U.S. Fish and Wildlife Service

Draft Environmental Assessment

Kīlauea Point National Wildlife Refuge Trail Stabilization

October 2015

Prepared by:

U.S. Fish and Wildlife Service
Kaua'i National Wildlife Refuge Complex
P.O. Box 1128
Kīlauea, HI 96754

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INTRODUCTION, PURPOSE, AND NEED

1.1 Introduction

The U.S. Fish and Wildlife Service (USFWS) is proposing to stabilize the walking trail between the visitor center and Daniel K. Inouye Kīlauea Point Lighthouse (lighthouse) at the Kīlauea Point National Wildlife Refuge (KPNWR or Refuge) on Kauaʻi, Hawaiʻi (Figure 1-1). The walking trail has experienced undermining and settlement due to existing slope conditions and erosional processes. Surface water runoff and wind erosion along the walking trail has contributed to increased slope erosion and slope instability issues. As a result of the stormwater runoff, sediment deposition along sections of the walking trail has created operation and maintenance (O&M) issues for the Refuge as well as public safety concerns for Refuge visitors. Trail stabilization measures and stormwater runoff management would be required along impacted sections of the walking trail to address the slope erosion, trail instability, maintenance issues, and public safety concerns.

The primary goal of this document is to analyze impacts to the natural and human environment from the proposed project. This Environmental Assessment (EA) is being prepared by the USFWS to comply with the requirements of the National Environmental Policy Act (NEPA) of 1969 and its implementing regulations, which are set forth in the Council on Environmental Quality regulations 40 CFR Parts 1500-1508. The EA assists the USFWS in determining if the preferred alternative would have a significant impact on the quality of the natural and human environment and if preparation of an Environmental Impact Statement (EIS) is required.

1.1.1 Decision Matrix

The USFWS must decide on an alternative that meets the purpose and need for the project. The USFWS must also decide if the preferred alternative would or would not constitute a major federal action significantly affecting the quality of the natural and human environment. If the USFWS Responsible Official determines that the recommended alternative would not significantly affect the quality of the natural and human environment, then they will prepare and sign a Finding of No Significant Impact (FONSI), and the project may proceed. If the USFWS Responsible Official determines that the recommended alternative would significantly affect the quality of the natural and human environment, then an Environmental Impact Statement (EIS) and a Record of Decision (ROD) must be prepared and signed before the project can proceed.

1.2 Project Location

The Refuge is located off Kīlauea Road at the northern-most point of Kauaʻi, approximately 1 ¼ miles north of Kīlauea, in Kauaʻi County, Hawaiʻi (Figure 1-1). The project area is located on land owned and managed by the USFWS and is adjoined to the north and west by the Pacific Ocean, to the south by private property, and to the east by Refuge land. Table 1-1 identifies the parcel, coordinates, and address of the project area.

Table 1-1. QNFH Location Description

Kauaʻi County Parcel	Coordinates (WGS84)	Address
520040170000	22.231048, -159.401882	3500 Kīlauea Road, Kīlauea, HI 96754

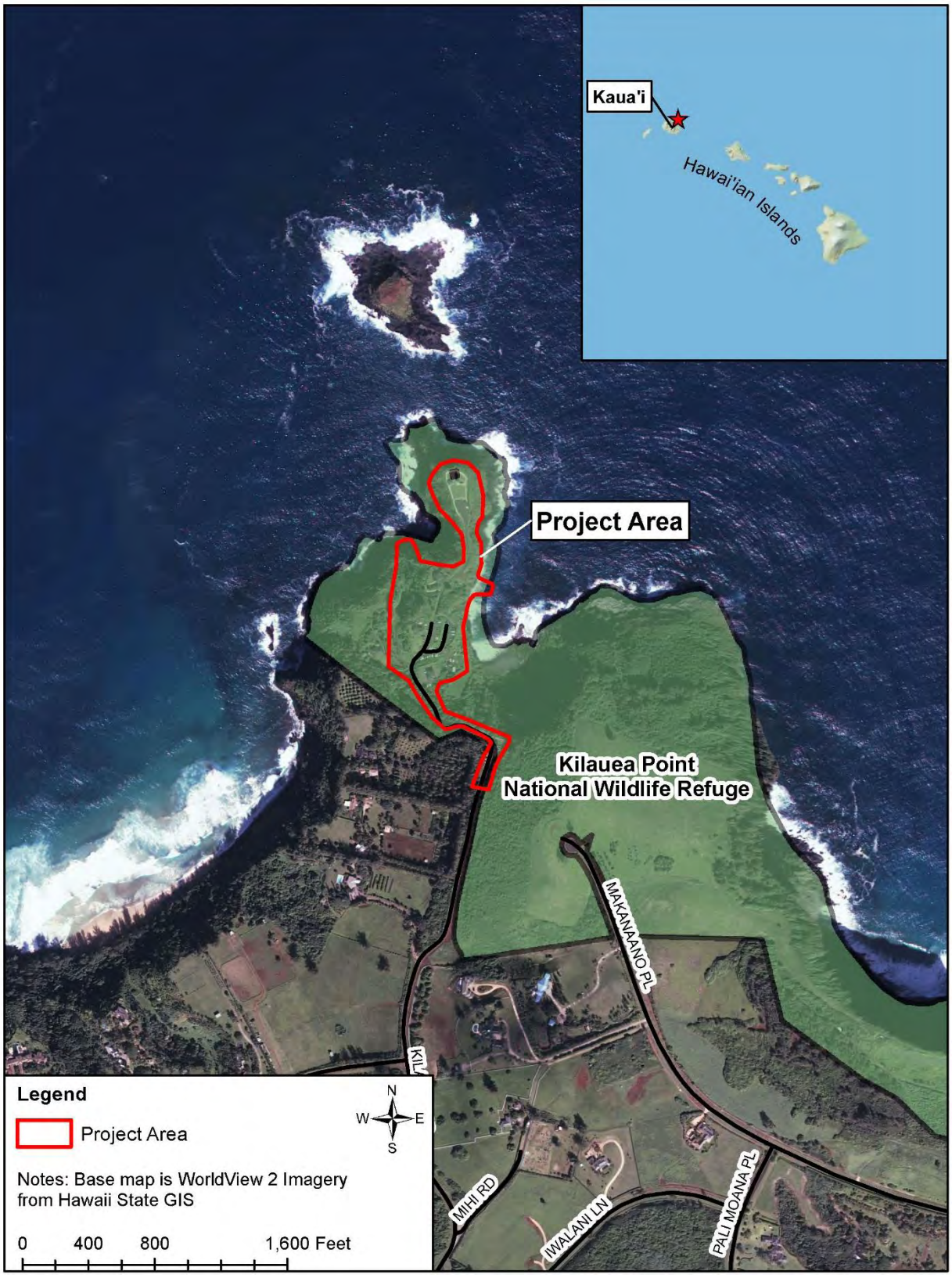

Figure 1-1. Vicinity Map

1.3 Background

The Refuge currently consists of 199-acres of land that is home to many federal and state sensitive animal species, migratory birds, and native plant communities. The project area is located in an area of the Refuge developed with the historic Daniel K. Inouye Kīlauea Point Lighthouse, a walking trail, and visitor facilities including paved parking areas, a visitor center, and other associated offices and structures. A walking trail extends from the Refuge paved parking area to the historic lighthouse and provides easy access for observation and photography of Kauaʻi wildlife, native plant communities, the lighthouse, and Pacific Ocean views. Wind and water erosional processes and stormwater runoff issues have produced slope erosion, settling, undermining and sediment deposition along a section of the walking trail. These conditions are creating public safety concerns as well as O&M issues for Refuge staff.

The Refuge was established in 1985 under several establishment authorities which include:

- *The Transfer of Certain Real Property for Wildlife Conservation Act (16 U.S.C. 667b-667d, May 19, 1948, as amended 1949, 1972, and 1995).* This act provides authority to the Administrator of the General Services Administration to transfer real property no longer needed by a Federal agency to the Secretary of the Interior if the land has particular value for migratory birds.
- *Refuge Recreation Act (16 U.S.C. §§ 460k through 460k-4, September 28, 1962, as amended 1966, 1972, 1973, and 1978).* This act authorizes the Secretary of the Interior to allow public recreation in Federal conservation areas when compatible with the purposes of these areas, acquire lands that are suitable for incidental fish and wildlife-oriented recreational development, protect natural resources, and conserve endangered or threatened species.
- *Endangered Species Act (ESA) (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976, 1977, 1978, 1979, 1980, 1982, 1984, 1988, 1992, and 1997).* The ESA provides for the conservation of threatened and endangered species of fish, wildlife, and plants by Federal action and by encouraging the establishment of state programs. It supersedes and strengthens two earlier endangered species acts, the Endangered Species Preservation Act of 1966 and The Endangered Species Conservation Act of 1969. Section 5 of the ESA provides guidance for the Service to use its existing authorities to acquire lands to conserve those species listed as endangered or threatened. It also provides for the determination and listing of endangered and threatened species and the designation of critical habitats. Section 7 of the ESA requires Refuge Managers to perform consultations before initiating projects that affect or may affect endangered species.
- *Kīlauea Point Expansion Act of 2004 (Expansion Act) (16 USC 668dd December 23, 2004).* The Expansion Act, Public Law 108-481, directs the Secretary of the Interior to acquire by donation, purchase with donated or appropriated funds, or exchange, all or a portion of approximately 234 acres of land adjacent to the Kīlauea Point NWR to be managed for the protection and recovery of endangered Hawaiian water birds and other endangered birds, including the nēnē (Hawaiian goose), and the conservation and management of native coastal strand, riparian, and aquatic biological diversity.

As a result of the various establishment authorities above, there are several purposes for Kīlauea Point NWR:

- ... particular value in carrying out the national migratory bird management program.16 U.S.C. § 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes).
- ... suitable for— (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...16 U.S.C. § 460k-1.

- ... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...16 U.S.C. § 460k-2 (Refuge Recreation Act [16 U.S.C. § 460k-460k-4], as amended).
- ... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants … 16 U.S.C. § 1534 (Endangered Species Act of 1973).
- (1) the protection and recovery of endangered Hawaiian waterbirds and other endangered birds, including the Nene (Hawaiian goose); and (2) the conservation and management of native coastal strand, riparian, and aquatic biological diversity. Public Law 108-481 (Kīlauea Point National Wildlife Refuge Expansion Act of 2004).

1.4 Purpose and Need

The purpose of the project is to stabilize the walking trail to the Daniel K. Inouye Kīlauea Point Lighthouse. The need of the project is to provide slope stability for public safety concerns along trail sections that have experienced slope erosion, undermining, and settlement.

1.5 Native Hawaiian Organizations Trust and Responsibilities

To comply with Executive Order 13175 the USFWS performed necessary consultation with federally recognized Native Hawaiian organizations including the Office of Hawaiian Affairs (OHA) and the Kaua‘i Ni`ihau Island Burial Council. Consultation with federally recognized Native Hawaiian organizations will be ongoing throughout the development of this EA and throughout the permitting process for the project.

1.6 Project Area and Existing Conditions

The Trail Stabilization project area covers approximately 11 acres and consists of the extents depicted in the Existing Site Plan (Figure 1-2).

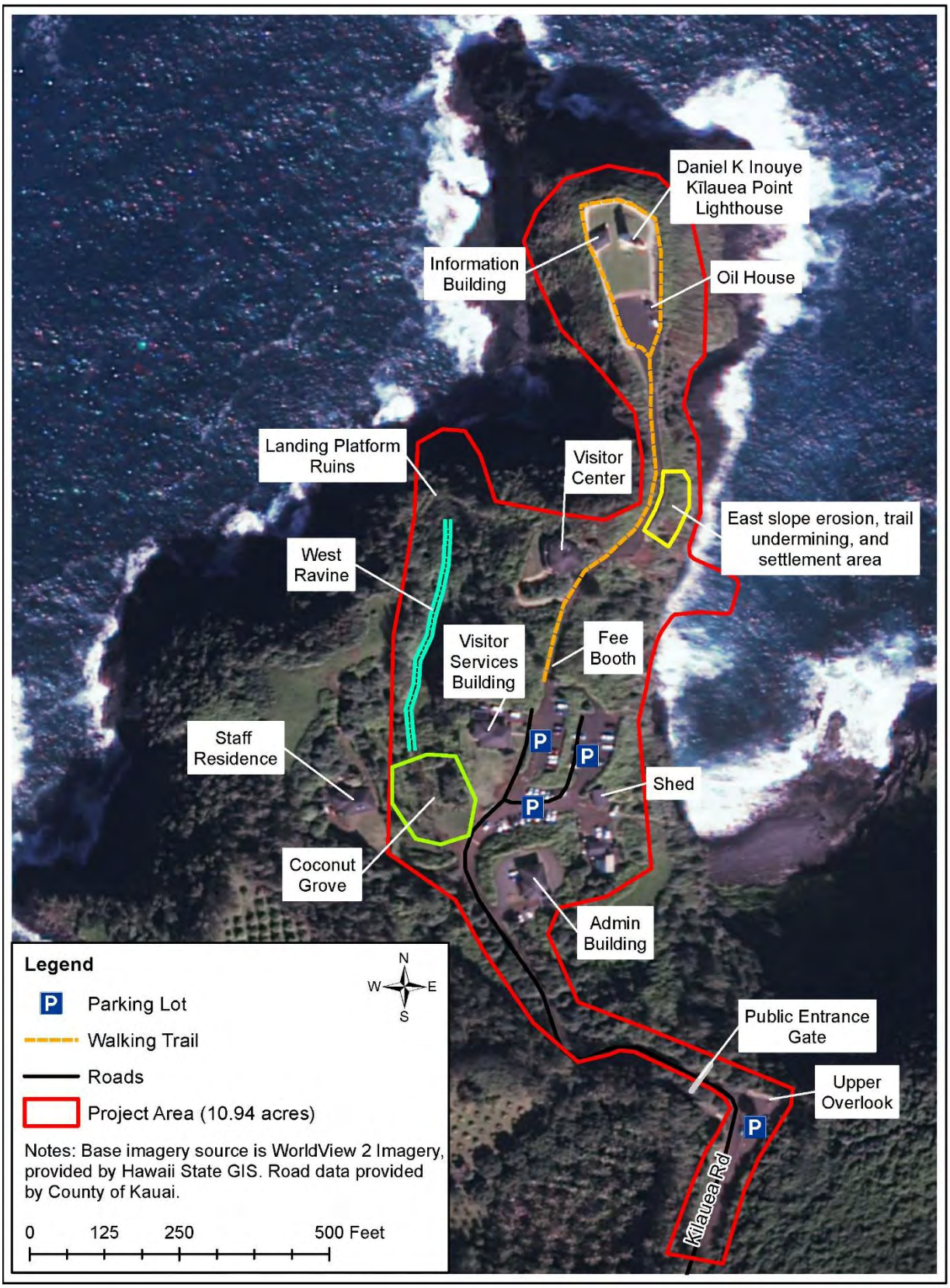

Figure 1-2. Existing Site Plan

The project area is located in a developed section of the Refuge. The southern portion of the project area consists of an upper scenic overlook and public entrance access road with an access gate (Figures 1-3 through 1-6). A parking area for visitors adjoins the overlook to the southeast. A graveled area in the County road right-of-way of Kīlauea Road (south of the overlook), is used by visitors as overflow parking (Figure 1-5).

Figure 1-3. Upper Scenic Overlook
(General view looking north at the upper scenic overlook)

Figure 1-4. Public Access
(Upper scenic overlook looking west at the public access road and gate)

Figure 1-5. Overlook Access
(Looking south at Kīlauea Road leading up to the upper outlook and the overflow parking)

Figure 1-6. Public Access Road
(General view looking southeast along the public access road)

The access road opens up to the coconut grove and parking areas surrounded by multiple buildings and structures in the central portion of the project area (Figure 1-7). There are three parking lots in this area (west, east, and south parking lots). The west parking lot adjoins the visitor services building, the east parking lot is located downslope to the east of the west parking lot, and the south parking lot is located downslope to the south of both (Figures 1-8 through 1-10). Buildings around the parking area consist of the visitor services building (Figure 1-11), administration building (Figure 1-12), maintenance sheds, and a fee booth (Figure 1-13). The coconut grove area consists of a mowed grassy area and coconut trees (Figure 1-14). Downstream of the coconut grove is a small ravine (west ravine) with a channel at the base that is normally dry and only conveys water during precipitation events (Figure 1-15).

Figure 1-7. Central Project Area Parking
(General view looking north across the parking areas)

Figure 1-8. West Parking Lot
(Looking south at the west parking lot)

Figure 1-9. East Parking Lot
(Looking south at the east parking lot)

Figure 1-10. South Parking Lot
(Looking west at the south parking lot)

Figure 1-11. Visitor Services Building
(Looking west from the west parking lot at the visitor services building and two adjoining sheds)

Figure 1-12. Administration Building
(Looking south from the west parking lot at the administration building)

Figure 1-13. Fee Booth
(Looking northeast at the fee booth)

Figure 1-14. Coconut Grove
(Looking northwest at the coconut grove)

Figure 1-15. West Ravine
(Standing at the base of the ravine looking north along the dry channel)

The northern portion of the project area consists of the walking trail alignment which extends from the fee booth north to the lighthouse (Figures 1-16 through 1-18). There are multiple structures adjoining the

walking trail alignment including the visitor center (Figure 1-19), lighthouse (Figure 1-20), information building (Figure 1-20), and an oil house.

Figure 1-16. Walking Trail Alignment (Southern Portion)
(Looking north from the fee booth along the southern portion of the walking trail alignment)

Figure 1-17. Walking Trail Alignment (Central Portion)
(Looking south along the central portion of the walking trail alignment)

Figure 1-18. Walking Trail Alignment (North Portion)
(Looking south at the walking trail alignment from the north edge of the walking trail)

Figure 1-19. Visitor Center
(Looking west from the walking trail at the visitor center)

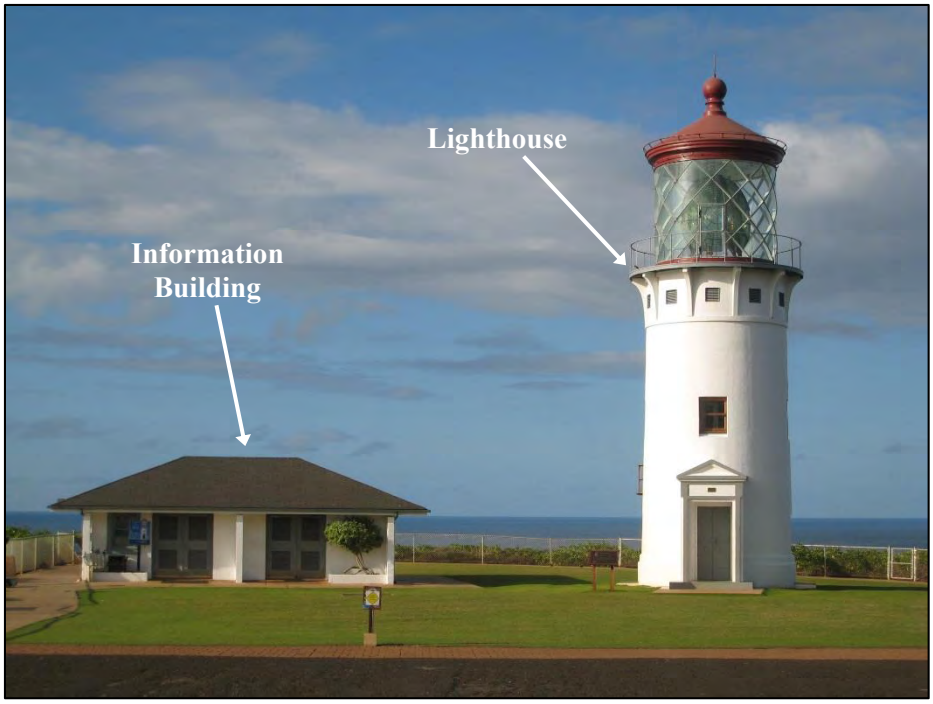

Figure 1-20. Information Building and Lighthouse
(Looking north at the information building and lighthouse)

The walking trail consists of an asphalt path that is approximately 700 feet long. A concrete retaining wall supports the east side of the walking trail for about 260 feet. Shotcrete, a cement-like substance, has been placed downslope from the retaining wall to help prevent erosion and undermining of the wall in various sections. Undermining and settlement of the walking trail along with water and sediment deposition on the trail has raised slope erosion, trail instability, O&M issues, and public safety concerns. Damage to the walking trail has been documented with most of the damage occurring from undermining and settlement along an approximate 100-foot length of the trail (Figure 1-21). Damage to the walking trail, retaining wall and Shotcrete include:

- Severe cracking of the existing concrete retaining wall (Figure 1-22);
- Transverse and longitudinal cracking of the asphalt walking trail (Figures 1-22 and 1-23);
- Cracking of the Shotcrete (Figure 1-24);
- Shotcrete moving downslope and pulling away from the retaining wall (Figure 1-24); and
- Severe undermining along the base of the Shotcrete (Figure 1-21 and 1-25).

Figure 1-21. Walking Trail Slope Erosion and Undermining Area
(Looking north from the upper scenic overlook at the middle and northern portion of the walking trail alignment)

Figure 1-22. Retaining Wall and Walking Trail Cracking
(Cracking of concrete retaining wall and longitudinal and transverse cracking of asphalt walking trail)

Figure 1-23. Walking Trail Transverse Cracking

Figure 1-24. Shotcrete Damage
(Cracking and pulling away of Shotcrete from the concrete retaining wall)

Figure 1-25. Shotcrete Undermining and Slope Erosion

SECTION 2
CONSULTATION AND PUBLIC PARTICIPATION

2.1 Consultation

This section describes the agency coordination efforts during the scoping process for the KPNWR Trail Stabilization project. Additional consultation with agencies will be ongoing throughout the development of this EA.

2.1.1 U.S. Fish and Wildlife Service

The USFWS Ecological Services division was informally consulted under section 7 of the Endangered Species Act to assess impacts to threatened and endangered species. Refuge staff met with USFWS Ecological Services staff during an informal scoping meeting on January 27, 2015 to discuss the project (meeting minutes are located in Appendix A). There are listed threatened and endangered species within the project area and the results of section 7 consultation will be documented in the Final EA once a preferred alternative has been selected.

2.1.2 U.S. Army Corps of Engineers

The United States Army Corps of Engineers (USACE) has jurisdiction over work in waters of the U.S. under Section 404 of the Clean Water Act. There are no proposed construction activities in jurisdictional waters of the U.S.; therefore, consultation with the USACE will not be required for the project.

2.1.3 Hawai‘i State Historic Preservation Division

The Hawai‘i Department of Land and Natural Resources (DLNR) State Historic Preservation Division (SHPD) was informally consulted under Section 106 of the National Historic Preservation Act to assess impacts to historic and cultural resources. Refuge staff met with SHPD staff during an informal scoping meeting on January 28, 2015 to discuss the project (meeting minutes are located in Appendix A). There are historic buildings and properties within the project area and the results of Section 106 consultation will be documented in the Final EA once a preferred alternative has been selected.

2.1.4 Hawai‘i Division of Forestry and Wildlife

The Hawai‘i DLNR Division of Forestry and Wildlife (DOFAW) was consulted in regards to impacts to state sensitive species. Refuge staff met with DOFAW staff during an informal scoping meeting (conference call) on January 28, 2015 to discuss the project (meeting minutes are located in Appendix A). There are state sensitive wildlife species within the project area and the results of consultation will be documented in the Final EA once a preferred alternative has been selected.

2.1.5 Hawai‘i Office of Conservation and Coastal Lands

The Hawai‘i Office of Conservation and Coastal Lands (OCCL) was consulted regarding the Conservation District Use Permit. The project is located on land designated as a “Protected” Conservation Subzone. Refuge staff met with OCCL staff during an informal scoping meeting (conference call) on January 28, 2015 to discuss the project (meeting minutes are located in Appendix A). A permit will be required for the

project and initial coordination has suggested that the project may be approved under a site plan approval since the use of the site is not changing from existing conditions. If a board permit is required, the OCCL may use this EA to comply with the Hawai'i Environmental Policy Act (HEPA) requirements for the preparation of an EA or EIS.

2.1.6 County of Kaua'i

Refuge staff met with the County of Kaua'i engineering and planning staff during an informal scoping meeting on January 28, 2015 to discuss the project (meeting minutes are located in Appendix A). Refuge staff agreed to submit the project plans and EA to the county as a courtesy. Additional coordination with the County was conducted on September 16, 2015 to determine mitigation measures and permitting requirements for traffic congestion at the upper scenic overlook for the proposed closure of the Refuge during project activities. A detailed description of consultation with the County has been provided in Section 5.5.5 of this report.

2.2 Public Participation

2.2.1 Public Outreach

Table 2-1 lists the project's public outreach activities. The public was notified of each activity listed below and provided with opportunities to comment on the project.

Table 2-1. Public Participation Milestones

Date	Purpose	Type
April 2, 2015	Scoping Notice Published	Scoping Notice Mailed and Posted to Website Public Notice Published in the Garden Island newspaper
April 2, 2015	Scoping – Public Comment Period Open	
April 9, 2015	Scoping Notice Published	Public Notice Published in the Garden Island Newspaper
April 16, 2015	Scoping Meeting	Scoping Public Meeting Held
May 1, 2015	Scoping Period Close	
October 13, 2015	Notice of Draft EA Public Comment Period	Draft EA Notice Mailed and Posted to Website Public Notice Published in the Garden Island newspaper
October 13, 2015	Draft EA Public Comment Period Open	
October 20, 2015	Notice of Draft EA Public Comment Period	Public Notice Published in the Garden Island newspaper
October 27, 2015	Draft EA Public Meeting	Draft EA Public Meeting
November 11, 2015	Draft EA Public Comment Period Close	
December 2015 (estimated)	Final EA	

2.2.2 Scoping

The participation of the public is a vital component of the project so that those who are interested in or potentially affected by proposed alternatives have an opportunity to share their concerns and provide input regarding the EA during the initial stages of the process. The Scoping Report (see Appendix B) outlines the scoping efforts and comments received from the agencies and general public during the scoping process.

Project scoping questions, comments, and concerns were requested from the public and government agencies during the preliminary scoping period, both orally at public meetings and via written submittal of comments. The main goal of public participation during the scoping period was to involve a diverse group of public and government agency participants to solicit input and provide timely information regarding their concerns pertaining to the project and the proposed alternatives. A summary of resource concerns and their relevancy to the proposed action is provided in Table 2-2 below.

Table 2-2. Resource Concerns Summary

Item/Concern	Relevant to the proposed Action? Yes	No	Rationale
Physical Environment			
Prime and Unique Farmland		X	Prime farmland and farmland of statewide importance is not located in the project area based on a review of web soil survey data (NRCS 2014a).
Geology / Mineral Resources		X	According to mineral resource data from the United States Geological Survey (USGS) there are no metallic or non-metallic resources in or near the project area (USGS 2011).
Soil and Erosion	X		The walking trail has experienced undermining and settlement due to existing slope conditions and erosional processes.
Surface/Ground Water Quality		X	No change in groundwater quality is anticipated. There are no surface water bodies located in the project area. Best management practices (BMPs) would be implemented and measures taken to reduce or eliminate sediment from flowing off the project site during precipitation events.
Ground Water Quantity		X	No change from existing conditions
Waters of the U.S.		X	Waters of the U.S are not located in the project area.
Regional Water Mgt. Plans and Coastal Zone Management Areas		X	The project area is located within a Coastal Zone Management Area (CZMA). Special Management Area (SMA) Permits are required for CZMA within SMAs. According to the State of Hawai‘i’s SMA locator interactive map (State of Hawai‘i 2015) the project area is not within a SMA.
Floodplain Management		X	According to the FEMA map that includes the project area (FEMA 2005), flood zone VE adjoins the western site boundary. Flood zone VE has base flood elevations (BFEs) of the 100 year flood with additional hazards due to storm induced velocity wave action at 33 and 34 feet. The project area and any ground disturbing activities would be at elevations well above 34 feet outside of the BFEs of the 100 year flood zone.
Wetlands		X	Wetlands are not located within the project area and would not be impacted by project actions.
Wild and Scenic Rivers		X	None of the rivers in Hawai‘i are designated as Wild and Scenic Rivers according to the National Wild and Scenic River System (NWSRS) website (NWSRS 2015).
Sole Source Aquifers		X	There are none in or near the project area according to USEPA Sole Source Aquifer Program Map (USEPA 2014).
Air Quality / Greenhouse gasses		X	Project actions would not have a measurable impact to air quality or greenhouse gas emissions.
Clean Air Act		X	Permits not required.
Biological Environment			
Special Status Plant and Animal Species (Federal and State listed)	X		Federal and state-listed plant and animal species and associated habitat are present in the project area.
Forest Resources		X	Clearing of forested areas would not be performed for project activities.
Noxious Weeds and Invasive Plant Species		X	Construction disturbance increases risk of invasive species becoming established. BMPs would be implemented and measures taken to reduce or eliminate species from becoming established.

Item/Concern	Relevant to the proposed Action? Yes	No	Rationale
Conservation Areas	X		The project area is located within a national wildlife refuge. A Comprehensive Conservation Plan is currently under development for the Refuge and can be accessed online at http://www.fws.gov/kilaueapoint.
Riparian Areas		X	There are no riparian areas that would be impacted by project actions.
Essential Fish Habitat	X		Essential Fish Habitat (EFH) is located within ocean waters adjoining the project area. Project activities would have a beneficial impact to EFH as proposed water discharge treatment measures would decrease the amount of sediment in water running downslope into the adjoining ocean waters.
National Wildlife Refuges / Wilderness Areas	X		The project area is located within the KPNWR. There are no designated Wilderness Areas located in or near the project area.
Wildlife Habitat	X		Disturbance to general wildlife and wildlife habitat during construction.
Coral Reefs	X		A coral reef is located within ocean waters adjoining the project area. Project activities would have a beneficial impact to the coral reef as proposed water discharge treatment measures would decrease the amount of sediment in water running downslope into the adjoining ocean waters.
Invasive Animal Species		X	Construction disturbance increases risk of introduction of invasive species. BMPs would be implemented and measures taken to reduce or eliminate the introduction of invasive species.
Migratory Birds/Bald and golden Eagles	X		Multiple Migratory Birds of Concern (MBOC) occur within the project area. Bald and golden eagles do not occur on Kaua‘i.
Livestock Grazing		X	Livestock grazing does not occur in or near the project area.
Human Environment			
Socioeconomics	X		The Refuge would be closed during construction and impact Socioeconomics.
Historic Properties/Cultural Resources	X		There are multiple sites listed on the National Register of Historic Places within the project area.
Hazardous Materials		X	All federal, state, and local laws and regulations pertaining to pollution and contamination of the environment to prevent pollution of surface water, groundwater, soil, and air with any hazardous materials, would be followed.
Environmental Justice and Civil Rights		X	Per Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations”, the project will not have disproportionately high and adverse human health or environmental effects … on minority populations and low-income populations.”
Public Health and Safety	X		There would be a beneficial impact to public health and safety by providing trail stabilization measures and decreasing sediment and water slip hazards on the trail.
Recreation	X		The Refuge would be closed to visitors during construction.
Land Use/Public Access	X		Public access to the Refuge would be closed during construction.
Visual Resources	X		There would be short and long term visual impacts from project activities.
National Scenic and Historic Trails		X	There are no National Scenic and Historic Trails located in or near project area according to a National Trails System Map (National Park Service [NPS] 2010).
Natural Areas and Parklands		X	The majority of the project area is developed with no natural areas. There are no State or National Parks located in or near project area according to State Parks Map (State of Hawai‘i 2015) and NPS Map (NPS 2015a).

Item/Concern	Relevant to the proposed Action? Yes	No	Rationale
Transportation Infrastructure		X	There would be no impacts to transportation infrastructure
Noise	X		Temporary construction related noise will occur. All county and state noise ordinance laws and regulations would be adhered to during construction.
National Landmarks and Monuments		X	None located in or near project area based on National Natural Landmarks Map (NPS 2012), National Monument Map (NPS 2015b), and National Historic Landmarks list (NPS 2015c).
Scientific Resources		X	N/A

Resource concerns determined to be relevant to the proposed project are discussed in detail in Section 4.

2.2.3 Draft EA

This portion will be completed in the Final EA to document the Draft EA public comment process. Comments and responses on the Draft EA will be included in Appendix A of the Final EA.

2.2.4 Final EA

When the Final EA is issued, a Notice of Availability will be published locally to notify the public of the finding and copies made available on the project website.

SECTION 3
ALTERNATIVES

3.1 Formulation Process

Numerous alternatives were developed by the project team based on the ability to address the purpose and need of the project, and were formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. In accordance with NEPA (40 CFR 1502.14) some of these initial alternatives were eliminated from further analysis due to high cost or other critical factors. Two action alternatives (Trail Stabilization with East Slope Drainage and Trail Stabilization with West Ravine Discharge) and one No Action alternative were selected by the USFWS and the project team to be analyzed.

3.2 Alternatives Considered but Eliminated from Detailed Study

The following alternatives and options were considered early in the project scoping phases, but were eliminated from detailed study as they were either considered ineffective, unacceptable, or did not meet the purpose and need of the project. The alternatives eliminated from detailed study consist of walking trail improvements and stormwater drainage improvements with options for treatment of stormwater.

3.2.1 Lighthouse Relocation and Trail Closure

This alternative would involve relocating the historic lighthouse, radio beacon house (information building), and oil house from the peninsula to a stable location. The walking trail north of the Visitor Center would be permanently closed and eventually become to unsafe and unstable to traverse due to slope failure. Visitors or Refuge staff would no longer have access to the point. As this alternative does not meet the purpose and need for the project and would have significant impacts to multiple resources it was eliminated from detailed study.

3.2.2 Trail – Existing Trail Alignment with Soil Nail Wall Repair

This alternative would leave the trail in its current alignment and attempt to provide a new wall system structurally designed to accommodate the steep slope and erosion on the downhill side. Due to the deteriorating condition of the existing retaining wall, a permanent tie-back anchor system would consist of installing tie-back anchors through the existing concrete masonry unit (CMU) retaining wall to provide lateral support for a new Shotcrete retaining wall in front of the existing retaining wall.

A borehole would be drilled through the existing wall and into the soil behind the wall (under the existing asphalt trail) approximately 12-16 feet deep at each anchor location. Anchor spacing would typically be spaced approximately 5 to 6 feet apart. A steel tendon or reinforcing bar would be inserted into the borehole and pressure grouted into place. A securing plate and nut would be installed on the surface of the anchor against the wall securing the wall to the anchor system. The permanent tie-back anchors would derive support principally from the bond between the grout and stiff to hard saprolite soil material matrix found underlying the trail.

In order to reduce the potential for future undermining of the bottom of the retaining wall, the wall would need to be embedded into the existing slope. The existing Shotcrete and soil material would be removed at the base of the wall and the slope would be excavated at the base of the wall to install a lower soil nail wall for stability and to accommodate future erosion of the slope.

This alternative was eliminated from detailed study because the soil nails are not as structurally stable as other trail stabilization measures. Since the intent of the project is to stabilize the walking trail for safety purposes, this alternative was not chosen since there are other alternatives that will provide a higher degree of safety, such as micropiles.

3.2.3 Trail – Existing Trail Alignment with Deep Foundation Support

This alternative would preserve the trail within its existing alignment and grade. In lieu of stabilizing the trail by fortifying the trail retaining wall system; however, this alternative would stabilize the walkway by constructing a new walkway supported on a deep foundation system. The new walkway would follow the same grades and alignment as the existing walkway and would consist of a structurally reinforced concrete deck supported on micropile foundations.

This micropile system would be similar to the soil nail assemblies. An approximately 8-inch borehole would be advanced vertically approximately 50 to 60 feet down into the weathered rock under the walkway. A reinforcing steel rod would be inserted into the center of the hole and the hole would be grouted solid to form an auger-cast pile. This new walkway would be designed so the micropiles would support the walkway, even if undermining of the walkway areas occur in the future. The micropiles could be drilled through the existing asphalt trail surface. Then the walkway would be excavated to accommodate the thickness of the new reinforced deck. Reinforcing bars would be installed to tie the new structural slab into the micropiles and the concrete deck would be poured. The existing concrete retaining wall would be removed, but otherwise the downhill slope would remain relatively untouched. Over time, further erosion would likely occur on the downhill slope and the new pile-support structural deck could become more elevated. The deck would be structurally designed to accommodate further erosion under the deck. A new railing would be installed for the new walkway.

This alternative was eliminated from detailed study because a straight alignment would provide more structural stability against the existing soil bank than the existing curved alignment along that trail section. Since the intent of the project is to stabilize the walking trail for safety purposes, this alternative was not chosen since there are other alternatives that will provide a higher degree of safety.

3.2.4 Trail – Offset Trail Alignment into Hillside with Soil Nail Retaining Wall

This alternative would relocate the trail alignment in the localized area of wall and slope damage. The trail would be set into the hillside approximately 10 feet and would require a short retaining wall on the uphill side approximately 3 to 4 feet tall. A small wall would also be constructed on the downhill side of the new trail (approximately 4 feet high). Depending on how far the trail is offset into the hillside from its current alignment, these retaining walls could be conventional segmental precast walls (‘Keystone’ type) or soil nail walls. This alternative has the benefit of providing for future erosion as well as establishing a shallow sloped area on the downhill side of the trail for re-vegetation. By relocating the walkway further to the west into the hillside, the new walkway would be further away from the face of the slope and would dramatically reduce the potential for future stability issues resulting from ongoing erosion of the slope and undermining of the walkway.

This alternative was eliminated from detailed study because the soil nails are not as structurally stable as other trail stabilization measures. Since the intent of the project is to stabilize the walking trail for safety purposes, this alternative was not chosen since there are other alternatives that will provide a higher degree of safety, such as micropiles.

3.2.5 Trail – Install Bridge Over Eroded Slope

This alternative would consist of installing a free hanging bridge over the slope erosion area in the same location as the existing trail. The trail would be raised to allow erosion to pass underneath the bridge and continue downhill. This alternative would allow erosion to occur and not impact the structural stability of the walking trail.

This alternative was eliminated from detailed study since the micropile support alternative would provide the same level of slope protection at a considerably lower cost as compared to a bridge structure. Additionally due to the large amount of area that would have to be disturbed for construction of a bridge and associated impacts to environmental resources, this alternative may significantly impact the environment.

3.2.6 Trail – Pathway Surfacing

The walking trail starting from the lighthouse down to the fee both would be replaced with either: 1) concrete, 2) hard resin, 3) gravel, or 4) pervious surface.

These pathway surfacing alternatives were eliminated from detailed study for the following reasons: 1) concrete is more expensive than asphalt and asphalt provides the same structural stability required for the project; 2) the hard resin is not as structurally strong as asphalt or concrete; 3) the gravel surface may cause erosion issues during storm events; and 4) the pervious surface would allow water to infiltrate through the pathway into the subgrade causing safety concern for stability on the hillside when the soil becomes saturated.

3.2.7 Stormwater – East Slope Drainage in Multiple Locations

The walking trail would be regraded to drain stormwater to the downhill side of the trail and provide regular drainage paths to drain water off the edge of the trail onto the planted hillside. Drainage paths would be provided at regular short intervals to re-create as closely as possible original sheet flow conditions down the hillside.

This alternative was eliminated from detailed study because it does not meet the purpose and need by draining stormwater over the edge of the east slope in multiple locations which may accelerate erosion and lead to increased safety concerns.

3.2.8 Stormwater – West Ravine Trail and Parking Lot Collection

All of the stormwater would be collected for the full length of the walking trail and from the parking lot. Collected stormwater would be discharged into the coconut grove and would flow downstream to the west ravine. Stormwater would be conveyed either by installing catch basins and drainage piping or by correcting the trail drainage to convey it the complete distance and prevent water running down the sidewalk behind the visitor center.

This alternative was eliminated from detailed study due to the large volume of water that would be collected in the stormwater system and discharged down the west ravine. The new system would combine runoff from both non-pollution generating surfaces (pathway) and pollution generating surfaces (parking lot)

which would adversely impact the treatment design and requirements. Additionally collection of water within the parking lot does not help meet the purpose and need of the project.

3.2.9 Stormwater – West Ravine Trail Collection with Discharge at Coconut Grove

Stormwater would be collected along the walking trail from the lighthouse to the visitor center. An underground pipe would convey the stormwater from the visitor center to discharge at the coconut grove where water would flow downstream to the west ravine. Stormwater would be collected and conveyed either by installing catch basins and drainage piping or by correcting the trail drainage to convey it to the visitor center and prevent water running down the sidewalk behind the visitor center.

This alternative was eliminated from detailed study because it would discharge excessive stormwater at the coconut grove and require treatment of stormwater sources outside of the flows collected along the walking trail. Refuge staff use the coconut grove for access to an equipment tent in the west ravine and excessive stormwater may cause O&M issues from erosion and sedimentation. Additionally stormwater treatment systems at the discharge point would have to take into consideration the combined flows from the diverted walking trail stormwater as well as other sources of stormwater draining to the coconut grove. Treatment of stormwater from other drainage sources into the coconut grove does not help meet the purpose and need for the project.

3.2.10 Stormwater – West Ravine Trail Collection with Discharge into Cistern

Stormwater would be collected along the walking trail from the lighthouse to the visitor center. An underground pipe would convey the stormwater from the visitor center and route it to a historic cistern behind the visitors services building. Any flows in excess of the cistern capacity would be conveyed from the cistern downstream through a pipe and discharge into the west ravine. Stormwater would be collected and conveyed either by installing catch basins and drainage piping or by correcting the trail drainage to convey it to the visitor center and prevent water running down the sidewalk behind the visitor center.

This alternative was eliminated from detailed study since the existing cistern would not provide sufficient storage capacity to mitigate the additional flows to the ravine. The cistern would also be prone to collect sediment which would be difficult to clean.

3.2.11 Stormwater Discharge Treatment Options

The items below summarize treatment options of stormwater discharge for the alternatives listed in Sections 3.1.6 through 3.1.9 above.

<u>Option 1 – No Treatment</u>
Stormwater at the discharge point would flow directly onto the ground surface and travel down the slope or ravine in its natural course. This option was eliminated from detailed study due to the erosion potential caused by routing additional flows to new locations.

<u>Option 2 – Energy Dissipater</u>
Stormwater at the discharge point would flow into an energy dissipation structure to reduce the velocities that could cause excessive erosion on the ground. Water would continue to flow downstream out of the energy dissipater structure in its natural course. This option was eliminated from detailed study since it does

not address the increased flow to some areas caused by alternating the existing flow paths and discharge locations.

Option 3 – 100-Year Infiltration
Stormwater at the discharge point would flow into an infiltration system consisting of an infiltration basin and infiltration trench. The infiltration system would be designed to capture up to the 100-year storm event. Storm events greater than the 100-year would overtop the basin and flows would be allowed to travel down the slope or ravine in its natural course. This option was eliminated from detailed study due to the size of infiltration basin that would be required and the associated environmental impacts to bird breeding habitat.

3.3 Alternatives Considered for Detailed Study

There were two action alternatives considered for the project that were carried forward to detailed analysis in this EA. The No Action Alternative must also be considered. The alternatives are described below.

3.3.1 No Action

The No Action alternative would consist of leaving the existing conditions intact and does not involve any improvements. This alternative would not improve or address slope erosion, instability, maintenance issues, and public safety concerns that currently exist along the walking trail. It is assumed that that by no federal action there would not be any other funding available to stabilize the walking trail and that it may ultimately fail causing the Refuge to close access to the lighthouse.

3.3.2 Trail Stabilization with East Slope Discharge

Proposed activities for the Refuge Trail Stabilization project would include stabilizing a segment of the walking trail with a pile-supported section, asphalt resurfacing, and stormwater drainage improvements.

Walking Trail
Approximately 700 linear feet of the existing asphalt along the walking trail from the fee booth north to the lighthouse area would be removed. Within this trail section approximately 300 feet of existing fence, 90 feet of retaining wall, and 1,000 square feet of Shotcrete along the east side would be removed, as well approximately 200 feet of concrete curbing along the west side. A 100-foot section of the walking trail would be realigned and micropile supported for stabilization (see Pile Supported Trail description below). To reduce future erosion, a stormwater drainage system would be installed for proper collection, conveyance and discharge of stormwater (see Stormwater Improvements description below). The existing base material along the walking trail (outside of the pile supported section) would be left in place and regraded as required. The walking trail would be repaved with a 2-inch layer of asphalt upon completion of regrading. Any fencing removed for repaving activities would be replaced with similar fencing and adequate space would be left for seabird movements beneath the fence (as-is). See Figure 3-1 below for walking trail modifications. Any salvageable materials removed during construction would be reused where appropriate, recycled, or stored by the Refuge for reuse at other locations on the Refuge.

Pile Supported Trail
The 100-foot section of the walking trail, most impacted from erosion, settlement and undermining, would be realigned approximately 2 to 4 feet west of its current alignment into the existing hillside. This section would be pile supported with approximately twelve, 6-inch diameter micropiles extending 50 to 60 feet

below ground surface (bgs) and topped with a 14-inch thick concrete slab. The concrete slab would tie into a concrete stem wall approximately 2 feet tall along the east side and an approximate 3- to 6-foot tall retaining wall along the west side. To prevent water overflow and sediment deposition on the trail, a small concrete gutter or gully will be placed on the back of the west wall. This gully will convey runoff from the hillside to 24-inch by 24-inch catch basins on the north and south side of the wall. Approximate 12-foot long pipes would be installed under the walking trail connecting the catch basin to the stormwater collection system. See Figure 3-2 below for a plan and section of the proposed pile supported trail.

Stormwater Improvements

Existing Conditions

Currently there is not a stormwater collection system associated with the walking trail. With regards to Stormwater features, the walking trail can be divided into three sections. The first section begins at the north end of the trail, adjacent to the light house and runs approximately 60 feet to the south. This is the location of the high point on the trail and is approximately 3,900 square feet in area. Flows from this section flow to the north and either onto the grass area in front of the light house or off of the sides. The middle section runs from the high point to just in front of the visitor center. It is made up of approximately 9,400 square feet of paved area and there is also approximately 6,500 square feet of vegetated area above the trail that drains onto the surface. Stormwater from this section typically flows to the east side of the trail and then will flow off, onto the slope at various locations, making its way to the ocean. These flows have contributed to the erosion and destabilization of the slope and walking trail and have carried sediment to the ocean. The last section begins in front of the visitor center and runs to the end of the trail, near the fee booth. This section is approximately 1,400 square feet in area and stormwater typically runs along the sides of the trail, then flows onto the parking lot. From here the flows run off the parking lot into the coconut grove and continue downstream to the west ravine and to the ocean.

To alleviate the erosion and destabilization of the slope and walkway, a stormwater collection system is proposed for the middle section of the walking trail.

Stormwater Collection

The stormwater collection system would be installed and designed for collection and conveyance of water for a 10-year storm event over an approximate 0.365-acre area (15,900 square feet). The system would consist of three, 6-inch wide by 12-foot long trench drain collection systems that would be installed on the east side of the walking trail. In order to prevent injury to bird species that inhabit the area and to comply with Americans with Disabilities Act (ADA) regulations the trench drains would be covered with a grate that has a maximum spacing of ½-inch. A 12-inch diameter corrugated high density polyethylene (HDPE) pipe would be placed under the trail alignment to convey collected flows to the south, and would be connected to the drains with 8-inch pipe. Pre-cast concrete manholes would be installed along the conveyance pipe at connection points and points of alignment change. The system would be designed to maintain self-cleaning velocities to avoid plugging and minimize future maintenance. See Figure 3-1 below for the approximate stormwater collection system alignment and placement of trench drains and manholes.

Stormwater Discharge / Treatment

Although the walkway is not consider a pollution generating surface and does not require water quality treatment, the current stormwater runs off of the walking trail, flows down the steep slope, generating erosion and impacting the ocean below. The proposed design will collect and convey those flows to a new location, less likely to cause erosion and damage to the walking trail. The Hawai‘i State Department of

Transportation (DOT) – Storm Water Permanent Best Management Practice (BMP) Manual was conferred to determine an appropriate BMP to control these flows. With the limited space available on the peninsula, the use of stormwater infiltration was selected. This will reduce the amount of stormwater that discharges onto the surface and reduce sediment load generated by erosion. Per the Hawai‘i State DOT Manual, the design storm for sizing the selected infiltration BMP is a 1-inch in 24-hour event. This event is intended to capture the 85-percentile storm. Based on historic precipitation data for Kīlauea Point (Western Regional Climate Center 1985), from 1949 to 1985 there was on average 10 precipitation events annually that exceeded 1-inch in 24-hours. For the area that will be collected (15,900 square feet), the required volume to be infiltrated is approximately 1,130 cubic feet of stormwater.

The infiltration system would consist of an infiltration basin, infiltration trench, berm, overflow pipe, and outlet riprap. The system would have dimensions approximately 40 feet by 55 feet. The infiltration basin would have a minimum bottom area of approximate 250 square feet with sides sloped out at 2:1. Water would pool up to 2 feet above the bottom of the basin and then infiltrated into the ground. The sloped sides would be lined with 4 to 6-inch quarry spall riprap up to the anticipated top water surface, and be planted with vegetation above that. A 3-foot deep infiltration trench would be installed below the bottom of the basin. The infiltration trench would be lined and covered with a filter fabric, and backfilled with 1 ½ to 2 ½-inch clean stone. A layer of pea gravel would be placed over the top of the backfilled trench. This bottom infiltration trench will provide additional capacity as well as increase the available area for infiltration. Overflows from the infiltration system (storm events over the 1-inch design storm) would enter into a small existing gully that would be lined with riprap at the discharge point. See Figure 3-3 below for a plan and section of the stormwater infiltration system.

East Slope Discharge

Water would be discharged into an infiltration system on the east slope from the manhole at the visitor center through a 35-foot long, 18-inch HDPE pipe. The infiltration system would be located in an area currently containing primarily invasive haole koa which will be cleared for construction with dimensions approximately 70 feet by 40 feet. Overflow water from storm events over the 1-inch design storm, would discharge into an existing channel and travel approximately 100 feet down the slope to the cliff face at the ocean. Once water reaches the cliff face it would cascade over the cliff into the ocean.

Construction Staging and Access

The Refuge property inside of the public entrance gate would be closed to the public during construction, since the only access to the lighthouse would be unsafe for the visiting public. The existing parking lots would be used for the construction staging area for all activities. Access to the various construction elements will utilize the walking trail to reach the lighthouse. A designated access path to the east slope infiltration system would be cleared across from the visitor center and no other off-trail access would be allowed on the Refuge.

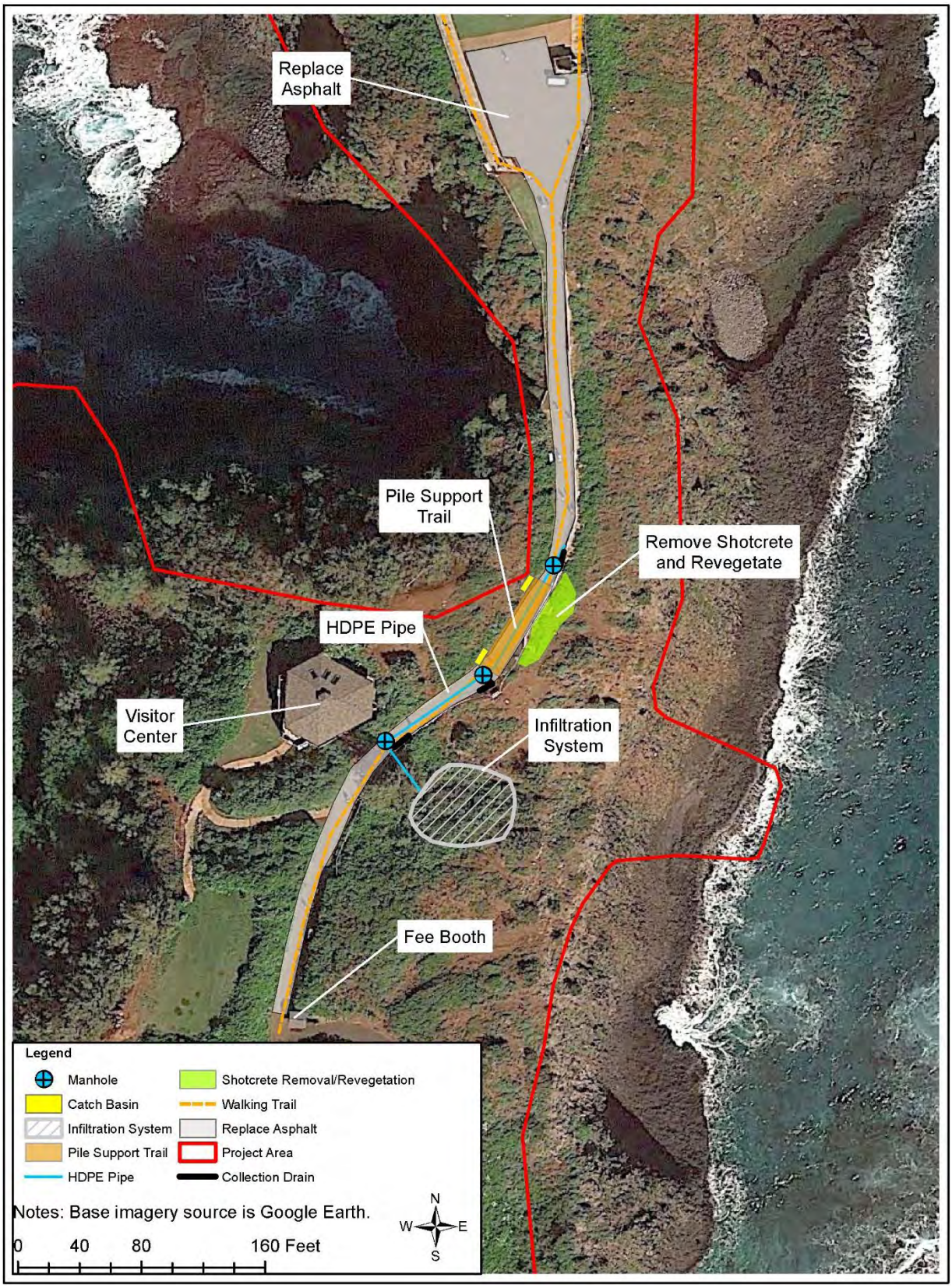

Figure 3-1. Alternative 1 –Trail Stabilization with East Slope Discharge

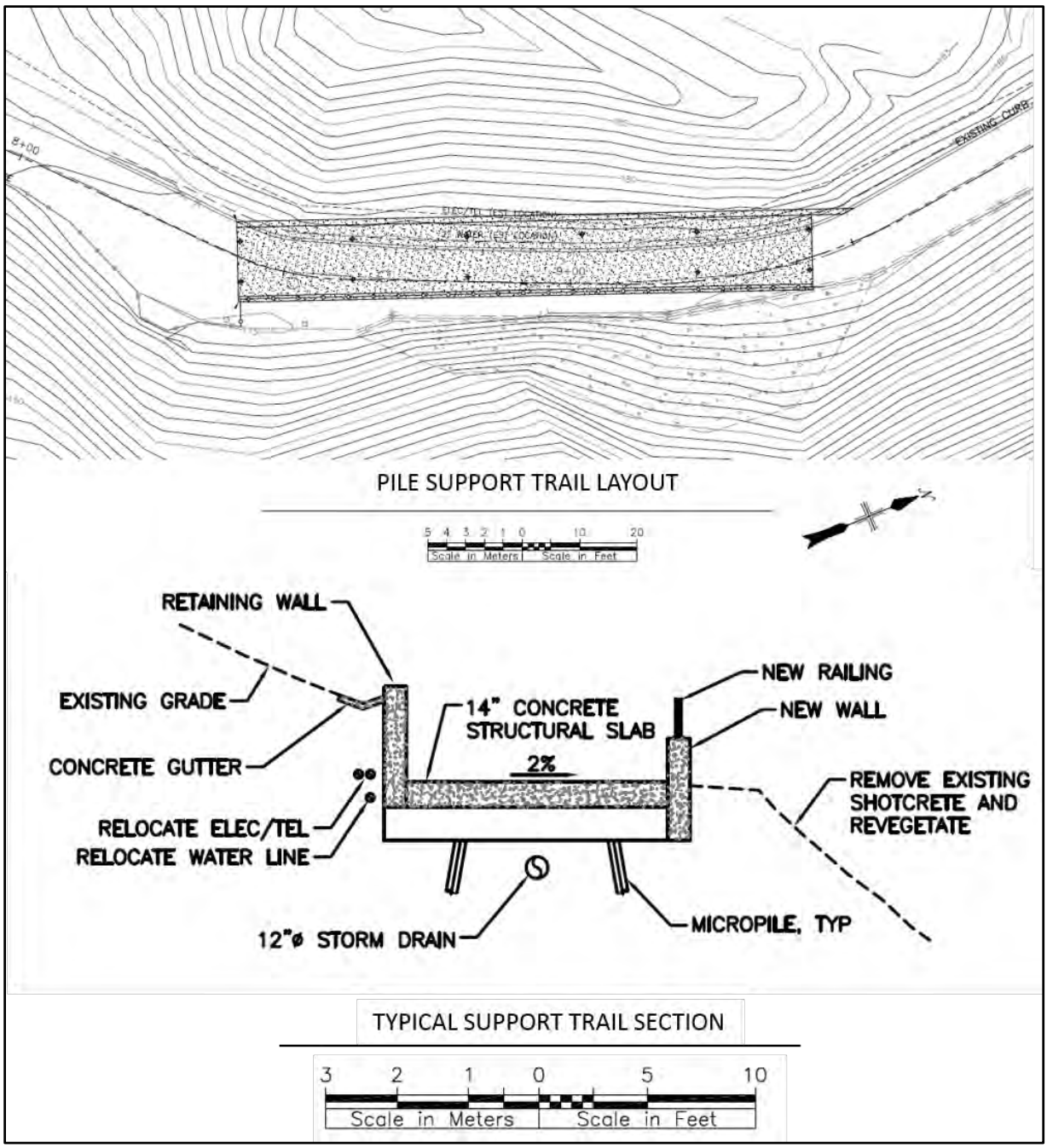

Figure 3-2. Pile Supported Trail

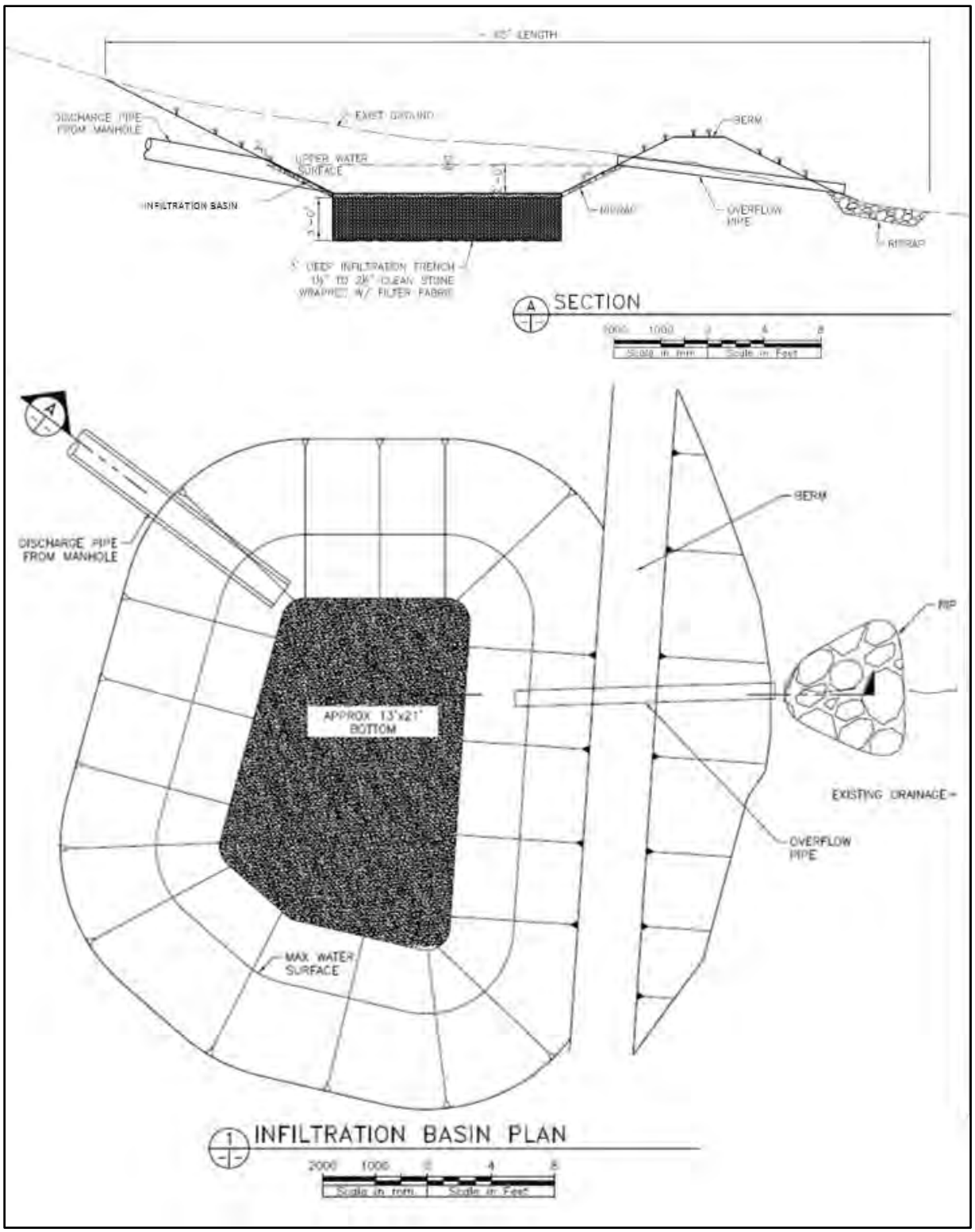

Figure 3-3. East Slope Discharge Stormwater Infiltrations System Plan and Section

3.3.3 Trail Stabilization with West Ravine Discharge

The Walking Trail, Pile Supported Trail, and Stormwater Improvements-Stormwater Collection elements are the same as the Trail Stabilization with East Slope Discharge Alternative. See Section 3.3.2 above for a detailed description of these project elements.

Stormwater Improvements

West Ravine Discharge

The west ravine discharge would consist of extending the conveyance pipe underground from the visitor center south along the walking trail alignment 250 feet to the visitor service building driveway and then generally west approximately 180 feet to the west ravine. The pipe would discharge into an infiltration system constructed in the bottom of the ravine (See Figure 3-4 below). Existing natural flows would continue to flow within the existing ravine channel without impedance of flow, but would require a bypass pipe in the area of the infiltration system. The infiltration system would consist of an infiltration basin and infiltration trench designed similar to the East Slope Discharge Alternative, but would be approximately 40% larger. The size of basin for this alternative would capture collected flows for a 1.4-inch storm event. Overflow water from storm events over the 1.4-inch design storm, would discharge from the infiltration system downstream and combine with the existing drainage flow. The channel would be lined with riprap at the discharge point of the bypass pipe and basin overflow, and flows would continue downstream in the existing ravine approximately 300 feet to the ocean. See Figure 3-5 below for a plan and section of the stormwater infiltration system.

Construction Staging and Access

The Refuge property inside of the public entrance gate would be completely closed to the public during construction, since the only access to the Lighthouse would be unsafe for the visiting public. The existing parking lots would be used for the construction staging area for all activities. Access to the various construction elements would utilize the walking trail to reach the lighthouse. A designated access path through the coconut grove leading to the west ravine infiltration system would be cleared for construction access and revegetated upon construction completion. Construction access from the visitor services building will also be created by temporarily moving the shed and clearing a path to the ravine. No other off-trail access would be allowed on the Refuge.

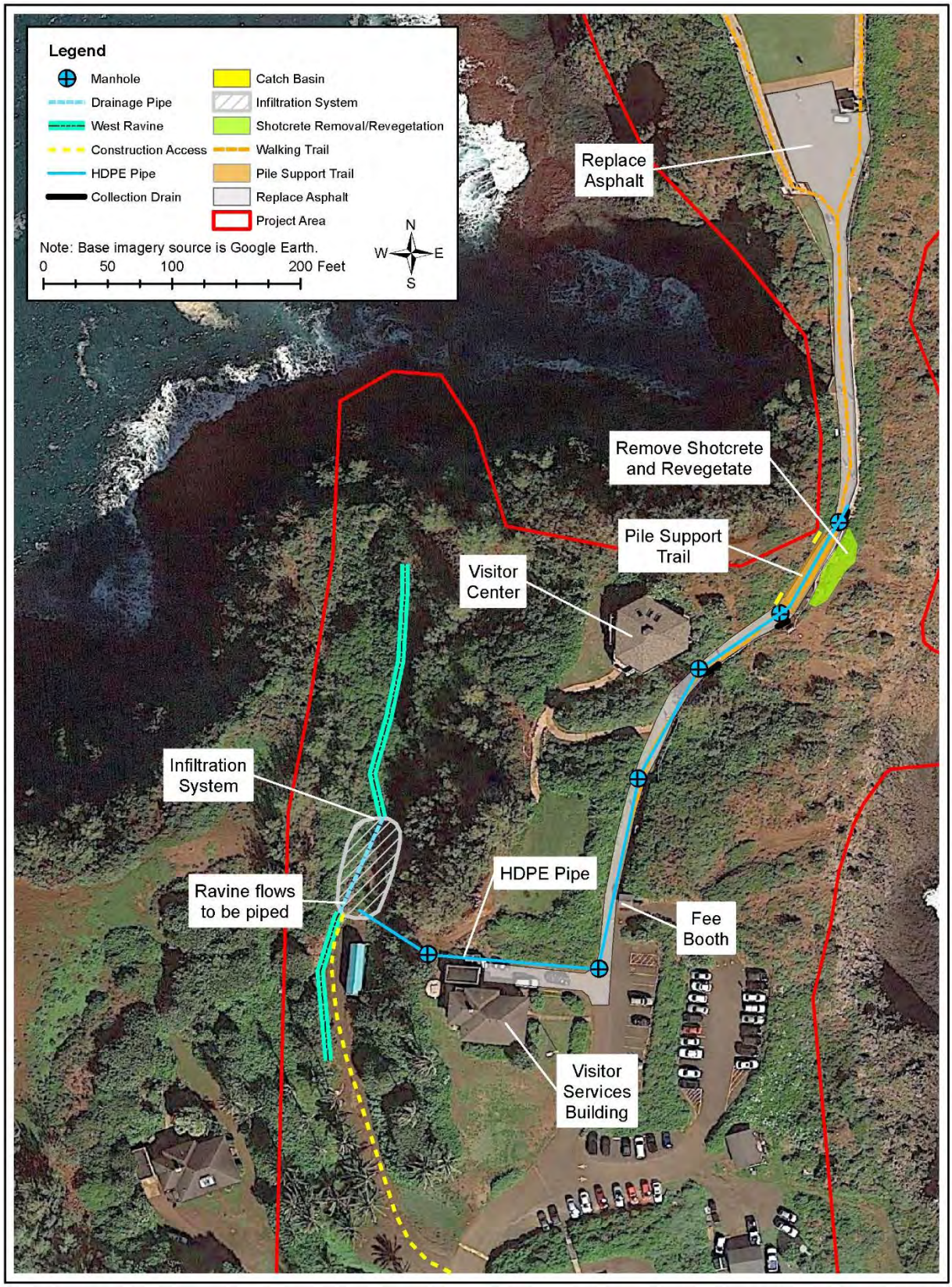

Figure 3-4. Alternative 2 –Trail Stabilization with West Ravine Discharge

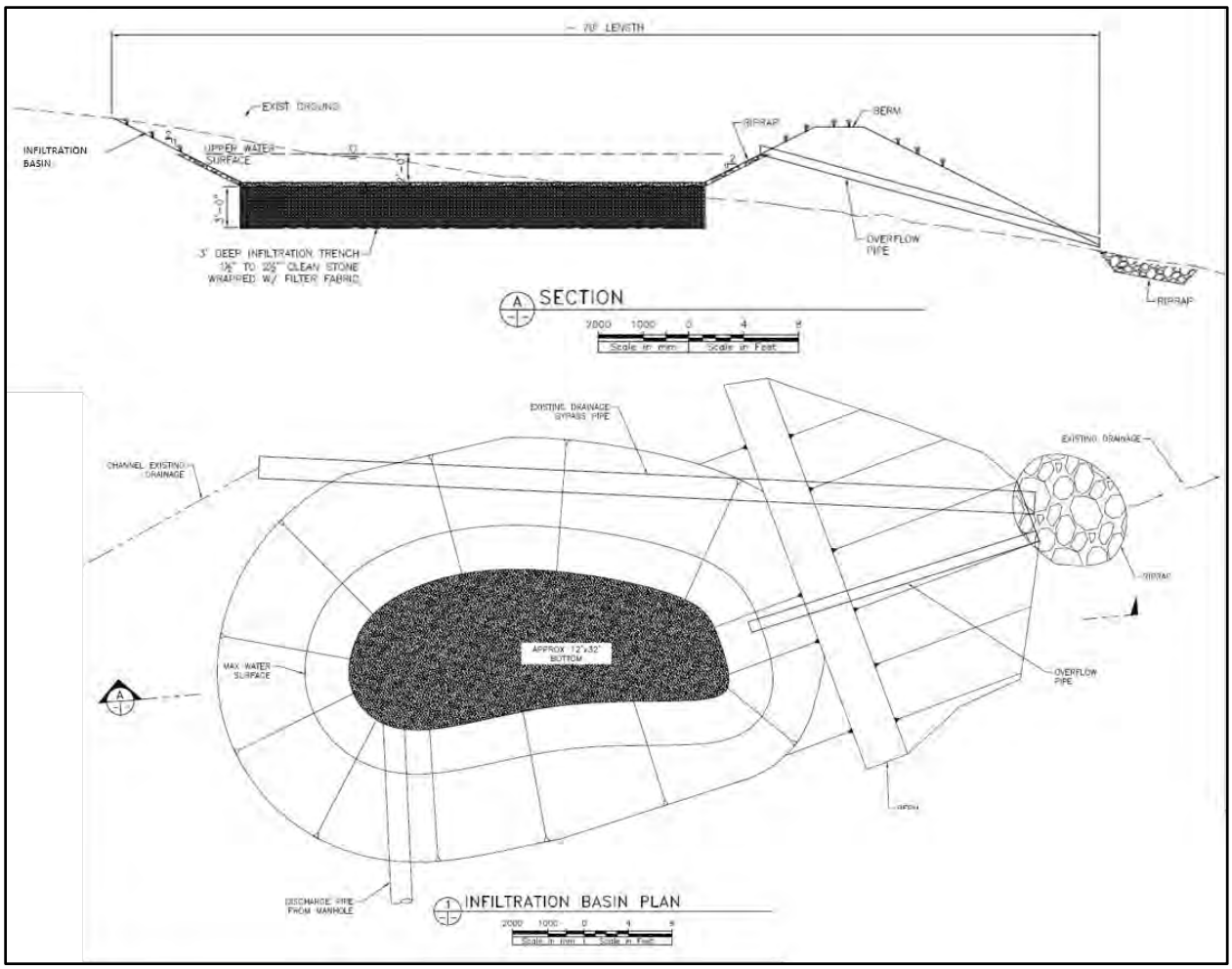

Figure 3-5. West Ravine Discharge Stormwater Infiltrations System Plan and Section

3.3.4 Mitigation, Minimization, and Avoidance

The following mitigation, minimization and avoidance measures are proposed for project activities. Note that consultation with agencies for this project is ongoing and changes or additions to these measures may be required as consultations are completed.

Federal and state-listed special status species / Wildlife / MBOC:

- A USFWS biologist, or a construction staff designated and trained by a USFWS biologist, will be onsite as necessary during construction activities to map and monitor all breeding activity within the project area, to clear for access to construction areas, and to address sensitive plant or animal species that may be found onsite.
- The USFWS biologist will inspect restoration activities to make sure disturbed areas are restored according to permit stipulations;
- The contractor will only enter/exit the action area through areas pre-cleared by the biologist or a designated and trained construction staff;
- Once the construction activity is complete temporarily disturbed surfaces will be restored/re-vegetated using native plant species approved by the USFWS;

- Construction activities will be confined to previously disturbed areas where possible for work, staging, and storage activities, waste areas, and vehicle and equipment parking areas. Vegetation disturbance will be minimized as much as possible;
- The mast of the drilling equipment will only be raised during daylight hours and would be lowered at the end of each work day prior to dusk;
- A temporary perimeter fence will be established for the construction site to keep threatened and endangered (T&E) species from entering the construction site;
- Heavy construction activities as well as construction of storm-water drainage system will occur outside of the Newell's shearwater breeding season (prior to March);
- There will be no night-time construction activities; and
- The construction schedule will be planned to avoid sensitive nesting areas and dates.

Recreation:

- The upper scenic overlook would remain open to visitors to maintain opportunities for wildlife observation and photography and viewing/photography of the lighthouse as well as the scenic views.
- The Kīlauea Point Natural History Association (KPNHA) gift shop currently located in the visitor center would be relocated to an accessible area in Kīlauea (Kong Lung Historic Market Center) where visitors could still learn about the refuge and purchase gifts and souvenirs.
- Existing paved parking areas and overflow parking at the upper scenic overlook would continue to be utilized during the closure to provide visitor parking and access.
- Temporary restroom facilities would be provided at the upper scenic overlook for visitors.

Public Access:

- Existing access will be maintained at residential properties and to the upper scenic overlook.
- Traffic control measures would be in place to handle visitor traffic and congestion issues at the upper scenic overlook. Traffic control measures may include signage, speedbumps, fencing, cones, candles, barrels, and traffic control personnel.
- Parking time restrictions would in place and appropriate time restriction signage would be posted to manage visitation flow at the upper scenic overlook.
- Signs indicating closure of the Refuge would be posted at multiple locations in Kīlauea.

Visual:

- Native vegetation would be planted around the perimeter of the infiltration system to help conceal the basin.

Noise:

- Construction activities which would emit noise in excess of the County maximum permissible sound levels (MPSLs) (measured at the closest property boundary) would be performed between the hours of 7:00 a.m. and 6:00 p.m. Monday through Friday, and 9:00 a.m. to 6:00 p.m. on Saturday (to the extent operable).
- Work which would emit noise in excess of the MPSLs (measured at the closest property boundary) would not be performed on Sundays or holidays.
- A decibel meter will be used at the edge of the Refuge property to document noise emissions from the construction area. If noise emissions are in excess of the MPSLs during the selected day and time periods, corrective measures will be performed to reduce noise emissions.
- No equipment or material deliveries would occur on Sundays at the Refuge.

3.3.5 Project Schedule and Sequencing

The following describes the construction sequencing for both of the Action Alternatives:

January 2016

1. Close Refuge (January 1) at the entrance gate to the public;
2. Mobilize project equipment and materials to site;
3. Install temporary Best Management Practices (BMPs) including, silt fence, straw wattles, stabilized construction ingress/egress;
4. Set up staging and laydown area;
5. Demolish existing asphalt walking trail and dispose offsite at an appropriate facility;
6. Mobilize micropile drilling equipment to the site. Drill down to bedrock installing pile for a total of 12 to 16 piles;
7. Form pile cap together with reinforcing, pour, and cure; and
8. Strip forming material and backfill to grade of walking trail.

February 2016

9. Install underground stormwater pipe system and catch basins;
10. Clear vegetation in stormwater collection area on east slope or in west ravine;
11. Excavate ditch and install stormwater pipe; and
12. Construct infiltration system.

March 2016

13. Reseed or revegetate disturbed areas with approved plant species;
14. Grade and compact trailway;
15. Install asphalt on new walking trail; and
16. Complete curbing and install new fencing to replace what was removed for construction.

April 2016

17. Project site cleaning and owner training for maintenance;
18. Demobilize project equipment and materials from the site; and
19. Reopen Refuge (April 30) to the public.

Construction activities would be completed in one season, pending the bird breeding season and weather conditions. Work would be completed seven days per week between the hours of 7am and 6pm according to the Kauaʻi County noise ordinance.

3.4 Preferred Alternative

A preferred alternative has not been selected for the project as part of this Draft EA. Once comments are received on the proposed alternatives, the Refuge will recommend a Preferred Alternative and it will be documented in the Final EA.

If the USFWS Responsible Official determines that the recommended alternative would not significantly affect the quality of the natural and human environment, then they will prepare and sign a Finding of No Significant Impact (FONSI), and the project may proceed. If the USFWS Responsible Official determines that the recommended alternative would significantly affect the quality of the natural and human environment, then an Environmental Impact Statement (EIS) and a Record of Decision (ROD) must be prepared and signed before the project can proceed.

SECTION 4
AFFECTED ENVIRONMENT

4.1 Introduction

The purpose of this chapter is to describe the area that could be affected by the proposed alternatives, including the areas of physical, biological and human environment resources affected by the proposed action. The purpose of describing the affected environment is to define the context in which the impacts could occur. The environmental analysis process has been conducted in compliance with applicable federal, state, and local regulations. The resources described below were determined during the scoping process to be relevant to the proposed action. Resources determined to not be relevant to the proposed action have been eliminated from detailed study. Refer to Section 2.0 for a complete list of resources and rationale for including or eliminating them from detailed study.

Table 4-1. Physical Setting Summary

Physical Setting Information		Information Source
Location		
Location	The Refuge is located off Kīlauea Road at the northern-most point of Kaua‘i, approximately 1 ¼ miles north of Kīlauea, in Kaua‘i County, Kaua‘i.	N/A
Topography		
Elevation	Approximately 120 to 240 feet above mean sea level (AMSL).	U.S. Geologic Survey (USGS) Anaholoa, HI 7.5’ Quadrangle (USGS 2013)
General Topographic Gradient	Very steeply sloping cliff faces surround the project area to the north, east and west.	
Geology		
Geologic Units	Lava Flows (Qkl)	Geologic and Topographic Map of the Island of Hawai‘i (Macdonald and others 1960)
Unit Description	Nepheline basalt, melitite-nepheline basalt, olivine basalt, picrate-basalt, and basanite lava flows of the Koloa Volcanic Series. Flows erupted from multiple vents scattered over the eastern portion of the island.	
Soil Characteristics		
Soil Type	**Koloa stony silty clay, 15-25% slopes (KvD)** – Consists of Koloa, stony, and similar soils that formed from basic igneous rock. A typical soil profile includes stony silty clay over bedrock to 60 inches. **Lihue silty clay, 15-25% slopes (LhD)** – Consists of Lihue and similar soils that formed from basic igneous dust. A typical soil profile includes silty clay to 60 inches. **Rock Outcrop (rRO)** – Basalt bedrock	Soil Survey website (NRCS 2014)

4.2 Physical Environment

4.2.1 Soil and Erosion

Soils

The northern coast of Kaua‘i is generally underlain by a thick sequence of residual soils and extremely weathered basaltic rock (saprolite) in the Koloa Volcanic Series. Soil along the northern coast generally

consist of in-situ basalt rock and cinder that has been deeply weathered to form a silty and clayey residual and saprolitic soils with embedded decomposed rock material (GHD Inc. 2014). Soils within the project area generally consist of very stiff to hard clayey silts, overlain by sandy silts and silty sands with some weathered gravel and cobbles (in some areas), overlain by basalt.

In September of 2015 percolation testing was conducted in subsurface soils at the Refuge at two locations. A percolation test was performed along the east slope and one in the west ravine at the project proposed infiltration system locations. Soils on the east slope generally consisted of clayey silt with occasional basalt cobbles to about 2 feet. Soils in the west ravine generally consisted of clayey silt with sand and trace basalt gravel to about 2 feet. Preliminary results of the percolation test show that the approximate percolation rate in subsurface soils (within approximately 2 feet of ground surface) was about 6.6 inches per hour at the east slope location and 74.7 inches per hour at the west ravine location.

Erosion
The 1- to 4-inch thick paved walking trail and 2- to 3-inch base course material currently rest on native clayey silt. Slope erosion and settlement of the walking trail has occurred along a relatively isolated length of the trail (less than 100-foot length). In a 2014 geotechnical investigation the following preliminary conclusions were made for the direct causes for the slope degradation and structural wall damage (GHD 2014):

- Naturally high wind and rain surface erosion. (Note that this is the general nature of the site and whatever wall repair solution is selected, the design will need to accommodate future erosion of soil down the slope.)
- Native site soil is reddish clay and is susceptible to erosion.
- The downhill slope is excessively steep and is exposed to potential erosion action.
- In storm events, wind driven rain may be striking the wall & shotcrete and causing scour at the base.
- It appears that water may be entering the soil profile behind the wall and potentially removing away fines particles causing potential voids.
- The path of water into the soil profile has not been confirmed and may be a combination of surface water running down the path and/or subgrade water migration through the utility trenches.
- It appears the problem may be accelerating.

4.3 Biological Environment

4.3.1 Special Status Plant and Animal Species

There are 44 animal, four arthropod, two snail, 14 plant species, and 8 plant clusters federally-listed as threatened and endangered (T&E) for the Pacific Islands. There are an additional 48 species only found on the island of Kauaʻi that are federally listed as T&E which consist of 45 plants, two birds and one insect. The Hawaiʻi DOFAW indigenous wildlife and plant and animal T&E lists (Hawaiʻi DOFAW 2015) identify 589 plant species as candidate, a species of concern (SOC) or T&E, and 79 T&E wildlife species. The state list also includes a listing of 126 indigenous wildlife species.

A comprehensive list of species that may occur in the vicinity of the project area was created. Based on a review of available information, the state and federal listings for these species and likely occurrence of the species within the project area was determined. See table 4-2 below for the comprehensive list of species,

listing status, and likely occurrence within the project area. Additional discussion is included below the table for those species likely to occur in the project area.

Table 4-2. Species List

Hawaiian Name	Common Name	Scientific Name	Federal Listing			State Listing				Likely Occurrence in PA
			T/E	MBOC	USPI SOPCI	T/E	C	SOC	I	
Birds										
ʻAʻo[3]	Newell's Shearwater	*Puffinus auricularis newelli*	T	X		T			X	Yes
Nēnē[3]	Hawaiian Goose	*Branta sandvicensis*	E	X		E			X	Yes
Pueo[3]	Hawaiian Short-eared Owl	*Asio flammeus sandwichensis*				E[1]			X	Yes
Mōlī	Laysan Albatross	*Phoebastria immutabilis*		X					X	Yes
ʻUaʻu kani	Wedge-tailed Shearwater	*Puffinus pacificus*		X					X	Yes
Koaʻe kea	White-tailed Tropicbird	*Phaethon lepturus*		X					X	Yes
Koaʻe ʻula	Red-tailed Tropicbird	*Phaethon rubricauda*		X					X	Yes
ʻĀ	Red-footed Booby	*Sula sula*		X					X	Yes
Kaʻupu	black-footed Albatross	*Phoebastria nigripes*		X					X	Yes
ʻĀ	brown booby	*Sula leucogaster*		X					X	Yes
ʻIwa	Frigatebird	*Fregata minor*		X					X	Yes
Kōlea	Pacific golden-plovers	*Pluvialis dominica*		X	X				X[2]	Yes
ʻAkekeke	Ruddy turnstones	*Arenaria interpres*		X	X				X[2]	Yes
ʻUlili	Wandering tattlers	*Tringa incana / Heteroscelus incanu*		X	X				X[2]	Yes
Huna Kai	Sanderling	*Calidris alba*		X					X[2]	No
Kioea	Bristle-thighed curlews	*Numenius tahitiensis*		X	X				X[2]	No
Mammals										
ʻŌpeʻapeʻa[3]	Hawaiian hoary bat	*Lasiurus cinereus semotus*	E			E			X	Yes
ʻIlio-holo-i-ka-uaua[3]	Hawaiian monk seal	*Monachus schauinslandi*	E			E			X	Yes
Reptiles										
Honuʻea	Hawksbill turtle	*Eretmochelys imbricata*	E			E				No
Honu	Green turtle	*Chelonia mydas*	T			T			X	Yes

Hawaiian Name	Common Name	Scientific Name	Federal Listing			State Listing				Likely Occurrence in PA
			T/E	MBOC	USPI SOPCI	T/E	C	SOC	I	
Plants										
Pokulakalaka	N/A	*Munroidendron racemosum*	E			E				No
Alula	N/A	*Brighamia insignis*	E			E				No
N/A	Dwarf naupaka	*Scaevola coriacea*	E			E				No
Loulu	N/A	*Pritchardia aylmer-robinsonii*	E			E				No
Loulu	N/A	*Pritchardia napaliensis*	E			E				No
Ohai	N/A	*Sesbania tomentosa*	E			E				No

[1]Endangered in Oahu only, [2]Regular winter migrant, [3]Endemic to Hawaiian Islands, [4]Dominant plant species in the Refuge
USPI SOPCI - U.S. Pacific Islands Shorebird of Primary Conservation Importance, MBOC - Migratory Bird of Concern, T – Threatened, E – Endangered, C – Candidate, SOC - Species of Concern, I – Indigenous, PA – Project Area

‘A‘o (Newell’s Shearwater)

‘A‘o are federally-listed as threatened (T) and a migratory bird of concern (MBOC), and state-listed as a threatened (T) and indigenous (I) species endemic to the Hawaiian islands. Relict populations of ‘A‘o nest in burrows on steep mountain slopes which are used year after year, typically by the same pair of birds (USFWS 2012). However, on KPNWR ‘A‘o nest on flat and sloped terrain in the coastal zone. ‘A‘o forage over deep waters east and south of Hawai‘i and feed primarily on squid. The breeding season is about 9 months and occurs from April through November. A single egg is laid in a burrow or on the ground and the incubation and chick-rearing period is approximately 62 to 92 days (USFWS 2015a). ‘A‘o breeding is known to occur in the project area. Within the project area there are approximately 11 to 13 breeding pairs.

Nēnē (Hawaiian Goose)

Nēnē are federally-listed as E and a MBOC, and state-listed as an I and E species endemic to the Hawaiian islands. In the 1950s, the nēnē population declined to about 30 birds on Hawai‘i because of introduced predators, overhunting, and habitat loss. In 2011, there were an estimated 2,457–2,547 nēnē on four islands, including growing numbers on Kaua‘i, which supports 1,421–1,511 birds, or 59 percent of the state population. Nearly all birds are the result of an aggressive captive propagation and release program which was initiated by the Territorial government in 1949. This program is credited with bringing nēnē back from the brink of extinction; however, despite a comeback, nēnē still face major obstacles on the road to recovery. Current threats include depredation by introduced predators, inadequate nutrition, lack of suitable lowland habitat, human-related disturbance and mortality, behavioral problems, lack of genetic diversity, and disease (USFWS 2015a).

Habitat types frequently used by nēnē at the Refuge include grasslands dominated saltgrass and Kikuyu grass, open-understory shrublands, and sea cliffs. Breeding habitats are generally associated with woody vegetation and nests are on the ground typically under woody and herbaceous plants with an open canopy. The breeding season starts about October and continues until March (USFWS 2015a). The mean clutch size is three (3) eggs and the incubation period is approximately 30 days. Diet consists of seeds of grasses and herbs, leaves, buds, flowers, and fruits of various plants (USFWS 2012). Nēnē breeding is known to occur in the project area. Based on a survey conducted of nests and broods at the KPNWR for the 2011-2013 breeding seasons there were approximately 12 late broods located within the project disturbance area during the months of January and February. Based on surveys conducted in 2015 there were approximately 7 breeding pairs of nēnē within the project area between January and March. Nests are not anticipated to be present within the project disturbance area during January through April.

Pueo (Hawaiian Short-Eared Owl)

Pueo are state-listed as I species endemic to the Hawaiian islands and also as E on the island of O'ahu only. Habitat of the Pueo include occasionally wet and dry forests and commonly grasslands, shrublands, and montane parklands, including urban areas and those actively managed for conservation (Mitchell and others 2005). Pueo can be found on all the Main Hawaiian Islands (MHI) from sea level to 8,000 feet above mean sea level (AMSL). Nests are constructed on the ground and consist of scrapes in the ground lined with grasses and feather down. Little is known about the pueo, but they can be sighted roosting on and soaring over Crater Hill and Mōkōlea Point within the Refuge (USFWS 2015a). Breeding is not known to occur in the project area. If present Pueo would likely be seen soaring above the project area and not on the ground within the project area.

Mōlī (Laysan Albatross)

Mōlī are federally-listed as a MBOC, and state-listed as I. Mōlī usually stay at least 20 to 30 kilometers offshore during the nonbreeding months (July through October) (USFWS 2015b). Breeding habitat in the Refuge consist of steep rocky areas and nest sites are typically closer to vegetation than ka'upu (black footed albatross). Nests vary from a scrape to a ring-like structure comprised of sand, vegetation, and debris. Eggs are laid between November and December and chicks fledge in July. Mōlī diet primarily consists of squid, deep-water crustaceans, fish and flying fish eggs (Mitchell and others 2005). Mōlī breeding is known to occur in the project area.

'Ua'u kani (Wedge-Tailed Shearwater)

'Ua'u kani are federally-listed as a MBOC, and state-listed as I. The breeding season starts at the refuge in late February and March with the first eggs being laid in June and fledging in November. Nests are constructed on the ground and consist of burrows or rock crevices. 'Ua'u kani diet consists of larval goatfish, flying fish, squirrelfish, and flying squid (Mitchell and others 2005). Ua'u kani breeding is known to occur in the project area. There are approximately 100 active burrows within the east infiltration system disturbance area alone and likely 500 or more breeding pairs within the project area.

Koa'e kea (White-Tailed Tropicbird)

Koa'e kea are federally-listed as a MBOC, and state-listed as I. They can be observed at the Refuge year-round, but appear to be less common in the winter (USFWS 2015a). Breeding occurs in March through October and nests are placed in hard to reach locations on cliffs, in caves and tree hollows. The nests have little if any material. Koa'e kea diet consists of flyingfish and prey is caugh ply plunge diving from 50-60 feet above the water (Mitchell and others 2005). Koa'e kea breeding is not known to occur in the project area. Koa'e kea nest in low numbers on the refuge adjacent to the project area, and are known to fly over the project area.

Koa'e 'ula (Red-Tailed Tropicbird)

Koa'e 'ula are federally-listed as a MBOC, and state-listed as I. Outside of the breeding season they are pelagic and their range is poorly known (USFWS 2013). Breeding can occur throughout the year, but most nests are active between February and June. Nest are constructed on the ground as a scrape lined with simple vegetation. The nests are generally in inconspicuous places such as under vegetation or in cliff crevices. Koa'e 'ula diet consists of flying fish, squid, mackerel scads, dolphinfish, truncated sunfish, and bollonfish (Mitchell and others 2005). Koa'e 'ula breeding is known to occur in the project area and there are likely approximately 25 to 50 breeding pairs within the project area.

‘Ā (Red-Footed Booby)
‘Ā are federally-listed as a MBOC, and state-listed as I. Little is known about the movements of the ‘Ā outside of the breeding season. Breading can occur throughout the year with the peak egg laying February through April and with most young fledging the nest by September. The nests consist of twigs, grass and other vegetation in bushes or trees. Ā diet consist of flyingfish and squid, but also includes mackerel scads, saury, and anchovies (Mitchell and others 2005). ‘Ā breeding is known to occur in the project area.

Ka‘upu (Black-Footed Albatross)
Ka‘upu are federally-listed as a MBOC, and state-listed as I. They feed primarily on flyingfish eggs, squid and crustaceans. Breeding occurs in large colonies and nests are placed on open, sandy beaches or dunes. Eggs are laid in November and chicks fledge in June and July. (Mitchell and others 2005). Breeding is not known to occur within the KPNWR. If present Ka’upu would likely be seen soaring above the project area and not on the ground within the project area.

‘Ā (Brown Booby)
‘Ā are federally-listed as a MBOC, and state-listed as I. They feed primarily on flying fish, squid, mackerel scad, juvenile goatfish, and anchovy. They breed on small islands or islets, both on low-lying coralline sand islands and high volcanic islands, breeding on open ground or on cliff ledges. Peak egg laying occurs between March and May and chicks fledge by September (Mitchell and others 2005). Breeding is not known to occur within the KPNWR. If present ‘Ā would likely be seen soaring above the project area and not on the ground within the project area.

‘Iwa (Frigatebird)
‘Iwa are federally-listed as a MBOC, and state-listed as I. They feed primarily on flyingfish and squid. ‘Iwa breed and roost on small remote islands, typically within regions with tradewinds. Nests are built on the tops of various species of low lying bushes and trees (Mitchell and others 2005). Breeding season occurs between March and November (USFWS 2013). Breeding is not known to occur within the KPNWR. If present ‘Iwa would likely be seen soaring above the project area and not on the ground within the project area.

Kōlea (Pacific-Golden Plovers)
Kōlea are federally-listed as a MBOC and a U.S. Pacific Islands Shorebird of Primary Conservation Importance (USPI SOPCI), and state-listed as I. They winter in the MHIs and breed in Siberia and westernmost Alaska. Most adults arrive in Hawai‘i in August with juveniles arriving in October, and spring departures begin in late April. The winter range of kōlea is extremely varied, including crop fields, pastures, coastal salt marshes, mudflats, beaches, mangroves, grassy areas at airports, cemeteries, athletic fields, parks, residential lawns, golf courses, roadsides, and clearings in heavily wooded areas. Kōlea feed primarily on terrestrial insects such as cockroaches, moths, caterpillars, and earwigs (Mitchell and others 2005). Kōlea may be present in the project area while foraging.

‘Akekeke (Ruddy Turnstones)
‘Akekeke are federally-listed as a MBOC and a USPI SOPCI, and state-listed as I. ‘Akekeke winter across a wide swath of tropical coastal regions from southeastern Asia to southwestern Africa and southern Europe. In Hawai‘i, ‘akekeke are more prevalent on shorelines of the Northwestern Hawaiian Islands (NWHIs) than in the MHIs. ‘Akekeke are almost exclusively coastal, foraging mostly along stony or rocky shorelines with abundant seaweed in winter. They are also common on sandy shorelines and in mudflats and river deltas in Hawai‘i. Preferred habitats include ocean beaches along sheltered coastlines or bordering estuaries and other wetlands (Mitchell and others 2005). ‘Akekeke may be present in the project area passing through on their way to foraging grounds.

‘Ulili (Wandering Tattler)

‘Ulili are federally-listed as a MBOC and a USPI SOPCI, and state-listed as I. ‘Ulili winter throughout the Pacific and are common in coastal areas on coral reefs and the basalt platforms of most atolls and islands. They can be found in NWHI on pickleweed flats, and elsewhere in Hawai‘i they will forage in grassy areas around airports and golf courses. Diet while wintering consists of invertebrates such as marine worms, aquatic insects, mollusks, crustaceans and small fish. Foraging occurs mostly in intertidal habitats and also in soft mud or sand, along mountain streams, in wetlands, fish ponds, and human-modified areas (Mitchell and others 2005). ‘Ulili may be present in the project area while foraging or passing through on their way to foraging grounds.

‘Ōpe‘ape‘a (Hawaiian Hoary Bat)

‘Ōpe‘ape‘a are federally-listed as E and state-listed as an E and I species endemic to the Hawaiian islands. The‘ōpe‘ape‘a is a major predator of night-flying insects such as moths, beetles, and termites. Bats forage in open and wooded landscapes and linear habitats such windbreaks and riparian zones, and roost in trees with dense foliage and with open access for launching into flight. Females are believed to give birth to twins May to August and rear pups May to September. Pups fledge from about July to September, which is a critical time in the reproductive cycle. The population size is unknown. Resident populations occur on Kaua‘i, Maui, and Hawai‘i, and possibly other main islands, with the highest abundance on Kaua‘i and Hawai‘i. (USFWS 2015a). It is possible that ‘Ōpe‘ape‘a could occur in the project area.

‘Ilio-holo-i-ka-uaua (Hawaiian Monk Seal)

‘Ilio-holo-i-ka-uaua are federally-listed as E and state-listed as an E and I species endemic to the Hawaiian Islands. Approximately 1,200 seals remain today with the majority in the NWHI, but there is a small and potentially growing population of seals in the MHI where a 2005 survey documented 76 individuals. They feed on reef fishes, he‘e (octopus), squid, and lobsters down to depths of 1,000 feet. ‘Ilio-holo-i-ka-uaua are usually solitary except when on preferred beaches when they may be close together and interact. Terrestrial habitat is used about one-third of the time and requirements include haul-out areas for pupping, nursing, and resting, primarily on sandy beaches, but virtually all substrates are used. Seals frequently haul out on shorelines to rest and molt and females may haul out on shore for up to 7 weeks to give birth and nurse their pups. Pups and moms stay ashore until weaned. Gestation is approximately 1 year and pupping occurs in late winter and spring. ‘Ilio-holo-i-ka-uaua can be observed during most months of the year at the Refuge, most often in the cove below the upper scenic overlook (USFWS 2015a).

Honu (Green Turtle)

Honu are federally-listed as T and state-listed T and I. Historically, honu most likely inhabited the waters around the all Hawaiian Islands. Today, they still live and forage around all the Hawaiian Islands. Honu are most often found in shallow, protected, or semi-protected water around coral reefs and coastal areas. These habitats contain critical foraging areas consisting of sea grasses and algae and they provide some shelter from predators such as tiger sharks. Post-hatchlings and juveniles live in pelagic waters, but little is known of their specific distribution. Little information exists on the feeding behavior of post-hatchlings and juveniles living in pelagic habitats, but most likely they are exclusively carnivorous (e.g., soft-bodied invertebrates, jellyfish, and fish eggs). Subadult and adult turtles residing in nearshore benthic environments are almost completely herbivorous, feeding primarily on select macroalgae and sea grasses. Adult honu can weigh up to 500 pounds and are often found living near coral reefs and rocky shorelines where limu is plentiful. Honu can be observed offshore during most months of the year at the Refuge (USFWS 2015a).

4.3.2 Conservation Areas

The Refuge is managed by the USFWS as part of the National Wildlife Refuge System (Refuge System). The Refuge was originally established to preserve and enhance seabird breeding colonies, but also provides habitat for endangered plant and animal species, other migratory bird species, and native coastal plant

communities. A Comprehensive Conservation Plan (CCP) has been drafted for the Refuge to provide a management plan for the conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreations uses (USFWS 2015a). The public comment period for the Draft CCP opened on February 12, 2015 and ended on March 27, 2015. The Refuge finalized the Final CCP in September 2015.

4.3.3 Essential Fish Habitat

According to the National Oceanic and Atmospheric Administration (NOAA) Essential Fish Habitat (EFH) mapper, EFH for bottomfish and coral reef ecosystems is located in ocean waters adjacent to the project area. EFH for bottomfish consist of the water column and all bottom habitat extending from the shoreline to a depth of approximately 1,300 feet. EFH for coral reef ecosystems consist of specific habitat composites (e.g., sand, live coral, seagrass beds, mangrove, open ocean) for each life history stage, consistent with the depth of the ecosystems to 50 fathoms and to the limit of the exclusive economic zone (EEZ).

4.3.4 National Wildlife Refuges

The project area is located within the KPNWR. The Refuge is managed by the USFWS as part of the Refuge System. The Refuge is one of the few places in the MHIs with an abundant diversity of seabirds, and provides high-island refugium for seabird populations whose low lying islands and atolls are threatened by climate change. The most numerous species on the Refuge is ʻUaʻu kani (wedge-tailed shearwaters), but ʻā (red-footed boobies), mōlī (Laysan albatross), koaʻe ʻula (red-tailed tropicbirds), koaʻe kea (white-tailed tropicbirds), ʻaʻo (Newell's shearwater), and nēnē (Hawaiian goose) are all present and breed/nest within the Refuge. A total of 33 seabird species have been observed at the Refuge, making it one of the premier sites for seabirds in Hawaiʻi (USFWS 2015a).

The National Wildlife System Goals identify five (5) goals to help guide the development of CCPs and the administration, management and growth of the Refuge System, and are listed below (601 FW 1).

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

4.3.5 Wildlife and Wildlife Habitat

The Refuge and adjoining areas currently supports six species of breeding migratory seabirds, one non-migratory endemic goose, and at least 30 species of non-breeding migratory birds. Two of the breeding species are federally-listed under the ESA. Within the project area there are two coastal habitats, coastal mixed woodland-grassland and sea cliff. Coastal mixed woodland-grassland consists of flats and bluffs with a <45° slope dominated by low-growing trees and shrubs and perennial herbs that are adapted for salt, wind, and low precipitation. These areas are important breeding habitat for the species of breeding seabirds on the Refuge, breeding and flocking habitat for the endangered nēnē, wintering or stopover habitat for migratory shorebirds, and probably foraging and breeding habitat for pueo. Sea cliff habitat consists of nearly vertical cliff faces with >45° slope and rocky, shallow, highly erodible substrates exposed to wind, rain and sea. Because of the steep topography this habitat provides a refugium for seabirds and other native species from large mammalian predators and human disturbance (USFWS 2015a). These areas are important breeding habitat for multiple bird species.

4.3.6 Coral Reefs

Coral reefs are carbonate rock structures that support viable populations of reef-building corals and are typically confined to warm tropical and subtropical waters. Maximum reef growth and productivity occur between 5 and 15 meters, and maximum diversity of reef species occurs at 10 to 30 meters. Hard corals and branching or "tabletop" Acropora species of coral form the majority of reefs in the Pacific and provide a large amount of complex three-dimensional structure and protected habitat for a wide variety of fish and invertebrates. Due to its isolated position in the Pacific, Hawai‘i has relatively few species of hard and branching corals. As a consequence, Hawaiian coral reefs provide limited protected habitat which is thought to account for the high rate of uniqueness among Hawaiian marine species (Western Pacific Regional Fishery Management Council [WPRFMC] 2009).

The condition of coral reef ecosystems around the Hawai‘i Archipelago ranges from fair to excellent, but many of the Main Hawaiian Islands reefs are threatened by continued population growth, overfishing, urbanization, runoff and development. There is a lack of well-developed fringing reefs around most of Kaua‘i. As Kaua‘i is the oldest and wettest island in the Main Hawaiian Islands it is suggested that sedimentation is responsible for this. Reefs that are most heavily impacted by sediments are those in shallow or enclosed areas that have restricted circulation. Additional impacts perceived to be a problem on Kaua‘i reefs include activities from fishing and poor water quality (WPRFMC 2009).

Some of the healthiest reefs around Kaua‘i were historically found on the exposed northeast and north coasts where the sediment is washed away by waves and currents. These reefs typically exist in deep water (45 to 75 feet deep) where there is less exposure to sediment laden streams, water quality is higher, and human fishing pressure is lower (WPRFMC 2009). There are currently coral reefs located in ocean waters surrounding Kīlauea Point.

4.3.7 Migratory Birds

Based on a review of the USFWS Trust Resource List (USFWS 2015c) for the project area and other species information there are 16 MBOC listed with the potential to occur in the project area or soar above the project area. These species are listed in Table 4-3 below. Refer to Section 4.3.1 for species descriptions for MBOC likely to occur in the project area.

Table 4-3. Migratory Birds of Concern with Potential to be Present in the Project Area

Species Name	Seasonal Occurrence in Kauaʻi	Potential Breeding Habitat in Project Area	Potential Foraging Habitat in Project Area
Kaʻupu-Black-Footed Albatross (*Phoebastria nigripes*)	Prospecting / Roosting	No	No
Mōlī - Laysan Albatross (*Phoebastria immutabilis*)	Breeding	Yes	No
ʻAʻo (*Puffinus auricularis newelli*) - Threatened	Breeding	Yes	No
Nēnē (*Branta sandvicensis*) - Endangered	Breeding	Yes	Yes
ʻUaʻu kani (*Puffinus pacificus*)	Breeding	Yes	No
Koaʻe kea (*Phaethon lepturus*)	Breeding	Yes	No
Koaʻe ʻula (*Phaethon rubricauda*)	Breeding	Yes	No
ʻĀ (*Sula sula*)	Breeding	No	No
ʻĀ (*Sula leucogaster*)	Prospecting / Roosting	No	No
ʻIwa (*Fregata minor*)	Prospecting / Roosting	No	No
Kōlea (*Pluvialis dominica*)	Wintering	No	Yes
ʻAkekeke (*Arenaria interpres*)	Wintering	No	Yes
ʻUlili (*Tringa incana / Heteroscelus incanu*)	Wintering	No	Yes
Pueo (*Asio flammeus sandwichensis)*	Breeding	Yes	Yes
Bulwer's petrel (*Bulweria bulwerii*)	Breeding	No	No
Kermadec patrel (*Pterodroma neglecta)*	Prospecting / Summering	No	No

4.4 Human Environment

4.4.1 Socioeconomics

The socioeconomic area of consideration surrounding the project area can be assessed on a state, county, and local scale. For the purposes of this study, socioeconomic condition is presented as the Kīlauea Census Designated Place (CDP). The KPNWR CCP identifies the economic impact region for the Refuge as the County of Kauaʻi. The following sections and tables describe the current demographic, employment, income and economic conditions that have a potential to be affected by the project.

4.4.1.1 Community

Kīlauea Town is the gateway to the Refuge. The town covers about 1.5 square miles, and has a population of 2,803 residents in 2010 (U.S. Census Bureau 2010).

As a former sugar plantation town, Kīlauea has a rural quality and residents feel a strong connection to the agricultural heritage of the area (County of Kauaʻi 2006). Visitors travel to Kīlauea mainly to visit the Refuge; however, some also enjoy hiking in the area (Go Hawaiʻi 2011).

4.4.1.2 Population and Demographics

Demographic Data, Kīlauea CDP (U.S. Census Bureau 2010) is included in Table 4-4 and 4-5 below.

Table 4-4. Race and Ethnicity, Kīlauea Census Designated Place

RACE	Number	Percent
Total population	2,803	100.0
One Race	2,342	83.6
White	1,538	54.9
Black or African American	15	0.5
American Indian and Alaska Native	14	0.5
Asian	597	21.3
Native Hawaiian and Other Pacific Islander	137	4.9
Some Other Race	41	1.5
Two or More Races	461	16.4
Race alone or in combination with one or more other races: [4]		
White	1,903	67.9
Black or African American	31	1.1
American Indian and Alaska Native	102	3.6
Asian	924	33.0
Native Hawaiian and Other Pacific Islander	394	14.1
Some Other Race	77	2.7
ETHNICITY		
Hispanic or Latino (of any race)	260	9.3
Not Hispanic or Latino	2,543	90.7

Table 4-5. Sex and Age, Kīlauea Census Designated Place

SEX AND AGE	
Total population	2,803
Under 5 years	159
5 to 9 years	180
10 to 14 years	179
15 to 19 years	191
20 to 24 years	151
25 to 29 years	213
30 to 34 years	184
35 to 39 years	180
40 to 44 years	188
45 to 49 years	206
50 to 54 years	244
55 to 59 years	260
60 to 64 years	206
65 to 69 years	94
70 to 74 years	64
75 to 79 years	35
80 to 84 years	27
85 years and over	42
Median age (years)	38.9

4.4.1.3 Employment

Table 4-6 below summarizes the employment status and poverty from the Kīlauea CDP.

Table 4-6. Employment Status and Poverty, Kīlauea Census Designated Place

EMPLOYMENT STATUS	Estimate	Percent
Population 16 years and over	2,429	100%
In labor force	1,739	71.6%
Civilian labor force	1,739	71.6%
Employed	1,616	66.5%
Unemployed	123	5.1%
Armed Forces	0	0.0%
Not in labor force	690	28.4%
Civilian labor force	1,739	1,739
Percent Unemployed	(X)	7.1%
POVERTY LEVEL		
All People	3,063	7.1%
Under 18 years	742	7.7%
Related children under 18 years	719	4.7%
18 to 64 years	1,999	5.7%
65 years and over	322	14.9%
All People	3,063	7.1%
Under 18 years	742	7.7%
Related children under 18 years	719	4.7%

4.4.1.3.1 Industry

The tourism industry in Kauaʻi has grown tremendously over the past 50 years and has become a key foundation of the island's economy. Employment in all travel and tourism sectors including retail trade, passenger transportation, arts, entertainment and recreation, and accommodation and food constitutes 40.3 percent of total private employment in Kauaʻi County, compared to 27.8 percent statewide and 15.2 percent nationally (U.S. Census Bureau 2012). These percentages are similar to those in Kīlauea Town, which showed close to 38% in the travel and tourism sector in 2000 (see Table 4-7 below).

The Refuge is located 1 mile from Kīlauea Town, where local businesses include restaurants, specialty gift stores, and one of only two gas stations on Kauaʻi's North Shore. In 2005, 13.7 percent of visitors surveyed at the Refuge reported Kīlauea as the primary town in which their local purchases were made (Sexton and others 2005).

For Kīlauea Town, about 71.6 percent of the town population is in the labor force. The bulk of this workforce is involved in arts, entertainment, and recreation, accommodation, and food services (23.6 percent); retail trade (13.1 percent); construction (11.9 percent); and professional, scientific, management, administrative, and waste management services (11.7 percent) (U.S. Census Bureau 2011; KPNWR CCP). Table 4-7 below summarizes the occupation and industrial types generally found in the area, along with the percentage of workers (U.S. Census Bureau 2000).

Table 4-7. Occupation and Industry, Kīlauea Census Designated Place

OCCUPATION	Number	Percent
Management, professional, and related occupations	253	23.1
Service occupations	380	34.8
Sales and office occupations	244	22.3
Farming, fishing, and forestry occupations	22	2.0
Construction, extraction, and maintenance occupations	132	12.1
Production, transportation, and material moving occupations	62	5.7
INDUSTRY	**Number**	**Percent**
Agriculture, forestry, fishing and hunting, and mining	59	5.4
Construction	135	12.4
Manufacturing	18	1.6
Wholesale trade	7	0.6
Retail trade	133	12.2
Transportation and warehousing, and utilities	29	2.7
Information	18	1.6
Finance, insurance, real estate, and rental and leasing	61	5.6
Professional, scientific, management, administrative, and waste management services	131	12.0
Educational, health and social services	133	12.2
Arts, entertainment, recreation, accommodation and food services	279	25.5
Other services (except public administration)	49	4.5
Public administration	41	3.8

4.4.1.3.2 Refuge and KPNHA Employment

Employees on the Refuge consist of USFWS staff as well as Kīlauea Point Natural History Association (KPNHA) staff. The entrance fees to the Refuge fund the majority of the USFWS staff's salaries. The KPNHA operate out of the visitor center on the Refuge and are a non-profit, tax-exempt educational organization. It is independent of government funding and is sustained by membership fees, contributions, and gift shop sales. The gift shop funds 100% of the KPNHA staff's salaries. Table 4-8 below summarizes the full time and part time employees as well as the volunteers that work at the Refuge.

Table 4-8. Employment on the Refuge

Position	USFWS	KPNHA
Full Time	8	2
Part Time	4	3
Volunteers	80	0

4.4.2 Historic Properties/Cultural Resources

Kīlauea Point Light Station was built in 1913 and listed on the Hawai'i Register of Historic Places on September 23, 1974 and on the National Register of Historic Places (NRHP) on October 18, 1979. At the time of its 1979 listing nominating officials attributed the light stations significance to its potential for historical archaeology and its role in communications, military, transportation, and navigation history. The

NRHP listing was later amended to include additional primary structures as part of the Kīlauea Point Light Station (e.g., keeper's quarters, two assistant keeper's quarters, oil house, landing station, derrick site, engine room, volcanic stone retaining wall, and stone stairway/moorings), three cisterns, water storage tank, storage shed/garage (Northwest Heritage Consultants 2006). The Kīlauea Point Light Station is also considered a historic district.

Kīlauea Point (31 acres) was purchased from C. Brewer and Company by the U.S. Coast Guard to build a lighthouse as a navigational aide for the growing commercial maritime trade between Hawai'i and Asia. Construction on the lighthouse and keeper's quarters began in 1912 and on May 1, 1913 the lighthouse officially began operation. Local visitors were welcomed to the site to view the technological wonder of the lighthouse. The former keepers estimated that 20 people per week visited the lighthouse, but after Statehood, visitation increased with hotel and airline development. The lighthouse gained national recognition in June 1927 when it aided the first trans-Pacific flight from California to Hawai'i by the U.S. Army, thereby encouraging development of commercial trans-oceanic airline service and military flights to remote regions. In 1976, the Service reached an agreement with the U.S. Coast Guard which allowed use of the 33-acre light station site for Service administrative facilities. Lighthouse use continued until 1976, at which point the U.S. Coast Guard installed an automated electronic beacon. Visitation at this time was recorded at 84,000 people annually (USFWS 2015a).

In 1985 the land was transferred to the USFWS and became a national wildlife refuge. Through the years, several of the onsite structures have undergone restoration and renovation, including the radio beacon building, keeper's quarters, and lighthouse (particularly after Hurricane Iniki in 1992). Restoration measures of the lighthouse have included repairs to the unique cast iron roof and lantern assembly, removal of interior and exterior coatings, repairs to the concrete tower, removal of concrete blocks from where windows were formerly located, installation of new windows, corbels, and doors, and repair of the Fresnel lens, and the inclusion of additional safety measures. On May 4, 2013, the lighthouse was renamed the Daniel K. Inouye Kīlauea Point Lighthouse to honor the late U.S. Senator from Hawai'i who had championed and provided funds for the restoration work (USFWS 2015a).

The following historic contributing resources are located within the project area:

- Kīlauea Point Lighthouse (Lighthouse): The lighthouse started construction in 1912 and started operation on May 1, 1913. It was constructed to aide for the growing commercial maritime trade between Hawai'i and Asia. The structure is a 56 foot tall reinforced concrete round conical tower. The lighthouse was painted light gray from 1913 to 1924, but has been painted white from 1924 to the present. The tower has four stories, including an 11 -foot-deep basement. The lighthouse was restored in 2012 to celebrate its 100-year anniversary. The lighthouse itself is one of only eight surviving reinforced concrete lighthouse towers in the U.S. before 1916 concrete standards were published (Northwest Heritage Consultants 2006).
- Second-Order Fresnel Lens: The illuminating apparatus for Kīlauea Point Light was a flashing lens composed of two groups of panels, each panel subtending at an angle of forty-five degrees. Seven refracting and seventeen reflecting prisms make up each panel. Barbier, Bernard, and Turenne manufactured the lens at Paris, France in 1912. During its first years of operation an oil vapor lamp provided the light source for the lens before it was upgraded to an electric bulb. The lens remained in operation with a bulb for the light source until 1974 when it was taken out of service and replaced with an electronic optic strapped to the railing outside the lantern room. The electronic optic was replaced in February of 1976 with a rotating beacon on top of a 10 foot high concrete column constructed northwest of the lighthouse (Northwest Heritage Consultants 2006).

- Radio Beacon House (Information Building): This structure was built in 1952 to replace a hurricane-damaged predecessor structure erected in 1929. The building served to house the radio operator and associated equipment. It is a single-story 20- by 32-foot concrete block structure on a concrete slab. The original shake-single hipped roof has been extensively altered several times. Hurricane Iniki tore off the building's original roof and gutted the interior. Roof replacement and interior rehabilitation were expedient rather than faithful to the 1952 original and the building's integrity is diminished (Northwest Heritage Consultants 2006).
- Landing Platform Ruins: The original landing platform and derrick were built in 1912 and were erected within 10 days. The landing platform and derrick allowed delivery of construction materials and supplies by ship to Kīlauea Point. The derrick was 90 feet above the water and the landing platform was 110 feet above water level. They were both dismantled after the tender Kukui stopped servicing Kīlauea Point Light Station in 1927. A volcanic rubble stone retaining wall, steps from the top of the stone, and the concrete landing platform and concrete slab for the derrick and its engine still remain in place at the bottom of the west ravine (Northwest Heritage Consultants 2006).
- Oil House: The oil house was constructed between 1912 and 1913 at the same time the lighthouse was constructed. It is located approximately 105 feet southwest of the lighthouse and consists of an 8-foot by 8-foot concrete structure, seven feet high. The structure was used for storage of oil fueling the light's vapor lamp. In 1925, a small concrete block addition enclosing a toilet was appended to the east side of the oil house. The oil vapor lamp was taken out of service in 1929 and has since been used for storage of other flammable materials Ravine (Northwest Heritage Consultants 2006). This oil house currently stores grounds maintenance equipment.
- Keepers' Quarters consist of the following three structures:
    - Keepers' Quarters (Visitor Services/Quarters #1)
    - First Assistant Keepers' Quarters (Staff Residences/Quarters #2)
    - Second Assistant Keepers' Quarters (Administration Building/Quarters 3)

  Construction started on the all three structures in 1912 at the same time the lighthouse began construction. These quarters are identical single-story volcanic rubble stone bungalows with hipped roofs (originally asbestos slate shingle). They have inset lanai (porches) extending halfway across the facade. Each dwelling has its own system for draining rainwater from the roof to a cistern, with tinned copper roof valleys and gutters. In 1929, a 74-foot long concrete retaining wall was constructed south of the First Assistant Keeper's Quarters and is still in place. Since 1985 the First Assistant Keeper's Quarters has been in use as housing for refuge staff living onsite. A set of concrete steps and a sidewalk were added to the Second Keepers' Quarters in 1927. Since 1985 the Second Assistant Keeper's Quarters has been in use as temporary housing for newly arrived refuge staff and summer interns. In 1990, the USFWS renovated the quarters including windows, bathrooms, kitchens, and electrical/plumbing systems (Northwest Heritage Consultants 2006). This building is currently used as the Refuge staff administration building.
- Historic Garage: This structure was built in 1933 east of the First Keepers' Quarters and was used as the Kīlauea Point Light Station garage. It later became a storage and workshop building when the Refuge took over the Kīlauea Point Light Station. It is a wood frame building with tongue and groove vertical siding. Extensive repairs were made to the building after Hurricane Iniki in 1992, but the 1933 siding and trim were left in place and painted (Northwest Heritage Consultants 2006).

The following historic noncontributing resources are located within the project area:

- Visitor Center/Environmental Education Center: This two-story concrete structure was built in 1988 into the west side of the walking trail between the lighthouse and the parking area. The visitor center houses interpretive and educational displays, a bookstore, meeting room, storage and restrooms.
- Shed: This one-story wood structure was built sometime after 1992 and is located north of the historic garage
- Garages at Keepers' Quarters: A garage was constructed at each Keepers' Quarters after 1992 Hurricane Iniki damaged the structures carports.

4.4.3 Public Health and Safety

The walking trail has experienced undermining and settlement due to existing slope conditions and erosional processes. Sediment deposition along sections of the walking trail has created public safety concerns for Refuge visitors. As a result of the stormwater runoff, sediment deposition along sections of the walking trail has created O&M issues for the Refuge as well as public safety concerns for Refuge visitors. Slope stabilization measures and stormwater runoff management would be required along impacted sections of the walking trail to address the slope erosion, trail instability, maintenance issues, and public safety concerns.

4.4.4 Recreation

The Refuge is one of over 560 refuges in the U.S., the fourth most visited Refuge in the Refuge System, and 8th most visited attraction in the state. The Refuge offers exceptional opportunities for wildlife observation and photography and is one of the best accessible locations in the Main Hawaiian Islands for viewing wildlife. This is due to the high diversity of breeding birds at one location. The sheer number of birds as well as their proximity, makes for an extremely high-quality viewing and photography experience. Humpback whales, groups of spinner dolphins, the Hawaiian monk seal, and green sea turtle can be spotted in waters surrounding the Refuge. Viewing scopes are available at multiple locations around the Point and volunteers around the Point help visitors use scopes, identify species, and provide wildlife information, interpretation about the lighthouse, the Refuge, and its resources. Interpretive panels are also located around the Point that highlight native and nonnative plants and wildlife. Between 2010 and 2013, total wildlife observation visits annually ranged from 366,890 to 376,937 and photography ranged from 290,000 to 300,100 (USFWS 2015a).

The historic lighthouse is one of the most popular and notable features on the Refuge. Lighthouse guided tours are offered weekly and are dependent upon staff and volunteer availability. The tours allow the public to experience the interior of the Lighthouse and take photos.

It is estimated that one-third of visitors to Kaua‘i go to the Refuge. Approximately 5 percent of the Refuge's visitors are local residents and the rest are nonlocal. For both local and nonlocal visitors, their travel to the Refuge is often part of a trip to visit other island attractions, run errands, etc. (CCP reference: Sexton et al. 2012). Visitors are able to visit the Refuge Point from 10 a.m. to 4 p.m. Tuesday through Saturday, except on Federal holidays, with an entrance fee of $5.00 per person paid at the fee booth. The visitor center averages about 189,963 visitors per year. Visitation to the Point and associated revenue from entrance fees only for the proposed duration of construction closure (January through April) are provided in Table 4-9 below.

Table 4-9. Summary of Visitation and Associated Revenue at Kīlauea Point

Month	2015		2014	
	Visitors	Revenue	Visitors	Revenue
January	18,695	$57,250	20,571	$71,465
February	17,347	$56,190	15,856	$53,705
March	18,667	$61,640	17,932	$61,565
April	16,532	$55,215	15,833	$55,040
TOTAL	**71,241**	**$230,295**	**70,192**	**$241,775**

The number of areas providing specific recreation activities on Kauaʻi are outlined in the Hawaiʻi DLNRs Recreation Plan (Hawaiʻi DLNR 2009). Table 4-10 below shows the specific recreation activities available and the associated number of areas providing the specific activity on Kauaʻi.

Table 4-10. Areas Providing Specific Recreation Activities on Kauaʻi

Recreation Activity	Number of Areas Providing Activity
Education/interpretative display	13
Hiking	10
Scenic lookouts	7
Historic/cultural sites	7

4.4.5 Public Access

Travel patterns along Kīlauea Road tend to be limited to local traffic from residential properties and visitors to the refuge. According to the CCP, an estimated 25 percent of the traffic on Kīlauea Road is attributable to visitors to the Refuge (CCP reference: Parsons Brinckerhoff 2006). The Town Plan indicates "… visitor traffic brought about by the Refuge and, in particular, the Kīlauea Lighthouse as a scenic attraction. The most often mentioned problem is the speed and volume of through traffic along Kīlauea Road, which serves as a link between Kūhiō Highway and Kīlauea Point and traverses a residential neighborhood in the mauka portion of this route." (Kīlauea Town Plan, County of Kauaʻi, September 2006).

The Refuge can be accessed from a gate at the end of Kīlauea Road. Adjoining the access gate are five designated paved parking stalls. Kīlauea Road at the Refuge entrance has a turn-around, with a graveled area south of the turn-around that is utilized by visitors for overflow parking. When the refuge access gate is closed, visitors are still able to park and view/photograph the lighthouse and wildlife from the upper scenic overlook. Kīlauea Road and the graveled overflow parking is owned and maintained by the County of Kauaʻi. A portion of the turn-around area and paved parking area, and the upper scenic overlook is owned and maintained by the Refuge. The remaining portions of the turn-around area and paved parking area is owned and maintained by the County.

4.4.6 Visual Resources

Kīlauea's natural setting offers magnificent scenic vistas and provides important habitat for native wildlife, including some rare and endangered species that are inhabitants of the Refuge. The Refuge offers many scenic overlook areas along the walking trail and an upper scenic overlook at the Refuge access gate. The dramatic views of the coastline from the areas open to the public on the Refuge are commonly photographed by visitors. The lighthouse and the peninsula (Kīlauea Point) on which it stands are also commonly photographed sites (both from the ground and aerially) with images often used for tourism and sightseeing related purposes.

Viewsheds of the project area can be accessed via several different locations on the Refuge. The main viewing locations are the upper scenic overlook, multiple areas along the walking trail, and the point of the peninsula. The upper scenic overlook offers a sweeping view of the east side Kīlauea Point and its cliff face with the Pacific Ocean as its backdrop. The historic lighthouse and Radio Beacon House (information building), visitor center, walking trail, and paved parking lots are visible from the upper scenic overlook. Along either side of the walking trail visitors can get close up views of various native plant and animal species and distant views of cliff faces and the Pacific Ocean. The point offers close up views of the historic lighthouse and Radio Beacon House and a nearly 360 degree view of the Pacific Ocean and adjoining cliff terrain.

4.4.7 Noise

Noise at the refuge consists of natural sounds associated with wind, waves, and calls of seabirds, as well as human generated noises. Wind- and wave-generated sounds vary greatly and are affected by the season, among other factors. On the Refuge point, the wind and waves can be weak and quiet or strong and loud. Seabirds can be heard almost year round (USFWS 2015a). Human related noises consist of noise from traffic, maintenance equipment (chainsaw, lawn mower, leaf blower, etc.), general visitor activities, and voices. A typical passenger car traveling 30 miles per hour (mph) generates approximately 70 A-weighted decibels (dBA) at a distance of 8 feet away (CCP reference; de Roo and others 2011). According to a sound chart (Center for Hearing, Speech and Language 2015) maintenance equipment such as chainsaws and lawn mowers can generate as much as 120 dBA.

According to the Hawai‘i Administrative Rules (State of Hawai‘i 1996) MPSLs for stationary noise sources, and equipment related to agricultural, construction, and industrial services are specified in table 4-11 below. A permit or variance would be required for noises exceeding MPSLs for more than 10 percent of the time within any twenty minute period for areas within the jurisdiction of Kaua‘i County. For impulsive noises above 10 dBA of the MPSL a "fast" meter response shall be used to measure the noise.

Table 4-11. Maximum Permissible Sound Levels for Noise Sources

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

Class A zoning districts include all areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type.
Class B zoning districts include all areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.
Class C zoning districts include all areas equivalent to lands zoned agriculture, country, industrial, or similar type.

Specific permit restrictions for construction activities are also defined in the Administrative Rules for areas within the jurisdiction of Kauaʻi County and include the following:

- No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels for the hours before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday;
- No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels for the hours before 9:00 a.m. and after 6:00 p.m. on Saturday; and
- No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays.

The project area is not located within the jurisdiction of Kauaʻi County and a noise permit or variance would not be required for project actions.

SECTION 5
ENVIRONMENTAL CONSEQUENCES

5.1 Introduction

The USFWS has the responsibility under NEPA to identify and address effects on the natural and human environment that may occur as a result of the alternative plans. The alternatives considered include No Action, Trail Stabilization with East Slope Discharge, and Trail Stabilization with West Ravine Discharge. The following describes the potential effects of the alternatives within each resource category as described in Section 4.0.

5.2 Methods of Assessing Impacts

Potential impacts on the natural and human environment are described in terms of their duration, level of intensity, and type. The following describes the specific terminology used to describe impacts associated with project actions.

Duration
Short Term – Temporary impacts that last during construction only (approximately 4 months or less)
Long Term – Permanent impacts that last during and/or after construction (approximately 4 months or more)

Level of Intensity
Negligible – Resource conditions would not change or would be so slight there would no measurable or perceptible consequence to the resource.
Minor – A small measureable effect to the resource, but localized, small, and of little consequence to the resource. Mitigation, if needed to offset adverse effects, would be easily implemented and successful based on knowledge and experience.
Moderate – A measureable effect to the resource from the alternative actions. Mitigation measures would likely be needed to offset adverse effects, and could be extensive, moderately complicated to implement, and probably successful based on knowledge and experience.
Significant – Substantial measureable consequence to the resource from the alternative actions.

Type (can either be adverse impact or beneficial impact)
Direct Effect – Impacts caused by a proposed action and occurring at the same time and place.
Indirect Effect – Impacts caused by an action that are later in time or farther removed in distance, but are still reasonably foreseeable.
Cumulative Effect – The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertaking such other action.

5.3 Impacts to the Physical Environment

5.3.1 Soil and Erosion

No Action
There would be no impact to soils or erosion for this alternative. Erosion would continue to occur along the east slope under the same conditions that currently exist.

Trail Stabilization with East Slope Discharge
This alternative would have a minor short term adverse impact during construction and a minor long term beneficial impact to soils and erosion after construction completion. Erosion may occur on disturbed and cleared areas within the project boundary during construction. Proper BMPs would be installed during and after construction to prevent and control soil erosion. Areas disturbed during construction activities would be stabilized and restored with native vegetation upon completion of activities. This alternative would collect stormwater and discharge it into an infiltration system located outside of the east slope erosion area. This would slightly decrease the amount of water erosion that occurs on the east slope. A slight increase in erosion downstream of the infiltrations system may occur, but riprap would be placed at the infiltration system discharge point to help dissipate flows that may occur from storm events exceeding a 1-inch in 24 event.

Trail Stabilization with West Ravine Discharge
This alternative would have a minor short term adverse impact during construction and a minor long term beneficial impact to soils and erosion after construction completion. Erosion may occur on disturbed and cleared areas within the project boundary during construction. Proper BMPs would be installed during and after construction to prevent and control soil erosion. Areas disturbed during construction activities would be stabilized and restored with native vegetation upon completion of activities. This alternative would collect stormwater and discharge it into an infiltration system located outside of the east slope erosion area. This would slightly decrease the amount of water erosion that occurs on the east slope. A slight increase in erosion downstream of the infiltrations system may occur, but riprap would be placed at the infiltration system discharge point to help dissipate flows that may occur from storm events exceeding a 1.4-inch in 24-hour event. Existing conditions in the west ravine would allow for a larger infiltration basin that could capture more water and has a quicker infiltration rate than the East Slope Discharge Alternative. This would result in a long-term beneficial impact with a slightly higher degree of benefit than the East Slope Discharge Alternative.

5.4 Impacts to the Biological Environment

5.4.1 Special Status Plant and Animal Species

5.4.1.1 Federally-Listed Species

Federally-listed species expected to occur in the project area with the potential to be impacted by alternative actions include ʻAʻo (Newell's Shearwater), Nēnē (Hawaiian Goose), and ʻŌpeʻapeʻa (Hawaiian Hoary Bat). ʻIlio-holo-i-ka-uaua (Hawaiian Monk Seal) and Honu (Green Turtle) are also present in the project area, however, they are not anticipated to be impacted by alternative actions. See section 4.3.1 for species descriptions and occurrence within the project area. Note that the quality of T&E habitat in the infiltration system areas for both action alternatives are considered to be equivalent to each other. The USFWS Ecological Services division will be consulted under section 7 of the ESA to assess impacts to threatened and endangered species. An Intra-Service Biological Evaluation (BE) Form will be completed and the results of informal section 7 consultation will be documented in the Final EA.

No Action
There would be no impacts to special status plant or animal species for this alternative as there would be no change from the existing conditions.

Trail Stabilization with East Slope Discharge
This alternative would consist of a construction disturbance area of approximately 1.2 acres (Figure 5-1). Within the 1.2-acres only approximately 4,400 square feet (sf) (0.1 acres) would be outside of the existing

paved walking trail alignment or paved parking areas. Approximately 2,850 sf of habitat would be disturbed by construction of a stormwater infiltration system and pile-support trail, and 1,000 square feet of habitat would be created from the removal of Shotcrete and revegetation of the eroded area below it along the east side of the walking trail. This area would be stabilized and revegetated after the Shotcrete is removed. The remaining 550 sf of impact outside of the paved walking trail/parking areas consists of disturbance to habitat during construction, but these areas would be restored with native vegetation upon completion of activities. Since there is suitable habitat adjacent to the project disturbance area, birds will only be temporarily displaced and short-term impacts will be negligible since there are no nests expected to be within the project disturbance area during construction.

Other short-term impacts during construction would include minor amounts of vibration from construction equipment, flight hazards, and construction generated noise. The noise and vibration disturbance may temporarily disturb and displace species, if present, to adjacent habitats. Flight hazards would be present while performing micropile drilling as the drilling equipment has a mast that extends approximately 20 feet high. However, nēnē are expected to avoid these hazards since there are numerous similar hazards present on the Refuge in the immediate vicinity. The mast would only be raised during daylight hours and would be lowered at the end of each work day prior to dusk to avoid bird collisions. Newell's Shearwater are also only prospecting for nests during this time and are not creating nests; therefore, construction activities are not anticipated to deter them from nesting in the project vicinity at a future date.

The Hawaiian Monk Seal and Green Turtle are located in ocean waters outside of areas proposed for disturbance and conditions during and after construction for the species would not change from existing conditions. There is no vegetation proposed for clearing greater than 15 feet, thus there are no impacts anticipated to the Hawaiian Hoary Bat.

Construction activities would take place from January 1st through April 30th during the T&E bird breeding periods shown in Table 5-1 below. Activities would occur during daylight hours when birds could easily be seen and avoided by construction equipment, and lighting would not be required.

Table 5-1. T&E Bird Breeding and Construction Schedule

Construction Schedule	JAN	FEB	MAR	APR
T&E Bird Breeding Period				
Demolish asphalt trail / Install micropiles and pile supported trail				
Complete installation of pile supported trail / Install stormwater pipe / Install east or west infiltration system				
Regrade and repave asphalt trail				
Site cleanup and demobilization				

	Peak	Off-Peak
Nēnē Breeding Period		
ʻAʻo Breeding Period		N/A

Note that the ʻŌpeʻapeʻa birthing and pup rearing season is from May through September, outside of the construction work window.

The following avoidance and minimization measures would be adhered to for construction.

- A USFWS biologist, or a construction staff designated and trained by a USFWS biologist, will be onsite as necessary during construction activities to map and monitor all breeding activity within the project area, to clear for access to construction areas, and to address sensitive plant or animal species that may be found onsite.
- The USFWS biologist will inspect restoration activities to make sure disturbed areas are restored according to permit stipulations;
- The contractor will only enter/exit the action area through areas pre-cleared by the biologist or a designated and trained construction staff;
- Once the construction activity is complete temporarily disturbed surfaces will be restored/re-vegetated using native plant species approved by the USFWS;
- Construction activities will be confined to previously disturbed areas where possible for work, staging, and storage activities, waste areas, and vehicle and equipment parking areas. Vegetation disturbance will be minimized as much as possible;
- The mast of the drilling equipment will only be raised during daylight hours and would be lowered at the end of each work day prior to dusk;
- A temporary perimeter fence will be established for the construction site to keep T&E species from entering the construction site;
- Heavy construction activities as well as construction of storm-water drainage system will occur outside of the Newell's shearwater breeding season (prior to March);
- There will be no night-time construction activities; and
- The construction schedule will be planned to avoid sensitive nesting areas and dates.

Note that consultation with the USFWS Ecological Services division for this project is ongoing and changes or additions to these measures may be required as consultation is completed. Avoidance and minimization measures determined during informal section 7 consultation will be documented in the Final EA.

Based on the small amount of disturbance, short duration of construction activities, and adherence to the avoidance and minimization measures described above this alternative would have a may affect, but not likely to adversely affect or adversely modify critical habitat determination for ʻaʻo (Newell's shearwater) and nēnē (Hawaiian goose).

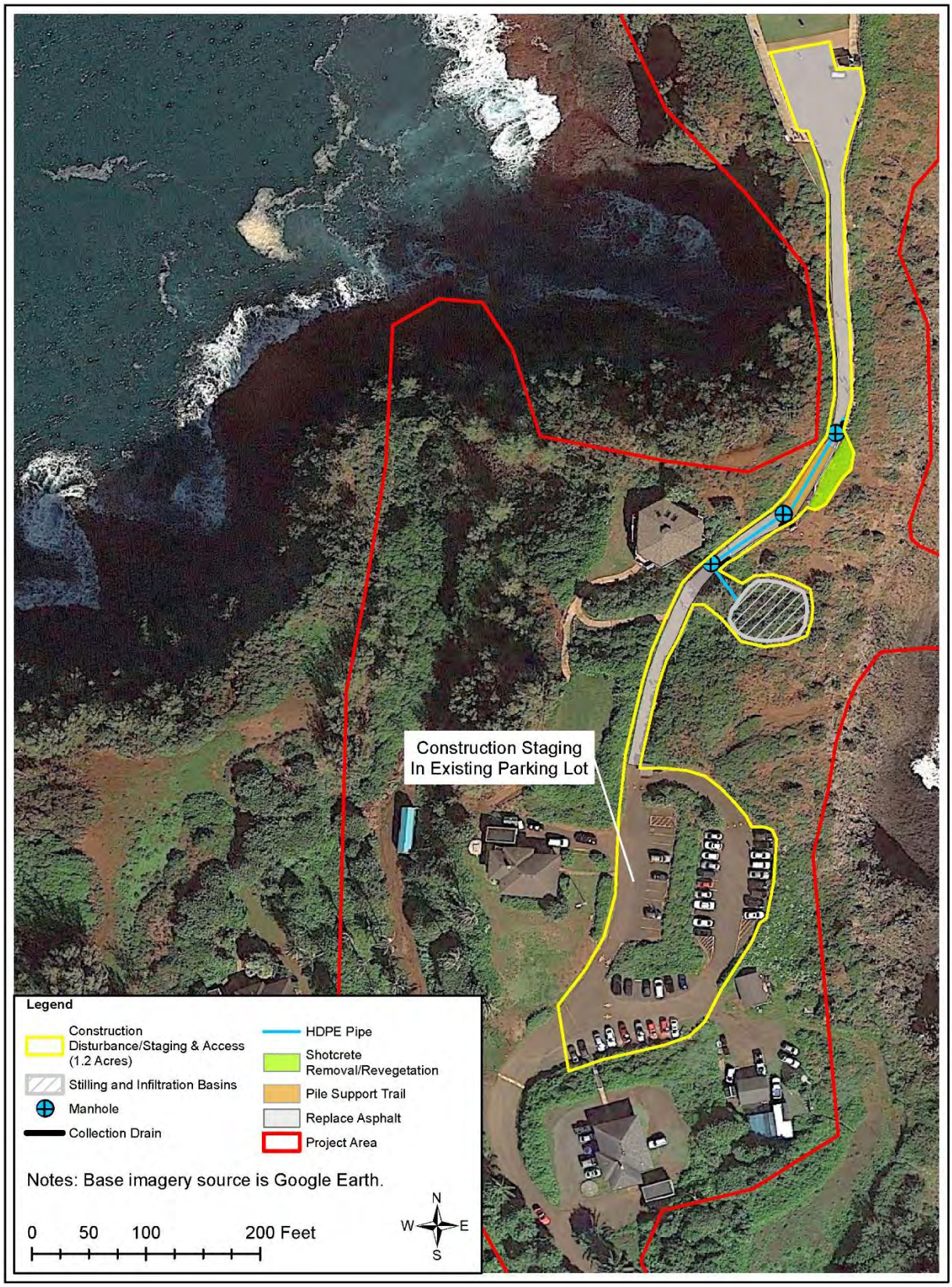

Figure 5-1. Trail Stabilization with East Slope Discharge Construction Disturbance Area

Trail Stabilization with West Ravine Discharge

This alternative would consist of a construction disturbance area of approximately 1.5 acres (Figure 5-2). Within the 1.5-acres only approximately 0.4 acres would be outside of the existing paved walking trail alignment or paved parking areas. Approximately 3,450 sf of habitat would be disturbed by construction of a stormwater infiltration system and pile-support trail, and 1,000 square feet of habitat would be created from the removal of Shotcrete along the west side of the walking trail. This area would be stabilized and revegetated after the Shotcrete is removed. The remaining impact area outside of the paved walking trail/parking areas (0.32 acres) consists of disturbance to habitat for access during construction, but these areas would be restored with native vegetation upon completion of activities. Since there is suitable habitat adjacent to the project disturbance area, birds will only be temporarily displaced and short-term impacts will be negligible since there are no nests expected to be within the project disturbance area during construction.

Other short-term impacts during construction would include minor amounts of vibration from construction equipment, flight hazards, and construction generated noise. The noise and vibration disturbance may temporarily disturb and displace species, if present, to adjacent habitats. Flight hazards would be present while performing micropile drilling as the drilling equipment has a mast that extends approximately 20 feet high. However, nēnē are expected to avoid these hazards since there are numerous similar hazards present on the Refuge in the immediate vicinity. The mast would only be raised during daylight hours and would be lowered at the end of each work day prior to dusk to avoid bird collisions. Newell's Shearwater are also only prospecting for nests during this time and are not creating nests; therefore, construction activities are not anticipated to deter them from nesting in the project vicinity at a future date.

The Hawaiian Monk Seal and Green Turtle are located in ocean waters outside of areas proposed for disturbance and conditions during and after construction for the species would not change from existing conditions. There is no vegetation proposed for clearing greater than 15 feet, thus there are no impacts anticipated to the Hawaiian Hoary Bat.

Construction activities would take place from January 1st through April 30th during the T&E bird breeding periods shown in Table 5-2 below. Activities would occur during daylight hours when birds could easily be seen and avoided by construction equipment, and lighting would not be required.

Table 5-2. T&E Bird Breeding and Construction Schedule

Construction Schedule	JAN	FEB	MAR	APR
T&E Bird Breeding Period				
Demolish asphalt trail / Install micropiles and pile supported trail				
Complete installation of pile supported trail / Install stormwater pipe / Install east or west infiltration system				
Regrade and repave asphalt trail				
Site cleanup and demobilization				
	Peak	Off-Peak		
Nēnē Breeding Period				
ʻAʻo Breeding Period		N/A		

Note that the ʻŌpeʻapeʻa birthing and pup rearing season is from May through September, outside of the construction work window.

The following avoidance and minimization measures would be adhered to for construction.

- A USFWS biologist, or a construction staff designated and trained by a USFWS biologist, will be onsite as necessary during construction activities to map and monitor all breeding activity within the project area, to clear for access to construction areas, and to address sensitive plant or animal species that may be found onsite.
- The USFWS biologist will inspect restoration activities to make sure disturbed areas are restored according to permit stipulations;
- The contractor will only enter/exit the action area through areas pre-cleared by the biologist or a designated and trained construction staff;
- Once the construction activity is complete temporarily disturbed surfaces will be restored/re-vegetated using native plant species approved by the USFWS;
- Construction activities will be confined to previously disturbed areas where possible for work, staging, and storage activities, waste areas, and vehicle and equipment parking areas. Vegetation disturbance will be minimized as much as possible;
- The mast of the drilling equipment will only be raised during daylight hours and would be lowered at the end of each work day prior to dusk;
- A temporary perimeter fence will be established for the construction site to keep T&E species from entering the construction site;
- Heavy construction activities as well as construction of storm-water drainage system will occur outside of the Newell's shearwater breeding season (prior to March);
- There will be no night-time construction activities; and
- The construction schedule will be planned to avoid sensitive nesting areas and dates.

The project would divert water from the walking trail into the west ravine increasing flow. Additional water from the collection area was compared to the existing ravine drainage area and flow conditions. Based on this comparison it is likely that water elevations in the ravine would have only a slight change of approximately 1-inch or less rise in water levels for a 100-year or less precipitation event. No impact to federally-listed species is anticipated from the slight increase in flow in the west ravine.

Based on the small amount of disturbance, short duration of construction activities, and adherence to the avoidance and minimization measures described above this alternative would have a may affect, but not likely to adversely affect or adversely modify critical habitat determination for ʻaʻo (Newell's shearwater) and nēnē (Hawaiian goose).

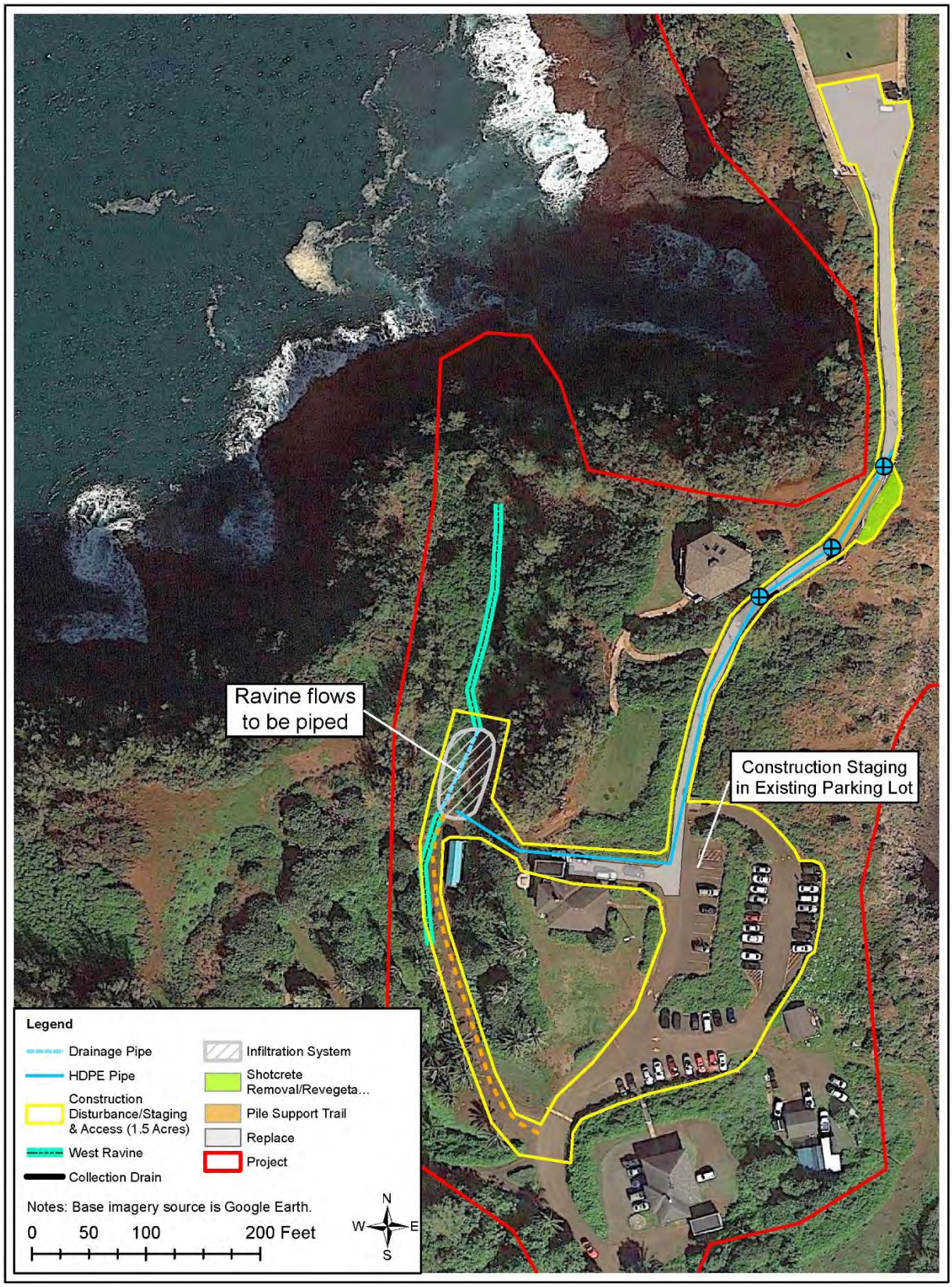

Figure 5-2. Trail Stabilization with West Ravine Discharge Construction Disturbance Area

5.4.1.2 State-Listed Species

State-listed special status species expected to occur in the project area with the potential to be impacted by alternative actions include: ʻAʻo (Newell's Shearwater), Nēnē (Hawaiian Goose), Pueo (Hawaiian Short-Eared Owl), Mōlī (Laysan Albatross), ʻUaʻu kani (Wedge-Tailed Shearwater), Koaʻe kea (White-Tailed Tropicbird), Koaʻe ʻula (Red-Tailed Tropicbird), ʻĀ (Red-Footed Booby), Kaʻupu (Black-Footed Albatross), ʻĀ (Brown Booby), ʻIwa (Frigatebird), Kōlea (Pacific-Golden Plovers), ʻAkekeke (Ruddy Turnstones), ʻUlili (wandering tattlers). See section 4.3.1 for species descriptions and occurrence within the project area. Refuge staff met with DLNR DOFAW staff during an informal scoping meeting (conference call) on January 28, 2015 to discuss the project. DOFAW will be provided the opportunity to comment on impacts to state-listed species within the project area during the Draft EA process. Comments and consultation with DOFAW will be documented in the Final EA.

No Action

There would be no impacts to state-listed special status plant or animal species for this alternative as there would be no change from the existing conditions.

Trail Stabilization with East Slope Discharge

Impacts to state-listed species and avoidance and minimization measures would be the same as those listed for federally-listed species described for the Trail Stabilization with East Slope Discharge alternative in Section 5.4.1.1 above. For state-listed species not included in Section 5.4.1.1, minor short-term adverse impacts during construction, and a negligible long-term impacts are anticipated.

Construction activities would take place from January 1st through April 30th during the state-listed bird breeding periods shown in Table 5-3 below. Activities would occur during daylight hours when birds could easily be seen and avoided by construction equipment, and lighting would not be required.

Table 5-3. State-Listed Bird Breeding and Construction Schedule

Construction Schedule	JAN	FEB	MAR	APR
State-Listed Bird Breeding Period				
Demolish asphalt trail / Install micropiles and pile supported trail				
Complete installation of pile supported trail / Install stormwater pipe / Install east or west infiltration system				
Regrade and repave asphalt trail				
Site cleanup and demobilization				

	Peak	Off-Peak
Nēnē Breeding Period		
ʻAʻo Breeding Period		N/A
Mōlī		N/A
ʻUaʻu kani / Koaʻe ʻula		
Koaʻe kea		N/A

Note that breeding of Pueo, Kaʻupu, ʻĀ (Brown Booby), ʻIwa, Kōlea, ʻAkekeke and ʻUlili does not occur in the project area and therefore, breeding information has not been included in this table for those species.

Trail Stabilization with West Slope Discharge

Impacts to state-listed species and avoidance and minimization measures would be the same as those listed for federally-listed species described for the Trail Stabilization with West Slope Discharge alternative in Section 5.4.1.1 above. The bird breeding and construction schedule would be the same as the one outlined

in Table 5-3 above. For state-listed species not included in Section 5.4.1.1, minor short-term adverse impacts during construction, and a negligible long-term impacts are anticipated.

5.4.2 Conservation Areas

The project area is located in a conservation area within a National Wildlife Refuge. The CCP for the Refuge provides management plans for the conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreations uses (USFWS 2015a).

No Action
Under this alternative stabilization measures for the walking trail would not be addressed. The walking trail would eventually become too unstable and unsafe for Refuge visitors and staff to traverse and would likely be closed. There would be a significant adverse impact to the management plans for the conservation area. Opportunities for compatible wildlife-dependent recreation would decrease, as refuge visitors would no longer have access to wildlife observation and photography along the trail alignment. Additionally the USFWS would no longer have safe and easy access to transplanting, monitoring, and reestablishment areas on the point.

Trail Stabilization with East Slope Discharge
This alternative would have a moderate beneficial impact over the long-term to the management plans for the conservation area. Stabilizing the walking trail would continue to provide the USFWS a safe and easy access to transplanting, monitoring, and reestablishment areas on the point, as well as continued access for recreationist wildlife observation and photography.

Trail Stabilization with West Ravine Discharge
This alternative has the same impacts to the resource as the Trail Stabilization with East Slope Discharge alternative.

5.4.3 Essential Fish Habitat (EFH)

The ocean waters adjoining the project area is EFH for bottomfish and coral reef ecosystems. See Section 4.3.3.

No Action
This alternative would have a minor adverse impact over the long-term to EFH located in ocean waters adjoining the project area. The Refuge walking trail alignment does not currently have a stormwater system to route or treat stormwater runoff. Stormwater flows off the trail onto the adjoining slopes then ultimately downslope into the ocean. Increased sediment load in runoff is more likely without treatment of stormwater before it enters the ocean. Sedimentation is a major threat to reef ecosystems.

Trail Stabilization with East Slope Discharge
This alternative includes installing a stormwater system with an infiltration system to manage and treat collected stormwater. There would be a minor beneficial impact over the long-term to EFH as the infiltration system would likely decrease the amount of sediment transported downstream into ocean waters from slope erosion.

Trail Stabilization with West Ravine Discharge
This alternative includes installing a stormwater system with an infiltration system to manage and treat collected stormwater. There would be a minor beneficial impact over the long-term to EFH as the infiltration system would likely decrease the amount of sediment transported downstream into ocean waters from slope erosion. Existing conditions in the west ravine would allow more water to be treated in the infiltration system than the East Slope Discharge Alternative. This would result in a slight increase to the beneficial impact of this alternative when compared to the East Slope Discharge Alternative.

5.4.4 National Wildlife Refuges

No Action
Under this alternative stabilization measures for the walking trail would not be addressed. The walking trail would eventually become too unstable and unsafe for Refuge visitors and staff to traverse and would likely be closed. There would be a significant adverse impact over the long-term to the five National Wildlife System goals. Opportunities for compatible wildlife-dependent recreation would decrease, as refuge visitors would no longer have access to wildlife observation and photography along the trail alignment. Additionally the USFWS would no longer have safe an easy access to transplanting, monitoring, and reestablishment areas on the point.

Trail Stabilization with East Slope Discharge
This alternative would have a moderate beneficial impact over the long-term to the five National Wildlife System goals. Stabilizing the walking trail would continue to provide the USFWS a safe an easy access to transplanting, monitoring, and reestablishment areas on the point, as well as continued access for recreationist wildlife observation and photography.

Trail Stabilization with West Ravine Discharge
The impacts for this alternative would be the same as the Trail Stabilization with East Slope Discharge alternative.

5.4.5 Wildlife and Wildlife Habitat

No Action
No impacts to wildlife and wildlife habitat for this alternative as there would be no change from the existing conditions.

Trail Stabilization with East Slope Discharge
This alternative would consist of a construction disturbance area of approximately 1.2 acres (Figure 5-1). Within the 1.2-acres only approximately 4,400 square feet (sf) (0.1 acres) would be outside of the existing paved walking trail alignment or paved parking areas. Approximately 2,850 sf of wildlife habitat would be disturbed by construction of a stormwater infiltrations system and pile-support trail, and 1,000 square feet of habitat would be created from the removal of Shotcrete along the west side of the walking trail. This area would be stabilized and revegetated after the Shotcrete is removed. The remaining 550 sf of impact outside of the paved walking trail/parking areas consists of temporary disturbance to habitat during construction, but these areas would be restored with native vegetation upon completion of activities. See Figure 5-1 for a map of the proposed construction disturbance area for this alternative. Other short-term impacts during construction would include minor amounts of vibration from construction equipment, flight hazards, and construction generated noise. The noise and vibration disturbance may temporarily disturb and displace wildlife to adjacent habitats. Flight hazards would be present for birds while performing micropile drilling during daylight hours. The drilling equipment would have a mast that extends

approximately 20 feet high. The mast would only be raised during daylight hours and would be lowered at the end of each work day prior to dusk to avoid bird collisions.

Avoidance and minimization measures as described in Section 5.4.1 above would be adhered to during construction.

Based on the small amount of disturbance to habitat, short duration of construction activities, and adherence to the avoidance and minimization measures described in Section 5.4.1 above, this alternative would have minor short-term adverse impacts during construction, and negligible long-term impacts to wildlife and wildlife habitat.

Trail Stabilization with West Ravine Discharge

This alternative would consist of a construction disturbance area of approximately 1.5 acres (Figure 5-2). Within the 1.5-acres only approximately 0.4 acres would be outside of the existing paved walking trail alignment or paved parking areas. Approximately 3,450 sf of wildlife habitat would be removed by construction of a stormwater infiltration system and pile-support trail, and 1,000 square feet of habitat would be created from the removal of Shotcrete along the west side of the walking trail. This area would be stabilized and revegetated after the Shotcrete is removed. The remaining impact outside of the paved walking trail/parking areas (0.32 acres) consists of temporary disturbance to wildlife habitat for access during construction, but these areas would be restored with native vegetation upon completion of activities. See Figure 5-2 for a map of the proposed construction disturbance area for this alternative. Other short-term impacts during construction would include minor amounts of vibration from construction equipment, flight hazards, and construction generated noise. The noise and vibration disturbance may temporarily disturb and displace wildlife to adjacent habitats. Flight hazards would be present for birds while performing micropile drilling during daylight hours. The drilling equipment would have a mast that extends approximately 20 feet high. The mast would only be raised during daylight hours and would be lowered at the end of each work day prior to dusk to avoid bird collisions.

Avoidance and minimization measures as described in Section 5.4.1 above would be adhered to during construction.

Based on the small amount of disturbance to habitat, short duration of construction activities, and adherence to the avoidance and minimization measures described in Section 5.4.1 above, this alternative would have minor short-term adverse impacts during construction, and negligible long-term impacts to wildlife and wildlife habitat.

5.4.6 Coral Reefs

No Action

This alternative would have a minor adverse impacts over the long-term to coral reefs located in ocean waters adjoining the project area. The Refuge walking trail alignment does not currently have a stormwater system to route or treat stormwater runoff. Stormwater flows off the trail onto the adjoining slopes then ultimately downslope into the ocean. Increased sediment load in runoff is more likely without treatment of stormwater before it enters the ocean. Sedimentation is a major threat to coral reefs.

Trail Stabilization with East Slope Discharge

This alternative includes installing a stormwater system with an infiltration system to manage and treat collected stormwater. There would be a minor beneficial impact over the long-term to coral reefs as the infiltration system would likely decrease the amount of sediment transported downstream into ocean waters during precipitation events.

Trail Stabilization with West Ravine Discharge
This alternative includes installing a stormwater system with an infiltration system to manage and treat collected stormwater. There would be a minor beneficial impact over the long-term to coral reefs as the infiltration system would likely decrease the amount of sediment transported downstream into ocean waters during precipitation events. Existing conditions in the west ravine would allow more water to be treated in the infiltration system than the East Slope Discharge Alternative. This would result in a slight increase to the beneficial impact of this alternative when compared to the East Slope Discharge Alternative.

5.4.7 Migratory Birds

MBOC expected to occur in the project area or fly over the project area with potential to be impacted by alternative actions include: ʻAʻo (Newell's Shearwater), Nēnē (Hawaiian Goose), Mōlī (Laysan Albatross), ʻUaʻu kani (Wedge-Tailed Shearwater), Koaʻe kea (White-Tailed Tropicbird), Koaʻe ʻula (Red-Tailed Tropicbird), ʻĀ (Red-Footed Booby), Kaʻupu (Black-Footed Albatross), ʻĀ (Brown Booby), ʻIwa (Frigatebird), Kōlea (Pacific-Golden Plovers), ʻAkekeke (Ruddy Turnstones), and ʻUlili (*Tringa incana / Heteroscelus incanu*). See section 4.3.1 for species descriptions and occurrence within the project area. Note that the quality of MBOC habitat in the infiltrations system areas for both action alternatives are considered to be equivalent to each other.

No Action
There would be no impacts to MBOC for this alternative as there would be no change from the existing conditions.

Trail Stabilization with East Slope Discharge
Construction activities would take place from January 1st through April 30th during the bird breeding periods shown in Table 5-1 from Section 5.4.1.2. Activities would occur during daylight hours when birds could easily be seen and avoided by construction equipment, and lighting would not be required. Impacts to MBOC and avoidance and minimization measures would be the same as those listed for state-listed species described for the Trail Stabilization with East Slope Discharge alternative in Section 5.4.1.2 above.

Trail Stabilization with West Ravine Discharge
Construction activities would take place from January 1st through April 30th during the bird breeding periods shown in Table 5-1 from Section 5.4.1.2. Activities would occur during daylight hours when birds could easily be seen and avoided by construction equipment, and lighting would not be required. Impacts to MBOC and avoidance and minimization measures would be the same as those listed for state-listed species described for the Trail Stabilization with West Ravine Discharge alternative in Section 5.4.1.2 above.

5.5 Human Environment

5.5.1 Socioeconomics

No Action
Under this alternative stabilization measures for the walking trail would not be addressed. The walking trail would eventually become too unstable and unsafe for Refuge visitors and staff to traverse and would likely be closed. There would be a significant adverse impact over the long-term to socioeconomics for this alternative. The Refuge would lose approximately $650,000 in fee revenues annually collected at the fee booth. A decrease in visitors would be anticipated if there was no longer an opportunity to observe and photograph wildlife and scenic views along the walking trail, or visit the historic lighthouse. Decreased visitation at the Refuge may result in loss of jobs at the refuge as well as in Kīlauea.

Trail Stabilization with East Slope Discharge
This alternative would have a long-term beneficial impact to socioeconomics by allowing the Refuge to continue functioning and bringing in visitors and associated revenues at the Refuge and in Kīlauea. There would be short-term moderate adverse impacts to the Refuge and the community as the Refuge would be closed during construction (4 months). It is estimated that the Refuge will not collect approximately $230,000 from entrance fees in 2016 from the Refuge closure. The upper scenic overlook would remain open, but visitation to the upper scenic overlook is anticipated to decrease for the duration of construction.

All full time and part time USFWS Refuge staff would continue to work and receive salaries during the 4-month closure. KPNHA full time and part time staff would also continue to work and receive salaries during the Refuge closure. The current location of the gift shop would be temporarily relocated from the visitor center to a building located in Kīlauea at the Kong Lung Historic Market Center. After construction completion the gift shop would return the original location in the visitor center. Refuge volunteers would also continue to work at the Refuge as needed during construction.

Trail Stabilization with West Ravine Discharge
The impacts for this alternative would be the same as the Trail Stabilization with East Slope Discharge alternative.

5.5.2 Historic Properties/Cultural Resources

There are historic buildings and properties within the project area. Section 106 consultation will be conducted with the SHPD to assess impacts to historic properties/cultural resources once a preferred alternative has been selected. The results of Section 106 consultation will be documented in the Final EA.

No Action
Under this alternative stabilization measures for the walking trail would not be addressed. The walking trail would eventually become too unstable and unsafe for Refuge visitors and staff to traverse and would likely be closed. Visitors would not be able to visit historic properties on the Refuge and a major shutdown of the Refuge would be required to reconstruct the walking trail. This No Action Alternative would have a significant adverse impact to cultural resources over the long-term.

Trail Stabilization with East Slope Discharge
This alternative would have a long-term beneficial impact to historic properties located on the Refuge as it would stabilize the walking trail allowing continued access for the public and staff to access the lighthouse. The walking trail use would stay consistent with existing use and there would be long-term direct impacts that are considered minor from trail stabilization measures. The east slope infiltration system would consist of clearing vegetation on the east slope of the walking trail in an area that does not contain any historic structures. There are no adverse impacts to historic structures anticipated as part of this alternative.

In the event that cultural/archaeological resources are found during construction activities, construction would stop and the appropriate USFWS cultural resource staff and SHPD staff would be notified.

Trail Stabilization with West Ravine Discharge
This alternative would have a beneficial impact to historic properties located on the Refuge as it would stabilize the walking trail allowing continued access for the public and staff to access the lighthouse. The walking trail use would stay consistent with existing use and there would be long-term direct impacts that are considered minor from trail stabilization measures. The west ravine infiltration system would consist

of clearing vegetation in the coconut grove and west ravine to allow access to the infiltration system area. This direct impact area does not contain any historic structures. However, at the downstream end of the west ravine is the historic landing platform ruins. The water that currently drains down the ravine flows over the landing platform ruins and into the ocean. The platform diverts water over the top of the structure and there is no sign of erosion or disrepair that would cause concern for additional water to flow over the structure. The additional water collected from the walking trail and discharged down the west ravine would have minor impacts to the landing platform ruins. There are no adverse impacts to historic structures anticipated as part of this alternative.

In the event that cultural/archaeological resources are found during construction activities, construction would stop and the appropriate USFWS cultural resource staff and SHPD staff would be notified.

5.5.3 Public Health and Safety

No Action
This alternative would have a significant adverse impact over the long-term to public health and safety. Under this alternative stabilization measures for the walking trail would not be addressed. The walking trail would eventually become too unstable and unsafe for Refuge visitors and staff to traverse and would likely be closed. The slip hazard associated with water and sediment collecting on the walking trail would also continue to be present.

Trail Stabilization with East Slope Discharge
This alternative would have a beneficial impact over the long-term to public health and safety. The walking trail would be stabilized to ensure public safety and a stormwater collection system would be installed. The stormwater collection system would decrease the amount of sediment and water collecting along the trail that poses slip hazards. This alternative would address the slope erosion, trail instability, maintenance issues, and public safety concerns that currently exist.

Trail Stabilization with West Ravine Discharge
The impacts for this alternative would be the same as the Trail Stabilization with East Slope Discharge alternative.

5.5.4 Recreation

No Action
There would be a permanent significant adverse impact over the long-term to recreation for this alternative. The walking trail would eventually become too unstable and unsafe for Refuge visitors and staff to traverse and would likely be closed. A decrease in visitors would be anticipated if there was no longer an opportunity to observe and photograph wildlife and scenic views along the walking trail, or visit the historic lighthouse.

Trail Stabilization with East Slope Discharge
There would be a long-term beneficial impact to recreation for this alternative. Visitors would continue to have opportunities for observation and photography of wildlife and scenic views along the walking trail, and to visit the historic lighthouse. There would be short-term moderate adverse impacts to recreation as the Refuge would be closed to visitors for the duration of construction (4 months). There are other areas nearby and accessible to the public that offer similar recreational opportunities. The following avoidance and minimization measures would be in place to minimize impacts to recreation.

- The upper scenic overlook would remain open to visitors to maintain opportunities for wildlife observation and photography and viewing/photography of the lighthouse as well as the scenic views.
- The KPNHA gift shop currently located in the visitor center would be relocated to an accessible area in Kīlauea (Kong Lung Historic Market Center) where visitors could still learn about the refuge and purchase gifts and souvenirs.
- Existing paved parking areas and overflow parking at the upper scenic overlook would continue to be utilized during the closure to provide visitor parking and access.
- Temporary restroom facilities would be provided at the upper scenic overlook for visitors.

Based on the duration of construction activities, availability of similar recreational activities nearby, and adherence to the avoidance and minimization measures described above, this alternative would have a direct moderate short-term adverse impact to recreation during construction. After construction completion the Refuge would be reopened and recreation would return to preconstruction conditions.

Trail Stabilization with West Ravine Discharge
The impacts for this alternative would be the same as the Trail Stabilization with East Slope Discharge alternative.

5.5.5 Public Access

Refuge staff met with the County of Kaua‘i engineering and planning staff during an informal scoping meeting on January 28, 2015 to discuss the project. Additional coordination with the County was conducted on September 16, 2015 to determine mitigation measures and permitting requirements to handle traffic congestion and public access at the upper scenic overlook during the proposed closure of the Refuge. Consultation and necessary permitting through the County would be performed as a part of the action alternatives.

No Action
There would be no impacts to public access for this alternative as there would be no change from the existing conditions.

Trail Stabilization with East Slope Discharge
There would be no long-term impacts for this alternative as the Refuge would continue to operate as it is currently after construction. The Refuge would be closed for 4 months during construction which would have short-term moderate adverse impacts on public access. The following avoidance and minimization measures would be in place to minimize impacts to public access during construction.

- Existing access will be maintained at residential properties and to the upper scenic overlook.
- Traffic control measures would be in place to handle visitor traffic and congestion issues at the upper scenic overlook. Traffic control measures may include signage, speedbumps, fencing, cones, candles, barrels, and traffic control personnel.
- Parking time restrictions would in place and appropriate time restriction signage would be posted to manage visitation flow at the upper scenic overlook.
- Signs indicating closure of the Refuge would be posted at multiple locations in Kīlauea. See Figure 5-3 for sign posting locations.

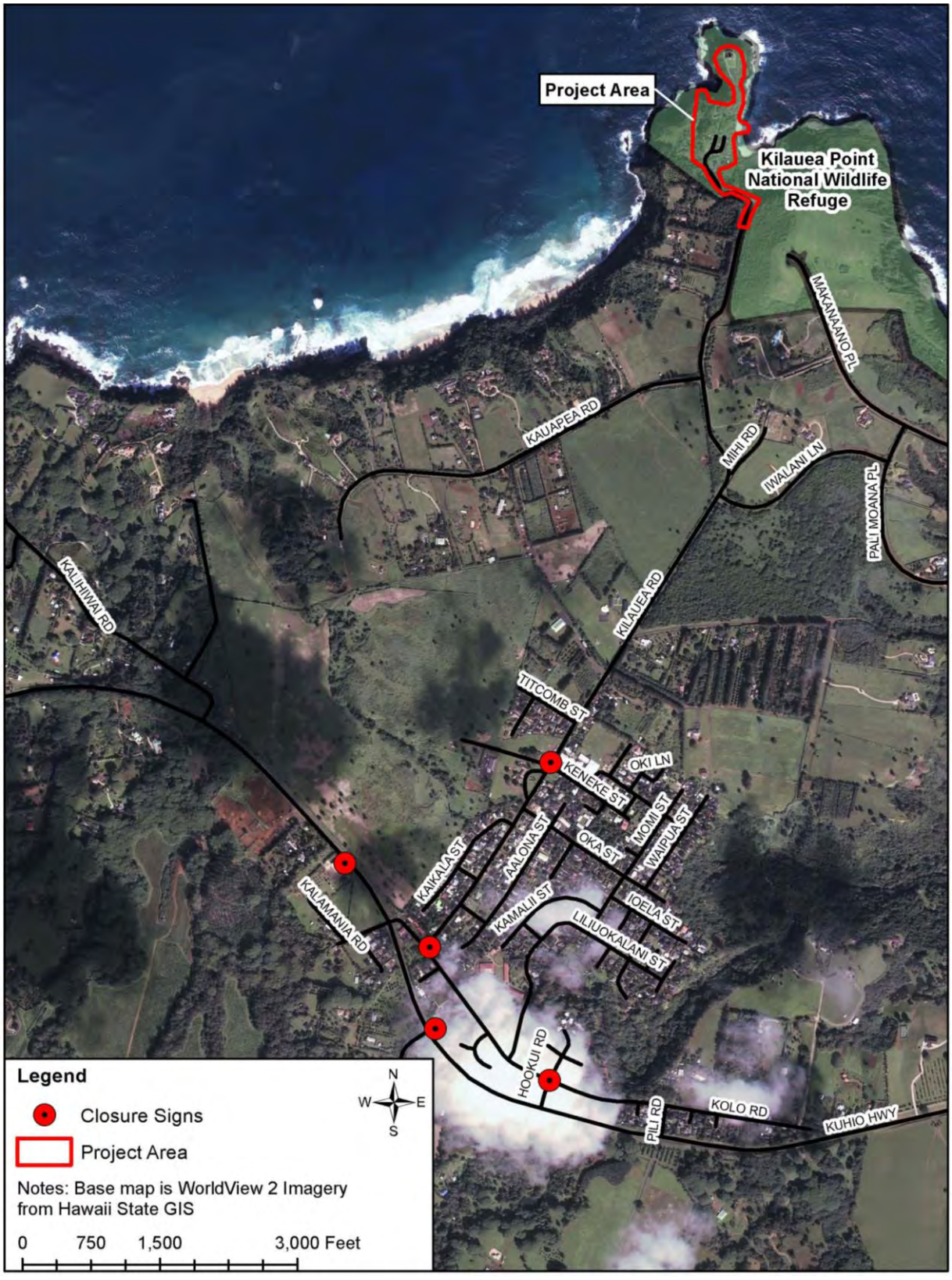

Figure 5-3. KPNWR Closure Sign Posting Locations

Trail Stabilization with West Ravine Discharge
The impacts for this alternative would be the same as the Trail Stabilization with East Slope Discharge alternative.

5.5.6 Visual Resources

No Action
There would be no impacts to visual resources for this alternative as there would be no change from the existing conditions.

Trail Stabilization with East Slope Discharge
Long-term and short-term adverse impacts are anticipated for this alternative. Minor short-term impacts are anticipated during construction, as the upper overlook includes a view of the construction disturbance area. See Figure 5-4 below for a view of the project area from the upper scenic overlook. This alternative includes construction an approximate 40-foot by 55-foot infiltration system on the east slope that would potentially be visible from the upper scenic overlook and from a section of the walking trail (Figure 5-4 and 5-5). To help conceal the infiltration system, native vegetation would be planted around the perimeter which is anticipated to take several years to become established. The infiltration system is not anticipated to be visible at the upper scenic overlook, but may be visible from the walking trail after vegetation becomes established. Based on the visibility from the upper overlook this alternative would have a negligible long-term adverse impact and from the walking trail would have a minor long-term adverse impact to visual resources.

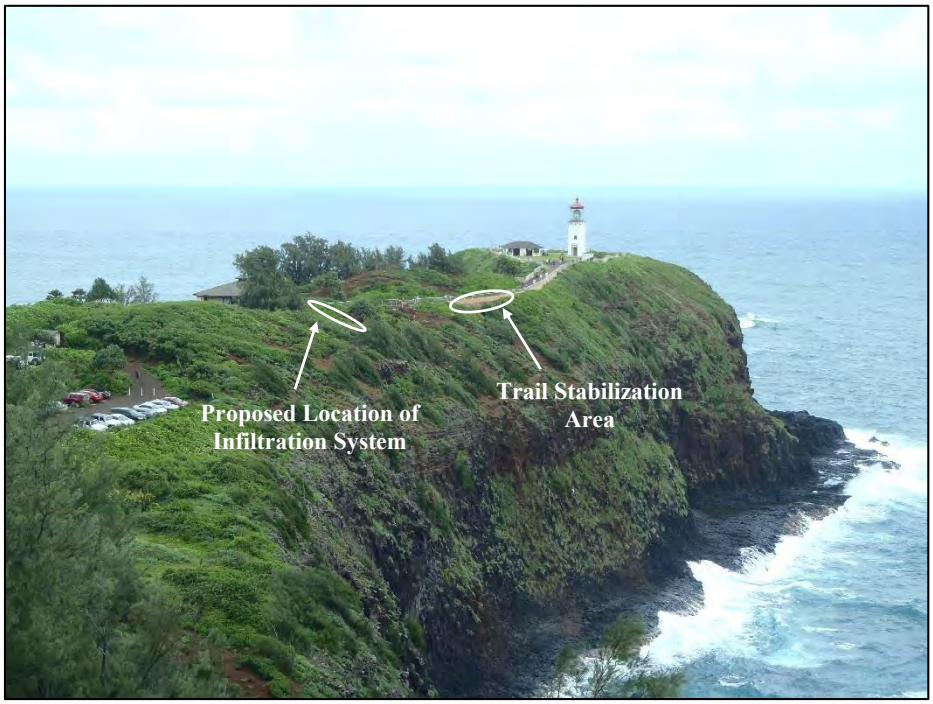

Figure 5-4. Viewshed of East Slope from the Upper Scenic Overlook

Figure 5-5. Viewshed of the East Slope from the Walking Trail

Trail Stabilization with West Ravine Discharge
There would be no long-term impacts to visual resources for this alternative. Minor short-term impacts are anticipated during construction, as the upper overlook includes a view of the construction disturbance area. See Figure 5-4 above for the viewshed of the project area from the upper scenic overlook. The west ravine infiltration system is located in an area that is inaccessible to the public and cannot be seen from any public access point within the project area.

5.5.7 Noise

No Action
There would be no impacts to noise for this alternative as there would be no change from the existing conditions.

Trail Stabilization with East Slope Discharge
The project area is not located in a densely populated area. The closest adjoining property to the project area is approximately 200 feet away, and there are only three residences within approximately 1,000 feet. Various noises from construction activities would be produced for an approximate 4 month period. Noise sources would include:

- Micro pile drilling machine (<120 dBA): ~2 weeks
- Air compressor (60-90 dBA): 4 months
- Generator (80 dBA): 4 months
- Plate compactor (90-100 dBA): 2 months
- Jumping Jack compactor (90-100 dBA): 2 months
- Back-up Beepers on equipment (90-100 dBA): 4 months
- Backhoe, Dump Truck, Loader (80-85 dBA): 4 months

The project area is not located within the jurisdiction of Kaua‘i County and adherence to the County noise ordinance is not required. However, project activities would adhere to the specific permit restrictions for construction activities, to the extent operable, as defined in the Administrative Rules. Construction activities which would emit noise in excess of the MPSLs (measured at the closest property boundary) would be performed between the hours of 7:00 a.m. and 6:00 p.m. Monday through Friday, and 9:00 a.m. to 6:00 p.m. on Saturday. Work which would emit noise in excess of the MPSLs (measured at the closest property boundary) would not be performed on Sundays or holidays. A decibel meter will be used at the edge of the Refuge property to document noise emissions from the construction area. If noise emissions are in excess of the MPSLs during the selected day and time periods, corrective measures will be attempted to reduce noise emissions. No equipment or material deliveries would occur on Sundays at the Refuge. Note that noise attenuates approximately 6 dBA for each doubling of the distance from the noise source. Therefore the sounds at the closest residence (200 feet) would be approximately 12 dBA quieter (approximately one-half as loud).

Based on the rural location of the project and adherence to County noise restrictions for construction activities, this alternative would have short-term minor noise impacts to neighbors.

Trail Stabilization with West Ravine Discharge

The impacts for this alternative would be the same as the Trail Stabilization with East Slope Discharge alternative.

5.6 Cumulative Impacts

Cumulative impacts for the project include the following other projects:

- Kīlauea Ag Park Complex (Non-Federal): The Ag Park resides on a 75-acre parcel off of Kīlauea Road approximately 0.5 miles south of the Refuge. The park makes land available to small farmers at reasonable lease costs. It will serve thousands of residents on Kaua‘i as a regional food hub assisting Hawai‘i’s shared efforts to increase food security, preserve rural character, provide viable, agriculturally based economic development with a long term vision to provide our youth with rewarding jobs and skills in agriculture. Construction of this Ag Park is scheduled to start in early 2016.

- Kīlauea Lighthouse Village (Non-Federal): The village is a new neighborhood mixed-use retail, office, and residential development located in the town of Kīlauea at the intersection of Kīlauea Road and Keneke Street, approximately 1.5 miles south of the Refuge. Construction of this village is scheduled to start in January 2016.

- Hawaiian Petrel Relocation Project: A Draft EA has been completed for these management actions identifying a preferred alternative action consisting of a bird translocation program combined with social attraction techniques in the fenced predator-free unit at Nihoku. This unit is located approximately 0.7 miles southeast of the Refuge. These management actions are anticipated to start as soon as November 2015 and will occur over a period of 5 to 10 years. The petrels are only expected to be transiting through the project area from January through April and not nesting or brooding. No work is proposed at night and tall construction equipment will be lowered at the end of each work day. Construction noise should also be attenuated from the project area to non-disturbance levels. There are no cumulative impacts anticipated to the Hawaiian petrel.

5.6.1 Cumulative Impacts to the Physical Environment

There are no relevant cumulative Physical Environment impact resource concerns for the alternatives analyzed. Please refer to Table 2-2 for a list of Physical Environment resource concerns and their relevancy to project actions.

5.6.2 Cumulative Impacts to the Biological Environment

There are no relevant cumulative Biological Environment impact resource concerns for the alternatives analyzed. Please refer to Table 2-2 for a list of Biological Environment resource concerns and their relevancy to project actions.

5.6.3 Cumulative Impacts to the Human Environment

There are no relevant cumulative Human Environment impact resource concerns for the following resources for the alternatives analyzed: socioeconomics, historic properties/cultural resources, public health and safety, recreation, visual resources, and noise. The following resource was analyzed for cumulative impacts: land use and public access.

5.6.3.1 Land Use and Public Access

The construction of the Kīlauea Ag Park Complex and the Kīlauea Lighthouse Village would result in increased construction traffic along Kīlauea Road in the vicinity of the project. This increase in traffic would occur during the same months (January through March 2016) and may cause delays in public access to the upper scenic overlook at the Refuge. However, these delays will be mitigated by the placement of Refuge closure signs at specific locations on Highway 56 and around the town of Kīlauea which should decrease the amount of visitors attempting to drive to the Refuge. The increase in traffic is expected to be short-term and minor.

5.7 Irreversible and Irretrievable Resource Commitments

NEPA requires that environmental analysis include identification of "… any irreversible and irretrievable commitments of resource which would be involved in the Proposed Action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects this use could have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural resource).

Implementing the proposed actions would involve a commitment of a range of natural, physical, human, and fiscal resources. Considerable amounts of fossil fuels, labor, and construction materials would be expended. Additionally, moderate amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials are generally not retrievable. They are not; however, in short supply and their use would not have an adverse effect upon continued availability of these resources. Any construction would also require a substantial one-time expenditure of federal and funds that would not be retrievable.

5.8 Environmental Consequences Summary

Table 5-4 below lists the resources of concern and summarizes the impacts associated with the No Action, Trail Stabilization with East Slope Discharge, and Trail Stabilization with West Ravine Discharge alternatives. Resources that would not be impacted by the project are not listed in this table.

Table 5-4. Summary of Impacts to Resources of Concern

Resource Concern	No Action	Trail Stabilization with East Slope Discharge	Trail Stabilization with West Ravine Discharge
Physical Environment			
Soil and Erosion	No Impacts	Minor short term adverse impact during construction and a minor long term beneficial impact after construction completion.	Minor short term adverse impact during construction and a minor long term beneficial impact after construction completion. Slightly higher degree of benefit comparative to the East Slope Discharge Alternative.
Biological Environment			
Federally Listed Plant and Animal Species	No Impacts	No effect to listed T&E species except for ʻaʻo (Newell's shearwater) and nēnē (Hawaiian goose) which have a may affect, but not likely to adversely affect or adversely modify critical habitat determination.	No effect to listed T&E species except for ʻaʻo (Newell's shearwater) and nēnē (Hawaiian goose) which have a may affect, but not likely to adversely affect or adversely modify critical habitat determination.
State Listed Plant and Animal Species	No Impacts	Direct minor short-term impacts during construction and negligible long-term impacts to animal species. No impact to listed plant species.	Direct minor short-term impacts during construction and negligible long-term impacts to animal species. No impact to listed plant species.
Conservation Areas	Significant adverse impact to the management plans for the conservation area	Moderate long-term beneficial impact to the management plans for the conservation area.	Moderate long-term beneficial impact to the management plans for the conservation area.
Essential Fish Habitat	Minor adverse impact to EFH located in ocean waters adjoining the project area.	Minor beneficial impact from a decrease in sediment transported downstream in to ocean waters.	Minor beneficial impact from a decrease in sediment transported downstream in to ocean waters. Slight increase in benefit comparative to the East Slope Discharge Alternative.
National Wildlife Refuges	Significant adverse impact to the five National Wildlife System goals.	Moderate long-term beneficial impact to the five National Wildlife System goals.	Moderate long-term beneficial impact to the five National Wildlife System goals.
Wildlife and Wildlife Habitat	No Impacts	Direct minor short-term impacts during construction and negligible long-term impacts.	Direct minor short-term impacts during construction and negligible long-term impacts.
Coral Reefs	Minor adverse impacts to coral reefs located in ocean waters adjoining the project area.	Minor long-term beneficial impact from a decrease in sediment transported downstream in to ocean waters.	Minor long-term beneficial impact from a decrease in sediment transported downstream in to ocean waters. Slight increase in benefit comparative to the East Slope Discharge Alternative.
MBOC	No Impacts	Direct minor short-term impacts during construction and negligible long-term impacts.	Direct minor short-term impacts during construction and negligible long-term impacts.

Resource Concern	No Action	Trail Stabilization with East Slope Discharge	Trail Stabilization with West Ravine Discharge
Human Environments			
Socioeconomics	Indirect significant adverse impact from loss of revenue and jobs from future failure of walking trail.	Long-term beneficial impact from continued visitation and associated revenues and jobs. Short-term adverse impacts from closure of refuge for 4 months during construction.	Long-term beneficial impact from continued visitation and associated revenues and jobs. Short-term adverse impacts from closure of refuge for 4 months during construction.
Historic Properties / Cultural Resources	No Impacts	Long-term beneficial impact from continued public access to historic places. No adverse impact to historic structures.	Long-term beneficial impact from continued public access to historic places. No adverse impact to historic structures.
Public Health and Safety	Significant adverse impact from continued trail instability, and slip hazards from accumulated sediment on the trail.	Long-term beneficial impact from stabilization of trail and decrease in sediment on the trail posing slip hazards.	Long-term beneficial impact from stabilization of trail and decrease in sediment on the trail posing slip hazards.
Recreation	Significant adverse impact from eventual trail closure.	Long-term beneficial impact from continued opportunities to observe and photograph wildlife and scenic views along the walking trail, and visit the historic lighthouse. Short-term moderate adverse impacts from closure of refuge for 4 months during construction.	Long-term beneficial impact from continued opportunities to observe and photograph wildlife and scenic views along the walking trail, and visit the historic lighthouse. Short-term moderate adverse impacts from closure of refuge for 4 months during construction.
Public Access	No Impacts	Short-term moderate adverse impacts from closure of refuge for 4 months during construction.	Short-term moderate adverse impacts from closure of refuge for 4 months during construction.
Visual Resources	No Impacts	Minor short-term adverse impacts during construction. Negligible long-term adverse impact from the upper scenic overlook and minor long-term adverse impact from the walking trail.	Minor short-term adverse impacts during construction. No long-term impacts.
Noise	No Impacts	Short-term minor noise impacts during construction (4 months).	Short-term minor noise impacts during construction (4 months).
Cumulative Impacts	No Impacts	Short-term minor impacts to public access from additional traffic along Kīlauea Road from Kīlauea Ag Park Complex and the Kīlauea Lighthouse Village projects. No other cumulative impacts are anticipated	Short-term minor impacts to public access from additional traffic along Kīlauea Road from Kīlauea Ag Park Complex and the Kīlauea Lighthouse Village projects. No other cumulative impacts are anticipated

SECTION 6
LIST OF PREPARERS AND COORDINATION

6.1 List of Preparers

Figure 6-1. List of Preparers

Name Title	Contributions
Michael Mitchell Acting Project Leader, USFWS	Developer/Reviewer: physical and biological affected environment and environmental consequences
Greg Allington Senior Biologist, McMillen Jacobs Associates	Writer/Analysis: biological affected environment and environmental consequences
Bobbi Preite Environmental Specialist, McMillen Jacobs Associates	Writer/Analysis: physical and biological affected environment and environmental consequences
Aimee Hill Senior NEPA Specialist, McMillen Jacobs Associates	Writer/Analysis: social affected environment and environmental consequences
John Etulain Civil Engineer, McMillen Jacobs Associates	Designer: conceptual design alternatives
Charlie Pelizza Assistant Refuge Supervisor, USFWS	Reviewer: biological affected environment and environmental consequences
Jennifer Waipa Supervisory Park Ranger, USFWS	Developer/Reviewer: social affected environment and environmental consequences
Brad Senatra Project Engineer, USFWS	Reviewer: conceptual design
Kimberly Uyehara Biologist, USFWS	Reviewer: biological affected environment and environmental consequences

SECTION 7
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