DRAFT
ENVIRONMENTAL ASSESSMENT
KEKAHA LANDFILL
PHASE II VERTICAL EXPANSION
KEKAHA, KAUA`I, HAWAI`I

County of Kaua`i
Department of Public Works
Solid Waste Division
4444 Rice Street
Mo`ikeha Building, Suite 275
Līhu`e, Hawai`i 96766

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Prepared for:

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Līhu`e, Hawai`i 96766

Prepared by:

AECOM Technical Services, Inc.
1001 Bishop Street, Suite 1600
Honolulu, HI 96813-3698

July 2013

EXECUTIVE SUMMARY

The County of Kaua`i, Department of Public Works, Solid Waste Division, hereafter referred to as the "County", is proposing a vertical expansion of the Kekaha Landfill (KLF) on the Island of Kaua`i, Hawai`i. The KLF is located 1.3 miles northwest of the town of Kekaha on the southwest side of the Island of Kaua`i and identified with Tax Map Keys 1-2-002:009 and 1-2-002:001. This facility is situated on approximately 98 acres of land adjacent to Kaumuali`i Highway approximately 1,700 feet (ft) from the shoreline of the Pacific Ocean. The KLF is comprised of two distinct refuse fill areas identified as Phase I and Phase II. Phase I began operations in 1953 and ceased operations on October 8, 1993. Phase II began operations on October 9, 1993 and was originally permitted to reach a height of 37 ft above mean sea level (msl), which was anticipated to provide capacity for municipal solid waste (MSW) filling operations through 2003. However, due to the additional MSW resulting from Hurricane Iniki, the capacity was prematurely consumed, and the Phase II landfill was expanded vertically in 1998 to accommodate more MSW by increasing the height limit to 60 ft msl. A second vertical expansion of Phase II was approved in 2005 allowing a height of 85 ft msl, which is currently the permitted maximum height. A lateral expansion of the KLF ("Cell 1") was constructed in 2010 to further extend the life of the facility. An additional lateral expansion ("Cell 2") is currently in the permitting process, and is anticipated to be permitted within the coming years. The currently permitted fill areas (i.e., Phase II, including Cell 1) are expected to reach capacity early in 2014.

The purpose of the proposed action is to vertically expand the currently permitted Phase II/Cell 1 area and the proposed Cell 2 lateral expansion, thereby prolonging the life of the KLF, which is the only permitted MSW landfill on the Island of Kaua`i. The need arises because the currently-permitted KLF Phase II is projected to reach capacity in early 2014, at which time the Island of Kaua`i would be without a landfill for the safe disposal of MSW.

The proposed project occurs on State of Hawai`i land and would use County of Kaua'i funds, which triggers the environmental review process mandated under the Hawai`i Revised Statutes (HRS) Chapter 343. This environmental assessment (EA) analyzes the potential environmental consequences of the proposed action and alternatives to determine whether there would be significant short-term, long-term, and/or cumulative impacts on the human, natural, or historic environments resulting from the proposed action.

All activities conducted in support of this EA, including reports, field investigations, and public involvement are conducted in accordance with HRS Chapter 343, Environmental Impact Statements; the Hawai`i Administrative Rules (HAR), Title 11, Chapter 200, Hawai`i State Department of Health implementing rules for the environmental review process; and Act 50, HRS Chapter 343, requiring impacts to Hawai`i's culture, traditional cultural properties and practices, and customary rights be addressed in the environmental review process.

PROPOSED ACTION AND ALTERNATIVES

The proposed action and the no-action alternative are described as follows:

- **Proposed Action.** The proposed vertical expansion is planned in two areas: the Phase II/Cell 1 vertical expansion and the Cell 2 vertical expansion. The Phase II/Cell 1 landfill is currently permitted to receive MSW up to 85 ft above msl, and is currently in use. Upon acceptance of this EA and receipt of a Solid Waste Management Permit, the Phase II/Cell 1 vertical expansion could begin operations. The Cell 2 lateral expansion is currently being designed and permitted, and is expected to be constructed in the coming years. The Cell 2 vertical expansion, therefore, while included in the proposed action, will be permitted concurrently with the Cell 2 lateral expansion. Table ES-1 summarizes the status of the recent and proposed expansions, listed in order of anticipated implementation, with the subject of this EA shown in bold font.

- **No-Action Alternative.** Under the no-action alternative, the KLF facility would be left *status quo*. The County would not implement the Phase II/Cell 1 and Cell 2 vertical expansion of the facility and the KLF would reach capacity in early 2014. At that time, the Island of Kaua`i would be left without an active landfill and without safe means for MSW disposal.

Table ES-1: Summary of Recent and Proposed Landfill Expansions

Order	Expansion Maximum Height (ft msl)	Maximum Height (ft msl)	Related Environmental Assessment	Solid Waste Permit Status	Comments
1	Cell 1 Lateral Expansion	85	November, 2007	Currently permitted as part of the Phase II landfill	Currently being used to landfill Kauai's waste
2	**Phase II-Cell 1 Vertical Expansion**	**120**	**In progress**	**After EA is completed (expected early 2014)**	**Subject of this Environmental Assessment**
3	Cell 2 Lateral Expansion	85	November, 2007	Permit currently being processed (permit anticipated after Vertical Expansion)	Expected to be implemented after the Phase II-Cell 1 Vertical Expansion
4	**Cell 2 Vertical Expansion**	**120**	**In progress**	**Concurrent with Cell 2 lateral expansion**	**Subject of this Environmental Assessment**

Bold shading denotes expansions applicable to this EA.

SUMMARY OF ENVIRONMENTAL IMPACTS

The environmental impacts from the proposed action and alternatives are summarized below:

- **Proposed Action.** The proposed action would vertically expand the Phase II/Cell 1 and Cell 2 of the KLF. Short-term adverse impacts to air quality, noise, and safety and health are expected during construction; however, implementation of construction best management practices during expansion activities would reduce these impacts to a level of non-significance.

  The proposed landfill expansion would be designed, constructed, and operated in accordance with the provisions of HAR 11-58.1 (DOH 1994) developed to prevent pollution, conserve natural resources, and protect public health and safety. The landfill expansion would make use of the existing Subtitle D base liner system, and landfill gas and leachate collection and treatment systems, such that no additional impacts to air or water resources would result from the proposed action. The landfill gas collection and management systems would be incrementally replaced with an active system, thereby eventually resulting in air impact improvements. Additional operating procedures and/or mitigation measures for odor and dust control, hazardous materials and hazardous waste, natural hazards, safety and health, visual resources, and water resources have also been incorporated to minimize impacts to the natural and human environments, such that no significant adverse impacts are anticipated from operation of the Phase II/Cell 1 and Cell 2 Vertical Expansion.

- **No-Action Alternative.** The no-action alternative would leave the County without a landfill facility for the safe disposal of MSW beginning in early 2014. The lack of a permitted MSW landfill would result in adverse effects on the environment and public health. Waste would not be properly disposed of, and contamination and unsanitary conditions would propagate vectors and pose a serious risk to public health and the environment.

DETERMINATION

To determine whether the proposed action would have a significant impact on the human, natural, or historic environments, the project, its anticipated direct and indirect effects, and the short-term, long-term, and cumulative impacts have been evaluated. Based on the analysis and resources evaluated, a Finding of No Significant Impact is anticipated.

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ACRONYMS AND ABBREVIATIONS

§	Section
ADC	Alternative Daily Cover
bgs	below ground surface
BMP	Best Management Practices
CAB	Clean Air Branch, State of Hawai`i
CCD	Census County Division
CDUA	Conservation District Use Application
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CH_4	methane
CO_2	carbon dioxide
cy	cubic yard
dBA	decibel (A-weighted scale)
DPW	Department of Public Works, County of Kaua`i
DLNR	Department of Land and Natural Resources, State of Hawai`i
DOH	Department of Health, State of Hawai`i
EA	environmental assessment
EIS	environmental impact statement
EPA	Environmental Protection Agency, United States
FEMA	Federal Emergency Management Agency
FIRM	flood insurance rate map
ft	foot/feet
ft/day	foot per day
HAR	Hawai`i Administrative Rules
HDPE	high-density polyethylene
HIOSH	Hawai`i Occupational Safety and Health
HRS	Hawai`i Revised Statutes
KLF	Kekaha Landfill
LFG	landfill gas
msl	mean seal level
MSW	municipal solid waste
MW	monitoring well
NAAQS	National Ambient Air Quality Standards
no.	number
NOAA	National Oceanographic and Atmospheric Administration
O_2	oxygen
PGE	Pacific Geotechnical Engineers, Inc.
PMRF	Pacific Missile Range Facility
POC	point-of-compliance
ppm	parts per million
PQL	practical quantitation limit
RCRA	Resource Conservation and Recovery Act
ROI	region of influence
SHPD	State Historic Preservation Division
SHWB	Solid and Hazardous Waste Branch, State of Hawaii
SMA	special management area
SPCC	Spill Prevention, Control, and Countermeasures Plan
TDS	total dissolved solids

TMK	Tax Map Key
U.S.	United States
U.S.C.	United States Code
USGS	Unites States Geological Survey
WMH	Waste Management of Hawaii

1.0 INTRODUCTION

The County of Kaua`i, Department of Public Works, Solid Waste Division, hereafter referred to as the "County", is proposing a vertical expansion of the Kekaha Landfill (KLF) on the Island of Kaua`i, Hawai`i. The KLF is located 1.3 miles northwest of the town of Kekaha on the southwest side of the Island of Kaua`i and identified with Tax Map Keys 1-2-002:009 and 1-2-002:001. This facility is situated on approximately 98 acres of land adjacent to Kaumuali`i Highway approximately 1,700 feet (ft) from the shoreline of the Pacific Ocean (Figure 1-1). The KLF is comprised of two distinct refuse fill areas identified as Phase I and Phase II. Phase I began operations in 1953 and continued until operations ceased on October 8, 1993. Phase II began operations on October 9, 1993 and was originally permitted to reach a height of 37 ft above mean sea level (msl), which was anticipated to provide capacity for municipal solid waste (MSW) filling operations through 2003. However, due to the additional MSW resulting from Hurricane Iniki, the capacity was prematurely consumed, and the Phase II landfill was expanded vertically in 1998 to accommodate more MSW by increasing the height limit to 60 ft above msl. A second vertical expansion of Phase II was approved in 2005 allowing a height of 85 ft above msl, which is the currently permitted maximum height. A lateral expansion of the KLF ("lateral expansion Cell 1") was completed in 2010 to further extend the life of the facility. An additional lateral expansion ("lateral expansion Cell 2") is currently in the permitting process, and may be permitted within the coming year. The currently permitted fill areas are expected to reach capacity early in 2014: in this document Phase II refers to the original Phase II landfill plus lateral expansion Cell 1, which together comprises the currently permitted Phase II landfill.

This environmental assessment (EA) analyzes the potential environmental consequences of the proposed action and alternatives to determine if there would be significant short-term, long-term, and/or cumulative impacts on the human, natural, or historic environments.

All activities conducted in support of this EA, including reports, field investigations, and public involvement are conducted in accordance with Hawai`i Revised Statutes (HRS) Chapter 343, Environmental Impact Statements (EIS); the Hawai`i Administrative Rules (HAR) Title 11, Chapter 200, State of Hawai`i Department of Health (DOH) implementing rules for the environmental review process; and Act 50, HRS Chapter 343, requiring impacts to Hawai`i's culture, traditional cultural properties and practices, and customary rights be addressed in the environmental review process.

1.1 PURPOSE OF AND NEED FOR ACTION

The purpose of the proposed action to vertically expand the currently permitted Phase II area and the proposed Cell 2 lateral expansion, is to prolong the life of the KLF, which is the only permitted MSW landfill on the Island of Kaua`i. The need arises because the currently-permitted KLF Phase II is projected to reach capacity in 2014, at which time the Island of Kaua`i would be without a landfill for the safe disposal of MSW. The lack of a permitted MSW landfill would result in adverse effects on the environment and public health. Waste would not be properly disposed of and unsanitary conditions would propagate vectors and pose a serious risk to public health and the environment.

1.2 ENVIRONMENTAL PERMITS, CONSULTATIONS, AND APPROVALS

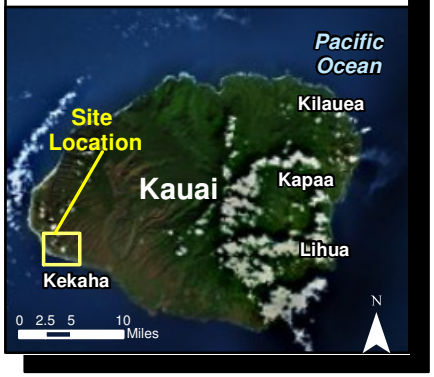
In addition to the environmental disclosure requirements of HRS Chapter 343, the implementation of the proposed action would require coordination and consultation with the federal, state, and county agencies for permits, clearances, or approvals as presented in Table 1-1 (see Appendix A for agency correspondence).

Table 1-1: Permits and Approvals for Implementation of the Proposed Action

Permit or Approval	Description	Regulation(s)	Administrative Authority
Conservation District Use Application	Land uses within any State of Hawai`i Conservation District must be approved by the Board of Land and Natural Resources or the Chairperson, prior to initiation. (Applicable to Cell 2 vertical expansion only)	HAR 13-5	DLNR Office of Conservation and Coastal Lands
SMA Permit	A SMA Permit is required for any development within the SMA boundary, including construction, reconstruction, demolition, or alteration of the size of any structure. (Applicable to Cell 2 vertical expansion only)	HAR 15-150	County of Kaua`i Department of Planning
Solid Waste Management Permit	Expansion of a MSW landfill must be authorized under a Solid Waste Management Permit issued by the DOH SHWB.	HRS 342H; HAR 11-58.1-04	DOH SHWB
Initial Covered Source Air Permit	Covered sources include those sources that are major sources of air emissions and sources subject to a federal performance or control technology standard.	HAR 11-60.1-82	DOH CAB
Title V Air Permit	A Title V air permit is required to comply with the New Source Performance Standards found in 40 CFR Part 60, Subpart WWW.	40 CFR Part 60	DOH CAB; EPA
Historic Preservation Review	State and county projects that may affect a historic property must obtain a concurrence of “no affect” to historic properties from SHPD, prior to commencement.	HRS Chapter 6E-8; HAR 13-275	DLNR SHPD

CAB Clean Air Branch
CFR Code of Federal Regulations
DLNR Department of Land and Natural Resources
EPA Environmental Protection Agency
No. number
SHPD State Historic Preservation Division
SHWB Solid and Hazardous Waste Branch
SMA special management area

LOCATION MAP



LEGEND

Roads

NOTES

1. Map projection is Hawaii State Plane, Zone 4, NAD83.
2. Base map: ArcGIS Bring Map Aerial

N

0 1,000 2,000 4,000 Feet

Figure 1-1
Site Location Map
Kekaha Vertical Expansion
Kauai, Hawaii

P:\ENV\Non-Federal\County of Kauai\60135722 KAUAI-Kekaha Cell 1\07 Deliverables\GIS\02_MXD\Figure 1-1 - Site Location Map.mxd

2.0 PROJECT DESCRIPTION

This section provides background information on the proposed project and a description of the proposed action and the no-action alternative.

2.1 PROJECT LOCATION AND BACKGROUND

Location. The KLF is located 1.3 miles northwest of the town of Kekaha on the southwest side of the Island of Kaua`i and identified with tax map keys (TMKs) 1-2-002:009 and 1-2-002:001 (Figure 1-1). The KLF is located adjacent to Kaumuali`i Highway (Highway 50) and Phase I is approximately 1,700 ft from the shoreline of the Pacific Ocean. The facility is situated on approximately 98 acres of land and is comprised of two distinct refuse fill areas identified as Phase I, approximately 33 acres, and Phase II, approximately 38 acres (Figure 2-1). Phase I began operations in 1953 and continued until operations ceased on October 8, 1993. Phase I has no liner system beneath the refuse. Phase II began operations on October 9, 1993 after the closure of Phase I. Phase II of the KLF was constructed to meet Resource Conservation and Recovery Act (RCRA) Subtitle D criteria and is currently the only active, permitted MSW landfill on the Island of Kaua`i. The KLF is bounded by Kaumuali`i Highway to the northeast, an unpaved access road and agriculture land to the southeast, aquaculture to the northwest, federal reserve lands to the west, the Hawai`i National Guard Rifle Range to the southwest, and a drag strip to the south. The KLF is located on the Mana Plain, which is the coastal plain of southwestern Kaua`i. Historically, the Mana Plain was predominately used for agricultural purposes and portions are still used for agricultural purposes. Natural elevations on the Mana Plain range from sea level to approximately 10 ft above msl.

The KLF Phase II is a landfill permitted for the disposal of non-hazardous MSW. The permitted Phase II fill area, which occupies approximately 38 acres, is subdivided into 14 waste disposal cells (each about 2.3 acres in size and approximately 100 ft wide and 800 to 1,100 ft long) plus lateral expansion Cell 1. An office, public convenience center, leachate evaporation pond, stormwater infiltration basin, and maintenance shop are located along the northeastern property line of the facility along Kaumuali‘i Highway.

Background. The County has an island-wide system of solid waste collection and disposal facilities and operations that serve the general population including commercial, business, and self-haulers. The two primary components of the Kaua`i solid waste management system are the KLF and the refuse transfer stations. The County operates four refuse transfer stations located in Hanalei, Kapa`a, Līhu`e, and Hanapēpē. Solid waste is collected, sorted, and then transferred to the appropriate facility depending on whether it is recyclable material, green waste, or solid waste accepted for disposal in the KLF. The County provides, for residential use only, recycling drop-off bins at nine convenient locations across the island of Kaua`i. The KLF Phase II was initially permitted for a maximum elevation of 37 ft above msl. However, to accommodate waste generated by Hurricane Iniki in 1992, a vertical expansion was approved in 1998, raising the maximum fill elevation to 60 ft above msl. This vertical expansion added an additional 6 years of use to the site (Belt Collins 1998). A second vertical expansion was subsequently approved in 2005 to raise the maximum final cover elevation to 85 ft above msl.

An EA, Kekaha Landfill Phase II Lateral Expansion, addressing the potential to laterally expand the limits of Phase II to include three additional expansion cells was completed in 2007. Cell 1 was subsequently permitted to expand Phase II into the former leachate lagoon and adjacent area. Cell 1 was constructed in 2010 and is currently accepting waste. Cell 1 added an additional four to five years of use to the site, which is now expected to allow landfilling operations through early 2014. Cell 2 was proposed to expand Phase II into the valley area between the closed Phase I and the existing Phase II. Cell 2 permitting is currently in progress and construction is anticipated to begin within the next few years. Cell 2 is expected to add another five years of use to the site (See Figure 2-1). Cell 3 was proposed to expand Phase II directly over the closed Phase I landfill. The County does not expect to implement Cell 3 (the 2007 EA stated that if a new landfill can be sited within the life of Cells 1 and 2, the development of Cell 3 would not necessarily proceed). Public concerns over Cell 3

construction and high costs have dissuaded the County from moving forward with Cell 3. Additionally, the County continues to attempt to site a new MSW landfill at another location on the island, and the construction of the Cell 2 lateral expansion plus the proposed vertical expansion is expected to provide sufficient capacity until the new landfill is operational.

The Phase II landfill containment system consists of a landfill liner and a leachate collection system, which route leachate to the leachate evaporation lagoon, for onsite treatment. The base liner consists of a geosynthetic clay layer (bentonite [clay with high shrink-swell properties]) overlain by a geomembrane liner (60 millimeter thick high density polyethylene [HDPE]). Above the base liner, there is a 2-foot layer of sand containing perforated HDPE pipes at 100-foot intervals. These pipes direct leachate into collection manholes at the perimeter of the landfill unit. Leachate from these manholes is then directed via a pump station to the lined leachate evaporation lagoon. Sensors detect manhole leachate levels and automatically activate pumps when the leachate reaches a predetermined level. The leachate lagoon is lined with a 6-inch foundation layer, a geosynthetic clay liner covered with a 60 millimeter HDPE geomembrane and geotextile (HDPE net), and a 6-inch layer of concrete (listed in ascending order). The 1.9 acre lagoon has a maximum depth of 6 ft with an additional 2 ft of freeboard, and it was designed to completely evaporate all leachate collected from the landfill during a normal precipitation/evaporation year. Two floating paddle wheel aerators are used to accelerate evaporation.

Currently, daily operations require spreading the waste in 2-ft layers up to a 5:1 slope to a height of 10 ft and maintaining a working face of 100 ft by 75 ft maximum. Next, these 2-foot layers are compacted to a minimum of 1,300 pounds per cubic yard (cy). To minimize the exposure of the working face to the elements, the waste is covered each day with a geosynthetic tarp and/or soil. This cover helps to mitigate problems with odors, vectors, leachate, and windblown trash and complies with HAR Title 11, Chapter 58.1. The geosynthetic tarp is used as a temporary daily cover before the design grade is met, which helps to minimize soil use and maximize the landfill capacity. A soil cover (consisting of fine-grained silty clay from the former Kekaha Sugar Company mill settling basins) is used when the design grade of a particular layer is reached. Under contract with the County, Waste Management of Hawaii (WMH) manages Phase II. County employees operate equipment and perform manual tasks necessary to sustain daily operations.

Compliance with HAR Title 11, Chapter 58.1 requires that groundwater and landfill gas (LFG) monitoring be performed as part of the landfill operations. Groundwater from three Phase I and six Phase II groundwater monitoring wells (MWs) (Figure 2-1) is sampled on a semi-annual basis to determine whether there are any landfill-related contaminants present in the groundwater. The groundwater in the site vicinity and down-gradient is brackish and, therefore, not suitable for use as irrigation water or as a potable water supply. The nearest potable well is approximately 3,400 ft northwest and up/side-gradient of the site. Six LFG probes sited along the perimeter of Phase I and six LFG probes sited 1,000 ft apart along the perimeter of Phase II (Figure 2-1) are used to sample for methane (CH_4), carbon dioxide (CO_2), and oxygen (O_2).

2.2 PROPOSED ACTION

As shown in Figure 2-2,the proposed vertical expansion will comprise two areas, the Phase II/Cell 1 vertical expansion and the Cell 2 vertical expansion. The term “proposed vertical expansion,” when used by itself, refers to both the Phase II/Cell 1 vertical expansion, and the Cell 2 vertical expansion, collectively. The Phase II/Cell 1 landfill is currently permitted to receive waste up to 85 ft above msl. Cell 2 is currently being designed and permitted, and is expected to be constructed in the coming years. The Cell 2 vertical expansion would be permitted concurrently with the Cell 2 lateral expansion.

Table 2-1 briefly summarizes of the status of the recent and proposed expansions, listed in order of anticipated implementation, with the subject of this EA shown in bold font.

Table 2-1: Summary of Recent and Proposed Landfill Expansions

Order	Expansion Maximum Height (ft msl)	Maximum Height (ft msl)	Related Environmental Assessment	Solid Waste Permit Status	Comments
1	Cell 1 Lateral Expansion	85	November, 2007	Currently permitted as part of the Phase II landfill	Currently being used to landfill Kauai's waste
2	**Phase II-Cell 1 Vertical Expansion**	**120**	**In progress**	**After EA is completed (expected early 2014)**	**Subject of this Environmental Assessment**
3	Cell 2 Lateral Expansion	85	November, 2007	Permit currently being processed (permit anticipated after Vertical Expansion)	Expected to be implemented after the Phase II-Cell 1 Vertical Expansion
4	**Cell 2 Vertical Expansion**	**120**	**In progress**	**Concurrent with Cell 2 lateral expansion**	**Subject of this Environmental Assessment**

Bold shading denotes expansions applicable to this EA.

The proposed Phase II/Cell 1 vertical expansion would extend the existing engineered waste disposal area upwards, without affecting any additional acreage. The proposed Phase II/Cell 1 vertical expansion would not alter the current Phase II/Cell 1 permitted limit-of-waste footprint of 38.4 acres, and the proposed Cell 2 vertical expansion would not alter the additional anticipated permitted footprint of 6.4 acres for the Cell 2 lateral expansion. The proposed maximum height of the final cover system upon closure of the vertical expansion is proposed to be 120 ft above msl. Minimal construction (if any) would be required for the Phase II/Cell 1 vertical expansion, which would make use of the existing, continuous, Phase II Subtitle D base liner system that underlies all of the Phase II landfill.

The Phase II/Cell 1 vertical expansion is expected to provide an estimated 662,000 cy of gross airspace based on the proposed expansion limits and a final cover elevation of 120 ft above msl. Based on current landfill waste mass density and daily waste disposal rates, the Phase II/Cell 1 vertical expansion could potentially provide an additional 5.3 years of service. Similarly, the vertical expansion above the planned Cell 2 is expected to provide an estimated 317,000 cy of gross airspace, or an extra 2.5 years.

Although the proposed Phase II/Cell 1 vertical expansion provides the needed airspace to operate the facility, current site operating systems, such as leachate management and surface water management, would not need further enhancement. Currently, the leachate extracted from Phase II and Cell 1 is collected and managed in an evaporation pond north of Phase II, which was relocated and constructed as part of the Cell 1 expansion. Leachate from Phase II and Cell 1 is collected through a passive gravity design and discharged through pumps and piping to the pond, and these operations would not change as a result of the proposed Phase II/Cell 1 vertical expansion.

Surface water drainage features would need to be modified slightly (i.e., increased upwards) to accommodate the increase in sideslope lengths due to the proposed vertical increase. Presently, collected surface water discharges to an infiltration ditch located between Phases I and II, as well as to infiltration ditches located around the perimeter of Phase II. The vertical expansion would not require additional capacity in the existing 2-acre area infiltration basin and existing infiltration ditch to successfully manage surface water.

Airspace is gained from increasing the overall final cover height of Phase II and Cell 1 from 85 ft msl to 120 ft msl. The proposed grading design of the final cover consists of 3.5:1 (horizontal:vertical) sideslopes with a 3 percent top grade, similar to the design of the permitted Phase II final cover. The proposed action, final cover grade, and cross sections are presented as Figure 2-2, Figure 2-3, Figure 2-4, and Figure 2-5.The estimated amount of gross airspace (waste mass and daily cover

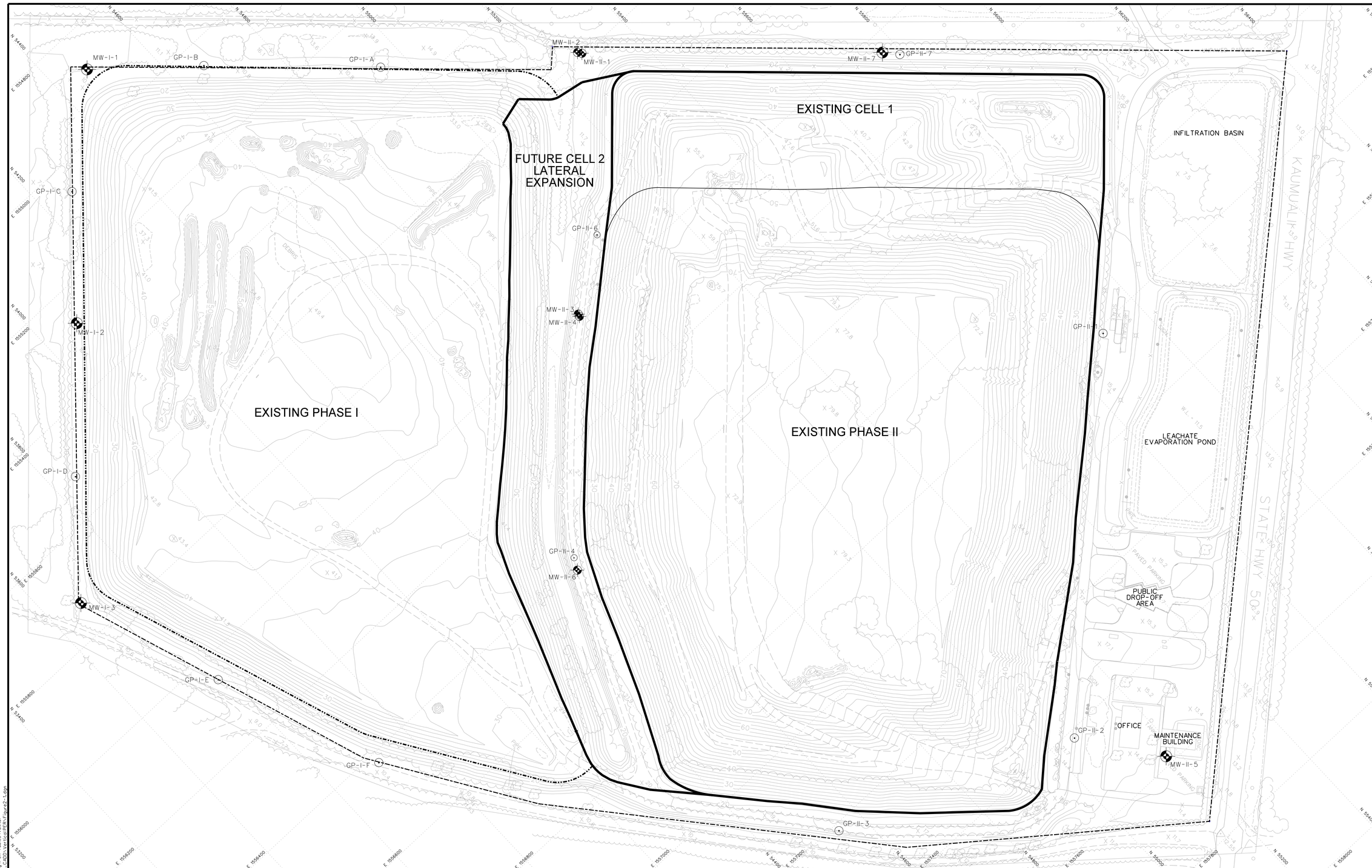
soils) for the Phase II/Cell 1 vertical expansion is 662,000 cy (Table 2-2). The estimated amount of gross airspace (waste mass and daily cover soils) for the Cell 2 vertical expansion is 317,000 cy.

Table 2-2: Estimated Additional Landfill Capacity

Proposed Expansion Area	Additional Design Volume (cy)	Soil Cover to Waste Ratio	Annual Tonnage (tons)	Annual In-place Waste (cy)	Annual Daily Cover (cy)	Additional Years of Capacity With Vertical Expansion
Phase II- Cell 1 Vertical Expansion	662,000	3:1	82,000	124,200	41,400	5.3
Cell 2 Vertical Expansion	317,000	3:1	82,000	124,200	41,400	2.5

Assumptions:
(1) Design volume determined to be the volume from the bottom of the 12-inch intermediate cover soil of the final cover system to the top of the 24-inch operation layer of the base liner system of Cell 1.
(2) Waste density of 1,300 pounds of waste per total cubic yard (WMH 2012).

At the current rate of landfilling, without the proposed action, the permitted KLF would reach capacity in early 2014, leaving the island with no safe means of disposing of MSW. Once evaluated through the Hawaii Environmental Policy Act process, and permitted by the DOH, the vertical expansion could be implemented in relatively short order to meet the anticipated demands, as very little (if any) construction would be required to begin accepting waste within the Phase II/Cell 1 footprint.



LEGEND

- 680 EXISTING TOPOGRAPHY
- PROPERTY LINE
- EXISTING LIMIT OF WASTE
- PROPOSED LIMIT OF WASTE

NOTES:

1. TOPOGRAPHIC MAP PREPARED BY AEROMETRIC, INC., SEATTLE, WASHINGTON. DATE OF FLIGHT: APRIL 20, 2012.
2. HORIZONTAL DATUM IS BASED ON NAD83 (1986), HAWAII ZONE 4. VERTICAL DATUM IS SITE SPECIFIC AND CORRELATES TO DESIGNATED USGS BRASS MONUMENT G1000 PLUS 1.21 FEET.

SCALE 0' 50' 100' 200'

NO	REVISIONS	DRN	CHK	DATE

Sheboygan, Wisconsin

DRN	DRB
DES	NKW/TCR
CHK	FLC/MRH
APP	KJB

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KEKAHA SANITARY LANDFILL
KAUAI, HAWAII

EXISTING SITE CONDITIONS

DATE	MAY 2013
PROJECT NO	60135722
FILENAME	Figure2-1.dgn
SHEET NO	
FIGURE NO	2-1

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EXISTING CELL 1

FUTURE CELL 2
LATERAL
EXPANSION

EXISTING PHASE I

EXISTING PHASE II

INFILTRATION BASIN

KAUMUALII HWY

LEACHATE
EVAPORATION POND

STATE HWY 50

PUBLIC
DROP-OFF
AREA

OFFICE

MAINTENANCE
BUILDING

PAVED PARKING

PROPOSED CELL 2
VERTICAL EXPANSION

PROPOSED PHASE II/CELL 1
VERTICAL EXPANSION

LEGEND

680	EXISTING TOPOGRAPHY
	PROPERTY LINE
	EXISTING LIMIT OF WASTE
	PROPOSED LIMIT OF WASTE

NOTES:

1. TOPOGRAPHIC MAP PREPARED BY AEROMETRIC, INC., SEATTLE, WASHINGTON. DATE OF FLIGHT: APRIL 20, 2012.
2. HORIZONTAL DATUM IS BASED ON NAD83 (1986), HAWAII ZONE 4. VERTICAL DATUM IS SITE SPECIFIC AND CORRELATES TO DESIGNATED USGS BRASS MONUMENT G1000 PLUS 1.21 FEET.

SCALE 0' 50' 100' 200'

NO	REVISIONS	DRN	CHK	DATE

Sheboygan, Wisconsin

DRN	DRB
DES	NKW/TCR
CHK	FLC/MRH
APP	KJB

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KEKAHA SANITARY LANDFILL
KAUAI, HAWAII

PROPOSED ACTION

DATE	MAY 2013
PROJECT NO	60135722
FILENAME	Figure2-2.dgn
SHEET NO	
FIGURE NO	2-2

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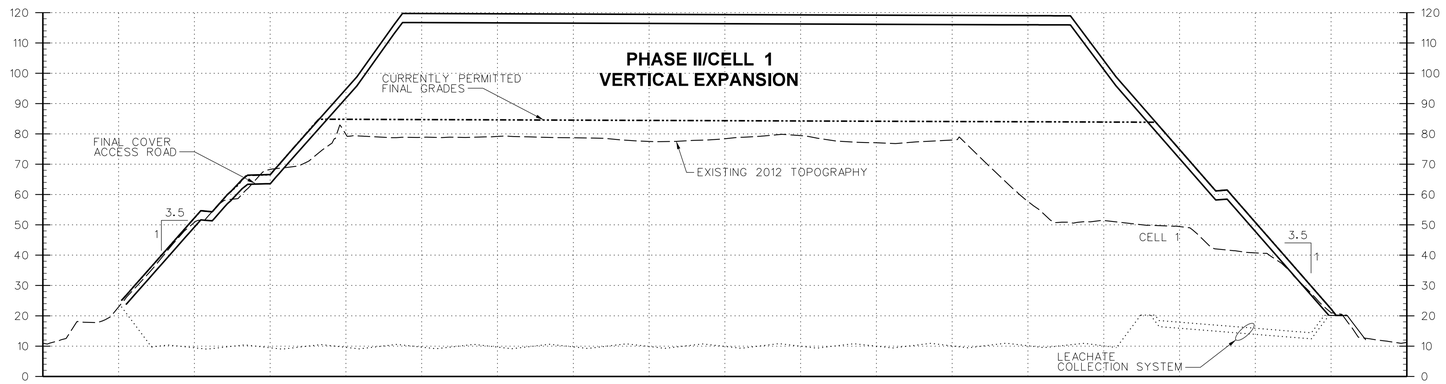
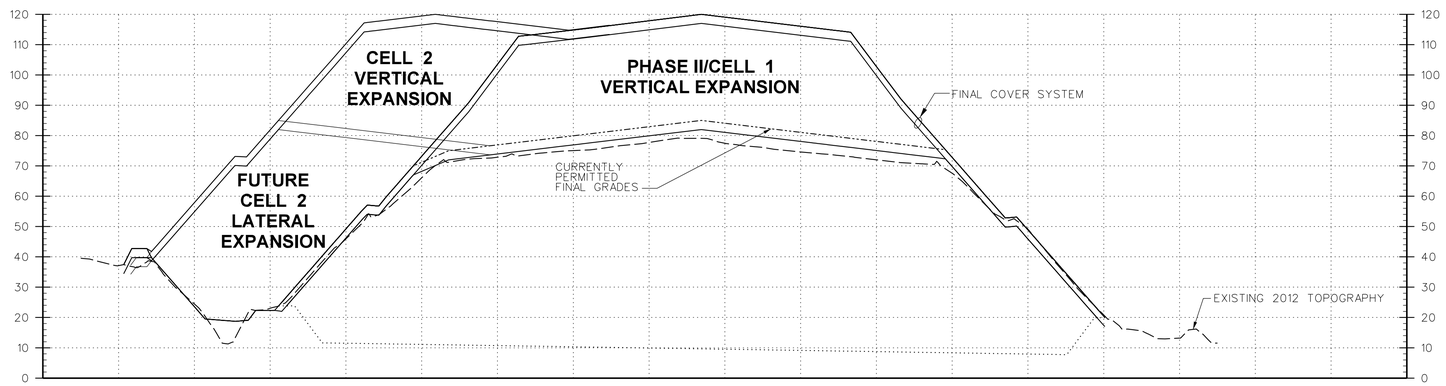


CROSS SECTION A-A



CROSS SECTION B-B

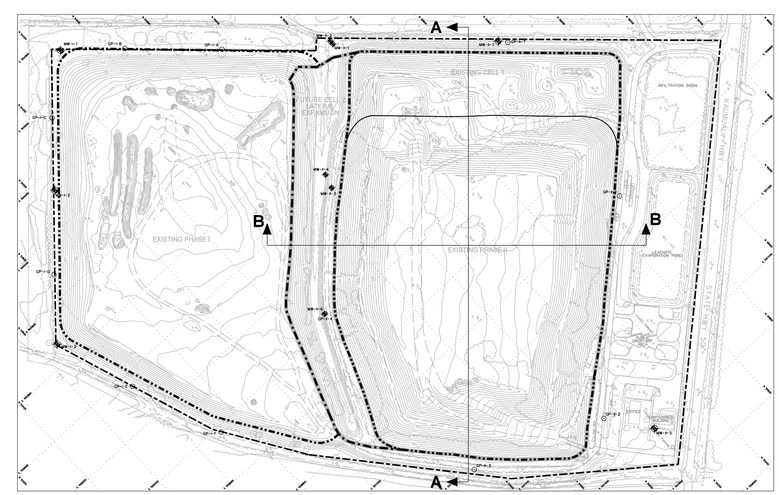
NOTES:

1. TOPOGRAPHIC MAP PREPARED BY AEROMETRIC, INC., SEATTLE, WASHINGTON. DATE OF FLIGHT: APRIL 20, 2012.
2. GRADES SHOWN DEPICT TOP OF FINAL COVER SYSTEM. MAXIMUM FINAL COVER ELEVATION IS 120 FEET.

SCALE
HORIZ. 0' 50' 100' 200'
VERT. 0' 40' 80'

Summary of Recent and Proposed Landfill Expansions

Order	Expansion	Maximum Height (ft msl)	Related Environmental Assessment	Solid Waste Permit Status	Comments
1	Cell 1 Lateral Expansion	85	November, 2007	Currently permitted as part of the Phase II landfill	Currently being used to landfill Kauai's waste
2	Phase II-Cell 1 Vertical Expansion	120	Subject of this Environmental Assessment	After EA is completed (expected early 2014)	Planned for use after current Cell 1 Lateral Expansion is completed
3	Cell 2 Lateral Expansion	85	November, 2007	Future	Expected to be permitted and constructed after the Phase II-Cell 1 Vertical Expansion
4	Cell 2 Vertical Expansion	120	Subject of this Environmental Assessment	Future (after Cell 2 Lateral Expansion)	Will be used after current Cell 2 Lateral Expansion and the the Phase II-Cell 1 Vertical Expansion, if necessary



CROSS SECTION LOCATOR

NO	REVISIONS	DRN	CHK	DATE

Sheboygan, Wisconsin

DRN	DRB
DES	NKW/TCR
CHK	FLC/MRH
APP	KJB

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KEKAHA SANITARY LANDFILL
KAUAI, HAWAII

CROSS SECTIONS A-A AND B-B

DATE	MAY 2013
PROJECT NO	60135722
FILENAME	Figure2-3.dgn
SHEET NO	
FIGURE NO	2-3

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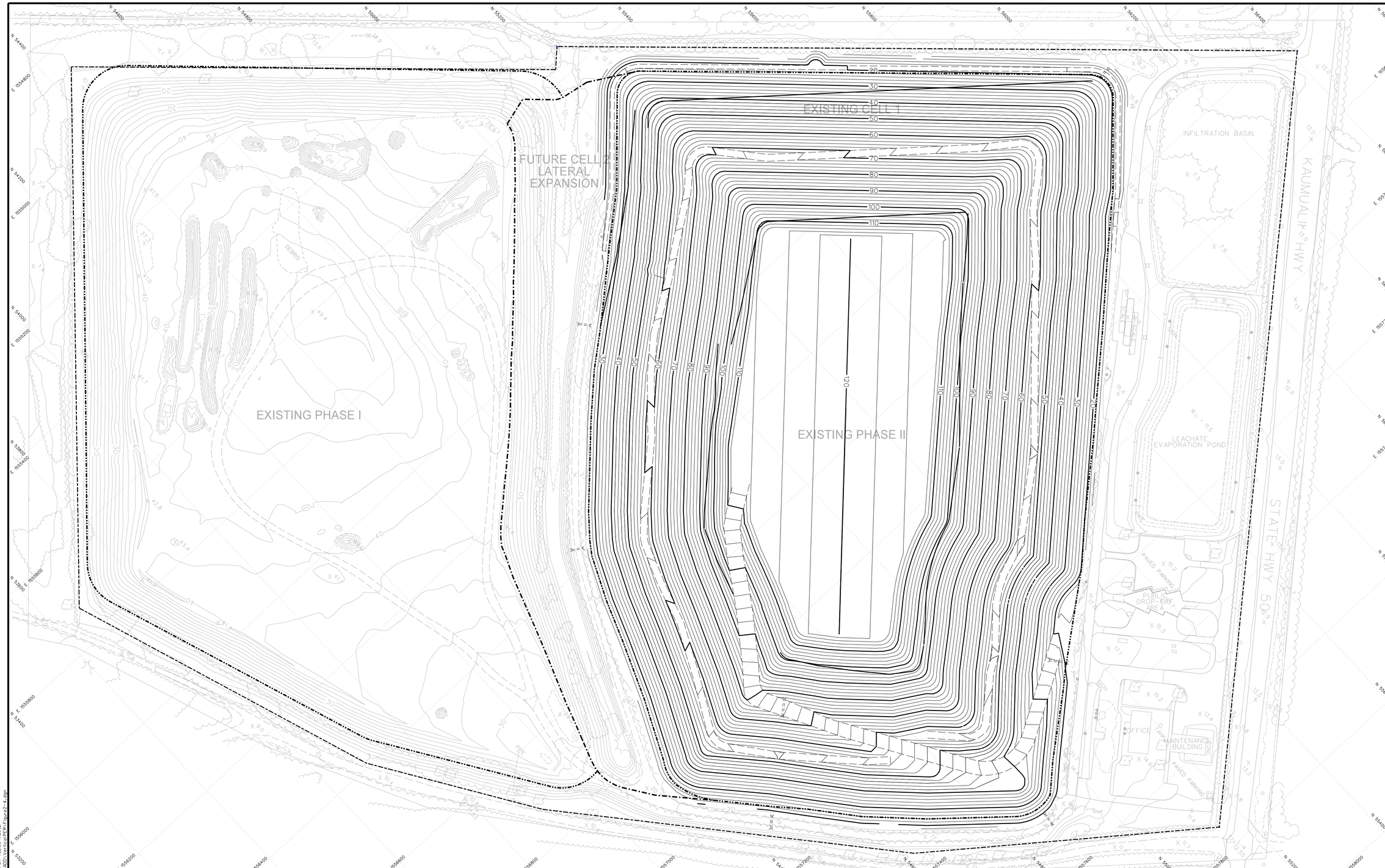

LEGEND

- EXISTING TOPOGRAPHY
- PROPERTY LINE
- EXISTING LIMIT OF WASTE
- PROPOSED LIMIT OF WASTE

NOTES:

1. TOPOGRAPHIC MAP PREPARED BY AEROMETRIC, INC., SEATTLE, WASHINGTON. DATE OF FLIGHT: APRIL 20, 2012.
2. HORIZONTAL DATUM IS BASED ON NAD83 (1986), HAWAII ZONE 4. VERTICAL DATUM IS SITE SPECIFIC AND CORRELATES TO DESIGNATED USGS BRASS MONUMENT G1000 PLUS 1.21 FEET.

NO	REVISIONS	DRN	CHK	DATE

Sheboygan, Wisconsin

DRN	DRB
DES	NKW/TCR
CHK	FLC/MRH
APP	KJB

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KEKAHA SANITARY LANDFILL
KAUAI, HAWAII

PHASE II/CELL 1 FINAL GRADE

DATE	MAY 2013
PROJECT NO	60135722
FILENAME	Figure2-4.dgn
SHEET NO	
FIGURE NO	2-4

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EXISTING CELL 1

PROPOSED CELL 2

EXISTING PHASE I

EXISTING PHASE II

INFILTRATION BASIN

LEACHATE EVAPORATION POND

PUBLIC DROP-OFF AREA

OFFICE

MAINTENANCE BUILDING

KAUMUALII HWY

STATE HWY 50

3%

3%

3%

LEGEND

680	EXISTING TOPOGRAPHY
	PROPERTY LINE
	EXISTING LIMIT OF WASTE
	PROPOSED LIMIT OF WASTE
	SPECIAL MANAGEMENT AREA

NOTES:

1. TOPOGRAPHIC MAP PREPARED BY AEROMETRIC, INC., SEATTLE, WASHINGTON. DATE OF FLIGHT: APRIL 20, 2012.
2. HORIZONTAL DATUM IS BASED ON NAD83 (1986), HAWAII ZONE 4. VERTICAL DATUM IS SITE SPECIFIC AND CORRELATES TO DESIGNATED USGS BRASS MONUMENT G1000 PLUS 1.21 FEET.

SCALE 0' 50' 100' 200'

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NO	REVISIONS	DRN	CHK	DATE

Sheboygan, Wisconsin

DRN	DRB
DES	NKW/TCR
CHK	FLC/MRH
APP	KJB

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KEKAHA SANITARY LANDFILL
KAUAI, HAWAII

CELL 2 FINAL GRADE

DATE	MAY 2013
PROJECT NO	60135722
FILENAME	$FILES$
SHEET NO	
DRAWING NO	2–5

2.3 PROJECT SCHEDULE, COSTS, AND SOURCE OF FUNDING

Because minimal construction (if any) would be required to begin operating the Phase II/Cell 1 vertical expansion, the landfilling of waste could begin shortly after the HRS Chapter 343 environmental review and permitting processes are complete. Construction activities for the vertical expansion into Phase II/Cell 1 could commence in approximately January 2014, and the Phase II/Cell 1 vertical expansion could begin accepting waste in March 2014. Construction activities for the Cell 2 vertical expansion would commence after the Cell 2 lateral expansion is permitted and constructed. The vertical expansion would incur costs for preparation of the plans, the EA, and permits. No property would need to be purchased; no new structures or infrastructure would be required.

Alternatives to the Proposed Action. In addition to the proposed action, the no-action alternative will be analyzed in this EA. Three other alternatives were considered in the design phase but were determined to be not feasible and were eliminated from further consideration. The alternatives considered but not carried forward are presented below in Section 2.3.2.

2.3.1 No-Action Alternative

Under the no-action alternative, Phase II/Cell 1 and Cell 2 would not be vertically expanded, resulting in the closure of the landfill in 2014 when the currently permitted landfill capacity would be reached. The Island of Kaua`i would be left without a permitted facility for the safe disposal of MSW.

2.3.2 Alternatives Considered But Not Carried Forward

Only the alternatives that were technically feasible and satisfied the purpose of and need for action were carried through the EA analysis. Other alternatives considered but not carried forward are summarized in the paragraphs below.

Siting and Constructing a New Landfill Facility. While the County is currently working on the task of siting and writing an EIS for a new landfill facility on Kaua`i, this cannot be accomplished prior to 2014, when the KLF Phase II is projected to reach capacity. Siting a new landfill involves numerous steps and substantial time. An implementation schedule presenting the steps and time required to site, permit, and construct a new landfill is presented in Table 2-3 below. These are estimated durations; actual durations may vary.

Table 2-3: Implementation Schedule to Site, Permit, and Construct a New Landfill

Item	Duration
Complete MSW Landfill Siting Study	(completed August 2012)
Prepare Initial Site Report and EIS	1.5 years
Acquire Land	2 years
Prepare Feasibility Report	1 year
Prepare Operations Plan and Design	1 year
Permit Application to DOH	1 year
Award Construction Contract and Construct MSW Landfill	2 years
Total Time Duration	~7.5 years

With this implementation schedule, the County expects that a new landfill cannot reasonably be sited in less than 8 years. The County is currently in the EIS stage of the process. If there are significant regulatory, technical, or community issues to overcome, siting a new facility could take much longer (e.g. greater than 9 years). Because this alternative could not satisfy the stated need for additional landfill capacity by 2014, it was not carried forward in this analysis. However, the County is still

proceeding with plans to site a new landfill as part of its long-term planning objectives, and the proposed Cell 2 expansion, as well as the proposed vertical expansion, are expected to provide the required time to implement the new landfill.

Excavation of Phase I to Construct a New Subtitle D Base Liner System. This alternative proposes to excavate and remove the MSW from Phase I and construct a new base liner system in the Phase I area. Phase I would be re-designed and permitted as a modern, RCRA Subtitle D MSW landfill and the excavated MSW would be relocated into the newly constructed Subtitle D facility. This alternative would slightly extend the expected lifetime of the Kekaha landfill compared to the proposed action. However, the excavation and relocation of Phase I could have a number of adverse environmental effects such as excessive odor and gas, the potential for landfill fires due to the introduction of oxygen, short-term health and safety concerns, and the potential to release elements that have been contained for over two decades. Additionally, this alternative may be the most costly. Therefore, the benefits from excavating and lining the closed Phase I are not sufficient to offset the environmental risks or monetary costs; therefore this alternative was eliminated from further consideration.

Off-Island Disposal. MSW would be shipped from Kaua`i to off-island landfills. Such a plan would require a transfer station and additional funds to support the transfer costs (inter-island shipping and off-island hauling). Transporting solid waste off-island would proportionally increase the likelihood of accidental releases during transport. This option carries the risk that disposal facilities owned and operated by others could become unavailable, leaving the county without a safe disposal option. The high cost associated with off-island disposal would raise waste disposal facility costs and fees and could result in widespread illegal disposal of MSW throughout rural Kaua`i. For the foregoing reasons, this alternative was eliminated from further consideration.

3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This section describes the affected environment associated with the proposed action and the no-action alternative at the KLF. The information provided serves as a baseline from which to identify and evaluate potential environmental impacts that may result from the implementation of the proposed action or the no-action alternative.

The affected environment describes the natural and man-made environments, which includes air quality, biological resources, cultural resources, geology and soils, hazardous materials and hazardous waste, land use, natural hazards, noise, safety and health, socioeconomics, transportation, utilities and infrastructure, visual resources, and water resources. The region of influence (ROI) is defined for each resource area affected by the proposed action and the no-action alternative. The resource-specific ROI determines the geographical area to be addressed as the affected environment.

3.1 AIR QUALITY

The ROI for air quality is the KLF facility and downwind areas. Downwind areas vary during the year and air quality is affected by the climate. The climate is characterized by two distinct seasons, primarily defined by the annual variation in persistence of the northeast trade winds and by the associated amount of precipitation. The summer months from May to September are typically drier and warmer, while the winter months from October to April are usually wetter and cooler.

Modeling of downwind areas was not completed as part of this assessment. However, typical predominant downwind areas of the ROI would normally include places to the west or southwest. During Kona winds, downwind areas would typically be places to the north or east.

Ambient air quality, which refers to the purity of the general outdoor atmosphere, is regulated under the Clean Air Act and the United States (U.S.) Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS) (40 Code of Federal Regulations [CFR] Part 50). The DOH also regulates air quality and established ambient air quality standards (HAR Title 11, Chapter 59-4) that are as strict as or, in some cases, stricter than the NAAQS. The State of Hawai`i has also established standards for fugitive dust emissions emanating from construction activities (HAR Title 11, Chapter 60.1-33). These standards prohibit any visible release of fugitive dust from construction sources without taking reasonable precautions.

The State of Hawai`i monitors ambient air quality for six regulated pollutants:

- Particulate Matter less than 10 microns
- Particulate Matter less than 2.5 microns
- Carbon Monoxide
- Ozone
- Sulfur Dioxide
- Nitrogen Dioxide

In 2011, all areas in the State of Hawai`i met all federal ambient air quality standards (DOH 2012).

Sources of air pollutants/emissions at the KLF facility include: diesel- and gasoline-powered equipment, motor vehicles and refuse transfer trucks, LFG, and fugitive dust.

Landfill Gas. LFG is generated from the decomposition of organic material and can migrate either laterally in the subsurface or vertically to the atmosphere, depending upon environmental and

physical constraints. LFG consists primarily of CH_4 and CO_2, as well as lesser amounts of non-methane organic compounds.

Odor Control. The odor control program at KLF Phase II consists of identification and special handling of odorous wastes, effective application of daily and intermediate cover, and management of LFG, as described below.

Management of Odorous Wastes. Wastes capable of creating offsite odor problems receive special handling to minimize potential odor problems. Odorous waste include: sewage sludge and grits; dead animals; grease trap pumping waste; and food wastes. Upon receipt at the scalehouse, these wastes are designated as odorous loads and directed to a designated part of the active disposal area. A bulldozer excavates a trench or pit in previously placed solid waste known to contain no odorous special wastes and the odorous load is discharged into the pit. The bulldozer immediately covers the odorous material with solid waste excavated to create the pit, and firmly compacts it. Daily cover soil is placed and compacted above the solid waste.

Daily Cover Soil. The most effective means of preventing odors from general solid waste activities is by application of daily and intermediate cover soil over the MSW. A minimum of 6 inches of soil material or Alternative Daily Cover (ADC) is placed daily on all waste fills. Per the DOH Solid Waste Management Permit, the KLF is approved to use tarps as ADC for a period not to exceed 24 hours. Intermediate cover, consisting of an additional 6 inches of soil material, further controls odors on a long-term basis. Regular inspection and maintenance of cover to eliminate cracks and fissures in cover soil is also conducted as an important element of odor control from solid waste after it is buried.

Landfill Gas Control. Odorous conditions at landfills are often associated with uncontrolled LFG. Construction activities for closure of Phase I included construction of a passive gas extraction system. A LFG collection system was designed for Phase II as part of the Closure Plan to address LFG migration and odor concerns. The LFG collection system consisting of vertical gas extraction wells and horizontal collectors would be constructed as part of the Phase II closure actions. Additionally, permitting of the vertical expansion would trigger additional requirements, including the eventual installation of active LFG collection and management systems across both the Phase I and Phase II landfills.

Fugitive Dust. KLF Phase II personnel are responsible for preventing the emission of excessive dust from the facility. The site's water truck is used during dry weather to spray water on access roads and other areas generating wind-blown dust. The volume of water and frequency of spraying is increased as needed during particularly dry and windy conditions.

3.2 BIOLOGICAL RESOURCES

The ROI for biological resources, including flora and fauna, is the KLF facility. A faunal survey of the KLF in 1982, prior to construction of the Phase II landfill, did not record the presence of any endangered bird species. A survey of the KLF prior to Phase II construction found only exotic (introduced) flora species. No uncommon or rare native plants were found. The irrigation ditches that were used by Kekaha Sugar Company provided a marginal wetland habitat in the project vicinity (Belt Collins 1998). Since these biological surveys were completed, the site has been further disturbed by earthmoving activities required for construction of Phase II and associated support facilities. The habitat quality of the KLF facility for native fauna is marginal at best, and no rare or protected species are believed to use the site with any frequency. There is a potential for protected seabirds, including the Newell's shearwater and Hawaiian petrel, to fly over the project area, particularly during an annual migration of fledglings from mid-September through mid-December; however, no impacts due to the proposed vertical expansion are anticipated.

3.3 CULTURAL RESOURCES

The ROI for cultural resources is the KLF facility. This resource encompasses prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. For the purpose of this EA, archaeological/cultural resources are defined to include prehistoric and historic archaeological sites, historic buildings and structures, and traditional (i.e., native Hawaiian) sites.

Kaua`i's west coast and the Mana Plain have been surveyed by archaeologists over the last 60 years. Before sugarcane was cultivated, much of the Mana Plain was a marsh bounded by cliffs on the east and sand dunes on the west. Permanent habitation areas in the Kekaha area were mainly among the mauka foothills, at the bases of the shore-facing cliffs. Extending up the gulches were agricultural areas watered by rainfall and intermittent streams. Makai of the foothills were fishponds and cultivated wetlands fed by springs. Beyond this was the great swamp, then the broad stretch of sand which continued to the shoreline. Fishing camps and other temporary habitation areas existed on the beach and there were burials in the inland stretches of the sand.

This scenario was likely in place at the time of first western contact and remained relatively undisturbed throughout most of the 1800's. Since then, physical evidence of this settlement pattern in the project vicinity has been obliterated by commercial agriculture and other operations. The foothills and wetland areas have been extensively planted in cane, livestock has been run up the gulches, and even the beach areas have been heavily disturbed by massive shoreline stabilization projects (refer to Appendix B for a detailed historical and cultural overview of land settlement and use in Kekaha, Kaua`i).

An archaeological inventory survey of the entire 63.2-acre Phase II site was conducted by Cultural Survey Hawai`i, Inc. in May 1993, with the Department of Land and Natural Resources (DLNR) oversight (Appendix B). The archaeological inventory survey included extensive subsurface test excavations by backhoe. The survey report determined that the former natural landform was likely one of linear sand dunes oriented southeast to northwest, created by the northeast tradewind flow as it circles around the east and south sides of Kaua`i. Geomorphic and stratigraphic observations, reinforced by local verbal accounts, suggest that these dunes were in large part obliterated by mechanical means to create level graded land for plantation agriculture and pasturage of plantation animals.

A historic canal cutting the parcel in two from north to south, and a linear mound oriented perpendicular to the canal, were both constructed by mechanically mounding up sand deposits derived from the surrounding area. These features are the remains of an attempt in the 1950s to farm portions of this land. Neither feature is a historic site nor were historic cultural resources evident in subsurface deposits. Based on results of the inventory survey and subsurface testing, no further archaeological study of Phase II was recommended. The State Historic Preservation Division (SHPD) was contacted on May 10, 2013 and a concurrence that no historic properties will be affected is expected (Appendix A). Consultation is currently in process.

3.4 GEOLOGY AND SOILS

Geology. The KLF is located within the Mana coastal plain and is approximately 1,700 ft from the Pacific Ocean. The Mana coastal plain is arch-shaped and is approximately 15 miles long and 2 miles wide. The coastal plain consists primarily of older alluvium and contemporary coralline and marl sedimentary rocks of marine, littoral, and terrestrial origin. These sedimentary rocks were deposited in lagoon and estuarine environments and in a flanking terrestrial environment. The thickness of the coastal plain sedimentary deposits ranges from zero on the inland edge to more than 400 ft along the seaward edge of the plain. The surface deposits (to a depth of 50 ft) consist predominantly of loose sand, coral fragments, and shell debris. The thickness of sedimentary deposits underneath the KLF is estimated to be over 400 ft. The coastal plain sediments are

underlain by basalt; the top of the basalt is a drowned, wave-cut bench sloping gently seaward (Earth Tech 2007a).

Soils. Soils of the Mana Plain are classified by the U.S. Department of Agriculture Soil Conservation Service as Jaucus loamy fine sand that forms a well-drained calcareous soil. This soil is too permeable to allow for surface water ponding or runoff; as a result, the potential for vertical migration of water is great, but erosion by surface water runoff is unlikely. Wind erosion is a severe hazard in the absence of vegetation (Earth Tech and Wil Chee 2004).

Pacific Geotechnical Engineers, Inc. (PGE) has completed three geotechnical investigations of KLF in November 2006, December 2006, and August 2012. Over the course of the investigations PGE completed a total of 16 soil borings, 15 test pits, and 4 field percolation tests, and related geotechnical laboratory analysis of soil samples. The predominant onsite foundation soils are poorly graded sands. Results of the percolation tests determined percolation rates of 2 to 6 minutes per inch (Earth Tech 2007b, PGE 2012).

3.5 HAZARDOUS MATERIALS AND HAZARDOUS WASTE

The ROI for hazardous materials and hazardous wastes is the KLF facility. For the purpose of the following analysis, the term hazardous materials or hazardous waste will mean those hazardous materials and wastes as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code (U.S.C.) Sections (§§)9601 et seq., and RCRA, 42 U.S.C. §6901–6992. In general, these include substances that, because of their quantity, concentration, or physical, chemical, or toxic characteristics, may present an unreasonable risk to health, safety, and the environment when released.

The KLF does not accept materials designated as hazardous under 40 CFR Part 261, polychlorinated biphenyl wastes as defined in 40 CFR Part 761, radioactive materials, insecticides and poisons, untreated infectious waste or improperly packaged asbestos waste. Operating procedures currently in-place to prevent the disposal of unacceptable wastes are outlined in the *Operating Plan, Kekaha Landfill Phase II* (AECOM 2010). Unacceptable Waste Exclusion Program procedures include: customer notification, scale house monitoring and inspection, random inspections, and landfill working face inspections. If hazardous or unacceptable wastes are discovered during inspections or through visual observation during unloading, KLF personnel will reject such wastes, require the prohibited wastes to be reloaded onto the transporting vehicle, and complete a load rejection form. The transporter is responsible for returning the rejected waste to the generator for proper disposal.

The KLF stores and uses petroleum products such as diesel fuel, lubricating oils, and waste oil. The KLF has a low potential for spills of hazardous materials, but incidents are possible in the event of vehicle accidents or malfunctions that could cause spills of coolant, fuel, or lubricants. The KLF maintains a Spill Prevention, Control, and Countermeasures (SPCC) Plan, as required by 40 CFR Part 112, to prevent and manage spills should they occur (AECOM 2012).

A 2,000-gallon diesel above ground storage tank ("Tank Number [No.] 1") is located in the maintenance/equipment fueling area. The tank is double-walled and encased within a reinforced concrete secondary containment structure that can contain 100 percent of the tank's rated capacity. In addition to this concrete structure, there is a tertiary containment system that consists of a low concrete wall built around the perimeter of the tank; this containment system is capable of holding 1,480 gallons. The entire fueling area is protected from accidental traffic collisions by high visibility yellow traffic bollards, spaced at approximately 6-ft intervals.

A mobile refueler/service tank truck is used for daily fueling and servicing of equipment, and is equipped with two tanks: Mobile 1 (300 gallons diesel), and Mobile 2 (182 gallons AW68 hydraulic oil). When not in use, the mobile refueler/service truck will be parked adjacent to the maintenance shop in the bermed wash rack area, or within the limits of the lined landfill.

Fifty-five gallon drums of lubricants, greases, used oil, and coolant are stored in the maintenance building on spill control pallets capable of holding 110 percent of the contents of the 55-gallon drums. The maintenance building has an impervious concrete floor. The KLF maintains spill kits, sorbent materials, and drain blockers for the drums located within the maintenance facility, and for fueling vehicles that enter and exit the site.

Daily visual inspections consist of a complete walk-through of the facility property to check for valve, appurtenances, and tank damage or leakage, including liquids within the secondary containment structures. Tanks are also inspected for corrosion or deterioration of secondary containment system foundations. Written inspection procedures and monthly inspections are signed by the inspector and maintained at the facility for three years.

There are no outstanding compliance issues related to hazardous materials or hazardous waste within the project area. According to facility personnel, no major spill events have occurred in the past five years (AECOM 2012). In addition, there are no identified CERCLA or RCRA sites within or immediately adjacent to the project area.

3.6 LAND USE AND OWNERSHIP

The land use and ownership ROI is the KLF facility and adjacent properties. The KLF facility is located on land owned by the State of Hawai`i and administered by the DLNR (Figure 3-1). Phase I, identified by TMK 1-2-002:009, has a state land use designation of Conservation District (Figure 3-2). Phase I is designated a Special Planning Area on the county zoning maps and is also within a County of Kaua`i Special Management Area (Figure 3-2). Phase II, identified by TMK 1-2-002:001, has a state and county land use designation of Agricultural District. Executive Order 1558 (signed April 27, 1953) and Executive Order 2872 (signed October 6, 1977) set aside Phase I and Phase II for landfill purposes, to be under the control and management of the County of Kaua`i. Cell 2 is located on the special management area (SMA) and Conservation District Use Application (CDUA) boundaries. SMA and CDUA permits were previously obtained for the Cell 2 Lateral Expansion and will be obtained or revised for the implementation of the Cell 2 vertical expansion.

Phase II of the KLF was approved for use by the State Land Use Commission through the issuance of a Special Permit on May 28, 1993. This Special Permit allows for land classified as a State Agricultural District to be used for landfill purposes. The Special Permit requires that use of the land follow specific conditions as provided by the County of Kaua`i Planning Department, County Planning Commission, and the approving agency, which is the State Land Use Commission. No time limit was set for this Special Permit, and the proposed action complies with the conditions set forth.

3.7 NATURAL HAZARDS

Natural hazards that may occur in and affect the proposed project area include floods, tsunamis, hurricanes, earthquakes, and other natural events. The ROI for natural hazards is the KLF facility.

Floods. The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) flood zone designations are:

- A – Areas of 100-year flood, base flood elevations not determined
- AE – Areas of 100-year flood, base flood elevation determined
- XS – Areas of 500 year flood; areas of 100-year flood with average depths of less than one foot or within the drainage area less than one square mile, and areas protected by levees from 100-year flood
- X – Areas determined to be outside the 500-year flood plain

- D – Areas in which flood hazard is undetermined
- VE – Areas of 100-year coastal flood with velocity (wave action), base flood elevations determined

Per FIRM Maps 1500020232E and 1500020251E, the KLF facility is within a FIRM Zone X, an area determined to be outside the 100-year and the 500-year flood plain. To date, the KLF facility has not sustained any flood-related damage.

Tsunamis. Tsunamis are a series of destructive ocean waves generated by seismic activity that could potentially affect shorelines. Tsunamis affecting Hawai`i are typically generated in the waters off South America, the U.S., Alaska, and Japan. Local tsunamis have also been generated by seismic activity on the Island of Hawai`i. The Oahu Civil Defense Agency establishes tsunami evacuation zones and maps for all coastal areas in Hawai`i. Tsunami maps for the inland areas of Kaua`i indicate that the KLF facility is within the tsunami evacuation zone. However, the KLF facility is not mapped within the tsunami inundation zone (HLA 1994) as defined in the State of Hawaii landfill regulations [HAR § 11-58.1-13(g)(1)].

A search of the National Oceanographic and Atmospheric Administration's tsunami run-up database returned tsunami run-up data for two events in the vicinity of Kekaha. Run-up heights of 2.1 and 3.0 meters (6.9 and 9.8 ft) in Kekaha were recorded for tsunamis on March 9, 1957 and May 22, 1960, respectively (NOAA 2013). The run-up height represents the maximum elevation the wave reaches at the maximum inundation. These run-up heights would not affect the proposed vertical expansions. To date, the KLF facility has not sustained any tsunami-related damage.

Hurricanes. The Hawaiian Islands are seasonally affected by Pacific hurricanes from June to November. These storms generally travel toward the islands from a southerly or southeasterly direction and can deposit large amounts of rain with high winds on the Hawaiian Islands. The storms generally contribute to localized flooding and coastal storm surges. To date, the KLF facility has not sustained any significant damage from hurricanes.

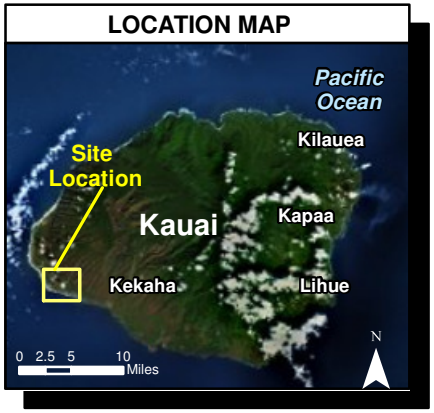
Earthquakes. Because Kaua`i is an older Hawaiian Island with dormant volcanic activity, it is not particularly prone to seismic activity. The KLF is not located in a seismic impact zone as defined under HAR § 11-58.1-13(e) (DOH 1994) and the Subtitle D regulations for MSW landfills (40 CFR Part 258.14) (Earth Tech 2007b). To date, the KLF facility has not sustained any earthquake-related damage.

3.8 NOISE

The ROI for noise effects is the KLF facility and adjacent areas. Noise is defined as any sound that may produce adverse physiological and psychological effects or interfere with individual or group activities, including but not limited to communication, work, rest, recreation or sleep (HAR Title 11, Chapter 46). Under certain conditions, noise can interfere with human activities at home or work and affect human health and well-being. The accepted unit of measure for noise levels is the decibel because it reflects the way humans perceive changes in sound amplitude. Sound levels are easily measured, but human response and perception of the wide variability in sound amplitudes is subjective.

Different sounds have different frequency content. When describing sound and its effect on a human population, A-weighted (dBA) sound levels are typically used to account for the response of the human ear. The term "A-weighted" refers to a filtering of the noise signal to emphasize frequencies in the middle of the audible spectrum and to de-emphasize low and high frequencies in a manner corresponding to the way the human ear perceives sound. This filtering network has been established by the American National Standards Institute. The A-weighted noise level has been found to correlate well with a person's judgment of the noisiness of different sounds and has been used for many years as a measure of community noise.

The State of Hawai`i regulates noise exposure in the following statutes and rules: HRS Chapter 342F - *Noise Pollution*, HAR Title 11, Chapter 42 - *Vehicular Noise Control for Oahu*, HAR Title 11, Chapter 46 - *Community Noise Control*, and HAR §12-200.1 *Occupational Noise Exposure.* Maximum permissible sound levels for Class C zoning districts including lands zoned agricultural and industrial is 70 dBA 24-hours a day (HAR Title 11, Chapter 46-4). KLF ambient noise is generated by garbage trucks and equipment used to operate Phase II. Around the perimeter of Phase II, operational noises are no more noticeable than the natural wind sounds and traffic on Kaumuali`i Highway. The nearest noise receptor is a residential population located 1.3 miles away in the community of Kekaha.



LEGEND

- Roads
- A State of Hawaii (DNLR)
- B State of Hawaii (DNLR)
- C State of Hawaii (DNLR)
- D State of Hawaii (DNLR)
- E State of Hawaii (DNLR)
- F U.S. of America
- G U.S. of America

NOTES

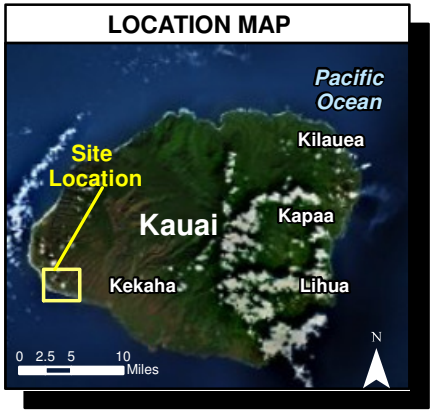
1. Map projection is Hawaii State Plane, Zone 4, NAD83.
2. Base map: ArcGIS Bring Map Aerial

N

0 1,000 2,000 4,000 Feet

Figure 3-1
Land Ownership and User
Kekaha Vertical Expansion
Kauai, Hawaii

P:\ENV\Non-Federal\County of Kauai\60135722 KAUAI-Kekaha Cell 1\07 Deliverables\GIS\02_MXD\Figure 3-1 - Landonwers and Users.mxd



LEGEND

- Kekaha Cells
- Conservation District
- Special Management Area
- Roads

NOTES

1. Map projection is Hawaii State Plane, Zone 4, NAD83.
2. Base map: ArcGIS Bring Map Aerial

N

0 500 1,000 2,000 Feet

Figure 3-2
State Land Use Districts
Kekaha Vertical Expansion
Kauai, Hawaii

P:\ENV\Non-Federal\County of Kauai\60135722 KAUAI-Kekaha Cell 1\07 Deliverables\GIS\02_MXD\Figure 3-2 - State Land Use Districts.mxd

3.9 SAFETY AND HEALTH

The ROI for safety and health is the KLF facility. Specific safety and health concerns related to landfill operation include heavy equipment operation, vector control, explosive gas, and landfill fires. Current operating procedures in-place to control risks related to these safety and health concerns are discussed below.

Heavy Equipment Operation. Heavy equipment presently used at the KLF to handle waste and transport/apply cover soil includes the following: compactor, bulldozer, excavator, dump truck, grader, water truck, roll-off truck, and auxiliary equipment. Access to the KLF is controlled by a perimeter fence and a gated entrance. Visitors to the KLF proceed directly to the scale house, from which they are directed to the appropriate disposal area where waste is unloaded under the supervision of KLF personnel.

WMH provides training and strict enforcement of a comprehensive program to ensure the safety of customers and employees. Access routes are clearly marked, and an onsite speed limit of 20 miles per hour is enforced. Customers are directed by spotters to specific locations for unloading, with traffic managed to avoid accidents. Employees are equipped with personal protective equipment including reflective vests and hard hats. Safety devices on equipment include seat belts, roll-over protective cabs, and audible reverse warning devices.

Vector Control. Vectors are organisms such as insects, rodents, or birds that can carry disease-causing microorganisms from infected individuals to other persons or from infected animals to human beings. The goal of vector control is to prevent the spread or overpopulation of areas with organisms which are able to transmit infectious agents of disease. KLF personnel are trained to observe and identify the first signs of vectors. The current practices of compaction and daily cover of wastes are effective in controlling vectors and normally prevent vectors from actively using the landfill.

Explosive Gas. CH_4 gas is produced by the anaerobic decomposition of organic components of solid waste. The KLF implements a Site-Specific Gas Monitoring Plan to ensure that methane gas does not cause safety or environmental problems (AECOM 2010). Specifically, the program must demonstrate compliance with the requirements of HAR 11-58.1-18(d) (DOH 1994) that concentrations of CH_4 do not exceed 25 percent of the lower explosive limit in facility structures, or 100 percent of the lower explosive limit at the property boundary. The lower explosive limit for CH_4 is 5 percent by volume (50,000 parts per million [ppm]).

CH_4 monitors are installed in the landfill office building and in the maintenance building to measure explosive gas levels continuously and provide an alarm if levels reach 10,000 ppm (20 percent of the lower explosive limit). This program ensures that explosive gas levels in buildings are below the 25 percent limits set forth in HAR 11-58.1-18(d) (DOH 1994). Monitoring is conducted on a monthly basis to ensure compliance with HAR 11-58.1-18(d)(1)(B) (DOH 1994), which specifies that the concentration of CH_4 gas at the property boundary shall not exceed the lower explosive limit. Monitoring is conducted using six permanent gas probes installed at 1,000-ft intervals around the KLF Phase II perimeter.

The proposed vertical expansion will eventually result in the installation of active landfill gas collection and management systems across both the Phase I and Phase II landfills, resulting in further safety improvements.

Landfill Fires. The rapid decomposition of waste generates heat, which may ignite subsurface fires in the presence of O_2 gas. Landfill fires are prevented by employing good sanitary landfill practices that include compaction of wastes and daily cover. Compacting and covering waste daily minimizes air space and limits the supply of O_2 needed for the combustion of landfill gasses and the growth of underground fires.

Surface fires may also result if “hot” loads are disposed of at the landfill. Personnel at the scale house and unloading areas are trained and directed to notice any smoldering or burning material in incoming waste, and prevent it from contacting other combustible material or being buried in the disposal area before all combustion is extinguished.

Fire extinguishers are provided in all buildings and vehicles at the site for use in extinguishing small fires, and equipment or water is used to put out larger fires. The KLF maintains, on a 24-hour basis, a 4,000-gallon capacity water truck, a bulldozer, a Caterpillar 950F loader, and an excavator for use in firefighting.

The following actions are taken if a fire occurs in a refuse fill area prior to application of interim cover or near the surface:

- Burning refuse is excavated and separated from the fill area and covered immediately with onsite soil.
- If necessary, water is applied to the burning refuse using the onsite water truck.
- The local Fire Department is summoned if site personnel and equipment cannot extinguish the fire.

3.10 SOCIOECONOMICS

This section summarizes the demographic and income characteristics of residents in the vicinity of the project area. Data summarized in Table 3-1 are taken from the 2010 U.S. Census and the 2007-2011 American Community Survey 5-Year Estimates. Census data are used to describe the existing social and economic characteristics of the ROI and to determine whether any minority or low-income population may experience disproportionately high adverse impact from the proposed action or alternatives. The ROI for socioeconomics is Kekaha Census County Division (CCD), the County of Kaua`i, Hawai`i, in which the project area is located. Data for the County of Kaua`i is presented for the purpose of comparison.

As shown in Table 3-1, in 2010, the County of Kaua`i reported 67,091 residents and the Kekaha-Waimea CCD reported 5,561 residents. The population within the Kekaha-Waimea CCD is 31.6 percent Asian, 14.2 percent Native Hawaiian and Pacific Islander, 0.7 percent African American, 0.4 percent American Indian or Alaska Native, and 19.8 percent White, compared to 31.3 percent Asian, 9 percent Native Hawaiian and Pacific Islander, 0.4 percent African American, 0.2 percent American Indian and Alaska Native, and 33 percent White within the general population of the Island of Kaua`i.

Median family income ($54,271) and per capita income ($24,363) within the Kekaha-Waimea CCD are slightly lower than the County of Kaua`i. The percent of families below poverty (14.1 percent) within the Kekaha-Waimea CCD is twice as much as for the County of Kaua`i, while the percentage of individuals below the poverty level (8.7 percent) is below the rate for the County of Kaua`i.

Table 3-1: Demographic and Income Characteristics

	County of Kaua`i		Kekaha-Waimea CCD	
Characteristic	**No.**	**Percent**	**No.**	**Percent**
Population	67,091		5,561	
Ethnicity				
Asian	21,016	31.3	1,757	31.6
Native Hawaiian and Pacific Islander	6,060	9	787	14.2
African American	278	0.4	39	0.7
American Indian and Alaska Native	254	0.4	21	0.4

	County of Kaua`i		Kekaha-Waimea CCD	
Characteristic	**No.**	**Percent**	**No.**	**Percent**
White	22,159	33	1,101	19.8
Other Ethnicity	608	0.9	41	0.7
More than one Ethnic Group	16,716	24.9	1.815	32.6
Income				
Median Family Income	$64,422		$54,271 [a,b]	
Per capita income	$26,591		$24,363 [a,b]	
Poverty Status in 2009 [a]				
Families below poverty level	NA	8.8	NA	14.1 [b]
Individuals below poverty level	NA	12.3	NA	8.7 [b]

Source: U.S. Census Bureau, 2010 Census of Population and Housing (U.S. Census Bureau 2010).
NA not applicable
no. number
[a] U.S. Census Bureau, 2007-2011 American Community Survey 5-Year Estimates (U. S. Census Bureau 2011)
[b] Kekaha Census Designated Place

3.11 TRANSPORTATION

The ROI for transportation is the KLF facility and adjacent roadways. The average annual daily traffic data obtained for the State Department of Transportation indicate that approximately 3,300 vehicles per day use Kaumuali`i Highway in the vicinity of the KLF (DOT 2013). The KLF on average accepts approximately 27 commercial loads and 80 non-commercial loads per day, which includes loads consisting of both recyclable and non-recyclable material (Tanigawa 2013). Therefore, on average, landfill related traffic accounts for approximately 3 percent of the traffic volume on Kaumuali`i Highway in the vicinity of the KLF. Traffic volumes at the landfill are generally highest on Saturdays when the facility is open to receive beverage containers under the HI-5 program.

3.12 UTILITIES AND INFRASTRUCTURE

This section includes information on infrastructure related to electrical power, telecommunications, potable water and wastewater systems, and solid waste disposal. The ROI for utilities and infrastructure is the KLF facility.

Potable water supplied to the office, scale house, and maintenance shop is obtained from the County water system serving the town of Kekaha, and then piped into the facility via a Navy-owned water main that serves federal reserve lands. In accordance with the "Three Party Service Agreement" executed in 1994 between the DPW, Pacific Missile Range Facility (PMRF), and the County of Kaua`i, Department of Water, water use from the existing landfill water meter is limited to 31,000 gallons per month.

Non-potable water for dust control and fire protection is obtained from a former Kekaha Sugar Company irrigation ditch, and transported to the site using a 4,000-gallon capacity water truck. The County has plans (under a separate project) to restore the defunct pump station at the former Kekaha Sugar Company irrigation ditch to filter and chlorinate water, and pump it to the site. Wastewater from the office and maintenance shop is handled by an onsite septic system. Other wastewater, such as wash down water from the maintenance shop, is treated via an oil/water separator system. Electricity for onsite use is supplied by Kaua`i Electric. A 105 kilowatt diesel-powered emergency standby generator automatically operates when normal power is interrupted. Solid waste generated onsite is either recycled or deposited in the active cell of the Phase II landfill.

3.13 VISUAL RESOURCES

Visual resources are the aggregate of characteristic features imparting visually aesthetic qualities to a natural, rural, or urban environment. The ROI for visual resources includes the view planes toward the KLF in both directions of travel along Kaumuali`i Highway as well as mauka-makai view planes that intersect the KLF facility. This resource is assessed to determine whether the proposed action and no-action alternative would be compatible with the existing landscape and development plans for the area.

County land use policies relevant to visual resources are contained in Sections 3.2 and 5.5 of the Kaua`i General Plan. Section 3.2 of the Kaua`i General Plan outlines County policies for the protection of scenic views. Section 3.2.1 directs the County to preserve scenic resources and public views in developing public facilities and in administering land use regulations. Specifically, the County is directed to: 1) preserve public views that exhibit a high degree of intactness or vividness, 2) preserve the scenic qualities of mountains, hills, and other elevated landforms, and 3) preserve the scenic qualities of lowland/open space features such as the shoreline.

Although Section 5.5 of the Kaua`i General Plan designates Kaumuali`i Highway in the vicinity of the KLF as a scenic roadway corridor, the road corridor along the KLF boundaries meets none of the requirements set forth in Section 3.2.1 of the Kaua`i General Plan. The KLF is located between the coastal dunes and Kaumuali`i Highway on the undeveloped Mana Plain and does not exhibit a high degree of intactness and vividness and does not block any scenic landforms; scenic view planes; or shoreline views. It is mainly undulated sand dunes and agriculture lands with sparse vegetation.

The closed Phase I is covered with grassy vegetation and has a peak elevation varying from 37 to 51 ft above msl. There are stockpiles of yard waste on top of Phase I. Phase II, with a currently permitted height of 85 ft above msl, obscures the line-of-sight to the lower elevation Phase I, such that Phase I is not visible from Kaumuali`i Highway. Phase II is only partially visible from the south and east due to treelines located along Kaumuali`i Highway and the access road adjacent to the southeastern boundary of the KLF facility that create a vegetative visual buffer. The Phase II landfill has the appearance of a flat earthen mound when viewed from the northwest. The active Phase II is covered daily with landfill cover and is partially vegetated. The earth-tone daily landfill color is consistent in color with the surrounding agricultural areas. The line-of-sight to the KLF from the shoreline is obstructed by coastal dunes and an earthen berm associated with the National Guard Rifle Range, and the KLF is not visible from the shoreline. Views of the KLF from Kaumuali`i Highway and from the shoreline are presented in Appendix C.

3.14 WATER RESOURCES

This section describes the availability and quality of water resources, including surface water and groundwater. Surface water includes lakes, perennial/intermittent streams, and drainage ways. Groundwater includes water present in aquifers (perched, unconfined, confined, or artesian). The ROI for water resources includes the surface water bodies and drainage features identified within, or downgradient of, the KLF facility and the underlying aquifer.

Surface Water. Runoff from the top of the closed Phase I flows radially off the landfill and is collected at a series of inlet pipe slope drains located around the perimeter of the landfill. These slope drains discharge to an infiltration ditch that surrounds the entire closed Phase I.

Phase II contains the active landfill area and the site facilities, which include a scale house, waste drop-off bins, maintenance shop, and offices. The active tipping face is segregated from the remainder of the area by an earthen berm. Drainage from the tipping face is collected in the leachate collection system.

Storm water runoff from the rest of Phase II flows radially off the landfill where it is currently directed by perimeter berms to storm water “letdowns” (locations where drainage channels have been lined with plastic to convey runoff from the steep side slopes of the landfill without causing erosion to the cover). Runoff from the letdowns and overland flow off the Phase II side slopes discharges into infiltration ditches or channels located on each side of Phase II. From these areas, runoff infiltrates, evaporates, or flows overland to a stormwater infiltration ditch located in the northwestern corner of the site, where it infiltrates or evaporates. The facility does not discharge water to offsite areas.

Runoff from paved parking areas is collected and discharged to an infiltration ditch along the landfill access road, where it is conveyed to the infiltration basin. Storm water runoff from the material drop off facility is conveyed to the leachate evaporation lagoon for onsite treatment.

Groundwater. Two aquifers with distinct hydrogeologic properties underlie the Kekaha-Mana coastal plain: a coastal plain aquifer within the near-surface sedimentary (caprock) deposits and a deep aquifer within the underlying fractured basalt. The basaltic aquifer occurs within lava flows of the Nāpali Formation. This aquifer typically yields large quantities of water from wells and shafts with relatively little drawdown, reflecting generally high hydraulic conductivity, estimated by the U.S. Geological Survey (USGS) as approximately 400 ft per day (ft/day). Saturated sediments of the caprock formation (the caprock aquifer) overlie the basaltic aquifer and retard the seaward discharge of groundwater from the deeper aquifer. According to the USGS, the regional average hydraulic conductivity of the coastal plain aquifer is relatively low, approximately 0.12 ft/day (Burt 1979).

The water table level in the site area is artificially controlled by pumping stations in the area operated and maintained by the State of Hawaii Agribusiness Development Corporation and the Kekaha Agricultural Association, in coordination with the U.S. Navy. The primary pumping station in the Kekaha area (Kawaiele) is a drainage pumping station comprised of three pumps that can achieve a flow of 50 mgd. If the groundwater management system pumps were shut down, lower elevations on the Mana Plain would reportedly be flooded due to a rise in the groundwater level (Sanifill and Baquerizo 1996).

Shallow groundwater underlying the KLF occurs within the surficial sedimentary deposits of the coastal plain aquifer; the water table ranges in depth from approximately 4 ft to 7 ft msl. The historical water level monitoring data indicate that groundwater typically flows toward the ocean in a west-southwest direction, with a hydraulic gradient of approximately 0.0005 ft per ft. However, the historical monitoring data indicate that the direction of groundwater flow at the site can periodically shift more than 90 degrees toward the north and more than 60 degrees toward the south relative to the typical west-southwest flow direction, and the gradient sometimes becomes essentially flat.

Several factors may contribute to periodic shifts in the groundwater flow direction at the landfill. The direction of the local hydraulic gradient may be affected by variations in pumping rates for the groundwater management system wells and other production wells near the site. These nearby wells are used to supply water for irrigation and other non-potable purposes and to draw down the groundwater table to prevent saturation of surface soil by the brackish groundwater, thus allowing cultivation of sugarcane and other crops on the Mana Plain. Infiltration from leaks in the aquaculture (shrimp farm) ponds located immediately northwest of the Phase II Landfill site may also contribute to periodic fluctuations in the hydraulic gradient. Similarly, the landfill’s storm- and surface-water control systems, particularly the infiltration basin, may affect localized groundwater flow patterns, especially after rain events. As discussed below, tidal study results suggest that tidal effects do not significantly influence the prevailing groundwater flow direction; however, short-term tidal effects may also contribute to the flow direction and gradient variations indicated by the historical monitoring data.

The vertical component of groundwater flow at the site is negligible; therefore, the groundwater flows horizontally beneath the facility, ultimately discharging to the ocean southwest of the site. The KLF monitoring wells therefore target the upper interval of the coastal plain aquifer.

Groundwater quality underneath the KLF is brackish and, therefore, not suitable for current or future use as irrigation water or as a potable water supply. The nearest potable well is approximately 3,400 ft northwest and side- or up-gradient of the site.

Phase II Groundwater Monitoring. Groundwater monitoring at the KLF Phase II site has been performed on a semi-annual basis since 1994. Currently, four point-of-compliance (POC) wells, including monitoring wells MWII-2, MWII-4, MWII-6, and MWII-7 are utilized for detection monitoring of Phase II. These wells are situated hydraulically in cross- or down-gradient areas that intercept potential primary migration pathways, as controlled by the hydrogeologic setting. Their purpose as POC wells is to provide the earliest possible detection, should a release occur from the facility. MWII-5, located hydraulically upgradient of the Kekaha Landfill, is used to monitor potential upgradient sources of groundwater contamination. The field and laboratory results from each monitoring period are submitted to the DOH in semi-annual monitoring reports.

Major findings and conclusions based on the results of the recent February 2013 KLF Phase II groundwater sampling event are summarized below:

- The data collected for this monitoring event suggested no significant impact to groundwater due to operations at the KLF Phase II.
- The February 24, 2013 water level data indicated that the hydraulic gradient sloped toward the south. The flow direction was generally consistent historical data suggesting that groundwater at the site generally flows south/southwest toward the ocean.
- There were no detections above the laboratory reporting levels for volatile organic compounds, semivolatile organic compounds, pesticides, polychlorinated biphenyls, herbicides, or dioxins.
- The concentration of dissolved arsenic at MWII-4 and MWII-7 detected during the February 2013 monitoring event exceeded the statistical background control limit. Concentrations of ammonia as nitrogen, dissolved arsenic, dissolved calcium, and dissolved potassium have also exceeded their respective control limits in MWII-7. Other constituents present in significant concentrations in the Phase II leachate were not detected in excess of their statistical background control limits. Pursuant to HAR 11-58.1-16 and the DOH Landfill Groundwater Monitoring Guidance Document (DOH 2002), assessment monitoring will be conducted at MWII-4 and MWII-7 and a groundwater sample collected during the next quarterly sampling event for all 40 CFR 258 Appendix II analytes in both wells.
- Similar to the previous monitoring event in November 2012, the dissolved solids, sodium, chloride, bromide, and calcium concentrations detected in MWII-7 during the February 2013 monitoring event were several orders of magnitude higher than the other Phase II wells. As previously suggested in the 2012 alternative source demonstration (GeoChem 2012), the SSIs at MWII-7 may be the result of brackish water impacts from an offsite source (e.g., possible the nearby shrimp farms).

Phase I Groundwater Monitoring. Post-closure groundwater monitoring for the closed Phase I landfill is conducted on a semi-annual basis in accordance with the *Revised Groundwater Monitoring Plan* (Earth Tech 2004) for Phase I. The purpose of the monitoring is to collect the data required to assess whether chemicals typically found in landfill leachate occur in groundwater downgradient of Phase I at concentrations that would warrant continued groundwater monitoring or corrective action. The methods and procedures presented in the *Revised Groundwater Monitoring Plan* follow the general statistical approach described in the *State of Hawai`i Landfill Groundwater Monitoring Guidance Document* (DOH 2002).

Three groundwater monitoring wells (MWI-1, MWI-2, and MWI-3) were installed hydraulically downgradient of Phase I for the post-closure monitoring program. Depths of the downgradient wells range from 18 to 19 ft below ground surface (bgs). Monitoring well MWII-5 is located northeast of the

Phase II expansion, and reaches a depth of 13 ft bgs; this well is sampled as a hydraulically upgradient well under the Phase I monitoring program.

Major findings and conclusions based on groundwater monitoring results obtained during the March 2012 to March 2013 monitoring period are summarized below:

- Based on groundwater monitoring results obtained during the March 2012 to March 2013 monitoring period, it appeared that groundwater in the shallow coastal plains aquifer beneath the unlined KLF Phase I landfill may be partially impacted by landfill leachate from the unlined Phase I landfill.
- The hydraulic gradient (change in hydraulic head over horizontal distance) in the area of the monitoring wells ranged from approximately 0.0004 foot per foot toward the south during the July 2012 monitoring event and 0.0008 foot/foot toward the southeast during the December 2012 monitoring event. As observed during previous sampling events, the hydraulic gradient may vary in magnitude and direction across the site but generally flows south toward the Pacific Ocean.
- Concentrations of ammonia as nitrogen, bicarbonate alkalinity, dissolved iron, dissolved magnesium, dissolved potassium, dissolved sodium, sulfate, total dissolved solids (TDS), and total organic carbon were detected above the established site background limits in the downgradient wells during the July and December 2012 assessment monitoring events. However, since no DOH maximum contaminant level exists for these indicator parameters and they are not on the Appendix II list (RCRA Subtitle D) for assessment monitoring, no additional evaluation is warranted. Furthermore, many of these detections (dissolved magnesium, dissolved potassium, dissolved sodium, chloride, and TDS) may be explained by the fact that the downgradient wells are much closer to the ocean and have higher corresponding salinity. Based on these results, the shallow coastal plains aquifer in the vicinity of KLF appears to be heterogeneous, with significant geochemical variations between the upgradient and downgradient monitoring wells.
- During the December 2012 monitoring event, 1,4-Dichlorobenzene and diethyl phthalate were detected above their respective laboratory practical quantitation limits (PQLs) in monitoring well MWI-2, and bis(2-ethylhexyl) phthalate was detected above its PQL in MWI-1. Because the analytes were not concurrently detected in the upgradient well MWII-5 during the December 2012 monitoring event, verification resampling of MWI-1 and MWI-2 was conducted in February 2013 to confirm the presence of the chemicals. Laboratory analysis of the samples collected during the February 2013 resampling did not detect bis(2-ethylhexyl) phthalate, diethyl phthalate, and 1,4-Dichlorobenzene above their respective PQLs. The resampling results therefore suggest the analytes are not persistent threats to groundwater and may be the result of other sources (e.g., laboratory contamination) rather than leachate contamination.

4.0 ENVIRONMENTAL CONSEQUENCES

Project-related effects, both adverse and beneficial, include primary, secondary, and cumulative effects. Primary effects, or direct impacts, are caused by the action and occur at the same time and place. Secondary effects or indirect impacts are caused by the action and occur later in time or are farther removed in distance, but are still reasonably foreseeable. Cumulative effects refer to impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor yet collectively significant actions taking place over a period of time.

Effects of the proposed project are divided into short-term and long-term effects. Short-term effects are typically related to construction activities. The only anticipated construction associated with the proposed project is potential shoring up of the existing access road, and it is possible that the project may be implemented without any construction at all. Long-term effects refer to the effects caused from implementation of the proposed action, and are longer in duration. Anticipated environmental effects of the proposed action and no-action alternative, cumulative impacts, and proposed mitigation measures, where applicable, are summarized below. This section analyzes the environmental consequences of a vertical expansion of Kekaha Landfill.

4.1 AIR QUALITY

Proposed Action. During construction, if any, potential emission sources that may affect air quality at the project site include: 1) fugitive dust emissions from excavation and construction activities, and 2) emissions from diesel and/or gasoline-powered construction equipment and motor vehicles. Construction vehicles traveling to and from the proposed project area and onsite construction equipment consisting of primarily diesel engines would contribute to local air pollution. Construction activities may also generate short-term fugitive dust particulate emissions. These sources would be combined with existing emissions from current landfill operations and local traffic.

Because levels of criteria pollutants in the State of Hawai`i are consistently well below federal and state air quality standards (DOH 2006), and because the prevailing trade winds rapidly carry pollutants off-shore limiting the effect on receptors, short-term increases in levels of criteria pollutants at the project area from construction activities, if any, are not expected to be significant.

The proposed Phase II/Cell 1 and Cell 2 vertical expansion would extend the operations at the KLF for an estimated 7.8 years at the current filling rate. Daily emissions from landfill equipment and refuse trucks would remain unchanged because the number of daily trips to the landfill and the daily quantities of waste placed on the landfill would not change. No changes in existing practices for odor control (e.g., compaction and daily covering of refuse) would occur. Adverse impacts related to nuisance odors are not anticipated.

No-Action Alternative. Under the no-action alternative, the Phase II/Cell 1 and Cell 2 vertical expansion would not occur. While waste disposal under this scenario may be uncontrolled, no additional emission sources would be added at the site; hence, there would be no change to air quality at or near the site. No additional impact to air quality is anticipated from the no-action alternative.

Mitigation Measures. Construction activities, if required, would be conducted in accordance with State of Hawai`i air pollution control regulations (HAR Title 11, Chapter 60.1) and would employ the proper administrative and engineered controls to reduce air emissions. Dust control measures including a dust control (watering) program, covering of soil stockpiles during transport or storage, and stabilization of graded or cleared areas would be implemented. Construction vehicles would either remain onsite or be scheduled to arrive and depart the project site during non-peak traffic hours, to reduce vehicle emissions. It is anticipated that EPA and DOH ambient air quality standards would not be exceeded during construction activities.

4.2 BIOLOGICAL RESOURCES

Proposed Action. Kaua'i supports approximately 80 percent of the world's remaining Newell's shearwater breeding population. Hawaiian petrels also breed on Kaua`i but in smaller numbers than the Newell's shearwater.

Both of these species nest in mountainous forest habitat and fly over the lowland areas to reach the sea. During this migration, they can become attracted to outdoor lights, and as a result fall to the ground where they can be injured or killed. The fledgling seabirds are particularly sensitive to lighting during their first flight to the sea, a migration that occurs annually from mid-September through mid-December.

The existing outdoor lighting at the KLF is limited to street lighting and outdoor lights placed above the maintenance shop, employee kitchen, employee restroom, and supervisor's doors. Normal operating hours are 7:00 a.m. to 5:00 p.m. Lighting is generally only needed during the early morning or evening hours during the winter months, when daylight hours are reduced. Outdoor lighting is controlled by timers that automatically turn off outdoor lights after the facility has closed and site personnel have left. Because placement of outdoor lighting is restricted to key locations outside administrative buildings, and is only used seasonally and/or for short durations, the potential for attracting protected seabirds with existing lighting is minimal.

The proposed action does not include plans to add or alter outdoor lighting beyond what currently exists. Filling operations are conducted primarily during daylight hours and outdoor lighting would not be required for the vertical expansion. If a need arises to add additional outdoor lighting in the future, the County would consult with the DLNR Division of Forestry and Wildlife. No other potential impacts to protected species have been identified. No impacts to flora would occur with the proposed action.

No-Action Alternative. Under the no-action alternative, the Phase II/Cell 1 and Cell 2 vertical expansion would not be implemented and there would be no change to the biological resources of the project area. Therefore, no biological impacts are anticipated with implementation of the no-action alternative.

4.3 CULTURAL RESOURCES

Proposed Action. The Phase II/Cell 1 and Cell 2 vertical expansion would remain within the existing footprint of the KLF and would not involve excavation or other disturbance of any new area. An archaeological inventory survey conducted in 1993 found no evidence of archaeological resources or historic properties within the ROI (Appendix B), and none were encountered during previous site activities.

Areas proposed for the vertical expansion (e.g., Phase II/Cell 1 and Cell 2) have already been heavily disturbed. Therefore, no adverse impacts to historic properties are anticipated from implementation of the proposed action. The SHPD was contacted on May 10, 2013 and a concurrence that no historic properties will be affected is expected (Appendix A). Consultation is currently in process.

Access to the 98 acre KLF facility is controlled by a perimeter fence and gated entrance to ensure the safety of customers and employees. There are no cultural uses within the KLF facility footprint.

No-Action Alternative. Under the no-action alternative, the Phase II/Cell 1 and Cell 2 vertical expansion would not be implemented and there would be no change to the cultural resources of the project area. Therefore, no cultural impacts are anticipated with implementation of the no-action alternative.

Mitigation Measures. In the unlikely event that historic resources including human skeletal remains are inadvertently discovered during construction activities, the construction contractor would cease

all construction activities and immediately notify the SHPD, Kaua`i Section prior to the continuation of activities.

4.4 GEOLOGY AND SOILS

Proposed Action. The Phase II/Cell 1 and Cell 2 vertical expansion would not significantly impact the soils at the KLF. The proposed action would be implemented on the active Phase II/Cell 1 and Cell 2 areas. The footprint would remain the same, no new areas would be disturbed, and the existing liner and leachate collection system would prevent contamination of soils beneath and surrounding the site.

The final geometry of the proposed Phase II/Cell 1 and Cell 2 vertical expansion with a maximum elevation of 120 ft above msl was verified for slope stability at final build-out. The final build-out condition represents the site's final shape after waste placement has ceased and final cover has been installed. Top slopes are designed to be sloped at 3 percent. Final cover side slopes are designed to be sloped at a ratio of 3.5 horizontal to 1 vertical. The stability analysis looked at two different failure scenarios based upon the geometry of the facility, foundation soils, and waste mass. Based on the soil and waste mass properties, the proposed landfill expansion is expected to remain stable (AECOM 2013).

No-Action Alternative. Under the no-action alternative, the Phase II/Cell 1 and Cell 2 vertical expansion would not be implemented and no new construction activities would occur at the KLF. Therefore, no geological or soil impacts are anticipated with implementation of the no-action alternative.

4.5 HAZARDOUS MATERIALS AND HAZARDOUS WASTE

Proposed Action. Short-term construction-related impacts from hazardous materials and hazardous waste would be possible, but not expected, with implementation of the proposed action. Construction equipment and vehicles contain hazardous materials such as gasoline, diesel, oil, hydraulic and brake fluids. Accidental release of these materials into the environment would be possible, but not anticipated, and spill kits are available onsite.

The types of waste to be accepted at the KLF would not change under the proposed action and current permitted procedures to prevent disposal of hazardous waste at the facility would be maintained. Potential releases from landfill equipment and refuse trucks would remain unchanged because the number of daily trips to the landfill and the amounts of waste placed on the landfill would not change significantly. Adherence to the SPCC Plan developed for the KLF greatly reduces the likelihood of significant impacts resulting from any spill. No significant long-term impacts are anticipated.

No-Action Alternative. Under the no-action alternative, the Phase II/Cell 1 and Cell 2 vertical expansion would not occur, resulting in closure of the landfill in 2014 when landfill capacity is expected to be reached. No hazardous materials are disposed of at the KLF and no significant adverse impacts related to hazardous materials or hazardous waste are anticipated with implementation of the no-action alternative.

Mitigation Measures. Site-specific best management practices (BMPs), including procedures for hazardous material storage, handling, and staging; spill prevention and response; waste disposal; and good housekeeping would be developed and implemented by the construction contractor, if any. Spill control measures would entail minimization of hazardous materials on the project site, good housekeeping, and rapid spill response in the event of a release. Material management practices would be used to reduce the risk of spills or other accidental release of materials and substances into the environment. Landfill operations would continue to be conducted in accordance with the Operating Plan and SPCC Plan developed for the KLF.

4.6 LAND USE AND OWNERSHIP

Proposed Action. There would be no change to land use or ownership of the KLF facility with implementation of the proposed action and no adverse impacts are anticipated. Consistency of the proposed action with land use plans and policies is discussed in Section 4.16.

No-Action Alternative. Under the no-action alternative, land use at the KLF would change from an active landfill to a closed landfill in 2014, when the landfill is expected to reach capacity.

4.7 NATURAL HAZARDS

Proposed Action. The KLF is located 1,700 ft inland from the coast. In the event of a hurricane, coastal storm surges would not impact the project area, and the project area is outside the 100-year and 500-year flood plain. Response procedures to protect against excessive erosion, flooding, and wind damage before and during severe storms are described as mitigation measures below.

Although, the site is located in the designated tsunami evacuation zone, it is not mapped within the tsunami inundation zone (HLA 1994) as defined in the State of Hawaii landfill regulations [HAR §11-58.1-13(g)(1)]. Destructive tsunamis are rare occurrences. In the unlikely event that a destructive tsunami came ashore in the area of the KLF, the energy of any tsunami would be dampened when it encounters the coastal dunes prior to reaching the KLF. The proposed expansion areas would also be protected against tsunami wave action by the Phase I landfill. All MSW to be placed in Phase II/Cell and Cell 2 would be placed at elevations above 10-ft above msl. No tsunami run-ups in the Kekaha area have been recorded to reach above those elevations.

The KLF is not located in a seismic impact zone as defined under HAR §11-58.1-13(e) (DOH 1994) and the Subtitle D regulations for MSW landfills (40 CFR Part 258.14). Therefore, an evaluation of seismic loading effects on the stability of the proposed expansion is not required and was not conducted. Response procedures to be implemented in the event of a significant earthquake are described as mitigation measures below.

For the reasons stated above, no adverse impacts from natural hazards are anticipated with implementation of the proposed action.

No-Action Alternative. Under the no-action alternative, Phase II/Cell and Cell 2 would not be vertically expanded resulting in closure of the landfill in approximately 2014 when the landfill is expected to reach capacity. No significant adverse impacts relative to natural hazards are anticipated with the no-action alternative.

Mitigation Measures. The KLF maintains a detailed Emergency Management Plan that provides detailed procedures to be followed by site personnel in the event of an emergency. The Emergency Management Plan outlines chains of command and communication, preparatory activities, response procedures, personnel evacuation procedures, and recovery activities. Specific procedures established for natural disasters are described below.

Severe Storms. The following actions would be taken to protect against excessive erosion, flooding, and wind damage before and during severe storms.

During routine landfill operations, site personnel would inspect all drainage structures on the site and verify they are in working order. Excessive silt in ditches and basins would be removed, and the condition of pipes and discharge structures from basins would be verified. Prior to a forecast storm, site personnel would again inspect all drainage structures on the site, verify these structures are in working condition and take action if repairs are necessary. Diversion berms would be constructed around the current disposal area as needed to prevent run-off from upgradient areas from entering the waste fill, and to prevent run-off from the waste fill area to downgradient areas of the site. Interim

cover would be placed over exposed waste at the end of the working day prior to the forecast beginning of a severe storm.

At the discretion of the site manager, the site may be closed for business during storm periods. In this event, the working face would be closed and covered with interim cover, which would be graded to discharge surface runoff to the site surface water drainage system. Temporary diversion berms would be constructed as necessary to divert potential surface water run-on away from areas of exposed waste.

Facility personnel would periodically inspect site drainage systems during any prolonged storm involving extensive rain, and correct or repair as needed any conditions with potential to cause damage to onsite or offsite facilities.

Earthquake. In the unlikely event of a significant earthquake, the KLF would immediately cease or limit landfill operations and promptly conduct a visual survey of the facility to identify any slope failure, fires, LFG collection system failures, or other conditions that could threaten employee or public safety.

4.8 NOISE

Proposed Action. Only short-term construction-related noise impacts, if any, are anticipated with implementation of the proposed action. Construction equipment employed to implement the proposed action may include trucks, bulldozers, scrapers, etc.

Noise generated by construction equipment could produce localized noise events of 100 dBA or higher at the construction site, with noise levels decreasing with distance from the site. Typical noise levels generated by construction tools range from 65 dBA to 110 dBA. Heavy construction equipment noise levels at 50 ft typically range between 75 and 89 dBA, for equipment such as concrete or flat-bed trucks, cranes, bulldozers, scrapers, and trenching machines (USACE 1978). Noise from construction activities would decrease with distance from the project area through divergence, atmospheric absorption, shielding by intervening structures, and absorption and shielding by ground cover.

Properties adjacent to the KLF are used for agricultural purposes, a National Guard Rifle Range, and federal reserve lands at Barking Sands. The nearest town, Kekaha, is located 1.3 miles to the southeast. The daily operations of the landfill would not change as a result of the Phase II/Cell 1 and Cell 2 vertical expansion; therefore, it is not anticipated that noise levels would change or significantly impact the surrounding area.

No-Action Alternative. Under the no-action alternative, Phase II/Cell 1 and Cell 2 would not be vertically expanded, resulting in closure of the landfill in approximately 2014 when the landfill is expected to reach capacity. There would be no immediate change to the noise environment; noise sources would be reduced upon landfill closure. As such, no adverse impacts from noise are anticipated under the no-action alternative.

Mitigation Measures. To minimize noise impacts, construction activities, if any, would be conducted in accordance with State of Hawai`i requirements set forth in: HRS Chapter 342F - *Noise Pollution*; HAR Chapter 11, Chapter 42 – *Vehicular Noise Control for Oahu*, establishing noise level limits for light and heavy vehicles and HAR Title 11, Chapter 46 – *Community Noise Control*, establishing maximum permissible sound levels from excessive noise sources, noise prevention, control and abatement guidelines, and permit criteria.

The Hawai`i Occupational Safety and Health (HIOSH) Division has set the permissible occupational noise exposure at 90 dBA for a continuous 8-hour exposure. Permissible noise exposures for shorter periods are higher, with a maximum exposure of 115 dBA permissible for a duration of 15 minutes or

less (HAR Title 12, Chapter 200.1 *Occupational Noise Exposure*). Enforcement of HIOSH occupational noise exposure regulations would be the responsibility of the construction contractor. If workers experience noise exceeding HIOSH standards, administrative or engineering controls would be implemented. Use of personal protective equipment such as earplugs or muffs may also be required.

4.9 SAFETY AND HEALTH

Proposed Action. The proposed action would have long-term positive impacts on public safety and health by allowing for proper and safe disposal of MSW on the Island of Kaua`i.

Potential short-term construction-related impacts to safety and health relate to worker safety during construction. Health and safety issues concerning workers include: exposure to operation of construction equipment, occupational noise, fugitive dust, heavy lifting, slips, trips, and falls while working on uneven terrain, exposure to heat, and biological exposure (bites, stings, and allergens).

Current operating procedures in place to mitigate safety and health concerns related to heavy equipment operation, vector control, explosive gas, and landfill fires (Section 3.9) would continue. No significant adverse impacts to safety and health are anticipated from implementation of the proposed action.

No-Action Alternative. Under the no-action alternative, the landfill would not be vertically expanded. Closure of the KLF prior to a new facility being sited and permitted to accept MSW would leave the island without a safe means to dispose of MSW, and would likely result in widespread illegal dumping across the Island of Kaua`i, with potentially significant adverse impacts to public safety, health, and the environment.

Mitigation Measures. The safety and health of workers during construction would be the responsibility of the construction contractor. Mitigation measures addressing air quality at the construction site and occupational noise exposure are presented in Sections 4.1 and 4.8, respectively. Current procedures developed to ensure safe operation of the KLF, as specified in the Operating Plan (AECOM 2010), would be continued.

4.10 SOCIOECONOMICS

Proposed Action. The proposed Phase II/Cell 1 and Cell 2 vertical expansion would have no significant adverse socioeconomic impact. No significant adverse impacts to employment, income, or demographics are anticipated from implementation of the proposed action.

No-Action Alternative. The no-action alternative should not significantly impact employment, income, or demographics within the ROI. However, closure of the KLF prior to a new facility being sited and permitted to accept MSW could result in significant increases in waste disposal costs if MSW had to be shipped off-island, and could therefore have adverse effects on the island economy.

4.11 TRANSPORTATION

Proposed Action. Currently, the KLF on average accepts approximately 27 commercial loads and 80 non-commercial loads per day (Tanigawa 2013), which accounts for approximately 3 percent of the traffic volume on Kaumuali`i Highway in the vicinity of the KLF (DOT 2013). It is assumed that filling rates would not change significantly over the life of the KLF Phase II/Cell 1 or Cell 2 vertical expansion and there would not be any significant change to landfill-related traffic on Kaumuali`i Highway. Therefore, significant adverse impacts to the transportation resource from implementation of the proposed action are not anticipated.

No-Action Alternative. Under the no-action alternative, the landfill would not be expanded resulting in closure of the landfill in approximately 2014 when the landfill is expected to reach capacity. Commercial truck traffic to the KLF would cease upon closure of the KLF.

4.12 UTILITIES AND INFRASTRUCTURE

Proposed Action. Vertical expansion of Phase II/Cell 1 and Cell 2 would not increase the daily load on public utilities (e.g., water, electrical power) over existing levels although use of public utilities would continue for an additional estimated eight years. The current KLF utility requirements do not exceed the existing capacity and no adverse impacts to utilities are anticipated from implementation of the proposed action.

The proposed action would increase the capacity of Phase II/Cell 1 and Cell 2, resulting in a positive impact for solid waste infrastructure on Kaua`i.

No-Action Alternative. Under the no-action alternative, Phase II/Cell 1 and Cell 2 would not be vertically expanded and the County would be without a landfill for the disposal of MSW beginning in approximately 2014. Therefore, adverse impacts to the island's solid waste infrastructure would occur under the no-action alternative.

4.13 VISUAL RESOURCES

Proposed Action. The County proposes to vertically expand Phase II/Cell 1 and Cell 2 by 35 ft to a maximum height of 120 ft above msl. The Phase II/Cell 1 landfill is currently permitted to receive waste up to 85 ft above msl, and is currently in use for landfilling operations. Cell 2 is currently being designed and permitted to 85 ft msl, and is expected to be constructed in the next few years.

The line-of-sight to Phase II/Cell 1 is currently partially visible from both the Kekaha- and PMRF bound direction of Kaumuali`i Highway. Cell 2 may also be partially visible from the Kekaha and PMRF-bound direction of Kaumuali`i Highway. The KLF is not presently visible from the shoreline (see Appendix C). The maximum height of the facility would increase 35 ft with the proposed action, thus increasing visibility from surrounding areas other than the shoreline.

The proposed action would not impact visual resources. Only one landfill cell would be open and operational at a time and debris would be spread, compacted, and covered each night with daily cover. Closure plans for the expansion would include provisions for landscaping of the fill areas, as well as site perimeter, to minimize visual impacts (see the mitigation measures outlined below). With implementation of the mitigation measures described below, significant adverse impacts to visual resources are not anticipated.

The existing KLF is not within a view plane that exhibits a high degree of intactness and does not block any scenic landforms; scenic view planes; or shoreline views, as defined in Section 3.2.1 of the Kaua`i General Plan, it is not identified as an "important landform" on the West Side Planning District Heritage Resources Map, and is not visible from the shoreline. Therefore, both the existing and the proposed expansion do not conflict with County policies for the protection of scenic resources.

The highway in the vicinity of the proposed project, Kamualii Highway, is designated as a Scenic Roadway Corridor (County of Kaua`i 2000).The primary intent of designating scenic roadway corridors is to establish principals for roadway design and land use within scenic corridors which promote setbacks, landscaping, and views of scenic features. Scenic roadway corridors are intended to provide design guidance but not to restrict the principal land uses of urban areas. Incorporation of the mitigation measures described below for screening landfill operations and landscaping the landfill slopes is consistent with County objectives for scenic roadway corridors.

No-Action Alternative. Under the no-action alternative, no construction activities would occur and there would be no change to the visual quality of the project area. Therefore, no impacts to visual resources are anticipated under the no-action alternative.

Mitigation Measures. Mitigation measures for visual impacts would include a landscaping and revegetation program to include screen planting along frontage roads and the site perimeter as well as plans for revegetation of the landfill base and slopes. There would be plantings of the perimeter areas and the base of the landfill prior to closure to establish a screen for landfill operations. Screen plantings along frontage roads would be continuous. Plant densities, depth of planting, and species composition for screen planting would be adapted to ensure adequate screening and consistency of plantings with the surrounding environment, and to select against significant maintenance requirements.

After the landfill is closed, the surface would be covered with an engineered cap and soil, and then planted with vegetation. The top of the landfill would be vegetated primarily with native grasses due to shallow soils. Random groups of shrubs and low trees would be planted on the landfill slopes, where the soil depth would be greater, and where taller plants may be used without penetrating the engineered cap. A variety of native trees and shrubs would be selected, with an understory of native species. Varying plant heights on the landfill top and side slopes and planting with native species would serve to break up the engineered topography of the landfill final cover grade and provide for a more natural appearance.

Litter Control. The KLF uses permanent litter fences, portable screens, and routine site cleanup operations to prevent wind-blown litter from leaving the landfill premises and creating nuisance conditions in the area. Portable skid-mounted litter screens, typically 8 ft high, are located in downwind locations near the active MSW disposal area as the first line of defense against litter. The screens are relocated frequently as the active area moves across the site. Temporary litter fences, consisting of reusable fence posts and poultry wire, are near the working face in places where they will not hinder traffic control. The chain link fence surrounding the entire KLF property provides a final level of physical containment of any litter that leaves the active working area.

Routine site cleanup and litter collection are the final elements of the litter control program. KLF personnel remove litter from portable screens and permanent fences on a daily basis, and pick up litter around the site. Daily inspections and litter cleanup activities are also conducted along the access road leading to the back gate of PMRF and the access road to the drag strip, firing range, and beach along the southeast property line. These measures would continue with implementation of the proposed action. The trucks that haul the MSW to the landfill will also continue to be monitored on a routine basis to ensure they are not contributing to litter along the truck haul routes and, if they were determined to be, corrective actions would be implemented immediately.

4.14 WATER RESOURCES

Proposed Action. Surface Water. Surface water drainage features will need to be modified slightly (i.e., developed upwards as the expansions are filled in) to accommodate the increase in sideslope lengths due to the proposed vertical increase. Presently, portions of collected surface water discharges to infiltration ditches located around the perimeter of Phase II, and portions are conveyed to the infiltration pond in the north corner of the site. The vertical expansion will not require further capacity in the existing 2-acre area infiltration basin and existing infiltration ditch to successfully manage surface water. The KLF will remain a non-discharging site. Therefore, no significant adverse impacts to surface water are anticipated.

Groundwater. Groundwater monitoring at the KLF would continue to be conducted in accordance with the requirements of HAR Title 11, Chapter 58.1 to ensure that groundwater underneath the KLF facility is not being contaminated by landfill operations. The proposed action would not change the current KLF groundwater monitoring schedule as described in Section 3.14.Therefore, no significant adverse impacts to groundwater are anticipated.

No-Action Alternative. Under the no-action alternative, the Phase II/Cell 1 and Cell 2 vertical expansion would not be implemented and there would be no change to the water resources within the project area. Therefore, no impacts to water resources are anticipated with implementation of the no-action alternative.

4.15 CUMULATIVE IMPACTS

Cumulative impacts refer to impacts on the environment that result from the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (county, state, or federal) or person undertakes such actions. Cumulative impacts can result from individually minor yet collectively significant actions taking place over a period of time. Land use in the project vicinity is agricultural and lightly developed open space. A summary of resource attributes that may contribute to cumulative impacts is provided below.

Air Quality. Emissions associated with proposed expansion activities and operations at the KLF would not hinder conformance with the EPA and DOH ambient air quality standards. Construction activities would be conducted in accordance with State of Hawai`i air pollution control regulations and would employ proper administrative and engineered controls to reduce air emissions. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to air quality when combined with implementation of the proposed expansion of the landfill.

Biological Resources. Flora and fauna of the KLF site are characteristic of disturbed areas and no special status species are known to occur within the project area. No adverse impacts to biological resources are anticipated with implementation of the proposed action and no other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to biological resources when combined with implementation of the proposed expansion of the landfill.

Cultural Resources. Proposed expansion activities would remain within the existing footprint of the KLF and would not involve excavation. An archaeological inventory survey conducted in 1993 did not identify any archaeological resources or historic properties within the project area. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to cultural resources when combined with implementation of the proposed expansion of the landfill.

Geology and Soils. Analysis of soil borings, test pits, and laboratory results indicate that the project site is suitable for construction of the proposed expansion from a geotechnical standpoint. Based on the soil and waste mass properties, and the designed slopes of the landfill, the proposed landfill expansion is expected to remain stable. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to geology and soils when combined with implementation of the proposed expansion of the landfill.

Hazardous Materials and Hazardous Waste. The types of waste to be accepted at the KLF would not change under the proposed action, and procedures to prevent disposal of hazardous waste at the facility would be maintained. Prior to implementing expansion activities, BMPs would be developed and implemented by the construction contractor to eliminate or minimize the potential of a release during expansion activities. Landfill operations would continue to be conducted in accordance with the Operating Plan and the SPCC Plan developed for the KLF. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to hazardous materials and hazardous waste when combined with implementation of the proposed expansion of the landfill.

Land Use. There would be no change to land use or ownership of the KLF facility with implementation of proposed expansion activities. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to land use when combined with implementation of the proposed expansion of the landfill.

Natural Hazards. There have been no historical adverse impacts to the KLF facility from natural hazards. With implementation of the proposed action, no adverse impacts from natural hazards (e.g., hurricanes, storm surges, tsunamis, and earthquakes) have been identified. No other foreseeable actions have been identified in the vicinity of the KLF that would cause cumulative natural hazard impacts when combined with implementation of the proposed expansion of the landfill.

Noise. Only short-term construction-related noise impacts are anticipated with implementation of proposed expansion activities. Noise from construction activities would decrease with distance from the project area. Daily operations at the landfill would not change as a result of the proposed expansion. Properties adjacent to the KLF are used for agricultural purposes, a firing range, and federal reserve lands at Barking Sands, and the nearest town, is approximately 1.3 miles to the southeast. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative noise impact when combined with implementation of the proposed expansion of the landfill.

Safety and Health. Current procedures developed to ensure safe operation of the KLF, as specified in the Operating Plan, would be continued. The proposed expansion of the KLF would result in long-term positive impacts on public safety and health by allowing for continued safe disposal of MSW on the Island of Kaua`i. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to safety and health when combined with implementation of the proposed expansion of the landfill. Cumulative impacts are not expected.

Socioeconomics. No adverse impacts to employment, income, or demographics are anticipated from implementation of the proposed expansion activities. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative socioeconomic impact when combined with implementation of the proposed expansion of the landfill.

Transportation. Landfill filling rates are not expected to change significantly over the life of the KLF expansion and there would not be any significant change to landfill-related traffic on local roadways. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to transportation when combined with implementation of the proposed expansion of the landfill.

Utilities. Proposed expansion activities would not result in an increase in the daily load on public utilities, although use of public utilities would likely continue for an additional estimated 7.8 years. The current KLF utility requirements would not exceed the existing capacity of local utility companies. The proposed expansion would increase the capacity of the existing landfill, resulting in a positive impact for the solid waste infrastructure on Kaua`i. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to utilities when combined with implementation of the proposed expansion of the landfill.

Visual Resources. Maximum height of the landfill and final cover upon closure would be no greater than 120 ft above msl. Closure plans for the KLF Phase II would include provisions for landscaping of the fill areas, as well as the site perimeter, to minimize visual impacts. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to visual resources when combined with implementation of the proposed expansion of the landfill.

Water Resources. Surface water drainage features will need to be modified slightly (i.e., extended upwards as the expansion is landfilled) to accommodate the increase in sideslope lengths due to the proposed vertical increase. Groundwater monitoring at the KLF would continue to be conducted. No other foreseeable actions have been identified in the vicinity of the KLF that would cause a cumulative impact to water resources when combined with implementation of the proposed expansion of the landfill.

4.16 COMPATIBILITY OF THE PROPOSED ACTION WITH OBJECTIVES OF FEDERAL, STATE, AND LOCAL LAND USE PLANS AND POLICIES

Compatibility of the proposed action with land use plans and policies is discussed below.

**Hawai`i State Plan.** The Hawai`i State Plan provides guidelines for the long range development of the State in Chapter 226, HRS. Objectives and policies pertaining to solid waste are outlined in Section 226-15. Specifically, Section 226-15(a) identifies the "Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes" as the planning objective for State facility systems with regard to solid and liquid waste. The KLF Phase II/Cell 1 and Cell 2 vertical expansion would support this objective as it would provide the means to maintain basic public health and sanitation standards relating to the disposal of MSW.

**County of Kaua`i General Plan.** In 2000, the County of Kaua`i Planning Department updated the Kaua`i General Plan. This plan describes the County's 20-year vision for Kaua`i and sets policies for achieving that vision. The County's role in solid waste management is outlined in Section 7.8 (Solid Waste) of the Kaua`i General Plan (County of Kaua`i 2000):

> "*Using long-range integrated resource planning, the County shall manage an island wide system of solid waste collection, recycling and disposal that is environmentally sound and cost effective; increases diversion of waste from the island's landfill; and provides for the timely and orderly expansion of solid waste facilities."*

The proposed Phase II/Cell 1 and Cell 2 vertical expansion is consistent with Section 7.8 of the Kaua`i General Plan because it provides an environmentally sound and cost effective way to provide a timely and orderly expansion of solid waste facilities on Kaua`i.

Consistency of the proposed action with Section 3.2 (Scenic Views) and Section 5.5 (Scenic Roadway Corridors) of the Kaua`i General Plan is discussed in Section 4.13.

State Land Use Plans. The State land use designation for the KLF Phase II is Agricultural. Phase II was approved for use by the State Land Use Commission through the issuance of a Special Permit on July 1, 1993. This Special Permit allows for land classified as a State Agricultural District to be used for landfill purposes.

**County of Kaua`i Zoning Ordinances.** The County of Kaua`i developed comprehensive zoning ordinances as an implementing tool for the Kaua`i General Plan to address long-range growth and development. The KLF Phase II/Cell 1 and Cell 2 is located within a county Agricultural District.

HRS 205A: Coastal Zone Management. The proposed Phase II/Cell 1 and Cell 2 vertical expansion would not result in significant adverse impacts to recreational, historic, or scenic and open space resources; coastal ecosystems; public use beaches/shoreline access; or marine resources. The project area is not mapped within a flood plain, the tsunami inundation zone, an erosion-prone area, or on geologically hazardous area, and is not at increased risk of damage from coastal hazards. Public participation will be incorporated into the environmental review process for compliance with HRS 343. Therefore the proposed expansion is consistent with the objectives and policies of the coastal zone management program as outlined in HRS §205A-2.

4.17 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Construction of the proposed action, if required, may result in short-term impacts to air quality and noise. Impacts to these resources would be short-term and would be mitigated by implementation of construction BMPs as described in Sections 4.1 and 4.8, respectively. Vertical expansion of Phase II/Cell 1 and Cell 2 would provide long-term benefits for solid waste infrastructure on Kaua`i by extending the life of the landfill. Adverse environmental impacts resulting from the proposed action would be minimal as the KLF facility is already in use as a MSW landfill, and the vertical expansion would not expand Phase II/Cell 1 and Cell 2 beyond the existing 98-acre KLF facility footprint. The proposed action would result in positive environmental impacts by continuing to provide for the safe, on-island disposal of MSW.

4.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Environmental impacts resulting from this expansion would be minimal as the KLF facility is already in use as a MSW landfill, and the expansion would not expand Phase II Cell 1 and Cell 2 beyond the existing 98-acre KLF facility footprint, which has already been set aside for landfill purposes by executive orders 1558 and 2872. Implementation of the proposed action would not result in an irreversible or irretrievable commitment of resources, except for the financial resources, fuel, and other consumable materials required for construction, operation, closure, and post-closure that would be required wherever such a facility is located.

5.0 FINDINGS AND DETERMINATION

The following sections summarize the significance criteria used to determine whether the proposed action would have a significant effect on the environment (Section 5.1) and the resulting determination (Section 5.2).

5.1 SIGNIFICANCE CRITERIA

In accordance with HAR §11-200-12, the proposing agency has considered every phase of the proposed action, the expected consequences, both primary (direct) and secondary (indirect), and the cumulative as well as the short-term and long-term effects of the action, in order to determine whether the proposed action may have a significant effect on the environment. In making this determination, the proposed action has been evaluated with respect to the significance criteria established in HAR §11-200-12. These significance criteria are summarized below:

- **Involves an irrevocable commitment to, loss or destruction of any natural or cultural resources.** The proposed Phase II/Cell 1 and Cell 2 vertical expansion would not cause significant adverse impacts to biological resources (Section 4.2), cultural resources (Section 4.3), geology and soils (Section 4.4), or water resources (Section 4.14), and therefore does not involve an irrevocable commitment to, loss or destruction of, any natural or cultural resources.
- **Curtails the range of beneficial uses of the environment.** The proposed Phase II/Cell 1 and Cell 2 vertical expansion would not expand the overall footprint of the KLF facility or change the land use within the facility footprint. The approximately 98 acre KLF facility has already been set aside for use as a MSW landfill. The proposed vertical expansion within the facility footprint would not curtail the range of beneficial uses of the environment.
- **Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.** The proposed Phase II/Cell 1 and Cell 2 vertical expansion is consistent with the state environmental policies, goals, and guidelines established in Chapter 344, HRS. The County has integrated the review of environmental effects with existing planning processes, and has developed the Phase II/Cell 1 and Cell 2 vertical expansion with consideration for avoiding, minimizing, and mitigating any adverse environmental effects. Other federal, state, and county agencies identified as having expertise or jurisdiction by law will be consulted during the planning and permitting processes. In accordance with HRS §344-5, this EA is made available for public review and comment for a period of thirty days. All comments received during the public comment period will be responded to in the Final EA. The proposed action is also consistent with Executive Orders 1558 and 2872 setting aside the KLF footprint for landfill purposes.
- **Substantially affects the economic welfare, social welfare, and cultural practices of the community or State.** No significant adverse impacts to employment, income, or demographics are anticipated from implementation of the proposed action (Section 4.10). No cultural resources are present within the KLF footprint and the KLF facility is not associated with any cultural practices (Section 3.3).
- **Substantially affects public health.** The proposed action would have long-term positive impacts on public safety and health by allowing for continued proper and safe disposal of MSW on the Island of Kaua`i. Current operating procedures in-place to mitigate for safety and health concerns related to heavy equipment operation, vector control, explosive gas, and landfill fires would continue (Section 3.9). No significant adverse impacts to public safety and health are anticipated from implementation of the proposed action.
- **Involves substantial secondary impacts, such as population changes or effects on public facilities.** No adverse secondary impacts are anticipated with implementation of the proposed action.

- **Involves a substantial degradation of environmental quality.** The design and construction of the proposed vertical expansion would conform to the provisions of HAR 11-58.1 (DOH 1994), including provisions for construction of a base liner, and LFG and leachate management systems, and therefore would not involve a substantial degradation of environmental quality. The continued presence of a modern engineered landfill for safe disposal of MSW improves the overall environmental quality of the Island of Kaua`i.
- **Is individually limited, but cumulatively has considerable effect on the environment, or involves a commitment for larger actions.** The proposed action would not have significant cumulative impacts (Section 4.15) and does not involve a commitment for larger actions.
- **Substantially affects a rare, threatened, or endangered species or its habitat.** No special status species have been identified within the KLF facility. No adverse impacts to biological resources are anticipated from implementation of the proposed action.
- **Detrimentally affects air or water quality or ambient noise levels.** Only potential temporary construction-related impacts are anticipated to affect ambient noise levels (Section 4.8). The Phase II/Cell 1 and Cell 2 vertical expansion would be subject to requirements of a Covered Source Air Permit pursuant to HAR 11-60.1-82, and administered by the DOH Clean Air Branch, therefore, due to the anticipated requirement for active LFG collection and management, long-term operational improvements to air quality are anticipated if the proposed action is implemented.

  A base liner and leachate collection system are currently in place at Phase II/Cell 1, and the base liner for Cell 2 would be subject to DOH approval. Groundwater monitoring would continue to ensure that groundwater underneath the KLF facility is not being contaminated by KLF Phase II. Therefore, detrimental effects to water quality are not anticipated.
- **Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, freshwater, or coastal waters.** The KLF facility is not mapped within a flood plain, a seismic impact zone, a tsunami inundation zone, an erosion-prone area, an estuary, freshwater, or coastal water.
- **Substantially affects scenic vistas and view planes identified in County or state plans or studies.** The existing KLF is not within a view plane that exhibits a high degree of intactness or vividness, as defined in Section 3.2.1 of the Kaua`i General Plan; is not identified as an “important landform” on the West Side Planning District Heritage Resources Map; and is set back approximately 1,700 ft from the shoreline. No significant adverse visual impacts are anticipated (Section 4.13).
- **Requires substantial energy consumption.** Energy requirements of the KLF include minor electricity consumption for management and maintenance facilities and diesel fuel for operation of heavy equipment. The proposed Phase II/Cell 1 and Cell 2 vertical expansion would not increase the daily load on local utilities or increase daily consumption of fossil fuels.

5.2 DETERMINATION

Based on the above evaluation of the significance criteria and the discussion of impacts and mitigation measures contained in this document, it is anticipated that the proposed project would not have a significant adverse impact on the environment. Therefore, a Finding of No Significant Impact is anticipated.

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Appendix A
Agency Correspondence

AECOM
1001 Bishop Street, Suite 1600
Honolulu, Hawaii 96813-3698
www.aecom.com

808 523 5380 tel
808 523 8950 fax

Memorandum

To	Brian J. Campilango, CIV, DON
CC	Troy Tanigawa and Donald Fujimoto, County of Kauai Department of Public Works
Subject	Kekaha Landfill Phase II Vertical Expansion Airspace Memo, Revision 01
From	Frank Cioffi, AECOM
Date	August 2, 2011

Dear Mr. Campilango,

As I previously mentioned, the County of Kauai Department of Public Works would like to implement a vertical expansion for the Kekaha Landfill, Phase II. We would like to achieve a final maximum elevation of 120 feet above mean sea level (ft msl), thus providing the island with approximately 3.6 extra years of useful landfill life.

We looked at the dimensions of the proposed landfill expansion and the PMRF's Runway 34 (see attached graphic), and used the data you provided. Because Runway 34 is greater than 3,200 feet in actual length, FAA notification is required for construction of greater height that an imaginary surface extending at a 100:1 slope from the runway.

In our analysis, we used the following assumptions:

- Both the nearest point on the runway, and nearest point of the Phase II landfill are as shown on the attached Figure (this is conservative because the maximum grade of the landfill would not occur at the property border). The coordinates are:
    - Runway 34: 22°00'51.49"N
159°46'59.41"W
    - Phase II Landfill corner: 21°59'7.66"N
159°45'2.78"W
- The FAA notification criteria is a 100:1 (H:V) slope, per "§77.13 Construction or alteration requiring notice," paragraph (a)2(i).
- We understand per your email that that the runway elevation is 14.53 ft msl.

The distance between the two points is 15,167 ft. At a slope of 100:1, the imaginary surface would lie 151.67 ft above the runway elevation of 14.52 ft msl. Therefore, the maximum elevation at the landfill that would not require FAA notification would be 151.67 ft + 14.53 ft msl, or 166.20 ft msl.

The maximum proposed elevation for the landfill is 120 ft msl.

AECOM

Even allowing for occaisional motorized equipment (dozers, etc.) on top of the landfill, it appears that the proposed vertical expansion (120 ft msl) would not come close to potentially affecting PMRF's airspace. Please let us know if you determine otherwise, or if you would like any additional information.

It also seems that we would also not be required to submit FAA FORM 7460-1, because this proposed project would not fall under the triggering criteria listed in "§77.13 Construction or alteration requiring notice," and because the proposed expansion is not a lateral expansion, per 11 HAR 58.1-13(a)2.

Thank you for your assistance in this matter. Please let me know if you have any comments or would like to discuss this further.

Sincerely,

Frank Cioffi, PE
AECOM Environment, West Region, Pacific District
D 808.356.5380 M. 808.223.7168
frank.cioffi@aecom.com

From: Zimmerman, Julie
To: Zimmerman, Julie
Subject: FW: Kekaha Landfill Vertical Expansion Airspace Memo
Date: Wednesday, June 12, 2013 2:13:26 PM

-----Original Message-----
From: Tottori, Leland O CIV NAVFAC HI, PRB [mailto:leland.tottori@navy.mil]
Sent: Friday, November 18, 2011 2:34 PM
To: Cioffi, Frank
Cc: Sagum, Roland D CIV NAVFAC HI, PRB; Campilango, Brian J CIV PMRF Barking Sands, N3A-3; Baise, John W LCDR PMRF, PWO; Morgan, Larry P LT PMRF, N3A
Subject: RE: Kekaha Landfill Vertical Expansion Airspace Memo

Mr. Cioffi,

Thank you for the opportunity to review the County's proposed Landfill Vertical Expansion plan.

In response to your email inquiry and memorandum dated 02 August 2011, the Pacific Missile Range Facility staff has reviewed your request for comments on the proposed Kekaha Landfill Vertical Expansion.

We have reviewed comprehensively from the airspace/airfield criteria standpoint, as well as for any operational impacts that may be related to the expansion.

We have concluded that there are no known impacts to the base at this time. Should the planning criteria for the project change from what is currently proposed, request we be given the opportunity to review and comment again.

Please contact me if there are any question regarding this matter.

Sincerely,

Leland Tottori
Deputy Public Works Officer
Pacific Missile Range Facility
NAVFAC HI
(808) 335-4636

AECOM
1001 Bishop Street, Suite 1600
Honolulu, Hawaii 96813-3698
www.aecom.com

808 523 8874 tel
808 523 8950 fax

May 10, 2013

Ms. Pua Aiu
Administrator
Attention: Susan Lebo
Department of Land and Natural Resources
Hawaii State Historic Preservation Division
Kakuhihewa Building
601 Kamokila Blvd, Suite 555
Kapolei, Hawai`i, 96707

Subject: Chapter 6E- Historic Preservation Review and Clearance
Kekaha Landfill Phase II Vertical Expansion
TMKs: 1-2-002:009 and 1-2-002:001
Kekaha, Kauai,

Ms. Aiu,

The County of Kaua`i, Department of Public Works (DPW), Solid Waste Division (the County) is proposing a vertical expansion of the Kekaha Landfill (KLF) on Kaua`i, Hawai`i. The KLF is located 1.3 miles northwest of the town of Kekaha on the southwest side of the Island of Kaua`i and identified with Tax Map Keys 1-2-002:009 and 1-2-002:001. This facility is situated on approximately 98 acres of land adjacent to Kaumuali`i Highway, approximately 1,700 feet from the shoreline of the Pacific Ocean (See Figure 1-1 Site Location Map). SHPD was previously consulted when an Environmental Assessment (EA) was conducted in 2006-2007 to expand the landfill, using the same footprint currently proposed for expansion.

Background and Existing Conditions

The KLF is comprised of two distinct refuse fill areas identified as Phase I and Phase II. Phase I began operations in 1953 and continued until operations ceased on October 8, 1993. Phase II began operations on October 9, 1993 and was originally permitted to reach a height of 37 feet above mean sea level (msl), which should have allowed municipal solid waste (MSW) filling operations through 2003. However, due to the additional MSW resulting from Hurricane Iniki, it quickly reached capacity and was expanded vertically in 1998 to accommodate more MSW by increasing the height limit to 60 feet above msl. A second vertical expansion of Phase II was approved in 2005 allowing the current maximum permitted height of 85 feet above msl.

An EA addressing the potential to laterally expand the limits of Phase II to include three additional expansion cells was completed in 2007 (See Figure 2- Cell Development). Cell 1 was subsequently permitted to expand Phase II into the existing leachate lagoon and adjacent acreage. Cell 1 was completed in 2010 and is currently accepting waste. Cell 1 added an additional estimated 4.0 years of use to the site, which may allow filling operations through

early 2014. Cell 2 was proposed to expand Phase II into the valley area between the closed Phase I and the existing Phase II. Cell 2 permitting is currently in process and construction is anticipated to begin within the next few years. Cell 2 is expected to add 5.0 years of use to the site.

Cell 3 was proposed to expand Phase II directly over the closed Phase I landfill. The County has chosen not to move forward with Cell 3 construction (the previous EA stated that if a new landfill can be sited within the life of Cells 1 and 2, development of Cell 3 would not necessarily proceed). Public concern over Cell 3 construction and high costs have dissuaded the County from moving forward with Cell 3 and have required investigating other options, such as this proposed vertical expansion.

The current maximum permitted height of Phase II and Cell 1 is 85 feet above msl, and the currently permitted Phase II/Cell 1 landfill area is expected to reach capacity by early 2014.

Proposed Action

The proposed vertical expansion will comprise two distinct areas, as shown in Figure 2: the Phase II/Cell 1 vertical expansion, and the Cell 2 vertical expansion. The Phase II/Cell 1 landfill is currently permitted to receive waste up to 85 ft msl, and is currently in use for landfilling operations. Upon completion of an EA and receipt of a solid waste management permit, the Phase II/Cell 1 vertical expansion can begin operations. Cell 2 is currently being designed and permitted, and is expected to be constructed in the future. The Cell 2 vertical expansion, therefore, while subject of this consultation and the upcoming EA, will not be permitted until after the Cell 2 lateral expansion is permitted and constructed.

Table 1 summarizes the status of recent and proposed lateral and vertical landfill expansions, highlighting those that are the subject of this consultation. The expansions are presented in the order they are expected to be implemented.

Table 1: Summary of Recent and Proposed Landfill Expansions

Order	Expansion	Maximum Height (ft msl)	Related Environmental Assessment	Solid Waste Permit Status	Comments
1	Cell 1 Lateral Expansion	85	November, 2007	Currently permitted as part of the Phase II landfill	Currently being used to landfill Kauai's waste
2	Phase II-Cell 1 Vertical Expansion	120	To be completed 2013	After EA is completed (expected early 2014)	Subject of this consultation
3	Cell 2 Lateral Expansion	85	November, 2007	Future (after Phase II-Cell 1 Vertical Expansion)	Expected to be permitted and constructed after the Phase II-Cell 1 Vertical Expansion
4	Cell 2 Vertical Expansion	120	To be completed 2013	Future (after Cell 2 Lateral Expansion)	Subject of this consultation

The proposed Phase II/Cell 1 vertical expansion would extend the existing engineered waste disposal area upwards, without affecting any additional acreage. The proposed vertical expansion will not alter the current Phase II/Cell 1 permitted limit-of-waste footprint of 38.4 acres, plus the additional anticipated permitted footprint of 6.4 acres for Cell 2. The proposed maximum height of the final cover system upon closure of the vertical expansion is proposed to be 120 feet above msl. Very minimal construction (if any) will be required for the Phase II/Cell 1 vertical expansion, which will make use of the existing, continuous, Phase II Subtitle D base liner system that underlies all of the Phase II landfill.

The Phase II/Cell 1 vertical expansion is expected to provide an estimated 662,000 cubic yards of gross airspace, based on the proposed expansion limits and a final cover elevation of 120 feet above msl. Based on current landfill waste mass density and daily waste disposal rates, the Phase II/Cell 1 vertical expansion could potentially provide an additional 5.3 years of service. Similarly, the vertical expansion above the planned Cell 2 is expected to provide an estimated 317,000 cubic yards of gross airspace, or an extra 2.5 years.

Although the proposed vertical expansion provides the needed airspace to operate the facility, current site operating systems, such as leachate management and surface water management, will not need further enhancement. Currently, the leachate extracted from Phase II and Cell 1 is collected and managed in an evaporation pond north of Phase II (which was relocated and constructed as part of the Cell 1 expansion). Leachate from Phase II and Cell 1 is collected through a passive gravity design and discharged through pumps and piping to the pond.

Surface water drainage features will need to be modified slightly (i.e., increased upwards) to accommodate the increase sideslope lengths due to the proposed vertical increase. Presently, collected surface water discharges to an infiltration ditch located between Phases I and II, as well as to infiltration ditches located around the perimeter of Phase II. The vertical expansion will not require further capacity in the existing 2-acre area infiltration basin and existing infiltration ditch to successfully manage surface water.

At the current rate of landfilling, without the proposed action, the permitted KLF will reach capacity in 2014. Once permitted and evaluated through the Hawaii Environmental Policy Act process, the vertical expansion could be permitted and implemented in relatively short order to meet the anticipated demands, as very little (if any) construction would be required to begin accepting waste.

In summary, the first phase of the proposed vertical expansion would be completely contained within the existing, permitted Phase II/Cell 1 footprint, and the second phase of the proposed vertical expansion would be completely contained within the planned Cell 2 footprint. The net effect of the proposed vertical expansions would be to provide for safe disposal of MSW on the island for years to come, by making the landfills higher, without increasing lateral coverage.

AECOM

Determination of Effect

Actions relevant to the State Historic Preservation Division for this project include historic preservation clearance. As the proposed work would be conducted in areas previously heavily disturbed, the County is seeking concurrence that the proposed vertical expansion will have no adverse effect on significant historic properties. Past construction projects at the KLF have been cleared by SHPD as intensive cultivation has altered the land, previous grubbing/grading has altered the land, and a previous accepted archaeological inventory (1993) survey found no historic properties anywhere on the property.

In light of existing importance and need for this project, we respectfully request your response and concurrence within 30 days of this letter.

Should you have any questions, please contact Julie Zimmerman of AECOM at Julie.Zimmerman@aecom.com, or 808-356-3592.

Sincerely,

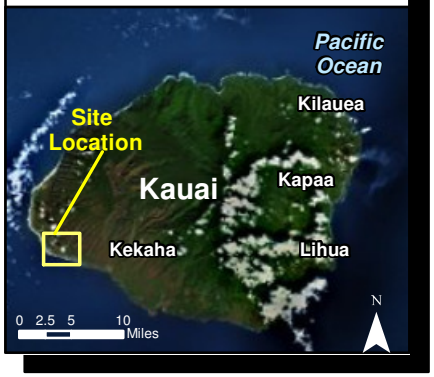
Frank Cioffi, AECOM

cc:

Donald Fujimoto, County of Kauai
Troy Tanigawa, County of Kauai
Julie Zimmerman, AECOM

Enclosures

LOCATION MAP



LEGEND

Roads

NOTES

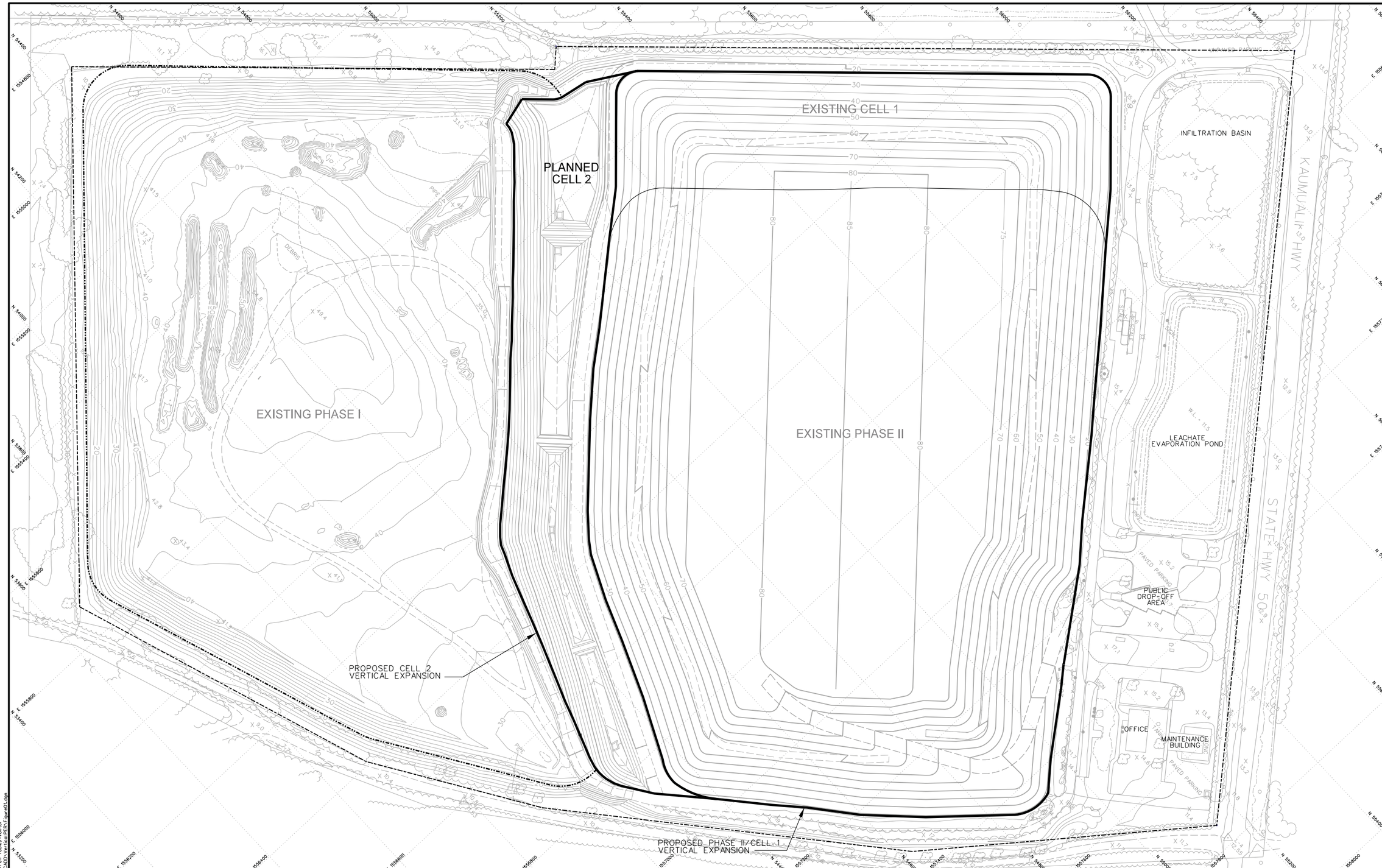
1. Map projection is Hawaii State Plane, Zone 4, NAD83.
2. Base map: ArcGIS Bring Map Aerial

N

0 1,000 2,000 4,000 Feet

Figure 1-1
Site Location Map
Kekaha Vertical Expansion
Kauai, Hawaii

P:\ENV\Non-Federal\County of Kauai\60135722 KAUAI-Kekaha Cell 1\07 Deliverables\GIS\02_MXD\Figure 1-1 - Site Location Map.mxd



LEGEND

- EXISTING TOPOGRAPHY
- PROPERTY LINE
- EXISTING LIMIT OF WASTE
- PROPOSED LIMIT OF WASTE

NOTES:

1. TOPOGRAPHIC MAP PREPARED BY AEROMETRIC, INC., SEATTLE, WASHINGTON. DATE OF FLIGHT: APRIL 20, 2012.
2. HORIZONTAL DATUM IS BASED ON NAD83 (1986), HAWAII ZONE 4. VERTICAL DATUM IS SITE SPECIFIC AND CORRELATES TO DESIGNATED USGS BRASS MONUMENT G1000 PLUS 1.21 FEET.

Figure 2

SCALE 0' 50' 100' 200'

NO	REVISIONS	DRN	CHK	DATE

Sheboygan, Wisconsin

DRN	DRB
DES	NKW/TCR
CHK	FLC/MRH
APP	KJB

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PREPARED BY AECOM

KEKAHA SANITARY LANDFILL
KAUAI, HAWAII

CELL DEVELOPMENT

DATE	MAY 2013
PROJECT NO	60135722
FILENAME	Figure01.dgn
SHEET NO	
DRAWING NO	1

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Pentable = G:\Work\Library\Plotting\Pen Tables\BL.tbl
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Appendix B
Archaeological Inventory Survey

Archaeological Inventory Survey and Subsurface Testing at the Kekaha Phase II Landfill Site

(TMK 1-2-02:9)

DRAFT

by

William H. Folk, B.A.
and
Hallett H. Hammatt, Ph.D.

with Historical Research
by
Gerald K. Ida, B.A.

Prepared for

Harding Lawson Associates

Cultural Surveys Hawaii
August 1993

ABSTRACT

An archaeological inventory survey including extensive subsurface test excavations by backhoe was conducted in May 1993 on 63.2 acres known as TMK 1-2-02:9 for the Phase II expansion of the Kaua'i County landfill at Kekaha, Kaua'i.

The ancient landscape, dominated by dunes of calcareous sand, was leveled for plantation use.

An historic canal cutting the parcel in two from north to south, and a linear mound oriented perpendicular to the canal were both constructed by mechanically mounding up sand deposits derived from the surrounding area. These features are the remains of an attempt, in the 1950s, to farm potions of this land. This information was related to the authors by Mr. William Martin of Kekaha sugar company.

No historic cultural resources were evident in the project area or in the subsurface deposits. It is likely that if cultural resources were present in the project area in the past they were removed with the sand dunes.

No further archaeological study is recommended for the proposed landfill expansion site.

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INTRODUCTION

On May 19 through May 23, 1993 personnel of Cultural Surveys Hawaii conducted an archaeological inventory survey of the 63.2 acre site (TMK 1-2-02:9) proposed for Phase II expansion of the existing landfill located at Kekaha, Kaua'i (Figure 1-3). Inventory survey of this parcel included subsurface test excavations by backhoe (Figure 4). The archaeological work was done for Harding Lawson Associates at the direction of Kaua'i County.

Scope of Work

The following Scope of Work, developed in conjunction with and approved by the State Historic Preservation Division, Department of Land and Natural Resourses, was utilized for the inventory survey of the Phase II Landfill site at Kekaha;

1. A ground survey of the project area was conducted for the purpose of archaeological site inventory. All sites located were to be described and mapped with evaluation of function, interrelationships, and significance. Documentation was to include photographs and scale drawings of selected sites and complexes. Any historically significant sites were to be assigned State Site numbers.

2. Subsurface testing in the project area was conducted to determine stratigraphic history of sediments and to determine depth and quantity of cultural materials within archaeological sites, if any; and to obtain datable samples for chronological information. Because no surface archaeological sites were present in the project area, testing included excavation of approximately one trench per acre throughout the project area to determine presence or absence of buried cultural layers and to record stratigraphy.

3. Research on historic and archaeological background - including a search of historic maps, written records, Land Commission Awards and associated native and foreign testimony - was conducted. The research focused on the specific area with general background on the *ahupua'a* and district, with an emphasis on settlement patterns as they are related to the project area.

4. Preparation of this survey report which includes;

    a. A map of the survey area showing the location of excavation trenches;
    b. Description of the stratigraphic record of sediments within the project area today with selected photographs, scale drawings, and discussion;

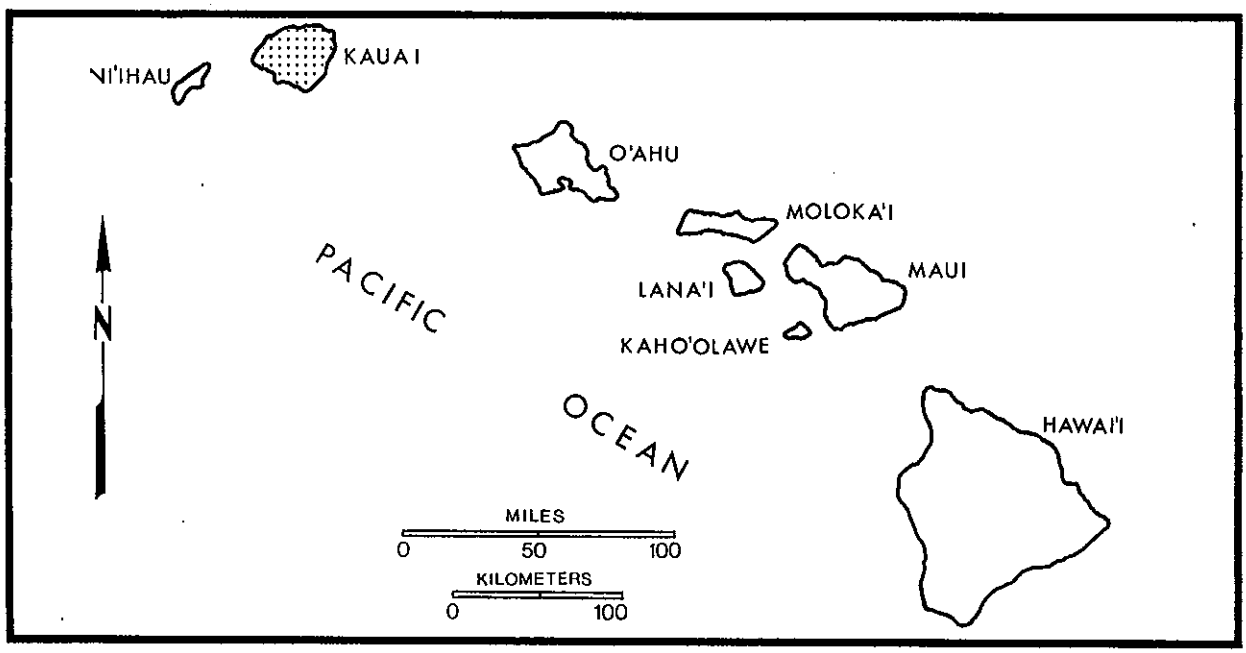

FIGURE 1
State of Hawai'i

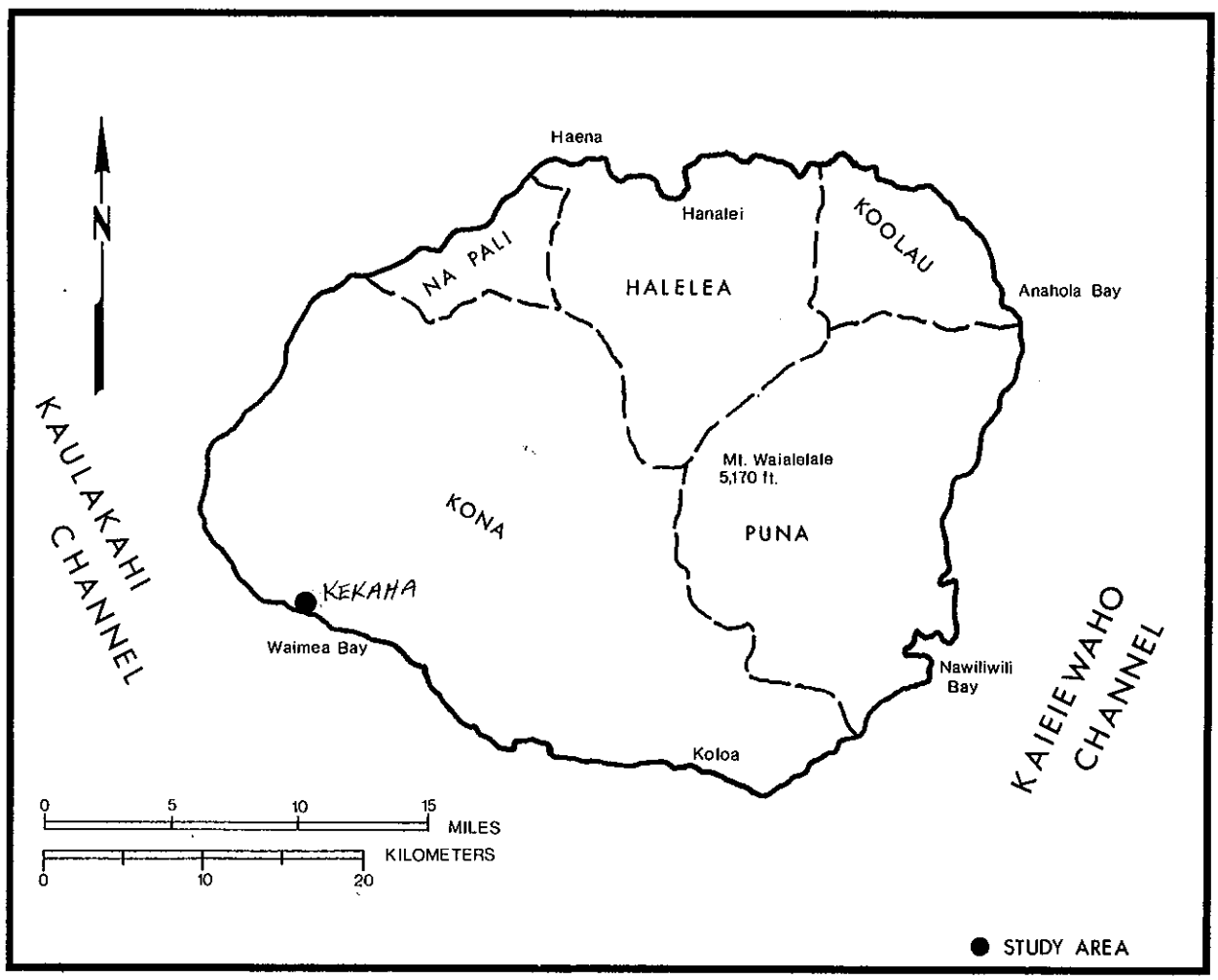

FIGURE 2
General Location Map, Kaua'i Island

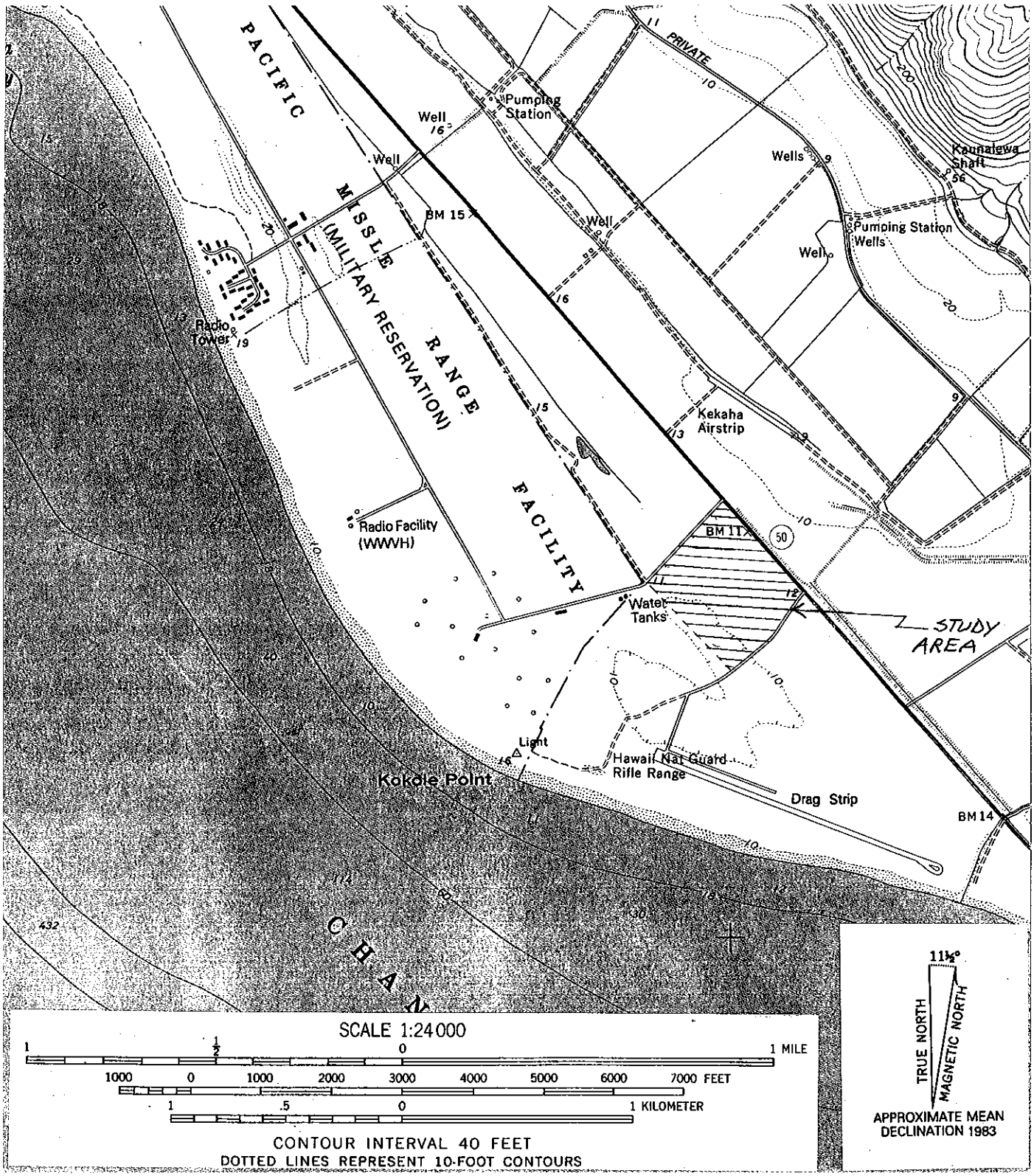

Figure 3 Portion of USGS Topographic Map, 7.5 Minute Series, Portion of Kekaha Quadrangle, Showing Project Location

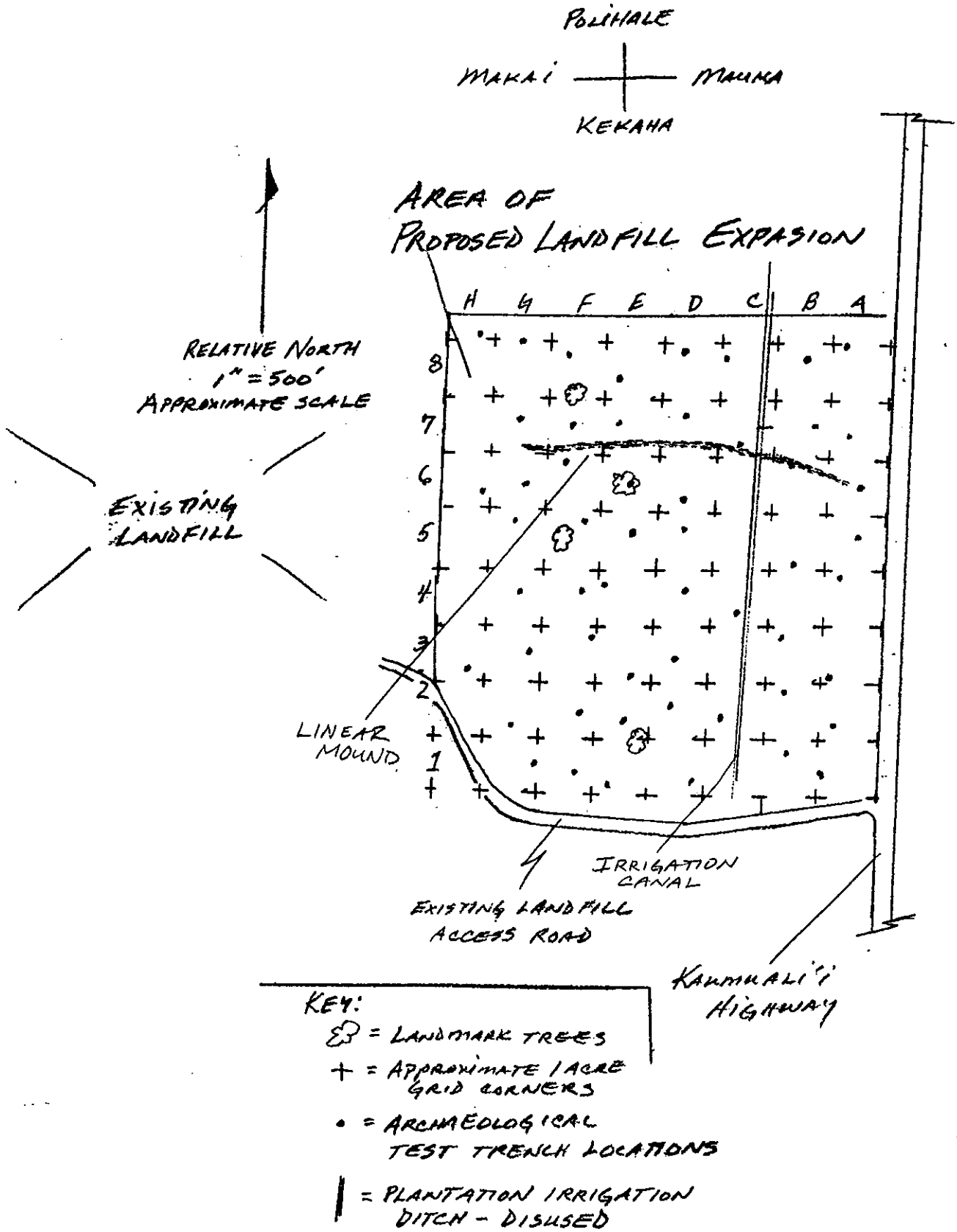

Figure 4 Project Area Showing Location of Test Excavations and Historic Surface Features

c. Historical and archaeological background section summarizing prehistoric and historic land use as they relate to the project area;

d. Recommendations based on all information generated which will specify what steps should be taken to mitigate impact of development on archaeological resources, if any.

Project Area Description

The Kekaha Landfill, and Phase II expansion - the area of archaeological study - is located at the south end of the Mānā plain. The Mānā Plain is situated at the base of ancient sea cliffs at the extreme western end of Kaua'i island. This plain is constructional in character with calcareous sands dominating the seaward margin, and terrigenous alluvium from the valleys of the western slopes of the island dominating the landward margin. The seaward margin of the plain is a beach ridge built upon a submerged wave-cut terrace (Macdonald and Abbott 1974:395). The beach ridge forms a barrier against the sea which created a shallow lagoon environment inland. The lagoon was drained and filled during the mid-nineteenth century to create Mānā Plain as it appears today. Part of the seaward barrier of the plain consists of a formation of "Moderately to well cemented calcareous sand dunes...[that] appear to have formed during the Waipio stand of the sea." (*Ibid*). Remnants of these cemented dunes are extant to the south near Kekaha but little evidence of them are found within the study area where beach sediments predominate.

The Kaua'i island soil survey by Donald Foote, *et al.* (1972) describes soils in the project area as Jaucas loamy fine sand, occurring on old beaches and on windblown sand deposits. Annual rainfall in the project area is less than 20 inches, occurring primarily in the fall and winter months (September to March). Maximum and minimum average temperatures throughout the year vary little from other coastal areas around Kaua'i, but in the field it feels considerably hotter due in part to more variable and lighter winds on this leeward side of the island.

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HISTORICAL AND CULTURAL OVERVIEW

OF LAND SETTLEMENT AND USE IN KEKAHA, KAUA'I

by
Gerald Ida, B.A.

Introduction and Setting

Kekaha is a locality in the *ahupua'a* of Waimea on the southwest side of the island of Kaua'i. Part of the old district or *moku* of Kona, the Waimea *ahupua'a* is by far the largest on the island, comprising 92,646 acres, more than a quarter of the total land area of Kaua'i. It encompasses all of the Waimea River Canyon area, the uplands of Kōke'e, the high swampy plateau of Alaka'i and the northwestern coastal valleys of Nu'alolo and Miloli'i (Boundary Commission 1875: 140-146).

On the southwestern leeward coast, a broad, flat plain stretches between the Waimea River delta and Polihale to the north. It is here that Kekaha is located, backed on the *mauka* side by steep low cliffs and a series of small valleys and gulches.

Because of its size, the Waimea *ahupua'a* includes several regions which are very different in climate and terrain. These differences essentially dictated the kinds of resources that were available, and hence had much to do with the way the *ahupua'a* was settled by prehistoric Hawaiians. The well-watered valley and delta of the Waimea River were ingeniously developed and engineered for wetland agriculture, and represent the epitome of the typical Hawaiian and Kauai'i-type valley settlement (Handy 1972:393-397).

In contrast, Kekaha and other settlements on the Mānā plain suffered from a definite lack of fresh surface water. The *mauka* gulches had only intermittent stream flows and water sources were primarily springs along the base of the cliffs. For this reason, this portion of the report will focus mainly on the specific area of Kekaha and not attempt to cover the entire *ahupua'a* of Waimea.

The *Ahupua'a* of Kekaha?

Although the Boundary Commission officially surveyed and set the bounds of the *ahupua'a* of Waimea in 1875 as generally described previously, there are a few sources which contradict this, maintaining that Kekaha was a separate *ahupua'a*.

Testimony in the mid-1800s that supports the native land claim of R. Naumu refers to the "Kekaha ahupua'a" in describing the properties (Native Testimony, n.d. Vol. 11:15).

Valdemar Knudsen, an early *haole* settler in the area, also refers to the "ahupua'a of Ketaha" in a letter to John Dominis, Commissioner of Crown Lands (V. Knudsen 1866:3). A late 19th century map (Imlay 1891) shows a pie-shaped land section that is labelled "Kekaha," indicated by a dotted line boundary that encompasses the area from the top of Waiaka ridge to the shoreline (Figure 5).

Handy (1972:427) implies that Kekaha as well as Polihale and Mānā were individual *ahupua'a* of Waimea however the reasoning for this is not given. However, the native land claim of Elia Lihau for the land of Wai'awa, just west of Kekaha, concedes that this area was indeed part of the *ahupua'a* of Waimea (Native Claims 1848; Vol. 9:244).

Admittedly, it is unusual for a single *ahupua'a* to occupy such a large percentage of the land area of a major Hawaiian island. It could easily be argued that the comparatively low agricultural productivity of the Mānā plain due to the scarcity of water, is the basis for its inclusion into Waimea.

However the same cannot be said for the watered valleys of Nu'alolo and Miloli'i, both of which could easily support typical and self-contained valley settlements of perhaps small but stable populations.

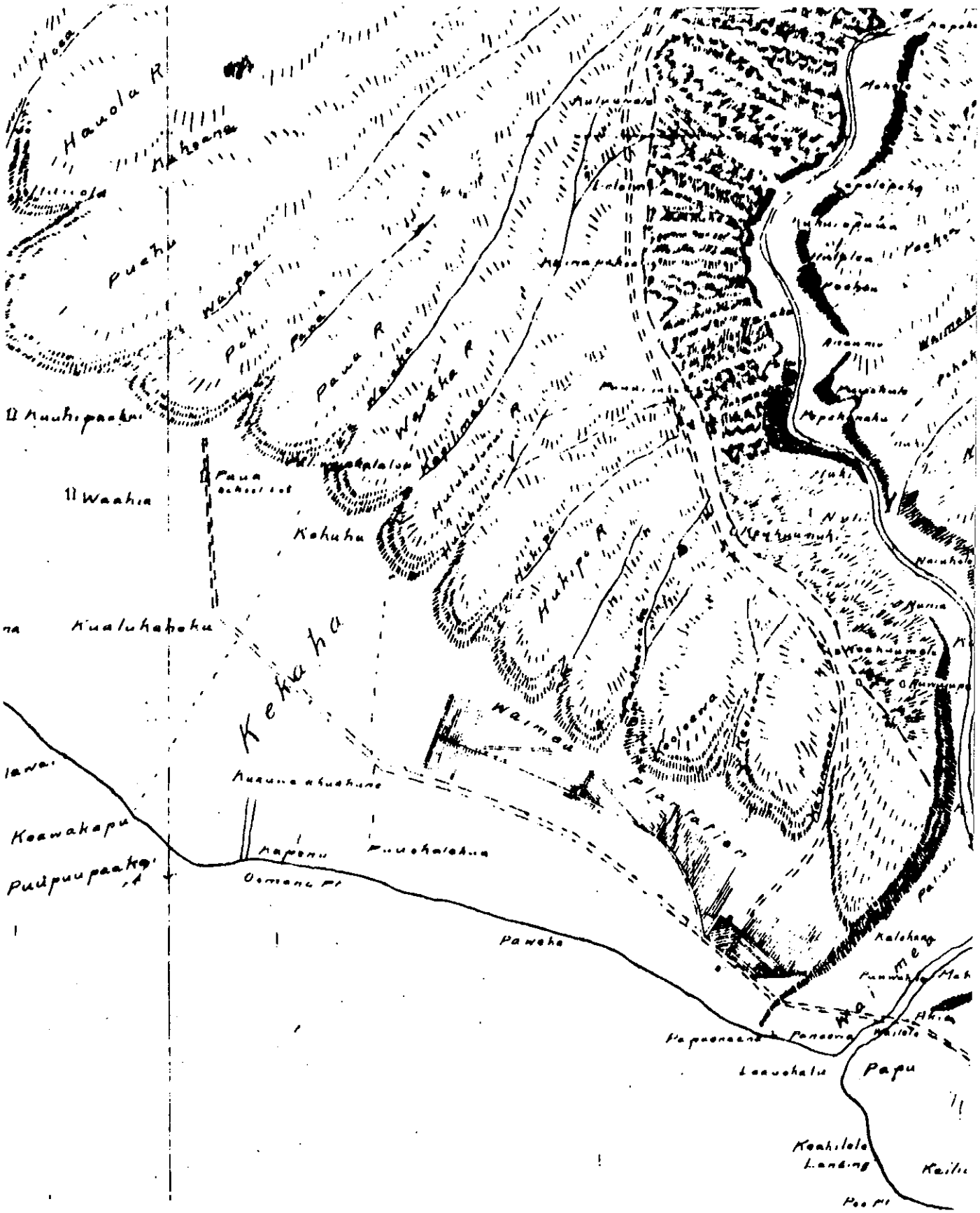


Figure 5 L.E. Imlay Map of Gay and Robinson Lands, Kekaha Area, 1891

It could also be speculated that Waimea, being one of the two areas of the island that traditionally was the domain of the high chiefs (the other being Wailua), commanded the resources of the large upland region of Kōke'e and Alaka'i, among them the large *koa* trees out of which the hulls of canoes were hewn, and forest birds which supplied the feathers for cloaks, capes, and other items associated with the *ali'i*.

It is quite possible that at one time, Waimea was divided into several smaller *ahupua'a* , perhaps before the Great Mahele or even in pre-contact times. To ignore this possibility could only cultivate a static and non-developmental view of the Hawaiian land system and Hawaiian society in general. The exploration of this matter could well be a major topic of further research.

The Place Name: Kekaha

Pukui (1974:106) gives the literal translation of Kekaha as "the place." However, Handy's (1972:54) definition gives more insight as to the descriptiveness of the place name.

> Kaha was a special term applied to areas facing the shore but not favorable for planting. Kekaha in Kona, Hawaii, was one so named, and Kekaha on Kauai another.

Kelly (1971:2) describes Kekaha on the island of Hawai'i as *'āina malo'o* or "dry land," and indeed the same could be said of Kekaha, Kauai'i if one considered the area's low annual rainfall and lack of perpetual streams. Kekaha, however, was not void of water or of a prehistoric population which made use of the local resources.

1797 to 1850

A thorough search of major Hawaiian myths and legends found no mention of Kekaha, but the first western description of the place comes only nine years into the post-

contact era. William Beresford was the supercargo on board the British ship Queen Charlotte under Captain George Dixon which, along with the King George, captained by Nathanial Portlock, sailed on an exploratory voyage to the northwest coast of America. In 1798 both ships wintered in Hawai'i, spending much time off Waimea, Kaua'i. On one of the several shore outings, Beresford visited nearby Kekaha, which he called "A Tappa" (Dixon 1968:124-126).

> Having frequently heard our people who had been on shore speak of a village, called by the natives A Tappa, where a great number of people were commonly employed in manufacturing cloth, curiosity prompted me to walk to that place first, as I found it was not more than three miles distant, so that I could easily get back by Tyheira's dinner time.
>
> The country, from the place where we landed to A Tappa is tolerably level, and for the space of two miles, very dry. The soil here is a light red earth, and with proper cultivation, would produce excellent potatoes, or any thing that suits a dry soil; but at present, it is entirely covered with long coarse grass: the inhabitants, I suppose, finding plenty of ground near their habitations, more conveniently situated for their various purposes. So far, the space from the beach to the foot of the mountains, is about two miles in breadth; but from hence to A Tappa, it grows gradually narrower, till it terminates in a long sandy point, which I have already observed, is the West extreme of Wymea Bay.
>
> A Tappa is a pretty large village, situated behind a long row of cocoa-nut trees, which afford the inhabitants a most excellent shelter from the scorching heat of the noon-day sun. Amongst these cocoa-trees is a good deal of wet swampy ground, which is well laid out in plantations of taro and sugar-cane.
>
> I had laid my account in seeing their method of manufacturing cloth; but here I was mistaken. A number of our people, prompted by the same curiosity as myself, were got to A Tappa before, where "Labour stood suspended as we passed." The people flocked eagerly about us; some asking us to repose ourselves under the shady branches of trees planted about their doors; other running to the trees for cocoa-nuts and presenting them to us with every mark of kindness and good nature; in short, every inhabitant of the village was fully employed, either in relieving our wants, or gratifying their curiosity in looking at us.
>
> The day being very sultry, we walked leisurely back, and I returned by a different path from that I had taken, in going to A Tappa. On examining the grass, which in most places is higher than the knee, I found

> it no altogether of a rough coarse sort, but intermixed with various sorts of flowers, together with different grasses, of the meadow kind; so that I have no doubt, with proper management, it would make excellent hay.

Oddly, Beresford's remark that the dry soil conditions in the area would be most suitable for potatoes is in line with Handy's (1972:410) assertion that the sweet potato was probably the prime staple of the village, and not taro because of the limited water resources.

While Beresford described taro, sugarcane and coconut being cultivated in Kekaha, no mention is made of *wauke*, the inner bark of which is the raw material for making *kapa* or bark cloth. This seems curious in light of his statement that cloth-making was a major activity of the village and the main purpose of his trek there was to observe this process.

Due to the climatic conditions, the Mānā plain was probably not a prime *wauke* growing area (*Ibid.*:209). However Beresford did note on a later excursion through the lower Waimea Valley that "cloth mulberry" trees were numerous around the house sites there (Dixon 1968:131). It may be likely that there was some sort of trade going on between the residents of Waimea and Kekaha involving the raw material and the labor which turned it into cloth.

Native claims for land made to the Board of Commissioners to Quiet Land titles in 1848 also sheds some light as to land settlement and use in the area during the early historic period. Only three claims were made in and nearby Kekaha.

Keaona (No. 8841) claimed a house lot, six *lo'i* and some *kula* land near the base of the *pali* at Pōki'i, about a mile north of Kekaha (Native Register 1848; Vol. 9:397). Elia Lihau (No. 6698) claimed all the land of Wai'awa (just west of Pōki'i), most of which was unused *kula* but included a restricted fishery. This claim was never awarded (Native Testimony, Vol 11:155).

The only one to claim land actually in Kekaha was B. Naumu (No. 5386). Mentioned here are *lo'i* , a house lot, salt bed (*aliapa'akai*) and a *muliwai* called Kapenu. Naumu developed the *lo'i* in 1844, stating that it was previously overgrown land (*Ibid.*:146).

A 1891 map of West Kaua'i by L.E. Imlay (see Figure 5) shows Kapenu as a stream entered the ocean just east of 'Ō'ōmanō Point. A later map (Evans 1921) does not show the stream but places one of Naumu's awarded lots in the same area near the shore (Figure 6). He was also awarded a parcel in Kekaha at the base of the *makai*-facing *pali* of Hululunui Ridge.

Interestingly, Evans' 1921 map shows an irregular-shaped depression occupying the southeast corner of Naumu's beach lot. In a more recent map (Tax Map; Figure 7) this same depression is labelled a fish pond, and was probably of the *pu'u one* type. Naumu makes no mention of such in his claim and the pond was probably developed in a later historic period by him or his heirs.

1850 to 1900

Most sources of historical accounts of Kekaha during this period are letters, papers, and books authored by Valdemar Knudsen and his immediate offspring Eric A. Knudsen and Ida Elizabeth Knudsen Von Holt. Knudsen came to Hawai'i from Norway via the mainland where he had business dealings. He settled at Wai'awa in 1854 as a rancher, agriculturalist and later, sugar planter.

Knudsen took over the lease of government land there from Archibald Archer and a Mr. Gruben. The two men were involved in a failing tobacco farming enterprise. Associated with them was a Mr. Clifford who made cigars (Lydgate 1991:92).

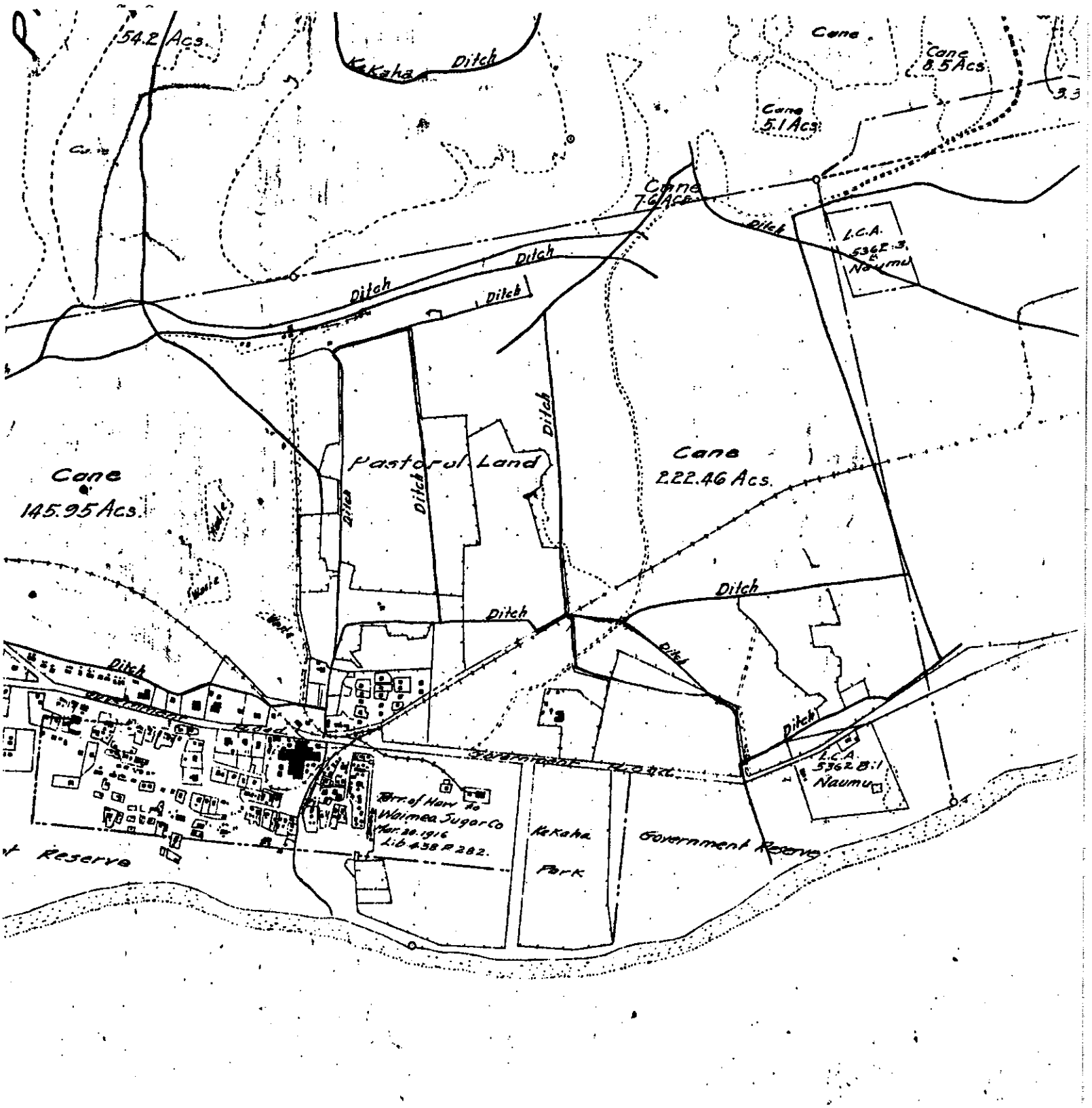


Figure 6 T. J. Evans Map of Kekaha Cane and Pasture Lands, circa 1921

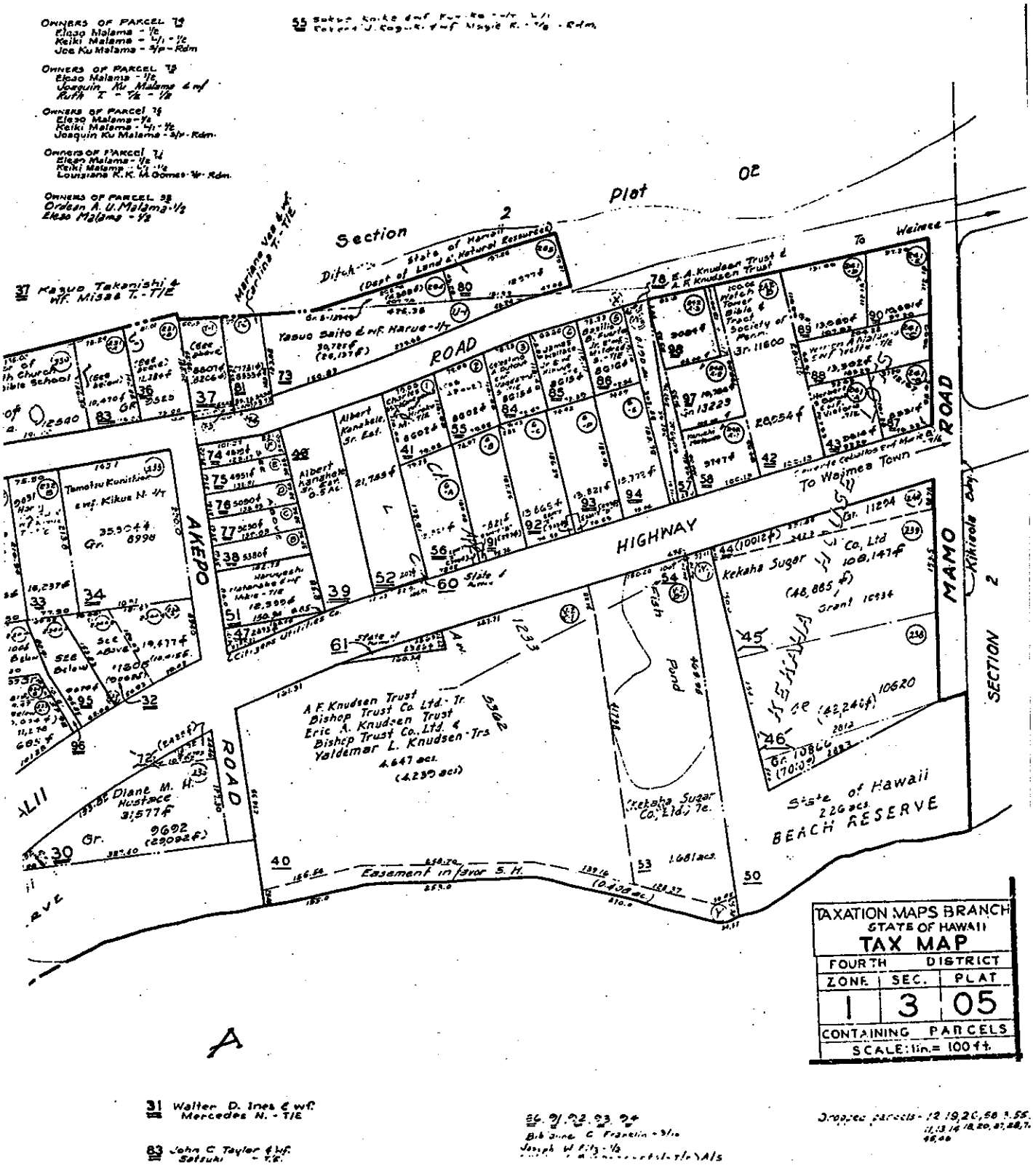


Figure 7 Tax Map 1-3-05 Showing Area of Naumu Land Commission Award

Eventually Knudsen controlled the entire district, excluding *kuleana* lands, from Nu'alolo to Waimea, including all the *mauka* area (E. Knudsen 1945:35). In this post-Mahele era, he held the title of *konohiki*, and Hawaiians with no *kuleana* of their own who lived in the district, reportedly numbering three to four hundred people, worked for Knudsen three days out of the month as "rental" payment (Von Holt 1985:61).

As a side note, among the employees on Knudsen's ranch was a young Hawaiian from Kekaha named Ko'olau who would later become famous as the leprous "outlaw" who defied banishment to the leper settlement at Kalaupapa, Moloka'i and successfully held off a siege by government troops on his refuge in Kalalau Valley on the Nāpali coast of Kaua'i (Hofgaard 1991:108-109).

Knudsen described Kekaha as "a low marsh land, full of fish ponds and cocoanut-trees, but the ponds are overgrown with bulrushes and would cost more than they are worth to bring in order. I tried once and it cost me circa $200.00. - There is not much grazing lands belonging to Ketaha and it is chiefly pili grass" (V. Knudsen 1866:304).

Valdemar's son Eric, later made this observation (1991:98):

> From Waimea towards Mana there were no tree, no fences, no cane, all was open country; along the taro patches of Kekaha and Pokii grew quite a number of cocoanuts. The mango trees were planted by my father. Numbers of Hawaiians lived about Kekaha and Pokii, where there were springs and taro land. Then the land was bare again until you reached Waiawa. Above the road in Pokii, where the cane loaders now stand, was a row of thatched houses and the natives planted a lot of tobacco.

Evidently the area had changed little since Beresford's visit in 1787.

The perpetual swamplands of the plain apparently were greatly enlarged during periods of heavy winter rains. It was possible on these occasions to paddle a canoe from Mānā to Waimea on this inland waterway (*Ibid*:99; Von Holt 1985:77-78).

Waterfowl present in the wetlands provided a food resource for the area residents. Among them the koloa and especially the 'alae and āe'o (kukuluāe'o) were numerous (Von

Holt 1985:78). All three were traditionally caught and consumed by the Hawaiians (Malo 1951:39).

Kekaha was watered by a spring called Kauhika located at the base of the *pali.* The spring had a fishpond, then taro *lo'i* and rice fields before flowing into the swamp (E. Knudsen 1945:62).

Most of the residents also lived in this area, near the water source and cultivatable lands. An anecdotal description is given by Eric Knudsen (1991:101, 102):

> A row of grass houses extended all the way along the foothills from Waimea to Mana. Every house site had a name. To find a man you had to find his house name. The natives seemed to know every name and would keep sending you along until you finally came to the spot you were looking for.
>
> At certain hours all the women sat in their houses and beat tapa cloth and as they beat they talked to one another in a tapa beater's code. They could send a message with great speed from Waimea to Mana. When the men returned from the mountains with fire wood or canoes, the woman that saw them at once tapped out the news and it flew from house to house with the result that every man, when he came home, found his house in order and no surprised visitors hanging around. The men tried to learn this secret code but never did, though an old man at Mana told my father that the men had tried for years to learn the secrets of the tapa code but were never able to do so.
>
> The grass houses were all built in one general design - one big living room and two doors - one on each side and opposite to one another. One day my father noticed that all were built with their gable-ends east and west and the doors facing the ocean and the hills. He asked one of the men why that was so and he replied, "Why, you know that Po, the abode of the dead, lies under the ocean just outside Polihale, where the cliffs and the ocean meet, and the spirits of the dead must go there. As the spirits wander along their way to Po, they will go around the gable-end of a house but if the house stood facing the other way, the spirits would walk straight through and it would be very disagreeable to have a spirit walk past you as you were eating your meal. "In fact," he continued, "we can always tell when a battle has been fought by the number of spirits passing at the same time."

Between the swamp and the shoreline was a broad sand deposit, likely inhabited by fishermen on the *makai* side. At Pu'upu'upa'akai ("salt piled in heaps") on the shore

directly *makai* of the sugar mill, was the only canoe landing through the reef in the area. A "large settlement" was there with "canoe sheds lining the beach" (E. Knudsen 1945:50).

Rice Cultivation

Commercial rice growing came to the Kekaha-Mānā plain in the 1860s. The area's most prolific planter was Leong Pah On, a Chinese immigrant (Joesting 1984:206).

Pah On started farming in Waimea Valley and eventually met Valdemar Knudsen who allowed him to cultivate the swamp lands. He imported Chinese laborers, drained the swamps with ditches brought in water buffaloes and eventually acquired more land. At his peak he had about 600 acres in rice throughout Mana, Kekaha and Waimea (Char 1979:21).

Pah On's enterprise ended suddenly in 1922. The leases on government lands were expiring and H. P. Faye, manager of the Kekaha Sugar Co. convinced Pah On not to bid on new leases and let the sugar company take over control of the land. In return Kekaha Sugar would sub-lease the rice fields back to Pah On. The successful rice grower could have easily out-bid the sugar concern, but agreed to the plan. When Kekaha Sugar secured the leases its board of directors overruled Faye and denied any subleases to Pah On (*Ibid.*:22).

Sugar

The Reciprocity Treat of 1876 between the United States and Hawai'i gave impetus for the expansion of the sugar industry throughout the islands. The first commercial cane in the Kekaha area was planted in 1878 near Pōki'i by Knudsen and a partner, Christian L'Orange. Hane P. Faye, Knudsen's nephew, was brought in as another grower, and it

was he who dug the fist artesian wells in the islands at Kekaha. With a steady but still small water source, investors showed interest and the Kekaha Sugar Co. was incorporated in 1898 (Wenkam 1977:63; Joesting 1984:216-217). The mill was set up on the sand lands of Kekaha at the *makai* edge of the swamp, its foundations set deep into the underlying coral (E. Knudsen 1945:161-162).

The Kekaha Sugar Co. saw expansion after 1907 when the construction of the plantation's major irrigation ditch was completed. The engineering feat brought water to the area from eight miles up the Waimea River via a series of ditches, flumes, tunnels and siphons (Thrum 1918:158-159).

Summary and Settlement Patterns

A settlement pattern emerges through the study of historical material concerning the Kekaha area.

Permanent habitation areas were mainly among the *mauka* foothills, at the bases of the shore-facing cliffs. Extending up the gulches were agricultural areas watered by rainfall and intermittent streams. This has been confirmed by the archaeological investigations of Bennett (1931:103) and Sinoto (1978:2-6).

Makai of the foothills were fishponds and cultivated wetlands fed by springs. Beyond this was the great swamp, then the broad stretch of the sand lands which continued to the shoreline. Fishing camps and other temporary habitation areas existed on the beach and in the inland stretches of the sand there were burials.

This scenario was likely in place at the time of first western contact and remained relatively undisturbed throughout most of the 1800s.

Since then, much physical evidence of this settlement pattern has been obliterated

by commercial agriculture and other operations. The foothills and wetland areas have been extensively planted in cane, livestock has been run up the gulches, and even the beach areas have been much disturbed by massive shoreline stabilization projects.

Archaeological Research in Kekaha

There has been little large-scale and systematic archaeological research in the Kekaha area. The authors checked with the Hawaiian Homes Land Planning Office in Honolulu and were told that no systematic survey of the Kekaha area was done by them, although notes had been gathered in old times (Mr. Charlie Ice, Pers. Comm.) However, the sizeable number of small-scale studies have covered a variety of terrain and elevations. A summary of these studies can help in developing a predictive model for site location in this leeward environment.

Narrow Valleys and Ridges

William Bennett, in his 1931 *Survey of Kauai* (Bennett 1931), recorded major prehistoric sites in the vicinity of Kekaha (Sites 11-16). These are listed by Bennett as

> Site 11. Makahoe heiau and village site on Niu ridge, Kaunalewa. A small, platform village shrine. Thrum describes the village as "Four and one-half miles from the coast and at an altitude of 1200 feet. This village had about 0.5 acres of taro land besides the dry crops to depend on." On the inland side of Niu ridge small valleys are found with small streams and a few taro terraces. Petroglyphs were reported for this area.
>
> Site 12. Hooneenuu heiau, along the ditch line inland from the government road near the center of Kaunalewa ridge.
>
> Site 13. Burial caves, on Kaunalewa ridge.
>
> Site 14. Two small heiaus, near Waiawa, described by Thrum as a 12 by 20-foot shrine, and an 18 by 28-foot shrine.
>
> Site 15. House sites and taro terraces, in Waiawa valley.

Some taro lines may still be seen in lower Waiawa valley. Many house sites are in evidence. They consist for the most part of leveled ground, faced in front with stone, or merely outlined with stone.

Site 16. Hauola heiau, in Hoea valley at the base of Hauola ridge.

Site 17. Burial caves, on Pokii ridge (Bennett 1932:102-103).

Bennett provides greater detail on these sites in his text, but the important point is that he shows habitation evidence in small valleys dissecting Niu Ridge as well as on the ridge itself. Waiawa Valley contains "many" house sites and associated taro *lo'i* and *heiau* appear both in valleys and on ridges.

A check of the USGS Map shows that even the narrowest valleys and ridges have names and if one compares this to other dissected slopes in leeward environments. The place names are not always so ubiquitous on small features such as these.

Bennett's Survey apparently predated at least some of the land impact associated with sugar growing and was early enough to record sites at the base of the Waimea slope and to allow us to take note of the former importance of this area for the traditional Kekaha Hawaiians.

Sinoto returned to the bases of these narrow valleys overlooking present Kekaha Town in 1978 during a study for potential rock borrow areas for the Corps of Engineers (Sinoto 1978). Archaeological sites were noted in Waiakea, Pawa, Waipoao, Waiawa, Kahoana and Hō'ea. These sites survived in spite of heavy impact of sugar activities and grazing and provide reinforcement for this particular zone edging on the Kekaha flats as being a focus of permanent Hawaiian habitation with a steady supply of water from springs.

The Swamp Lands

The swamp lands between the cliffs and the sand flats are now the level sugar fields of Kekaha. Draining of the once giant swamp for agriculture began before this century and presently archaeological potential here is nil. However, this does not mean that the Hawaiians did not use this land. Its fringes would be useful for taro, and water fowl must have been abundant at times. There are accounts of widespread seasonal flooding of these lands. It is a reminder of the adaptability of Hawaiian planters to recount a unique method of taro growing practiced at Mānā as related by Pukui,

> As the plants grew, the rootlets were allowed to spread undisturbed, because they helped to hold the soil together. When the rainy season came, the whole was flooded as far as Kalamaihiki, and it took weeks for the water to subside.
> The farmers built rafts of sticks and rushes, then dived into the water. They worked the base of the taro mounds free and lifted them carefully, so as not to disturb the soil, to the rafts where they were secured. The weight of the mounds submerged the rafts but permitted the taro stalks to grow above the water just as they did before the flood came. The rafts were tied together to form a large, floating field of taro (Pukui 1983:232).

The Sandy Plan and Shoreline

The bulk of the short archaeological studies in Kekaha have been done on the flat lands near the coast. Sand deposits between the swamp lands (now drained sugar fields) and the ocean have high potential for shoreline occupation and scattered human burials, particularly along the *mauka* fringes of the sand bar.

Human burials have been discovered in sand deposits in Waimea Town to the east of Kekaha (Cox 1975; Kikuchi 1985) and short archaeological reconnaissance studies of sand areas have noted potential for burials even though none were immediately found (Ching 1982; McMahon 1988a, 1988b; Bordner 1977).

Although Bennett recorded cave burials along the slopes and ridges it is also clear

that sand burial was commonly practiced around Kekaha. Although human burials could occur scattered throughout the sandy plains it is predicted that the larger clusters of burials will be found at the *mauka* fringes of the sand bar, fringing onto the former marsh.

An existing public cemetery lies at the east end of Kekaha down Iwipolena Road (See Figure 7). This cemetery of nearly 2 acres was examined during the present project. Tombstones show interments throughout the last fifty years in the main part of the cemetery. However, at the northern end are older style graves marked by rectangular stone alignments and stone-lined earthen mounds. It could be that this cemetery has been in use well into the last century and perhaps even before.

Closer to the shoreline would have been the fishing oriented settlements now represented by cultural layers buried in backshore sand deposits. There were probably also occasional fishponds and salt pans. The occurrence of Hawaiian activity along the shoreline would be strongly influenced by the location of suitable canoe landings. For example, *pu'u pu'u pa'a kai* was a canoe landing *makai* of the sugar mill with a large settlement (Knudsen 1945:50).

In short, we can divide the traditional Hawaiian settlement of the Kekaha region into 5 zones:

1. Ridges above the cliffs for dryland agriculture, forest gathering, and religious structures;
2. narrow valleys and slope bases with intermittent streams, narrow alluvial terraces, and some permanent springs. These areas supported taro growing and permanent habitation. The steep slopes of these valleys would contain burial caves. House sites were reported to be plentiful and closely spaced;

3. The swamp and marsh lands, the fringes of which would have supported taro farming and fishponds and which were probably an important source of water fowl.

4. The *mauka* part of the sand plain would be the preferred location for human burial;

5. Along the shoreline - the fishing camps and the settlements would be clustered around canoe landings with a few small *pu'u one* fishponds and many salt pans.

This can be expressed in table from, hopefully without oversimplifying.

Zone	Environment	Resources	Kinds of Sites
Zone 1	ridges and slopes	Kula land, forest products, dryland cultigens	*heiau*, burials on slopes
Zone 2	narrow valleys and slope bases	intermittent streams, springs, taro, sugar cane	*lo'i*, permanent houses, *heiau*, and terraces
Zone 3	marsh lands	taro, sugarcane, fowl, fish	fishponds, taro *lo'i* on marsh edges
Zone 4	sand plain, *mauka* portion	coconuts	clustered burials
Zone 5	sand plain, *makai* portion	coconuts, marine resources, salt	fishing camps, canoe landings, fishponds, isolated burials, salt pans

The Edge Effect

Perhaps the essence of the dynamic relationship between the Hawaiians and their environment in this fairly unique area is not in terms of a narrow perception of coping with a hot harsh land, but in terms of a concept known in ecology as the "edge effect" or use of ecotones. The most productive environment is that at the edge of 2 ecological zones. The boundaries between environments in Kekaha are sharply defined rather than transitional and most importantly there is much land occurring along these edges between environmental zones. This phenomenon serves to increase options and access to resources for human subsistence and can do much to explain the presence of a particularly flourishing community as reported in historic and archaeological sources.

SURVEY RESULTS

Surface Survey

Field Methods

The archaeological surface survey of the project area was carried out by walking contiguous parallel transects across the project area in a generally *mauka-makai* or east-west orientation with archaeologists spaced 50-60 feet apart. Ground visibility was good to excellent over approximately 80% of the area because of the presence of grazing animals and very dry climatic conditions. The 20% obscured area was covered by *kiawe* thicket, however, during testing some of the obscured area was penetrated with the backhoe and underwent subsurface testing. Our position in the field, and the location of adjacent survey transect lines were known at all times with the aid of an aerial photograph.

Analysis of the subsurface deposits was accomplished by excavating 55 backhoe trenches (refer to Figure 4) of a minimum of 10 feet in length and of varying depth, depending on cementation of subsurface layers and depth of the ground water table. The trenches were distributed roughly one per acre across the project area. A modern irrigation canal and an associated linear mound were excavated by trenching perpendicular to their lengths to illustrate their recent position in the stratigraphic sequence.

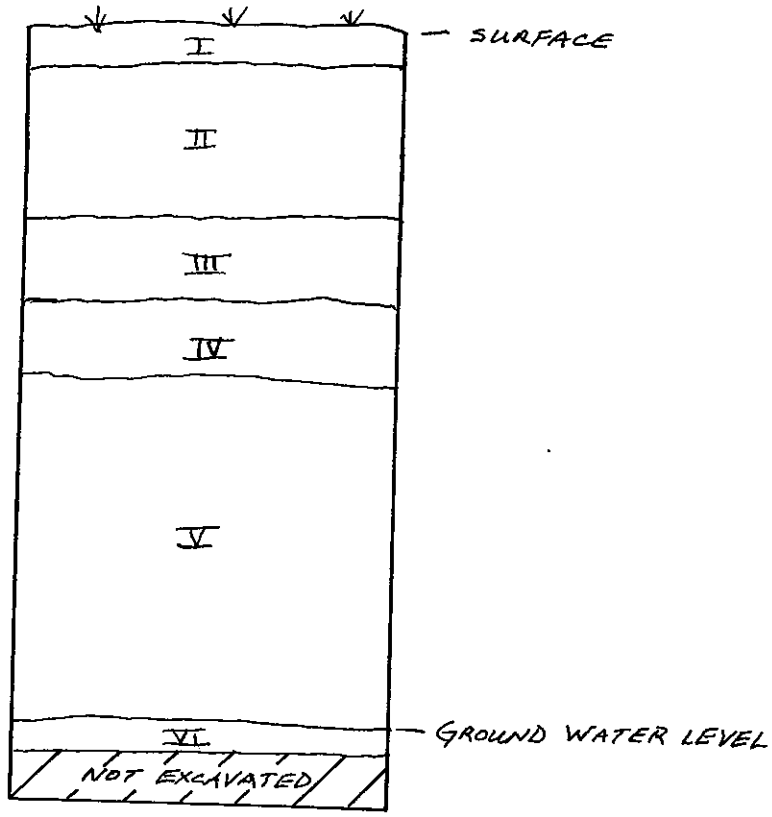
The stratigraphy in each of the 55 trenches was documented by means of profile drawings to scale with soil descriptions, of a representative one meter section. The stratigraphic profiles throughout the project area were uniform and predictable with similar strata and sequences and only minor differences in thickness. For this reason only a typical profile is shown to avoid presentation of repetitive information. Trenches through the modern canal and linear mound were drawn in their entirety.

Findings

The former natural landform is viewed by us to have been one of linear sand dunes oriented southeast to northwest, created by the northeast tradewind flow as it circles around the east and south sides of Kaua'i. These dunes once extended into the project area from at least as far east as the present day town of Kekaha. The last remnants of the dunes can still be seen there rising 30 to 40 feet (9-12 meters) above the leveled plain, now in cultivation. And the dune bases, on a foundation of beach sand extending well below the ground water level, can be traced across the landscape in various profiles of drainage canals and excavations for water lines and aquaculture ponds and throughout the project area. A typical profile in the project area is illustrated in Figure 8. That these dunes were altered or in large part obliterated by mechanical means to create level graded land for plantation agriculture and pasturage of plantation animals is clear from geomorphic and stratigraphic observations, reinforced by local oral sources - sugar company employees and long-time residents.

Since removal of the upper extent of the sand dunes, a weak A-horizon has developed on the new surface. The A-horizon averages about 10 centimeters thick across the majority of the project area (refer to Figure 8), except where it has been disturbed. There are places where the A-horizon has been removed by recent activity such as vehicular traffic and small scale (individual) sand mining. And beneath the few large trees in the project area the uppermost sediment layers are mixed by the milling of horses there.

Two modern-era surface features are present in the proposed landfill site or project area. These are an irrigation canal of mounded sand, and a low linear sand mound for irrigation control in the pasturages (see Figure 4). Both features stratigraphically post



KEY:

STRATUM I 10YR 5/3 BROWN. FINE LOAMY CORALLINE SAND. LOOSE. MODERN A-HORIZON. NO CULTURAL MATERIAL.

STRATUM II 10YR 7/6 YELLOW. FINE, WELL SORTED CORALLINE SAND. LOOSE EOLIAN DEPOSIT. NO CULTURAL MATERIAL.

STRATUM III 10YR 8/2.5 WHITE TO VERY PALE BROWN. FINE, WELL SORTED CORALLINE SAND. STRONGLY CEMENTED.

STRATUM IV 10YR 8/6 YELLOW. FINE, POORLY SORTED CORALLINE SAND. LOOSE BEACH SAND. NO CULTURAL MATERIAL.

STRATUM V 10YR 8/4 VERY PALE BROWN. FINE, GRADING DOWNWARDS TO MEDIUM OR COARSE CORALLINE SAND. WEAKLY TO STRONGLY CEMENTED. NO CULTURAL MATERIAL.

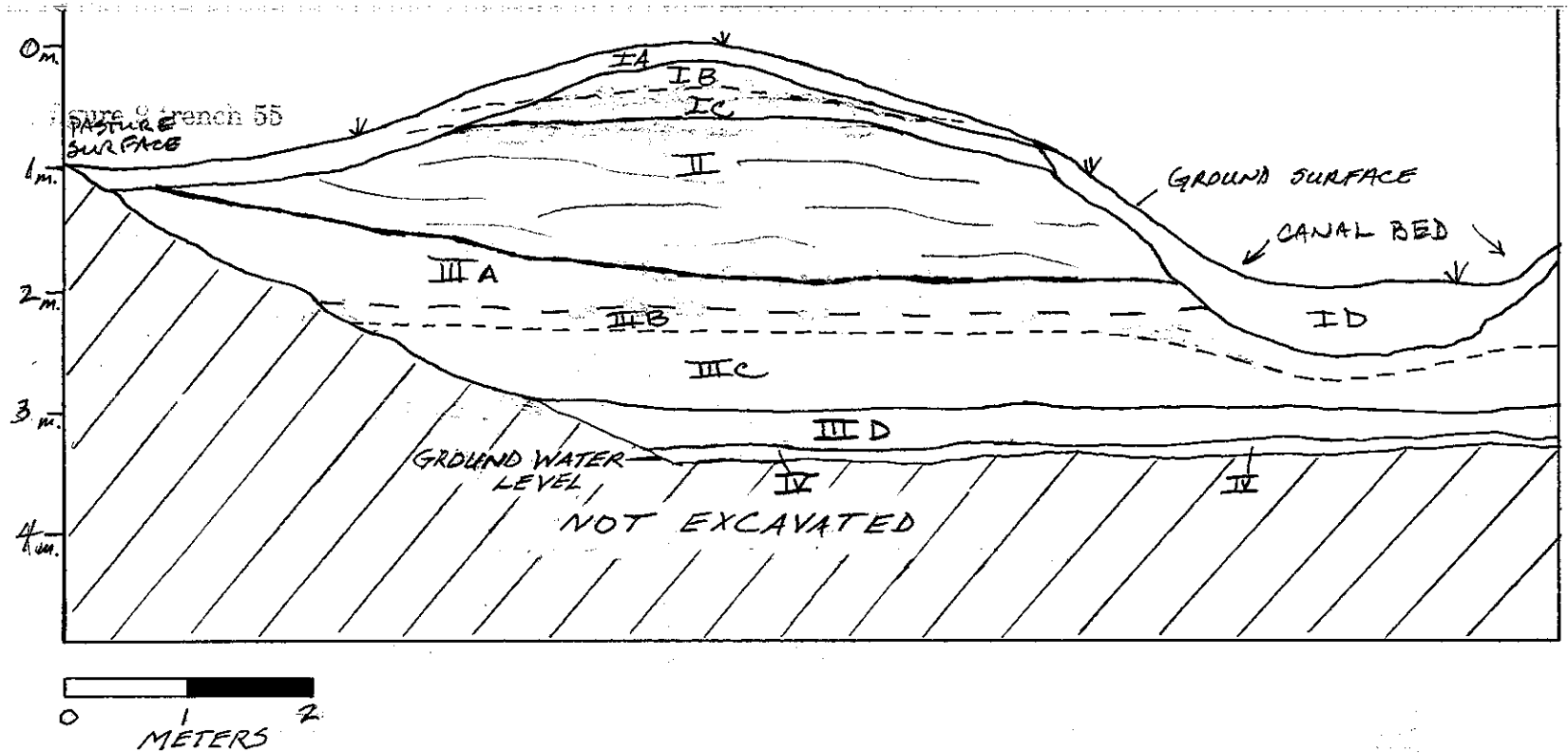
STRATUM VI 5Y 7/1 LIGHT GRAY. COARSE CORALLINE SAND WITH CORAL GRAVELS AND PEBBLES COMMON. LOOSE BEACH OR LAGOONAL DEPOSIT. NO CULTURAL MATERIAL.

Figure 8 Trench 43, Illustrating The Typical Profile in Project Area

date the removal of the sand dunes from the project area, and were pointed out by Mr. William Martin of Kekaha sugar company, as having been made in the 1950s for experimental farming of these sandy lands.

The irrigation canal (Figure 9) is a large feature made from two parallel mounds of sand over 6 feet (about 2 meters) in height. These features are oriented in a north-south direction, cutting the project area in two. The bed of the canal formed by the mounded sides is at a lower elevation than the ground surface outside of the canal.

The low linear mound for irrigation control runs roughly perpendicular to the length of the irrigation canal (refer to Figure 4). On the surface, the linear mound is clearly visible for much of its length, rising about 3 feet above the surrounding ground surface. The mound itself is composed of slightly compact, silty coralline sand with horizontal mottles of brown and light brown color (Figure 10). This mottling is physical evidence of mechanized construction of the mound by scraping and piling up the surrounding area's surface layers. Thus, the mound construction post dates removal of the ancient dunes, and development of the modern A-horizon in the project area. The linear mound extending out from the opposite side of the drainage canal was also cross sectioned, by Trench 13 (Figure 11), and yielded similar findings for the age and character of the linear mound.



KEY:

STRATUM IA 10YR5/3 BROWN. LOAMY SAND MODERN A-HORIZON. LOOSE.

STRATUM IB 10YR 7/3 VERY PALE BROWN, MEDIUM SAND. LOOSE.

STRATUM IC 10YR 6/4 LIGHT YELLOWISH BROWN, VERY FINE SAND. LOOSE

STRATUM ID 5YR 6/8 GRADING DOWN TO 5YR4/6 SILTY SAND. CEMENTED.

STRATUM II 10YR 4/4 DARK YELLOWISH BROWN WITH HORIZONTAL MOTTLES OF 10YR5/4 YELLOWISH BROWN LOAMY SAND. CANAL CONSTRUCTION LAYER. LOOSE.

STRATUM IIIA 10YR 7/6 YELLOW, FINE SAND. SLIGHTLY COMPACT.

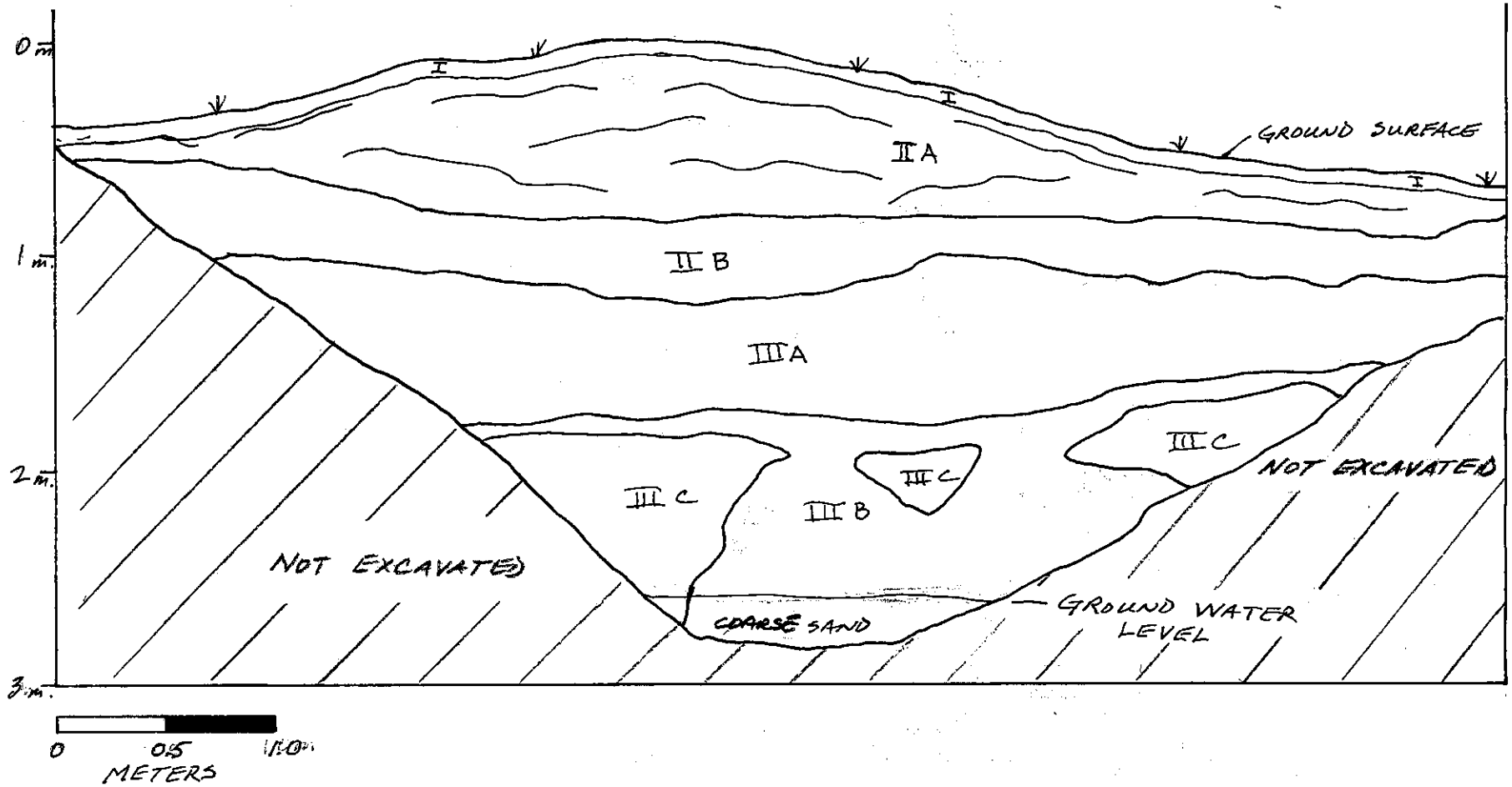
STRATUM IIIB 10YR7/6 YELLOW, MEDIUM SAND. 10% LAVA GRAINS

STRATUM IIIC 10YR 7/6 YELLOW, FINE SAND. INCREASING CEMENTATION

STRATUM IIID 10YR8/3 VERY PALE BROWN. STRONGLY CEMENTED FINE SAND.

STRATUM IV 5Y7/1 LIGHT GRAY, VERY FINE SAND. LOOSE.

Figure 9 Trench 55 Profile of North Face Showing West Bank and Bed of Drainage Canal



KEY:

STRATUM I 10YR 5/3 BROWN, LOAMY SAND MODERN A-HORIZON. LOOSE.

STRATUM IIA 10YR4/3 BROWN WITH HORIZONTAL MOTTLES OF 10YR 6/3 PALE BROWN, LOOSE, LOAMY SAND. LINEAR MOUND CONSTRUCTION LAYER.

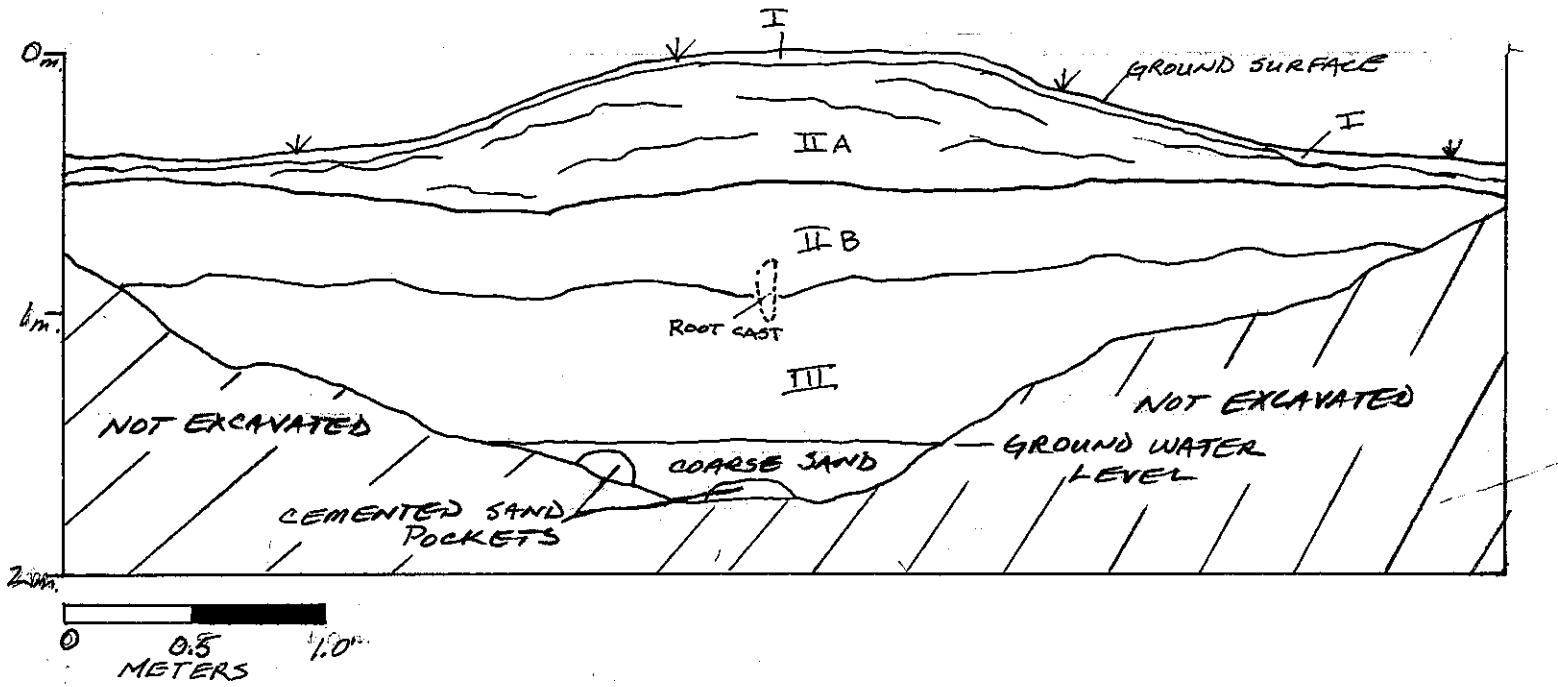
STRATUM IIB 10YR 7/1 LIGHT GRAY LOAMY SAND. LOOSE

STRATUM IIIA 10YR 7/4 VERY PALE BROWN, MEDIUM SAND. SLIGHTY CEMENTED.

STRATUM IIIB 10YR 8/2 WHITE, FINE SAND. CEMENTED.

STRATUM IIIC 10YR 8/4 VERY PALE BROWN, COARSE, UNSORTED SAND.

Figure 10 Trench 29 North Profile



KEY:

STRATUM I	10YR 5/3 BROWN. LOAMY SAND. MODERN A-HORIZON
STRATUM IIA	10YR 4/3 BROWN WITH HORIZONTAL MOTTLES OF 10YR 6/3 PALE BROWN, LOOSE, LOAMY SAND. LINEAR MOUND CONSTRUCTION LAYER.
STRATUM IIB	10YR 7/2 LIGHT GRAY, LOAMY SAND, LOOSE.
STRATUM III	10YR 8/4 VERY PALE BROWN. FINE TO MEDIUM, UNSORTED SAND.

Figure 11 Trench 13 South Profile

SUMMARY AND RECOMMENDATIONS

Site Significance

The canal and linear mound, both constructed in the 1950s by the mounding up of sand deposits derived from the surrounding area, are of recent age relative to the removal of the former sand dune deposits for plantation use of the lands. This is clearly evident in that they are constructed upon the ground surface that was created by the truncating and grading of the original dunes to the present elevation. Neither feature is an historic site.

No historic cultural resources were evident in the project area or in the subsurface deposits. It is likely that if cultural resources were present in the project area in the past they were removed with the sand dunes.

Recommendations

No further archaeological study is recommended for the proposed landfill expansion site.

Archaeological monitoring on site was initially proposed during removal of the remaining sand deposits at the proposed site. However, the shallow depth of cemented sand deposits, and the truncated character of the ancient dunes here may argue against the necessity -for on site monitoring.

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Appendix C
Photo Log

Photo 1. View toward the southeast from Kaumuali`i Highway – 0.2 mile from KLF.

Photo 2. View toward the southeast from Kaumuali`i Highway – 0.6 mile from KLF.

Photo 3. View toward the southeast from Kaumuali`i Highway – 0.9 mile from KLF.

Photo 4. View toward the southeast from Kaumualii Highway -1.3 mile from KLF.

Photo 5. Entranceway to KLF near Kaumuali`i Highway.

Photo 6. View toward the southwest from Kaumuali`i Highway – 0.2 mile from KLF.

Photo 7. View toward the northwest from Kaumuali`i Highway – 0.5 mile from KLF. Landfill not visible behind treeline.

Photo 8. View toward the northwest from Kaumuali`i Highway – 1.1 mile from KLF. Landfill not visible behind treeline.

Photo 9. Makai-mauka viewplane from the shoreline adjacent to KLF. Landfill not visible behind coastal dunes (pali visible in the background).

Photo 10. Makai-mauka viewplane from the shoreline adjacent to KLF. Landfill not visible behind coastal dunes (pali visible in the background).