Volume 2 of 3

Final Environmental Impact Statement
Prepared in Accordance with Chapter 343, Hawaii Revised Statutes and Title 11, Chapter 200, Hawaii Administrative Rules

Appendices Waimānalo Gulch Sanitary Landfill Lateral Expansion

Waimānalo Gulch, O‘ahu, Hawai‘i
TMKs: (1) 9-2-003: 072 and 073

October 2008

City and County of Honolulu
Department of Environmental Services
1000 Uluohia Street, 3rd Floor
Kapolei, Hawai‘i 96707

R. M. TOWILL CORPORATION
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Honolulu, Hawaii 96819-3494

1-21149-00

Volume 2 of 3

Draft Environmental Impact Statement

Appendices
Waimānalo Gulch Sanitary Landfill Lateral Expansion

Waimānalo Gulch, Oʻahu, Hawaiʻi
TMKs: (1) 9-2-003: 072 and 073

October 2008

Prepared Pursuant to
Chapter 343, Hawaiʻi Revised Statutes, and
Title 11, Chapter 200, Hawaiʻi Administrative Rules

Prepared for:
City and County of Honolulu
Department of Environmental Services
Kapolei, Hawaiʻi 96707

Prepared by:
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Appendix A

Notice of Violation, January 31, 2006, and
Settlement Agreement, December 7, 2007,
State Department of Health

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EMD/SHWB

January 31, 2006

S0203JR

CERTIFIED MAIL NO. 7005 1160 0003 8275 9819
RETURN RECEIPT REQUESTED

Mr. Paul Burns, Vice President/General Manager
Waste Management of Hawaii, Inc.
92-460 Farrington Highway
Kapolei, Hawaii 96707

CERTIFIED MAIL NO. 7005 1160 0003 8275 9758
RETURN RECEIPT REQUESTED

Mr. Eric Takamura, Director
Department of Environmental Services
City and County of Honolulu
1000 Uluohia Street
Kapolei, Hawaii 96707

Dear Messrs. Burns and Takamura:

SUBJECT: NOTICE OF VIOLATION/ORDER

Under the authority of section 342H-7 of the Hawaii Revised Statutes, you are hereby notified that we are issuing a Notice of Violation (NOV) and Order for the implementation of corrective actions regarding state solid waste noncompliance issues. The documents are enclosed.

Pursuant to section 342H-7, any order issued shall become final, and the penalty imposed under this chapter shall become due and payable twenty (20) calendar days after the notice of penalty is served, unless the person or persons named therein request a hearing before the Director of Health. The request for a hearing must be made in writing, no later than twenty (20) calendar days after the NOV and Order are served. Furthermore, if the penalty is not paid to the Department of Health within thirty (30) calendar days after it becomes due and payable, the Director may institute a civil action in the name of the State to recover the civil penalty, which shall be a government realization.

Please direct all inquiries concerning this matter to Steven Y.K. Chang, P.E., Chief, Solid and Hazardous Waste Branch, Department of Health, 919 Ala Moana Boulevard, Room 212, Honolulu, Hawaii 96814.

Sincerely,

Linda Rosen

LAURENCE K. LAU
Deputy Director for Environmental Health

Enclosures

c: Kathleen Ho, Deputy Attorney General
Thomas P. Rack, Hearings Officer (NOV, Order)

IN THE DEPARTMENT OF HEALTH

STATE OF HAWAII

DEPARTMENT OF HEALTH, STATE OF HAWAII, COMPLAINANT, vs. WASTE MANAGEMENT OF HAWAII, INC. AND CITY and COUNTY OF HONOLULU; RESPONDENTS.	DOCKET NO. 05-SHW-SWS-004 NOTICE AND FINDING OF VIOLATION

NOTICE AND FINDING OF VIOLATION

A. INTRODUCTION

1. This is an administrative enforcement action instituted pursuant to §342H-7 of the Hawaii Revised Statutes ("HRS"), and the Department of Health's Solid Waste Management Control Rules, Chapter 11-58.1, Hawaii Administrative Rules ("HAR"). Complainant is the Department of Health ("DOH"), Solid Waste Section ("SWS"). RESPONDENTS are Waste Management of Hawaii, Inc. (WMH) and City and County of Honolulu ("RESPONDENTS").

2. At all times pertinent hereto, RESPONDENTS owned, operated, controlled, or managed a solid waste disposal facility at the Waimanalo Gulch Sanitary Landfill ("facility") located at 92-460 Farrington Highway, Kapolei, Hawaii.

3. On the basis of information obtained during the course of investigation, SWS has determined that RESPONDENTS have violated HRS 342H, HAR 11-58.1, and RESPONDENTS' solid waste management permit.

B. JURISDICTION

4. HRS §342H-7 authorizes DOH to issue orders assessing a penalty for any past or current violation of HRS chapter 342H, the rules adopted thereunder, or any term or condition of a permit issued pursuant to the chapter, and to require compliance

immediately or within a specified time.

5. RESPONDENTS are a "person" as defined in HRS §342H-1.

6. At all relevant times pertinent hereto, RESPONDENTS held a Solid Waste Management Permit ("permit"), Permit Number LF-0054-02, which was issued on May 15, 2003 and expires on April 30, 2008.

C. STATEMENT OF FACTS

COUNT I

(Exceedence of Permitted Grades)

7. Paragraphs 1 through 6 above are incorporated herein by this reference as if they were set forth here in their entirety.

8. On January 26, 2005, during a meeting between WMH and DOH, WMH stated that they overfilled areas in the ash monofill and MSW cells. WMH provided a drawing documenting the overfill areas to DOH. The drawing was based on an aerial survey conducted in January 7, 2005.

9. In a letter dated February 3, 2005, WMH states "approximately 100,000 tons of ash delivered from the H-Power facility has been placed above the current permitted grades of the ash monofill". The February 3, 2005 letter further states that the placement of ash occurred during 2004.

10. In WMH's Annual Operating Report (AOR) for 2004, dated February 20, 2005, WMH states that for the period between July 1, 2003 and June 30, 2004, the landfill received 96,239 tons of H-Power ash. The AOR further states that based on the January 15, 2004 topography, there is no remaining airspace in the ash monofill.

11. With a submission dated February 22, 2005, WMH provided DOH an isopach drawing dated February 2005, showing 2005 topography and master plan final grades. WMH noted that 139,485 cubic yards of ash and 129,240 cubic yards of MSW were placed beyond the permitted grades.

12. In a letter dated March 29, 2005, WMH stated, "Ash placement above the approved 2002 grades in the ash disposal cell was initially noted following the aerial flyover conducted in January 2004. Identification of an overfill condition in the MSW cell areas was noted following the flyover conducted in January 2005."

13. In a letter dated December 17, 2004 and during a meeting between WMH and DOH on January 26, 2005, DOH stated concern over the stability of the landfill for grades greater than the current design, as the factor of safety of the design grades is

1.5. During the January 26, 2005 meeting and in a February 7, 2005 letter, DOH requested that additional stability analysis be conducted to evaluate the overfill areas.

14. In a letter dated February 21, 2005, WMH's engineering consultant, GeoSyntec Consultants (GeoSyntec), states that the static stability analysis of the landfill with the overfill areas identified in their January 2005 survey, resulted in a factor of safety ranging between 1.3 and 1.8.

15. In a letter dated February 16, 2005, Waste Management proposed the construction of a stability berm along the downstream toe of the ash monofill. WMH stated "*This berm would be design to increase the factor of safety along Section 11 to a minimum of 1.5 and,* would *allow waste to be placed to grades approximately the same as those in the original 1989 design.*"

16. Solid Waste Management Permit Number LF-0054-02, Special Conditions III, Item 9 provides:

> *The waste fill height of this landfill shall not exceed 510 feet above mean sea level and shall be in accordance with the document entitled "14.9-Acre Master Plan Fill Grades" dated September 2002 by GeoSyntec Consultants submitted with the Lateral Expansion application dated September 27, 2002, or any other subsequent submission approved by the Department.*

17. Since the issuance of the solid waste permit, the Department did not approve any changes to the landfill grades.

18. Based on the tonnage estimate of placed ash exceeding design grades and WMH's statement that ash placement above the approved 2002 grades was noted after a January 2004 flyover, the RESPONDENTS placed at least one years' worth of ash over the permitted grades and exceeded design grades for over a year.

19. RESPONDENTS placed ash and MSW above grades presented in the 14.9-Acre master Plan Fill Grades, in violation of Solid Waste Management Permit Number LF-0054-02, Special Conditions III, Item 9.

COUNT II

(Failure to Submit Annual Operating Reports in a Timely Manner)

20. Paragraphs 1 through 19 above are incorporated herein by this reference as if they were set forth here in their entirety.

21. Solid Waste Management Permit Number LF-0054-02, Special Conditions III, Item 2 provides:

The permittee shall submit an Annual Operating Report (AOR), using July 1 to June 30 as the reporting period. The AOR shall be submitted by July 31 of each year unless otherwise specified under Item 3 of this section....

22. Solid Waste Management Permit Number LF-0054-02, Special Conditions III, Item 3 provides:

The Annual Operating Report shall include the following information...

a. *Quantities of filled airspace for the present year, past filled airspace and remaining airspace in both cubic yards and years shall be provided...*
b. *On or before July 31 of each year, the permittee shall submit an annual topographic survey of the site as prepared by a land surveyor registered in the State of Hawaii. This survey shall clearly show the horizontal and vertical dimensions of the landfilled area;*
c. *A Sequencing Plan, including a drawing, identifying the cell areas to be filled in the coming year including identification of the wet weather areas. The cell areas and wet weather area capacity shall be provided using an appropriate unit of measure; and*
d. *Final fill areas, intermediate fill areas, and future unused fill areas shall be identified for the projected year.*

23. On July 24, 2003, WMH submitted their 2003 AOR. The AOR did not contain the required information for filled airspace for that year, past filled airspace and remaining airspace in cubic yards and years. The 2003 AOR was also missing the annual topographic survey, a sequencing plan for the coming year and a summary plan identifying filled areas, intermediate fill areas that can still accept waste and future unused fill areas. These items are consistent with the requirements of Special Conditions III, Item 3.

24. On December 22, 2004, WMH requested a 30-day extension for the submission of their 2004 AOR, which was due July 31, 2004.

25. In February 7, 2005, DOH issued a warning letter stating the deficiencies of the 2003 AOR and the non-submission of the 2004 AOR.

26. On February 23, 2005, DOH received the missing documentation required of the 2003 AOR and the 2004 AOR from WMH dated February 22, 2005, which utilized aerial topographies dated March 24, 2003 and January 15, 2004, respectively. In the February 22, 2005 incident report, WMH states:

Second, under separate cover, we are providing you with a copy of the 2004 Annual Operating Report (AOR) as required in the permit. Oral notification was provided in July 2004 to Mr. Gary Siu of the DOH that this report would be delayed due to information required from the annual topographic survey.

Additionally written notification of the delay was provided to Mr. Siu in December 2004. These aerial flyovers of the landfill have been scheduled during January of each year for the benefit of reporting to the City and County of Honolulu. Steps will be taken to prevent recurrence by our commitment to reschedule all future aerial flyovers in June of each calendar year to coincide with the timing of the AOR.

Third, under separate cover, a completed 2003 AOR is being provided to you with the information that was required in the February 7 letter. This information was incomplete due to our misunderstanding of the new requirements in the permit, which was issued May 15, 2003.

27. By the late submission of the required information, RESPONDENTS were in violation of Solid Waste Management Permit Number LF-0054-02, Special Conditions III, Items 2 and/or 3.

COUNT III

(Failure to place daily cover on the active face of MSW landfill)

28. Paragraphs 1 through 27 above are incorporated herein by this reference as if they were set forth here in their entirety.

29. HAR 11-58 .1-15(b)(1) provides:

> *Cover Material requirements. The owners or operators of all MSWLF units must cover disposed solid waste with six inches of earthen material at the end of each operating day, or at more frequent intervals if necessary, to control disease vector, fires, odors, blowing litter, and scavenging.*

30. Solid Waste Management Permit Number LF-0054-02, Special Condition IIIA, 2 provides:

> ***Daily Cover Material*** *shall be a minimum of six inches of earthen material or an alternative in accordance to HAR 11-58.1-15(b). Request for the use of an alternative daily cover (ADC) as cover shall be submitted to the Director of the Department of Health at the address listed in Item 2 of Special Conditions III.*
>
> *Request for the use of an alternative daily cover (ADC) shall consist of a written request for the approval of a demonstration period whereby an evaluation and demonstration shall be made that the ADC and its thickness control disease vectors, fires, odors, blowing litter, and scavenging without presenting a threat to human health and the*

environment. The use of alternative cover materials is limited to daily cover use only. The written request shall evaluate the potential ADC as to its specific characteristics and its appropriate use at the facility. Demonstration period are to be in increments of six months. The demonstration period or the approved use of an ADC may be rescinded or cancelled by either the Department of Health or the Operator at anytime without cause.

31. Solid Waste Management Permit Number LF-0054-02, Special Condition III, Item 11 provides:

> *A revised written Operating Plan shall be prepared and filed with the Department, no later than 90 days after receipt of this permit. The permittee shall implement the plan upon submission to the Department; however, the Department may require revisions to the written plan as a condition of approval...*

32. The Facility's Operating Plan, dated July 2004, Section 5.8.1, Daily Cover states:

> *The active MSW disposal area is covered at the end of each day with a minimum of 6 inches of daily cover soil. In areas where additional waste will not be placed for a period of 30 days or more, intermediate cover consisting of a minimum of 12 inches of soil is placed over the waste, and graded to promote surface water drainage. When additional waste is to be placed over such areas, the upper part of the intermediate cover soil may be scraped off for subsequent reuse.*

33. On January 28, 2005, the DOH inspectors noticed inadequate soil cover adjacent to the workface area (previous day's workface) in Cell E-1, showing excessive flagging (less than 6 inch of cover with trash protrusion) and without the required six inches of soil cover. The dozers/compactor were working on the current day's workface and away from the area that was showing flagging and no attempt were made to cover the exposed flagging.

34. On February 8, 2005, due to the lack of soil cover, flagging was noticed again in an area away from the workface of Cell E-1. Mr. Cassulo, the facility manager was notified of the noncompliance issue.

35. On February 9, 2005, the DOH inspectors continued to notice flagging on the east side of MSW E-1 due to lack of soil cover.

36. On February 17, 2005, the DOH inspectors observed less than 6-inches of soil cover and exposed trash (flagging) on MSW Cell E-1, on an area of the cell that the facility had completed a week before.

37. On February 17, 2005, a large portion of MSW Cell E-1 top deck was observed with heavy flagging due to lack of soil cover.

38. On February 24, 2005, the DOH-inspectors observed a former cell area previously filled with solid waste from the week before with exposed trash (flagging). The front slope of the MSW Cell E-1 was also observed with heavy flagging again due to inadequate soil cover.

39. On March 11, 2005, a large area of the top deck was observed with heavy flagging and exposed MSW.

40. On March 15, 2005, stockpile of soil cover within the workface area was observed, however, some areas of the top deck of MSW Cell E-1 was observed with exposed MSW and flagging.

41. On March 22, 2005, the inspectors observed some flagging fronting the slope of MSW Cell E-1.

42. On March 30, 2005, the inspectors observed the front slope of MSW Cell E-1 with exposed MSW and heavy flagging due to inadequate soil cover.

43. On April 6, 2005, the east top deck of MSW Cell E-1 was noticed with exposed bags of MSW without soil cover, and the front slope of the cell not covered with soil for days as observed from previous inspections.

44. On April 6, 2005, the inspectors observed exposed MSW and flagging on an area located adjacent to the active workface area.

45. On April 11, 2005, the inspectors observed an entire cell from the day before located at the north area of MSW Cell E-1 not covered with soil. The dozer operator was noticed still trying to cover the large cell of exposed MSW with soil cover. Heavy flagging and plastic bags of MSW were also noted fronting the slopes of MSW Cell E-1.

46. On April 15, 2005, at 9:00 A.M. the DOH inspector observed a portion of MSW from the previous day was not properly covered. Due to gusty wind the litter fences were loaded with litter and some flagging was also noted due to inadequate soil cover.

47. On April 20, 2005, at 6:20 P.M. the facility has stopped accepting waste for the day and a few trucks were observed delivering soil to the workface area for daily cover. At 7:00 P.M. the DOH inspectors observed the operators haul in tarps onto the workface to be used to cover part of the workface due to lack of soil cover. The use of tarps was not approved by DOH to be used as alternative daily cover (ADC) for the facility. At 7:45 P.M. the operators had stopped working and left for the night without covering a major part of the workface area. Mr. David Fuiava of WMH was asked about

completing the cell with daily cover and he said "call it a day, will use another plan tomorrow."

48. On April 21, 2005, at 6:45 P.M. the operators had stopped work for the evening and the DOH inspectors noticed heavy flagging throughout the cell. The DOH inspectors also noted uncovered and partially covered MSW within the cell area. The unauthorized use of the tarp for alternative daily cover was still in place from the previous day.

49. On April 22, 2005, the DOH inspectors continued to observed heavy flagging on the front slopes and the northeast side of MSW Cell E-1. The workface center top deck area of MSW Cell E-1 had exposed MSW and heavy flagging due to inadequate soil cover. The inspectors noticed the ADC tarp was still in placed from previous days.

50. On April 25, 2005, at 4:40 P.M. the DOH inspectors observed the landfill equipment operators working the MSW at workface area. The workface area was observed with large amount of MSW not covered with soil at 6:42 P.M. At 6:49 P.M. the operators parked their equipment and left for the evening without covering the MSW for the day. The Environmental Compliance Officer was asked if the operators were done for the day and he said that he had no control of the operators. The DOH inspectors walked the top deck of MSW Cell E-1 and observed large amount of MSW not covered with soil, including the side slopes of the cell.

51. On April 26, 2005, at 5:20 P.M. the DOH inspectors noted a large MSW area on the northeast corner of MSW Cell E-1 from the night before that had not been covered with soil. Heavy flagging was also noted throughout the top deck of MSW Cell E-1 and along the east banks of the cell. The inspectors observed the operators trying to cover the workface area with soil until 7:30 P.M. and the operators had to stop work due to darkness. Inadequate soil was observed throughout the workface and with some exposed MSW.

52. On April 27, 2005, at 6:30 P.M. heavy flagging and exposed MSW was observed at the center portion of MSW Cell E-1 and the MSW was not covered with adequate soil at the end of the day. The northeast side of MSW Cell E-1 continues to be observed with heavy flagging due to inadequate amount of soil cover for the past two weeks.

53. On April 28, 2005 at 6:55 P.M. the DOH inspectors observed the northeast corner of the workface (an old workface from the previous day) with heavy flagging and exposed MSW. The south slopes of MSW Cell E-1 fronting Koolina Resort continues to be observed with exposed MSW and heavy flagging.

54. On May 1, 2005, the DOH inspectors observed an inactive area of MSW Cell E-1 fronting Koolina Resort with exposed MSW. At the end of the day (5:10 P.M.) the inspectors observed a large MSW drop off area of the active workface in MSW Cell E-1 & E-2 with large amounts of exposed MSW and without the required daily soil cover.

Soil cover was available at the MSW Cell-10 storage area, but the facility had insufficient personnel on Sunday to cover the cell at the end of the day. The northeast corner of MSW Cell E-1 and top deck has exposed MSW and has not been covered with soil for the past week. Heavy flagging and exposed MSW on the front slope fronting Koolina Resort continues to be uncovered with daily soil cover.

55. On May 3, 2005, the DOH inspector continued to observe the sloped area of MSW Cell E-1 fronting Koolina Resort with exposed MSW and heavy flagging. The workface area for MSW Cell E-2 was inadequately covered with soil and heavy flagging was noted. At the end of the day (6:30P.M.) the active workface area was inadequately covered with soil. The northeast corner of MSW Cell E-1 and top deck had exposed MSW and has not been covered with soil for the past few weeks.

56. On May 6, 2005, at 5:00P.M. the DOH inspectors observed facility operator park the equipment and drive away for the day. The inspectors observed heavy flagging and exposed MSW without adequate soil cover at the MSW Cell E-2 workface.

57. On May 9, 2005, at 6:20 P.M., DOH inspectors observed exposed MSW and heavy flagging on a large area of MSW Cell E-2 workface without adequate soil cover.

58. On May 19, 2005, the DOH inspectors continue to notice the bottom slope of MSW Cell E-1 fronting Koolina Resort with exposed MSW and heavy flagging.

59. The issue was reported to the Environmental Compliance Officer and Operation Manager on May 19, 2005; however, no action was taken to correct the problem.

60. On May 25, 2005, the DOH inspectors observed exposed MSW and heavy flagging on the recently completed northeast end of MSW Cell E-1, due to inadequate soil cover. Ms. Gordy, the Environmental Manager, was notified of the issue and was present during the inspection.

61. On June 3, 2005, the south slopes of MSW Cell E-1 fronting Koolina Resort continues to be observed with exposed MSW and heavy flagging. Mr. Cassulo said that WMH is leveling high spots within MSW Cell E-1 and once completed the area will be covered with intermediate soil.

62. On June 9, 2005, the inspectors observed large amounts of exposed MSW on a closed cell fronting MSW Cell E-2.

63. The RESPONDENTS failed to provide six inches of daily soil cover at the end of day on the aforementioned dates.

64. RESPONDENTS did not receive prior written approval from the Director of Health to use alternative daily cover.

65. RESPONDENTS violated HAR 11-58 .1-15(b)(1) and Solid Waste Management Permit Special Permit Condition IIIA, Item 2 on 27 separate occasions.

COUNT IV

(Failure to place intermediate cover material on the ash monofill)

66. Paragraphs 1 through 65 above are incorporated herein by this reference as if they were set forth here in their entirety.

66. Solid Waste Management Permit Number LF-0054-02, Special Condition IIIB, Item 2 provides:

> *Intermediate cover is required for the MSW ash monofill to control fugitive dust, if the ash is exposed for more than seven days. A minimum of 6 inches of earthen material shall be used for cover except where cover cannot be reasonable or safely applied. In those areas an alternative dust control cover shall be used with the approval of the Department.*

67. The Facility's Operating Plan, dated July 2004, Section 5.9.2. Cover provides:

> *Intermediate soil cover is placed over areas that are not being actively worked and are exposed for more than 7 days without receiving additional ash. Intermediate cover consists of soil compacted to a minimum thickness of six inches and graded to promote runoff of surface water.*

68. Aerial photographs of the landfill facility dated 1-3-00, 1-6-01, 3-24-03, 2-13-04, and 1-7-05, as reviewed by a DOH inspector at WMH's office, shows that the percentage of intermediate soil cover on the monofill varies from year to year.

69. On January 28, 2005, the DOH inspectors noticed large inactive cell areas of the ash monofill without intermediate soil cover. DOH inspectors voiced their concern to the facility manager Mr. Joe Hernandez, on the requirement for the ash monofill intermediate cover and were told that the facility plans to regrade the ash monofill sometime soon.

70. On February 9, 2005, DOH inspectors observed a WMH worker operating a grader and leveling/regrading the overfilled ash monofill on Ash Cells 5 & 6. The inspectors observed exposed ash monofill cells 5, 6, 7, & 8 without the required seven-day intermediate cover. Some soil stockpiles were noticed stored on the top deck of the ash monofill, but was not at that time being used as cover material. The re-grading of the ash monofill was observed to create significant fugitive dust without any mitigation controls.

71. On February 9, 2005, DOH inspectors noted the active ash disposal cell 3 area with large stockpiles of ash without the required seven day intermediate cover and DOH

voiced their concerns to Mr. Cassulo for the required intermediate cover. Mr. Cassulo said that they could not cover the ash because the ash is wet and takes a while to dry. He also mentioned that he does not interpret the permit condition requiring the ash to be covered every seven days. Mr. Cassulo also stated that they are cutting the ash piles to reduce the overfilled ash areas (cells 5 & 6) and WMH plans to have it completed by the following week.

72. On February 17, 2005, DOH inspectors observed the grader operator partially covering part of the top deck of ash monofill of cells 4 & 5 with intermediate soil cover.

73. On February 24, 2005, DOH inspectors observed the ash monofill top deck partially covered with intermediate soil cover, however, the side slope of the ash monofill had no intermediate cover. At the time of inspection, no equipment was observed working on the ash monofill area.

74. On February 24, 2005, the DOH inspectors observed two separate ash workface areas without soil cover. The entire side slope areas of the ash monofill landfill area are not covered with intermediate soil cover.

75. On March 11, 2005, a major part of the ash monofill landfill area continues to be without the required soil cover. Most of the side slope is not covered with soil.

76. On March 15, 2005, intermediate soil cover was noted on the top deck the ash monofill area, however, the side slopes have not been covered with soil. The entire ash monofill in Cell 5 has not yet been covered with intermediate soil.

77. On March 22, 2005, DOH inspectors noted that the side slopes of the ash monofill cells 6 & 7 were still not covered with intermediate soil.

78. On March 30, 2005, the DOH inspectors observed the side slopes of the ash monofill area without intermediate soil cover. The active ash monofill area was not being covered with the required soil cover every seven days.

79. On April 6, 2005, a former active ash monofill lift located on the northeast corner of ash cell 4 was observed without the required intermediate soil cover.

80. On April 11, 2005, the DOH inspectors continue to observe the side slopes of the ash monofill area without the required intermediate soil cover.

81. On April 15, 2005 to June 28, 2005, the DOH inspectors continue to observe the ash monofill side slopes and other areas of the ash monofill without the required intermediate soil cover.

82. On May 12, 2005, DOH continues to observe the active workface with stockpiles of ash from H-Power and without the required intermediate cover. H-Power facility was

closed for their annual maintenance on April 13, 2005 for about a month. WMH did not place the required soil cover on the active workface area during this entire period.

83. On June 29, 2005, DOH continued to observe ash monofill cell 3 areas without the required soil cover. The inspectors observed WMH equipment placing intermediate cover and grading the side slope of the ash monofill cells 6 & 7.

84. On July 27, 2005, the inspector observed the top deck and side slopes of the ash monofill landfill completely covered with intermediate soil and meeting regulatory requirements.

85. RESPONDENTS have failed to place intermediate cover on the ash monofill and have violated the facility's permit Special Conditions IIIB, Item 2 and facility's Operations Plan Section 4.9.2 for at least 153 days.

COUNT V

(Exceedance of leachate head on the liner in ash monofill)

86. Paragraphs 1 through 85 above are incorporated herein by this reference as if they were set forth here in their entirety.

87. HAR 11-58.1-14(b) provides:

> *The design shall either:*
> *(1) Ensure that the concentration values listed in Table 1, which is incorporated by reference, or Hawaii Administrative Rules, title 11, chapter 20, whichever is more stringent, will not be exceeded in the uppermost aquifer at the relevant point of compliance, as specified by the director under subsection (e); or*
> *(2) Include a composite liner as described in subsection (c) and a leachate collection system that is designed and constructed to maintain less than a thirty-centimeter depth of leachate over the liner.*

88. **RESPONDENTS** chose to meet HAR 11-58.1-14(b)(1). WMH submitted *Point of Compliance (POC)* documents dated, May 25, 1993 to demonstrate that the proposed `alternative liner and leachate collection system are designed to meet HAR 11-58.1-14(b)(1). The assumptions made in *POC* documents dated, May 25, 1993 was that leachate head on the liner will not exceed 30 centimeters.

89. The facility has three separate leachate collection systems that feed into three separate sumps. The ash monofill leachate sump is located at the south end of the ash monofill. The MSW leachate sump that services the primary section of the MSW landfill is located at the south end of MSW Cell 4B and is referred to Sump 4B. Leachate sump E-1 is located at the southern end of MSW Cell E-1, and services only the lateral

MSW expansion cells.

90. Based on as-built drawings contained in the Ash Cell 8 CQA report prepared by A-Mehr, Inc. and dated October 8, 1998, the depth of the ash monofill sump is approximately 6 feet deep. Therefore the maximum depth of leachate allowed in the sump as to provide no more than 12 inches (30 centimeters) of leachate on the liner system is approximately 7 feet. In a letter dated August 6, 1999, A-Mehr, Inc., further states that they recommend a maximum leachate level of 5 feet be maintained within the sump.

91. On March 11, 2005, the DOH inspectors requested a copy of the leachate log maintained at the facility for the three-leachate sumps that are located within the facility. Mr. Joe Hernandez of WMH provided the log to the inspectors and the log shows that the last time the ash monofill leachate sump was measure was back in October 28, 2003.

92. On March 11, 2005, the DOH inspectors located the ash monofill leachate sump at the south end of Ash Cell 8 and measured the leachate inside the sump. The leachate depth was measured with the facility's pre-marked six-foot solid rod attached to a rope and inserted into the vertical manhole sump. The homemade measuring device was lowered into the bottom of the manhole and next to the PVC pipeline used to pump the leachate out of the sump. Leachate measurements collected from the sump indicated 14 feet 2 inches of leachate inside the sump, or approximately 8.2 feet of leachate on the liner system.

93. On March 15, 2005, the DOH inspectors measured the leachate sump using the same six-foot solid rod and attached rope. Again, the homemade measurement device was lowered inside the sump. The device was removed, placed on the ground and measured with a tape measure. The rope was used because it showed a wet mark with an indication of the amount of liquid inside the sump. The inspectors recorded a measurement of 22 feet 8 inches of leachate inside the sump, or approximately 16 feet 8 inches of head on the liner system.

94. From March 16, 2005 to June 16, 2005 leachate was observed by DOH to be seeping and ponding at the bottom slopes outside of the lined cell areas fronting ash cell 8 and MSW cell E-1.

95. On March 22, 2005, the DOH inspectors visited the site and measured the leachate sump manhole utilizing the same pipe and rope. The inspectors recorded a measurement of 22 feet 3 inches of leachate inside the ash monofill sump, or approximately 16.3 feet of leachate head on the liner system. The water truck was parked near the sump and the fill pipe was connected to the water truck. No leachate was being pumped into the water truck at that time.

96. In a letter dated June 22, 2005, WMH provided leachate logs for the ash sump,

which indicated that leachate level of 22 feet was measured on February 9, 2005.

97. Sometime between July 15, 2005 and July 22, 2005, the leachate head on the liner system was lower to below the maximum head allowance of 30 centimeters.

98. RESPONDENTS have exceeded the maximum leachate head allowance of 12 inches or 30 centimeters on the ash monofill liner for at least 156 days, in conflict with their POC, dated May 25, 1993 and in violation of HAR 11-58.1-14(b)(1).

COUNT VI

(Exceedance of leachate head on liner in MSW Cell E-1 sump)

99. Paragraphs 1 through 98 above are incorporated herein by this reference as if they were set forth here in their entirety.

100. In WMH's letter dated June 22, 2005, they state that MSW Cell E-1 leachate sump was initially installed in November 2003.

101. Based on a design drawing of the E-1 sump, dated August 22, 2003, and provided by WMH, the depth of the sump is 3 feet. Therefore the maximum depth of leachate allowed in the sump as to provide no more than 12 inches (30 centimeters) of leachate on the liner system is 4 feet.

102. On March 11, 2005, the DOH inspectors requested a copy of the leachate log maintained at the facility for the three-leachate sumps that are located within the facility. Mr. Joe Hernandez of WMH could not produce a leachate log for MSW Cell E-1 sump.

103. On March 22, 2005, the DOH inspectors measured the hose attached to the pump leading to the bottom of MSW Cell E-1. The inspectors measured the hose and determine that the hose length is 80 feet long to the bottom of the sump. The inspectors pulled out 30 feet of hose from the lateral leachate line when the pump reached air and stopped pumping leachate. Based on the angle of the leachate riser (2:1) and the measured length of leachate in the pipe, DOH calculated that the vertical depth of the leachate in the sump is approximately 10.4 feet, or 7.4 feet on the liner.

104. On April 11, 2005, the inspectors observed a large puddle of leachate ponding at the bottom slope of MSW Cell 4-B. The leachate was seeping from the bottom slope of MSW Cell E-1.

105. On April 15, 2005, DOH inspector observed test holes at the bottom slope of MSW Cell E-1 filled with leachate. The test holes were about five foot in depth and contained approximately three feet of leachate.

106. In a letter dated June 22, 2005, WMH provided a leachate log for the E-1 Sump,

which lists 74 feet of leachate measured on April 29, 2005 and May 26, 2005.

107. Sometime between July 22, 2005 and August 1, 2005, WMH reported that leachate head no longer exceeds 30 centimeters on the liner system.

108. RESPONDENTS have exceeded the maximum leachate head allowance of 12 inches or 30 centimeters on the MSW E-cell liner for at least 123 days, in conflict with their POC, dated May 23, 1993 and in violation of HAR 11-58.1-14(b)(1).

COUNT VII

(Failure to Measure Leachate Levels and to Maintain Records on Leachate Levels in Cell 4B Sump)

109. Paragraphs 1 through 108 above are incorporated herein by this reference as if they were set forth here in their entirety.

110. Solid Waste Management Permit Number LF-0054-02, Special Condition III, Item 6 provides:

> *The permittee shall implement the final Groundwater and Leachate Monitoring Plan dated October 7, 1995, and revised in June 1997.*

111. The facility's Groundwater and Leachate Monitoring Plan dated October 7, 1995 and revised in June 1997, states in Section 4.2 *Leachate Monitoring:*

> *For the MSW landfill, the sump which is located in cell 4B, is checked monthly for any traces of liquids. Monitoring is done manually through the use of a steel tape which is lowered down the leachate extraction riser. If liquids are detected at any time during the monthly checks, monitoring frequency is increased to weekly until it is determined that liquid levels have stabilized or evacuation of liquids is required.*

112. Solid Waste Management Permit Number LF-0054-02, General Conditions I, Item 9b and 9c provides:

> a. *The permittee shall retain at the facility or other location designated by this permit, records of all monitoring information...copies of all reports required by this permit, and records of all data use to complete the application for this permit. The time period of retention shall be a minimum five (5) years unless otherwise specified by the Director. The groundwater, leachate, and air monitoring data must be maintained through the closure and post-closure periods.*
> b. *Records of monitoring information shall include:*

- *The dates, exact place, and time of sampling or measurements;*
- *The person responsible for performing the sampling or measurements;*
- *The date(s) analyses were performed;*
- *The person responsible for performing the analyses;*
- *Analytical techniques or methods used; and*
- *Results of such analyses.*

113. On March 11, 2005, the DOH inspectors requested a copy of the leachate log maintained at the facility for the three-leachate sumps that are located within the facility. Mr. Joe Hernandez provided the log to the inspectors and the log shows that the leachate sump in MSW Cell 4-B has not been measured since May 2003.

114. In a letter dated June 22, 2005, WMH provided another copy of the leachate log, which indicated that the leachate level in MSW Cell 4B could not be measured since June 2003, due to "lost measuring unit". The log continues to document the inability to measure until October 2003.

115. In the letter dated June 22, 2005, WMH stated that the 4-B sump has been inaccessible during the 2003-2005 time period due to a blockage of the riser by equipment used to take water level readings. The riser has recently been cleared of the obstruction, however, as of August 15, 2005, no leachate level measurements have been taken since May 2003.

116. RESPONDENTS have violated Solid Waste Management Permit Number LF-0054-02, Special Condition III, Item 6 and General Conditions I, Items 9b and 9c, and their Groundwater and Leachate Monitoring Plan, for not measuring leachate levels and/or maintaining records from at least June 2003 to July 2005.

COUNT VIII

(Failure to Measure Leachate Levels and to Maintain Records on Leachate Levels in the Ash Monofill Sump)

117. Paragraphs 1 through 116 above are incorporated herein by this reference as if they were set forth here in their entirety.

118. Solid Waste Management Permit Number LF-0054-02, Special Condition III, Item 6 provides:

> *The permittee shall implement the final Groundwater and Leachate Monitoring Plan dated October 7, 1995, and revised in June 1997.*

119. The facility's Groundwater and Leachate Monitoring Plan dated October 7, 2005

and revised in June 1997, states in Section 4.2 *Leachate Monitoring:*

> *For the ash landfill, the leachate monitoring and sump evacuation procedures are similar to MSW landfill. In the existing operating area of the ash landfill, a manhole serves as the leachate collection system sump (ash cell 1). This sump is also monitored monthly, as well as following significant rainfall events, by lowering a steel tape to the bottom and checking liquid level.*

120. On March 11, 2005, the DOH inspectors requested a copy of the leachate log maintained at the facility for the three-leachate sumps that are located within the facility. Mr. Joe Hernandez provided the log to the inspectors and the log shows that the leachate sump in the ash monofill has not been measured since October 2003.

121. In a letter dated June 22, 2005, WMH provided another copy of the leachate log, which indicated that the leachate level in the ash monofill was not measured between October 28, 2003 and February 9, 2005.

122. RESPONDENTS have violated Solid Waste Management Permit Number LF-0054-02, Special Condition III, Item 6 and General Conditions I, Items 9b and 9c, and their Groundwater and Leachate Monitoring Plan, for not measuring leachate levels and/or maintaining records from at least November 2003 to January 2005.

COUNT IX

(Failure to notify DOH of noncompliance on equipment blockage in MSW Cell 4-B leachate lateral line and inability to measure leachate levels)

123. Paragraphs 1 through 122 above are incorporated herein by this reference as if they were set forth here in their entirety.

124. On March 11, 2005, inspectors were told by Joe Hernandez and based on leachate logs provided that the leachate sump in MSW Cell 4-B has not been measured since May 2003. No written notification was submitted to the department.

125. The facility claims that a "Lizard" (a device with wheels used to lower measuring equipment inside the lateral pipe) was stuck inside the lateral leachate pipe and blocked the line, thus WMH was unable to properly measure or pump the leachate.

126. Solid Waste Management Permit Number LF-0054-02, General Conditions I, Item 5 provide:

> *If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in the permit, the permittee shall notify the Department orally within 24 hours followed by a written incident report within seven days of the oral notification. The written incident report shall contain the*

following information:

a. *A description of and the cause of noncompliance;*
b. *The period of noncompliance, including exact dates and times, or, if not corrected, the anticipated time the noncompliance is expected to continue; and*
c. *Steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance.*

The permittee shall be responsible for any and all damages, which may result and may be subject to enforcement action by the Department for penalties or revocation of this permit.

The use of an electronic facsimile device (FAX) for use in notifications is acceptable. Any data transmission or detailed explanations transmitted shall be accompanied by regular mail submissions. Failure to notify in accordance to this requirement may initiate enforcement action.

The reporting requirements of General Condition I, Condition 5 does not apply if the following conditions are met:

a. *Failure to comply will not create an immediate and significant risk to health, safety, or the environment;*
b. *The permittee is using its best efforts to comply; and*
c. *The permittee will be able to comply within 30 days.*
d. *With the exception that all incidents of fire or releases/spills over 25 gallons shall be reported.*

127. In the letter dated June 22, 2005, WMH stated that the 4-B sump has been inaccessible during the 2003-2005 time period due to a blockage of the riser by equipment used to take water level readings. The riser has recently been cleared of the obstruction, however, as of August 15, 2005, no leachate level measurements have been taken since June 2003.

128. On or about May 20, 2005, WMH was able to retrieve the "lizard" from the lateral leachate pipe. As of August 15, the facility has not measured leachate level and has not removed the leachate from the lateral sump.

129. RESPONDENTS have violated Solid Waste Management Permit Number LF-0054-02, *General Conditions I, Item 5 by* not notifying DOH of the problem and failure to provide a written notification.

COUNT X

(Failure to Notify DOH of Noncompliance in a Timely Manner on the Exceedences of Permit Grades and Submission of the AORs)

130. Paragraphs 1 through 129 above are incorporated herein by this reference as if they were set forth here in their entirety.

131. On January 26, 2005, during a meeting between DOH and WMH, WMH notified DOH of the exceedence of waste above permitted grades.

132. On February 7, 2005, DOH issued a warning letter stating oral notification on noncompliance issues (exceedence of permitted grades, and failure to submit AOR information) has not been provided in a timely manner, that an incident report has not been submitted, in violation of General Conditions I, Item 5.

133. Solid waste Management Permit Number LF-0054-02, General Conditions I, Item 5 provide:

> *If for any reasons, the permittee does not comply with or will be unable to comply with any condition or limitation specified in the permit, the permittee shall notify the Department orally within 24 hours followed by a written incident report within seven days of the oral notification. The written incident report shall contain the following information:*
>
> *a. A description of an the cause of noncompliance;*
> *b. The period of noncompliance, including exact dates and times, or, if not corrected, the anticipated time the noncompliance is expected to continue; and*
> *c. Steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance.*
>
> *The permittee shall be responsible for any and all damages, which may result and may be subject to enforcement action by the Department for penalties or revocation of this permit.*
>
> *The use of an electronic facsimile device (FAX) for use in notification is acceptable. Any data transmission or detailed explanations transmitted shall be accompanied by regular mail submissions. Failure to notify in accordance to this requirement may initiate enforcement action.*
>
> *The reporting requirements of General Condition I, Condition 5 does not apply if the following conditions are met:*
> *a. Failure to comply will not create an immediate and significant risk to health, safety, or the environment;*
> *b. The permittee is using its best efforts to comply; and*
> *c. The permittee will be able to comply within 30 days.*
> *d. With the exception that all incidents of fire or releases/spills over 25 gallons*

shall be reported.

134. On February 3, 2005, WMH submitted a written incident report, notifying the DOH of the exceedences. The incident report did not include all of the requirements specified in General Condition I, Item 5.

135. On February 22, 2005, WMH submitted another incident report, reiterating the written notification on the exceedences on the permitted grades and providing additional information in an attempt to meet the requirements of General Condition I, Item 5.

136. In the February 22, 2005 incident report, WMH states:

Second, under separate cover, we are providing you with a copy of the 2004 Annual Operating Report (AOR) as required in the permit. Oral notification was provided in July 2004 to Mr. Gary Siu of the DOH that this report would be delayed due to information required from the annual topographic survey/ Additional written notification of the delay was provided to Mr. Siu in December 2004. These aerial flyovers of the landfill have been scheduled during January of each year for the benefit of reporting to the City and County of Honolulu. Steps will be taken to prevent recurrence by our commitment to reschedule all future aerial flyovers in June of each calendar year to coincide with the timing of the AOR.

Third, under separate cover, a completed 2003 AOR is being provided to you with the information that was required in the February 7 letter. This information was incomplete due to our misunderstanding of the new requirements in the permit, which was issued May 15, 2003.

137. On February 22, 2005, WMH submitted a revised 2003 AOR dated February 20, 2005 and the 2004 AOR dated February 20, 2005. The AORs utilized aerial topographies dated March 24, 2003 and January 15, 2004, respectively.

138. In a letter dated March 29, 2005, WMH states "Ash placement above the approved 2002 grades in the ash disposal cells was noted following the flyover conducted in January 2004."

139. RESPONDENTS were in violation of Solid Waste Management Permit Number LF-0054-02, General Conditions I, Item 5 for notifying the DOH over a year after WMH first noted permitted grade exceedences, and providing written notification on the delay of the 2004 AORs over 4 months after the date the document was due.

COUNT XI

(Unauthorized storage of material on the ash monofill)

140. Paragraphs 1 through 139 above are incorporated herein by this reference as if they were set forth here in their entirety.

141. Solid Waste Management Permit Number LF-0054-02, Special Condition IIIB, Item 5 provides:

> *No storage of material is allowed on the MSW ash landfill area.*

142. The Facility's Operating Plan, dated July 2004, Section 5.9.5. Use of Filled Areas provides:

> *Developed or filled areas of the ash monofill will not be used for other activities. Specifically, they will not be used for storage of green waste, tires, white goods or unacceptable wastes removed from the MSW landfill. The only use that may be made of ash monofill areas is for temporary soil stockpiling, provided the affected ash monofill area has received intermediate soil cover.*

143. On January 28, February 8, 9, 17 and 24, 2005, the inspectors noticed a large stockpile of rocks mixed with dirt located on portions of MSW ash Cell 4/5 and MSW Cell 5 and 4B.

144. From around March 2005, the rock stockpile started to be moved and used in the construction of the stability berm fronting the ash monofill.

145. In a letter dated March 29, 2005, WMH stated that the placement of the rock stockpile from the construction of MSW Cell E-1 occurred in July 2003.

146. RESPONDENTS stockpiled rocks mixed with soil on the MSW ash landfill area in violation of facility's permit Special Conditions IIIB, Item 5 and facility's Operations Plan Section 5.9.5.

COUNT XII

(Failure to manage and ban the acceptance of special waste)

147. Paragraphs 1 through 146 above are incorporated herein by this reference as if they were set forth here in their entirety.

148. Solid Waste Management Permit Number LF-0054-02, Special Condition IIIA, states that the items under Special Conditions IIIA, are to be included in the Operating Plan and implemented accordingly as specified in Special Condition III, Item 11.

149. Solid Waste Management Permit Number LF-0054-02, Special Condition IIIA,

Item 14 provides:

> ***Adequate Storage Procedures*** *for green waste, scrap vehicles, tires, and white goods shall be included in a written plan with record keeping to prevent vector and pollution problems. Bulk green waste, scrap vehicles, tires and white goods may not be disposed of at any solid waste facility in accordance with 11-58.1-65(b) and (c).*

150. HAR 11-58.1-65 Special solid waste controls. Subsection (c) provides:

> *Scrap automobiles, white goods, and tires. Scrap automobiles may not be accepted at disposal facilities permitted under these rules. White goods and motor vehicle tires may not be accepted at disposal facilities permitted under these rules after June 30, 1994. A plan must be developed by the operator of solid waste disposal facility and included in the facility operations plan to implement this ban.*

151. The Facility's Operating Plan, dated July 2004, Section 5.7, Storage and Disposition of Non-Disposable Waste states:

> *WGSLF does not accept for disposal the following categories of waste which are prohibited for disposal by Hawaii solid waste regulations:*
>
> •Tires
>
> *Tires are placed in a roll-off bin and stored until a full container is accumulated, at which time they are transported to an approved tire recycler. The bin is covered with a tarp to keep rain out and prevent vectors from using the tires.*

152. The inspectors at no time observed a roll-off bin to store the tires as stated in the facility's Operating Plan. As of July 27, 2005, the inspectors have not observed a roll-off bin for used tire storage on site.

153. During DOH's February 9, 2005 inspection, the inspectors witnessed the operator bury two whole tires at the workface of the facility. At no time did the dozer operator attempt to push the tires on the side for later recovery. The operator instead covered the tires with solid waste and continued to compact the trash at the workface. The observation of the tire burial was observed from the top of MSW Cell 1.

154. On February 17, 2005, DOH inspectors observed four whole tires on the side slopes of MSW Cell E-1. A few of the tires were partially buried with soil. The facility's Environmental Coordinator was notified of the noncompliance issue.

155. On March 11, 2005, the Inspectors noted that the tires observed on the side slope of MSW Cell-1 had not been removed from the February 17, 2005 visit.

156. On May 1, 2005, the inspectors observed the compactor operator at the workface bury a whole tire.

157. On May 1, 2005, an inactive area fronting MSW E-1 was observed by the inspectors with three whole tires partially buried with soil and MSW. The operator was alerted of the buried tires and said that he will remove the tires the next day.

158. On May 1, 2005, after the operators were done for the day, the inspectors walked the workface area and observed a whole tire buried in the soil.

159. On May 19, 2005, the inspectors observed a whole tire on the active workface of MSW Cell E-1 (northeast corner). A short time later, the inspectors observed the dozer operator cover the used tire with MSW.

160. On six separate occasions, the RESPONDENTS have improperly buried whole tires at the facility, in violation of HAR 11-58.1-65(c), Special Condition IIIA, Item 14, and facility's Operating Plan, Section 4.7.

COUNT XIII

(Failure to maintain records and record location of asbestos disposal at the landfill)

161. Paragraphs 1 through 160 above are incorporated herein by this reference as if they were set forth here in their entirety.

162. Solid Waste Management Permit Number LF-0054-02, Special Condition IIIA, Item 9 provides:

Asbestos Disposal, a written plan with recordkeeping shall be prepared to ensure that the disposal of asbestos waste is in accordance to current NESAHP (National Emission Standards for Hazardous Air Pollutants) regulations, 40 CFR 61.

163. The Facility's Operating Plan, dated July 2004, Section 5.6.2. Special Waste Procedures states:

> *Asbestos*
> *Special procedures applicable to asbestos waste are detailed in the Asbestos Disposal Plan. This plan contains measures to ensure that the requirements of 40 CFR 61.154 (National Emission Standards) are met at WGLF. After complying with all special waste acceptance procedures, asbestos waste transporters are allowed entry to the site at a pre-schedule time. After inspection of the load to ensure it meets all*

packaging requirements, the transporter proceeds to a prepared disposal trench, and discharges the load. All asbestos waste is covered with MSW and 6 inches of daily cover. Documentation of the date, time, names of the waste generator and transporter and location within the site where the waste was disposed are placed in the site's permanent operating records.

164. Facility's Operating Plan, dated July 2004, Section 8.13 Asbestos Disposal records states:

> *WGSLF is required by permit to maintain a record of each load of asbestos waste disposed at the site. Information to be recorded includes the type of waste, source and location, preferably by GPS or survey coordinates, of its disposal location in the landfill. Asbestos disposal records may be incorporated in the records of the hazardous waste exclusion or special waste screening programs.*

165. In a letter dated May 23, 2005, DOH requested WMH to provide special waste disposal logs, and disposal locations for the asbestos received at the facility for the past two years.

166. In a letter dated June 22, 2005, WMH provided copies of the daily logs on the disposal of accepted asbestos waste for the past two years. WMH claims that they have been unable to locate records on the disposal locations for asbestos waste at the landfill for the last two years.

167. As of July 27, 2005, WMH does not have records to provide to DOH showing disposal locations for the asbestos waste disposed at the landfill.

168. The RESPONDENTS failed to record and maintain records regarding the location of asbestos disposal in violation of Special Conditions III, Item 11 and the facility's operating plan.

COUNT XIV

(Failure to cover a dead animal)

169. Paragraphs 1 through 168 above are incorporated herein by this reference as if they were set forth here in their entirety.

170. Solid Waste Management Permit Number LF-0054-02, Special Condition IIIA, Item 10 provides:

> ***Dead Animals and Offal**, shall be addressed by a written plan requiring a minimum of two feet of soil, solid waste or other approved cover material*

and be compacted before the end of the workday.

171. The Facility's Operating Plan, dated July 2004, Section 5.6.2, provides:

- *Specialized procedures will be used to manage the categories of special waste described in this section:*

  Dead Animals and Offal
  Dead animals and offal (hides, intestines, and other waste from slaughtered animals) is not subject to special waste acceptance procedures, but will be identified by the transporter at the scale house. Loads known to contain dead animals or offal, and such wastes discovered incidental to other loads after dumping at the active face, will be placed in an area where they can be covered with additional solid waste immediately after being placed. Wherever possible, this will be accomplished by excavating it in the solid waste at the working face, placing the animal waste in it, and filling back in with MSW. Any areas that have received animal waste will be covered with daily cover soil at the end of the working day.

172. On February 17, 2005, the inspectors noticed along the bottom of MSW Cell E-1, a partially covered dead animal away from the landfill's workface area. The distance from the workface area to the dead animal was over 300 feet away.

173. On February 17, 2005, Mr. Hernandez was advised of the dead animal located at the bottom of MSW Cell E-1.

174. On March 15, 2005, Mr. David Fuiava informed the inspectors that the dead animal was discovered four days after acceptance and subsequently buried.

175. RESPONDENTS failed to properly handle a dead animal at the facility by not covering the dead animal with soil or waste immediately, which has resulted in violations of the facility's permit special conditions and facility's Operating Plan.

COUNT XV

(Failure to Submit Annual Surface Water Management Plan)

176. Paragraphs 1 through 175 above are incorporated herein by this reference as if they were set forth here in their entirety.

177. Solid Waste Management Permit Number LF-0054-02, Special Condition III, Item 11h provides:

The Surface Water Management Plan shall be updated annually and filed with

the Department by no later than September 1 of each year. It shall contain the following information:

(1) Report of an annual inspection of surface water management features and facilities, together with a description of required maintenance and changes;

(2) Updated drawings showing current topography of the landfill, surface water drainage system modifications planned for the next year in response to waste filling;

(3) Engineering calculations documenting the capability of the surface water management system to comply with the run-on and run-off requirements listed under 3 (a) above; and

(4) Any Storm Water Pollution Prevention Plan or Spill Prevention Control and Countermeasure Plan prepared pursuant to federal requirements under the Clean Water Act.

178. The Facility's Operating Plan, dated July 2004, Section 6.8.5 Annual Update of Surface water Management Plan, provides:

WGSL will prepare and submit to HDOH an annual update to the surface water management plan, by September 1 of each year. The annual surface water report will contain the following information:

- Results of an inspection of surface water management features and facilities, together with a description of recommended maintenance and changes;
- Updated drawings of the surface water management system;
- Engineering calculations confirming the capacity of the system;
- Any updates to the site's SPCC Plan

179. In a letter dated May 23, 2005, DOH requested the September 2003 and September 2004 annual updates as required by the permit.

180. In a letter dated June 22, 2005, WMH stated that they have not been able to locate the annual updates for 2003 and 2004.

181. To date, the DOH has not received the annual updates for 2003 and 2004. The facility has failed to comply with the facility's permit Special Conditions III, Item h Surface Water Management Plan and facility's Operations Plan Section 6.8.5, Annual Update of Surface Water Management Plan.

COUNT XVI

(Failure to control the generation of dust from vehicular traffic)

182. Paragraphs 1 through 181 above are incorporated herein by this reference as if

they were set forth here in their entirety.

183. Solid Waste Management Permit Number LF-0054-02, Special Condition III, Item 11 and 11m provides:

> *A revised written **Operating Plan** shall be prepared and filed with the Department, no later than 90 days after receipt of this permit. The permittee shall implement the plan upon submission to the Department; however, the Department may require revision to the written plan as a condition of approval. The revised **Operating Plan** shall include the following topics:*
>
> ***Mud and Dust Prevention Program,** a written plan for minimizing the tracking of mud onto public roads, or the generation of dust from vehicular traffic on site. The plan shall contain measures related to on-site road maintenance and cleaning, provision of a wet-weather disposal area, and an area for the wash-down of trucks or truck wheels prior to leaving the site. The possible methods include: rumble strips, drive-through tire wash, trash clean out pad, or wash pad.*

184. The Facility's Operating Plan, dated July 2004, Section 6.3 Mud and Dust states:

> *WGSLF personnel are responsible for preventing the emission of excessive dust from the facility. The site's water trucks are 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.*

185. On February 9, 2005, DOH inspectors noticed the significant generation of dust from vehicular traffic ingress and egress down the road by MSW Cell 1 near the landfill's workface and surrounding area. DOH inspectors did not see a water truck being used to minimize the generation of fugitive dust during the two plus hours spent on site for the inspection. It takes approximately 15 minutes to fill the 5,000-gallon water truck and an additional 15 minutes to empty the truck of its contents. Inspectors outbriefed, Mr. Steve Cassulo, General Manager, of the noncompliance issues and said that the water truck was pumping leachate from manholes at the facility.

186. On February 17, 2005, DOH revisited the site and noticed heavy vehicular dust generation starting from the bottom road to the facility's workface area. The dirt areas near the workface and roads were observed to be very dry. The facility did not have a water truck in use at the site to spray for dust and to control dust problem.

187. On many site visits the DOH inspectors requested WMH to spray the main road leading into the landfill and near the workface area with water due to the heavy dust

generation from vehicular traffic or windy conditions at the site.

188. RESPONDENTS have violated Solid Waste Management Permit Special Condition III, Item 11 and Facility's Operating Plan Section Requirement 5.3 on at least two occasions.

COUNT XVII

(Failure to minimize free litter generation in the landfill)

189. Paragraphs 1 through 188 above are incorporated herein by this reference as if they were set forth here in their entirety.

190. Solid Waste Management Permit Number LF-0054-02, Special Condition IIIA, Item 8 provides:

> ***Litter Control,*** *a written plan with record keeping shall be prepared to provide measures to minimize free litter in the landfill and prevent its occurrence beyond the property line of the facility. The plan shall contain, at a minimum, the following information:*
>
> a. *Design of portable litter screens, the number of screens available on the site, and a description of how they are to be deployed under various operating conditions;*
> b. *Design and location of permanent or semi-permanent litter screen fences;*
> c. *Special procedures to be followed during the period when the H-Power waste-to-energy plant shuts down and the volume of municipal solid waste increases above quantities; and*
> d. *Procedures for litter prevention and cleanup in the event of a major windstorm or other incident in which litter escapes the normal litter containment systems.*

191. The Facility's Operating Plan, dated July 2004, Section 6.4, Litter states:

> *WGSLF 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. These litter control program elements are described below:*
>
> • *Portable litter screens, typically 12 feet and 20 feet wide, 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.*

• Approximately 600 lineal feet of 30-foot tall permanent litter fence is installed between the ash monofill and the MSW fill area, as the second line of defense.

• The chain link fence surrounding the lower elevation areas of the WGSLF property provide 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. WGSLF personnel remove litter from portable screens and permanent fences on a daily basis, clean haul roads weekly, and pick up litter anywhere on the site at any time. In the event of a major wind storm that creates excessive litter, temporary personnel are brought in on as as-needed basis to collect litter, both on and off the WGSLF property as needed. Additional personnel are also made available as needed during the period when the H-Power plant shuts down and MSW volume increases above normal levels.

• Information will be included in the site's daily operating log to document unusual litter problems or control activities, including instances when temporary personnel are used to collect or control litter on or off-site.

Daily records are kept of litter control activities, and maintained in the site's operating record.

192. The Facility's Operating Plan, dated July 2004, Section 8.12, Litter Control Records states:

> *A daily record will be kept of litter control activities, and maintained in the operating record. The log will contain information on the wind conditions each day, the number of litter control personnel on site, and the volume of litter collected.*

193. On February 17, 2005, DOH visited the facility and from the top of MSW Cell 1, a large accumulation of blown litter was observed on the permanent perimeter litter fence and portable screens. At the time of inspection the wind velocity was 15 to 18 MPH from a northeasterly direction.

194. The DOH inspectors also observed other areas of the landfill beyond the litter fences to include the front area of workface, side slopes of MSW Cell E-1 and the road leading to the top of the landfill with litter accumulation and wind blown litter. At no time did the inspectors observe anyone picking up litter at the facility. However, documents provided by the facility, shows that two temporary personnel were on site picking up

litter. One individual worked from 7:30 A.M. to 11:30 A.M. and the other litter picker worked from 7:00 A.M. to 3:30 P.M. The facility does not keep a log indicating the number of personnel utilized on a daily basis and the number of bags collected by the temporary help.

195. On February 24, 2005, DOH visited the site and observed litter downgradient of the workface and on an area by MSW Cell 1. The inspectors did observed a temporary litter picker collecting litter near the mobile fences. On the north side bottom slope of MSW Cell E-1, two temporary litter pickers were observed collecting litter. The amount of litter observed by the inspectors at the facility and the number of temporary litter pickers observed collecting the litter were not sufficient to collect the amount of litter for the day at the facility.

196. On March 15, 2005, the inspectors observed large amount of scattered litter accumulated along the east side of the perimeter property fence adjacent to MSW Cell E-1 and outside of the property boundaries. No litter pickers were observed in the immediate area.

197. The facility failed to deploy or relocate portable litter fences downwind as the active workface area moves on seventeen occasions from January 28 to May 1, 2005.

198. On April 15, 2005, wind conditions were between 18 to 25 mph. The inspectors observed large accumulation of litter on the primary and secondary litter fences down gradient of the workface area. Four litter pickers were observed along the primary litter fences collecting litter, but due to the large open area of the workface (pancake fill) the litter plan was ineffective.

199. On April 20 to 22, 2005, the inspectors observed large amount of litter throughout the landfill. The facility failed to implement the require litter control plan because of the amount of MSW present and uncovered at the landfill workface area.

200. On April 25 to 28, 2005, the inspectors observed the same situation as described above with the same results, lack of daily cover generating litter.

201. On May 1, 3, 6, and 8, 2005, the inspectors continue to observed large amounts of scattered litter throughout the MSW landfill area due to lack of soil cover.

202. On May 9, 12, 15, and 19, 2005, the inspectors continue to observed accumulation of litter throughout the MSW landfill areas due to lack of soil cover.

203. On June 9, 2005, the inspectors observed large accumulation of litter along primary and secondary litter fences at the southwest area of MSW Cell E-1.

204. On June 24, 2005, the inspectors observed the southeast end slope of MSW Cell E-1 with large accumulation of litter due to lack of soil cover. WMH was advised of

the problem and they acknowledge the litter/flagging problem and management plans to dressed-up the area soon.

205. RESPONDENTS failed to implement its litter control program effectively, due to either lack or improper placement of litter fences and documentation of litter control efforts, which has resulted in violations of the facility's permit special conditions.

COUNT XVIII

(Failure to monitor explosive gases and maintains monitoring records)

206. Paragraphs 1 through 205 above are incorporated herein by this reference as if they were set forth here in their entirety.

207. HAR Section 11-58.1-15(d)(1) and (2) provides:

> *(d) Explosive gases control.*
> *(1) Owners and operators of all MSWLF units must ensure that:*
> *(A) The concentration of methane gas generated by the facility does not exceed twenty-five per cent of the lower explosive limit for methane in facility structures (excluding gas control or recovery system components); and*
> *(B) The concentration of methane gas does not exceed the lower explosive limit for methane at the facility property boundary.*
> *(2) Owners or operators of all MSWLF units must implement a routine methane monitoring program to ensure that the standards of paragraph (1) are met.*
> *(A) The type and frequency of monitoring must be determined based on the following factors:*
> *(i) Soil conditions;*
> *(ii) The hydrogeologic conditions surrounding the facility;*
> *(iii) The hydraulic conditions surrounding the facility; and*
> *(iv) The location of facility structures and property boundaries.*
> (B) *The minimum frequency of monitoring shall be quarterly.*

208. Solid Waste Management Permit Number LF-0054-02, Special Condition IIIA, Item 7 provides:

> ***Explosive Gases Control**, which shall include a written plan with recordkeeping for a routine methane gas monitoring program in accordance to HAR 11-58.1-15(d). The plan shall include a minimum*

monitoring frequency of once per month.

209. The Facility's Operating Plan, dated July 2004, Section 6.6, Explosives Gas states:

> *Methane gas is produced by anaerobic decomposition of organic components of solid waste. WGSLF implements a Site Specific Gas Monitoring Plan to ensure that methane gas does not cause safety or environmental problems. Specifically, the program must demonstrate with the requirements of HAR 11-58.1-18(d) that concentrations of methane do not exceed 25% of the lower explosive limits in facility structures, or 100% of the lower explosives limits at the property boundary. The lower explosive limit for methane is 5% by volume (50,000 ppm)*
>
> *Methane monitors are installed in the landfill office building and in the maintenance to measure explosive gas levels continuously and provide an alarm if levels reach 10,000 ppm (20% of the lower explosive limit). This program ensures that explosives gas levels in building are below the 25% limits set forth in HAR 11-58.1-18(d).*
>
> *Monitoring is conducted on a monthly basis to ensure compliance with HAR 11-58.1-18(d)(1)(B), which specifies that the concentration of methane gas at the property boundary shall not exceed the lower explosive limit. Under this program, barhole monitoring is conducted along the perimeter of the site, measuring methane concentrations to depths of about 3 feet.*
>
> *A monthly summary of gas monitoring results is placed in the operating record.*
>
> *To date, minimal methane has been detected at WGSLF. Should this change in the future, a landfill gas collection and treatment system will be developed to minimize potential gas migration problems.*

210. In a letter dated May 23, 2005, DOH requested all reports on all explosive gas monitoring data collected in accordance with explosive gas requirements in permit, LF0054-02 and HAR 11-58.1 from 2003.

211. In a letter dated June 22, 2005, WMH provided explosive gas monitoring data for 2005, but could not find data collected for prior years.

212. RESPONDENTS failed to monitor for explosive gases in 2003 and 2004, in violation 11-58.1-15(d), Special Conditions III Item 11 and Special Conditions IIIA Item 7, General Conditions I Item 9, and the facility's Operating Plan.

D. FINDINGS

On the basis of the provisions of Jurisdiction and Statement of Facts cited above, it is hereby found and determined that:

213. RESPONDENTS are therefore subject to the provisions of sections 342H-7 *Enforcement*, 342H-9 *Penalties*, 342H-10 *Administrative Penalties*, and 342H-11 *Injunctive Relief*, HRS, including penalties not to exceed $10,000 for each day of each violation.

DATED: Honolulu, Hawaii JAN 3 1 2006.

DEPARTMENT OF HEALTH
STATE OF HAWAII

LAURENCE K. LAU
Deputy Director for Environmental Health

APPROVED AS TO FORM:

KATHLEEN S.Y. HO
Deputy Attorney General

IN THE DEPARTMENT OF HEALTH

STATE OF HAWAII

DEPARTMENT OF HEALTH, STATE OF HAWAII, COMPLAINANT, vs. WASTE MANAGEMENT OF HAWAII, INC. AND CITY AND COUNTY OF HONOLULU RESPONDENTS	)	DOCKET NO.05-SHW-SWS-004 Waimanalo Gulch Sanitary Landfill (Solid waste management rules and Permit Conditions) ORDER

ORDER

Pursuant to chapter 342H, Hawaii Revised Statutes, the Department of Health's Solid Waste Management Control rules, and the attached Notice and Finding of Violation made this day in Docket No. 05-SHW-SWS-004, Waste Management of Hawaii, Inc. and City and County of Honolulu, Department of Environmental Services, hereinafter "RESPONDENTS," are hereby ordered to:

1. Immediately implement a full-time spotter for the hazardous waste and special waste-screening program as defined in the facility permit conditions. The spotter shall stop any unauthorized solid waste disposal

such as, whole tires, white goods, and lead acid batteries. Spotter and equipment operators shall be considered separate positions.

2. Continue to develop, revise and implement a revised groundwater monitoring plan that was developed to expand monitoring coverage for the entire landfill, and seepage areas, as requested in our letter dated July 27, 2005 to Mr. Paul Burns of Waste Management of Hawaii, Inc. The development, revision and implementation of a revised groundwater monitoring plan shall follow the proposed timeline presented with your Tidal Study Results and Groundwater Monitoring Well Network, prepared by EarthTech and dated December 15, 2005.

3. Remove the storage of all materials from the ash monofill and MSW landfill area with the exception of cover material. All stockpiled soil materials, except continuously operated stockpiles of less than one-week capacity, shall have stormwater/erosion controls and shall not exceed permit grades. Stockpiled soil materials shall not impede surface water drainage paths to conveyance channels. Only stockpiled soil materials for use as daily or intermediate cover are allowed on the active portion of the landfill, with a maximum capacity of 3 months and in not more than two stockpiles.

4. Place daily cover on the active MSW workface at the end of each workday. Submit daily-cover-verification photographs of the active MSW work area at noon and at the end of the workday. The photographs shall be identified with date and time of photograph, cell number, and name of responsible person taking the photo. The photographs taken on the same day shall be taken from the same perspective.

5. Operate only one workface in the ash monofill at any given time. In accordance with Solid Waste Management Permit Number LF-0054-02, Special Conditions IIIB, Item 1e, fresh MSW ash material may be used as daily cover material for the ash monofill provided that Special Conditions IIIB, Items 1a, b, c and d are met and such usage is limited to the active area where MSW ash is being placed on a daily basis. If this condition cannot be met, then fresh MSW ash may not be used and daily soil cover shall be place. If fresh MSW ash is used as daily cover, intermediate cover shall be placed over the MSW ash at least every 7 days to control fugitive dust. Submit daily/intermediate cover verification photographs of the active MSW ash workface at noon and at the end of the workday. The photographs shall be identified with the date and time of photograph, cell number and name of responsible person taking the photo. The

photographs taken on each workface and cell shall be taken from the same perspective.

6. Within thirty (30) days of this order becoming final, complete or submit the following items to the department for review and approval:

   a. A plan and time schedule for the construction of the MSW leachate manhole in MSW Cell 4B. The RESPONDENTS shall implement the plan in accordance with the approved time schedule. The leachate manhole shall be constructed to allow for automated and manual measurements of leachate head on the liner system, and automated pumping of leachate. The overflow of leachate generated in the MSW cell into the ash cell is not acceptable.

      Upon the completion of the leachate manhole construction in MSW Cell 4B, revise the "Groundwater and Leachate Monitoring Plan," dated October 7, 1997, to reflect depths and locations of all leachate sumps to include present and all new or future leachate sumps within the site including E cell lateral expansion and ash monofill leachate drain line in the ash buttress. The revised plan should include diagrams (blueprints) for any new or future leachate sumps location and provide validation of all diagrams.

   b. Install and maintain grade survey control markers to delineate the boundaries and elevations of the ash monofill and MSW landfill areas, including the delineation of overfilled areas. Submit updated drawings with grades, and height of the control markers on a quarterly basis.

   c. A plan and time schedule for the correction of the overfill areas of the ash monofill and MSW landfill to meet permit grades. The plan shall address waste capacity needs for the county until the expiration date of the landfill permit.

   d. A plan and time schedule for the management of county waste after the expiration date of the landfill. Should the City and County of Honolulu decide to continue operations at the Waimanalo Gulch Sanitary Landfill or at a different location, a <u>complete</u> solid waste management permit application shall be submitted at least one year prior to the current expiration date of Solid Waste Management Permit (LF-0054-02) for the Waimanalo Gulch Sanitary Landfill.

7. On a daily basis, maintain the following records. The daily records shall be summarized with monthly and annual totals. The records and copies of the records shall be made available to the department upon request.

   a. Tabulate records addressing the use of daily and intermediate soil cover material for the MSW workface, ratio of daily soil cover used to the amount of waste placement, dimensions of daily waste cell, tonnage of waste and volume of soil utilized as daily for the completed MSW cells, and the volume of intermediate soil cover utilized.

   b. Tabulate records addressing the use of daily and intermediate soil cover material for the ash monofill, ratio of daily cover to ash, dimensions of the ash cell on a daily basis, tonnage of ash received, and volume of soil utilized as daily and intermediate cover for completed ash cells.

   c. Tabulate records relating to daily tonnage, personnel/position and equipment utilization records. Identify days in which personnel/position and/or equipment was not available. Identify personnel that will place/manage litter fences, direct surface water, and leachate management.

8. On a quarterly basis complete and submit the following documents to the department:

   a. Reports on landfill operations based on annual operating report requirements. The reports shall include an updated isopach drawing comparing current fill elevations with permitted grades.

   b. Leachate management reports that include, daily to weekly leachate head measurements for all leachate sumps within the facility, monthly manual reading verification, quantity of leachate removed, disposition of leachate, leachate constituent analyses, and name of the individual responsible for the collection and data recording.

   c. Records addressing the use of intermediate soil cover on the active portion of the landfill for addressing erosion, stormwater water management and traffic. The intermediate cover shall be maintained to ensure a twelve-inch cover.

d. Monthly methane gas monitoring data collected from perimeter and enclosed structures. Results that exceed regulatory limits or show increasing trend should be accompanied with an explanation and type of corrective actions to mitigate the problem. The RESPONDENTS shall mitigate the situation to ensure concentrations below regulatory levels.

e. Inspect and maintain the surface water management systems, and maintain records of the inspection and any repairs. The surface water run-on controls shall maintain paths to the surface water basin and eliminate water ponding against landfill edges. The run-off controls shall direct surface water away from active workface, maintain paths including on-site silt control to surface water collection system and siltation basin, and eliminate stormwater ponding within the landfill. These records do not need to automatically be submitted to the department, however, the records and copies of the records shall be made available to the department upon request

9. Within ninety (90) days of the order becoming final, RESPONDENTS shall submit the following plans to the Department of Health for review and approval. The plans shall be implemented in accordance with the approved time schedule.

a. A plan and time schedule to repair the top decks and side slopes of the ash monofill and MSW landfill areas to ensure an appropriate cover thickness (12-inch intermediate cover).

b. A plan and time schedule on how the facility will manage the disposal of asbestos and maintain disposal location information to ensure that present and future asbestos material can be located/avoided in the future. Provide 30-day advance written notification to DOH on any future drilling/excavation through waste, including any future installation of gas collection wells. The notification shall include excavation/drilling plans and locations.

c. A plan and time schedule describing how the facility will keep litter to a minimum by minimizing cell geometry, the placement of primary and secondary litter fences, wind influencing barriers and litter pickers. Records documenting litter collection such as, amount of litter collected, number of litter pickers utilized each day,

wind velocity, and speed shall be maintained and made available for department review. In addition, the workface area and litter fences shall be free of litter at the end of the workday.

d. A plan to manage waste in an event of a natural disaster (i.e. seismic event) such that the Waimanalo Gulch Sanitary landfill and ash monofill are not able to accept waste. The alternative shall provide for MSW and ash disposal, with a minimum five-year capacity, to allow for repairs / new site developments. The alternate site must be approved in accordance with Hawaii Administrative Rules Chapter 11-58.1 and meet DOH Solid Waste Management Permit requirements.

10. The duration of the activities specified in this order shall be continued as applicable until the issuance of a modified or renewed solid waste permit that would otherwise supercede Solid Waste Management Permit LF-0054-02.

11. Send to the Director of Health, within ten (10) days after this order becomes final, a certified check payable to the State of Hawaii in the amount of two million seven hundred sixty nine thousand six hundred sixteen dollars ($2,769,616).

Paragraphs 1 to 11 of this Order and the Notice and Finding of Violation shall become final and effective twenty (20) days after receipt, unless the RESPONDENTS submit a written request to the Director for a hearing pursuant to section 342H-7, H.R.S. before the twenty (20) days are up. If a hearing on paragraphs 1 to 10 of this Order and the Notice and Finding of Violation is requested, it will be held in conjunction with the hearing on the penalty imposed by paragraph 11 of this Order.

If a hearing is requested, it will be held on a date, time, and place to be specified later. The hearing will be conducted in accordance with Chapter 91, H.R.S. and the Rules of Practice and Procedure of the Department of Health; the hearing will address the issues raised by the Notice and Finding of Violation and Order in this case. If a hearing is requested, RESPONDENTS must attend a pre-hearing conference scheduled for March 7, 2006, at 10:00am in Room 200, 1250 Punchbowl Street, Honolulu, Hawaii. At the pre-hearing conference, the date(s) of the hearing as well as other pertinent deadlines will be determined.

If you have special needs due to a disability that will aid you in participating in the hearing or pre-hearing conference, please contact the Hearings Officer at (808)

586-4409 (voice) or through the Telecommunications Relay Service (711), at least ten (10) working days before the hearing or pre-hearing conference date.

Parties may present evidence and argument on any issue raised by any paragraph in the Notice and Finding of Violation or Order or otherwise raised by this case. Parties may examine and cross-examine witnesses and present exhibits.

Parties may be represented by legal counsel at their own expense. An individual may appear on his own behalf, or a member of a partnership may represent the partnership, or an officer or authorized employee of a corporation or trust or association may represent the corporation, trust, or association.

After such hearing, this Order shall be affirmed, modified, or rescinded by the Director.

Please direct the written request for a hearing, if any, and all inquiries concerning this case to:

Steven Y.K. Chang, P.E., Chief
Solid and Hazardous Waste Branch
State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801
Telephone: (808)586-4226

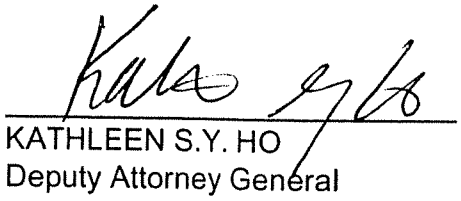
Failure to comply with this Order may subject the RESPONDENTS to additional penalties of $1,000 a day and measures under chapter 342H, H.R.S. and the rules adopted thereunder.

DATED: Honolulu, Hawaii JAN 3 1 2006

DEPARTMENT OF HEALTH
STATE OF HAWAII

LAURENCE K. LAU
Deputy Director for Environmental Health

APPROVED AS TO FORM:



KATHLEEN S.Y. HO
Deputy Attorney General

IN THE DEPARTMENT OF HEALTH

STATE OF HAWAII

Department of Health, State of Hawaii, Complainant, vs. Waste Management of Hawaii, Inc. And City and County of Honolulu, Respondents.	))))))))))))	DOCKET NO. 05-SHW-SWS-004 **SETTLEMENT AGREEMENT**

SETTLEMENT AGREEMENT

This is a Settlement Agreement ("Agreement") between the Solid Waste Section, Department of Health, State of Hawaii ("DOH"), and Waste Management of Hawaii, Inc. ("WMH") and the City and County of Honolulu, hereinafter referred to as "RESPONDENTS", to set forth RESPONDENTS' responsibilities relating to the payment of penalties and injunctive relief.

I. PRELIMINARY STATEMENT

1. On or about January 31, 2006, COMPLAINANT DOH, filed an eighteen count, Notice and Finding of Violation and Order in Docket No. 05-SHS-SWS-004 ("NFV") for certain permit violations concerning the operations and management of the Waimanalo Gulch Sanitary Landfill (the "Landfill") which is owned, operated and/or controlled by RESPONDENTS. The NFV is incorporated by reference and made a part of the settlement of this case.

2. Pursuant to HRS sections 342H-9 and 342H-10, the DOH NFV assessed a total penalty of $ 2,769,616.00 against RESPONDENTS. Shortly thereafter, to correct an error in calculating the penalty amount, DOH reduced the assessed penalty to $2,445,130.00.

3. The DOH and RESPONDENTS have agreed to conclude this enforcement action by entering into this Agreement.

II. WAIVER OF RIGHTS

4. RESPONDENTS hereby agree to waive any rights RESPONDENTS may have to a hearing on any issue relating to the factual allegations or legal conclusions set forth in the NFV.

5. RESPONDENTS admit and agree that the DOH has jurisdiction to enter into this Agreement and to enforce its terms. Further, RESPONDENTS agree that the DOH has jurisdiction and authority to compel compliance with the terms and conditions of this Agreement in an enforcement proceeding and be bound by the laws and rules of the State of Hawai'i.

III. PARTIES BOUND

6. This Agreement shall apply to and be binding upon the DOH and RESPONDENTS. RESPONDENTS agree to carry out all actions required of RESPONDENTS by this Agreement. The signatories to this Agreement certify that they are authorized to execute and legally bind the parties they represent to this Agreement. RESPONDENTS shall give notice of this Agreement to any successors in interest prior to transfer of ownership of the Landfill or of the contractor operating the Landfill. No change in ownership or corporate status of RESPONDENTS or of the Landfill shall alter RESPONDENTS' responsibilities under this Agreement without written consent by the DOH.

IV. CORRECTIVE ACTIONS AND COMPLIANCE REQUIREMENTS

7. RESPONDENTS agree to act in accordance with the Hawaii Revised Statutes, the Hawaii Administrative Rules, the conditions of their solid waste management permit and this Agreement.

7.1. RESPONDENTS shall make every practicable effort to screen waste and prevent disposal of any unacceptable waste, including but not limited to, whole tires, white goods, and lead-acid batteries, from entering and being disposed at the Landfill.

7.2. RESPONDENTS shall implement the Groundwater and Leachate Monitoring Plan dated August 2007, and any approved subsequent submissions. Groundwater and leachate samples from each monitoring well and leachate sump shall be collected and analyzed on a quarterly basis, or as required or otherwise approved by the DOH.

a. Groundwater samples shall be analyzed for constituents listed in 40 CFR 258, Appendix I, major cations and anions (Mg, Na, Ca, K, Cl, CO3, SO4, HCO3), major leachate indicators (TDS, TOC, total alkalinity, nitrogen-ammonia, Cl, and Fe), COD, nitrate-N, bromide, and field measurements (electrical conductance, pH, temperature, turbidity, and groundwater surface elevation), or as required or otherwise approved by the DOH.

b. Groundwater samples from newly installed wells shall also be analyzed for the following constituents in the first quarterly monitoring event: constituents listed in 40 CFR 258, Appendix II, major cations and anions (Mg, Na, Ca, K, Cl, CO3, SO4, HCO3), major leachate indicators (TDS, TOC, total alkalinity, nitrogen-ammonia, Cl, Fe), COD, nitrate-N, bromide, and field measurements (electrical conductance, pH, temperature, turbidity, and groundwater surface elevation), or as required or otherwise approved by the DOH.

c. Leachate samples shall be analyzed for constituents listed in 40 CFR 258, Appendix II, major cations and anions (Mg, Na, Ca, K, Cl, CO3, SO4, HCO3), major leachate indicators (TDS, TOC, total alkalinity, nitrogen-ammonia, Cl, Fe), COD, nitrate-N, bromide, and field measurements (electrical conductance, pH, temperature, and turbidity), or as required or otherwise approved by the DOH.

7.3. RESPONDENTS shall place a minimum of 6-inches of daily cover on the active MSW workface at the end of each workday, and shall leave no exposed waste. RESPONDENTS shall implement a Daily Cover Monitoring Verification Program as follows:

a. RESPONDENTS shall take digital photos of the active workface at the middle and end of each weekday (Monday through Friday), from the same perspective, to document the placement and thickness of daily cover. Digital photo records shall be maintained at the facility and submitted to the DOH via email by 12:00 noon on the next business day, with cell location information. RESPONDENTS and DOH will work cooperatively to determine the best perspective for the photos.

b. RESPONDENTS shall record the following quantitative items on a daily basis:
   i. Volume of waste disposed,
   ii. Cell geometry, and
   iii. Volume and type of daily cover used.

7.4. RESPONDENTS shall apply at least six inches of soil cover over exposed ash (not inclusive of alternative daily cover of fresh ash) every seven (7) days, or more frequently as required by the DOH. RESPONDENTS shall implement a Weekly Cover Monitoring Verification Program as follows:

a. RESPONDENTS shall take digital photos of the active ash workface on a weekly basis, prior to the placement of the weekly cover and after the weekly cover has been placed. Digital photo records shall be maintained at the facility and submitted to the DOH via email by 12:00 noon on the next business day following the day on which weekly cover was placed, with cell location information. RESPONDENTS and DOH will work cooperatively to determine the best perspective for the photos.

b. RESPONDENTS shall record the following quantitative items on a weekly basis:
   i. Volume of waste ash disposed,
   ii. Cell geometry, and
   iii. Volume of soil cover used.

7.5. RESPONDENTS shall cover all inactive ash and MSW areas with intermediate cover. Inactive areas are areas that do not receive waste (ash or MSW) within a 30-day period. RESPONDENTS shall also cover any area receiving vehicular traffic with intermediate cover, regardless of the time period since last receiving waste. Intermediate cover shall be a minimum of 12 inches of earthen material (may include six inches of soil daily cover). Particle size shall be adequate to minimize infiltration and direct stormwater to collection systems.

7.6. RESPONDENTS shall submit an application to the DOH for a permit modification to increase the maximum final grades of the ash monofill.

7.7. RESPONDENTS shall maintain the MSW leachate collection sump (4B-cell sump) leachate discharge riser and associated pumps and instrumentation. The sump leachate discharge riser shall be constructed in accordance with design drawing titled, *Sump 4B Riser* Replacement, by Sanborn, Head and Associates, Inc., dated July 26, 2007, and approved subsequent submissions. RESPONDENTS shall submit a written report, within 30 days of the Effective Date or receipt of a revised solid waste permit, whichever is earlier, documenting installation of the 4-B cell sump leachate discharge riser and associated equipment. The report shall be prepared by or approved by a professional engineer licensed in the State of Hawaii, and at a minimum, shall include the following:

a. Description of procedures for the installation of the 4-B cell sump leachate discharge riser and associated equipment,

b. Identification of any deviations from the written installation instructions, the reason for the deviations, and assessment of any effects on the usability of the sump or human health and the environment.

c. Discussion of observations (visual, meter readings, etc.) noted during installation of the leachate discharge riser system, including the presence of charred waste and observations related to the sump location, gravel depth, and liner system. Photo documentation shall also be provided.

d. Survey and as-built drawings documenting the location and construction details of the newly installed 4B-cell sump leachate discharge system.

e. Description of associated appurtenances associated with the sump leachate discharge riser. A copy of the manufacturer's specifications for any pumps and control and measuring devices shall also be provided.

f. Specify the sump depth, top of riser and compliance levels associated with the sump in feet above mean sea level (msl).

g. Certification that the sump leachate discharge riser, and associated appurtenances, were installed in accordance with the design and shall provide adequate means of complying with the leachate management provisions of HAR 11-58.1, the operations plan, and the revised solid waste permit.

7.8. Leachate Monitoring and Recordkeeping.

a. RESPONDENTS shall use automated monitoring systems to monitor leachate levels in all sumps and storage tanks. The automated systems shall include an alarm system to alert RESPONDENTS to anomalous conditions in the sumps or storage tanks.

b. RESPONDENTS shall maintain a log of the status of the leachate collection systems, and record in the log at least three times per week the date, level of leachate in each sump, volume of leachate in each tank, and associated pump rates.

c. RESPONDENTS shall take manual measurements of leachate levels in the ash sump and 4B sump, at least once per month. RESPONDENTS shall take manual measurements of leachate levels in the E1 sump on an annual basis. If manual measurements are inconsistent with automated readings or other problems are identified with the system, the DOH may increase the frequency of manual measurements.

7.9. RESPONDENTS shall remove leachate from the Landfill via each of the leachate sumps, in a manner that maintains a maximum depth of 30 centimeters (12 inches) of leachate above any part of the liner in the cell, outside the sump area.

7.10. Within thirty (30) days of the Effective Date, RESPONDENTS shall install and maintain grade survey control markers to delineate the boundaries and elevations of the ash monofill and MSW landfill areas in sufficient number to ensure compliance with permitted grades.

7.11. RESPONDENTS shall implement the Asbestos Management and Disposal Plan, as provided in the Site Operations Manual. Compliance with the plan does not preclude compliance with other applicable statutes, regulations, and rules. RESPONDENTS shall document the quantity, type, and location of asbestos disposed of in the MSW landfill. Disposal locations shall be recorded with GPS coordinates. RESPONDENTS shall maintain records on the amount and location of asbestos disposal.

7.12 RESPONDENTS shall implement the Interim Perimeter Gas Monitoring Plan dated December 2006, and approved subsequent submissions, until

implementation of the permanent Perimeter Gas Monitoring Plan required by Section 7.13. The gas monitoring program shall also be conducted in accordance with HAR 11-58.1-15(d) and these conditions.

a. RESPONDENTS shall monitor the concentration at depths that will minimize the infiltration of and dilution from atmospheric air.

b. RESPONDENTS shall minimize the amount of time that the probe is open prior to recording the gas concentrations.

c. The interim plan results shall all include the duration of time that the probe was open prior to recording the concentration, length of PVC piping extending above ground surface, and length of tubing inserted at each well.

7.13 RESPONDENTS shall implement the Perimeter Gas Monitoring Plan dated October 2007, and approved subsequent submissions, within six (6) months of the Effective Date or receipt of a revised solid waste permit, whichever is earlier. The gas monitoring program shall also be conducted in accordance with HAR 11-58.1-15(d) and these conditions.

a. The well shall not be vented, or opened prior to measuring the gas concentration.

b. RESPONDENTS shall install permanent gas monitoring probes within four (4) months of the Effective Date, or receipt of a modified solid waste permit, whichever is earlier, and provide documentation of installation within sixty (60) days of completion. Documentation shall include, but is not limited to, geologic logs of each probe location, surveyed locations and elevations of probes, and as-built drawings of each monitoring probe.

7.14 RESPONDENTS shall monitor the concentration of gases, including oxygen, methane, carbon dioxide, and hydrogen. RESPONDENTS shall monitor the concentration of gases in facility structures, including temporary structures, and at the property boundary on a monthly basis, or other frequency as approved by the DOH. If an exceedance is identified, RESPONDENTS may conduct a verification monitoring event, provided that the verification monitoring is conducted within one (1) hour of the initially detected exceedance. If exceedances or other anomalous conditions are identified, the DOH may increase the frequency of monitoring events.

a. The concentration of methane gas shall not exceed 25% of the lower explosive limit (LEL) for methane in facility structures.

b. The concentration of methane gas shall not exceed the LEL for methane at the facility property boundary.

c. The concentration of hydrogen gas shall not exceed 25% of the LEL for hydrogen in facility structures.

d. The concentration of hydrogen gas shall not exceed the LEL for hydrogen at the facility property boundary.

7.15 RESPONDENTS shall submit a report with results within 45 days of each monitoring event. The results shall include the date and time, gas concentrations by volume, barometric pressure, site conditions, name of personnel conducting the monitoring, description of equipment and calibration results, description of monitoring procedure, and identification of any procedures or observations outside of normal conditions.

If verification monitoring performed within one (1) hour of the initial exceedance shows concentrations below the limits in Section 7.14, RESPONDENTS shall place results in the operating record and send written notification of the exceedance and verification monitoring results to the DOH within seven (7) days.

7.16 If combustible gas concentrations exceed the limits in Section 7.14, and verification monitoring is not performed within one (1) hour of the initial exceedance or verification monitoring confirms the initial exceedance, RESPONDENTS shall perform the following.

a. Immediately take all necessary steps to ensure protection of human health;

b. Immediately notify the DOH of the exceedance;

c. Within three (3) days of detection, place in the operating record and submit to the DOH, the type of gas, gas levels detected and a description of the steps taken to protect human health; and

d. Within sixty (60) days of detection, prepare and implement a remediation plan for the combustible gas releases, place a copy of the plan in the operating record, provide a copy of the plan to the DOH, and notify the DOH that the plan has been implemented.

e. Within thirty (30) days after the remediation plan has been completed, submit a report to the DOH documenting the actions taken, additional monitoring results, and plans to prevent future recurrences.

f. The DOH may modify the reporting and implementation schedule, as necessary to protect human health and the environment.

7.17 This Article IV and its compliance requirements shall be effective until issuance of a revised solid waste permit for continued operations, if such a

permit is issued, or until closure for the Landfill, if such a permit is not issued. Thereafter, these requirements shall terminate except for the compliance date set forth in Section 7.13(b) and the Landfill shall be subject to the requirements set forth any revised solid waste permit, or in any permits, statutes, rules, or regulations governing closure.

V. PAYMENTS AND CONSIDERATION FOR SETTLEMENT

8. Civil Penalty Amount. RESPONDENTS shall pay a civil penalty in the amount of ONE MILLION FIVE HUNDRED THOUSAND DOLLARS ($1,500,000). RESPONDENTS may, in their discretion, satisfy this civil penalty through either of the following two options:

8.1. Cash Payment. Within THIRTY (30) days after the Effective Date of this Agreement, RESPONDENTS shall deliver payment in the amount of ONE MILLION FIVE HUNDRED THOUSAND DOLLARS ($1,500,000) to the DOH at the following address:

Solid and Hazardous Waste Branch
Environmental Management Division
Hawaii State Department of Health
919 Ala Moana Blvd., Room 212
Honolulu, Hawaii 96814

8.2. Cash Payment and Supplemental Projects. Within THIRTY (30) days after the Effective Date of this Agreement, RESPONDENTS shall notify the DOH of RESPONDENTS' election to satisfy the civil penalty through a combination of a cash payment to the DOH and Supplemental Environmental Projects, as described below. If RESPONDENTS elect this option, RESPONDENTS shall satisfy a, b and c as indicated below:

a. Within THIRTY (30) days after the Effective Date of this Agreement, RESPONDENTS shall deliver payment in the amount of FIVE HUNDRED TWENTY THOUSAND DOLLARS ($520,000) to the DOH at the address set forth in Section 8.1 above;

b. RESPONDENTS shall pay the amount of SIX HUNDRED THIRTY-SEVEN THOUSAND FIVE HUNDRED DOLLARS ($637,500) in the following manner;

(1) to the DOH, for deposit into a fund be established by order of the Hearings Officer in Docket No. 05-SHW-SWS-004 in an account established within the State of Hawaii Department of Accounting and General Services ("DAGS"). This fund shall be known as a Supplemental Environmental Project ("SEP") Fund and the amounts in the SEP Fund shall be used to fund environmentally beneficial projects to benefit Leeward communities located near the

landfill, or other communities or residents of Oahu, as selected by the DOH or any other State agency designated by the DOH after consultation with the Leeward communities located near the Landfill. RESPONDENTS shall deliver the funds to the DOH at the address stated in Section 8.1 above within THIRTY (30) days after receiving notice from the DOH that the SEP Fund has been established by DAGS, and that such funds are to be deposited. RESPONDENTS shall not participate in the selection of projects funded by the SEP Fund. If the DOH elects to hire a Supplemental Environmental Coordinator, the sum of $ 100,000.00, or such lesser amount as DOH may designated, from the SEP fund shall be used by the DOH to hire a Supplemental Environmental Coordinator to oversee the SEPs that will be selected by the DOH; or

(2) to environmentally beneficial projects selected by the DOH within 30 days of notification;

(3) or to a combination of (1) and (2), as determined by DOH.

If any funds paid in accordance with Section 8.2(b), remain unexpended for environmentally beneficial projects, those monies shall be paid to the DOH at the address listed in Section 8.1 at the discretion of DOH;

c. RESPONDENTS shall satisfy the balance of the penalty amount ($342,500) by designing, engineering, permitting, and constructing at an estimated cost of at least FOUR HUNDRED FIFTY THOUSAND DOLLARS ($450,000) a community drop off center (the "Drop-Off Center") to be located at the Landfill for use by local residents to drop-off solid waste and recyclables in the vicinity of the current scalehouse and administrative building. The design of the Drop-Off Center shall be approved by the DOH. The purpose of the Drop-Off Center is to allow members of the public to conveniently and safely deliver solid waste and/or recyclables to the Landfill for disposal and/or recycling without entering areas of the Landfill with active landfilling operations. If the actual cost to design, engineer, permit, and construct the Drop-Off Center does not exceed $450,000, then RESPONDENTS shall pay the difference to the DOH at the address set forth in Section 8.1 above.

Notwithstanding any other provision in this Agreement, if RESPONDENTS elect to satisfy the civil penalty amount through this option, RESPONDENTS shall be obligated to design, engineer, permit, and construct the Drop-Off Center only when the Landfill is issued all final permits and approvals required for the expansion of the Landfill and continuation of Landfill disposal operations. If RESPONDENTS are not

able to permit or construct the Drop-Off Center consistent with this Agreement and in spite of their reasonable efforts, then in lieu thereof, RESPONDENTS shall pay to the DOH the amount of FOUR HUNDRED THOUSAND DOLLARS ($400,000) at the address set forth in Section 8.1 above.

VI. RELEASES

9. Upon payment of the amounts set forth in Section V (PAYMENTS AND CONSIDERATION FOR SETTLEMENT), any and all violations and claims alleged or which could have been alleged by the DOH in the NFV shall be discharged, dismissed, waived and released as against RESPONDENTS, their respective directors, officers, employees, servants, agents, (former directors, officers, employees, servants and agents), assigns, attorneys, administrators, insurers, subsidiaries, affiliates and/or related entities.

VII. STIPULATED PENALTIES AND ENFORCEMENT

10. Failure by RESPONDENTS to pay the amounts in Section V (PAYMENTS AND CONSIDERATION FOR SETTLEMENT), shall obligate RESPONDENTS to pay a stipulated penalty of $1,000 per day for each day that such failure continues.

11. RESPONDENTS shall pay any stipulated penalties within seven (7) days of demand as set forth in Section VIII (Form of Payment).

12. If RESPONDENTS breach the terms of Section IV (CORRECTIVE ACTION AND COMPLIANCE REQUIREMENTS) prior to the termination of those requirements, RESPONDENTS agree to be subject to the penalties set forth in section 342H-9(a), Hawaii Revised Statutes for such breaches. RESPONDENTS reserve their rights to argue all legal and factual defenses under the law, except for any argument that penalties for such breaches may not be imposed pursuant to that section, any such arguments being contractually waived herein, in consideration of and for this Settlement Agreement. Further RESPONDENTS agree that for the purposes of said section 342H-9(a), any breach of the terms of Section IV (CORRECTIVE ACTION AND COMPLIANCE REQUIREMENTS) shall be considered breaches of a permit and/or variance issued pursuant to Chapter 342H, Hawaii Revised Statutes.

13. The provisions of this section shall not be construed to limit any other remedies, including but not limited to institution of proceedings for civil or criminal liability, available to DOH for violations of this Agreement future violations of the permit, or for violations of any other provision of law.

VIII. FORM OF PAYMENT

14. The amounts payable under Sections V (PAYMENTS AND CONSIDERATION FOR SETTLEMENT and VII (STIPULATED PENALTIES AND ENFORCEMENT) shall

be paid by cashier's check, payable to the State of Hawaii, and shall be delivered to the DOH as set forth in Section XI (NOTIFICATION).

IX. DELAYS OR IMPEDIMENTS TO COMPLIANCE

15. RESPONDENTS shall notify the DOH orally, as soon as feasible, and in writing within ten (10) calendar days of any delay or anticipated delay which does or may affect compliance with this Agreement. The notice shall describe in detail the anticipated length of the delay, the precise cause(s) of the delay, the measures taken and to be taken by RESPONDENTS to prevent or minimize the delay, the timetable by which those measures will be implemented, and the expected effect on the environment of the delay. RESPONDENTS shall take all reasonable measures to avoid or minimize any such delay.

16. The burden of proving that any delay is caused by circumstances entirely beyond the control of RESPONDENTS shall rest with RESPONDENTS.

X. ENTRY AND INSPECTION

17. Any authorized representative of the DOH, upon presentation of credentials, may enter upon the Landfill premises and/or inspect the Landfill records of RESPONDENTS at any time for the purpose of monitoring compliance with the provisions of this Agreement. This provision shall not be deemed to limit any authority the DOH otherwise has to enter and inspect.

XI. NOTIFICATION

18. Whenever, under the terms of this Agreement, a notice, report, or payment is required to be given by one party to another, such notice, report, or payment shall be directed to the individuals specified below, at the addresses given, unless a party gives notice in writing to the other parties that another individual has been designated to receive such communications:

Steven Y.K. Chang, P.E., Chief
Solid and Hazardous Waste Branch
Environmental Management Division
Hawaii State Department of Health
919 Ala Moana Blvd., Room 212
Honolulu, Hawaii 96814
Telephone: (808) 586-4226
Telefax: (808) 586-7509

Department of Environmental Services
City and County of Honolulu
1000 Uluohia Street, Suite 308
Kapolei, Hawaii 96707
Telephone: (808) 768-3486
Telefax: (808) 768-3487

Director of Operations
Waste Management of Hawaii, Inc.
Waimanalo Gulch Landfill
92-460 Farrington Hwy.
Kapolei, HI 96707
Telephone: (808) 668-2985
Telefax: (808) 668-1366

General Counsel, Western Group
Western Group Legal Department
7025 North Scottsdale Road, Suite 200
Scottsdale, AZ 85253
Telephone: (480) 624-8400
Telefax: (480) 951-5280

XII. AUTHORITY OF SIGNATORIES

19. Each undersigned representative or a party to this Agreement certifies that he or she has full authority to enter into the terms of this Agreement and legally to bind the party which he or she represents.

20. Compliance with this Agreement does not relieve RESPONDENTS' responsibility to comply with all other applicable laws and regulations.

XIII. NO ADMISSION OF LIABILITY

21.The parties acknowledge that neither this Agreement, nor the fact of settlement, nor the civil penalty and settlement payments, nor the settlement proceeds are, may be construed as, may be deemed evidence of, or may be used at any time as an admission, concession, presumption, or inference of fault, wrongdoing or liability of any party. The Agreement is to be construed strictly as a compromise and settlement of all the alleged violations in NFV for the purpose of ending past and present controversies, litigation of the contested case, and expenses.

XIV. ENTIRE AGREEMENT

22. This Agreement sets forth the entire agreement between the parties with respect to this matter.

XV. EFFECTIVE DATE

23. This Agreement shall become effective as soon as it has been signed by all the parties (the "Effective Date").

XVI. MODIFICATIONS

24. This Agreement shall not be modified except in writing, signed by all the parties.

XVII. TERMINATION

25. RESPONDENTS must demonstrate to the DOH's satisfaction that RESPONDENTS have made the payment required by Sections 8.1 or 8.2 (as appropriate) of this Agreement, and implemented the corrective actions and compliance requirements of Section IV (until those requirements are governed by a revised solid waste permit, as provided for in Section 7.17 of this Agreement. Within thirty (30) working days after such a showing by RESPONDENTS, the DOH shall issue a letter to RESPONDENTS certifying satisfactory compliance, which shall terminate this Agreement.

XVIII. EFFECT

26. This Agreement constitutes the final agreement between the parties and the settlement of Docket No. 05-SHW-SWS-004; and concludes the contested case proceedings which shall be dismissed with prejudice upon execution of this Agreement.

XIX. FEES AND COSTS

27. Each party shall bear its own costs and attorneys' fees.

XX. GOVERNING LAW

28. This Agreement shall be enforceable under, and interpreted according to the laws of the State of Hawaii.

XXI. SEVERABILITY OF UNLAWFUL PROVISIONS

29. Should any provision of this Agreement be declared or be determined by any court to be illegal or invalid, the validity of the remaining parts, terms, or provisions shall not be affected thereby and said illegal or invalid part, term, or provision shall be deemed not to be a part of this Agreement.

XXII. COUNTERPART/FACSIMILE SIGNATURES

30. This Agreement may be executed in two or more counterparts or by facsimile, and any set of the counterparts or facsimile that are collectively executed by the Parties hereto shall be sufficient proof of this Agreement.

Dated: Honolulu, Hawaii DEC - 7 2007

DEPARTMENT OF HEALTH
STATE OF HAWAII

LAURENCE K. LAU
Deputy Director for Environmental Health

APPROVED AS TO FORM:

KATHLEEN S.Y. HO
Deputy Attorney General

WASTE MANAGEMENT OF HAWAII, INC,

ANDREW M. KENEFICK
Senior Legal Counsel
per Corporate Resolution (Dec. 6, 2007)

APPROVED AS TO FORM:

LORRAINE H. AKIBA
Attorney for Waste Management of Hawaii, Inc.

CITY AND COUNTY OF HONOLULU

DIRECTOR, DEPARTMENT OF
ENVIRONMENTAL SERVICES

APPROVED AS TO FORM:
AND LEGALITY:

Deputy Corporation Counsel

Department of Health, State of Hawaii vs. Waste Management, Inc. and City and County of Honolulu; Docket No. 05-SHW-SWS-004; Settlement Agreement

Appendix B

Finding and Notice of Violation, Docket No. R6-06-06
Environmental Protection Agency, April 5, 2006

United States
Environmental Protection
Agency

Regional Administrator
75 Hawthorne Street
San Francisco, CA 94105-3901

Region 9, Arizona, California
Hawaii, Nevada, Guam
American Samoa,
Northern Marianas Islands

EPA Environmental News

For Immediate Release: April 5, 2006
Contact: Dean Higuchi, 808-541-2711, higuchi.dean@epa.gov

EPA cites two Hawai'i landfills for clean air violations

Waimanalo Gulch on Oahu and West Hawai'i on the Big Island

HONOLULU – The U.S. Environmental Protection Agency recently announced that Waste Management of Hawaii, Inc., and island governments on Oahu and Hawai'i have violated the Clean Air Act at the Waimanalo Gulch landfill at Kapolei and West Hawai'i landfill at Waikaloa.

The violations pertain to the Waimanalo Gulch landfill at Kapolei on Oahu and West Hawai'i landfill at Waikaloa on the Big Island. The Waimanalo Gulch landfill is owned by the City and County of Honolulu, and the West Hawai'i landfill is owned by the County of Hawai'i. Both landfills are run and operated for the counties by Waste Management of Hawaii, Inc.

"Landfill owners and operators need to meet the planning, permitting and control requirements to comply with clean air rules," said Deborah Jordan, director for the EPA Pacific Southwest Region's Air Division. "The goal of our action is to ensure that Waste Management and the counties effectively control emissions from both landfills."

At the Waimanalo Gulch landfill, EPA inspectors found that the gas collection and control system was installed seven years late in August 2005, and does not meet requirements. At the West Hawaii landfill, Waste Management and the County of Hawai'i violated several reporting requirements. Both landfills have been required to comply with the clean air rules since March 1996.

The EPA is requiring Waste Management and the counties to get both landfills into compliance with clean air rules. Under the Clean Air Act, they could face fines of up to $32,500 per day, per violation. Staff from the Hawai'i Department of Health's Clean Air Branch provided assistance to the EPA's investigators.

Nonmethane landfill gas contains volatile organic compounds and hazardous air pollutants that can result in adverse effects to the respiratory system, cancer, and damage to the nervous system. Methane emissions contribute to global climate change and can result in fires or explosions when they accumulate in structures on or off the landfill site.

# # #

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

CERTIFIED MAIL NO. 7003 3110 0006 2000 8182
RETURN RECEIPT REQUESTED

Paul Burns
General Manager
Waste Management of Hawaii, Inc.
92-460 Farrington Highway
Kapolei, HI 96707

CERTIFIED MAIL NO. 7003 3110 0006 2000 8175
RETURN RECEIPT REQUESTED

Eric S. Takamura, P.E.
Director
Department of Environmental Services
City and County of Honolulu
1000 Uluohia St., Suite 308
Kapolei, HI 96707

In Reply: AIR-5
Refer To: Docket No. R9-2006-06

Dear Messrs. Burns and Takamura:

Enclosed is a copy of a Finding and Notice of Violation ("NOV") that the United States Environmental Protection Agency ("EPA") is issuing to Waste Management of Hawaii ("WMH") and the City and County of Honolulu ("CCH") pursuant to Section 113 (a) of the Clean Air Act (the "Act"), 42 U.S.C. § 7413 (a). The NOV is intended to notify WMH and CCH of EPA's finding that Waimanalo Gulch Solid Waste Landfill at Kapolei on Oahu (the "Landfill") has been and is in violation of the Act.

You should be aware that Section 113(a) of the Act provides that EPA may issue an Order requiring compliance, issue an Order assessing a civil administrative penalty, or commence a civil action seeking an injunction and/or a civil penalty. Furthermore, Section 113(c) of the Act provides for criminal penalties in certain cases.

Upon a finding of adequate evidence of a continuing violation, EPA may place the Landfill on the List of Violating Facilities. See Section 306 of the Act and the regulations promulgated in 40 C.F.R. Part 32. Such facility would be declared ineligible for participation in any federal contract, grant, loan, or subagreement thereunder.

If you wish to discuss the NOV, you may request a conference with EPA. The conference will afford WMH and CCH an opportunity to present information bearing on the finding of violation, the nature of the violation, any efforts you have taken to achieve compliance, and the steps you propose to take to achieve compliance.

Please contact Brian Riedel, Office of Regional Counsel, at (415) 972-3924, to request a conference. Such request should be made as soon as possible, but in any event no later than 10 business days after receipt of this letter. Thank you for your cooperation in this matter.

Sincerely,

Deborah Jordan
Director, Air Division

Enclosures

cc: Wilfred Nagamine, CAB, HSDOH

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

CERTIFIED MAIL NO. 7004 1160 0004 3168 5961
RETURN RECEIPT REQUESTED

Paul Burns
General Manager
Waste Management of Hawaii, Inc.
92-460 Farrington Highway
Kapolei, HI 96707

CERTIFIED MAIL NO. 7004 1160 0004 3168 5978
RETURN RECEIPT REQUESTED

Michael Dworsky
Division Head
Solid Waste
Department of Environmental Management
County of Hawaii
25 Aupuni Street, Room 214
Hilo, HI 96720

In Reply: AIR-5
Refer To: Docket No. R9-2006-07

Dear Messrs. Burns and Dworsky:

Enclosed is a copy of a Finding and Notice of Violation ("NOV") that the United States Environmental Protection Agency ("EPA") is issuing to Waste Management of Hawaii ("WMH") and the County of Hawaii ("CH") pursuant to Section 113 (a) of the Clean Air Act (the "Act"), 42 U.S.C. § 7413 (a). The NOV is intended to notify WMH and CH of EPA's finding that West Hawaii landfill at Waikaloa on the Big Island (the "Landfill") has been and is in violation of the Act.

You should be aware that Section 113(a) of the Act provides that EPA may issue an Order requiring compliance, issue an Order assessing a civil administrative penalty, or commence a civil action seeking an injunction and/or a civil penalty. Furthermore, Section 113(c) of the Act provides for criminal penalties in certain cases.

Upon a finding of adequate evidence of a continuing violation, EPA may place the Landfill on the List of Violating Facilities. See Section 306 of the Act and the regulations promulgated in 40 C.F.R. Part 32. Such facility would be declared ineligible for participation in any federal contract, grant, loan, or subagreement thereunder.

If you wish to discuss the NOV, you may request a conference with EPA. The conference will afford WMH and CH an opportunity to present information bearing on the finding of violation, the nature of the violation, any efforts you have taken to achieve compliance, and the steps you propose to take to achieve compliance.

Please contact Brian Riedel, Office of Regional Counsel, at (415) 972-3924, to request a conference. Such request should be made as soon as possible, but in any event no later than 10 business days after receipt of this letter. Thank you for your cooperation in this matter.

Sincerely,

Deborah Jordan
Director, Air Division

Enclosures

cc: Wilfred Nagamine, CAB, HSDOH

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

In the Matter of: Waste Management of Hawaii, Inc. 92-460 Farrington Highway Kapolei, Oahu, Hawaii 96707 County of Hawaii 25 Aupuni Street Hilo, Hawaii 96720 Proceeding under Section 113 of the Clean Air Act, 42 U.S.C. § 7413	Docket No. R9-06-07 Finding and Notice of Violation

This Finding and Notice of Violation ("NOV") is issued pursuant to the authority of Section 113 of the Clean Air Act, 42 U.S.C. §§ 7401-7671q (the "Act") to Waste Management of Hawaii, Inc. ("WMH") and the County of Hawaii ("CH") for violations of the Act at West Hawaii Sanitary Landfill ("West Hawaii Landfill" or "Landfill") located at 71-1111 Queen Kahumanu Hwy., Waikoloa, Hawaii. The authority of the Administrator of the United States Environmental Protection Agency ("EPA") to issue an NOV pursuant to Section 113(a) of the Act, 42 U.S.C. § 7413(a), has been delegated to the Regional Administrator, EPA Region IX, and redelegated to the Director, Air Division, EPA Region IX.

STATUTORY AND REGULATORY AUTHORITY

1. Section 111(b)(1)(A) of the Act, 42 U.S.C. § 7411(b)(1)(A), requires EPA to publish a list of

categories of stationary sources that emit or may emit any air pollutant. The list must include any categories of sources which are determined to cause, or significantly contribute to, air pollution which may be reasonably anticipated to endanger public health or welfare. "New source[s]" are defined as stationary sources, the construction or modification of which is commenced after the publication of the regulations or proposed regulations prescribing a standard of performance applicable to such source. 42 U.S.C. § 7411(a). These standards are known as New Source Performance Standards ("NSPS").

2. Section 111(e) of the Act, 42 U.S.C. § 7411(e), prohibits an owner or operator of a new source from operating that source in violation of an NSPS.

3. Pursuant to Section 111(b)(1)(A) of the Act, 42 U.S.C. § 7411(b)(1)(A), and at 40 C.F.R. § 60.16, EPA has identified municipal solid waste landfills as one category of stationary sources that cause, or contribute significantly to, air pollution that may reasonably be anticipated to endanger public health or welfare. EPA also promulgated the Standards of Performance for Municipal Solid Waste Landfills ("NSPS Subpart WWW" or "Subpart WWW"), at 40 C.F.R. Part 60, Subpart WWW, §§ 60.750 - 60.759, effective March 12, 1996.

4. NSPS Subpart WWW applies to each municipal solid waste landfill ("MSW landfill" or "landfill") that commenced

construction, reconstruction or modification on or after May 30, 1991.

5. Pursuant to NSPS Subpart WWW, each owner or operator of an MSW landfill having a design capacity $\geq$ 2.5 million megagrams ("Mg") and 2.5 million cubic meters ("m^3") must calculate its nonmethane organic compounds ("NMOC") emissions potential using procedures specified in 40 C.F.R. § 60.754 and report the results to EPA on an annual basis. *See* 40 C.F.R. §§ 60.752(b) and 60.757(b)(1).

6. The annual NMOC emission rate emission rate report must include all the data, calculations, sample reports and measurements used to estimate annual emissions. 40 C.F.R. § 60.757(b)(2).

7. If the calculated NMOC emissions $\geq$ 50 Mg/yr, the owner or operator must submit a gas collection and control design plan ("design plan") within 1 year, and install a gas collection and control system ("GCCS") within 30 months of the first report indicating emissions $\geq$ 50 Mg NMOC/yr, unless the landfill performs Tier 2 or 3 measurements that show NMOC emissions < 50 Mg/yr. *See* 40 C.F.R. §§ 60.752(b) and 60.757(c).

8. If the calculated NMOC emissions > 50 Mg/yr and the owner or operator elects to perform Tier 2 NMOC sampling and analysis pursuant to 40 C.F.R. § 60.754(a)(3), a revised NMOC emission rate report, with the recalculated emission rate, based on Tier 2 sampling and analysis, must be submitted to EPA within

180 days of the first calculated exceedance of 50 Mg/yr. *See* 40 C.F.R. § 60.757(c)(1).

9. On January 30, 2006, EPA delegated authority to implement and enforce NSPS Subpart WWW to the State of Hawaii, Department of Health.

10. Pursuant to Section 502(a) of the Act, sources subject to regulation under Section 111 of the Act (NSPS) must obtain an operating permit under Title V of the CAA, unless the source category is exempted by EPA.

11. Pursuant to 40 C.F.R. § 60.752(b), the owner or operator of an MSW landfill that is subject to NSPS Subpart WWW with a design capacity $\geq$ 2.5 million Mg and 2.5 million m^3 is subject to part 70 or 71 permitting requirements. *See also* 40 C.F.R. § 60.752(c).

12. Forty C.F.R. § 70.5(a)(1) requires a source applying for a part 70 permit for the first time to submit an application within 12 months after the source becomes subject to the part 70 permit program.

FINDING OF VIOLATION

13. The West Hawaii Landfill commenced construction on or after May 30, 1991.

14. Beginning March 12, 1996, the Landfill became subject to NSPS Subpart WWW.

15. On March 12, 1996, the Landfill had a design capacity that exceeded 2.5 million Mg and 2.5 million m^3.

16. On June 9, 1996, WMH submitted an Initial Design Capacity Report and Initial NMOC Emission Rate Report

(collectively, "Initial Report") for the Landfill to EPA pursuant to 40 C.F.R. §§ 60.757(a)(1), 60.757(a)(2) and 60.757(b).

17. In the Initial Report for the Landfill, submitted by WMH to EPA on June 9, 1996, Tier 1 calculations indicated that the NMOC emission rate < 50 Mg/yr.

18. WMH or CH was required to submit Annual NMOC Emission Rate Reports for 2001, 2002, 2003, 2004 and 2005 to EPA on an annual basis.

19. WMH and CH failed to submit Annual NMOC Emission Rate Reports for 2001, 2002, 2003, 2004 and 2005 to EPA on an annual basis.

20. The failure of WMH and CH to submit Annual NMOC Emission Rate Reports for 2001, 2002, 2003, 2004 and 2005 to EPA on an annual basis constitutes five (5) violations of Section 111 of the Act and 40 C.F.R. § 60.757(b).

21. On August 8, 2005, WMH completed Tier 1 calculations for the Landfill that revealed an NMOC emission rate ≥ 50 Mg/yr in 2002.

22. WMH has elected to recalculate the NMOC emission rate for the Landfill pursuant to Tier 2 sampling and analysis, but, to date, has not submitted a revised NMOC emission rate report to EPA.

23. WMH and CH failed to submit a revised NMOC emission rate report based on Tier 2 sampling and analysis for the Landfill within 180 days of June 9, 2002, or by December 9, 2002.

24. WMH and CH also failed to submit a design plan for the Landfill to EPA with one year of June 9, 2002 or by June 9, 2003, and failed to install a GCCS within 30 months of June 9, 2002 or by December 9, 2004.

25. The failures of WMH and CH described in the preceding two paragraphs constitute a violation of Section 111 of the Act and 40 C.F.R. § 60.757(c).

26. Pursuant to 40 C.F.R. § 70.5(a)(1), WMH or CH was required to submit an application for a part 70 permit for the Landfill within 1 year of March 12, 1996, or by March 12, 1997.

27. On June 19, 2001, CH submitted its first part 70 permit application for the Landfill.

28. WMH and CH violated 40 C.F.R. § 70.5 by failing to submit the first part 70 permit application for the Landfill by March 12, 1997.

ENFORCEMENT

29. Section 113(a)(3) of the Act provides that whenever EPA finds that any person has violated, or is in violation of, any requirement or prohibition of, *inter alia*, subchapter I or V of the Act, including, but not limited to, any requirement or prohibition of any rule promulgated under Sections 111 or 502 of the Act, EPA may,

- issue an administrative penalty order pursuant to Section 113(d) for civil administrative penalties of up to $ 32,500 per day of violation, or

- issue an order requiring such person to comply with such requirement or prohibition, or
- bring a civil action pursuant to Section 113(b) for injunctive relief and/or civil penalties of not more than $ 32,500 per day for each violation.

42 U.S.C. § 7413(a)(3), as amended by Pub. L. 104-134. Furthermore, for any person who knowingly violates a requirement or prohibition of Sections 111 or 502 of the Act, Section 113(c) provides for criminal penalties or imprisonment, or both. In addition, under Section 306(a), the regulations promulgated thereunder (40 C.F.R. Part 32), and Executive Order 11738, facilities to be used in federal contracts, grants, and loans must be in full compliance with the Act and all regulations promulgated pursuant to it. Violation of the Act may result in the subject facility being declared ineligible for participation in any federal contract, grant, or loan.

PENALTY ASSESSMENT CRITERIA

Section 113(e)(1) of the Act states that the Administrator or a court, as appropriate, shall, in determining the amount of any penalty to be assessed, take into consideration (in addition to such other factors as justice may require) the size of the business, the economic impact of the penalty on the business, the violator's full compliance history and good faith efforts to comply, the duration of the violation as established by any credible evidence (including evidence other than the applicable test

method), payment by the violator of penalties previously assessed for the same violation, the economic benefit of noncompliance, and the seriousness of the violation. Section 113(e)(2) of the Act allows the Administrator or a court to assess a penalty for each day of violation.

OPPORTUNITY FOR CONFERENCE

WMH and/or CH may, upon request, confer with EPA. The conference will enable WMH and/or CH to present evidence bearing on the finding of violation, the nature of the violation, and any efforts it may have taken or proposes to take to achieve compliance. WMH and/or CH may be represented by counsel. A request for a conference must be made within ten (10) working days of receipt of this NOV. The request for a conference or other inquiries concerning the NOV should be made in writing to:

Brian P. Riedel (ORC-2)
Office of Regional Counsel
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105
(415) 972-3924
facsimile (415) 947-3570

4-4-06
Date

Deborah Jordan
Director, Air Division

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

In the Matter of: Waste Management of Hawaii, Inc. 92-460 Farrington Highway Kapolei, Hawaii 96707 City and County of Honolulu 1000 Uluohia Street, Suite 308 Kapolei, Hawaii 96707 Proceeding under Section 113 of the Clean Air Act, 42 U.S.C. § 7413	Docket No. R9-06-06 Finding and Notice of Violation

This Finding and Notice of Violation ("NOV") is issued pursuant to the authority of Section 113 of the Clean Air Act, 42 U.S.C. §§ 7401-7671q (the "Act") to Waste Management of Hawaii, Inc. ("WMH") and the City and County of Honolulu ("CCH") for violations of the Act at Waimanalo Gulch Municipal Solid Waste Landfill ("Waimanalo Gulch Landfill" or "Landfill") located at 92-460 Farrington Highway, Kapolei, Oahu, Hawaii. The authority of the Administrator of the United States Environmental Protection Agency ("EPA") to issue an NOV pursuant to Section 113(a) of the Act, 42 U.S.C. § 7413(a), has been delegated to the Regional Administrator, EPA Region IX, and redelegated to the Director, Air Division, EPA Region IX.

STATUTORY AND REGULATORY AUTHORITY

1. Section 111(b)(1)(A) of the Act, 42 U.S.C.

§ 7411(b)(1)(A), requires EPA to publish a list of categories of stationary sources that emit or may emit any air pollutant. The list must include any categories of sources which are determined to cause, or significantly contribute to, air pollution which may be reasonably anticipated to endanger public health or welfare. "New source[s]" are defined as stationary sources, the construction or modification of which is commenced after the publication of the regulations or proposed regulations prescribing a standard of performance applicable to such source. 42 U.S.C. § 7411(a). These standards are known as New Source Performance Standards ("NSPS").

2. Section 111(e) of the Act, 42 U.S.C. § 7411(e), prohibits an owner or operator of a new source from operating that source in violation of an NSPS.

3. Pursuant to Section 111(b)(1)(A) of the Act, 42 U.S.C. § 7411(b)(1)(A), and at 40 C.F.R. § 60.16, EPA has identified municipal solid waste ("MSW") landfills as one category of stationary sources that cause, or contribute significantly to, air pollution that may reasonably be anticipated to endanger public health or welfare. EPA also promulgated the Standards of Performance for Municipal Solid Waste Landfills ("NSPS Subpart WWW" or "Subpart WWW"), at 40 C.F.R. Part 60, Subpart WWW, §§ 60.750 - 60.759, effective March 12, 1996.

4. NSPS Subpart WWW applies to each MSW landfill that

commenced construction, reconstruction or modification on or after May 30, 1991.

5. Pursuant to NSPS Subpart WWW, each owner or operator of an MSW landfill having a design capacity $\geq$ 2.5 million megagrams ("Mg") and 2.5 million cubic meters ("m^3") must calculate its nonmethane organic compounds ("NMOC") emissions potential using the Tier 1 calculations at 40 C.F.R. § 60.754 and report the results to EPA. If this report indicates NMOC emissions $\geq$ 50 Mg/yr, the owner or operator must submit a collection and control design plan ("design plan"), prepared by a professional engineer, to EPA within 1 year, and install a gas collection and control system ("GCCS") within 30 months of the first report indicating emissions $\geq$ 50 Mg NMOC/yr, unless the landfill performs Tier 2 or 3 measurements that show NMOC emissions < 50 Mg/yr. *See* 40 C.F.R. §§ 60.752(b) and 60.757(c).

6. A GCCS installed in accordance with 40 C.F.R. § 60.752(b)(2) must meet the design and operation requirements of 40 C.F.R. §§ 60.752(b)(2)(ii) and 60.752(b)(2)(iii).

7. On January 30, 2006, EPA delegated authority to implement and enforce NSPS Subpart WWW to the State of Hawaii, Department of Health.

FINDING OF VIOLATION

8. The Waimanalo Gulch Landfill is owned by CCH and operated by WMH.

9. The Waimanalo Gulch Landfill commenced modification after May 30, 1991.

10. Beginning March 12, 1996, the Landfill became subject to NSPS Subpart WWW.

11. On March 12, 1996, the Landfill had a design capacity $\geq$ 2.5 million Mg and 2.5 million m^3.

12. On June 9, 1996, WMH submitted an Initial Design Capacity Report and Initial NMOC Emission Rate Report (collectively, "Initial Report") for the Landfill to EPA pursuant to 40 C.F.R. §§ 60.757(a)(1), 60.757(a)(2) and 60.757(b).

13. The Initial Report for the Landfill, submitted by WMH to EPA on June 9, 1996, is the first report in which the Landfill had an NMOC emission rate $\geq$ 50 Mg/yr.

14. WMH or CCH was required to either submit a design plan to EPA within 1 year of June 9, 1996, or by June 9, 1997, or perform Tier 2 measurements that show NMOC emissions < 50 Mg/yr and report such results to EPA by December 9, 1996.

15. WMH and CCH failed to submit a design plan to EPA by June 9, 1997.

16. WMH and CCH failed to submit Tier 2 results to EPA by December 9, 1996.

17. WMH and CCH violated Section 111 of the Act, 40 C.F.R. §§ 60.752(b)(2)(i) and 60.757(c) by failing to submit a design plan to EPA by June 9, 1997 or submit Tier 2 recalculations to EPA by December 9, 1996.

18. WMH or CCH was required to install a GCCS for the

Landfill within 30 months of June 9, 1996, or by December 9, 1998.

19. WMH and CCH failed to install a GCCS for the Landfill by December 9, 1998.

20. WMH and CCH violated Section 111 of the Act and 40 C.F.R. § 60.752(b)(2)(ii) by failing to install a GCCS for the Landfill by December 9, 1998.

21. On August 1, 2005, full operation of a GCCS for the Landfill began. However, the GCCS has not complied with, and does not comply with, the design and operation requirements of 40 C.F.R. § 60.752(b)(2). Therefore, WMH and CCH have been in violation, and are considered to be in violation, until WMH and/or CCH establishes continuous compliance with 40 C.F.R. § 60.752(b)(2).

ENFORCEMENT

22. Section 113(a)(3) of the Act provides that whenever EPA finds that any person has violated, or is in violation of, any requirement or prohibition of, *inter alia*, subchapter I or V of the Act, including, but not limited to, any requirement or prohibition of any rule promulgated under Sections 111 or 502 of the Act, EPA may,

- issue an administrative penalty order pursuant to Section 113(d) for civil administrative penalties of up to $ 32,500 per day of violation, or
- issue an order requiring such person to comply with such requirement or prohibition, or

- bring a civil action pursuant to Section 113(b) for injunctive relief and/or civil penalties of not more than $ 32,500 per day for each violation.

42 U.S.C. § 7413(a)(3), as amended by Pub. L. 104-134. Furthermore, for any person who knowingly violates a requirement or prohibition of Sections 111 or 502 of the Act, Section 113(c) provides for criminal penalties or imprisonment, or both. In addition, under Section 306(a), the regulations promulgated thereunder (40 C.F.R. Part 32), and Executive Order 11738, facilities to be used in federal contracts, grants, and loans must be in full compliance with the Act and all regulations promulgated pursuant to it. Violation of the Act may result in the subject facility being declared ineligible for participation in any federal contract, grant, or loan.

PENALTY ASSESSMENT CRITERIA

Section 113(e)(1) of the Act states that the Administrator or a court, as appropriate, shall, in determining the amount of any penalty to be assessed, take into consideration (in addition to such other factors as justice may require) the size of the business, the economic impact of the penalty on the business, the violator's full compliance history and good faith efforts to comply, the duration of the violation as established by any credible evidence (including evidence other than the applicable test method), payment by the violator of penalties previously assessed for the same violation, the economic benefit of

noncompliance, and the seriousness of the violation. Section 113(e)(2) of the Act allows the Administrator or a court to assess a penalty for each day of violation. For purposes of determining the number of days of violation, where EPA makes a prima facie showing that the conduct or events giving rise to this violation are likely to have continued or recurred past the date of this NOV, the days of violation shall be presumed to include the date of this NOV and each and every day thereafter until the defendant or respondent establishes that continuous compliance has been achieved, except to the extent that the defendant or respondent can prove by the preponderance of the evidence that there were intervening days during which no violation occurred or that the violation was not continuing in nature.

OPPORTUNITY FOR CONFERENCE

WMH and/or CCH may, upon request, confer with EPA. The conference will enable WMH and/or CCH to present evidence bearing on the finding of violation, the nature of the violation, and any efforts it may have taken or proposes to take to achieve compliance. WMH and/or CCH may be represented by counsel. A request for a conference must be made within ten (10) working days of receipt of this NOV. The request for a conference or other inquiries

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concerning the NOV should be made in writing to:

Brian P. Riedel (ORC-2)
Office of Regional Counsel
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105
(415) 972-3924
facsimile (415) 947-3570

4-4-06
Date

Deborah Jordan
Director, Air Division

Appendix C

EIS Public Scoping Conducted for the Proposed Expansion of the Waimānalo Gulch Sanitary Landfill, October 2006

Appendix C
EIS Public Scoping

Waimānalo Gulch Sanitary Landfill Lateral Expansion
Waimānalo Gulch, Oahu, Hawaii

October 2006

City & County of Honolulu
Department of Environmental Services
1000 Uluohia Street, 3rd Floor
Kapolei, Hawai'i 96707

R. M. TOWILL CORPORATION
SINCE 1930
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

1-19777-01

Appendix C

EIS Public Scoping

Waimanalo Gulch Sanitary Landfill Lateral Expansion EIS
Waimānalo Gulch, O'ahu, Hawai'i
TMKs: (1) 9-2-003: 072 and 073

October 2006

Prepared for:
City & County of Honolulu
Department of Environmental Services
Kapolei, Hawaii 96707

Prepared by:
R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawai'i 96817

Environmental Impact Statement (EIS)
Public Scoping Summary

1. Background

The Department of Environmental Services (ENV) held a series of four EIS Community Scoping Meetings between July 10 and August 10, 2006 to obtain input on issues that islandwide communities feel should be addressed in the preparation of the EIS for the expansion of the Waimanalo Gulch Sanitary Landfill. Waimanalo Gulch is located close to the boundaries of the Nanakuli and Ewa regions of Oahu but is used islandwide by all Oahu communities for the disposal of municipal refuse. The series of public scoping meetings were therefore convened to obtain input from the communities closest to the landfill, as well as other communities that are important users of the facility. The meetings were held on the following dates and at the following locations:

Mtg. No. 1	July 10, 2006	Nanakuli High and Intermediate School 98-980 Nanakuli Avenue Waianae, Hawaii 96792
Mtg. No. 2	July 11, 2006	Benjamin Parker Elementary School 45-259 Waikalua Road Kaneohe, Hawaii 96744
Mtg. No. 3	July 27, 2006	Mission Memorial Auditorium 550 South King Street Honolulu, Hawaii 96813
Mtg. No. 4	August 10, 2006[1]	Kapolei Hale 1000 Uluohia Street Kapolei, Hawaii 96707

[1]The date for this meeting was changed from a previous date on July 26th that conflicted with the scheduling of Neighborhood Board No. 34, Makakilo/Kapolei.

2. EIS Public Scoping Meeting Agenda

Each of the four public scoping sessions was conducted by a meeting facilitator who explained that the purpose of the meetings are to obtain community input on environmental issues that the public feels should be addressed in the preparation of the project EIS. The agenda used for the meetings included:

A. An overview of the purpose of the meeting;
B. Remarks by the Department of Environmental Services (ENV) concerning the need for the project and important events that have transpired since the last EIS for the expansion of Waimanalo Gulch was approved in 2003;
C. A session during the meeting when the community provides comments on issues or subject areas that they feel should be addressed in the EIS;
D. A session summarizing the input provided by the community during the last 15-30 minutes of the meeting; and
E. Adjournment and "Thank You" to audience for attendance.

3. List of Participants and Summary of Issues and Concerns Raised

A record of each of the four meetings is attached and includes the date of the meeting, the sign-in list of meeting attendees, and written comments that were received by the close of the EIS Public Scoping comment period on August 30, 2006.

4. Summary of Issues by Topic Area

A combined summary list incorporating comments received from the four meetings are attached. Bulleted comments that are in bold are those received in writing that do not duplicate what was already provided by the community.

Meeting No. 1

Nanakuli High and Intermediate School

Monday, July 10, 2006

Public Scoping Meeting for Preparation of EIS
Waimanalo Gulch Sanitary Landfill Expansion
July 10 11, 2006
Nanakuli High and Intermediate School/Benjamin Parker Elementary School

	NAME	Address	Phone No.	E-mail Address
1	Bud Ebel EBEL	84-854 FRICKE ST	696-8765	bud96792@hotmail.com
2	Lee Munson	Ko Olina	924-2345	lmunsonusa@aol.
3	Mary Josue	89-407 Mokiawe St	668-1423	lady bank 1st@hawaii.rr.com
4	Romeo Moncus	Ko Olina Kai	671-2890	romeo@royalhawaiianresort.com
5	Harry Basso	89-246 Puaale	668 5417	
6	Nina Fisher	89-639 Nanakuli		
7	Uhna Kinilau	"		
8	Hanalei Aipoalani	89-308 Mokiawe St	351-3989	haipoalani@yahoo.com
9	Clara Batongbacal	87-140 Helekua St #2		cbatongbac01@hawaiiantel.ne
10	Ralph F. Harris	92-1527-H Aliinui Dr	440-7999	Ralph.Harris@Koolina.c
11	Todd Apo	92-1184 Olani St	680-7660	TAPO@HONOLULU.GOV
12	Cynthia K.L. Rezentes	87-149 Maipela St.	696-0131	rezentesc@aol.com
13	Kamaki Kanahele	89-237 Kanuali	696-1515	
14	Agnes Cope	" "	" "	
15	Ken Williams	92-1480 Aliinui	6712512	ken@koolina.com
16	Carolyn Holway	84-192 Kapuo	695 5069	Carolyn@wisconsultingllc.com
17	Mapuana Tector	85-832 Old Gov Rd	696 7812	Mapuana@Hawaii.edu
18	Kahilaina Naomi	89-416 Nanakuli Ave	668-1039	
19	Kahilaina Michael P.	"	"	"
20	Terrie Spotkaeff	PO Box 1888 Waianae 96792	3064164	tspotkaeff@AOL.com

Public Scoping Meeting for Preparation of EIS
Waimanalo Gulch Sanitary Landfill Expansion
July 10-11, 2006
Nanakuli High and Intermediate School/Benjamin Parker Elementary School

	NAME	Address	Phone No.	E-mail Address
1	Johnnie-Mae L. Perry	Waianae	—	—
2	Herb. Henlen	86-313 [illegible]	Waianae	
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COMMENT FORM

Waimanalo Gulch Sanitary Landfill Expansion
Public Scoping Meeting for Environmental Impact Statement (EIS)
July 10-11, 2006

Your comments are important and appreciated. Please use this form to make your comments regarding issues or concerns pertinent to the preparation of the EIS for this project. All comments should be received by **August 10, 2006. Please send to**:

Department of Environmental Services, Refuse Division
City & County of Honolulu
1000 Uluohia Street, Suite 212, Kapolei, Hawaii 96707

It is very frustrating to have been involved in mtgs. w/ city council hearings + testimony for several years now and then to gear up for battle again ??
The community has said "No More Landfill!" When will the City get the message - No Landfill - Yes JDI Plasma Arc Gasification!! Stop thinking about the money - think + look at our community, our families health + safety - How about designating landfills for East/Windward + Central Areas - We always take everybody's opala - Seriously, JDI can eliminate alot of this "opala mea" plus renewable energy for who? Us, the people - Address our health, safety concerns stop looking at $money, give us a chance - look at "JDI plasma arc gasification! People take time to voice their concern - Are you all hearing them?? STOP Landfills!!

Name: Naomi Kahikina

Address: 89-416 nanakuli Ave

Telephone: 668-1033 Fax:

COMMENT FORM

Waimanalo Gulch Sanitary Landfill Expansion
Public Scoping Meeting for Environmental Impact Statement (EIS)
July 10-11, 2006

Your comments are important and appreciated. Please use this form to make your comments regarding issues or concerns pertinent to the preparation of the EIS for this project. All comments should be received by **August 10, 2006. Please send to**:

Department of Environmental Services, Refuse Division
City & County of Honolulu
1000 Uluohia Street, Suite 212, Kapolei, Hawaii 96707

Waimanalo Gulch Issues:

o Health concerns

1. Unknown effects to the land, water + air
2. Who is liable is people get sick or hurt? City? Private?
3. Community has right to sue?

o Community Benefits:

1. What community benefits? Who defines?
2. Who and how selection to committee is done?
3. Not living up to agreement with community in closure.

o Alternative Processing:

1. Plasma Arc Gasification
   Jacoby Inc.

Name: Representative Michael P. Kahiking

Address: 89-416 Nanakuli Ave.

Telephone: 668-1033 Fax: 586-8469

Meeting No. 2

Benjamin Parker Elementary School

Tuesday, July 11, 2006

Public Scoping Meeting for Preparation of EIS
Waimanalo Gulch Sanitary Landfill Expansion
July 10-11, 2006
Nanakuli High and Intermediate School/Benjamin Parker Elementary School

	NAME	Address	Phone No.	E-mail Address
1	Shirley Foley	3926 Ala Kanaka St.	780-7774	foleyhawaii@aol.com
2	Sonia W. Yick	email - jsonigwy@aol.com		
3	Bill Sager	bsager@lavanet		
4	Ron Boyle	47-128 Pulama Rd Kaneohe 96744	239 5621	boyler@rr.hawaii
5	Ken Williams	92-1480 Aliinui	6712512	ken@koolina.com
6	STANN REIZISS	KAILUA PO Box 1517	230-8199	REIZISS@CCHMO.com
7	Lucy Gay	86-088 Farrington Hwy	696-6378	lucy@hawaii.edu
8	SUSAN BACA	47459 HUI IWA	3921416	SUEBACA@HOTMAIL
9	Andrew Malahoff	503 S. King St.	527-5813	amalahoff@honolulu.gov
10	Wane Kinilau	85-639 Nanakuli Ave		
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COMMENT FORM

Waimanalo Gulch Sanitary Landfill Expansion
Public Scoping Meeting for Environmental Impact Statement (EIS)
July 10-11, 2006

Your comments are important and appreciated. Please use this form to make your comments regarding issues or concerns pertinent to the preparation of the EIS for this project. All comments should be received by **August 10, 2006. Please send to:**

Department of Environmental Services, Refuse Division
City & County of Honolulu
1000 Uluohia Street, Suite 212, Kapolei, Hawaii 96707

I support the full use of ~~of~~ the Waimanalo Site before any other site is considered. Any thing else would be a terrible waste of money & resources.

Incorporate a comprehensive waste management program to minimize waste stream which needs to be land filled. Include analysis in EIS.

Address problem of fire burning deep into land fill & being impossible to put out.

Address issue of vegetation to be used when land fill is closed. Impact of hydromulch

Name: Bill Sager

Address: 44-211 Mikida Dr, Kaneohe, HI 96744

Telephone: 235-0757 Fax: bsager@lava.net

Meeting No. 3

Mission Memorial Auditorium

Thursday, July 27, 2006

Public Scoping Meeting for Preparation of EIS
Waimanalo Gulch Sanitary Landfill Expansion
July 27 - August 10, 2006
Mission Memorial Auditorium/Kapolei Hale

	NAME	Address	Phone No.	E-mail Address
1	Paul Herrán	1301 Lusitana St. #611	383-8829	pherran@honolulu.gov
2	JIM CORCORAN	1171 LUNA KAILUA ROAD PL	263-3093	corcoran@lava.net
3	ROY SOON	39 MAKAWEU ST.	396-5613	
4	Rod Ohira	Honolulu Advertiser		
5	TODD APO	530 S. KING	5477001	
6	ROBERT KAIALAU III	565 KOKEA ST. D-7 Hon 96817	3069787	—
7	Randy Ching	1560 Kanunu St #818	942-0145	oahurandy@yahoo.com
8	Cynthia K.L. Rezentes	87-149 Maipela St. 96792	696-0131	rezentesc@aol.com
9	Ichua Kimilau	89-639 Nanakuli Ave.		
10	Kyle Kajihiro	2426 Oahu Ave	988 6266	KKajihiro@afsc.org
11				
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Meeting No. 4

Kapolei Hale

Thursday, August 10, 2006

Public Scoping Meeting for Preparation of EIS
Waimanalo Gulch Sanitary Landfill Expansion
July 27 - August 10, 2006
Mission Memorial Auditorium/Kapolei Hale

	NAME	Address	Phone No.	E-mail Address
1	BUD EBEL	84-854 FRICKE ST.	696-8164	bud96792@hotmail.com
2	JAMES KAYHI	89-796 ILIMAPAPAPA	668-9912	
3	Cameron Nekota	1917 Colburn St.	358-2792	cameron@hawaii.edu
4	Mike Freitas	92-1489 Hoalii	391-3702	MIKEFALOHA@YAHOO.COM
5	RALPH HARRIS	92-1527-H Aliinui	679-0085	Ralph.Harris@Koolina.Com
6	Ken Williams	92-1480 Aliinui	671 2512	Ken@koolina.com
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Public Scoping Meeting for Preparation of EIS
Waimanalo Gulch Sanitary Landfill Expansion
July 27 - August 10, 2006
Mission Memorial Auditorium/Kapolei Hale

	NAME	Address	Phone No.	E-mail Address
1	ROBERT H. KAIALAU III	505 KOKEA ST. Hon Hi 96817	808 3069787	—
2	DAVID Leong	1338 kawelokast P.C	3516714	
3	ROBERY STRATTON	87-207 WAIOLU	265-2784	
4	BRYAN HA'O		732-9751	
5	CHUCK & JENNIFER BENEKE	92-958 PANANA ST #27	672-8087	nobene8@aol.com
6	Michael Kalukuna	89-416 Nanakuli Ave Nanakuli, He 96792	668-1033	mkalukuna@bgch.com
7	GREGORY FUJITA	92-608 MALAHANA LP KAPOLEI, HI 96707	682-4889	fujitag@msn.com
8	Beverly Munson	590 Farrington Hwy Kapolei, HI 96707	Ste 524 BTB 133	
9	Lee Munson	"	"	
10	Kuulei Jolonina	92-769 Paakai St. Kapolei 96707	682-3002 (h) 542-0628 (c)	Kuuleij@aol.com
11	STEVE KELLY	1001 KAMOKILA #255 KAPOLEI 96707	674-3289	stevek@kapolei.com
12	Cynthia K. L. Rezentes	87-149 Maipela St. Waianae HI 96792	696-0131	rezentesc@aol.com
13	PAT CHARDON	92-963 LAALOA ST KAPOLEI	682-6020	
14	LORRAINE MARTINEZ			
15	TODD APO	530 S. King St Hon 96813	547-7001	TAPO@HONOLULU.GOV

Public Scoping Meeting for Preparation of EIS
Waimanalo Gulch Sanitary Landfill Expansion
July 27 - August 10, 2006
Mission Memorial Auditorium/Kapolei Hale

	NAME	Address	Phone No.	E-mail Address
1	Maeda Timson	Kapolei Neighborhood Board		
2	C. Manu DeLaCruz	Villages of Kapolei board		
3	Michael & Pam Anderson	Nanakuli HI		
4	Robert Webster	91-174 Hanua St. Kapolei	682-0201	
5	Lehua Kinilau	89-639 Nanakuli		
6	Colleen Hanabusa	[illegible]		
7	Hanale Aipoalani	Nanakuli, HI		
8	Nalani Aipoalani-Tuari-Tiotio	Helelua		
9	Todd Upton	91-1067 Makahala	561-3802	
10	Kelli Upton	↓	↓	
11				
12				
13				
14				
15				

Bud Ebel Republican Candidate For The 45th District House Representatives

The Landfill ! - Just a short time ago the C&C of Honolulu was under the threat of huge fines (perhaps millions of dollars) for the operation and illegal continued use of the Waimanalo Gulch landfill by the EPA, State of Hawaii and some private watchdog groups threatening legal action.

First lets get it straight ! The government will never pay a dime in fines ! Only the tax payers have that privilege.

The latest proposal is an offer by the Waste Management Co. to take over operation of the gulch from the C&C of Honolulu which has by some miracle found room for 15 years of trash storage at the site.

Needless to say the residents of the west coast are a bit perturbed.

I am fully cognizant of the fact that trash removal services are the responsibility of the county.

However as a candidate for the 45th district State House the questions about the landfill are unavoidable and must be addressed.

My Solution

Legislation being passed requiring each council district to be responsible for the trash from their district being buried in their district. If the residents of the Districts will not consent to a landfill in their district it may be buried in the Waimanalo gulch at an additional tipping charge. These charges must be of sufficient rate as to (A) encourage each district to be responsible for their trash or (B) be adequate enough for the residents of the 1st district to accept the trash from any other districts. These monies would be used for the sole benefit of the legal residents of the 1st district and only them. They could be used to offset property taxes, utility charges or many other lawful use as provided by law.
The most important safeguard would be strict accounting and keeping these monies out of the hands of any but the legal beneficiaries.

Respectfully submitted for discussion. Bud Ebel republican candidate 45th house district

Robert H Kaialau III
565 Kokea Street, Suite D7 ❖ Honolulu, HI 96817
(808) 306-9787 ❖ robert@fightdrugs.us

10 August 2006

City and County of Honolulu
Department of Environmental Services – Refuse Division
1000 Uluohia Street, Suite 212
Kapolei, HI 96707

RE: Waimanalo Gulch Sanitary Landfill Expansion – EIS Public Scoping Meeting

I am Robert H Kaialau III, and I am testifying in opposition to the proposed expansion and permit extension for the Waimanalo Gulch Sanitary Landfill.

On Friday, February 3, 2006 the Honolulu Star Bulletin reported on the $2.8 million dollar fine imposed by the State Department of Health on the City and County of Honolulu and its landfill operator Waste Management, Inc. for permit violations at the Waimanalo Gulch Sanitary Landfill. To date, the public has yet to be advised of the final disposition of those fines. Have they been paid? How have the violations cited in the order been addressed?

The information provided in the Star Bulletin article validated long-held concerns by the community. In addition to the multiple environmental, health and safety threats attributable to the existing landfill – the management company contracted to operate the landfill, is unable to properly and consistently adhere to the requirements of the state issued DOH Solid Waste and LUC Special Use permits.

Mayor Hannemann's veto of Bill 37, CD 2 presented a list of "indisputable facts". Of these, the assertion that 1) the City cannot have a new landfill in operation by May 1, 2008 and 2) for the *foreseeable* future, the City "needs" a landfill on island are both inaccurate and misleading.

Before any approval of the requested permits are considered, the City and County of Honolulu's administration must be required to demonstrate the following:

1. The timely completion of the long delayed Integrated Solid Waste Management Plan, which was to have been completed and submitted to the Honolulu City Council for review and approval in 2003.
2. The issuance of a "Request for Proposals" notice and initiation of the review process for the consideration of alternative MSW processing technologies by October 2006 as stated by Director Takamura at the last City Council Public Works committee meeting held on July 27, 2006 .
3. The presentation of a plan to the Honolulu City Council for the execution of a long overdue comprehensive and mandatory island-wide Recycling program by December 2006.
4. A detailed, comprehensive closure plan for the existing Waimanalo Gulch landfill site irrespective of the proposed closure date. The plan must include details on required permits for closure, the identification of the authorizing government agencies and the listing of required monitoring activities after the closure process is complete.

In closing, it is my desire to provide the decision making body reviewing the proposed application with an additional perspective and a few requirement considerations regarding the existing landfill.

Thank you for this opportunity to provide my testimony.

Sincerely,

Robert H. Kaialau III

Robert H Kaialau, III

Additional Letters Received

Wm. Anderson and Sara Barnes
92-1001 Aliinui Drive
Kapolei, HI 96707

City & County of Honolulu
Department of Environmental Services, Refuse Division
1000 Uluohia Street, Suite 212
Kapolei, Hawaii 96707

Re: Waimanalo Gulch Landfill Hearing

Dear City and County Leaders:

As residents of Kai Lani at Ko Olina, we are writing to urge that you not expand the landfill at Waimanalo Gulch either temporarily or permanently. Indeed, we urge you to close the landfill as you originally promised.

We are subject to excessive dust, blowing plastic bags and garbage, increased truck traffic and noise on the highway, and at times, sickening smells due to the landfills current location and activities.

We understand the need to have landfills. As a Texas friend of mine said recently: "Everyone wants to have their trash picked up, but nobody wants to have it put down." And so, on a positive note, we think that there are three things that need to be done to address the trash/garbage problem.

1. Immediately start easy-to-use, comprehensive recycling programs throughout the island. After all, this is an island and our land and resources are even more precious here than on continental places in the world. Glass, plastic, metal and newspapers should all go into one bin and be picked up and sorted for recycling.
2. Start innovative programs to encourage us all to use less and re-use what we have. Get the business community involved in this effort. (For example: How many shoppers throw out their plastic grocery store bags? How many return them for recycling? How reuse them several times before they do any of the above? How many use cloth bags instead? Couldn't Safeway do some inexpensive consciousness raising about this?) The city and county of Honolulu and its business community could and should become a national and international leader in this area.
3. With the latest innovative technology in mind, open a new landfill at another site on another part of the island. Start over the right way. We know that this is a political challenge, but done right, it will help to teach us all – on all sides of the island - to be better stewards of the land; educate us in the latest landfill technologies; and say to the people of the Wai'anae Coast that you value this area and do not see it - or its people - as a place of garbage.

Wm. Anderson and Sara Barnes
92-1001 Aliinui Drive
Kapolei, HI 96707

We urge you to honor your previous commitment to close the landfill. We urge you not to expand it, either temporarily or permanently. We urge you to exert your leadership in being good stewards of the land and give us easy-to-accomplish incentives to re-use and recycle.

In order to remain economically viable, Honolulu must grow, but it must grow in a sustainable way. Thank you for your service to us all and for considering these comments.

Sincerely,

Wm. Anderson and Sara Barnes

DEPARTMENT OF ENVIRONMENTAL SERVICES

CITY AND COUNTY OF HONOLULU

1000 ULUOHIA STREET, SUITE 308, KAPOLEI, HAWAII 96707
TELELPHONE: (808) 692-5159 • FAX: (808) 692-5113 • WEBSITE: http://www.co.honolulu.gov

MUFI HANNEMANN
MAYOR

ERIC S. TAKAMURA, Ph.D., P.E.
DIRECTOR

KENNETH A. SHIMIZU
DEPUTY DIRECTOR

IN REPLY REFER TO:
RA 06-046

August 16, 2006

Mr. William Anderson and Ms. Sara Barnes
92-1001 Aliinui Drive
Kapolei, Hawaii 96707

Dear Mr. Anderson and Ms. Barnes:

Thank you for your letter regarding the Waimanalo Gulch Sanitary Landfill.

We appreciate your understanding of the need for landfills as part of our integrated solid waste management program. Our goal is to significantly reduce the volume of waste going to landfill. Over the past years our H-POWER facility has been the primary operation to meet this goal. We intend to further expand our waste-to-energy capability.

The collection of residential and commercial separated green waste for delivery and recycling to compost is another major diversion from landfill undertaking. Our sludge composting program will soon become operational. This material will also be diverted. Other materials under consideration for diversion include e-waste, mattresses, and carpet, which may better be recycled on the mainland.

As you know, we are preparing the EIS for the Waimanalo Gulch Sanitary Landfill. The community scoping meetings are part of the process and your letter will be forwarded for inclusion in the comments. We also have initiated a landfill oversight advisory committee to assist us in assuring that Waste Management Inc. continues to improve their operations.

We are proceeding in a deliberate and professional manner to manage our solid waste. Your input is again appreciated.

Sincerely,

Dr. Eric S. Takamura, P.E.
Director

cc: RM Towill w/attachment

MAKAIWA HILLS LLC

James Campbell Building, Suite 250
1001 Kamokila Boulevard
Kapolei, Hawaii 96707
Tel 808 674-3541 / Fax 808 674-3111

August 29, 2006

City & County of Honolulu
Department of Environmental Services, Refuse Division
1000 Uluohia Street, Suite 212
Kapolei, Hawaii 96707.

To Whom It May Concern:

Subject: Comments on Proposed Waimanalo Gulch Landfill Expansion EIS

Makaiwa Hills, LLC is the fee owner of approximately 1,700 acres of property located on the eastern boundary of the Waimanalo Gulch Sanitary Landfill ("Waimanalo Gulch"). It has come to our attention that certain blasting and grading activity has been occurring, and is planned as part of the proposed expansion, along the shared property line between Waimanalo Gulch and Makaiwa Hills. We are concerned that this type of activity could threaten the structural integrity of Makaiwa Hills, LLC property. Based on the foregoing, we request the Environmental Impact Statement ("EIS") address the following issues:

- Structural integrity of the slope along the shared property line.
- Appropriate blasting and grading setbacks from the shared property line.
- Proposed operations near the shared property line and line of sight to these operations.
- Proposed access points for any expansion of Waimanalo Gulch near the shared property line.
- The eventual height of Waimanalo Gulch along the shared property line.
- The distance from the top of slope that is being manufactured as part of the landfill to the shared property line.

Thank you for the opportunity to comment on the proposed EIS.

Sincerely,

Steve Kelly, AICP
Manager
Entitlements and Infrastructure

26034500\K10005

DEPARTMENT OF ENVIRONMENTAL SERVICES

CITY AND COUNTY OF HONOLULU

1000 ULUOHIA STREET, SUITE 308, KAPOLEI, HAWAII 96707
TELELPHONE: (808) 692-5159 • FAX: (808) 692-5113 • WEBSITE: http://www.co.honolulu.gov

MUFI HANNEMANN
MAYOR

ERIC S. TAKAMURA, Ph.D., P.E.
DIRECTOR

KENNETH A. SHIMIZU
DEPUTY DIRECTOR

IN REPLY REFER TO:
RA 06-068

October 16, 2006

Mr. Steve Kelly, AICP
Manager
Entitlements and Infrastructure
Makaiwa Hills LLC
James Campbell Building, Suite 250
1001 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Mr. Kelly:

Thank you. We received your written comments. We will incorporate the issues determined to be relevant within the environmental impact statement process.

Sincerely,

Eric S. Takamura

Dr. Eric S. Takamura, P.E.
Director

cc: Brian Takeda- RM Towill
Paul Herran-COR

COMMENT FORM

Waimanalo Gulch Sanitary Landfill Expansion
Public Scoping Meeting for Environmental Impact Statement (EIS)
July 27 - August 10, 2006

Your comments are important and appreciated. Please use this form to make your comments regarding issues or concerns pertinent to the preparation of the EIS for this project. All comments should be received by **August 30, 2006. Please send to:**

Department of Environmental Services, Refuse Division
City & County of Honolulu
1000 Uluohia Street, Suite 212, Kapolei, Hawaii 96707

Name: Cynthia K L Rezentes

Address: 87-149 Maipala St, Waianae 96792

Telephone: 696-0131 Fax: 696-0131
497-1432 (c)

Cynthia K.L. Rezentes
87-149 Maipela Street
Wai`anae, HI 96792-3154
(808) 696-0131
Email: Rezentesc@aol.com

August 29, 2006

Eric Takamura, Director
Department of Environmental Services, Refuse Division
City & County of Honolulu
1000 Uluohia Street, Suite 212
Kapolei, Hawaii 96707

RE: Comments Submitted for Environmental Impact Statement Public Scoping for the Proposed Waimanalo Gulch Sanitary Landfill Expansion

Dear Director Takamura:

Thank you for the opportunity to submit public scoping comments regarding the proposed Waimanalo Gulch Sanitary Landfill Expansion Environmental Impact Statement.

I continue to oppose the continuing operation of Waimanalo Gulch Sanitary Landfill beyond the agreed upon date of closure by the City and County of Honolulu in 2003 and as ordered by the State Land Use Commission. This should be the primary position of all concerned with actions taken to fulfill those commitments.

As many of us are aware, the City and County of Honolulu is at a critical point in time in making decisions as to how our municipal solid waste should be managed for future generations. It is imperative that we, as an island community, pursue the best solution for the long-term health and well being of all of the residents of O`ahu. It is with this in mind that I submit the following comments for consideration of inclusion in the proposed Draft Environmental Impact Statement (EIS) for the Waimanalo Gulch Sanitary Landfill (WGSL) to be released in the near future.

1. The EIS needs to address the State Land Use Commission Decision and Order which calls for the closure of the WGSL in May 2008 (which implies no further waste will be accepted at WGSL). This was the date presented by the previous City and County of Honolulu administration.

2. All previous violations as identified in "Department of Health, State of Hawaii v. Waste Management of Hawaii, Inc. and City and County of Honolulu" should be resolved and all challenges concluded prior to the drafting of an EIS for the expansion of WGSL. (In fact, no new permits or permit modifications should be allowed until the violations are addressed and resolved.) Each of the eighteen counts brought against Waste Management of Hawaii, Inc. (WMI) and the City and County of Honolulu (C&C) should be identified and a current status provided within the proposed EIS. Each of the following counts (Taken directly from the Notice and Finding of Violation – Docket No. 05-SHW-SWS-004) should be addressed:
    a. Exceedence of Permitted Grades
    b. Failure to Submit Annual Operating Reports in a Timely Manner
    c. Failure to place daily cover on the active faces of MSW landfill
    d. Failure to place intermediate cover material on the ash monofill
    e. Exceedance of leachate head on the liner in the ash monofill

f. Exceedance of leachate head on the liner in MSW Cell E-1 sump
g. Failure to Measure Leachate and to Maintain Records on Leachate Levels in Cell 4B Sump
h. Failure to Measure Leachate Levels and to Maintain Records on Leachate Levels in the Ash Monofill Sump
i. Failure to notify DOH of noncompliance on equipment blockage in MSW Cell 4-B leachate lateral line and inability to measure leachate levels
j. Failure to Notify DOH of Noncompliance in a Timely Manner on the Exceedences of Permit Grades and Submission of the AORs
k. Unauthorized storage of material on the ash monofill
l. Failure to manage and ban the acceptance of special waste
m. Failure to maintain records and record location of asbestos disposal at the landfill
n. Failure to cover a dead animal
o. Failure to Submit Annual Surface Water Management Plan
p. Failure to control the generation of dust from vehicular traffic
q. Failure to minimize free litter generation at the landfill
r. Failure to monitor explosive gases and maintains monitoring records

3. The EIS should clearly define the current state of the WGSL footprint and airspace occupied. This information should include the fact that the permit modification to allow the expansion for the 14.9 acres (to keep the landfill open until 2008) actually redesigned fill slopes and caused portions of the landfill to exceed the fills limits for the ash monofill. The information will provide the baseline of the actual dimensions of the landfill from which the expansion may be measured.

4. The current permitted WGSL footprint and airspace allowances should be completed and a closure plan (including stabilization of the structure) for the current permitted footprint and airspace allowances should be part of the EIS. This closure should include 30-year monitoring as part of the closure plan. This will act to separate the current landfill and any future expansion. This separation of the landfill into two separate permitted footprints with independent safety and monitoring issues effectively should build in a factor of safety thereby not compounding and confusing any future issues or problems that may arise from continued filling contiguous to the current landfill which has received numerous counts of violations in the Notice and Finding of Violation, Docket No. 05-SHW-SWS-004.

5. An explanation needs to be provided as to the conflicting position of the 1984/1985 EIS which stated that only 57+/- of the 200 or so acres owned were feasible for utilization as a landfill due to the slope angles of the hillsides. What conditions have changed to allow additional expansion? Is the quarrying of the mountain the reason for additional volume being available for MSW and monofill ash waste deposits? Has the quarrying effects on the remaining mountain range been analyzed to assure stability of not only the landfill but also the surrounding area? Those calculations should be included in the EIS. Also to be included in the EIS is the design and analysis of material removed and it's impacts on the landfill design (primarily safety issues of stability), if quarrying is the manner in which additional volume is freed up for MSW and monofill waste receipt.

6. Considering the extensive list of violations the current WGSL has received, the EIS needs to clearly identify who is to enforce the conditions of the Planning Commission Approval, LUC Decision and Order, DOH permit and as importantly, who is responsible for adherence to conditions placed on any expansion of the landfill? There needs to be a section on what

guarantees the public have that violations will not occur in the future and what role the public has in providing information regarding violations observed.

7. One of the conditions of the permit was to allow for ridgeline and site views being maintained. Currently, the landfill exceeds the view plains with the approach from Wai`anae to Honolulu. What will be done to rectify that situation and guarantee that this will not happen in the future?

8. There should be clearly identified, separate (physically divided) municipal solid waste (MSW) and ash monofill cells for the expansion

9. There should be a clearly identified location for the disposal of asbestos that is not contained within a MSW or monofill cell. This is required considering the location of the asbestos that has been disposed of in the past cannot be identified with any level of confidence.

10. Considering the violation identifying not having enough or not providing time to complete soil cover as required on a daily basis, the EIS should reflect from where the soil cover will be procured. There should be records kept on when soil cover is received and when it is used via a daily tracking system. In addition, the hours of operation should reflect the time of last disposal versus completion of the day's activities to allow for the soil cover to be done daily.

11. With the new expansion area, there should be separate stormwater retention basins, leachate systems, and methane gas monitoring and collection systems to preclude confusion with current systems and recognized violations assigned to these systems. This would be consistent with closure of the current landfill and the establishment of a new landfill with separate construction analyses, stormwater retention basins, leachate systems, gas monitoring and collection systems, and any other requirements that would need to be followed for a separate landfill.

12. The chemical composition of the ash monofill should be identified and specific issues addressed, i.e. detection of heavy metals, dioxins, furans, etc. and the information should be shared with the public. There should be established an independent testing and recording system.

13. The EIS needs to clearly identify how fugitive trash (e.g. flying plastic bags) will end. This includes fugitive trash that settles on the land or in the near shore waters. What extra measures will be taken when HPOWER (a waste-to-energy generation facility) is down for maintenance and all MSW is diverted to WGSL? As you go further back into the gulch you approach known high wind areas. That information should be included as a factor in the plans provided for fugitive trash control.

14. The EIS needs to define how dust control will be handled. During high wind days not only is fugitive trash a problem but high quantities of dust can be observed swirling above the site. This could create health problems with individuals downwind from the site and should be addressed as a plan on how this will be prevented and controlled in the future.

15. The EIS needs to provide data regarding how the current WGSL is affecting the near shore waters. This needs to include not just during arid times but also when there are significant rain events and what the stormwater runoff contains or how it will all be contained on the property.

16. The EIS needs to address traffic concerns:
    a. No trucks should be parked on Farrington Highway waiting for entrance into the facility
    b. Farrington Highway should not have mud and dirt dropped from exiting trucks (trucks should leave the facility clean)

c. Farrington Highway, fronting the facility, should be regularly cleaned of mud and dirt

17. There needs to be a commitment to maintain the route to WGSL in a clean condition (i.e. no roadside litter).

18. There should be identification of how the WGSL will be maintained facing Farrington Highway, landscaped to reflect surrounding areas, park-like upkeep, greenbelt, set backs, etc. What will this buffer look like to preclude visual impacts?

19. What specific controls will be put into place to address the odors emanating from the site? Will sewage sludge continue to be accepted, thereby adding to the odor concerns expressed in the past? Will it be pretreated or treated once received? A commitment should be made that if sewage sludge is received it will be given a high priority for immediate coverage to minimize the odor problems associated with this type of waste deposit and not wait until the end of the day final soil cover to be applied. The EIS should identify what will be contained in the odor plan and an outline should be listed.

20. There should be a section to specifically address the stability of the expansion. Static stability should discuss the safety factor with which the new expansion will be built and take into consideration and show the calculations used to provide the safety factor for construction (i.e. stability berm). What will be the safety factor (minimum is required to be 1.5 but should be greater, preferably 1.75-2.0).

    Deformation characteristics caused by an earthquake need to be discussed including potential liquefaction of the fill and subsequent consequences. Considering the August 28, 2006 earthquake experienced off the east coast of O`ahu at a magnitude between 3 and 4 on the Richter scale and the USGS position that we are in a seismically active region, this is no longer remote theory but a distinct possibility. How will that affect the overall safety factor applied to the structure's construction? There should be a higher safety factor applied to the proposed landfill expansion due to this seismic instability and not the minimum of 1.5 allowed by EPA. What are the alternatives to receiving MSW, monofill or other debris after an earthquake, if an analysis of the integrity of the liner system needs to be investigated? What are the alternatives if the liner system is compromised?

21. There has been a lack of urgency on the part of WMI to provide timely reports, how will that be addressed and how will the reports be made available to the public? I request that they be placed on the C&C webpage for the Environmental Services Division (www.opala.org) since they are public documents. There should be photos with a high resolution (perhaps 5M per photo) at the beginning, middle and end of the day to record the progress made during the depositing of MSW and monofill ash. These photos should be a part of the information made available to the public on the webpage. The C&C should also consider the potential of having a webcam on the operations of the site for recordation of the daily activities.

22. What are the impacts if leachate removal is required again in the future? In the past leachate was removed from WGSL and sent to the Wai`anae Wastewater Treatment Plant which discharges secondary treated water into the offshore waters. What kinds of affects could be expected on the offshore waters, flora or fauna considering leachate, at times contain heavy metals or other undesirable chemicals?

23. A full discussion on alternative methodologies for managing MSW and monofill ash needs to be included in this EIS. Currently, there are two for-profit projects being proposed in the Wai`anae

area to do composting on the organic portion of the MSW collected. The C&C needs to answer why if these projects are profitable for private enterprises, is the C&C not pursing these and other alternative technologies which have been presented, e.g. plasma arc/torch/gasification/vitrification?

24. What is the C&C's plans for recycling and reduction of the waste stream going into WGSL? Curbside recycling, green waste recycling, adding a third boiler to HPOWER, etc?

25. What role does this expansion play in the C&C's Solid Waste Management Plan and what does the plan state as to how the C&C will address landfills in the future considering a very limited number of sites which can qualify for receipt of MSW?

The items identified need to be addressed in addition to the standard requirements as an EIS is prepared. Some of the other standard requirements may include but are not limited to: archaeological impacts, cultural impacts, social impacts, traffic concerns, noise, odor, etc.

The proposed EIS for this expansion of WGSL needs to be as comprehensive as today's knowledge base allows us to have considering the consequences of the action proposed will continue to have effects on our residents for many years to come.

Sincerely,

Cynthia K.L. Rezentes

DEPARTMENT OF ENVIRONMENTAL SERVICES

CITY AND COUNTY OF HONOLULU

1000 ULUOHIA STREET, SUITE 308, KAPOLEI, HAWAII 96707
TELELPHONE: (808) 692-5159 • FAX: (808) 692-5113 • WEBSITE: http://www.co.honolulu.gov

MUFI HANNEMANN
MAYOR

ERIC S. TAKAMURA, Ph.D., P.E.
DIRECTOR

KENNETH A. SHIMIZU
DEPUTY DIRECTOR

IN REPLY REFER TO:
RA 06-068

October 16, 2006

Ms. Cynthia K.L. Rezentes
87-149 Maipela Street
Waianae, Hawaii 96792

Dear Ms. Rezentes:

Thank you. We received your written comments. We will incorporate the issues determined to be relevant within the environmental impact statement process.

Sincerely,

Dr. Eric S. Takamura, P.E.
Director

cc: Brian Takeda- RM Towill
Paul Herran-COR

State Capitol
415 S. Beretania Street
Honolulu, HI 96813

Hawaii State Senate

Fax

To:	Wilma Namumnart	**From:**	Senator Colleen Hanabusa
Fax:	692-5402	**Pages:**	9, including cover
Phone:	692-5410	**Date:**	08/30/06
Re:	Comments for EIS preparation on expansion of WGSL	**CC:**	

- **Comments:** Submittal via fax.

This message is intended only for the use of the individual or entity to which it is addressed and may contain information that is privileged or confidential. If the reader of this message is not the intended recipient, or the employee or agent responsible for delivering the message to the intended recipient, you are hereby notified that any dissemination, distribution, or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone. Thank you.

ROBERT BUNDA
PRESIDENT
DONNA MERCADO KIM
VICE PRESIDENT
COLLEEN HANABUSA
MAJORITY LEADER
CLAYTON HEE
MAJORITY FLOOR LEADER
SHAN S. TSUTSUI
MAJORITY CAUCUS LEADER
FRED HEMMINGS
MINORITY LEADER
BOB HOGUE
MINORITY FLOOR LEADER
GORDON TRIMBLE
MINORITY POLICY LEADER

FIRST DISTRICT
LORRAINE R. INOUYE
SECOND DISTRICT
RUSSELL S. KOKUBUN
THIRD DISTRICT
PAUL WHALEN
FOURTH DISTRICT
SHAN S. TSUTSUI
FIFTH DISTRICT
ROSALYN H. BAKER
SIXTH DISTRICT
J. KALANI ENGLISH
SEVENTH DISTRICT
GARY L. HOOSER
EIGHTH DISTRICT
SAM SLOM
NINTH DISTRICT
LES IHARA, JR.
TENTH DISTRICT
BRIAN T. TANIGUCHI
ELEVENTH DISTRICT
CARDI FUKUNAGA
TWELFTH DISTRICT
GORDON TRIMBLE
THIRTEENTH DISTRICT
SUZANNE CHUN OAKLAND
FOURTEENTH DISTRICT
DONNA MERCADO KIM
FIFTEENTH DISTRICT
NORMAN SAKAMOTO
SIXTEENTH DISTRICT
DAVID Y. IGE
SEVENTEENTH DISTRICT
RON MIZUNO
EIGHTEENTH DISTRICT
CLARENCE K. NISHIHARA
NINETEENTH DISTRICT
BRIAN KANNO
TWENTIETH DISTRICT
WILL ESPERO
TWENTY-FIRST DISTRICT
COLLEEN HANABUSA
TWENTY-SECOND DISTRICT
ROBERT BUNDA
TWENTY-THIRD DISTRICT
CLAYTON HEE
TWENTY-FOURTH DISTRICT
BOB HOGUE
TWENTY-FIFTH DISTRICT
FRED HEMMINGS
CHIEF CLERK
PAUL T. KAWAGUCHI

The Senate
The Twenty-Third Legislature
of the
State of Hawaii

STATE CAPITOL
HONOLULU, HAWAII 96813

August 30, 2006

Department of Environmental Services, Refuse Division
City & County of Honolulu
1000 Uluohia Street, Suite 212
Kapolei, HI 96707

RE: Comments for EIS preparation on the Expansion of Waimanalo Gulch Sanitary Landfill

To the Department of Environmental Services, Refuse Division:

The following are my comments which will set forth issues and concerns pertinent to the preparation of an EIS for this project.

Standard To Be Met.

The EIS process is governed by HRS §343. An EIS is:

§343-2 Definitions. As used in this chapter unless the context otherwise requires: . . .

"Environmental impact statement" or "statement" means an informational document prepared in compliance with the rules adopted under section 343-6 and which discloses the environmental effects of a proposed action, effects of a proposed action on the economic welfare, social welfare, and cultural practices of the community and State, effects of the economic activities arising out of the proposed action, measures proposed to minimize adverse effects, and alternatives to the action and their environmental effects.

The statute also sets forth what the Rules must contain, at minimum. HRS §343-6. The legal effect of administrative rules are well settled in this jurisdiction. Administrative Rules are to be followed and given the full effect of law. ***Williams v. Hawaii Medical Service Association,*** 71 Haw. 545, 549, 7984 P.2d 442, 444 (1990). The Supreme Court has clearly stated that arbitrary and

capricious application of the Rules will not be tolerated. ***Windward Marine Resorts v. Sullivan,*** 86 Haw. 171, 948 P.2d 592 (ICA 1997).

HAR §11-200-14 through 23 are the requirements in the preparation of Draft and Final Environmental Impact Statements. The "General Provisions" highlight the expectation of the EIS process.

I have grave concerns that you will comply with what is required of an EIS.

The following standard set in ***Life of the Land v. Ariyoshi,*** 59 Haw. 156, 164-165, 577 P.2d 1116 (1978) for a court to determine the sufficiency of an EIS:

> In making such a determination the court is guided by the "rule of reason," under which an EIS need not be exhaustive to the point of discussing all possible details bearing on the proposed action but will be upheld as adequate if it has been compiled in good faith and sets forth sufficient information to enable the decision-maker to consider fully the environmental factors involved and to make a reasoned decision after balancing the risks of harm to the environment against the benefits to be derived from the proposed action, as well as to make a reasoned choice between alternatives. County of Suffolk v. Secretary of Interior, 562 F.2d 1368, 1375 (2d Cir. 1977), cert. den., 434 U.S. 1064, 98 S. Ct. 1238, 55 L. Ed. 2d 764 (1978). [Emphasis added.]

The condition precedent to all EISs is that it be compiled in "good faith" and sets forth sufficient information. The past practice of the City has shown that EISs have not been compiled in good faith and nor does it provide sufficient information.

At the very minimum the City must take its past EISs and explain the discrepancies that have now been found and set forth whatever information it now relies upon to justify its change in position.

The best place to begin is with the discussion as to why we in the community have no rights to rely upon the representation of government that the WGSL will close. This is the position of the community that the WGSL should close.

What Was Represented As To The Closure.

At the outset, the City must explain why it has changed its position from an expansion of only 5 years to now an additional 15 years. I have heard comments from the City that there was never a "promise" to close the WGSL in 5 years; however, this is contrary to the statements made under oath to the Land Use Commission during their hearings on the conditional use permit as well as statements made in the Final Supplemental Environmental Impact Statement (FSEIS) for the 5 year expansion. The LUC was very clear in its questioning as to what the City intended to do. How does the City explain its statement under oath and the change in the FSEIS. A discussion should be had as to whether the City can be bound by its statements under oath like a person.

The EIS must address the following.

1. Waste Management's Contract

An EIS is "meaningless" if it is self-serving and rationalizes an outcome. The contract between Waste Management, Inc. and the City for the operation of WGSL was entered into in 1999 for 15 years. This was two years before the first Draft EIS in 2000; and three years before the FSEIS. At the very minimum, this shows the decision to expand WGSL was a done deal in 1999. Explain this contract and why the City entered into it in 1999. Also explain what was done after the City said the expansion would be for only 5 years. Was the contract amended?

2. Alternatives.

HRS §343-2 defines an EIS as one that discloses, among other items, the "alternatives to the action and their environmental effects."

HAR §11-200-17 addresses the requirement as to alternatives as follows:

> F. The draft EIS shall describe in a separate and distinct section alternatives which could attain the objectives of the action, regardless of cost, in sufficient detail to explain why they were rejected. The section shall include a rigorous exploration and objective evaluation of the environmental impacts of all such alternative actions. Particular attention shall be given to alternatives that might enhance environmental quality or avoid, reduce, or minimize some or all of the adverse environmental effects, costs, and risks. Examples of alternatives include: . . . (Emphasis added.)

Money is not the paramount criteria in arriving at a decision which is environmentally sound.

HAR §11-200-17 F. 5 states that "For any agency actions, the discussion of alternatives shall include, where relevant, those alternatives not within the existing authority of the agency." In ***Westlands Water District v. U.S. Dept. of Interior,*** 376 F.3d 853, 866 (9th Cir. 2004), the Ninth Circuit recently reaffirmed that alternatives must be rigorously explored and that "reasonable alternatives" include those not within the jurisdiction of the lead agency. ***Westlands, supra,*** at 868. The Ninth Circuit went on to say that "[t]he existence of a viable but unexamined alternative renders an environmental impact statement inadequate." ***Id.***, citing to ***Morongo Band of Mission Indians v. FAA,*** 161 F.3d 569, 575 (9th Cir. 1998).

3. Failure to Comply with the City's Ordinance.

Ordinance 9-1/1(a)(6)(b)(1) states that by the year 2000, at least 75 percent of the solid waste generated shall be recycled, reused, composted, or otherwise diverted from incineration or placement in the landfill. What is the status and what is the consequence of this non-compliance?

4. Sludge

A major source of "odor" for the landfill is sludge. What is the City's treatment of sludge and for what period of time will it continue to be dumped in the landfill.

5. Purpose and Need.

HAR §11-200-17 D requires the Draft SEIS to "contain a separate and distinct section that includes a statement of purpose and need for a proposed action." It is a similar provision under NEPA, which is looked upon to guide the discussion on alternatives. ***Westlands, supra,*** at 866. In ***Westlands,*** the Ninth Circuit looked to whether the preparers had "arbitrarily and capriciously" narrowed the scope of the statement, thereby affecting the discussion on the alternative.

There is an application for a private landfill pending and also the fact that the Department of Agriculture will now permit the transshipment of MSW. These points must be addressed in discussing any need of the expansion, especially in light of the prior statements that there will be no need for landfills in 5 years.

6. Excavation

The City must address the discrepancies in all the draft EISs along with the reports provided by RM Towill to the Blue Ribbon Commission which was tasked with siting the new landfill. The criteria was no excavation. RM Towill determined that WGSL had a life of 20 more years with the criteria. This is in direct conflict with other EISs also prepared by RM Towill. What does the City intend to do about this obvious misrepresentation? How does the City explain this discrepancy.

The extreme slope of WGSL for the proposed expansion and the newly constructed rock berm are related. What is the stability of the expansion? How much native soil will have to be removed? Where will it be removed to? Will the excavated materials be sold?

7. Stability of the Slope

In light of the concern over the stability of slope as evidenced by the construction of the rock berm wall, how will the community be assured about its stability? How is the integrity of the liner tested? Will the rock berm wall act as the retaining wall to justify and increase in the slope?

8. The Violations of the Existing Permit

The Notice and Finding of Violation ("Notice and Finding") and Order dated January 31, 2006, of the Department of Health ("DOH") as to the operations of WGSL must be addressed. The first point of discussion is why the City had no oversight and permitted these activities to go unchecked. These violations resulted in the largest fine in the history of the State of Hawai'i.

The following violations are the most critical and must be addressed, though all violations should be addressed:

1. Since 2003, the City has placed ash above the 2002 grades and exceeded the design grades for over a year from discovery in January 2004.
2. The control of leachate and the monitoring was discovered. The DOH found 16.3 feet of leachate on the liner and 22 feet and 3 inches in the sump area. More troubling is no monitoring has been conducted since October 26, 2003. This was attributed to the ash monofill landfill.
3. As for the MSW landfill, in April 2005 and May 2005, 74 feet of leachate was measured. This was in an area where the sump was installed in November, 2003 (MSW Cell E-1). There was a gross failure to monitor the leachate
4. The leachate level in the area of 4B was unavailable because no monitoring had taken place since May.
5. The removal of soil and its impact on stability. DOH has found that in January of 2005, they were notified of the fact that grades were exceeded. The City knew that the ash had exceeded the approved grades by January, 2004 as to the ash landfill

6. Disposal of asbestos is a major concern. DOH found that the City and its operator accepted asbestos at the landfill but do not have any logs as to where it has been buried.
7. Surface Water Management. There are no surface water management plans as required by the permit for the years 2003-2004.
8. DOH found a failure to control dust.
9. DOH found a failure to control litter.
10. DOH found that there has been no monitoring of methane gas at the landfill.

The DOH Order entered in this action demonstrates the seriousness of the violations and its agency's (including County's) responsibility to monitor. There are also additional violations that were not included in the DOH Order, such as the applicant's failure to submit a revised Closure and Post-Closure Plan no later than May 1, 2005, which was finally submitted on February 22, 2006 and the operators unauthorized night work preparing a new cell for receiving waste.

9. How the Public Trust Is Being Met

The recent Hokulia case makes clear the State's public trust for the waters of our State. How has this trust obligation been met?

10. Cumulative Effects

This EIS cannot merely address the proposed expansion. It must address the cumulative effects of the operation of WGSL since the 1980s in addition to the proposed expansion on the Coast, including the disposal of leachate off site at the Waianae Wastewater Treatment plant.

11. Environmental Justice

The EIS must address the concept of environmental justice and how the City's use of this landfill and others in the Waianae Coast affect the community.

These are concerns and issues which must be addressed in the EIS. It continues to remain my position that WGSL must close. I continue to be perplexed as to how the City can change its position without any sense of obligation of keeping its word to its people.

Sincerely,

Colleen Hanabusa
Senator, Twenty-First District

DEPARTMENT OF ENVIRONMENTAL SERVICES

CITY AND COUNTY OF HONOLULU

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MUFI HANNEMANN
MAYOR

ERIC S. TAKAMURA, Ph.D., P.E.
DIRECTOR

KENNETH A. SHIMIZU
DEPUTY DIRECTOR

IN REPLY REFER TO:
RA 06-068

October 16, 2006

The Honorable Colleen Hanabusa
State Senate
State Capitol
Honolulu, Hawaii 96813

Dear Senator Hanabusa:

Thank you. We received your written comments. We will incorporate the issues determined to be relevant within the environmental impact statement process.

Sincerely,

Eric S. Takamura

Dr. Eric S. Takamura, P.E.
Director

cc: Brian Takeda- RM Towill
Paul Herran-COR

Summary of Issues by Topic Area

Combined Issues by Topic Area for Consideration:
Developed At EIS Scoping Meetings In Waianae, Kaneohe, Downtown Honolulu, and Kapolei Regarding The Expansion Of Waimanalo Gulch Sanitary Landfill

October 31, 2006

Note: Issues that are in **bold** are those that were received in writing by August 30, 2006, and are not duplicative of what was already stated by the community during the course of the meetings.

General

- The 2001 EIS should not be used as the basis for this EIS
- EIS needs to clearly illustrate what expansion is taking place
- Need to provide number of years of continuing operation as well as the number of acres the expansion will take
- Need to clarify the location, size of the area and what the current zoning is. Documents need to be very clear and specify the boundaries
- Need to look at mainland sewage sludge studies
- New ash area that is covered in EIS needs to be specified where and size
- Impact of other new proposed private sites such as Nanakuli B – do not need both
- Need to identify impacts to RFP process
- Need to consider federal draft rules for shipping of waste
- Need to look seriously at all sites available around the island
- Need to discuss worst case scenario contingencies including earthquake etc.
- Need to determine how the DEIS will tie-in to the City's comprehensive, Solid Waste Integrated Management Plan (SWIMP) update that the city is supposed to prepare
- There is a need to be aware that other areas of the island have hosted landfill sites in the past until their capacity was reached i.e. Aikahi, Kawaianui Marsh, Kapa`a Quarry etc. – they have not all been on the Leeward side
- The EIS needs to reflect the current status at the landfill not the preferred status
- There was a concern expressed about the ability of a local planning firm to be neutral on this issue with all the political pressure
- Need to include all Federal, state and local laws that affect landfill operations
- Need to address Waste Management's 1999 contract with Mayor Harris
- Need clarity between airspace and landfill
- Need to explain why the community should believe the City at this point and why promises have not been kept
- HPOWER has never failed an EPA test on its ash – need to know why DOH has not approved reuse for concrete etc.
- Need to deal with the reality that because of our tourist economy or per person generation of waste is 7 pounds per day instead of the national average of 4 pounds

- Need to consult the County of Hawai`i who has just completed review of 61 alternatives and chosen 3 proven technologies to address this same issue
- **EIS needs to comply with all EIS rules and statutes – including those that require "good faith"**
- **Must not just address expansion but cumulative impacts since the 1980s**

Closure of Landfill

- EIS needs to focus on closing of Waimanalo Gulch now or as soon as possible – should not just go for life of area but should have a plan to reduce waste stream as quickly as possible to provide for closing sooner rather than later
- Review all alternatives available to reduce the waste stream with the intent of closing the landfill as soon as possible
- Need to consider the fact that many landowners and developers were fully aware of the landfill's existence pre-development of their current homes and projects and moved in anyway
- Landowners in the area maintain that they were told the landfill would close in '08 when they bought and had depended on these representations in making their decisions
- Need for active recycling program that would cut down the need for a landfill; need for a sensible plan that would allow for the earliest possible closure of the landfill
- Need for finite planning – Hawai`i should be at the cutting edge and shouldn't worry about costs to keep it a paradise
- City must explain why we are here – other meetings have been held in the past which promised closure of the landfill by 08 and it is still open
- EIS needs to provide factual/historic information for the issue of the promised closure in 2008 and the issuance of an operating permit that required closure in '08
- **Need a comprehensive closure plan for the existing Waimanalo Gulch landfill site irrespective of the proposed closure date**
- **Need to address the State Land Use Commission Decision and Order calling for closure in 2008**
- **Need to address the conflicting position of the 1984/1985 EIS which stated that only 57+/- of the 200 or so acres owned were feasible for utilization as a landfill due to the slop angles of the hillsides.**
- **Close it and put it somewhere else on the island**

Environmental

- Need to explain what the relationship will be between the newly created topography of the expanded landfill, and the prevailing wind patterns of the area including any impact on ocean currents and near shore water temperatures as well as any impacts the new topography may have on adjacent landowners (including the slope integrity along shared property lines, and heights and distances along these lines)
- Need to review Hawaiian Electric Company's wind study and explain the logic of the increase in height of the landfill in light of the wind energy study

- Need an assessment of the static stability of the landfill both ash and solid waste areas including consideration of past history as well as the dynamic stability of the landfill recognizing the fact that we live in a seismically active area
- Need to address how much of the mountain land space is being shaved for the landfill and discuss blasting or grading setbacks that are necessary
- Need to address environmental impacts of potential hazards
- Need to understand how 20 years of further capacity will be provided without excavation as previously stated – if there is excavation need to address where the soil will go
- Need to review recent State of Hawai`i Supreme Court case (Hokulia) regarding State DOH responsibility for water quality in relation to how it is being affected by the landfill e.g. ocean run off
- If expansion moves forward, storm water retention basins, leachate and gas monitoring systems are needed
- Address future ash monofills
- Need to know chemical composition of ash
- The location of potential hazards such as asbestos within the landfill need to be identified
- **Address unknown effects to the land, water, and air**
- **Need to address odor issues – will the expansion take sludge and if so for how long**
- **How is the liner tested and how secure is it needs to be addressed**
- **The ability of the rock berm to handle the expansion needs to be discussed**
- **Needs to address the need for a surface water management plan**
- **Need fugitive trash plan designed to end this problem**

Infrastructure

- Impact to landfill when H-POWER is down is an issue
- Impact on highway; road blockages, etc.
- Maintenance issues along Farrington Highway with heavy truck use – standards for adequate maintenance of this highway
- Any new access points and their impacts on adjacent property owners

Economic Issues

- Economic impacts
- Costs of closing landfill
- Need a solution to address lost revenues to the city should the solid waste go to a private landfill – tipping fees

Explore Alternatives

- Need to look at all alternatives that are appearing (i.e., Plasma ARC gasification, etc.) and determine how these alternatives fit in with everything else that the City is doing – including how they can reduce the waste stream to allow for the earliest closing possible of the landfill
- Need to explore all viable alternatives

- Need to look at other places, especially Europe, and how they dispose of their waste, the kinds of incentives/taxes/sanctions they use to reshape people's attitudes at the curbside
- Expansion should be limited to a specific time and coupled with a plan to reduce the waste stream
- Need to address things that can be done to reduce the amount of waste that goes to the landfill – curbside recycling, alternative technologies, partnerships with the business community to promote recycling and reuse, etc. Need to get innovative and creative.
- Need to increase HPOWER and explore reuse of ash – HPOWER type facilities could be decentralized and built anywhere
- Need to address trans-shipping of waste
- Need to address providing a funding stream to address alternatives
- Need to speed up action on alternatives
- **Plasma Arc Gasification – Jacoby Inc.**
- **Need to address the implementation of the comprehensive and mandatory island-wide recycling program (proposed to be done by December 2006)**
- **Alternatives looked at must be explained including why they are rejected – the exploration must be rigorous**

Facilities Management

- Need to look at as a facilities management problem and apply technologies correctly (especially as pertains to smells and debris)
- The EIS should address the status of all violations and what has been done regarding violations – need to close violations prior to new EIS and permit
- Hours of operation need to be clear and adhered to – the community recently expressed concerns about night operations taking place and the impact of the lighting on houses and neighborhoods
- Need to address overfilling of landfill site
- Need to look at rubbish control and sludge issues
- Need a specific operational plan for soil cover
- **Explain the contracts between the city and Waste Management Inc and the timing of these contracts.**
- **There should be a clearly identified, separate (physically divided) MSW and ash monofill cells for the expansion**
- **A separate area should be identified for asbestos disposal**
- **A full discussion of all management techniques must be included**
- **Impact of expanded operations on adjacent property owners including line of sight issues**

Monitoring and Enforcement

- Need to provide for air quality monitoring, testing as it corresponds to traffic at the site, and along the route to/from the site
- Need to examine enforcement capability and capacity of DOH – including the lack of resources required for monitoring, enforcement, reporting, and accountability

- Major dirt and dust issues; monitoring doesn't work – need for more data collection
- Need to consider past problems with the landfill (i.e., EPA violations, leachate collection system) and be sure the DEIS identifies ways to assure that they do not happen again
- Need to address and explain the $2.8 million fine that has been imposed on the landfill by the Department of Health and assure that these types of practices/violations do not continue in the expansion
- Need to assure that a system is in place to hold the operator accountable
- Monitoring should be adequate so that after the fact permit modification should not happen – example the permit modification needed for the leachate sump pump system
- Need to monitor methane gas levels
- Need to have rigid standards and adequate monitoring to ensure the health and safety of the community
- Need regular monitoring by the Department of Environmental Services
- Need to address who will be responsible for enforcement of things in the EIS and what guarantees will be made in the EIS
- Need to include status of compliance with current permit – by modifying the permit, are we negating prior violations which should not be allowed
- **Need to assure timely reporting by the operator and public access to these reports – consider webcam on site for monitoring purposes**

Leachates

- Need to also address leachate and its impact to groundwater, runoff to ocean, subsidence and slippage resulting from seismic activity, methane fires, and EPA violations relating to gas collection systems
- Need to look back and forward – what has been/will be done to take care of leachate problems and make sure these do not reoccur in the future
- Need to address leachate pumped out to the sewer treatment plant and what happens to it and what is its effect on the final outflow water quality from the sewer treatment plant
- Need to discuss comprehensively the leachate management system – including possible failure of the geo-membrane lining system and how it will be taken care of

Environmental Justice

- Need to address "environmental justice" along the Leeward Coast and as it pertains to this landfill, including the multitude of existing private and proposed sites in the area

Health impacts

- Need to include discussion of potential health hazards
- Who is liable for the health costs to residents should the landfill cause health problems
- When considering expansion, need to discuss EPA finding regarding gas collection system issues
- Compensation to neighbors for health impacts
- Impact of multiple landfills, both public and private, on air quality needs to be addressed
- Higher standards are needed for dust and debris and possible impacts to health

Community issues

- The DEIS needs to deal with the lack of sensitivity to cultural sites and issues
- What communities will benefit - who will be selected and how will the compensation benefits committees be set up also needs to be addressed
- Need to include impact of non-closure of Waimanalo Gulch on for-profit businesses in the area or planning to locate in the area
- Smells, trash escape, floating dust, truck traffic and speeding, trash on road, visual blight all need to be addressed
- Landfill should not be going above the ridge lines, which can be seen from Waianae
- **One of the conditions of the permit was to allow for ridgeline and site views being maintained**
- **No trucks should be parked on Farrington Highway waiting for entrance to the facility**
- **Trucks should be cleaned when leaving facility so the there is no mud or dirt dropped on the highway**
- **Route along Farrington Highway should be kept clean of rubbish or dirt generated by the facility**
- **There should be identification of how the Waimanalo Gulch Sanitary Landfill will be maintained facing Farrington Highway, landscaped to reflect surrounding areas, park-like upkeep, greenbelt, setbacks, etc.**

Appendix D

Hydrologic Setting and Groundwater Monitoring
Waimānalo Gulch Sanitary Landfill, 2006

Hydrologic Setting and Groundwater Monitoring
Waimānalo Gulch Sanitary Landfill
Kahe Valley, Island of O‘ahu, Hawai‘i

Waste Management, Inc./Geosyntec Consultants, Inc.
December 2006

1. HYDROGEOLOGIC SETTING
1.1 Climate and Topography

WGSL is located in a region of Oahu that is relatively arid when compared to the rest of the island due to the “rain-shadow” effect of the Waianae Mountain Range. The average annual rainfall in the area is approximately 20 inches, while gauge stations in the nearby mountains experience significantly higher rainfall averages (Hokuloa gauge, elevation 2,200 feet above mean sea level, average annual rainfall 42 inches).

The regional topography near the WGSL is dominated by the moderate to steep Waianae Range, a northerly trending volcanic mountain complex that is characterized by narrow valleys separated by steeply sloping hills and ridges. The range extends northward from the site approximately 20 miles and is up to approximately 4 miles in width. The WGSL is located at the southern toe of this range in a typically steep and narrow valley (gulch). Elevations along the main mountain ridgeline range from about 1,000 to 3,600 feet msl. Elevations drop dramatically away from the main ridgeline. Lateral slopes along the Waianae Range are asymmetrical, with steeper slopes to the west. Typical slopes on the sides of the range drop some 2,600 feet over distances of two miles or less. Near the WGSL, the mountains of the Waianae Range transition to the low-lying coastal plains. Elevations abruptly diminish from 2,300 feet msl (Puu Manawahua) to sea level in a lateral distance of two miles in the WGSL vicinity (RUST, September 1993).

The WGSL is located in a relatively narrow gulch with a steeply sloping valley floor and sides. At the mouth of the gulch, the elevation of the valley floor is

approximately 50 feet msl and rises to 450 feet msl over a distance of 4,800 feet (up to an 18% slope). Relative elevations between the valley floor and the tops of the adjacent ridges range from about 60 feet to 240 feet. Waimanalo Gulch is approximately 1,000 feet wide from ridge to ridge at its widest point, and is about 500 feet wide at its narrowest point (near the confluence of the upstream tributaries). Site elevations vary from a low of about 70 feet msl in the southeast corner to a high of about 940 feet msl in the northern portion of the property.

1.2 Regional Geology

The island of Oahu represents the eroded remnants of two shield volcanoes, Waianae and Koolau. The Koolau volcano was active after the Waianae volcano became dormant, and its flows backed against the Waianae volcano shield to form the Schofield Plateau. After a long quiescent period during which erosion cut canyons several thousand feet deep, another series of lava flows, the Honolulu Volcanic Series, formed cinder and cones primarily along the southeastern portion of the island.

The Waianae Volcanic Series was formed during the Tertiary period and forms the majority of the Waianae Range. This series is divided into lower, middle and upper members. The lower member consists of sequenced lava flows and associated pyroclastic material up to 2,000 feet thick, which makes up the majority of the Waianae shield volcano. The rocks of this member are mostly thin-bedded pahoehoe that are locally intruded by dikes in the southwestern portion of the island (Takasaki, 1971).

The middle member of the Waianae Volcanic Series is in unconformable contact with the lower member and consists of rocks that accumulated in the caldera and, as such, are thick (on the order of 2,000 feet) and generally horizontally bedded (Macdonald, 1940). This member resembles the lower member but contains more a'a flows than in the lower member. The middle member also is

locally intruded by dikes in the southwestern portion of the island (Takasaki, 1971).

The upper member is about 2,300 feet thick, and is mostly massive a'a flows that issued from large cinder cones (Takasaki, 1971). Dikes also locally intrude the upper member in the southwestern portion of the island, but fewer dikes are present in the upper member than in the lower two members. The valleys of the Waianae Range typically contain moderately thick deposits of alluvium[1] and colluvium[2].

Erosion has removed most of the western slope of the Waianae shield and exposed the internal structure of the volcano. The shield was built by eruptions that took place along three rift zones. The two principal rift zones trended northwestward and southeastward from the summit, while a lesser one trends northeastward (Takasaki, 1971). A rift zone of an active volcano is characterized by parallel to subparallel fissures and a line of cinder and spatter cones. These features are absent in older, dormant volcanoes such as the Waianae volcano where rift zones are identified by erosion-exposed dike complexes (Takasaki, 1971). The dikes are generally basalts and diabases and are aphanitic or have only a small content of phenocrysts. The dikes typically have glassy chilled margins and show a gradual steady increase in grain size from rim to center. Near surface lava in Hawaii typically contains high numbers of cooling joints, vesicle partings, flow-unit boundaries, rubble layers and other planes of weakness (Walker, 1987). Dikes cutting near surface flows can be highly irregular in shape. Dikes are common in the western and southwestern Waianae Range. They are sparse in the less permeable, massive, thick-bedded flows of

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[1] Sediments deposited by erosional processes, usually by streams, www.weather.gov/glossary/glossary.php.

[2] Rock and soil accumulated at the foot of a slope from gravitational forces, www.blm.gov/nhp/Commercial/SolidMineral/3809/deis/glossary.html.

the upper member and more numerous in the highly permeable, thin-bedded flows of the lower member of the Waianae Volcanic Series (Takasaki, 1971).

"Caprock", which consists primarily of alluvium, terrigenous and marine clays, and fossilized coral reef with associated calcareous detritus, overlies the volcanic sequences along much of the Oahu coastline. Portions of the caprock are important local coastal aquifers, such as in the Ewa Plain. However, much of caprock is less permeable than the sequences of volcanic rocks so it acts a confining unit above the volcanic aquifer sequence (Hufen et al, 1980; RUST, September 1993).

1.3 Regional Hydrogeology

On a regional scale, fresh groundwater in aquifers on Oahu is similar to other islands, and occurs as a lens floating above and displacing saline groundwater. Generally, the fresh water lens is thickest at the center of the island and thins toward the edges of the island at sea level (e.g. Hufen and others, 1980).

In the southeastern portion of the Waianae Range, the principal groundwater aquifer system is the middle and lower members of the Waianae Volcanic Series. The volcanic aquifers are recharged by infiltration of rainfall and surface runoff originating in the Waianae and Koolau Ranges. Flows of the upper member are largely above the water table and contain only a small perennial supply. Permeability of a volcanic aquifer is generally high due to presence of pahoehoe lava tubes and loose clinker zones and rubble between lava flows. However, permeability is highly variable on a local scale and the low-permeability dense interiors of a'a lava flows and cross-cutting near-vertical volcanic dikes can function as hydraulic barriers that locally partition groundwater both vertically and horizontally. Groundwater gradients in portions of the southern Waianae Range have been shown to be step-like rather than smooth due to the presence of dikes that act as barriers to groundwater flow (Takasaki, 1971; Hufen and others, 1980).

Groundwater generally flows from inland areas outward toward the coast. However, locally, discharge of groundwater to the sea is limited by low permeability “cap rock” that overlies the volcanics along much of the coast of Oahu. Locally, the caprock prevents the free discharge of groundwater to the ocean, and diverts groundwater flow parallel to the coastline toward areas without confining cap rock where the groundwater discharge to the sea is unimpeded.

Waimanalo Gulch is located in the Makaiwa Aquifer System as defined by the Commission on Water Resource Management (CWRM) Water Resource Protection Plan Volume II (George A. L. Yuen & Assoc., 1990). This aquifer has not been assigned a sustainable yield by CWRM, though it is adjacent to the Ewa-Kunia Aquifer System to the east and the Nanakuli Aquifer System to the northwest. The estimated sustainable yield of the Ewa-Kunia Aquifer System is 16 million gallons per day (mgd); while the Nanakuli Aquifer System is assigned one (1) mgd for sustainable yield.

Although no groundwater is developed in the Makaiwa Aquifer System and near Waimanalo Gulch, several monitoring wells and test holes have been drilled in the lower part of the valley and the neighboring Kahe Point area.

Present water levels encountered in the Ewa-Kunia Aquifer System, east of Waimanalo Gulch, are greater than 13 feet above msl. Near Makaiwa Gulch, just east of Waimanalo Gulch, a hydrologic discontinuity occurs where water levels drop to less than 6 feet above msl (see Stearns, 1940, p.36). U. S. Geological Survey test holes T-4 (2006-12) in the Ewa-Kunia Aquifer System and T-5 (2007-01) in the Makaiwa Aquifer System are only a mile apart and reflect the discontinuity (CWRM well database). **Figure 1, Well Location Map**, is a well location map that also depicts the approximate location of wells T-4 and T-5 and the boundary between the Ewa-Kunia and Makaiwa Aquifer systems. When originally drilled in 1938, the water levels for T-4 and T-5 were 17.0 feet and 6.5

feet above msl, respectively (Stearns, 1940). The last water level measurement for T-4 was 13.73 ft above msl (December 6, 2001, Honolulu Board of Water Supply measurement). Well T-5 was previously abandoned and sealed.

The Nanakuli Aquifer System, to the west of the Makaiwa Aquifer System, has only a few wells and test holes. One observation well of note was test hole T-15 (2307-01) described by Stearns (1940) and Mink (1978). This hole was drilled at an elevation of 479.6 ft above amsl. It penetrated 100 feet of talus and old alluvium before entering basalt. It was drilled to -9.0 feet above msl and had an initial water level of 2.6 feet above msl. According to Mink (1978), T-15 was used as an observation well until 1969. Regular monthly water levels were measured from 1940-1953 and ranged from 1.60 feet to 3.14 ft above msl. The average water level for the period of record was 2.0 feet above msl. Chlorides varied from 86 to 119 milligrams per liter (mg/L).

Hydraulic conductivities in dike-free basaltic lavas on Oahu typically range between 1,000 and 2,000 feet per day (ft/d). A value of 1,500 to 2,000 ft/d is commonly used in analytical and numerical groundwater models (Mink, 1980; Oki, 1997). The hydraulic gradient for dike-free lava flows is typically 1-foot per mile, which is the value found in the adjoining Ewa-Kunia Aquifer System.

For dike-impounded aquifers, the hydraulic conductivity depends upon dike spacing, their distribution and continuity, and depth of penetration into the aquifer. In an aquifer where there are more than 100 dikes per linear mile, or as used by Takasaki and others (1969) as constituting 5 percent or more of the country rock, the hydraulic conductivity is generally low (<1 percent), typically ranging between 1 and 100 ft/d. While in the marginal dike zone where dike occurrence is much less, the conductivity values typically range between 100 and 1,000 ft/d (Takasaki and Mink, 1982; Takasaki and Mink, 1985).

Wells, test holes, and monitoring observation wells were drilled in the lower valley as part of a regular monitoring program and for the proposed expansion plan.

Wells are sampled regularly and used to determine groundwater gradients. The wells listed below in **Table 1** are located near Makaiwa Gulch, Waimanalo Gulch, and Kahe Valley. Well data are from the CWRM database and data for the monitoring wells are provided by Waste Management of Hawaii, Inc.

Table 1: Wells in the Kahe Point/Waimānalo Gulch Sanitary Landfill Area

(Source: CWRM Well Database and Waste Management, Inc.)

Well No.	Old Name	Init. WL (ft amsl)	Init. Cl (mg/L)	Grnd El. (ft amsl)	Bot. Hole Elevation (ft. bmsl)	Casing Diameter (in.)	Length Screen Interval (ft)
2007-01*	T-5	5.5	484	80	-20	6	15
2107-01*	T-51	3.2	492	203	-7	4	11
2107-02	T-128	2.1	N/A	22	-182	N/A	N/A
2107-03	T-129	1.7	6750	28	-176	N/A	N/A
2107-04	T-130	5.8	362	62	-65	N/A	N/A
2107-05	T-131	1.9	3300	40	-51	N/A	N/A
2107-06	T-68	2.1	2410	58	-67	N/A	N/A
2107-07 (MW07)[a]		3.82	890	202.4**	-14.6	2	30
MW02 [a]		3.88	1400	73.82**	-8.8	2	15
MW03 [a]		3.84	1100	77.14**	-7.5	2	18
MW10		N/A	N/A			2	
MW11		N/A	N/A			2	

*sealed and/or lost

**top well head

a – data from Quarterly Monitoring Report for January –March 2006 at the WGSL

The wells shown in **Table 1** are located in lava flows defined by Stearns (1940) as “Lower and Middle Members” of the Waianae Volcanic Series. **Figure 1, Well Location Map** identifies the location of wells and also depicts the location of T-15.

The quality of groundwater in the volcanic aquifers is generally good, except where proximity to the ocean results in elevated salinity (Takasaki, 1971). Other sources of lower quality groundwater include leaching of hydrothermally altered volcanic rocks in the central vent area and of carbonate rocks above or adjacent to the volcanic aquifer (i.e., caprock; Takasaki, 1971). Total dissolved solids concentrations in wells to the northwest of the WGSL range from about 200 to about 2,000 mg/l. Chloride concentrations in these same wells range from about 10 to greater than 10,000 mg/l.

1.4 Site Geology

This section summarizes the results of studies related to site geology, hydrogeology, and geochemistry that have been performed at the WGSL since the early to mid 1990s.

The sequence of volcanic rocks encountered in borings and exposed on slopes at the WGSL is the lower member of the Waianae Volcanic Series (e.g. TNWRE, August 7, 1993). The lava flows include both a'a and pahoehoe flows ranging from aphanitic to porphyritic. Coloring of the rock material varies from grey to reddish grey to red, and the texture varies widely from highly vesicular to dense and fine-grained.

Based on observations made during drilling and down-hole video logs of borings drilled in October 2006 for monitoring wells MW-10 and MW-11, lava flows range in thickness from 3 to 20 feet thick, and loose clinker zones between flows comprise approximately 20 percent of the volcanic sequence (Geosyntec, December 7, 2006).

U. S. Geological Survey (USGS) personnel identified a near-vertical dike striking between about 15 and 20 degrees west of north, located at the approximate midpoint of the WGSL property. Furthermore, dikes have been documented to exist through visual observation from site personnel during excavation activities.

Two dikes were documented during the construction of Cell E1 (A-Mehr Inc, 2003). In addition, recent geologic reconnaissance has confirmed the presence of dikes to the north of the site (Mink & Yuen and Knight Enterprises, 2006). The trends of the dikes are predominantly north/northwest, and when projected to the southwest, intersect portions of the northern and northeastern cells of the existing landfill. The approximate location of near vertical dikes in the vicinity of the WGSL that cross-cut the sequence of basaltic lava flows are shown on **Figure 2**.

1.5 Site Hydrogeology

Groundwater under the WGSL is present within the lower and middle members of the Waianae Volcanic Series that dips slightly towards the coast (southwest). In the vicinity of the lower portion of the WGSL, the water table occurs at an elevation of approximately 4 feet above msl and is very flat. As a consequence of the topographic relief, depth to groundwater at the five monitoring wells ranges from 55 to 200 feet. **Table 2** provides depths and screened interval information for the five monitoring wells.

Table 2: Monitoring Wells at WGSL

	Northing (feet)	Easting (feet)	MP Elevation (ft above MSL)	approximate casing stickup (ft above gs)	-------- screen -------- top (ft bgs)	bottom (ft bgs)	10/20/2006 depth to gw (ft below MP)	10/20/2006 gw elevation (ft above MSL)	11/20/2006 depth to gw (ft btoc**)	11/20/2006 gw elevation (ft above MSL)
MW-2	66,879.36	456,496.80	73.85	1.9	82.6	82.6	69.62	4.25	69.66	4.19
MW-3	67,383.32	456,311.18	77.18	1	84.6	84.6	72.94	4.26	73	4.18
MW-7	68,092.04	456,724.17	202.42	2.3	217	217	198.31	4.13	198.28	4.14
MW-10	67,186.53	457,050.04	123.48	0	135	135	119.11	4.37	119.14	4.34
MW-11	66,570.31	456,821.29	61.13	3.5	67	67	56.68	4.45	56.775	4.36

Notes:
All five monitoring wells are Schedule 40 PVC casing.
All five monitoring wells surveyed by Park Engineering 24 October 2006.
Surveyed MP (measuring point) is top of PVC casing (TOC).
Oct 20, 2006 depth to water at MW-2, MW-3, and MW-7 was measured from top of cap for pump assembly, which is 3/16 inch (0.0156 ft) above top TOC
**** Pump assemblies at MW-2, MW_3 & MW-7 were removed prior to 11/20/2006 measurments so depth to water was measured from TOC for all wells.**
Water levels in monitoring wells are tidally influenced. Water levels reported here do not include averaging or compensation for tidal influence.

The marine sediments of the Ewa Plain to the south and east form a low permeability caprock that inhibits groundwater discharge to the ocean south and east of the WGSL. However, the caprock is reported to be generally absent along the coast to the west and northwest of Waimanalo Gulch, in the area of the Kahe Park. The distribution of confining caprock is interpreted to control the westward flow of groundwater and unimpeded discharge to the sea west to northwest of the WGSL. Salinity measurements of ocean water along this stretch of coastline performed by the USGS and TNWRE in 1991 are consistent with major discharge of fresh groundwater in this area (RUST, September 1993, 1997; Earth Tech, 2006). **Figure 3** shows an aerial photo of the general vicinity of the WGSL with approximate groundwater elevations at wells. This data supports a general northwest direction of groundwater flow toward the Kahe Beach coastline.

In the upper portion of the WGSL, a few near-vertical, north-northwest trending basaltic dikes have been mapped that cross cut the sequence of lava flows. Additional investigation is in progress to evaluate the potential influence of the dikes on groundwater flow in the upper portion of the WGSL. However, as stated earlier, all the dikes are up-canyon from the existing leachate collection sumps, so even if the dikes are barriers to groundwater flow they do not influence monitoring of groundwater for detection of potential leaks from the existing leachate collection sumps within the existing landfill footprint.

1.5.1 Hydrogeochemistry

The inorganic geochemistry of groundwater beneath the WGSL is fairly complex, reflecting both the facility's coastal location and its proximity to the coastal cap rock. Groundwater monitoring wells at the WGSL are screened within a transitional groundwater zone in which there is mixing between freshwater and seawater. Groundwater from each of the WGSL monitoring wells is a sodium-magnesium-calcium-chloride (Na-Mg-Ca-Cl) type water which generally reflects this mixing of freshwater and seawater. Total dissolved solid (TDS) concentrations in Monitoring Wells 03M and 07 are consistently lower than TDS

concentrations in Monitoring Well 02M, a condition that is also consistent with the facility's position within the coastal transition zone. The relative percentage of dissolved calcium in groundwater from Monitoring Well 02M is slightly higher than that in groundwater from Monitoring Wells 07 and 03M. This is likely related to the fact that Monitoring Well 02M is located nearer the cap rock (primarily calcium carbonate) than are Monitoring Wells 07 and 03M.

The most comprehensive study of groundwater chemistry was conducted in 1992 (by the former Waste Management Environmental Monitoring Laboratory in Geneva, Illinois). The purpose of that study was to establish the degree of hydraulic continuity across the WGSL and to further establish if the groundwater on either side of the dikes was hydraulically connected. The results of the geochemical study were consistent with little to no barrier to lateral groundwater flow between the downgradient edge of the landfill and the ocean west of the WGSL. This is further corroborated through the results of the tidal study described above which show hydraulic continuity between all monitoring wells at the WGSL with the sea. This also is consistent with the concept of transition-zone groundwater (RUST, 1997).

2. GROUNDWATER MONITORING

2.1 Groundwater Monitoring Network

Detection monitoring wells installed for the WGSL were located using previous flow direction information to better target the primary points of leachate accumulation (leachate sumps). An appropriate groundwater detection monitoring network can be designed based on flow direction and velocity information.

Water levels in monitoring wells at the WGSL are tidally influenced. The results of a tidal study conducted in November 2006 (Geosyntec, 2006) indicate groundwater flow to the northwest in the immediate vicinity of the WGSL. Historical elevations in the HECO wells indicate a water table elevation

approximately 2-3 feet lower than the WGSL wells, suggesting a westerly groundwater flow direction on a local-regional scale.

The gradient calculated using the groundwater elevation data collected during the November 2006 tidal study is about 0.0003 foot/foot (approximately 1.5 feet/mile) to the northwest. This value is consistent with the hydraulic gradient for dike-free lava flows, typically about 1 foot per mile, and indicates that groundwater flow in the lower part of the WGSL is not significantly affected by dikes. Groundwater velocity is calculated using the equation V= Ki/n, where K = hydraulic conductivity, i = hydraulic gradient, and n = effective porosity. Hydraulic conductivities in basaltic lavas on Oahu typically range between 1,000 and 2,000 ft/d for dike-free lavas with a value of 1,500 to 2,000 ft/d commonly used in analytical and numerical groundwater models (Mink, 1980; Oki, 1997). Using a K value of 1,500 ft/day, a gradient of 0.0003 ft/ft, and an effective porosity of 0.20, the groundwater velocity is calculated to be approximately 2.3 ft/day.

The current groundwater monitoring network includes five monitoring wells around the toe of the WGSL (02M, 03M, 07, MW-10, and MW-11). Locations of the five monitoring wells are shown on **Figure 2**. Based on the calculated groundwater flow directions and velocity, the existing monitoring wells are sufficient for monitoring potential impacts to groundwater downgradient of the toe of the WGSL, and the ash monofill sump in cell 8. Monitoring well 07 is located west of the MSW Cell E-1 Sump and the MSW Cell 4B Sump. Based on a westerly flow direction, this well is downgradient of the sumps. Based on a northwesterly flow direction, this well is cross-gradient to down-gradient of the sumps. As discussed above in Section 1.5.1, Hydrogeochemistry, above, the apparent northwestward flow toward monitoring well 07 may be a consequence of local recharge associated with the surface water detention pond elevating water levels in monitoring wells 02M and 03M.

Results of the long-term monitoring of the WGSL monitoring wells (currently equipped with pressure transducers and data loggers) will be used to continue

assessment of fluctuations in groundwater flow direction and gradient to further evaluate if the current monitoring network is sufficient for long-term detection monitoring.

2.2 Groundwater Monitoring Parameters

Chapter 11-58.1, HAR, (1) requires that MSW landfills routinely monitor groundwater for the 15 metals and 47 volatile organic compounds (VOC) listed in Appendix I of Chapter 11-58.1. This is the same list of monitoring parameters contained in the Federal Subtitle D regulations (40 CFR Part 258, Appendix I) and, in addition to containing an excessively large number of parameters, also contains several parameters (i.e., the 15 metals) which are generally viewed as ineffective monitoring parameters because of their limited mobility in most subsurface environments. The EPA intended the Appendix I analytes to be default parameters for use in those states which have not yet obtained Subtitle D authorization. Through 40 CFR Part 258.54 (a)(1) and (2), the EPA has provided authorized states, such as Hawaii, the flexibility to approve alternative lists of site-specific monitoring parameters. This flexibility, specifically outlined in Chapter 11-58.1 subsections (1)(A) and (B), HAR, has been reflected in the development of previous groundwater monitoring programs for the WGSL (e.g., RUST, 1997).

Accordingly, the groundwater monitoring program describes the approach for selecting an updated alternative list of site-specific groundwater monitoring parameters for use during detection monitoring at the WGSL, and incorporates the approximate 10 years of additional monitoring data collected since the preparation of the previous WGSL groundwater monitoring program (RUST, 1997).

2.2.1 Site-Specific Detection Monitoring Selection Strategy

It is widely accepted that a combination of volatile organic compounds (VOCs) plus selected general water quality parameters will typically provide the most reliable monitoring parameters for most MSW landfills. VOCs in particular can be highly effective parameters for providing an early indication of a potential release from a landfill because they are: (1) rarely detected in background groundwater samples; (2) detected more frequently than any other class of organic compounds in solid waste landfill leachate (Cravy et al., 1990; Plumb, 1991); and (3) are analytically sensitive (i.e., they can be detected at extremely low concentrations); and (4) are relatively mobile in the groundwater system. Although commonly present in MSW landfill leachate, semi-volatile organic compounds (SVOCs), as a group, are significantly less mobile than VOCs in most subsurface environments and do not typically provide for substantial additional monitoring benefits.

The above strategy (i.e., VOCs in conjunction with a short list of water quality parameters) has been implemented as a part of previous WGSL groundwater monitoring programs (e.g., RUST, 1997) and is consistent with the monitoring parameter selection strategy outlined in the Guidance Document. This groundwater monitoring program for WGSL reaffirms this strategy but provides a re-evaluation of water quality monitoring parameters using updated groundwater and leachate monitoring data.

The VOCs listed in Appendix I of Subtitle D, which have been monitored in accordance with the previous WGSL monitoring program (RUST, 1997) will continue to be routinely monitored.

2.2.2 Water Quality Monitoring Parameters

Water quality monitoring parameters are those parameters that occur naturally in groundwater and for which a background concentration must be established in

order to provide an indication of a possible leachate release. For detection monitoring purposes, the use of the minimum number of effective water quality monitoring parameters is always the most effective approach over utilization of a very long list of monitoring parameters, such as the list of metals in Appendix I or a generic list of cations, anions, and other common parameters such as TDS. This is true because of the direct relationship between the number of statistical comparisons performed during each sampling event and the resulting false positive error rates. For example, if a given detection monitoring program consists of 5 wells each of which is sampled for 20 parameters (i.e., 100 statistical decisions per monitoring event), even using a very low error rate (e.g., 0.01, or 1%), it would yield one false positive result every sampling event. The larger the number of statistical decisions that are performed each sampling event, the higher (i.e., less conservative) the associated statistical limit must be in order to avoid excessively high false positive results.

The selection of a list of alternative monitoring parameters for the WGSL is based on actual site conditions and involves a detailed evaluation of available site-specific groundwater and leachate data which, at the WGSL, now contains extensive long-term data Geosyntec 2006). Using the strategies outlined in the State of Hawaii Guidance Document, the first step is to identify those water quality parameters whose concentration in leachate are significantly higher than in groundwater, in order to account for dilution and attenuation processes. The resulting list of potential monitoring parameters is then refined further by identifying and removing parameters that provide substantially redundant coverage (e.g., monitoring for both electrical conductivity and TDS). From the remaining parameters, those anticipated to provide the earliest and most reliable indication of a release are selected as detection monitoring parameters for statistical evaluation purposes. This determination is based on the relative mobility of the constituents, the detectability of each parameter using existing analytical methods, the likelihood of false positive results associated with each parameter, as well as any changes in the parameter that might be expected

during its migration through the unsaturated and saturated zones beneath the facility (e.g., due to changes in pH or redox conditions).

The Guidance Document suggests that potential detection monitoring parameters first be screened by calculating the concentration contrast between leachate and groundwater. As noted in the Guidance Document, a potentially effective monitoring parameter would exhibit a concentration in leachate at least 5 times greater than the upper background limit in groundwater. Note that a leachate-groundwater contrast of 5 times is considered highly conservative based on EPA guidance, which identifies typical useful leachate-groundwater contrast for potentially useful indicator parameters of at least 10 to 20 times (EPA, 1996). If insufficient contrast exists for a specific parameter (i.e., the leachate concentration is consistently at or below the background groundwater limit), then that parameter is eliminated from further consideration for detection monitoring.

Table 3 summarizes the leachate-groundwater concentration contrast values for various inorganic and water quality parameters for the WGSL. These values were calculated by dividing the background concentrations using statistical prediction limits for pooled data from groundwater monitoring wells 02M, 03M, and 07 into maximum leachate values in the WGSL database (through the first half of 2005). The groundwater data was pooled in order to provide sufficient data for statistical calculations and it is assumed that the data is representative of background conditions (i.e., no leachate impact). This is a reasonable assumption given that no inorganic leachate impact is indicated in the WGSL monitoring wells, as described in the routine monitoring reports. Furthermore, numerous monitoring parameters are viable due to the large contrast between concentrations of chemicals in leachate and groundwater at the WGSL facilitates.

Table 3: Leachate - Groundwater Concentrations Contrasts
Waimānalo Gulch Sanitary Landfill

Analyte of Interest	Leachate Pt. Exhibiting Max. Concentration of Analyte of Interest[1]	Date of Max. Leachate Concentration[1]	Maximum Leachate Concentration	Groundwater Background Concentration[2]	Units	Leachate/ Groundwater Ratio
Sulfide	All	5/6/2005	ND[3]	0.05	mg/L	NM[4]
Cyanide, total	ASHMH	12/15/1998	0.022	0.02	mg/L	1.1
Iron*	MSWLS2	12/20/2004	780	636	ug/L	1.2
Sulfate	ASHMH	5/6/2005	890	514	mg/L	1.7
Arsenic*	MSWLS2	12/20/2004	37	10.0	ug/L	3.7
Magnesium*	ASHMH	12/15/1998	3390	793.9048	mg/L	4.3
Beryllium*	MSWLS2	12/20/2004	26	5.0	ug/L	5.2
Alkalinity (as caco3)	MSW-LSE1	5/6/2005	1800	288	mg/L	6.3
Specific conductance field	ASHMH	12/15/2002	91000	13047.5	umhos/cm	7.0
Cobalt*	MSWLS2	12/20/2004	420	50.0	ug/L	8.4
Thallium*	ASHMH	12/29/1999	146	10.0	ug/L	15
Vanadium*	MSWLS2	12/20/2004	1000	50.0	ug/L	20
Chloride	ASHMH	12/26/2000	100000	4510	mg/L	22
Solids, total dissolved	ASHMH	12/14/2001	185000	7891.257	mg/L	23
Calcium*	ASHMH	12/26/2000	21400	816.558	mg/L	26
Nickel*	MSWLS2	12/20/2004	1700	51.2	ug/L	33
Selenium-dissolved	ASHMH	5/6/2005	180	5.0	ug/L	36
Chemical oxygen demand	ASHMH	12/20/2004	5900	160.4427	mg/L	37
Mercury*	ASHMH	12/20/2004	8.7	0.20	ug/L	44
Sodium*	ASHMH	12/20/2004	51000	1108.4675	mg/L	46
Barium*	ASHMH	12/15/1998	11700	200	ug/L	59
Nitrogen, total kjeldahl	ASHMH	4/3/1996	84.4	1.0	mg/L	84
Chromium*	MSWLS2	12/20/2004	1000	10.0	ug/L	100
Bromide	ASHMH	12/26/2000	2270	22.1772	mg/L	102
Lead*	ASHMH	12/20/2004	630	5.0	ug/L	126
Zinc*	MSWLS2	12/20/2004	2700	20.0	ug/L	135
Copper*	ASHMH	12/20/2004	4900	25.0	ug/L	196
Total organic carbon	ASHMH	12/20/2004	2300	7.3	mg/L	315
Potassium*	ASHMH	12/29/1999	17800	38.3028	mg/L	465
Cadmium*	ASHMH	12/20/2004	2400	5.0	ug/L	480
Manganese*	DET-POND	5/20/2005	31	0.0522	mg/L	594
Nitrogen, nitrate	DET-POND	4/27/2005	5880	7.52	mg/L	782
Nitrogen, ammonia	DET-POND	4/27/2005	646	0.24	mg/L	2692

Notes:

[1] based on data through the first half of 2005

[2] based on statistical prediction limit of background data set through the first half of 2005

[3] ND = analyte not detected in any leachate samples

[4] NM = ratio not meaningful because leachate data sets contain no detections of this parameter

* Note that contrast evaluation compares the "total" concentration of a metal in leachate to the "dissolved" concentration in groundwater

The contrast values shown on **Table 3** range over several orders of magnitude and can be categorized as follows:

Leachate/Groundwater = <10:

- Arsenic
- Beryllium
- Cyanide, total
- Magnesium
- Sulfate
- Barium
- Chloride
- Mercury
- Selenium
- Sodium
- Thallium
- Alkalinity
- Cobalt
- Iron
- Specific conductance field
- Leachate/Groundwater = 10 to 99:
- Calcium
- Chemical oxygen demand
- Nickel
- Nitrogen, total Kjeldahl
- Solids, total dissolved
- Vanadium

Leachate/Groundwater = 100 to 999:

- Bromide
- Chromium
- Lead
- Nitrogen, nitrate
- Zinc
- Cadmium
- Copper
- Manganese
- Potassium
- Total organic carbon

Leachate/Groundwater = >1000

- Nitrogen, ammonia

Because of groundwater flow conditions at the WGSL, the latter two groups with leachate-groundwater concentration contrasts on the order of 100 to 1,000 are of particular interest in the process of identifying potentially useful site detection monitoring parameters and are further evaluated below.

In the group with contrast values between 100 and 999, the trace metals cadmium, chromium, copper, lead, manganese, and zinc are eliminated from consideration due to mobility considerations. Several processes interact to influence the transport of metals in the leachate-soil-groundwater system,

including complexation reactions, oxidation/reduction processes, and reactions that result in the removal of metal ions from liquid such as adsorption and precipitation. It is widely recognized that, due to the positive charge of metal ion species, adsorption of metals onto negatively charged clay mineral or organic matter is an important limiting process with respect to metals mobility in this environment. A cation with greater valence state is adsorbed more strongly that a cation with a lower valence state and, for a given valence state, the cation with the smallest radius is adsorbed more strongly than a cation with a large radius. Trace metals, therefore, can be expected to be adsorbed more strongly than the major metals, such as sodium, potassium, calcium, and magnesium, all of which possess relatively large atomic radii and relatively low valence states. Based on these factors, cadmium, chromium, copper, lead, manganese, and zinc are unlikely to provide effective indication of a release from the waste management.

Additionally, bromide is excluded from further consideration due to its association with seawater, which is known to influence site groundwater chemistry (**Section 1.3**). Therefore, Total organic carbon (TOC), potassium, and nitrate as nitrogen are considered potentially effective indicators of site leachate. However, for detection monitoring purposes at the WGSL, chemical oxygen demand (COD) is selected as a replacement for TOC, in spite of its lower concentration contrast. Both COD and TOC are gross-scale measures of the organic carbon content of water and a strong positive statistical correlation between TOC and COD is evident in site leachate. The WGSL's previous monitoring program incorporated COD as a detection monitoring parameter. Therefore, significantly more recent background data exist for COD in the WGSL database, thereby facilitating statistical analysis.

Ammonia-nitrogen exhibits a relatively large leachate-groundwater concentration contrast (approximately 2,700). Clearly, this parameter is highly concentrated in site leachate relative to groundwater. However, ammonia-nitrogen is most mobile under relatively strongly reducing and/or acidic conditions. Groundwater

conditions at WGSL are such that rapid oxidation and rapid neutral pH buffering can be expected. These effects would serve to limit the mobility of ammonia-nitrogen upon release to the groundwater system. Therefore, ammonia-nitrogen, in spite of its large contrast value, would be expected to be a less effective detection monitoring parameters than COD, potassium, and nitrate.

2.2.3 Supplemental Geochemical Parameters

In addition to the use of VOCs, COD, potassium, and nitrate as detection monitoring parameters, the WGSL also incorporates analysis of supplemental geochemical parameters into the routine monitoring program. These supplemental geochemical parameters augment the site-specific detection monitoring parameters such that the general chemical nature of groundwater can be further characterized and potential mechanisms affecting water quality (both natural and man-made) can be better understood and evaluated. The supplemental parameters will not be evaluated statistically. However, they can, on an as-needed basis, provide critical data for evaluating data reliability and potential changes in groundwater quality without affecting the site-wide false-positive statistical error rate. The following supplemental geochemical parameters are to be analyzed in conjunction with routine detection monitoring parameters during each monitoring event:

- Total Alkalinity (reported as bicarbonate and carbonate)
- Bromide
- Chloride
- Sulfate
- Dissolved Calcium, Magnesium, Potassium, Sodium
- Total Dissolved Solids

2.2.4 Summary of Site-specific Detection Monitoring and Supplemental Parameters

The updated detection monitoring parameters for use in detection monitoring at the WGSL are summarized in **Table 4**. Concentration limits using both statistical and non-statistical methods, as appropriate, will be established for each of the detection monitoring parameters (as described in Section 4.0). In addition to routine analysis of the detection monitoring parameters, the supplemental geochemical parameters listed in **Table 4** will also be analyzed during each routine monitoring event. These supplemental monitoring parameters are collected for geochemical informational purposes and are not subject to statistical analysis or other compliance-related evaluation.

As additional leachate data is generated throughout the course of landfill operations, the detection monitoring parameter list will be re-evaluated and updated as required. If parameters are added to the routine detection-monitoring list, background concentrations will be determined using appropriate statistical methods and added to the long-term monitoring program after the changes are approved by the DOH.

2.3 Groundwater Monitoring Schedule

Groundwater monitoring will be performed each quarter for recently installed wells MW-10 and MW-11 until a minimum of 8 background data sets are obtained to facilitate statistical evaluation (i.e., quarterly for a minimum of two years). Quarterly monitoring will continue at monitoring wells 02M, 03M, and 07 for two years. If appropriate and approved by DOH, and following statistical evaluation of two years of quarterly data from the five monitoring wells, the monitoring frequency will decrease from quarterly to semiannually.

Table 4: Detection Monitoring Parameters
Waimānalo Gulch Sanitary Landfill

Constituents	Frequency	Locations
GROUNDWATER Detection Monitoring Parameters Volatile Organic Compounds (VOCs) -- EPA 8260B Parameters Chemical Oxy. Demand; Potassium, dissolved; Nitrate-N	Quarterly	Wells: 02M, 03M, 07, MW-10 and MW-11
Supplemental Monitoring Parameters Total Alkalinity (reported as bicarbonate and carbonate) Bromide; Chloride; Sulfate; Dissolved Calcium; Dissolv. Magnesium; Dissolv. Sodium; Total Dissolv. Solids	Quarterly	Wells: 02M, 03M, 07, MW-10 and MW-11
Groundwater Characterization Parameters (1) detection monitoring parameters, above (2) supplemental geochemical parameters, above (3) Subtitle D Appendix II parameters, below 17 "dissolved" trace metals: Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, Sn, V, Zn Cyanide, total; Total Sulfide; Semivolatile Organic Compounds; Pesticides; Herbicides; PCBs	Once, upon installation	MW-10 and MW-11 first event; any newly installed wells
LEACHATE Routine Leachate Monitoring Parameters Total Alkalinity (reported as bicarbonate and carbonate); Bromide; Chloride; Sulfate; Calcium, total; Magnesium, total; Potassium, total; Sodium, total; Total Dissolved Solids; Chemical Oxygen Demand; Nitrate-N; VOCs (EPA Method 8260B analytes)	Annually	Ash monofill (Cell 8 Sump), MSW Cell E-1 Sump, MW Cell 4B Sump
Non-Routine Leachate Characterization Parameters 17 "total" trace metals: Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, Sn, V, Zn Cyanide, total; Total Sulfide; Semivolatile Organic Compounds; Pesticides; Herbicides; PCBs Major cations and anions (covered by routine monitoring, above) – (Mg, Na, Ca, K, Cl, carbonate, sulfate, and bicarbonate) Major leachate indicators (partially covered by routine monitoring, above) – (TDS, TOC, Total Alkalinity, Nitrogen–Ammonia, Cl, Fe) Field measurements (performed in accordance with Sampling and Analysis procedures in Section 5.0) – (electrical conductance, pH, temperature, and turbidity)	Biennially	Ash monofill (Cell 8 Sump), MSW Cell E-1 Sump, MW Cell 4B Sump, plus any newly sampled leachate locations

3. LEACHATE MONITORING

Leachate monitoring has been performed on a routine basis at the WGSL in accordance with the WGSL solid waste operating permit and with previous site monitoring programs (e.g., RUST 1997). Currently, monitoring is conducted pursuant to the Monitoring Plan, the *Groundwater, Surface Water, and Leachate Sampling Guide* (WMI 2000), and the DOH letter request (DOH 2005). Monitoring is conducted quarterly and reported along with groundwater monitoring (e.g. Earth Tech, 2006).

3.1 Leachate Monitoring System

Leachate samples will be routinely collected to augment the database of potential source information and to evaluate the suitability of site monitoring parameters. Sampling of the following leachate monitoring locations (see **Figure 1**) is proposed on an annual basis:

- Ash monofill (Cell 8 Sump)
- MSW Cell E-1 Sump
- MW Cell 4B Sump (pending DOH approval and installation)

3.2 Leachate Monitoring Parameters

Routine leachate monitoring parameters will consist of the same parameters used for groundwater detection monitoring and the supplemental geochemical parameters including:

- Total Alkalinity (reported as bicarbonate and carbonate)
- Bromide; Chloride; Sulfate
- Calcium, total
- Magnesium, total
- Potassium, total
- Sodium, total
- Total Dissolved Solids

- Chemical Oxygen Demand
- Nitrate-N
- VOCs (EPA Method 8260B analytes)

Note that leachate samples are not filtered and, therefore, the major cations are shown as “total” for leachate (as opposed to “dissolved” for groundwater).
In addition to the above routine parameters, leachate samples collected from new leachate locations, and leachate samples collected from existing locations every two years (biennial characterization) will be analyzed for the following Subtitle D Appendix I parameters and “leachate indicators”, per the Guidance Document:

- 17 trace metals (Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, Sn, V, Zn) plus cyanide and sulfide
- Semivolatile Organic Compounds
- Pesticides
- Herbicides
- PCBs
- Major cations and anions (covered by routine monitoring, above) – (Mg, Na, Ca, K, Cl, CO3, SO4, HCO3)
- Major leachate indicators (partially covered by routine monitoring, above) – (TDS, TOC, Total Alkalinity, Nitrogen–Ammonia, Cl, Fe)
- Field measurements (performed in accordance with Sampling and Analysis procedures in Section 5.0) – (electrical conductivity, pH, temperature, and turbidity)

4. DATA EVALUATION METHODS

The following subsections describe the criteria by which groundwater data will be evaluated at the WGSL for detection monitoring purposes. These criteria represent a conservative approach to groundwater analysis and incorporate

state–of–the–practice statistical and other evaluation methodologies consistent with the Guidance Document.

4.1 Statistical Methodology for Evaluation of Inorganic Parameters

Consistent with the existing groundwater monitoring program at the WGSL, an intra-well monitoring strategy using Shewhart-CUSUM control charts will be used for routine detection monitoring. Shewhart-CUSUM control charts (Gibbons, 1992; Gibbons 1994) are particularly effective in this capacity because they are capable of detecting both sudden and gradual changes in groundwater chemistry. Combined Shewhart–CUSUM control charts will be constructed for each well where intra-well monitoring is performed to provide a statistical and visual tool for detecting trends and abrupt changes in inorganic groundwater chemistry. The combined Shewhart–CUSUM procedure assumes that the data are independent and normally distributed. The most important assumption is independence (Gibbons, 1994). Therefore, care should be taken to never sample wells more frequently than sample independence can be demonstrated based on site–specific hydrogeological factors. The assumption of normality is somewhat less of a concern because the data can usually be adequately transformed for most applications. Non-detects (NDs) can be replaced by one–half of the PQL without serious consequence, although this procedure should be applied only to constituents that are detected in at least 25% of all samples. For data sets with less than 25% detected values in the background data set, non-parametric prediction limits will be used in lieu of Shewhart-CUSUM control charts.

Intra-well monitoring is always the preferred approach for wells not already impacted by inorganic waste constituents because it eliminates the spatial component of chemistry variability from the statistical evaluation. No impact from inorganic waste constituents has been identified to date in WGSL groundwater. A statistically significant trend in sodium concentrations exhibited by well 03M, as reported in 2004 was demonstrated to be unrelated to impact from the facility (A-Mehr, 2004).

For intrawell comparisons, a minimum of eight background samples (i.e., from each well in the monitoring program) is required for parametric (i.e., Shewhart-CUSUM) tests and 13 background samples for nonparametric (i.e., Prediction Limit) tests. Additional discussion of intrawell monitoring can be found in Gibbons (1987a, 1987b, 1990, and 1994). Statistical evaluation of groundwater monitoring data will be performed using DUMPStat™ statistical modeling software, developed consistent with USEPA and ASTM guidance on groundwater monitoring at Subtitle D and Subtitle C facilities (Gibbons and Discerning Systems, 1994; www.discerningsystems.com).

4.2 Non-Statistical Methodology for Evaluation of VOCs

VOCs have been demonstrated to be effective indicators of a release from MSW landfills. However, because these compounds are rarely naturally detected in background groundwater samples, establishing monitor well–specific limits for VOCs is generally not an option. Therefore, a detection monitoring decision rule based on laboratory–specific practical quantitation limits (PQL) will be used to identify a statistically significant monitoring result with respect to VOCs.

It is generally accepted that when a landfill facility actually produces a leachate release to groundwater, multiple constituents contained in the leachate are associated with the source fluids and are subsequently detected by the groundwater monitoring program. A single constituent at very low concentration (i.e. below the PQL) typically is not the signature that is produced from an actual release. The calculation of laboratory–specific PQLs (Gibbons, et al., 1992) already incorporates a measure of the statistical uncertainty that is associated with the measurement process. Therefore, any VOC detected and verified at a concentration above the PQL would be statistically significant, and would therefore trigger assessment monitoring (or an alternative source demonstration if the detection is unrelated to a release from the landfill). This decision rule only

applies in cases where the constituent has rarely, or never, been detected in background samples.

PQLs assure that the quantitative value of the analyte is close to the measured value. Method detection limits (MDLs), on the other hand, indicate that the analyte is present in the sample with a specified degree of confidence (Gibbons et al., 1991). For analytes with estimated concentrations greater than the MDL but not the PQL, it can only be concluded that the true concentration is greater than zero; the actual concentration cannot be determined. The actual concentration of an analysis result between the PQL and the MDL (often referred to as a “trace” result or a “J-flagged” result) may actually be less than the MDL. Therefore, comparison of a detected concentration to a maximum contaminant level (MCL), or any other concentration limit, is not meaningful unless the concentration is greater than the PQL.

Although the use of VOC results reported between the MDL and PQL is not appropriate for use in the decision rule, such trace/J-flagged results can be used to guide further investigation in the event that long-term, repeatable trace/J-flagged results are observed, such as the recent case with WGSL well 07; in that case, repeatable trace detections of VOCs were the basis for initiating further study that resulted in the identification of a probable non-landfill source (GeoChem Applications, 2005).

4.3 Detection Verification Procedure

If groundwater analysis results have been collected, checked for quality assurance and quality control (QA/QC) consistency and are determined to be above the appropriate statistical level (i.e., the Shewhart-CUSUM control chart limit or non-parametric prediction limit for inorganic monitoring parameters, or the PQL for one or more VOCs), the results should be verified in accordance with the objectives of 40 CFR Part 258.53 and HAR Chapter 11-58.1.

Verification resampling is an integral part of the statistical methodology described by the USEPA's *Addendum to Interim Final Guidance Document – Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities* (July 1992). Without verification resampling, much larger statistical limits would be required to achieve site–wide false positive rates of 5% or less. Furthermore, the resulting false negative rate would be greatly increased. For the WGSL groundwater detection monitoring program, the following procedure will be performed for each compound determined to initially be above its statistical limit. Note that only those compounds that initially exceed their statistical limit should be sampled for verification purposes; otherwise, an unacceptably high false-positive error rate can be expected (e.g., if PCE is the only compound detected during an EPA Method 8260B scan, then only PCE is targeted and reported by the laboratory during the retest).

Volatile Organic Compounds

If one or more VOCs is/are detected above statistical limit(s) (i.e., PQL), one immediate resample and analysis should be conducted. A statistical exceedance will be recorded and assessment monitoring initiated if any single VOC is measured above the PQL in the verification resample, or an alternative source demonstration may be performed if the exceedance is not anticipated to be associated with a release from the facility.

Inorganic Constituents

If one or more of the inorganic parameters are detected above their statistical limit (i.e., Shewhart–CUSUM control chart limit or non-parametric Prediction Limit), one verification resample will be collected at the next scheduled sampling event. A statistical exceedance will be recorded and assessment monitoring initiated if verification of an elevated parameter is confirmed for one discrete verification resample, or an alternative source demonstration performed if the exceedance is not a result of a release from the facility

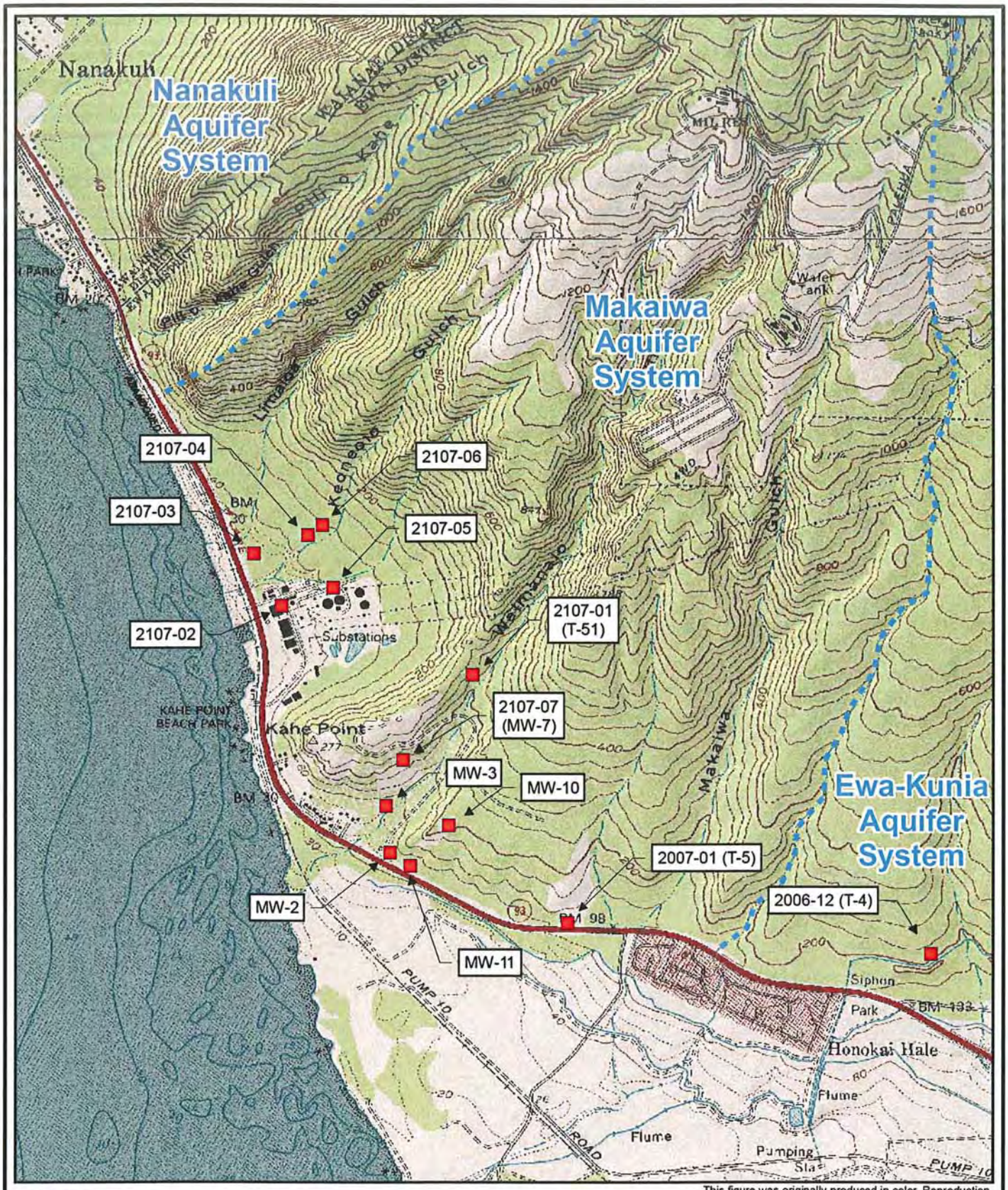
5. FIGURES

See attached figures referenced in this document:

Figure 1 - Well Location Map

Figure 2 - Near Vertical Dikes in the Vicinity of Waimānalo Gulch Sanitary Landfill

Figure 3 - Approximate Water Table Elevation, WGSL and Vicinity



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Monitoring Well Locations
- Major Aquifer Approximate Boundary

0 2000
Scale in Feet

Map Projection: GCS NAD 1983

Source: USGS

N

DRAFT

FIGURE 1

AREA AQUIFERS AND MONITORING WELLS

WAIMANALO GULCH SANITARY LANDILL

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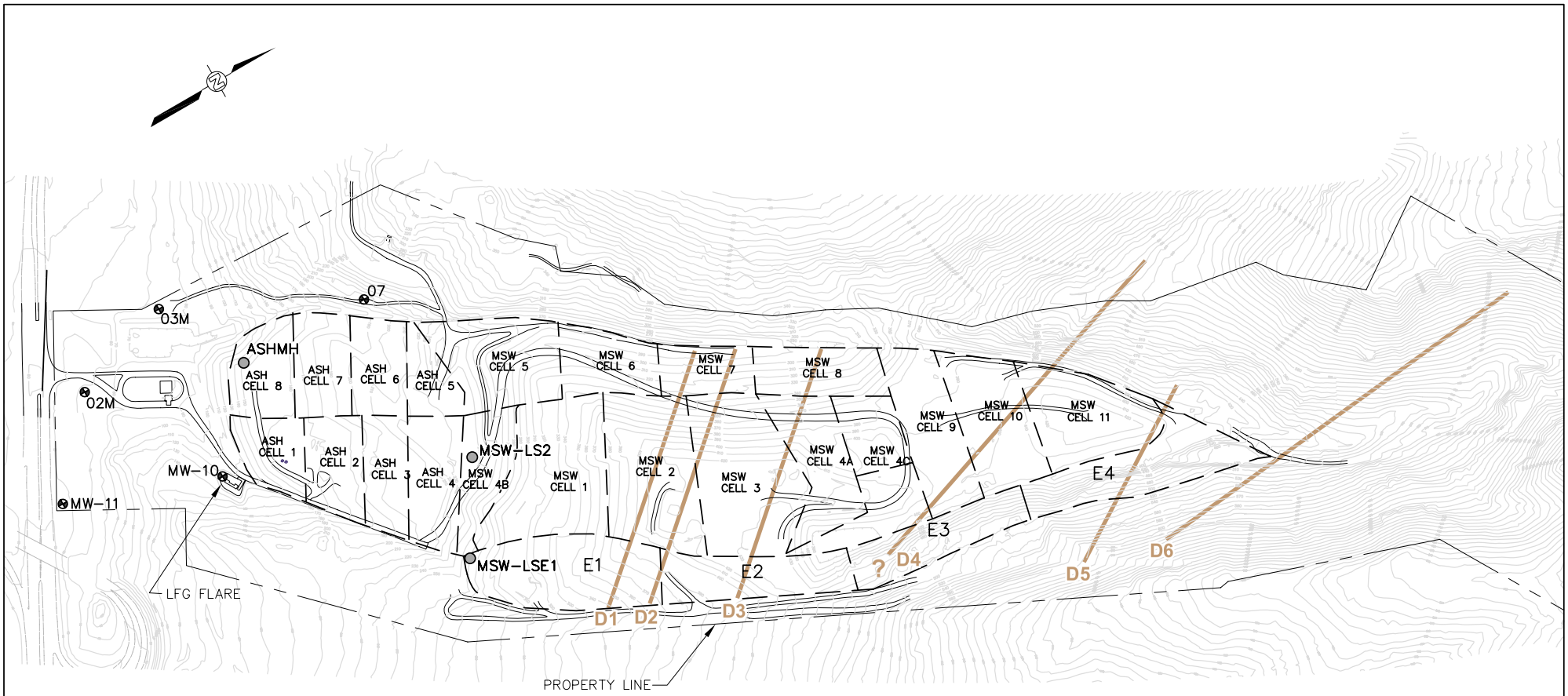

LEGEND

- EXISTING GROUND 10-FT CONTOUR (MSL)
- CELL BOUNDARY
- PROPERTY LINE
- 03M MONITORING WELLS (LOCATIONS APPROXIMATE)
- LEACHATE SUMP
- APPROXIMATE LOCATIONS OF REPORTED DIKES

400 200 0 400 800

SCALE IN FEET

NOTES:

1. EXISTING TOPOGRAPHY BASED ON 30 DECEMBER 2005 AND 29 DECEMBER 2001 AERIAL SURVEY PROVIDED BY OWNER USING LOCAL COORDINATE SYSTEM.

2. LOCATIONS OF DIKES D1, D2, AND D3 ARE BASED ON HISTORICAL REPORTS (E.G. RUST, 1993, 1997; EARTH TECH, 2006A) BUT NO EVIDENCE OF REPORTED DIKES D1, D2, AND D3 IS VISIBLE IN THE SLIDE SLOPES OF WAIMANALO GULCH. LOCATIONS OF DIKES D3, D4, AND D5 ARE BASED ON RECENT GEOLOGIC RECONNAISSANCE MAPPING AND GPS COORDINATES (MINK & YUEN AND KNIGHT ENTERPRISES, 2006).

GEOSYNTEC CONSULTANTS

SITE PLAN

WAIMANALO GULCH LANDFILL
OAHU, HAWAII

FIGURE NO.	2
PROJECT NO.	WR0935
DATE:	DECEMBER 2006

P:\GIS\Waimanalo\AI\August2007\Figure 2 Site Plan with MWs.ai

Notes:
1. MSL - Mean Sea Level
2. Posted values are general water levels elevations (ft above MSL)

N

0 2000 ft
Scale Approximate

GeoSyntec Consultants

Approximate Water Table Elevation
WGSL and Vicinity
Kapolei, Oahu, Hawaii

DRAFT

Figure 3
WR0935
December 2006

P:\GIS\Waimanalo\AI/Figure 5 Site Aerial.ai

6. REFERENCES

A-Mehr, Inc., 2003, *"E1 Cell at Waimanalo Gulch Landfill, Geological Investigation and Subdrain Design",* Letter from M. Ali Mehrazarin to Joe Hernandez of WMH, June 3.

A-Mehr, Inc., 2004, Alternative Source Demonstration Dissolved Sodium at Groundwater Monitoring Well 03M Waimanalo Gulch Sanitary Landfill, Oahu, Hawaii, August 9, 2004.

Cravy, T.D., McIsaac, P., and Gibbons, R.D., 1990, *Evaluation of organic indicator parameters using an Appendix VII/IX Database*: presented at Waste Tech '90, Landfill Technology: Back to Basics. San Francisco, CA.

Department of Health, State of Hawaii (DOH). 2002. *State of Hawaii Landfill Groundwater Monitoring Guidance Document. Ver. 1.8*. Honolulu: Solid and Hazardous Waste Branch. September.

DOH, 2005, Letter from Thomas E. Arizumi, Chief, to Mr. Paul Burns, General Manager, Waste Management of Hawaii, Inc. July 27.

Earth Tech, Inc. 2005. *Waimanalo Gulch Sanitary Landfill Tidal Study Results and Groundwater Monitoring Well Network*. December 15.

Earth Tech, Inc. 2006. *Quarterly Monitoring Report for January – March 2006, Waimanalo Gulch Sanitary Landfill, Kapolei, Oahu, Hawaii*, June 8.

Earth Tech, Inc. 2006. Workplan, *Groundwater Monitoring Well Installation, Phase I, Waimanalo Gulch Sanitary Landfill, Kapolei, Oahu, Hawaii*, August 4.

U.S. EPA, 1992, Addendum to interim final guidance document – Statistical analysis of ground–water monitoring data at RCRA facilities. July.

Gartner Lee, 1992, *Geophysical Survey Results, Waimanalo Gulch Site, Ewa Beach, Hawaii,* November 14.

GeoChem Applications, 2005, *Evaluation of Trace Level Tetrachloroethene (PCE) and 1,1-Dichloroethane (1,1-DCA) Detections in Groundwater Samples from Well 07, Waimanalo Gulch Sanitary Landfill* (Technical Project Memorandum transmitted to DOH), December.

George A. L. Yuen & Assoc., 1990, Water Resources Protection Plan Vol. II Appendix: Prepared for the Commission on Water Resource Management, Dept. of Land and Natural Resources, State of Hawaii, 203 p. and additional appendices.

Geosyntec Consultants, Inc., 2006, Phase I Monitoring Well Completion Report, Waimanalo Gulch Sanitary Landfill, Kapolei, Hawaii, Letter Report to DOH, December 7, 2006

Gibbons, R.D., 1987a, *Statistical prediction intervals for the evaluation of ground– water quality*, Ground Water, v.25, pp.455–465.

Gibbons, R.D., 1987b, *Statistical models for the analysis of volatile organic compounds in waste disposal facilities*, Ground Water, v.25, pp.572–580.

Gibbons, R.D., 1990, *A general statistical procedure for ground–water detection monitoring at waste disposal facilities*, Ground Water, v.28, pp.235–243.

Gibbons, R.D., 1991, *Some additional nonparametric prediction limits for ground–watermonitoring at waste disposal facilities*, Ground Water, v.29, 729–736.

Gibbons, R.D., 1992, *An overview of statistical methods for ground–water detection monitoring at waste disposal facilities: Ground–Water Contamination at Hazardous Waste Sites,* Chemical Analysis, Marcel Dekker, Inc., New York.

Gibbons, R.D., 1994, *Statistical methods for groundwater monitoring*: John Wiley & Sons, Inc., Publishers, 286 p.

Gibbons, R.D. and Discerning Systems, Inc., 1994, *"DUMPStat: An artificially intelligent computer program for statistical analysis of groundwater monitoring data under Subtitle C and Subtitle D Regulation"s*: Robert D. Gibbons LTD, Chicago, Illinois (unpublished). www.discerningsystems.com

Huffen, T.H., Eyre, P., and William, M.. 1980, *"Underground Residence Times and Chemical Qualityof Basal Groundwater in Pearl Harbor and Honolulu Aquifers, Oahu, Hawaii,"* University of Hawaii, Honolulu, HI, Water Resources Research Center, Technical Report No. 129, 75p.

Macdonald, G.A., 1940, *Petrography of the Waianae Range, Oahu*, in Stearns, H.T., ed., Hawaii (Terr.) Division of Hydrography Bulletin 5: Supplement to geology and ground-water resources of Oahu, Hawaii, p. 61-9.

Mink & Yuen and Knight Enterprises, 2006, *Geologic Reconnaissance at the Waimanalo Gulch, Oahu, Hawaii,* prepared for Golder Associates and Waste Management, November 10, 2006.

Plumb, R.H. 1991, *"The occurrence of Appendix IX organic constituents in disposal site groundwater"*: GWMR, 11(2):157164.

RUST, 1993, *"Site Specific Waimanalo Gulch Sanitary Landfill interim Groundwater Monirtoring Plan"*, Prepared for Waste Management, Inc., September.

RUST, 1995, *Groundwater and Leachate Monitoring Plan (the Monitoring Plan)*, October 7, 1995.

RUST, 1997, *Groundwater and Leachate Monitoring Plan (the Monitoring Plan*), Revised June 1997.

Serfes, M.E., 1991, *"Determining the mean hydraulic gradient of ground water affected by tidal fluctuations,"* Ground Water, vol., 29, no. 4., p 549-555.

Stearns, H.T., 1940*, Supplement to the geology and ground-water resources of the island of Oahu, Hawaii:* Hawaii (Terr.) Division of Hydrography Bulletin 5, 164 p.

Takasaki, K. J., 1971, *"Ground water in the Waianae District, Oahu, Hawaii":* U. S. Geological Survey Hydrologic Investigations Atlas HA-358, prepared in cooperation with the State of Hawaii, 2 sheets.

Tom Nance Water Resource Engineering (TNWRE), 1993, *"Data on the Formations Encountered and As-Built Dimensions of Well 2107-07M,"* Letter submittal to WGSL, 7 August.

Walker, G.P.L., 1987, *"The Dike Complex of Koolau Volcano, Oaho: Internal Structure of a Hawaiian Rift Zone"* in Volcanism in Hawaii, R.W. Decker, T.L. Writht, and P.H. Stauffer, editors, U.S. Geological Survey professional Paper No. 1350, Chapter 14, pp. 961-996.

Waste Management of Hawaii. 2001. General Well/Piezometer Construction Standard Revision 6.1. January 2001.

Waste Management, Inc., 2004, Groundwater, Surface Water, & Leachate Sampling Guide, Version 1.0, March 5.

Zawadzki, W., 2002, *"Capture-zone design in an aquifer influenced by cyclic fluctuations in hydraulic gradients"*, Hydrogeology Journal, vol. 10, No. 6, p. 601-60.

Appendix E

Botanical Resources Report for Alternative Municipal Refuse Disposal Sites on the Island of O'ahu, 2007

Botanical resources report for alternative municipal refuse disposal sites on the Island of O'ahu[1]

February 20, 2007 *AECOS* Consultants No. 065

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INTRODUCTION

Although solid waste generated by the populace on the Island of O'ahu is increasingly diverted to various other forms of disposal, there remains today a need to landfill a portion of the waste stream. The need for a solid waste disposal site will likely be reduced in the future, but not eliminated. This report considers botanical resources extant at potential landfill sites as presented by the City & County of Honolulu. The purpose of this report is to establish which, if any of the proposed locations, support plants of special concern: either species that are listed by the state and federal governments under an endangered species program, or plant assemblages that are substantially native in their composition, and therefore represent intact or partially intact native communities capable of supporting biological resources unique to the Hawaiian Islands.

Five (5) potential landfill sites are investigated: Mā'ile Quarry, Nānākuli B, Waimanalo Gulch (lateral expansion), Makaīwa Gulch, and Kapa'a (Fig. 1). All but the last site are located on leeward O'ahu; Kapa'a is the Ameron quarry site on windward O'ahu (located between Kāne'ohe and Kailua).

With respect to the potential for any of the sites to support an assemblage of plants with significant native species representation, it must be realized that selection of potential sites was limited to those parts of the island *makai* (seaward) of the Underground Injection Control (UIC) and *makai* of the Groundwater Protection Zone (GPZ). The boundaries defining these two

[1] This report was prepared for R. M. Towill for inclusion in the EIS titled "Waimanalo Gulch Sanitary Landill Lateral Expansion EIS."

zones closely approximate each other and the zones occupy most of the interior of the Island of O'ahu. This requirement for placement of a waste landfill restricts such development to a rather narrow coastal belt around the Island. This coastal belt is mostly populated or otherwise developed and disturbed; with few exceptions, most disturbed by human activities, including those of the ancient Hawaiian population. Further, from an initial larger set of potential sites, some that were in more pristine areas (such as 'Ohikilolo Valley) were eliminated from consideration for both environmental and accessibility reasons. Thus the selection process has already moved significantly in a direction driven in part by factors that minimize adverse impacts on special botanical resources.

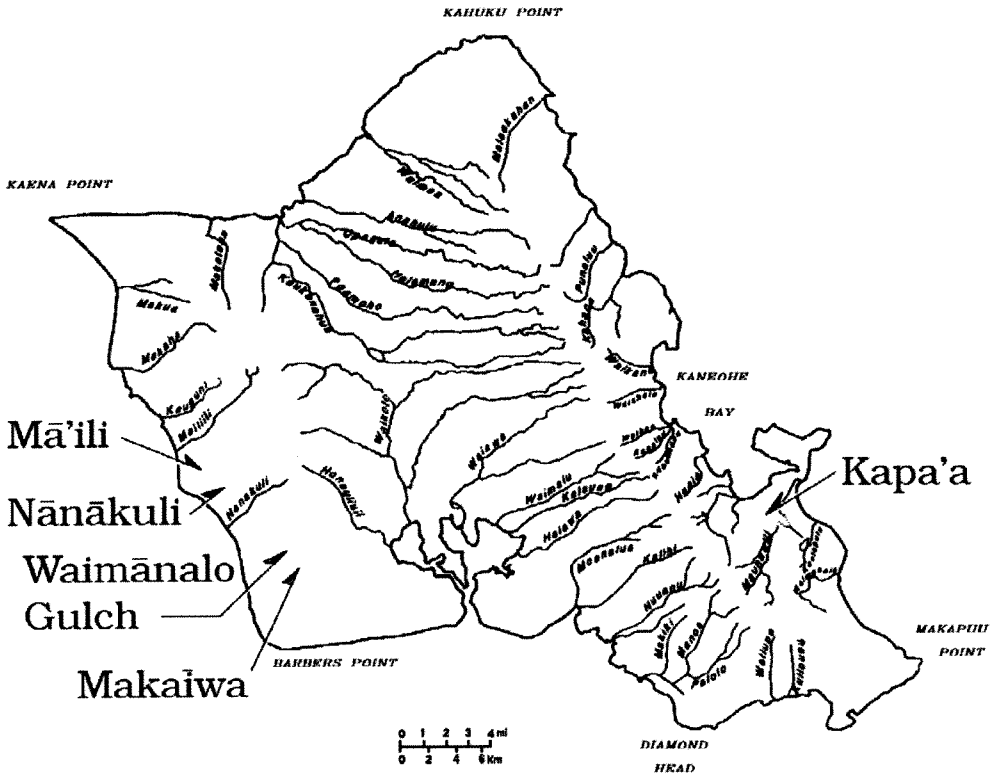

Figure 1. Map of O'ahu showing location of the five sites considered for solid waste landfills on the island.

METHODS

For various reasons, it was not possible to conduct surveys of the botanical resources found on each of the proposed landfill sites. Permission was granted, and a site survey conducted, in the Waimanalo Gulch Expansion Area, representing the alternative of expanding the present-day solid waste landfill site further back up into Waimanalo Gulch. For the other locations, botanical resources were assessed by means of consulting past reports, reviewing the Hawaii Natural Heritage Program (HNHP) data base, and visiting the area to establish the nature of the extant vegetation and the likelihood that valuable botanical resources would be present. Results of these approaches to establishing actual more likely botanical resources present are presented under the individual site descriptions that follow.

The botanical survey for the Waimanalo Gulch expansion area followed a standard protocol utilized for discovery-type surveys called a wandering pedestrian transect. In more basic terms, this amounts to a botanist hiking around the property in a manner that allows a visual survey of all of the various types of habitats present on the property. During the transect, each plant species is noted as it is encountered, material is collected where a field identification proves difficult, photographs are taken, and a sense of the relative abundance of each species on the property is developed.

As the survey progressed, 15 waypoints (intermittent position locations) were entered into a hand-held GPS unit (Garmin *eTrex* "Vista"®). These 15 positions were later downloaded into a computer mapping program (TOPO!®) and a map produced showing the general route of the survey.

The survey of the Waimanalo Gulch was conducted during the wet season (January 2007). Consequently, most of the plants encountered (including annuals) were growing well and were in flower, making positive field identifications relatively straight forward. Nonetheless, a one time survey cannot expect to list every plant species growing on a subject property. Some species are seasonal or opportunistic, while others might be present, but in such low numbers that they are simply not encountered. Every square foot of the land cannot reasonably be covered, and some areas—in this case dangerously steep portions of the gulch margins and high cliff faces—will not be accessed. The botanist attempts to reach all physiographic types characteristic of the property and reach plants appearing from a distance to be "unique". Steep but traversable portions of the gulch margins and smaller cliff faces serve as representative of the inaccessible habitats on the property.

SITE DESCRIPTIONS

This section of the report provides known information on the botanical resources of the five sites considered as potential landfill sites. The discussion of sites is arranged from west to east as shown in Fig.1.

MĀ'ILI

The Mā'ili Site (TMK: 8-7-10:003) is located in the Wai'anae District on leeward O'ahu. The approximately 200 ac (80+ ha) site presently supports an active limestone quarrying operation (Fig. 2). Although most of the site is clearly disturbed as quarry pits, material sorting and storage areas, access roads, or other ancillary operations as needed to support the quarry, some portions of the property do appear to retain a remnant *kiawe* forest. At least three separate quarry sites are present. The active quarry is the large central pit in Fig. 3. This pit has been expanded to the northwest through the buffel grass field seen in the satellite image since the image was obtained. Another pit, largely overgrown, appears in the satellite photo to the southeast. The original quarry pit is directly south, seen as an area of white soil with kiawe trees. Slurry lagoons lie along one side of this quarry pit.

The vegetation is largely ruderal in nature: consisting of plants adapted to disturbed ground. The assemblage would be mostly non-native in composition, although indigenous *'uhaloa* (*Waltheria indica*) and *'ilima* (*Sida fallax*) may be present as both respond well to land clearing. Less recently disturbed or undisturbed areas support either buffel grass (*Cenchrus ciliaris*) grassland or a *kiawe* forest with a buffel grass groundcover.

The adjacent Naval Radio Transmitting Facility (NRTF) was previously surveyed by Funk (Botanical Associates, 1984; Traverse Group, 1987) and more recently, Guinther and David (2003) surveyed the highly disturbed (by regular mowing) environment of the central part of NRTF across Pa'akea Road from Mā'ili Quarry. In general, there are a number of rare and/or listed species of plants found at much higher elevations of the Naval Reservation which extends to Kolekole Pass on the Wai'anae ridgeline, but few species of interest or concern have been found on the lowlands. Exceptions are a semi-aquatic fern called *'ili'ihi* (*Marsilea villosa*) and scattered occurrences of an endemic hibiscus, *ko`oloa ula* (*Abutilon menziesii*). The fern is discussed further on page 31; the hibiscus was noted in Guinther & David (2002) and later confirmed by Navy biologists (Julie Rivers, pers. comm.) This hibiscus, a listed species, is not expected to be present on the Mā'ili Site, although its presence cannot be ruled out

entirely, as the only reason it would not be present is the long-standing disturbance of most of the property.

No surveys of botanical resources at the Mā'ili Limestone Quarry are known to this author. The plant assemblages present is certainly dominated by non-natives. Native plants of interest or concern (for example, listed species) would be rare if present at all.

Figure 2. Pacific Aggregate (Mā'ili) Limestone Quarry. Quarry operations are mining an ancient limestone (reef) deposit, slowly removing the *kiawe* forest (background) on the northwest end of the property.

NĀNĀKULI

The Nānākuli (or "Nānākuli B" Site in some records of the site selection process; TMK: 8-7-9:001 & 8-7-21:026) is located in the Wai'anae District on leeward O'ahu. The site is presently undeveloped, but is adjacent to (and the land owned by) a private entity (PVT Land Co.) operating a landfill that accepts mostly construction debris. The PVT Landfill is located on the west side of Lualualei Naval Road across from the proposed Nānākuli Site,

which extends along the east side of that road to the vicinity of an old cement plant (Fig. 4 and 6).

Figure 3. Mā'ili Site (outlined in orange) is mostly a disturbed area supporting a limestone quarry operation. A *kiawe* forest is present in the southwest and northwest portions of the parcel. All of the upper corner in this satellite image is NRTF Lualualei where the grounds are regularly mowed to reduce fire hazard.

Figure 4. Much of the Nānākuli Site is low sloping grassland, here looking across the site towards the old cement plant and Lualualei Valley. The PVT Landfill is the hill across the Lualualei Naval Road (left of center).

The Nānākuli Site consists of gradually rising ground that becomes steeper to the east, eventually reaching a peak at 1890 ft (576 m) known as Pu'u Heleakalā. The lower, moderately sloped areas are colluvium: eroded material of basaltic origin moved by gravity and water flow downslope from the ridge. Above the colluvial slope (generally above 400 to 500 ft (120-150 m) the layers of basalt representing ancient lava flows form a characteristic cliff and ledge formation (Fig. 5).

The proposed landfill site was surveyed for botanical resources by *AECOS* Inc. in 1991 (Guinther & Miranda, 1992). Nearby lower slopes of Pu'u Heleakalā have also been surveyed for a proposed golf course just north of the Nānākuli site (Char, 1990a).

The vegetation of the site is mostly grassland. The dry conditions and occasional fires tend to favor exotic grasses over native grasses, shrubs, and trees. Scrutiny of the satellite image (Fig. 3) reveals a complex of fire roads cut into the steeper slopes to control the spread of fires that can

occur with unfortunate regularity on leeward O'ahu between about May and September of most years. Buffel grass dominates, and becomes self-preserving by increasing the intensity of fires that occur, itself capable of regrowing from basal stems when rains return (Hughes, Vitousek, and Tunison, 1991; Tix, undated, Latz, 1991). Native Hawaiian plants are not adapted to fire, and are gradually eliminated from areas subjected to repeated fires (Mueller-Dombois, 1981).

Figure 5. Alluvial pasture land (foreground), colluvial slope (middle ground with boulders and *kiawe* trees) and cliff and ledge habitats on Pu'u Heleakalā at and above the Nānākuli Site.

Table 1 is modified from Guinther & Miranda (1992) to reflect plants observed in a survey of the lands east of Lualualei Naval Road comprising the proposed Nānākuli Site (the complete survey report covered lands on both sides of the road as well as along Ulehawa Stream). The species list (flora) is fairly typical for this part of the Wai`anae coast. The only species of interest is *'ihiahialo'e* or coast sandalwood (*Santalum ellipticum*), an endemic species that does persist in areas invaded by exotics (Wagner, Herbst, and Sohmers, 1990) and Hawaiian cotton or *ma'o* (*Gossypium*

Figure 6. The Nānākuli Site (outlined in orange) lies on the east side of Lualualei Naval Road against a ridge of Pu'u Heleakalā (far right).

Table 1. Listing of plants (flora) for the Nānākuli Site, west O'ahu, Hawai'i from a survey conducted October and December, 1991 (Guinther & Miranda, 1992)

Species listed by family	Common name	Status	Abundance LOW	Abundance UPL	Notes
	FERNS				
POLYPODIACEAE					
indet.	---	Nat.		R	(2)
PTERIDACEAE					
Pteris sp.	?cliff brake	Nat.		R	
	FLOWERING PLANTS				
	DICOTYLEDONES				
AMARANTHACEAE					
Amaranthus spinosus L.	spiny amaranth	Nat.		R	
ASTERACEAE (COMPOSITAE)					
Bidens sp.	---	Nat.		U	
Emilia fosbergii Nicolson	*pualele*	Nat.		O	
Pluchia carolinensis (Jacq.) G. Don	sourbush	Nat.		U	
Sonchus oleraceus L.	sow thistle	Nat.		U	
Synedrella nodiflora (L.) Gaertn.	nodeweed	Nat.		R	
Verbesina enceliodes (Cav.) Benth. & Hook.	golden crown-beard	Nat.		U	
CACTACEAE					
Opuntia ficus-indica (L.) Mill.	*pānini*	Nat.		U	
CONVOLVULACEAE					
Ipomoea cairica (L.) Sweet	*koali 'ai*	**Ind.**		C	
Merremia aegyptia (L.) Urb.	hairy merremia	Nat.		C	
EUPHORBIACEAE					
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	Nat.		U	
FABACEAE					
Acacia farnesiana (L.) Willd.	*klu*	Nat.	U	O	
Desmanthus virgatus (L.) Willd.	virgate mimosa	Nat.	C		
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat.	A	A	
Indigofera suffruticosa Mill.	indigo	Nat.	R	U	
Macroptilium lathyroides (L.) Urb.	cow pea	Nat.		O	
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	Nat.		O	
LAMIACEAE					
Hyptis pectinata (L.) Poit.	comb hyptis	Nat.		U	
MALVACEAE					
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	Nat.		R	
Abutilon incanum (Link) Sweet	*ma'o*	**Ind.**		O	(1)
Gossypium tomentosum Nutt. ex Seem.	*ma'o*	**End.**	U		
Malvastrum coromandelianum (L.) Garck	false mallow	Nat.		O	(1)

Table 1 (continued).

Species listed by family	Common name	Status	Abundance LOW	Abundance UPL	Notes
MALVACEAE (continued)					
Sida fallax Walp.	*`ilima*	**Ind.**	C	C	(1)
PASSIFLORACEAE					
Passiflora foetida L.	love-in-a-mist	Nat.		R	
PORTULACACEAE					
Portulaca oleracea L.	pigweed	Nat.		O	
Portulaca pilosa L.				O	
SANTALACEAE					
Santalum ellipticum Gaud.	*'iliahialo'e*	**End.**		R	
STERCULIACEAE					
Waltheria indica L.	*`uhaloa*	Nat..	A	A	(1)
VERBINACEAE					
Stachytarpheta jamaicensis (L.) Vahl.	Jamaican vervain	Nat.		U	
MONOCOTYLEDONES					
COMMELINACEAE					
Commelina benghalensis L.	hairy *honohono*	Nat.		O	
POACEAE					
Cenchrus ciliaris L.	buffelgrass	Nat.	AA	A	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat.	P	R	
Melinus repens (Willd.) Zizka	Natal redtop	Nat.	R		
Panicum maximum Jacq.	Guinea grass	Nat.		C	

STATUS = distributional status for the Hawaiian Islands:
- **end.** = endemic; native to Hawaii and found naturally nowhere else.
- **Ind.** = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.
- nat. = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

ABUNDANCE AREAS:
- LOW – Grassland, to moderate slopes on colluvium.
- UPL – Rocky tallus and cliffed areas

ABUNDANCE CODES:
Abundance codes used in 1991 have been modified here to fit more recent practice as reflected in Table 2, below.

NOTES:
- (1) – locally abundant in disturbed areas (road and fire trail cuts).
- (2) – only dried fronds presnt.

tomentosum). Neither one is a listed species, but both are increasingly uncommon on O'ahu due to steady development of dry, lowland environments for housing. In 1991, *ma'o* was far more abundant in this area on the west side of Lualualei Naval Road; being rather rare in the proposed landfill site. Char (1990a) reported a very similar flora for the adjacent property to the north, although with only one endemic plant present, the *wiliwili* (*Erythrina sandwicensis*) tree.

Although no part of the property is included in a designated critical habitat for an endangered species, the eastern property boundary lies west some 200 and 300 ft (60 to 90 m) of the O'ahu critical habitat Unit 15 boundary (USFWS, 2003). Unit 15 in this area incorporates the steepest parts of Pu'u Heleakalā; on the western slope incorporating elevations above 400 to 600 ft (120 to 180 m). This part of Unit 15 includes critical habitat for an endangered species of *'akoko* (*Chamaesyce kuwaleana*; see page 33).

WAIMĀNALO GULCH EXPANSION AREA

Waimānalo Gulch (TMK: 9-2-3:072 & 073) is located along the southern slopes of the Wai'anae Mountain. It is the last gulch above the 'Ewa Plain, traveling westward, before the Wai'anae coast, lying between Kahe Gulch on the west and an unnamed gulch (part of Makaīwa watershed) on the east. The Expansion Area comprises about 60.5 acres (24 ha) of the property above the existing municipal landfill (Fig. 7).

The v-shaped gulch is narrow and incised on the order of 200 ft (60 m) into the Wai'anae mountain. The gulch margins vary from steep to very steep (Fig. 8) and show the same alternating cliff and ledge structure so apparent on the dry, leeward parts of the island. Along the bottom of the gulch is an intermittent stream.

The Waimānalo Gulch Expansion Area was surveyed for this report. The general route taken by the biological team is indicated in Fig. 9 from the recorded waypoints as described under Methods, above, in this case transferred onto a satellite image after plotting on a topographic map. The actual route taken by the team was more convoluted than is shown on the map. The results of the floristic survey are summarized in Table 2: a listing of species observed and their relative abundances as recorded by the survey team.

The vegetation of the expansion area is fairly homogeneous, consisting of grassed slopes with scattered *kiawe* trees. In places, especially along the

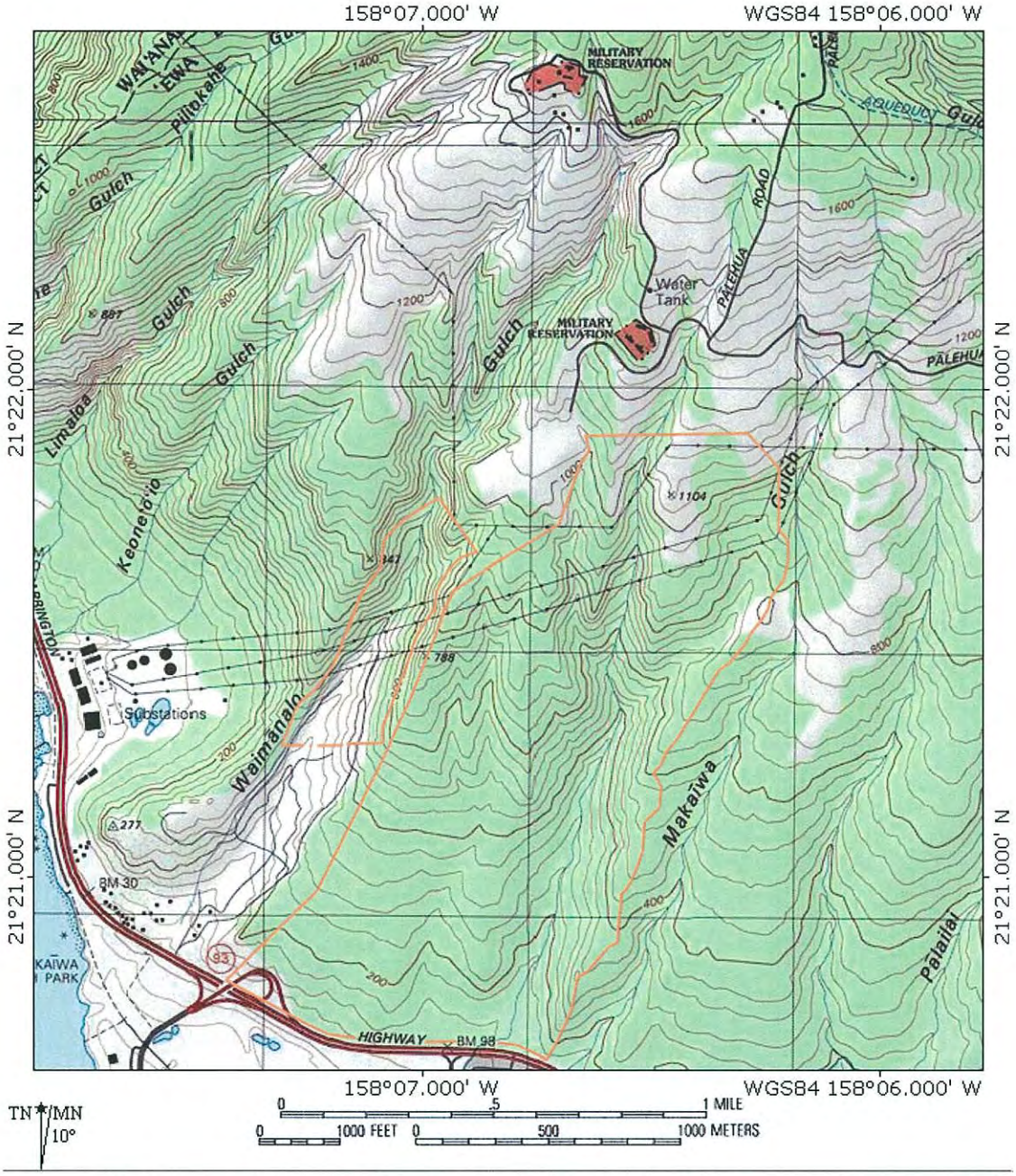

Figure 7. Topographic map showing the Waimānalo Gulch expansion area and Makaīwa Gulch parcel.

bottom and eastern slope of the gulch, the trees form an open forest grading to savannah. The grass is predominantly Guinea grass (*Panicum maximum*),although near the ridgelines, buffel grass (*Cenchrus ciliaris*) becomes the dominant species, and in one area along the top of the western

ridge, native pili grass (*Heteropogon contortus*) is abundant in large patches. *Kiawe*, *klu* (*Acacia farnesiana*), and *koa-haole* dominate the scrub-shrub and tree components of the vegetation, which are relatively sparse on the upper slopes particularly, and made more so by recent fires that have burned across portions of the property and destroyed many of the *kiawe* trees. Crude roads have been bulldozed into the gulch, and these are marked by a diverse assemblage of weedy plants (see Note 1 in Table 2).

Figure 8. Steep, rocky terrain typifies most of the Waimānalo Gulch Expansion Area. In the background (down slope) can be seen the upper end of grading operations at the existing municipal landfill

A total of 50 species were recorded from the proposed Expansion Area. Of these, only 6 species (12%) are indigenous species (plants native to Hawai`i, but found elsewhere as natives as well). Lowland sites on O'ahu typically have between 6 and 12% of the species present as natives. Thus, the percentage of natives in lower Waimānalo Gulch is better than might be expected, although not special. All of the species are widely encountered on leeward O'ahu; none is considered rare or threatened. The only unusual botanical resource encountered was several large patches of *pili* grass across a broad shoulder of the ridge between Waimānalo Gulch and Kahe

Gulch at the 600 ft (180 m) elevation. *Pili* grass may be locally abundant because there is no longer any grazing of cattle in this particular area.

Table 2. Listing of plants (flora) for the Waimanalo Gulch expansion area, west O'ahu, Hawai'i

Species listed by family	Common name	Status	Abundance	Notes
FLOWERING PLANTS				
DICOTYLEDONES				
AMARANTHACEAE				
Amaranthus spinosus L.	Spiny amaranth	Nat.	U	(1)
Amaranthus virdis L.	slender amaranth	Nat.	R	
ASCLEPIADACEAE				
Stapelia gigantea N.E. Brown	giant toad plant	Nat.	U	
ASTERACEAE (COMPOSITAE)				
Agerarum conyzoides L.	*maile honohono*	Nat.	U2	(1)
Bidens cynapiifolia Kunth	---	Nat.	R	
Emilia fosbergii Nicolson	*pualele*	Nat.	O2	(1)
Pluchia carolinensis (Jacq.) G. Don	sourbush	Nat.	U	
Sonchus oleraceus L.	sow thistle	Nat.	O2	
Tridax procumbens L.	coat buttons	Nat.	U3	(1)
Verbesina enceliodes (Cav.) Benth. & Hook.	golden crown-beard	Nat.	R	
CACTACEAE				
Opuntia ficus-indica (L.) Mill.	*pänini*	Nat.	R	
CHENOPODIACEAE				
Atriplex cf. *suberects* Verd.	saltbush	Nat.	R	
CONVOLVULACEAE				
Ipomoea obscura (L.) Ker-Gawl.	---	Nat.	U	
Merremia aegyptia (L.) Urb.	hairy merremia	Nat.	C	
CUCURBITACEAE				
Momordica charantia L.	balsam pear	Nat.	U	
EUPHORBIACEAE				
Chamaesyce hirta (L.) Millsp.	garden spurge	Nat.	O2	
Ricinus communis L.	castor bean	Nat.	U	
FABACEAE				
Acacia farnesiana (L.) Willd.	*klu*	Nat.	C	
Crotalaria incana L.	fuzzy rattlepod	Nat.	U	
Crotalaria pallida Aiton	smooth rattlepod	Nat.	O3	(1)
Desmanthus virgatus (L.) Willd.	virgate mimosa	Nat.	C	
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat.	C	
Indigofera suffruticosa Mill.	indigo	Nat.	U	
Macroptilium atropurpureum (DC) urb.	---	Nat.	C	(1)

Table 2 (continued).

Species listed by family	Common name	Status	Abundance	Notes
FABACEAE (continued)				
Macroptilium lathyroides (L.) Urb.	cow pea	Nat.	U	
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	Nat.	O	(2)
LAMIACEAE				
Hyptis pectinata (L.) Poit.	comb hyptis	Nat.	R	(1)
Leonotis nepetifolia (L.) R. Br.	lion's ear	Nat.	A	(1)
MALVACEAE				
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	Nat.	O	
Abutilon incanum (Link) Sweet	*ma'o*	**Ind.**	C	
Malvastrum coromandelianum (L.) Garck	false mallow	Nat.	U	(1)
Sida fallax Walp.	*`ilima*	**Ind.**	O	
NYCTAGINACEAE				
Boerhavia acutifolia (Choisy) J.W. Moore	*alena*	**Ind.**	U	
PLUMBAGINACEAE				
Plumbago zeylanica Lam.	*'ilie'e*	**Ind.**	U	
PAPAVERACEAE				
Argemone sp.	prickly poppy	???	R	(3)
PASSIFLORACEAE				
Passiflora foetida L.	love-in-a-mist	Nat.	R	
PORTULACACEAE				
Portulaca oleracea L.	Pigweed	Nat.	U	
SOLANACEAE				
Nicandra physalodes (L.) Gaertn.	apple of Peru	Nat.	R	
Nicotiana glauca R.C. Graham	tree tobacco	Nat.	C	(1)
Solanum americanum Mill.	*pöpolo*	**Ind.**	R	
Solanum lycopersicum var. *cerasiforme* (Dunal) Spooner, G. Anderson,& Jansen	wild cherry tomato	Nat.	R	
STERCULIACEAE				
Waltheria indica L.	*`uhaloa*	Nat..	C	
VERBINACEAE				
Stachytarpheta jamaicensis (L.) Vahl.	Jamaican vervain	Nat.	R	
MONOCOTYLEDONES				
COMMELINACEAE				
Commelina benghalensis L.	hairy *honohono*	Nat.	R	
POACEAE				
Cenchrus ciliaris L.	buffelgrass	Nat.	AA	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat.	U2	

Table 2 (continued).

Species listed by family	Common name	Status	Abundance	Notes
POACEAE (continued)				
Heteropogon contortus (L.) P. Beauv, ex Roem. & Schult.	*pili* grass	**Ind.**	U3	
Melinus repens (Willd.) Zizka	Natal redtop	Nat.	O2	
Panicum maximum Jacq.	Guinea grass	Nat.	AA	
Paspalum sp.			R1	(1)

STATUS = distributional status for the Hawaiian Islands:
end. = endemic; native to Hawaii and found naturally nowhere else.
Ind. = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.
nat. = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

ABUNDANCE AREAS:
Expansion Area is treated as one plant assemblage or association.

ABUNDANCE CODES:
R – Rare; seen in only one or perhaps two locations.
U – Uncommon; seen at most in several locations
O – Occasional; seen with some regularity
C – Common; observed numerous times during the survey
A – Abundant; found in large numbers; may be locally dominant.
AA - Very abundant; abundant and dominant; defining vegetation type.

Numbers following an occurrence rating indicate clusters within the survey area. The ratings above provide an estimate of the likelihood of encountering a species within the specified survey area; numbers modify this where abundance, as encountered, tends to be greater than the occurrence rating:
1 – several plants present
2 - many plants present
3 – locally abundant

NOTES:
(1) – Especially abundant in disturbed areas as along rough graded road into valley.
(2) – Previously more common, but many burned trunks now present.
(3) – Plant lacking flowers or fruit.

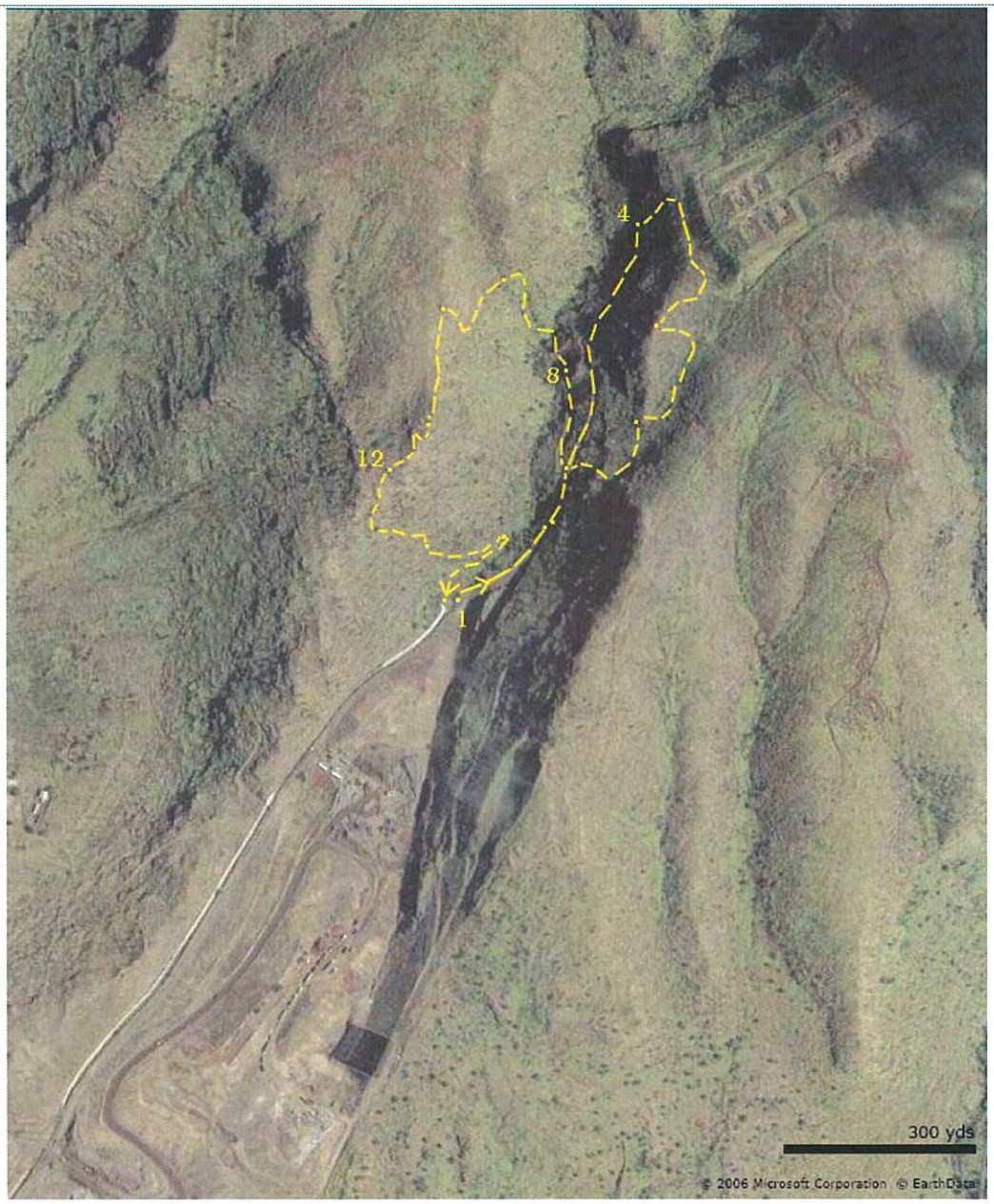

Figure 9. Satellite image of the Waimanalo Gulch landfill and proposed expansion area further upslope, showing general route taken during the botanical survey. Selected waypoints are numbered.

MAKAĪWA GULCH

Makaīwa Gulch (TMK: 9-2-3) is located along the southern slopes of the Wai'anae Mountain directly east of Waimanalo Gulch. The proposed site actually is a parcel encompassing two unnamed gulches between Makaīwa Gulch on the west and Waimanalo Gulch on the east (Fig. 7), within which a 338 ac (137 ha) area (essentially the eastern of the two unnamed gulches) was selected as an optional location for a municipal landfill. This gulch has generally less severe side slopes than nearby Waimānalo Gulch (Fig. 10).

Figure 10. The unnamed gulch (proposed landfill site) immediately west of Makaīwa Gulch photographed in the early morning.

Because this land is part of the land-owners long-range plans for expansion of the Makakilo residential area (to be called Makaīwa Hills), various surveys have been undertaken on the property, including botanical surveys in 1990 (Char, 1990b) and 2005 (David and Guinther, 2006b). A flora listing from the latter survey (and including plants observed only in 1990) is provided herein as Table 3.

Table 3. Listing of plants (flora) for the Makaīwa Gulch Site on west O'ahu, Hawai'i (after David & Guinther, 2006 and Char, 1990b).

Species listed by family	Common name	Status	Abundance	Notes
FERNS				
PTERIDACEAE				
Doryopteris decipiens (Hook.) J. Sm.	*kumuniu*	**End.**	--	(1)
FLOWERING PLANTS				
DICOTYLEDONES				
ACANTHACEAE				
Asystasia gangetica (L.) T. Anderson	Chinese violet	Nat.	U	
AIZOACEAE				
Trianthema portulacastrum L.	---	Nat.	O	
AMARANTHACEAE				
Achyranthes aspera L.	---	Nat.	--	(1)
Amaranthus spinosus L.	spiny amaranth	Nat.	--	(1)
Amaranthus viridis L.	slender amaranth	Nat.	U	
ANACARDIACEAE				
Schinus terebinthefolius Raddi	Christmasberry	Nat.	R	
ARALIACEAE				
Schefflera actinophylla (Endl.) Harms.	octopus tree	Nat.	--	(1)
ASCLEPIADACEAE				
Crypyostegia grandiflora (Roxb.) R.Br.	Indian rubber vine	Nat.	--	(1)
Stapelia gigantea N.E. Brown	carrion flower	Nat.	O	
ASTERACEAE (COMPOSITAE)				
Acanthospermum australe (Loefl.) Ktze.	spiny-bur	Nat.	--	(1)
Ageratum conyzoides L.	*maile hohono*	Nat.	R	
Ambrosia artemisiifolia L.	common ragweed	Nat.	--	(1)
Bidens cynapiifolia Kunth	---	Nat.	O	
Bidens pilosa L.	---	Nat.	--	(1)
Calyptocarpus vialis Less.	---	Nat.	O	
Conyza bonariensis (L.) Cronq.	horseweed	Nat.	R	
Eclipta prostrata (L.) L.	---	Nat.	R	
Emilia fosbergii Nicolson	*pualele*	Nat.	U	
Lactuca serriola L.	prickly lettuce	Nat.	--	(1)
Lipochaeta lobata (Gaud.) DC	*nehe*	**End.**	--	(1)
Pluchia carolinensis (Jacq.) G. Don	sourbush	Nat.	U	
Pluchea indica (L.) Less.	Indian fleabane	Nat.	--	(1)
Sonchus oleraceus L.	sow thistle	Nat.	R	
Tridax procumbens L.	coat buttons	Nat.	U	
Verbesina enceliodes (Cav.) Benth. & Hook.	golden crown-beard	Nat.	U	

Table 3 (continued).

Species listed by family	Common name	Status	Abundance	Notes
ASTERACEAE (continued)				
Vernonia cinerea var. *parviflora* (Reinw.) DC	little ironweed	Nat.	--	(1)
Xanthium strumarium L.	*kikiana,* cockleburr	Nat.	R	
BRASSICACEAE				
Lepidium virginicum L.	peppergrass	Nat.	--	(1)
CACTACEAE				
Opuntia ficus-indica (L.) Mill.	*panini*	Nat.	R	
CAPPARACEAE				
Cleome gynandra L.	wild spider flower	Nat.	R	
CHENOPODIACEAE				
Atriplex semibaccata R. Br.	Australian saltbush	Nat.	--	(1)
Atriplex suberecta Verd.	---	Nat.	O	
Chenopodium carinatum R. Br.	---	Nat.	U	
Chenopodium murale L.	*`aheahea*	Nat.	--	(1)
CLUSIACEAE				
Clusia rosea Jacq.	copey	Nat.	--	(1)
CONVOLVULACEAE				
Ipomoea cairica (L.) Sweet	*koali `ai*	**Ind.**	U	
Ipomoea obscura (L.) Ker-Gawl.	---	Nat.	O	
Merremia aegyptia (L.) Urb.	hairy merremia	Nat.	O	
CUCURBITACEAE				
Coccinia grandis (L.) Voigt.	scarlet-fruited gourd	Nat.	R	
Cucumis dipsaceus Ehrenb. ex Spach	teasel gourd	Nat.	--	(1)
Momordica charantia L.	balsam pear	Nat.	U	
EUPHORBIACEAE				
Chamaesyce hirta (L.) Millsp.	garden spurge	Nat.	U	
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	Nat.	--	(1)
Euphorbia heterophylla L.	*kaliko*	Nat.	U	
Phyllanthus debilis Klein ex Willd.	niruri	Nat.	--	(1)
Ricinus communis L.	castor bean	Nat.	U	
FABACEAE				
Acacia confusa Merr.	Formosan koa	Nat.	--	(1)
Acacia farnesiana (L.) Willd.	*klu*	Nat.	A	
Chamaecrista nictitans (L.) Moench.	*lauki*	Nat.	U	
Crotalaria incana L.	fuzzy rattlepod	Nat.	--	(1)
Crotalaria pallida Aiton	smooth rattlepod	Nat.	O	
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	Nat.	U	
Desmodium tortuosum (Sw.) DC	Florida beggarweed	Nat.	--	(1)

Table 3 (continued).

Species listed by family	Common name	Status	Abundance	Notes
FABACEAE (continued)				
Indigofera suffruticosa Mill.	indigo	Nat.	--	(1)
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat.	C	
Macroptilium atropurpureum (DC) Urb.	---	Nat.	R	
Macroptilium lathyroides (L.) Urb.	cow pea	Nat.	U	
Mimosa pudica L.	sensitive plant	Nat.	--	(1)
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	Nat.	A	
Senna surattensis (N.L. Burm.) H. Irwin & Barneby	*kolomana*	Nat.	R	
GENTIANACEAE				
Centaurium erythraea Raf.	bitter herb	Nat.	--	(1)
LAMIACEAE				
Hyptis pectinata (L.) Poit.	comb hyptis	Nat.	O	
Hyptis suaveolens (L.) Poit.	---	Nat.	--	(1)
Leonotis nepetifolia (L.) R. Br.	lion's ear	Nat.	U	
Ocimum basilicum L.	wild basal	Nat.	O	
MALVACEAE				
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	Nat.	R	
Abutilon incanum (Link) Sweet	hoary abutilon	**Ind.**	O	
Malva parviflora L.	cheese weed	Nat.	R	
Malvastrum coromandelianum (L.) Garck	false mallow	Nat.	U	
Sida ciliaris L.	---	Nat.	O	
Sida fallax Walp.	*`ilima*	**Ind.**	AA	
Sida rhombifolia L.	Cuba jute	Nat.	U	
Sida spinosa L.	prickly sida	Nat.	R	
MORACEAE				
Ficus microcarpa L. f.	Chinese banyan	Nat.	--	(1)
MYRTACEAE				
Eucalyptus sp.	gum tree	Nat.	--	(1)
Syzygium cumini (L.) Skeels	Java plum	Nat.	R	
NYCTAGINACEAE				
Boerhavia acutifolia (Choisy) J.W. Moore	*alena*	**Ind.**	O	
PAPAVERACEAE				
Argemone glauca (Nutt. ex Prain) Pope	*pua kala*	**End.**	--	(1)
PASSIFLORACEAE				
Passiflora foetida L.	running pop	Nat.	U	
Passiflora suberosa L.	*huehue-haole*	Nat.	--	(1)
PLUMBAGINACEAE				
Plumbago zeylanica L.	*'ilie'e*	**Ind.**	R	

Table 3 (continued).

Species listed by family	Common name	Status	Abundance	Notes
PORTULACACEAE				
Portulaca oleracea L.	pigweed	Nat.	U	
PROTEACEAE				
Grevillea robusta A. Cunn. ex R.Br.	silk oak	Nat.	R	
RUBIACEAE				
Hedyotis corymbosa (L.) Lam.	---	Nat.	R2	
Spermacoce assurgens Ruiz & Pav..	buttonweed	Nat.	R	
SAPINDACEAE				
Dodonaea viscosa Jacq.	*a'ali'i*	**Ind.**	--	(1)
SOLANACEAE				
Solanum lycopersicum var. *cerasiforme* (Dunal) Spooner, G. Anderson,& Jansen	wild cherry tomato	Nat.	--	(1)
Nicandra physalodes (L.) Gaertn.	apple of Peru	Nat.	--	(1)
Solanum americanum Mill.	*popolo*	**Ind.**	--	(1)
Solanum linnaeanum Hepper & P. Jaeger	apple-of-Sodom	Nat.	--	(1)
STERCULIACEAE				
Waltheria indica L.	*'uhaloa*	Nat..	C	
VERBENACEAE				
Lantana camara L.	lantana	Nat.	R	
Stachytarpheta australis Moldenke		Nat.	O	
Stachytarpheta cayennensis (Rich.) Vahl.	nettle-leaved vervain	Nat.	--	(1)
Stachytarpheta jamaicensis (L.) Vahl.	smooth vervain	Nat.	R	
Verbena littoralis Kunth	*oi*	Nat.	--	(1)
MONOCOTYLEDONES				
AGAVACEAE				
Agave sisalana Perrine	sisal	Nat.	R	
CYPERACEAE				
Cyperus rotundus L.	nutgrass	Nat.	--	(1)
COMMELINACEAE				
Commelina benghalensis L.	hairy honohono	Nat.	U	
POACEAE				
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	Nat.	A	
Brachiaria mutica (Forssk.) Stapf	California grass	Nat.	--	(1)
Cenchrus ciliaris L.	buffelgrass	Nat.	AA	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat.	C	
Chloris radiata (L.) Sw.	radiate fingergrass	Nat.	--	(1)
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat.	--	(1)
Digitaria ciliaris (Retz.) Koeler	crabgrass	Nat.	--	(1)

Table 3 (continued).

Species listed by family	Common name	Status	Abundance	Notes
POACEAE (continued)				
Digitaria insularis (L.) Mez. ex Ekman	sourgrass	Nat.	--	(1)
Digitaria setigera Roth	*kukaipua'a*	**Ind.**	--	(1)
Echinochloa colona (L.) Link	jungle-rice	Nat.	R	
Eleusine indica (L.) Gaertn.	beach wiregrass	Nat.		
Eragrostis cf. *tenella* (L.) R & S	lovegrass	Nat.	O	
Eragrostis sp.			U	
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	*pili*, pili grass	**Ind.**	--	(1)
Melinus repens (Willd.) Zizka	Natal redtop	Nat.	O	
Panicum maximum Jacq.	Guinea grass	Nat.	AA	
Panicum maximum var. *trichoglume* Eyles ex Robyns	Guinea grass	Nat.	--	(1)
Paspalum sp.		Nat.	R	
Setaria verticillata (L.) P. Beauv.	bristly foxtail	Nat.	--	(1)
Sporobolus sp.	---	Nat.	U	

STATUS = distributional status for the Hawaiian Islands:
- **end.** = endemic; native to Hawaii and found naturally nowhere else.
- **Ind.** = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.
- nat. = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

ABUNDANCE AREAS:
Expansion Area is treated as one plant assemblage.

ABUNDANCE CODES:
- R – Rare; seen in only one or perhaps two locations.
- U – Uncommon; seen at most in several locations
- O – Occasional; seen with some regularity
- C – Common; observed numerous times during the survey
- A – Abundant; found in large numbers; may be locally dominant.
- AA - Very abundant; abundant and dominant; defining vegetation type.

NOTES:
- (1) – Especially abundant in disturbed areas as along unpaved road into valley.
- (2) – Prev iously more common, but many burned trunks now present.
- (3) – Plant lacking flowers or fruit.

Char (1990b) divided the vegetation on the hillside (her survey covered a wider area) into two vegetation types: (1) Grassland/Shrubland and (2) Kiawe Forest. These vegetation types were somewhat reinterpreted by David & Guinther (2006). The higher elevation slopes of the parcel are dominated by a Grassland/Shrubland of mostly Guinea grass, but several other

prominent grass species are present as well: buffelgrass, pitted beardgrasss (*Bothriochloa pertusa*), and *Chloris* spp. (not in flower at the time of the survey). Common shrubs and large herbs include *klu* (*Acacia farnesiana*), *'ilima* (*Sida fallax*), wild basal (*Ocimum basilicum*), and *'uhaloa* (*Waltheria indica*). Near the upper boundary at Pālehua Road, several tree species (e.g., Christmasberry or *Schinus terebinthifolius*) are present that increase in abundance upslope, but are not present much below the road. *Kiawe* abundance, on the other hand, increases downslope, the trees forming copses scattered around the hills and open to closed forest stands along gulch bottoms. Further downslope is an open *kiawe* forest dominated by an understory of buffelgrass, characteristic of the natural vegetation of lower slopes on leeward O'ahu.

No ferns or fern allies were observed during the 2005 plant survey, although Char (1990) earlier reported *kumuniu* (*Doryopteris decipiens*), a native species. The vegetation is comprised of flowering plants which are overwhelmingly dominated by alien plant species, especially grasses. Of the total of 72 species of plants identified as present in 2006 by David & Guinther (2006), only five (6.9%) are known from the Hawaiian Islands before the arrival of James Cook in 1778. None of these five species is considered an endemic (that is, a species unique to the Hawaiian Islands). All five are indigenous species, and therefore not likely to be of concern for future listing as threatened or endangered under either Federal or State of Hawai'i endangered species statutes. One species, hoary abutilon (*Abutilon incanum*), common in the mid-to-lower elevations on the property, is considered to be somewhat rare on O'ahu. If we consider the abundance estimates for these six native species, all but three (*'Ilima* or *Sida fallax*, hoary abutilon or *Abutilon incanum*, and *'alena* or *Boerhavia acutifolia*) are rare or uncommon in the survey area. Thus, in terms of biomass, as well as number of species, native plants are a relatively minor component of the vegetation found on the site.

Where access by cattle is restricted (and perhaps moisture regime enhanced) in the steep gulch margins, Guinea grass is especially dense and grows to a large stature. On more gentle slopes accessed by grazing cattle, the grasses tend to be cropped and erosion can be a problem, although areas of dense buffelgrass are present where cattle have not recently grazed.

Of particular interest in considering the results of the two surveys conducted in and around the proposed landfill site at Makaīwa are three endemics recorded in 1990, but not seen in 2005. These are *kumuniu* (fern; *Doryopteris decipiens*), *nehe* (*Lipochaeta lobata*), and *pua kala* (*Argemone glauca*), none of which was observed in 2005. These species were noted

mostly from the upper part of the property (near Pālehua Road, presumably). *Kumuniu* is described as a relatively common fern in dry shrublands, grasslands, and forests (Palmer, 2003). A variety of *nehe* (*L. lobata* var. *leptophylla* is a listed species (Federal Register, 1991) and known only from a few locations between Kolekole Pass and Kānehoa (Lualaulei) on the Wai`anae Mountain. This plant grows on dry to mesic cliffs, ridges, and slopes between 840 and 3208 ft (256 to 978 m) elevations (Federal Register, 2003). The more common variety—*L. l.* var. *lobata*, presumably the variety observed by Char—is found near the coast from 0 to 1300 ft (0 to 400 m) on Ni'ihau, O'ahu, and West Maui (Wagner, Herbst, and Sohmer, 1990). *Pua kala* is common in leeward parts of all the islands.

Figure 11. A significant determinant of natural vegetation at the Makaīwa Gulch, Waimānalo Gulch, and Nānākuli proposed landfill sites are frequent fires. This view looking downslope into Makaīwa Gulch was taken on August 24, 2005 from Pālehua Road at the 1500 ft (460 m) elevation.

A significant factor in determining the nature of the flora at the Nānākuli, Waimanalo Gulch, and Makaīwa Gulch sites are dry season fires that sweep over grass-covered hillsides (Fig. 11, above). The origin of many fires in these areas in recent years has been arson, although an accident caused the smaller Makaīwa Mauka fire that burned lower Pālailai Gulch in 2005

and power line electrical arching was suspected in the Nānākuli fire of 2005 (Fujimori, 2005a,b). Modern landfills, such as the existing one in Waimanalo Gulch, do not burn garbage and are not a source of accidental wildfires.

KAPA'A GULCH

Kapa'a Gulch (TMK: 4-2-015:001) is located in the District of Ko'olaupoko on the windward side of O'ahu. The proposed landfill site is a presently active basalt rock quarry operated by Ameron International Inc encompassing 391 acres (158 ha). Neither maps of the site provided showing the property nor recent USGS topographic sheets (Kaneohe and Koko Head quadrangles dated 1998) reflect the true contours of this site, which today presents a deep pit with sheer walls cut back towards Mahinui Ridge (Fig. 12).

Figure 12. In this aerial photo of the Ameron Quarry at Kapa'a, north is roughly to the left and Mahinui Ridge runs along the bottom. The large road passing left to right near the top of the photograph is the H-3 Interstate (photo by Brian Daniel, September 20, 2002).

The proposed landfill would utilize the existing quarry, shown in Fig. 13. The quarry pit is massive, certainly the largest on O'ahu. Although plants are present along the ledges above each vertical step, these ledges are planted and maintained by Ameron. Given that a municipal landfill operation in Kapa'a Valley would likely utilize the existing pit without the need to expand over undisturbed ground, and soil cover would come from existing, adjacent overburden stock piles, impacts to vegetation would be minimal.

Figure 13. Ameron International quarry pit at Kapa'a. Only minimal vegetation grows in the pit area, proposed as landfill site.

Botanical resources within Kapa'a Valley were surveyed in 2002 (Oceanit, 2002; see also Guinther, undated). In general, where undisturbed, the valley is inhabited by a mesic forest dominated by *koa haole* on the upper slopes, grading into a more diverse forest of Java plum (*Syzigium cumini*) and monkeypod (*Samanea saman*) near the valley floor. The somewhat scrubby growth of *koa haole* on the higher slopes is increasingly invaded by fiddlewood (*Citharexylum caudatum*) all along the Oneawa Hills (Mahinui Ridge). The lower half of the valley is highly disturbed, although once contained an extension of Kawai Nui marsh on the valley floor. While some wetland still remains here, much of this area is now fill land.

Plant surveys along the ridgelines of Ulumawao, the upland forming the east side of Kapa'a Valley, have revealed several native species as present: 'ūlei (*Osteomeles anthyllidifolia*), 'ākia (*Wikstroemia oahuensis*), and 'ōhi'a lehua (*Metrosideros polymorpha*; Guinther and Montgomery, pers. comm.). The latter species is particularly interesting as this species occurs as a small copse of stunted shrubs (Fig. 14) on the northern side of the highest part of Ulumawao where the peak rises to 980 ft (m). These native species might also occur on the Mahinui ridgeline above the quarry.

Figure 14. Dr. S. Montgomery inspecting *'ōhi'a lehua* blossoms for insects near the top of Ulumawao in Kailua.

PLANT RESOURCES DISCUSSION

This section of the report covers various jurisdictional issues and data bases containing information relative to special botanical resources at or near the proposed landfill sites. In addition, plant species of interest or concern are discussed in more detail as each species is brought in from a record of interest.

USFWS CRITICAL HABITAT DESIGNATIONS

Critical habitat under the Endangered Species Act of 1973 (ESA) refers to specifically bounded areas thought to be important to the conservation and recovery process of species listed under the ESA. Although federal actions within a designated critical habitat area require consultation under Section 7 of the ESA, actions by other entities also come under this requirement if the action is funded or authorized by a federal agency. All entities are subject to provisions of the ESA when it comes to actions impacting on a listed species; critical habit involves actions occurring within a designated area, whether the listed species is present or not.

A total of 22,274 ha (55,040 ac) of land on O'ahu have been designated as critical habitat for 99 species of plants. The total number of separate areas (known as "units") on O'ahu representing designated habitats for these 99 species of plants is 36.

There are no critical habitat units in the vicinity of Waimanalo Gulch, Makaīwa Gulch, or Kapa'a Valley. Closest to any of these three sites is Unit 16, encompassing much of the south slopes of Nānākuli Valley between about 400 and 1500 ft (120 to 460 m), designated as critical habitat for *Isodendrion pyrifolium.*, a species last seen on O'ahu in 1870 (Wagner, Herbst, & Sohmer, 1990). The ridgeline representing the southernmost extent of Unit 16 is just over 1 mi (1.8 km) from the northwest ridgeline bounding the Waimanalo Gulch parcel. No part of any proposed site overlaps into a critical habitat unit (Federal Register, 2003). However, critical habitat units are close to the proposed Mā'ili and Nānākuli sites.

The proposed Mā'ili site is near Units 12, 13, and 14. Unit 12 encompasses Pāhe'ehe'e Ridge and Mauna Kūwale as designated for *Chamaesyce kuwaleana*. This unit is about 2 mi (3.2 km) north of the quarry at Mā'ili. Unit 13 is located at the westernmost corner of the Naval Radio Transmitting Facility (NRTF) at Lualualei near Ma'ili'ili Stream, only a short distance west of the Mā'ili site property boundary. Both Unit 13 and nearby Unit 14 are designated for the fern, *Marsilea villosa*. Unit 14 is

located just inside the southern boundary of the NRTF Lualualei approximately 0.5 mi (0.8 km) southeast of the Mā'ili quarry site.

The proposed Nānākuli Site is near Critical Habitat Units 14 and 15. As described above, Unit 14 is located just inside the southern boundary of the NRTF Lualualei—0.75 mi (1.2 km) northwest of the closest part of the proposed Nānākuli Site. Unit 15 covers an extensive area of the uplands surrounding Lualualei Valley above 500 ft (150 m). A portion of this designated unit is directly upslope of the Nānākuli Site, encompassing the upper slopes of Pu'u Heleakalā. Although 39 species of listed plants have some part of Unit 15 designated as critical habitat, only *Chamaesyce kuwaleana*, has critical habitat on Pu'u Heleakalā. The area proposed for the landfill lies mostly at the base of the western face of Pu'u Heleakalā between 60 and 120 ft (18 – 37 m) elevations (the 611 ac parcel extends up to about the 360 ft or 110 m elevation).

ENDANGERED SPECIES ACT LISTED SPECIES

The previous subsection described relationships between designated critical habitat areas on O'ahu and the five proposed landfill sites. Although no site is within any of the 36 designated critical habitat units on the Island, this fact does not preclude their being ESA listed species present on one or more of the sites. In the absence of recent site surveys for four of the five sites, endangered species presence or absence must be inferred from what is known about the sites and the distribution of those species likely to be present based upon historical data. Presumably, once a site is selected and before it is developed, a botanical survey would be undertaken, and the finding of a listed species would then subject the site development process to provisions of the Act.

A number of species are known from individual specimens or populations growing near to some of the proposed municipal landfill sites and these are discussed here.

Marsilea villosa or *'ili'ihi* is a small aquatic or semi-aquatic fern resembling a clover (Fig. 15). The fern requires periodic flooding and drying of the ground to complete its short life cycle, and thus is confined to shallow basins subjected to brief periods of flooding during the wet season. The following description is from the Recovery Plan for the *Marsilea villosa* as given by USFWS (undated):

> This fern requires periodic flooding for spore release and fertilization, then a decrease in water levels for the young plants to establish. It typically occurs in

shallow depressions in clay soil, or lithified sand dunes overlaid with alluvial clay. All reported populations occur at or below 500 feet (150 meters) elevation. While *M. villosa* can withstand minimal shading, it appears most vigorous growing in open areas.

Figure 15. The fern, *Marsilea villosa* or *'ili'ihi*, is an endangered species, here growing among grasses at O'ahu critical habitat Unit 15 on Naval Transmitting Facility property at Lualualei.

Five populations are known from three locations on O'ahu at Koko Head (2), Lualualei Naval Reservation (2), and Kealakipapa (near Makapu'u) (Palmer, 2003), although a USFWS website confusingly lists 6 locations to account for "three currently occur[ing populations] on O`ahu... (USFWS, undated).

It is possible that *'ili'ihi* could occur on the Mā'ili Site given the close proximity of known populations of this fern. Both populations are located

at topographically low points on the Base, and were perhaps more extensive before off base areas were developed. On the Base, periodic mowing of the areas appears to help maintain the populations against overgrowth by aggressive introduced species, thus extensive disturbance of the Mā'ili Site by quarrying operations cannot be cited as a reason to rule out the ferns presence there. Exclusion of grazing may be a factor in the preservation of the fern populations where they are presently found.

The author surveyed both the Nānākuli A and B sites in 1991 before the PVT landfill occupied most of the Nānākuli A site (Guinther & Miranda, 1992). *Marsilea villosa* was not recorded and no habitat suitable for this fern was observed on the Nānākuli A or B sites, the latter being mostly a sloped hillside (Fig. 5). Similarly, suitable habitat is not present at Waimanalo Gulch, Makaīwa Gulch, or Kapa'a sites.

Chamaesyce kuwaleana, is a species of *'akoko* listed as endangered (Federal Register, 1991). Critical habitat for this species has been designated in seven units. Unit 15 encompasses 454 ac (184 ha) of Pu'u Heleakalā and is thought to presently harbor 300 individual plants (USFWS, 2003). Unit 15 lies upslope of the Nānākuli site. The plant is a small shrub between 0.2 and 0.9 m (8 to 35 in) high, known only from "arid volcanic cliffs, 250 m [820 ft high], Wai'anae Mountains, and also known from one specimen from Mokumanu, Kāne'ohe, O'ahu" (Wagner, Herbst, and Sohmer, 1990).

HAWAII NATURAL HERITAGE DATABASE

The Hawaii Natural Heritage Program (HNHP) was accessed and maps showing data entries were reviewed covering the lands for at least 1 mile around each proposed site. The data base has no rare or listed species of native plants at or close to any of the five proposed landfill sites. Within a distance of 1.25 mile (2 km), the data base yields entries for some of the sites.

For the proposed Mā'ili Quarry Site, the *'ili'ihi* fern is shown occupying an area on NRTF Lualualei close to Mā'ili Stream. This is the same area designated as critical habitat for this species, and is something less than 0.5 mile from the closest edge of the quarry property. However, given the special habitat requirement of this species (see p. 31, above), more than proximity would be required for the species to be established on the Mā'ili Site.

Schiedea ligustrina is indicated as having been reported from near the peak (northeast slope) of Pu'u Heleakalā approximately 0.7 mi (1.2 km) from the Nānākuli Site. At nearly the same distance away, at Ulehawa Beach Park, two rare plant records are in the data base: *maiapilo* (*Capparis sandwichiana*) and *nehe* (*Lipochaeta lobata* var. *lobata*).

Schiedea ligustrina is an endemic shrub that grows "[s]cattered in dry forest to diverse mesic forest, often on cliffs, usually in shaded sites, (305)-640-730(-830) m, Pālehua to Pu'ulaua and Keawapilau Gulch, and Mokulē'ia, Wai'anae Mountains, O'ahu" (Wagner, Herbst, and Sohmer, 1990). *Schiedea ligustrina* is not a listed species. *Maiapilo* is uncommon on O'ahu, but also not a listed species.

Nehe (*Lipochaeta lobata*) is presently considered to be found in the wild as two distinguishable varieties (Wagner, erbst, and Sohmer, 1990). *Lipochaeta lobata* var. *leptophylla* is a listed variety (Federal Register, 1991); The few remaining plants of *L. l.* var. *leptophylla* are located above Lualualei Valley but the known elevation range of this variety is well above the properties proposed for landfill use. The lowland or coastal variety, *L. l.* var. *lobata* is not listed and not presently regarded for listing consideration.

Within roughly 1 mi (1.6 km) of the Waimānalo Gulch and Makaīwa Gulch properties, the data base indicates the now extirpated populations of *'Ewa 'akoko* (*Chamaesyce skottsbergii* var. *skottsbergii*) that once occupied land that is Barbers Point Deep Draft Harbor and associated dredge tailings. This endangered variety is no longer present in this area (David and Guinther, 2006), but is being maintained at several sites in Kalaeloa (former Barbers Point Naval Air Station).

CONCLUSIONS

The results of all botanical surveys and searches of pertinent sources of information indicate that there are no special concerns or legal constraints related to botanical resources on any of the proposed sites. Non-native or introduced species of plants clearly dominate the natural vegetation in all areas proposed for landfill use, and the remnants of native vegetation extant on or near these sites consists of generally sparse growth of a limited number of species that remain relatively common in all undeveloped lowlands around O'ahu. Although some rare native plants, and in a couple of cases, endangered species or varieties of plants, can be found within 2 km (1.2 mi) of a proposed landfill site, there is no reason to believe that the operation of a landfill at these sites would have any adverse impacts on such species.

Figure 16. Composite photo of the eastern side of Waimānalo Gulch showing the upper end of the permitted landfill area (right) with reshaping of the site underway.

The operation of a municipal solid waste landfill, by its very nature and in compliance with the most modern environmental requirements designed to minimize and contain offsite movement of pollutants, will require removal of the vegetation from the selected site. Figure 16 (above) shows the Waimānalo Gulch (existing City & County landfill) operation at the very beginning of setting up the cells into which refuse is permanently stored. Although for each site this may differ to some degree, this initial phase entails making cuts into hillsides to create room and obtain inert material for use as cover. Whatever botanical resources are present at the selected site will likely be completely removed, the only possible exceptions being

areas around the margins of a site where the terrain becomes too steep to alter. Following grading and use of the site for land-filling, surface stabilization practices will eventually include replacing the vegetation. An emphasis on utilizing appropriate native species could be followed.

It is generally the case that many rare native plants of interest (an exception is the fern, *'ili'ihi*) growing in the lowlands of O'ahu will be confined to steep gulch slopes and cliffs. In most cases, these habitats would tend not to be developed, although as Fig. 16 shows, steep gulch slopes could be incorporated into the overall reshaping of the site to a greater degree than might be the case for most other kinds of land development. At two of the proposed sites (Mā'ili Quarry and Kapa'a Quarry), the landfill would utilize existing, highly disturbed, quarry pits. The conclusion cannot be drawn that because steep, rocky gulch margins and cliff faces and ledges provide habitat for rare native plants, the two existing quarry sites (Mā'ili and Kapa'a) might then harbor special species. Rare plants occur in nearly inaccessible places because these places are not accessed by grazing cattle and, certainly in some cases, are protected from fires spreading over the landscape. The special plants hang on in these locations because the common sources of disturbance are minimized. Quarry walls and ledges are highly disturbed sites and not ideal habitat for rare native plants. These plants—in the absence of the many disturbances (including aggressive introduced species)—would populate areas today used for housing, recreation, and grazing.

This report provides information from the recent investigation of the Waimānalo Gulch site and data associated with prior investigations of the Nānākuli, Mā'ili, Makaīwa, and Kapa'a sites. There is no guarantee that some small number of specimens of a listed species might be present at one or another of the proposed sites that have not been subjected to a recent survey. Should one or more of these sites be selected for landfill use, additional botanical surveys should be conducted as deemed practical to better establish the conclusion of no adverse impacts on listed species. The desirability of doing such a future survey or surveys will depend upon habitat present at the site, proximity of the site to known populations of endangered species, and how recently and completely past botanical surveys covered the site. For assessment purposes, this report should suffice to cover any such concerns involving investigation of the Waimānalo Gulch site.

REFERENCES

Carr, G. undated. *Cenchrus ciliaris* web site at URL: http://www.botany.hawaii.edu/Faculty/Carr/cen_cil.htm (visited 2/06/2007).

Char, W. P. 1990a. Appendix H. Botanical survey, propposed Lualualei Golf Course, Lualualei, Nanakuli, O`ahu. In: *Final Environmental Impact Statement, Lualualei Golf Course, Nanakuli, Oahu, Hawaii.* Prep. for Hida, Okamoto & Assoc., Inc. 13 pp.

_____. 1990b, Botanical Survey, Maka'iwa Hills, 'Ewa, District, O'ahu. Prepared for: William E. Wanket, Inc. 23 pp.

David, R. and E. Guinther. 2005. A Survey of Botanical, Avian and Mammalian Resources, Hawaiian Electric Generating Station and Transmission Additions Project Site, Campbell Industrial Park, 'Ewa District, O'ahu, Hawai'i. Prep. for Planning Solutions, Inc. & Hawaiian Electric Company.

_____ & _____. 2006a. A Survey of Botanical, Avian, and Mammalian Resources, Kapolei Harborside Center, 'Ewa District, O'ahu, Hawai'i. Prep. for: Group 70 International and The Estate of James Campbell.

_____ & _____. 2006b. A Survey of Botanical, Avian and Mammalian Resources on the Makaīwa Hills Project Site, 'Ewa District, O'ahu, Hawai'i. Prep. for: Group 70 International and The Estate of James Campbell.

D'Antonio, C. M. and P. M. Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. *Annual Review of Ecology and Systematics*, 23: 63-87.

Daehler, C. C., and D. A. Carino. 1998. Recent replacement of native pili grass (*Heteropogon contortus*) by invasive African grasses in the Hawaiian Islands. *Pacific Science*, 53(3): 220-227.

Federal Register. 1991. Department of the Interior. Fish and Wildlife Service. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for 26 Plants from the Waianae Mountains, Island of Oahu, Hawaii. 56 (209; Tuesday, October 29, 1991): 55770-55786. (URL: http://ecos.fws.gov/docs/federal_register/fr1952.pdf)

Federal Register. 2003. Part II. Department of the Interior. Fish and Wildlife Service. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Final Designations or Nondesignations of Critical Habitat for 101 Plant Species from the Island of Oahu, HI; Final Rule. 68 (116; Tuesday, June 17, 2003): 35950-36406. (PDF URL at http://www.fws.gov/pacificislands/CHRules/oahufinal.pdf).

Fujimori, Leila. 2005a. Nanakuli fire claims 1,000 acres, nears preserve. *Star Bulletin*, Friday, May 13, 2005.

_____. 2005b. Nanakuli fire strains resources. *Star Bulletin*, Wednesday, August 17, 2005.

Funk, E. 1984. Flora and fauna report of the Radio Transmitting Facility, Lualualei, Oahu, Hawaii. Prep. for the U.S. Navy Pacific Division by Botanical Consultants, Inc.

Guinther, E. B. undated website. Kapa'a Valley. The TMDL Sub-Basins. URL: http://www.aecos.com/KOOLAU/Kapaa_Subbasins.html.

_____ and R. David. 2002. Biological surveys in support of a Remedial Investigation at the former Building 4 Pesticide Shop, Lualualei Branch, Naval Magazine Pearl Harbor, Oahu. Prep. for Earth Tech by *AECOS* Inc. AECOS No. 1005: 18 pp.

_____ and _____. 2003. Biological surveys in support of Remedial Investigations at NRTF Lualualei and NCTAMS Wahiawa, O`ahu. Prep. for Earth Tech, Honolulu by *AECOS* Inc. *AECOS* No. 1019: 20 pp.

_____ and D. Miranda. 1992. Biological surveys for the Heleakala Planned Community and Golf Course. Prep. for Wil Chee Planning by *AECOS* Inc. AECOS No. 662: 12 pp.

Hawaii Natural Heritage Program (HNHP). Undated. Hawaii Natural Heritage Program, Center for Conservation Research and Training, University of Hawaii at Manoa. Data provided by Roy Kam, Database Manager, accessed February 6, 2007. (URL:)

Herbst, D. R. 1986. Endangered and threatened wildlife and plants; determination of endangered status for *Abutilon menziesii* (*ko`oloa`ula*). *Federal Register*, 51: 34412-34415.

Hughes, R. F., P. M. Vitousek, and T. Tunison. 1991. Alien grass invasion and fire in the seasonal submontane zone of Hawaii. *Ecology*, 72: 743-746.

Latz, P. K. 1991. Buffel and couch grass in Central Australian creeks and rivers. *Newsletter of the Central Australian Conservation Council, Inc.* April 1991: 5. [Cited in Adair, R.J. and R.H. Groves. 1998. Impact of environmental weeds on biodiversity. A review and development of methodology. Environment Australia, Weeds Program.]

Mac, M. J., P. A. Opler, C. E. Puckett Haeker, and P. D. Doran. 1998. Status and trends of the nation's biological resources. Vol. 1 and 2. U.S. Department of the Interior, U.S. Geological Survey, Reston, Va. 1-964 pp. (URL: http://biology.usgs.gov/s+t/SNT/index.htm [visited 2/05/2007]).

Mueller-Dombois, D. 1981b. Fire in tropical ecosystems. Pp. 137-176 *in* H. A. Mooney, T. M. Bonnicksen, N. L. Christensen, J. E. Lotan, and W. A. Reiners (editors). Fire regimes and ecosystem properties. U.S. Forest Service General Technical Report WO-26. Proceedings of a conference, 11-15 December 1978, Honolulu, Hawaii.

Oceanit Laboratories Inc. (Oceanit). 2002 Kapa`a Stream Hydrology, Biology, and Water Quality Survey. Prep. for Ameron, Hawaii by Oceanit Laboratories, Inc with AECOS, Inc. December 2002.

Palmer, Daniel D. 2003. *Hawai'i's Ferns and Fern Allies*. University of Hawai'i Press, Honolulu. 325 pp.

Tix, D. undated. *Cenchrus ciliaris* invasion and control in southwestern U.S. grasslands and shrublands. Dept. Horticultural Science, University of Minnesota. Unpublished at URL: http://horticulture.coafes.umn.edu/vd/h5015/00papers/tix.htm

Traverse Group, Inc. 1987. Natural resources management plan, NAVCAMS EASTPAC. Prep. for Pacific Division, Naval Facilities Engineering Command. Contract No. N62742-86-C-0538.

U.S. Fish and Wildlife Service (USFWS). Undated website. Pacift Islands – Endangered Species. Threatened and Endangered Animals (sic) in the Hawaiian Islands. The Recovery Plan for the *Marsilea villosa*. URL: http://www.fws.gov/pacificislands/wesa/marsileavilidx.html (visited 2/6/2007).

Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1990. *Manual of the Flowering Plants of Hawai`i.* Spec. Publ. 83. University of Hawaii Press and Bishop Museum Press. Bishop Museum. 1854 pp.

Appendix F

Survey of the Avifaunal and Feral Mammals for the Proposed Waimānalo Gulch Landfill Expansion Project, O'ahu, 2007

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS FOR THE PROPOSED WAIMANALO GULCH LANDFILL EXPANSION PROJECT, OAHU

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INTRODUCTION

The purpose of this report is to present the findings of a bird and mammal field survey, conducted on 26 September 2006 at Waimanalo Gulch, Leeward Oahu. This same area was previously surveyed (Bruner 1999). Data from the earlier study is also given in this report for comparison purposes, along with references to pertinent literature and unpublished reports since 1999.

The objectives of the field survey were to:

1- Document what bird and mammal species currently occur on the property.

2- Provide comparative data on the relative abundance of each species.

3- Determine the presence or likely occurrence of native or migratory birds, those that are listed as endangered or threatened.

4- Determine if the habitats on this site are comparable with that seen in 1999.

SITE DESCRIPTION

The proposed expansion area is located in a narrow "V" shaped valley with a dry stream bed that only contains water during flash flood events. Introduced vegetation continues to dominate the plant communities at this site. Many of the trees that were present in 1999 were burned in the August 2005 fire that ravaged this region. Most of the surviving trees are along the stream bed. Dry grass covers most of the site.

Weather during the survey was clear and warm. Winds were from the east at 10-15mph.

STUDY METHODS

The site was walked using the same access road as in 1999. I also continued on mauka from the end of the road to an old fence that crossed the valley. Field observations were made with the aid of binoculars and by listening for vocalizations.

All birds seen or heard were tallied. These data provide the basis for the relative abundance estimates given in Table One. Data from the 1999 survey are also given for comparison. Observations of feral mammals were limited to visual sightings. No attempts were made to trap mammals in order to obtain data on their relative abundance and distribution.

Scientific names of birds and mammals used in this report follow those given in Checklist of the Birds of Hawaii (Pyle 2002) and Mammal Species of the World (Honacki et al. 1982). These sources use names cited in the most current scientific literature.

RESULTS AND DISCUSSION

Resident Endemic (Native) Birds:

As was the case in 1999 no native land birds were recorded on the survey. The Hawaiian Owl or Pueo (*Asio flammeus sandwichensis*) is listed as endangered by the State of Hawaii on the island of Oahu. This species was not recorded on the survey but may forage in this area. Since 1999 I have observed Pueo in Leeward Oahu at locations only a few miles on either side of this property. Pueo hunt over grasslands as well as forests and nest on the ground in tall grass (Pratt et al. 1987, Hawaii Audubon Society 2005).

Migratory Indigenous (Native) Birds:

No migratory shorebirds were recorded on the survey. This area lacks suitable habitat for these species.

Resident Indigenous (Native) Seabirds:

No seabirds were observed. The White-tailed Tropicbird (*Phaethon lepturus*) can be seen soaring above valleys and over ridges on Oahu. This species is not endangered or threatened.

Resident (Native) Waterbirds:

The stream only contains water during flash floods. No waterbirds would be expected at this site.

Exotic (Introduced) Birds:

Only nine species of exotic birds were recorded during the course of the field survey compared with 13 species in 1999. The array of species was comparable to that observed on other surveys in similar habitat (Bruner 1989, 1990a, 1990b, 1992, 1993, 1996, 1999, 2000, 2001a, 2001b, 2002, 2003). Table One gives the relative abundance of each species recorded on the 1999 and 2006 survey. None of these species are listed as endangered or threatened.

Feral Mammals:

The only feral mammal observed was the Small Indian Mongoose (*Herpestes auropunctatus*). Two were seen in the stream bed. Rats (*rattus sp.*) and Mice (*Mus musculus*) were not seen but probably occur on this site. The endemic and endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) is rarely seen on Oahu (Tomich 1986, Kepler and Scott 1990). No bats were observed on the survey. This species is known to roost solitarily in trees and forages for flying insects (Jacobs 1993). They use a variety of habitats including native forests, ranchlands, ponds and bays as well as urban areas (Jacobs 1991, Reynolds et al. 1998).

CONCLUSIONS

The absence of native and migratory birds on this property is not unexpected given the elevation and available habitats. The Pueo (Hawaiian Owl) might forage on occasion in this region. All of the birds recorded in 1999 and on this survey were alien (non-native, introduced) species. The fact that there were fewer alien species and lower relative abundance on this 2006 survey may be due to the August 2005 fire which had a major impact on this habitat. Other factors may also account for the differences in bird populations between 1999 and 2006 (Williams 1987, Moulton 1990). In conclusion this site is not remarkable in either the array or number of birds and mammals. There are no unique habitats. Similar areas occur all along the leeward side of Oahu.

TABLE 1

Alien (introduced) species of birds recorded on and near the site of the proposed Waimanalo Gulch Landfill Expansion, Oahu during the 1999 and 2006 field surveys. Relative abundance estimates are based on total numbers of birds recorded:
A = abundant (30-50); C = common (15-29); R = rare (1-4).
Species not recorded are indicated by a (-).

Common Name	**Scientific Name**	**Relative Abundance**	
		1999	**2006**
Cattle Egret	*Bubulcus ibis*	U	R
Erckel Francolin	*Francolinus erckelii*	R	-
Rock Dove	*Columba livia*	C	-
Spotted Dove	*Streptopelia chinensis*	A	C
Zebra Dove	*Geopelia striata*	C	U
Red-vented Bulbul	*Pycnonotus cafer*	A	R
Common Myna	*Acridotheres tristis*	A	U
Japanese White-eye	*Zosterops japonicus*	R	C
Northern Cardinal	*Cardinalis cardinalis*	R	R
House Finch	*Carpodacus mexicanus*	U	-
Common Waxbill	*Estrilda astrild*	A	C
Red Avadavat	*Amandava amandava*	-	R
Nutmeg Mannikin	*Lonchura punctulata*	U	-
Java Sparrow	*Padda oryzivora*	R	-

SOURCES CITED

Bruner, P.L. 1989. Survey of the avifauna and feral mammals at the proposed Camapbell Commercial-Industrial site, Ewa, Oahu. Prepared for William E. Wanket, Inc.

_____ 1990a. Survey of the avifauna and feral mammals at the proposed Campbell Industrial park Division, Ewa, Oahu. Prepared for Belt Collins and Associates.

_____ 1990b. Survey of the avifauna and feral mammals at Makaiwa Hills, Ewa, Oahu. Prepared for Williams E. Wanket, Inc.

_____ 1992. Findings of an avifaunal and feral mammals survey of Upper Makua Valley, Oahu. Prepared for Wilson Okamoto and Associates, Inc.

_____ 1993. Survey of the avifauna and feral mammals along the proposed alignment of the Ewa by Gentry East Offsite Drainage Ditch, Oahu. Prepared for Parametrix, Inc.

_____ 1996. Wildlife inventory report of Hickam Air Force Base and Satellite Installations. Prepared for EA Engineering, Science and Technology, Inc.

_____ 1999. Survey of the avifauna and feral mammals for the proposed At&T Cable project-Makaha to Keawaula, Oahu. Prepared for Townscape, Inc.

_____ 2000. Faunal (Bird & Mammal) Survey of approximately 520 acres at NAVMAG Lualualei, Waikele branch , Oahu. MS. Prep. For Belt Collins & Associates.

_____ 2001a Avifaunal and feral mammal survey of the proposed Mililani Mauka Phase III Project, Oahu. Prep. For Kusao and Kurahashi, Inc.

_____ 2001b. Avifaunal and feral mammal field survey for the proposed Waianae Coat Emergency Access Road, Oahu. Prep. for Townscape.

_____ 2002. Avifaunal and feral mammal survey of proposed BWS Kalaeloa Desalination facility, Kalaeloa, Ewa, Oahu, Hawaii. Prep. for Oceanit.

_____ 2003. Avifaunal and feral mammal field survey of the Barbers Point 215' Non Potable Reservoir site at Makakilo, Oahu. Prep. for PBR-Hawaii and The Limtiaco Consulting Group.

Hawaii Audubon Society. 2005. Hawaii's Birds. Sixth edition. Hawaii Audubon Society, Honolulu. 141pp.

Honacki, J.H., K.E. Kinman and Koeppl ed. 1982. Mammal species of the world: A taxonomic and geographic reference. Allen Press, Inc., and the Association of Systematic Collections, Lawrence, Kansas.

Jacobs, D.S. 1991. The distribution and abundance of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), on the island of Hawaii. Unpubl. report submitted to University of Hawaii, Department of Zoology. 16pp.

_____ 1993. Foraging behavior of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). Final report to U.S. Fish and Wildlife Service. Grant No. 14-48-0001-92570.

Kepler, C.B. and J.M. Scott. 1990. Notes on distribution and behavior of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). 'Elepaio 50(7):59-64.

Moulton, M.P., S.L. Pimm and M.W. Krissinger. 1190. Nutmeg Mannikin (*Lonchura punctulata*): a comparison of abundance in Oahu vs Maui sugarcane fields, evidence for competitive exclusion? 'Elepaio 50(10):83-85.

Pratt, H.D., P.L. Bruner and D.G. Berrett. 1987. A field guide to the birds of Hawaii and the tropical Pacific. Princeton University Press.

Pyle, R.L., Checklist of the birds of Hawaii – 2202. 'Elepaio 62(6):137-148.

Reynolds, M.H., B. Nielsen, and J.D. Jacobi. 1998. Surveys of the Hawaiian Hoary Bat in the district of Puna, Hawaii Island.

Tomich, P.Q. 1986. Mammals in Hawaii. Bishop Museum Press. Honolulu.

Williams, R.N. 1987. Alien Birds on Oahu 1944-1985. 'Elepaio 47(9):87-92.

REPORT OF POTENTIAL BIRDS AND MAMMALS AT FOUR PROPOSED ALTERNATIVE LANDFILL SITES ON OAHU

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INTRODUCTION

The purpose of this report is to provide a guideline of the potential birds and mammals that might be found on a field survey of each of the four proposed alternative landfill sites on Oahu. In addition, any potential problems associated with a landfill and native or migratory birds on or nearby the sites is noted.

MAILI SITE

Native Birds:

None would be expected on this site due to its location, lack of appropriate habitats and current land use.

Migratory Birds:

The potential species that might forage at this site, provided there is open habitat is the Pacific Golden-Plover or Kolea (*Pluvialis fulva*). This species often forages on lawns and fallow agricultural lands. It is not endangered or threatened. They spend the non-breeding season (August – April) in Hawaii and nest in western Alaska during June – July.

Alien (Non-native, Introduced) Birds:

Without actually surveying the site it is impossible to provide a complete and accurate accounting of alien birds on this site. Nevertheless some of the more common species likely to be found on or near this area include:

Spotted Dove (*Streptopelia chinensis)*

Zebra Dove (*Geopelia striata*)

Red-vented Bulbul (*Pycnonotus cafer*)

Common Myna (*Acridotheres tristis*)

House Finch (*Carpodacus mexicanus*)

Common Waxbill (*Estrilda astrild*)

NANAKULI B SITE

Native Birds:

The only native bird that might forage on or around this site is the Hawaiian Owl or Pueo (*Asio flammeus sandwichensis*). The Oahu population of this species is listed as endangered by the state of Hawaii. They forage over a variety of habitats included lands such as the Nanakuli B site and area up slope of this property. I have seen Pueo as

recently as three years ago in the general area of this proposed alternative landfill site. Pueo forage in a wide variety of natural and disturbed habitats.

Migratory Birds:

The only migrant that might be expected in large open spaces free of brush and high grass is the Pacific Golden-Plover or Kolea (*Pluvialis fulva*).

Alien (Non-native, Introduced) Birds:

The most likely common species are:

Spotted Dove (*Streptopelia chinensis*)

Zebra Dove (*Geopelia striata*)

Red-vented Bulbul (*Pycnonotus cafer*)

Common Myna (*Acridotheres tristis*)

Japanese White-eye (*Zosterops japonicus*)

House Finch (*carpodacus mexicanus*)

Common Waxbill (*Estrilda astrild*)

Game Birds such as Erckel Francolin (*Francollinus erckelii*) and Gray Francolin (*Francolinus pondicerianus*) may also occur in the steeper areas above the site.

MAKAIWA GULCH SITE

Native Birds:

Aside from the Pueo (Hawiian Owl) no native birds likely would be found at this site.

Migratory Birds:

The only migratory bird that could occur on the property is the Pacific Golden-Plover.

Alien (Non-native, Introduced) Birds:

This site is so similar in habitat, topography and elevation to the Waimanalo Gulch site that the list of alien species that probably occur on or near this area would coincide with that obtained in the 1999 and the current 2006 faunal field surveys of Waimanalo Gulch. The relative abundance of these species might vary a little between the two sites.

AMERON QUARRY SITE

Native Birds:

Native birds would not be expected to frequent the actual quarry site but several species of native, endangered waterbirds do occur at the nearby Kawainui Marsh. Of the four alternative landfill sites, Ameron Quarry poses the greatest potential threat to native birds through groundwater or flood water contamination of Kawainui Marsh.

Migratory Birds:

The Pacific Golden-Plover occurs in open habitats around the quarry.

Alien (Non-native, Introduced) Birds:

Common alien species in this area include but are not limited to:

Cattle Egret (*Bubulcus ibis*)

Spotted Dove (*Streptopelia chinensis*)

Zebra Dove (*Geopelia striata*)

Red-vented Bulbul (*Pycnonotus cafer*)

Common Myna (*Acridotheres tristis*)

Japanese White-eye (*Zosterops japonicus*)

Northern Cardinal (*Cardinalis cardinalis*)

Red-crested Cardinal (*Paroaris coranata*0

House Finch (*Carpodacus mexicanus*)

Common Waxbill (*Estrilda astrild*)

FERAL MAMMALS

All four sites likely have some or all of the following feral mammals: cats, dogs, rats, mice and the Small Indian Mongoose.

CONCLUSIONS

This report is only intended to provide a general overview of the more common species of birds and mammals that might be expected at the alternative landfill sites. An actual field survey would obviously yield a more complete assessment of faunal use of these areas. The only alternative site with potentially serious impact is the Ameron Quarry property. Its proximity to a wetland with endangered species could spell trouble in the form of water contamination from flooding or through groundwater drainage.

Appendix G

Archaeological Inventory Survey
Waimānalo Gulch Landfill Expansion Project, 2008

Archaeological Inventory Survey for the Waimānalo Gulch Sanitary Landfill Expansion Project Honouliuli Ahupuaʻa, ʻEwa District, Island of Oʻahu (TMK: [1] 9-2-003: por. 072 and 073)

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Management Summary

Reference	Archaeological Inventory Survey for the Waimānalo Gulch Sanitary Landfill Expansion Project, Honouliuli Ahupua‘a, ‘Ewa District, Island of O‘ahu (TMK: [1] 9-2-003: por. 072 and 073) (Dalton and Hammatt 2008)
Date	September 2008
Project Number	Cultural Surveys Hawaii, Inc. (CSH) Job Code: HONOU 6
Investigation Permit Number	The fieldwork for this investigation was carried out under archaeological permit number 07-19, issued by the Hawai‘i State Historic Preservation Division/Department of Land and Natural Resources (SHPD/DLNR), per Hawai‘i Administrative Rules (HAR) Chapter 13-282.
Project Location	The proposed landfill expansion area is located immediately *mauka* (northeast) of the existing Waimānalo Gulch Sanitary Landfill. Waimānalo Gulch is generally located immediately inland of Farrington highway, roughly between the Honokai Hale residential subdivision and Ko Olina Resort to the southeast, and the Hawaiian Electric Co.’s (HECO) Kahe Power Plant to the northwest. This area is depicted on the 1998 ‘Ewa USGS 7.5 minute topographic quadrangle.
Project Funding and Land Jurisdiction	City and County of Honolulu (City)
Agencies	City Department of Environmental Services, SHPD
Project Description	The proposed landfill expansion area comprises approximately 90 acres of undeveloped land within the overall 200-acre Waimānalo Gulch Landfill property (TMK: [1] 9-2-003: 072 and 073). The proposed landfill expansion area is to be used for the disposal of municipal refuse, H-POWER associated ash and residue, and operational activities associated with running the landfill. The landfill expansion is meant to increase the capacity and lifespan of the existing Waimānalo Gulch Sanitary Landfill. Minimally, land disturbing activities associated with the landfill expansion project would include: major grading, including blasting of exposed rock surfaces, and excavation of the base and walls of Waimānalo Gulch to prepare the expansion area for landfill use; grading for a perimeter road around the expansion area; excavations for stockpiling of sediment for use as cover material; excavations for associated landfill infrastructure; excavation for the installation of a storm water runoff control channel along the west side of the gulch; and filling of the expansion area with refuse material.

Area of Potential Effect (APE)	The project’s APE is defined as the entire approximately 90-acre proposed expansion area.
Definition of the Current Study Area.	Background research confirmed that the approximately 90-acre landfill expansion project area had been previously surveyed by CSH as part of an earlier archaeological inventory survey (AIS) of the entire 200-acre Waimānalo Gulch Landfill property (Hammatt and Shideler 1999). In early 2007, at the request of the project proponents, CSH completed additional AIS investigation, including systematic pedestrian inspection and limited subsurface testing, of a 36-acre portion of the overall 90-acre APE that represents the core of the expansion area (located within TMK: [1] 9-2-003: 073). This 36-acre portion of the overall 90-acre APE is defined as the study area for the current AIS investigation.
Historic Preservation Regulatory Context	As a City-funded project on City-owned land, the proposed landfill expansion is a project requiring compliance with State of Hawaii historic preservation review legislation. This investigation was performed to fulfill Hawaii State archaeological inventory survey standards (Hawaii Administrative Rules [HAR] Chapter 13-276) and support the project’s historic preservation review under Hawaii Revised Statutes [HRS] Chapter 6E-8 and HAR Chapter 13-275. It also is intended to support the project’s environmental review under HRS Chapter 343.
Fieldwork Effort	Fieldwork for the current AIS investigation of the study area was accomplished over a one-week period from January 25, 2007 to February 2, 2007. The CSH field crew consisted of Matt Bell, B.A., Amy Hammermiester, B.A., and Kevin Dalton, B.A., under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator). The field effort required 13 person-days to complete.
Results	Through the combined effort of the earlier AIS investigation of the entire 200-acre Waimanalo Gulch Landfill property (Hammatt and Shideler 1999) and the current AIS investigation of the 36-acre study area, all of the expansion area APE was subjected to systematic pedestrian inspection, with limited subsurface testing where appropriate. This effort located a single historic property: SIHP # 50-80-12-6903, three rock uprights, which are recommended eligible to the Hawai‘i Register of Historic Places (Hawaii Register) under significance Criteria D (for information content) and E (for traditional-cultural significance to Native Hawaiians).

Consultation Effort Related to SIHP # 50-80-12-6903	For the project’s AIS consultation effort, CSH worked with the Office of Hawaiian Affairs, SHPD, and knowledgeable cultural consultants. This effort was dove-tailed with the cultural consultation effort for the project’s cultural impact assessment, which CSH prepared pursuant to HRS Chapter 343 and the Office of Environmental Quality Control’s guidelines for assessing cultural impacts. This consultation effort included several on-site, at the SIHP # 50-80-12-6903 location, meetings that included SHPD personnel (Mr. Adam Johnson, Ms. Teresa Davan, Ms. Linda Kaleo Paik, and Ms. Lauren Morawski), as well as knowledgeable cultural consultants, including Mr. McD Philpotts, Mr. Alika Silva, Mr. Glen Kila, Mr. Shad Kane, Mr. William Ailā, and Mr. Eric Enos. Through this consultation CSH sought the opinions of cultural consultants regarding the age, function, cultural affiliation, and significance of the three stone uprights. All cultural consultants felt the stones were significant Native Hawaiian cultural resources that were used in the past by traditional Hawaiian cultural practitioners. There is no clear consensus, however, regarding the specific function of the upright stones. Potential functions discussed included trail markers, markers for observation points for celestial observation and/or navigation, or markers used to calculate the location of specific coastal and/or off-shore resources. Potential mitigation measures for the stones, including preservation in place and relocation, were discussed with the cultural consultants.
Effect Recommendation	After weighing the options, the project proponents have determined that the three stones that make up SIHP # 50-80-12-6903 cannot be preserved in place in a safe and appropriate manner. Accordingly, a project effect determination of “effect with agreed upon mitigation commitments” is warranted.

Mitigation Recommendation	The project proponents propose the interim relocation of the three SIHP # 50-80-12-6903 stones to the vicinity of Battery Arizona, located in the southwestern portion of the Waimānalo Gulch Landfill property. The proposed relocation would ensure the safety of the stones during the landfill’s expansion and would make them much more accessible to interested parties. The City & County is willing to commit to move the stones back to, as close as possible, their original location and is prepared to commit to this in a Memorandum of Agreement. This relocation could only take place after that portion of the landfill had been filled. At this time there is some uncertainty regarding when that portion of the landfill would be closed but it seems likely it will take at least 15 years and could take as long as 50 years. The specifics of the proposed stone relocation would be the subject of the project’s archaeological preservation/ mitigation plan for SIHP # 50-80-12-6903. Additionally a Memorandum of Agreement will be drafted by the project proponents and will be reviewed by the SHPD prior to the implementation of the project.

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Section 1 Introduction

1.1 Project Background

The City and County of Honolulu (City) intends to expand the active landfill operations within the 200-acre Waimānalo Gulch Sanitary Landfill property, located in Honouliuli Ahupua‘a, ‘Ewa District, Island of O‘ahu (TMK: [1] 9-2-003: 072 and 073). Waimanalo Gulch is generally located immediately inland of Farrington highway, roughly between the Honokai Hale residential subdivision and Ko Olina Resort to the southeast, and the Hawaiian Electric Co.’s (HECO) Kahe Power Plant to the northwest. This area is depicted on the 1998 ‘Ewa USGS 7.5 minute topographic quadrangle. The proposed expansion area includes approximately 90 acres of the overall property that is located generally *mauka* (northeast) of the existing and in-use landfill operations (Figure 1, Figure 2, & Figure 3).

The Waimānalo Gulch Sanitary Landfill was established in 1989; is owned by the City and County of Honolulu (C&C) under the jurisdiction of the Department of Environmental Services/Refuse Division, and operated by Waste Management of Hawai‘i. The landfill currently takes in roughly 500,000 tons per year.

The proposed landfill expansion area of potential effect (APE) comprises approximately 90 acres of undeveloped land within the overall 200-acre Waimānalo Gulch Landfill property (TMK: [1] 9-2-003: 072 and 073). The proposed landfill expansion area is to be used for the disposal of municipal refuse, H-POWER associated ash and residue, and operational activities associated with running the landfill. The landfill expansion is meant to increase the capacity and lifespan of the existing Waimānalo Gulch Sanitary Landfill. Minimally, land disturbing activities associated with the landfill expansion project would include: major grading, including blasting of exposed rock surfaces, and excavation of the base and walls of Waimānalo Gulch to prepare the expansion area for landfill use; grading for a perimeter road around the expansion area; excavations for stockpiling of sediment for use as cover material; excavations for associated landfill infrastructure; excavation for the installation of a storm water runoff control channel along the west side of the gulch; and filling of the expansion area with refuse material.

As a City-funded project on City-owned land, the proposed landfill expansion is by definition a project requiring compliance with Hawaii State environmental (Hawaii Revised Statutes [HRS] Chapter 343) and historic preservation [HRS Chapter 6E-8 and Hawaii Administrative Rules (HAR) Chapter 13-275] review legislation. Accordingly, at the request of R.M. Towill Corporation, on behalf of the City, Cultural Surveys Hawai‘i Inc. (CSH) conducted an archaeological inventory survey (AIS) to support the project’s environmental and historic preservation review. This investigation was performed to fulfill Hawaii State archaeological inventory survey standards (HAR Chapter 13-276) and support the project’s environmental and historic preservation review. An earlier (April 2008) draft of the present AIS was reviewed by the SHPD in their Chapter 6E-8 Historic Preservation review letter of August 29,2008 (Log No 2008.1458, Doc No 0808LM10; present Appendix A). This revised AIS addresses the concerns enumerated.

Background research confirmed that the approximately 90-acre landfill expansion project area had been previously surveyed by CSH as part of an earlier archaeological inventory survey (AIS)

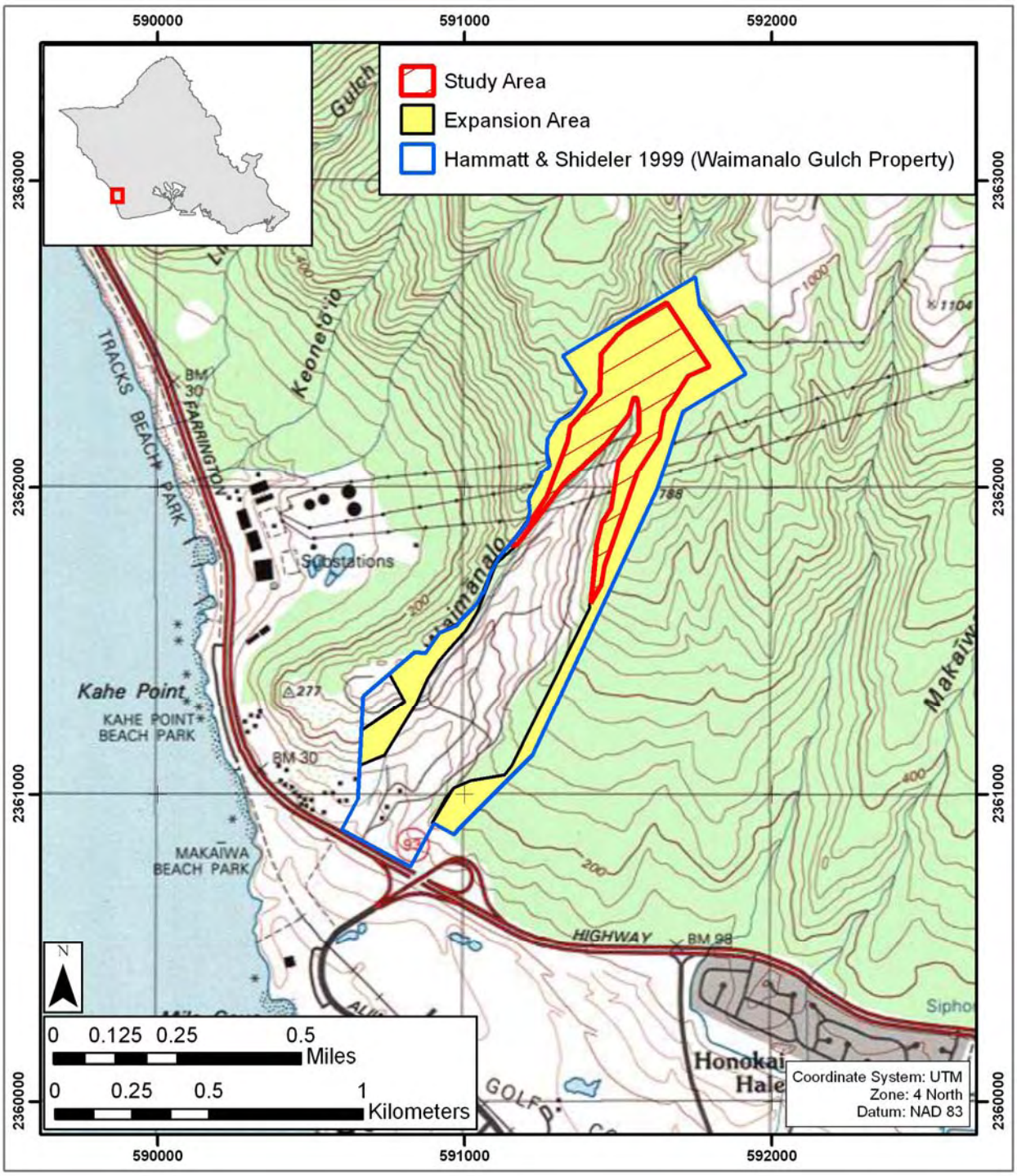

Figure 1. USGS 7.5 Minute Series Topographic Map, Ewa Quadrangle (1998), showing the location of the Hammatt & Shideler (1999) study area, the Waimānalo Gulch Sanitary Landfill proposed expansion area, and the current study area

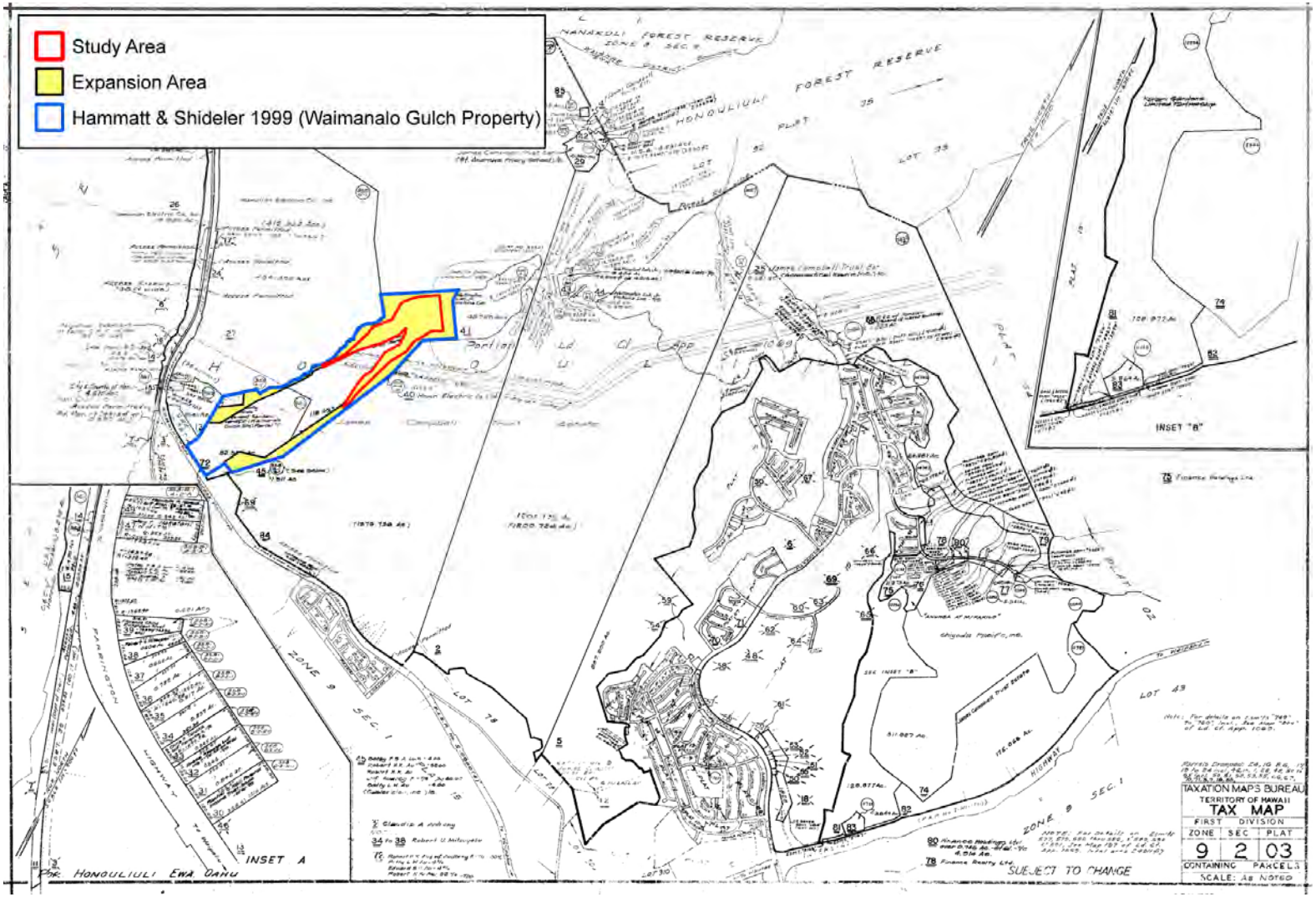

Figure 2. TMK [1] 9-2-03 showing the location of the Hammatt & Shideler (1999) study area, the Waimānalo Gulch Sanitary Landfill proposed expansion area, and the current study area

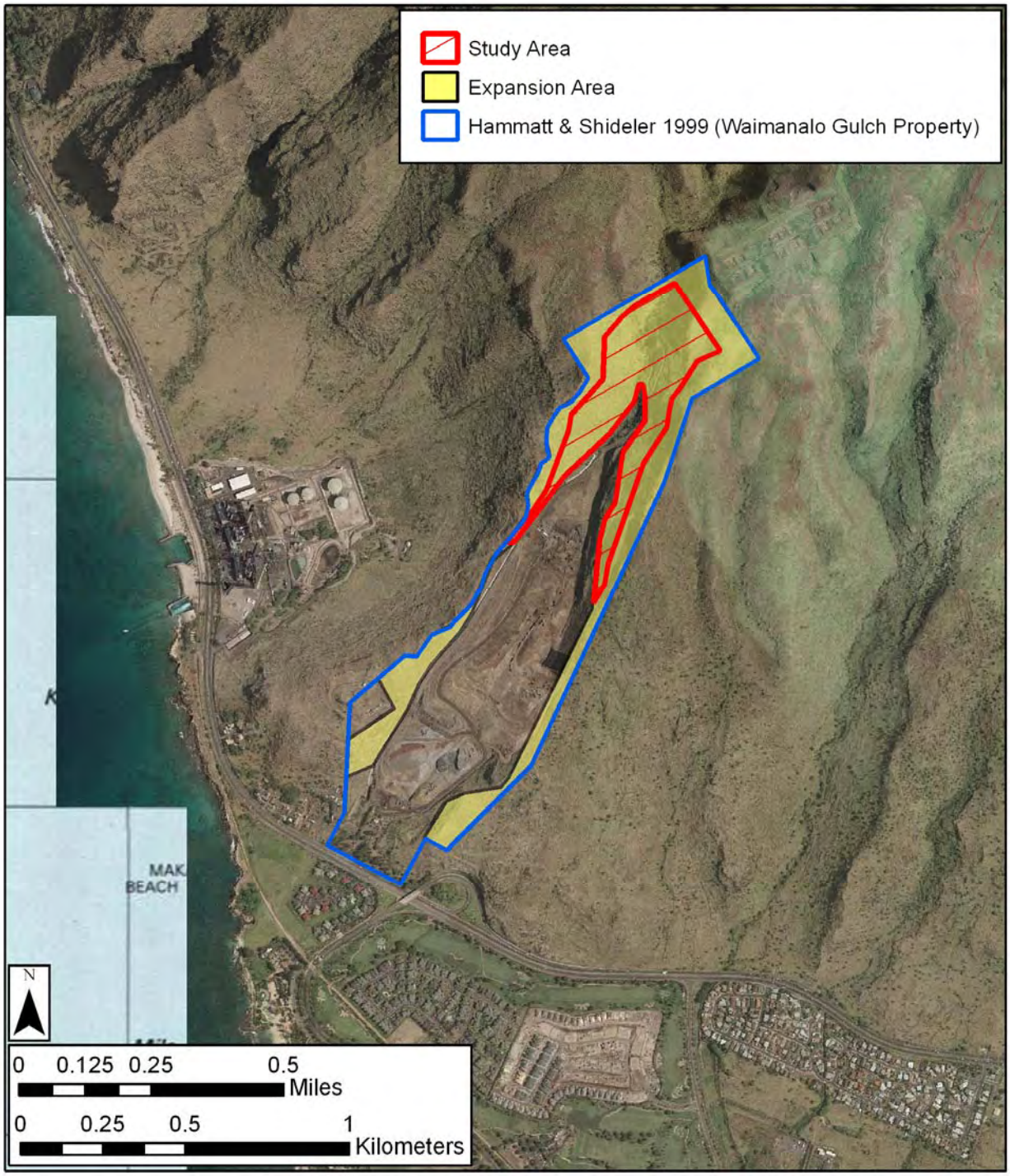

Figure 3. Aerial photograph showing the location of the Hammatt & Shideler (1999) study area, the Waimānalo Gulch Sanitary Landfill proposed expansion area, and the current study area (source: USGS Orthoimagery 2005)

of the entire 200-acre Waimānalo Gulch Landfill property (Hammatt and Shideler 1999). In early 2007, at the request of the project proponents, CSH completed additional AIS investigation, including systematic pedestrian inspection and limited subsurface testing, of a 36-acre portion of the overall approximately 90-acre landfill expansion APE (see Figure 1, Figure 2, & Figure 3). This 36-acre area represents the core of the expansion area (located within TMK: [1] 9-2-003: 073, refer to Figure 1). This 36-acre portion of the overall approximately 90-acre APE is defined as the study area for the current AIS investigation. Through the combined effort of the earlier AIS investigation of entire 200-acre Waimanalo Gulch Landfill property (Hammatt and Shideler 1999) and the current AIS investigation of the 36-acre study area, 100 percent of the project APE was subjected to systematic pedestrian inspection, with limited subsurface testing where appropriate.

1.2 Scope of Work

The archaeological inventory survey and its accompanying report document all historic properties within the project’s APE. The following scope of work satisfies State and County requirements for an archaeological inventory survey [per HAR 13-13-276]:

1. A complete ground survey of the entire project area for the purpose of site inventory was completed. All sites were located, described, and mapped with evaluation of function, interrelationships, and significance. Documentation included photographs and scale drawings of selected sites and complexes. All sites were assigned State Inventory of Historic Properties (SIHP) numbers.
2. Limited subsurface testing was conducted to determine if subsurface deposits were located in the project area (particularly in potential archaeological sites).
3. Research on historic and archaeological background, including search of historic maps, written records, and Land Commission Award documents. This research focused on the specific area with general background on the *ahupua‘a* and district and emphasized settlement patterns.
4. As appropriate, consultation with knowledgeable individuals regarding the project area’s history, past land use, and the function and age of the historic properties documented within the project area.
5. Preparation of this inventory survey report included the following:
   a) A project description;
   b) A section of a USGS topographic map showing the project area boundaries and the location of all recorded historic properties;
   c) Historical and archaeological background sections summarizing prehistoric and historic land use of the project area and its vicinity;
   d) Descriptions of all historic properties, including selected photographs, scale drawings, and discussions of age, function, laboratory results, and significance, per the requirements of HAR 13-276;

e) A section concerning cultural consultations [per the requirements of HAR 13-276-5(g) and HAR 13-275/284-8(a)(2)].

f) A summary of historic property categories, integrity, and significance based upon the Hawai‘i Register of Historic Places criteria;

g) A project effect recommendation;

h) Treatment recommendations to mitigate the project’s adverse effect on any historic properties identified in the project area that are recommended eligible to the Hawai‘i Register of Historic Places.

This scope of work included coordination with the State Historic Preservation Division (SHPD), and County relating to archaeological matters.

1.3 Environmental Setting

1.3.1 Natural Environment

The proposed Waimānalo Gulch Landfill expansion area is located within Waimānalo Gulch, in the southern foothills of the Wai‘anae Mountain range. The proposed expansion area is located approximately 400 to 970 meters east of the coastline. Elevations within the proposed expansion area range from approximately 90 to 1000 ft AMSL. Lands within the proposed expansion area generally consist of steep sloping gulch walls, with a dry stream channel at the base of the gulch. The stream channel is understood to only have running water during periods of heavy rainfall, which are relatively uncommon in dry leeward O‘ahu. The proposed expansion area receives an average of approximately 600-700 mm (24-28 in.) of annual rainfall (Giambelluca et al. 1986).

Soils within the study area consist entirely of Rock Land (rRK) (Foote et al. 1972) (Figure 4). Rock Land is described as “made up of areas where exposed rock covers 25 to 90 percent of the surface…rock outcrops and very shallow soils are the main characteristics” (Foote et al. 1972).

With regards to the vegetation Frierson (1972) suggests that prior to the introduction of exotic vegetation in 1790, the slopes of the Wai‘anae Range extending down to about 150 m (500 ft.) elevation supported a dry forest of native trees and shrubs between an upper *‘ōhi‘a* wet forest and lower grassy savannah area. Frierson (1972:4) summarizes the following patterns suggested by J.F. Rock (1913) for the indigenous vegetation in the area prior to 1778:

a) Lowland zone - open grassland on the leeward side

b) Lower Forest - beginning about 1000 feet and richer in species than the rainforest: *kukui*, *‘ōhi‘a ‘ai*, *koa*, *kalia*, sandalwood, *‘ōhi‘a lehua*, *hau*, *ti*, *ape*, *pia*, banana, ginger, birdnest fern and *honohono*, as well as grasses and cyperaceous plants.

c) Specifically leeward lower forest – *‘ohe*, *wiliwili*, *maile*, *halapepe* and *alani*, with almost no undergrowth.

Historical accounts presented by Frierson (1972) describe these lower forest species as extending to 500 feet, with the presence of sandalwood observed down to as low as 300 feet. The lower forest then is hypothesized to have covered much of the current landfill expansion area.

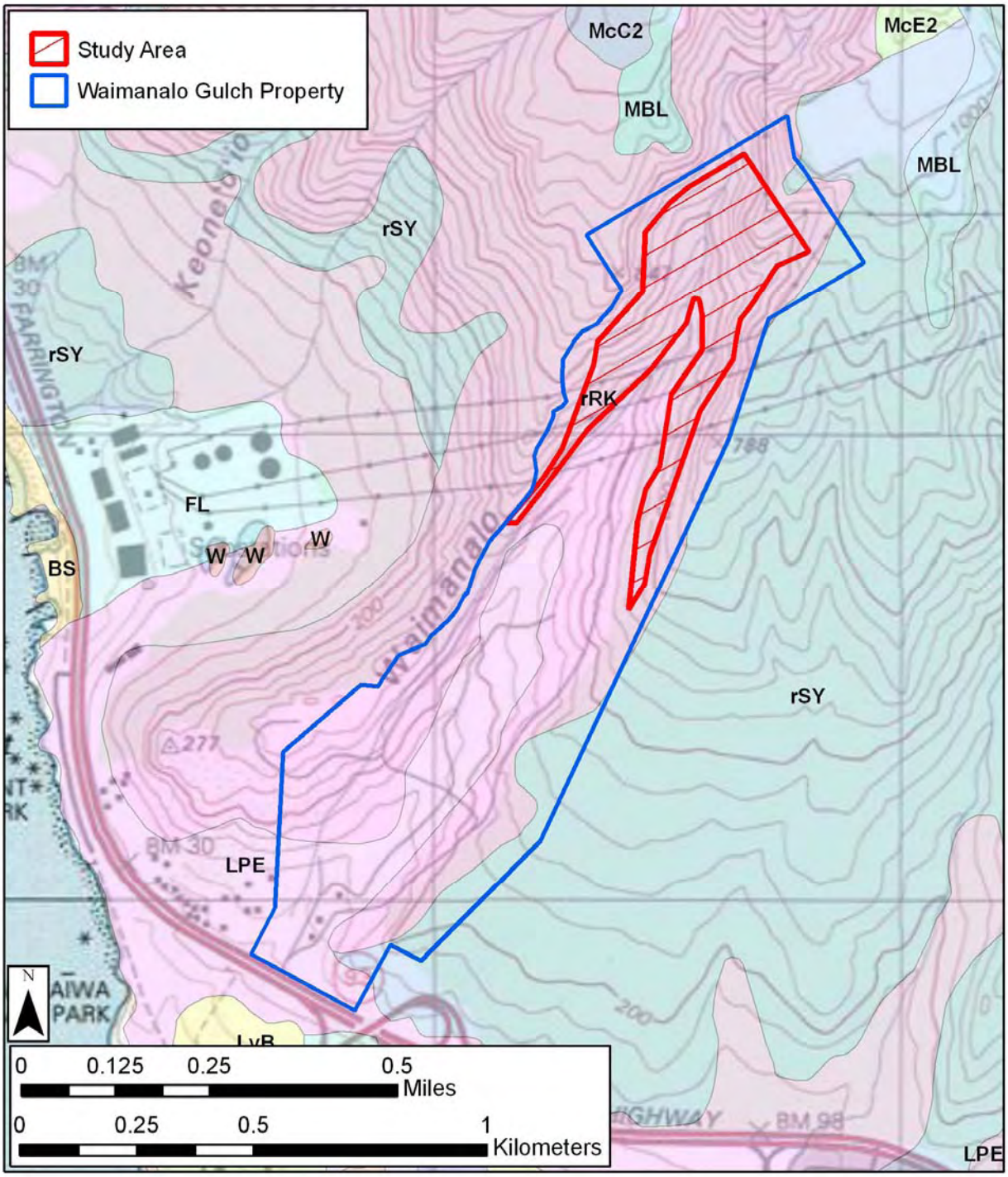

Figure 4. Overlay of Soil Survey of the State of Hawai‘i (Foote et al. 1972), indicating sediment types within the study area (source: Soils Survey Geographic Database [SSUGRO] 2001, U.S. Department of Agriculture)

This was always a rain shadow slope and we may more accurately envisage a park land community rather than a thick forest in early Hawaiian times. The current vegetation in the project area is comprised mostly of scattered *koa haole* and various grasses. As a result of a relatively recent wildfire, the grasses within the project area have grown dense and thick, covering about 90% of the ground surface, making ground surface observation difficult throughout the project area (Figure 5 and Figure 6).

1.3.2 Built Environment

Lands within the study area are currently undeveloped, with the exception of unpaved access roads. Lands within Waimānalo Gulch, immediately *makai* (southwest) of the study area consist of the active Waimānalo Gulch Sanitary Landfill, and include solid waste disposal sites and associated landfill infrastructure. *Makai* (southwest) of the landfill site is the Ko Olina Resort, including a golf course and residential subdivision. West of the landfill site are the Kahe Point Homes residential subdivision and the HECO Kahe Power Plant. Lands to the east and north of the Waimānalo Gulch landfill are the undeveloped Makaiwa Hills and Palehua areas.

The present state of the study area can be seen in Figure 5 and Figure 6.

Figure 5. Photograph showing the *makai* portion of the study area, view to southwest

Figure 6. Photograph showing the *mauka* portion of the study area, view to northeast

Section 2 Methods

2.1 Field Methods

Fieldwork was accomplished over a one-week period from January 25th to February 2nd, 2007. The CSH field crew consisted of Matt Bell, B.A., Amy Hammermiester, B.A., and Kevin Dalton, B.A., under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator). The field effort required 13 person-days to complete.

Fieldwork consisted of a 100% coverage pedestrian inspection of the study area and limited subsurface testing at select locations. The pedestrian inspection of the study area was accomplished through systematic sweeps (transects). The spacing interval between archaeologists was 5-10 meters. Cliffs and rock overhangs were inspected thoroughly for evidence of burials or cultural activity. All potential historic properties encountered were recorded and documented with a written field description, site map, photographs, and located utilizing the Global Positioning System technology utilizing a Garmin GPSmap76S unit (three to five meter horizontal accuracy) or a Trimble PRO XR GPS (submeter horizontal accuracy).

Subsurface testing consisted of the partial excavation, by hand, of selected natural features located during the pedestrian survey. The purpose of the subsurface testing was to aid in determining if selected geological features (i.e. rock shelters, rock mounds, etc.) had been culturally modified or contained subsurface cultural deposits. All excavated material was sifted through a 1/8 in. wire mesh screen to separate out the soil matrix. Each test excavation was documented with a scale section profile, photographs, and sediment descriptions. Sediment descriptions included characterizations of Munsell color, compactness, texture, structure, inclusions, cultural material present, and boundary distinctness and topography.

2.2 Document Review

Background research included a review of previous archaeological studies on file at the State Historic Preservation Division (SHPD) of the Department of Land and Natural Resources (DLNR); a review of geology and cultural history documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Archives of the Bishop Museum; study of historic photographs at the Hawai‘i State Archives and the Archives of the Bishop Museum; and a study of historic maps at the Survey Office of the DLNR. Information on LCAs was accessed through Waihona ‘Āina Corporation’s Māhele Data Base (www.waihona.com).

This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources studied were used to formulate a predictive model regarding the expected type and location of sub-surface pre and post-contact historic properties in the project area.

2.3 Consultation

For the project’s archeological inventory survey consultation effort, carried out pursuant to the requirements of HAR 13-276-5(g) and HAR 13-275/284-8(a)(2), CSH worked with the

Office of Hawaiian Affairs (OHA), SHPD, and knowledgeable cultural consultants. This effort is dove-tailed with the cultural consultation effort currently underway for the project’s cultural impact assessment, which CSH is also preparing pursuant to HRS Chapter 343 and the Office of Environmental Quality Control’s guidelines for assessing cultural impacts. Table 1 summarizes the individuals and organizations/agencies that have been consulted.

Table 1. Cultural and/or Agency Consultants

Name	Affiliation
Ailā , William	Hui Malāma I Nā Kūpuna
Amaral, Annelle	‘Ahahui Siwila Hawai‘i O Kapolei Hawaiian Civic Club
Cope, Aggie	Hale O Na‘auao Society
Desoto, Frenchy	Wai‘anae Coast Archaeological Preservation Representative
Davan, Teresa	O‘ahu Island Archaeologist, SHPD
Eaton, Arline	*Kupuna* at Iroquois Elementary School
Enos, Eric	Cultural practitioner and director of Ka‘ala Farms
Flanders, Judith	Granddaughter of Alice Kamōkila Campbell
Greenwood, Alice	O’ahu Island Burial Council Member, Wai‘anae District
Ho‘ohuli, “Black” Jo	Wai‘anae Neighborhood Board No 24
Rezentes, Cynthia	Wai‘anae Neighborhood Board No 24
Johnson, Adam	Former O‘ahu Island Archaeologist, SHPD
Johnson, Rubellite	Hawaiian scholar
Josephides, Analu	O‘ahu Island Burial Council Member, Wai‘anae District
Kanahele, Kamaki	President of Nānākuli Homestead Association
Kane, Shad	Member of the Makakilo, Kapolei, Honokai Hale Neighborhood Board and ‘Ahahui Siwila Hawai’i O Kapolei Hawaiian Civic Club
Kila, Glenn	Koa Mana
Makaiwi, Martha	Makakilo, Kapolei, Honokai Hale Neighborhood Board No. 34
McKeaque, Kawika	O‘ahu Island Burial Council member ‘Ewa District
Momoa, Joseph	*Kama‘āina* of Nānākuli and member of Kamo‘i Canoe Club
Morawski, Lauren	O’ahu Island Archaeologist, SHPD
Nāmu‘o, Clyde	Administrator at Office of Hawaiian Affairs
Paik, Kaleo	Culture and Historic Branch, SHPD
Philpotts, McD	Cultural practitioner and long time resident of Waimānalo ‘Ili
Silva, Alika	Koa Mana

Name	Affiliation
Tiffany, Nettie	Kahu of Lanikūhonua and Former O‘ahu Island Burial Council member, ‘Ewa District
Timson, Maeda	Member of the Makakilo, Kapolei, Honokai Hale Neighborhood Board No. 34 and President of Ua Au O Kapolei

This consultation effort has included written consultation letters, which were sent via email and U. S. post. These consultation letters were followed up with telephone communication. Additionally, project-related cultural consultation included several on-site meetings that included SHPD personnel (Mr. Adam Johnson, Ms. Teresa Davan, Ms. Linda Kaleo Paik, and Ms. Lauren Morawski), as well as knowledgeable cultural consultants, including Mr. McD Philpotts, Mr. Alika Silva, Mr. Glen Kila, Mr. Shad Kane, Mr. William Ailā, and Mr. Eric Enos. Through this consultation CSH has sought the opinions of cultural consultants regarding the age, function, cultural affiliation, and significance of the single historic property documented within the project’s APE. Potential historic property mitigation measures, including preservation in place and relocation, were discussed with these cultural consultants during the on-site meetings.

Section 3 Background Research

3.1 Traditional and Historical Background

3.1.1 Historical Setting

Waimānalo Gulch is located in the western portion of Honouliuli Ahupua‘a, within the ‘Ewa District of Leeward O‘ahu (Figure 7). Honouliuli Ahupua‘a is the largest traditional land unit on O‘ahu, extending from the West Loch of Pearl Harbor in the east, to the border of Nānākuli Ahupua‘a at Pili o Kahe in the west. Honouliuli Ahupua‘a includes approximately 19 km (12 mi.) of open coastline from One‘ula westward to Pili o Kahe. The *ahupua‘a* extends *mauka* (almost pie-shaped) from West Loch nearly to Schofield Barracks in Wahiawā; the western boundary is the Wai‘anae Mountain crest running north as far as Pu‘u Hapapa (or to the top of Ka‘ala Mountain according to some).

Within Honouliuli Ahupua‘a, not only is there a long coastline fronting the normally calm waters of leeward O‘ahu, but there is also four miles of waterfront along the west side of West Loch of Pearl Harbor. The land immediately *mauka* of the coast consists of a flat, karstic raised limestone reef, forming a level nearly featureless "desert" plain marked in pre-contact times by a thin or non-existent soil mantle. The micro-topography is notable in containing countless sinkholes caused by chemical weathering (dissolution) of the limestone shelf. Proceeding *mauka* from this limestone plain, the shelf is overlain by alluvium deposited through a series of gulches draining the Wai‘anae Mountains. The largest of these is Honouliuli Gulch, located in eastern Honouliuli, which empties into the West Loch of Pearl Harbor. To the west are fairly steep gradient gulches forming a more linear than dendritic drainage pattern. The major gulches are, from east to west: Kalo‘i, Makakilo, Awanui, Pālailai, Makaīwa, Waimānalo, and Limaloa. These gulches are steep-sided in the uplands and generally of a high gradient until they emerge onto the flat ‘Ewa plain. The alluvium they have carried has spread out in delta fashion over the *mauka* portions of the plain, which comprises a dramatic depositional environment at the stream gradient change. These gulches are generally dry, but during seasonal Kona storms carry immense quantities of runoff onto the plain and into the ocean. As typical drainages in arid slopes they are either raging uncontrollably or are dry, and as such do not form stable water sources for traditional agriculture in their upper reaches. The western Honouliuli gulches, in contrast to those draining into Pearl Harbor to the east, do not have valleys suitable for extensive irrigated agriculture. However, this lack is more than compensated by the rich watered lowlands of the base of Honouliuli Gulch (the *‘ili* of Honouliuli).

Honouliuli Ahupua‘a, as a traditional land unit, had tremendous and varied resources available for exploitation by early Hawaiians. The “karstic desert” and marginal characterization of the limestone plain, which is the most readily visible terrain, does not do justice to the *ahupua‘a* as a whole. The richness of this land unit is marked by the following available resources:

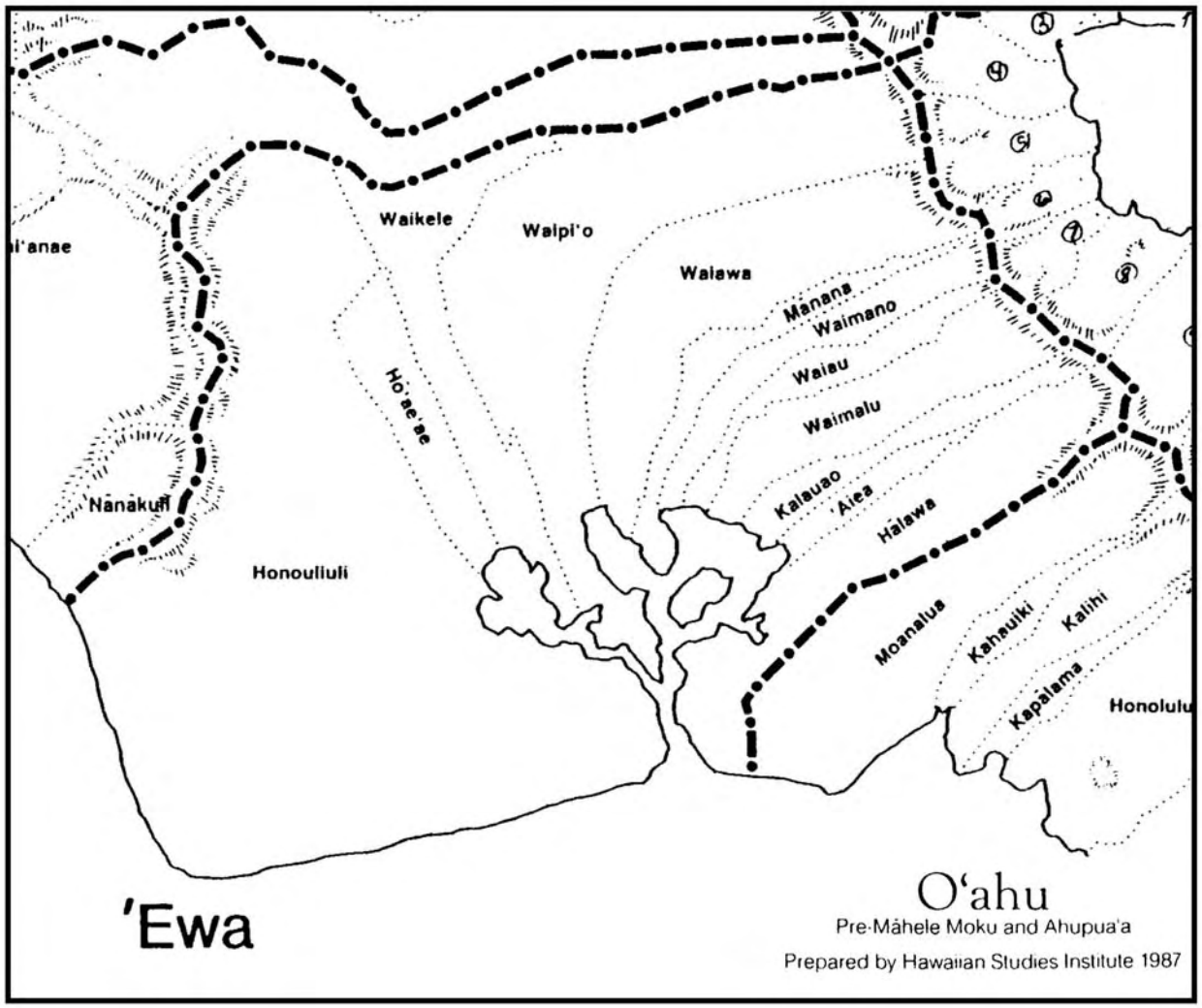

Figure 7. Portion of Hawaiian Studies Institute (1987) map of O‘ahu, showing pre-Māhele *moku* (district) and *ahupua‘a* boundaries

1. 12 miles of coastline with continuous shallow fringing reef, which offered rich marine resources.

2. Four miles of frontage on the waters of West Loch that offered extensive fisheries (mullet, *awa*, shellfish) as well as frontage suitable for development of fishponds (for example, Laulaunui).

3. The lower potion of Honouliuli Gulch in the ‘Ewa plain offered rich level alluvial soils with plentiful water for irrigation from the stream as well as abundant springs. This irrigable land would have stretched well up the valley.

4. A broad limestone plain which, because of innumerable limestone sinkholes, offered a nesting home for a large population of avifauna. This resource may have been one of the early attractions to human settlement.

5. An extensive upland forest zone extending as much as 12 miles inland from the edge of the coastal plain. As Handy and Handy (1972:469) have pointed out, the forest was much more distant from the lowlands here than on the windward coast, but it was much more extensive. Much of the upper reaches of the *ahupua‘a* would have had species-diverse forest with *kukui*, *‘ōhia*, *‘iliahi* (sandalwood), *hau*, *ti*, banana, etc.

The political and cultural center of the Honouliuli Ahupua‘a is understood to have been the relatively dense settlement and rich lands for irrigated taro cultivation at the *‘ili* of Honouliuli located where Honouliuli Stream empties into the north portion of West Loch. The name of the *ahupua‘a*, translated as “dark bay” (Pukui et al. 1974:51) may refer to the nature of the waters of West Loch at the mouth of Honouliuli Stream. Early accounts and maps indicate a large settlement at the *‘ili* of Honouliuli and it may well be that the political power of this village was so great that it was able to extend its jurisdiction well to the northwest into an area which might have been anticipated to fall under the dominion of the Wai‘anae ruling chiefs.

3.1.2 Mythological and Traditional Accounts

The traditions of Honouliuli Ahupua‘a have been complied and summarized numerous times, in studies by Sterling and Summers (1978), Hammatt and Folk (1981), Kelly (1991), Charvet-Pond and Davis (1992), Maly and Rosendahl (1993), and Tuggle & Tuggle (1997). Some of the themes of these traditions, include connections with Kahiki (the traditional homeland of Hawaiians, probably in reference to central Polynesia) and the special character and relationship of the places known as Pu‘uokapolei and Kualaka‘i (near Barbers Point).

Connections with Kahiki are found in numerous place names, traditional events, and with the beings associated with Honouliuli. There are several versions of Kaha‘i leaving from Kalaeloa for a trip to Kahiki to bring breadfruit back to ‘Ewa (e.g. Kamakau 1991:110). There are several stories that associate places in the region with Kamapua‘a and the Hina family, as well as with Pele’s sisters, all of whom have strong connections with Kahiki (cf. Kamakau 1961:111; Pukui et al. 1974:200).

Pu‘uokapolei was one of the most sacred places in Honouliuli (cf Sterling and Summers 1978:33). Pu‘uokapolei’s connections with Kahiki are emphasized when it is noted that the hill was the home of Kamapua‘a’s grandmother, Kamaunuaniho, the Kahiki ancestor to the people of O‘ahu (Fornander 1916-20, V:318; Kahiolo 1978:81, 107). By name, Kapolei is associated with the goddess Kapo, another connection with the Pele and Kamapua‘a stories (Kamakau 1976:14).

McAllister (1933:108) records that a *heiau*, or temple, was located on Pu‘uokapolei, but was destroyed before his survey of the early 1930s. The *heiau* may have been associated with the sun (Fornander 1916-20, III:292). The hill was used as a point of solar reference or as a place where such observations were made. Pu‘uokapolei might have been understood as the gate of the setting sun. It is notable that the rising sun at the eastern gate of Kumukahi in Puna is associated with the Hawaiian goddess Kapo (Emerson 1978:41). There is little specific information for Pu‘uokapolei, but the place name itself (“hill of beloved Kapo”) is hard to ignore. It is mentioned in some cosmologies that Kū was the god of the rising sun, and Hina should be associated with the setting sun (Hina is the mother of Kamapua‘a). Fornander (1916-20, III; 292) states, Pu‘uokapolei may have been a jumping off place (also connected with the setting sun) and associated with the dead who roamed the adjacent Plain of Kaupe‘a.

Pu‘uokapolei was also the primary landmark for travelers between Pearl Harbor and the west O‘ahu coast, with a main trail running just inland of it (‘Ī‘ī 1959:27, 29; Figure 8). Pu‘uokapolei was probably the most common name used as a reference for the area of the ‘Ewa Plain in traditional Hawai‘i (cf. Fornander 1916-20, II: 318; E.M. Nakuina 1904, in Sterling and Summers 1978:34).

3.1.3 Early Historic Period

Although no specific documentation of pre-contact or early historic land use is known for the specific study area in Waimānalo Gulch, various Hawaiian legends and early historical accounts indicate that the *ahupua‘a* of Honouliuli was once widely inhabited by pre-contact Hawaiian populations, including the Hawaiian *ali‘i*. This substantial population is attributable for the most part to the plentiful marine and estuarine resources available at the coast, along which several sites interpreted as permanent habitations were located. Other attractive subsistence-related features of the *ahupua‘a* included irrigated lowlands suitable for wetland taro cultivation (Hammatt and Shideler 1990), as well as the lower forest area of the mountain slopes for the procurement of forest goods.

Exploitation of the forest resources along the slopes of the Wai‘anae Range - as suggested by E. S. and E.G. Handy - probably acted as a viable subsistence alternative during times of famine:

> ...The length or depth of the valleys and the gradual slope of the ridges made the inhabited lowlands much more distant from the *‘wao*, or upland jungle, than was the case on the windward coast. Yet the *‘wao* here was more extensive, giving greater opportunity to forage for wild foods during famine time. (Handy and Handy 1972:469-470)

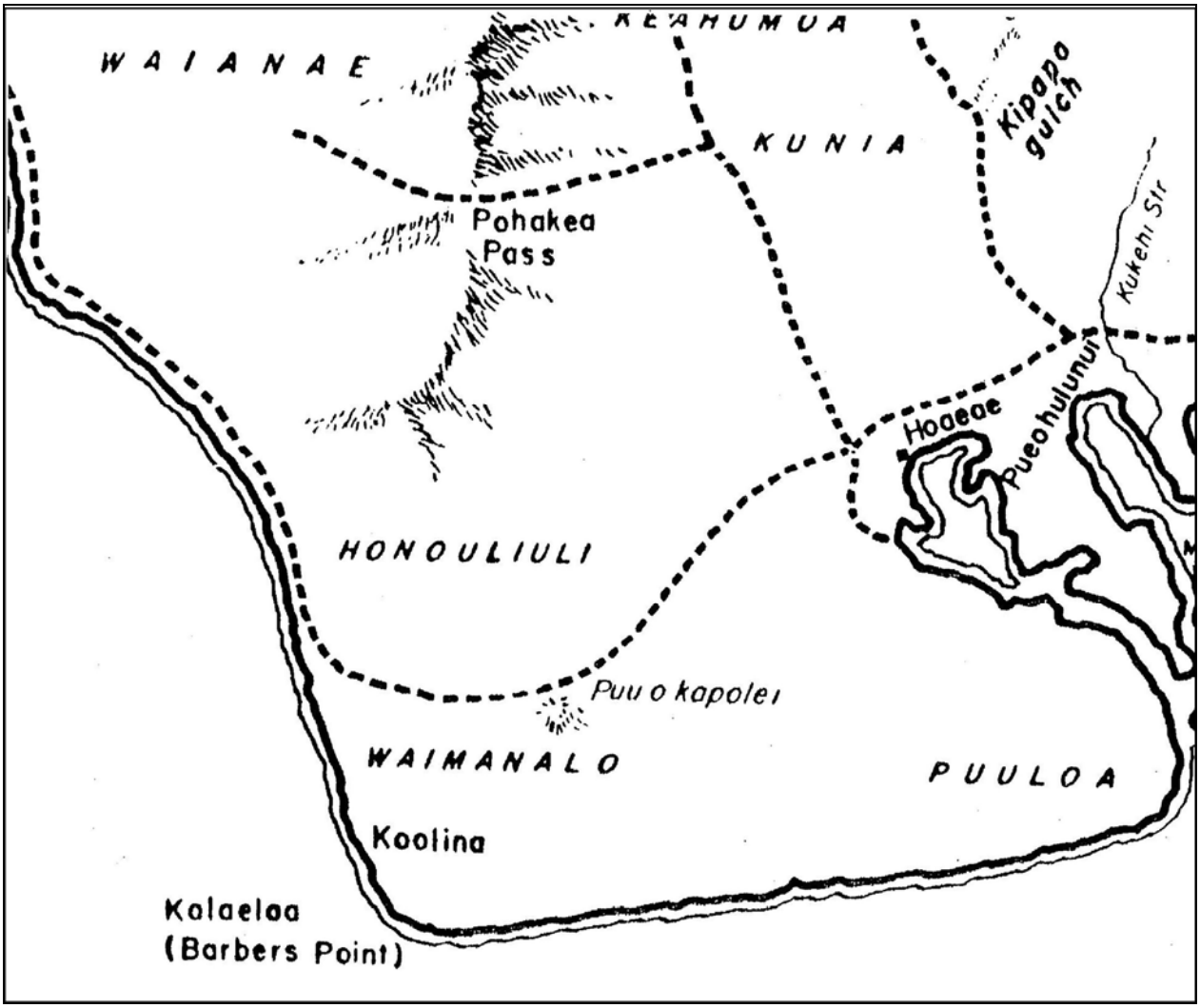

Figure 8. Trails of Leeward O‘ahu as Described by John Papa ‘Ī‘ī; Map by Paul Rockwood (‘Ī‘ī 1983:96)

These upper valley slopes may have also been a significant resource for opportunistic quarrying of basalt for the manufacturing of stone tools. This is evidenced in part by the existence of a probable quarrying site (50-80-12-4322) in Makaīwa Gulch at 152 m (500 ft.) elevation, east of the current project area (Hammatt et al. 1991).

The Hawaiian *ali‘i* were also attracted to the region. One historical account of particular interest refers to an *ali‘i* residing in Ko Olina, southwest of the current project area:

> Ko Olina is in Waimānalo near the boundary of ‘Ewa and Wai‘anae. This was a vacationing place for chief Kākuhihewa and the priest Napuaikamao was the caretaker of the place. Remember reader, this Ko Olina is not situated in the Waimānalo on the Ko‘olau side of the island but the Waimānalo in ‘Ewa. It is a lovely and delightful place and the chief, Kākuhihewa loved this home of his (Sterling and Summers 1978:41).

John Papa ‘Ī‘ī describes a network of Leeward O‘ahu trails (see Figure 8) which in later historic times encircled and crossed the Wai‘anae Range, allowing passage from West Loch to the Honouliuli lowlands, past Pu‘u Kapolei and Waimānalo Gulch to the Wai‘anae coast and onward circumscribing the shoreline of O‘ahu (‘Ī‘ī 1959:96-98). Following ‘Ī‘ī’s description, a portion of this trail network would have passed immediately *makai* (south) of the southern border of the Waimānalo Gulch property, roughly following the route of the present Farrington Highway.

‘Ī‘ī, who was born about 1800, also recounts an incident at Waimānalo that occurred when he was eight or nine years old. While the young ‘Ī‘ī was staying at Nānākuli, he learned:

> …of the burning of the houses in Waimanalo. The overseer in charge of the burning told [‘Ī‘ī and his relatives] that it was so ordered by the royal court because the people there had given shelter to the chiefess, Kuwahine, who ran away from her husband Kalanimoku after associating wrongfully with someone. Kuwahine was the daughter of the Kaikioewa who reared Kamehameha III in his infancy. She had run away because she had been beaten for her offense and for other reasons, too, perhaps. She had remained hidden for about four or five days before she was found. Here we see the sadness that befell the people through the fault of the chiefs. The punishment fell on others, though they were not to blame. (‘Ī‘ī 1959:29)

‘Ī‘ī’s sad account reveals that the coastal Waimānalo portion of Honouliuli Ahupua‘a continued to be inhabited during the first portion of the 19th century.

Other early historical accounts of the general region typically refer to the more populated areas of the ‘Ewa district, where missions and schools were established and subsistence resources were perceived to be greater. However, the presence of archaeological sites along the coral plains and coast of southwest Honouliuli Ahupua‘a, indicate that pre-contact and early post-contact populations also adapted to less inviting areas, despite the environmental hardships.

Subsequent to western contact in the area, the landscape of the ‘Ewa plains and Wai‘anae slopes was adversely affected by the removal of the sandalwood forest, and the introduction of domesticated animals and new vegetation species. Domesticated animals including goats, sheep

and cattle were brought to the Hawaiian Islands by Vancouver in the early 1790s, and allowed to graze freely about the land for some time after. L.A. Henke reports the existence of a longhorn cattle ranch in Wai‘anae by at least 1840 (in Frierson 1972:10). During this same time, perhaps as early as 1790, exotic vegetation species were introduced to the area. These typically included vegetation best suited to a terrain disturbed by the logging of sandalwood forest and eroded by animal grazing. The following dates of specific vegetation introduced to Hawai‘i are given by R. Smith and outlined by Frierson (1972:10-11):

1. “early,” c. 1790:

   Prickly pear cactus, *Opuntia tuna*
   Haole koa, *Leucaena leucocephala*
   Guava, *Psidium guajava*

2. 1835-1840:

   Burmuda [sic] grass, *Cynodon dactylon*
   Wire grass, *Eleusine indica*

3. 1858:

   Lantana, *Lantana camara*

The *kiawe* tree (*Prosopis pallida*) was also introduced during this period, either in 1828 or 1837 (Frierson 1972:11).

Intensive sandalwood harvesting, according to H. St. John (in Frierson 1972:7) occurred in the Hawaiian Islands between 1815-1830. As it is likely that sandalwood forests once occupied the lower, dry slopes of the Wai‘anae Range, the current project area was likely impacted by the cutting and burning of these forests.

3.1.4 Mid- to late-1800s

Associated with the Māhele of 1848, 99 individual land claims in the *ahupua‘a* of Honouliuli were registered and immediately awarded by King Kamehameha III. The vast majority of the Land Commission Awards (LCA) were located near the Pu‘uloa Salt Works and the taro lands of the *‘ili* of Honouliuli. The present study area appears to have been included in the largest award (Royal Patent 6071, LCA 11216, ‘Āpana 8) granted in Honouliuli Ahupua‘a to Miriam Ke‘ahi-Kuni Kekau‘ōnohi on January 1848 (Native Register). Kekau‘ōnohi acquired a deed to all unclaimed land within the *ahupua‘a*, including a total of 43,250 acres.

Kamaukau relates the following about Kekau‘ōnohi as a child:

> Kamehameha's granddaughter, Ke-ahi-Kuni Kekau-‘ōnohi...was also a tabu chiefess in whose presence the other chiefesses had to prostrate and uncover themselves, and Kamehameha would lie face upward while she sat on his chest. (in Hammatt and Shideler 1990:19-20)

Kekau‘ōnohi was one of Liholiho’s (Kamehameha II's) wives, and after his death, she lived with her half-brother, Luanu‘u Kahala‘i‘a, who was governor of Kaua‘i (Hammatt and Shideler

1990:20). Subsequently, Kekau‘ōnohi ran away with Queen Ka‘ahumanu’s stepson, Keli‘i-ahonui, and then became the wife of Chief Levi Ha‘alelea. Upon her death on June 2, 1851, all her property was passed on to her husband and his heirs. When Levi Ha‘alelea died the property went to his surviving wife, who in turn leased it to James Dowsett and John Meek in 1871 for stock running and grazing.

In 1877, James Campbell purchased most of Honouliuli Ahupua‘a for a total of $95,000. He then drove off 32,347 head of cattle belonging to Dowsett, Meek and James Robinson and constructed a fence around the outer boundary of his property (Bordner and Silva 1983:C-12). In 1879, Campbell brought in a well-driller from California to search the ‘Ewa plains for water, and a “vast pure water reserve” was discovered (Armstrong and Bier 1983). Following this discovery, plantation developers and ranchers drilled numerous wells in search of the valuable resource. By 1881, the Campbell property of Honouliuli prospered as a cattle ranch with “abundant pasturage of various kinds” (Briggs in Haun and Kelly 1984:45). Within 10 years of the first drilled well in ‘Ewa, the addition of a series of artesian wells throughout the island was supplying most of Honolulu’s water needs (Armstrong and Bier 1983).

In 1889, Campbell leased his property to Benjamin Dillingham, who subsequently formed the O‘ahu Railway & Land Co. (O.R. & L) in 1890. To attract business to his new railroad system, Dillingham subleased all land below 200 feet elevation to William Castle who in turn sublet the area to the ‘Ewa Plantation Company for sugar cane cultivation (Frierson 1972:15)(Figure 9). Dillingham’s Honouliuli lands above 200 feet elevation that were suitable for sugar cane cultivation were sublet to the O‘ahu Sugar Co. Throughout this time and continuing into modern times, cattle ranching continued in the area, and Honouliuli Ranch established by Dillingham was the "fattening" area for the other ranches (Frierson 1972:15).

‘Ewa Plantation Co. was incorporated in 1890 and continued in full operation up into modern times (Figure 9). The plantation grew quickly with the abundant artesian water. As a means to generate soil deposition on the coral plain and increase arable land in the lowlands, the ‘Ewa Plantation Co. installed ditches running from the lower slopes of the mountain range to the lowlands and then plowed the slopes vertically just before the rainy season to induce erosion (Frierson 1972:17).

The O‘ahu Sugar Co. was incorporated in 1897, and included lands in the foothills above the ‘Ewa plain and Pearl Harbor. Prior to commercial sugar cultivation, the lands occupied by the O‘ahu Sugar Co. were described as being “of near desert proportion until water was supplied from drilled artesian wells and the Waiāhole Water project” (Conde and Best 1973:313). The O‘ahu Sugar Co. took control over the ‘Ewa Plantation lands in 1970 and continued operations into the 1990s.

Dillingham’s *mauka* lands in western Honouliuli that were unsuitable for commercial sugar production remained pasture for grazing livestock. From 1890 to 1892, the Ranch Department of the O.R. & L. Co. desperately sought water for their herds of cattle by tapping plantation flumes and searching for alternative sources of water. Ida von Holt leaves this account of her husband Harry’s (Superintendent of the O.R. & L Ranch Dept.) search for water in the foothills of the Wai‘anae Range:

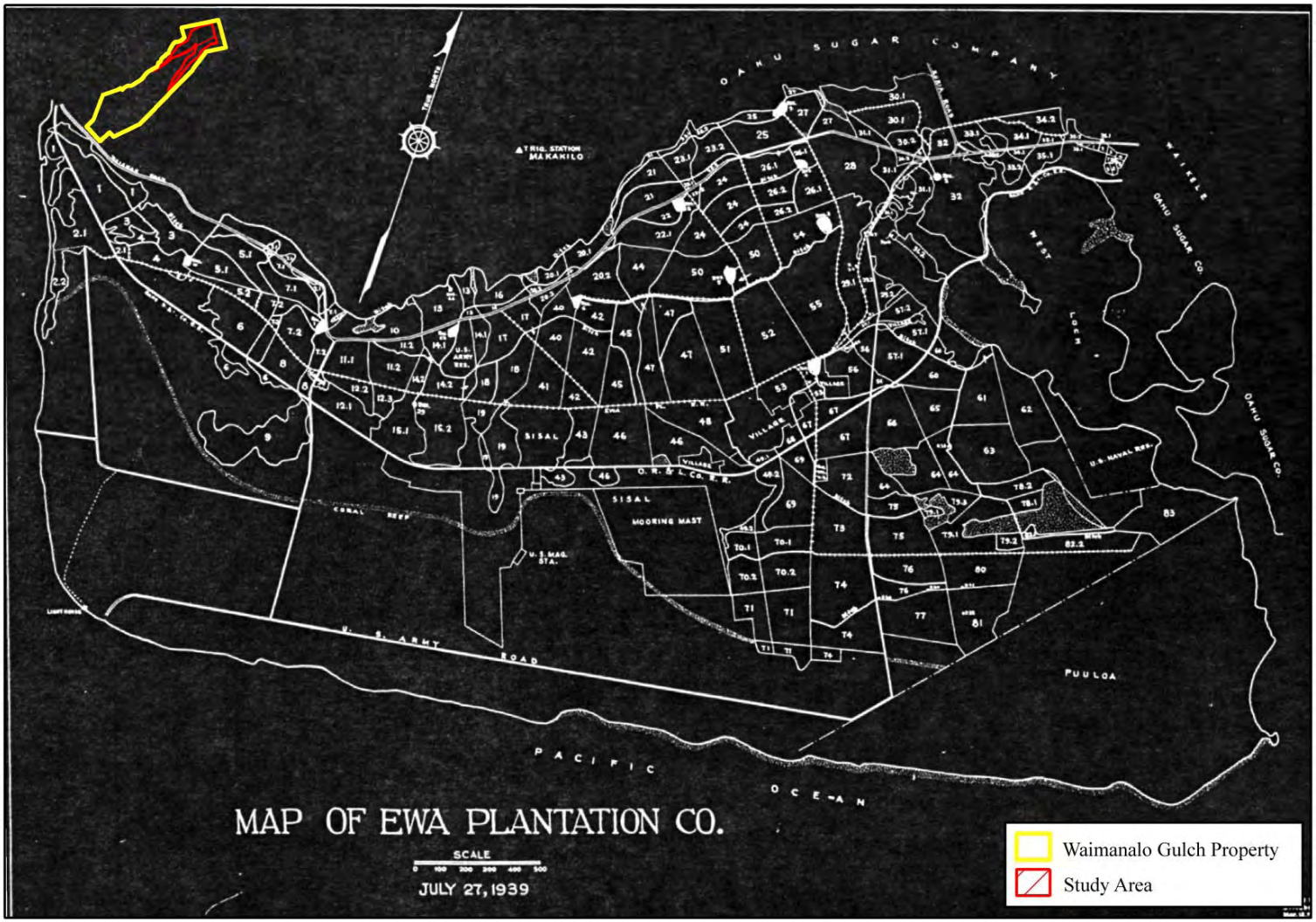

Figure 9. Map of ‘Ewa Plantation Co. (Conde and Best 1973:285), showing the extent of sugar cane cultivation in the vicinity of the study area.

> One of those places is on the old trail to Palehua, and had evidently been a place of which the Hawaiians had known, for its name is Kaloi (the taro patch), and even in dry weather water would be standing in the holes made by the cattle, as they tried to get a drop or two. (Von Holt 1985:136)

A second account is given of the discovery of spring water in an area over the ridge on the north side of Kalo‘i Gulch:

> Shouting to the men to come over with their picks and shovels, he [Harry von Holt] soon got them busy clearing away lots of small stones and earth. Almost at once they could see that there were evidences of a paved well, and at about three feet down they came upon a huge flat rock, as large around as two men could span with their arms. Digging the rock loose and lifting it to one side, what was their astonishment to find a clear bubbling spring! (Von Holt 1985:138).

Following the discovery, two old Hawaiians began to ask Von Holt about the spring:

> Finally he [Harry von Holt] got them to explain that the spring, called “Waihuna” (Hidden Spring) had been one of the principal sources of water for all that country, which was quite heavily populated before the smallpox epidemic of 1840…A powerful Kahuna living at the spring had hidden it before he died of the smallpox, and had put a curse on the one who disturbed the stone, that he or she would surely die before a year was out. (Von Holt 1985:138-140)

3.1.5 1900s

By 1920, the lands of Honouliuli were used primarily for commercial sugar cane cultivation and ranching (Frierson 1972:18). Much of the *mauka* lands in western Honouliuli, including ridges and deep gulches, were unsuitable for commercial sugar cultivation and remained pasture for grazing livestock. Historic maps of the Waimānalo Gulch area indicate a lack of any significant development in the area into the 1940s (Figure 10, Figure 11, & Figure 12). Modest constructions in the area included the realignment of the “Waianae Road” (present Farrington Hwy.) to run along the *makai* (southern) edge of the Waimānalo Gulch property, and a road the top of the Kahe Point ridge, within the Waimānalo Gulch property.

In the late 1920s, the main residential communities were at the northeast edge of the ‘Ewa Plain. The largest community was still at Honouliuli village. ‘Ewa was primarily a plantation town, focused around the sugar mill, with a public school as well as a Japanese School. Additional settlement was in Waipahu, centered around the Waipahu sugar mill, operated by the O‘ahu Sugar Company.

Major land use changes came to western Honouliuli when the U.S. Military began development in the area. Long before the Japanese bombing of Pearl Harbor in December 1941, the U.S. military had initiated the Oahu Coast Defense Command, a series of coastal artillery batteries designed to assist in the defense of Pearl Harbor and to prevent invasion of O‘ahu. Military installations were constructed both near the coast, as well as in the foothills and upland areas. The following military installations were located in the general vicinity of the current study area. Barbers Point Military Reservation (a.k.a. Battery Barbers Point, 1937-1942),

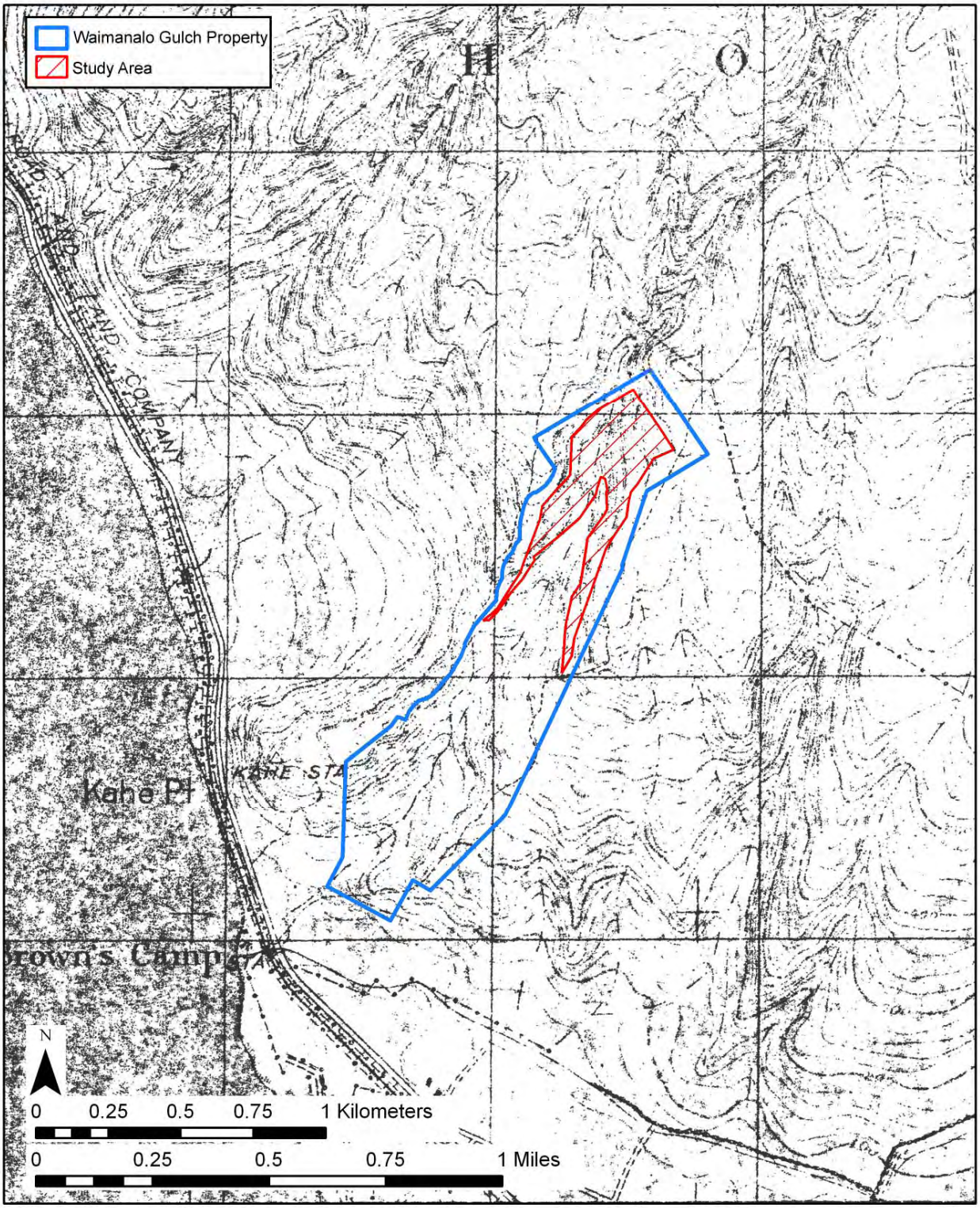

Figure 10. 1918 Fire Control Map, showing the location of the Waimānalo Gulch property and study area

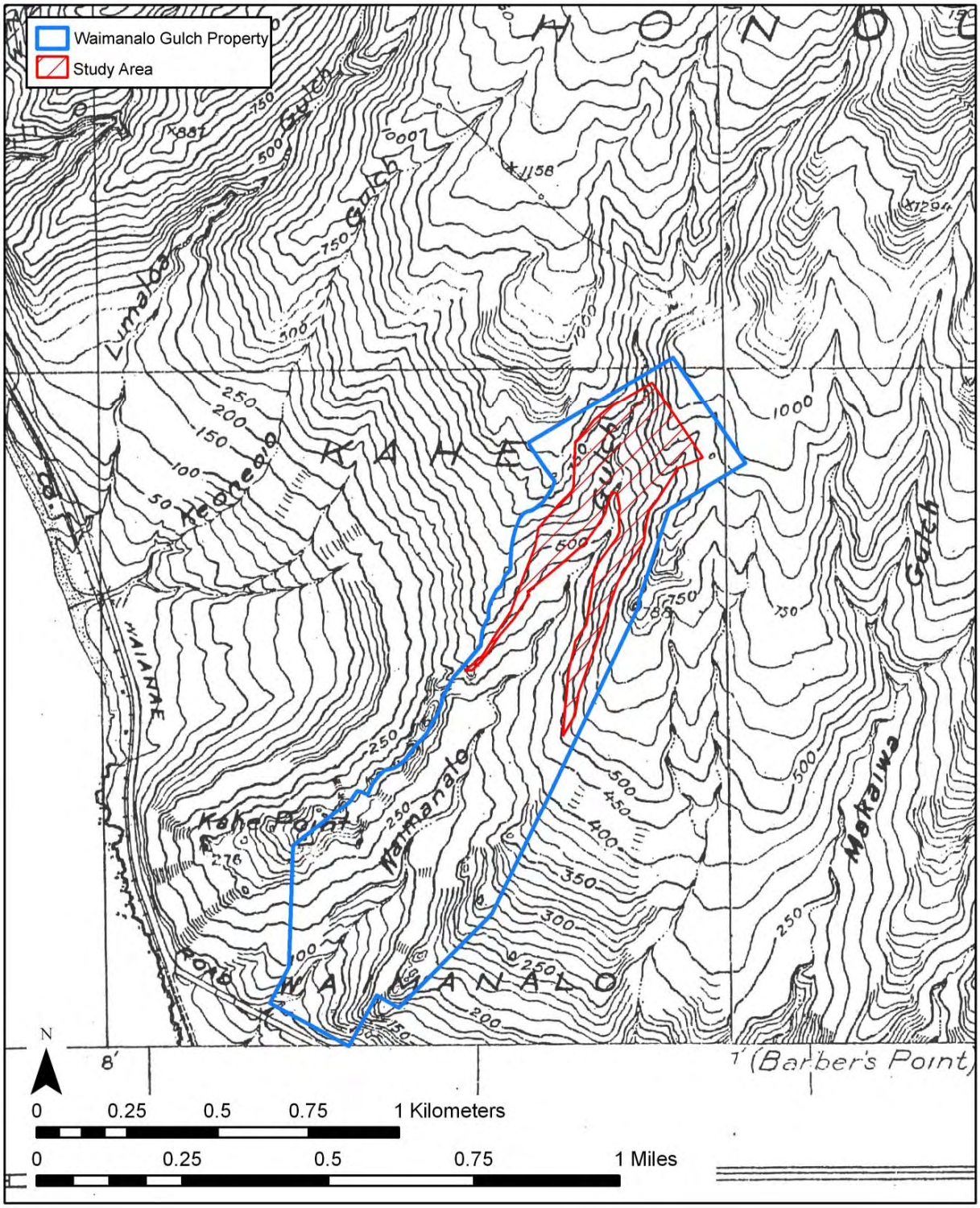

Figure 11. 1928 USGS Topographic Map, Wai‘anae Quad, showing the location of the Waimānalo Gulch property and the study area

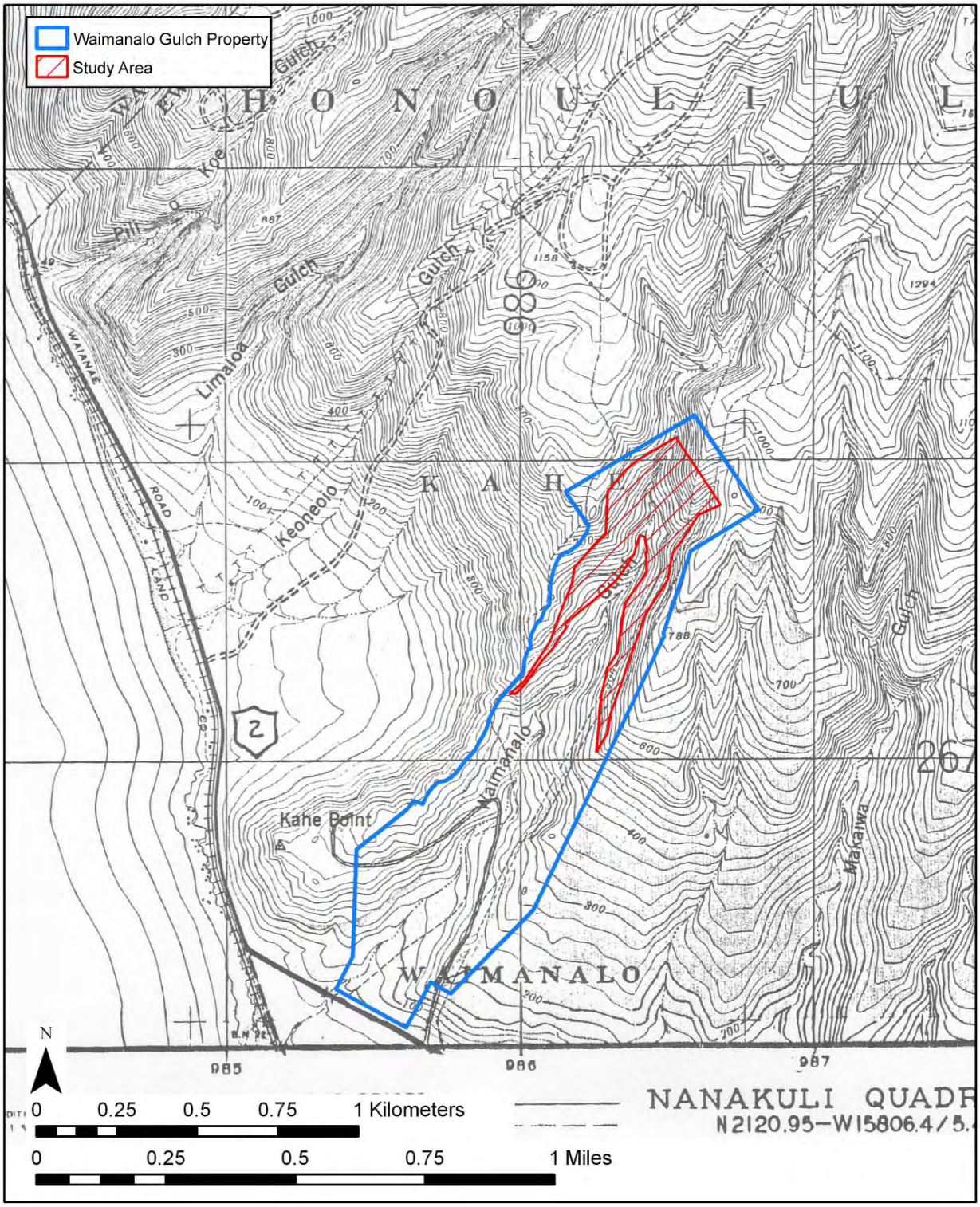

Figure 12. 1943 War Department Map, Nanakuli Quad, showing the location of the Waimānalo Gulch property and the study area

located at Barbers Point Beach, was used beginning in 1921 as a training area for firing 155 mm guns (Payette 2003). Camp Malakole Military Reservation (a.k.a. Honouliuli Military Reservation until 1941), located south of Barbers Point Harbor, was used from 1939 as an anti-aircraft artillery training firing point (Payette 2003). Gilbert Military Reservation, located east of Barbers Point Harbor, was used from 1922-1944 as a railway battery firing position (Payette 2003). Brown’s Camp Military Reservation (a.k.a. Brown’s Camp Battery from 1937-1944 and Battery Awanui from 1940-1945), located near Kahe Point (Figure 13), was a railway battery firing position (Payette 2003). Fort Barrette (a.k.a. Kapolei Military Reservation and Battery Hatch), located atop Pu‘u Kapolei, was in use from 1931 to 1948 for housing four 3-inch anti-aircraft batteries (Payette 2003). In the 1950s, the site was used as a NIKE missile base. Palailai Military Reservation (a.k.a. Battery Palailai from 1942-1944), located atop Pu‘u Palailai, was used from the 1920s and included Fire Control Station “B” (Payette 2003). Barbers Point NAS, in operation from 1942 into the 1990s, was the largest and most significant base built in the area. It housed numerous naval and defense organizations, including maritime surveillance and anti-submarine warfare aircraft squadrons, a U.S. Coast Guard Air Station, and the U.S. Pacific Fleet.

3.1.6 Battery Arizona

On the southwest ridge above Waimānalo Gulch are the subterranean remnants of Battery Arizona, an ambitious World War II military project. The attack of December 7, 1941 impelled the construction of further defensive armament for portions of the O‘ahu coastline not protected by the existing batteries. Even the sunken ships at Pearl Harbor would be enlisted in O‘ahu’s defense. When, early in 1942, it was discovered that the two rear three-gun turrets of the U.S.S. Arizona were salvageable, an ambitious plan to mount them at two land installations on O‘ahu was set into motion. The two sites chosen were the tip of Mōkapu Peninsula at Kāne‘ohe Bay, designated Battery Pennsylvania, and Kahe Point above the Wai‘anae Coast, designated Battery Arizona.

Construction of Batteries Pennsylvania and Arizona commenced in April 1943. A formidable subterranean complex was contrived to house the turrets at the two sites. According to a U.S. Army Corps of Engineers report prepared in 1946:

> The design that was eventually produced consists of a central barbette well of concrete set in rock, having an overall depth of about 60 ft. and an inside diameter of about 24 ft., with three levels below the bottom of the turret connected by stairways. Two tunnels radiate from this well to house projectiles and powder magazines immediately adjacent to the well. Beyond and in line with the projectile magazine is a large power room for three 125 KW generators, all miscellaneous switchgear, air conditioning, and ventilating equipment. In a separate tunnel off the main tunnel in the vicinity of the powder room is a 10,000 gallon emergency water tank to maintain the battery for several days in case of siege. Beyond the power room in a separate leg of the tunnel are the operations rooms. Because during prolonged action it might be necessary for the entire battery personnel to remain in the battery and be self sustaining, these gas proofed and air conditioned operations rooms normally comprised of radio and

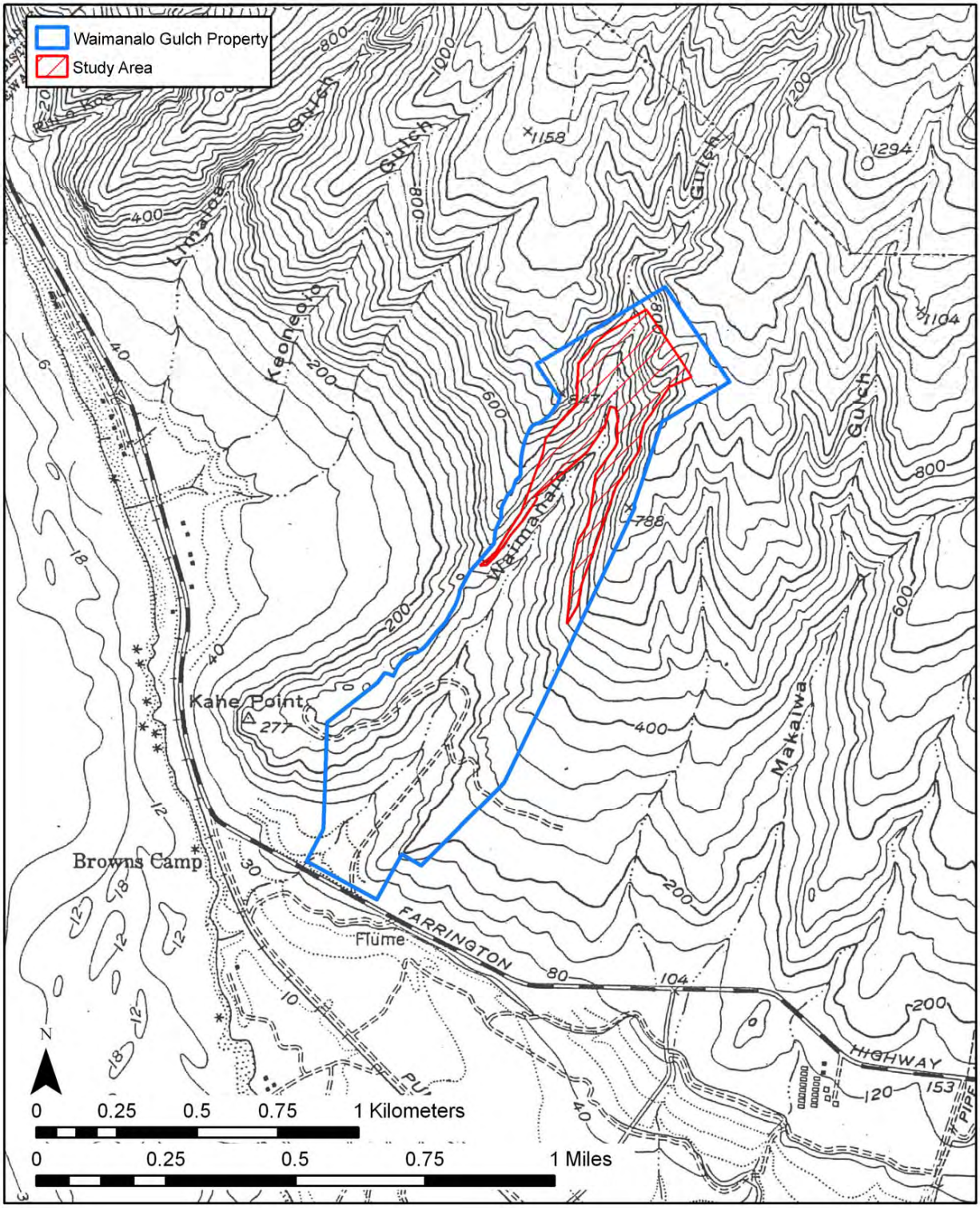

Figure 13. 1953 USGS Topographic Map, ‘Ewa Quad., showing the location of the Waimānalo Gulch property and the study area

> switchboard, plotting, and radar rooms included latrines for officers and enlisted men, a galley, first aid room, offices, and storerooms.

The salvaged turrets were stored at a facility on Pearl City Peninsula. Refurbishing of the turrets proved to be a formidable task:

> An immediate complication arose from the fact that removal of the turrets from the Arizona was begun prior to any thought of their reuse; hence, much of the cutting was done rapidly and crudely with no consideration for future reassembly. As a result, the reconstruction frequently was held up by the painstaking realignment and joining of turret segments. Other difficulties arose from the initial damage and subsequent immersion suffered by the armament components. (Kirchner and Lewis 1967:432)

Records in the archives of the U.S. Army Museum at Ft. DeRussy reveal the months' long search across the Mainland for replacement parts, especially motors, and for parts to adapt the turrets to installation on land. It was finally determined that, because they had been so long under water, every part of the turrets' operating systems had to be repaired or replaced.

Perhaps appropriately for the former battleship armaments, the turrets were transported to their respective battery sites by sea. According to the 1946 Army Corps of Engineers report:

> The heavy section of the turrets comprising three 14-inch guns were moved by barge from Pearl Harbor to beaches near the battery sites. Here they were cleaned, painted, and put into condition for installation in the barbette. Special equipment was designed at each site for raising the parts from the ground and lowering to their correct position in the barbette.

Construction of the two batteries continued through all of 1944 and into two-thirds of 1945. Problems--associated with wartime conditions and the unique engineering feat of adapting shipboard weaponry to land installation--dogged the two projects over the many months:

> This work involving repair, replacement, or remanufacture of thousands of separate parts placed great demands upon the Army and Navy ordnance facilities and workers. Often, drawings were not available for damaged or missing items, and a particular stage of reconstruction had to be awaited before such parts could be reproduced...In one instance, well over a year was required to procure a single turret turning gear worm and pinion.
>
> ...The various problems were further complicated by the sheer mass of the armament and the size of the battery structures...Special heavy equipment...had to be erected at each installation for raising the turret members from the shore and for assembling the armament at the site. Some segments had to be moved on rollers along specially constructed roads, while the 71-ton gun tubes were lifted by parkbuckles from the beaches to the emplacements high above.

> ...Site peculiarities placed severe restrictions upon the battery layouts. The fire-control radars, for example, because of their sensitivity to concussion, could not be near the turrets; yet the ideal positions for the radars both technically and topographically were but a few yards away...
>
> During late 1944, the battery construction reached a bottleneck stage when progress depended upon a few highly skilled technicians and the closely timed arrival of a few critical armament components. By Christmas, 1944, the number of personnel that could effectively work at the two installations was limited to about 35 specialists. At this time, Battery Pennsylvania’s turret was roughly half assembled, while Battery Arizona was even further behind. (Kirchner and Lewis 1967:432-433)

The slow pace of construction of the two batteries reflected a diminishing urgency for defense of O‘ahu and its military installations. The war front was moving west across the Pacific as successive defeats impelled Japan’s retreat. Battery Pennsylvania at Mōkapu Point was near completion in August 1945 when its guns were test fired around the same time of Japan’s surrender. Battery Arizona had not been completed by the war’s end; its guns, though installed, were never fired.

Neither of the two batteries was ever placed in operation during the post-war years. The batteries had been rendered obsolete “due to the development of air power, new assault techniques and nuclear weapons. The guns were scrapped in 1949...” (Bouthillier 1995: 12).

A 1943 War Department map (see Figure 12) indicates a road was constructed within the *makai* (southern) portion of Waimānalo Gulch, ascending the western slope to the top of the Kahe Point ridge. This road, along with several other roads and trails indicated on the map, were likely constructed in association with the Battery Arizona complex and other military installations and training areas in the vicinity.

3.1.7 1950s to Present

Waimānalo would once again play a role in the O‘ahu defense system when, sometime after 1959, the United States Army purchased or exchanged land with the Campbell Estate for the construction of a Nike-Hercules anti-aircraft missile base located at the head of Waimānalo Gulch (Figure 14). The Nike complex, in used between 1961 and 1968 consisted of two control sites and one double-sized launcher site (Murdock 2003). The tunnel complex of Battery Arizona was also used for civil defense circa 1960.

Development in the uplands of western Honouliuli have generally been limited to ranch related housing and infrastructure, military training and NIKE missile stations, as well as the construction of military and commercial communication and atmospheric observation stations on the ridges near Pālehua. In 1975, the U.S. Air Force constructed the Pālehua Solar Observatory with five solar optical telescopes. A circa 1980s aerial photograph (Figure 15) shows limited development in the vicinity of the Waimānalo Gulch landfill property.

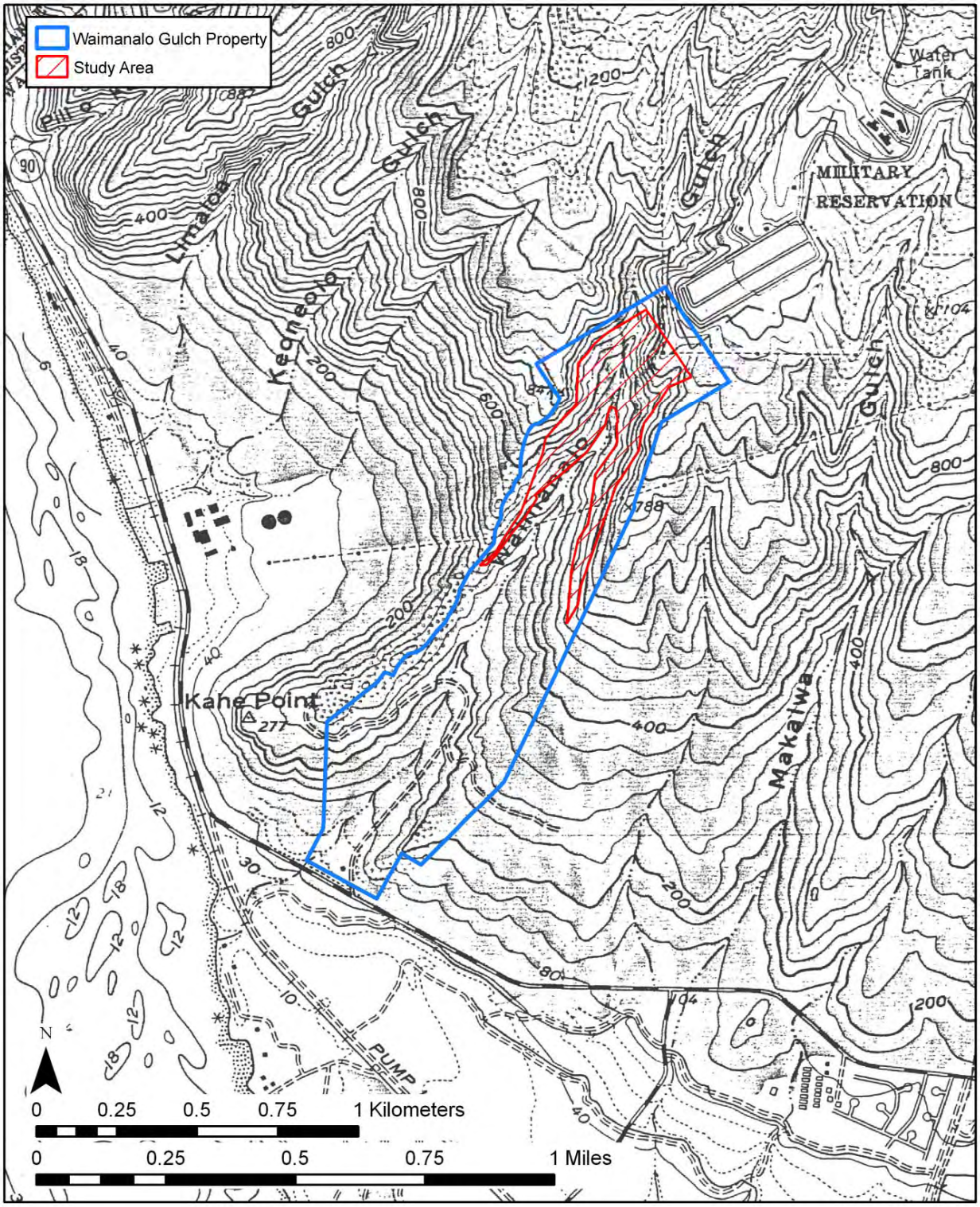

Figure 14. 1962 USGS Topographic Map, ‘Ewa Quad., showing the location of the Waimānalo Gulch property and the study area

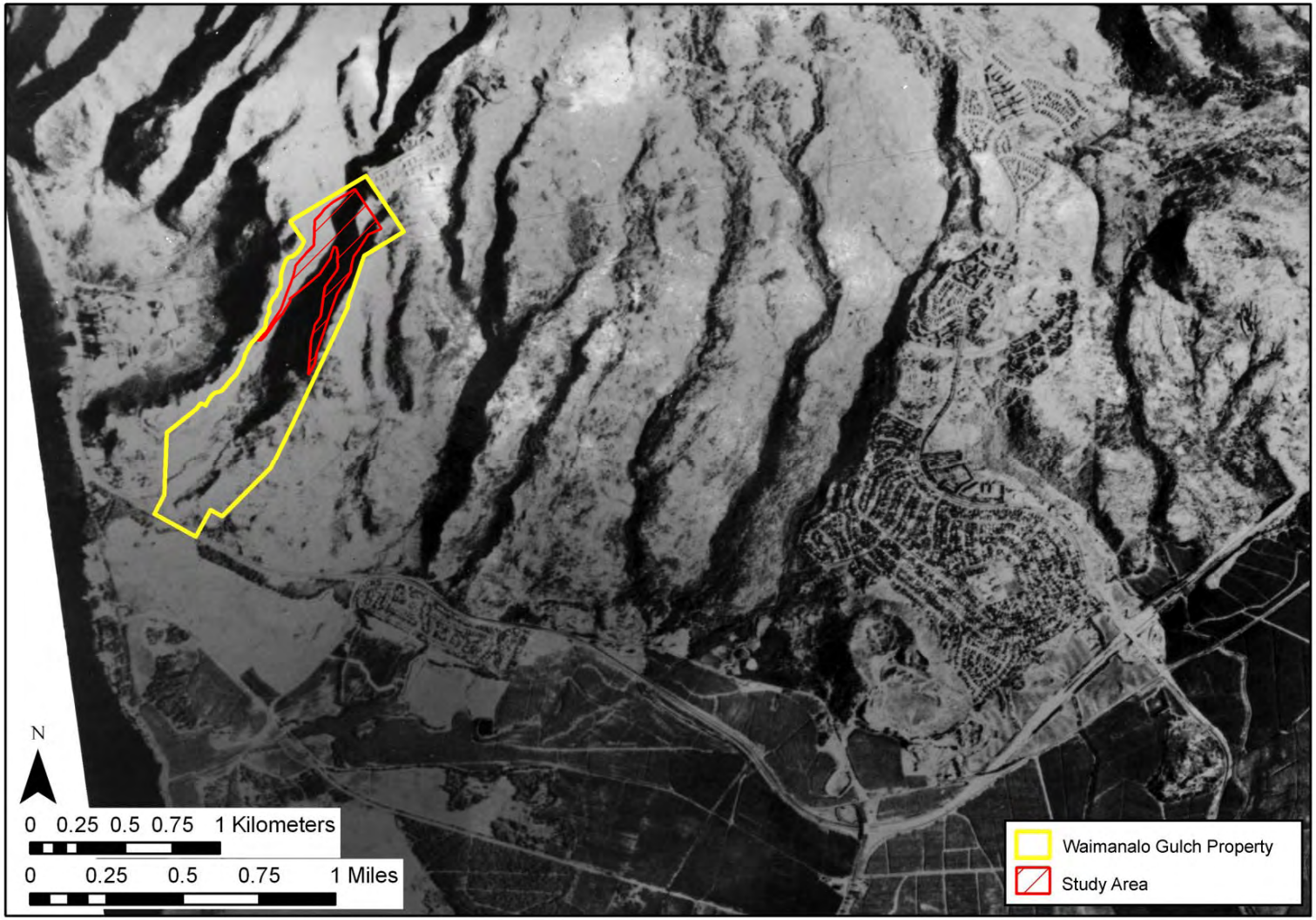

Figure 15. Circa 1980s aerial photograph of western Honouliuli, showing the location of the Waimānalo Gulch property and the study area

In 1985, the City and County of Honolulu condemned 81.5 acres of agricultural land in Waimānalo Gulch for use as a landfill to dispose of municipal refuse and ash from the H-POWER incinerator to be built nearby at Campbell Industrial Park. Work on the landfill began in 1987. In 1988, workers constructing the Waimānalo Gulch landfill were reporting strange incidents at the site. According to a newspaper article by Bob Krauss:

> “We’ve been having funny things happen,” said one of the men on the site. “Unnatural things. In one case, a man was standing on a flat rock and the thing threw him over. All of a sudden, it just flipped over.”
>
> Another time a backhoe was knocking down kiawe trees. The trees have shallow roots systems so they usually just fall down. But one of the trees jumped up and did a somersault...
>
> Then there was the payloader filling in a huge hole where a $17,000 fiberglass fuel tank had been placed. The story is that the driver put his machine in reverse but it jumped forward and leaped into the hole, smashing the tank (Honolulu Advertiser, 6/20/88:A-1, A-4).

Other incidents reported to Krauss were a truck that had flipped over, tools that had vanished, and a huge stone that had disappeared. The workers called in:

> a woman recommended for lifting curses and banishing evil spirits. She said the trouble was caused by a certain stone, the “chief of the valley,” which was lying on its side.
>
> The men quickly set the stone upright. But they got it upside down. Things went from bad to worse. The woman came out again and recommended they place the stone on the hill where it will not be covered by rubbish when the landfill opens(Honolulu Advertiser, 6/20/88:A-1, A-4).

According to Krauss, in April 1988, the stone was moved to a “nest of boulders so that it faces east,” at the “end of a Hawaiian Electric Co. Road to one of its relay stations on top of [a] hill.” This site lies close to the Battery Arizona bunkers in the southwest portion of the Waimānalo Gulch landfill property.

3.2 Previous Archaeological Research

The coral plains of ‘Ewa have been the focus of more than 50 archaeological studies over the last two decades, largely as the result of required compliance with county, state, and federal legislation. The Kalaeloa (Barber’s Point) area is one of the most studied places in Polynesia. In contrast, relatively little research has been conducted in the uplands of Honouliuli, along the southern slopes of the Wai‘anae Range. This discussion of previous archaeological research will focus on the results of this prior archaeological work at the southern end of the Wai‘anae range (Table 1).

Recent archaeological investigations in the southern Wai‘anae Range have generally been focused on deep gulch areas for potential landfill locations, lower slopes for residential development, and mountain peaks for antennae or satellite tracking infrastructure (Figure 16).

Table 1. Previous Archaeological Investigations in the in the Uplands of Honouliuli Ahupua‘a

Reference	Type of Investigation	General Location	Findings
Kelly 1959	Kū‘ula stone documentation	Along Pālehua Rd., TMK [1] 9-2-003: 002	One Kū‘ula stone documented (SIHP No. 50-80-08-2316).
Soehren 1964	House site documentation	Waimānalo Gulch, TMK [1] 9-2-003: 072	House site documented (SIHP No. 50-80-12-2317).
Bordner 1977a	Archaeological Reconnaissance	Proposed Makaīwa Gulch Landfill Site	No archaeological sites identified.
Bordner 1977b	Archaeological Reconnaissance	Proposed Kalo‘i Gulch Landfill Site	3 sites (-2600, -2601, -2602), low stacked boulder walls.
Bordner and Silva 1983	Archaeological Reconnaissance and Historical Documentation	Proposed Waimānalo Gulch Landfill Site	No archaeological sites identified.
Sinoto 1988	Archaeological Reconnaissance	Makakilo Golf Course	Low stacked boulder wall (-1975).
Bath 1989	Petroglyph Documentation	Waimānalo Gulch	3 petroglyphs (SIHP No. 50-80-12-4110).
Hammatt & Shideler 1989	Archaeological Reconnaissance	[1] 9-2-003: 027	One pre-Contact agricultural terrace observed.
Hammatt et al. 1991	Archaeological Inventory Survey	Makaīwa Hills Project Site, TMK: [1] 9-1-015: 005 & 017; 9-2-003: 002, 005, and 084.	34 sites, including prehistoric habitation and agricultural features, rock shelters, petroglyphs, *ahu*, and various sugar cane cultivation infrastructure.
Cleghorn & Anderson 1992	Archaeological Inventory Survey	Kahe Point “Tracks” Beach Park, TMK [1] 9-2-003: 26	Section of the previously recorded Oahu Railway and Land Company Right of Way (SIHP No. 50-80-12-9714) observed.

Reference	Type of Investigation	General Location	Findings
Hammatt 1992	Archaeological Inventory Survey	KAIM Radio Tower, Pālehua, TMK [1] 9-2-005: 013	No archaeological sites identified.
Nakamura et al. 1993	Archaeological Inventory Survey	Makakilo D and D-1 Development Parcels	Cement irrigation flume (-4664).
Borthwick & Hammatt 1997	Archaeological Assessment	Satellite Multi-Ranging Station, Pālehua, TMK: TMK: [1] 9-2-003: 002	No archaeological sites identified.
Dega et al. 1998	Archaeological Inventory Survey	UH West O‘ahu, TMK: [1] 9-2-002: 001 & [1] 9-2-002: 001	Two historic site complexes, (50-80-08-5593 historic irrigation system and 50-80-09-2268 Waiāhole Ditch System).
Hammatt and Shideler 1999	Archaeological Inventory Survey and Assessment	Waimānalo Gulch Sanitary Landfill Project Site	Battery Arizona Complex and modern “shrine” site.
Hammatt and Shideler 2001	Archaeological Assessment	TMK: TMK: 9-2-03: 084	No archaeological sites identified.
Monahan 2004	Archaeological Inventory Survey	TMK: 9-2-03: 002	4 historic properties associated with19th or 20th century commercial agriculture identified: SIHP No. 50-80-12-4341, water flume that is a component of the previously identified site by Hammatt et al. 1991; SIHP No. 50-80-12-6654, a stone ranch wall; SIHP No. 50-80-12-6655, a pair of concrete bridge supports; and SIHP No. 50-80-12-6656, low rock walls and rock stacking.

Reference	Type of Investigation	General Location	Findings
Tulchin, J and Hammatt 2004	Archaeological Field Inspection	Proposed HECO Meteorological Observation Stations	Three small stone features identified: an *ahu*, a stone terrace, and a small C-shape.
Tulchin, T. and Hammatt 2004a	Archaeological Inventory Survey	86-Acre Proposed Pālehua Community Association (PCA) Common Areas Parcels, Makakilo (TMK: 9-2-03: 78 por. and 79)	4 historic properties identified: a complex of concrete and iron structures associated with industrial rock quarry operations (Site 50-80-12-6680); three boulder mounds believed to be related to land clearing or ditch construction by the Oahu Sugar Co. (Site 50-80-12-6681); a small terrace believed to function as a historic water diversion feature (Site 50-80-12-6682); and a remnant portion of the Waiāhole Ditch (Site 50-80-09-2268).
Tulchin, T. and Hammatt 2004b	Archaeological Inventory Survey	Adjacent to Kahe Power Plant, TMK [1] 9-2-03: 027	A total of four archaeological sites (SIHP No. 50-80-12-6647, -6648, -6649, & -6650) comprising fifteen individual features were identified. Sites observed consisted of rock walls, mounds, and platforms. Site age ranged from historic to pre-Contact. Site function was determined to be predominantly agricultural in nature.
Hoffman et al. 2004	Archaeological Assessment	Adjacent to Kahe Power Plant, TMK [1] 9-2-03: 027	No historic properties identified.
Tulchin, T. and Hammatt 2005	Archaeological Inventory Survey	71-Acre Proposed Pālehua East B Project, Makakilo, (TMK: 9-2-03: 76 and 78)	Three historic properties identified: SIHP No. 50-80-12-6666 (pre-contact agricultural alignment and mound), SIHP No. -6667 (plantation-era stacked basalt boulder walls and a ditch), and SIHP No. -6668 (single alignment of upright basalt boulders and a small, low terrace).

Reference	Type of Investigation	General Location	Findings
O’Leary et al. 2007	Archaeological Inventory Survey Addendum	Makaīwa Hills Project Site, TMK: [1] 9-1-015: 005 & 017; 9-2-003: 002, 005, and 084.	Two historic properties identified: SIHP No. 50-80-12-6870, a terrace, three springs, and a small rock shelter; SIHP No. -6871, a paved area situated on a ridge top.
Tulchin & Hammatt 2007	Archaeological Field Inspection	TMK: [1] 9-2-003:002 por. and 005 por.	A total of 26 archaeological sites were identified. Archaeological features representing distinct periods of land use were observed, including: pre-contact indigenous Hawaiian habitation and associated agricultural and ceremonial features; historic ranching and related features; and historic quarrying and related features.
Tulchin & Hammatt 2008	Archaeological Field Inspection	TMK: [1] 9-2-003: 004, 009, 029, 084 por., & 085	Pedestrian inspection has confirmed the presence of 10 archaeological sites within the study area. Archaeological features representing distinct periods of land use were observed, including: pre-contact indigenous Hawaiian habitation; historic ranching; and historic railroad operations.

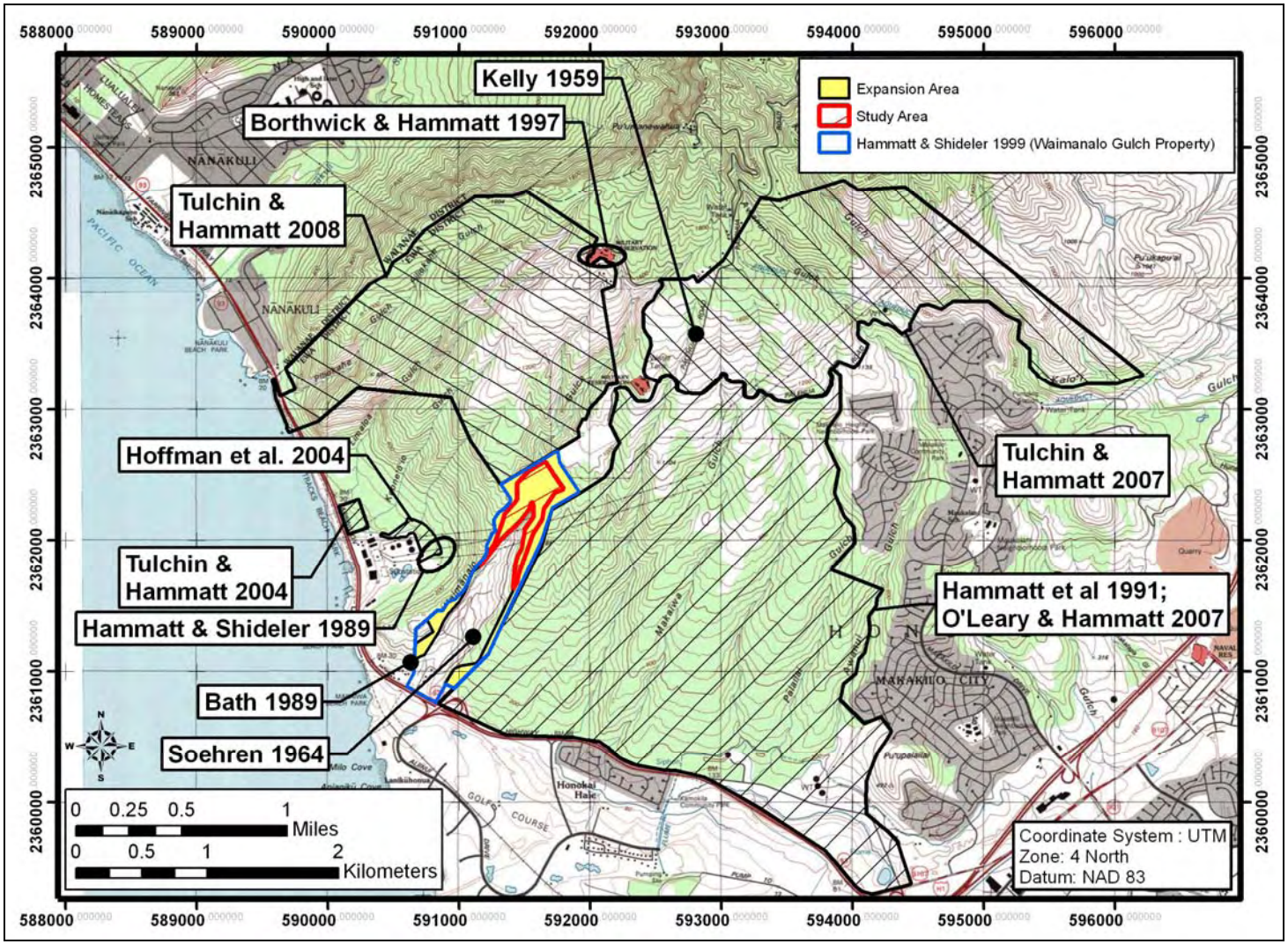

Figure 16. Previous archaeological investigations in the vicinity of the study area

The earliest attempt to record archaeological remains in Honouliuli Ahupua‘a was made by Thrum (1906). He reports the existence of a *heiau* located on Pu‘u Kapolei, approximately 5 km (3 mi.) southeast of the current study area. Pu‘u Kapolei Heiau was described as “Ewa-size and class unknown. Its walls thrown down for fencing” (Thrum 1906:46).

In his surface survey of 1930, archaeologist J. Gilbert McAllister recorded the specific locations of important sites, and the general locations of less important sites (at least at Honouliuli). Archaeological investigations by McAllister along the southern slopes of the Wai‘anae Range identified a number of sites which are of interest (Figure 17).

McAllister documents Pu‘u Kapolei Heiau as Site 138 and notes:

> The stones from the heiau supplied the rock crusher which was located on the side of this elevation, which is about 100 feet away on the sea side. There was formerly a large rock shelter on the sea side where Kamapuaa (the pig-god) is said to have lived with his grandmother (Kamaunuahihio). (McAllister 1933:108)

McAllister’s Site 136 is located near Mauna Kapu, northeast of the current study area, and is described as a small platform on the ridge dividing the ‘Ewa and Wai‘anae districts. The 4 to 6 square foot platform was constructed of coral and basalt stones, and was believed to be an alter (McAllister 1933:107). It is noted to have been destroyed by the time of Sterling and Summers’ work in the late 1950’s (Sterling and Summers 1978:32).

McAllister’s Site 137 is located at Pu‘u Ku‘ua, a prominent landmark northeast of the current study area. Pu‘u Ku‘ua Heiau was described by McAllister as:

> (Destroyed) The heiau was located on the ridge overlooking Nanakuli as well as Honouliuli at the approximate height of 1800 feet. Most of the stones of the heiau were used for a cattle pen located on the sea side of the site. The portion of the heiau which has not been cleared for pineapple has been planted in ironwoods. (McAllister 1933:32)

The presence of Pu‘u Ku‘ua *heiau*, provides some archaeological evidence of the Pu‘u Ku‘ua settlement described in the Hawaiian Newspaper “*Ka Loea Kalaiaina*” (see Section III: Honouliuli Settlement Patterns).

None of these sites are in the immediate vicinity of the current study area. However, the presence of extant or former archaeological remains demonstrates Hawaiian use of these *mauka* lands.

In 1959, the Bishop Museum was notified of a *kū‘ula* stone (stone god used to attract fish) located along Pālehua Road. The *kū‘ula* stone was briefly documented and assigned as SIHP No. 50-80-08-2316 (Kelly 1959). SIHP No. 50-80-08-2316 is located approximately 1500 m northeast of the current study area, along the western edge of Pālehua Road.

In 1964, the Bishop Museum was notified of a “house site” located in the lower elevations of Waimanalo Gulch. The site was briefly documented and assigned as SIHP No. 50-80-12-2317 (Soehren 1964). SIHP No. 50-80-12-2317 is located approximately 500 m southwest of the current study area.

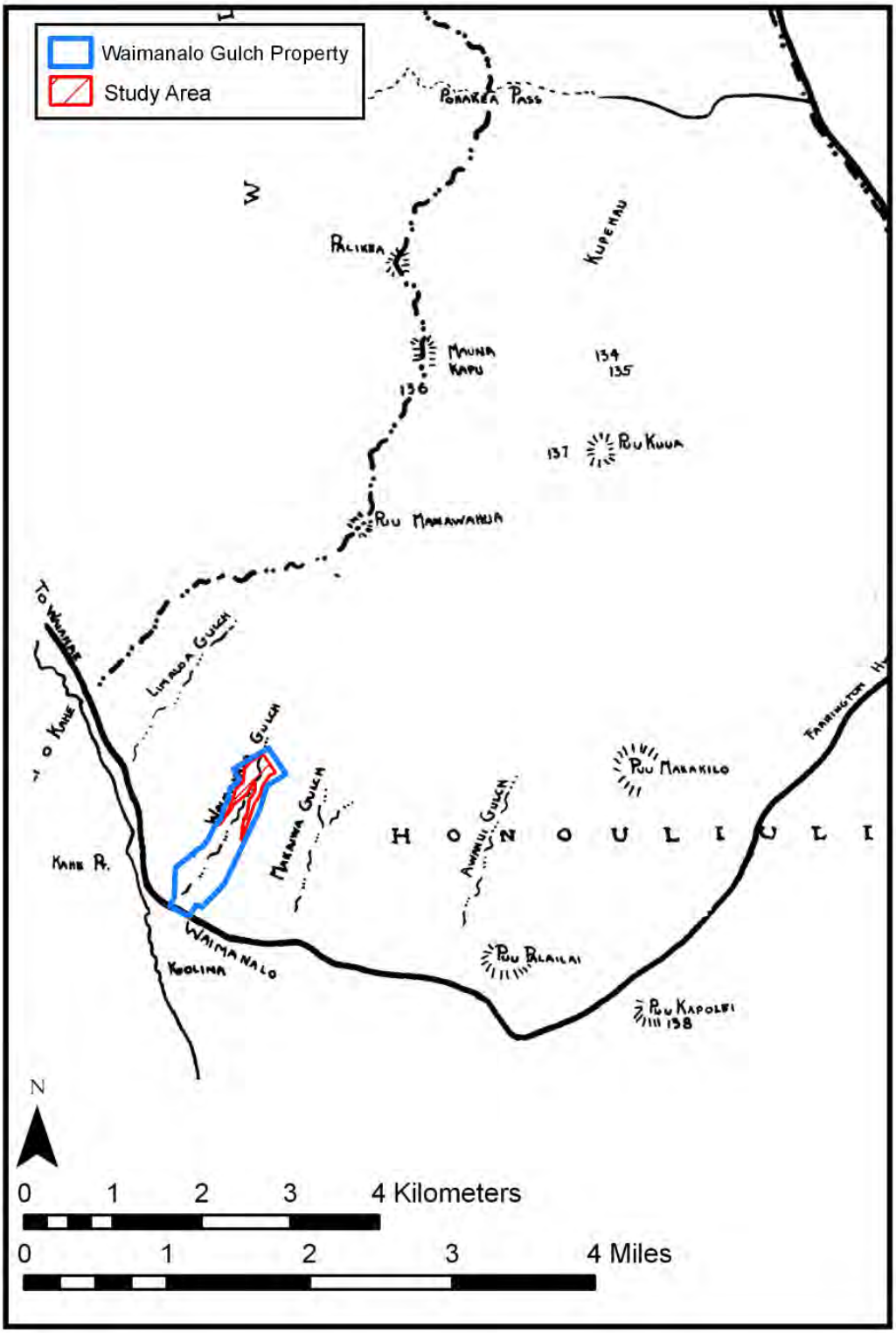

Figure 17. Portion of Map by Sterling and Summers (1978), showing the location of the Waimānalo Gulch property in relation to archaeological sites discussed in the text

In 1983, an archaeological survey of the lower portions of Waimānalo Gulch (the future site of the Waimānalo Gulch Sanitary Landfill), up to the 430-foot elevation, identified no archaeological sites (Bordner and Silva 1983).

In 1989, SHPD was notified of petroglyphs located in the lower elevations at the mouth of Waimanalo Gulch. Three petroglyphs were observed “pecked into black lava rock” (Bath 1989). Two were anthropomorphic and one consisted of abstract symbols. The site was briefly documented and assigned as SIHP No. 50-80-12-4110. SIHP No. 50-80-12-4110 is located approximately 900 m southwest of the current study area.

In 1989, CSH conducted an archaeological reconnaissance for a proposed HECO training facility located approximately 200 m west of the current study area (Hammatt & Shideler 1989). One small rock terrace was observed and documented. The terrace was thought to be associated with pre-contact agricultural activities.

An archaeological inventory survey of the “Makaīwa Hills” development project, just 80 m east of the current study area, located several pre-contact as well as post-contact archaeological sites (Hammatt et al. 1991). A total of 34 historic properties were located, including pre-contact habitation structures (temporary and permanent), agricultural features (terrace and mounds), rock shelters, petroglyphs, *ahu*, and various sugar cane cultivation infrastructure (Figure 18).

Within the “Makaīwa Hills” project area, habitation sites were found to be clustered in higher elevations above 1000 ft., and in lower elevations below 500 ft (Hammatt et al. 1991). The higher elevations would contain ample forest subsistence resources for gathering on both a continual basis, as well as during times of famine and drought. The lower elevations would be in close proximity to the shoreline and bountiful coastal resources.

In 1997, CSH conducted an archaeological assessment for the proposed Ministry of Transportation Satellite Multi-Ranging Station project site, located 1500 m to the northwest of the current study area (Borthwick & Hammatt 1997). No historic properties were identified.

In 1999, CSH conducted an archaeological inventory survey for the proposed Waimanalo Gulch Sanitary Landfill Project Site (Hammatt & Shideler 1999). The study area included a large section of Waimanalo Gulch, extending from the base of the gulch up to a 1000 ft elevation, and encompasses the proposed expansion area, including the current study area. The “Battery Arizona” military complex (WWII bunker complex) and a contemporary shrine site (two sacred stones and a petroglyph) were observed (Figure 19). The stones of the “shrine” site were understood to have been previously relocated from the central portion of Waimānalo Gulch circa 1988. Both sites are located within the Waimanalo Gulch property, but are outside of the proposed expansion area. It was recommended that impact to the southwestern portion of the Waimanalo Gulch Sanitary Landfill property, containing the Battery Arizona and the contemporary shrine, be avoided.

In 2004, CSH conducted an archaeological assessment of an approximately 30-acre parcel adjacent to the Kahe Power Plant, located approximately 640 m southwest of the current study area (Hoffman et al. 2004). No historic properties were observed.

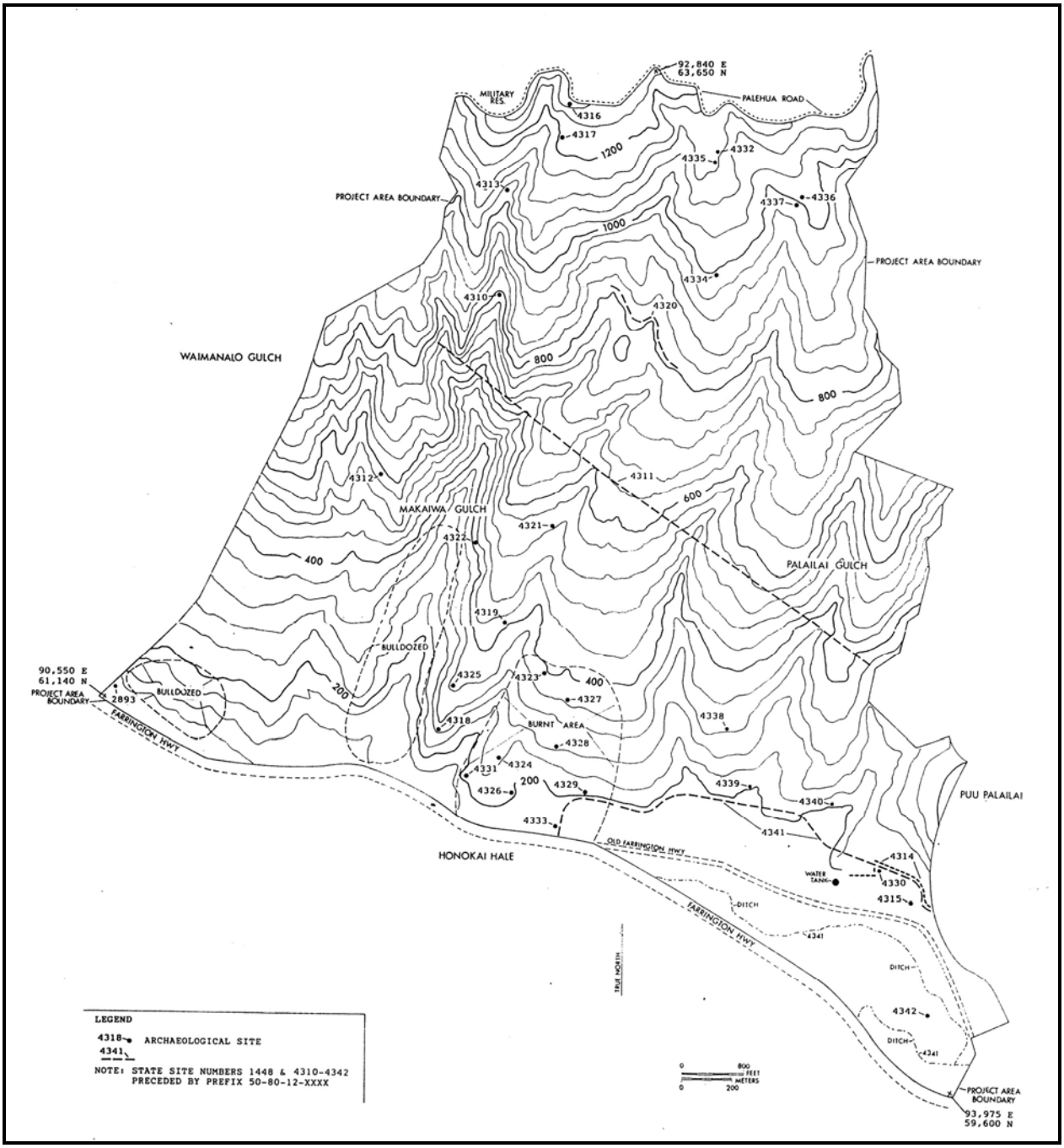

Figure 18 . Makaīwa Hills Project Area Showing the Location of Identified Archaeological Sites (Hammatt et al 1991:7)

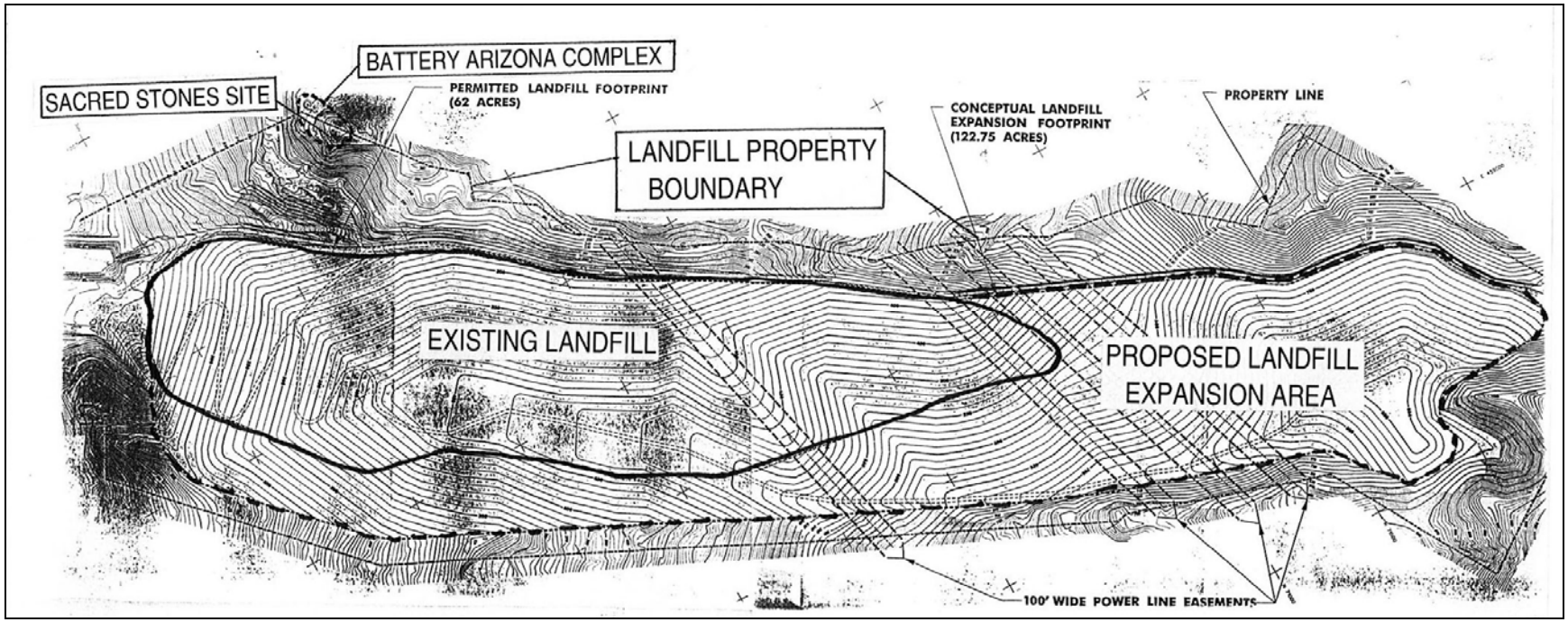

Figure 19. Waimanalo Gulch Sanitary Landfill Project Site Showing the Location of Identified Archaeological Sites (Hammatt & Shideler 1999)

In 2004, CSH conducted an archaeological inventory survey of an approximately 24-acre parcel adjacent to the Kahe Power Plant, located approximately 630 m south of the current study area (T. Tulchin & Hammatt 2004). A total of four archaeological sites (SIHP No. 50-80-12-6647, -6648, -6649, & -6650) comprising fifteen individual features were identified. Sites observed consisted of rock walls, mounds, and platforms. Site age ranged from historic to pre-Contact. Site function was determined to be predominantly agricultural in nature. Of note was the presence of a possible fishing shrine (*ko‘a*) at the base of Keone‘ō‘io Gulch. The shrine is constructed of both upright and stacked limestone boulders creating a level paved platform. Branch coral and water rounded coral cobbles were observed within the interior cobble fill of the structure.

In 2007, O’Leary conducted an addendum to the archaeological inventory survey conducted for the “Makaīwa Hills” development project, originally surveyed by Hammatt et al in 1991 (see above). Because 15 years had passed since the last archaeological inspection of the project area CSH field personnel conducted a reconnaissance of the project area to relocate the 17 historic properties. During this fieldwork two additional historic properties were identified in the *mauka*/west corner of the project area. SIHP No. 50-80-12-6870 consists of a historic ranching-era terrace constructed to create a large level soil area in front of three natural springs. The second site, SIHP # 50-80-12-6871, consists of a paved area comprised of large basalt boulders prominently positioned on a ridge top overlooking the western half of the ‘Ewa Plain, possibly functioning as a resting place, a trail marker, or possibly had a religious role. The excavation of test units at both sites did not reveal any further information regarding site function.

In 2007, CSH conducted an archaeological field inspection of an approximately 790-acre parcel at Pālehua, located just east of the current study area (J. Tulchin & Hammatt 2007). A total of 26 archaeological sites were identified. Archaeological features representing distinct periods of land use were observed, including: pre-contact indigenous Hawaiian habitation and associated agricultural and ceremonial features; historic ranching and related features; and historic quarrying and related features.

In 2008, CSH conducted an archaeological field inspection of an approximately 809-acre of Kahe Ranch Land, abutting the northeast corner of the current study area (J. Tulchin & Hammatt 2008). A total of 10 archaeological sites were identified. Archaeological features representing distinct periods of land use were observed, including: pre-Contact indigenous Hawaiian habitation; historic ranching; and historic railroad operations.

3.3 Background Summary and Predictive Model

Historical background research of Honouliuli Ahupua‘a indicated that pre-contact settlement of the *ahupua‘a* would have been centered around the rich cultivated lands of Honouliuli *‘ili* for extensive wetland taro cultivation and abundant coastal resources. The extensive limestone plain would also include recurrent use habitations for fishermen and gatherers, and sometimes gardeners. The upland dry forest areas would be used for hunting and gathering of forest resources, but likely not for widespread permanent settlement. In the intermediate area between the limestone plain and the upland forests indigenous Hawaiian activities would have been limited to dry land agriculture within gulches or near springs, and *mauka*/*makai* transportation routes (i.e. trails) and associated temporary shelters.

By 1920, the lands of Honouliuli were used primarily for commercial sugar cane cultivation and ranching (Frierson 1972:18). Much of the *mauka* lands in western Honouliuli, including ridges and deep gulches, were unsuitable for commercial sugar cultivation and remained pasture land for grazing livestock. Historic maps indicate a lack of any significant development within the study area into the late 1920s, suggesting that the lands within the study area were unsuitable for commercial sugar cane cultivation and were utilized as pasture land for grazing livestock.

Major land use changes came to western Honouliuli when the U.S. Military began development in the area. Military installations were constructed both near the coast, as well as in the foothills and upland areas. A 1943 War Department map reflects the military presence and associated land use within and south of the study area during this time period. Access roads to power lines and telecommunications lines are indicated throughout the southeastern portion of study area. Also of note are the presence of access roads leading to the Battery Arizona, a subterranean WWII bunker complex identified by Hammatt and Shideler in 1999, situated on the southwest ridge above Waimānalo Gulch.

Previous archaeological research in the vicinity of the study area has identified numerous pre-contact sites including: habitation structures (platforms and enclosures), agricultural features (walls, terraces, and mounds), and religious sites (*kū‘ula* stone and *ko‘a*). Within the “Makaīwa Hills” project area, which is abuts the southeastern boundary of the current study area, pre-contact habitation sites were found to be clustered in higher elevations above 1000 ft., and in lower elevations below 500 ft (Hammatt et al. 1991).

Historic archaeological sites identified in the vicinity of the study area include the Battery Arizona military complex (WWII bunker complex), sugar cane cultivation infrastructure, and walls and fences attributed to the Campbell Ranch.

Based on background research historic properties are not expected to be encountered within the study area. This is based on a review of the archaeological inventory survey for the proposed Waimanalo Gulch Sanitary Landfill Project Site conducted by CSH in 1999, in which no historic properties were identified within the current study area (Hammatt & Shideler 1999). However, if historic properties are encountered they are likely to include both pre-contact and historic archaeological sites. Pre-contact archaeological sites may include: dry land agricultural sites, including planting mounds and terraces in the vicinity of springs or drainage gulches; habitation sites, including enclosures and platforms; trail markers (*ahu)*; religious sites including enclosures, terraces, platforms, and/or upright stones located on prominent hills or other significant locations; and burials located within discrete rock shelters and/or caves. Historic archaeological sites may include: ranch related structures including walls, fences, and maintained springs; and military related structures including concrete bunkers, radio towers and related infrastructure.

Section 4 Results of Fieldwork

Fieldwork for the current AIS investigation of the study area was accomplished over a one-week period from January 25, 2007 to February 2, 2007. The CSH field crew consisted of Matt Bell, B.A., Amy Hammermiester, B.A., and Kevin Dalton, B.A., under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator). The field effort required 13 person-days to complete. CSH completed the archaeological assessment fieldwork under state archaeological permit No. 07-19 issued by SHPD, per HAR Chapter 13-13-282. Fieldwork involved a 100% pedestrian inspection of the study area with limited subsurface testing.

4.1 Survey Findings

Pedestrian inspection of the study area identified one historic property, State Inventory of Historic Properties (SIHP) # 50-80-12-6903, within the study area (Figure 20). SIHP #50-80-12-6903 is of pre-contact origin, and consists of three large upright boulders potentially utilized as trail or boundary markers. A detailed description of this historic property is presented in Section 4.3 below.

Numerous caves and rock shelters were observed within the study area. These caves and rock shelters were thoroughly inspected for cultural modifications and/or the presence of human burials. Where significant sediment deposits were observed, subsurface testing in the form of controlled hand excavation was undertaken to establish if any subsurface cultural deposits were present. Documentation of the inspection and testing of these natural geologic features is presented in Section 4.2 below.

The observed topography within the study area consisted of talus slopes with an average slope of 65°. The observed geology consisted of exposed basalt outcrops with minimal soil deposition. Figure 21 shows the topography and geology encountered during the survey of the study area.

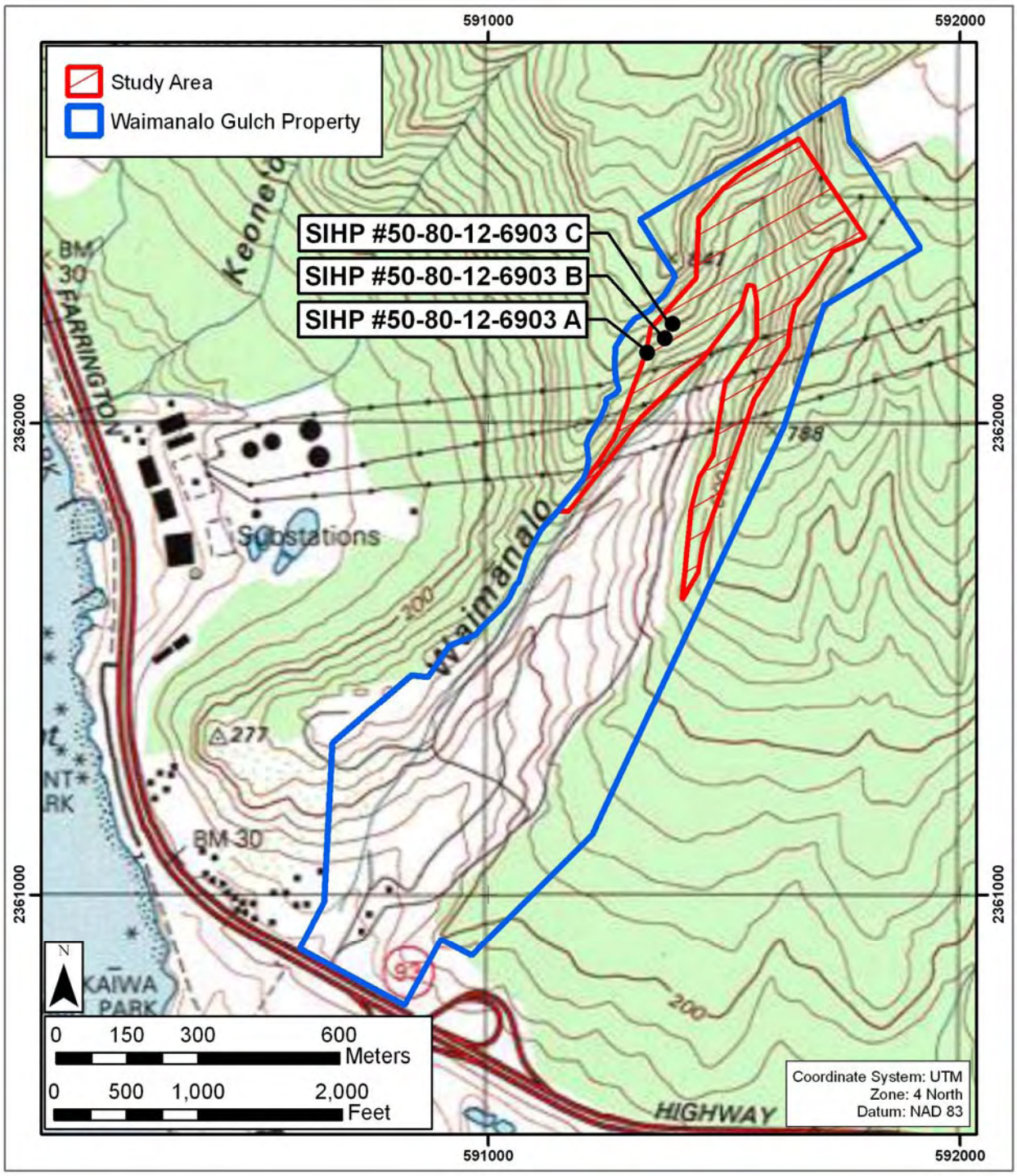

Figure 20. USGS 7.5 Minute Series Topographic Map, Ewa Quadrangle (1998), showing location of SIHP #50-80-12-6903 (Features A-C)

Figure 21. Photograph looking west, showing the topography and geology of the study area

4.2 Inspection and Subsurface Testing of Geologic Features

Numerous natural caves and rock overhangs area were discovered and investigated during the pedestrian inspection of the study area. The larger caves and overhangs (greater than two meters in depth and 4 meters in width) were documented and their position mapped using a Garmin GPSmap76S unit or a Trimble PRO XR GPS (Figure 22).

Also of note was a rock alignment (CSH 3) located near the northeastern edge of the study area. The alignment was determined to be of modern origin due to its location along a talus slope, in which soil erosion and rainwater runoff channels were observed. If the feature was of antiquity it would reflect disturbances associated with erosion and/or rainwater runoff, such as the retention of eroding rock and soil or the displacement of boulders incorporated into the alignment. Subsurface testing was conducted at this alignment to confirm the initial age determination of this feature.

4.2.1 Cave 1

Cave 1 is located on the western slope of Waimānalo Gulch, situated at the base of a small rock outcrop (see Figure 22). The mouth of the cave opens to the northeast and measures 1.5 m high (Figure 23). The internal dimensions of the cave are as follows: 8.0 m wide and 4.0 m deep, with a maximum ceiling height of 1.2 m. No cultural material or human skeletal remains were observed on the surface of the cave floor.

Due to the presence of soil within the cave interior, two 0.5m^2 test units (TU 1 & TU 2) were excavated in order to determine if any subsurface cultural deposits were present (Figure 24). The stratigraphy of Test Unit 1 (TU 1) consisted of a single stratum of sandy loam (Stratum I) overlying bedrock (Figure 25 & Table 2). No cultural material was observed during the excavation of this test unit.

The stratigraphy of Test Unit 2 (TU 2) consisted of consisted of a sandy loam deposit (Stratum I) overlying a thin layer of decomposing bedrock (Stratum II) (Figure 26 & Table 3). No cultural material was observed during the excavation of this test unit.

4.2.2 Cave 2

Cave 2 is located on the western slope of Waimānalo Gulch, situated at the base of a pronounced rock outcrop (see Figure 22). The mouth of the cave opens to the east and measures 1.3 m high (Figure 27). The internal dimensions of the cave are as follows: 8.0 m wide and 4.1 m deep, with a maximum ceiling height of 0.8 m. The roof of the cave has experienced some collapse and now covers approximately 70 percent of the floor (Figure 28). No cultural material or human skeletal remains were observed on the surface of the cave floor.

Due to the presence of soil within the cave interior, two 0.5m^2 test units (TU 1 & TU 2) were excavated in order to determine if any subsurface cultural deposits were present. The stratigraphy of Test Unit 1 (TU 1) consisted of a sandy loam deposit (Stratum I) followed by a layer of decomposing bedrock (Stratum II) (Figure 29 & Table 4). No cultural material was observed during the excavation of this test unit.

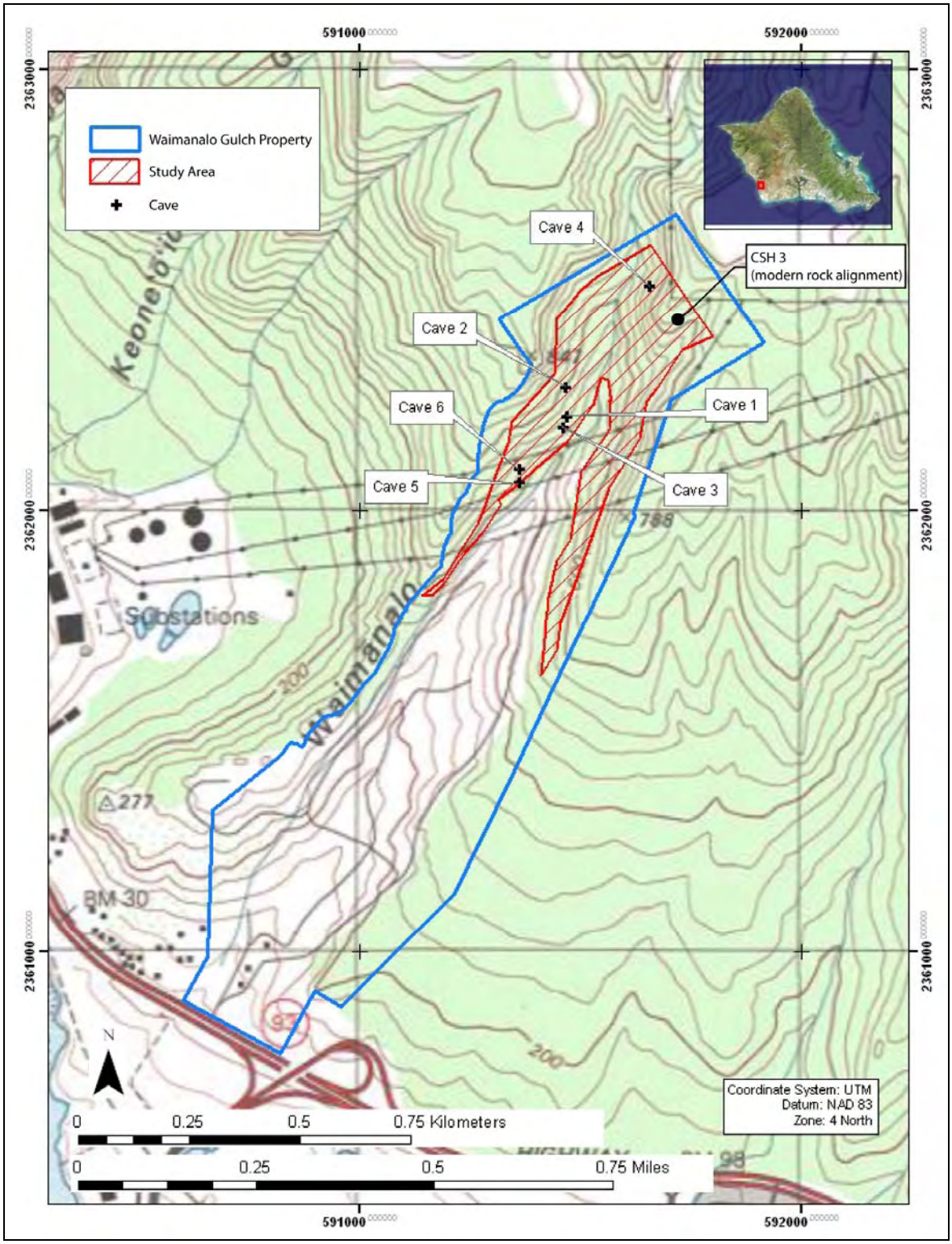

Figure 22. USGS 7.5 Minute Series Topographic Map, Ewa Quadrangle (1998), showing the location of documented caves within the study area

Figure 23. Photograph of opening of Cave 1, view to north

Figure 24. Photograph of interior of Cave 1, view to south

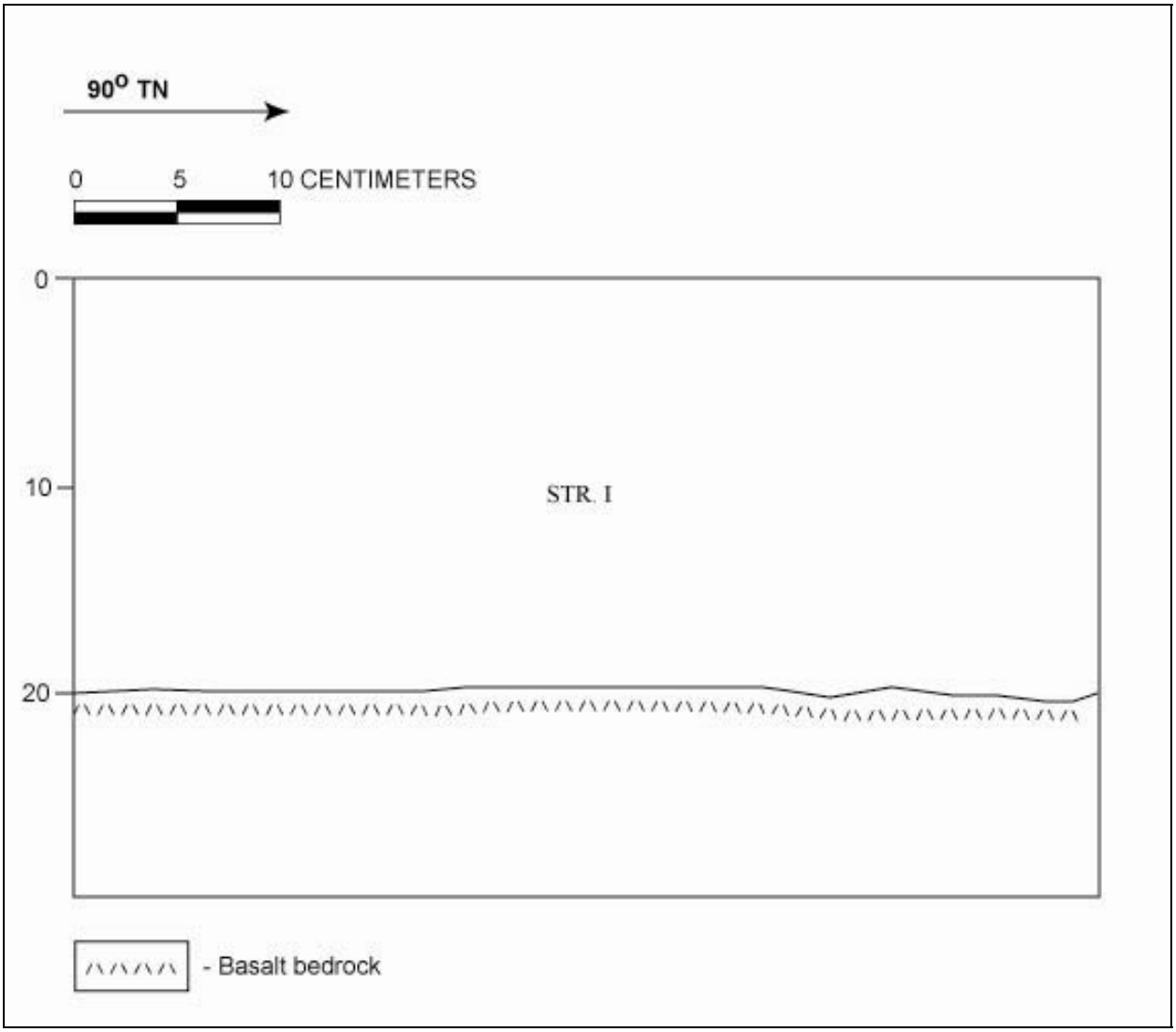

Figure 25. Cave 1, profile of the east wall of Test Unit 1

Table 2. Strata Observed at Cave 1, Test Unit 1

Stratum	Depth (cmbs)	Description
I	0 – 20	10 YR 3/2, dark brown; sandy loam; weak, fine, crumb structure; weakly coherent dry consistency; non plastic; no cementation; terrestrial origin; clear boundary; smooth topography. Stratum I is conprised of loose volcanic soil of aeoloian origin. No clutural material observed.

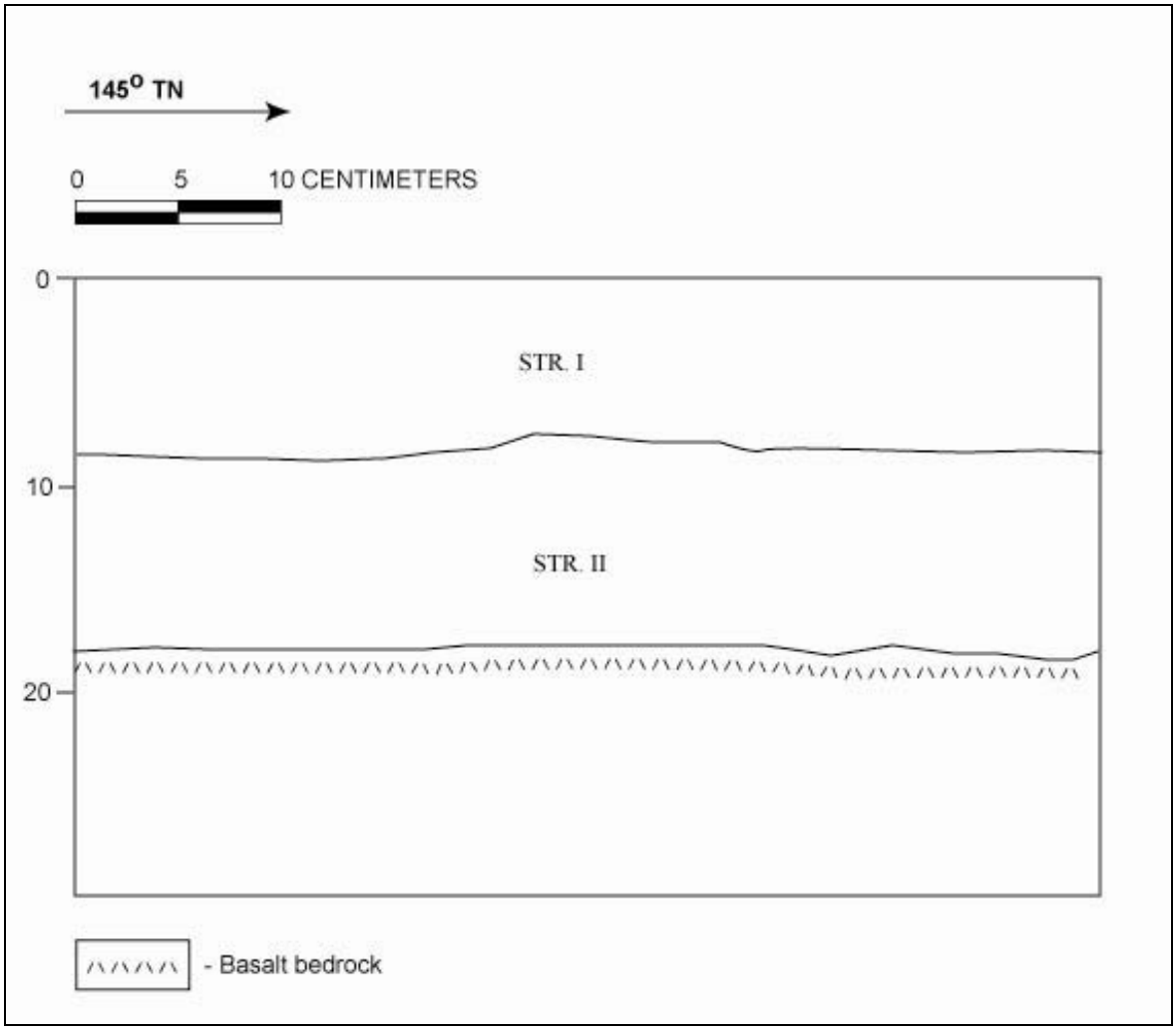

Figure 26. Cave 1, profile of the south wall of Test Unit 2

Table 3. Strata Observed at Cave 1, Test Unit 2

Stratum	Depth (cmbs)	Description
I	0 – 8	10 YR 3/2, very dark grayish brown; sandy loam; weak, fine, crumb structure; weakly coherent dry consistency; non plastic; no cementation; terrestrial origin; clear boundary; smooth topography. Stratum I is comprised of loose volcanic soil of aeoloian origin. One fish vertabra was observed. No ccultural material observed.
II	8 - 18	10 YR 5/4, yellowish brown; deteriorated bedrock; weak, coarse, crumb structure; slightly hard dry consistency; non plastic; weak cementation; terrestrial origin; abrupt boundary; irregular topography. Sediment is a mixture of aeolian silt and decomposing bedrock. No clutural material observed.

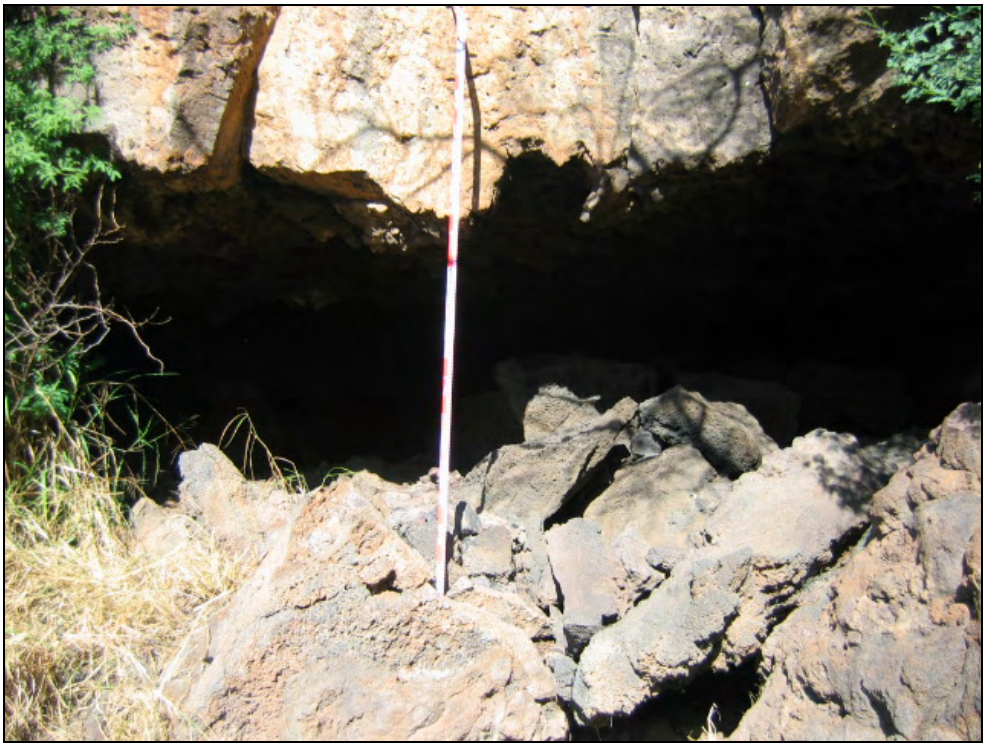

Figure 27. Photograph of Cave 2 opening, view to the northwest

Figure 28. Photograph Cave 2 interior, view to the west

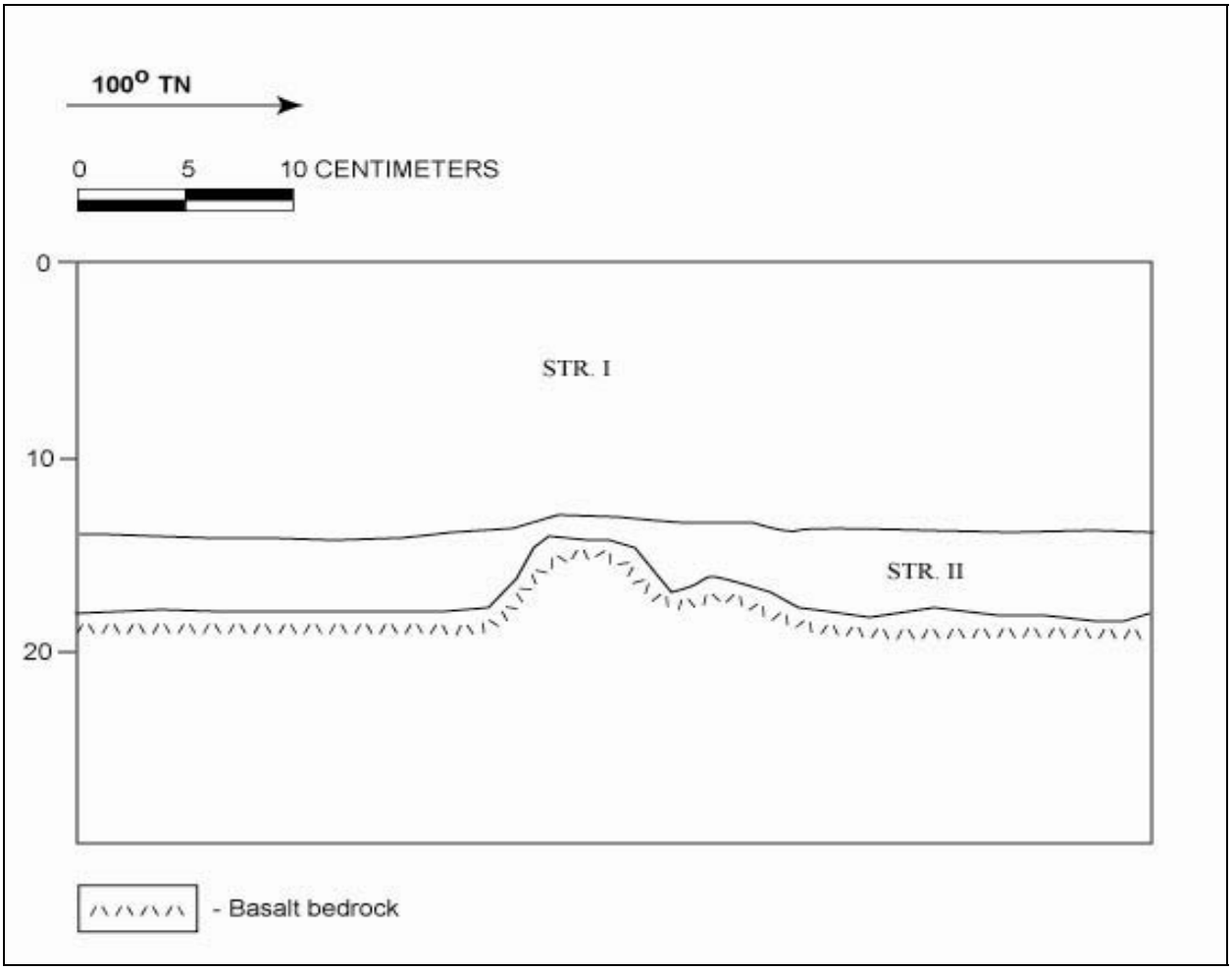

Figure 29. Cave 2, profile of the north wall of Test Unit 1

Table 4. Strata Observed at Cave 2, Test Unit 1

Stratum	Depth (cmbs)	Description
I	0 – 14	10 YR 3/3, dark brown; sandy loam; weak, fine, granular structure; weakly coherent dry consistency; non plastic; no cementation; terrestrial origin; clear boundary; irregular topography. Stratum I is comprised of loose volcanic soil of aeoloian origin. No cultural material observed.
II	14 - 18	10 YR 4/6, dark yellowish brown; deteriorated bedrock and sandy loam mix; weak, coarse, crumb structure; slightly hard dry consistency; non plastic; weak cementation; terrestrial origin; abrupt boundary; irregular topography. Sediment is a mixture of aeolian silt and decomposing bedrock. No cultural material observed.

The stratigraphy of Test Unit 2 (TU 2) consisted of sandy loam (Stratum I) overlying bedrock (Figure 30 & Table 5). No cultural material was observed during the excavation of this test unit.

4.2.3 Cave 3

Cave 3 is located on the western slope of Waimānalo Gulch (see Figure 22). The mouth of the cave opens to the south and measures 1.2 m high. The internal dimensions of the cave are as follows: 4.0 m wide and 2.0 m deep, with a maximum ceiling height of 1.2 m. No cultural material or human skeletal remains were observed on the surface of the cave floor.

Only minimal soil deposits were observed within the cave interior and thus no subsurface testing was conducted at Cave 3.

4.2.4 Cave 4

Cave 4 is located on the eastern slope of Waimānalo Gulch (see Figure 22). This cave consists of a rock overhang situated at the base of the large rock outcrop (Figure 31). The mouth of the cave opens to the west and measures 2.0 m high. The internal dimensions of the cave are as follows: 10.0 m wide and 4.0 m deep, with a maximum ceiling height of 2.5 m. A pair of small skeleton keys was observed within the cave (Figure 32). No other cultural material or human skeletal remains were observed on the surface of the cave floor.

Only minimal soil deposits were observed within the cave interior and thus no subsurface testing was conducted at Cave 4.

4.2.5 Cave 5

Cave 5 is located on the western slope of Waimānalo Gulch, situated near the southwestern end of the study area, overlooking the modern landfill (see Figure 22). The mouth of the cave opens to the south and measures 1.0 m high. The internal dimensions of the cave are as follows: 1.4 m wide and 1.3 m deep, with a maximum ceiling height of 0.8 m. No cultural material or human skeletal remains were observed on the surface of the cave floor.

Only minimal soil deposits were observed within the cave interior and thus no subsurface testing was conducted at Cave 5.

4.2.6 Cave 6

Cave 6 is located on the western slope of Waimānalo Gulch (see Figure 22). The mouth of the cave opens to the east and measures 1.2 m high. The internal dimensions of the cave are as follows: 2.4 m wide and 1.5 m deep, with a maximum ceiling height of 0.7 m. No cultural material or human skeletal remains were observed on the surface of the cave floor.

Only minimal soil deposits were observed within the cave interior and thus no subsurface testing was conducted at Cave 6.

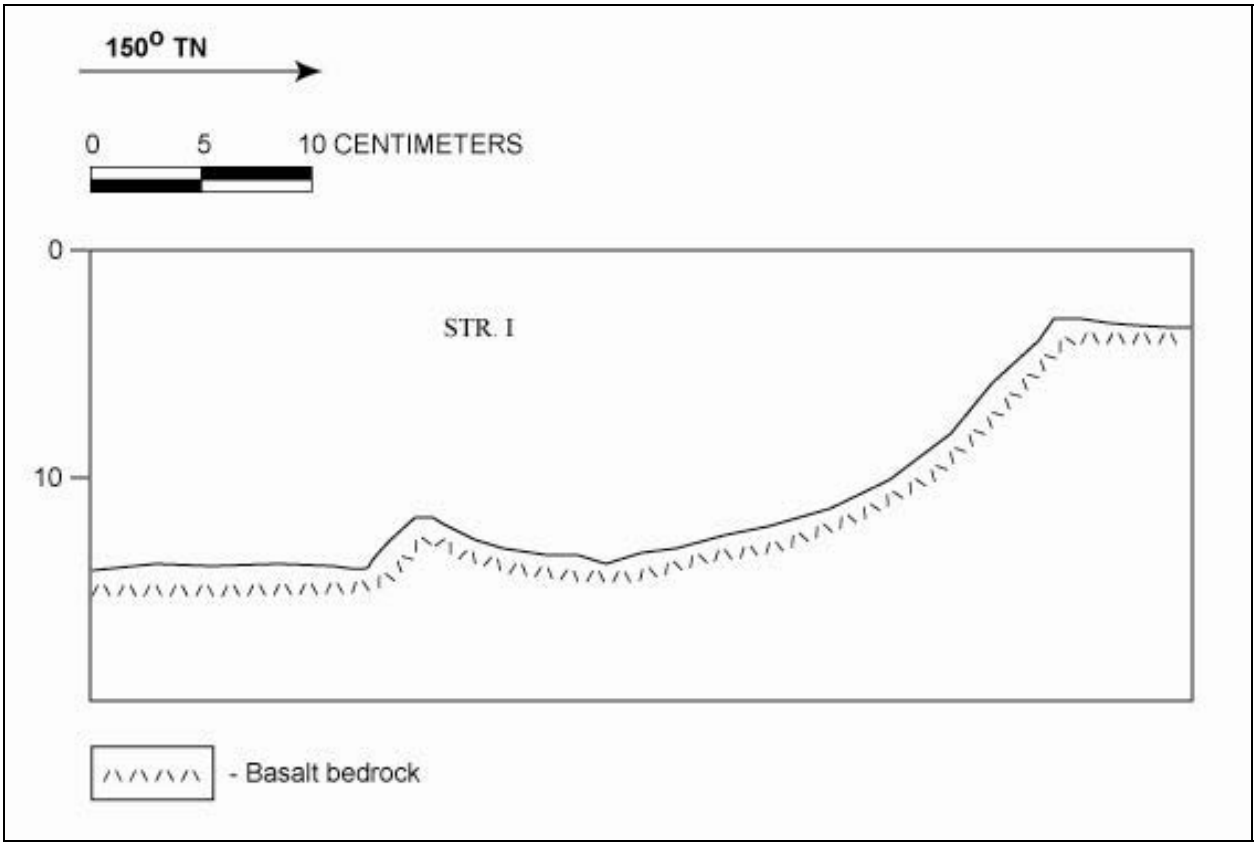

Figure 30. Cave 2, profile of the north wall of Test Unit 2

Table 5. Strata Observed at Cave 2, Test Unit 2

Stratum	Depth (cmbs)	Description
I	0 - 14	10 YR 3/3, dark brown; sandy loam; weak, fine, granular structure; weakly coherent dry consistency; non plastic; no cementation; terrestrial origin; clear boundary; irregular topography. Stratum I is comprised of loose volcanic soil of aeoloian origin. No cultural material observed.

Figure 31. Photograph of Cave 4 opening, view to the northeast

Figure 32. Photograph of skeleton keys from Cave 4

4.2.7 Modern Rock Alignment (CSH 3)

A linear rock alignment (CSH 3) was located near the northeastern edge of the study area (see Figure 22). The alignment is constructed of a single course of six small boulders, situated on the eastern slope of Waimānalo Gulch (Figure 33 & Figure 34). It measures 1.2 m long and 0.6 m wide, and is aligned cross slope. The alignment was determined to be of modern origin due to its location along a talus slope, in which soil erosion and rainwater runoff channels were observed. If the feature was of antiquity it would reflect disturbances associated with erosion and/or rainwater runoff, such as the retention of eroding rock and soil or the displacement of boulders incorporated into the alignment. No cultural material was observed on the ground surface in the vicinity of this feature.

One 0.5m^2 test unit (TU 1) was excavated in the center of the rock alignment (CSH 3) to prospect for subsurface cultural deposits and to confirm the initial age determination of this feature. The stratigraphy of Test Unit 1 (TU 1) consisted of sandy loam (Stratum I) overlying bedrock (Figure 35 & Table 6). No cultural material was observed during the excavation of this test unit. Test excavation confirmed that the alignment consisted of only a single course of boulders and that no buried wall construction was present, thus confirming the modern origin of the feature.

Figure 33. Photograph of CSH 3, view to west

Figure 34. Photograph of CHS 3, view to south

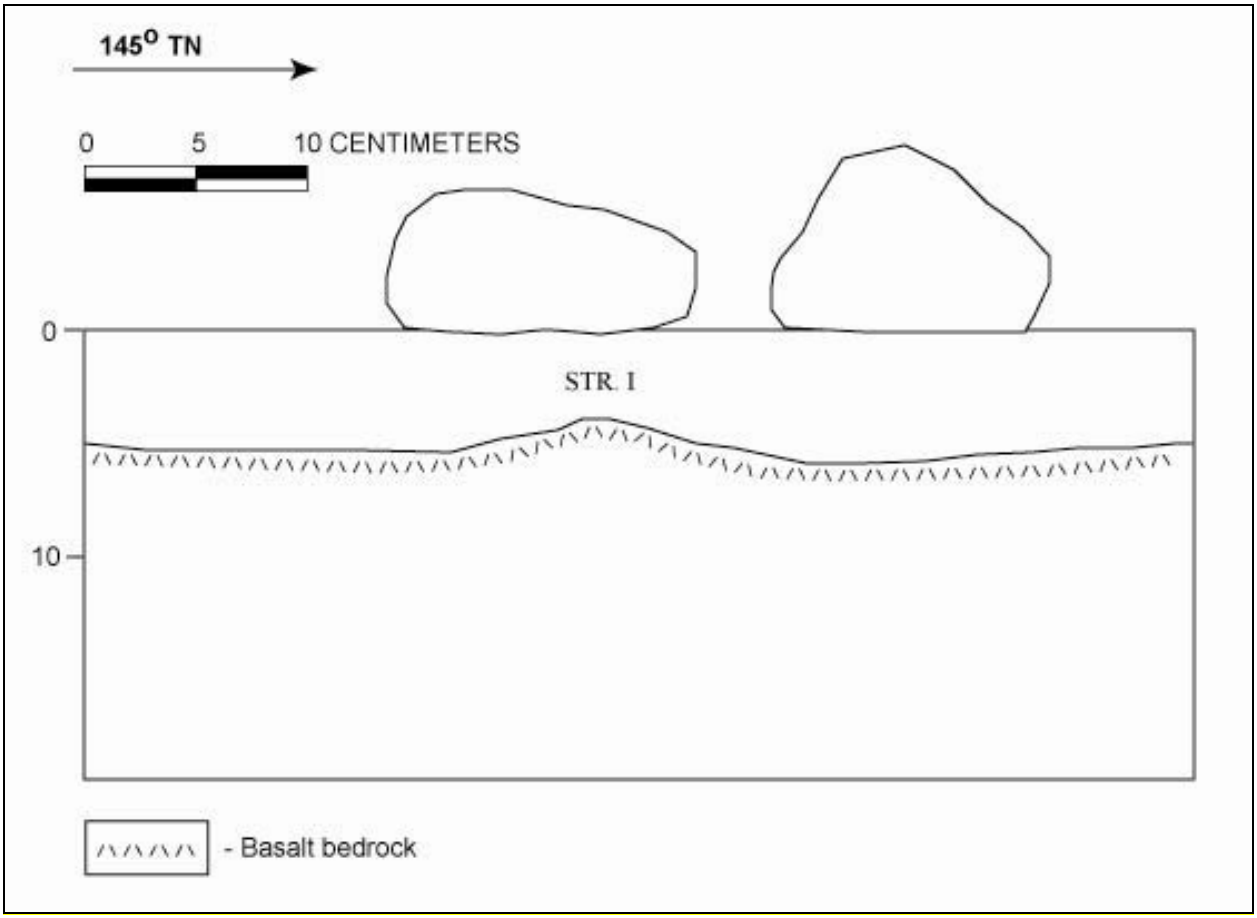

Figure 35. CSH 3, profile of the east wall of Test Unit 1

Table 6. Strata Observed at CSH 3, Test Unit 1

Stratum	Depth (cmbs)	Description
I	0 - 5	10 YR 3/2, dark brown; sandy loam; weak, fine, granular structure; weakly coherent dry consistency; non plastic; no cementation; terrestrial origin; clear boundary; irregular topography. Stratum I is comprised of loose volcanic soil of aeoloian origin. No cultural material observed.

4.3 Historic Property Descriptions

4.3.1 SIHP # 50-80-12-6903

FORMAL TYPE:	Rock uprights
FUNCTION:	Trail / boundary marker
# OF FEATURES:	3
AGE:	Pre-contact
DIMENSIONS:	80 m long (NE-SW) x 10 m wide (NW-SE)
LOCATION:	Waimānalo Gulch
TAX MAP KEY:	TMK: [1] 9-2-003:073
LAND JURISDICTION:	City and County of Honolulu

SIHP #50-80-12-6903 consists of three large upright boulders (Features A-C) utilized as trail or boundary markers, located approximately 1320 m (4330 ft) inland of the coast along the western edge of the study area (see Figure 20). The site is situated approximately 140 m (459 ft) north of existing Waimanalo Landfill operations. The topography of the immediate area is moderately sloping to the southwest, while the geology consists of exposed basalt bedrock outcrops with pockets of shallow soil. *Koa haole* and exotic grasses dominate the surrounding landscape.

SIHP# 50-80-12-6903 Feature A consists of a large upright basalt boulder measuring 1.20 m length, 1.12 m wide, and 2.10 m high (Figure 36 & Figure 37). There appears to be no intentionally placed rocks surrounding the base of this upright. The flat face of this stone is directed south, as to mark a trail or boundary for a traveler moving up slope. The face of this feature is discolored and appears to have once rested on the ground. Feature A is interpreted as being of pre-contact origin, and its function is determined to be a trail or boundary marker. No cultural material was observed on the ground surface in the vicinity of this feature.

SIHP # 50-80-12-6903 Feature B consists of a large triangular upright basalt boulder measuring 1.63 m long, 0.75 m wide, and 1.78 m high (Figure 38 & Figure 39). The upright appears to have one or more stones intentionally set at its western base. However, the majority of the upright’s base rests upon naturally exposed bedrock. Feature B is interpreted as being of pre-contact origin, and its function is determined to be a trail or boundary marker. No cultural material was observed on the ground surface in the vicinity of this feature.

SIHP # 50-80-12-6903 Feature C consists of a large upright basalt boulder measuring 2.3 m long, 1.7 m wide, and 2.5 m high (Figure 40 & Figure 41). This feature is believed to be in a natural upright position. Feature C is interpreted as being of pre-contact origin, and its function is determined to be a trail or boundary marker. No cultural material was observed on the ground surface in the vicinity of this feature.

Cultural consultation with knowledgeable community members was utilized to better establish the age, function, cultural affiliation, and significance of this historic property (see Section 5 below).

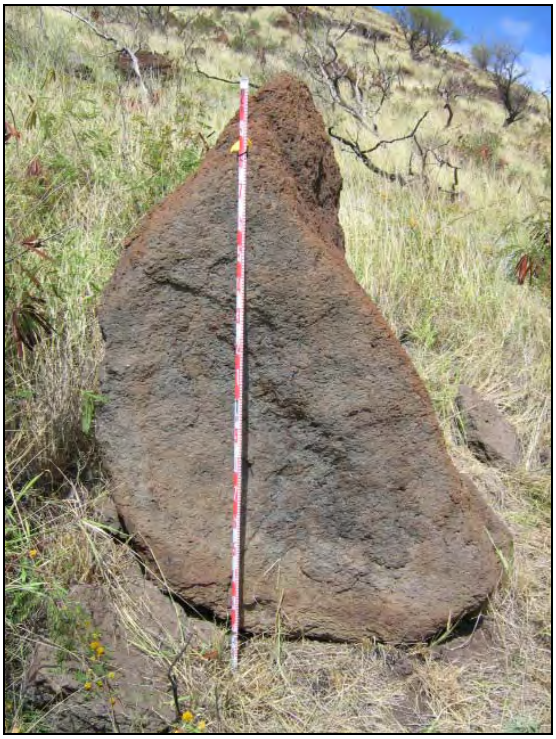

Figure 36. Photograph of SIHP #50-80-12-6903 Feature A, upright boulder, view to north

Figure 37. Photograph of SIHP #50-80-12-6903 Feature A, upright boulder, view to west

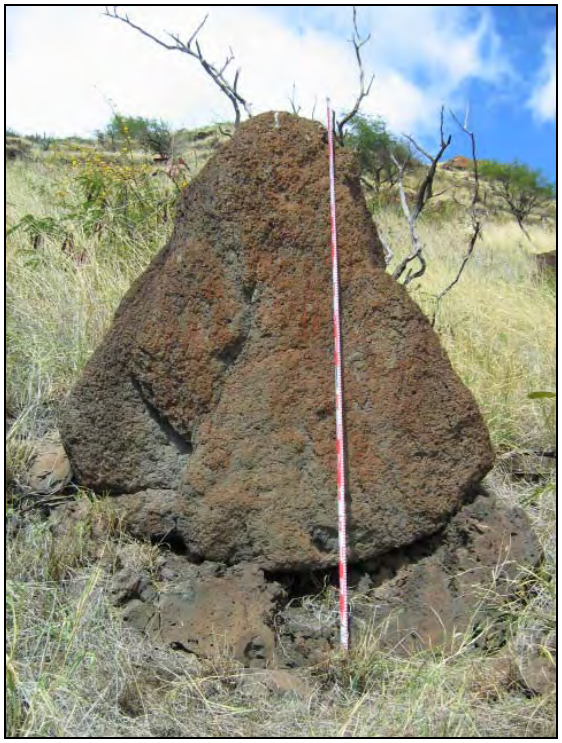

Figure 38. Photograph of SIHP #50-80-12-6903 Feature B, upright boulder, view to north

Figure 39. Photograph of SIHP #50-80-12-6903 Feature B, upright boulder, view to west

Figure 40. Photograph of SIHP #50-80-12-6903 Feature C, upright boulder, view to west

Figure 41. Photograph of SIHP #50-80-12-6903 Feature C, upright boulder, view to northwest

Section 5 Cultural Consultation Results

Pursuant to the requirements of State of Hawaii archaeological inventory survey regulations [HAR 13-276-5(g)] and State of Hawaii historic preservation review legislation [HAR 13-275-8(a)(2)], CSH carried out cultural consultation for this archaeological inventory survey investigation. This cultural consultation effort focused on locating any additional cultural and/or historical land use information for the study area. It also focused on better establishing the age, function, cultural affiliation, and significance of the historic property documented within the study area. Finally, this consultation effort focused on the development of appropriate mitigation for the significant historic property that will be affected by landfill expansion.

This consultation effort focused particularly on SIHP #50-80-12-6903, three large upright boulders utilized as trail or boundary markers. The following discussion is arranged chronologically and documents the effort and the results.

5.1 Chronology of Consultation Effort and Results

March 13, 2007

During an SHPD site visit to the study area, then Oahu Island Archaeologist Mr. Adam Johnson toured the location of SIHP #50-80-12-6903 and its vicinity. At this on-site meeting SHPD directed CSH to proceed with cultural consultation to establish the cultural significance of the three upright stones. Mr. Johnson indicated that, based on the results of this consultation, it was likely that the upright stones would be determined significant under criteria D (information content) and E (traditional cultural significance to an ethic group) of the Hawaii Register of Historic Places.

March 27 2007

CSH conducted a cultural consultant site visit of SIHP #50-80-12-6903 and its vicinity with Mr. William Ailā (Hui Malāma I Nā Kūpuna), Mr. Eric Enos (cultural practitioner and Director of Ka‘ala Farms), Mr. Shad Kane (‘Ahahui Siwila Hawai’i O Kapolei Hawaiian Civic Club), and Mr. McD Philpotts (long-time resident of Waimānalo ‘Ili). At this meeting the age, function, cultural affiliation, and significance of the upright stones were discussed. Potential functions for the stones included trail markers, markers for observation points for celestial observation and/or navigation, or markers used to calculate the location of specific coastal and/or off-shore resources. Although there was no clear consensus regarding the function of the stones, all of the cultural consultants present indicated that the stones were significant and that they had been used by traditional Native Hawaiian cultural practitioners in the past. They indicated that the stones’ location was likely an important part of their cultural significance and function. Potential mitigation measures, including preservation in place and relocation were discussed.

The cultural consultants at this meeting expressed concern regarding the final appearance of the landfill once it has reached capacity and will no longer be used. They wanted to see the new surface of the landfill naturalized with the random placement of basalt boulders and more natural vegetation, preferably Native Hawaiian dry land species, so that the final landfill surface appears more like the surrounding hill sides.

May 1 2007

CSH mailed out a consultation letter to the Office of Hawaiian Affairs (OHA). This consultation was initiated pursuant to HAR Chapter 13-276-5 and 13-275-6. Appendix B is a copy of this consultation letter.

May 24 2007

OHA provides a response to CSH’s May 1 2007 consultation letter. Appendix C is a copy of this letter. With its response letter, OHA asked for additional project-related cultural consultation with members of the Koa Mana organization, as well as Ms. Nettie Tiffany of Lanikūhonua. Additionally, the letter queried whether or not subsurface testing was undertaken as part of the project’s archaeological inventory survey. Finally, OHA’s letter took the position that the single historic property documented in the project area, SIHP #50-80-12-6903--three upright stones, should be preserved through adjustment of the current study area boundaries.

CSH responded to OHA’s May 24 2007 letter in a March 7 2008 mitigation consultation letter, see discussion below. As a result of OHA’s suggestions, members of the Koa Mana organization came out to the SIHP #50-80-12-6903 location and its vicinity and provided their input. Additionally, Ms. Nettie Tiffany was included in further cultural consolation.

July 18 2007

CSH held another on-site cultural consultant visit to the SIHP #50-80-12-6903 location and its vicinity. Mr. Glenn Kila and Mr. Alika Silva from Koa Mana were present, along with Ms. Kaleo Paik from the SHPD Culture and History Branch. At this meeting the age, function, cultural affiliation, and significance of the upright stones were discussed. Potential mitigation measures, including preservation in place and relocation were discussed. Once again, there was no clear consensus regarding the function of the stones, all of the cultural consultants present indicated that the stones were significant and that they had been used by traditional Native Hawaiian cultural practitioners in the past.

October 5 2007

CSH holds another on-site meeting at the SIHP #50-80-12-6903 location with the current SHPD Oahu Island Archaeologists, Ms. Lauren Morawski and Ms. Teresa Davan. The archaeological inventory survey effort and results are discussed and the three upright stones are observed. CSH provided the SHPD archaeologists with a summary of the project’s cultural consultation effort to date.

March 7 2008

A mitigation consultation letter was sent out to OHA, SHPD, Mr. William Ailā (Hui Malāma I Nā Kūpuna), Mr. Eric Enos (cultural practitioner and Director of Ka‘ala Farms), Mr. Shad Kane (‘Ahahui Siwila Hawai’i O Kapolei Hawaiian Civic Club), Mr. McD Philpotts (long-time resident of Waimānalo ‘Ili), Ms. Nettie Tiffany (Lanikūhonua), Mr. Glenn Kila (Koa Mana) and Mr. Alika Silva (Koa Mana). This consultation letter included response information to OHA’s May 24, 2007 letter. It included the results of the project’s archaeological inventory survey investigation and a description of SIHP #50-80-12-6903, the three upright stones. It also summarized the project’s cultural consultation effort to date. Finally, it described the proposed mitigation measures for SIHP #50-80-12-6903. Appendix D is a copy of this consultation letter.

In March 2008, following the posting and emailing of the March 7 2008 consultation letter, CSH attempted to contact letter recipients by email and telephone to obtain their feedback and comments. As a result of this effort on March 20 2008, CSH was contacted by telephone by Mr. Shad Kane (‘Ahahui Siwila Hawai’i O Kapolei Hawaiian Civic Club) and Mr. McD Philpotts (long-time resident of Waimānalo ‘Ili). Their comments are summarized below.

Mr. Doug “McD” Philpotts telephoned Matt McDermott of CSH at 3:45 pm on March 20 2008. Mr. Philpotts had four general comments based on his review of the March 7 2008 mitigation consultation letter:

1) He confirmed that he felt the stones were indeed naturally occurring and that they had not been modified or set up-right by human hands.
2) He and his son went out in his canoe to see how visible the stones were from offshore Lanikūhonua, *makai* of Waimanalo Gulch. He said he could see the stones faintly, by knowing where to look, but that the stones did not stand out on the Waimanalo Gulch slope and were hard to see. He said the stones did line up with the location of a fishing spot he knew, but that other landscape features were more easily discernable and made much better geographic reference points for triangulation.
3) He finds the proposed treatment of the stones, their movement to the Battery Arizona location, an acceptable form of mitigation
4) He is most concerned about the final look of the landfill once it reaches capacity and the area will no longer be used. He feels the new final surface of the landscape needs to be landscaped to be more natural, with native Hawaiian dry-land vegetation, and a more natural land covering of basalt stones. He thinks this naturalization of the surface will make the area much more useful in the future.

Mr. Shad Kane telephoned Matt McDermott of CSH at 5:45 pm on March 20 2008. Mr. Kane had five general comments based on his review of the March 7 2008 mitigation consultation letter:

1) He is disappointed about the landfill project as a whole as well as the proposed movement of the three stones (SIHP #50-80-12-6903)—but he understands the need and why the landfill needs to be expanded and the stones need to be moved.
2) He indicated that the stones’ meaning and significance will be lost once they are moved from their original location.
3) He is interested in having research continue on the stones after they were moved. This further research should focus on determining the stones past use and/or significance to Native Hawaiian cultural practitioners.
4) He is in favor of interpretation of the stones based on the results of further research, with signage and public access.
5) He would like to see the stones moved back to as close as possible to their original location, from temporary curation at Battery Arizona, after the landfill has reached capacity and it would be safe to move the stones back.

As a result of follow up telephone contact to the March 7, 2008 consultation letter, Ms. Nettie Tiffany (Lanikūhonua) telephoned Matt McDermott of CSH at 8:45 am on March 31, 2008. Although Ms. Tiffany had not participated in the previous site visits to the SIHP # 50-80-12-

6903 location, she did have four general comments based on her review of the mitigation consultation letter:

1) She indicated the description of the stones, their location, and photographs included in the consultation letter accurately portrayed what her mother described to her as trail markers that marked *mauka*/*makai* trails. These trails were used by Native Hawaiians to support *mauka*/*makai* trade and/or resource distribution. They were also used by bird catchers to access the *mauka* forests.
2) She was disappointed with the Landfill expansion project and that the stones could not be left in place.
3) She felt that the stones significance as trail markers would be ruined if the stones are relocated.
4) She would like to see the stones moved back to as close as possible to their original location, from temporary curation at Battery Arizona, after the landfill has reached capacity and it would be safe to move the stones back.

March 25 2008

SHPD staff Ms Kaleo Paik (Culture and History Branch) and Oahu Island Archaeologists Ms. Lauren Morawski and Ms. Teresa Davan met with CSH to discuss the project’s ongoing consultation effort results. The project proponent’s proposed mitigation for SIHP #50-80-12-6903 where also discussed. The SHPD staff had the following comments regarding the stones and their proposed mitigation:

1) Ms. Kaleo Paik thought it was unlikely that the stones would have functioned for marking coastal or offshore locations or resources, because of their position and the difficulty of seeing the stones from a distance.
2) All felt that the stones should be preserved in place if at all possible because their significance and function are likely tied to their current location.
3) If preservation in place is truly not an option, they were in favor of temporary relocation of the stones to Battery Arizona, with movement back of the stones to as near as possible to their original location once the landfill is closed.
4) They all were in favor of further research regarding the stones significance and function, with eventual public signage and interpretation for the stones once they are moved back to as close as possible to their original location.

5.2 Consultation Summary

This cultural consultation effort focused on locating any additional cultural and/or historical land use information for the study area. It also focused on better establishing the age, function, cultural affiliation, and significance of SIHP #50-80-12-6903, three large upright boulders documented within the study area. Finally, this consultation effort focused on the development of appropriate mitigation for the significant historic property (SIHP #50-80-12-6903) that will be affected by landfill expansion.

Consultation efforts determined that there was no clear consensus regarding the function of SIHP #50-80-12-6903, however, all of the cultural consultants indicated that the stones were significant and that they had been used by traditional Native Hawaiian cultural practitioners in the past. All cultural consultants also felt that the stones should be preserved in place if at all possible because their significance and function are likely tied to their current location. If preservation in place is truly not an option, most were in favor of temporary relocation of the stones to Battery Arizona, with movement of the stones back to as near as possible to their original location once the landfill is closed.

Some cultural consultants expressed an interest in having research continue on the stones after they were moved. This further research would focus on determining the stones past use and/or significance to Native Hawaiian cultural practitioners. Once the results of this additional research were interpreted, public access to the stones with interpretive signage was felt to be appropriate.

The cultural consultants also expressed concern regarding the final appearance of the landfill once it has reached capacity and will no longer be used. They wanted to see the new surface of the landfill naturalized with the random placement of basalt boulders and more natural vegetation, preferably Native Hawaiian dry land species, so that the final landfill surface appears more like the surrounding hill sides.

CSH would like to thank all the cultural consultants and OHA and SHPD representatives for their time and consideration during the project’s archaeological consultation effort. Their input is extremely valuable and will help all concerned parties make the best, most well-informed management decisions for the historic property in the project APE.

Section 6 Summary and Interpretation

In compliance with and to fulfill applicable Hawai‘i state historic preservation legislation, CSH completed this archaeological inventory survey investigation for the proposed Waimānalo Gulch Landfill Expansion. Land disturbing activities associated with the landfill expansion would include: major grading, including blasting of exposed rock surfaces, and excavation of the base and walls of Waimānalo Gulch to prepare the expansion area for landfill use; grading for a perimeter road around the expansion area; excavations for stockpiling of sediment for use as cover material; excavations for associated landfill infrastructure; excavation for the installation of a storm water runoff control channel along the west side of the gulch; and filling of the expansion area with refuse material.

Per the Hawai‘i state requirements for archaeological inventory surveys [HAR Chapter 13-276], this inventory survey investigation includes the results of cultural, historical, and archaeological background research, cultural consultation, and fieldwork. The background research focused on summarizing the study area’s pre- and post-contact land use, cultural significance, and types and locations of potential historic properties within the study area and its vicinity. The cultural consultation focused on potential mitigation measures for the single historic property identified within the study area.

Pedestrian inspection of the study area identified one historic property, SIHP #50-80-12-6903. SIHP #50-80-12-6903 is located along the western edge of the study area, situated on the western slope of Waimānalo Gulch (see Figure 20). It is of pre-contact origin, and consists of three large upright boulders (Features A-C) utilized potentially as trail or boundary markers.

The inventory survey fieldwork also involved a thorough inspection of caves and rock shelters observed within the study area (see Figure 22). These caves and rock shelters were inspected for cultural modifications and/or the presence of human burials. Where significant sediment deposits were observed, subsurface testing in the form of controlled hand excavation was undertaken to establish if any subsurface cultural deposits were present. All observed and inspected caves contained no indications of cultural modification, subsurface cultural deposits, or use a human interment site.

Also of note was a rock alignment (CSH 3) located near the northeastern edge of the study area (see Figure 22). The alignment was determined to be of modern origin due to its location along a talus slope, in which soil erosion and rainwater runoff channels were observed. If the feature was of antiquity it would reflect disturbances associated with erosion and/or rainwater runoff, such as the retention of eroding rock and soil or the displacement of boulders incorporated into the alignment. Test excavations yielded no cultural material and confirmed the modern construction of the alignment.

These findings are largely in keeping with expectations, based on background research. An archaeological inventory survey of the “Makaīwa Hills” development project, totaling 1850 acres and encompassing large portions of Makaīwa and Pālailai gulches, identified pre-contact habitation sites clustered in higher elevations above 1000 ft., and in lower elevations below 500 ft (Hammatt et al. 1991). Hammatt et al. (1991) indicated that the higher elevations would contain ample forest subsistence resources for gathering on both a continual basis, as well as

during times of famine and drought, while the lower elevations would be in close proximity to the shoreline and bountiful coastal resources. The current study area is located 80 m east of the "Makaīwa Hills" development project, contains a similar topographic and geologic setting, and is situated within an elevation range of 400 to 900 ft, the zone in which pre-contact archaeological sites were absent in the neighboring "Makaīwa Hills" study area. Thus, the fact that only a single historic property was identified within the current study area is not surprising as it is consistent with the pattern observed by Hammatt et al. in 1991. Furthermore the historic property (SIHP #50-80-12-6903) consists of trail and/or boundary markers utilized by pre-contact populations, suggesting that portions of the study area were utilized for transportation to more resource rich areas (i.e. the coast and upland forest).

Both the Hammatt et al. (1991) study and the current archaeological inventory survey are important because they have provided valuable data towards establishing a settlement pattern for the leeward gulches and ridges of Honouliuli Ahupua‘a. The current study area has been determined to be situated in an intermediate zone between the coast and the upland forest. This intermediate zone is defined by an extremely arid environment, a lack of vegetation, and steep rocky terrain which would have made pre-contact habitation and agriculture very difficult. This intermediate zone is focused between 500 and 1000 ft elevations and was most likely utilized for transportation between the more hospitable coast and upland forest areas.

Section 7 Significance Assessments

The inventory survey investigation and documentation of the project area’s single historic property have provided sufficient information for significance evaluations. Significance is determined after evaluation of each historic property in light of the five broad criteria used by the Hawai‘i State Registers of Historic Places (HAR 13-275-6). The criteria are the following:

A Historic property reflects major trends or events in the history of the state or nation.

B Historic property is associated with the lives of persons significant in our past.

C Historic property is an excellent example of a site type.

D Historic property has yielded or may be likely to yield information important in prehistory or history.

E Historic property has cultural significance to an ethnic group, including, but not limited to, religious structures and burials.

SIHP #50-80-12-6903, three rock uprights, has integrity of location and materials and is recommended eligible to the Hawai‘i Register under criteria D & E

Section 8 Project Effect and Mitigation Recommendations

It is the position of the project proponents (the City and County of Honolulu) that, as the only municipal landfill site on the island of O‘ahu, the continued use of the Waimānalo Gulch facility is of utmost importance to the health and safety of the island’s population. The expansion of the existing Waimānalo Gulch facility is crucial to the facility’s continued operation over the next approximately 15 year period of anticipated use. After weighing the options, the project proponents have determined that the three stones that make up SIHP #50-80-12-6903 cannot be preserved in place in a safe and appropriate manner.

Preservation in place would require a significant reduction of the overall area and volume of the proposed facility expansion. Additionally, with the proposed blasting, mass grading, and excavation in the vicinity of the stones, the safety of the stones cannot be guaranteed if they were preserved in place. For example, refer to Figure 42, which shows the stones’ proximity to the large storm water drainage channel and Cell E6, immediately above and below the stones’ location. The controlled blasting, mass grading, and excavation associated with the installation of needed landfill infrastructure would subject the stones to repeated vibration over the next approximately 15 years as the landfill expansion progressed. The vibrations from mass grading, controlled blasting, and related earthwork would potentially be sufficient to dislodge the stones from their current resting place, causing them to roll down the steep slope they rest on. Finally, the relocation of the stones would be considered a more culturally sensitive treatment that would provide for their future preservation.

8.1 Project Effect

After weighing the options, the project proponents have determined that the three stones that make up SIHP # 50-80-12-6903 cannot be preserved in place in a safe and appropriate manner. Accordingly, a project effect determination of “effect with agreed upon mitigation commitments” is warranted.

8.2 Mitigation Recommendations

The project proponents propose the relocation of the three SIHP # 50-80-12-6903 stones to the vicinity of Battery Arizona, located in the southwestern portion of the Waimānalo Gulch facility (Figure 43). There is a precedent for this relocation as three noteworthy stones of cultural significance to Native Hawaiians have already been relocated to the Battery Arizona site from the expanding Waimānalo Gulch Landfill. These stones, described by Hammatt and Shideler (1999), were relocated to the Battery Arizona site in 1988. Figure 44 shows the location of this already established stone repository in relation to the Battery Arizona features. Figures 48 and 49 are photographs, showing the proposed relocation area for SIHP # 50-80-12-6903 along the southeast facing slope at Battery Arizona and in relation to the already established stone repository. The proposed relocation would ensure the safety of the stones during the landfill’s expansion and would make them much more accessible to interested parties.

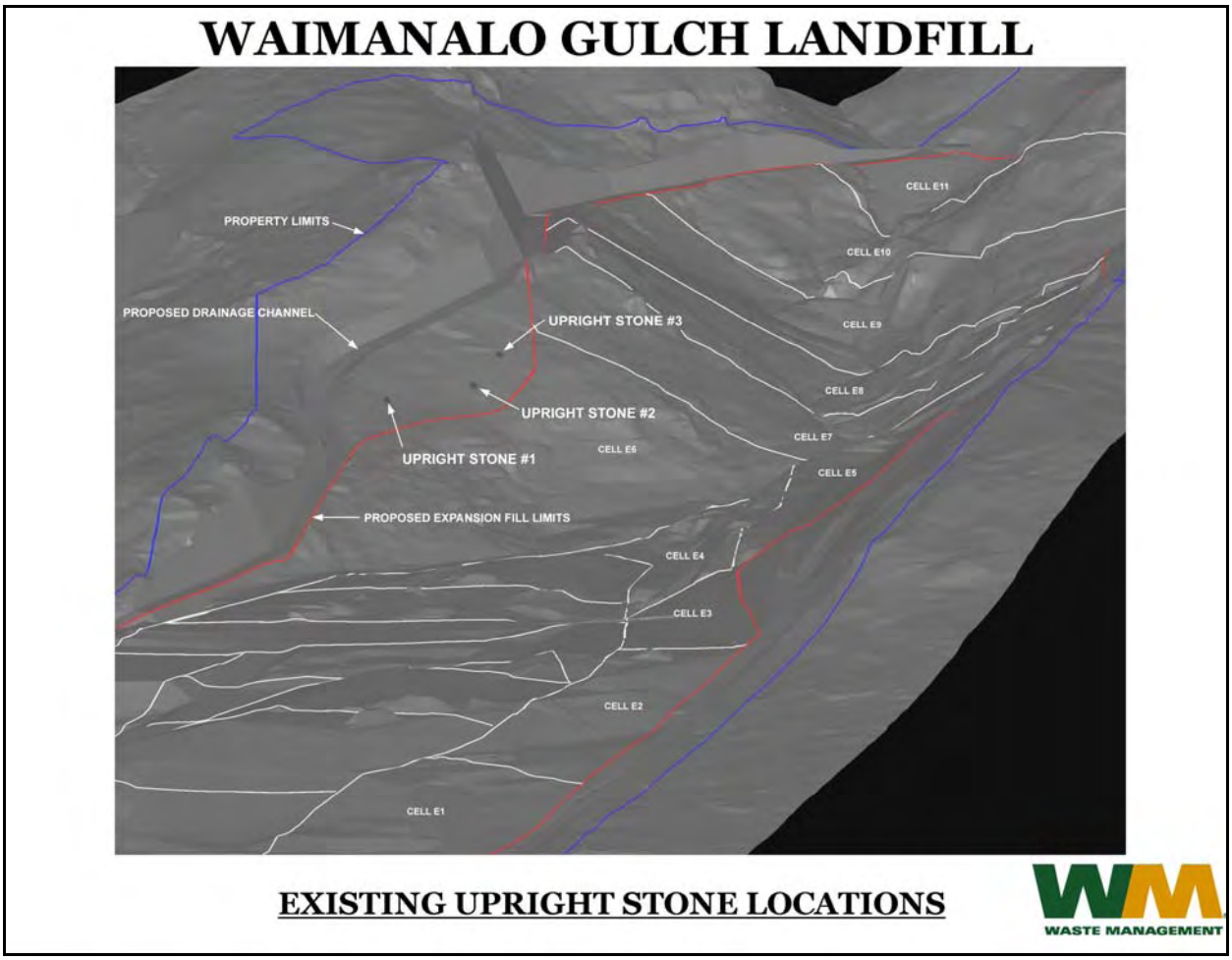

Figure 42. Three-dimensional graphic showing the proposed landfill expansion in relation to the three stones of SIHP # 50-80-12-6903. Note the large drainage channel upslope of the stones and the cell E6 immediately down slope

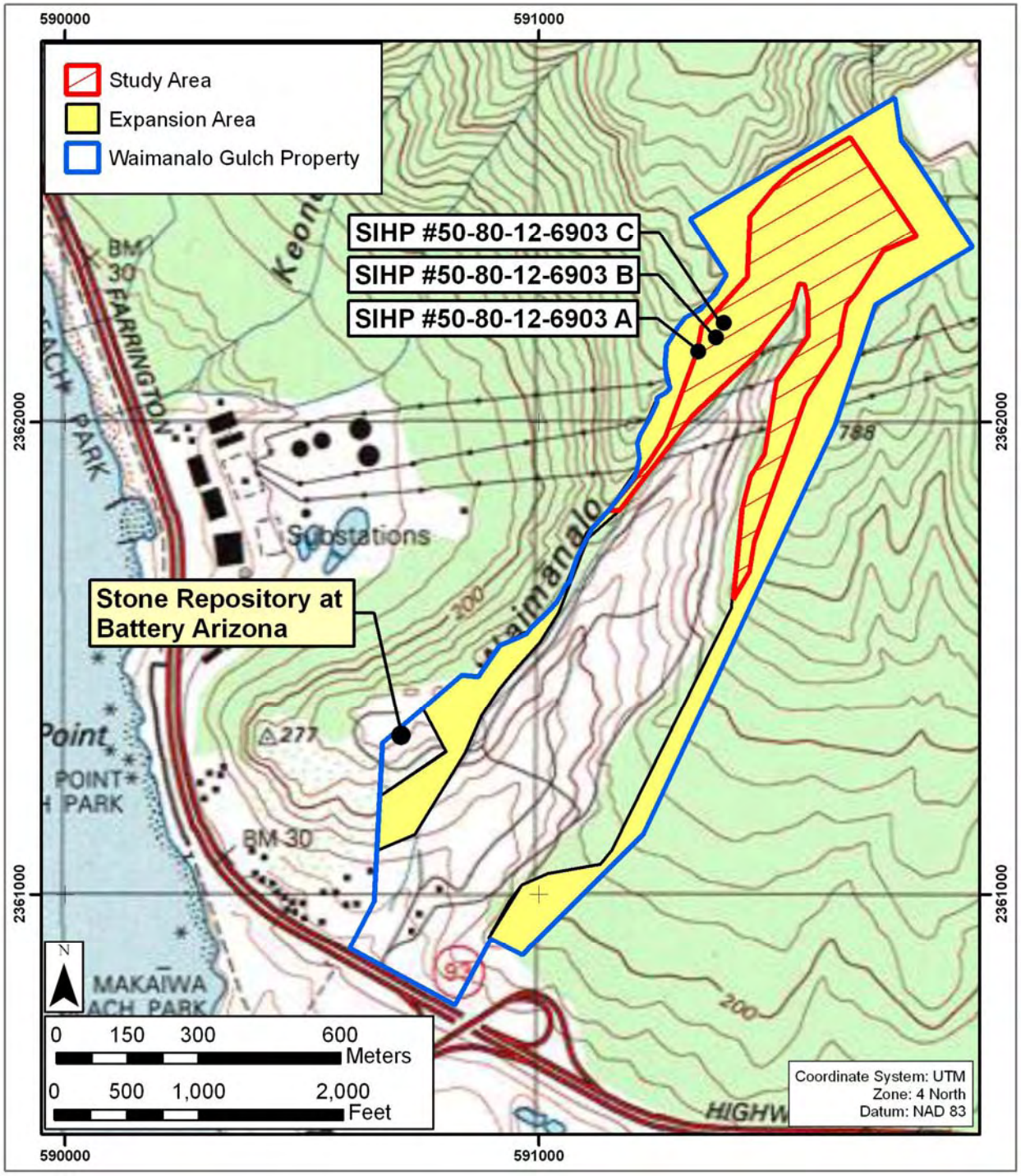

Figure 43. Portion of the 1998 ‘Ewa USGS 7.5-minute topographic quadrangle showing the Waimānalo Gulch property boundaries, the boundaries of the proposed 90-acre expansion area, the 36-acre study area, the location of Features A, B, and C of SIHP #50-80-12-6903, and the previously established stone repository at Battery Arizona.

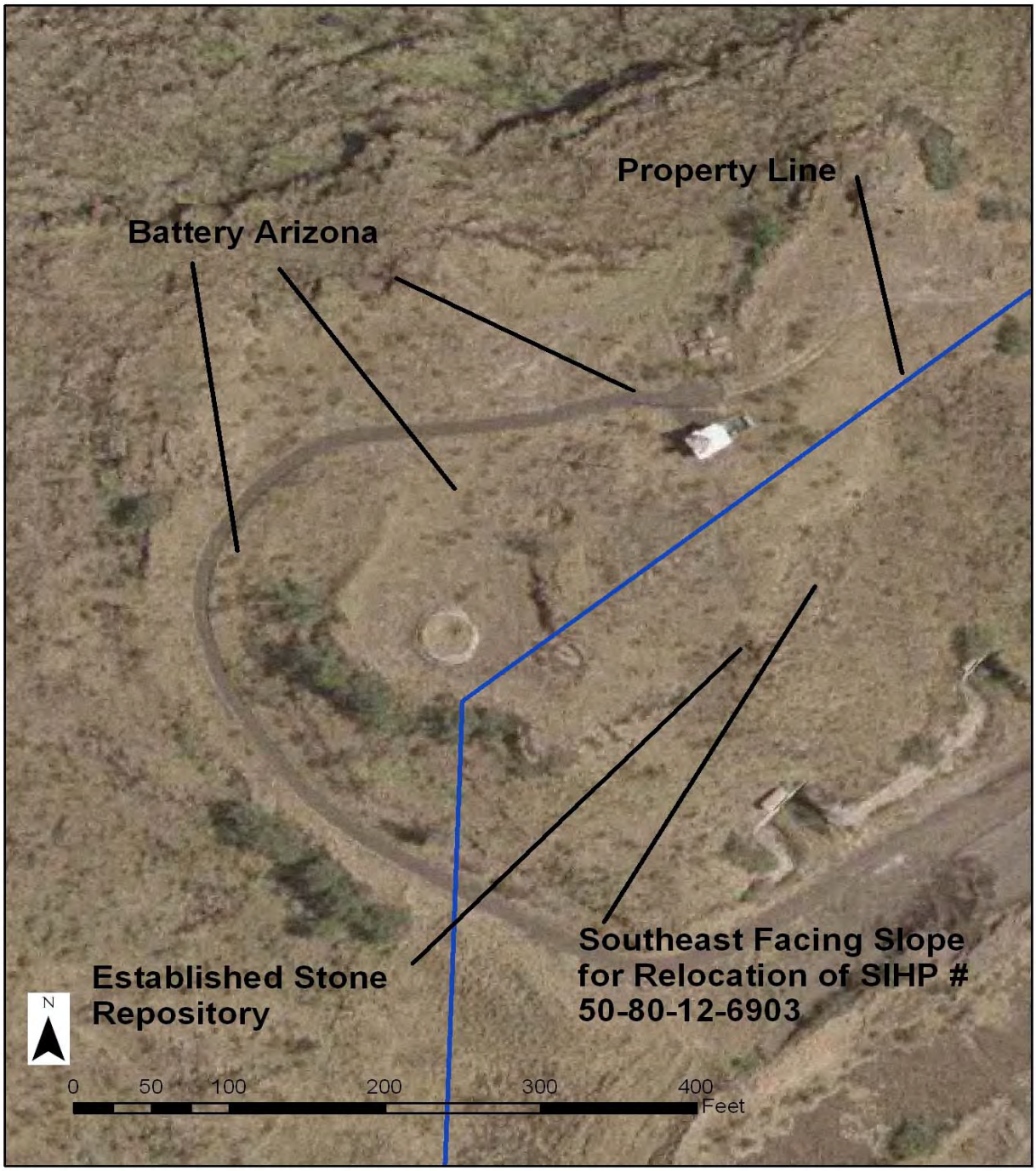

Figure 44. Aerial photograph of Battery Arizona showing the established stone repository and the proposed relocation area for SIHP # 50-80-12-6903

Figure 45. Photograph, view to the south, of the proposed relocation area at Battery Arizona for SIHP # 50-80-12-6903

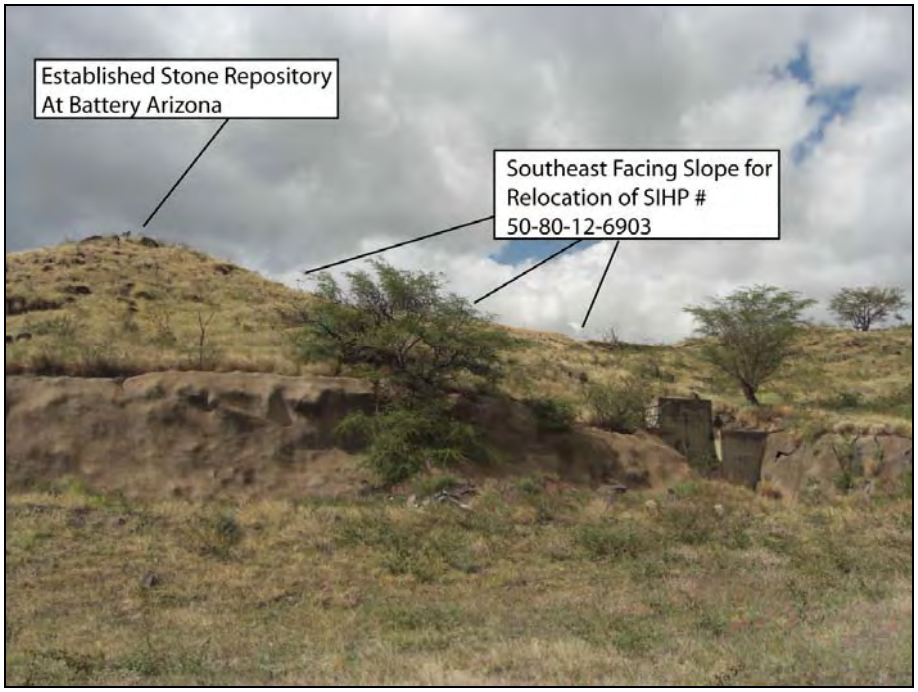

Figure 46. Photograph, view to the north, of the proposed relocation area at Battery Arizona for SIHP # 50-80-12-6903

The specifics of the proposed stone relocation would be the subject of the project’s archaeological mitigation plan for SIHP # 50-80-12-6903. These specifics would be worked out through further consultation with cultural consultants, SHPD, and the project proponents. Based on the results of cultural consultation, cultural informants would prefer to see the stones eventually returned to near their original resting places, once the landfill is no longer active, with interpretive signage based on further background research and public access. The City & County of Honolulu is willing to commit to putting the stones back, as close as possible to their original resting places. Figure 47 is a modified photograph that shows approximately what this would look like from coastal Honouliuli. This relocation could only take place after that portion of the landfill had been filled. At this time there is some uncertainty regarding when that portion of the landfill would be closed but it seems likely it will take a minimum of approximately 15 years.

A Preservation/Mitigation Plan detailing the relocation and interim preservation methods and the long term preservation including appropriate signage and interpretation will be submitted and reviewed by the SHPD. Additionally a Memorandum of Agreement will be drafted by the project proponents and will be reviewed by the SHPD prior to the implementation of the project.

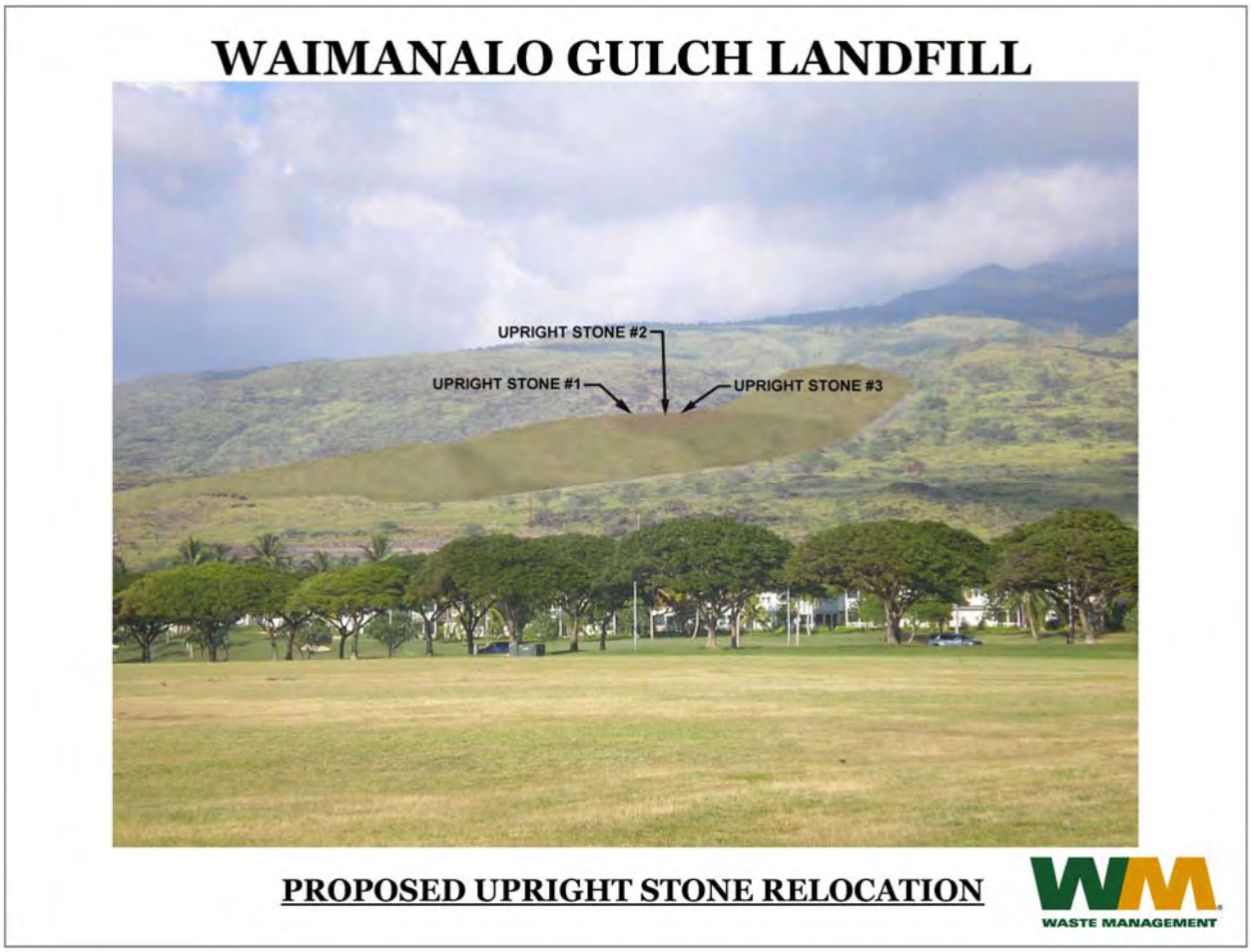

Figure 47. Altered photograph showing the planned landfill surface topography in 15 years. The potential SIHP # 50-80-12-6903 relocation site, on top of the new landfill surface, is shown

Section 9 References Cited

Armstrong, R.W. and J.A. Bier
1983 *Atlas of Hawaii. 2nd ed*. University of Hawaii Press, Honolulu, HI.

Bath, Joyce
1989 Waimānalo Gulch Petroglyphs 80-12-4110 Waimānalo Gulch, Honouliuli, ‘Ewa, O‘ahu

Bordner, Richard M.
1977a *Archaeological Reconnaissance of the Proposed Makaiwa Gulch Landfill Site, ‘Ewa, O‘ahu*, Archaeological Research Center Hawai`i, Inc.

1977b *Archaeological Reconnaissance of the Proposed Kalo‘i Gulch Landfill Site, `Ewa, O‘ahu,* Archaeological Research Center Hawaii, Inc., Lawai, HI.

Bordner, Richard, and Carol Silva
1983 *Archaeological Reconnaissance and Historical Documentation: Waimanalo Gulch, Oahu, TMK: 9-2-03: 2,40,13 (por).*

Borthwick, Douglas and Hallett Hammatt
1997 Archaeological Assessment for the proposed Ministry of Transportation Satellite Multi-Ranging Station (MTSAT-MRS) project site, Palehua, Honouliuli, Ewa, Oahu Island, Hawaii (TMK 9-2-3: por 2), Cultural Surveys Hawai‘i, Kailua, HI.

Charvet-Pond, Ann and Bertel D. Davis
1992 *West Beach Data Recovery Program Phase 4, Archaeology and Paleontological Excavations*, PHRI Hilo

Conde, Jesse and Gerald Best
1975 *Sugar Trains Pictoria*l, Felton, CA:Glenwood Publishers.

Dega, Michael F., Randy Ogg, Michael T. Carson, and Leina`ala Benson
1998 *An Archaeological Inventory Survey of the University of Hawai`i, “West O`ahu Campus, District of `Ewa, Island of O`ahu, Hawai`i (TMK 9-2-02:01, 9-2-02:03, 9-2-02:05, SCS, Honolulu, HI.*

Davis, Bertell, D. and Alan E. Haun
1987 *Interim Report Phase 2 – Intensive Survey and Test Excavations West Beach Data Recovery Program, Honouliuli, ‘Ewa, Island of O‘ahu*, PHRI Inc.

Emerson, N.B.
1978 *Pele and Hi‘iaka, A Myth From Hawai‘i*, Tuttle, Rutland VT.

Foote, Donald E., E.L. Hill, S. Nakamura and F. Stephens
1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii*, U.S. Dept. of Agriculture, U.S. Government Printing Office, Washington, D.C.

Fornander, Abraham

1919 *Fornander Collection of Hawaiian Antiquities and Folklore*, T.G. Thrum edit., Memoirs of the Bernice Pauahi Bishop Museum (Vol. VI, Part I), Bishop Museum Press, Honolulu, HI.

1920 *Collection of Hawaiian Antiquities and Folklore*, T.G. Thrum edit., Memoirs of the Bernice Pauahi Bishop Museum (Vol. VI, Part III), Bishop Museum Press, Honolulu, HI.

1917-1918 *Collection of Hawaiian Antiquities and Folklore*, T.G. Thrum edit., Memoirs of the Bernice Pauahi Bishop Museum (Vol. IV & V), Bishop Museum Press, Honolulu, HI.

1916-1919 *Fornander Collection of Hawaiian Antiquities and Folk-Lore, with translations edited and illustrated with notes by Thomas G. Thrum*, Volume 4, First series, 1916 - l917 notes by Thomas G. Thrum, Memoirs of the Bernice P. Bishop Museum, Vols. 4, 5, 6, Honolulu, HI. Indexes Only

Frierson, Barbara

1972 *A Study of Land Use and Vegetation Change: Honouliuli, 1790-1925*, Manuscript prepared for Graduate Seminar in Geography (750), University of Hawaii, Honolulu, HI.

Giambelluca, Thomas W., Michael A. Nullet and Thomas A. Schroeder

1986 *Rainfall Atlas of Hawai‘i*, Department of Land and Natural Resources, Honolulu, HI.

Hammatt, Hallett H.

1992 *Archaeological Inventory Survey of Proposed K-A-I-M Radio Tower, Palikea, Honouliuli, ‘Ewa, O‘ahu, (TMK 9-2-005:13 Portion*), Cultural Surveys Hawaii, Kailua, HI.

Hammatt, Hallett H. and David W. Shideler

1990 *Archaeological Inventory Survey of the West Loch Bluffs Project Site, Honouliuli, ‘Ewa, O‘ahu*, Cultural Surveys Hawaii, Kailua, HI.

1999 *An Archaeological Inventory Survey for the Waimānalo Gulch Sanitary Landfill Project Site, Honouliuli, ‘Ewa, O‘ahu*, Cultural Surveys Hawai‘i, Inc.

Hammatt, Hallett H., Jennifer Robins, Mark Stride and Matthew McDermott

1991 *An Archaeological Inventory Survey for the Makaīwa Hills Project Site, Honouliuli, `Ewa, O`ahu*, Cultural Surveys Hawaii, Kailua, HI.

Hammatt, Hallet, Kēhaulani Souza and David Shideler

2002 A Cultural Impact Assessment for Proposed 14.9-Acre Expansion of the Waimānalo Gulch Sanitary Landfill Project Site, Honouliuli, ‘Ewa, O‘ahu (TMK 9-2-03:72 & 073), Cultural Surveys Hawaii, Kailua, HI

Hammatt, Hallett H. and William H. Folk

1981 *Archaeological and Paleontological Investigation at Kalaeloa (Barber's Point), Honouliuli, ‘Ewa, O‘ahu, Federal Study Areas 1a and 1b, and State of Hawai'i Optional Area 1, ARCH 14-115.*

Handy, E.S. Craighill and Elizabeth G. Handy

1972 *Native Planters in Old Hawaii: Their Life, Lore, and Environment*, B.P. Bishop Museum Bulletin 233, B.P. Bishop Museum, Honolulu, HI.

Haun, Alan E. and Marion Kelly

1984 *Research Design for an Archaeological Survey of Naval Communication Area Radio Transmission Facility, Lualualei; and Naval Air Station, Barbers Point, Oahu, Hawaii*, Dept. of Anthropology, B.P. Bishop Museum, Honolulu, HI.

Honolulu Advertiser

1988 6/20/88:A-1, A-4

‘Ī‘ī, John Papa

1959 *Fragments of Hawaiian History* (Pukui translation), Bishop Museum Press, Honolulu, HI.

1983 *Fragments of Hawaiian History*, Revised, Bishop Museum Press, Honolulu, HI.

Kahiolo, G. W.

1978 *He Moolelo No Kamapuaa, The Story of Kamapuaa*, translated by Esther T. Mookini and Erin C. Neizmen with the assistance of David Tom, Hawaiian Studies Program, University of Hawaii, Manoa,HI

Kamakau, Samuel Manaiakalani

1961 *Ruling Chiefs of Hawaii*, The Kamehameha Schools Press, Honolulu, HI.

1976 *The Works of the People of Old, Na Hana a ka Po‘e Kahiko*, Bishop Museum Special Publication, No. 61, Honolulu, HI.

1991 *Tales and Traditions of the People of Old, Nā Mo‘olelo a Ka Po`e Kahiko:* The Bishop Museum, Sp. Publication 51, Bishop Museum Press, Honolulu, HI

Kelly, Marion

1959 Palehua Ku`ula Stone, ‘Ewa, O‘ahu. B.P. Bishop Museum, Honolulu, HI.

1991 *Notes on the History of Honouliuli, IN: An Archaeological Survey of the Naval Air Station, Barber’s Point, O`ahu, Hawai`i*, B.P. Bishop Museum, Honolulu, HI.

Kirchner, E.R. Lewis

1967 *The Oahu Turrets*, The Military Engineer 59. November-December 1967, 43 0-3 3;

Maly, Kepa and Paul H. Rosendahl

1993 *‘Ewa Marine Community Project, Memorandum of Agreement, Items 2.a,b Compliance Plans, Land of Honouliuli, ‘Ewa District, Island of Oahu (TMK 9-1-001-001,2,3,4,5,6,7; 9-1-012:2,3,5-17,23)*, PHRI, Hilo, HI.

McAllister, J.G.
1933 *Archaeology of O‘ahu*, Bishop Museum, Bulletin 104, Honolulu, HI.

Nakamura, Barry, Jeffrey Pantaleo and Aki Sinoto
1993 *Archaeological Inventory Survey of Proposed Development Parcels D and D-1, Makakilo, Honouliuli, ‘Ewa, O‘ahu Island (TMK 9-2-3:18 por.;75; por.; 81 por.),* Aki Sinoto Consulting, Honolulu, HI

Nakuina, Emma M.
1904 *Hawaii - Its People and Their Legends*, Honolulu, HI.

O’Leary, Owen, David Shideler, and Hallett Hammett
2007 Archaeological Inventory Survey Addendum for the Makaīwa Hills Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMK: [1] 9-1-015:005 por. and 017; 9-2-003:002 por., 005 por., and 084 por. Cultural Surveys Hawai‘i, Kailua, HI.

Payette, Pete
2003 American Forts: Hawai‘i (http://www.geocities.com/naforts/hi.html

Pukui, Mary K., Samuel H. Elbert and Esther Mookini
1974 *Place Names of Hawaii*, University of Hawaii Press, Honolulu, HI.

Rock, J.F.
1913 *The Indigenous Trees of the Hawaiian Islands*, Published under patronage, Honolulu, Territory of Hawaii.

Sinoto, Akihiko
1988 *Surface Survey of Proposed Makakilo Golf Course, Ewa, Oahu, TMK 9-2-03:18,* Bishop Museum, Honolulu, HI.

Soehren, Lloyd
1964 Waimanalo Gulch House Site, Bishop Museum, HI.

Sterling, Elspeth P. and Catherine C. Summers
1978 *Sites of O`ahu*, Dept. of Anthropology, Elspeth P. Sterling and Catherine C. Summers (comp.), B.P. Bishop Museum, Honolulu, Hi.

Thrum, Thomas G.
1906 *Heiaus and Heiau Sites Throughout the Hawaiian Islands, Hawaiian Annual for 1907*

Tuggle, H. David and M.J. Tomonari-Tuggle
1997 *Synthesis of Cultural Resource Studies of the ‘Ewa Plain, Task 1a: Archaeological Research Services for the Proposed Cleanup, Disposal and Reuse of Naval Air Station Barbers Point, O’ahu, Hawai`i*, IARII, Honolulu, HI.

Tulchin, Jon and Hallett H. Hammatt
2004 Archaeological Field Inspection for the Proposed HECO Meteorological Observation Stations, Honouliuli Ahupua‘a, ‘Ewa District, Island Of O‘ahu. Cultural Surveys Hawai‘i, Kailua, HI.

2007 Literature Review and Field Inspection of an Approximately 790-Acre Parcel at Pālehua, Honouliuli Ahupua‘a, ‘Ewa District, Island of Oahu, TMK: [1] 9-2-003:002 por. and 005 por., Cultural Surveys Hawai‘i, Kailua, HI.

2008 Archaeological Literature Review and Field Inspection of Approximately 809 Acres of Kahe Ranch Land, Honouliuli Ahupua‘a, ‘Ewa District, Island of O‘ahu (TMK: [1] 9-2-003: 004, 009, 029, 084 por., & 085). Cultural Surveys Hawai‘i, Kailua, HI.

Tulchin, Todd and Hallett H. Hammatt

2004a Archaeological Inventory Survey Of The Approximately 86-Acre Proposed Pālehua Community Association (PCA) Common Areas Parcels, Makakilo, Honouliuli Ahupua‘a, ‘Ewa District, Island Of O‘ahu (TMK: 9-2-03: 78 por. and 79), Cultural Surveys Hawai‘i, Kailua, HI.

2004b Archaeological Inventory Survey Of The Approximately 24-Acre Parcel Adjacent to the Kahe Power Plant, Honouliuli Ahupua‘a, ‘Ewa District, Island of O‘ahu, TMK: 9-2-03: 27, Cultural Surveys Hawai‘i, Kailua, HI.

2005 Archaeological Inventory Survey of the Approximately 71-Acre Proposed Pālehua East B Project, Makakilo, Honouliuli Ahupua‘a, ‘Ewa District, Island Of O‘ahu (TMK: 9-2-03: 76 and 78), Cultural Surveys Hawai‘i, Kailua

Von Holt, Ida Elizabeth Knudsen

1985 Stories of Long Ago Niihau, Kauai, Oahu. Daughters of Hawaii, Honolulu.

Waihona ‘Aina Corp. Compiler

2000 The Mahele Database, Waihona ‘Aina Corp., Compiler, fttp//waihona.com.

Appendix A SHPD Chapter 6E-8 Historic Preservation Review of August 29, 2008

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
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BOARD OF LAND AND NATURAL RESOURCES
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KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

August 29, 2008

David Shideler
Cultural Surveys Hawai'i, Inc.
P.O. Box 1114
Kailua Hawai'i 96734

LOG NO: 2008.1458
DOC NO: 0808LM10
Archaeology

Dear Mr. Shideler:

SUBJECT: Chapter 6E-8 Historic Preservation Review –
Archaeological Inventory Survey for the Waimānalo Gulch Sanitary Landfill Expansion Project.
Honouliuli Ahupua'a, `Ewa District, Island of O'ahu
TMK: (1) 9-2-003: por. 072 & 073

Thank you for the opportunity to review the aforementioned archaeological inventory survey (Dalton and Hammatt 2008), which we received on April 17, 2008. We apologize for the delay in our review. Pedestrian survey was concentrated in the 36 acre core expansion area of the overall 90 acre expansion area. Additionally limited subsurface testing of natural caves and rock overhang areas did not produce any evidence of human activities. The archaeological inventory survey of approximately 90 acres identified one significant historic property consisting of three individual features. The historic property identified during the survey was assigned State Inventory of Historic Properties (SIHP) # 50-80-12-6903. Site 6903 consists of three upright pōhaku (stones) determined eligible for the Hawai'i Register of Historic Places under significance Criteria D (informational content) and E (traditional-cultural significance to Native Hawaiians). The proposed functions, based on consultation with knowledgeable individuals from the area of the pōhaku, include; trail markers, markers for observation points for celestial and/or navigation, or markers used to calculate the location of specific coastal and/or offshore resources.

The proposed mitigation for the site includes the temporary relocation of the pōhaku to Battery Arizona to facilitate the landfill expansion. Upon completion or closure of the landfill the pōhaku will be moved back to, as close as possible, their original location. A Preservation/Mitigation Plan detailing the interim preservation methods and the long term preservation including appropriate signage and interpretation will be submitted and reviewed by SHPD. Additionally a Memorandum of Agreement will be drafted by the project proponents and will be reviewed by SHPD prior to the implementation of the project.

At this time archaeological inventory survey does not satisfy the requirements of Hawai'i Administrative Rules (HAR) Chapter 13-276-5. The survey will be accepted as soon as the following revisions are incorporated,. Please complete the following minor revisions and submit appropriate replacement pages.

1. pg iii-Mitigation Recommendations, the relocation could only take place after that portion of the landfill has been filled, most likely in 15 years. During our meeting on August 22, 2998 the project proponents discussed a 50 year closure. Please Amend.
2. Please include a statement regarding the City and County's commitment to provide a Memorandum of Agreement in all sections relevant to site mitigation.

Figure 48. SHPD Chapter 6E-8 Historic Preservation Review letter of August 29,2008, page 1

Mr. Shideler
Page 2

Please contact Lauren Morawski (O‘ahu Archaeologist) at (808) 692-8015 if you have any questions or concerns regarding this letter.

Aloha,

Nancy McMahon, Archaeology and Historic Preservation Manager
State Historic Preservation Division

LM

Figure 49. SHPD Chapter 6E-8 Historic Preservation Review letter of August 29,2008, page 2

Appendix B CSH Request for Cultural Consultation from OHA

Cultural Surveys Hawai'i Inc.
Archaeological and Cultural Impact Studies
Hallett H. Hammatt, Ph.D., President

Providing Excellence in Cultural Resource Management

O'ahu P.O. Box 1114
Kailua, HI 96734
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Fax.: (808) 262-4950

Maui 16 S. Market St., #2N
Wailuku, HI 96793
Ph.: (808) 242-9882
Fax.: (808) 244-1994

Kaua'i P.O. Box 498
Lawai, HI 96765
Ph.: (808) 245-4883

1 May 2007

CSH Job Code: HONOU 6

Mr. Clyde W. Nāmu‘o
Administrator
State of Hawai‘i Office of Hawaiian Affairs (OHA)
711 Kapi‘olani Boulevard, Suite 500
Honolulu, Hawai‘i 96813

Subject: CSH’s request to OHA for cultural consultation and/or comment regarding the archaeological inventory survey fieldwork results, historic property significance evaluations, and proposed historic property treatment/mitigation for the Waimānalo Gulch Sanitary Landfill expansion project Honouliuli Ahupua‘a, ‘Ewa District, Island of O‘ahu TMK: [1] 9-2-003:073 por.

Dear Mr. Nāmu‘o:

Cultural Surveys Hawai‘i, Inc. (CSH) recently completed fieldwork for an archaeological inventory survey associated with the Waimānalo Gulch Sanitary Landfill expansion. The landfill expansion area is located immediately mauka of the existing Waimānalo Gulch Sanitary Landfill. Waimānalo Gulch is generally located immediately inland of Farrington highway, roughly between the Honokai Hale residential subdivision and Ko Olina Resort to the southeast, and the Hawaiian Electric Co.’s (HECO) Kahe Power Plant to the northwest. Please refer the to Figure 1 for area orientation.

The proposed landfill expansion area is comprised of approximately 36-acres of undeveloped land within the Waimānalo Gulch Landfill property. The proposed landfill expansion area is to be used for the disposal of municipal refuse. The landfill expansion is meant to increase the capacity and lifespan of the existing Waimānalo Gulch Sanitary Landfill. Minimally, land disturbing activities associated with the landfill expansion project would include: major grading and excavation of the base and walls of Waimānalo Gulch to prepare the expansion area for landfill use; grading for a perimeter road around the expansion area; excavations for stockpiling of sediment for use as cover material; excavations for associated landfill infrastructure; and filling of the expansion area with refuse material. The project’s area of potential effect (APE) is defined as the entire proposed expansion area.

With this letter, CSH is providing OHA with a summary of the archaeological inventory survey fieldwork results and the significance assessments and potential mitigation recommendations for one historic property located within the project area. This historic property (SIHP # 50-80-12-6903) was discovered during the archaeological inventory survey near the southwest edge of the Waimānalo Gulch Sanitary

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Landfill expansion area. This resource is comprised of three rock uprights designated Features A-C, which may have been placed upright or may be in a natural standing position. These features rest on an east facing slope, they are situated on exposed outcrops, with Feature A and Feature B along the same outcrop, and Feature C located on an outcrop upslope, they are spaced 50-60 meters apart. This resource is interpreted as traditional Native Hawaiian, and may have functioned as a trail or boundary markers. No additional cultural constituents were observed near this location. In consultation with the State Historic Preservation Division, this historic property is recommended eligible to the Hawai'i Register of Historic Places (Hawai'i Register) under criterion D, for its potential to yield information important in prehistory or history, and under criterion E, for its cultural significance to an ethnic group.

Pursuant to Hawai'i Administrative Rules (HAR) Chapter 13-276-5 and 13-275-6, CSH is hereby seeking OHA's input regarding the significance and treatment of these historic properties.

As part of this cultural consultation effort, CSH is working with SHPD and knowledgeable cultural consultants, including Mr. William Aila and Mr. Shad Kane. In mid-March 2007 SHPD Oahu Island Archaeologist Mr. Adam Johnson visited the site with CSH personnel. In late March 2007, CSH made a site visit to SIHP # 50-80-12-6903 with Mr. William Aila and Mr. Shad Kane, where their opinions regarding the age, function, and significance of the site were discussed. Throughout April 2007 CSH has worked with the cultural consultants to obtain their input regarding the site. This input will be included in the project's archaeological inventory survey report.

The project's archaeological inventory survey fieldwork was carried out in January and February 2007. Background research confirmed that that some of the project area had been surveyed by Cultural Surveys Hawaii previously, however due to changes in the project area and the political context of this project, a new 100% pedestrian survey was conducted of the entire proposed expansion area. The archaeological inventory survey resulted in the location of one new historic property (SIHP # 50-80-12-6903). This historic property is briefly described below and shown on the attached USGS topographic map (Figure 2 and Figure 3).

SIHP # 50-80-12-6903 was discovered during the archaeological inventory survey near the southwest edge of the Waimānalo Gulch Sanitary Landfill expansion area and is comprised of three stone uprights designated Features A-C.

SIHP # 50-80-12-6903 Feature A measures 1.20 m maximum length, 1.12 m maximum width, and 2.10 m maximum height. There appear to be no intentionally placed rocks surrounding the base of this upright. The flat face of this stone is directed south. The face of this feature is discolored and appears to have once rested on the ground (Figure 4 and Figure 5).

SIHP # 50-80-12-6903 Feature B measures 1.63 m maximum length, .75 m maximum width, and 1.78 m maximum height. The upright appears to have one or more stones at its western base, which may have been intentionally placed, however the majority of this uprights base rests in a natural area of exposed bedrock. Once identified this feature could be clearly scene from the landfill below. Feature B is triangular in shape forming a small point at its apex (Figure 6 and Figure 7).

1 May 2007

SIHP # 50-80-12-6903 Feature C measures 2.3 m maximum length, 1.7 m maximum width, and 2.5 m maximum height. The upright is believed to be in a natural standing position. This upright has a natural crack in the east face, which may give it a feminine association (Figure 8 and Figure 9).

It is CSH's understanding that this resource will be removed under the current landfill expansion plan. Potential ideas for mitigation include: preservation, relocation, and or adjustment of the expansion area.

I hope the attached summary provides the information you require to comment on the inventory survey findings and the proposed historic property significance assessments and treatment. Per the requirements of HAR Chapter 13-276-8, CSH is interested in OHA's input and comment regarding the significance of these resources.

Thank you very much for your assistance with this matter. Please contact me with any questions.

Sincerely,

Matt McDermott
Projects Manager, Cultural Surveys Hawaii, Inc.
P. O. Box 1114
Kailua, Hawaii 96734
Tel. (808) 262-9972
Fax. (808) 262-4950
mmcdermott@culturalsurveys.com

1 May 2007

Attachments:

Figure 1. Aerial photograph showing the location of the Waimānalo Gulch Sanitary Landfill property and the proposed expansion project area (source: USGS Orthoimagery 2005)

Figure 2. USGS 7.5 Minute Series Topographic Map, Ewa Quadrangle (1998), showing the location of the Waimānalo Gulch Sanitary Landfill property, the proposed expansion project area, and the newly documented historic property (SIHP # 50-80-12-6903)

Figure 3. USGS 7.5 Minute Series Topographic Map, Ewa Quadrangle (1998), showing a close-up view of the location of historic property (SIHP # 50-80-12-6903)

Figure 4. SIHP # 50-80-12-6903 Feature A, Photograph of face of rock upright, view to the north

Figure 5. SIHP # 50-80-12-6903 Feature A Photograph of side profile of rock upright, view to the south

Figure 6. SIHP # 50-80-12-6903 Feature B, Photograph of face of rock upright, view to the northwest

Figure 7. SIHP # 50-80-12-6903 Feature B, Photograph of side profile of rock upright, view to the south

Figure 8. SIHP # 50-80-12-6903 Feature C, Photograph of side profile of rock upright, view to the

Figure 9. SIHP # 50-80-12-6903 Feature B, Photograph of side profile of rock upright, view to the southwest

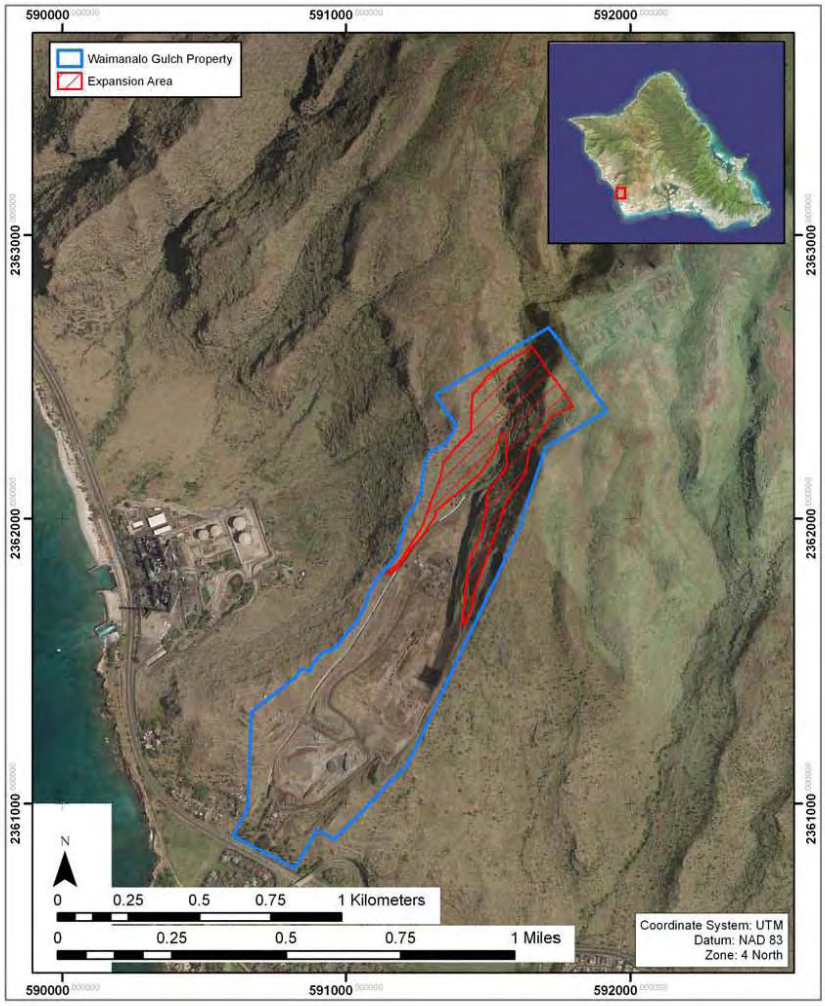

Figure 1. Aerial photograph showing the location of the Waimānalo Gulch Sanitary Landfill property and the proposed expansion project area (source: USGS Orthoimagery 2005)

1 May 2007

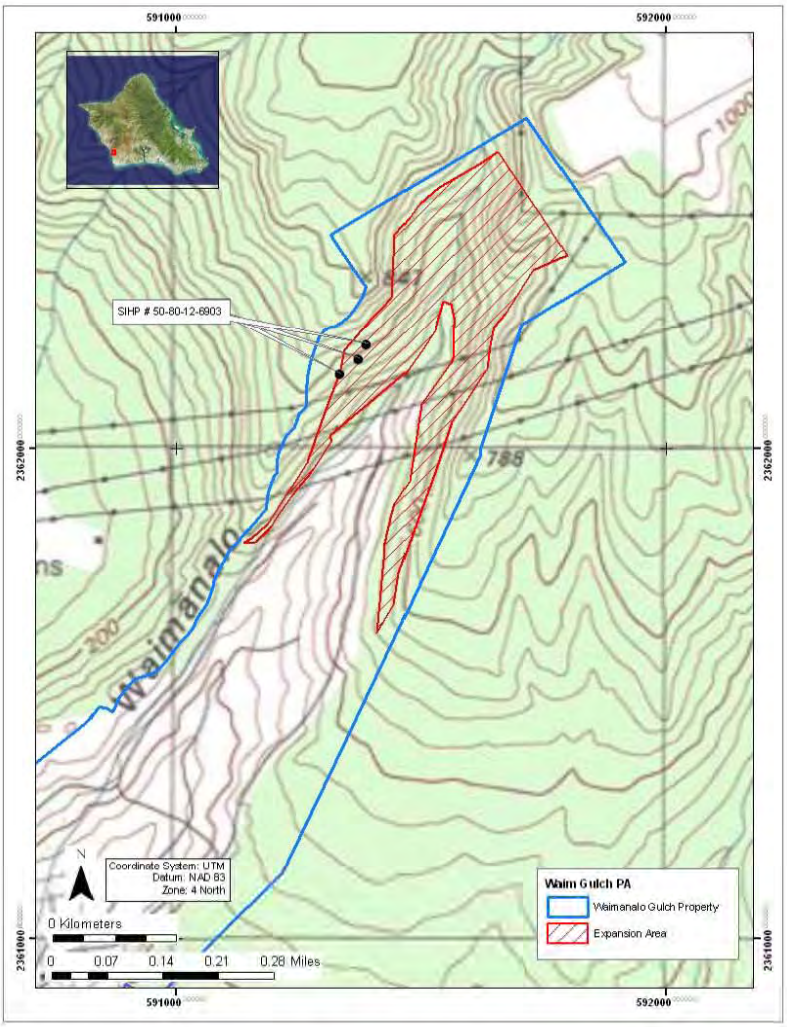

Figure 2. USGS 7.5 Minute Series Topographic Map, Ewa Quadrangle (1998), showing the location of the Waimānalo Gulch Sanitary Landfill property, the proposed expansion project area, and the newly documented historic property (SIHP # 50-80-12-6903)

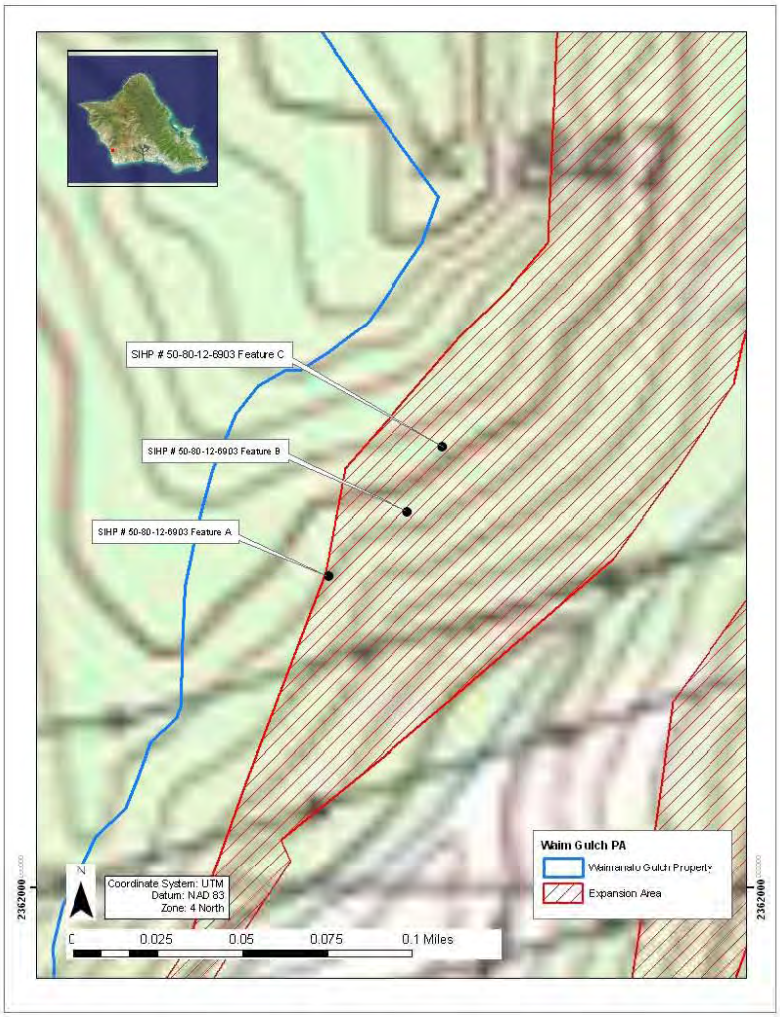

Figure 3. USGS 7.5 Minute Series Topographic Map, Ewa Quadrangle (1998), showing a close-up view of the location of historic property (SIHP # 50-80-12-6903)

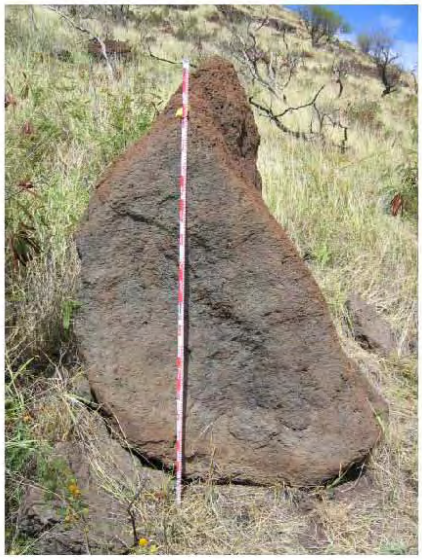

Figure 4. SIHP # 50-80-12-6903 Feature A, Photograph of face of rock upright, view to the north

Figure 5. SIHP # 50-80-12-6903 Feature A Photograph of side profile of rock upright, view to the south

Figure 6. SIHP # 50-80-12-6903 Feature B, Photograph of face of rock upright, view to the northwest

Figure 7. SIHP # 50-80-12-6903 Feature B, Photograph of side profile of rock upright, view to the south

Figure 8. SIHP # 50-80-12-6903 Feature C, Photograph of side profile of rock upright, view to the west

Figure 9. SIHP # 50-80-12-6903 Feature B, Photograph of side profile of rock upright, view to the southwest

Appendix C OHA Response to CSH Request for Cultural Consultation

PHONE (808) 594-1888 FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

May 24, 2007 HRD07_2765C

Matt McDermott, Projects Manager
Cultural Surveys Hawai'i, Inc.
P.O. Box 1114
Kailua, Hawai'i 96734

Dear Mr. McDermott

Re: Request for cultural consultation and/or comment regarding the archaeological inventory survey fieldwork results, historic property significance evaluations, and proposed historic property treatment/mitigation for the Waimanalo Gulch Sanitary Landfill expansion project
Honouliuli Ahupua'a, 'Ewa District, Island of O'ahu
TMK: (1) 9-2-003:073 por.

The Office of Hawaiian Affairs (OHA) is in receipt of your May 1, 2007 letter which provides a summary of archaeological inventory survey fieldwork results and the significance assessments and potential mitigation recommendations for one historic property (SIHP # 50-80-12-6903) identified within the subject project area.

SIHP # 50-80-12-6903 consists of three component features spaced 50-60 meters apart, is currently interpreted as traditional Native Hawaiian, and is believed to have functioned as a trail or boundary marker. This cultural resource is currently recommended eligible to the Hawai'i Register of Historic Places under criterion D for its potential to yield information important in prehistory and history, and under criterion E for its cultural significance to an ethnic group.

OHA commends you for initiating a consultation effort, and conducting site visits with State Historic Preservation Division staff and knowledgeable individuals, including Mr. William Aila and Shad Kane. OHA recommends that you also initiate consultation with Mr. Alika Silva and Mr. Glen Kila of the community group Koa Mana, and Ms. Nettie Tiffany of Lani Ku Honua.

Matt McDermott, Project Manager
Cultural Surveys Hawai'i Inc.
May 24, 2007
Page 2

There is also institutional knowledge within OHA which indicates reinterments of Native Hawaiian burials have occurred mauka of Farrington Highway in the general vicinity of the project area.

OHA initially questions whether the transect distances used during the pedestrian survey were adequate, and whether subsurface testing was conducted during archeological inventory survey fieldwork.

Should SIHP # 50-80-12-6903 prove to function as a trail marker, it is highly probable that such a trail would continue beyond the currently identified boundaries of the site. Consideration should also be given for modern access to the trail for protected cultural and traditional purposes.

It appears that the site is located on the periphery of the project area, and OHA maintains a position that the site should be preserved through adjustment of the current project area and appropriate mitigation measures established.

Thank you for the opportunity to review and provide comment on the archaeological inventory survey fieldwork results, historic property significance evaluations, and proposed historic property treatment/mitigation for the Waimanalo Gulch Sanitary Landfill project area. Should you have any questions, please contact Keola Lindsey, Lead-Advocate-Culture at (808) 594-1904 or keolal@oha.org.

'O wau iho nō,

Clyde W. Nāmu'o
Administrator

Appendix D CSH Response to OHA

CULTURAL SURVEYS HAWAI'I
ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL DOCUMENTATION SERVICES - SINCE 1982

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7 March 2008

Mr. Clyde W. Nāmu'o
Administrator
State of Hawai'i Office of Hawaiian Affairs (OHA)
711 Kapi'olani Boulevard, Suite 500
Honolulu, Hawai'i 96813

Subject: Proposed historic property treatment/mitigation for the Waimānalo Gulch Sanitary Landfill Expansion Project, Honouliuli Ahupua'a, 'Ewa District, Island of O'ahu TMK: [1] 9-2-003:073 por.

Cultural Surveys Hawaii, Inc (CSH). Job Code: HONOU 6

Aloha Mr. Nāmu'o:

Background to This Letter and Purpose

In a May 1st, 2007 letter to the Office of Hawaiian Affairs (OHA), CSH asked for cultural consultation regarding the archaeological inventory survey results, historic property significance evaluations, and proposed historic property treatment for the proposed Waimānalo Gulch Sanitary Landfill Expansion Project. This consultation was initiated pursuant to Hawai'i Administrative Rules (HAR) Chapter 13-276-5 and 13-275-6. OHA responded in a May 24th, 2007 letter, asking for additional cultural consultation with members of the Koa Mana organization, as well as Ms. Nettie Tiffany of Lani Ku Honua. Additionally, the letter queried whether or not subsurface testing was undertaken as part of the project's archaeological inventory survey. Finally, OHA's letter took the position that the single historic property documented in the project area, State Inventory of Historic Properties (SIHP) # 50-80-12-6903--three upright stones, should be preserved through adjustment of the current project area boundaries.

With this letter, CSH is responding to OHA's May 24th, 2007 letter, providing a response to OHA's request for information, and offering an update concerning CSH's on-going project-related cultural consultation with knowledgeable parties. Additionally, CSH is hereby seeking OHA's input regarding the proposed mitigation of SIHP # 50-80-12-6903.

Project Description

The landfill expansion area is located immediately *mauka* of the existing Waimānalo Gulch Sanitary Landfill. Waimānalo Gulch is generally located immediately inland of Farrington Highway, roughly between the Honokai Hale residential subdivision and Ko Olina Resort to the southeast, and the Hawaiian Electric Co.'s (HECO) Kahe Power Plant to the northwest. Please refer the to Figure 1 for area orientation.

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The proposed landfill expansion area is comprised of approximately 92.5-acres of undeveloped land within the Waimānalo Gulch Landfill property. The proposed landfill expansion area is to be used for the disposal of municipal refuse, H-POWER associated ash and residue, and operational activities associated with running the landfill. The landfill expansion is meant to increase the capacity and lifespan of the existing Waimānalo Gulch Sanitary Landfill. Minimally, land disturbing activities associated with the landfill expansion project would include: major grading, including blasting of exposed rock surfaces, and excavation of the base and walls of Waimānalo Gulch to prepare the expansion area for landfill use; grading for a perimeter road around the expansion area; excavations for stockpiling of sediment for use as cover material; excavations for associated landfill infrastructure; excavation for the installation of a storm water runoff control channel along the west side of the gulch; and filling of the expansion area with refuse material. The project's area of potential effect (APE) is defined as the entire proposed expansion area.

Archaeological Inventory Results and Description of SIHP # 50-80-12-6903

Background research confirmed that the 92.5-acre landfill expansion project area had been surveyed by CSH as part of an earlier archaeological inventory survey of Waimānalo Gulch (Hammatt and Shideler 1999). In early 2007, at the request of the project proponents, CSH completed additional archeological inventory survey investigation, including systematic pedestrian inspection and limited subsurface testing, of a 36-acre portion of the overall 92.5-acre APE that represents the core of the expansion area (refer to Figure 1 where the 36-acre survey area is shown in red and labeled the Expansion Area). For the investigation's pedestrian inspection there was a 10 to 15 meter interval between archaeologists (the general standard in Hawaii for archaeological inventory surveys). CSH's subsurface testing program for this project's archaeological inventory survey included the excavation of controlled test units in several natural rock shelters/overhangs that were noted in the project area. Although there were no surface indications of archaeological deposits in these natural features, this testing was carried out to determine if buried cultural deposits were present. No cultural deposits were found as a result of this subsurface testing.

The single historic property (SIHP # 50-80-12-6903) that was documented during the archaeological inventory survey was found near the southwest edge of the Waimānalo Gulch Sanitary Landfill expansion area (Figure 1). This resource is comprised of three rock uprights designated Features A-C, which, based on available information are naturally upright standing. These stone uprights rest on a steep southeast facing slope, are spaced 50-60 meters apart, and are situated on exposed outcrops (Figure 2). Feature A and Feature B are along the same outcrop, while Feature C is located on a higher outcrop upslope. This resource is interpreted as traditional Native Hawaiian, and may have functioned as trail or boundary markers. No additional feature components were observed near this location. In consultation with the State Historic Preservation Division (SHPD), this historic property is recommended eligible to the Hawai'i Register of Historic Places (Hawai'i Register) under criterion D, for its potential to yield information important in prehistory or history, and under criterion E, for its cultural significance to Native Hawaiians. This historic property is briefly described below and shown on the attached USGS topographic map and photograph (Figure 1 and Figure 2). Figures 3 and 4, a map and photograph respectively, show SIHP # 50-80-12-6903 as viewed from coastal Honouliuli.

SIHP # 50-80-12-6903 Feature A measures 1.20 m maximum length, 1.12 m maximum width, and 2.10 m maximum height. There appear to be no intentionally placed rocks surrounding the base of this upright.

The flat face of this stone is directed south. One surface of this stone is discolored and appears to have once rested on the ground (Figure 5 and Figure 6).

SIHP # 50-80-12-6903 Feature B measures 1.63 m maximum length, 0.75 m maximum width, and 1.78 m maximum height. The upright appears to have one or more stones at its western base, which may have been intentionally placed, however the majority of this upright's base rests in a natural area of exposed bedrock. Feature B is triangular in shape, forming a small point at its apex (Figure 7 and Figure 8).

SIHP # 50-80-12-6903 Feature C measures 2.3 m maximum length, 1.7 m maximum width, and 2.5 m maximum height. The upright is believed to be in a natural standing position. This upright has a natural crack in the east face, which may give it a feminine association (Figure 9 and Figure 10).

Summary of Consultation Effort

For the project's archeological inventory survey consultation effort, CSH is working with OHA, SHPD and knowledgeable cultural consultants. This effort is dove-tailed with the cultural consultation effort currently underway for the project's cultural impact assessment, which CSH is also preparing pursuant to HRS Chapter 343 and the Office of Environmental Quality Control's guidelines for assessing cultural impacts. Table 1 summarizes the individuals and organizations/agencies that have been consulted.

Table 1. Cultural and/or Agency Consultants

Name	Affiliation
Ailā , William	Hui Malāma I Nā Kūpuna
Amaral, Annelle	‘Ahahui Siwila Hawai'i O Kapolei Hawaiian Civic Club
Cope, Aggie	Hale O Na‘auao Society
Desoto, Frenchy	Wai‘anae Coast Archaeological Preservation Representative
Davan, Teresa	O'ahu Island Archaeologist, SHPD
Eaton, Arline	*Kupuna* at Iroquois Elementary School
Enos, Eric	Cultural practitioner and director of Ka‘ala Farms
Flanders, Judith	Granddaughter of Alice Kamōkila Campbell
Greenwood, Alice	O'ahu Island Burial Council Member, Wai‘anae District
Ho‘ohuli, “Black” Jo	Wai‘anae Neighborhood Board No 24
Rezentes, Cynthia	Wai‘anae Neighborhood Board No 24
Johnson, Adam	Former Oahu Island Archaeologist, SHPD
Johnson, Rubellite	Hawaiian scholar
Josephides, Analu	O‘ahu Island Burial Council Member, Wai‘anae District
Kanahele, Kamaki	President of Nānākuli Homestead Association
Kane, Shad	Member of the Makakilo, Kapolei, Honokai Hale Neighborhood Board and ‘Ahahui Siwila Hawai'i O Kapolei Hawaiian Civic Club
Kila, Glenn	Koa Mana
Makaiwi, Martha	Makakilo, Kapolei, Honokai Hale Neighborhood Board No. 34

McKeaque, Kawika	O'ahu Island Burial Council member 'Ewa District
Momoa, Joseph	Kama'āina of Nānākuli and member of Kamo'i Canoe Club
Morawski, Lauren	O'ahu Island Archaeologist, SHPD
Nāmu'o, Clyde	Administrator at Office of Hawaiian Affairs
Paik, Kaleo	Culture and Historic Branch, SHPD
Philpotts, McD	Cultural practitioner and long time resident of Waimānalo 'Ili
Silva, Alika	Koa Mana
Tiffany, Nettie	Kahu of Lanikūhonua and Former O'ahu Island Burial Council member, 'Ewa District
Timson, Maeda	Member of the Makakilo, Kapolei, Honokai Hale Neighborhood Board No. 34 and President of Ua Au O Kapolei

This consultation effort has included several on-site, at the SIHP # 50-80-12-6903 location, meetings that included SHPD personnel (Mr. Adam Johnson, Ms. Teresa Davan, Ms. Linda Kaleo Paik, and Ms. Lauren Morawski), as well as knowledgeable cultural consultants, including Mr. McD Philpotts, Mr. Alika Silva, Mr. Glen Kila, Mr. Shad Kane, Mr. William Ailā, and Mr. Eric Enos. Through this consultation CSH has sought the opinions of cultural consultants regarding the age, function, cultural affiliation, and significance of the three stone uprights.

All cultural consultants felt the stones were significant Native Hawaiian cultural resources that were used in the past by traditional Hawaiian cultural practitioners. There is no clear consensus, however, regarding the specific function of the upright stones. Potential functions discussed included trail markers, markers for observation points for celestial observation and/or navigation, or markers used to calculate the location of specific coastal and/or off-shore resources. Potential mitigation measures for the stones, including preservation in place and relocation, were discussed with these cultural consultants during the on-site meetings.

Proposed Mitigation

It is the position of the project proponents (the City and County of Honolulu) that, as the only municipal landfill site on the island of O'ahu, the continued use of the Waimānalo Gulch facility is of utmost importance to the health and safety of the island's population. The expansion of the existing Waimānalo Gulch facility is crucial to the facility's continued operation over the next decades. After weighing the options, the project proponents have determined that the three stones that make up SIHP # 50-80-12-6903 cannot be preserved in place in a safe and appropriate manner.

Preservation in place would require a significant reduction of the overall area and volume of the proposed facility expansion. Additionally, with the proposed blasting, mass grading, and excavation in the vicinity of the stones, the safety of the stones cannot be guaranteed if they were preserved in place. For example, refer to Figure 11, which shows the stones' proximity to the large storm water drainage channel and Cell E6, immediately above and below the stones' location. The blasting, mass grading, and excavation associated with the installation of these needed landfill features would subject the stones to repeated vibration and blasting debris over the next approximately 15 years as the landfill expansion progressed. The vibrations from blasting and mass grading would potentially be sufficient to dislodge the stones from

their current resting place, causing them to roll down the steep slope they rest on. Finally, considering the use of the site as a landfill, preservation in place is not thought to be an appropriate mitigation treatment for the stones, considering their cultural sensitivity.

The project proponents propose the relocation of the three SIHP # 50-80-12-6903 stones to Battery Arizona, located in the southwestern portion of the Waimānalo Gulch facility (refer to Figure 1). There is a precedent for this relocation as three noteworthy stones of cultural significance to Native Hawaiians have already been relocated to the Battery Arizona site from the expanding Waimānalo Gulch Landfill. These stones, described by Hammatt and Shideler (1999), were relocated to the Battery Arizona site in 1988. Figure 12 shows the location of this already established stone repository in relation to the Battery Arizona features. Figures 13 and 14 are photographs, showing the proposed relocation area for SIHP # 50-80-12-6903 along the southeast facing slope at Battery Arizona and in relation to the already established stone repository. The proposed relocation would ensure the safety of the stones during the landfill's expansion and would make them much more accessible to interested parties.

The specifics of the proposed stone relocation would be the subject of the project's mitigation plan for SIHP # 50-80-12-6903. These specifics would be worked out through further consultation with cultural consultants. There is the option of putting the stones back near their original resting places. Figure 15 is a modified photograph that shows approximately what this would look like from coastal Honouliuli. This relocation could only take place after that portion of the landfill had been filled, most likely in approximately 15 years. The permanent relocation of the stones to Battery Arizona is another, more feasible mitigation option.

Versions of this consultation letter will be sent to SHPD and the cultural consultants that made site visits to the project area. Along with OHA's response, the archaeological inventory survey report will summarize the input from these cultural consultants.

Thank you very much for your assistance with this matter. Please contact me with any questions.

Sincerely,
Cultural Surveys Hawaii, Inc.

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C: Mr. Keola Lindsey, OHA; Ms. Linda Kaleo Paik and Ms. Lauren Morawski, SHPD

Hammatt, Hallett H. and David Shideler
1999 *An Archaeological Inventory Survey for the Waimānalo Gulch Sanitary Landfill Project Site, Honouliuli, `Ewa, O`ahu.* Cultural Surveys Hawaii, Inc. Kailua, HI.

Attachments:

Figure 1. Portion of the 1998 'Ewa USGS 7.5-minute topographic quadrangle showing the Waimānalo Gulch property boundaries, the boundaries of the proposed 36-acre expansion area, the location of Features A, B, and C of SIHP # 50-80-12-6903, and the previously established stone repository at Battery Arizona.

Figure 2. Photograph of the southeast facing slope of Waimānalo Gulch, showing the locations of features A, B, and C of SIHP # 50-80-12-6903

Figure 3. Map showing the location from which the Figure 4 photograph was taken

Figure 4. Photograph of the SIHP # 50-80-12-6903 location, taken from coastal Honouliuli, view to the northeast (refer to Figure 3), showing the stones' visibility from the coast

Figure 5. SIHP # 50-80-12-6903 Feature A, Photograph of face of rock upright, view to the north

Figure 6. SIHP # 50-80-12-6903 Feature A Photograph of side profile of rock upright, view to the south

Figure 7. SIHP # 50-80-12-6903 Feature B, Photograph of face of rock upright, view to the northwest

Figure 8. SIHP # 50-80-12-6903 Feature B, Photograph of side profile of rock upright, view to the south

Figure 9. SIHP # 50-80-12-6903 Feature C, Photograph of side profile of rock upright, view to the

Figure 10. SIHP # 50-80-12-6903 Feature B, Photograph of side profile of rock upright, view to the southwest

Figure 11. Three-dimensional graphic showing the proposed landfill expansion in relation to the three stones of SIHP # 50-80-12-6903. Note the large drainage channel upslope of the stones and the cell E6 immediately down slope

Figure 12.Aerial photograph of Battery Arizona, refer to Figure 1 for its location within the project area, showing the established stone repository and the proposed relocation area for SIHP # 50-80-12-6903

Figure 13. Photograph, view to the south, of the proposed relocation area at Battery Arizona for SIHP # 50-80-12-6903

Figure 14. Photograph, view to the north, of the proposed relocation area at Battery Arizona for SIHP # 50-80-12-6903

Figure 15. Altered photograph showing the planned landfill surface topography in 15 years. The potential SIHP # 50-80-12-6903 relocation site, on top of the new landfill surface, is shown

Mr. Clyde W. Nāmu'o **Page 7**

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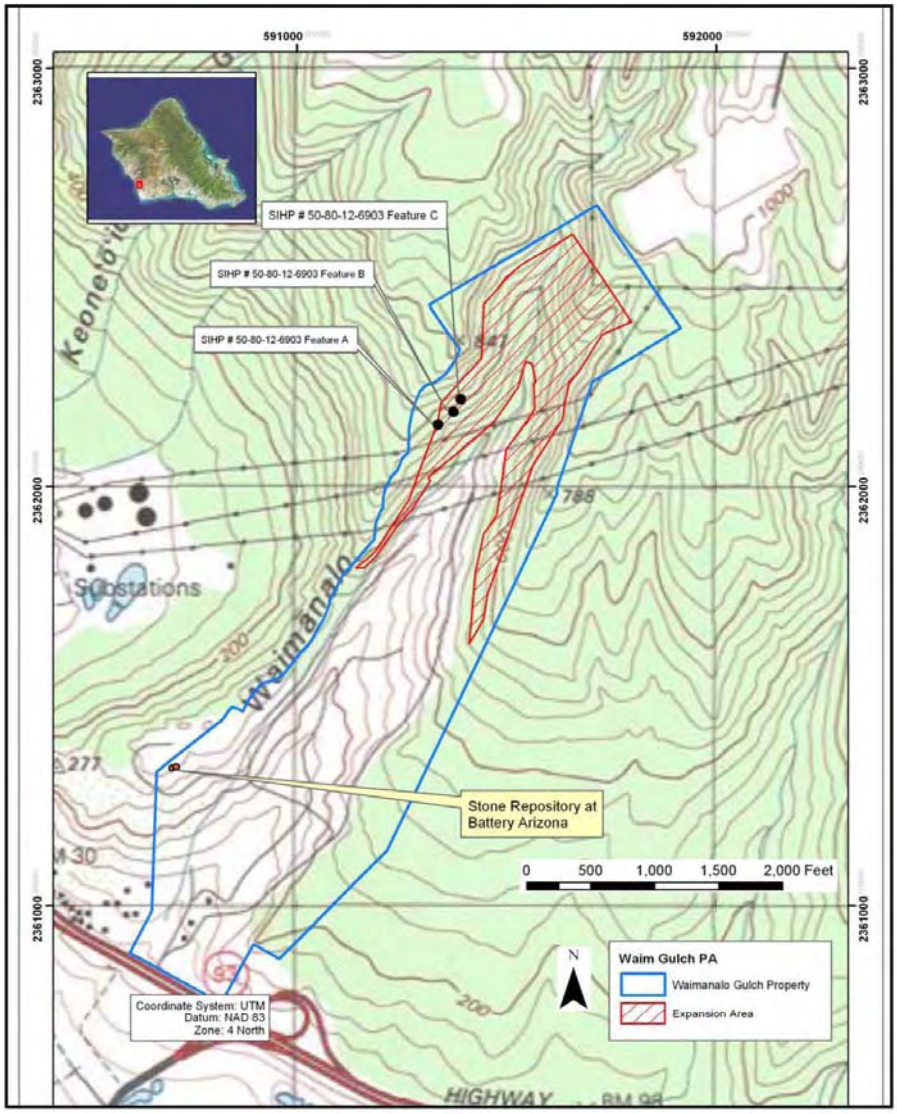
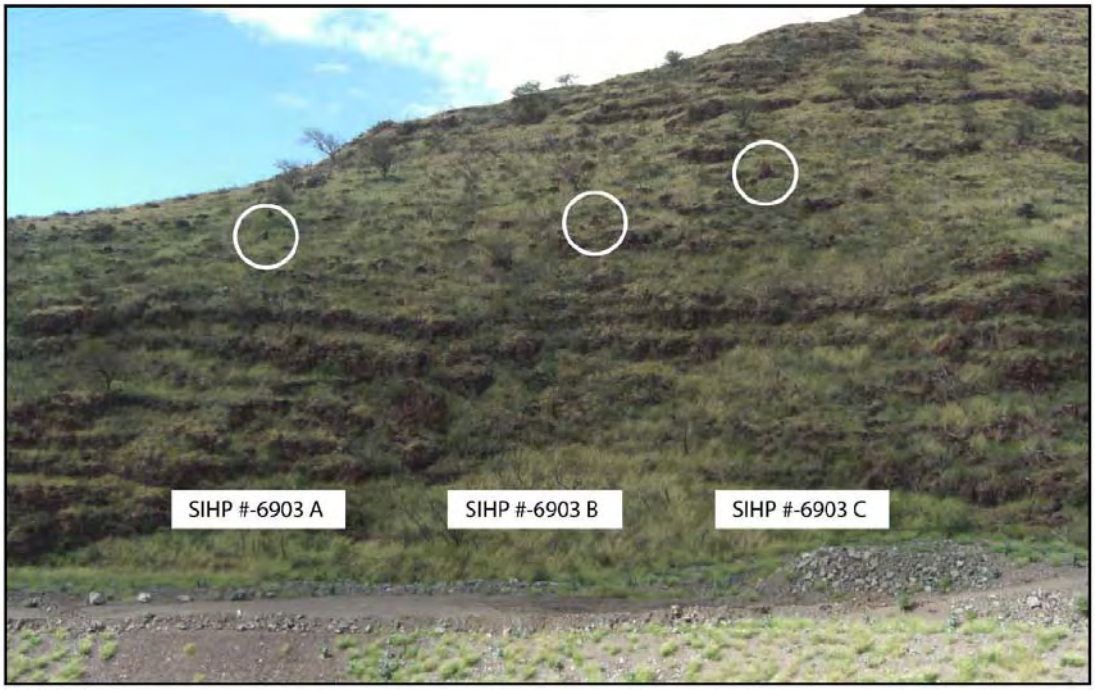


Figure 1. Portion of the 1998 `Ewa USGS 7.5-minute topographic quadrangle showing the Waimānalo Gulch property boundaries, the boundaries of the proposed 36-acre expansion area, the location of Features A, B, and C of SIHP # 50-80-12-6903, and the previously established stone repository at Battery Arizona.

Proposed historic property treatment/mitigation for the Waimānalo Gulch Sanitary Landfill Expansion Project, Honouliuli Ahupuaʻa, ʻEwa District, Island of Oʻahu TMK: [1] 9-2-003:073 por.



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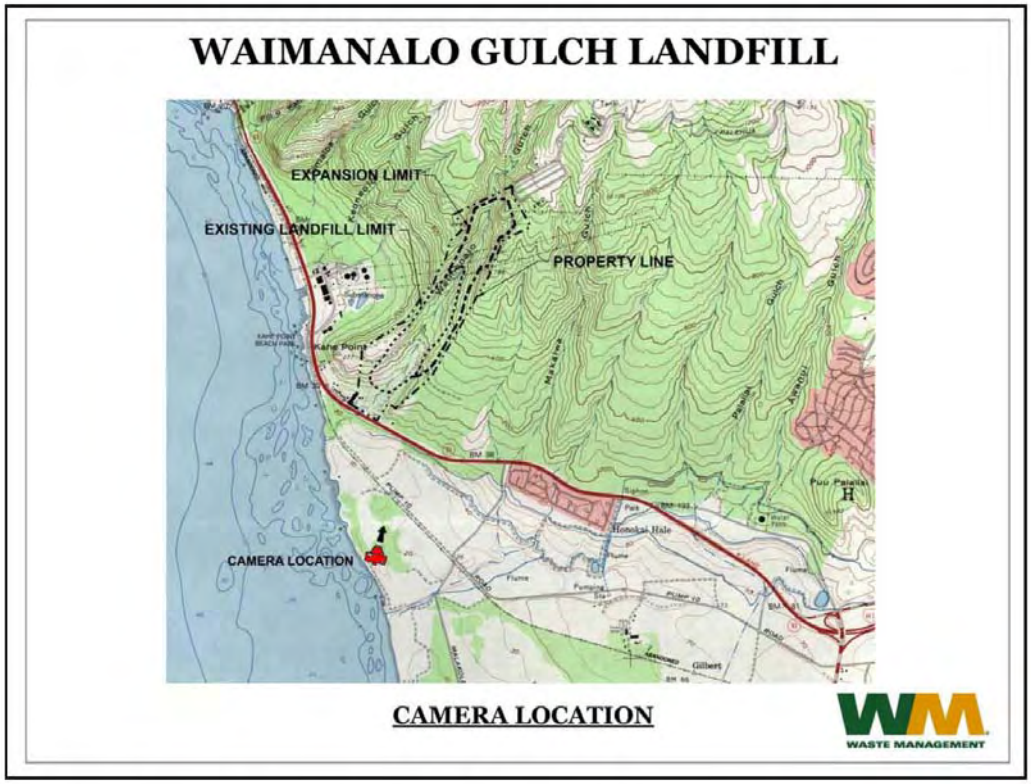

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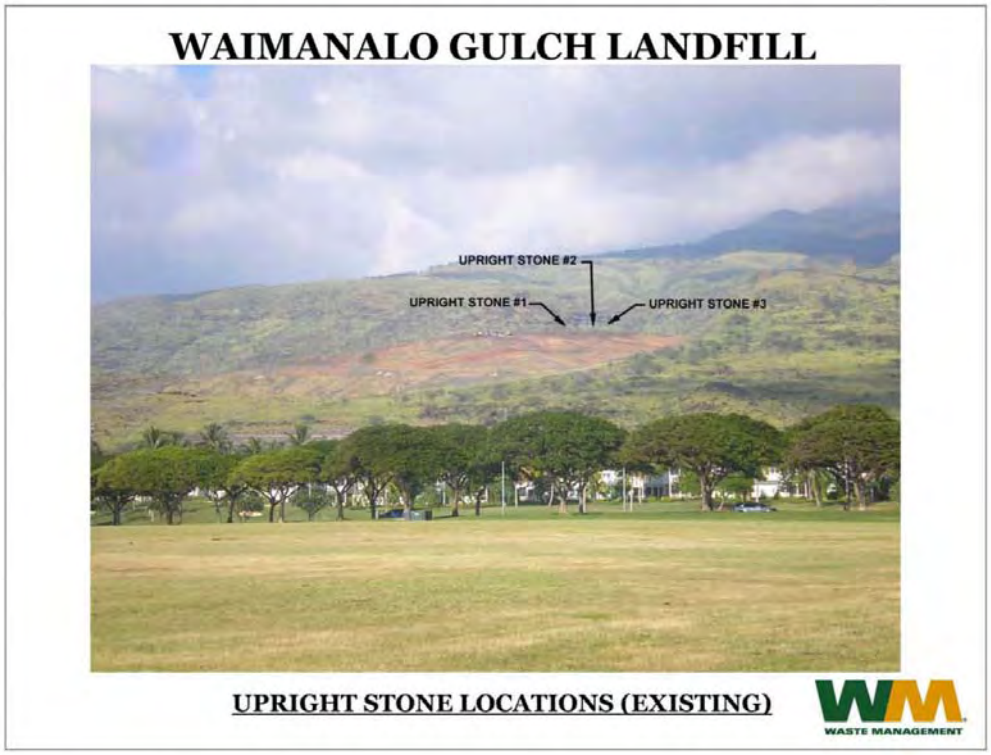

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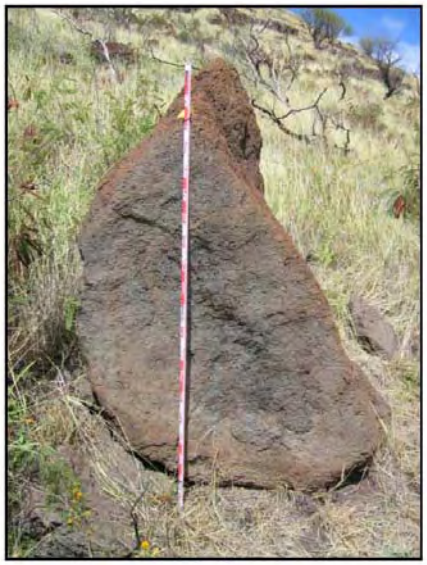


Figure 5. SIHP # 50-80-12-6903 Feature A, Photograph of face of rock upright, view to the north

Figure 6. SIHP # 50-80-12-6903 Feature A Photograph of side profile of rock upright, view to the south

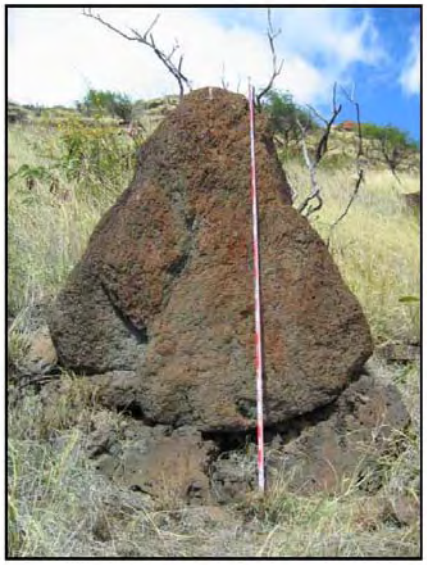
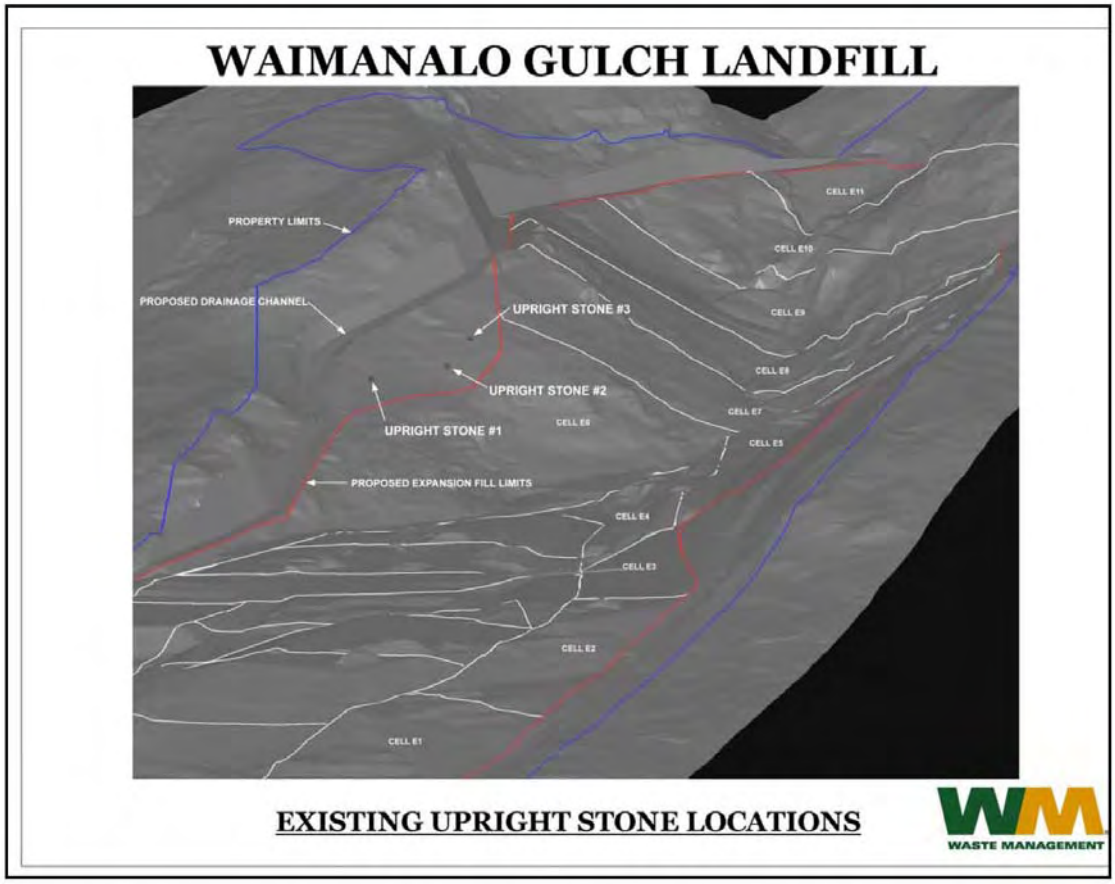


Figure 7. SIHP # 50-80-12-6903 Feature B, Photograph of face of rock upright, view to the northwest

Figure 8. SIHP # 50-80-12-6903 Feature B, Photograph of side profile of rock upright, view to the south

Figure 9. SIHP # 50-80-12-6903 Feature C, Photograph of side profile of rock upright, view to the west

Figure 10. SIHP # 50-80-12-6903 Feature B, Photograph of side profile of rock upright, view to the southwest



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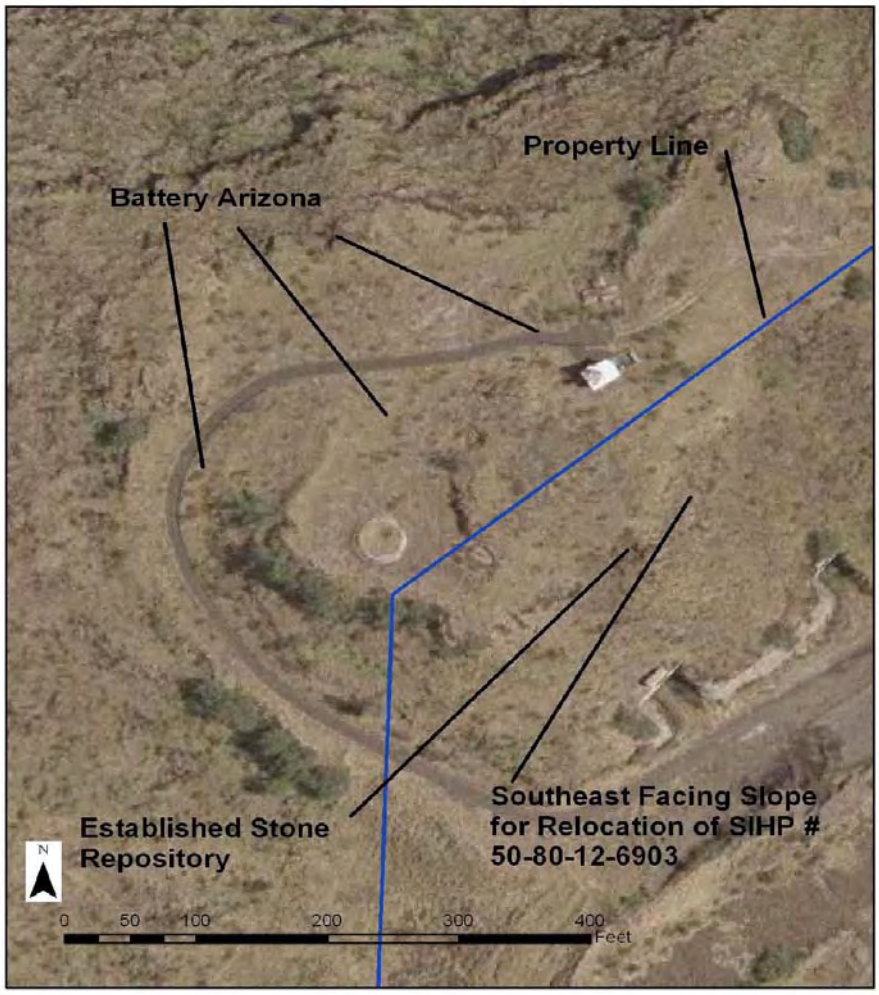

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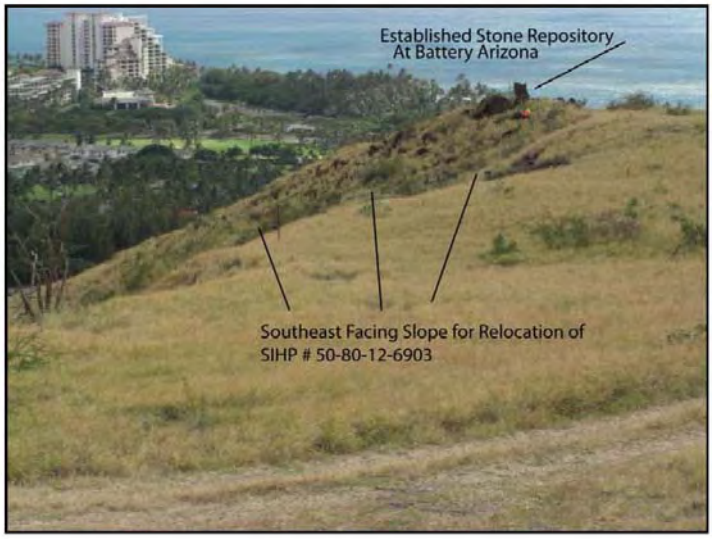

Figure 13. Photograph, view to the south, of the proposed relocation area at Battery Arizona for SIHP # 50-80-12-6903

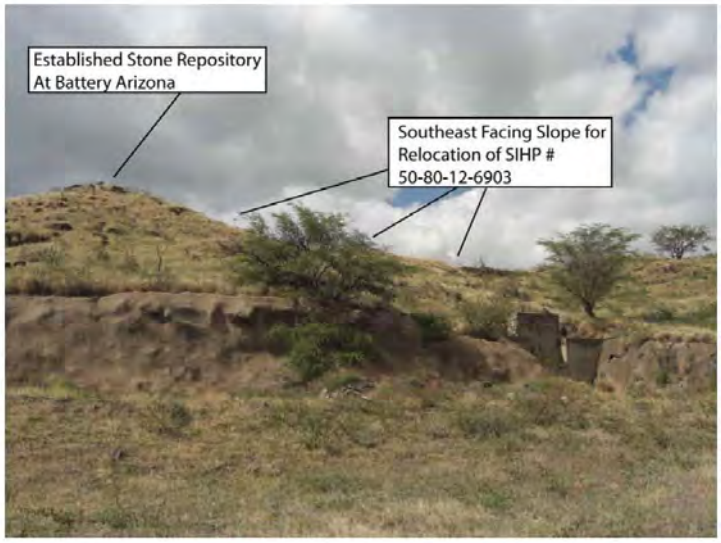

Figure 14. Photograph, view to the north, of the proposed relocation area at Battery Arizona for SIHP # 50-80-12-6903

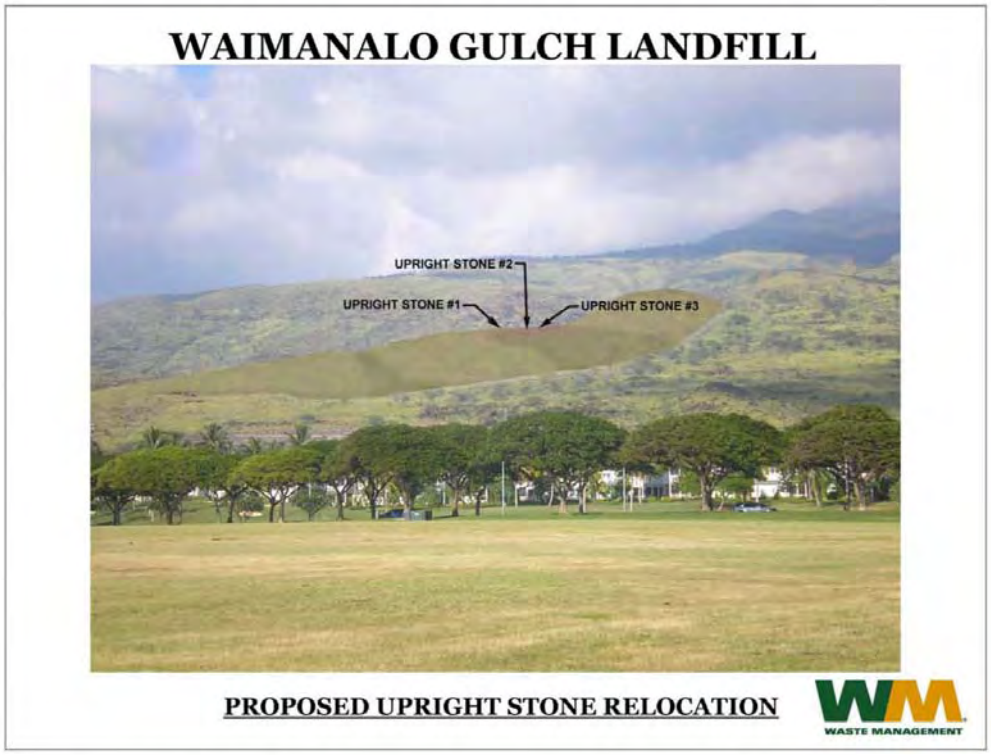

Figure 15. Altered photograph showing the planned landfill surface topography in 15 years. The potential SIHP # 50-80-12-6903 relocation site, on top of the new landfill surface, is shown

Appendix H

Cultural Impact Assessment
Waimānalo Gulch Landfill Expansion Project, 2008

A Cultural Impact Assessment for the Waimānalo Gulch Landfill Expansion Project Waimānalo ʻIli, Honoʻuliʻuli Ahupuaʻa, ʻEwa District TMK: [1] 9-2-003:073 por.

Prepared for

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Management Summary

Reference	Cultural Impact Assessment for the Waimānalo Gulch Sanitary Landfill Expansion Project, Hono'uli'uli Ahupua'a, 'Ewa District, Island of O'ahu (TMK: [1] 9-2-003:073 por.) (Souza, Uyeoka, Shideler and Hammatt 2008)
Date	April 2008
Project Number(s)	HONOU 7 (and companion Archaeological Inventory Survey HONOU 6)
Project Location	The proposed project area is located *mauka* (inland) and northeast of the existing Waimānalo Gulch Sanitary Landfill, just inland of Farrington Highway; between the Honokai Hale residential subdivision and Ko Olina Resort to the southeast, and the Kahe Power Plant to the northwest. This area is depicted on the 1998 'Ewa USGS 7.5 minute topographic quadrangle.
Land Jurisdiction	City and County of Honolulu
Agencies	City and County Department of Environmental Services, State Historic Preservation Division (SHPD)
Project Description	The proposed landfill expansion is meant to increase the capacity and lifespan of the existing Waimānalo Gulch Sanitary Landfill. Planned construction includes: major grading and excavation of the base and walls of Waimānalo Gulch to prepare the expansion area for landfill use; grading for a perimeter road around the expansion area; excavations for stockpiling of sediment for use as cover material; excavations for associated landfill infrastructure; and filling of the expansion area with refuse material.
Project Acreage	Approximately 90 acres, of which approximately 36 acres will be used as the actual foot print of the landfill cells used for refuse.
Document Purpose	This project requires compliance with the State of Hawai'i environmental review process [Hawai'i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed project's effect on cultural practices. At the request of R.M. Towill Corporation, CSH undertook this Cultural Impact Assessment (CIA). Through document research and cultural consultation efforts this document provides information pertinent to the assessment of the proposed project's impacts to cultural practices (per the OEQC's Guidelines for Assessing Cultural Impacts). The document is intended to support the project's environmental review and may also serve to support the project's historic preservation review under HRS Chapter 6E-8 and Hawai'i Administrative Rules (HAR) Chapter 13-275.
Consultation Effort	Twenty-one (21) Hawaiian organizations, agencies and community members contributed specific knowledge of and / or concerns about the project area and vicinity. The organizations consulted included the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), the O'ahu Island Burial Council (OIBC), Wai'anae Neighborhood Board, The Cultural Learning Center at Ka'ala, Wai'anae Elders and Nānāikapono Hawaiian Civic Club. Site visits were conducted with McD Philpotts, Shad Kane, William Ailā and Eric Enos. Seventeen (17) individuals contributed specific information via formal interviews, informal "talk story" discussion and / or email. One person (McD Philpotts) was formally interviewed for this project (see Appendix B). One person (Shad Kane) was previously interviewed during a prior (2002) CIA for an earlier version of the subject project (see Appendix A, used with permission from Shad Kane).

Cultural Impact Results	Background research for this CIA yielded the following results: (1) The nearest main settlement areas in pre-Contact and early historic times were located *makai* (seaward) of the project area along the coast at Ko'olina and Kalaeloa. The project area is a transitional zone between the *mauka* (upland) resources of the mountains and the *makai* resources of the coast and ocean; and it also marks the boundary between Wai'anae and 'Ewa Moku (traditional districts). The main trail from Pu'uloa (Pearl Harbor area) to Wai'anae runs just below the project area near the existing Farrington Highway. Other trails followed the ridges defining either side of Waimānalo Gulch. (2) The subject project area is associated with numerous named *pu'u* (hills and mountains) in the general vicinity, all of which are associated with specific *mo'olelo.* (3) There are a few specific *mo'olelo* (oral histories) about Waimānalo 'Ili dealing with the marking of the boundary between Wai'anae and 'Ewa at Pili o Kahe. (4) There are dozens of specific *mo'olelo* about Hono'uli'uli Ahupua'a dealing with gods and demi-gods such as Kāne, Kanaloa, Pele, Pele's sister Hi'iaka, Pele's sister Kapo (as in Kapo-lei), Māui, Kamapua'a (pig god), Maunauna (shark deity), Ka'ahupāhau, and Palila; with chiefly lineages and references to the ruling chiefs Hilo-a-Lakapu, Kūali'i, and Kākuhihewa; and with connections to other parts of O'ahu (e.g., Wai'anae). Community consultation yielded the following results: (1) Many participants talked about the project area as a pathway for *huaka'i pō* (the night marchers) as they move between the mountains and the sea; preservation of the view plane of this pathway from *mauka* to *makai* is important to many people. (2) Several participants made site visits to a group of several large *pōhaku* (stones) located in the project area (designated State Inventory of Historic Properties [SIHP] No. 50-80-12-6903); although no specific cultural information or associated *mo'olelo* was shared by participants about this site at this time, there is general agreement that the *pōhaku* should be protected from harm. (3) At least one participant is concerned about several caves and rock overhangs located in the northwest portion of the project area (documented in detail by Dalton and Hammatt 2008), although archaeological investigations of these by CSH indicated they contain no cultural materials, burials, or human remains. (4) Participants provided new *mo'olelo* about Waimānalo Gulch for which no previous written documentation has been found, including stories and legends about the Spirits *('Uhane*), the "Legend of the Slain Girl," the "Legend of Two Giants," and associations with the Pueo 'Aumakua (Owl Family Deity).

Cultural Impact Recommendations	Based on the results of this CIA, CSH recommends the following actions in order to address the concerns raised by community members: (1) Should removal of the *pōhaku* designated SIHP # 50-80-12-6903 be necessary, it should be conducted in a culturally sensitive manner with a cultural monitor given the opportunity to carry out appropriate protocols. Several participants agree the *pōhaku* should be removed from their original locations during construction, then later reunited with their former locations and preserved in place. A preservation plan should guide all aspects of the movement of these *pōhaku*, as well as their temporary storage and care, and return to their original locations. Community members should be involved in this process. (2) The traditional view of the Hawaiian landscape as a continuum should be taken into consideration during the planning process. (3) Several community members believe it is important to keep the pathway of the *pōhaku* (night marchers) clear of visual and / or structural blockage from *mauka* to *makai* on the east ridge of Waimānalo Gulch. CSH recommends this topic should be addressed in greater detail through further consultation with the community. (4) Six caves and rock overhangs in the northwestern portion of the project area documented by CSH during archaeological inventory survey (Dalton and Hammatt 2008) yielded no significant cultural material. However, at least one community participant (see Table 2) has voiced concerns about possible disturbances to burials in these caves. CSH recommends cultural monitoring of any proposed disturbance to these caves by qualified native Hawaiians familiar with the project area. (5) Although the land has been dramatically altered, there remains a possibility that burials and other archaeological sites may be present in and around the proposed project area. Efforts need to be made to insure adequate archaeology and cultural monitoring are conducted at this project site. In addition to this cultural impact assessment, CSH is conducting an Archaeological Inventory Survey for this project area that was ongoing at the time of this report's completion (Dalton and Hammatt 2008); its findings and recommendations should be faithfully carried out in accordance with applicable laws and administrative rules governing historic preservation work in the State of Hawai'i. (6) CSH recommends that consultation with community members continue throughout the planning process. Addressing these cultural concerns is part of the City and County of Honolulu's "good faith" effort to minimize the impact of the proposed project on Hawaiian culture, its practices and traditions. (7) The consultation results contained in this CIA, which refer specifically to the 36-acre area of the landfill proper, will be augmented and expanded prior to preparation of the Final Environmental Impact Statement. The individuals and agencies listed in Table 2 will be contacted again with the new information about the larger project area.

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Section 1 Introduction

1.1 Project Background

At the request of R.M. Towill Corporation, on behalf of the City and County of Honolulu Department of Environmental Services/Refuse Division, Cultural Surveys Hawai'i Inc. (CSH) conducted a Cultural Impact Assessment (CIA) of the Waimānalo Gulch Sanitary Landfill Expansion Project, Waimānalo 'Ili, Hono'uli'uli Ahupua'a, 'Ewa District, O'ahu (TMK: 9-2-003: 073). The purpose of the CIA is to assess potential impacts to cultural practices and resources resulting from the future development of the proposed Landfill Expansion Project, which is intended to increase the capacity and lifespan of the existing Waimānalo Gulch Sanitary Landfill.

The proposed landfill expansion area is located immediately *mauka* (inland) and northeast of the existing Waimānalo Gulch Sanitary Landfill (Figures 1-4). Waimānalo Gulch is generally located immediately inland of Farrington highway, roughly between the Honokai Hale residential subdivision and Ko Olina Resort to the southeast, and the Hawaiian Electric Co.'s (HECO) Kahe Power Plant to the northwest. This area is depicted on the 1998 'Ewa USGS 7.5 minute topographic quadrangle.

The Waimānalo Gulch Sanitary Landfill was established in 1989; is owned by the City and County of Honolulu under the jurisdiction of the Department of Environmental Services/Refuse Division, and operated by Waste Management of Hawai'i. The landfill currently takes in roughly 500,000 tons of waste per year.

The project area is comprised of approximately 90 acres of currently undeveloped land within the Waimānalo Gulch Landfill property. The proposed landfill expansion area—that is, the total area to be used for the disposal of municipal refuse—comprises an approxiamtly 36-acre portion of the total 90-acre area. Portions of the remaining area outside of the 36-acre landfill site proper will be modified for drainage improvements, roads, and stockpile areas needed for continued use of the landfill. Minimally, land disturbing activities associated with the landfill expansion project would include: major grading and excavation of the base and walls of Waimānalo Gulch to prepare the expansion area for landfill use; grading for a perimeter road around the expansion area; excavations for stockpiling of sediment for use as cover material; excavations for associated landfill infrastructure; and filling of the expansion area with refuse material.

When the expansion project's CIA consultation was initiated, communication with the project proponents indicated that the proposed expansion area would be 36 acres—the same 36 acres that the project proponents were having surveyed as part of the project's archaeological inventory survey of the expansion area. For this reason, the initial project consultation letters describe the expansion area as approximately 36 acres. It was only later that CSH learned that the expansion area was actually approximately 90 acres. The 36 acres corresponds with the actual foot print of the landfill cells that will be created and used for refuse. Portions of the remaining approximately 90-acre expansion area will be used for the aforementioned appurtenances. Therefore, although the foot print of the proposed area to be disturbed is larger than the 36 acres indicated in the initla CIA consultation, the actual portion of the gulch to be used specifically as a landfill (36 acres) has not changed. The consultation results contained in

this CIA, which refer specifically to the 36-acre area of the landfill proper, will be augmented and expanded prior to preparation of the Final Environmental Impact Statement, as described and discussed in Section 5 (Results of the Community Contact Process).

1.1.1 Archaeological Inventory Survey

An archaeological inventory survey including a 100% coverage pedestrian inspection of the project area and limited subsurface testing at select locations is being conducted for the project area. The results of the archaeological study will be presented in a companion report titled, "Archaeological Inventory Survey for the Waimānalo Gulch Sanitary Landfill Expansion Project, Hono'uli'uli Ahupua'a, 'Ewa District, Island of O'ahu, TMK: [1] 9-2-003:073 por." (Dalton and Hammatt 2008).

1.2 Document Purpose

The purpose of this CIA is to consider the effects the proposed expansion of the Waimānalo Gulch Sanitary Landfill may have on traditional cultural practices and resources. The Hawai'i State Constitution, Article XII, Section 7 protects "all rights" of native Hawaiians that are "customarily and traditionally exercised for subsistence, cultural and religious purposes".

In 1997, the Office of Environmental Quality Control (OEQC) issued Guidelines for Assessing Cultural Impacts. The Guidelines discuss the types of cultural practices and beliefs that might be assessed.

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man-made and natural, including submerged cultural resources, which support such cultural practices and beliefs.

Most recently, H. B. No. 2895 was passed by the 20th Legislature, and approved by then Governor Cayetano as Act 50 on April 26, 2000. The bill acknowledges that:

> . . the past failure to require native Hawaiian cultural impact assessments has resulted in the loss and destruction of many important cultural resources and has interfered with the exercise of native Hawaiian culture. The legislature further finds that due consideration of the effects of human activities on native Hawaiian culture and the exercise thereof is necessary to ensure the continued existence, development, and exercise of native Hawaiian culture.

This bill issues a directive that " . . . environmental assessments or environmental impact statements should identify and address effects on Hawai'i's culture, and traditional and customary rights." The process for evaluating cultural impacts is constantly evolving. There continue to be gray areas and unresolved issues pertaining to traditional access and gathering rights. Act 50 is an attempt to balance the scales between traditional lifestyles and development and economic growth.

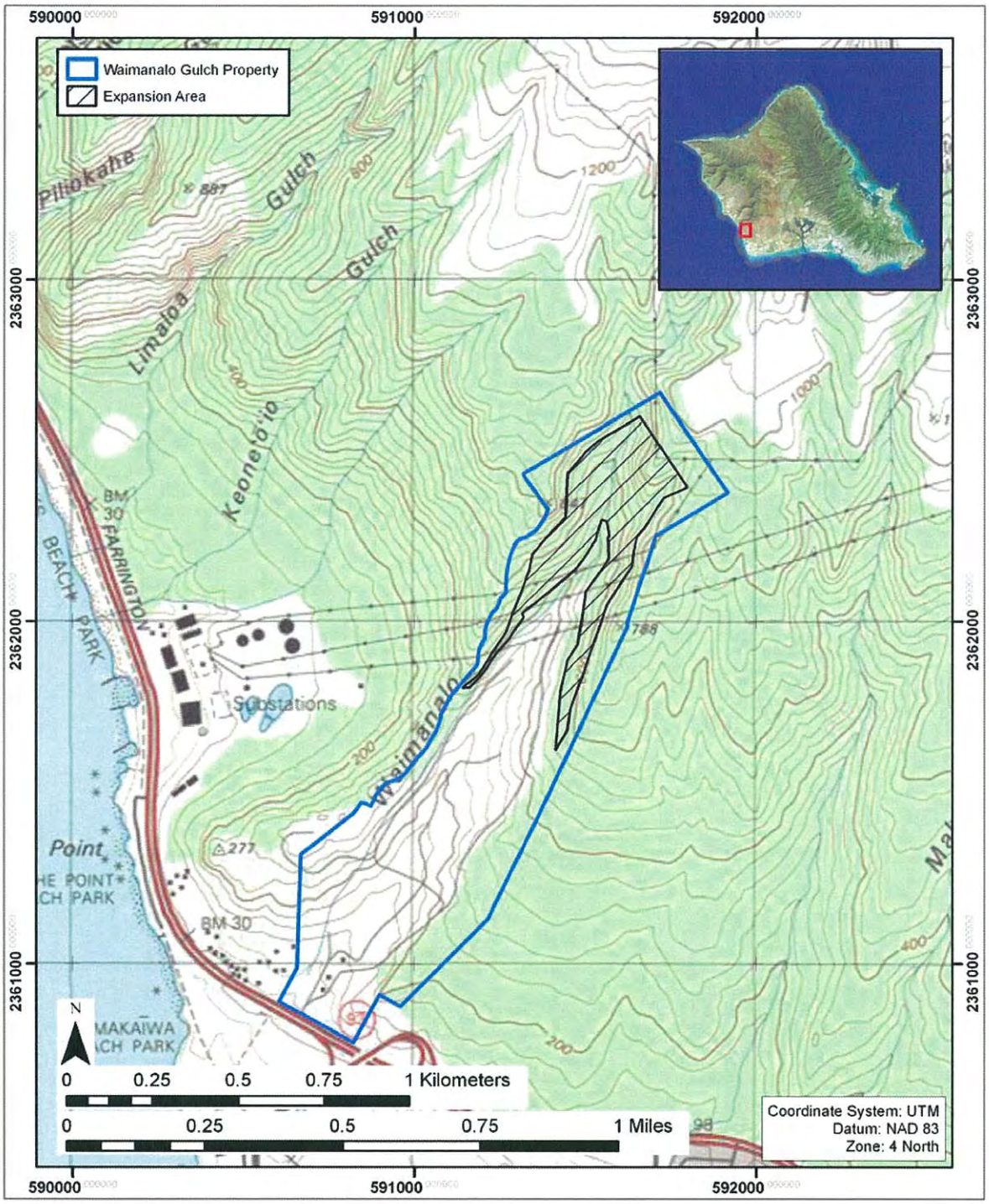

Figure 1. USGS 7.5 Minute Series Topographic Map, Ewa Quadrangle (1998), showing the location of the Waimānalo Gulch Sanitary Landfill property and the proposed expansion project area

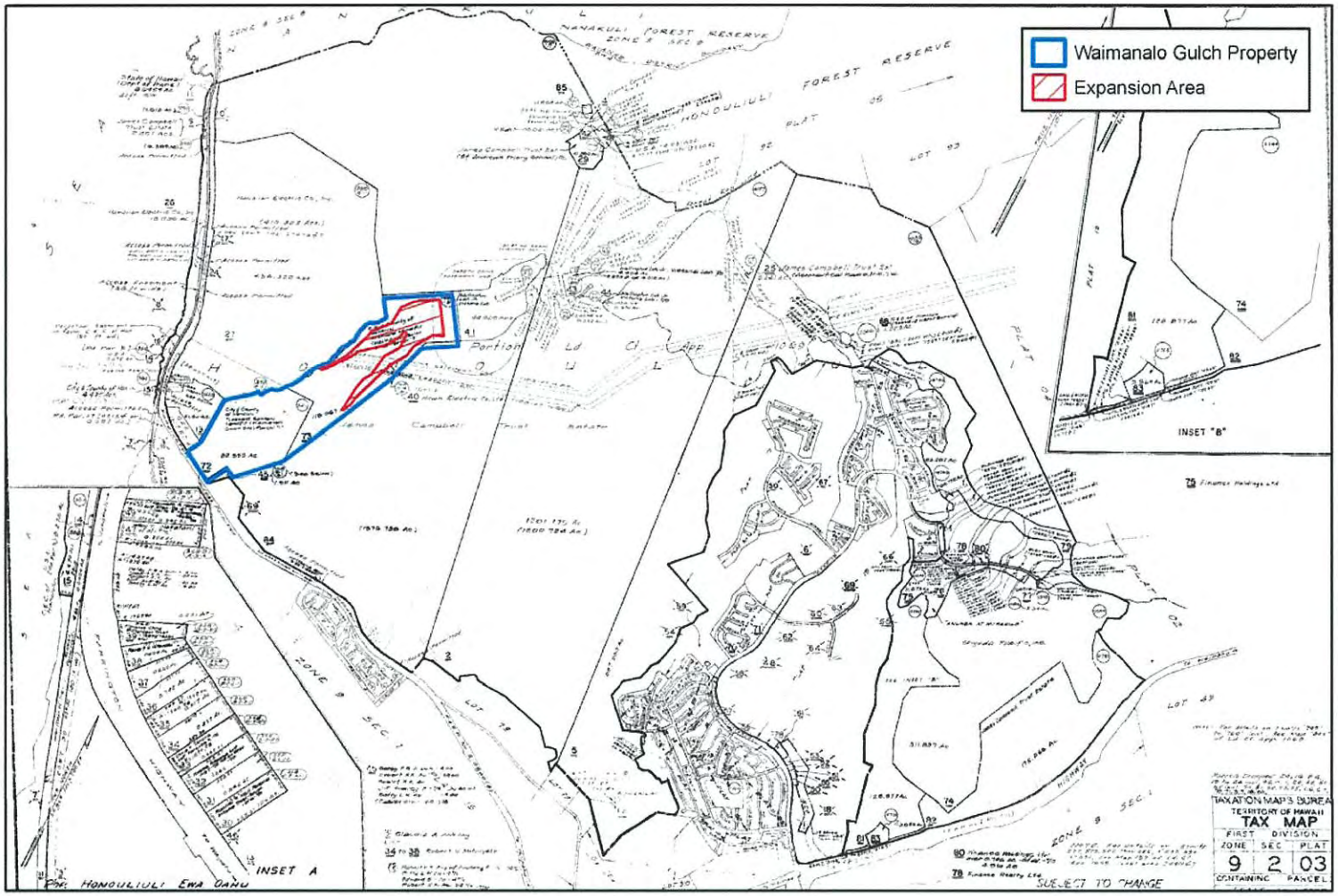

Figure 2. TMK 9-2-03 showing the location of the Waimānalo Gulch Sanitary Landfill property and the proposed expansion project area

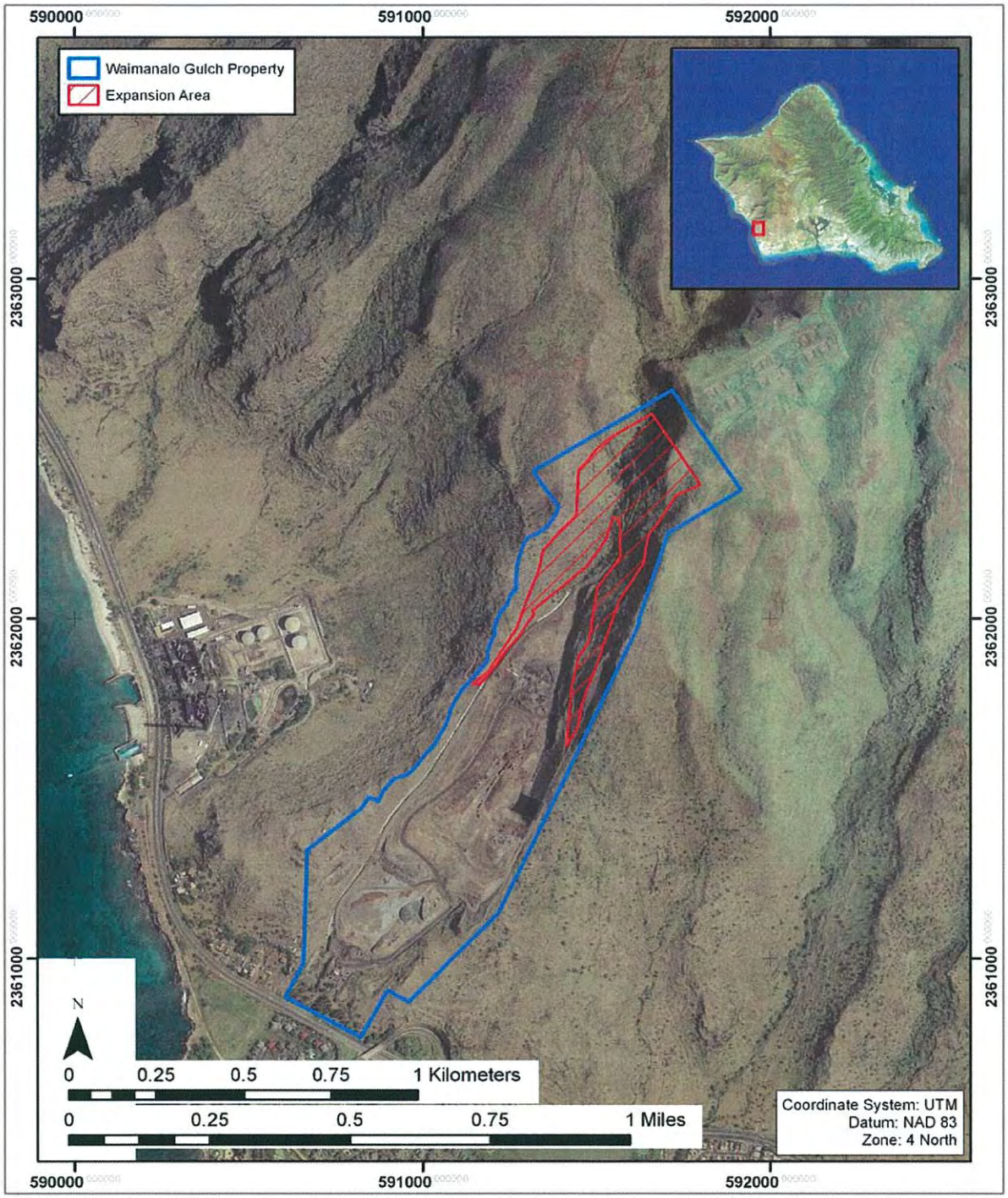

Figure 3. Aerial photograph showing the location of the Waimānalo Gulch Sanitary Landfill property and the proposed expansion project area (USGS Orthoimagery 2005)

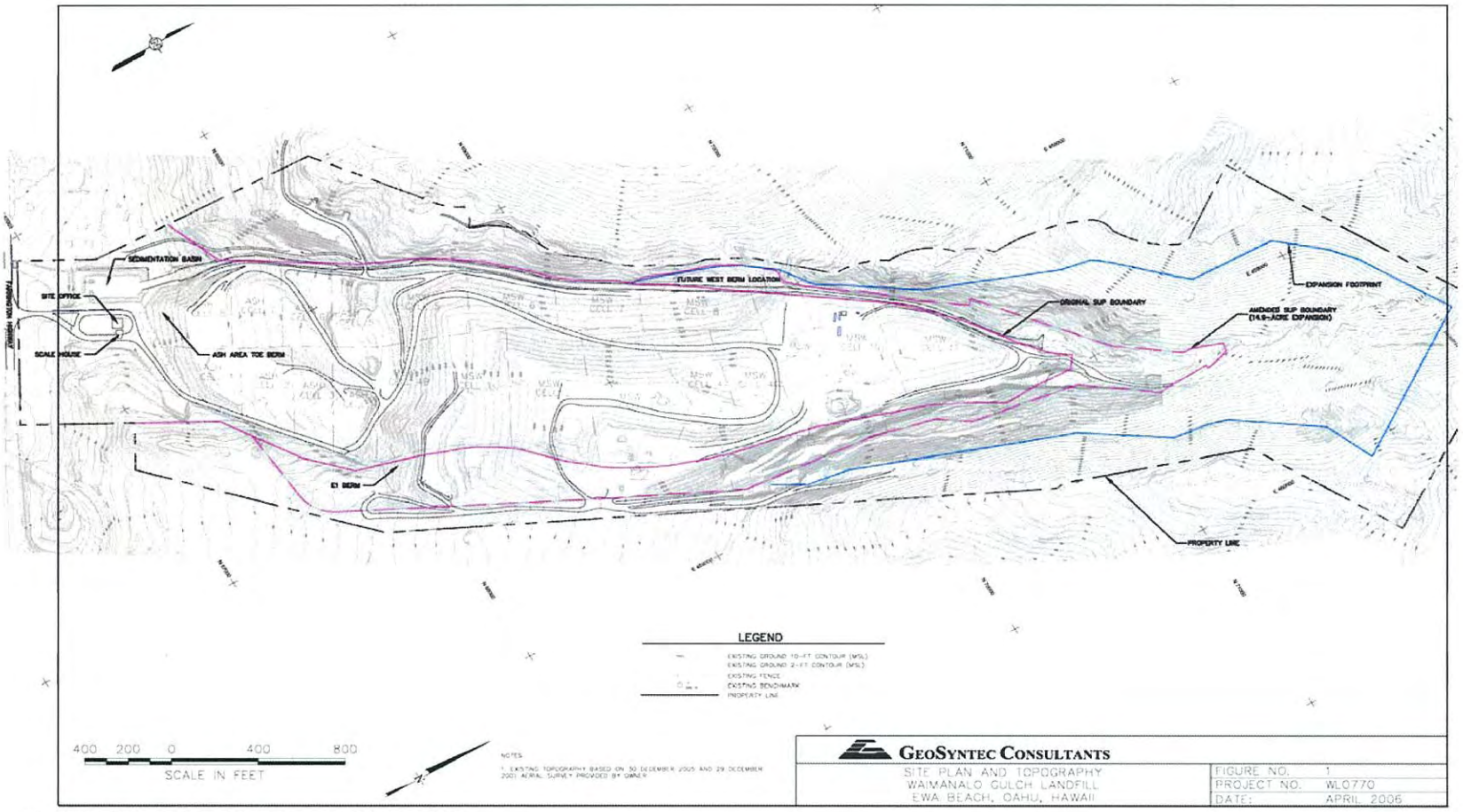

Figure 4. Site plan for the proposed Waimānalo Gulch Landfill Expansion project, showing the location of the existing landfill and proposed expansion area

This project requires compliance with the State of Hawai'i environmental review process [Hawai'i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed project's effect on cultural practices. At the request of R.M. Towill Corporation, CSH undertook this CIA. Through document research and cultural consultation efforts this document provides information pertinent to the assessment of the proposed project's impacts to cultural practices (per the OEQC's Guidelines for Assessing Cultural Impacts). The document is intended to support the project's environmental review and may also serve to support the project's historic preservation review under HRS Chapter 6E-8 and Hawai'i Administrative Rules (HAR) Chapter 13-275.

1.3 Scope of Work

The scope for the CIA includes:

1. Examination of historical documents, Land Commission Awards, and historic maps with the specific purpose of identifying Hawaiian activities including gathering of plant, animal and other resources or agricultural pursuits as may be indicated in the historic record.
2. A review of the existing archaeological information pertaining to the sites on the property as they may allow us to reconstruct traditional land use activities and identify and describe the cultural resources, practices and beliefs associated with the parcel and identify present uses, if appropriate.
3. Oral interviews with persons knowledgeable about the historic and traditional practices in the project area and region.
4. Preparation of a report on items 1-3 summarizing the information gathered related to traditional practices and land use. The report will assess the impact of the proposed action on the cultural practices and features identified.

1.4 Methods

Historical documents, maps and existing archaeological information pertaining to the sites in the vicinity of this project were researched at the State Historic Preservation Division library, the Cultural Surveys Hawai'i library, and the University of Hawai'i's Hamilton Library. The Office of Hawaiian Affairs, O'ahu Island Burial Council, and members of other community organizations were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the study area and the surrounding vicinity. The names of potential community contacts were also provided by colleagues at CSH and from the researchers' familiarity with the families who live in the area. Some of the prospective community contacts were not available to be interviewed as part of this project. A discussion of the consultation process can be found in Section 5 (Results of the Community Contact Process). Please refer to Table 2 in Section 6 below for a complete list of individuals and organizations contacted.

Section 2 Project Area Description

2.1 Environmental Setting

2.1.1 Natural Environment

The proposed Waimānalo Gulch Landfill expansion area is located within the *mauka* portion of Waimānalo Gulch, in the southern foothills of the Wai'anae Mountain range. The project area is located 970 meters east of the coastline. Elevations within the proposed expansion area range from approximately 90-210 m (300-700 ft.) AMSL. Lands within the proposed expansion area generally consist of steep sloping gulch walls, with a dry stream channel at the base of the gulch. The stream channel is understood to only have running water during periods of heavy rainfall, which are relatively uncommon in the dry, leeward O'ahu. The proposed expansion area receives an average of approximately 600-700 mm (24-28 in.) of annual rainfall (Giambelluca et al. 1986).

Soils within the undeveloped portions of the Waimānalo Gulch Landfill property consist primarily of Rock Land (rRK), with a small area of Stony Steep Land (rSY) in the northeastern portion of the property. Soils within the proposed landfill expansion area consist entirely of Rock Land (rRK) (Foote et al. 1972) (Figure 5). Rock Land is described as "made up of areas where exposed rock covers 25 to 90 percent of the surface...rock outcrops and very shallow soils are the main characteristics" (Foote et al. 1972). Stony Steep Land is described as consisting of "a mass of boulders and stones deposited by water and gravity on side slopes of drainage-ways...stones and boulders cover 50 to 90 percent of the surface...there is a small amount of soil among the stones that provides a foothold for plants...rock outcrops occur in many places" (Foote et al. 1972).

With regards to the vegetation, Frierson (1972) suggests that prior to the introduction of exotic vegetation in 1790, the slopes of the Wai'anae Range extending down to about 150 m (500 ft.) elevation supported a dry forest of native trees and shrubs between an upper *'ōhi'a* wet forest and lower grassy savannah area. Frierson (1972:4) summarizes the following patterns suggested by J.F. Rock (1913) for the indigenous vegetation in the area prior to 1778:

a) Lowland zone - open grassland on the leeward side

b) Lower Forest - beginning about 1000 feet and richer in species than the rainforest: *kukui*, *'ōhi'a 'ai, koa, kalia*, sandalwood, *'ōhi'a lehua, hau, tī, ape, pia*, banana, ginger, birdnest fern and *honohono*, as well as grasses and cyperaceous plants.

c) Specifically leeward lower forest – *'ohe, wiliwili, maile, halapepe* and *alani*, with almost no undergrowth.

Historical accounts presented by Frierson (1972) describe these lower forest species as extending to 500 feet, with the presence of sandalwood observed down to as low as 300 feet. The lower forest then is hypothesized to have covered much of the current landfill expansion area. This was always a rain shadow slope and we may more accurately envisage a park land community rather than a thick forest in early Hawaiian times.

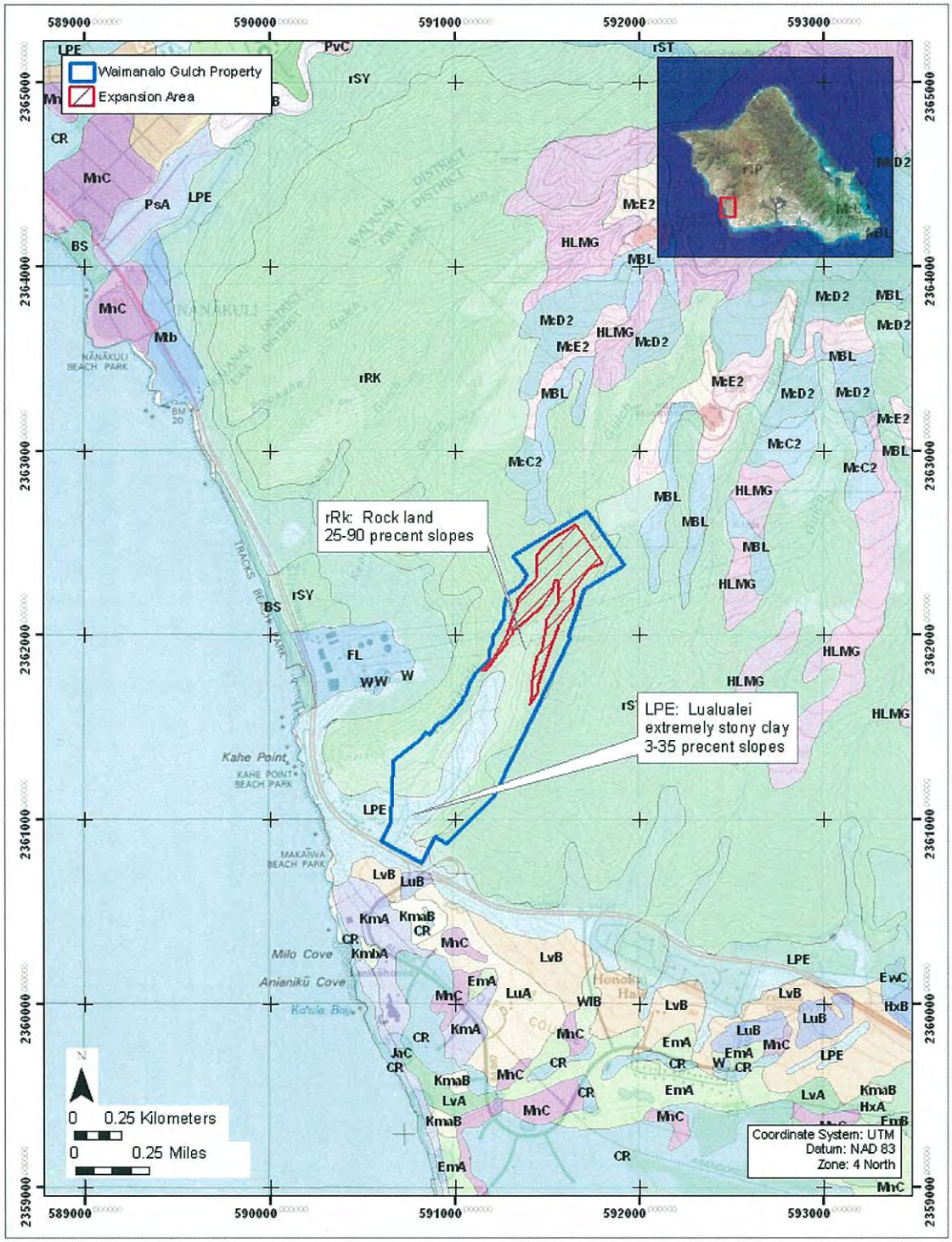

Figure 5. Waimānalo Gulch soils (http://soils.usda.gov/survey/printed_surveys/state.asp?state=Hawaii&abbr=HI)

The current vegetation in the project area is comprised mostly of scattered *koa haole* and various grasses. As a result of a relatively recent wildfire, the grasses within the project area have grown dense and thick, covering about 90% of the ground surface, making ground surface observation difficult throughout the project area.

2.1.2 Built Environment

Lands within the proposed landfill expansion area are currently undeveloped, with the exception of unpaved access roads. Lands within Waimānalo Gulch immediately *makai* (seaward) of the proposed expansion area consist of the active Waimānalo Gulch Sanitary Landfill, and include solid waste disposal sites and associated landfill infrastructure. *Makai* of the landfill site is the Ko Olina Resort, including a golf course and residential subdivision. West of the landfill site are the Kahe Point Homes residential subdivision and the HECO Kahe Power Plant. Lands to the east and north of the Waimānalo Gulch landfill are the undeveloped Makaīwa Hills and Pālehua areas.

Section 3 Traditional and Historic Background

3.1 Introduction to the Cultural Landscape

The project area is situated on the eastern side of the Wai'anae Mountains in Hono'uli'uli Ahupua'a (traditional land division) sub-divided into the *'ili* of Waimānalo in the *moku* or district of 'Ewa. Hono'uli'uli is the largest *ahupua'a* on the island of O'ahu. Hono'uli'uli includes all the land from the western boundary of Pearl Harbor (West Loch or Kaihuopala'ai) westward around the southwest corner of O'ahu to the 'Ewa/ Wai'anae District Boundary with the exception of the west side of the harbor entrance which is in the *ahupua'a* of Pu'uloa (the 'Ewa Beach/Iroquois Point area). Hono'uli'uli Ahupua'a includes approximately nineteen kilometers (twelve miles) of open coastline from One'ula westward to the boundary known as Pili o Kahe. The *ahupua'a* extends *mauka*, almost pie-shaped, from West Loch nearly to Schofield Barracks in Wahiawā; the western boundary is the Wai'anae Mountain crest running north as far as Pu'u Hapapa (or to the top of Ka'ala Mountain according to some).

Not only does Hono'uli'uli Ahupua'a include a long coastline fronting the normally calm waters of leeward O'ahu but there is also four miles of waterfront along the west side of West Loch. The land immediately *mauka* of the Pacific coast consists of a flat karstic raised limestone reef forming a level nearly featureless "desert" plain marked in pre-Contact times (previous to illuviation caused by sugar cultivation) by a thin or non-existent soil mantle. The micro-topography is notable in containing countless sinkholes caused by chemical weathering (dissolution) of the limestone shelf. Proceeding *mauka* from this limestone plain, this shelf is overlain by alluvium deposited through a series of gulches draining the Wai'anae Mountains. The largest of these is Hono'uli'uli Gulch towards the east side of the plain that drains into West Loch. To the west are fairly steep gradient gulches forming a more linear than dendritic drainage pattern. The major gulches are, from east to west: Awanui, Pālailai, Makaīwa, Waimānalo and Limaloa. These gulches are steep-sided in the uplands and generally of a high gradient until they emerge onto the flat 'Ewa plain. The alluvium they have carried has spread out in delta fashion over the *mauka* portions of the plain, which comprises a dramatic depositional environment at the stream gradient change. These gulches are generally dry, but seasonal Kona storms carry immense quantities of runoff onto the plain and into the ocean. As typical drainages in arid slopes they are either raging uncontrollably, or are dry and as such do not form stable water sources for traditional agriculture in their upper reaches. The Hono'uli'uli gulches, in contrast to those draining into Pearl Harbor to the east, do not have valleys suitable for extensive irrigated agriculture. However, the lack of suitable valleys is compensated for by the rich watered lowlands at the base of Hono'uli'uli Gulch (the *'ili* of Hono'uli'uli).

Hono'uli'uli Ahupua'a, as a traditional land unit, had tremendous and varied resources available for exploitation by early Hawaiians. The "karstic desert" and marginal characterization of the limestone plan, which is the most readably visible terrain, does not do justice to the *ahupua'a* as a whole. The richness of this land unit is marked by the following resources:

1) Twelve miles of coastline with continuous shallow fringing reef that offered rich marine resources.

2) Four miles of frontage on the waters of West Loch which offered extensive fisheries (mullet, *awa*, shellfish), as well as frontage suitable for development of fishponds (for example, Laulaunui)
3) The lower portion of Hono'uli'uli Valley in the 'Ewa plain offered rich level alluvial soils with plentiful water for irrigation from the stream as well as abundant springs. This land would have stretched well up the valley.
4) A broad limestone plain which because of innumerable limestone sink holes offered a nesting home for a large population of avifauna. This resource may have been one of the early attractions to human settlement.
5) An extensive upland forest zone extending as much as twelve miles inland from the edge of the coastal plain. As Handy and Handy have pointed out, the forest was much more distant from the lowlands here than it was on the windward side, but on the leeward side was more extensive (1972:469). Much of the upper reaches of the *ahupua'a* would have had species-diverse forest with *kukui, 'ōhi'a*, sandalwood, *hau*, *kī,* banana, etc.
6) A network of trails giving access to Lualualei and Wai'anae coastal reaches.

3.2 Main Areas of Settlement

Within this natural setting, cultural, archaeological, and historical sources show a general pattern of three main areas of settlement within the *ahupua'a*: a coastal zone, inland settlement at Pu'u Ku'ua and the Hono'uli'uli taro lands.

3.2.1 The Coastal Zone - Ko'olina and Kalaeloa (Barbers Point)

Ko'olina

There are three major studies on the Ko'olina project area (Davis et al. 1986a; Davis et al. 1986b; and Davis and Haun 1987). Davis documents around 180 component features at 48 sites and site complexes consisting of habitation sites, gardening areas, and human burials. Chronologically the occupation covers the entire span of Hawaiian settlement in what Davis and Haun describe as "one of the longest local sequences in Hawaiian prehistory" (Davis and Haun 1987:37). The earliest part of the sequence relates to the discovery of an inland marsh and early dates were also obtained for the beachfront site (Lanikūhonua) and an inland rock shelter.

Kalaeloa (Barbers Point)

Archaeological research at Barbers Point has focused on the areas in and around the newly constructed Deep Draft Harbor (Barrera 1975; Davis and Griffin 1978; Hammatt and Folk 1981, McDermott et al. 2000). Series of small clustered shelters, enclosures and platforms show limited but recurrent use at the shoreline zone for marine oriented exploitation. This settlement covers much of the shoreline with more concentrated features around small marshes and wet sinks. Immediately behind the shoreline under a linear dune deposit is a buried cultural layer believed to contain some of the earliest habitation evidence in the area.

A significant attraction of the area to early Hawaiians was the plentiful and easily exploited bird population. Particular evidence for taking of petrel occurs at Site -2763 (Hammatt and Folk 1981:13). Initial heavy exploitation of nesting seabirds and other species in conjunction with habitat destruction probably led to early extinction.

There is some indication of limited agriculture in mulched sink holes and limited soil areas. Considering the low rainfall, this activity would have been limited, but probably involved tree crops and roots (sweet potatoes). The archaeological content of the sites indicates a major focus on marine resources.

Davis and Griffin (1978) distinguish functional classes of sites, based on surface area size and argue that the Barbers Point settlement consists of functionally integrated multi-household residence groups. Density contours of midden (by weight) and artifacts (by numbers) plotted for residence sites by Hammatt and Folk (1981) generally indicate narrowly defined spatial foci of discard, possibly indicating continuous use, or at least with no refurbishing or additions to the structures through time (Hammatt and Folk 1981). The focus is small habitation sites, typically lacking the full range of features found in large permanent residence complexes such as high platforms, complex enclosures, and ceremonial sites.

3.2.2 Pu'uku'ua: Inland Settlement

It is mentioned in *mo'olelo* (oral history) that the area of Pu'uku'ua, on the east side of the Wai'anae Ridge, north east of the current project area, seven miles inland of the coast, was a Hawaiian place of great importance.

In 1899, the Hawaiian language Newspaper "*Ka Loea Kālai'āina*" relates a story of Pu'uku'ua as "a place where chiefs lived in ancient times" and a "battle field," "thickly populated." This area was well known by all O'ahu chiefs and customary for them to visit. The term Kauwā was first used here because of a one armed chiefess who was ashamed and ran when other chiefs would visit. She was not a Kauwā she only behaved as one. The article:

> The chiefs of old, who lived at that time, were of divine descent. The two gods [Kāne and Kanaloa] looked down on the hollow [vicinity of Pu'u Ku'ua] and saw how thickly populated it was. The mode of living here was so that chiefs and commoners mixed freely and they were so like the lowest of people (Kauwā). That is what these gods said and that was the time when the term kauwā was first used, and was used for many years afterwards. After the first generations of chiefs had passed away and there descendants succeeded them, a chiefess Oahu to visit this place to see the local chiefs. They did this always. When the time came in which a new chiefess ruled, an armless chiefess, she ran away to hide when other chiefs came to visit as usual because she was ashamed of her lack of an arm. Because she was always running away because of being ashamed the chiefs that visited her called her the low-born (kauwā). Thus the term remained in the thoughts down to this enlightened period. She was no truly a kauwā but was called that because she behaved like one. This was how they were made to be kauwā.... (Ka Loea Kālai'āina, July 8, 1899 in Sterling and Summers 1978:33).

McAllister recorded three sites in this area: two *heiau* (shrines) (sites 134 Pu'u Kuina and 137 Pu'uku'ua; both destroyed) and a series of enclosures in Kukuilua which he calls "*kuleana* sites" (McAllister, 1933). On the opposite side of the Wai'anae range along the trail to Pōhākea Pass, as Cordy (2002) states, "Kākuhihewa was said to have built (or rebuilt) Nīoi'ula, a *po'okanaka heiau* (1,300 sq. m.) in Hālona in upper Lualualei, along the trail to Pōhākea Pass leading into 'Ewa, ca. A.D. 1640-1660" (Cordy 2002:36). There is no direct archaeological evidence

available to the authors' knowledge that intensive Hawaiian settlement occurred along the Pōhākea Pass trail but it is considered as a place of higher probability for traditional Hawaiian sites, based on the above indications. John Papa 'Ī'ī (1959) described a journey that Liholiho took which led him and an entourage through inland Hono'uli'uli and over Pōhākea Pass. Geographically, the area receives sufficient quantities of water and would have had abundant locally available forest resources.

3.2.3 Hono'uli'uli Taro Lands

Centered around the west side of Pearl Harbor at Hono'uli'uli Stream and its broad outlet into the West Loch are the rich irrigated lands of the *'ili* of Hono'uli'uli which give the *ahupua'a* its name. The major archaeological reference to this area is Dicks, Haun and Rosendahl (1987) who documented remnants of a once-widespread wetland system (*lo'i* and fishponds) as well as dry land cultivation of the adjacent slopes.

The area bordering West Loch was clearly a major focus of population within the Hawaiian Islands and this was a logical response to the abundance of fish and shellfish resources in proximity to a wide expanse of well-irrigated bottomland suitable for wetland taro cultivation. The earliest detailed map (Malden 1825) shows all the roads of southwest O'ahu coalescing and descending the *pali* as they funnel into the locality (i.e., Hono'uli'uli Village) which gave the *ahupua'a* of Hono'uli'uli its name. Dicks et al. (1987:78-79) conclude, on the basis of nineteen carbon isotope dates and three volcanic glass dates that "Agricultural use of the area spans over 1,000 years." Undoubtedly, Hono'uli'uli was a locus of habitation for thousands of Hawaiians. Prehistoric population estimates are a matter of some debate but it is worth pointing out that in the earliest mission census (Schmitt 1973:19) 1831-1832, the land (*'āina*) of Hono'uli'uli contained 1,026 men, women, and children. It is not clear whether this population relates to Hono'uli'uli Village or to the entire *ahupua'a* but the village probably contained the vast majority of the district's population at that time. The nature of the reported population structure for Hono'uli'uli (less than 20% children under twelve years of age) and the fact that the population decreased more than 15% in the next four years (Schmitt 1973:22) suggests that the prehistoric population of Hono'uli'uli Village may well have been significantly greater than it was in 1831-1832. A conservative estimate would be that tens of thousands of Hawaiians lived and died at Hono'uli'uli Village.

3.3 Traditional and Legendary Accounts of Hono'uli'uli

Hono'uli'uli, O'ahu is associated with a number of legendary accounts. Many of these concern the actions of gods or demi-gods such as Kāne, Kanaloa, Māui, Kamapua'a, the pig god, Maunauna, the shark deity, Ka'ahupāhau, and the hero Palila. There are several references to chiefly lineages and references to the ruling chiefs Hilo-a-Lakapu and Kūali'i, (Ko 'Olina is reported to have been a vacationing place for Kākuhihewa). Traditional and legendary accounts are presented below starting with the one's pertaining to Pōhākea Pass and then in a loose arrangement from more mythological accounts of gods and demi-gods to accounts of a more historical nature. There is no sharp distinction in this regard.

3.3.1 The Naming of Hono'uli'uli (Legend of Lepeamo'a)

In the legend of Lepeamoa, the chicken-girl of Pālama, Hono'uli'uli is the name of the husband of the chiefess Kapālama and grandfather of Lepeamoa (Thrum 1923:164-184). "Her grandfather gave his name, Hono'uli'uli to a land district west of Honolulu..." (Thrum 1923:170). Westervelt (1917:209) gives an almost identical account.

3.3.2 The Pele Family at Hono'uli'uli

Kapolei (beloved Kapo), specifically the 166-foot high cone of that name, is understood to have been named in reference to the volcano goddess Pele's sister Kapo (Pukui et al. 1974:89). Pōhākea Pass is understood as one of the resting places of Pele's sister Hi'iaka as she was returning from Kaua'i with Pele's lover Lohiau (Fornander 1919 Vol. V: 188 note 6). A considerable number of *mele* (songs) and *pule* (prayers) are ascribed to Hi'iaka as she stood at the summit of Pōhākea (*Aluna au a Pōhākea, Kū au, nānā ia Puna...*)(Emerson 1915:162-168). From this vantage point Hi'iaka could see, through her powers of vision, that her beloved *lehua* groves and friend Hopoe at Puna, Hawai'i Island had been blasted by her jealous sister Pele. She could also see that in her canoe, off the coast of Wai'anae, Lohiau was seducing her traveling companion Wahine'ōma'o! A spring located at Kualaka'i near Barbers Point was named Hoaka-lei (*lei* reflection) because Hi'iaka picked *lehua* flowers here to make a *lei* and saw her reflection in the water.

3.3.3 Keahumoa, Residence of Māui's Grandfather (Legend of Māui's Flying Expedition)

In the Legend of Māui's Flying Expedition (Thrum 1923:252-259) Māui-kupua looks toward Pōhākea Pass and sees his wife, Kumulama, being carried away by chief Pe'ape'amakawalu. After failing to recover her, Māui returns and tells his problems to his mother, Hina. Hina instructs her son to go to Keahumoa and visit his grandfather Kuolokele who lives there in a large hut. The hump-backed Kuolokele returns home with a load of potato leaves and Māui cures him by striking him in the back with a stone (which Kuolokele throws to Waipahu where it remains). Kuolokele has Māui gather *kī* leaves *'ie'ie* vines and bird feathers from which the old man fabricates a "bird-ship" (*moku-manu*) which Māui uses to defeat Pe'ape'amakawalu and recover his wife. They return to Kuolokele's house where they feast and Māui eats Pe'ape'amakawalu's eyeballs.

3.3.4 Kāne and Kanaloa and the Boundaries of 'Ewa (Simeon Nawaa account)

It seems likely the boundaries of the western-most *ahupua'a* of 'Ewa were and still are often contested between the Wai'anae and 'Ewa people:

> When Kāne and Kanaloa were surveying the islands they came to O'ahu and when they reached Red Hill saw below them the broad plains of what is now 'Ewa. To mark boundaries of land they would throw a stone and where the stone fell would be the boundary line...They hurled the stone as far as the Wai'anae Range and it landed somewhere in the Waimānalo section...Eventually the stone was found at Pili o Kahe. This is a spot where two small hills of the Wai'anae Range come down parallel on the boundary between Hono'uli'uli and Nānākuli ('Ewa and Wai'anae). The ancient Hawaiians said the hill on the 'Ewa side was

> the male and the hill on the Wai'anae side was female. The stone was found on the Waianae side hill and the place is known as Pili oKahe (Pili= to cling to, Kahe= to flow). The name refers, therefore, to the female or Waianae side hill. And that is where the boundary between the two districts runs. (Simeon Nawaa in Sterling and Summers 1978:1)

3.3.5 Kamapua'a, the pig god, is associated with Hono'uli'uli:

> Kamapua'a subsequently conquered most of the island of O'ahu, and, installing his grandmother [Kamaunuaniho] as queen, took her to Puuokapolei, the lesser of the two hillocks forming the southeastern spur of the Wai'anae Mountain Range, and made her establish her court there. This was to compel the people who were to pay tribute to bring all the necessities of life from a distance, to show his absolute power over all. (Nakuina 1904:50)

Emma Nakuina goes on to note: "A very short time ago [prior to 1904] the foundations of Kamaunuaniho's house could still be seen at Puuokapolei" (Nakuina 1904:50). Another account (*Ka Loea Kālai'āina* January 13, 1900) speaks of Kekeleaiku, the older brother of Kamapua'a, who also was said to have lived on Pu'uokapolei.

3.3.6 Home of the Shark-Goddess Ka'ahupāhau (Legend of Ka'ehuikimanōo Pu'uloa)

In the Legend of Ka'ehuikimanōo Pu'uloa (Thrum 1923:293-306) the Big Island shark god, Ka'ehuiki travels to visit the famous shark deity Ka'ahupāhau "reaching Hono'uli'uli, the royal residence." Ka'ahupāhau is said to have lived in a royal cave at Hono'uli'uli (Thrum 1923:302).

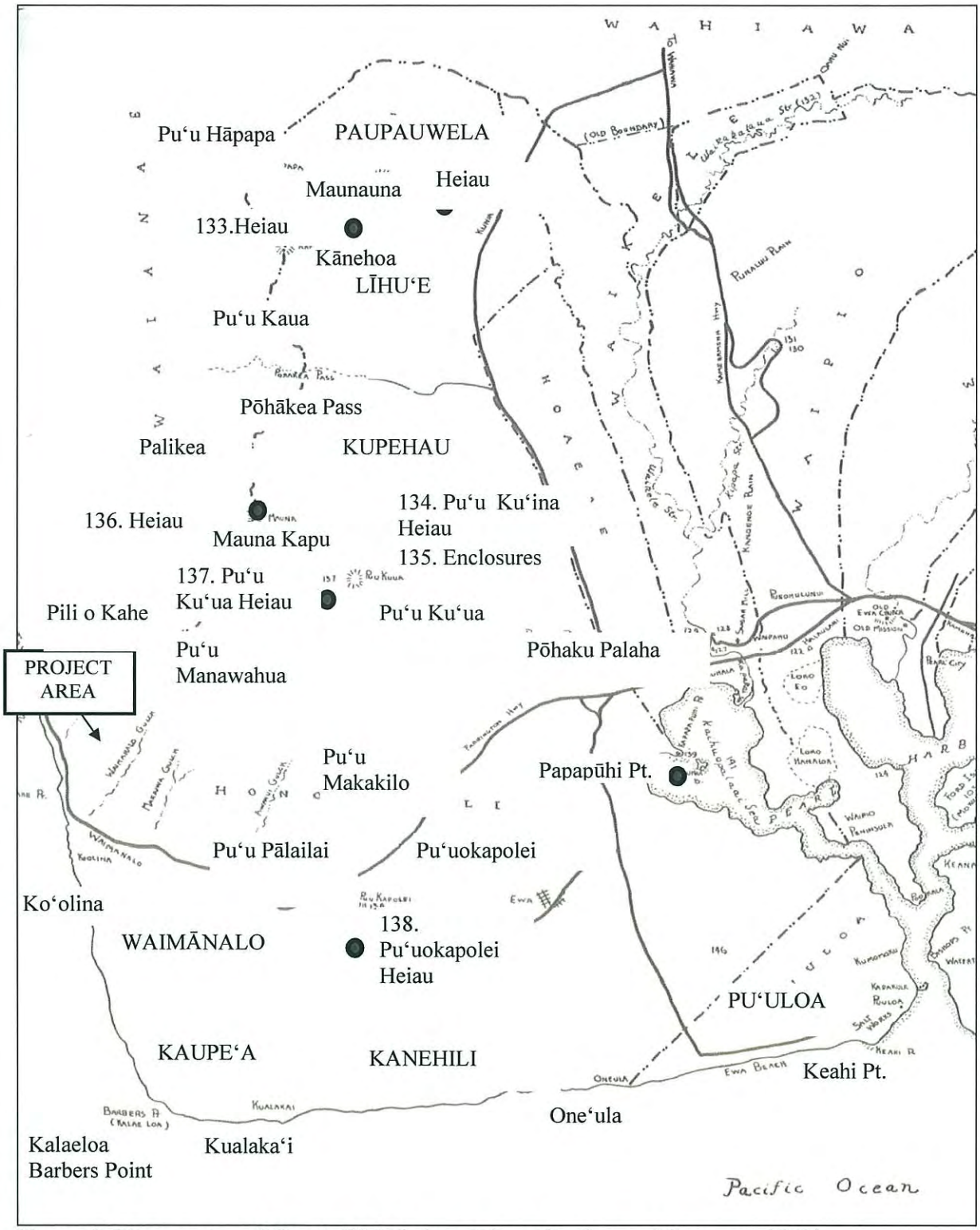

Figure 6. Place names of Hono'uli'uli (adapted from Sterling and Summers 1978)

3.3.7 The Frightened Populace of Hono'uli'uli *(He Ka'ao no Palila)*

In the Legend of Palila, the *kupua* or demigod hero of Kaua'i, he lands at Ka'ena point with his fabulous war club (*lā'au pālau*), which required eighty men to carry it, and crosses into Hono'uli'uli through the Pōhākea Pass. He descends to the plain of Keahumoa:

> Kū kēia i laila nānā i ke kū ka ea o ka lepo i nā kānaka, e pahu aku ana kēia i ka lā'au pālau aia nei i kai o Hono'uli'uli, kū ka ea o ka lepo o ka honua, me he ōla'i la, maka'u nā kānaka holo a hiki i Waikele...
>
> At this place he stood and looked at the dust as it ascended to the sky caused by the people who had gathered there; he then pushed his war club toward Hono'uli'uli. When the people heard something roar like an earthquake they were afraid and they all ran to Waikele ... (Fornander 1917 Vol. V 136-153)

3.3.8 Two Old Women Who Turned To Stone *(Ka Loea Kālai'āina)*

The Hawaiian language newspaper *Ka Loea Kālai'āina* relates that near Pu'uokapolei, on the plain of Pukaua, on the *mauka* side of the road, there was a large rock. The legend is as follows:

> There were two supernatural old women or rather peculiar women with strange powers and Pu'ukaua belonged to them. While they were down fishing at Kualaka'i [near Barbers Point] in the evening, they caught these things, 'a'ama crabs, pipipi shellfish, and whatever they could get with their hands. As they were returning to the plain from the shore and thinking of getting home while it was yet dark, they failed for they met a one-eyed person [bad omen]. It became light as they came near to the plain, so that passing people were distinguishable. They were still below the road and became frightened lest they be seen by men. They began to run - running, leaping, falling, sprawling, rising up and running on, without a thought of the 'a'ama crabs and seaweeds that dropped on the way, so long as they would reach the upper side of the road. They did not go far for by then it was broad daylight. One woman said to the other, "Let us hide lest people see us," and so they hid. Their bodies turned into stone and that is one of the famous things on this plain to this day, the stone body. This is the end of these strange women. When one visits the plain, it will do no harm to glance on the upper side of the road and see them standing on the plain. (Ka Loea Kālai'āina, January 13, 1900)

3.3.9 The Strife of Nāmakaokapāo'o and Puali'i (*Ka'ao no* Nāmakaokapāo'o)

In the Legend of Nāmakaokapāo'o the brave boy, Nāmakaokapāo'o, and his mother, Pōka'ī, appear to have been living near the coast but were quite destitute (*'ilihune loa*). His mother met Puali'i when he came from Līhu'e to fish at Hono'uli'uli and the family went to live on the plains of Keahumoa (*ke kula o Keahumoa*). Puali'i kept sweet potato patches (*māla 'uala*) and fished for *ulua*. Following a dispute over sweet potatoes, Nāmakaokapāo'o defeated his step-father, Puali'i and:

> Lālau aku la o Nāmakaokapāo'o i ke po'o o Puali'i a kiola aku la i kai o Waipouli, he ana ma kahakai o Hono'uli'uli, o kona loa, 'elima mile ka loa...
>
> Nāmakaokapāo'o picked up Puali'i's head and threw it towards Waipouli, a cave situated on the beach at Hono'uli'uli (a distance of about five miles)... (Fornander 1917 Vol. V 274-277)

3.3.10 The Story of Kaihuopala'ai Pond, Hono'uli'uli (*Ka'ao no Maikohā*)

In the Legend of Maikohā a sister of Maikohā (a deified hairy man who became the god of tapa makers) named Kaihuopala'ai, journeys to O'ahu:

> 'Ike aku la o Kaihuopala'ai i ka maikai o Kapapaapuhi, he kāne e noho ana ma Hono'uli'uli ma 'Ewa. Moe iho la lāua, a noho iho la o Kaihuopala'ai i laila a hiki i kēia lā. 'Oia kēlā loko kai e ho'opuni ia nei i ka 'anae, nona nā i'a he nui loa, a hiki i kēia kākau ana.
>
> Kaihuopala'ai saw a goodly man by the name of Kapapaapuhi who was living at Hono'uli'uli, 'Ewa; she fell in love with him and they were united, so Kaihuopala'ai has remained in 'Ewa to this day. She was changed into that fishpond in which mullet are kept and fattened, and that fishpond is used for that purpose to this day [1919]. (Fornander 1917 Vol. V 270-271)

3.3.11 The Traveling Mullet of Hono'uli'uli (Fish Stories)

The story of (Ka)Ihuopala'ai is also associated with the tradition of the *'anae-holo* or traveling mullet (Thrum 1907:270-272):

> The home of the 'anae-holo is at Hono'uli'uli, Pearl Harbor, at a place called Ihuopala'ai. They make periodical journeys around to the opposite side of the island, starting from Pu'uloa and going to windward, passing successively Kumumanu, Kalihi, Kou, Kālia, Waikīkī, Ka'alāwai, and so on, around to the Ko'olau side, ending at Lā'ie, and then returning by the same course to their starting point.(Thrum 1907:271)

In Thrum's account, Ihuopala'ai is a male who possesses a Kū'ula or fish god which supplied the large mullet known as *'anae*. His sister lived in Lā'ie and there came a time when there were no fish. She sent her husband to visit Ihuopala'ai who was kind enough to send the fish following his brother-in-law on his trip back to Lā'ie.

This story is associated with a poetical saying documented by Mark Pukui about Hono'uli'uli:

> Ka i'a hali a ka makani
>
> The fish fetched by the wind (Pukui 1983: # 1330)

Pukui explains "The *'anaeholo*, a fish that travels from Hono'uli'uli, where it breeds, to Kaipāpa'u on the windward side of O'ahu. It then turns about and returns to its original home. It is driven closer to shore when the wind is strong." Whether this saying was used in contexts other than in reference to mullet is unclear.

3.3.12 Hono'uli'uli and the Head of Hilo-a-Lakapu (Legend of the Sacred Spear-point)

In the Legend of the Sacred Spear-point (Kalākaua 1888:209-225) is a reference to the Hawai'i Island chief Hilo-a-Lakapu. Following his unsuccessful raid against O'ahu "he was slain at Waimano, and his head was placed upon a pole near Hono'uli'uli for the birds to feed upon"(Kalākaua 1888:224).

3.3.13 The Strife at Hono'uli'uli from which Kūali'i unites Hawai'i nei (Mo'olelo o Kūali'i)

The celebrated chief, Kūali'i, is said to have lead an army of twelve thousand *('ekolu mano)* against the chiefs of Ko'olauloa with an army of twelve hundred *('ekolu lau)* upon the plains of Keahumoa (Fornander 1917 Vol. IV 364-401). Perhaps because the odds were so skewed the battle was called off and the *ali'i* (chiefs) of Ko'olau ceded (*ha'awi a'e*) the districts of Ko'olauloa, Ko'olaupoko, Waialua and Wai'anae to Kūali'i. When the *ali'i* of Kaua'i heard of this victory at Hono'uli'uli they gave Kaua'i to Kūali'i as well and thus he became possessed of all the islands (*a lilo a'e la nā moku a pau ia Kūali'i mai Hawai'i a Ni'ihau*). The strife at Hono'uli'uli was the occasion of the recitation of a song for Kūali'i by a certain Kapa'ahulani (*Ka Pule Ana a Kapa'ahulani*) that makes passing reference in word play to the blue poi, which appeases the hunger of Hono'uli'uli (*Uliuli ka poi e piha nei - o Hono'uli'uli*).

3.3.14 The Last Days of Kahahana and Hono'uli'uli (The Land is the Sea's)

In the tradition of the prophecy of the *kahuna* Ka'opulupulu, Moke Manu relates that the deposed O'ahu chief Kahahana fled for his life:

> Upon the arrival here at O'ahu of Kahekili, Kahahana fled, with his wife Kekuapoi, and friend Alapa'i, and hid in the shrubbery of the hills. They went to Āliamanu, Moanalua, to a place called Kinimakalehua; then moved along to Keanapua'a, and Kepo'okala, at the lochs of Pu'uloa, and from there to upper Waipi'o; thence to Wahiawā, Helemano, and on to Līhu'e; thence they came to Po'ohilo, at Hono'uli'uli, where they first showed themselves to the people and submitted themselves to their care. (Thrum 1907:203-214)
>
> Through treachery, Kahahana was induced to leave Po'ohilo, Hono'uli'uli and was killed on the plains of Hō'ae'ae (Thrum 1907:213-214).

3.3.15 Pu'uokapolei and the Reckoning of the Seasons (Kamakau)

Samuel Kamakau relates:

> ...the people of O'ahu reckoned from the time when the sun set over Pu'uokapolei until it set in the hollow of Mahinaona and called this period Kau [summer], and when it moved south again from Pu'uokapolei and it grew cold and the time came when young sprouts started, the season was called from their germination ('ōilo) the season of Ho'oilo [winter, rainy, season]. (Mo'olelo Hawai'i Vol. I, Chap. 2, p. 23)

3.3.16 Hono'uli'uli in the Poetry of Halemano (Ka'ao no Halemano)

In the Legend of Halemano the romantic O'ahu anti-hero chants a love song with a reference to Hono'uli'uli:

> Huli a'e la Ka'ala kau i luna, Waiho wale kai o Pōka'ī, Nānā wale ke aloha i Hono'uli'uli, Kokolo kēhau he makani no Līhu'e...
>
> Search is made to the top of Ka'ala, The lower end of Pōka'ī is plainly seen. Love looks in from Hono'uli'uli, The dew comes creeping, it is like the wind of Līhu'e... (Fornander 1917 Vol. V 252)

3.4 Legends and Traditional Places in Upland Hono'uli'uli

3.4.1 Kahalaopuna at Pōhākea Pass

One of the most popular legends of O'ahu is that of Kahalaopuna (or Kaha) a young woman of Mānoa who is slandered by others and is then killed by her betrothed, Kauhi, a chief from Ko'olau, O'ahu. While the numerous accounts (Day 1906:1-11, Fornander 1919 Vol. V: 188-193, Kalākaua 1888:511-522, Nakuina 1904:41-45, Patton 1932:41-49, Skinner 1971:220-223, Thrum 1907:118-132, Westervelt 1907a 127-137, Westervelt 1907b 84-93) vary in details they typically have Kahalaopuna slain and then revived repeatedly with the aid of a protective owl spirit. Kauhi forces her to hike west from Mānoa through the uplands until they get to Pōhākea Pass through the southern Wai'anae Range in north Hono'uli'uli. At Pōhākea Pass, Kauhi beats her with a stick until she is very dead ("*Ia hahau ana a Kauhi i ka lā'au, make loa o Kahalaopuna*"). Her spirit (*'uhane*) flies up into a *lehua* tree and chants for someone to go notify her parents of her fate. Upon hearing the news her parents fetch Kahalaopuna back to Mānoa and she is restored to life.

3.4.2 *Mo'o* at Maunauna (*Kuokoa*)

Moses Manu in recounting the Legend of Keaomelemele makes a reference to a *mo'o* (fabulous lizard, dragon, serpent) named Maunauna who lived above Līhu'e (presumably at the landform of that name in extreme northern Hono'uli'uli) and who was regarded as a bad lizard (*Kuokoa* April 25, 1885).

3.4.3 Paupauwela and Līhu'e

Paupauwela, also spelled Popouwela (derivation unknown), is the name of the land area in the extreme *mauka* section of Hono'uli'uli Ahupua'a. The land area of Līhu'e is just *makai* of this land, and extends into the *ahupua'a* of Waipi'o (adjacent to the eastern border of Hono'uli'uli). Both place names are mentioned in a chant recorded by Abraham Fornander, which was composed as a *mele* for the O'ahu king, Kūali'i, as he was preparing to battle Kuiaia, the chief of Wai'anae:

Where? Where is the battle field	Ihea, ihea la ke kahua,
Where the warrior is to fight?	Paio ai o ke koa-a?

On the field of Kalena,	I kai i kahua i Kalena,
At Manini, at Hanini,	I Manini, i Hanini
Where was poured the water of the god	I ninia i ka wai akua,
By your work at Malamanui;	I ko hana i Malamanui
On the heights of Kapapa, at Paupauwela,	Ka luna o Kapapa, i Paupauwela,
Where they lean and rest;	I ka hilinai i ke kalele,
At the hala trees of indolent Halahalanui,	Ka hala o Halahalanui maauea,
At the ohia grove of Pule-e	E kula ohia ke Pule-e,
The god of Lono, of Makalii	Ke 'kua o Lono o Makalii
Thr fragrant branch of the Ukulonoku,	Ka lala aalao Ukulonoku,
Mayhap from Kona, from Lihue,	No Kona paha, no Lihue.
For the day at Maunauna	No ka la i Maunauna,
For the water at Paupauwela.	No ka wai i Paupauwela.
Red is the water of Paupauwela,	Ula ka wai i Paupauwela,
From the slain at Malamani,	Ke kilau o Malamani,
The slain on the ridge at Kapapa.	Ka moo kilau I Kapapa.

(Fornander 1917, Vol. IV, Part 2:384-386).

The derivation of the place name Līhu'e (meaning "cold chill") is illustrated in the following poem; all other places names mentioned in this poem are in Waipi'o:

The icy wind of Lihue plied its spurs,

Pulling up the bridle of Haleauau,

Speeding headlong over Kalena

And running over the plain of Kanoenoe

(Ka Loea Kālai'āina, July 22, 1899, translated in Sterling and Summers 1978:21)

This explains the meaning of a Hawaiian saying "*Hao na kēpā o Līhu'e i ke anu*" (The spurs of Līhu'e dig in with cold) (Pukui 1983:#479).

The icy winds of Hono'uli'uli are also noted in a *mele* for the high king Kūali'i. In this *mele*, the cold winds of Kumomoku and Leleiwe, near Pu'uloa in Hono'uli'uli are compared unfavorably to the god Kū.

Not like these are thou, Ku	Aole i like Ku.
[Nor] the rain that brings the land breeze,	Ia ua hoohali kehau,
Like a vessel of water poured out.	Mehe ipu wai ninia la,

Nor to the mountain breeze of Kumomoku,	Na hau o Kumomoku;
[The] land breeze coming round to Leleiwi.	Kekee na hau o Leleiwi,
Truly, have you not known?	Oi ole ka oe i ike
The mountain breezes, that double up your back,	I ka hau kuapuu.
[That make you] sit crooked and cramped at Kaimohala,	Kekee noho kee, o Kaimohala,
The Kanehili at Kaupea?	O Kanehili i Kaupea-la
Not like these are thou, Ku.	Aole i like Ku.

(Fornander 1917, Vol. IV, Part II:390-391)

In the Legend of Halemano (Fornander 1919, Vol. V, Part II: 252), the romantic O'ahu anti-hero chanted a love song with a reference to the winds of Līhu'e:

Search is made to the top of Ka'ala,	Huli a'e la Ka'ala kau i luna,
The lower end of Pōka'ī is plainly seen.	Waiho wale kai o Pōka'ī,
Love looks in from Hono'uli'uli,	Nānā wale ke aloha i Hono'uli'uli,
The dew comes creeping, it is like the wind of Līhu'e...	Kokolo kēhau he makani no Līhu'e.

The wind of Līhu'e and others in the region are also named by Moses K. Nakuina, as follows:

Moa'e-kū is of 'Ewaloa

Kēhau is of Waiopua

Waikōloa is of Līhu'e

Kona is of Pu'uokapolei

Maunuunu is of Pu'uloa

(Nakuina 1992:43)

The *ali'i* were closely associated with Līhu'e, which had habitation areas and playing grounds set aside for their sports. 'Ewa

> Lolale was the father and Keleanohoapiapi the mother of Ka-lo-kaholi-a-Lale. He was born in the land of Lihue and there he was reared into manhood. He excelled in good looks and greatly resembled his mother.
>
> In the olden days the favorite occupation of Lihue chiefs was spear throwing and the best instructors hailed from this locality. (Ka Nūpepa Kū'oko'a, Aug. 26, 1865, translation in Sterling and Summers 1978:23)

Līhu'e was also the home of a famous cannibal king-man, Kaupe, who overthrew the ruling chiefs to become the paramount power between Nu'uanu and the sea. He had a home and a *heiau* in Līhu'e. Kaupe was a *kapua*, a supernatural being who could take the form of a man or a dog; this type of dog man was known as an *'ōlohe*. Although he left the O'ahu *ali'i* alone, he killed many commoners in the area, and eventually sailed to the island of Hawai'i on a raid, where he captured a chief's son; he planned to sacrifice this boy at his *heiau* in Līhu'e. The father came to O'ahu, and with the help of the priests of the Hawaiian hero, Kahanaiakeakua, was able to free his son, escape back to Hawai'i, and eventually kill the dog-man, Kaupe (Westervelt 1963:90-96).

3.4.4 Hill of Maunauna

The hill Maunauna lies between the lands Paupauwela and Līhu'e. One translation of Maunauna is "mountain sent [on errands]." Two servant *mo'o* who lived here had no keepers to supply their needs" (Pukui et al. 1974:149). It was at Maunauna, according to one tradition, that the forces of the chiefs Kūali'i and Kuiaia of Wai'anae met to do battle, which was averted when a *mele* honoring the god Kū was chanted (see previous section). (Fornander 1917, Vol IV, Part 2:348). In the Legend of Ke-ao-melemele, a woman named Paliuli traveled in this area.

> In a very short time she [Paliuli] walked over the plain of Ewa; Ewa that is known as the land of the silent fish [pearl oysters]...She went on to the plain of Punalu'u and turned to gaze at Maunauna point and the plain of Lihue. (Manu 1885, translation in Sterling and Summers 1978:21)

Certain place names in the uplands, including Maunauna, are also mentioned in the story of Lo-lae's Lament. The place of Lolale's residence is given in King Kalākaua's version of this story. According to him (Kalākaua 1990:232): "There lived there at that time in Lihue, in the district of 'Ewa, on the island of Oahu, a chief named Lo-lale, son of Kalona-iki, and brother of Piliwale, the *alii-nui*, or nominal sovereign, of the island, whose court was established at Waialua."

In this story, Lolale was a chief of O'ahu who asked his friend Kalamakua to find him a bride (Kalākaua 1990:228-246; Skinner 1971:217-219). Kalamakua traveled to Maui and chose Kelea, the chief's sister, and returned with her to O'ahu; during this time the two grew close. Kelea lived with Lolale for a while, but he was a silent type that was often away from home playing sports and walking in the woodlands. Longing for Kalamakua, Kelea decided to leave her husband, Lolale voiced no "spoken bitterness;" however, after she left, he sang this lament:

> Farewell, my partner of the lowland plains,
>
> On the waters of Pohakeo, above Kanehoa,
>
> On the dark mountain spur of Mauna-una!
>
> O, Lihue, she is gone!
>
> Sniff the sweet scent of the grass,
>
> The sweet scent of the wild vines
>
> That are twisted by Waikoloa,

By the winds of Waiopua,

My flower!

As if a mote were in my eye.

The pupil of my eye is troubled.

Dimness covers my eyes. Woe is me!

[Kalākaua 1990:244-245].

3.5 Prehistory and Early History

Various Hawaiian legends and early historical accounts indicate that the *ahupua'a* of Hono'uli'uli was once widely inhabited by pre-Contact populations. This would be attributable for the most part to the plentiful marine and estuarine resources available at the coast, along which several sites interpreted as permanent habitations and fishing shrines were located. Other attractive subsistence-related features of the *ahupua'a* include irrigated lowlands suitable for wetland taro cultivation (Hammatt and Shideler 1990), as well as the lower forest area of the mountain slopes for the procurement of forest resources.

Exploitation of the forest resources along the slopes of the Wai'anae Range - as suggested by E. S. and E.G. Handy - probably acted as a viable subsistence alternative during times of famine:

> ...The length or depth of the valleys and the gradual slope of the ridges made the inhabited lowlands much more distant from the *wao*, or upland jungle, than was the case on the windward coast. Yet the *wao* here was more extensive, giving greater opportunity to forage for wild foods during famine time. (Handy and Handy 1972:469)

These upper valley slopes may have also been a significant resource for sporadic quarrying of basalt for the manufacturing of stone tools. This is evidenced in part by the existence of a probable quarrying site (50-80-12-4322) in Makaīwa Gulch at 152 m. (500 ft.) a.m.s.l. (Hammatt et al. 1991).

The Hawaiian *ali'i* were also attracted to the region, which is steeped in myth.

> Ko 'Olina is in Waimānalo near the boundary of 'Ewa and Wai'anae. This was a vacationing place for chief Kākuhihewa and the priest Napuaikamao was the caretaker of the place. Remember reader, this Ko Olina is not situated in the Waimānalo on the Ko'olau side of the island but the Waimānalo in 'Ewa. It is a lovely and delightful place and the chief, Kākuhihewa loved this home of his. (Ke Au Hou July 13, 1910)

Other early historical accounts of the general region typically refer to the more populated areas of the 'Ewa district, where missions and schools were established and subsistence resources were perceived to be greater. However, the presence of archaeological sites along the barren coral plains and coast of southwest Hono'uli'uli Ahupua'a, indicate that prehistoric and early historic populations also adapted to less inviting areas, despite the environmental hardships.

Barbers Point is named after Captain Henry Barber whose vessel ran aground on October 31, 1796. Subsequent to western contact in the area, the landscape of the 'Ewa plains and Wai'anae slopes was adversely affected by the removal of the sandalwood forest, and the introduction of domesticated animals and new vegetation species. Domesticated animals including goats, sheep and cattle were brought to the Hawaiian Islands by Vancouver in the early 1790s, and allowed to graze freely about the land for some time after. It is unclear when the domesticated animals were brought to O'ahu; however, L.A. Henke reports the existence of a longhorn cattle ranch in Wai'anae prior to 1840 (in Frierson 1972:10). During this same time, perhaps as early as 1790, exotic vegetation species were introduced to the area. These typically included vegetation best suited to a terrain disturbed by the logging of sandalwood forest and eroded by animal grazing. The following dates of specific vegetation introduced to Hawai'i are given by R. Smith and outlined by Frierson:

1) "early", c. 1790:
Prickly pear cactus, *Opuntia tuna*
Haole koa, *Leucaena glauca*
Guava, *Psidium guajava*

2) 1835-1840
Burmuda [sic] grass, *Cynodon dactylon*
Wire grass, *Eleusine indica*

3) 1858
Lantana, *Lantana camara*

The *kiawe* tree (*Prosopis pallida*) was also introduced during this period, either in 1828 or 1837 (Frierson 1972:11).

Intensive sandalwood harvesting, according to H. St. John (in Frierson 1972:7) occurred in the Hawaiian Islands from 1815 to 1830. As it is likely that sandalwood forests once occupied the lower, dry slopes of the Wai'anae Range, the current project area was likely impacted by the cutting and burning of these forests.

3.5.1 Mid- to late-1800s

Associated with the Māhele of 1848, 99 individual land claims in the *ahupua'a* of Hono'uli'uli were registered and immediately awarded by King Kamehameha III. The vast majority of the Land Commission Awards (LCA) were located near the Pu'uloa salt works and the taro lands of the *'ili* of Hono'uli'uli. The present study area appears to have been included in the largest award (Royal Patent 6071, LCA 11216, 'Āpana 8) granted in Hono'uli'uli Ahupua'a to Miriam Ke'ahi-Kuni Kekau'ōnohi on January 1848 (Native Register). Kekau'ōnohi acquired a deed to all unclaimed land within the *ahupua'a*, including a total of 43,250 acres.

Kamaukau relates the following about Kekau'ōnohi as a child:

> Kamehameha's granddaughter, Ke-ahi-Kuni Kekau-'ōnohi...was also a tabu chiefess in whose presence the other chiefesses had to prostrate and uncover themselves, and Kamehameha would lie face upward while she sat on his chest. (In Hammatt and Shideler 1990:19-20)

Kekau'ōnohi was one of Liholiho's (Kamehameha II) wives, and after his death, she lived with her half-brother, Luanu'u Kahala'i'a, who was governor of Kaua'i (Hammatt and Shideler 1990:20). Subsequently, Kekau'ōnohi ran away with Queen Ka'ahumanu's stepson, Keli'i-ahonui, and then became the wife of Chief Levi Ha'alelea. Upon her death on June 2, 1851, all her property was passed on to her husband and his heirs. When Levi Ha'alelea died the property went to his surviving wife, who in turn leased it to James Dowsett and John Meek in 1871 for stock running and grazing.

In 1877, James Campbell purchased most of Hono'uli'uli Ahupua'a for a total of $95,000. He then drove off 32,347 head of cattle belonging to Dowsett, Meek and James Robinson and constructed a fence around the outer boundary of his property (Bordner and Silva 1983:C-12). In 1879, Campbell brought in a well driller from California to search the 'Ewa plains for water, and a "vast pure water reserve" was discovered (Armstrong and Bier 1983). Following this discovery, plantation developers and ranchers drilled numerous wells in search of the valuable resource. By 1881, the Campbell property of Hono'uli'uli prospered as a cattle ranch with "abundant pasturage of various kinds" (Briggs in Haun and Kelly 1984:45). Within 10 years of the first drilled well in 'Ewa, the addition of a series of artesian wells throughout the island was supplying most of Honolulu's water needs (Armstrong and Bier 1983).

In 1889, Campbell leased his property to Benjamin Dillingham, who subsequently formed the O'ahu Railway & Land Co. (O.R. & L) in 1890. To attract business to his new railroad system, Dillingham subleased all land below 200 feet elevation to William Castle who in turn sublet the area to the 'Ewa Plantation Company for sugar cane cultivation (Frierson 1972:15) (Figure 7). Dillingham's Hono'uli'uli lands above 200 feet elevation that were suitable for sugar cane cultivation were sublet to the O'ahu Sugar Co. Throughout this time and continuing into modern times, cattle ranching continued in the area, and Hono'uli'uli Ranch established by Dillingham was the "fattening" area for the other ranches (Frierson 1972:15).

'Ewa Plantation Co. was incorporated in 1890 and continued in full operation up into modern times (Figure 7). The plantation grew quickly with the abundant artesian water. As a means to generate soil deposition on the coral plain and increase arable land in the lowlands, the 'Ewa

Plantation Co. installed ditches running from the lower slopes of the mountain range to the lowlands and then plowed the slopes vertically just before the rainy season to induce erosion (Frierson 1972:17).

The O'ahu Sugar Co. was incorporated in 1897 and included lands in the foothills above the 'Ewa plain and Pearl Harbor. Prior to commercial sugar cultivation, the lands occupied by the O'ahu Sugar Co. were described as being "of near desert proportion until water was supplied from drilled artesian wells and the Waiāhole Water project" (Condé and Best 1973:313). The O'ahu Sugar Co. took control over the 'Ewa Plantation lands in 1970 and continued operations into the 1990s.

Dillingham's *mauka* lands in western Hono'uli'uli that were unsuitable for commercial sugar production remained pasture for grazing livestock. From 1890 to 1892, the Ranch Department of the O.R. & L. Co. desperately sought water for their herds of cattle by tapping plantation flumes and searching for alternative sources of water. Ida von Holt leaves this account of her husband Harry's (Superintendent of the O.R. & L Ranch Dept.) search for water in the foothills of the Wai'anae Range:

> One of those places is on the old trail to Palehua, and had evidently been a place of which the Hawaiians had known, for its name is Kaloi (the taro patch), and even in dry weather water would be standing in the holes made by the cattle, as they tried to get a drop or two. (Von Holt 1985:136)

A second account is given of the discovery of spring water in an area over the ridge on the north side of Kalo'i Gulch:

> Shouting to the men to come over with their picks and shovels, he [Harry von Holt] soon got them busy clearing away lots of small stones and earth. Almost at once they could see that there were evidences of a paved well, and at about three feet down they came upon a huge flat rock, as large around as two men could span with their arms. Digging the rock loose and lifting it to one side, what was their astonishment to find a clear bubbling spring! (Von Holt 1985:138)

Following the discovery, two old Hawaiians began to ask Von Holt about the spring:

> Finally he [Harry von Holt] got them to explain that the spring, called "Waihuna" (Hidden Spring) had been one of the principal sources of water for all that country, which was quite heavily populated before the smallpox epidemic of 1840...A powerful Kahuna living at the spring had hidden it before he died of the smallpox, and had put a curse on the one who disturbed the stone, that he or she would surely die before a year was out. (Von Holt 1985:138-140)

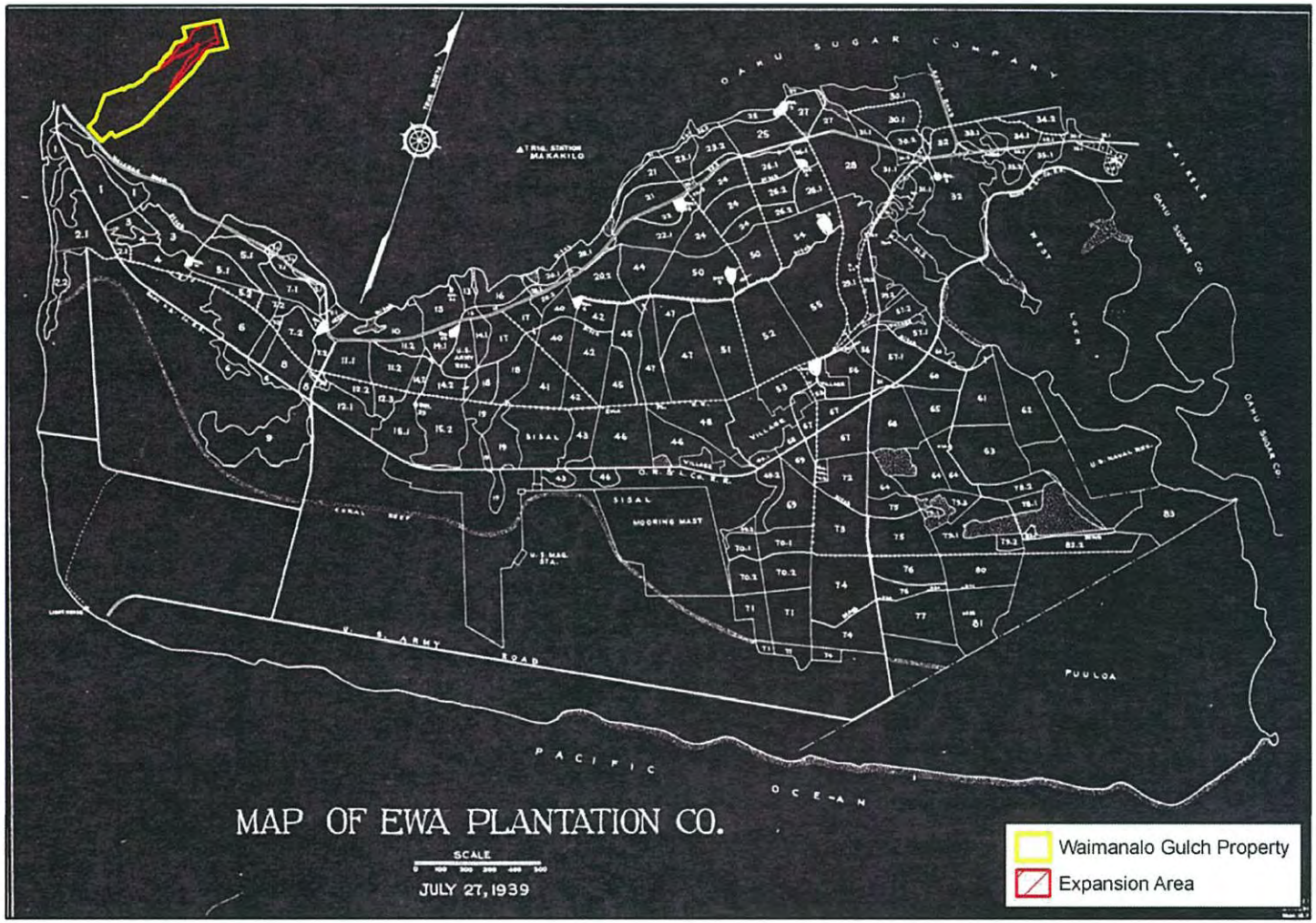

Figure 7. Map of 'Ewa Plantation Co. (Condé and Best 1973:285), showing the extent of sugar cane cultivation in the vicinity of the Waimānalo Gulch property.

3.5.2 1900s

By 1920, the lands of Hono'uli'uli were used primarily for commercial sugar cane cultivation and ranching (Frierson 1972:18). Much of the *mauka* lands in western Hono'uli'uli, including ridges and deep gulches, were unsuitable for commercial sugar cultivation and remained pasture for grazing livestock. Historic maps of the Waimānalo Gulch area indicate a lack of any significant development in the area into the 1940s (Figures 8-10). Modest constructions in the area included the realignment of the "Waianae Road" (present Farrington Hwy.) to run along the *makai* / southern edge of the Waimānalo Gulch property, and a road the top of the Kahe Point ridge, within the Waimānalo Gulch property.

In the late 1920s, the main residential communities were at the northeast edge of the 'Ewa Plain. The largest community was still at Hono'uli'uli village. 'Ewa was primarily a plantation town, focused around the sugar mill, with a public school as well as a Japanese School. Additional settlement was in Waipahu, centered around the Waipahu sugar mill, operated by the Oahu Sugar Company.

Major land use changes came to western Hono'uli'uli when the U.S. Military began development in the area. Long before the Japanese bombing of Pearl Harbor in December 1941, the U.S. military had initiated the Oahu Coast Defense Command, a series of coastal artillery batteries designed to assist in the defense of Pearl Harbor and to prevent invasion of O'ahu. Military installations were constructed both near the coast, as well as in the foothills and upland areas. The following military installations were located in the general vicinity of the current Waimānalo Gulch project area. Barbers Point Military Reservation (a.k.a. Battery Barbers Point, 1937-1942), located at Barbers Point Beach, was used beginning in 1921 as a training area for firing 155 mm guns (Payette 2003). Camp Malakole Military Reservation (a.k.a. Hono'uli'uli Military Reservation until 1941), located south of Barbers Point Harbor, was used from 1939 as an anti-aircraft artillery training firing point (Payette 2003). Gilbert Military Reservation, located east of Barbers Point Harbor, was used from 1922-1944 as a railway battery firing position (Payette 2003). Brown's Camp Military Reservation (a.k.a. Brown's Camp Battery from 1937-1944 and Battery Awanui from 1940-1945), located near Kahe Point was a railway battery firing position (Payette 2003). Fort Barrette (a.k.a. Kapolei Military Reservation and Battery Hatch), located atop Pu'u Kapolei, was in use from 1931 to 1948 for housing four 3-inch anti-aircraft batteries (Payette 2003).

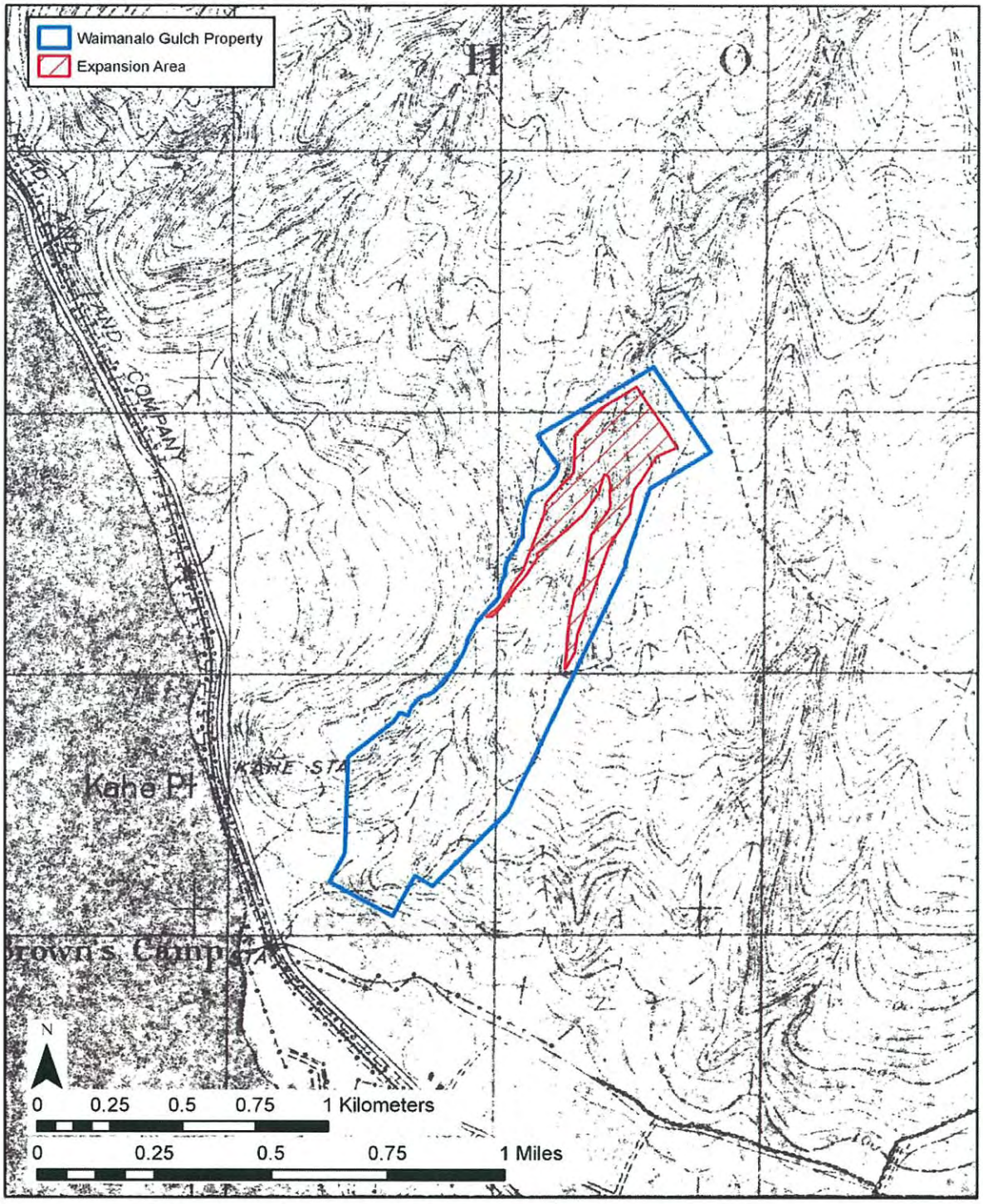

Figure 8. 1918 Fire Control Map, showing the location of the Waimānalo Gulch property and proposed landfill expansion area

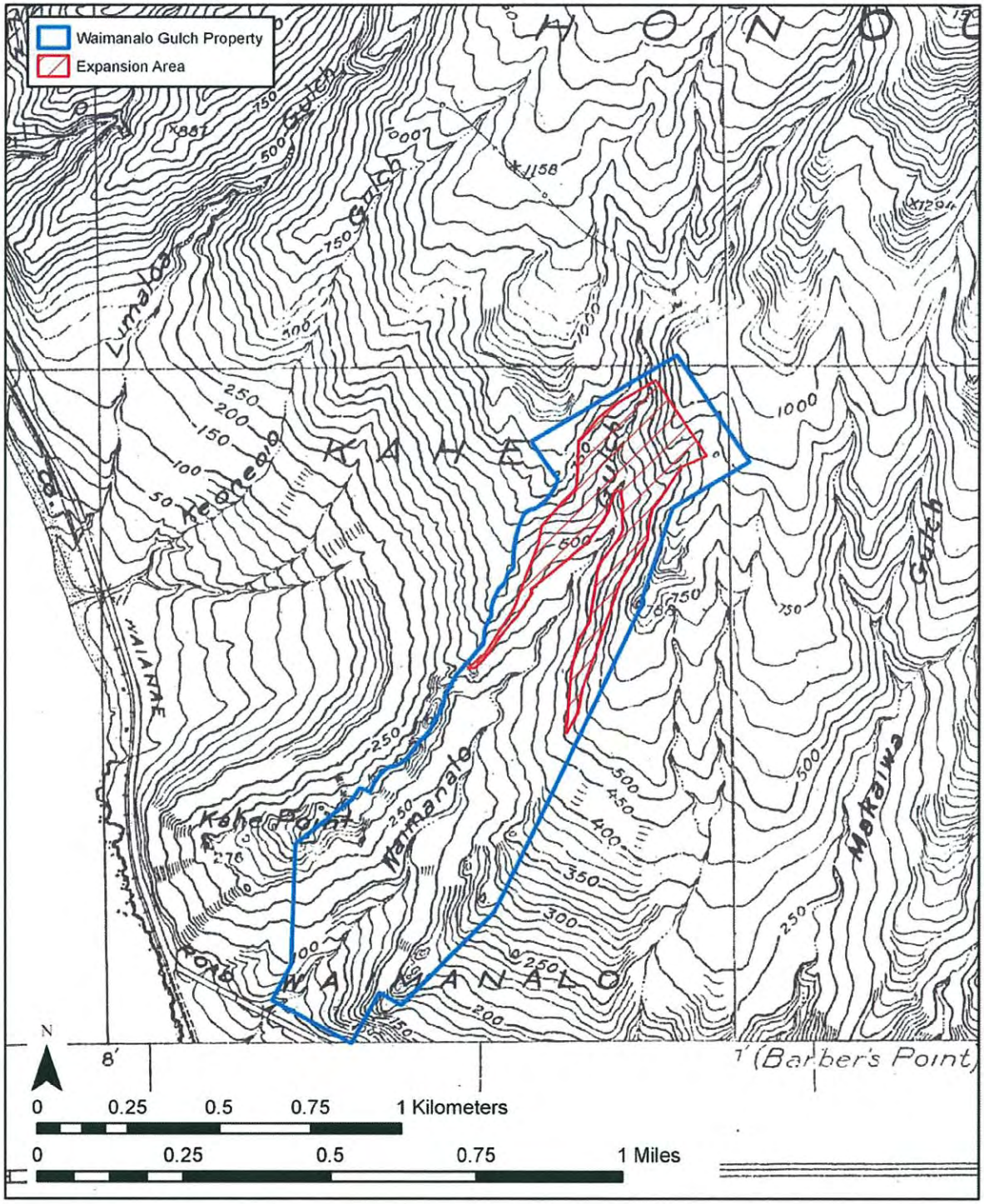

Figure 9. 1928 USGS Topographic Map, Wai'anae Quad, showing the location of the Waimānalo Gulch property and proposed landfill expansion area

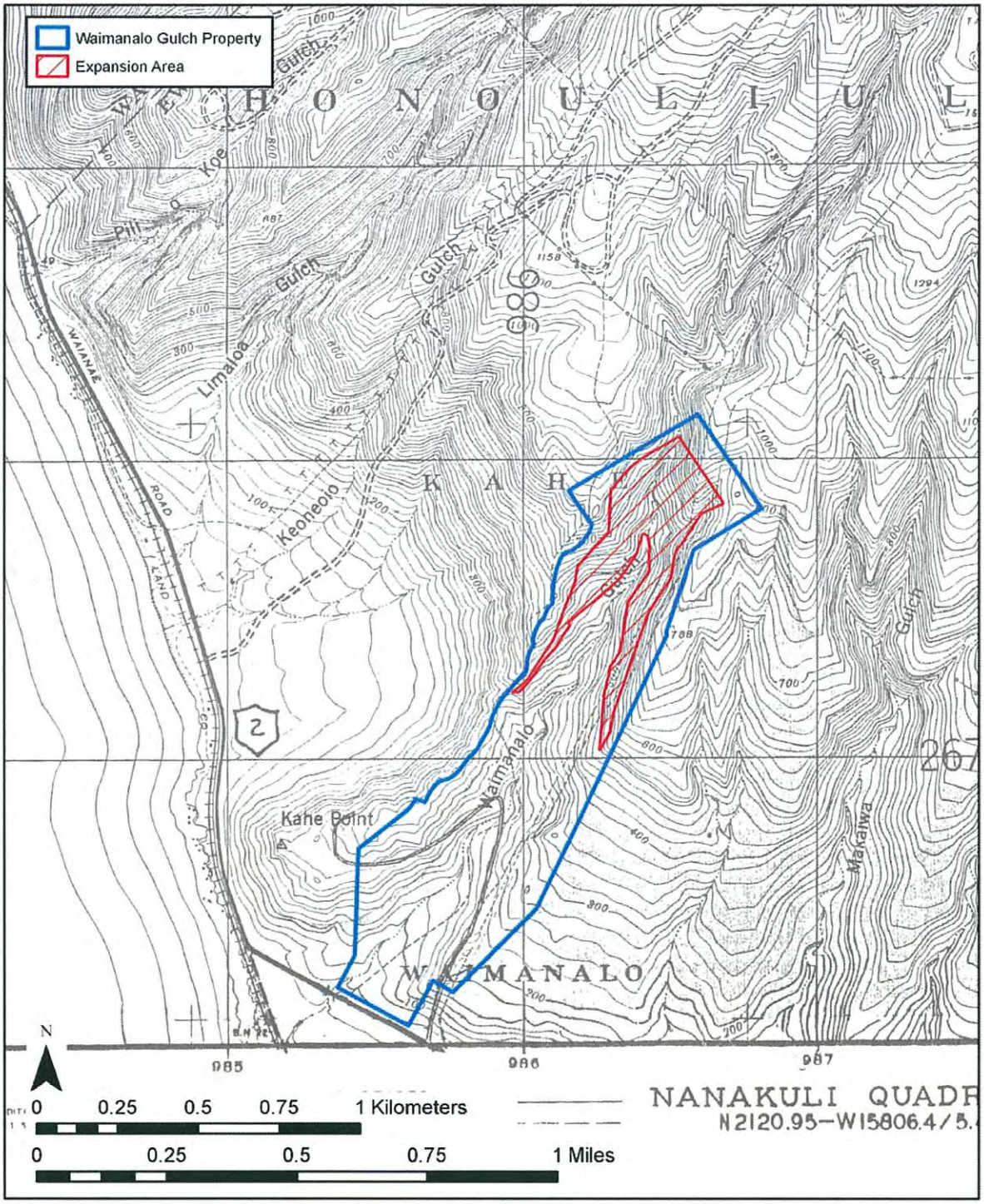

Figure 10. 1928 USGS Topographic Map, Wai'anae Quad, showing the location of the Waimānalo Gulch property and proposed landfill expansion area

In the 1950s, the site was used as a NIKE missile base. Palailai Military Reservation (a.k.a. Battery Palailai from 1942-1944), located atop Pu'u Palailai, was used from the 1920s and included Fire Control Station "B" (Payette 2003). Barbers Point NAS, in operation from 1942 into the 1990s, was the largest and most significant base built in the area. It housed numerous naval and defense organizations, including maritime surveillance and anti-submarine warfare aircraft squadrons, a U.S. Coast Guard Air Station, and the U.S. Pacific Fleet.

3.5.3 Battery Arizona

On the southwest ridge above Waimānalo Gulch are the subterranean remnants of Battery Arizona, an ambitious World War II military project. The attack of December 7, 1941 impelled the construction of further defensive armament for portions of the O'ahu coastline not protected by the existing batteries. Even the sunken ships at Pearl Harbor would be enlisted in O'ahu's defense. When, early in 1942, it was discovered that the two rear three-gun turrets of the U.S.S. Arizona were salvageable, an ambitious plan to mount them at two land installations on O'ahu was set into motion. The two sites chosen were the tip of Mōkapu Peninsula at Kāne'ohe Bay, designated Battery Pennsylvania, and Kahe Point above the Wai'anae Coast, designated Battery Arizona.

Construction of Batteries Pennsylvania and Arizona commenced in April 1943. A formidable subterranean complex was contrived to house the turrets at the two sites. According to a U.S. Army Corps of Engineers report prepared in 1946:

> The design that was eventually produced consists of a central barbette well of concrete set in rock, having an overall depth of about 60 ft. and an inside diameter of about 24 ft., with three levels below the bottom of the turret connected by stairways. Two tunnels radiate from this well to house projectiles and powder magazines immediately adjacent to the well. Beyond and in line with the projectile magazine is a large power room for three 125 KW generators, all miscellaneous switchgear, air conditioning, and ventilating equipment. In a separate tunnel off the main tunnel in the vicinity of the powder room is a 10,000 gallon emergency water tank to maintain the battery for several days in case of siege. Beyond the power room in a separate leg of the tunnel are the operations rooms. Because during prolonged action it might be necessary for the entire battery personnel to remain in the battery and be self sustaining, these gas proofed and air conditioned operations rooms normally comprised of radio and switchboard, plotting, and radar rooms included latrines for officers and enlisted men, a galley, first aid room, offices, and storerooms.

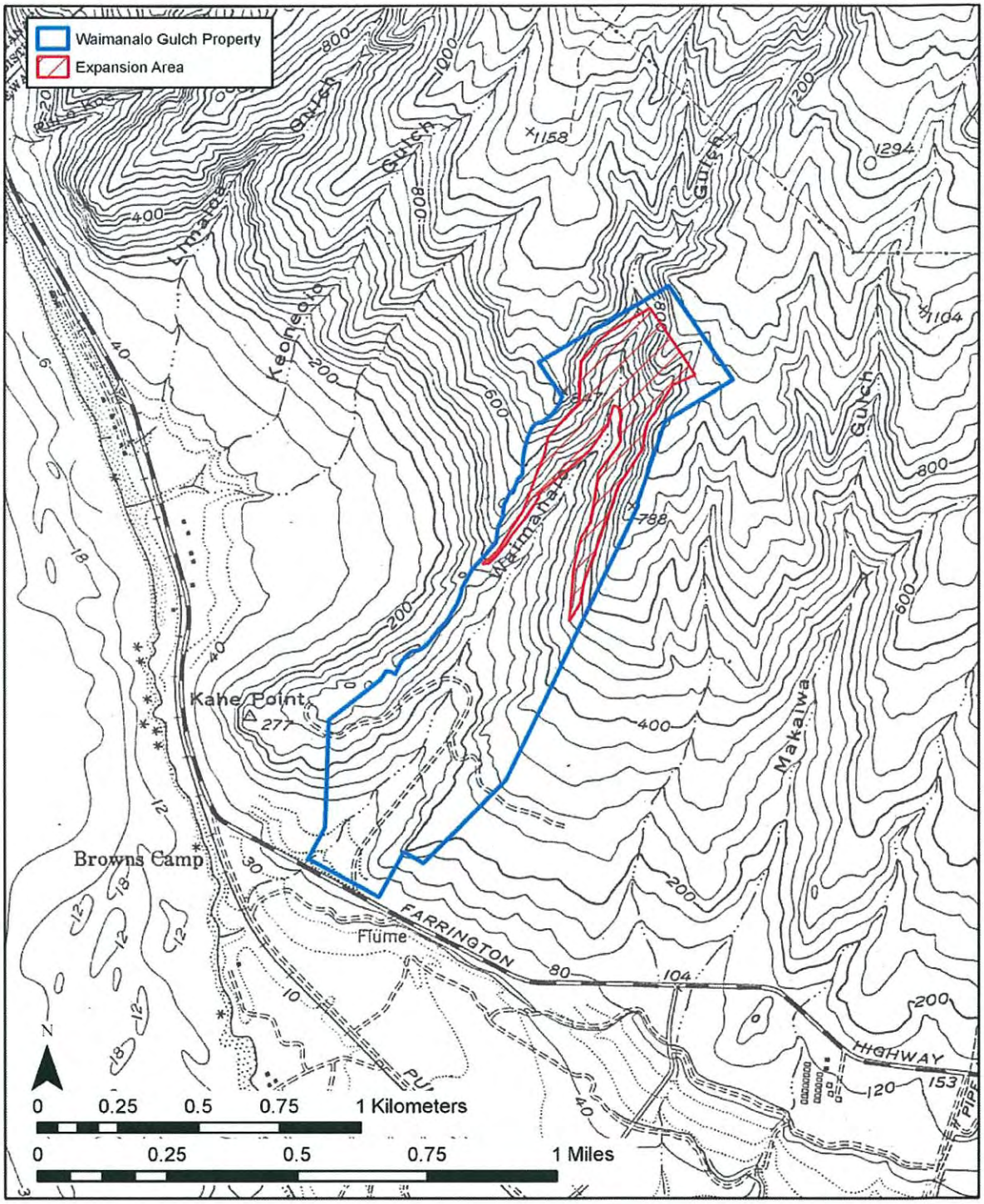

Figure 11. 1953 USGS Topographic Map, 'Ewa Quad., showing the location of the Waimānalo Gulch property and proposed landfill expansion area

The salvaged turrets were stored at a facility on Pearl City Peninsula. Refurbishing of the turrets proved to be a formidable task:

> An immediate complication arose from the fact that removal of the turrets from the Arizona was begun prior to any thought of their reuse; hence, much of the cutting was done rapidly and crudely with no consideration for future reassembly. As a result, the reconstruction frequently was held up by the painstaking realignment and joining of turret segments. Other difficulties arose from the initial damage and subsequent immersion suffered by the armament components. (Kirchner and Lewis 1967:432)

Records in the archives of the U.S. Army Museum at Ft. DeRussy reveal the months-long search across the Mainland for replacement parts, especially motors, and for parts to adapt the turrets to installation on land. It was finally determined that, because they had been so long under water, every part of the turrets' operating systems had to be repaired or replaced.

Perhaps appropriately for the former battleship armaments, the turrets were transported to their respective battery sites by sea. According to the 1946 Army Corps of Engineers report:

> The heavy section of the turrets comprising three 14-inch guns were moved by barge from Pearl Harbor to beaches near the battery sites. Here they were cleaned, painted, and put into condition for installation in the barbette. Special equipment was designed at each site for raising the parts from the ground and lowering to their correct position in the barbette.

Construction of the two batteries continued through all of 1944 and into two-thirds of 1945. Problems--associated with wartime conditions and the unique engineering feat of adapting shipboard weaponry to land installation--dogged the two projects over the many months:

> This work involving repair, replacement, or remanufacture of thousands of separate parts placed great demands upon the Army and Navy ordnance facilities and workers. Often, drawings were not available for damaged or missing items, and a particular stage of reconstruction had to be awaited before such parts could be reproduced...In one instance, well over a year was required to procure a single turret turning gear worm and pinion.
>
> ...The various problems were further complicated by the sheer mass of the armament and the size of the battery structures...Special heavy equipment...had to be erected at each installation for raising the turret members from the shore and for assembling the armament at the site. Some segments had to be moved on rollers along specially constructed roads, while the 71-ton gun tubes were lifted by parkbuckles from the beaches to the emplacements high above.
>
> ...Site peculiarities placed severe restrictions upon the battery layouts. The fire-control radars, for example, because of their sensitivity to concussion, could not be near the turrets; yet the ideal positions for the radars both technically and topographically were but a few yards away...

> During late 1944, the battery construction reached a bottleneck stage when progress depended upon a few highly skilled technicians and the closely timed arrival of a few critical armament components. By Christmas, 1944, the number of personnel that could effectively work at the two installations was limited to about 35 specialists. At this time, Battery Pennsylvania's turret was roughly half assembled, while Battery Arizona was even further behind. (Kirchner and Lewis 1967:432-433)

The slow pace of construction of the two batteries reflected a diminishing urgency for defense of O'ahu and its military installations. The war front was moving west across the Pacific as successive defeats impelled Japan's retreat. Battery Pennsylvania at Mōkapu Point was near completion in August 1945 when its guns were test fired around the same time of Japan's surrender. Battery Arizona had not been completed by the war's end; its guns, though installed, were never fired.

Neither of the two batteries was ever placed in operation during the post-war years. The batteries had been rendered obsolete "due to the development of air power, new assault techniques and nuclear weapons. The guns were scrapped in 1949..." (Bouthillier 1995:12).

A 1943 War Department map indicates a road was constructed within the *makai* / southern portion of Waimānalo Gulch, ascending the western slope to the top of the Kahe Point ridge. This road, along with several other roads and trails indicated on the map, were likely constructed in association with the Battery Arizona complex and other military installations and training areas in the vicinity.

3.5.4 1950s to Present

Waimānalo would once again play a role in the O'ahu defense system when, sometime after 1959, the United States Army purchased or exchanged land with the Campbell Estate for the construction of a Nike-Hercules anti-aircraft missile base located at the head of Waimānalo Gulch. The Nike complex, in used between 1961 and 1968 consisted of two control sites and one double-sized launcher site (Murdock 2003). The tunnel complex of Battery Arizona was also used for civil defense circa 1960.

Development in the uplands of western Hono'uli'uli have generally been limited to ranch related housing and infrastructure, military training and NIKE missile stations, as well as the construction of military and commercial communication and atmospheric observation stations on the ridges near Pālehua. In 1975, the U.S. Air Force constructed the Pālehua Solar Observatory with five solar optical telescopes. A circa 1980s aerial photograph (Figure 13) shows limited development in the vicinity of the Waimānalo Gulch landfill property.

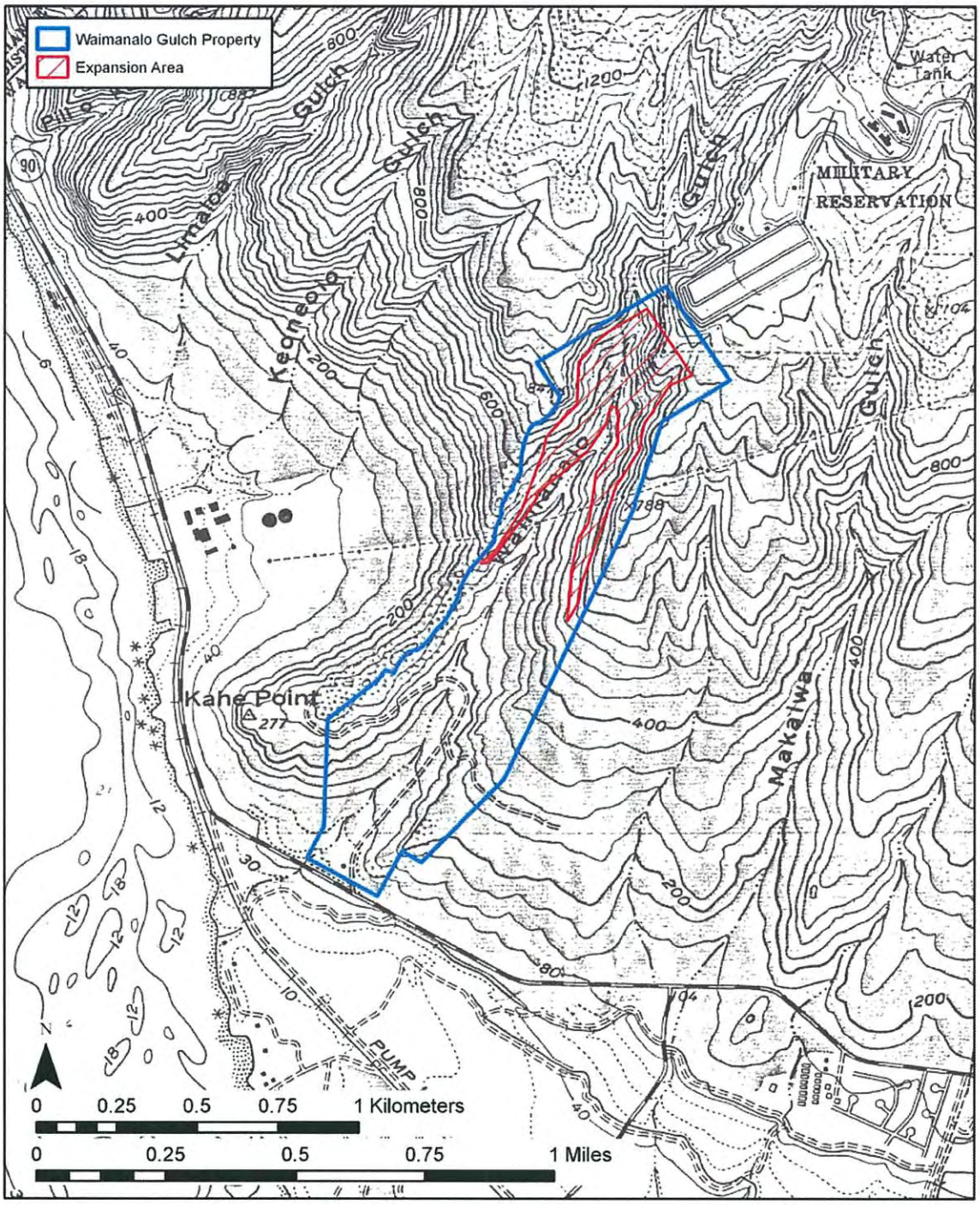

Figure 12. 1962 USGS Topographic Map, 'Ewa Quad., showing the location of the Waimānalo Gulch property and proposed landfill expansion area

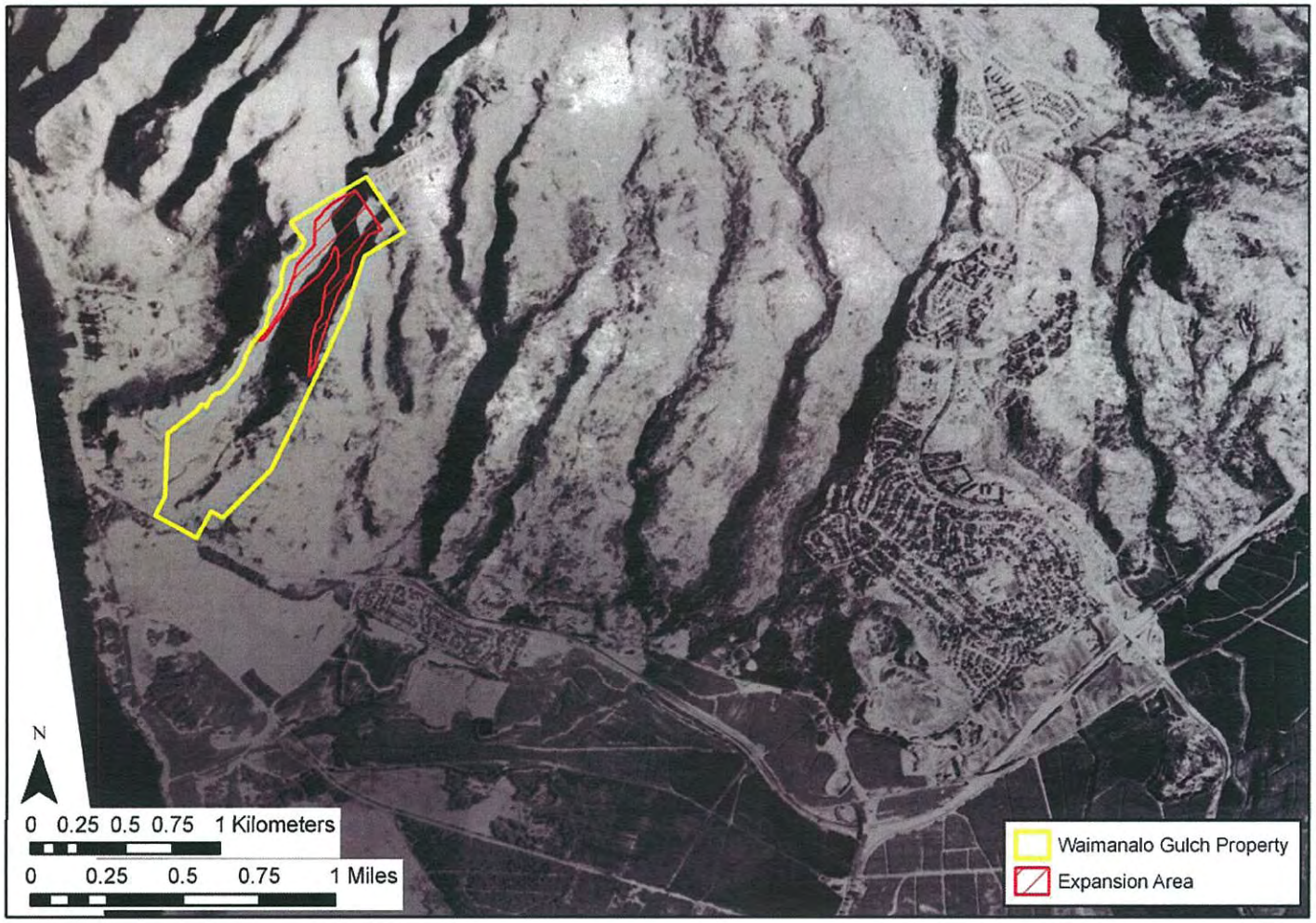

Figure 13. Circa 1980s aerial photograph of western Hono'uli'uli, showing the location of the Waimānalo Gulch property and proposed landfill expansion area

In 1985, the City and County of Honolulu condemned 81.5 acres of agricultural land in Waimānalo Gulch for use as a landfill to dispose of municipal refuse and ash from the H-POWER incinerator to be built nearby at Campbell Industrial Park. Work on the landfill began in 1987. In 1988, workers constructing the Waimānalo Gulch landfill were reporting strange incidents at the site. According to a newspaper article by Bob Krauss:

> "We've been having funny things happen," said one of the men on the site. "Unnatural things. In one case, a man was standing on a flat rock and the thing threw him over. All of a sudden, it just flipped over."
>
> Another time a backhoe was knocking down kiawe trees. The trees have shallow roots systems so they usually just fall down. But one of the trees jumped up and did a somersault...
>
> Then there was the payloader filling in a huge hole where a $17,000 fiberglass fuel tank had been placed. The story is that the driver put his machine in reverse but it jumped forward and leaped into the hole, smashing the tank. (Honolulu Advertiser, 6/20/88:A-1, A-4)

Other incidents reported to Krauss were a truck that had flipped over, tools that had vanished, and a huge stone that had disappeared. The workers called in:

> ...a woman recommended for lifting curses and banishing evil spirits. She said the trouble was caused by a certain stone, the "chief of the valley," which was lying on its side.
>
> The men quickly set the stone upright. But they got it upside down. Things went from bad to worse. The woman came out again and recommended they place the stone on the hill where it will not be covered by rubbish when the landfill opens.(Honolulu Advertiser, 6/20/88:A-1, A-4)

According to Krauss, in April 1988, the stone was moved to a "nest of boulders so that it faces east," at the "end of a Hawaiian Electric Co. Road to one of its relay stations on top of [a] hill." This site lies close to the Battery Arizona bunkers in the southwest portion of the Waimānalo Gulch landfill property.

Section 4 Previous Archaeological Research

The coral plains of 'Ewa have been the focus of more than 50 archaeological studies over the last two decades, largely as the result of required compliance with county, state, and federal legislation. The Kalaeloa (Barbers Point) area, in particular, has been intensively studied. In contrast, relatively little research has been conducted in the uplands of Hono'uli'uli, along the southern slopes of the Wai'anae Range. This discussion of previous archaeological research will focus on the results of this prior archaeological work at the southern end of the Wai'anae range.

Recent archaeological investigations in the southern Wai'anae Range have generally been focused on deep gulch areas for potential landfill locations, lower slopes for residential development, and mountain peaks for antennae or satellite tracking infrastructure (Table 1 and Figure 14).

Table 1. Previous archaeological investigations in the uplands of Hono'uli'uli Ahupua'a

Reference	Type of Investigation	General Location	Findings
Bordner 1977a	Archaeological Reconnaissance	Proposed Makaīwa Gulch Landfill Site	No archaeological sites identified
Bordner 1977b	Archaeological Reconnaissance	Proposed Kalo'i Gulch Landfill Site	3 sites (-2600, -2601, -2602), low stacked boulder walls
Bordner and Silva 1983	Archaeological Reconnaissance and Historical Documentation	Proposed Waimānalo Gulch Landfill Site	No archaeological sites identified
Sinoto 1988	Archaeological Reconnaissance	Makakilo Golf Course	Low stacked boulder wall (-1975)
Bath 1989	Petroglyph Documentation	Waimānalo Gulch	3 petroglyphs (-4110)
Hammatt et al. 1991	Archaeological Inventory Survey	Makaīwa Hills Project Site	34 sites, including prehistoric habitation and agricultural features, rock shelters, petroglyphs, *ahu*, and various sugar cane cultivation infrastructure
Hammatt 1992	Archaeological Inventory Survey	KAIM Radio Tower, Pālehua	No archaeological sites identified

Reference	Type of Investigation	General Location	Findings
Nakamura et al. 1993	Archaeological Inventory Survey	Makakilo D and D-1 Development Parcels	Cement irrigation flume (-4664)
Borthwick 1997	Archaeological Assessment	Satellite Multi-Ranging Station, Pālehua	No archaeological sites identified
Dega et al. 1998	Archaeological Inventory Survey	UH West O'ahu	Two historic site complexes, (50-80-08-5593 historic irrigation system and 50-80-09-2268 Waiahole Ditch System)
Hammatt and Shideler 1998	Archaeological Inventory Survey and Assessment	Waimānalo Gulch Sanitary Landfill Project Site	Battery Arizona Complex and modern "shrine" site

The earliest attempt to record archaeological remains in Hono'uli'uli Ahupua'a was made by Thrum (1906). He reports the existence of a *heiau* located on Pu'u Kapolei, southeast of the current project area. Pu'u Kapolei Heiau was described as "Ewa-size and class unknown. Its walls thrown down for fencing" (Thrum 1906:46).

In his surface survey of 1930, archaeologist J. Gilbert McAllister recorded the specific locations of important sites, and the general locations of less important sites (at least at Hono'uli'uli). Archaeological investigations by McAllister along the southern slopes of the Wai'anae Range identified a number of sites, which are of interest (Figure 15).

McAllister documents Pu'u Kapolei Heiau as Site 138 and notes:

> The stones from the heiau supplied the rock crusher which was located on the side of this elevation, which is about 100 feet away on the sea side. There was formerly a large rock shelter on the sea side where Kamapuaa (the pig-god) is said to have lived with his grandmother (Kamaunuahihio). (McAllister 1933:108)

McAllister's Site 136 is located near Mauna Kapu, northeast of the current project area, and is described as a small platform on the ridge dividing the 'Ewa and Wai'anae districts. The 4 to 6 square foot platform was constructed of coral and basalt stones, and was believed to be an altar (McAllister 1933:107). It is noted to have been destroyed by the time of Sterling and Summers' work in the late 1950's (Sterling and Summers 1978:32).

McAllister's Site 137 is located at Pu'u Ku'ua, a prominent landmark northeast of the current project area. Pu'u Ku'ua Heiau was described by McAllister as:

> (Destroyed) The heiau was located on the ridge overlooking Nanakuli as well as Hono'uli'uli at the approximate height of 1800 feet. Most of the stones of the heiau were used for a cattle pen located on the sea side of the site. The portion of

> the heiau which has not been cleared for pineapple has been planted in ironwoods. (McAllister 1933:32)

The presence of Pu'u Ku'ua Heiau provides some archaeological evidence of the Pu'u Ku'ua settlement described in the Hawaiian Newspaper "*Ka Loea Kalaiaina*" (see Section V: Background Research).

Makaīwa Gulch, the next major gulch east of Waimānalo Gulch was surveyed as a potential landfill location (Bordner 1977a). The reconnaissance survey included lands within Makaīwa Gulch from Farrington Highway *mauka* to the approximately 1000 ft (305 m) elevation. One archaeological feature was identified, a complex of three concrete platforms that was interpreted to be a military related structure.

An archaeological inventory survey of the "Makaīwa Hills" development project located several traditional as well as post-contact archaeological sites (Hammatt et al. 1991). The project area included a 1,915-acre parcel in Hono'uli'uli Ahupua'a, located between the town of Makakilo and Waimānalo Gulch, and bounded to the south by Farrington Highway and to the north by Pālehua Road (immediately east of the current project area). 34 sites were located, including prehistoric habitation structures (temporary and permanent), agricultural features (terrace and mounds), rock shelters, petroglyphs, *ahu*, and various sugar cane cultivation infrastructure (Figure 16).

Within the "Makaīwa Hills" project area, habitation sites were found to be clustered in higher elevations above 1000 ft., and in lower elevations below 500 ft (Hammatt et al. 1991). The higher elevations would contain ample forest subsistence resources for gathering on both a continual basis, as well as during times of famine and drought. The lower elevations would be in close proximity to the shoreline and bountiful coastal resources.

> In sum, this site type and patterning sample suggests that prehistoric and historic Hawaiian populations utilized the present study area as a recurrent and temporary habitation area focused mainly on the gathering of specialized goods, such as wild forest plants from the upper elevations and the quarrying of lithic material within the lower elevations. (Hammatt et al. 1991:106)

Kalo'i Gulch, which borders the northern portion of the current project area, was also surveyed as a potential landfill location (Bordner 1977b). The survey included lands within Kalo'i Gulch and its smaller tributaries from the *makai* end of the gulch up to the 1,400 ft elevation. It was noted that bulldozing extensively modified lands at the base of the gulch, *makai* of an historic quarry. In the *mauka* portions of the project area, three sites, possibly prehistoric, were identified. The three sites (50-80-12-2600, -2601, -2602) consisted of low-stacked basalt boulder walls located along the north side of the Kalo'i Stream channel.

During the initial archaeological survey of the lower portions of Waimānalo Gulch (the future site of the Waimānalo Gulch Sanitary Landfill), up to the 430-foot elevation, no archaeological sites were identified (Bordner and Silva 1983). In 1989, three petroglyph units (Site 50-80-12-4110) were located within the previously surveyed parcel (Bath 1989). Site -4110 is located in the southwest corner of Waimānalo Gulch, at approximately 80 ft. elevation.

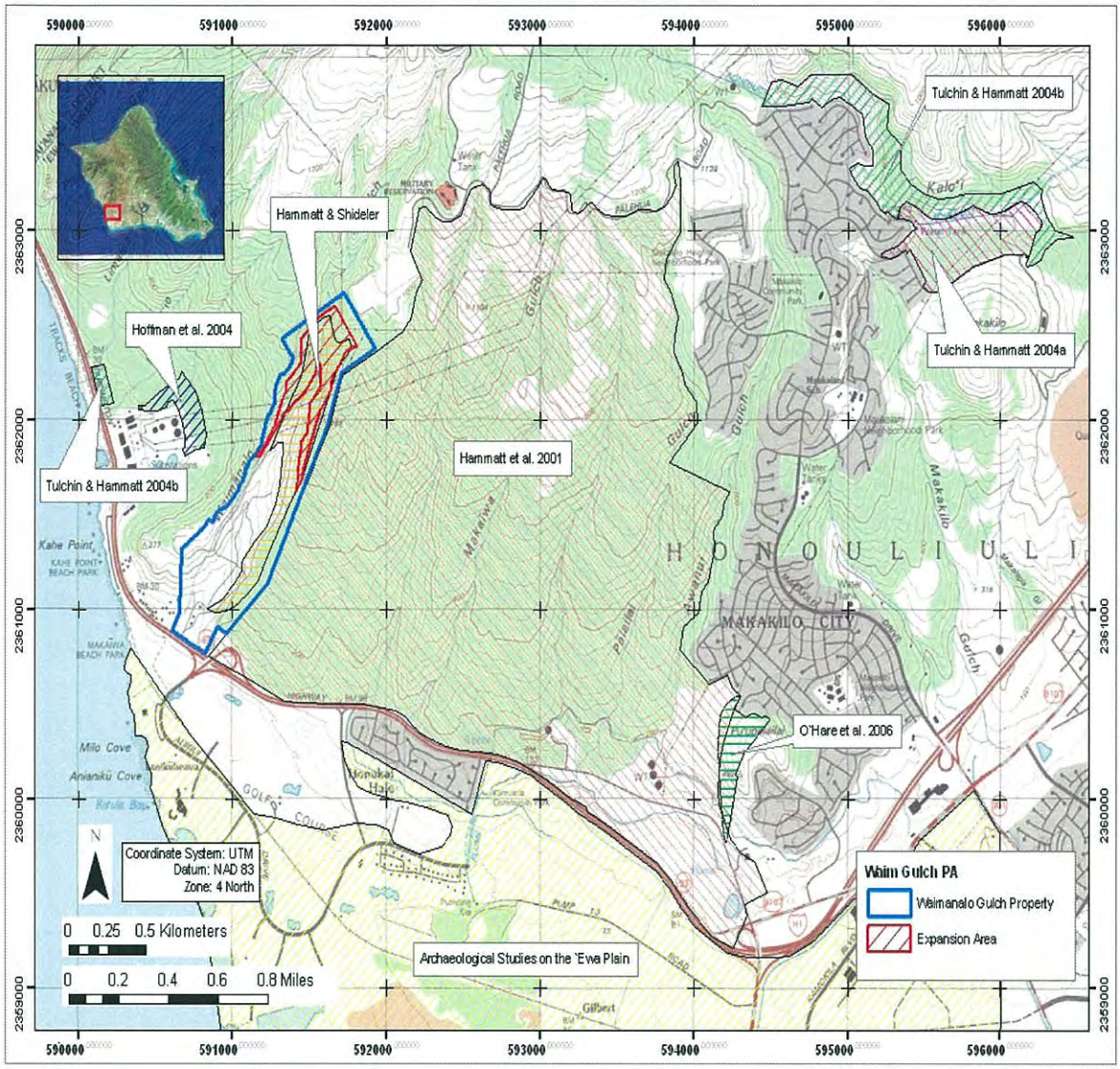

Figure 14. Previous archaeology work for the Waimānalo 'Ili

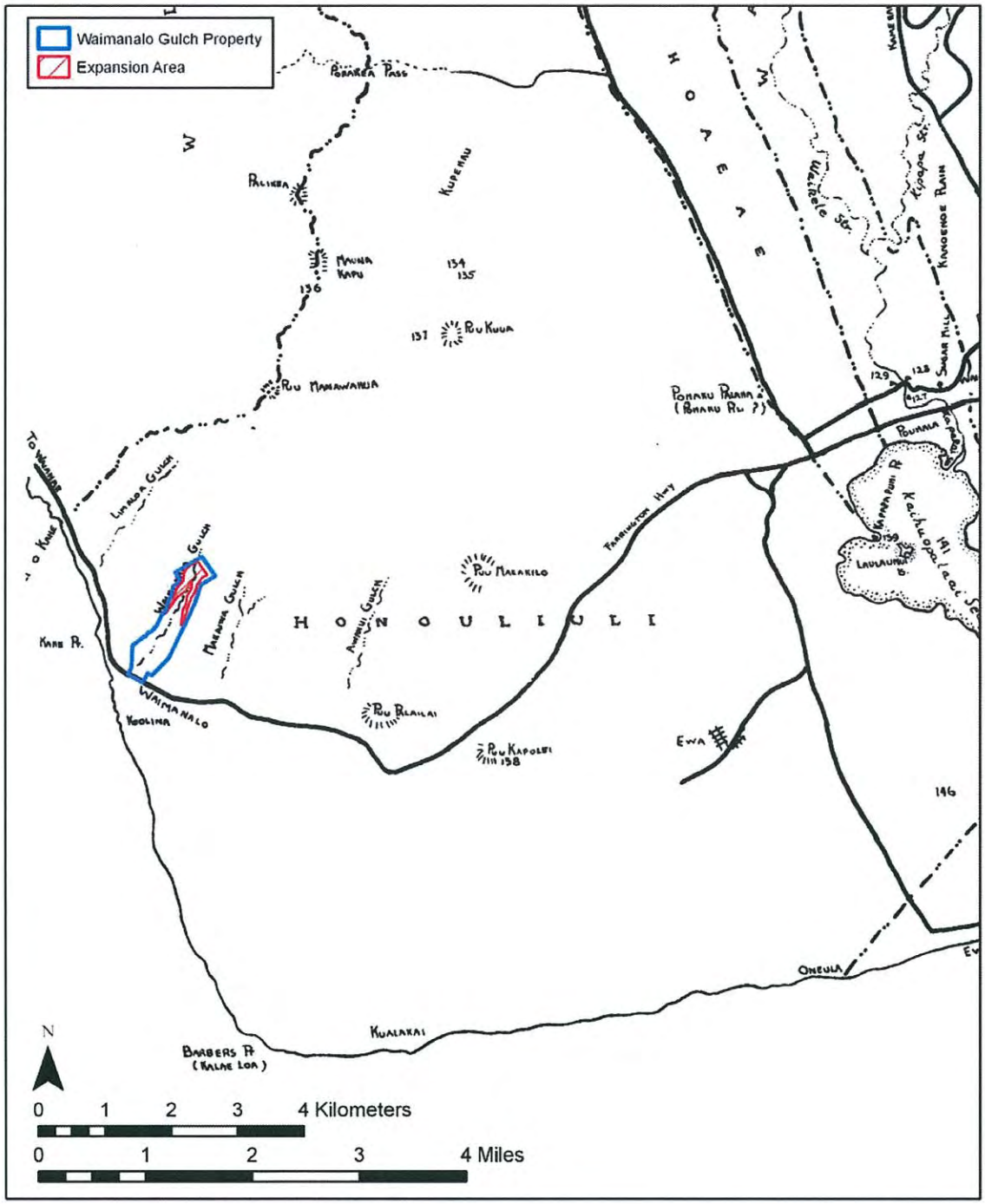

Figure 15. Portion of a 1930 map by archaeologist J. Gilbert McAllister showing Waimānalo Gulch property in relation to archaeological sites discussed in the text (base map from Sterling and Summers 1978)

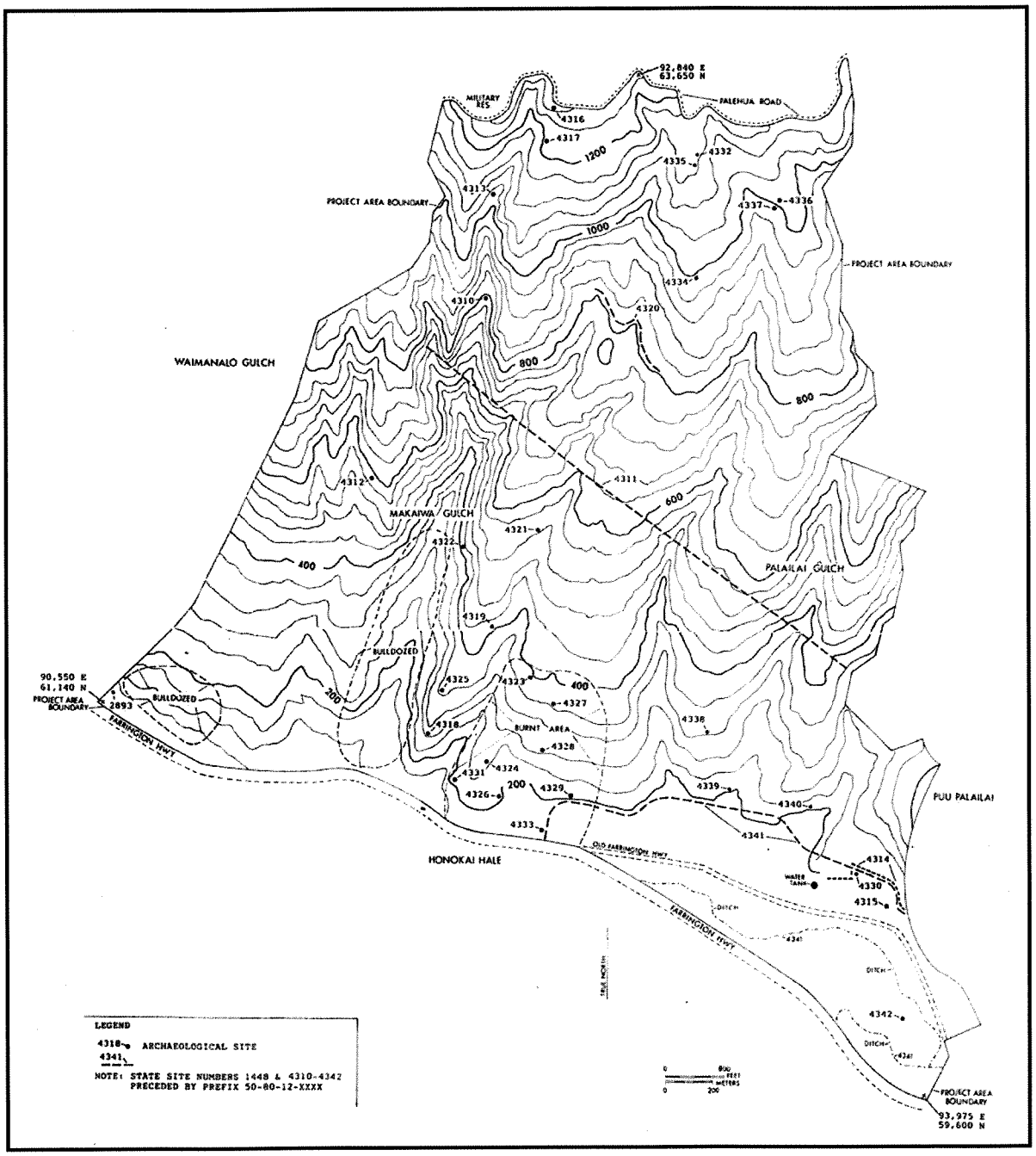

Figure 16. Makaīwa Hills project area showing the location of identified archaeological sites (Hammatt et al. 1991:7)

Further archaeological study within Waimānalo Gulch was conducted for the expansion of the sanitary landfill (Hammatt and Shideler 1998). No archaeological sites were located with the project area; however two sites, the Battery Arizona bunker complex and a modern "shrine" site, were observed along the northern ridge that separates Waimānalo Gulch from the HECO Kahe Power Plant property. The stones of the "shrine" site were believed to have been previously relocated from the central portion of Waimānalo Gulch circa 1988.

An archaeological inventory survey for the proposed University of Hawai'i-West O'ahu campus was conducted by Dega et al. (1998). The survey area included 991 acres in the vicinity of Pu'u Kapu'ai, northeast of the current project area. No traditional Hawaiian sites were located. The project area was noted to have undergone extensive land modification associated with commercial agriculture. Two historic site complexes (50-80-08-5593 historic irrigation system, 50-80-09-2268 Waiahole Ditch System) were documented. Identified features included flumes, aqueducts, ditches, pumps, and other irrigation infrastructure.

Two archaeological studies were made in the Pālehua area, *mauka* of Makakilo. An archaeological inventory survey of the proposed KAIM radio tower (Hammatt 1992), located northwest of the current project area identified no archaeological remains. An archaeological assessment for the proposed Ministry of Transportation Satellite Multi-Ranging Station project site (Borthwick 1997), which abuts the western perimeter of the Air Force Solar Observatory facility, identified no archaeological remains. In 2002, an informal survey conducted by SHPD/DLNR identified an enclosure site (50-80-08-6402) just off of Pālehua Road (SHPD personal communication 2004). The site consisted of two enclosures; one enclosure was determined to be of prehistoric origin, while the other was historic.

Archaeological studies associated with the proposed Makakilo Golf Course (Sinoto 1988) and the Makakilo D and D-1 Development Parcels (Nakamura et al. 1993) were conducted in the immediate vicinity of the current project area. Archaeological reconnaissance of the Makakilo Golf Course property included lands along the southern and eastern slopes of Pu'u Makakilo. Severe erosion was noted throughout the property. A single archaeological feature, a low stacked basalt boulder wall (50-80-12-1975), was identified (Sinoto 1988). Archaeological inventory survey of the Makakilo D and D-1 Development Parcels included lands on the southern and western slopes of Pu'u Makakilo, adjacent to the golf course property. A single historic property, a cement irrigation flume (50-80-12-4664), was located in the southern portion of the project area near the H-1 Freeway (Nakamura et al. 1993). No sites were located in the vicinity of Pu'u Makakilo.

Section 5 Results of the Community Contact Process

Throughout the course of this study, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about traditional cultural practices specifically related to the Waimānalo Gulch. This effort was made by letter, e-mail, telephone or in-person contact. In the majority of cases, letters – along with a map of the project area – were mailed with the following text:

> In collaboration with Waste Management of Hawai'i and the City & County of Honolulu Department of Environmental Services, Cultural Surveys Hawai'i is conducting a Cultural Impact Assessment for the expansion of approximately of the approximately 36-acre Waimānalo Gulch Sanitary Landfill Expansion Project, (TMK [1] 9-2-003:073 por) in Hono'uli'uli Ahupua'a, 'Ewa District, O'ahu. An overview of the historical and cultural literature background is provided for your convenience.
>
> The purpose of this assessment is to identify any traditional cultural practices associated with the project area, past or present. We are seeking your kōkua and guidance regarding the following aspects of our study:
>
> - General history and present and past land use of the study area.
> - Knowledge of cultural sites which may be impacted by the project – for example, historic sites, archaeological sites, and burials.
> - Knowledge of traditional gathering practices in the study area–both past and on-going.
> - Cultural associations with the study area through legends, traditional use or otherwise.
> - Referrals of kūpuna or anyone else who might be willing to share their general cultural knowledge of the study area.
> - Any other cultural concerns the community might have related to cultural practices in the Waimānalo area.

A total of twenty-one (21) individuals, organizations, and agencies were consulted for this CIA (Table 2). Four of these referred CSH to other individuals who were included in the study. Seventeen (17) individuals contributed specific and relevant information via formal interviews, informal "talk story" discussion and / or email. One person (Douglas McDonald Philpotts) was formally interviewed for this project (see transcription in Appendix B). One person (Shad Kane) was previously interviewed during a prior (2002) CIA for an earlier version of the subject project (see Appendix A for a transcription of the interview, used with permission from Shad Kane).

Table 2. Summary of consultation efforts

Name	Affiliation	Comments
Ailā , William	Hui Mālama I Nā Kūpuna o Hawai'i Nei	Mr. Ailā feels it is very important to preserve the sites of this area. See Section 6 below for response.
Amaral, Annelle	'Ahahui Siwila Hawai'i O Kapolei Hawaiian Civic Club	Made referral to Shad Kane.
Cope, Aggie	Hale O Na'auao Society	Mrs. Cope mentioned that that area was known for the night marchers trail from *mauka* to *makai*. See Section 6 below for response.
Desoto, Frenchy	Wai'anae Coast Archaeological Preservation Representative	Made referral to Gary Omori, William Ailā .
Eaton, Arline	*Kupuna* at Iroquois Elementary School	See Section 6 below for response.
Enos, Eric	Cultural practitioner and director of Ka'ala Farms	Mr. Enos visited Site 6903 to view *pōhaku* within the project area. He is concerned about the protection of this site.
Flanders, Judith	Granddaughter of Alice Kamōkila Campbell	See Section 6 below for response.
Greenwood, Alice	O'ahu Island Burial Council Member, Wai'anae District	Ms. Greenwood spoke of a village at Makaīwa. She recalls a story about a ceremony in the area that mentioned possible burials. She remembers the *mo'olelo* had the names of the unknown gulches. She also spoke about the *huaka'i pō* (procession of the night marchers) and *akua lele* (flying god, usually a poison god sent to destroy, sometimes in the form of fireballs). See Section 6 below for response.
Ho'ohuli, "Black" Jo	Wai'anae Neighborhood Board No. 24	Mr. Ho'ohuli is concerned about caves in the *mauka* area that may contain burials.
Rezentes, Cynthia	Wai'anae Neighborhood Board No. 24	Mrs. Rezentes suggested contacting Frenchy Desoto. She is very concerned about the view plane.
Johnson, Rubellite	Hawaiian scholar	Ms. Johnson recommended consulting people who are from the project area.
Josephides, Analu	O'ahu Island Burial Council Member, Wai'anae District	See Section 6 below for response.
Kanahele, Kamaki	President of Nānākuli Homestead	See Section 6 below for response.
Kane, Shad	Member of the Makakilo, Kapolei, Honokai Hale Neighborhood Board and 'Ahahui Siwila Hawai'i O Kapolei Hawaiian Civic Club	Mr. Kane made two site visits with CSH to the project area. Mr. Kane is very concerned about the cultural sites within the project area and wants to be involved in the preservation process. He is also concerned about the view plane. See Appendix A for complete interview conducted in 2002 in association with a previous CIA of portions of the project area (cf. Souza and Hammatt 2002)

Name	Affiliation	Comments
Makaiwi, Martha	Makakilo, Kapolei, Honokai Hale Neighborhood Board No. 34	Made referral to Maeda Timson and Shad Kane.
McKeague, Kawika	O'ahu Island Burial Council member 'Ewa District	See Section 6 below for response.
Momoa, Joseph	Kama'āina of Nānākuli and member of Kamo'i Canoe Club	Mr. Momoa mentioned the night marcher path in Waimānalo area and he feels the path needs to be kept clear of visual blockage.
Nāmu'o, Clyde	Administrator at Office of Hawaiian Affairs	OHA recommended: (1) Consultation with seven specifc individuals, all of whom CSH attempted to contact. (2) The project area be considered a portion of a larger traditional cultural landscape, and that the possible presence of one or more Traditional Cultural Properties be considered (See Appendix C for OHA letter).
Philpotts, Douglas McDonald	Cultural practitioner and long time resident of Waimānalo 'Ili	Mr. Philpotts made a site visit to view the uprights within the projet area. See Section 6 below for response and Appendix B for complete interview.
Tiffany, Nettie	Kahu of Lanikūhonua and Former O'ahu Island Burial Council member, 'Ewa District	See Section 6 below for response.
Timson, Maeda	Member of the Makakilo, Kapolei, Honokai Hale Neighborhood Board No. 34 and President of Ua Au O Kapolei	Mrs. Timson shared two stories told to her by her Tutu Defreitas. Her *tutu* would bless the *hale* with *tī* (or *kī*) leaf and Hawaiian salt because all the *keiki* would get *maka'u* (scared). They also had *tī* leaf on all four corners of the house for protection.

As described in Section 1(Introduction), when the expansion project's CIA consultation was initiated, communication with the project proponents indicated that the proposed expansion area would be 36 acres—the same 36 acres that the project proponents were having surveyed as part of the project's archaeological inventory survey of the expansion area. For this reason, the initial project consultation letters describe the expansion area as approximately 36 acres. It was only later that CSH learned that the expansion area was actually approximately 90 acres. The 36 acres corresponds with the actual foot print of the landfill cells that will be created and used for refuse. Portions of the remaining approximately 90-acre expansion area will be used for the aforementioned appurtenances. Therefore, although the foot print of the proposed area to be disturbed is larger than the 36 acres indicated in the initla CIA consultation, the actual portion of the gulch to be used specifically as a landfill (36 acres) has not changed.

The consultation results contained in this CIA, which refer specifically to the 36-acre area of the landfill proper, will be augmented and expanded prior to preparation of the Final Environmental Impact Statement. The individuals and agencies listed in Table 2 will be contacted again with the new information about the larger project area.

Section 6 Cultural Resources and Traditional Practices

The areas of Waimānalo Gulch, Makaīwa Gulch, Ko'olina, Lanikūhonua and the uplands of Pālehua and Pu'uku'ua are within the *'ili* of Waimānalo located in the *ahupua'a* of Hono'uli'uli, 'Ewa District (see Figure 11). 'Ili is defined as "a land section, next in importance to *ahupua'a* and usually a subdivision of an *ahupua'a*" (Pukui and Elbert 1971:91).

The current project area was a zone of less intensive land use between resource rich areas *mauka* and *makai.* The *makai* area has marine resources, a canoe landing, *ko'a* (fishing grounds) and *lo'i* (pondfield) that sustained a fishing village. The *mauka* area is considered a sacred place with many *heiau*, myths and legends.

Although this area has been placed in the district of 'Ewa and the *ahupua'a* of Hono'uli'uli, some Wai'anae community members feel a strong connection with this place as many traverse this area fequently to get in and out of Wai'anae. Participants also mentioned the many natural and cultural resources of the region.

Specific aspects of traditional Hawaiian culture mentioned during information gathering interviews and "talk story" sessions are incorporated throughout this section as they relate to the project area. Some interview material is excerpted from past CIAs conducted by CSH. Interviewees for the current project gave their permission for past interviews to be included in this report. Participants also provided new stories for Waimānalo Gulch for which we have found no previous written documentation. Some of these stories include Spirits *('Uhane*), the "Legend of the Slain Girl", the "Legend of Two Giants", and associations with the Pueo 'Aumakua.

Concerns for sacred sites in the area focused on the Pueo Stone which was relocated around 1988 for preservation. Nana Veary, a respected *kupuna*, relocated the *pōhaku*. Gary Omori asserts that after the Pueo Stone was moved to safe ground "the strange events stopped." Another concern of the area surrounds the tradition of "Night Marchers" (*huaka'i pō*); in particular, the passage in the *makai* region close to human habitation at Lanikūhonua. The *huaka'i pō* inland route is somewhat vague but appears to be up the southern ridge of Waimānalo Gulch.

6.1 Traditional Hawaiian Beliefs

A number of *kūpuna* and other community members spoke of beliefs associated with Waimānalo 'Ili of Hono'uli'uli and the surrounding valleys. While these beliefs and traditions are interrelated, they are discussed below in terms of the presence of *'uhane* (soul, spirit, ghost), traditions of *huaka'i pō* (procession of the night marchers), a legend of a slain girl, a legend of two giants, and a tradition of owl *'aumakua* (ancestor gods), in addition to accounts of other mysterious and strange incidents.

<u>Association with *'Uhane*</u>

Several people familiar with the area mentioned that Waimānalo Gulch and Makaīwa Gulch are associated with *'uhane*. In *Nānā i Ke Kumu*, a source book on Hawaiian cultural practices, concepts and beliefs, *'uhane* are introduced as follows:

> Says Mary Kawena Pukui of certain of her ancestral beliefs, "Some things are 'e'epa. Unexplainable. "Accept that, and it becomes easier to know about 'uhane. For in Hawai'i's religious mystic tenets, 'uhane was:
>
> The animating force which, present in the body, distinguished the quick from the dead. And so 'uhane can be called "spirit."
>
> The vital spark, that departed from the flesh, lived on through eternity, rewarded for virtue or punished for transgressions in life. Thus 'uhane is "spirit" in the immortal sense, and the "soul" of Christian concept.
>
> Or, as immortal spirit or soul, the 'uhane might return to visit the living and so be termed a "ghost". (Pukui et al. Vol. I, 1972:193)

The presence of *'uhane* at Waimānalo Gulch was mentioned previously in a CIA for Waimānalo Gulch Landfill by Black Ho'ohuli, who is a cultural practitioner and Nānākuli Hawaiian Homestead resource person; Gary Omori, who was the consultant for Ko Olina Resort at the time the Waimānalo Gulch landfill was proposed; Maylene Keamo, who is the Wai'anae Ahupua'a Council President; and Alice Greenwood a *kupuna* in the Wai'anae area (Souza and Hammatt 2002).

Often the perception seems to be more a matter of the person feeling the presence of the *'uhane* in the area rather than knowledge of transmitted lore. Mrs. Keamo also talked about the wandering spirits. Wandering *('auana)* spirits were particularly associated with desolate places in 'Ewa District. Samuel Kamakau (Mo'olelo Hawai'i, Vol. II, Chap. 12, p 23) associates them with the plain of Kama'oma'o, the rough country of Kaupe'a and Leilono - all in 'Ewa District. The belief was that these wandering souls were friendless and wandered in desolate places like the plain of Kaupe'a catching night moths (*pulelehua*) and spiders (*nanana*) for food (*Ke Au Hou*, July 12, 1911; *Ka Po'e Kahiko* 1964:49).

6.1.1 Huaka'i Pō or 'Oi'o (Procession of the Night Marchers)

There are Hawaiian beliefs regarding the presence of what are commonly known as "night marchers" and the *huaka'i pō* or the, "night procession or parade, especially the night procession of ghosts that is sometimes called *'oi'o*" (Pukui and Elbert 1986:84). The night marchers are the souls of those who have passed on. An *'ōlelo no'eau* (proverb) makes reference to this tradition: "*He pō Kāne kēia, he mā'au nei nā 'e'epa o ka pō.*" (This is the night of Kāne, for supernatural beings are wandering about in the night) (Pukui 1983:98).

> Family ties in the afterworld remain unbroken, and all Hawaiians believe in the power of sprits to return to the scenes they know on earth in the form in which they appeared while they were alive. Especially is this true of the processions of gods and spirits who come on certain sacred nights to visit the sacred places, or to welcome a dying relative and conduct him to the 'aumakua world. "Marchers of the night" (Hauaka'ipo) or "Spirit ranks" (Oi'o) they are called. Many Hawaiians and even some person of foreign blood have seen this spirit march or heard the "chanting voices, the high notes of the flute, and drummi8ng so loud as to seem beaten upon the side of the house." Always, if seen, the marchers are dressed according to ancient usage in the costume of chiefs or of gods. If the procession

> is one of gods, the marchers move five abreast, with five torches burning red between the ranks, and without music save that of the voice raised in chant. Processions of chiefs are accompanied by 'aumakua and march in silence, or to the accompaniment of drum, nose-flute, and chanting. They are seen on the sacred nights of Ku, Lono, Kane, or Kanaloa, or they may be seen by day if it is a procession to welcome the soul of a dying relative. To meet such a procession is very dangerous. "O-ia" (Let him be pierced) is the cry of the leader and if no relative among the dead or none of his 'aumakua is present to protect him, a ghostly spearsman will strike him dead. The wise thing to do is to "remove all clotting and turn face up and feign sleep." (Beckwith 1970:164).

Several of the participants in this cultural study talked about night marchers. Aunty Arline Eaton commented that there is a pathway for the night marchers that travel from the *mauka* area of Waimānalo 'Ili down to the special place of Lanikūhonua. She feels strongly that this pathway must be kept clear for them to continue their traditional passage.

Aunty Aggie Cope and Kamaki Kanahele both mentioned that the *'ili* of Waimānalo was well known for the pathway of the night marchers and they both feel it is of great importance to keep that pathway clear of visual impact.

Judith Flanders mentioned that her grandmother Kamōkila Campbell spoke about the night marchers' trail that came from the uplands to the ponds at Lanikūhonua.

Mrs. Nettie Armitage-Lapilio related a tradition that at certain times of the year night marchers would come down from the uplands to the vicinity of Kamōkila Campbell's place on the coast (Lanikūhonua). The procession route indicated was on the east ridge of Waimānalo Gulch which is the west ridge of Makaīwa Gulch (Souza and Hammatt 2002).

Analu Josephides recalls *mo 'oleo* told to him by his *kūpuna*:

> I grew up knowing about the land area known as Makaīwa. My mother, my Tutu Wahine, as well as, *kūpuna* within my *'ohana* had shared various stories about this area. One of the many stories shared and landscapes pointed out is both the path of the night marchers and of the night marchers themselves. One of the stories that Tutu Wahine related was that in the old days no homes were built in this particular area except for the *mauka* area of Makaīwa to the west, the *mauka* area to the east known as Makakilo, and the *makai* area below where in ancient time was the dwelling place of the Kamapua'a *'ohana*.
>
> We were told as children that one of the reasons that homes were not built on the path of the night marchers were that the night marchers and those who leaped from this world and taken to be with these clans were said to carry the burning *kapu* of Pihenakalani. This was a *kapu* that descends from Kaua'i from the ancient days of the Mū and the Menehune people. It was also known as the prostrating *kapu* of Kalanikauleleiaiwi.
>
> Tutu went on to state that if a *hale* was built upon the path of the night marchers that it would be destroyed by fire. A similar life story occurred in Opihali, South Kona, Hawaii where a grand-uncle of my Tutu Wahine named Ioane Kuahiwinui

> was said to have warned his brother not to build his home in a certain area in Opihali or else the night marchers would take it; and sure enough when the *hale* was finished, on the night of the night marchers, the new *hale* was burned to the ground. Not long after this home was built and burned did they build another home in a location off and away from the path of the marchers and till today that home is standing, *makai* of Mamalahoa highway near the 95 mile marker.
>
> Tutu spoke of how nothing should be on the path of the night marchers as when they came through they would destroy anything and everything in their way. It is also believed that if a person was on the path of the night marchers they would prostrate themselves and keep their face hidden lest they are succumbed to the marchers and join them in their realm. The story continues, that if the night marcher came upon you and you were not family nor the chief of the particular area they would take your soul and you would continue your spiritual life marching with them forever. It is believed that in this particular area called Makaīwa that Hi'iakaikapoliopele, the sister of Pele, would be the last one in the night marchers' line because of her back having been placed under *kapu*; therefore no one was allowed to walk behind her.
>
> For these historical reasons the path of the night marchers should be preserved so that the marchers who are the ancestors of many of our Kānaka Maoli [native born] can continue to travel.

Mrs. Nettie Tiffany discussed her childhood memories about what her aunty called the "bird catchers." They would come down from the Waimānalo and Makaīwa Gulch area through a trail that was marked by a large *pōhaku* (stone). The bird catchers would come down from the gulch to take a bath in the waters fronting Lanikūhonua.

The following excerpt is from the 'Ahahui Siwila Hawai'i O Kapolei letter regarding the Makaīwa Gulch project. They gave permission to reprint that letter for this project:

> There were many stories associated with night marchers walking from the area of Lanikuhonua mauka crossing Farrington Hwy in the area *makai* of Honokai Hale and walking mauka by way of Makaiwa Gulch. When Kamōkila Campbell lived at Lanikuhonua she had always left an opening in the Naupaka hedge that separated the beach from her property. This opening in the hedge was cut to allow night marchers to pass through the area on their way *mauka*. Members of the Campbell family have shared this story. There are many unexplained accidents that have occurred on Farrington Highway between Honokai Hale and the entrance to Ko Olina when drivers turned off the road in an effort to avoid something that they saw, or thought they saw, ahead of them.

The excerpt below is taken from an interview with the late Uncle Walter Kamanā (WK) who shared his *mana'o* (concerns) with CSH on the Pō Kāne (Souza and Hammatt 2003):

WK: Ok there is no such thing that *menehune* (legendary little people of old) and night marchers are different people. They are the same. Some people use the *menehune* to tell old stories the *menehune* get power like they translate the word from Kona you know! On that side that they when build the big stones to put in the water outside. But through the

menehune lazy work before they never complete that *loko* the pond. So here when they say night marchers the *menehune* coming down go *holoholo* [taking a walk] down the beach.

CSH: You said get one from here to there (looking on map)

WK: Yeah that's a trail way but now get houses. But now today many of the secret path are gone. So the night walkers they come out certain times, like pō kane night or certain Hawaiian nights they going march through. The nightwalkers got to come down to the ocean. There is something between the ocean and them and the mountain, you know! That's why when you see long trail like over here over here Waimānalo, Puko, (Ko'olina).

CSH: Yeah. I heard there is one over there too!

WK: Yeah goes from Ko'olina, goes to Nanikono come out I the only guy who knows the trail. Before certain time they use to come down you know where the red trail come over into Nānākuli, before they improve that road it come right from there come down. Where the guy call it Pahe or Kihei because it is house of the wind. Same like here they name it Ilimapapa the name of this place was called Hualilili house of the wind, same like here they name 'em Ilimapapa because of all the flat land. The twin sisters start from in here. The twin sisters was a whirlwind, that certain time of the year they like go down the beach and bath. So when they come they going come right through come spinning right down through Poku and come up. You know they bang this wall come over in Lualualei go down cross over you know that get Hakimo and Pa'akea and go down inside into Leihōkū area into Wai'anae into where Pōka'ī Bay and head out the ocean. So when it use to come in here it use to develop an air pocket. There were no coincidences except the rock in Kolekole Pass. The guy that bulldozed that he was living and he died. The son must remember, his name was David Kilikahua. The father was the one who pushed the rock over Kolekole Pass. He told the story and some old timers who died, they said had three of them who pushed the rock over the Pali. The next morning the rock was standing right back up there. So when their boss saw he said go move 'em again. He said how can a big boulder come back up? They figure the *menehune* when bring 'em up but nobody saw 'em they only saw the rock back. Later part of the year they made heads to tails to the rock in Nānākuli.

6.1.2 Legend of Two Giants

A legend told by Alice Greenwood mentions two giants who live in the Waimānalo and Makaīwa area. The legend indicates that when one giant opens his eyes it means the giant will take someone's life. There is concern that these legends may be connected with unexplained car accidents that have occurred on Farrington Highway in front of the two gulches. Few details of this legend were provided.

There are also several accounts of giants in the vicinity. The Hawaiian gods Kāne and Kanaloa, who are sometimes understood to attain supernatural size, are associated with the area of Piliokahe where stones they hurled from red hill landed (Simeon Nawa'a 1954 in Sterling and Summers 1978:1). Simeon Nawa'a related another account of Piliokahe associating two hills with a male and a female - seemingly of fabulous size. The demi-god Māui is associated with the

southern Wai'anae area (particularly Lualualei) and is often thought of as a giant in his superhuman efforts to snare the sun.

6.1.3 Legend of the Slain Girl

These *'uhane* may be explained by a few legends concerning the Waimānalo Gulch area. Mr. Omori tells about one legend of two lovers (Souza and Hammatt 2003):

> ...the girl is hunted down and killed in the Waimānalo Gulch. People say that the girl's 'uhane lingers in this gulch and an image of a white lady appears at times and strange things happen in the area. For example, unexplained car accidents happen on Farrington Highway.

This account has strong similarities with the famous legend of Kahalaopuna, the young woman of Mānoa who is murdered repeatedly (she revives repeatedly) by Kauhi, her jealous lover from Ko'olau. Enraged at accounts of her sleeping with various lovers, Kauhi leads Kahalaopuna through the uplands of south O'ahu traveling west from Mānoa Valley (with Kahala being slain repeatedly). While the many accounts differ in detail a common setting for the last of the beatings is Pōhākea Pass in Hono'uli'uli north of the project area. After being put to death, her *'uhane* flies up into an *'ōhi'a lehua* tree and calls out to travelers passing along the road asking them to inform her parents of her death. An interesting aspect of the story is:

> Kū iho lā ka huakai e ho'olohe, i kēia leo, e kanaka paha, he makani paha, he 'uwī lā'au paha. 'Elua oli ana o Kahalaopuna, maopopo ia lākou, he 'uhane ua make.

Translation:

> The travelers stood and listened, to this voice, was it a person or perhaps the wind, or the rubbing together of trees. The travelers are at first uncertain but when she cries a second time they know it is a spirit that has died. (Fornander 1919: Vol. V 192-193)

While it is certainly possible that Mr. Omori's account is unrelated, similarities include: a woman who is slain by her lover in the uplands of Hono'uli'uli, that the slain woman's spirit lingers in the vicinity of her death, and that the spirit causes unexpected events to travelers. The nature of the legend of Kahalaopuna, with events happening in many different places, lends itself to becoming incorporated in other settings - particularly desolate areas in which the wind or creaking trees might sound like a human voice.

6.1.4 'Aumakua Pueo of the 'Ili of Waimānalo

Many people consulted for this project mentioned the frequent sighting of *pueo* (owl) in the area. Gary Omori and William Ailā mentioned that the *pueo* was the *'aumakua* of the *'ohana* in the area (Souza and Hammatt 2002). In *Nānā i Ke Kumu*, a source book on Hawaiian cultural practices, concepts and beliefs, the concept of *'aumakua* is introduced as: "ancestor gods; the god spirits of those who were in life forebears of those now living; spiritual ancestors" (Vol. I, 1972:35). *'Aumakua* fall into the English category of totems and were typically animal or plant species. *'Aumakua* could be inherited bilaterally, from both the father's and mother's kin groups (*'ohana*). Each individual had the opportunity to retain multiple *'aumakua.* Mary Kawena

Pukui's childhood education included memorizing the names of fifty of her family *'aumakua* (Nānā i Ke Kumu Vol. I, 1972:356). Aunty Aggie Cope mentioned that there was a rock in Waimānalo Gulch that resembles a *pueo.* The presence of the Pueo Rock connects the traditions and beliefs directly to this area. The Waimānalo and Makaīwa Gulches are typical habitat for *pueo* and they are often seen hunting in the grasslands.

6.2 Burials

Most Hawaiians in the pre-Contact period belonged to the *maka'āinana* or commoner class and their bones were usually buried in their particular *'ili*. Burials are commonly reported from clean, consolidated sand deposits, which was clearly a common method of internment practiced by Hawaiians (Cleghorn 1987:42).

Commenting on the nature of burial areas and body positions used in burial, William Ellis (1827: 361-363) says: "The common people committed their dead to the earth in a most singular manner." The body was flexed, bound with cord, wrapped in a coarse mat, and buried one or two days after death. Graves were "...either simply pits dug in the earth, or large enclosures... Occasionally they buried their dead in sequestered places at a short distance from their habitations, but frequently in their gardens and sometimes in their houses. Their graves were not deep and the bodies were usually placed in them in a sitting posture.". Hawaiians placed significance on the *iwi* that were regarded as a lasting physical manifestation of the departed person and spirit. "The bones of the dead were guarded, respected, treasured, venerated, loved or even deified by relatives; coveted and despoiled by enemies" (Pukui et al. 1972:107).

No burials or *iwi kūpuna* (ancestral human remains) have been documented in two archaeological inventory surveys of the project area (Hammatt and Shideler 1998; Dalton and Hammatt 2008). The closest known burials were found in the Ko'olina and Lanikūhonua in caves, sand dunes and sinkholes. However, Dalton and Hammatt's (2008) report states it is possible that burials may be discovered during proposed construction activities; in particular, several small caves and overhangs in the northwest portion of the current project area may contain such evidence. Some participants strongly recommend that the project does not extend any further into the *mauka* region, which may contain burials.

Mrs. Nettie Tiffany urged caution in regards to burials in the project area; she feels although the land has been heavily altered by ranching and other activities there is still a possibility of finding *iwi kūpuna*. She also strongly suggests that there be a plan of action if there are burials found during the project.

Aunty Arline also mentioned that if people lived in the project area, there might be a possibility of finding burials:

> My only thought is that for every person that lives in that area, that's where they bury their people... We never said anything if people died, we'd go over there and they'd bury them right there where the house is. We'd never go four-hundred-million-miles away, it's right there. All your *'ohana* stay right in the same area. We never went afar, not in the rural areas.

6.3 Trails

Trails connected the settlements throughout the District of 'Ewa and Wai'anae. Based on nineteenth and twentieth century maps, the primary transportation routes correlated closely to the existing major roadways. John Papa 'I'ī describes a network of Leeward O'ahu trails that in later historic times encircled and crossed the Wai'anae Range, allowing passage from West Loch to the Hono'uli'uli lowlands, past Pu'uokapolei and Waimānalo Gulch to the Wai'anae coast and onward, circumscribing the shoreline of O'ahu ('Ī'ī 1959:96-98). Following 'I'ī's description, a portion of this trail network passed close to the current Farrington Highway.

It seems clear that a major east/west artery from 'Ewa and Kona O'ahu to Wai'anae ran just south of Makaīwa Gulch roughly along the Farrington Highway alignment. "As mentioned before, there were three trails to Wai'anae, one by way of Pu'u o Kapolei, another by way of Pōhākea, and the third by way of Kolekole" ('Ī'ī 1959:97).

'Ī'ī, who was born about 1800, also recounts an incident at Waimānalo that occurred when he was eight or nine years old. While the young 'Ī'ī was staying at Nānākuli, he learned:

> ...of the burning of the houses in Waimānalo. The overseer in charge of the burning told ['Ī'ī and his relatives] that it was so ordered by the royal court because the people there had given shelter to the chiefess, Kuwahine, who ran away from her husband Kalanimoku after associating wrongfully with someone. Kuwahine was the daughter of the Kaikioewa who reared Kamehameha III in his infancy. She had run away because she had been beaten for her offense and for other reasons, too, perhaps. She had remained hidden for about four or five days before she was found. Here we see the sadness that befell the people through the fault of the chiefs. The punishment fell on others, though they were not to blame. ('Ī'ī 1959:29)

Ī'ī's sad account reveals that the coastal Waimānalo portion of Hono'uli'uli Ahupua'a continued to be inhabited into the early 19th century.

The following on ancient trails is from the 'Ahahui Siwila Hawai'i O Kapolei letter:

> There may have once existed an intersection of 2 trails in the approximate location where the present entrance to Ko Olina exist today. In ancient times there were 3 ways to get to Wai'anae. One was by way of Kolekole, one was by way of Pohakea and the 3rd was by way of Pu'uokapolei. Farrington Highway follows the path of the ancient trail that passed Pu'uokapolei.
>
> Generally, petroglyphs are found on the high ground between Waimānalo and Makaiwa Gulches indicating that a trail may have once existed in this area, again confirming a *mauka-makai* path. The existence of this trail is supported by numerous amounts of cultural resources and structures built along this lineal *mauka-makai* relationship that follows the path of Waimānalo and Makaiwa Gulches.

Shad Kane has also expressed his knowledge in regards to the many trails in Hono'uli'uli. Below is an excerpt from a previous interview with Mr. Kane (Souza and Hammatt 2002):

> One of the most elementary relationships in ancient times was the *mauka-makai* relationship. And the reason why I bring this one up is because it plays a very important role in having an understanding of the area surrounding Waimānalo Gulch. It's not to say that it wasn't important elsewhere. It may have been. Or I would say it was important all over, that *mauka-makai* relationship. But what makes this area unique is the fact that we have evidence, we have structures that support that *mauka-makai* relationship. Most places most of these kinds of structures – stone walls, habitation structures, cultural resources – most places they've largely been disturbed or destroyed. But in this respect, this particular *mauka-makai* relationship, there's, I think, sufficient structures that still exist today that you and I can look, see, feel and touch, that supports that *mauka-makai* relationship. And I think if we had a map, if you were to draw a line from the approximate area that may today identify as Ko'olina – If we were to draw a straight line from Ko'olina to Mauna Kapu you'd find that that passes along the northern ridge of Waimānalo Gulch, goes straight up to the ridgeline at Pu'u Manawahua, and follows pretty much a straight line to Mauna Kapu.
>
> Okay, a lot of the information that I shared too are things that you can actually find from different resources. And this is one. In ancient times there were several trails that people would take to come from Honolulu to come to this side of the island. I think there were three ways to get to Wai'anae. One was by way of Kolekole Pass. One was by way of Pōhākea. Another was by way of Pu'u Kapolei. Three trails. Obviously, another one along the shoreline which was the longest way to travel. Farrington Highway is very obviously a trail. Now, in the context of Waimānalo Gulch, what makes this extremely interesting is the fact that there's a series of petroglyphs that was preserved by the developer of Ko'olina or West Beach Estates. When they first started developing – There were a number of archaeological surveys that were done early on. And one of the key persons was Aki Sinoto. I've read a lot of Aki's work. Very interesting cultural information that he found – that whole area over there. And several other people. The interesting thing is that the first archaeological survey that was done was 1930 by Gilbert MacAllister. Between 1930 up until the '70s nothing was done. So 1970 was the start of all this discussion in regards to building in this whole region. And because of the requirements for the EIS and doing a cultural assessment – All of a sudden, since the 1970s until now, and the development of the Campbell Industrial Park and Kapolei and the resort area, we had all these archaeological surveys that came up. So Aki Sinoto is one of them, amongst others. But one of the things they discovered is the fact, in addition to all the information in the lower plains, in addition to the sinkholes and the bird bones, they also found what I think they refer to as the alluvial level or the higher elevation up above the coral plains. And what they found, they found habitation structures, they found burials, and some petroglyphs. I think they actually found

> two. I think they found one that's actually inside Waimānalo Gulch, up on the higher ridge. I've never seen it.
>
> Another one they found that was preserved at the entrance to Ko'olina. Now the interesting thing about petroglyphs is that most of them are built identifying trails. And you find them along ancient trails. And the significance of these particular petroglyphs here is that it actually defines the intersection of two trails – Farrington Highway and the *mauka-makai* trail. That *mauka-makai* trail is supported by everything else that I've shared with you in respect to the cultural sites up above. We need to understand the significance of that *mauka-makai* relationship because that was one of the relationships in ancient times. In ancient times, it was matter of life-or-death resources. It was food. So it was establishing that relationship between the people up above and the people at the ocean. So these were your closest friends. These were the people – So you don't have to go dive for fish. You just go down and you take what you got to share. You get fish from people down below. So these were your neighbors. So obviously there would be *mauka-makai* trails all over the islands. The significance of this one is the fact that you have structures that supports that idea, that's still intact today. And the petroglyphs along Farrington Highway is one of those supporting pieces of information.

The petroglyph site mentioned above (State Inventory of Historic Properties [SIHP] # 50-80-12-2893) is located outside the southeast corner of the current project area (see Previous Archaeological Research section above). The *mauka/makai* trail mentioned above is probably the one depicted on the 1914 Fire Control Map (Figure 17). The trail starts at the area of the petroglyphs (SIHP # 2893) and goes up between the east end of Waimānalo Gulch and the west end of Makaīwa Gulch. This trail is most likely a pathway to the former village of Pu'u Ku'ua and the *heiau* in the *mauka* region of Hono'uli'uli. This *mauka/makai* trail would have also intersected the well known trails of upper Hono'uli'uli, Pōhākea Pass, Kolekole and Palikea which all lead to Kūkaniloko, the center or *piko* of the Island of O'ahu.

Douglas McDonald Philpotts also spoke about trails in the *'ili* of Waimānalo:

> The main trails from this community to *makai* were in both Waimānalo and Makaīwa. These trails had water and springs there and were probably used more for uphill travel. The ridge between them was faster but there was no water so it was more than likely used for downhill travel. Another was down by Awanui just west of Pu'u Palailai and another was on the up side of Kaloi. The main trails had a spring or two along the way and if there was enough water something was grown there.

Another *mauka/makai* trail is depicted on the 1873 Alexander map (Figure 18) of Hono'uli'uli. The trail went from the uplands of Pu'umanawahua, Palikea (shown on map as "wooded hill"), Kapuai and Pu'ukuua passing Pu'umakakilo straight to Pu'u Pālailai, then to the coast of Ko'olina where there was once a village.

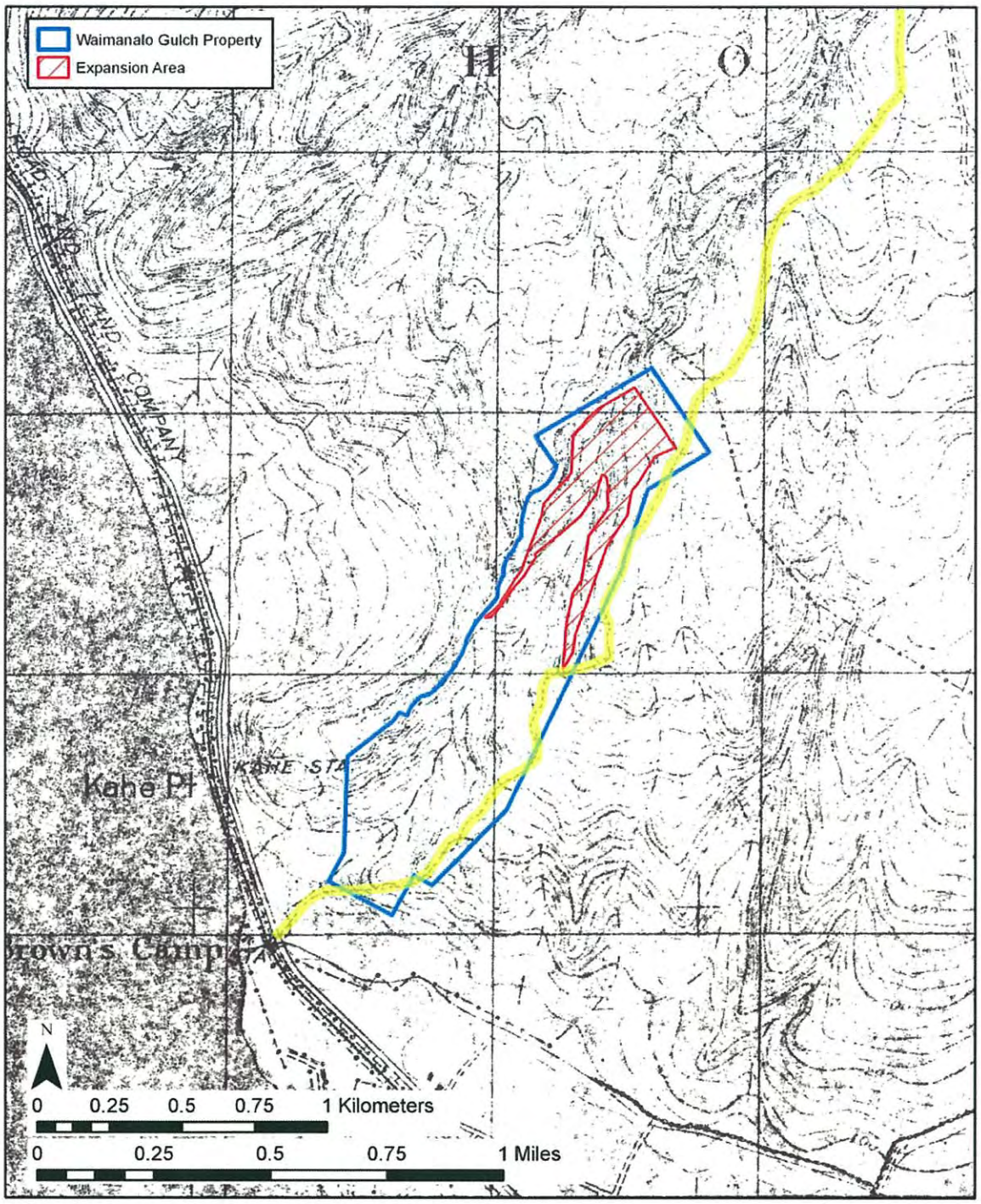

Figure 17. 1914 Fire control map showing *mauka/makai* trail from Brown's camp up to the *mauka* region of Hono'uli'uli

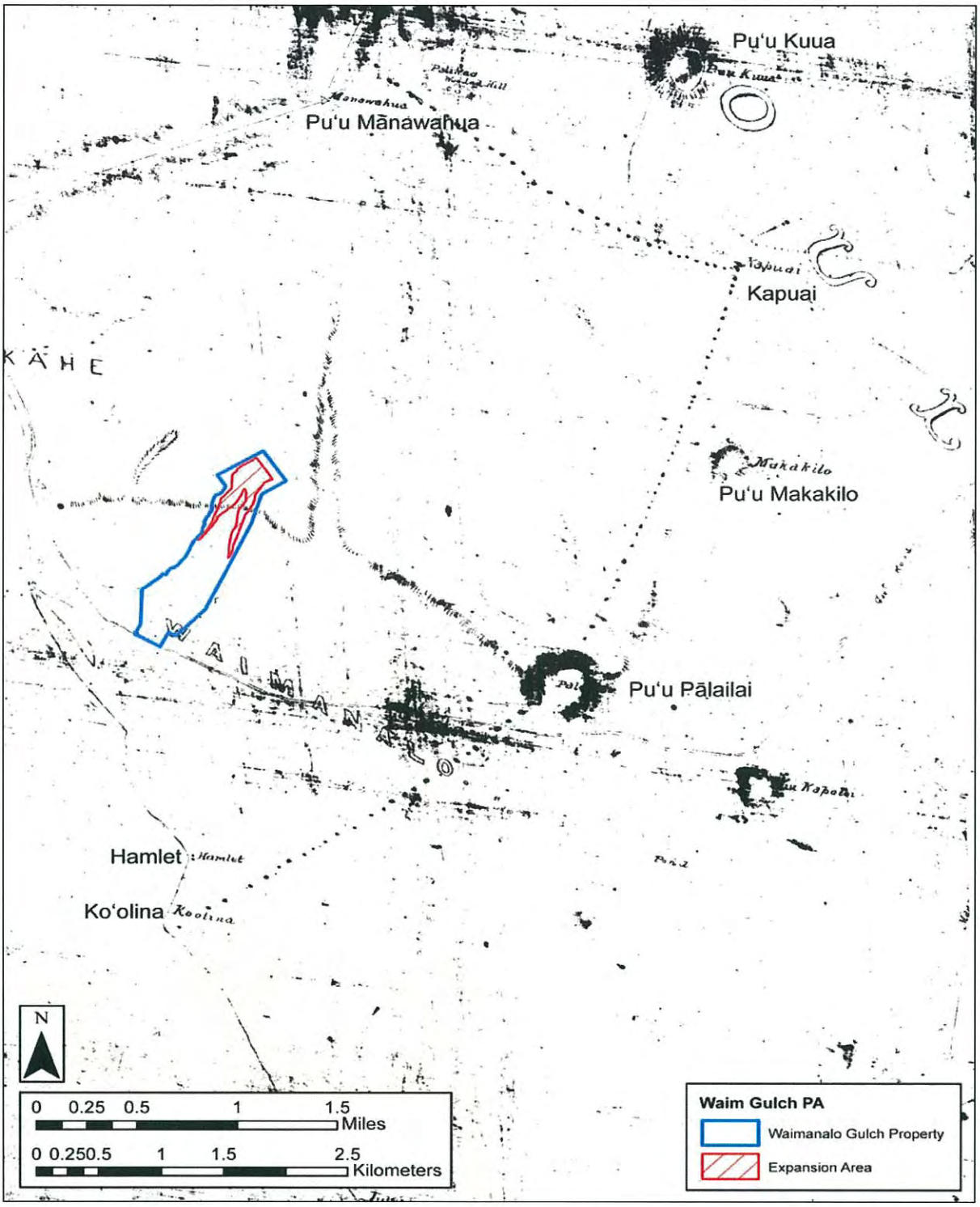

Figure 18. 1873 Alexander map showing *mauka/makai* trail from Pu'umanawahua to Ko'olina and a "Hamlet" (village)

6.4 Gathering of Plant Resources

Given the ecosystem diversity of coastal lowland, transition and upland forest zones in Hono'uli'uli Ahupua'a, it is likely that one of the primary traditional cultural practices associated with the present project area would have been the gathering of native plant resources. Table 3 lists Hono'uli'uli lowland plants and uses with columns for "common/Hawaiian name", "scientific name" and "use" based on research conducted by Barbara Frierson (1973) on native plant species present in Hono'uli'uli before 1790, in addition to plant use recorded by Isabella Abbott (1992).

Table 3. Native plants in Hono'uli'uli

Hawaiian/Common Name	Scientific Name	Use
Hala, pandanus	*Pandanus odoratissimus*	Weaving
Hau, hibiscus	*Hibiscus tiliaceus*	Cordage
Milo	*Thespesia paradisiaca*	Wood used for bowls
Neneleau, Sumac	*Rhus sandwicensis* *Rhus chinensis*	Unknown
'Ilima	*Sida cordifolia*	Leis, medicine
Kou	*Cordia subcordata*	Bowls
Makaloa, sedge	*Cyperus laevigatus*	Mats (Abbott)
Pili, grass	*Heteropogon contortus*	Thatch
Kakonakona, grass	*Panicum torridum*	Unknown
Honohonowai	*Commelina nudiflora*	Unknown
Ma'o, cotton	*Gossypium tomentosum* *Abutilon incanum*	Flowers used as dye for kapa (Abbott)
'Ūlei	*Osteomeles anthyllidifolia*	Branches used for fishing nets (Abbott)
'Uhaloa	*Waltheria americana*	Medicine (Abbott)
Koali'ai	*Ipomoea cairica*	Cordage (Abbott)
Pā'ū o Hiiaka	*Jacquemontia sandwicensis*	Unknown
Ko'oko'olau	*Bidens* sp.	Use as tea (Abbott)
'Ulu, breadfruit	*Artocarpus incisus*	Food
Kalo, taro	*Colocasia esculenta*	Food
Niu, coconut	*Cocos nucifera*	Food, liquid

The accessibility of Hono'uli'uli lands, including the present project area, to Hawaiians for gathering or other cultural purposes was radically curtailed during the second half of the nineteenth century. As noted above, by the 1870s, herds of cattle grazing across the 'Ewa Plain likely denuded the landscape of much of the native vegetation. Subsequently, during the last decade of the nineteenth century, the traditional Hawaiian landscape was further distorted by the introduction and rapid development of commercial sugar cane cultivation. Throughout the twentieth century sugar cane cultivation was the dominating land use activity within the project area. Cane cultivation – and the sense that the project area was private property – restricted access inside the project area to employees of Ewa Plantation.

6.5 Native Gathering Practices for Plant Resources

Mr. Hiram Kamanā indicated that he used to gather ingredients for a cleansing *lā'au lapa'au* (botanical medicine), including "*Kī Māmaki*" (*Māmaki, Pipturus* sp.), in the uplands. The bark, fruit and young leaves of the Māmaki were used medicinally (Wagner et al. 1990:1307). It is definitely understood that this was picked well *mauka* of the landfill (no *Māmaki* is known to grow in the immediate vicinity of the landfill). Mr. Kamanā also spoke of gathering Ha'uōwī (also known as Ha'uoi, Oī and Ōwī, *Verbena litoralis*) and Pānini (Prickly Pear cactus, *Pāpipi*; *Opuntia ficus-indica* aka *Opuntia megacantha*). Parts of the *Ha'uōwī* plant would be soaked in alcohol and the liniment would be used for arthritis. *Verbena litoralis* has been used medicinally as a mash applied to cuts and bruises and also to sprained and fractured areas (Wagner et al. 1990:1325). This exotic species is widely naturalized in Hawai'i (first documented in 1837) occurring in dry to wet habitats on all the major islands. The red fruit of the *Pānini* was used for sore stomachs. This exotic species was probably introduced to Hawai'i prior to 1809 and is naturalized in dry, disturbed habitats on the major islands (Wagner et al. 1990:420).

Ms. Nettie Armitage-Lapilio spoke of gathering plants for both medicine and ornament in the uplands. She spoke of gathering *Ēkoa* (also known as *Koa-haole* and *Lilikoa*; *Leucaena leucocephala* aka *Leucaena glauca*) seeds and or seedpods for *lei* which the *'ohana* would wear while performing *hula* and also sell to make extra money. She indicated the seeds/seedpods were gathered where the landfill is now. This exotic species (first collected on O'ahu in 1837) is very common, often forming the dominant element of the vegetation in low elevation, dry, disturbed habitats of all the major islands (Wagner et al. 1990:680).

Ms. Armitage-Lapilio mentioned gathering two species for *lā'au lapa'au*: *'Uhaloa* (*Waltheria indica* var. *americana*) and *Kīnehe* (Spanish Needle, *Bidens* spp.). According to Wagner et al. 1990:1280, '*Uhaloa*, which is known by many alternative names (e.g., *'Ala'ala, Pū loa, Hala uhaloa, Hi'aloa*, and *Kanakaloa*), is an indigenous pan-tropical plant, occurring in dry, often disturbed sites on all the major islands; it has been widely used medicinally by the Hawaiians as a painkiller especially for sore throat. *Kīnehe* (aka *Kī, Kī pipili* and *Nehe*) is a pan-tropical exotic weed widespread in disturbed areas (Wagner et al. 1990:279). Pukui and Elbert (1986:152) note for "*Kīnehe*" that: "The Spanish needle (*Bidens pilosa*) is a lowland weed; young fresh plants are still brewed for tea."

We are confident that *Māmaki* has not grown near the landfill in recent times as it prefers wetter environments found at higher elevations. *Ha'uōwī, Pānini, Ēkoa, Uhaloa*, and *Kīnehe* are all quite ubiquitous in similar dry, lowland areas. It is interesting to note in passing that four of

the six plant species used (*Ha'uōwī, Pānini, Ēkoa, Kīnehe*) are exotic species. We perceive no adverse impact on Hawaiian utilization of these species by the proposed landfill expansion action.

6.6 Taro in Hawaiian Culture

Taro cultivation was mentioned in two of the LCA testimonies for individual *kuleana* claims in the *'ili* of Waimānalo of Hono'uli'uli Ahupua'a. The testimonies indicated that these LCA's contained at least two *lo'i* as well as house lots, sweet potato, *kula*-at Pu'ukuua, ponds, streams and fishery. The taro cultivation here was not as intensive as the well known "Hono'uli'uli Taro Lands" near the mouth of Pear Harbor and the Hono'uli'uli Stream. Apparently Waimānalo 'Ili had sufficient water along with backshore swampy areas to provide personal *lo'i* on a small scale. Although these claims were not awarded they provide a wealth of information.

The area of Lanikūhonua south of the project area, once a marshy wetland fed by a natural springs, was an ideal place to cultivate taro. Davis et al. (1986) mapped the natural marshy area and spring (Figure 19). Many maps show water filtering down from the Waimānalo and Makaīwa Gulches as well as the unnamed gulches that could have also feed the *lo'i* of this area (Figure 20). There is no mention of taro grown in the project area but there were natural springs that could sustain a small patch. Aunty Nettie Tiffany, Aunty Arline Eaton and Douglas McDonald Philpotts all mentioned that the area of Waimānalo, Makaīwa, and Lanikūhonua had sources of fresh water.

Taro has an intimate connection to the Hawaiian culture. Taro (*kalo*; *Colocassia esculenta*) was probably brought to Hawai'i by the earliest Polynesian voyagers and has been a staple crop on the islands ever since. Taro is intimately connected through myth to the origins of Hawaiians as a people. There are different versions of this myth, but all of them make the connection between the first-born Hawaiian and the taro plant, according to Mary Kawena Pukui:

> The first Hāloa, born to Wākea and Ho'ohoku-ka-lani, became a taro plant. His younger brother, also named Hāloa, became the ancestor of the people. In this way, taro was the elder brother and man the younger-both being children of the same parents. (Pukui in Handy and Handy 1972:80)

The physical attributes, the growth patterns, and the propagation of taro all reflect the structure of Hawaiian kinship and an obvious relationship to the human body. The main plant in the center is the *makua* (parent), the smaller plants budding out of the *makua* are the *'ohā* (offspring). The center of the leaf where it connects to the stem is the growth center of the veins of the leaf and is called the *piko* (belly button). The stem is called *ha*, which is also a word for breath, the basis of life. The cycle of planting is a reflection of the human life cycle. When the taro is harvested the corm is cut right below the green top, the cut top is called the *huli* (turning, returning or transforming). The *huli* is replanted and the family of taro once again continues its growth cycle. The generations of taro are thought of interchangeably with the generations of Hawaiians as reflected in the saying "*Kalo kanu o ka 'āina*"-literally "taro planted on the land" but figuratively referring to successive generations of natives (Pukui 1983:157). Both the *'ohā* and the *makua* can be used as *huli,* but as in a family, the '*oha* (child) must be separated to become independent of the parent and – to become a parent itself. If it is not, it remains a

dependent attachment, overshadowed by the leaves of the *makua*. Another saying, *I makika'i kekalo i ka 'ohā*-"the goodness of the taro is judged by the young plant it produces" (Pukui 1983:133), is a metaphor for the parents being judged by the behavior of their children.

All parts of the taro plant are used for food: the corm is cooked and eaten as table taro or steamed and pounded into *poi*; the stem can be steamed and used in various soup and stew dishes; the young leaves are used for *laulau* and *lū'au* dishes mixed with fish, squid, pork, chicken or beef. Generally, the leaves are not harvested from the plants designated for corm production because continuous cutting makes the corms soft and tasteless (*loli*). Taro growers who grow leaf for home use or commercial purpose always have specially designated *lū'au* patches. It is traditional Hawaiian practice to use all the coarse green cuttings that are the by-product of the harvesting of the corms as food for the pigs. This green material, when cooked and fed to the animals, is highly nutritious. For this reason, raising pigs is traditionally is symbiotic relationship to taro production. In a traditional taro field, no space is wasted. The *lo'i* are used for the taro and any extra space on the banks is used for subsistence, utilitarian and medicinal plants, such as bananas, *noni*, and *tī* (also *kī*).

The practice of taro cultivation most resembles gardening in its scale and methods. Much of the work is undertaken by an individual or family, and is performed by hand. The *lo'i* and banks are beautifully manicured, and the result is aesthetically like a garden. Yet, taro production remains viable even on this small scale because of its high per-acre productivity.

Nowhere else in the world was taro cultivation more developed than in Hawai'i (Kirch 1985:215). It was the staple for the hundreds of thousands of Hawaiians before European contact. It was grown in areas with sufficient rainfall (above 30-50 inches per annum) or under dryland management. In areas of suitable water sources extensive and sophisticated irrigated systems were developed for its cultivation. The social requirement for the planning, development, and maintenance of theses irrigated systems was a stable political system and community cooperation. Although the cultivation and maintenance of individual fields could be the purview of single families or individuals, the maintenance of the water supply system, on which the entire system depended, had to be organized on a community level.

Although less than 100 varieties of taro survive today, there may have been, at one time, as many as 300 varieties in the islands, distinguished by leaf shape, corm, morphology, color and use. The labels of wetland and dryland taro do not refer to different taro varieties, but only to different cultivation practices. All varieties of taro can be grown in dryland fields and all but a few in *lo'i* (flooded fields). Today there are only a few widely grown commercial varieties. Mechanical devices are used, such as tillers and small tractors; in some cases PVC pipes have replaced earthen or stone lined *'auwai* or waterways, and commercial fertilizers are routinely used. A typical taro crop will take from 10 to 14 months to mature. With modern farming methods taro is one of the most productive per-acre staple crops in the world. However, in spite of these modern overlays, the bulk of the labor is done by hand in the context of the family and the essence of a traditional taro growing community. Cooperation in management of water and land resources remains an integral part of this lifestyle.

In pre-Contact Hawai'i, during the late prehistoric era, as documented by archaeological studies, taro cultivation was practiced in virtually every suitable locality, including floodplains in windward valleys with perennial streams, open lava and beach flats near stream systems, and

moist leeward slopes. Taro was such an important crop it was even grown in artificial microenvironments created by mulching pits in lava fields.

Since European contact there has been a slow but steady decline in taro cultivation. In the late nineteenth and early twentieth centuries, many of the large taro growing areas were given over to rice planting. Taro cultivation returned on a smaller scale to these areas after development of the California rice industry. Today, commercial Hawaiian taro cultivation is confined to a few areas in the islands: Hānalei/Waioli, Hanapēpē and Waimea on Kaua'i, Waikāne/Waiāhole and Haleiwa on O'ahu, Honokohau, Ke'anae/Wailuanui on Maui, and Waipi'o Valley on the island of Hawai'i. Although taro is not grown anymore near the project area there is documents that prove there once was taro cultivation west of Hono'uli'uli.

'Ewa was well known for its rare *kai* variety of taro that was very flavorful as well as the ability to reproduce itself over a ten year span. The *Kai O 'Ewa* was grown in mounds in marshy locations. The cultivation of this prized and delicious taro led to the saying:

> Ua 'ai i ke kāī-koi o 'Ewa.
>
> He has eaten the Kāī-koi taro of 'Ewa.
>
> Kāī is O'ahu's best eating taro; one who has eaten it will always like it. Said of a youth of a maiden of 'Ewa, who, like the Kāī taro, is not easily forgotten (Pukui 1983: #2770).

The taro of 'Ewa was poetically referred to a man's love for a 'Ewa women that was so strong he would never leave:

> The *kai* was native to 'Ewa and was often referred to as *kai o 'Ewa*. . . . An 'Ewa *kama'āina* described this in 1899: "When planted, it sends up shoots, more shoots and still more shoots. Again and again it will send up new shoots, filling the mounds until they mixed with the taro of other mounds." This description (*Ka Loea Kalani'āina*, June 3, 1899) indicates that in the flat, wet lowlands of 'Ewa this famous taro was grown in mounds (*pu'epu'e*) as in marshy localities. The article quoted above says that "*kai koi* multiplies itself over and over with one planting and often lasts as long as ten years." No other variety or locality can equal this. This fragrant taro was likened to a woman with whom a man falls in love. And it was said that anyone who married a native of 'Ewa would come and settle there and would never leave, because of the *kai koi* of 'Ewa. Our Hawaiian writer describes two other varieties of *kai*. *Kai 'ele'ele*, black *kai*, has a black stalk, with dark skin on stems and leaves; its corm was tough and hard to pound. *Kai kea*, white *kai*, had a light-colored stem and leaves; the skin (of the corm) was red, but the flesh was dark like that of black *kai*, the corm likewise tough. In 1931 we collected four varieties of *kai*: *kai koi*, whose corm was white, vase of stalk pink, petiole pink, with a pink edge on the leaf; *kai kea* or *keokeo* with white corm, white base, whitish stalk with red margin, and a leaf with white edge and white center and pinkish veins; *kai 'ula'ula* (red *kai*) with corm flesh purplish white, and cortex of corm reddish purple, base red, stalk green with black streaks becoming light green and pink above, and finally, *kai-uliuli* (dark-*kai*) with white

> corm and lavender cortex, red to pink base, whitish and dusky green petiole with red and white margin, and leaf with a slightly reddish center. It was the *kai keokeo* which was described as being fragrant (*'ala*). From this was made the poi reserved for the chiefs (*poi ali'i*). (Handy and Handy 1972:471)

Due to the dry conditions on the leeward side of O'ahu, taro wasn't as abundant in Waimānalo 'Ili as it was in some of the surrounding marshy areas. Though, there was a fair amount of water sources in the area if you knew where to find them. Douglas McDonald Pilpotts elaborates on the water sources in Waimānalo 'Ili and expalians why water was such a commodity here:

> By far the most important resource is always *wai*, freshwater, and with no year-round streams here it was definitely not an abundant resource. As you know *makai* there were sink holes with freshwater on the 'Ewa plane. Near Lanikuhonua, fresh water comes out right in the sand, between the rocks there. You can turn a gourd upside down in the ocean and get fresh water if you know where. Knowing where is the key, it's the same thing up *mauka*, there are no streams. There is what geologists call perched water. Places were water flows to the surface on top of impermeable layers of soil covered by a layer of fractured rock. A few of these at lower elevations still produced water today even in the driest times of the year. The greatest number of these springs are found between 1,200 and 1,800 foot elevations. However due to the reforestation efforts in the 1920s these springs no longer produce water year-round. This is also the elevation with the greatest concentration of archaeological sites. Most of these springs still have terraces and *lo'i* walls around them. The forests above also held substantial resources, but the ocean below by far had the most substantial resources and the leeward exposure provided the best conditions to exploit them. I believe when compared to other *ahupua'a* in ancient times this area was not seen as desirable for its abundant resources. With the commanding view from this place and the limited water resources on the 'Ewa plane this community was highly defendable.
>
> Many old maps show historic water tunnels and reforestation efforts also help to understand the water resources that were here to support pre-Contact populations.

6.7 Significant Cultural Sites within the Project Area

CSH previously performed an inventory survey of the project area in 1998 (Hammatt and Shideler 1998) and an additional assessment was conducted in 2007 (Dalton and Hammatt 2008). During the 2007 companion archaeological inventory survey, CSH identified one historic property within the project area: SIHP # 50-80-12-6903, three rock uprights, which were recommended eligible for the Hawai'i Register under Criteria D and E.

A culturally significant Pueo Stone was identified by Bath in 1989. This "Pueo Stone" eventually had to be relocated to the northwest ridge of the gulch. Due to the signifigance of this cultural site, it has been protected and cared for in a safe area by a cultural practitioner.

Douglas McDonald Philpotts has spent years hiking around Waimānalo 'Ili and he recalls coming across many Hawaiian cultural sites:

> So when hiking up here and going through the grass I feel things and I just turn right or left, or just open the grass in front of me and there's a huge *ahu* or a cave sometimes I think they led me right to it. So that's been the path, the journey about knowing, and learning and seeing different things and getting chicken skin many times. When I was younger I spent a lot of time out there in the woods at night just cruising, checking it out. I got spooked every so often out there, but then I get used to it.
>
> There are so many cultural sites here and all of these sites and their relationships between each other is what's valuable. It is in the collective relationship between all the sites. Studying this area gives us the opportunity to have a deeper understanding of those who lived here because it's still pretty clear. Their footprints are still right there. I think this place has revealed how much potential it has, and the value of how much it has yet to share. I really want to make sure that the cultural sites and what they tell us doesn't get erased.
>
> This area has great value in the collective because there is a window into the life of our culture pre-Contact. It's not just about how they built their house sites, what's important is where they built their houses in relationship to where the water was located. They built their houses out there, in the wind, with the risk of it blowing away in a big storm, because they wanted the view. The five brothers, the watchers, their house sites are still there. It's all about the view. How can we relate to these stories if the house sites are gone, or if you don't know where the spring is, or if you don't know where their food was? This is the whole picture, like that beautiful *ahupua'a* poster that Kamehameha Schools has, and it is right here you can walk on it! Due to the land use being limited to forestry, watershed and ranching, the area's pre-Contact archaeological sites have been preserved. For those who have an interest in really understanding or trying to step back in time, just for a moment, for a visit, they can. You can walk from the fishing *ko'a* to the *lo'i* or you can stop at the spring or the shelter cave or the *ahu*, the *heiau*, the *pā*. You can go a to the forest for lapaau and you can watch the sunset from the front of their *hale* and if you employ the right senses you can do all this with them, they are still here, that is why this place is so special.

Another signifigant site that Douglas McDonald spoke about was the *pā* (stone enclosure) that is located in the uplands of Waimānalo 'Ili:

> The center of this *mauka* community was here above Waimānalo and Makaīwa. Ida Von Holt writes that they were told the area was quite heavily populated before the smallpox epidemic of 1840 and that there was a school for over 40 children where the *pā* is now. This appears to be the case when compared to the size and number of structures in the area. Some of the adjacent pastors were cleared for pineapple years ago these pastors more than likely contained many sites and now they are lost forever.

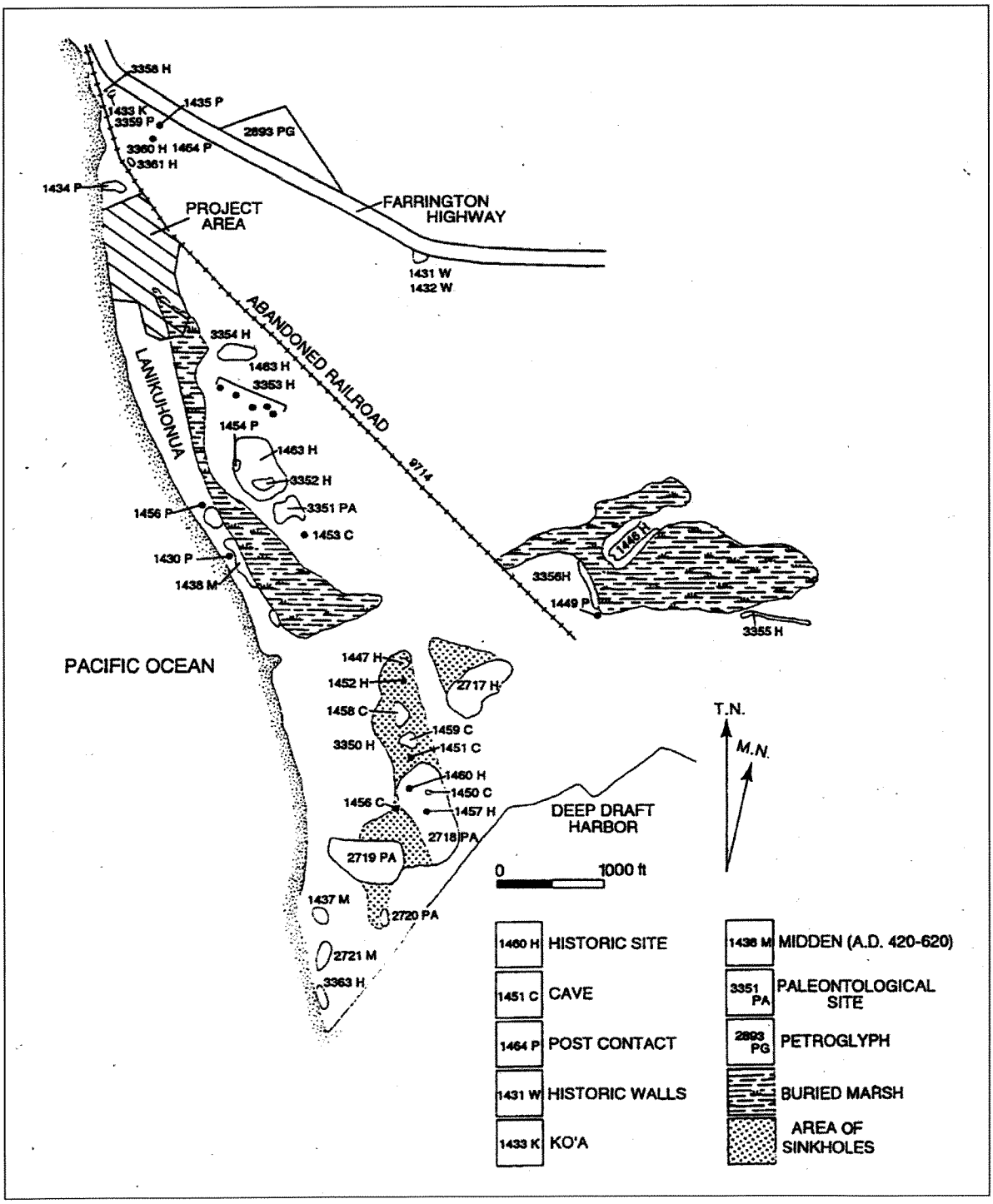

Figure 19. Pre-and post-Contact archaeological sites previously identified in Davis et al. (1986); south of the current project area (Lanikūhonua-Ko'olina-Waimānalo-Paradise Cove)

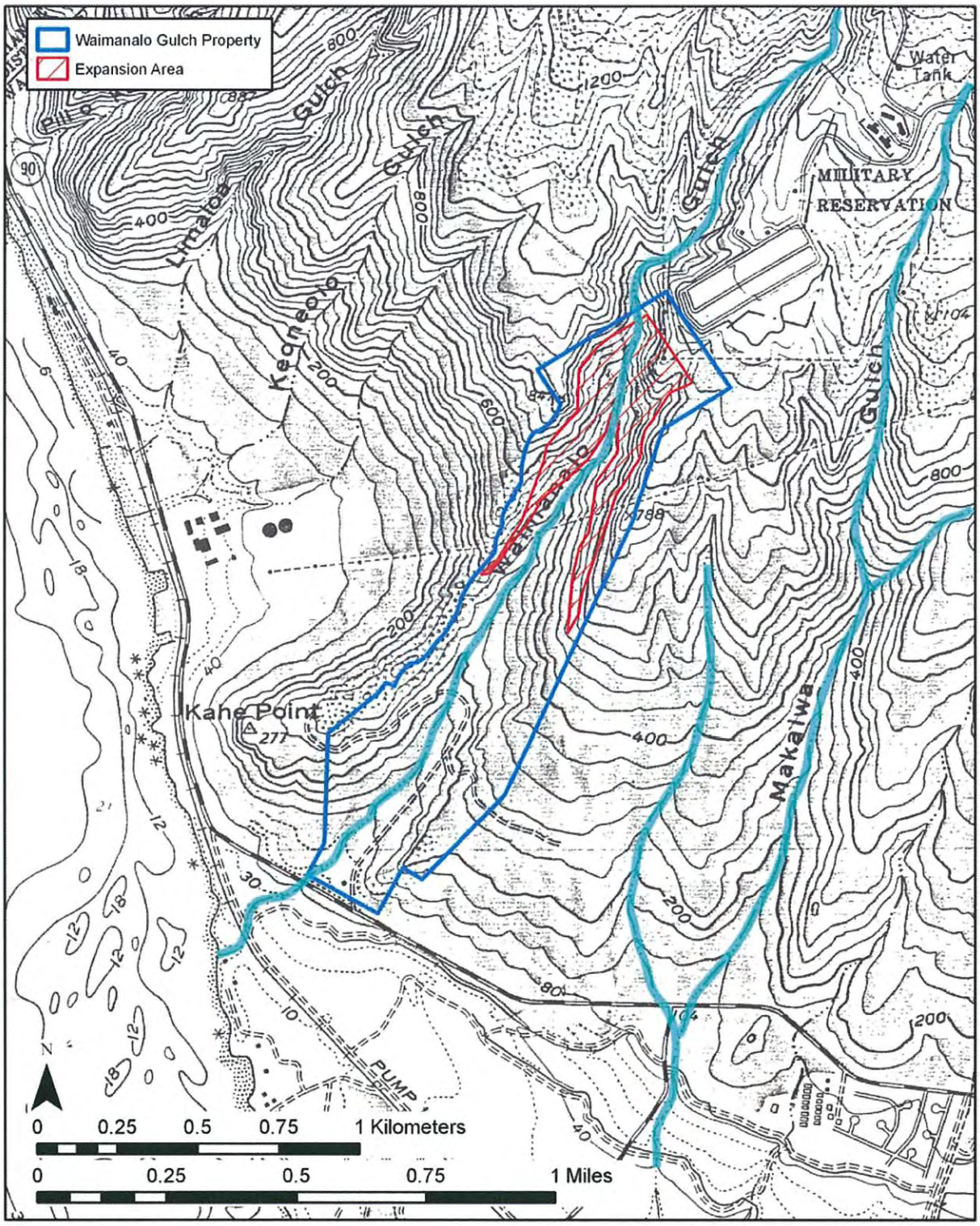

Figure 20. 1962 USGS Map showing seasonal streams

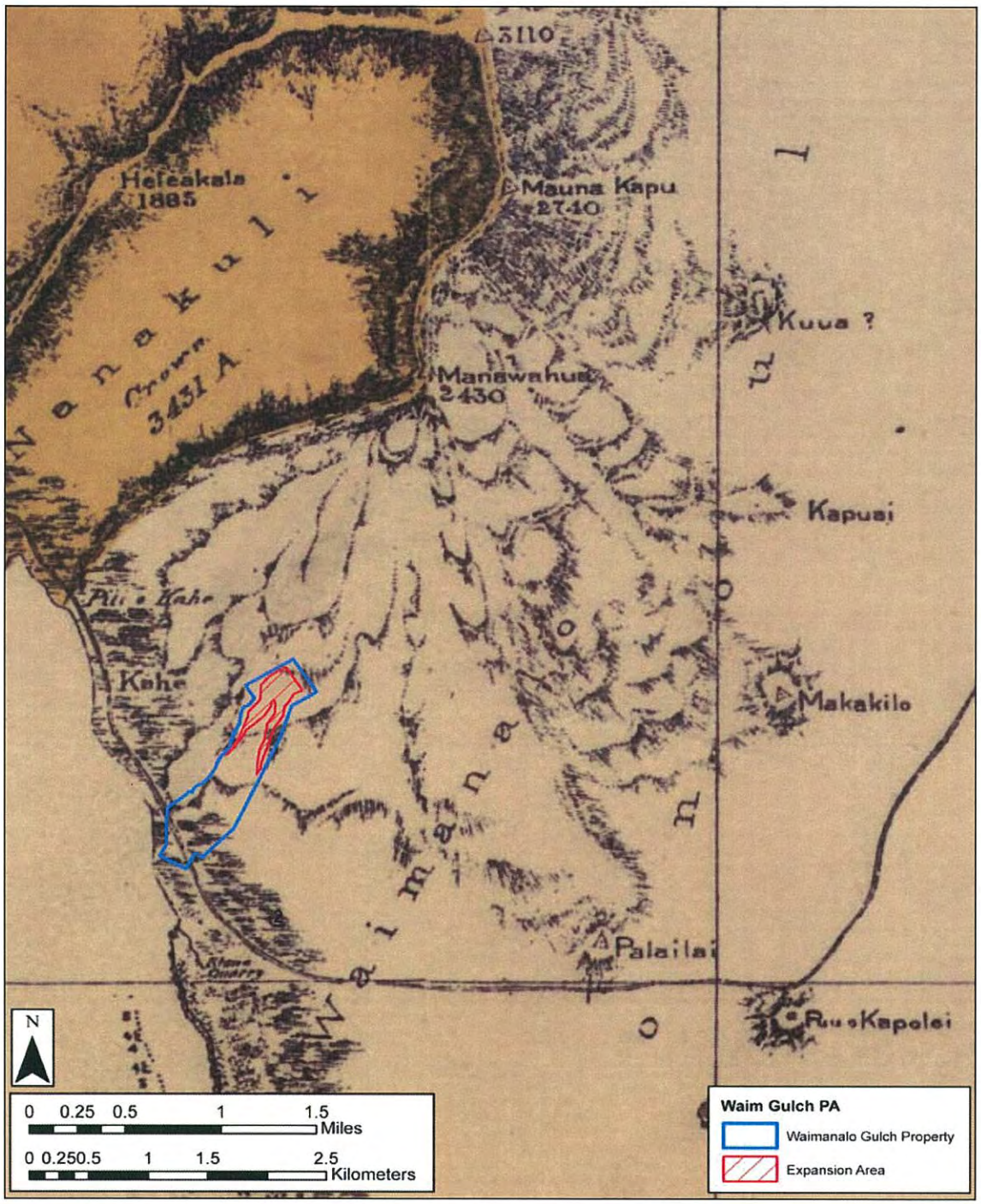

Figure 21. 1881 Hawaii Government Survey Map showing project area and the *'ili* of Waimānalo. Ko'olina is depicted south of the project area as well as a quarry. Also showing east/west trail

6.8 Marine Resources

The sea is a rich resource and the Hawaiian people were traditionally expert fishermen. Fish of all types supplied the Hawaiian diet with a rich source of protein. This source of food is a supplement to the things grown in the uplands. The LCA documents provide information that the people of Waimānalo area were utilizing the ocean resources as a fishery as well as the upland forest area for subsistence. This is a good example of the *ahupua'a* system that was once used.

Through the interview process, people mentioned a *ko'a* when asked about fishing south of the project area at Lanikūhonua. A *ko'a* is defined as "Fishing grounds, usually identified by lining up with marks on shore or shrine, often consisting of circular piles of coral or stone, built along the shore or by ponds or streams" (Pukui and Elbert 1971:144). Kamaki Kanahele is a *kama'āina* to the area and recalls his childhood memories of fishing the Wai'anae coast and using the many *ko'a* in the area to line up the fishing spots. Eddie Ka'anana was an avid fisherman and frequently fished for *'ōpelu* along the Wai'anae coast. He mentioned that he would fish using traditional methods on a canoe for *'ōpelu* as well as on a boat. Other types of fish that were caught were *u'u, akule*, and mullet. When asked about a *ko'a* he mentioned that he is aware of a *ko'a* along the Wai'anae coast and there was abundant fish in that area, which suggests that there may be a *ko'a* near by (Souza and Hammatt 2002). William Ailā also mentioned a *ko'a* and great *akule* fishing offshore fronting the project area. Nettie Tiffany also recalls the *ko'a* and her childhood memories of the shore fronting Lanikūhonua as having abundant fish such as mullet and reef fish.

Mr. George Ka'eliwai mentioned in a telephone interview in a recent report (Souza and Hammatt 2002):

> We all knew how to survive through our culture by the age of thirteen. The older boys would go up mountain and I had to know how to make the *palu* (bait) for fishing. You are not allowed to talk about fishing. You just get up early and go. I knew Tūtū (grandmother) Campbell on the ranch. She liked me and favored me. She gave me fishing rights as long as I gave her some fish.

Additionally Mr. Ka'eliwai confirms that there were activities related to early Hawaiian gathering practices from rich marine resources at Lanikūhonua. Mr. Ka'eiliwai spoke about the different types of fish that he and his uncle would gather; *manini, aweoweo, uhu,* and *menpachi.* This area was a great place for diving and throw net fishing.

Douglas McDonald Philpotts also refered to the plentiful marine resources at Lanikūhonua where he once lived, fished and threw net. He mentioned that Lanikūhonua was once a thriving fishing village, with a canoe landing and a fishing shrine.

> Our house was actually next to Lanikuhonua near the big banyan tree at Paradise Cove. Then there was my grandfather's coconut plantation where he had young coconut trees everywhere. The place was absolutely beautiful, and some of it still is. Some old maps have labeled hamlet on that spot and I'm sure there was a lot of *wa'a* on the beach there, this is the *makai* part of that *ahupua'a* poster. The fishing was great, and like I said earlier freshwater comes right out of the sand there.

> It really starts way back with Lanikuhonua and fishing. Uncle Sunny, Netty's father, kind of clued me in on throw netting. My Dad taught me how to get the net to open up but Uncle Sunny was the one that taught me how to use my senses to know where fish were. One night I was running out with my pole to set lines and he goes, "where's your throw net?" and I go, "it's dark now, you can't see the fish now." Then he said, "Go get your throw net." So I came back with my throw net and he said, "now where's your favorite spots?" And I said, "well its over there and over there and over there, but you can't see the fish" and he goes, "just go back to your favorite spots, you know every rock underneath there, you don't need to see the place to be able to know your way around." And I said, "yeah I can do that" and he said, "Just go to your favorite spot and stand there and wait until you feel the fish. When you feel the fish, you'll know, you'll feel them."

Hawaiians were very conservative when it came to marine resources. They set *kapu* on certain fish during their time of spawning and made sure that these fish had time to repopulate. The following exert is a passage from Hawaiian Fishing Traditions which talks about the *kapu* on *'ōpelu*:

> An important fishing *kapu* concerned the *'ōpelu* (mackerel) and the *aku* (bonito), two highly prized fish caught in great numbers in Hawaiian waters. *'Ōpelu* was netted from July through January. Walter Paulo and Eddie Ka'anana, two *'ōpelu* fishermen from Miloli'i, told me the best time for catching this fish is in October. 'Ōpelu was placed under *kapu* in February, until the end its spawning season, around July (Moku Manu and Others 1992:xii).

6.9 Wahi Pana (Storied Places)

The concept of *wahi pana*, a place with a story or legend attached to it, is very important in Hawaiian culture because it is a connection to the past and the ancestors. From place names, one can know intimate details about people who lived there, the environment, cultural practices and historical events that took occured. In Hawaiian culture, if a particular spot is given a name, it is because an event took place there that had meaning for the people of that time. Because Hawaiian culture was based on oral traditions, place names and their associated stories were an important way of remembering these traditions and ensuring these stories would be passed on to future generations. In Hawaiian thinking, the fact that a place has a name deems it important. Often, spiritual power or *mana* is attached to a place, which increases its importance. On the subject of *wahi pana*, Edward Kanahele writes:

> As a native Hawaiian, a place tells me who I am and who my extended family is. A place gives me my history, the history of my clan, and the history of my people. I am able to look at a place and tie in human events that affect me and my loved ones. A place gives me a feeling of stability and of belonging to my family, those living and dead. A place gives me a sense of well-being and of acceptance of all who have experienced that place. (Kanahele in James 1995:6)

Analu Kameeiamoku Josephides mentions a *mo'olelo* passed down to him by his *kūpuna* regarding some names of the Waimānalo 'Ili. The area was referred to as five brothers who protected and cared for the island of O'ahu; they were the "Eyes" of O'ahu:

> Another concern that I may have is the place names of this particular area. A story that has been passed down to me from my *kupuna* is that there were five brothers who were the watchers. Their names were Makaīwa, Maka'ike, Makaloa, Maka-Io, and Makakilo. It was known that Makaīwa was to the farthest west and that Makakilo was to the farthest east. That these five brothers were the eyes of the O'ahu people and were their protectors. They would watch for enemy intruders and relay messages to their *makulu* (runners). If enemy canoes were seen the *makulu* would run to the various districts and warn the chief and his/her people. This is why O'ahu was a hard island to conquer in the ancient times. By the time the war canoes of the enemies would reach the shores they would be greeted by the warriors of O'ahu, thus the enemies were never allowed to land upon the shores of O'ahu.

Douglas McDonald Philpotts also spoke about a connection between this area and the other islands through the path of the sun:

> Whether you're a spiritual person or not you will be impressed by the sheer beauty of this place, and the spectacular views from here. But many who come here are surprised by the sense of *mana* here. The view is special here, from the top of Pālehua between Pu'u Manawahua and Mauna Kapu you can see all the islands and all of the mountain tops on those islands, this is the only place in all the islands you can do this. Hermann von Holt showed me the trench that still remains on the Honolulu ridge of Mauna Kapu and said another one in the south was taken out when the road was put in. It was right where the big blockhouse is now. Herman said they were told by the Hawaiians in the ranch camp at Hono'uli'uli this was a most sacred place, and the place of great *mana*, and that is why I think the Hawaiians lived here and their spirits never left. This could be part of the meaning in the name Pālehua. In addition to the unique view of the islands I have observed the annual journey of *lā* (sun) from here. It starts on the first day of the celestial year on the winter solstice. At sunrise the sun can be seen rising from its house Haleakala as it begins its journey northward it rises from the west Maui Mountains and then from East Moloka'i. Reaching O'ahu it rises from Koko Head and moves from peak to valley north through the Ko'olau's reaching its destination Mokumanamana in exactly half a year. Then on June 21st, the summer solstice, the sun sets behind Kaua'i and starts its journey back home. On this solstice line connecting Haleakala, Pālehua and Mokumanamana are also several *heiau*. Twice a year on the equinox the sun sets over Pu'u Heleakala. To me these and many other things seem to be more than coincidence.
>
> I am just starting to understand that there is no other place like this when you add the layer of the winter and summer solstice; there is no other place that lines up like that. So I think the real resource is the view, and the power that comes from that.

6.9.1 Place Names

All place name translations were taken from Place Names of Hawai'i (Pukui et al. 1974) and the Hawaiian Dictionary (Pukui and Elbert 1986), in addition to being supplemented by other sources as well as community members (see Figure 6):

Aimea Name of fishpond in Hono'uli'uli (LCA 9037); Claimant, Kahakai claimed a right to *kalā* (fish) at this pond. The exact location of the pond is unknown.

Anianikū A small cove between Milo and Ka'ula at Lanikūhonua. *Lit.*, stand beckoning (Pukui et al. 1974:12).

Awanui Gulch Name of a gulch just west of Makakilo. The gulch name may pertain to the large *awa* or milkfish (*Chanos chanos*) or may be a reference to the impressive size of the *'awa* (kava) plants (*Piper methysticum*) growing at that location. Kawika McKeague gives another meaning "could reference the 'large passage,' indicative of birthing passage or 'outburst' (alluding to Papahanaumoku/Haumea's birth of the island- geologically one of the main outvents of Wai'anae volcanic eruption)."

Hapanui Name of a pond in Waimānalo, 'Ewa in which *kuleana* were claimed (LCA 9037 Kahakai); *Lit.,* greatest or largest portion.

Kalaipuawa Place name in Waimānalo, 'Ewa in which a taro patch was claimed (LCA 9037 Kahakai)

Kapua'i A high point in the uplands of Hono'uli'uli. Kapua'i is part of a traditional *mauka-makai* trail extending from near Pu'u Manawahua in the Hono'uli'uli uplands through Kapua'i and down to the coast at Kō'olina (1873 Alexander map). One meaning of *kapua'i* is footstep or footprint (Pukui and Elbert 1986: 133), a direct connection to the old trail. An alternative is suggested as "the flow (of water)" (Pukui et al. 1974:12:89) perhaps the source of spring water.

Ka'ula A small bay at Lanikūhonua. 'Ula suggests the sacred red color or perhaps, ghost or spirit (Pukui and Elbert 1986: 367).

Keone'ō'io Gulch in Nānākuli, O'ahu. *Lit.,* the sandy [place with] bonefish (Pukui et al. 1974:108).

Ko'olina Beaches, lagoons. *Lit.*, delightful, lovely; Ko'olina (Clark 2002:198) Ko'olina is also noted as a favorite vacationing spot of Kākuhihewa, with its sacred pools (Clark 1977:76). These pools are located near Kamokila's Lanikūhonua and are natural coves and limestone shelves.

Lanikūhonua An ocean retreat developed by Alice Kamokila Campbell in 1939. She named the spot after the beautiful sunsets, 'where heaven meets the earth' (Clark 2002:210). The rocky shoreline fronting this area is known for the *moi* (*Polydactus sexfilis*) fishing grounds (Clark 1977:76)

Limaloa Gulch in Hono'uli'uli, west of and adjacent to Waimānalo Gulch; *Lit.*, long arm (Pukui et al. 1974:133). Limaloa appears in legends of Kamapua'a as a star-crossed lover (Pukui et al. 1974:133). Known as the God of mirages (Pukui and Elbert 1986:207),. Limaloa appears in a chant offered by Maui's grandfather, Kuolokele, in Maui's attempt to rescue his wife who had been kidnapped by Pe'ape'amakawalu (eight-eyed bat) (Fornander v.5:458-463).

Makaike *Wahi pana* shared by Analu Kameeiamoku Josephides who told the story of five "Maka" brothers, the protectors who watched for enemy canoes from their high perches on the ridges above 'Ewa plains. As inferred by Analu's story, Makaike is assumed to be one of the ridges in between Makaīwa and Makakilo. Maka'ike: *Lit.*, seeing eye (Pukui and Elbert 1986:225). This type of observation is described as having the gift of "second sight" (Pukui and Elbert 1986:225).

Makaio One of the five "Maka" brothers, protectors of O'ahu, who watched for enemy canoes from the ridges above Hono'uli'uli (Personal communication Analu Kameeiamoku Josephides *in* Souza and Hammatt 2006). As inferred by Mr. Josephides' story, Makaio is assumed to be one of the ridges in between Makaīwa and Makakilo. May refer to the *'io*, the Hawaiian hawk (*Buteo solitarius*) (Pukui and Elbert 1986:102). Maka'io: *Lit.*, eyes of the hawk.

Makaīwa Gulch in Hono'uli'uli, east of and adjacent to Waimānalo Gulch; *Lit.*, mother-of-pearl eyes (as in an image) (Pukui et al. 1974:140). The westernmost of the five "Maka" brothers who helped protect O'ahu by serving as lookouts for enemy canoes (Analu Kameeiamoku Josephides). Makaīwa is inferred to be the westernmost ridge of the five ridges. Kawika McKeague gives alternate meaning "I think it's a shortened version of-Maka a aiwa, as in the face (essence) of complete mystery, incomprehensible (as in caught in a wake between two worlds- again transitional, balancing between two worlds)."

Makakilo Crater, land area, gulch, Wai'anae quad., O'ahu. *Lit.*, observing eyes (Pukui et al. 1974:140). Also *Pu'u Makakilo.* Hill above Kapolei; *Lit.*, observing eyes hill (Pukui et al. 1974:201).The easternmost of the five "Maka" brothers noted for their skill as lookouts for enemy invaders to O'ahu (Analu Kameeiamoku Josephides). Makakilo is inferred as the easternmost ridge of the five. Kilo is translated as "stargazer, reader of omens, astrologer; to watch closely, examine, spy" (Pukui and Elbert 1986:151). Kawika McKeague gives alternate meaning "any term with *kilo-* indicative of being able to read *ho'ailona*, second sighters, if you will."

Makaloa One of the five "Maka" brothers, shared in a story by (Analu Kameeiamoku Josephides). The Maka brothers were five brothers who were the watchers and protectors of O'ahu. They warned chiefs of

approaching enemy canoes and kept O'ahu's people safe. Makaloa is assumed to be one of the ridges in between Makaīwa and Makakilo. Makaloa suggests seeing great distances (*loa*).

Mauna Kapu Mountain at the border of Hono'uli'uli Reserve boundary; *Lit.*, sacred mountain (Pukui et al. 1974:148). Kawika McKeague gives alternate meaning "I know some say this is regards to Kakuhihewa's *kapu*. Could be- my *mana'o* is that this point clearly defines what is Wakea and what is Papa, my *mana'o* only...Papa giving birth- woman giving birth-probably the strongest period where Haumea thrives and is more "powerful" or omniscient than Wakea- *kapu* had to be established to protect both male/female sources of identity."

Milo Cove at Lanikūhonua. *Lit* to curl, twist or to whirl, as water; abortion. Possible reference to a common coastal shade tree, *milo* (*Thespesia populnea*).

Pālailai Gulch and hill above Kapolei to the east of Waimānalo Gulch; *Lit.*, the young *lai* fish (*Scomberoides spp.*) (Pukui et al. 1974:176). Kawika McKeague gives alternate meaning "I disagree with Pukui; I don't believe it's the "young of the lai fish"- my *hale* is on the northeast corner of its *kahua*- I believe it's to "experience or be in a state of being calm and clear"- again sensory; having clear vision or thought as something is born in thought through experience."

Pālehua Land division, hill and road in the Wai'anae area; "Lit., *lehua* flower enclosure" (Pukui et al. 1974:177). Kawika McKeague gives alternate meaning "I disagree with Pukui; I don't believe it's only meaning is the *lehua* enclosure; I see two other words prominent- *pale* and *hua*, the idea that this place is where the *hua* is protected or perhaps in another meaning one is protected by *hua*, by jealousy."

Palikea Peak above Lualualei in the Wai'anae mountains, O'ahu; *Lit.*, White cliff (Pukui et al. 1974:177). Kawika McKeague gives alternate meaning "- the cliff of Kea (Wakea)- he is detached from the processes of the childbearing activities that are evident with the form of these *pu'u*- this distinguished "setting aside" of place for Kea further support that the mountainscape down to Pu'uokapolei is female, is lifebearing, is transcending between this life and others yet to be or that have passed before."

Pu'ukuua Hill in the uplands of Waimānalo; "*Lit.*, relinquished hill"; In legend, Pu'uku'ua is famed for Kapo, Pele's sister, who once left her flying vagina here (Pukui et al. 1974:200); Māhele claimant and former *konohiki*, Kahakai, claims Puukuua as part of his *kula* land (LCA 9037).

Pu'u Manawahua Hill in upland of Hono'uli'uli. *Lit.*, swollen stomach (Pukui and Elbert 1986:237). Can also be a place to grieve summoning the deep emotions

that arise from the gut (Pukui and Elbert 1986:237). An 1873 map depicts a *mauka-makai* trail commencing near Pu'u Manawahua, extending through Kapua'i and ending at Ko'olina (1873 Alexander Map)

Waimānalo Name of land division, road and gulch in Hono'uli'uli, 'Ewa meaning "potable water"; also a famous resting place of Kākuhihewa (Pukui et al. 1974:225).

Wai-wanana Name of a place in Hono'uli'uli, 'Ewa in which *kuleana* were claimed (LCA 902); *wai* often pertains to water, though it may also refer to other liquids including liquids discharged from the body (Pukui and Elbert 1986:377). Wanana is indicative of a prophesy or foretelling (Pukui and Elbert 1986:382). The many references by interviewees to fresh water springs in the area, including springs used for family worship suggest a connection between the name and the place.

Kawika McKeague, a member of the O'ahu Island Burial Council and resident of Hono'uli'uli, shares his *mana'o* on the meaning of *wahi pana* and how Hawaiian culture is strongly rooted to their ancestors and *'āina*:

> 1) Spiritual transcendence imbued into physical landscape- there is a fine line of existence and being within the worlds of the ethereal and "reality" within the entire Hono'uli'uli Ahupua'a. This fine line between two worlds of knowing, perceiving, and attaining life essence creates a cultural/spiritual foundation for this area to provide the means for moments of revelation through various sensories. These *ho'ike* reveal themselves through *'ike papalua*, secondary sight/knowledge, *hihi'o, akaku*, and *ho'ike na ka po*.
>
> Even the name of the *ahupua'a* is suggestive of the deep well of knowledge and understanding that comes from the time of Po. Some of the supporting elements to this line of thought of extrasensory "enlightenment" to delve into different plains of being and existence include:
>
> a) Kapo'ulakina'u- (Kapo of the red streaked with dark) the female *akua* that provides inspiration and insight only through one's dreams- her presence demarked by the *ula* rays of the setting sun, which also belongs to Hina/Papa/Haumea;
>
> b) The area of Kaupe'a- the plains of the *ao auana*, where unsettled souls wander and dwell.
>
> c) Hoakalei- area near White Plains Beach- where it is said that Hi'iaka receives vision of the death of Hopoe and the burning groves of *lehua* on Hawai'i Island.
>
> e) Mo'olelo of Kamapua'a- foretells or gives Kamaunaaniho the *ho'ailona* that will reveal his death at Pu'uokapolei- the smelling burning bristles.

2) Sensory exploits of the female persona- you look at the natural landscape and you begin to understand some of the place names are related to physical, emotional, and spiritual cycles that are a natural part of a wahine's passage through and during childbirth. There's multiple loaded *kaona* [hidden meaning] in these place names but there is commonality again in sensory experiences that sustain the cyclic nature between life and death, ignorance and enlightenment, *pō* to *ao*.

c) Pu'umo'opuna- grandchild; offspring; relative or descendant two generations later.

e) Pu'upoulihale- again the reference to *uli*- any dark color, richness of vegetation, of seed banks; also female *akua* of certain sorcery; short for *'ouli*-study of omens; also the name for the developmental stage of a fetus, as the body begins to form. Pouli can mean darkness, sometimes ignorance (modern mental ascription to the night but a more traditional line of thinking could be that of Po, of knowledge beyond the sensory experiences of ao, of being awake, in the light; the knowledge that stems from such a time of antiquity).

f) Akupu- to sprout; germinate; supernatural.

Section 7 Summary and Conclusions

The Waimānalo Gulch Sanitary Landfill was established in 1987. The importation of landfill material over the past fifteen years has most likely eliminated any historic properties and plant resources related to Hawaiian cultural practices and beliefs that may have been present within the bounds of the landfill property. Additionally, the presence of the landfill over the last fifteen years has already precluded any traditionally established access to *mauka* areas through Waimānalo Gulch.

The accessibility of Hono'uli'uli lands, including the present project area, to the Hawaiians for gathering or other cultural purposes would be radically curtailed during the second half of the nineteenth century. As noted above in this evaluation, by the 1870s, herds of cattle grazing across the 'Ewa Plain likely denuded the landscape of much of the native vegetation. Subsequently, during the last decade of the nineteenth century, the traditional Hawaiian landscape was further distorted by the introduction and rapid development of commercial sugar cane cultivation. Throughout the twentieth century sugar cane cultivation was the dominating land use activity within the project area. Cane cultivation – and the sense that the project area was private property – restricted access inside the project area to employees of Ewa Plantation.

The *'ili* of Waimānalo including (Makaīwa, Lanikūhonua, Ko'olina, and the uplands) has been described by community participants in this assessment process as a sacred area of great cultural importance. Many of the individuals contacted or interviewed for this study have expressed concerns about cultural impacts within and beyond the boundaries of the proposed project area. These concerns are based on a traditional view of the Hawaiian landscape as a continuum, in which the *'ili* of Waimānalo is perceived in unbroken relationship between *mauka* and *makai* lands and to the ocean beyond. This relationship is reflected in the oral traditions mentioned by the people of this land, the sites documented within the project area, as well as the many sites *mauka* and *makai*. The current project area is located along an ancient pathway between the *mauka* and the *makai,* i.e., the uplands and the coast. Both of these two general areas contain diverse and abundant resources. This pathway is traversed by Hawaiian ancestors in both the physical and the spiritual form. The *makai* area was rich in estuarine and marine resources including a canoe landing, a *ko'a, ki'i pōhaku* as well as *lo'i* that sustained a thriving fishing village. The *mauka* area is covered with numerous religious cultural sites.

Community particpants have expressed great concern about the Huaka'i Pō Kāne, also known as the Night Marchers, a monthly procession of the spirits of the dead. According to *kūpuna*, the trail of the Night Marchers in this area runs from *mauka* to *makai*. Hawaiian cultural belief is that these trails are significant and must not be impeded for fear of retribution from spirits of the departed. This type of cultural tradition often goes unacknowledged because it is not an accepted part of the dominant Western culture; however it is very real for many people in Native Hawaiian communities. Hawaiian culture acknowledges a spiritual aspect to nature and interprets it in a way that has made certain Kānaka Maoli (native born) very sensitive to natural phenomena.

According to the state OEQC's guidelines for preparation of cultural impact studies, analysis must take into account culturally significant physical and natural features of the landscape. For example:

> Certain landmarks and physical features are used by Hawaiian navigators for sailing and the lines of sight from landmarks to the coast by fisherman to locate certain fishing spots. Blocking these features by the construction of buildings or tanks may constitute an adverse cultural impact. (Office of Environmental Quality Control 2004:47)

Based on the information gathered during the course of this study and presented in this report, the evidence indicates that the proposed project will affect traditional Native Hawaiian stone uprights (SIHP # 50-80-12-6903).

As described in Section 1(Introduction), when the expansion project's CIA consultation was initiated, communication with the project proponents indicated that the proposed expansion area would be 36 acres—the same 36 acres that the project proponents were having surveyed as part of the project's archaeological inventory survey of the expansion area. For this reason, the initial project consultation letters describe the expansion area as approximately 36 acres. It was only later that CSH learned that the expansion area was actually approximately 90 acres. The 36 acres corresponds with the actual foot print of the landfill cells that will be created and used for refuse. Portions of the remaining approximately 90-acre expansion area will be used for the aforementioned appurtenances. Therefore, although the foot print of the proposed area to be disturbed is larger than the 36 acres indicated in the initla CIA consultation, the actual portion of the gulch to be used specifically as a landfill (36 acres) has not changed.

The consultation results contained in this CIA, which refer specifically to the 36-acre area of the landfill proper, will be augmented and expanded prior to preparation of the Final Environmental Impact Statement. The individuals and agencies listed in Table 2 will be contacted again with the new information about the larger project area.

7.1 Recommendations

The following is a list of community concerns and recommendations based on the community consultation process for this CIA for the proposed Waimānalo Expansion Project:

1. If cultural site SIHP # 50-80-12-6903 needs to be removed, a cultural monitor should respectfully care it for. Douglas McDonald Philpotts, Shad Kane, William Ailā, and Eric Enos all agree that the upright *pōhaku* should be removed from its original place during construction, then reunited with its former space and preserved in place. The removal of the *pōhaku* should be conducted in a cultural manner with a cultural monitor and the proper protocols. There should be a preservation plan in place for future cultural access and these community members should be involved in the mitigation process.
2. The traditional view of the Hawaiian landscape as a continuum should be taken into consideration during the planning process. Waimānalo Gulch is perceived as an unbroken relationship between *mauka* and *makai* lands. This relationship is reflected in the traditions of the Waimānalo area mentioned by the community contacts. In this view, any future activity within the landfill property will further distort and diminish the traditional landscape.
3. The *huaka'i pō* (procession of the night marchers) view plane should be taken into account in the planning process. Several community participants in this study stated that

it is very important to keep the pathway clear of visual and structural blockage from *mauka* to *makai* on the east ridge of Waimānalo Gulch and the west ridge of Makaīwa Gulch, in order to allow the *huaka'i pō* to continue. Several participants in this study cited the establishment of visual and physical buffer zones to protect the *huaka'i pō*. CSH recommends this topic should be addressed in greater detail through further consultation with the community.

4. A series of six natural caves and rock overhangs located in the northwestern portion of the project area were examined and documented by CSH during archaeological inventory survey (Dalton and Hammatt 2008). Subsurface testing (excavation) was conducted at two of these features; most do not contain substantial sedimentary deposits. No significant cultural material was observed or discovered at any of these six caves and overhangs; thus, they have not been designated historic properties. However, at least one community participant (see Table 2) has voiced concerns about possible disturbances to burials in these caves. CSH recommends cultural monitoring of any proposed disturbance to these caves by qualified native Hawaiians familiar with the project area.
5. Although the land has been dramatically altered, there remains a possibility that burials and other archaeological sites may be present in and around the proposed project area Efforts need to be made to insure adequate archaeology and cultural monitoring are conducted at this project site. In addition to this cultural impact assessment, CSH is conducting an Archaeological Inventory Survey for this project area that was ongoing at the time of this report's completion (Dalton and Hammatt 2008); its findings and recommendations should be faithfully carried out in accordance with applicable laws and administrative rules governing historic preservation work in the State of Hawai'i.
6. CSH recommends that community members be further consulted about these and other concerns throughout the planning process. Addressing these cultural concerns is part of the City and County of Honolulu's "good faith" effort to minimize the impact of the proposed project on Hawaiian culture, its practices and traditions.
7. CSH recommends that the consultation results contained in this CIA, which refer specifically to the 36-acre area of the landfill proper, be augmented and expanded prior to preparation of the Final Environmental Impact Statement. The individuals and agencies listed in Table 2 (Section 5) will be contacted again with the new information about the larger project area.

Section 8 References Cited

Abbott, Isabella A.
1992 *La'au Hawai'i, Traditional Hawaiian uses of Plants.* Bishop Museum Press, Honolulu, HI

Barrera, William Jr.
1985 *West Beach Roadway Improvements: Archaeological Survey.* Chiniago Inc., Honolulu, HI.

Bath, Joyce
1989 *Waimanalo Gulch Petroglyphs 80-12-4110, Waimanalo Gulch, Hono'uli'uli, 'Ewa, O'ahu.* SHPD File # 0-561, Kapolei, HI.

Beckwith, Martha W.
1970 *Hawaiian Mythology.* University of Hawaii Press, Honoulu, HI.

Bordner, Richard M.
1977 *Archaeological Reconnaissance of the Proposed Makaiwa Gulch Landfill Site, 'Ewa, O'ahu.* Archaeological Research Center Hawai'i, Inc, Honolulu, HI.

1977 *Archaeological Reconnaissance of the Proposed Kalo'i Gulch Landfill Site, 'Ewa, O'ahu.* Archaeological Research Associates, Honolulu, HI.

Bordner, Richard M., and Carol Silva
1983 *Archaeological Reconnaissance and Historical Documentation: Waimanalo Gulch, O'ahu.* Archaeological Research Associates, Honolulu, HI.

Bouthillier, Katie
1995 "Artillery Batteries of Oahu," *Hawaii Pacific Architecture*, April 1995, pp.10-12.

Cleghorn, Paul, and Bertell D. Davis
1990 *Archaeological Paleontological Investigations at the Barbers Point Deep Draft Harbor, 'Ewa, O'ahu.* Biosystems Analysis, Honolulu, HI.

Dalton, Kevin, and Hallet H. Hammett
2008 Draft: *Archaeological Inventory Survey for the Waimānalo Gulch Sanitary Landfill Expansion Project, Hono'uli'uli, 'Ewa, O'ahu, TMK: [1] 9-2-003:073 por.* Cultural Surveys Hawai'i, Kailua, HI.

Davis, Bertell D.
1990 *Human Settlement in Pristine Insular Environments: A Hawaiian Case Study from Barber's Point, Southwestern O'ahu.* Ph.D. dissertation, University of Hawai'i at Mānoa, Honolulu, HI.

Davis, Bertell D., and Alan E. Haun
1987 *Interim Report: Phase 2 - Intensive Survey and Test Excavations West Beach Data Recovery Program, Hono'uli'uli, 'Ewa, Island of Oahu.* PHRI Inc., Hilo, HI.

Day, Frank R., Mrs.
1906 *The Princess of Manoa and other Romantic Tales from the Folk-lore of Old Hawaii.* P. Elder and Company, San Francisco and New York.

Dega, Michael, Randy Ogg, Michael T. Carson, and Lei Benson
1998 *An Archaeology Inventory Survey of the University of Hawai'i West O'ahu Campus, District of 'Ewa, Island of O'ahu, Hawai'i (TMK 9-2-02:01, 9-2-02:03. 9-2-02:05).* Scientific Consulting Services, Honolulu, HI.

Dicks, A. Merrill, Alan E. Haun, and Paul H. Rosendahl
1986 *Archaeological Reconnaissance Survey for Environmental Impact Statement, West Loch Estates Golf Course and Parks, Hono'uli'uli, 'Ewa, O'ahu.* PHRI Inc., Hilo, HI.

Emerson, Nathaniel B.
1915 *Pele and Hi'iaka.* Copyright 1993 by 'Ai Pōhaku Press, Honolulu, HI.

Foote, D. E., E. L. Hill, S. Nakamura, and F. Stephens
1972 *Soil Survey of the Islands of Kaua'i, O'ahu, Maui, Molokai, and Lāna'i, State of Hawai'i.* U.S. Dept. of Agriculture, Soil Conservation Service, and University of Hawaii Agricultural Experiment Station. U.S. Government Printing Office, Washington, D.C.

Fornander, Abraham
1919 *Fornander Collection of Hawaiian Antiquities and Folklore* (T.G. Thrum, Ed.), Memoirs of the Bernice Pauahi Bishop Museum, Bishop Museum Press, Honolulu, HI.

Frierson, Barbara
1972 *A Study of Land Use and Vegetation Change: Hono'uli'uli, 1790-1925.* University of Hawaii Geography Department, Honolulu, HI.

Giambelluca, Thomas W., Michael A. Nullett, and Thomas A. Schroeder
1986 *Rainfall Atlas of Hawai'i.* Department of Land and Natural Resources, State of Hawai'i, Honolulu, HI.

Hammatt, Hallett H.
1984 *Archaeological Reconnaissance at HECO Kahe Point Power Plant (Letter Report).* On file at CSH, Inc., Kailua, HI.

Hammatt, Hallett H.
1991 *Archaeological Inventory Survey of Proposed K-A-I-M Radio Tower, Palikea, Hono'uli'uli, 'Ewa, O'ahu, (TMK 9-2-005:13 por.).* Cultural Surveys Hawai'i, Kailua, HI.

Hammatt, Hallett H., and David W. Shideler
1989 *An Archaeological Assessment for the Proposed Kapolei Business/Industrial Park, Hono'uli'uli, 'Ewa, O'ahu.* Cultural Surveys Hawai'i, Kailua, HI.

Hammatt, Hallett H., and David W. Shideler
1989 *Archaeological Reconnaissance of the Six-Acre Proposed HECO Kahe Training Facility (TMK 9-1-3:27), Hono'uli'uli, 'Ewa, O'ahu.* Cultural Surveys Hawai'i, Kailua, HI

Hammatt, Hallett H., and David W. Shideler
1990 *Archaeological Inventory Survey of the West Loch Bluffs Project Site, Hono'uli'uli, 'Ewa, O'ahu.* Cultural Surveys Hawai'i, Kailua, HI

Hammatt, Hallett H., and David W. Shideler
1991 *Archaeological Inventory Survey for a Proposed Expansion of the St. Francis Medical Center West (TMK: 9-1-17: por. 56), Hono'uli'uli, 'Ewa, O'ahu.* Cultural Surveys Hawai'i, Kailua, HI

Hammatt, Hallett H., and David W. Shideler
1998 *Archaeological Inventory Survey for the Waimānalo Gulch Sanitary Landfill Project Site, Hono'uli'uli, 'Ewa, O'ahu (TMK: 9-2-3:40).* Cultural Surveys Hawai'i, Kailua, HI

Hammatt, Hallett H., Jennifer J. Robins, Mark Stride, and Matthew J. McDermott
1991 *An Archaeological Inventory Survey for the Makaīwa Hills Project Site, Hono'uli'uli, 'Ewa, O'ahu.* Cultural Surveys Hawai'i, Kailua, HI

Hammatt, Hallett H., and William H. Folk
1981 *Archaeological and Paleontological Investigation at Kalaeloa (Barber's Point), Hono'uli'uli, 'Ewa, O'ahu, Federal Study Areas 1a and 1b, and State of Hawai'i Optional Area 1.* ARCH 14-115, Archaeological Research Associates, Honolulu, HI.

Handy, E.S. Craighill
1940 *The Hawaiian Planter, Volume 1.* Bishop Museum Bulletin No. 161, B.P. Bishop Museum, Honolulu, HI.

Handy, E.S. Craighill, and Elizabeth G. Handy
1972 *Native Planters of Hawaii.* Bishop Museum Press, Honolulu, HI.

Haun, Alan E., and Marion Kelly
1984 *Research Design for an Archaeological Survey of Naval Magazine, Lualualei; Naval Communication Area Radio Transmission Facility, Lualualei; and Naval Air Station, Barber's Point, O'ahu, Hawaii.* Department of Anthropology, Bishop Museum, Honolulu, HI.

Haun, Alan E.
1986 *Preliminary Archaeological Reconnaissance Survey for Environmental Assessment (EA) Ewa Town Center/Secondary Urban Center Land of Hono'uli'uli, 'Ewa, Island of O'ahu.* PHRI Inc., Hilo, HI.

'Ī'ī, John Papa
1983 *Fragments of Hawaiian History* (translated by M. K. Pukui). Bishop Museum Press, Honolulu, HI.

James, Van
1995 *Ancient Sites of Hawai'i: A Guide to Hawaiian Archaeological Places of Interest on the Big Island.* Mana Arts, Honolulu, HI.

Kalākaua, David
1888 *The Legends and Myths of Hawaii* (Reprint of three volumes published in 1877-85). Charles L. Webster, New York, NY.

Kamakau, Samuel M.
1870 *Ka Mo'olelo o Hawai'i from Kuokoa.* Bishop Museum Press, Honolulu, HI.

Kirch, Patrick V.
1985 *Feathered Gods and Fishhooks.* University of Hawai'i, Honolulu, HI.

Kirchner, D.P., and E. R. Lewis
1967 "The Oahu Turrets," *The Military Engineer*, Nov.-Dec. 1967, pp.430-433.

Lewis, Ernest
1970 *The Campbell Project, a Preliminary Report.* Ms. in Dept. Anthropology, B.P. Bishop Museum, Honolulu, HI.

McAllister, J. G.
1933 *Archaeology of Oahu.* B.P. Bishop Museum Bulletin 104. Honolulu, HI.

Nakamura, Barry, Jeffrey Pantaleo, and Akihiko Sinoto
1991 *Archaeological Inventory Survey of Proposed Development Parcels D and D-1 Makakilo, Hono'uli'uli, 'Ewa, O'ahu Island (TMK 9-2-3:18 Por.; 75 Por.; 81 Por.).* Aki Sinoto Publishing, Honolulu, HI.

Nakuina, Emma M.
1904 *Hawaii - Its People and Their Legends.* Honolulu, HI.

Nakuina, Moses K.
1992 *The Wind Gourd of La'amaomao, The Hawaiian Story of Pāka'a and Kūapāka'a, Personal Attendants of Keawenuia'umi, Ruling Chief of Hawaii and Descendants of La'amaomao* (Collected, edited, and expanded by Moses K. Nakuina, translated by Esther T. Mookini and Sarah Nākoa). Kalamakū Press, Honolulu, HI.

Patton, Bernice A.
1932 *Legendes Hawaiiennes.* Dessins de J. M. Fraser. Societe d'edition "Les Belles letters," Paris.

Pukui, Mary K.
1983 *'Ōlelo No'eau: Hawaiian Proverbs and Poetical Sayings.* Bishop Museum Special Publication No.71, Bishop Museum Press, Honolulu, HI.

Pukui, Mary K., E.W. Haertig, and Catharine A. Lee
1972 *Nānā I Ke Kumu (Look to the Source).Vol.1.* Queen Lili'uokalani Children's Center, Honolulu, HI

Pukui, Mary K., and Samuel H. Elbert
1971 *Kona Legends.* University of Hawaii Press, Honolulu, HI.

Pukui, Mary K., and Samuel H. Elbert
1986 *Hawaiian Dictionary, 2nd Edition.* University of Hawaii Press, Honolulu, HI.

Pukui, Mary K., Samuel H. Elbert and Esther Mookini
1974 *Place Names of Hawaii.* University of Hawaii Press, Honolulu, HI.

Rock, J. F.
1913 "Indigenous Trees of the Hawaiian Islands." Unpublished MS, on file at CSH, Inc., Kailua, HI.

Schmitt, Robert C.
1973 "The Missionary Censuses of Hawaii," *Pacific Anthropological Records* 20.

Sinoto, Akihiko
1986 *Surface Survey of Proposed Makakilo Golf Course, Ewa, Oahu.* Bishop Museum Press, Honolulu, HI.

Smith, R.F.
1971 "The Results of a Preliminary Investigation of Early Plant Introductions into Hawaii." Unpuvblished MS on file at CSH, Inc., Inc., Kailua, HI.

Soehren, Lloyd J.
1964 *Waimanalo Gulch House Site.* Bishop Museum Press, Honolulu, HI.

Souza, Kēhaulani, and Hallett H. Hammatt
2002 *Cultural Impact Assessment for the Waimānalo Sanitary Landfill expansion of 14.9 acres TMK: 9-2-03:072 & 073, Hono'uli'uli, 'Ewa, O'ahu.* Cultural Surveys Hawai'i, Kailua, HI.

Souza, Kēhaulani, and Hallett H. Hammatt
2003 *Cultural Impacct Assessment in Support of the Proposed Wai'anae 242 Reservoir and Access Road Project, Lualualei Ahupua'a, Wai'anae District, Island of O'ahu (TMK: 8-6-01).* Cultural Surveys Hawai'i, Kailua, HI.

Sterling, Elspeth P. and Catherine C. Summers
1978 *Sites of O'ahu.* B.P. Bishop Museum, Honolulu, HI.

Skinner, Charles M.
1971 *Myths & Legends of Our New Possessions & Protectorate.* Gryphon Books, Ann Arbor, MI.

Thrum, Thomas G.
1923 *More Hawaiian Folk Tales.* A.C. McClurg & Co., Chicago, IL.

Thrum, Thomas G.
1907 *Hawaiian Folk Tales, A Collection of Native Legends.* A.C. McClurg & Co., Chicago, IL.

Thrum, Thomas G.
1886 "Hono'uli'uli Ranch," *Hawaiian Almanac and Annual.* Honolulu, HI.

Thrum, Thomas G.
1906 "Heiaus and Heiau Sites Throughout the Hawaiian Islands," *Hawaiian Annual for 1907*, Honolulu, HI.

Wagner, Warren L., Derral R. Herbst, and S.H. Sohmer
1990 *Manual of the Flowering Plants of Hawai'i,* 2 Volumes. University of Hawai'i Press, Honolulu, HI.

Westervelt, William D.
1915a *Legends of Old Honolulu.* Boston, MA.

Westervelt, William D.
1915b *Legends of Gods and Ghosts Collected* (translated by W. D. Westervelt). Press of George H. Ellis Co., Boston, MA.

Appendix A Shad Kane

Mr. Shad Kane (SK) was interviewed by Cultural Surveys Hawai'i (CSH) at his residence on December 6, 2002. Mr. Kane has agreed to re-use his interview for this project.

CSH: Today is December 6th, 2002. Can you state your name and where you were born and what year?

SK: The name is Shad Kane and I was born on the island of O'ahu and my birth date is February 23rd, 1945. At that time my parents, Hattie Kane and Tazoni Crowningberg Kane, were living at Pearl City Peninsula. I think my mom gave birth to me at Kapi'olani Maternity Hospital in Honolulu.

CSH: We're going to talk about Waimānalo Gulch. What in your opinion is significant about the gulch?

SK: I think what you need to understand, anytime you have a discussion in regards to Hawaiian culture and trying to get an understanding of some of the things we talk about, their significance and the role that they play, one of the most elementary things you need to understand is that our history is a fragmented history. And it's unique in that sense. Our history is a fragmented one and in order to understand that, you need to understand that the ancient Hawaiian history was an oral one. It was a history that was passed on from generation to generation, from families to families. And so a lot of this information was memorized, almost held by certain individuals, whether it was someone important within that community or whether it's someone within a family structure whose responsibility was to preserve the genealogy of a family. But we need to remember that it was an oral history. When Cook first came there were a lot of people living here. And in a short amount of time, by 1920, I think there were only some 20,000 Hawaiians in the islands. The significance of that, the purpose of that, is that so many people died for different reasons. We know a lot of them simply died from smallpox. That's the situation in this area we're talking about – Waimānalo, Palehua, Kaupea, Ko'olina – this whole area. There were significant numbers of people who lived in this area that died for a number of reasons. The challenges they could not deal with, the western challenges. Plus a lot of them died as a result of invasions from outside islands – Kahekili, Kamehameha. So O'ahu's history is one that's almost totally annihilated.

The interesting thing about the O'ahu history is its close ties to Tahiti. Because of the many Tahitian associations with the island of O'ahu. Especially this area, the area we're talking about. After having said that, anytime there's a discussion in regards to the things we're going to talk about, in ancient Hawai'i a lot of things were explained in terms of relationships and that there's many different kinds of relationships. One, the most elementary relationship is the *mauka-makai* relationship. There's relationships between us living today, our relationship with our ancestors. Our relationship with the people, our children who are unborn. Today we don't think about these things but these things were important in ancient history. So, when things were done, when structures were built, or events were played out in ancient culture, it was done with an understanding of these many different relationships.

One of the most elementary relationships in ancient times was the *mauka-makai* relationship. And the reason why I bring this one up is because it plays a very important role in having an understanding of the area surrounding Waimānalo Gulch. It's not to say that it wasn't important elsewhere. It may have been. Or I would say it was important all over, that *mauka-makai* relationship. But what makes this area unique is the fact that we have evidence, we have structures that support that *mauka-makai* relationship. Most places most of these kinds of structures – stonewalls, habitation structures, cultural resources – most places they've largely been disturbed or destroyed. But in this respect, this particular *mauka-makai* relationship, there's, I think, sufficient structures that still exist today that you and I can look, see, feel and touch, that supports that *mauka-makai* relationship. And I think if we had a map, if you were to draw a line from the approximate area that may today identify as Ko'olina – If we were to draw a straight line from Ko'olina to Mauna Kapu you'd find that that passes along the northern ridge of Waimānalo Gulch, goes straight up to the ridgeline at Pu'u Manawahua, and follows pretty much a straight line to Mauna Kapu.

There's several events in ancient history that makes this discussion important. One was, with an understanding of the significance of the *mauka-makai* relationship. Some of the information I'm going to share with you, you've probably heard before from other people that you've come to, other informants. And one of this is Waimānalo o Ko'olina was considered one of Kākuhihewa's favorite vacation places. It's a place where he enjoyed coming to and spent a lot of time there. I think he also had a kahuna by the name of Napuaikamau who served as caretaker of Ko'olina. Now, he liked this place so much that he placed a *kapu* on it. And that's documented. We know that he did this. He placed a *kapu* on this place. Today we have difficulty understanding this kind of cultural information. And we've lost the ability to appreciate ancient Hawaiian thought. But the significance of what he did there is that during this period of time, when one places a *kapu* on a shoreline that *kapu* extends out into the ocean and that *kapu* extends up to the tallest mountain in that lineal relationship.

CSH: The whole *ahupua'a*.

SK: The whole *ahupua'a*, that lineal relationship. So the *kapu* is not one spot. We think of it in terms of this one beach but no, in ancient Hawai'i it was not just the beach. Because the ancient understood that all the things up above and everything out in the ocean, surrounding area, impacts this particular site. So when he placed the *kapu* on it that *kapu* preserves the landscape. So he did this. Don't hold me to dates but I think Kākuhihewa lived around the 1600s, around that time. So this particular *kapu* is that old. Now the *kapu* extends up to the tallest mountain in that area. The tallest mountain in this lineal relationship is Mauna Kapu. Now there was another documented site that myself and Nature Conservancy and a bunch of other people tried looking for a particular site or small *heiau* that was built on the slopes of Mauna Kapu. It's in Sterling and Summers' *Sites of O'ahu*. I think it's McAllister's – It's referred to as a *heiau* but it was a small one. I think it was four feet by six feet so it must have been something small, a small little platform. But perhaps they may have had a koa on it or a shrine. But the significance of

this particular structure is not so much its size but the location that it was built, and when it was built, when it was laid out. This particular *heiau* which is one of the few – and the only one that I know of – I don't know about any other this particular small little platform was built of both basalt and also coral. Which is unusual. Now to most of us today, that will go right by us. But the significance of the coral is the fact that it ties Ko'olina to this place. So what it does, it provides supporting evidence for the idea of the *mauka-makai* relationship in ancient Hawaiian times. Now, this lineal relationship, there's a number of documented sites and there's a whole bunch of undocumented sites within this lineal relationship between Mauna Kapu and Ko'olina. There's one undocumented *heiau* that's maybe a hundred feet by hundred feet. And its walls are probably, if you take into consideration the amount of erosion and the amount of soil that's been deposited within the *heiau*, it's about four feet – the walls sticking up above the surface. So depending on where the cultural layer may be within this structure, we suspect within this whole one hundred by hundred feet, the cultural layer may vary from perhaps just a few inches below the surface to maybe a foot to two feet below. That being the case, the walls and inner walls would be perhaps, it's probably like around five or six feet. So it's a substantial structure that exists today.

The only documented information up here is Mauna Kapu. Now between Mauna Kapu and Pu'u Manawahua there's a whole bunch of undocumented sites. But before we get to that, let me just share the information on this particular structure. It's about a hundred feet by hundred feet. The walls perhaps four to five, maybe six feet. The interesting thing about this particular structure is that it has enclosures on four of the corners. And there's also shrines. That's very obvious, even to someone who doesn't know anything about Hawaiian cultural resources. There's a central stone in this particular structure. The stone is facing almost due north. So, some of the people that I've shown this site to, there's several opinions about it. And the thing about Hawaiian stuff is that I don't think anybody can really say with certainty today what we're looking at. So what we try to do is to share the information. And we try to get each other's opinion in regards to what we may be looking at. And we try to come to some kind of consensus amongst ourselves where we can agree on with respect to what we're looking at. With respect to this particular *heiau* I think most of us agree on it serving two purposes. One, it may have been a navigational *heiau* because of the central stone. And there seems to be a lineal relationship, the way it's set up, in the rising and the setting sun. Now, in addition to that, that supports the fact that it may have been a navigational *heiau* is the fact that, when we think of all major islands, there's places on the south side that is referred to as a point of departure. For example, on the Big Island, South Point, Ka'ū, the shoreline and the rocks. Kaho'olawe. Kealaikahiki Channel. It's all on the south side. So, likewise, this is basically the same kind of location with respect to the other islands, when you compare all the other islands. Now what makes it interesting is the fact, again, is the Tahitian connection with the island of O'ahu. Kūkaniloko is built here, the island of O'ahu. I think Marion Kelly refers to 'Ewa as the celebrated land of our ancestors. And other people too make references to 'Ewa as the land of the ancestors. And when they use that term ancestors, they refer to our Tahitian ancestors. There's a lot of Tahitian associations, Tahitian stories that's associated with this region. There's also structures associated with this region. I'm just trying to give you some understanding of the connection with this

heiau, what it may be, and that it may have been a navigational *heiau*. In terms of pointing the way home. There's a number of structures in Kalaeloa, the former Naval Air Station Barbers Point, an area that we know had the ancient name Kanehili. But the interesting thing about all the structures in the former Naval Air Station is the fact that not only is it made entirely out of coral, but when you take a look at some of the structures – For example when you take a look at the habitation structures and you take a look at one particular *heiau*, you find differences in the construction. Most Hawaiian stone masonry, dry stone masonry, the stones are laid flat and they tend to lock in the corners. Tahitian stone masonry, what they simply do is they take upright stones and they stand them up on the outside and they fill them up. And this particular *heiau* and some of the structures in Kalaeloa, what you find is an integration of Hawaiian stone masonry and Tahitian stone masonry. So it supports the Tahitian idea that they're associated with this region. There's a number of *mo'olelo* that ties us to Tahiti. One that really makes it clear is the story about – Kahai is one of the Tahitian chiefs who's credited for bringing the first *ulu* tree to the island of O'ahu. There's different stories, different places where he may have planted. But nevertheless the stories are real stories. And there's one particular story that refers to – It's a story about Nāmakaokapāo'o, who's the son of Kahai. You also need to understand that Kahai is also the son of Mo'ikeha. And Mo'ikeha is the brother of Olopana, who was killed by Kamapua'a. So you got to feel of how everything fits together. So, in this particular story, apparently Nāmakaokapāo'o and his father Kahai were somehow separated when he was young, as a boy. And he goes off and he lives his own life. And the story is that Kahai takes his *'ahu'ula*, his feather cape, and some other items and buries it beneath the *ulu* tree somewhere in this particular area. And the story is, if Nāmakaokapāo'o wanted to know his father, he would need to seek out an ulu tree and look for the father's *'ahu'ula.* And if he finds it, then he would know who he is. Okay, Kahai's name is – Hawaiians in ancient times, their names were long. So Kahai is also referred to as Ka'ulu o Kahai, the ulu tree of Kahai. If you say that name quick enough it almost sounds like Kualaka'i. So Kualaka'i may be a corruption of the word Ka'ulu o Kahai. So Kahai is credited for going to Tahiti or to Samoa and getting that ulu tree and coming by way of Tahiti and planting it at a place called Kualaka'i in Barbers Point Naval Air Station, which we know of today as Nimitz Beach. Now the significance of this story is that Nāmakaokapāo'o needs to find out who he is. And the deeper meaning to this is not just Nāmakaokapāo'o to find out who he is, it's for all of us to find out who we are. The story is, he did not go to Tahiti to get the *ulu* tree. He went to Samoa to get the *ulu* tree. Now this story is not unique to just Hawai'i. It's a story you find all over the Pacific. The story may vary a little-bit. But the significance of the *ulu* is the fact that it's viewed as, it's symbolic of rebirth or renewal. That's the significance of this story. The significance of the story is that we may have come from Tahiti but if we go back farther, we came by way of Samoa. I think only recently are we beginning to realize that the migrations of the people into this region came by way of Samoa. There's actually two migrations I think. One from this region and one from further up north.

Getting back to the *heiau*, because of our oral tradition it's so important that our children – If we take ourselves back– three, four hundred years ago – it's so important that our children know where you came from. So we need to know – if you got to go home – where home is. So that's the significance of navigational *heiau(s)*. This particular *heiau*,

like others in our islands, is pointing the way back home. Within this *heiau*, in addition to enclosures of the four corners and the central stone, on one side there's a lot of stones that we feel we're looking at just the top of them. If you look at this particular *heiau*, at least for me and my friends who are close to me and who look at this kind of cultural resources, we try to look through what has been disturbed and look for undisturbed sections of the *heiau*. So, if the cultural layer is about a foot down, and we got a stone that's buried within a major portion of this *heiau*, and it's buried in that cultural layer, the first thing that comes to mind is it was put there. If it's on the surface, our best guess is that it doesn't belong there. It just somehow ended up there. But there's a whole row of stones. And they kind of run *mauka-makai* and they run, as you're standing from the top stone and you're looking *makai* at these stepping stones in the *heiau*, you're looking southwest, that general direction. Not that it may be accurate but in a symbolic term it's important. Because, if in fact these stones were placed there, they were placed there for a reason. Because everything else in this *heiau* is cleared with the exception of the central stone. But, if in fact, the central stone and you got this series of stones on one side, in a row – If it's a navigational *heiau* there would be a map there. So we were searching for a map. And one particular stone, initially we thought had represented the island of O'ahu but it would be an excellent stone to represent all of the islands because of similarities with all the islands. Similarity – Not so much Kaua'i, because Kaua'i is an older island. It's been further eroded. However, when you take a look at O'ahu, Maui, the Big Island –

Much of what I'm sharing with you I realize it's hard for you to get a picture of what I'm saying. There's one particular stone that's maybe two and a half feet by two and a half feet. And it's shaped like the island of O'ahu in a sense that what you have, you have two high points in the stone and you got a saddle in the middle. One high point, in our opinion, represents the Ko'olaus. The other high point represents Wai'anae. The saddle represents the central plains of O'ahu. You use the same thinking, the other islands. Maui – West Maui mountains and Haleakala. The central plains representing the center of the island. Same stone can represent the Big Island, representing Mauna Kea, Mauna Loa, Hualalai and the saddle. In a sense it could also be representative of Moloka'i, but perhaps maybe not as clear. Likewise, Kaua'i because Kaua'i has been much more eroded. But our opinion is we're looking at the best representation of the islands, of all the islands. And this if this is a navigational *heiau* a map would be important. Now, when we look at this particular stone, and we're standing on the island of O'ahu and we're looking south, behind us is several stones embedded in the cultural layer. As we're looking at the other stones in the cultural layer, the first thing comes to mind – And every one is interesting, when you look at it. One has a big hole in the center and, in our opinion, it perhaps represents an atoll somewhere south of us. And then there's other stones, in our opinion, represent way finders or voyagers that they used, places to pick up on their travels. In addition to using the stars, these were stops that they would use to find their way around. So, in our opinion, because of all of this – the stones, the central stone, and everything else – we feel this may be a navigational *heiau*. One of the other things that we think that this *heiau* was used for – as a place of sharing information, because of the enclosures, four enclosures on the outside corners. On these enclosures we have four walls, elevated platform with upright stones that's a part of the elevated platform.

CSH: Did you say the walls were four feet high?

SK: The main structure – about a hundred feet by hundred feet – it's almost a perfect square. That particular wall, in some areas right now it's about four feet. But our thinking is that a couple hundred years of erosion – Our thinking is that some of that the walls are buried. So our best guess is that maybe this structure is about four feet from the inside. But the corners is what makes it extremely interesting because in the corners we have enclosures that's built onto the outside corner. And it's a very obvious enclosure. It's not a habitation structure. There's an elevated portion on it. We suspect if were to clean it out we'd probably find smaller stones on the top. There's very obvious shrines and *koas* that's associated with elevated platforms. But one of the other things we feel it may have been used for was a place for passing on information. Whatever that may be. That may simply be somebody sharing navigational information. Or it may be somebody sharing medicinal information. Or it may be somebody sharing religious or genealogical information. Whatever that might be. But it's very obvious that it's a place for sharing important information. Elevated platform, the *koas*. In our opinion the *koas* obviously serve as a podium. The *koas*, in our opinion, because it's oral history, it's very important that when you speak, you're heard. So you want the people you're talking to, you want their attention. If you're going to say something, they need to hear what you're saying and they're going to have to remember it because you're not going to say it again. These structures were built in a manner to get one's attention. So, in other words, when that person, whoever he is, who's standing on this elevated platform and speaking, is not speaking alone. He has others with him. He has a *koa*. He has his ancestors and everyone else. People know that in ancient time. We don't understand this kind of thinking today. We're getting lost but our *kupunas* knew this. So they understand how important it is to remember, how important it is to speak that's what the Niho Palaoa is. It gives one the authority to speak. Something so simple yet we don't understand how important it is to speak and be heard. These simple things was so important to our *kupunas*. So when they built these kinds of places, unless you have that kind of understanding you don't know what you're looking at. If you look at it in scientific terms, it's just a bunch of stones sitting there. And if you can understand the thinking three hundred years ago, all of a sudden the bunch of stones become – Oh, it's very interesting, all of a sudden. And you see that if you have that kind of understanding and you go to this place. And you look at these stone structures. It shouts out to you what these are. So these four enclosures, in our opinion – It's not Shad Kane's but a bunch of other people who've sat down and talked about – It's very obvious it was a place of sharing information. What makes it very special and this ties it to Waimānalo Gulch – If you take a look at this map, take a look at this photograph, all these gulches here, you think of this place as a barren region. As a matter of fact, one of the reasons why they chose Waimānalo Gulch is because of water. Right? Today the most obvious thing when I look at this is that there was water here. In order to gouge this thing out, there had to be substantial amount of water. Okay, getting back to the *heiau*, there's many – You read *Sites of O'ahu* or you read a lot of the other stories with respect to this region, you find out there's a lot of stories with respect to water, a lot of stories with respect to springs. This *heiau* – Two of the *makai* – This structure is kind of – It's not perfect flat. One portion, the *mauka* portion, there's an entrance on the *mauka* portion and there's an entrance on the *makai* portion. The two

enclosures on the *makai* portion, they have *tī* leaves growing in them, full-grown *tī* leaves. So we know they've been there for a long time. Another thing about *tī* leaves, the significance of *tī* leaves, is the fact that we know it's difficult to propagate from seeds. So somebody had to stick them in the ground. And we know it wasn't a cowboy. And we know it wasn't anybody recent who did that. So we suspect it had to be one of the *kūpuna* that planted it. Now, on one of them, the one on the Wai'anae side, there's the full-grown *tī* leaf and there's a whole series of boulders on the *makai* side of this enclosure. Now, most people, most of our *kupunas* in ancient times, when they built structures, from our experience in looking at them, they were basically geometrically shaped. We find them like square, rectangle, or triangle sometimes. They were basically geometrically shaped. In some cases you might find something that's round. But not very often. Normally square, rectangular kind of stuff. But not very often you're going to find an irregularly shaped one. Amongst those boulders, where this old-grown *tī* leaf is, there's an irregular-shaped wall. And we've had several people come up and take a look and try to figure out what the heck is this irregular-shaped wall. Because we know they don't generally build something like this. And one of the people that came up was a lady by the name of Mikilani Ho. She's a Hawaiian archaeologist and she has a number of publications out. But she's considered an expert in petroglyphs. So she came up and took a look at it. But she was there to look at petroglyphs. Because our thinking was, this *heiau* is on a trail, *mauka-makai*, so we're looking for petroglyphs to support the trail idea. So she came up there and she came up with something totally different. And when she brought this up, everybody seemed to understand exactly what she said. And when she took a look at this irregular shape wall, she said it was used to contain water. It was not necessarily used to stop it, but it was used to slow it down. But she was saying that was the beginning of a spring. And when you walk through the grass below the spring, this wall, was a riverbed. It's a riverbed that went all the way down and dropped off on the side of the wall that drops down into the valley. Not to say that's the only spring. There may have been hundreds. But what she said is that this *heiau* was built on a series of springs. And we tried to understand – When we first started looking at the amount of effort – It took apparently a lot of effort to build this one structure. We can't imagine people putting in that amount of effort and not having water. So the feeling is that this particular place is built on several springs. On the opposite side, the other enclosure on the Honolulu side, similar situation. Series of boulders, no wall, old-grown *tī*. But when we started walking through the grass there's a dry riverbed that goes all the way down. Stones all over. On the sides it's dirt but as you come into the lower area depression it's all stones – river-worn stones. So, the feeling is that this particular area was built on water, built on several springs which supports the fact that at one time there might have been a substantial amount of water that actually created Waimānalo Gulch. I've shared a whole lot of information on only one structure. I don't know how much time you have but that's only one. There's some other *heiaus* up there. Now you might be wondering how come it's not documented. We don't know. We don't know why it's been hidden. But what we do know is that it has been hidden for a long time and it's only been recently that it's been found. And it's buried under California grass and weeds for the longest time. There's a whole story on how we found this but that's another whole story, how it was found. Now the big question mark is what happened? Why is this a place that was totally disappeared.

And what makes this whole place up above the landfill important is the fact that nowhere else can you find a place in all the islands where you find so much cultural structures that supports that *mauka-makai* relationship. Below this *heiau* there's other enclosures. Marion Kelly referred to one as a *heiau* – two of them she referred to as a *heiau*. They're small. One I would say is about thirty by thirty feet. It's a terraced structure – a lower portion, upper portion. The lower portion is all paved with stones. The upper portion is paved with small stones, *'ili'ili* stones. And the lower portion, there's an upright stone that's actually laying on its side but we suspect it may have been standing up at one time. There's another *heiau* further down the valley, directly in line with Waimānalo Gulch that's set up – This particular structure – We got the opinion of *kumu hula* John Kaimikaua because John Kaimikaua – He's not too familiar with the O'ahu tradition but he's very familiar with the Moloka'i tradition. So when he speaks, he speaks in terms of what he knows of Moloka'i. But our thinking is that there may have been similarities here. Now, Moloka'i, they have several *hula heiaus* that are still in place up there. And, in any case, the *hula heiau* is built on a slope. It's built on a hill. So there is one *heiau* that's up above Waimānalo Gulch that's built on a slope. And I would say it's about fifty feet long and then it goes into the hillside, because it's a slope. So it has a high wall. In one portion the wall, I would say, is maybe about twelve, fifteen feet, on the slope side. Then the paved portion actually disappears into the hill. We suspect that because of the amount of erosion, we suspect that the paved area may be a little bit bigger. The actual exposed portion of this paved area is maybe about twelve feet. Maybe a little bit more than that. But we suspect it may go further in. The actual length of this particular structure is about forty, fifty feet long. And what makes it interesting is it looks like they gave up building it because we can see a portion of it that they did not finish. So we're actually looking at the inside, not the finished wall. Which makes it interesting because I can't think of anyplace else where you actually have a *heiau* that stopped being built while it was under construction. They decided to stop. Why they stopped, we don't know. But John Kaimikaua's opinion is that this is a *hula heiau* we're looking at. And Marion Kelly said the same thing. Marion Kelly looked at it. She supported that it's a *hula heiau*. Simply because it's on a slope. And both Marion and *kumu* said that in ancient times what they used to do, is that so that everybody has an unobstructed view, they go on a hill. And you watch across the hill to watch the performance, whatever the performance might be. So it's that kind of place. That's one. And there's a whole bunch of other structures in this particular area. And anyway, is that enough? This is just supporting information with respect to that *mauka-makai* relationship. And these are structures that are there today, to be seen. I'm sure that in time more people will be able to have a chance to take a look at it.

CSH: Can we talk about the trail that goes from here to the ridge?

SK: Okay, a lot of the information that I shared too are things that you can actually find from different resources. And this is one. In ancient times there were several trails that people would take to come from Honolulu to come to this side of the island. I think there were three ways to get to Wai'anae. One was by way of Kolekole Pass. One was by way of Pohakea. Another was by way of Pu'u Kapolei. Three trails. Obviously, another one along the shoreline which was the longest way to travel. Farrington Highway is very

obviously a trail. Now, in the context of Waimānalo Gulch, what makes this extremely interesting is the fact that there's a series of petroglyphs that was preserved by the developer of Ko'olina or West Beach Estates. When they first started developing – There were a number of archaeological surveys that were done early on. And one of the key persons was Aki Sinoto. I've read a lot of Aki's work. Very interesting cultural information that he found – that whole area over there. And several other people. The interesting thing is that the first archaeological survey that was done was 1930 by Gilbert MacAllister. Between 1930 up until the '70s nothing was done. So 1970 was the start of all this discussion in regards to building in this whole region. And because of the requirements for the EIS and doing a cultural assessment – All of a sudden, since the 1970s until now, and the development of the Campbell Industrial Park and Kapolei and the resort area, we had all these archaeological surveys that came up. So Aki Sinoto is one of them, amongst others. But one of the things they discovered is the fact, in addition to all the information in the lower plains, in addition to the sinkholes and the bird bones, they also found what I think they refer to as the alluvial level or the higher elevation up above the coral plains. And what they found, they found habitation structures, they found burials, and some petroglyphs. I think they actually found two. I think they found one that's actually inside Waimānalo Gulch, up on the higher ridge. I've never seen it. Another one they found that was preserved at the entrance to Ko'olina. Now the interesting thing about petroglyphs is that most of them are built identifying trails. And you find them along ancient trails. And the significance of these particular petroglyphs here is that it actually defines the intersection of two trails – Farrington Highway and the *mauka-makai* trail. That *mauka-makai* trail is supported by everything else that I've shared with you in respect to the cultural sites up above. We need to understand the significance of that *mauka-makai* relationship because that was one of the relationships in ancient times. In ancient times, it was matter of life-or-death resources. It was food. So it was establishing that relationship between the people up above and the people at the ocean. So these were your closest friends. These were the people – So you don't have to go dive for fish. You just go down and you take what you got to share. You get fish from people down below. So these were your neighbors. So obviously there would be *mauka-makai* trails all over the islands. The significance of this one is the fact that you have structures that supports that idea, that's still intact today. And the petroglyphs along Farrington Highway is one of those supporting pieces of information.

CSH: We need to document access. So when you guys go up there, which way do you guys go?

SK: In terms of gathering resources today?

CSH: Or to go up to these places up here, up to the *heiau* that are undocumented?

SK: We go through Palehua. That's why I say I've hiked most of it. The only area I haven't hiked was actually the stretch from Farrington Highway up to the Timberline intersection – of the Palehua and Timberline.

Sometimes when you've seen a lot of different structures, and you have something to compare it to, a lot of time all you need is two or three stones to get an idea of what might have been there, that might still be intact. So a lot of times we just look at the surrounding area. If we find two or three stones that seems to be aligned and then we look down slope

and we start seeing stones scattered all over the place down below – And if it looks like a place that may have stopped some erosion or it may have been a place where soil might have come down and then hit an obstruction that caused soil to deposit, then there may be cultural information buried there. But then when you look at a slope, you look at an area, you can tell whether the soil passed over it and went further down. Or may have stopped up against an obstruction. But you can only get a feeling for this by actually walking up and looking around.

CSH: Did night marchers come up in any of the stories?

SK: No. I know a lot of stories associated with that. Especially this area right here. And the significance of this area in terms of night marchers – You want me to share a little bit about that? One of the things we've done and we're still trying to do, we're trying to get support for restoring the ancient Hawaiian names. And I think that's happening all over the place right now. We've been able to restore one name so far. We've been able to change the name of Barbers Point to Kalaeloa. We did that. We changed that. But there's other names we want to change, to restore. There's a lot of them in this area. The significance of ancient names is the fact that – There's a lot of stories, mo'olelo, there's a lot of resources, legends, all these stories refer to different places by name. When you read these stories you don't know what they're talking about unless you know where the places are. So the thing is that we do have a history but it's hidden in ancient names. So in order to get people to understand that every area of this island, of all the islands, there are stories and histories of that place. But it's hidden. So one of the names of this region is Kaupea. And there's actually two ways of defining Kaupea. In order to understand the significance of Kaupea is kind of understanding how ancient Hawaiians thought in terms of life, death and sleep. Our *kupunas*, the ancient Hawaiians, believed that life, death and sleep overlap. The thing is, trying to explain this in western terms is hard because there's no real word to explain it. The words may be confusing so try to see through the words. In ancient Hawaiian there's two energies in all of us. One was defined in terms of the dream spirit. So when you go to sleep, when you dream, our *kupunas* felt that that dream was something real. In other words, you had actually visited – Your dream spirit would leave your body and travel. And you had an opportunity to visit different people. You may have an opportunity to visit a departed loved one, a grandmother. So if you were a pregnant lady and you woke up in the morning and you had a dream about your grandmother or your great-grandmother and she shared a name with you, you took that seriously. You actually visited her. She's telling you this is what you should name your child. And, likewise, if you were a *kahuna la'au lapa'au* and you dreamt about someone sharing thought with you in regards to using a particular plant to serve a particular purpose, you took that seriously. That was real to you. Somebody's giving you good information. Now, in order for you to wake up from your sleep, that dream spirit got to come back. Because the other energy within you is the energy that supports all your life functions – your breathing, your heart, your circulation. Without that dream spirit coming back – That simply defines death. You die. So that's why in ancient times when the first sailors came over here, they would come across a family, they would be chanting over the body. What they're doing, they're trying to get the spirit to come back. We refer to it as spirit but it could also be – We could also look at it in terms of one's spirituality. In a

Christian sense – I hate comparing Christian with Hawaiian thought but sometimes in order to help some of us today to understand, sometimes we need to do this. But we all as Christians today know that we all got souls. Is this what they're talking about? Now, what they also believe is – Say your dream spirit would not come back and you're basically dead, the ancient Hawaiians felt that if you were respectful of your *'aumakua*, you were respectful of your parents, you were basically a good Hawaiian, you had the benefit of your *'aumakua* to carry you somewhere. Take you to a place that is referred to as Laina Kauhane. Every island has it. On this island, the one that I know of for sure is the leina stone of Ka'ena Point leinaaka'uhane. The interesting thing about that stone is that it follows the ridge line of the Wai'anae Mountains. If you look at the map and you follow the ridge, the peaks all the way, and you come down Ka'ena Point, right down the slope, you land right on the *leina* stone. Now if you follow that same ridge line back up the mountain range and you come all the way across these mountains over here, you come straight down, you come right down to Kaupea. Pu'u o Kapolei sits right at the bottom of this hill. Kekuapo'i, when she wrote a kanikau with her husband Kahahana, one of the things she said in this very lengthy kanikau, she said that her husband's spirit entered that *milo* by way of Pu'u o Kapolei. Us trying to understand what she said, and having talked to a number of different people, she was saying that perhaps Pu'u o Kapolei is a conduit to another world, right in the middle of Kaupea. Okay, so on one end you got the leina stone and on the other end you got Pu'u o Kapolei that may have served as a conduit also, surrounded by Kaupea. Now, if you're respectful of your *'aumakua*, you will have the benefit of them taking you to a *leinaaka'uhane* and helping you leap into the next realm, a better place. If however, you were not respectful of your *'aumakua*, you were not a good person, you were a sinful person, you would not have that advantage. So our *kūpuna* felt that in that case you would be banned to barren and deserted places such as an Aokuewa . Aokuewa is a place of wandering spirits. Aokuewa is Kaupea. So, if you did not have the advantage of getting to the next realm, you would be doomed to live at Kaupea right back here. In a Christian sense, you got heaven, hell – You got one more place. The third place is purgatory. Okay, in Christian thought, purgatory is somewhere else. We don't know where but somewhere else. Our *kūpuna* said purgatory is here. Kaupea. Is Kaupea purgatory? So a lot of the stories that's associated with night marchers, most of them are associated with Aokuewa. These are the places that these kinds of things happen. To make it more real for you, in the context of what we're talking about here, I just retired from the police department a couple of years ago. So I've read all the police reports. That was my job – reading all these kinds of police reports. More than anyplace else on the island of O'ahu, the police reports over here were the accidents. We had so many unexplained accidents right along this intersection, passing through Kaupea, where we can't explain why the guy decided to make a ninety degree turn – No alcohol, the guy's okay, not a wacko, an average citizen, he just decides to make a right turn and drive off and hit the telephone pole and kill himself. So many. In addition to that, some of the recent information is that when they first started building the Kapolei Middle School, they spent I don't know how much money – Because the Kapolei Middle School is a high-tech school, it's all air conditioned, and every classroom has computers. So they spent a lot of money on a security alarm system in certain rooms because of the amount of computers, the amount

of stuff in there. They got audio, they got video monitors in the rooms. Not just sensors. Not just motion detectors. Not just that. But they also got audio that triggers, and they got video monitors that kick on in certain rooms. When they first opened up they had an incident – one o'clock, two o'clock in the morning – where it's monitored by somebody at the main office in Sand Island. This particular lady was watching this monitor. All of a sudden this red light comes on and she checks and it's an indication that someone is breaking into a room at Kapolei Middle School. She puts on some equipment and then video comes on. And then audio comes on. And she hears kids having a good time in the room. Lot of noise of kids yelling and screaming. And when she puts the video on she sees figures moving around. It's dark in the room but she can see little figures moving around. So she calls the principal. She calls 911. She calls everybody, the custodian. The principal lives in Kailua, drives all the way out there. The custodian gets there. They go in the room. They open the door. Nothing in that room. Everybody's upset. Check with the lady. The lady says "I got the video." They go into town. She switches everything on. Guess what? Nothing. That's typical of these kinds of places. Now, when they first shut down Barbers Point Naval Air Station they had to hire private security guards. And they had a hard time keeping them. Because the security guards – When the Navy moved out, they had a lot of abandoned buildings. The security guards were chasing children around in these abandoned buildings. And then the kids would disappear in the locked room. They go in the room, open them up, nothing. I mean, these guys were so scared, upset about it, that they actually called the police department. Most people, when that happens to you, you just – and don't call the cops. But these guys took it so seriously, that they were certain the kids were there that they called the police department up. Similar stories happened at the water park. The new building they just built, Kapolei Hale, they must have blessed it two or three times already. There are stories about that place – about drawers being left open and stuff like that. But, anyway, these stories that I've shared with you are recent stories that go way back. But they're typical of Aokuewa's around the island. That's what Kaupea is.

The next thing about Kaupea. The name Kaupea, if you take it literally, refers to the Southern Cross. One of the constellations that the Polynesian voyagers used in their travels, both north and south, is the Southern Cross. The Southern Cross is a very important constellation. It didn't necessarily tell them what to look for but it told them if they're going in the same general direction. So, in other words, the higher latitude you go, the Southern Cross is lower on the horizon. The farther south you go, the Southern Cross is higher up above you. So it basically tells you whether you're moving in the right direction. If you're going south, then you should see the Southern Cross. It should get higher up in the heavens. So, the ancient Hawaiians, when they did things they lined everything up. Not only did they line up heiaus, the *mauka-makai* relationship, the rising sun, the setting sun, structures – They're all connected. And what they also did, the *ahupua'a* lines, the *'ili* lines, also had a significance. We suspect – and not just me but I think I talked to Marion Kelly and a bunch of other people – These are things that we lost. Agriculture came in and they started bulldozing they destroyed all the boundary markers and things like that. So we have no idea where Kaupea may have been. But because of the name, because of the name Kaupea, we suspect that it may have been a marker pointing to the Southern Cross. So these are the places that surround Waimānalo

Gulch. So I'm talking about this because it's important to us. It's important to us as Hawaiians. And it's important for us to have a sense of direction in our lives. And it's important to us in terms of connecting with our *kupunas* and being able to share this information with our children. It's not about us. It's not about you and me. It's about everybody after us.

CSH: Thank you.

Appendix B Douglas McDonald Philpotts

Interview took place on August 12, 2007 at Douglas McDonald Phillpott's *hale* in the *ahupua'a* of Hono'uli'uli and the *'ili* of Waimānalo. Interview conducted by CSH staff Kēhaulani Souza and K. Lehuakeaopuna Uyeoka.

CSH: Can you please tell us your full name and your connection to this area?

McD: My name is Douglas McDonald Philipotts, but I go by McD. I live in Pālehua and I've been here since 1970, July 1st, which happens to be my 12th birthday. Prior to that we lived at what's now Paradise Cove next to Lanikuhonua. This is where I learned to swim and took my first steps. Lanikuhonua was my great grandmother Kamakila's house; her parents James and Abigail also had their ranch house in Hono'uli'uli so my children are now the sixth generation here. I also believe are Hawaiian genealogy from Kauai comes back here many generations earlier.

CSH: What are some of the sources or who are some of the people that have shared knowledge with you about this place?

McD: I've gotten most of what I know from just being here, and having an intense interest in the place and its history. I think compared to most places very little has been written about this area. Ida Von Holt's *Stories of Long Ago* is probably the best historic material I've read about this area. *Sites of Oahu* contains some material on this specific area - however it's also self-contradictory and very fractured. Kehau, the land claims you have provided me along with *mo'olelo* from Kupuna like Analu's, stories of the five brothers and the night marchers are also very insightful. Many old maps showing historic water tunnels and reforestation efforts also help to understand the water resources that were here to support pre-Contact populations. Ida's son Herman Von Holt also shared many stories of this place with me; he also spent most of his life on this land and like his father became manager of the Campbell estate for some years. Jimmy Greenwell who was the manager for Hawaii Meat Company, the ranch here in the 1930s and 40s, also had lots of good information as well as building its ranch house that we live in. But by far the greatest resource to share with me has been this place and to have the great fortune to spend a lifetime and now raise my children here.

CSH: Can you share with us your *mana'o* about why this place is so special?

McD: Whether you're a spiritual person or not you will be impressed by the sheer beauty of this place, and the spectacular views from here. But many who come here are surprised by the sense of mana here. The view is special here, from the top of Pālehua between Pu'u Manawahua and Mauna Kapu you can see all the islands and all of the mountain tops on those islands, this is the only place in all the islands you can do this. Hermann von Holt showed me the trench that still remains on the Honolulu ridge of Mauna Kapu and said another one in the south was taken out when the road was put in. It was right where the big blockhouse is now. Herman said they were told by the Hawaiians in the ranch camp

at Hono'uli'uli this was a most sacred place, and the place of great mana, and that is why I think the Hawaiians lived here and their spirits never left. This could be part of the meaning in the name Pālehua. In addition to the unique view of the islands I have observed the annual journey of *lā* from here. It starts on the first day of the celestial year on the winter solstice. At sunrise the sun can be seen rising from its house Haleakala as it begins its journey northward it rises from the west Maui Mountains and then from East Moloka'i. Reaching O'ahu it rises from Koko Head and moves from peak to valley north through the Ko'olau's reaching its destination Mokumanamana in exactly half a year. Then on June 21st, the summer solstice, the sun sets behind Kaua'i and starts its journey back home. On this solstice line connecting Haleakala, Pālehua and Mokumanamana are also several *heiau*. Twice a year on the equinox the sun sets over Pu'u Heleakala. To me these and many other things seem to be more than coincidence.

This area has great value in the collective because there is a window into the life of our culture pre-Contact. It's not just about how they built their house sites, what's important is where they built their houses in relationship to where the water was located. They built their houses out there, in the wind, with the risk of it blowing away in a big storm, because they wanted the view. The five brothers, the watchers, their house sites are still there. It's all about the view. How can we relate to these stories if the house sites are gone, or if you don't know where the spring is, or if you don't know where their food was? This is the whole picture, like that beautiful *ahupua'a* poster that Kamehameha Schools has, and it is right here you can walk on it! Due to the land use being limited to forestry, watershed and ranching, the area's pre-Contact archaeological sites have been preserved. For those who have an interest in really understanding or trying to step back in time, just for a moment, for a visit, they can. You can walk from the fishing ko'a to the lo'i or you can stop at the spring or the shelter cave or the ahu the *heiau* the *pā*. You can go a to the forest for lapaau and you can watch the sunset from the front of their hale and if you employ the right senses you can do all this with them, they are still here, that is why this place is so special.

CSH: Can you talk about when you were younger and some of the things you learned from the people and the resources here?

McD: It really starts way back with Lanikuhonua and fishing. Uncle Sunny, Netty's father, kind of clued me in on throw netting. My Dad taught me how to get the net to open up but Uncle Sunny was the one that taught me how to use my senses to know where fish were. One night I was running out with my pole to set lines and he goes, "where's your throw net?" and I go, "it's dark now, you can't see the fish now." Then he said, "Go get your throw net." So I came back with my throw net and he said, "now where's your favorite spots?" And I said, "well its over there and over there and over there, but you can't see the fish" and he goes, "just go back to your favorite spots, you know every rock underneath there, you don't need to see the place to be able to know your way around." And I said, "yeah I can do that" and he said, "Just go to your favorite spot and stand there and wait until you feel the fish. When you feel the fish, you'll know, you'll feel them."

So I think that was the first thing that clued me into knowing that we have this other sense. So when hiking up here and going through the grass I feel things and I just turn

right or left, or just open the grass in front of me and there's a huge ahu or a cave sometimes I think they led me right to it. So that's been the path, the journey about knowing, and learning and seeing different things and getting chicken skin many times. When I was younger I spent a lot of time out there in the woods at night just cruising, checking it out. I got spooked every so often out there, but then I get used to it.

CSH: What were some of the most abundant and important resources for this area?

McD: By far the most important resource is always wai, freshwater, and with no year-round streams here it was definitely not an abundant resource. As you know *makai* there were sink holes with freshwater on the 'Ewa plane. Near Lanikuhonua, fresh water comes out right in the sand, between the rocks there. You can turn a gourd upside down in the ocean and get fresh water if you know where. Knowing where is the key, it's the same thing up *mauka,* there are no streams. There is what geologists call perched water. Places were water flows to the surface on top of impermeable layers of soil covered by a layer of fractured rock. A few of these at lower elevations still produced water today even in the driest times of the year. The greatest number of these springs are found between 1,200 and 1,800 foot elevations. However due to the reforestation efforts in the 1920s these springs no longer produce water year-round. This is also the elevation with the greatest concentration of archaeological sites. Most of these springs still have terraces and loi' walls around them. The forests above also held substantial resources, but the ocean below by far had the most substantial resources and the leeward exposure provided the best conditions to exploit them. I believe when compared to other ahupua'a in ancient times this area was not seen as desirable for its abundant resources. With the commanding view from this place and the limited water resources on the 'Ewa plane this community was highly defendable.

I am just starting to understand that there is no other place like this when you add the layer of the winter and summer solstice; there is no other place that lines up like that. So I think the real resource is the view, and the power that comes from that.

CSH: Can you share any of your knowledge about cultural sites you have come across or heard about in this area?

McD: There are so many cultural sites here and all of these sites and their relationships between each other is what's valuable. It is in the collective relationship between all the sites. Studying this area gives us the opportunity to have a deeper understanding of those who lived here because it's still pretty clear. Their footprints are still right there. I think this place has revealed how much potential it has, and the value of how much it has yet to share. I really want to make sure that the cultural sites and what they tell us doesn't get erased.

CSH: Can you talk about the sights and trails above Waimānalo gulch?

McD: The center of this *mauka* community was here above Waimānalo and Makaiwa. Ida Von Holt writes that they were told the area was quite heavily populated before the smallpox epidemic of 1840 and that there was a school for over 40 children where the pā is now. This appears to be the case when compared to the size and number of structures in the area. Some of the adjacent pastors were cleared for pineapple years ago these pastors

more than likely contained many sites and now they are lost forever. The main trails from this community to *makai* were in both Waimānalo and Makaiwa. These trails had water and springs there and were probably used more for uphill travel. The ridge between them was faster but there was no water so it was more than likely used for downhill travel. Another was down by Awanui just west of Pu'u Palailai and another was on the up side of Kaloi. The main trails had a spring or two along the way and if there was enough water something was grown there.

CSH: Can you talk about your house at Lanikuhonua?

McD: Our house was actually next to Lanikuhonua near the big banyan tree at Paradise Cove. The house was surrounded by a big field which is basically the whole area that is now Paradise Cove. Then there was my grandfather's coconut plantation where he had young coconut trees everywhere. We were hidden from the view of Farrington Highway by sugarcane fields. The place was absolutely beautiful, and some of it still is. Some old maps have labeled hamlet on that spot and I'm sure there was a lot of wa'a on the beach there, this is the *makai* part of that ahupua'a poster. The fishing was great, and like I said earlier freshwater comes right out of the sand there.

CSH: Do you know of any *mo 'olelo* or *wahi pana* about this area?

McD: You have the *mo 'olelo* about the night marchers and I've heard several people say they've heard children or at least their voices in the forest in the *pā* area where the school was. Observing all of the house sites and everything that I know collectively, I have an opinion about how these people left this place and how it went down, and a lot of it is supported by historical records. Ida wrote that the *pā* was a school and you know we'll never know because she's not here nor the people that told her this. I think that when you give the collective, cooperative existence to the community up here, you understand that they all had to participate. 'Ōlelo supports this by hinting that there really wasn't a strong caste system of *ali 'i* hierarchy up here. Everybody had to have a specialty here, everybody had to contribute here to exist and they all did it because this place had the *mana* that kept everybody in line. We had two systems, we had a spiritual system and we had an *ali 'i* system. So these people all had to be close together and once some started to perish from the plagues, small pox and all the others, their system collapsed. The farmer was gone, the *kahuna lapa 'au* was tending to so many people, he got it. This community was pretty much erased, and those who survived probably left, but the spirits of those who didn't along with all those who came before the Lehua, are still here, the watchers, in the watching place, Pālehua the place of *mana*... look at all the clues they left in the place names here, and those you see from here. Do you feel *mana*? Are you a watcher too?

Place names of the area given by Douglas McDonald Philpotts:

Pa lehua	Mauna Loa
Mauna Kapu	Mauna Kea
Puu Manawahua	Hualalai
Puu Moopuna	Haleakala
Puu Heleakala	Puu Kukui
Puu Hapapa	Kamakou
Puu Kaua	Puu Konahuanui
Puu Kuua	Kukaniloko
Puu Poulihali	Kaala
Puu Makakilo	Waialeale
Puu Kapolei	Niihau
Makaiwa	Kaula
Waiwanana	Lehua
Moku Manamana	

Appendix C Office of Hawaiian Affairs

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HRD06/2765

November 2, 2006

Kēhaulani Souza
Cultural Surveys of Hawai'i, Inc.
P.O. Box 1114
Kailua, HI 96734

RE: Request for Information on a Cultural Impact Assessment for Waimānalo Gulch Sanitary Landfill Expansion Project, 'Ewa, O'ahu; TMK: 9-2-003:073

Dear Kēhaulani Souza,

The Office of Hawaiian Affairs (OHA) is in receipt of your October 16, 2006, request for comments on the above-referenced project, which would allow for an approximate expansion of the Waimānalo Gulch Sanitary Landfill by 36 acres. OHA offers the following comments.

OHA recommends that the applicant contact Alika Silva and Glen Kila (Koa Mana), Tom Lenchanko (Kukaniloko), Alice Greenwood (O'ahu Burial Council), William Ailā (Wai'anae Harbormaster), Nettie Tiffany, and Micah Kane (DHHL) to improve the consultation component of your Cultural Impact Assessment (CIA). We also recommend that you conceive of the project area as a portion of a larger traditional cultural landscape; and, that the possible presence of one or more Traditional Cultural Properties (TCPs) is considered in your CIA.

OHA further requests that if this project goes forward, should iwi kūpuna or Native Hawaiian cultural or traditional deposits be found during ground disturbance, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Thank you for the opportunity to comment. If you have further questions, please contact Kai Markell, Lead Advocate – Culture, at (808) 594-1945 or kaim@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator