8 of this document). Where avoidance of these sites is not possible or practicable, the preparation of a geotechnical study may be required as part of the grading and/or building permit process. The geotechnical study would be prepared by licensed civil or geotechnical engineers or engineering geologists and would provide design, construction, and possibly maintenance recommendations based on all applicable federal and state building codes for a specific project location.

GS-2 For coastal sites and other sites with a shallow groundwater table, dewatering of the foundation excavation may be required. Dewatering activities at construction sites are often covered under provisions of Section 401 and 404 of the Clean Water Act (CWA).

GS-3 Avoid the selection of landings sites on soils designated as “Prime” under the ALISH Rating system. Where avoidance of these sites is not possible or practicable, note that proposed development on ALISH-designated soils will need to meet state and county criteria for use of these lands, in addition to any underlying zoning and land use regulations. In general, the greater the ALISH value of the underlying soils at a

landing site area, the more stringent the criteria for conversion of the site for development.

(See Section 3.16.2 [Water Resources] for a full description of the permits described in GS-4, 5, and 6 below)

GS-4 Avoid the selection of landing area sites on or near identified wetlands or proximate to surface water/drainage ways. Where avoidance of these sites is not possible or practicable, development on these sites will require review, analysis, mitigation, and monitoring under provisions of the regulatory procedures and permits as outlined in Section 3.16.2 of this document, including those requirements of the U.S. Army Corps of Engineers (USACE) where the potentially impacted water body is determined to meet the definitions of "waters of the U.S."

GS-5 As part of the development, and if disturbing more than 1 acre of land, future developers will be required to secure a Water Quality Certification under provisions of Section 401 of the CWA. Examples of erosion control measures may include, but are not limited to, the creation of control swales to channel runoff; establishment of sediment traps, sediment basins, or erosion control berms; installation of silt fences; and temporary stabilization of areas graded and barren of vegetation. Upon project completion, permanent erosion control measures may be required. In addition to CWA permits, a grading/grubbing permit may be required by the requisite county at the time of issuance of a building permit.

GS-6 Potential impacts to water quality and quantity during grading and construction activities would be controlled through the issuance of a National Pollutant Discharge Elimination System (NPDES) permit under Section 403 permit of the CWA as well as the issuance of a grading/grubbing permit from the requisite county.

Table 3.3-1. Soil Types within the Maui-Kahului Harbor Landing Site Area

Soil Identifier	Soil Name	Description
AaB	Alae sandy loam	• 3 to 7 percent slopes • 50 to 600 feet in elevation • Excessively drained soils formed in volcanic ash and recent alluvium
Ae	Alaeloa silty clay series	• 7 to 35 percent slopes • 100 to 1,500 feet in elevation • Well-drained soils on uplands developed in material weathered from basic
BS	Beaches	• 0 to 3 percent slopes • Sea level to 150 feet in elevation • Sandy shores washed and rewashed by waves • Area may be partly covered with water during high tide or storms
DL	Dune land	• 0 to 5 percent slopes • Sea level to 150 feet in elevation • Hills of loose sandy material drifted and piled by the wind; sand dominantly from coral and seashells
Kb	Kahana silty clay series	• 3 to 25 percent slopes • 100 to 1,200 feet in elevation • Well-drained soils on uplands developed in material weathered from basic igneous rock
Ps	Pulehu clay loam	• 0 to 3 percent slopes • Sea level to 300 feet in elevation • Well-drained soils on alluvial fans, stream terraces, and in basins developed in alluvium washed from basic igneous rock
rL	Lava flows, aa	• Lava flows; lava flow a mass of clinker, sharp, jagged fragmental lava • Practically no soil covering • Vegetation is bare except for mosses, lichens, and ferns, and few small trees
rR	Rock, rough, broken land series	• Exposed rock covering 25 to 90 percent of the surface or, • Very steep land broken by numerous intermittent drainage channels or, • Areas of rock outcrop, stones, and soil slips occurring in gulches and on mountain sides • Near sea level to 6,000 feet in elevation
rSM	Stony alluvial land	• Stones, boulders, and soil deposited by streams along the bottoms of gulches and on alluvial fans • Near sea level to 1,000 feet in elevation

Source: DBEDT 2004

Table 3.3-2. Soil Types within the Maui-Kapalua Landing Site Area

Soil Identifier	Soil Name	Description
Ae	Alaeloa silty clay series	• 7 to 35 percent slopes • 100 to 1,500 feet in elevation • Well-drained soils on uplands developed in material weathered from basic
BS	Beaches	• 0 to 3 percent slopes • Sea level to 150 feet in elevation • Sandy shores washed and rewashed by waves • Area may be partly covered with water during high tide or storms
DL	Dune land	• 0 to 5 percent slopes • Sea level to 150 feet in elevation • Hills of loose sandy material drifted and piled by the wind; sand dominantly from coral and seashells.
Kb	Kahana silty clay series	• 3 to 25 percent slopes • 100 to 1,200 feet in elevation • Well-drained soils on uplands developed in material weathered from basic igneous rock
Ps	Pulehu clay loam	• 0 to 3 percent slopes • Sea level to 300 feet in elevation • Well-drained soils on alluvial fans, stream terraces, and in basins developed in alluvium washed from basic igneous rock
rL	Lava flows, aa	• Lava flows; lava flow a mass of clinker, sharp, jagged fragmental lava. • Practically no soil covering • Vegetation is bare except for mosses, lichens, and ferns, and few small trees
rR	Rock, rough, broken land series	• Exposed rock covering 25 to 90 percent of the surface or, • Very steep land broken by numerous intermittent drainage channels or, • Areas of rock outcrop, stones, and soil slips occurring in gulches and on mountain sides • Near sea level to 6,000 feet in elevation
rSM	Stony alluvial land	• Stones, boulders, and soil deposited by streams along the bottoms of gulches and on alluvial fans. • Near sea level to 1,000 feet in elevation

(DBEDT 2004)

Table 3.3-3. Soil Types within the Lānaʻi Landing Site Area

Soil Identifier	Soil Name	Description
BS	Beaches	• 0 to 3 percent slopes • Sea level to 150 feet in elevation • Sandy shores washed and rewashed by waves • Area may be partly covered with water during high tide or storms
JaC	Jaucas sand	• 0 to 15 percent slopes • Very deep, excessively drained, calcareous, sandy soils formed along the coast on from coral and sea shells
MmA	Mala silty clay	• 0 to 3 percent slopes • Well-drained soils on bottoms of drainageways and on alluvial fans on the coastal plains
rR	Rock land	• Exposed rock covering 25 to 90 percent of the surface or, • Very steep land broken by numerous intermittent drainage channels or, • Areas of rock outcrop, stones, and soil slips occurring in gulches and on mountain sides • Near sea level to 6,000 feet in elevation
rSL	Sandy alluvial land	• Unstabilized sandy sediments from recent stream deposits • Occurs along streams and along the coastal area flats
rV	Very stony land series	• Deep, well-drained stony and bouldery soils over weathered basalt saprolite • Sea level to 1,500 feet in elevation

(DBEDT 2004)

Table 3.3-4. Soil Types within the Moloka'i-Kaluakoi Landing Site Area

Soil Identifier	Soil Name	Description
BS	Beaches	• 0 to 3 percent slopes • Sea level to 150 feet in elevation • Sandy shores washed and rewashed by waves; partly covered with water during high tide or storms
Hv	Holomua silt loam series	• 3 to 15 percent slopes • 100 to 1,000 feet in elevation • Consists of well-drained soils on uplands developed in volcanic ash and material weathered from andesite rock and/or severely eroded
HyB3	Hoolehua silty clay loam	• 3 to 10 percent slopes, severely eroded • 400 to 1,300 feet in elevation • Well-drained soils in depressions and in drainageways developed in old alluvium
JaC	Jaucas sand	• 0 to 15 percent slopes • Very deep, excessively drained, calcareous, sandy soils formed along the coast from coral and sea shells
KKTC	Kapuhikani extremely stony clay	• 3 to 15 percent slopes • Sea level to 500 feet in elevation • Well-drained extremely stony soils on uplands developed in material from olivine basalt
KMW	Kealia silt loam	• Poorly drained saline soils formed from alluvium along the coastal flats • Sea level to 10 feet in elevation
LuA	Lualualei clay	• Well-drained soils on coastal plains, alluvial fans, and on talus slopes developed in alluvium and colluvium • 10 to 125 feet in elevation
MmA	Mala silty clay	• 0 to 3 percent slopes • Well-drained soils on bottoms of drainageways and on alluvial fans on the coastal plains, formed in recent alluvium • Sea level to 100 feet in elevation
Mu	Moloka'i silty clay loam series	• 0 to 15 percent slopes • Well-drained soils on uplands, formed from weathered volcanic basalt • Near sea level to 1,500 feet in elevation
MZ	Marsh	• 0 to 3 percent slopes • Sea level to 100 feet in elevation • Wet, flooded areas covered dominantly with sedges, grasses, bulrush, and other water tolerant plants along streams and in low-lying areas along the coastal plains; soil material is decomposed organic matter
PJD2	Pamoa stony silty clay	• 5 to 20 percent slopes, eroded • Well-drained soils formed in fine-textured old alluvium • 100 to 1,500 feet in elevation
rR	Rock land	• Exposed rock covering 25 to 90 percent of the surface or, • Very steep land broken by numerous intermittent drainage channels or, • Areas of rock outcrop, stones, and soil slips occurring in gulches and on mountain sides • Near sea level to 6,000 feet in elevation
rRO	Rock outcrop	• Exposures of bare, hard bedrock other than lava flows
rV	Holomua silt loam series	• Deep, well-drained stony and bouldery soils over weathered basalt saprolite • Sea level to 1,500 feet in elevation

(DBEDT 2004)

Table 3.3-5. Soil Types within the Moloka'i-Kaunakakai Landing Site Area

Soil Identifier	Soil Name	Description
KKTC	Kapuhikani extremely stony clay	• 3 to 15 percent slopes • Sea level to 500 feet in elevation • Well-drained extremely stony soils on uplands developed in material from olivine basalt
KMW	Kealia silt loam	• Poorly drained saline soils formed from alluvium along the coastal flats • Sea level to 10 feet in elevation
LuA	Lualualei clay	• Well-drained soils on coastal plains, alluvial fans, and on talus slopes developed in alluvium and colluvium • 10 to 125 feet in elevation
MmA	Mala silty clay	• 0 to 3 percent slopes • Well-drained soils on bottoms of drainageways and on alluvial fans on the coastal plains, formed in recent alluvium • Sea level to 100 feet in elevation
MZ	Marsh	• 0 to 3 percent slopes • Sea level to 100 feet in elevation • Wet, flooded areas covered dominantly with sedges, grasses, bulrush, and other water tolerant plants along streams and in low-lying areas along the coastal plains; soil material is decomposed organic matter
rV	Holomua silt loam series	• Deep, well-drained stony and bouldery soils over weathered basalt saprolite • Sea level to 1,500 feet in elevation

(DBEDT 2004)

Table 3.3-6. Soil Types within the Oʻahu-MCBH at Kāneʻohe Landing Site Area

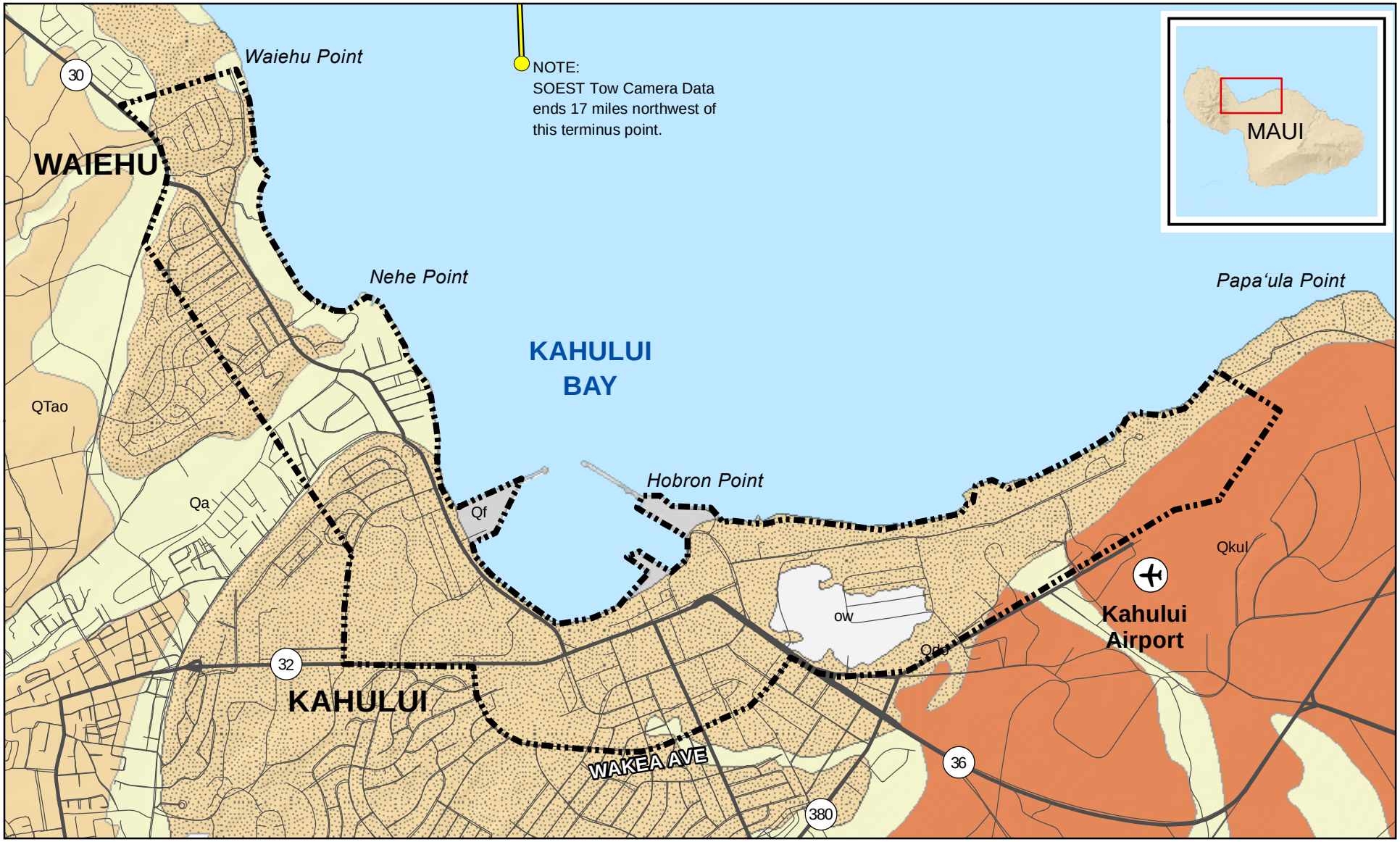
Soil Identifier	Soil Name	Description
BS	Beaches	• 0 to 3 percent slopes • Sea level to 150 feet in elevation • Sandy shores washed and rewashed by waves; partly covered with water during high tide or storms
EmA	Ewa silty clay loam	• 0 to 2 percent slopes • Well-drained soils in basins and alluvial fans developed in alluvium derived from basic igneous rocks • Near sea level to 150 feet in elevation
FL	Fill land	• Fill from material dredged from the reef or general material from other sources • Near sea level to 1,000 feet in elevation
Ja	Jaucas sand series	• 0 to 15 percent slopes • Very deep, excessively drained, calcareous, sandy soils formed along the coast from coral and sea shells
Km	Keaau clay series	• 0 to 2 percent slopes • Poorly drained soils on coastal plains, developed in alluvium deposited over reef limestone or consolidated coral sand • to 40 feet in elevation
Kt	Kokokahi clay series	• 6 to 35 percent slopes • Moderately well-drained soils on talus slopes and alluvial fans developed from alluvium and colluvium from basic igneous rock • Near sea level to 125 feet in elevation
Md	Makalapa clay series	• 2 to 12 percent slopes • Well-drained soils on uplands formed from volcanic tuff • 20 to 200 feet in elevation
MnC	Mamala stony silty clay loam	• 0 to 12 percent slopes • Shallow well-drained soils along the coastal plains formed in alluvium deposited over coral limestone and consolidated coral sand • 0 to 100 feet in elevation, in most places
M	Mokuleia loam series	• Well-drained soils along the coastal plains formed in recent alluvium deposited over coral sand
MuC	Molokaʻi silty clay loam	• 7 to 15 percent slopes • Well-drained soils on uplands • Near sea level to 1500 feet in elevation
PyF	Papaa clay	• 35 to 70 percent slopes • Well-drained soils on uplands formed in colluvium and residuum from basalt. • 0 to 500 feet in elevation
rR	Rock land series	• Exposed rock covering 25 to 90 percent of the surface or, • Very steep land broken by numerous intermittent drainage channels or, • Areas of rock outcrop, stones, and soil slips occurring in gulches and on mountain sides • Near sea level to 6,000 feet in elevation
rSY	Stony steep land	• Mass of boulders and stones deposited by water and gravity on side slopes of drainage ways. • 100 to 1,500 feet in elevation
WkA	Waialua silty clay	• 0 to 3 percent slopes • Moderately well-drained soils on alluvial fans, developed in alluvium weathered from basic igneous rock • 10 to 100 feet in elevation

(DBEDT 2004)

Table 3.3-7. Soil Types within the O‘ahu-Pearl Harbor Landing Site Area

Soil Identifier	Soil Name	Description
CR	Coral outcrop	• Consists of coral or cemented calcareous sand; coral reefs formed in shallow ocean water during the time the ocean stand was at a higher level • Elevations range from sea level to approximately 100 feet
EmA	Ewa silty clay loam	• 0 to 2 percent slopes • Well-drained soils in basins and alluvial fans developed in alluvium derived from basic igneous rocks • Near sea level to 150 feet in elevation
FL	Fill land	• Fill from material dredged from the reef or general material from other sources • Near sea level to 1,000 feet in elevation
JaC	Jaucas sand	• 0 to 15 percent slopes • Very deep, excessively drained, calcareous, sandy soils formed along the coast from coral and sea shells
Km	Keaau clay series	• 0 to 2 percent slopes • Poorly drained soils on coastal plains, developed in alluvium deposited over reef limestone or consolidated coral sand • to 40 feet in elevation
Md	Makalapa clay series	• 2 to 12 percent slopes • Well-drained soils on uplands formed from volcanic tuff • 20 to 200 feet in elevation
MkA	Makiki clay loam	• 0 to 2 percent slopes • Well-drained soils on alluvial fans and terraces, formed in alluvium mixed with volcanic ash and cinders • 20 to 200 feet in elevation
MnC	Mamala stony silty clay loam	• 0 to 12 percent slopes • Shallow well-drained soils along the coastal plains formed in alluvium deposited over coral limestone and consolidated coral sand • 0 to 100 feet in elevation, in most places

(DBEDT 2004)



Kahului Maui Landing Site Area: USGS Geology

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Open Water

USGS Geology Map Unit

- Open Water

Kula Volcanics

- Qkul - Lava flows

Surficial Deposits

- Qf - Fill
- Qa - Alluvium
- QTao - Older alluvium
- Qdo - Older dune

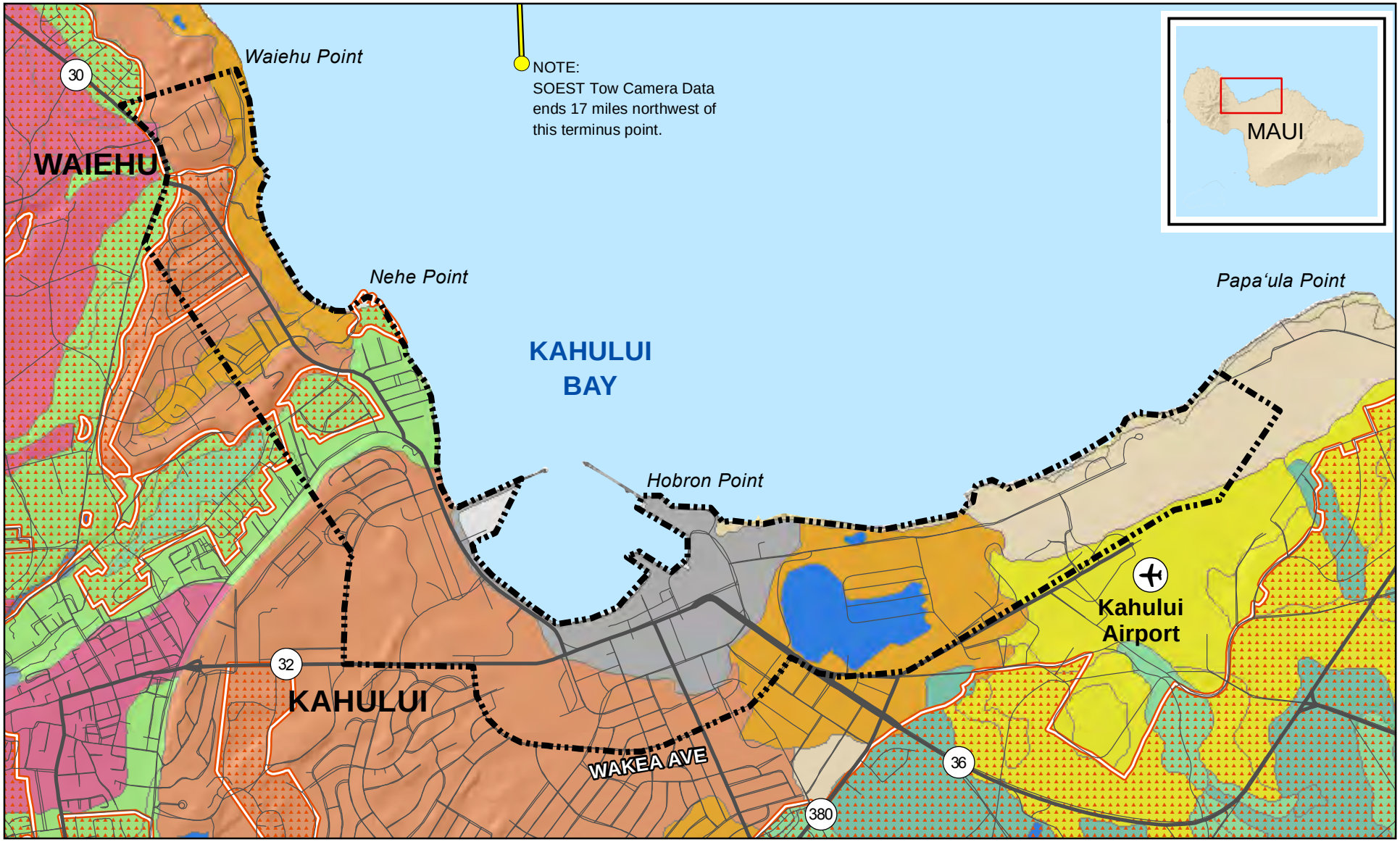
N

0 2,500 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012
Data Sources: HI-DBEDT, NOAA, USGS. UH-SOEST, AECOM, 2012

Figure 3.3-1



Kahului Maui Landing Site Area: USDA-NRCS Soils and ALISH Areas

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Open Water
- Agricultural Lands of Importance to the State of Hawai'i (ALISH)

USDA-NRCS Soils

Soil Name			
Jaucas	Keāhua	Waiakoa	Fill land
Pu'uone	Moloka'i	Wailuku	Rock land
'Īao	Nā'iwa	Stony alluvial land	Dune land
'Ewa	Pā'ia	Rough broken land	Beaches
	Hālawa	Rough mountainous land	Water > 40 acres
	Pūlehu	Cinder pit	

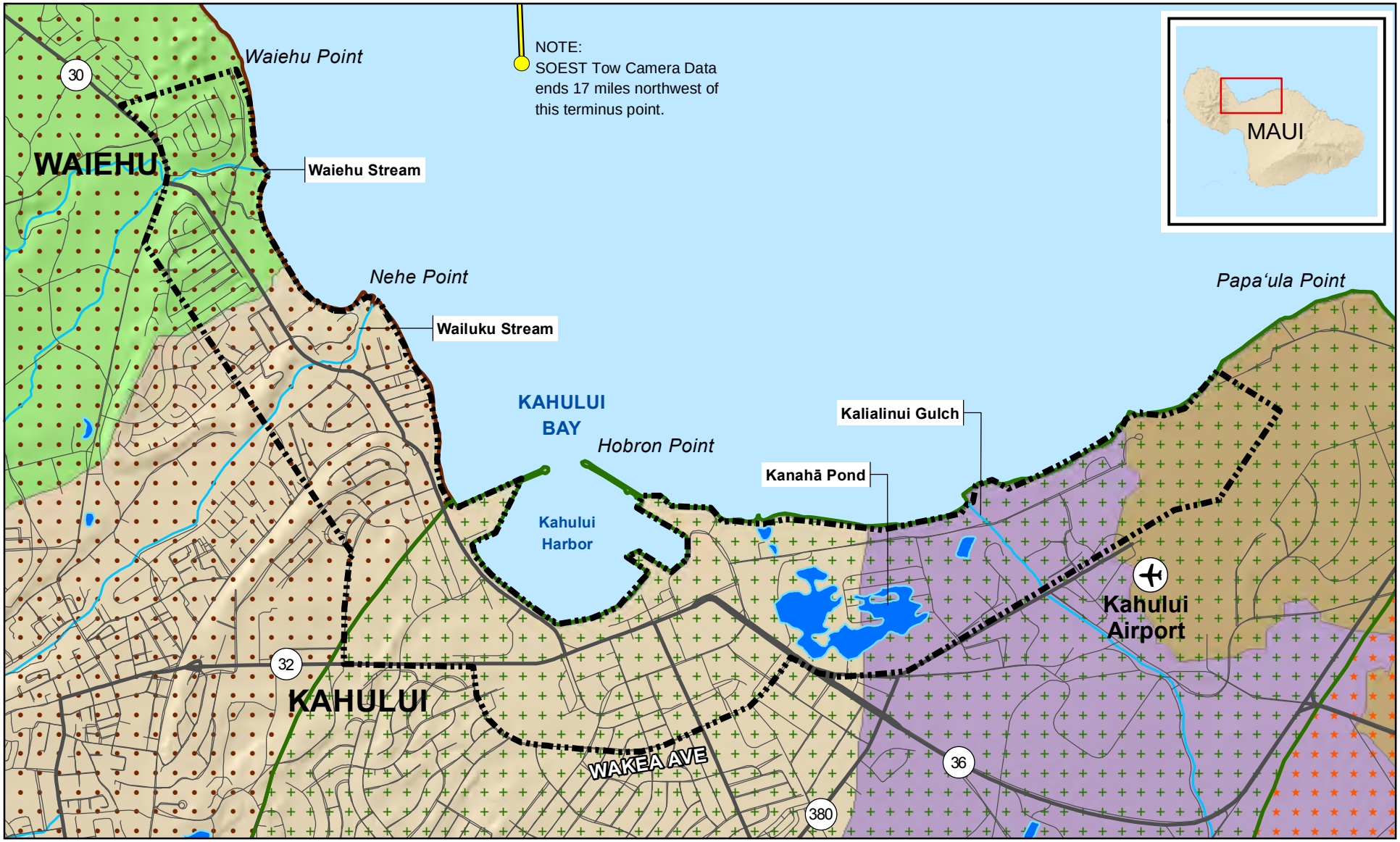
N

0 2,500 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012
Data Sources: HI-DBEDT, NOAA, USDA-NRCS. UH-SOEST, AECOM, 2012

Figure 3.3-2



Kahului Maui Landing Site Area: Aquifers and Watersheds

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Drainages, Rivers and Streams
- Freshwater Lake or Pond
- Open Water
- 'Īao Aquifer
- Kahului Aquifer
- Pā'ia Aquifer

Watersheds

- Waiehu
- 'Īao
- Kalialinui
- Kailua Gulch

N

0 2,500 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012
Data Sources: HI-DBEDT, USGS, UH-SOEST, AECOM, 2012

Figure 3.3-3

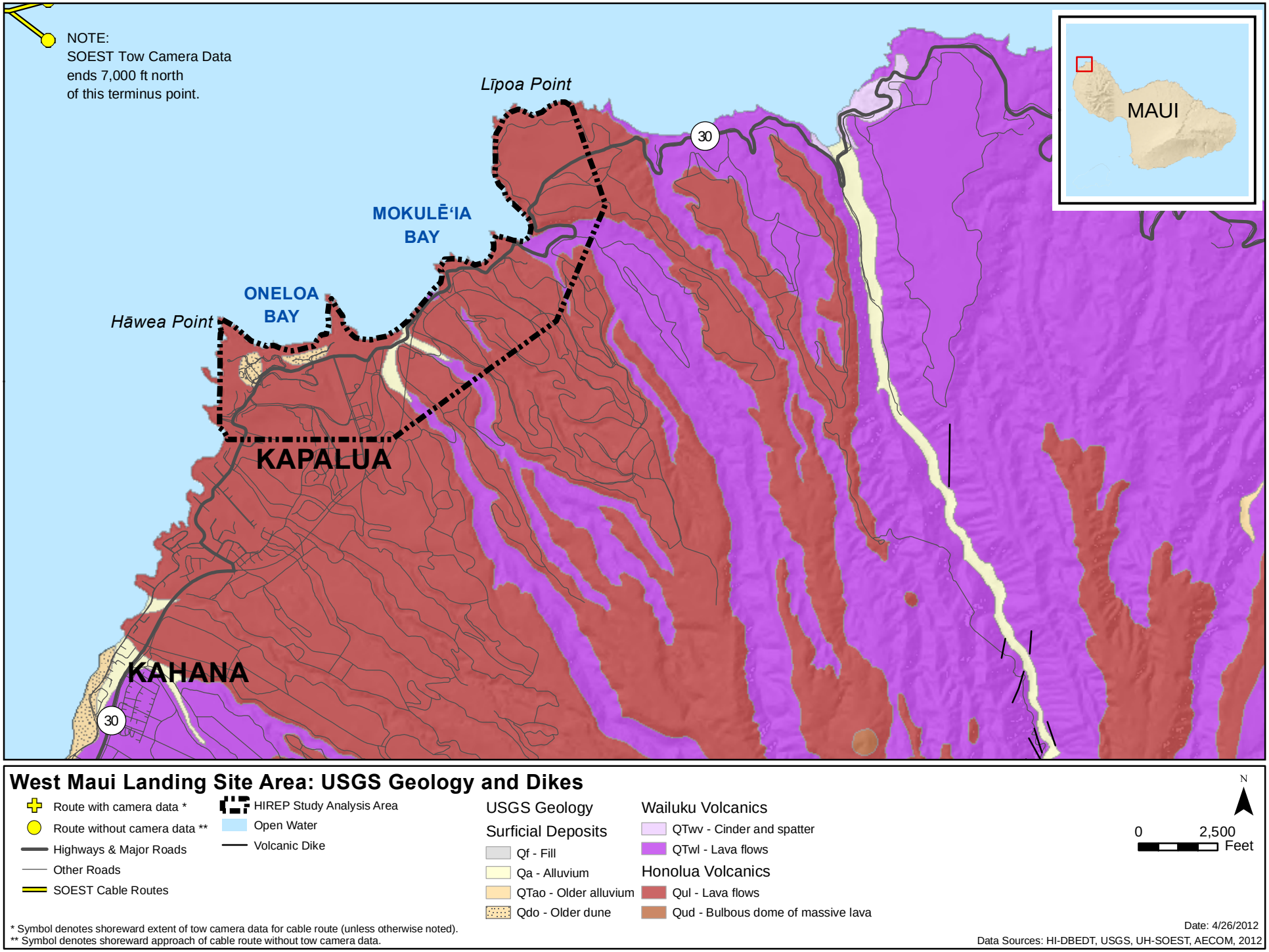
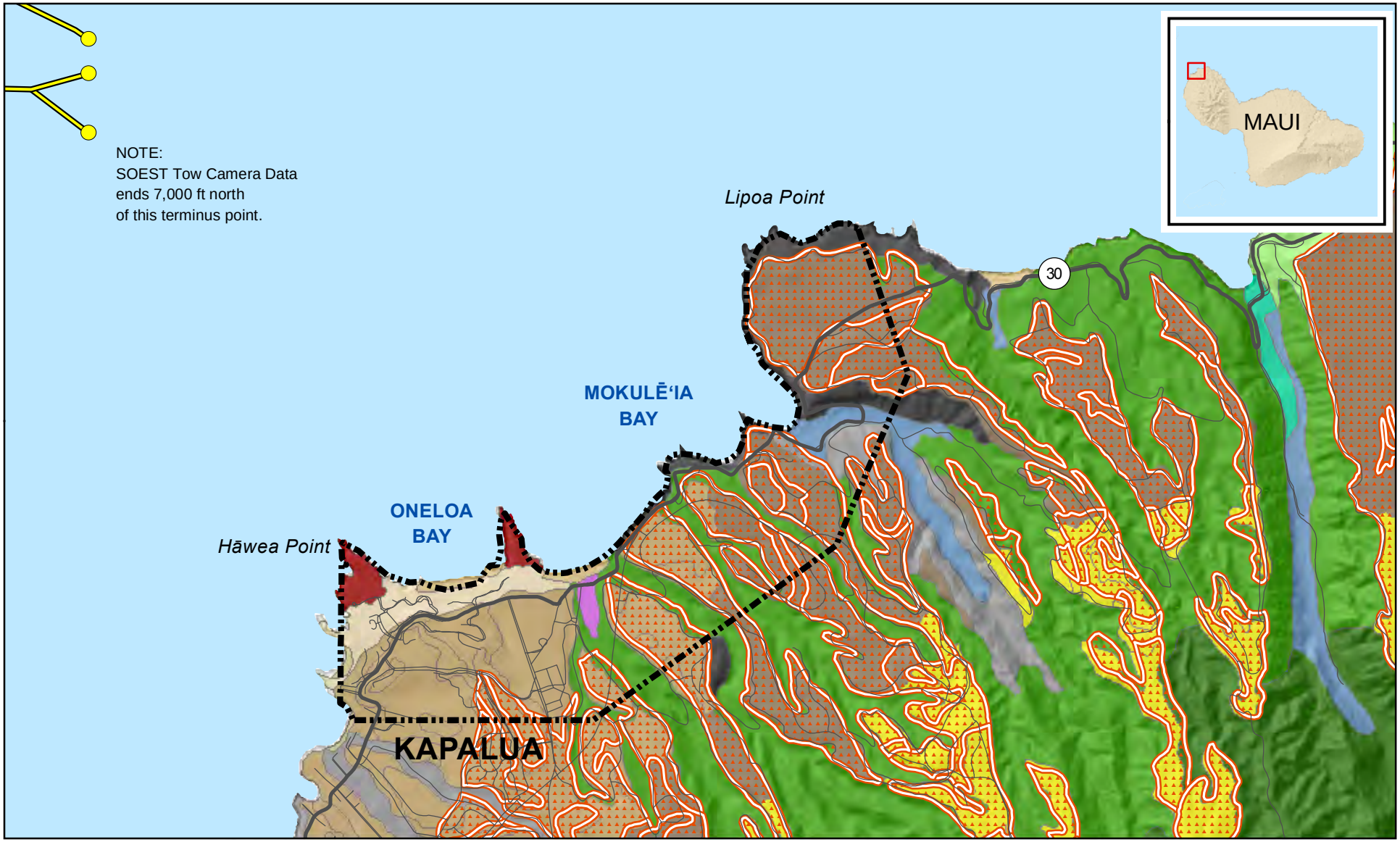

NOTE:
SOEST Tow Camera Data
ends 7,000 ft north
of this terminus point.
Līpoa Point
MOKULĒ'IA
BAY
ONELOA
BAY
Hāwea Point
KAPALUA
KAHANA
30
30
MAUI
West Maui Landing Site Area: USGS Geology and Dikes
Route with camera data *
Route without camera data **
Highways & Major Roads
Other Roads
SOEST Cable Routes
HIREP Study Analysis Area
Open Water
Volcanic Dike
USGS Geology
Surficial Deposits
Qf - Fill
Qa - Alluvium
QTao - Older alluvium
Qdo - Older dune
Wailuku Volcanics
QTwv - Cinder and spatter
QTwl - Lava flows
Honolua Volcanics
Qul - Lava flows
Qud - Bulbous dome of massive lava
N
0
2,500
Feet
* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.
Date: 4/26/2012
Data Sources: HI-DBEDT, USGS, UH-SOEST, AECOM, 2012

Figure 3.3-4



West Maui Landing Site Area: USDA-NRCS Soils and ALISH Areas

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Open Water
- Agricultural Lands of Importance to the State of Hawai'i (ALISH)

USDA-NRCS Soils

Soil Name

- ʻAlaeloa
- Beaches
- Dune land
- ʻEwa
- Hydrandepts
- Jaucas
- Kahana
- Kōʻele
- Lāhainā
- Lava flows
- Pūlehu
- Rock land
- Rough broken and stony land
- Rough broken land
- Rough mountainous land
- Stony alluvial land
- Tropaquepts

N

0 2,500 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012

Data Sources: HI-DBEDT, USDA-NRCS, UH-SOEST, AECOM, 2012

Figure 3.3-5

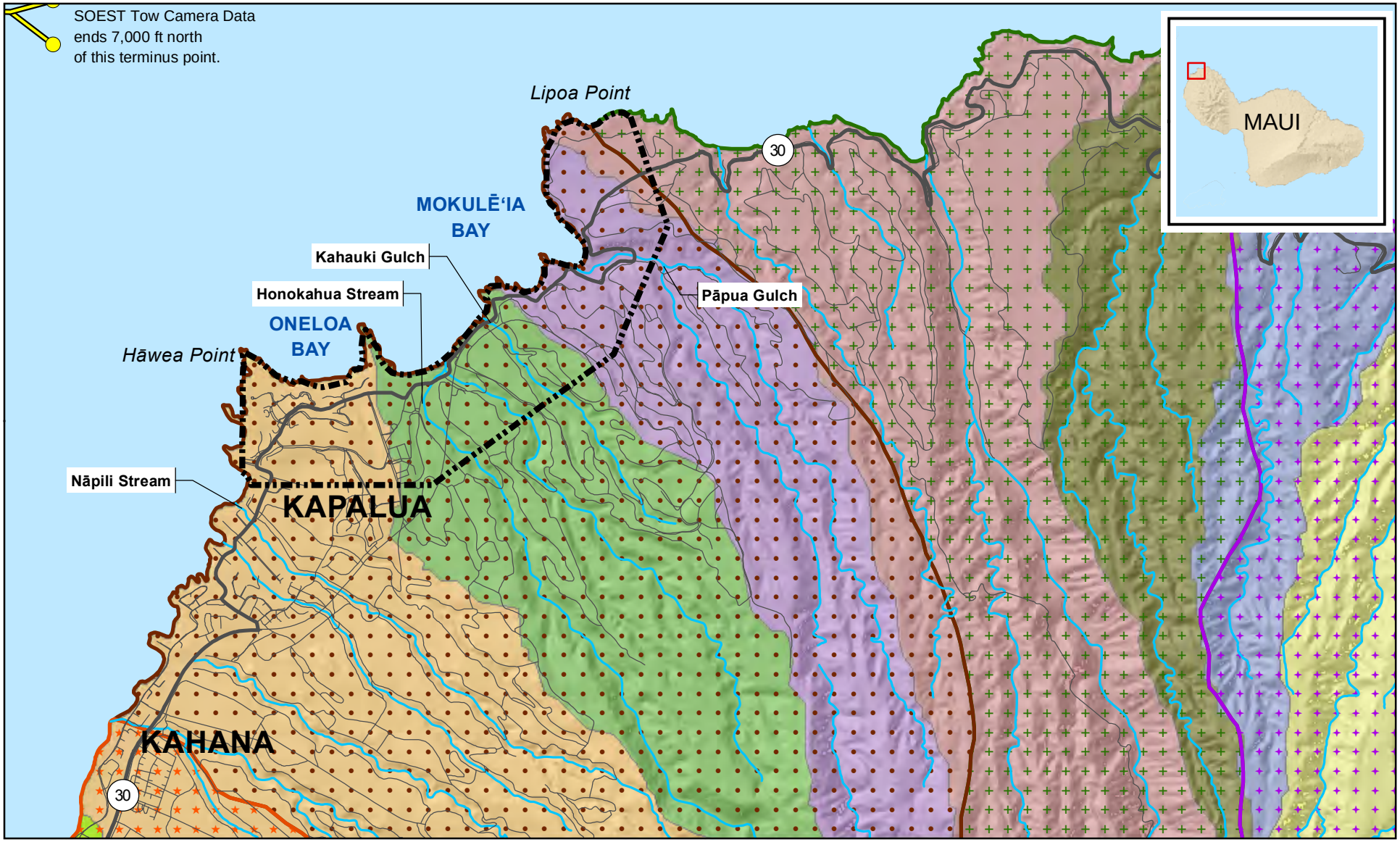
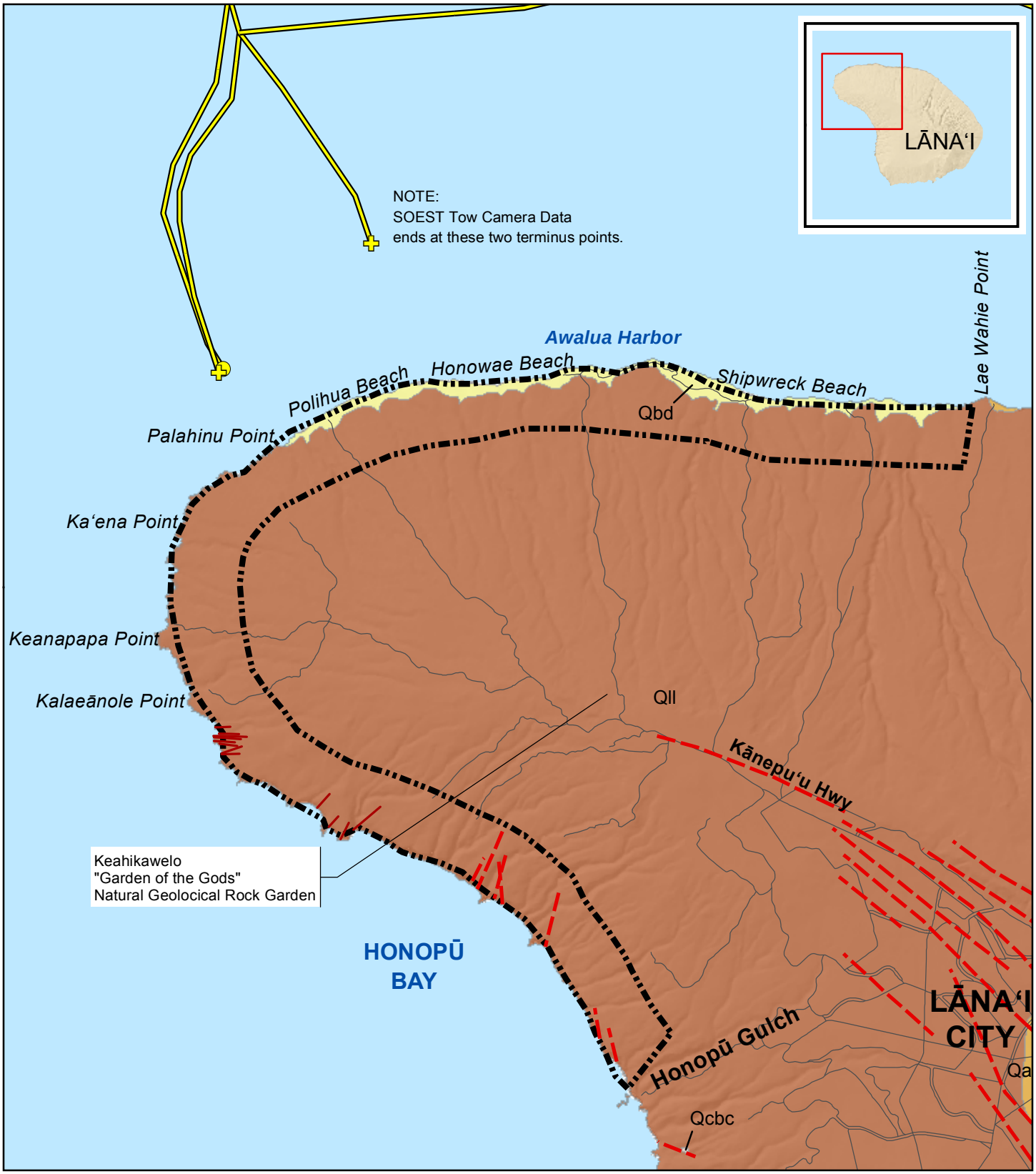

SOEST Tow Camera Data
ends 7,000 ft north
of this terminus point.
Lipoa Point
MOKULĒʻIA
BAY
Kahauki Gulch
Honokahua Stream
ONELOA
BAY
Hāwea Point
Pāpua Gulch
Nāpili Stream
KAPALUA
KAHANA
30
30
MAUI
West Maui Landing Site Area: Aquifers and Watersheds
Route with camera data *
Route without camera data **
Highways & Major Roads
Other Roads
SOEST Cable Routes
HIREP Study Analysis Area
Drainages, Rivers and Streams
Open Water
Honolua Aquifer
Honokohau Aquifer
Honokōwai Aquifer
Kahkuloa Aquifer
Watersheds
Kahana
Honokahua
Honolua
Honokōhau
Anakaluahine
Honanana
Honokōwai
Poelua
N
0
2,500
Feet
* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.
Date: 4/26/2012
Data Sources: HI-DBEDT, USGS, UH-SOEST, AECOM, 2012

Figure 3.3-6



Lānaʻi Landing Site Area: USGS Geology

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Open Water
- Major Fault Line
- Volcanic Dike

USGS Geology

Lānaʻi Basalt
- Qll - Lava Flows

Surficial Deposits
- Qa - Alluvium
- Qbd - Beach deposits
- Qcbc - Marine conglomerate and breccia

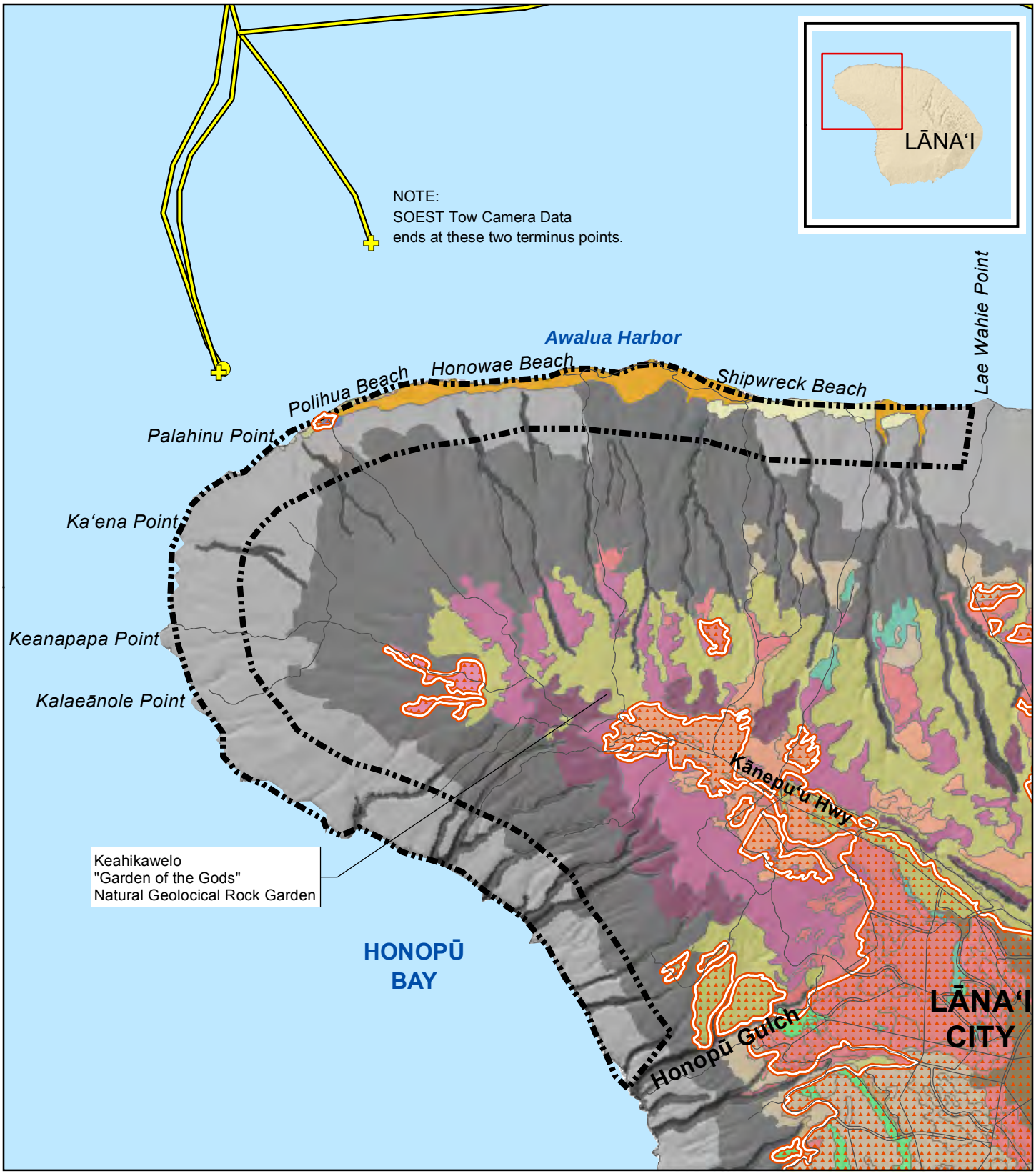
N

0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012
Data Sources: HI-DBEDT, USGS, UH-SOEST, AECOM, 2012

Figure 3.3-7



Lānaʻi Landing Site Area: USDA-NRCS Soils and ALISH Areas

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Open Water
- Agricultural Lands of Importance to the State of Hawai'i (ALISH)

USDA-NRCS Soils

Soil Name

- Jaucas
- Kahanui
- Kāla'e
- Kānepu'u
- Kō'ele
- Lāhainā
- Māla
- Moloka'i
- Moloka'i variant
- Pāmoa
- Uwala
- Waikapū
- Waihuna
- Sandy alluvial land
- Stony alluvial land
- Rough broken land
- Rough mountainous land
- Very stony land
- Very stony land, eroded
- Rock outcrop
- Rock land
- Blown-out land
- Stony blown-out land
- Beaches

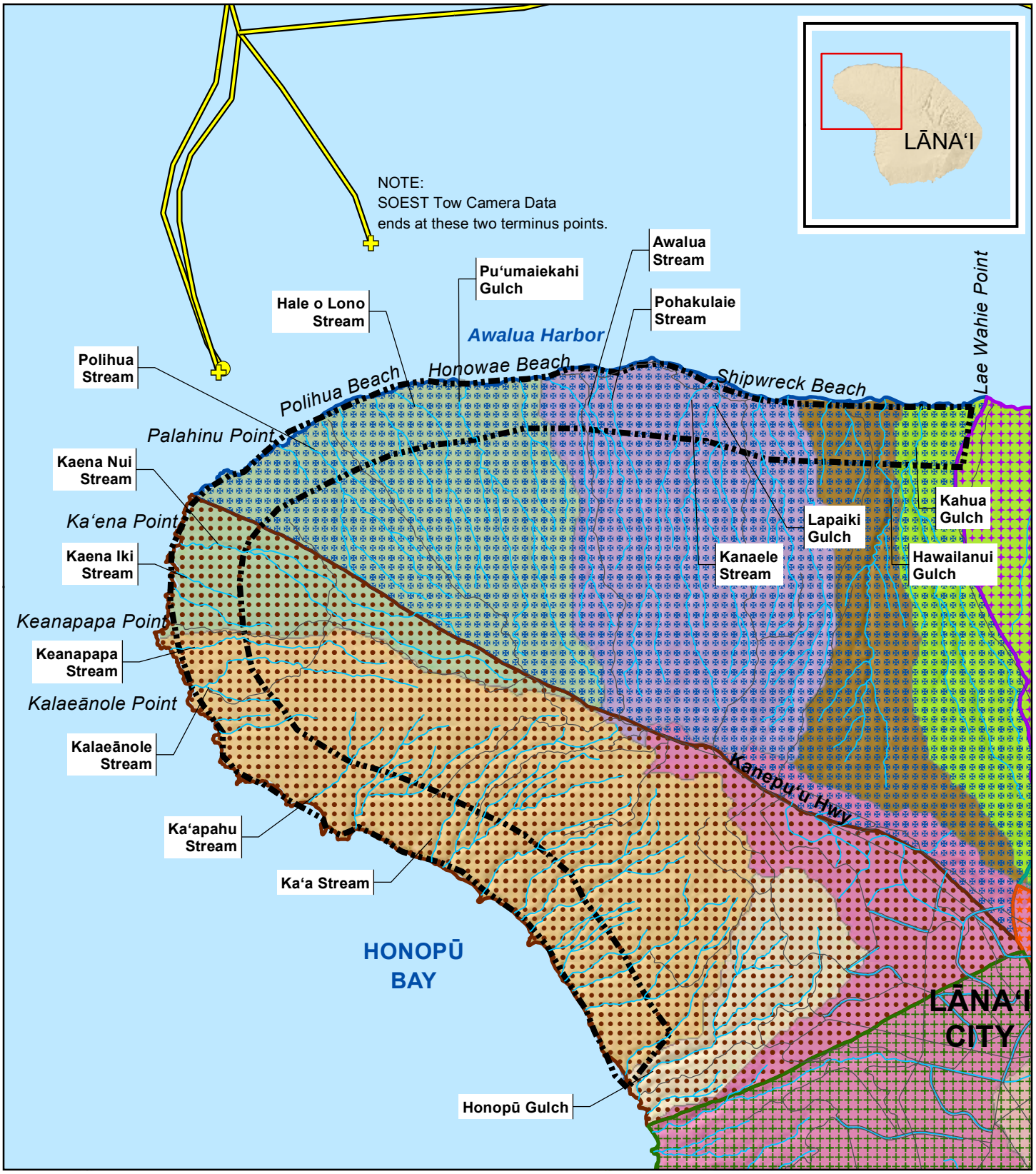
N

0 2,500 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012
Data Sources: HI-DBEDT, USDA-NRCS, UH-SOEST, AECOM, 2012

Figure 3.3-8



Lānaʻi Landing Site Area: Aquifers and Watersheds

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Drainages, Rivers and Streams
- Open Water

Aquifers
- Honopu Aquifer
- Kaumalapau Aquifer
- Maunalei Aquifer
- Paomai Aquifer
- Leeward Aquifer
- Windward Aquifer

Watersheds
- Hawaiilanui
- Honopū
- Kaʻāpahu
- Kahua
- Lapaiki
- Palawai Basin
- Paliamano
- Puumaiekahi

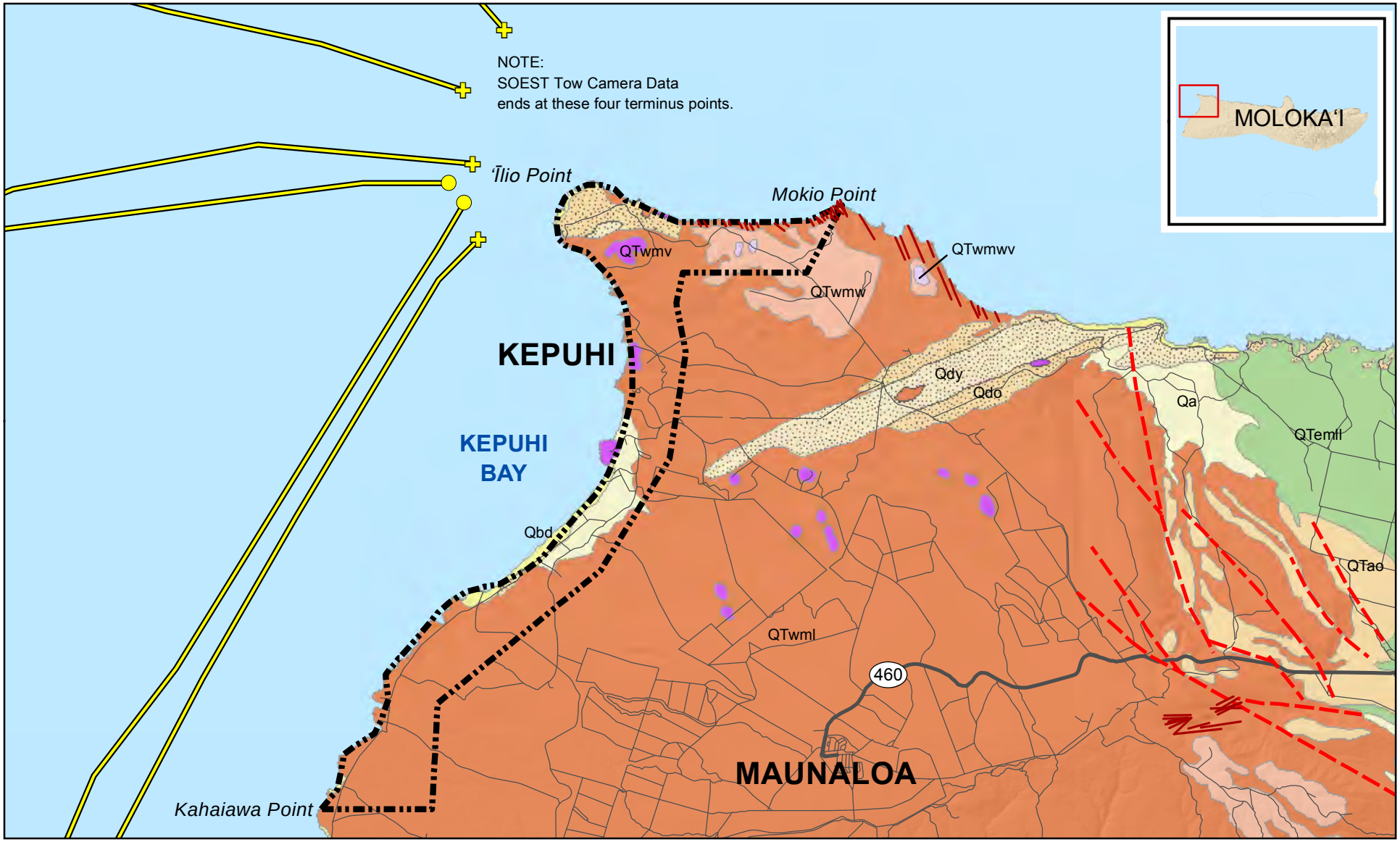
N

0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/28/2012
Data Sources: HI-DBEDT, NOAA, UH-SOEST, AECOM, 2012

Figure 3.3-9



West Moloka'i Landing Site Area: USGS Geology

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Open Water
- Major Fault Line
- Volcanic Dike

USGS Geology

Surficial Deposits
- Qa - Alluvium
- Qbd - Beach
- Qdo - Older dune
- QTao - Older alluvium
- Qdy - Younger dune

West Moloka'i Volcanics
- QTwml - Lava flows
- QTwmv - Vent deposits
- QTwmwv - Vent deposits (Waiele)
- QTwmw - Lava flows (Waiele)

East Moloka'i Volcanics
- QTeml - Lava flows (Lower member)

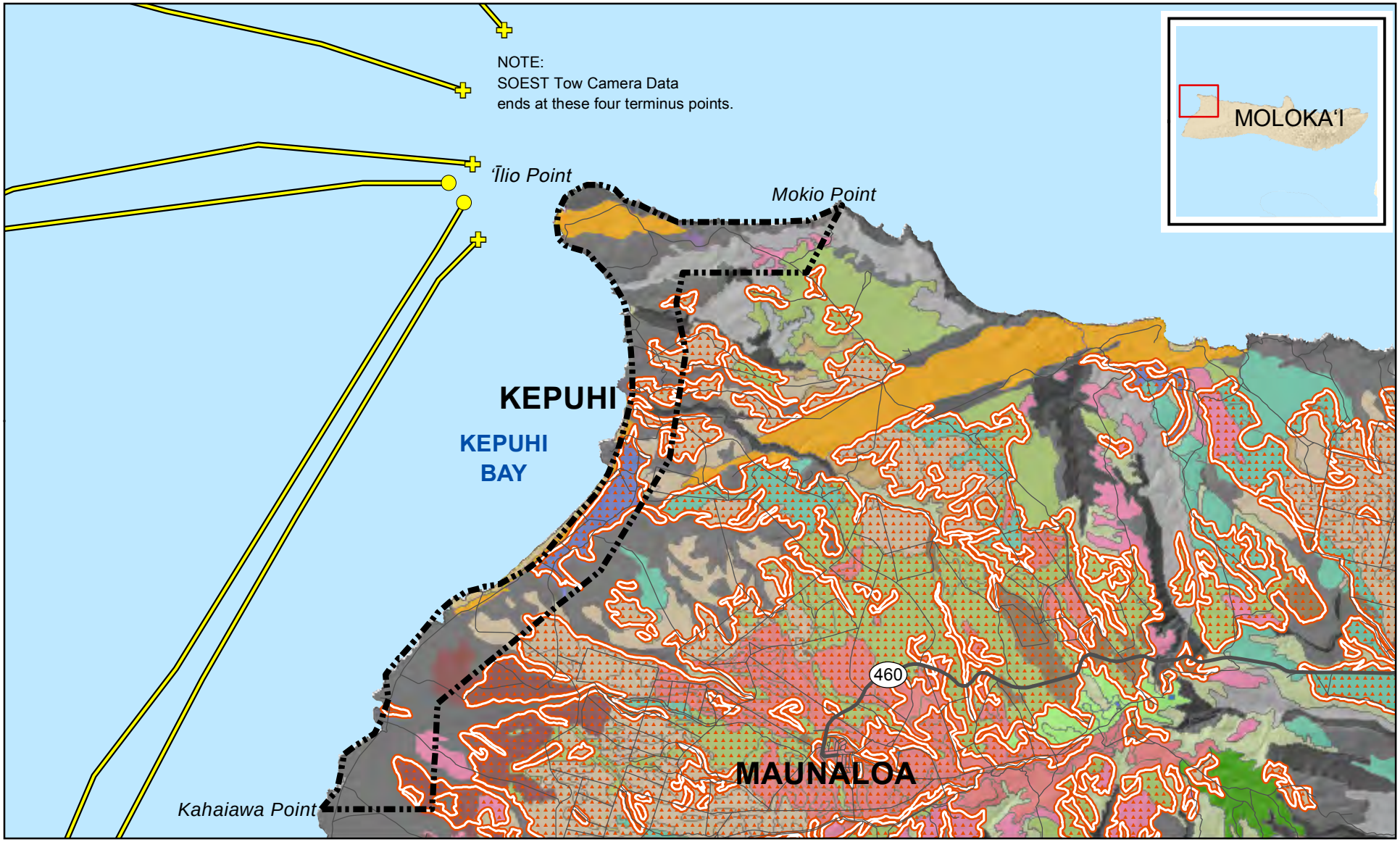
N

0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012
Data Sources: HI-DBEDT, NOAA, USGS, UH-SOEST, AECOM, 2012

Figure 3.3-10



West Moloka'i Landing Site Area: USDA-NRCS Soils and ALISH Areas

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Open Water
- Agricultural Lands of Importance to the State of Hawai'i (ALISH)

USDA-NRCS Soils

Soil Name

- Beaches
- Blown-out land
- Gullied land
- Holomua
- Ho'olehua
- Jaucas
- Kahanui
- Kala'e
- Kānepu'u
- Kapuhikani
- Keālia
- Kō'ele
- Lāhainā
- Lualualei
- Māla
- Marsh
- Moloka'i
- Moloka'i variant
- Pāmoa
- Rock land
- Rock outcrop
- Rough broken land
- Rough mountainous land
- Sandy alluvial land
- Stony alluvial land
- Stony blown-out land
- Uwala
- Very stony land
- Very stony land, eroded
- Waihuna
- Waikapū
- Water > 40 acres

N

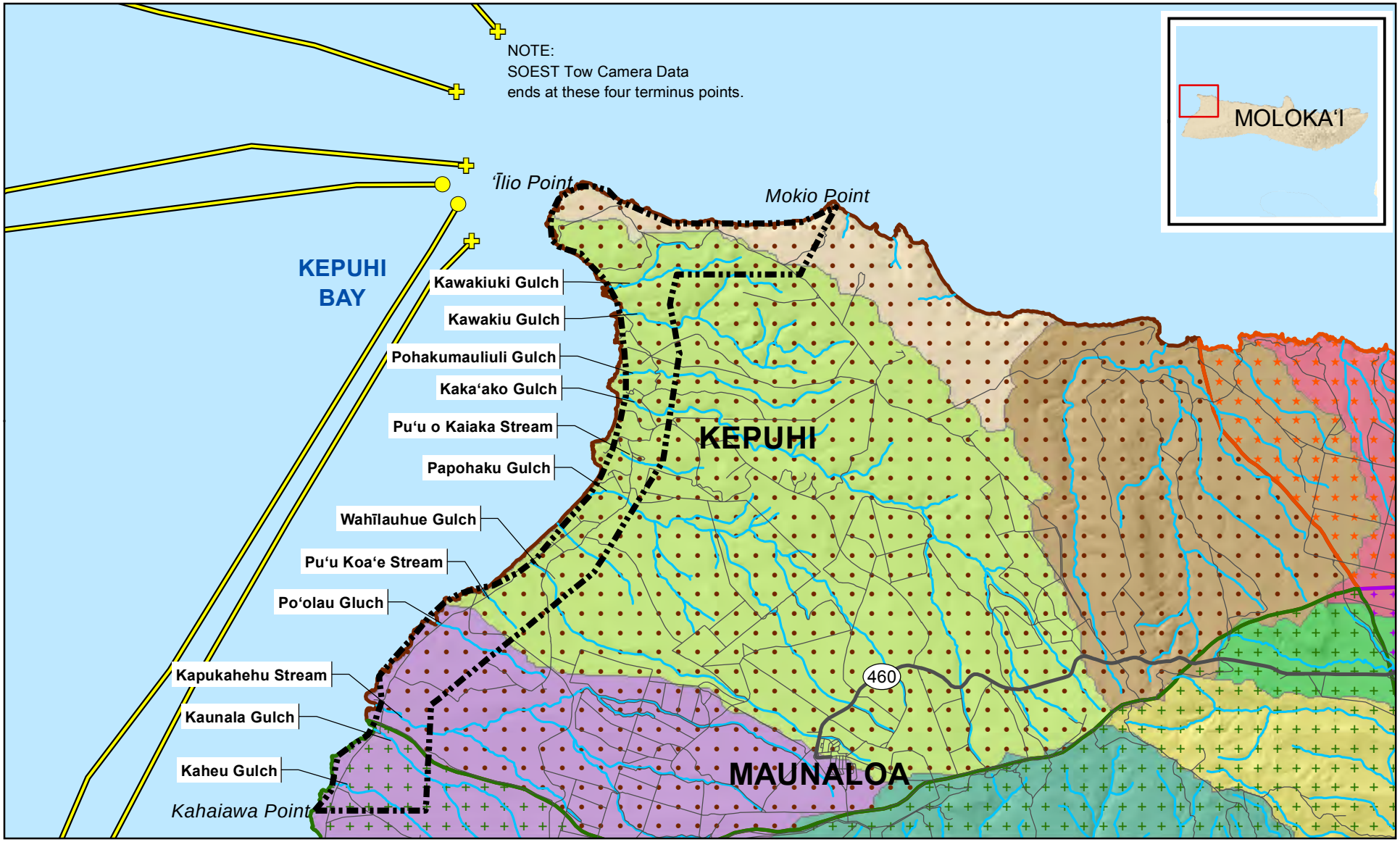
0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012

Data Sources: HI-DBEDT, NOAA, USDA-NRCS, UH-SOEST, AECOM, 2012

Figure 3.3-11



West Moloka'i Landing Site Area: Aquifers and Watersheds

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Drainages, Rivers and Streams
- Open Water

Watersheds

- Papōhaku
- Kaunala
- Ka'a
- Mo'omomi
- Kolo
- Kaluape'elua
- Waiahewahewa
- Maneopāpa

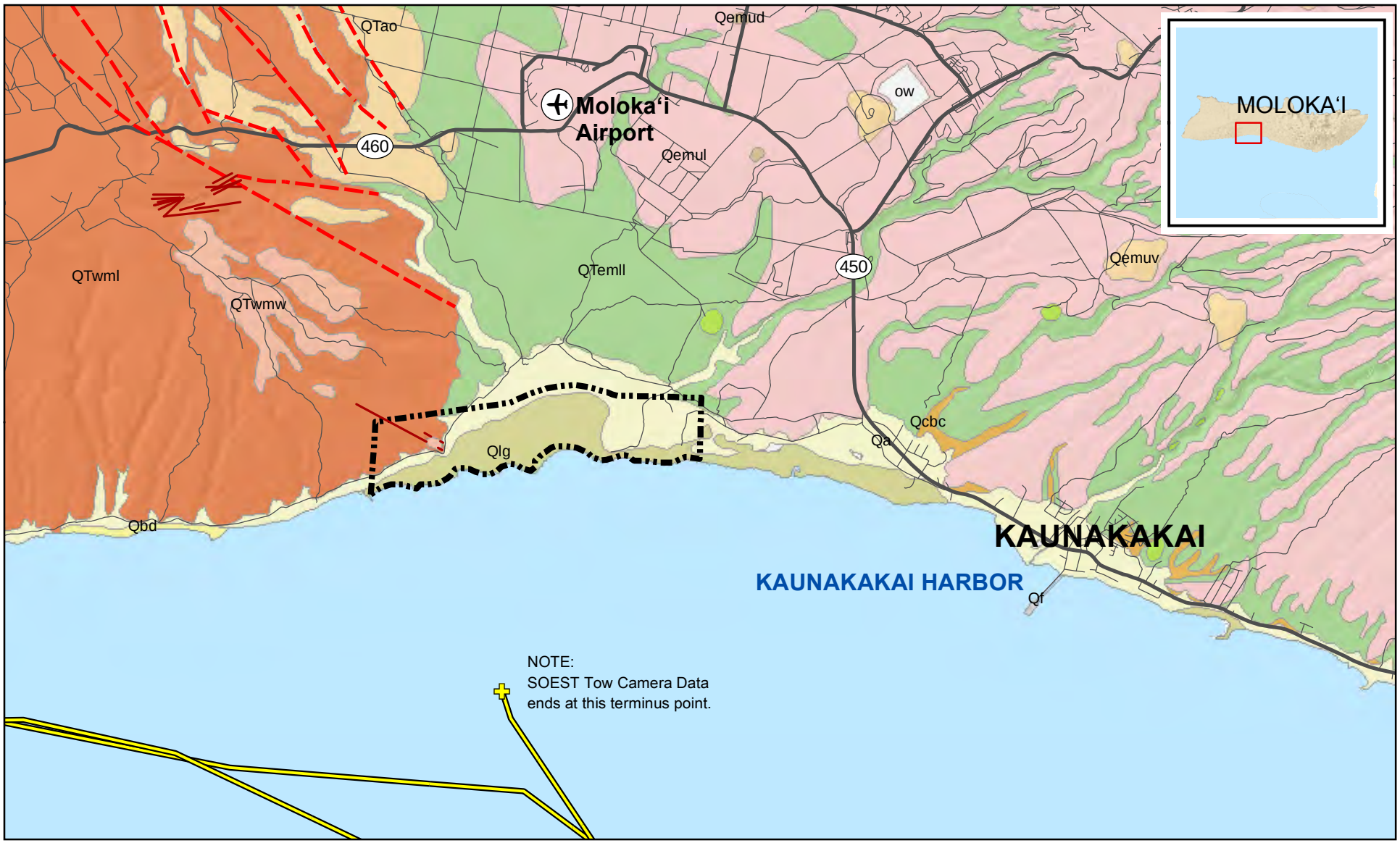
N

0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012
Data Sources: HI-DBEDT, USGS, UH-SOEST, AECOM, 2012

Figure 3.3-12



South Moloka'i Landing Site Area: USGS Geology

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Open Water
- Major Fault Line
- Volcanic Dike

USGS Geology

Map Units
- Open Water

Surficial Deposits
- Qlg - Silt and mud
- Qf - Manmade fill
- Qcbc - Fossiliferous breccia
- Qa - Alluvium
- Qbd - Beach
- QTao - Older alluvium

East Molokai Volcanics
- Qemul - Lava flows (Upper member)
- QTeml - Lava flows (Lower member)
- Qemuv - Vent deposits (Upper member)
- QTemlv - Vent deposits (Lower member)
- Qemud - Domes (Upper member)

West Molokai Volcanics
- QTwml - Lava flows
- QTwmw - Lava flows (Waiele)

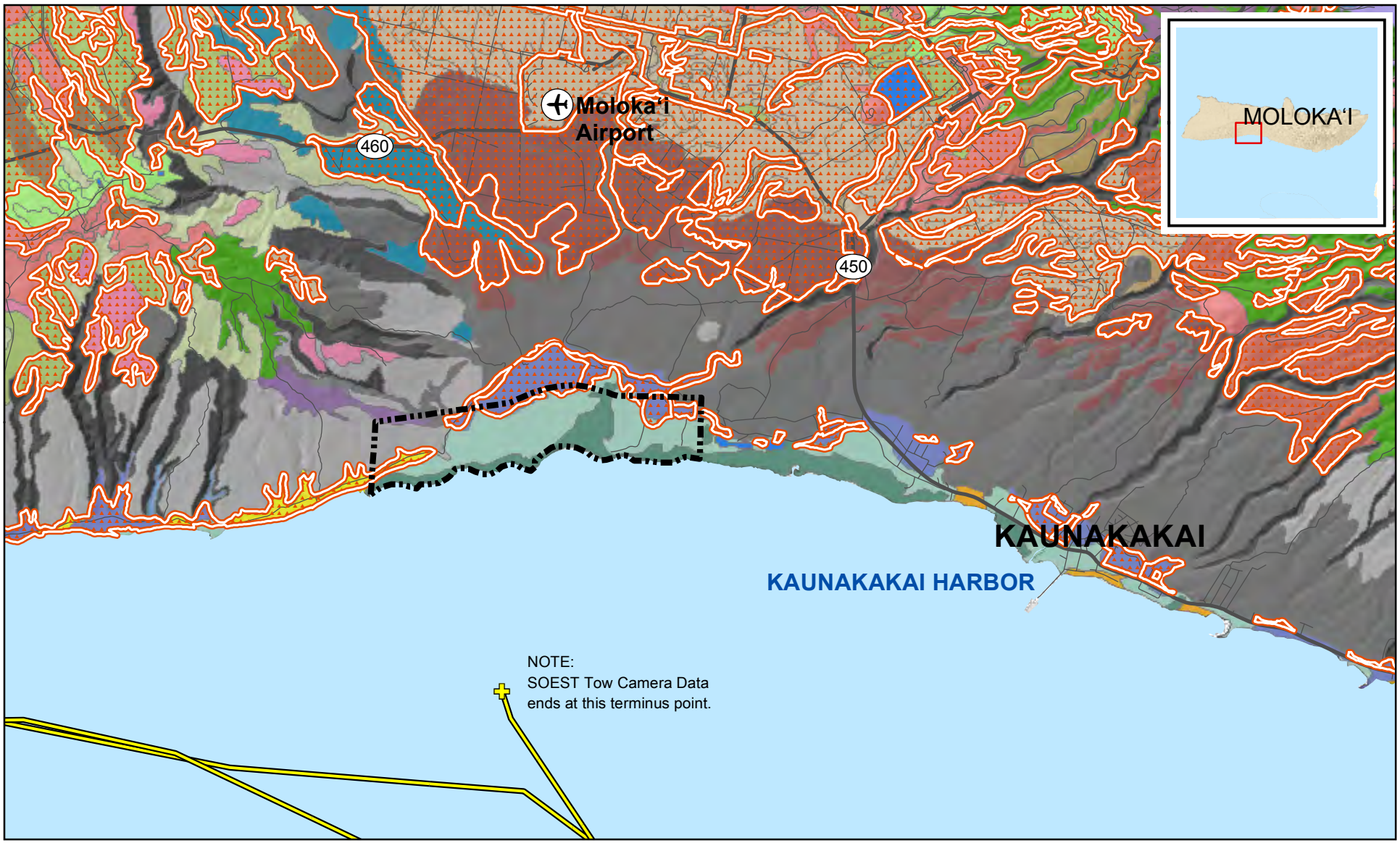
N

0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012
Data Sources: HI-DBEDT, NOAA, USGS, UH-SOEST, AECOM, 2012

Figure 3.3-13



South Moloka'i Landing Site Area: USDA-NRCS Soils and ALISH Areas

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Open Water
- Agricultural Lands of Importance to the State of Hawai'i (ALISH)

USDA-NRCS Soils

Soil Name

- Gullied land
- Hālawa
- Holomua
- Ho'olehua
- Jaucas
- Kahanui
- Kala'e
- Kapuhikani
- Kawaihāpai
- Keālia
- Lāhainā
- Lualualei
- Māla
- Marsh
- Moloka'i
- Moloka'i variant
- Nā'iwa
- 'ōlelo
- 'Oli
- Pāmoa
- Pūlehu
- Rock land
- Rock outcrop
- Rough broken land
- Rough mountainous land
- Stony alluvial land
- Very stony land
- Very stony land, eroded
- Waihuna
- Waikapū
- Water > 40 acres

N

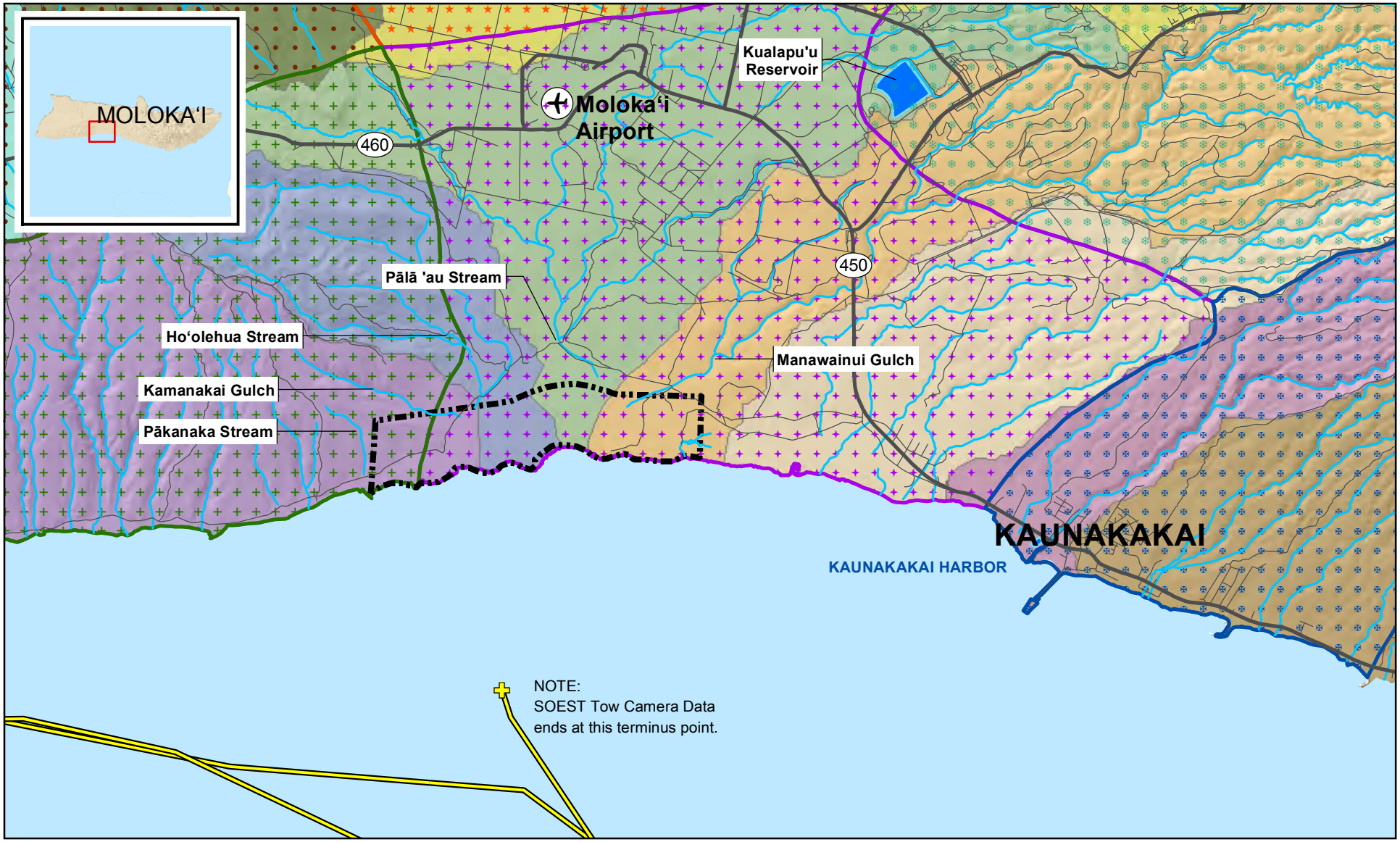
0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012

Data Sources: HI-DBEDT, NOAA, USDA-NRCS, UH-SOEST, AECOM, 2012

Figure 3.3-14



South Moloka'i Landing Site Area: Aquifers and Watersheds

- Route with camera data *
- Route without camera data **
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Drainages, Rivers and Streams
- Freshwater Lake or Pond
- Open Water

- Kaluako'i Aquifer
- Punakou Aquifer
- Ho'olehua Aquifer
- Manawainui Aquifer
- Kamiloloa Aquifer
- Kualapu'u Aquifer

Watersheds

- Kolo
- Waiahewahewa
- Kaluape'elua
- Kamiloloa
- Kalamaula
- Kaunakakai
- Manawainui
- Maneopapa
- Mo'omomi
- Papohaku

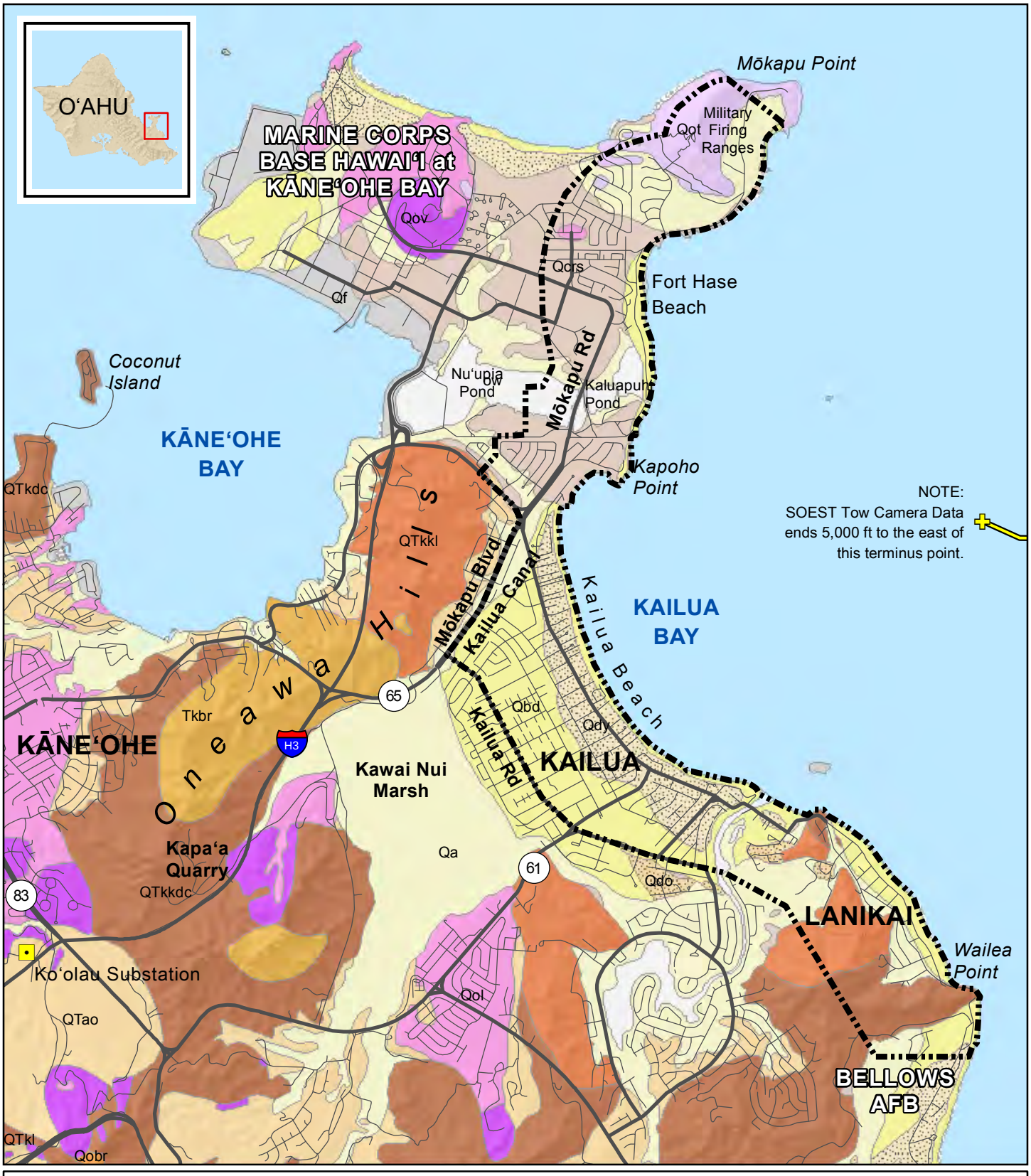
N

0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012
Data Sources: HI-DBEDT, USGS, UH-SOEST, AECOM, 2012

Figure 3.3-15



Kāne'ohe Landing Site Area: USGS Geology

- Route with camera data *
- Route without camera data **
- Identified O'ahu Substation
- Highways & Major Roads
- SOEST Cable Routes
- HIREP Study Analysis Area

USGS Geology Map Unit

- Open Water
- Surficial Deposits
  - Qf - Fill
  - Qbd - Beach
  - Qa - Alluvium
  - Qdy - Younger dune
  - Qdo - Older dune
  - Qcrs - Lagoon and reef
  - QTao - Older alluvium
- Honolulu Volcanics
  - Qol - Lava flows
  - Qobr - Breccia
  - Qov - Vent
  - Qot - Tuff
- Ko'olau Basalt
  - QTkl - Lava flows
  - QTkbr - Breccia
  - QTkdc - Dike complex

N

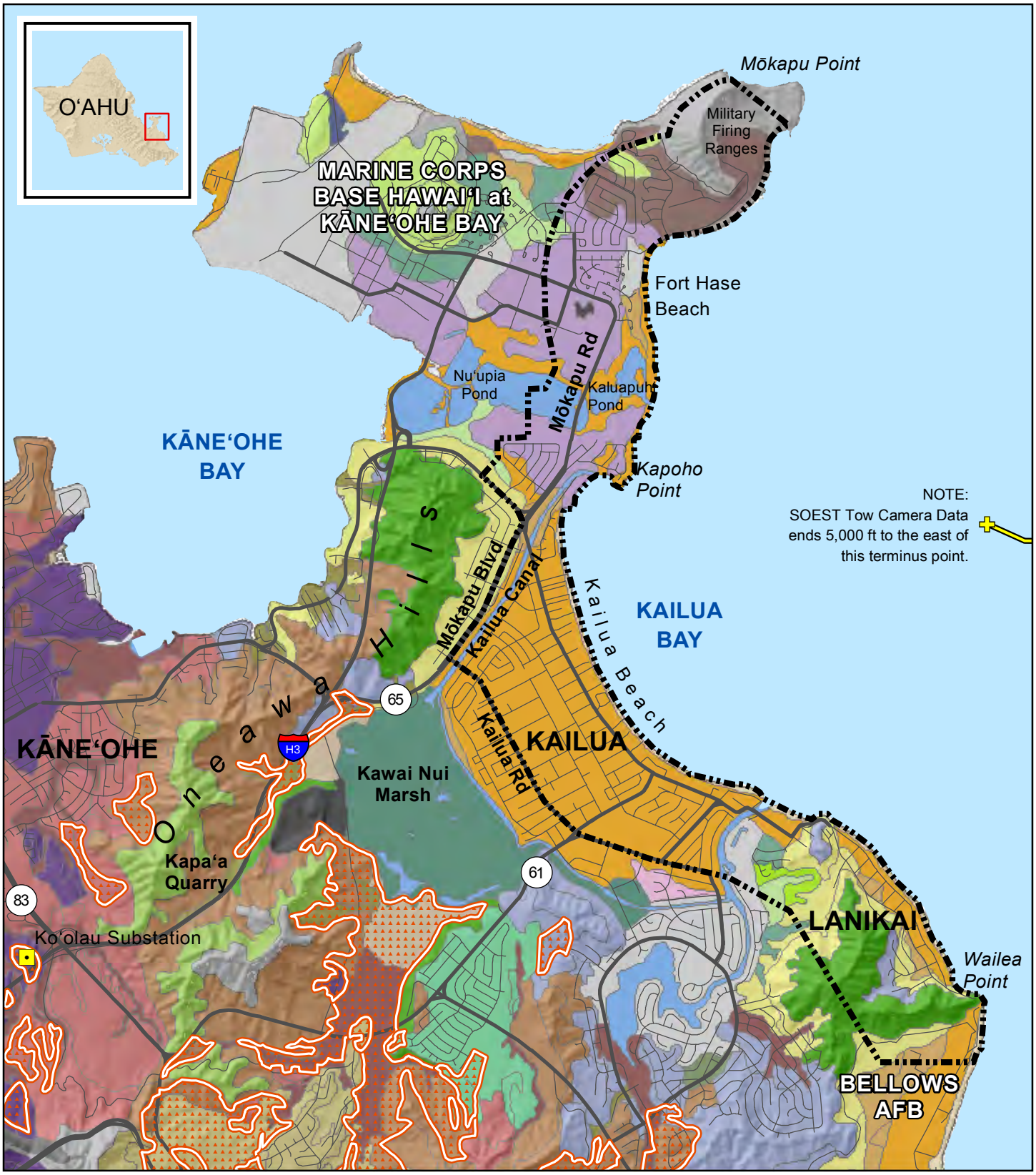
0 1,500 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012

Data Sources: HI-DBEDT, NOAA, USGS, CCH, UH-SOEST, AECOM, 2012

Figure 3.3-16



Kāne'ohe Landing Site Area: USDA-NRCS Soils and ALISH Areas

- Route with camera data *
- Route without camera data **
- Identified O'ahu Substation Location
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Agricultural Lands of Importance to the State of Hawai'i (ALISH)

USDA-NRCS Soils

Soil Name

- Jaucas
- Māmala
- Makalapa
- Kokokahi
- 'Alaeloa
- 'Ewa
- Hale'iwa
- Hanalei
- Helemano
- Honouliuli
- Kaloko variant
- Kāne'ohe
- Kawaihāpai
- Kea'au
- Loleka'a
- Lualualei
- Mokulē'ia
- Moloka'i
- Pāpa'a
- Pearl Harbor
- Pōhākupu
- Waialua
- WaiKāne
- Fill land, mixed
- Rock land
- Rock outcrop
- Stony steep land
- Rough mountainous land
- Quarry
- Marsh
- Water > 40 acres
- Coral outcrop
- Beaches

0 1,000 Feet

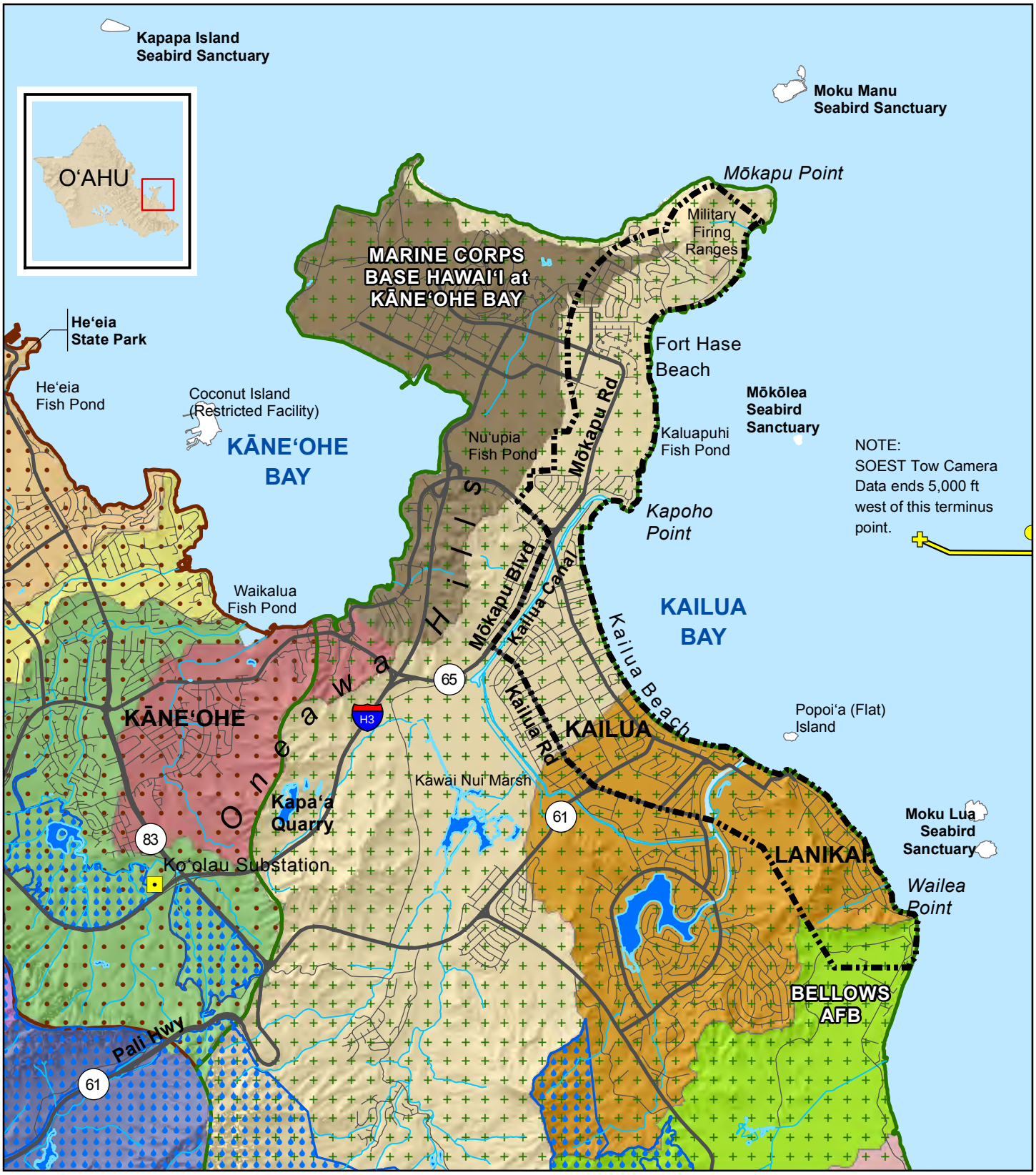
N

Date: 4/26/2012

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Data Sources: HI-DBEDT, NOAA, USDA-NRCS, CCH, UH-SOEST, AECOM, 2012

Figure 3.3-17



Kāne'ohe Landing Site Area: Aquifers and Watersheds

- Route with camera data *
- Route without camera data **
- Identified O'ahu Substation Location
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Drainages, Rivers and Streams
- Freshwater Lake or Pond
- Ko'olaupoko Aquifer
- Waimanalo Aquifer
- Ko'olau Mountain Watershed Partnership

Watersheds

- Kawainui
- Pu'u Hawaiiloa
- Kaelepulu
- Nu'uanu
- He'eia
- Kahawāi
- Kalihi
- Kāne'ohe
- Kawa
- Keā'ahala
- Wāimanalo
- Open Water

N

0 2,500

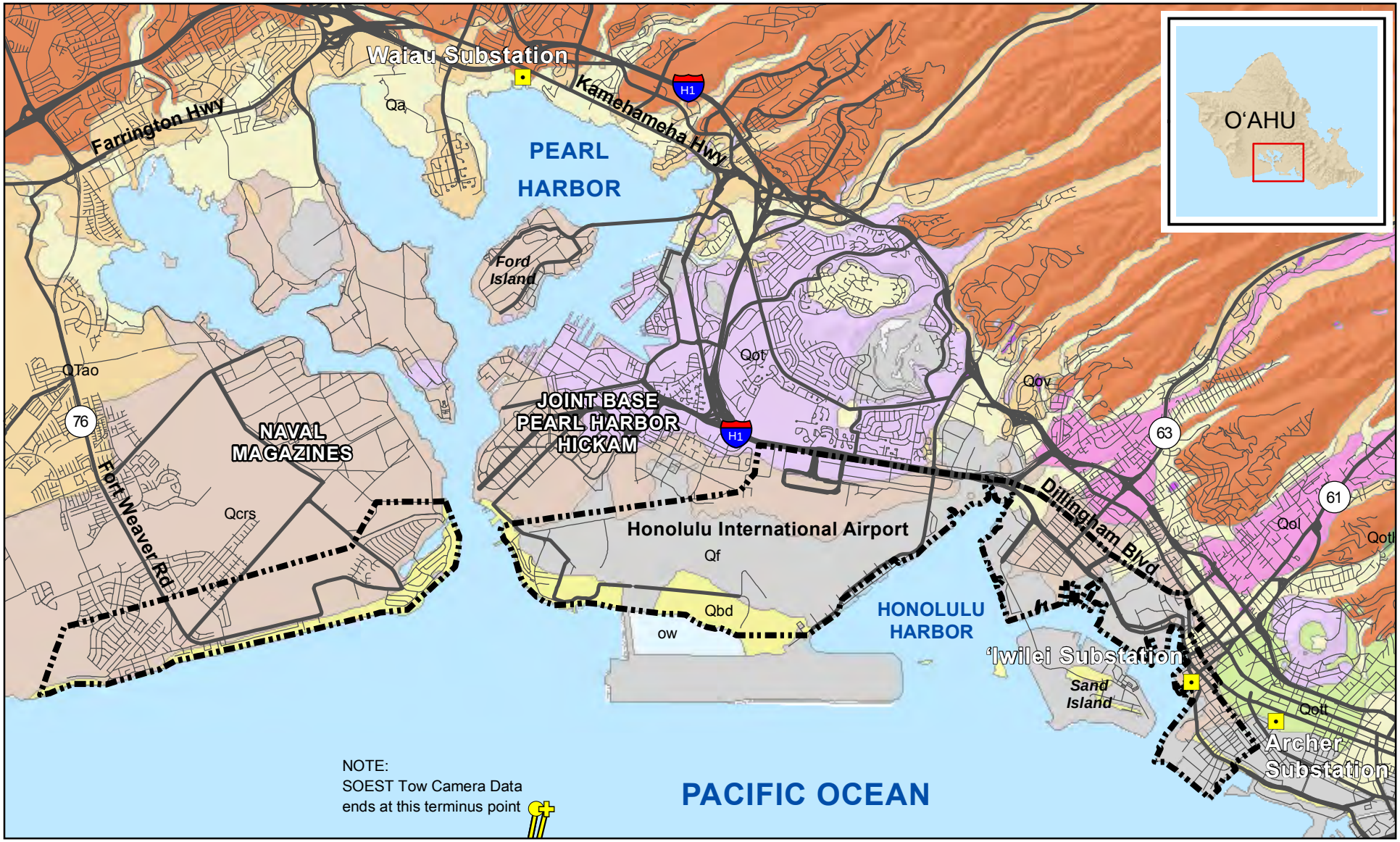
Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012

Data Sources: HI-DBEDT,NOAA, CCH, UH-SOEST, AECOM, 2012

Figure 3.3-18



Pearl Harbor Landing Site Area: USGS Geology

- Route with camera data *
- Route without camera data **
- Identified O'ahu Substation Locations
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area

USGS Geology Map Unit

- Open Water

Ko'olau Basalt

- QTkl - Lava flows

Surficial Deposits

- Qf - Fill
- Qbd - Beach
- Qa - Alluvium
- QTao - Older alluvium
- Qcrs - Lagoon and reef

Honolulu Volcanics

- Qol - Lava flows
- Qov - Vent
- Qott - Lava flows (Tantalus member)
- Qotl - Vent (Tantalus member)
- Qot - Tuff

N

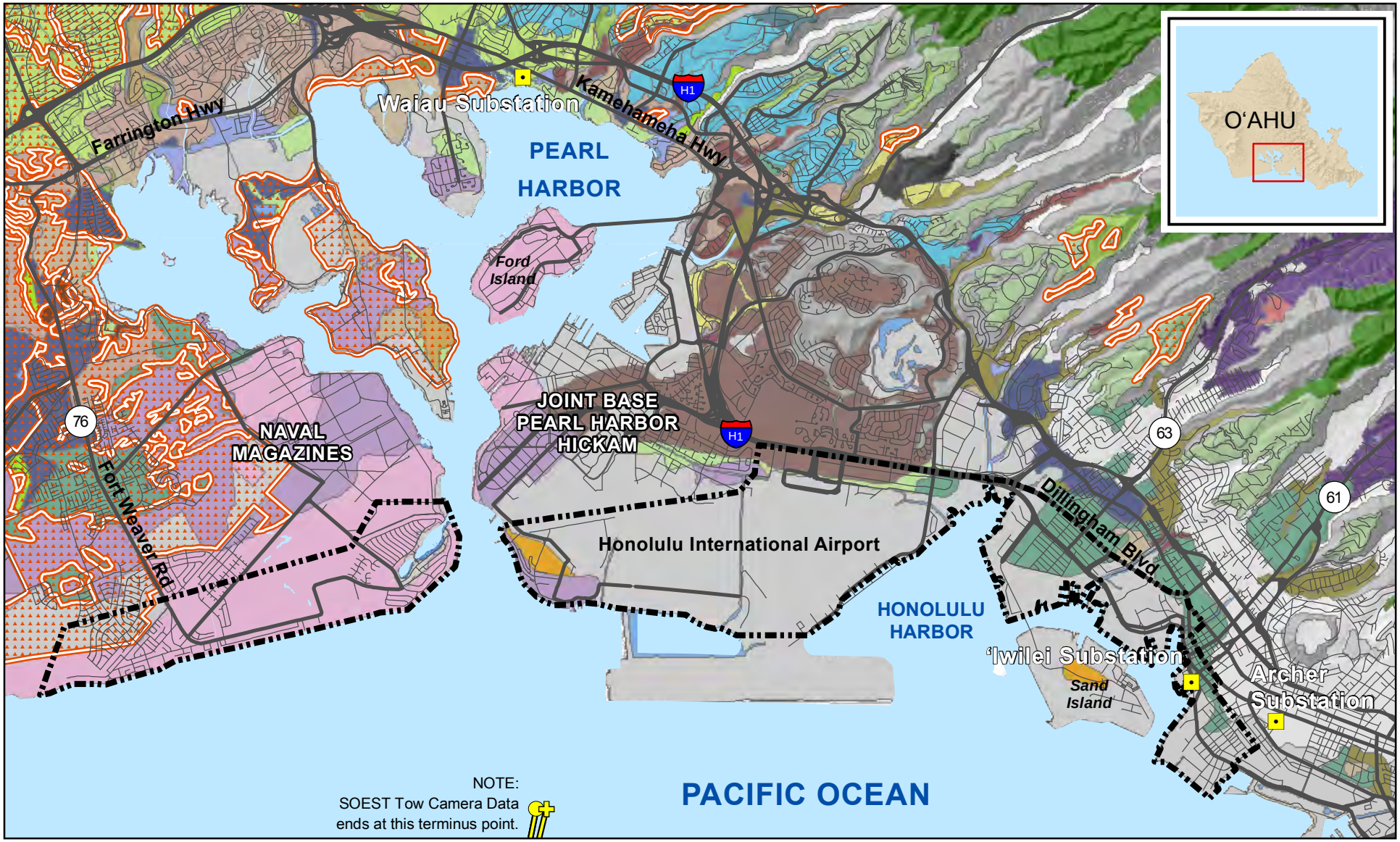
0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/26/2012

Data Sources: HI-DBEDT, USGS, CCH, UH-SOEST, AECOM, 2012

Figure 3.3-19



Pearl Harbor Landing Site Area: USDA-NRCS Soils and ALISH Areas

- Route with camera data *
- Route without camera data **
- Identified O'ahu Substation Locations
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Agricultural Lands of Importance to the State of Hawai'i (ALISH)

USDA-NRCS Soils

Soil Name

- 'Alaeloa
- Beaches
- Coral outcrop
- 'Ewa
- Fill land, mixed
- Hale'iwa
- Hanalei
- Helemano
- Honouliuli
- Jaucas
- Kaloko variant
- Kāne'ohe
- Kawaihāpai
- Kea'au
- Kokokahi
- Kolekole
- Kunia
- Lahaina
- Loleka'a
- Lualualei
- Mahana
- Makalapa
- Māmala
- Mānana
- Marsh
- Mokulē'ia
- Moloka'i
- Pāpa'a
- Pearl Harbor
- Pōhākupu
- Pūlehu
- Quarry
- Rock land
- Rock outcrop
- Rough mountainous land
- Stony land
- Stony steep land
- Tropaquepts
- Tropohumults
- Wahiawa
- Waialua
- WaiKāne
- Waipahū
- Water > 40 acres

N

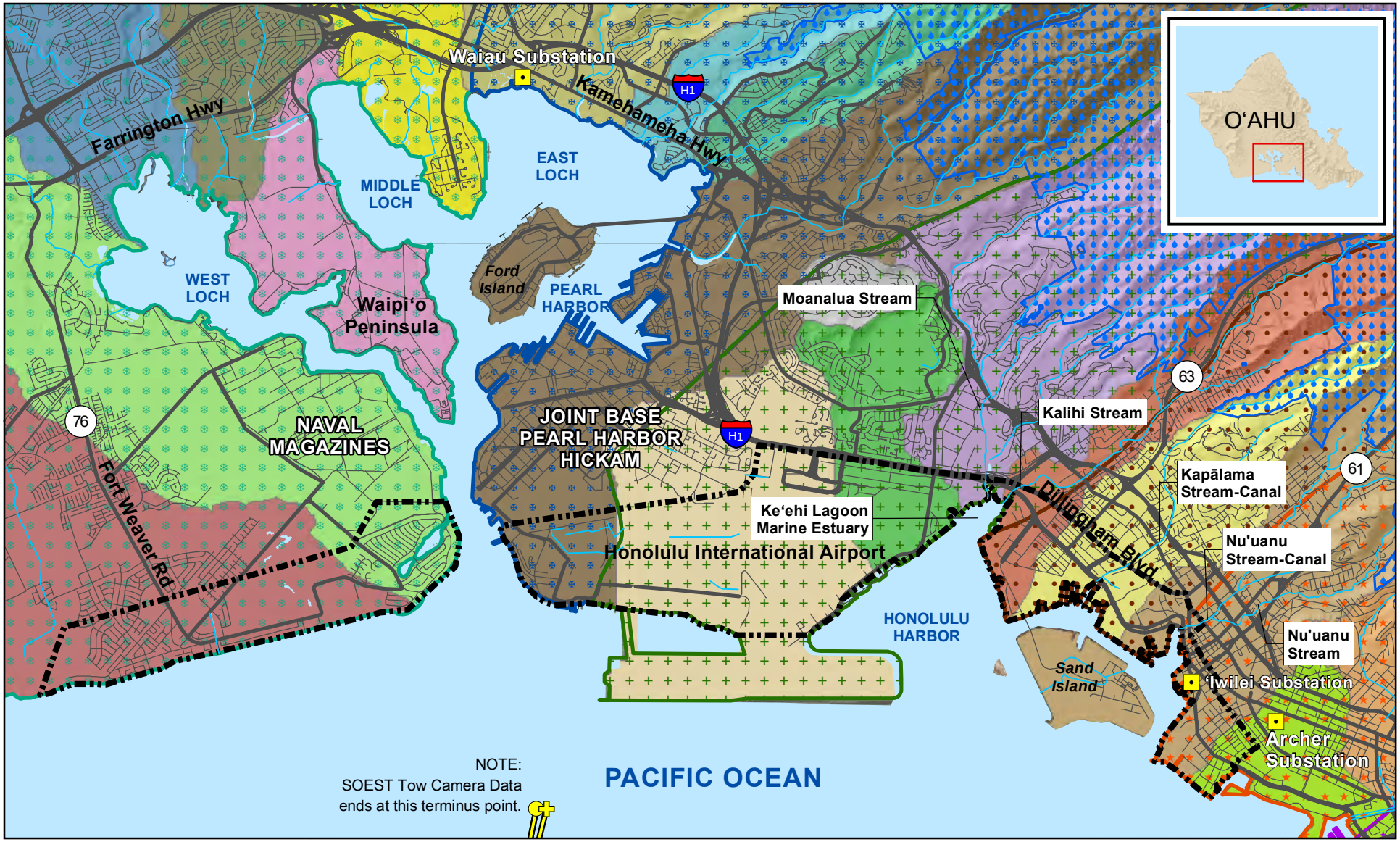
0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/29/2012

Data Sources: HI-DBEDT, CCH, USDA-NRCS, UH-SOEST, AECOM, 2012

Figure 3.3-20



Pearl Harbor Landing Site Area: Aquifers and Watersheds

- Route with camera data *
- Route without camera data **
- Identified O'ahu Substation Locations
- Highways & Major Roads
- Other Roads
- SOEST Cable Routes
- HIREP Study Analysis Area
- Drainages, Rivers and Streams
- Ko'olau Mountain Watershed Partnership
- Open Water

Aquifers

- Kalihi Aquifer
- Moanalua Aquifer
- Nu'uanu Aquifer
- Palolo Aquifer
- Waimalu Aquifer
- Waipahu-Waiawa Aquifer

Watersheds

- Aiea
- Ala Wai
- Hālawa
- Honouliuli
- Kalauao
- Kalihi
- Kaloi
- Kapakahi
- Kapālama
- Ke'ehi
- Makiki
- Manuwai
- Moanalua
- Nu'uanu
- Salt Lake
- Waiawā
- Waikele
- Waimalu
- Waipi'o

N

0 5,000 Feet

* Symbol denotes shoreward extent of tow camera data for cable route (unless otherwise noted).
** Symbol denotes shoreward approach of cable route without tow camera data.

Date: 4/27/2012

Data Sources: HI-DBEDT, USGS, CCH, UH-SOEST, AECOM, 2012

Figure 3.3-21

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3.4 LAND TRANSPORTATION

3.4.1 Resource Definition

Land transportation typically refers to travel movements by roads and/or rails. The transportation operations in the landing site areas would primarily focus on road transportation.

According to the Federal Highway Administration (FHWA), roadways are classified based on FHWA Functional Classification Guidelines.[3] The functional classification is the process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide. The process recognizes the travel movement of individual roads and streets through a network of roads in both urban and rural areas. According to the Guidelines, the hierarchy of roadway systems can be defined as below:

- Urban/rural principal arterials: Principal arterials refer to roadways that carry the major portion of trips entering and leaving the urban/rural area, as well as the majority of through movements desiring to bypass the central city/town. This type of roadway access includes interstate highway, other freeways and expressways, and other principal arterials with no control of access.
- Urban/rural minor arterial streets: Minor arterial streets include all arterials that are not classified as a principal and contain facilities that place more emphasis on land access than the higher system, and offer a lower level of traffic mobility. This type of access includes state highway/state roads and streets that link cities to larger towns such as major resort areas.
- Urban/rural collector streets: Collector streets refer to roadways that serve travel of primarily intra-county with moderate speeds. In urban areas, collector streets provide both land access service and traffic circulation within residential neighborhoods, and commercial and industrial areas. Collector streets also collect traffic from local streets and channel it to the arterial system.
- Urban/rural local streets: Local streets are those provide direct access to adjacent land and access to collector streets and/or sometimes minor arterial streets in a rural area. This type of street offers the lowest level of mobility. In some rural areas, they can be referred as unpaved roads and dirt roads that require a four-wheeler.

[3] The FHWA Functional Classification Guidelines are adapted from two previous FHWA manuals associated with functional highway classification that were prepared during 1969–1971. The Federal-Aid Highway Act of 1973 mandated the use of a functional highway classification to update and modify the federally funded highway system by July 1, 1976; and the requirement continues to be in place today.

Terrestrial including Shoreline

The transportation operations in the landing site area would primarily focus on road transportation. The delivery of heavy equipment and materials needed for site preparation and foundation construction is necessary, and the equipment and materials would be moved to the site by flatbed combination trucks. The movement of equipment and materials would go through a variety of access including interstate freeway, state highway, collector roads, local streets, and shoreline access roads.

Marine

The topic of marine transportation is addressed in Section 3.6 of this document.

3.4.2 Regulatory Setting

In the state of Hawai‘i, there are three types of administrators of public roads:

- U.S. Department of Transportation administers the Interstate Highway System (O‘ahu only);
- State of Hawai‘i, Department of Transportation, Highways Division (HDOT) administers state highways and roads under state administration; and
- Counties of Honolulu, Kauai, Hawai‘i, Maui administer county roads.

The HDOT Highways Division provides rules and regulations governing the movement of oversize and overweight vehicles or loads on state highways. HAR Title 19 Chapter 104 describes the purpose of issuance of policies and procedures for the movement of overweight vehicles as follows.

(1) To protect the general public from traffic hazards created by the movement;

(2) To give due regard to the comfort and conveniences of other motorists on the highway and to guard against undue hindrance to the normal flow of traffic; and

(3) To prevent damage to pavement, highway facilities and structures.

3.4.3 Region of Influence

The ROI is defined by the area from a harbor where project components would be shipped to, to a delivery site in a landing site area.

Maui

1. Maui-Kahului Harbor. The ROI is Kahului Deep Harbor and the towns of Kahului Wailuku, and Kanaha on the north end of the island isthmus.
2. Maui-Kapalua. The ROI is from Kahului Deep Harbor to the town of Kapalua on the northwest tip of the island.

Lānaʻi

1. North-West Lānaʻi. The ROI on Lānaʻi is from Kaumalapau Harbor to the western and northern perimeters of the island.

Molokaʻi

1. West Molokaʻi-Kaluakoi. The ROI is from Kaunakakai Harbor to the West End near Kepuhi, between Mokio Point and Kahaiawa Point.
2. South Molokaʻi-Kaunakakai. The ROI is from Kaunakakai Harbor to the part of the island south of the Hoolehua Airport between Kaunakakai town and Hale O Lono Harbor.

Oʻahu

1. MCBH at Kāneʻohe Bay. The ROI is from Honolulu Harbor to MCBH at Kāneʻohe Bay, and the town of Kailua.
2. Pearl Harbor. The ROI is from Honolulu Harbor to the southeastern side of the town of Ewa Beach, Honolulu International Airport, Joint Base Pearl Harbor-Hickam (JBPHH), Downtown, and Kakaako Makai.

3.4.4 Affected Environment

General

The affected environment associated with land transportation is typically the road condition and the transportation system. During the construction and operation period, frequent use of heavy load trucks for equipment and material delivery is anticipated. This may affect the current roadway condition and result in potential impacts.

In Hawaiʻi, the existing land transportation system is dominated by automobiles (Department of Planning and Permitting 2004; County of Maui 2010). Transportation-related activities including equipment delivery may need to rely heavily on road infrastructure. Description of existing road condition and relevant traffic system for specific landing site areas is as follows.

Maui County-Oʻahu Routing Specific

Maui

Maui-Kahului Harbor

Terrestrial

Kahului is a major center of activity in the landing site area on the island of Maui. It is located at the northern isthmus of the island and generates much of the traffic for the island. Due to its proximity from Kahului Deep Harbor and Kahului Airport, Kahului town also serves as a central receiving point for interisland shipment and visitors from neighbor islands and the U.S. mainland.

Kahului has six major arterial accesses (Figure 3.4-1) that provide direct connectivity to Waihee, Waiehu, Wailuku, Waikapu, Puunene, Kahana, and Paia (counterclockwise from west to east). Route 30 and Route 32 serve traffic from Kahului Harbor to Wailuku and Waikapu. Route 30 continues south along the western shoreline extended to Keawalua. Route 36 serves traffic between Hana and Kahului and passes by Paia and Kahana. Route 311 provides access to Puunene then farther south to Kihei. Route 340 is a scenic road routing along the northwestern shoreline of the island. It is accessed by Kahului Beach Road and later merges to Waiehu Beach Road. Route 340 meets Route 30 at Keawalua. Route 380, where it bridges between Route 36 and Route 30, provides a shortcut transporting vehicles between Paia and Maalaea.

In general, roadways in the vicinity of Kahului are paved and in good condition:

- Route 30 (Honoapiilani Highway) is a major arterial roadway that consists of two lanes with pedestrian sidewalk on one side. Route 30 passes through Wailuku and its historic and civic center districts. Route 30 also passes through a major residential area.
- As shown in Figure 3.4-2, Route 32 (Kaahumanu Avenue) is a major arterial roadway that consists of four lanes with grass median and bike lanes. Route 32 opens up to a six-lane roadway from Kahului Beach Road to east of Wharf Street. It is located along major commercial, residential, and entertaining areas where a large amount of traffic is often anticipated. Route 32 also serves as a major connection between Kahului Harbor, Kahului Airport, and the old Wailuku Town that serves as one of many visitor attractions on the island of Maui.
- Route 36 (Hana Highway) is a major arterial roadway that consists of six lanes with a landscaped median. This six-lane roadway, however, becomes a two-lane roadway headed to Hana after passing Route 37, Haleakalā Highway, and Kahului Airport. Route 36 in Kahului passes through commercial and industrial areas.

- Route 311 (Mokulele Highway) is a major arterial roadway that consists of four lanes with a double yellow-striped median. Route 311 serves as a connection between Kahului Harbor and Kihei town. After passing Route 380 and Kahului town, Route 311 penetrates through a large amount of agricultural lands. The condition of the pavement may be capable of handling heavy truckloads. There is no curb or gutter and no sidewalks.
- Route 340 (Kahekili Highway) is a major arterial roadway that consists of two lanes with no sidewalks, no curbs, and no gutters. It is a scenic roadway that connects to Kahului Harbor via two major arterials—Kahului Beach Road and Waiehu Beach Road—which move through a major residential area. Route 340 travels through the northern mountain ridge and merges with Route 30 at Honokohau Bay.
- As shown in Figure 3.4-3, Kahului Beach Road/Waiehu Beach Road are two minor major arterial roadways. Kahului Beach Road is a four-lane road with a double yellow-striped median. Waiehu Beach Road is a two-lane road passing through a major residential area. Kahului Beach Road and Waiehu Beach Road are part of Route 340.
- Route 380 (Kuihelani Highway) is a major arterial roadway that consists of four lanes with a low maintenance grass median and intermittent center turn lanes. Route 380 passes through large agricultural lands bridging between Route 311 and Route 30. Route 380 may be capable of handling overweight truckloads due to the current condition of the pavement.

Table 3.4-1 provides information regarding the roadway system hierarchy in the Maui-Kahului Harbor landing site area and its relevant roadway condition and capability.

State Waters

The topic of marine transportation is addressed in Section 3.6 of this document.

Maui-Kapalua (West Maui)

Terrestrial

Kapalua is located on the northwestern side of Maui Island. It is an important visitor destination with scenic golf courses, resorts, and public beaches. Kaanapali and Lahaina are the two historic towns adjacent to Kapalua that serve as the region's visitor, service, commercial, and residential center. They are located along Route 30 and receive a high volume of local and visitor traffic daily.

Currently only two major arterials roads serve traffic entering Kapalua (Figure 3.4-1):

- As shown in Figure 3.4-4, Route 30 (Honoapiilani Highway) is a major arterial road that consists of two lanes with shoulders, intermittent turn lanes, and bikeways. Bicycling is a popular activity on Route 30. The condition of the pavement is good but it may not be able to handle heavy loads.
- As shown in Figure 3.4-5, Route 340 (Kahekili Highway) is a major arterial roadway that consists of two lanes with no sidewalks, no curbs, and no gutters. Route 340 penetrates through the northern mountain ridge and connects with Route 30 at Honokohau Bay. Route 340 has many turns and an uneven number of lanes during the course of passage, and portions of the unpaved roads may not be ideal for oversize vehicle use.

State Waters

The topic of marine transportation is addressed in Section 3.6 of this document.

Lānaʻi

Terrestrial

The Lānaʻi landing site area is located along the western and the northern perimeter of the island. This area is mostly undeveloped.

- Route 440 (Kaumalapau Highway) is the only principal arterial road on the island of Lānaʻi (Figure 3.4-6). Route 440 serves Lānaʻi City and is mostly in good condition. The highway leads traffic from Manele Bay, east of Lānaʻi, toward the west of Lānaʻi Island. After passing Lānaʻi City, Kaumalapau Highway merges as Kanepuu Highway and later becomes Awalua Highway. Awalua Highway is an unpaved road with rocks and dirt on the surface. Awalua Highway leads travel movements to beaches and partly undeveloped trails including Kahua Trail, Lapaiki Trail, Polihua Trail (Figure 3.4-7), and Kaena Trail (counterclockwise from north to south in Figure 3.4-6). Although Route 440 connects to both Kaumalapau Harbor and Manele Small Boat Harbor, access to the landing site area is unpaved trail that requires the use of a four-wheel drive vehicle. (Oceanit 2005)

Table 3.4-2 provides information regarding the roadway system hierarchy in the landing site area and its relevant roadway condition and capability.

State Waters

The topic of marine transportation is addressed in Section 3.6 of this document.

Molokaʻi

Molokaʻi-Kaluakoi (West Molokaʻi)

Terrestrial

The landing site area is located on the island's west end at Papohaku Beach and the northwestern tip at ʻIlio Point. Kaluakoi in the landing site area is a former major resort on the beach with an adjoining golf course.

Five major arterials are on Molokaʻi: Routes 450, 460, 465, 470, and 480 (Figure 3.4-8). The landing site area can be accessed using Route 460 to Kaluakoi Road. Parts of the landing site area, including ʻIlio Point, contain unimproved access. The area may be accessed with the use of a four-wheel drive or on horseback.

- Route 460 (Maunaloa Highway) is a major arterial roadway connecting Kaunakakai Harbor and the town of Maunaloa near the west end. Route 460 is a paved two-lane road and mostly in good condition. Route 460 connects to Kaluakoi Road toward the landing site area to the north and Pohakuloa Road to the south toward Hale O Lono Harbor at the intersection of Maunaloa Village (Oceanit 2005)

Table 3.4-3 provides information regarding the roadway system hierarchy in the Molokaʻi-West landing site area, roadway condition, and capability.

State Waters

The topic of marine transportation is addressed in Section 3.6 of this document.

Molokaʻi-Kaunakakai (South Molokaʻi)

Terrestrial

The landing site area is located south of the Hoolehua Airport, between the Kaunakakai town and Hale O Lono Harbor. Access to the landing site area is through the use of Route 460 to Hoawa Road and Ulili Road. Some segments of the roads are only partially paved; some parts of the landing site area can only be reached by accessing unmarked roads (Oceanit 2005)

State Waters

The topic of marine transportation is addressed in Section 3.6 of this document.

Oʻahu

Oʻahu-MCBH at Kāneʻohe

Terrestrial

The landing site area is located in Koolaupoko region on the windward side of Oʻahu and includes portions of MCBH at Kāneʻohe Bay, Kailua town, and Lanikai. MCBH at Kāneʻohe Bay is a federal land managed and controlled by the U.S. Marine Corps; access is restricted to military-related traffic. Kailua is a major urban community in Koolaupoki and generates major traffic for the region. Lanikai is a bedroom community abutting Kailua to the southeast.

Four major arterial roadways are in the landing site area (Figure 3.4-9). MCBH at Kāneʻohe Bay is accessed by Interstate 3 (H-3) and Route 65—two major north-south arterial roadways. Kailua is primarily accessed by a major arterial (Route 61), which connects Kailua and downtown Honolulu. The landing site area can also be accessed via Route 63, a north-south road. Route 72 is an alternative route for traffic entering Kailua town. This route goes along east side of the shoreline and cuts into Route 61 before entering Kailua. It is a scenic route that serves major tourist traffic daily on the island. Among the above-mentioned major arterial routes, Route 61 and Route 65 provide connections to the collector roads and some local streets.

Of the four major arterials mentioned, four are in good condition and serve medium to high amounts of traffic daily:

- As shown in Figure 3.4-10, Interstate Route H-3 (John A. Burns Freeway) is a major arterial roadway consisting of four lanes with shoulders and a raised median. Portions of H-3 are two-way viaducts. H-3 is structurally capable of handling heavy truckloads. H-3 is also a scenic route carrying traffic to the island's many recreational areas on the windward side. H-3 provides direct connection to MCBH at Kāneʻohe Bay.
- As shown in Figure 3.4-11, Route 61 (Pali Highway) is a major arterial roadway consisting of four lanes with a raised median and street lights along the road. Route 61 is a major commuter route for the Kailua-downtown traffic. Route 61 is also a scenic route providing connections to several scenic lookouts as well as carrying traffic to the island's many recreational areas on the windward side. Route 61 also carries the island's bus ("The Bus") routes between downtown and the windward side.
- Route 63 (Likelike Highway) is a major arterial roadway consisting of four lanes with a raised median. Route 63 carries a high volume of traffic between Honolulu and Kāneʻohe. It traverses the Koolau Mountain Range and provides direct access to MCBH at Kāneʻohe Bay.

- As shown in Figure 3.4-12, Route 65 (Kāneʻohe Bay Drive) is a minor arterial roadway and consists of two lanes. Route 65 is structurally in good condition but may not be capable of handling heavy truckloads due to its capacity mostly as a residential purpose road. Route 65 provides direct connection to MCBH at Kāneʻohe Bay.

Table 3.4-4 provides information regarding the roadway system hierarchy in the landing site area, roadway condition, and capability.

State Waters

The topic of marine transportation is addressed in Section 3.6 of this document.

Oʻahu-Pearl Harbor

Terrestrial

The landing site area spans from Central Oʻahu, in the town of Ewa Beach, to metropolitan Honolulu, encompassing JBPHH, Honolulu International Airport, Honolulu Harbor, Downtown, and Kakaako Makai. Access to JBPHH is restricted to military-purpose vehicles only.

There are three major arterial roadways carrying traffic through the landing site area, from Downtown to the west side of the island (Figure 3.4-9). These roads include the Interstate Highway 1 (H-1), Route 76, and Route 92. Route 92 is the only major arterial roadway that passes through the landing site area and that connects to collector roads and local streets.

In general, three major arterial roadways are in good condition and serve high-volume local and tourist traffic daily:

- As shown in Figure 3.4-13, H-1 (Queen Liliuokalani Freeway) is a major arterial roadway consisting of six lanes with a raised median. H-1 is the most used arterial of Hawaiʻi and is overall in good condition. H-1 passes through Honolulu's major commercial, residential, and entertainment areas. H-1 also provides connection to Honolulu Harbor, JBPHH, and Honolulu International Airport.
- As shown in Figure 3.4-14, Route 76 (Fort Weaver Road) is a major arterial roadway consisting of four lanes. Route 76 provides connection to Pearl Harbor West Loch and the Naval Magazines (ammunition storage). Route 76 primarily serves the Ewa community area and is a major thoroughfare carrying traffic from densely developed residential areas. Route 76 is structurally capable of handling heavy truck and is in good condition.
- As shown in Figure 3.4-15, Route 92 (Nimitz Highway/Ala Moana Boulevard) is a major arterial roadway consisting of six lanes with a landscaped median and bike lanes on

both sides. Route 92 carries a large volume of traffic daily. Route 92 passes through the landing site area and several major industrial areas, including Honolulu Harbor. Route 92 is structurally capable of handling heavy-duty truck movements.

Table 3.4-5 provides information regarding the roadway system hierarchy in the landing site area, roadway condition, and capability.

State Waters

The topic of marine transportation is addressed in Section 3.6 of this document.

Federal Waters

Bureau of Ocean Energy Management (BOEM) Jurisdiction

The topic of marine transportation is addressed in Section 3.6 of this document.

National Oceanic and Atmospheric Administration (NOAA) Jurisdiction

The topic of marine transportation is addressed in Section 3.6 of this document.

3.4.5 Potential Impacts of Cable System Implementation

Description of Impact Types

The majority of transportation operations would involve the delivery of materials and equipment during the construction phase. The amount of materials and the type of the equipment may vary based on site features and the design selected. Assumingly, oversize equipment and overweight materials for site access, site preparation, and foundation construction would be needed. Therefore, the delivery of the equipment and materials may exceed normal traffic operation standard and result in unavoidable impacts on the roadways and relevant ground transportation issues.

Potential impacts in general may include:

- Deterioration of the current pavement condition. In general, the delivery of the construction materials requires medium- to heavy-duty all-wheel-drive pickup trucks. Depending on the load carried per truck and the frequency of the delivery, impacts to the condition of roads may occur.
- Alteration of the existing roadway conditions. Road widening may be needed on existing roads to accommodate large trucks. Additionally, unpaved roads may need to be surfaced to accommodate frequent use during construction and operation period.

- Lack of roads, resulting in the construction of new roads. Portions of the landing site area may not have existing roads. To make a landing site area accessible, new roads may need to be built.
- Increment of traffic congestion due to oversize vehicles traveling at slow speeds.
- Potential transportation safety issues resulting from traffic congestion and deteriorated road conditions.
- Potential impacts to the harbors. Heavy equipment may need to be shipped and loaded at harbors. Likely impacts such as the overcapacity of the harbor or the potential alteration of an existing harbor to accommodate oversize equipment movers/cargos may occur.

Maui County-O'ahu Routing Specific Description of Impact Types

Maui

Maui-Kahului Harbor

Terrestrial

The Maui-Kahului Harbor landing site area is situated adjacent to the Kahului-Wailuku urban center and Kahului Airport. This area contains most of the principal roadways on Maui and receives the most daily traffic. Proposed activities during the construction period, such as the transportation of heavy equipment and related actions taken, including the temporary traffic reroute, may result in potential impacts to the site as follows.

- Local traffic congestion: Kahului is the most populated urban center on Maui. Kahului Harbor and vicinal areas receive the most daily traffic. As the landing site area is located adjacent to Kahului Harbor, activities during the construction period, such as frequent deliveries during daytime work hours, heavy-duty pickup trucks traveling in and out of the site, and likely lane closures, may result in traffic congestion around the construction site and significant impacts may occur.
- Traffic safety and capacity: Kahului contains most of the principal roads but not all of them are capable of dealing with oversize and overweight delivery. For example, Waiehu Beach Road (Route 340) and Route 30 are both two-lane arterials that pass through major residential areas. Significant impacts may occur when heavy-duty trucks use these roads. In addition, frequent transporting of overweight vehicles may result in the deterioration of the roadway surface. Potholes may increase and consequently result in both maintenance and safety issues.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Maui-Kapalua (West Maui)

Terrestrial

The Maui-Kapalua landing site area is located in west Maui within a residential, commercial, and tourist-gathering center with golf courses and luxury resorts. However, only two major arterials are connected to west Maui. Route 340 enters west Maui along the northern shoreline. Route 30 brings traffic movement from Kahului to Kapalua passing Lahaina, one of the most popular tourist destinations on Maui, along the western shoreline. These two state highways are both scenic routes with two lanes that travel through the valleys or along the shoreline. Actions during the construction period may include oversize trucks transporting heavy materials to the landing site area at slow speed, and potential roadway development to create access to the landing site area. These actions may cause significant impacts as follows.

- Local traffic congestion: Similar to the impact in the Maui-Kahului Harbor landing site area, oversize vehicles may cause substantial traffic delays due to their slow movement on the two-lane scenic Routes 30 and 340. Particularly, Route 30 and Route 340 provide the only access to Kahului; therefore, a significant impact on traffic congestion may occur.
- Roadway safety and maintenance: Neither Route 30 nor Route 340 is structurally capable of handling heavy truckloads due to their current conditions and functionalities of providing services to primarily tourist traffic. Significant impacts regarding safety and maintenance may occur.

State Waters

This section is not applicable as no land transportation occurs in state waters.

<u>Lānaʻi</u>

Terrestrial

The Lānaʻi landing site area is located at the west tip of island of Lānaʻi. The landing site area is surrounded by largely undeveloped land; therefore, impacts regarding traffic congestion may be minimal. However, a potential transportation impact may occur on Route 440 during the construction period due to construction material delivery with heavy-duty trucks from Kaumalapau Harbor or Manele Small Boat Harbor. Awalua Highway is connected between Route 440 and west Lānaʻi, but the current roadway condition may not be able to handle heavy

truckloads due to the unfinished surface. To that effect, a significant impact regarding roadway safety may occur such as slippery driving conditions, hydroplaning, and stuck-in-mud situations. In addition, portions of the Lānaʻi landing site area may not have existing roads. Transportation impacts could occur, including new road construction and potential grade changes for new roadways.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Molokaʻi

Molokaʻi-Kaluakoi (Molokaʻi-West)

Terrestrial

As mentioned in Section 3.4.4, the Molokaʻi-Kaluakoi landing site area is located in a tourist destination where transportation related to future construction work may be affected. Route 460 is a two-lane road, and it is currently the only access to west Molokaʻi. With the current road width, oversize trucks may affect the regular traffic flow and travel speed. In addition, portions of Route 460 and its consequent local streets, Kaluakoi Road and Pohakuloa Road, may not be capable of handling overweight truckloads due to the current condition of the road surface. Parts of the landing site area may not have existing roads. Therefore, transportation impacts may occur, such as the construction of new roads and potential grade changes for new roads.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Molokaʻi-Kaunakakai (South Molokaʻi)

Terrestrial

The landing site area is located between Kaunakakai Harbor and Hale O Lono Harbor. These two harbors are connected by portions of Route 460 and Ulili Road, which provide services for transporting construction-related materials from the harbor to the landing site area. However, a significant impact may occur as the current roadways were not structurally designed for handling heavy truckloads. Most of the accesses are unpaved and located on uneven terrain, which could cause another impact regarding transportation safety.

State Waters

This section is not applicable as no land transportation occurs in state waters.

O‘ahu

O‘ahu-MCBH at Kāne‘ohe Bay

Terrestrial

The MCBH at Kāne‘ohe Bay landing site area is located adjacent to the Kailua urban center where large amounts of local traffic are often anticipated. As roadways connecting to the MCBH at Kāne‘ohe Bay landing site area were not designed to accommodate construction vehicles, such as oversize and overweight trucks, a potential impact could occur, including traffic congestion and the deterioration of the roadway surface. In addition, the base is located in the landing site area, so that construction-related vehicles may affect base activities and the military community.

- Local traffic congestion and safety: As mentioned above, traffic congestion resulting from slow-speed, oversize trucks may occur. Additionally, operating a heavy truckload delivery in a high-populated urban community requires a Transportation Management Plan (TMP) and a traffic detour plan. The alteration of daily transportation routes could be affected and therefore could cause excessive congestion. Travel movement outside of the MCBH at Kāne‘ohe Bay landing site area may also be affected due to the transporting of materials from Honolulu Harbor. As narrow, scenic roadways, Routes 61 and 63 are not capable of providing services for transporting materials; H-3 may be the only available access. However, H-3 was not structurally designed for handling overweight truckloads; therefore, an impact to transportation safety and roadway maintenance could occur.

State Waters

This section is not applicable as no land transportation occurs in state waters.

O‘ahu-Pearl Harbor

Terrestrial

The Pearl Harbor landing site area is located in the Primary Urban Center adjacent to Hawai‘i’s major commercial harbor and airport, business district, historic center, and most dense residential and major industrial areas. Traffic is usually busy in this area and mostly congested during peak hours. Construction-related work, including transporting construction equipment

and materials, may substantially impact traffic conditions. Additionally, the Pearl Harbor landing site area includes existing industrial areas frequented by large numbers of heavy-duty pickup trucks; consequently, the roadways adjacent to this area are heavily used for industrial transportation. During the construction period, the roadways may need to provide a double amount of industrial transportation services and the condition of the related roadways may deteriorate quickly. This may cause an impact to safety and maintenance for land transportation.

In addition to automobile use, roads adjacent to the Pearl Harbor landing site area, such as Route 99, provide the following important services for the Honolulu public transportation:

- Existing Bus Route: Route 99 is frequently used by buses, including Route 9, Route 20, and Route 31. For example, Route 20 provides services for tourists between Honolulu International Airport and Waikiki (The Bus Route Map 2009). During the construction period, bus routes may be altered and could increase the impact on public transportation services.
- Rapid Transit Corridor: To reduce automobile dependency and increased traffic congestion problems, the City and County of Honolulu have pursued a high-speed public transit system. Proposed stations adjacent to the Pearl Harbor landing site area, including Downtown Station, Chinatown Station, Iwilei Station, Kalihi Station, and Airport Station (Honolulu Rail Transit Map 2012), are tentatively planned for construction by 2019. The future location of the landing site area and its related construction may increase potential impacts to the proposed rapid transit route.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Federal Waters

BOEM Jurisdiction

Transportation infrastructure does not exist in the marine setting.

NOAA Jurisdiction

Transportation infrastructure does not exist in the marine setting.

3.4.6 General Siting Criteria and Special Conservation and Construction Measures

The selection of the site is an important decision in developing renewable energy. The site needs to provide adequate resources for forming an efficiently operated plan. The selection

criteria should include all aspects, taking account of information regarding health and safety, feasibility, and efficiency. Currently, the proposed landing site areas for this project are selected based on the best resources each site may receive. For land transportation, accessibility is an essential element, particularly during construction. In general, the siting criteria regarding land transportation are recommended as below:

- Roadway availability: Generally speaking, to provide efficient land transportation services during construction, a site should be selected with access roads nearby. The roadways should be ideally paved and in good condition, and potential routes should provide flexibility to accommodate unforeseen changes.
- Roadway development: As mentioned in the previous section, several landing site areas are located where access roads are unmarked or do not exist. It is recommended that necessary roadways be installed in order to reduce safety impacts during construction. New roadways should be designed to meet the HDOT requirements, and all county general plans/community plans where applicable. It is also recommended that new roads be designed to follow HAR Title 19 Chapter 104, The Movement of Oversize and Overweight Vehicles on State Highways by Permit.
- Roadway maintenance: Some access roads on landing site areas may not be capable of handling heavy truckloads. Necessary improvement should be provided for existing roads that require maintenance, including better pavement and/or flattening uneven roadway surface.
- Roadway Connectivity: Provide convenient access to a landing site area in order to save the amount of travel time and frequency. Avoid routes with substandard traffic conditions, congested intersections, over-capacity roadways, and roadways with geometric conditions (Tetra Tech EC, Inc. 2008), to minimize potential impacts the construction may cause to the roadways and local traffic.

General Level Special Conservation and Construction Measures

The means of transporting equipment and materials to the landing site areas should be determined early to accurately identify potential risks, impacts, and applicable regulatory requirements. This includes the identification of the most efficient routes to the sites, the capacity of the roads that can handle overweight materials, and any necessary alterations needed during the site preparation period. A TMP is necessary prior to the construction of the site.

LT-1 Identify efficient routes. A route map for transporting construction materials is necessary to identify the primary access routes to the landing site areas, and an appropriate delivery port on each island for loading the materials and equipment efficiently. Route selections should avoid roadways with highly congested conditions and travel directions toward urban centers, residential and commercial areas, and

tourist locations. Route selections should also identify roads with capacity of handling oversize and overweight vehicles and movements. Roads with good pavement condition are suggested but a postconstruction mitigation plan should be conducted for managing potential road damages resulting from the heavy delivery.

LT-2 Roadway Capacity Requirement and Analysis. To protect the general public from traffic hazards created by the movement; to guard against undue hindrance to the normal flow of traffic; and to prevent damage to pavement, highway facilities, and structures, the Hawai‘i State administrative rule HAR Title 19 Chapter 104 clearly defines the rules and regulations that govern oversize and overweight vehicles.

LT-3 Transportation Management Plan. Where avoidance is not possible, a TMP should be developed to ensure the safe flow of traffic during construction operations. It is necessary to consult and then coordinate with city, county, state, and federal agencies. A TMP should be conducted by following the U.S. Department of Transportation, FHWA regulation and policy, Section 630.1012 of the Work Zone Safety and Mobility Rule.

LT-4 Traffic Analysis Report. Conducting a traffic analysis is an important process of supporting the completion of a TMP. Traffic data for existing roadway conditions should be reviewed to determine the potential traffic impacts that may occur in regard to equipment delivery and heavy-duty vehicles in and out of the landing site area during construction and operation.

The undersea power cable system should comply with the following:

LT-5 Coordinate state, county, federal, and private transportation activities and programs toward the achievement of statewide objectives (State Plans, HRS Chapter 226-17, Objectives and policies for facility systems – transportation.)

LT-6 Provide for improved accessibility to shipping, docking, and storage facilities (State Plans, HRS Chapter 226-17, Objectives and policies for facility systems – transportation.)

LT-7 Increase the capacities of airport and harbor systems and support facilities to effectively accommodate transshipment and storage needs (State Plans, HRS Chapter 226-17, Objectives and policies for facility systems – transportation.)

LT-8 A permit is required when any person, firm, or corporation proposes to move, over state highways, a vehicle or combination of vehicles of a size or weight that exceeds the maximum dimensions or weights established by law (Hawai‘i State Administrative

Rules, HAR Title 19 Chapter 104, The Movement by Permit of Oversize and Overweight Vehicles on State Highways.)

Maui County-O'ahu Routing Specific Special Conservation and Construction Measures

Some major arterials on Maui contain high scenic value. The County of Maui set forth policies to preserve and promote this value, and to comply with Maui County General Plan 2030, Countywide Policy Plan as below:

LT-9 Preserve roadway corridors that have historic, scenic, or unique physical attributes that enhance the character and scenic resources of communities.

LT-10 Evaluate all alternatives to preserve quality of life before widening roads.

Maui

Maui-Kahului Harbor

Terrestrial

The Maui-Kahului Harbor landing site area is largely populated with commercial, residential, and industrial uses. To minimize impacts from construction-related transportation operations, conducting a traffic analysis study and producing a TMP are recommended.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Maui-Kapalua (West Maui)

Terrestrial

The Maui-Kapalua landing site area is situated in a touristic location. Only two major arterials are connected to this area and serve both local and tourist traffic. To avoid significant traffic congestion impacts to the landing site area during construction and operation, a traffic analysis report and a TMP are recommended.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Lānaʻi

No specific criteria or regulation policies are required for land transportation on Lānaʻi.

Terrestrial

There is no particular measure for this specific landing site area.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Molokaʻi

No specific criteria or regulation policies are required for land transportation on Molokaʻi.

Molokaʻi-Kaluakoi (Molokaʻi-West)

Terrestrial

There is no particular measure for this specific landing site area.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Molokaʻi-Kaunakakai (Molokaʻi-South)

Terrestrial

There is no particular measure for this specific landing site area.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Oʻahu

Due to the locations of both landing site areas near military bases (MCBH at Kāneʻohe Bay and JBPHH), it is recommended to work closely with the federal Department of Defense (DoD) Police Department and transportation-related agencies on-base to develop a TMP in compliance with the military security and law enforcement operation codes.

Oʻahu-MCBH at Kāneʻohe Bay

Terrestrial

The MCBH at Kāneʻohe Bay landing site area includes largely populated residential areas and regional town centers. Construction-related transportation operations such as equipment and material delivery should avoid the above-mentioned areas. A traffic analysis study and a TMP are suggested to minimize impacts resulting from these activities during construction and operation.

In addition to HAR Title 19 Chapter 104 as required by the State of Hawaiʻi (see Rule LT-4 as previously discussed in the General CCMs section), the military base may have requirements/restrictions associated with vehicle size and weight. Contacting the military police department for safety-related requirements is recommended, as well as contacting transportation-related departments for relevant information regarding size and weight limits.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Oʻahu-Pearl Harbor

Terrestrial

The Pearl Harbor landing site area is often highly congested. To avoid congested and over-capacity roadways is the primary mitigation plan. When avoidance is not possible, a TMP should be developed to minimize traffic-related impacts during construction and operation.

In addition to HAR Title 19 Chapter 104 as required by the State of Hawaiʻi (see Rule LT-4 as previously discussed in the General CCMs section), the military base may have requirements/restrictions made associated with vehicle size and weight. Contacting the military police department for safety-related requirements is recommended, as well as contacting transportation-related departments for relevant information regarding size and weight limit.

State Waters

This section is not applicable as no land transportation occurs in state waters.

Federal Waters

BOEM Jurisdiction

Transportation infrastructure does not exist in the marine setting.

NOAA Jurisdiction

Transportation infrastructure does not exist in the marine setting.

Table 3.4-1. Roadway Hierarchy for the Maui-Kahului Harbor Landing Site Area

Island	Planning Area	Functional System Hierarchy	Roadway	Road Condition	Weight Handling[1]	Connection to Harbor (DC/NDC)[2]
AREP	Kahului	Principal arterials	Route 30, Honoapiilani Hwy	paved	<80,800 LB	NDC
			Route 32, Kaahumanu Ave	paved	<80,800 LB	DC
			Route 36, Hana Hwy	paved	<80,800 LB	DC
			Route 311, Mokulele Hwy	paved	<80,800 LB	DC
			Route 340, Kahekili Hwy	paved		NDC
			Route 380, Kuihelani Highway	paved	<80,800 LB	NDC
		Minor arterial streets	Kahului Beach Road	paved/gravel		DC
			Waiehu Beach Road	dirt/grass		DC
		Local streets				

[1] According to HAR Title 19 Chapter 104-21 Legal Limitations (b), "No vehicle or combination of vehicles shall be used or operated on any state highway with a load upon any single or tandem axle or combination of axles which exceeds the carrying capacity of the axles specified by the manufacturer, or with a total weight in excess of its designed capacity as indicated by its designed gross vehicle weights or gross combination weights."
[2] DC = direct connection; NDC = no direct connection; LB = pounds

Table 3.4-2. Roadway Hierarchy Adjacent to Lānaʻi Landing Site Area

Island	Planning Area	Functional System Hierarchy	Roadway	Road Condition	Weight Handling[1]	Connection to Harbor (DC/NDC)[2]
Lānaʻi		Principal arterials	Route 440, Kaumalapau Hwy	paved	<80,800 LB	NDC
		Minor arterial streets	Awalua Hwy	rock/dirt		NDC
		Local streets	Polihua Road	rock/dirt		DC

[1] According to HAR Title 19 Chapter 104-21 Legal Limitations (b), "No vehicle or combination of vehicles shall be used or operated on any state highway with a load upon any single or tandem axle or combination of axles which exceeds the carrying capacity of the axles specified by the manufacturer, or with a total weight in excess of its designed capacity as indicated by its designed gross vehicle weights or gross combination weights."
[2] DC = direct connection; NDC = no direct connection; LB = pounds

Table 3.4-3. Roadway Hierarchy Adjacent to Molokaʻi-West Landing Site Area

Island	Planning Area	Functional System Hierarchy	Roadway	Road Condition	Weight Handling[1]	Connection to Harbor (DC/NDC)[2]
Molokaʻi	Molokaʻi-Kaluakoi	Principal arterials	Route 460, Maunaloa Hwy	paved	<80,800 LB	NDC
		Local streets	Kaulakoi Road	paved/rock/dirt		NDC
			Pohakuloa Road	paved/rock/dirt		NDC

[1] According to HAR Title 19 Chapter 104-21 Legal Limitations (b), "No vehicle or combination of vehicles shall be used or operated on any state highway with a load upon any single or tandem axle or combination of axles which exceeds the carrying capacity of the axles specified by the manufacturer, or with a total weight in excess of its designed capacity as indicated by its designed gross vehicle weights or gross combination weights."
[2] DC = direct connection; NDC = no direct connection; LB = pounds

Table 3.4-4. Roadway Hierarchy Adjacent to MCBH at Kāne'ohe Bay Landing Site Area

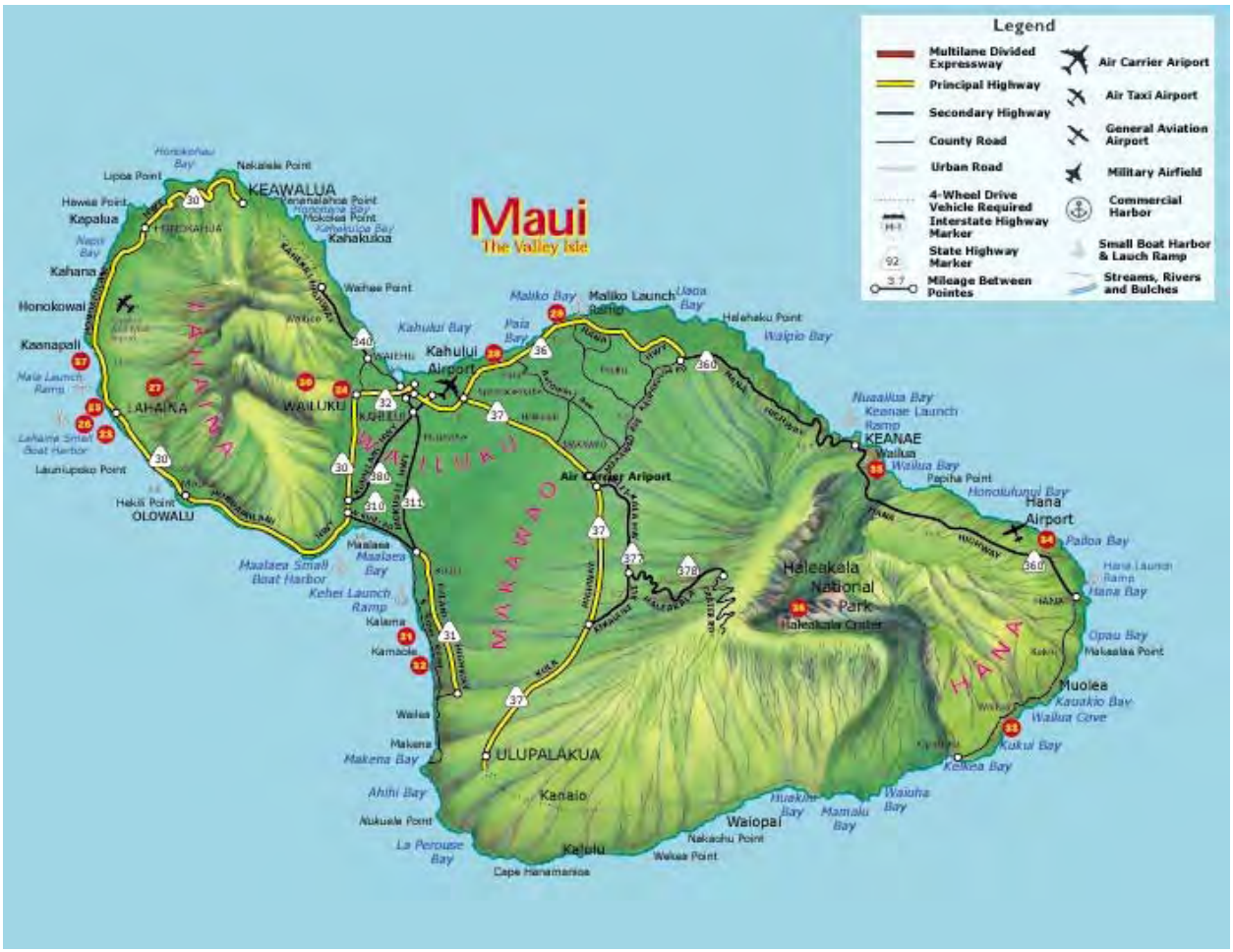
Island	Planning Area	Functional System Hierarchy	Roadway	Road Condition	Weight Handling[1]	Connection to Harbor (DC/NDC)[2]
O'ahu	MCBH at Kāne'ohe Bay	Principal arterials	Interstate Route H-3	paved	<80,800 LB	NDC
			Route 61, Pali Highway	paved		
			Route 63, Likelike Highway	paved		
		Minor arterial streets	Route 65, Kāne'ohe Bay Drive	paved	<80,800 LB	NDC

[1] According to HAR Title 19 Chapter 104-21 Legal Limitations (b), "No vehicle or combination of vehicles shall be used or operated on any state highway with a load upon any single or tandem axle or combination of axles which exceeds the carrying capacity of the axles specified by the manufacturer, or with a total weight in excess of its designed capacity as indicated by its designed gross vehicle weights or gross combination weights."
[2] DC = direct connection; NDC = no direct connection; LB = pounds

Table 3.4-5. Roadway Hierarchy Adjacent to Pearl Harbor Landing Site Area

Island	Planning Area	Functional System Hierarchy	Roadway	Road Condition	Weight Handling[1]	Connection to Harbor (DC/NDC)[2]
O'ahu	Pearl Harbor	Principal arterials	Interstate Route H-1	paved	<80,800 LB	NDC
			Route 76, Fort Weaver Rd	paved	<80,800 LB	DC
			Route 92, Nimitz Hwy/ Ala Moana Blvd	paved	<80,800 LB	DC
		Local streets	Iroquois Ave	paved		DC
			Worchester Ave	paved		DC
			Seaman Ave	paved		DC
			Lagoon Ave	paved		DC

[1] According to HAR Title 19 Chapter 104-21 Legal Limitations (b), "No vehicle or combination of vehicles shall be used or operated on any state highway with a load upon any single or tandem axle or combination of axles which exceeds the carrying capacity of the axles specified by the manufacturer, or with a total weight in excess of its designed capacity as indicated by its designed gross vehicle weights or gross combination weights."
[2] DC = direct connection; NDC = no direct connection; LB = pounds



Source: HDOT (2012)

Figure 3.4-1. Maui State Roads and Highways

Source: Google Street View (2012)

Figure 3.4-2. Route 32 near Kahului Beach road looking east

Source: Google Street View (2012)

Figure 3.4-3. Kahului Beach Road near Kahului Harbor looking west

Source: Google Street View (2012)

Figure 3.4-4. Route 30 near Napili looking north

Source: Google Street View (2012)

Figure 3.4-5. Route 340 near Poolua Bay looking west

Source: HDOT (2012)

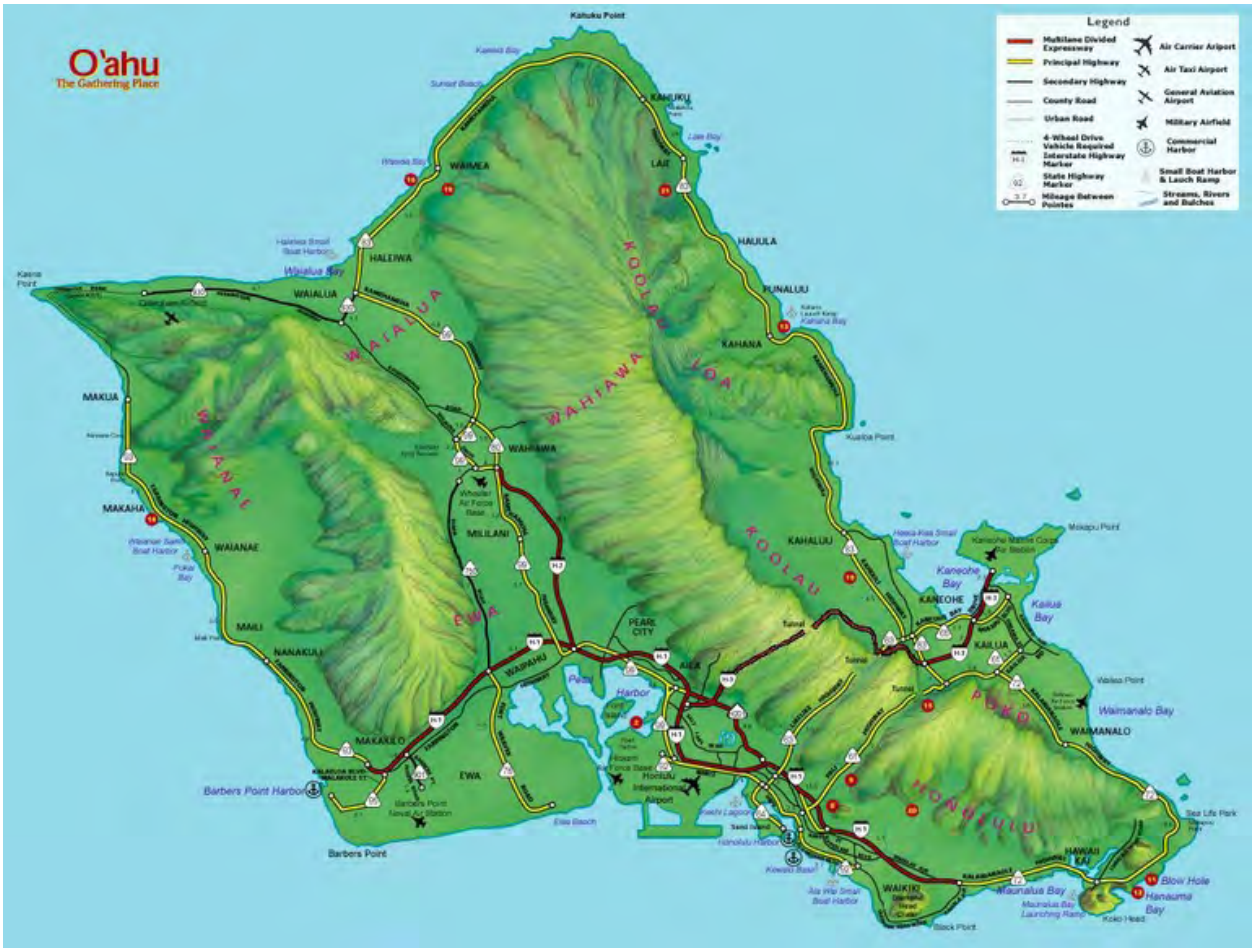
Figure 3.4-6. Lānaʻi State Roads and Highways

Source: AECOM (2011)

Figure 3.4-7. Polihua Trail

Source: HDOT (2012)

Figure 3.4-8. Moloka‘i State Roads and Highways



Source: HDOT (2012)

Figure 3.4-9. O‘ahu State Roads and Highways

Source: Google Street View (2012)

Figure 3.4-10. Interstate H-3 viaduct near Haiku Valley looking south

Source: Google Street View (2012)

Figure 3.4-11. Route 61 near Pali Golf Course looking north

Source: Google Street View (2012)

Figure 3.4-12. Route 65 near MCBH at Kāneʻohe Bay looking north

Source: Google Street View (2012)

Figure 3.4-13. Interstate H-1 near Pearl Harbor looking west

Source: Google Street View (2012)

Figure 3.4-14. Route 76 near Ewa Beach looking south

Source: Google Street View (2012)

Figure 3.4-15. Route 92 near Kalihi looking east

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