no complaints or staff concerns about WGSL Landfill or side effects including odor or children feeling ill at school. (SMS Research, 2008).

Development in the Kapolei area will lead to an increase in population, eventually causing the need for additional school locations. Expansion of the WGSL Sanitary Landfill will not create the need for additional elementary schools, nor will it affect existing elementary schools differently than they are affected at the present time. See also Section 6.8.1. Educational Facilities for other schools within the general project vicinity.

Library Services

Hawaii's public libraries are operated by the State Department of Education. Libraries are open in Waiʻanae, ʻEwa Beach and Kapolei. Due to limited funds, hours at libraries throughout Hawaiʻi have been reduced in recent years. No additional libraries have been announced. (SMS Research, 2008).

No impact on library services is anticipated as a result of the proposed project. See also Section 6.9.1. Library Services.

Parks and Recreation

There are parks situated in Waiʻanae, Māʻili, and Nānākuli, and throughout the major residential zones of ʻEwa. Also, beach parks are located along the Waiʻanae Coast at the tip of Barbers Point (in the Campbell Industrial Park) and in ʻEwa Beach. Odor issues and occasional airborne trash at nearby beach parks are the only reported issues caused by the current operations of the landfill. In the past, outdoor recreation at Ko Olina has been limited during occasions when odor was a problem. (SMS Research, 2008).

Long-term, WGSL may one day be used as a reclaimed recreational facility much like Ala Moana Park and the Honolulu Waterfront Park. (SMS Research, 2008).

After the closure of Barbers Point, much of the Navy land was conveyed to the City for eventual redevelopment as a recreation and sports facility. Funds for significant new developments have not been allocated, so major changes are not likely in the next few years. An expanded WGSL does not generate any additional demand for area parks. If odor issues and litter issues are adequately addressed, expansion and continued use of WGSL will have no impact on the use of nearby parks. (SMS Research, 2008). See also Section 6.10. Parks and Recreation.

Medical Services

Leeward O‘ahu is served by St. Francis West, a 100-bed hospital with 24 Emergency Service, located outside Waipahu, the Wai‘anae Coast Comprehensive Health Clinic, between Nānākuli and Wai‘anae, and clinics in Kapolei are maintained by other health care providers. SMS Research knows of no major changes in medical services planned for the study area. No impact is anticipated. (SMS Research, 2008).

7.1.4.2. Other Social Impacts

Positive Social Impacts

Reduced Impact on Other O‘ahu Communities

Unless a package of alternatives can feasibly process MSW and refuse currently handled by the WGSL, a landfill will still be needed. Without it, the health, sanitation and aesthetic issues associated with unprocessed waste or uncontrolled dumping will burden the entire island. Moving the current landfill operation to another O‘ahu location would only shift the potential for adverse impacts to another community, still requiring that the issues of litter, traffic, odors, and visual pollution be addressed and managed. (SMS Research, 2008).

Negative Social Impacts

Department of Health Issues

In February 2006, the Department of Health proposed one of the largest environmental fines against the City: Eighteen violations were identified in DOH’s six-month investigation. According to WMH, all but two violations were corrected when the Notice of Violation (NOV) was issued. The two violations were:

- Count VII, Failure to measure and maintain records of leachate levels in one sump due to a blockage caused by broken equipment, was addressed with the installation of the required equipment on September 27, 2007.
- Count I, Exceedance of permitted grades, was addressed through the submittal of an application to the DOH for a permit modification to increase the maximum final grades of the ash monofill. Public comments were solicited and a public hearing on the draft permit modification was held on December 11, 2007. The DOH permit allowing the height increase was approved on February 20, 2008.

On December 7, 2007, having addressed the two remaining counts identified in the NOV, the City and the DOH signed a settlement agreement which settled all issues arising from and related to the NOV. A summary of the counts identified in the DOH NOV are provided in **Table 7-3**.

According to WMH and the City, the public and the environment were never at risk during the period cited in the NOV or at any time over the period of use of the site. However, the public perception was of an improperly and poorly administered facility. An overview of the situation indicates:

- The DOH issuance of the NOV was based on information that was self-reported by WHM. WMH substantiates the safety of the WGSL with a number of technical studies and reports that serve as the basis for the design, operation, and monitoring of the facility, as required by both federal, state and City & County of Honolulu requirements, and WMH standards for safe engineering and operational practices.
- The community is highly sensitized to the presence of the landfill within the context of previous City administrations commitments to close the landfill, and experience with prior nuisances involving odor, litter, and visual aesthetics. Any activities of an operational nature will therefore continue to be scrutinized by the community. The situation involving the NOV exacerbates this and calls into question the management of the facility and its potential impact on the community and environment.

Table 7-3,
DOH Notices & Finding of Violations

Count	*Alleged Violation*	*Date of Last Alleged Violation*	*Compliance Status*
1	Exceeding Permitted Grades	2/20/08*	In compliance
2	Failure to submit Annual Operating Reports in a Timely Manner	2/22/2005	In compliance
3	Failure to Place Daily Cover on the Active Face of MSW Landfill	6/9/2005	In compliance
4	Failure to Place Intermediate cover Material on the Ash Monofil	6/29/2005	In compliance
5	Exceeding Leachate Head on th4e Liner in Ash Monofill	6/15/2005	In compliance
6	Exceeding Leachate Head on Liner in MSW Cell E-1 Sump	6/22/2005	In compliance
7	Failure to Measure Leachate Levels and to Maintain Records on Leachate Levels in Cell 4B Sump	9/26/07*	In compliance
8	Failure to Measure Leachate Levels and to Maintain Records on Leachate Levels in Ash Monofill Sump	2/9/2005	In compliance
9	Failure to notify DOH of Noncompliance on Equipment Blockage in MSW Cell 4B Leachate Lateral line and inability to Measure Leachate Levels	6/22/2005	In compliance
10	Failure to Notify DOH of Noncompliance in a Timely Manner on the Exceedances of Permitted Grades and submission of the Annual Operating Reports	2/22/2005	In compliance
11	Unauthorized Storage of Material on the Ash Monofill	3/2005	In compliance
12	Failure to Manage and Ban the Acceptance of Special Waste	5/19/2005	In compliance
13	Failure to Maintain Records and Record Location of Asbestos Disposal at the Landfill	7/2/2005	In compliance
14	Failure to Cover a Dead Animal	2/17/2005	In compliance
15	Failure to Submit annual Surface Water Management Plan	9/1/2005	In compliance
16	Failure to Control the Generation of Dust from Vehicular Traffic	2/17/2005	In compliance
17	Failure to Minimize Free Litter Generation in the Landfill	6/24/2005	In compliance
18	Failure to Monitor Explosive Gases and Maintain Monitoring Records	2004	In compliance

* Date the DOH deemed WGSL to be in compliance.

Property Values

The 2002 Socio-Economic Impact Assessment of WGSL Expansion presented property value results that were not necessarily in line with what experts and the public at large would have expected. See also Section 7.1.5. Addendum to Socioconomic Impact Assessment, for additional information. (SMS Research, 2008).

Research found that single-family homes fit the hypothesis that property values increase with distance from the landfill up to a distance of about three miles. However, the condominium analysis shows a significant correlation of increased value and proximity to the landfill – the opposite result. (SMS Research, 2008).

Condominium property values are higher near WGSL due to the location of the condominiums within the Ko Olina Resort. According to the Ko Olina website, Ko Olina Resort & Marina's residential development will be Hawai'i's premier location for homebuyers across the world and for local residents…Ko Olina will provide a feeling of luxury in a private community…(SMS Research, 2008).

Diminishing Community Trust

The failure to follow through on commitments from the City to close WGSL may be having an impact in eroding public trust and increasing cynicism toward City government. This is happening in the fastest growing community on the Island of O'ahu where private-public partnerships are necessary to ensure sensible and well-managed growth. (SMS Research, 2008).

The problem is complicated by a "community-benefits package" proposal that both proponents and opponents of the landfill who were interviewed expressed some hesitation. There appears to be general agreement among them that there has been insufficient community involvement in questions surrounding "who should benefit?", "what impacts are being addressed?", and "what services are appropriate?" (SMS Research, 2008).

~~Environmental Injustice~~

~~Environmental Injustice is defined as: "An environmental injustice exists when members of disadvantaged, ethnic, minority or other groups suffer disproportionately at the local, regional (sub-national), or national levels from environmental risks or hazards, and/or suffer disproportionately from violations of fundamental human rights as a result of environmental factors, and/or denied access to environmental investments, benefits, and/or natural resources, and/or are denied access to information; and/or participation in decision making; and/or access to justice in environment-related matters."~~[4]

~~A number of interviewees point out that Leeward O'ahu has been and continues to remain on the receiving end of many of O'ahu's burdens. They argue that within a 10-mile stretch along Farrington Highway there are two separate landfills handling hazardous~~[5]~~, construction and municipal waste, as well as an two existing electrical power plants, a proposed new generator unit at the Campbell Industrial Park, a deep draft harbor and the Campbell Industrial Park, all of which service the entire Island of O'ahu -- all of which adversely impacts the environment of these communities. Further, Leeward O'ahu is now the home of thousands of homeless people, many of whom were driven out of other communities only to be "welcomed" and "tolerated" in Coastal Wai'anae. Inteviewees argue that the continued use and expansion of WGSL will only increase the imbalance of those impacts on Leeward O'ahu. (SMS Research, 2008).~~

~~Proponents of keeping the landfill in operation point out that the siting of the landfill occurred long before the siting of the other examples noted above and had nothing to do with the demographics of the people in surrounding communities. Furthermore, the surrounding communities also accommodate one of the most beautiful resort complexes on O'ahu, abutting the ever expanding Second City of Kapolei. This is the fastest growing region on O'ahu and WGSL does not appear to have stymied its growth. They believe that this is not indicative of a community suffering from environmental injustice. (SMS Research, 2008).~~

~~[4] Wikipedia *Environmental Justice* http://en.wikipedia.org/wiki/Environmental_justice~~

~~[5] WGSL does not accept hazardous waste for disposal.~~

~~Data from the SMS Report would appear to support this position. Although the median household income in the Wai'anae DP Area ($42,451) is below the island average ($51,194), the median household income in the 'Ewa DP Area ($59,583), in which the WGSL is located, exceeds the island average. In addition, median household incomes for the two communities immediately surrounding the landfill all significantly exceed the island averages. These are Makakilo ($88,515) and Ko Olina/Honokai Hale ($74,083). (SMS Research, 2008).~~

~~Finally, Windward O'ahu residents note that for the last 40 years most of the active landfills were on the Windward side of the island. It is only recently that WGSL has been the only major landfill for MSW on O'ahu. (SMS Research, 2008).~~

Environmental Injustice (Addendum to Socioeconomic Impacts)

On February 11, 1994, President Clinton issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" to focus federal agencies' attention on disadvantaged communities with the goal of achieving Environmental Justice. Over the years, each federal agency has defined environmental justice or injustice within the context of the Executive Order and in a manner that allows its application to their particular agency's functions. The EPA defines **Environmental Justice** as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies".[6] (SMS Research, 2008).

[6] EPA goes on to define *Fair Treatment* to mean that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal environmental programs and policies. And they define *Meaningful Involvement* to mean that: (1) potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health; (2) the public's contribution can influence the regulatory agency's decisions; (3) the concerns of all participants involved will be considered in the decision-making process; and (4) the decision-makers seek out and facilitate the

The U.S. Department of Transportation, like other service agencies, goes slightly further by noting three pro-active environmental justice principles: "*(1) to avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations; (2) to ensure the full and fair participation by all potentially affected communities in the decision-making process'; and (3) to prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations".*[7] (SMS Research, 2008).

A number of interviewees point out that Leeward O'ahu has been and continues to remain on the receiving end of many of Oahu's burdens. They argue that within a 10-mile stretch along Farrington Highway there are two existing electrical plants, a proposed new generator unit at the Campbell Industrial Park, a deep draft harbor and a major industrial park, all of which service the entire Island of O'ahu – and all of which adversely impact the environment of these communities. Further, Leeward O'ahu is now the home of thousands of homeless people, many of whom were driven out of other communities only to be "welcomed" and "tolerated" on the Leeward Coast. They argue that the continued use and expansion of WGSL will only increase the imbalance of those impacts on Leeward O'ahu. They believe that the expansion of WGSL is a case of Environmental Injustice. (SMS Research, 2008).

Proponents of keeping the landfill in operation point out that when the landfill was sited, the only residential communities in the area were in Makakilo. The communities of Kapolei and Ko' Olina grew up on sugar fields that once abutted the landfill, after the landfill had already been in operation. Furthermore, they note that the surrounding communities also accommodate one of the more important and successfully developing resort complexes on Oahu, Ko 'Olina, and the ever-expanding Second City of Kapolei.

involvement of those potentially affected. (Toolkit for Assessing Potential Allegations of Environmental Injustice, Office of Environmental Justice, US Environmental Protection Agency, November, 2004).

[7] An Overview of Transportation and Environmental Justice, Federal Highways Administration, US Department of Transportation, May, 2000.

This is the fastest growing region of O'ahu and WGSL does not appear to have stymied its growth. They believe that this is not indicative of a community suffering from environmental injustice. Finally, Windward Oahu residents note that for the last 40 years most of the active landfills were on the Windward side of the island. It is only recently that WGSL has been the only major landfill for MSW on O'ahu. (SMS Research, 2008).

A closer examination of the surrounding communities against the definition of Environmental Justice provides further insight. In 2004, the O'ahu Metropolitan Planning Organization (OMPO) and the City & County of Honolulu, Department of Planning and Permitting (DPP) attempted to identify areas of the island that are vulnerable to Environmental Justice concerns.[8] Using definitions and criteria established by the Federal Highway Administration (FHWA) and 2000 U.S. Census block data, OMPO/DPP developed a systematic and comprehensive methodology to identify such communities. In their final analysis, 70 of the 435 blocks that make up O'ahu were determined to be environmental justice areas based on race, and 17 blocks were identified as environmental justice areas based on income. (SMS Research, 2008).

None of the Census blocks in the 'Ewa Development Plan Area were identified as environmental justice areas **based on income**. One can understand this as the overall average income in the 'Ewa DP of $59,583 far exceeds the island average of $51,194. Additionally, the median household incomes for the two communities in closest proximity to the landfill all significantly exceed the island averages. These are Makakilo ($88,515) and Ko 'Olina/Honokai Hale ($74,083). (SMS Research, 2008).

On the other hand, two of the Census blocks in proximity to the WGSL are environmental justice areas **based on race**, one in Makakilo and one in Honokai Hale. Both were selected because they have a Hispanic population that slightly exceeds the average settlement pattern plus an acceptable standard deviation for Hispanics. The acceptable index for Hispanics is 14.3 percent of the population. Hispanics make up 17.3 percent and 16.5 percent of these two communities respectively. No other minority

[8] Environmental Justice in the OMPO Planning Process: Defining Environmental Justice Populations, Oahu Metropolitan Planning Organization and the County Department of Planning and Permitting, March, 2004.

groups exceed their acceptable indices in any block in proximity to WGSL. (SMS Research, 2008).

Having identified these two communities as EJ areas, one asks whether these two blocks are subject to disproportionately high and adverse health and environmental impacts due to the WGSL and whether they have had meaningful access to decision-making regarding the WGSL. (SMS Research, 2008).

On the first point, the EIS findings to date would indicate that with the possible exception of views and windblown litter, no one is subject to disproportionately high and adverse health and environmental impacts based on the use of existing and future mitigation measures that have been identified in the subject DEIS document. Further, the significant mix of EJ and non-EJ communities in proximity to the WGSL would indicate that the EJ communities are not suffering disproportionately. (SMS Research, 2008).

On the second point, it would appear that everyone has had opportunity to make their preferences known. The subject has been presented in numerous Neighborhood Board meetings, and in community meetings with the Mayor and other County officials. Additionally, the County Councilman for this district is very approachable. He is also an articulate and forceful spokesperson in opposition to the lateral expansion of the WSGL, he ably defends that position, and he is one of nine votes on the County Council to whom this question will be presented for approval. For those who support the extension, their position has been expressed by the Mayor and his Administration. (SMS Research, 2008).

Finally, while the present EIS adheres to the requirements of Chapter 343, HRS, which does not mandate EJ as a criteria for evaluation, the Chapter 343, HRS, EIS process does specifically allow for review and comment by all citizens. There has been significant opportunity for any expression of concern and such expressions become a part of the record for review by decision-makers.

7.1.4.3. Economic Impacts

Approach and Terminology

This ~~economic impact~~ section reviews the impacts that this project will contribute to the economic environment. The technical terms make a distinction between different types of impacts. First, in economic analysis, a distinction is made between impacts of the actual construction and operations of a project, and the effects of project-related spending throughout the local economy. In discussions of jobs, earnings, and taxes, three broad types are distinguished (SMS Research, 2008):

- Direct jobs/earnings/taxes are immediately involved with construction of a project or with its operations. It is important to note that direct jobs are not necessarily on-site: construction supports company personnel in offices and base yards, as well as on-site.
- Indirect jobs/earnings/taxes are created as businesses directly involved with a project purchase goods and services in the local economy.
- Induced jobs/earnings/taxes are created as workers spend their income for goods and services.

Direct, Indirect and induced economic impacts in Hawai‘i can be estimated using multipliers from a model of input-output relations developed and refined by State researchers. (SMS Research, 2008).

It is also important to understand that although construction has a positive impact on the state economy, funds for the proposed expansion project will be generated from the tip fees assessed to haulers for the use of the landfill. These tip fees are translated to consumers and businesses through maintenance fees and collection fees. As a result, financial resources for construction will come from reallocation of funds that are already a part of the Hawai‘i State economy rather than out-of-state investment. The reallocation of state monies results in a negative impact on jobs, earnings and taxes. These positive and negative impacts must be considered to gain a clear picture of the economic impact of the WGSL expansion. (SMS Research, 2008).

Employment and Earnings

Construction

Expansion of WGSL is expected to take 10 years to complete. This expansion will result in an increase in the capacity of the landfill and is expected to increase the life expectancy of the landfill by 15 or more years. (SMS Research, 2008).

Pending the receipt of final engineering figures, the construction of the expansion has been estimated at $86,000,000 over ten years, with expenditures spread consistently over those ten years. The construction estimates were determined through discussions with officials from WMH, the current operator. The expansion is planned in several stages. Each stage and year of construction will result in approximately the same level of construction spending. (SMS Research, 2008).

Employment

Construction spending will create jobs and spending in related industries. Direct jobs created as a result of this project will include some 746 person-years of employment[3] over the ten-year construction period. Direct jobs are not necessarily located on-site. As a rule of thumb, about 20% of direct construction jobs are off-site (in base yards, offices, and the like). (SMS Research, 2008).

Indirect and induced jobs are also created throughout the state. These are likely to be concentrated in commercial and/or industrial centers, rather than near a job site. In addition, this project will support some 328 indirect and 720 induced person-years of employment. In total, approximately 1,795 person-years of employment will be created as a result of the WGSL expansion. (SMS Research, 2008).

This, however, is not the net impact of the project. The project will result in a reallocation of funds that could be otherwise spent in other areas of the economy. The cost of construction is generated by revenue received from tip fees and these fees are translated to Hawai‘i consumers; therefore, one must account for the negative impact associated with this project. Since tip fees are translated to consumers, it can be

[3] Person years of employment is the number of full time equivalent positions required to complete the work defined by the estimated cost of construction during the specific period of time.

inferred that the proposed expansion will have a negative impact on personal consumer expenditures. A reduction in personal consumer expenditures results in a negative impact on jobs, earnings, and tax revenues. **Table 7-4**, shows the negative impact on jobs associated with this project. (SMS Research, 2008).

Table 7-4, Economic Impact - Negative Impact on Jobs

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Cumulative
Direct Jobs Lost[1]	72	72	72	72	72	72	72	72	72	72	721
Indirect Jobs Lost	15	15	15	15	15	15	15	15	15	15	147
Induced Jobs Lost	31	30	29	28	27	27	26	26	26	26	275
Total Jobs Lost	117	117	116	115	114	113	113	113	113	113	1,143

[1] Person-years of employment
Source: DBEDT: State Input – Output Study 2002
Note: Totals do not add due to rounding.

As shown in **Table 7-5**, the WGSL expansion will result in a net positive impact. Despite the negative impact associated with the expansion, some 651 direct, indirect and induced person-years of employment will be created. (SMS Research, 2008).

Table 7-5, Economic Impact - Net Impact on Jobs

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Cumulative
Direct Jobs Net	13	10	7	5	2	0	(3)	(3)	(3)	(3)	25
Indirect Jobs Net	23	21	20	19	18	17	16	16	16	16	181
Induced Jobs Net	51	49	48	46	44	43	41	41	41	41	445
Total Jobs Net	87	81	75	70	64	59	54	54	54	54	651

[1] Person-years of employment
Source: DBEDT: State Input – Output Study 2002
Note: Totals do not add due to rounding.

Earnings

Positive workforce earnings associated with the project's construction will amount to $59.6 million in direct earnings and $40.1 million indirect and induced earnings (as shown in **Table 7-6**). The total positive impact on direct, indirect, and induced earnings associated with all construction will be about $99.8 million. (SMS Research, 2008).

Table 7-6, Economic Impact - Positive Impact on Earnings

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Cumulative
Construction Earnings [1]											
Direct Earnings	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	59.6
Indirect Earnings	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	14.3
Induced Earnings	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	25.8
Total	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	99.8

[1] Person-years of employment
Source: DBEDT: State Input – Output Study 2002
Note: Totals do not add due to rounding.

As with employment, this project will also have negative impacts on earnings. As shown in **Table 7-7**, a total negative impact on earnings of approximately $36.5 million can be expected. (SMS Research, 2008).

Table 7-7, Economic Impact - Negative Impact on Earnings

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Cumulative
Earnings [1]											
Direct Earnings Lost	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	19.3
Indirect Earnings Lost	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	7.7
Induced Earnings Lost	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	9.4
Total Lost Earnings	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	36.5

[1] Person-years of employment
Source: DBEDT: State Input – Output Study 2002
Note: Totals do not add due to rounding.

On balance, the proposed project will result in an overall positive impact on earnings. In total, approximately $63.3 million in earnings will be generated per **Table 7-8**. (SMS Research, 2008).

These earnings will boost the local economy, as many of the dollars will be used to purchase goods and services from other industries. **Figure 7-2, Consumer Spending Patterns by Industry, 2003 - 2004**, shows Honolulu consumer spending patterns to illustrate how earnings may be used. (SMS Research, 2008).

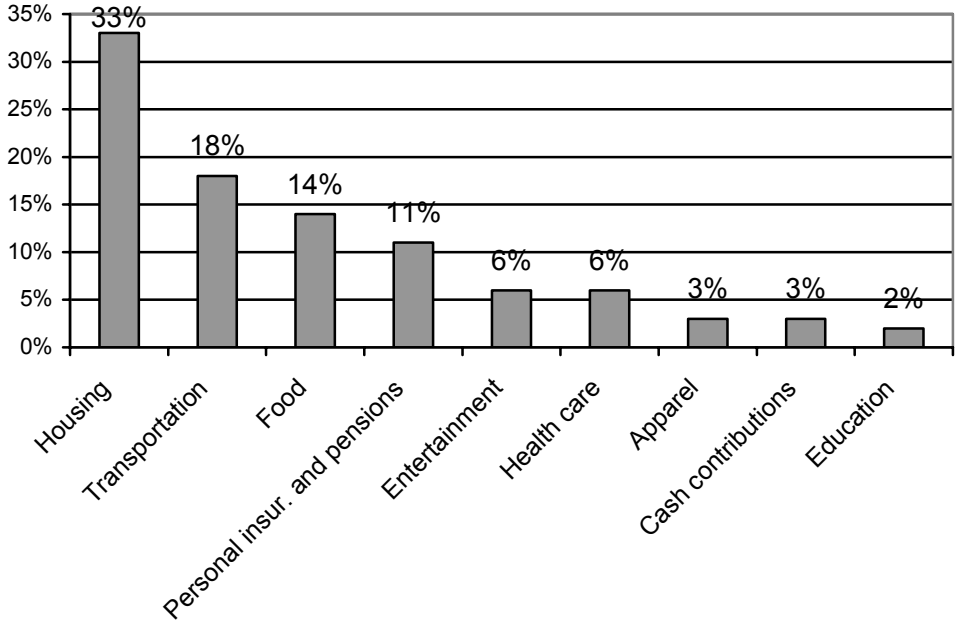
Table 7-8, Economic Impact - Net Impact on Earnings

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Cumulative
Earnings [1]											
Direct Earnings - Net	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	40.3
Indirect Earnings - Net	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	6.6
Induced Earnings - Net	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	16.4
Total Net	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	63.3

[1] Person-years of employment
Source: DBEDT: State Input – Output Study 2002
Note: Totals do not add due to rounding.

Housing costs such as shelter and utilities account for more than 33 percent of consumer expenditures. Food and transportation also account for a large amount of consumer spending (14 and 18 percent). It can be expected these patterns will continue in the future creating economic growth in several industries. (SMS Research, 2008).

Figure 7-2, Consumer Spending Patterns by Industry, 2003 - 2004



Source: US Census 2000, State of Hawaii Data Book 2005

Fiscal Impacts

State of Hawaii

Construction spending has an impact on state tax revenues. **Table 7-9**, displays the estimated positive impact as a result of the WGSL Expansion. The expansion cost is estimated at $86 million and the planned construction would result in $3.2 million in direct state tax revenues. The indirect and induced impact of this project will result in $6.2 million in state tax revenues. In total, the project would result in an estimated positive impact of $10.4 million in state tax revenues. (SMS Research, 2008).

Table 7-9, Positive Impact on State Tax Revenues

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Cumulative
State Taxes [1]											
Direct	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	3.18
Indirect	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	2.34
Induced	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	4.90
Total Net	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	10.42

[1] in millions of 2006 constant $
Source: DBEDT, State Input – Output Study, 2002
Note: Totals do not add due to rounding.

As shown in **Tables 7-10** and **7-11**, the total impact on state tax revenues will be positive. Approximately $6.6 million in state tax revenue will be lost as a result of this project. In total, there will be a small positive impact in state tax revenues of approximately $3.8 million during the 10 years of construction. (SMS Research, 2008).

Table 7-10, Negative Impact on State Tax Revenues

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Cumulative
State Taxes [1]											
Direct Lost	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	3.84
Indirect Lost	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.98
Induced Lost	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	1.79
Total Lost	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	6.61

[1] in millions of 2006 constant $
Source: DBEDT, State Input – Output Study, 2002
Note: Totals do not add due to rounding.

Table 7-11, Net Impact on State Tax Revenues

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Cumulative
State Taxes [1]											
Direct Net	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.67)
Indirect Net	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.36
Induced Net	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	3.11
Total Net	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	3.80

[1] in millions of 2006 constant $
Source: DBEDT, State Input – Output Study, 2002
Note: Totals do not add due to rounding.

In sum, the economic impacts of the expansion appear to be a net positive with approximately $63.3 million net flowing directly and indirectly through the economy and $3.8 million of net tax revenues being raised. All of the income is a result of a 10-year construction period. WMH does not believe the expansion will result in the need for new hiring or other increased operating costs. (SMS Research, 2008).

This socioeconomic analysis did not take into account any indirect or induced economic effects of the landfill operation on surrounding businesses. There was insufficient, verifiable information available at the time of the compilation of the report. As noted, the residential sales program at Ko Olina has been successful. If it could have been more successful without the landfill is speculative. (SMS Research, 2008).

7.1.5. Addendum to Socioeconomic Impacts

In September 2008, SMS Research completed its, Addendum to the Socioeconomic Impact Assessment, for the WGSL. The purpose of the addendum was to further investigate the potential for impacts to property values based on proximity of the WGSL to residential property. The study focused on the proposition that the closer a residential property is to the site of the landfill, the lower will be the sales price of that unit, other factors held constant.

The study data and findings are provided in the following and in **Appendix J**:

"For this study, we adopted the often used hedonic pricing model. The model considers a single family home to be a collection of attributes including physical characteristics (size, number of bedrooms and bathrooms, age, etc.) and location (neighborhood, distance from the landfill, etc.). The sales price of the unit is considered to be a function of all of these attributes. Multiple linear regression or some other appropriate analytical method is used to estimate the impact of each attribute net of the impacts of the other attributes. The impact of distance from the landfill, therefore, can be estimated independent of the other housing unit characteristics.

The data used for the study were a set of 173 property records taken from Multiple Listing Services for properties listed between August 1, 2007 and July 10, 2008. The properties were located in West O'ahu between 'Ewa and Mā'ili and within six miles of the landfill site. Data extracted for each property included physical attributes (unit type [single or multi-family], number of bedrooms, number of bathrooms, size in square feet, age in years, and date sold), and location (neighborhood name, distance from the Waimānalo Gulch Landfill site in miles). These data were analyzed using multiple linear regression with sales price as the dependent variable. Results for all communities are shown in Table 1.

Results show that four of the eight property attributes had statistically significant relationships with property value (price). Based on the unstandardized regression coefficient, the most highly related attribute was size in square feet. It was positively related to price. The age of the unit was negatively related to price. That is, as the age of the unit increased, the price decreased. The number of bedrooms was also negatively related to price, suggesting that the greater the number of bedrooms, the lower the price. And finally, the distance from the Waimānalo Gulch Landfill was negatively related to unit price. That is, the greater the distance from the landfill, the lower the price.

This analysis shows no empirical support for the proposition that the landfill results in lower residential property values for the Waimānalo Gulch Sanitary Landfill. Specifically, that distance from the landfill would be associated with lower property values.

Table 1: Regression Results for All Properties, 2008
(Addendum to Socioeconomic Impact Assessment, SMS Research)

Property Attributes	Coefficients		Significance Test Results		
	Unstandardized Coefficient B	Standardized Coefficient Beta	t-value	Sig.	Std. Error
unit size in square feet	435.17	0.755	9.78	0.000	44.50
distance from landfill in miles	-27,602.06	-0.287	-6.06	0.000	4,552.41
age of unit	-5,543.84	-0.330	-5.47	0.000	1,014.24
number bedrooms	-74,253.62	-0.279	-4.02	0.000	18,488.33
number bathrooms	-26,485.37	-0.082	-1.16	0.249	22,911.94
multi-family	48,240.65	0.046	1.13	0.262	42,864.92
date sold	0.00[9]	0.021	0.50	0.620	0.00
(Constant)	-5,754,621.47		-0.47	0.636	

Dependent Variable: Price

[9] Dates were stored as the number of seconds since October 14, 1582, the start of the Gregorian calendar. The unstandardized regression coefficient will therefore be very small, but can be statistically significant if real differences exist in the model.

Studies that report a negative relationship between sanitary landfills and residential property values are not unusual in the literature. Negative or statistically insignificant results have been reported by Bleich, Findlay and Philips (1991); Cartee (1989); Reichert, Small, and Mohanty (1992); Thayer, Albers and Rahamatian (1992), Zeiss and Atwater (1989). Furthermore, many reviewers have cautioned that disamenities such as landfills do not necessarily cause nearby residential property values to decrease. They note that several issues have been confounded in the discussion in the recent past. Sanitary landfills generally have much less impact on property values than hazardous materials landfills. Very large landfills have some impact on property values while smaller ones have none or even increase values (Lim and Missios, 2007). Overall, the characteristics of the residential unit (size, configuration, amenities) generally have a greater impact on market prices than distance from a landfill (Chan et. al., 1993; Kung et. al., 1993). In this particular case, two factors are probably more important. First, the sample size for the study is small and the number of variables may be too large for reliable estimates. The adjusted R-squared value for this analysis was .728, suggesting that the model with eight property attributes explained about 73 percent of the variance in the prices measured. That is considered a reasonable level of reliability. Nevertheless, 27 percent of the variance was unexplained.

Second, the results were consistent with known property values in West O‘ahu. Ko‘olina Resort properties are essentially “across the street” from the landfill site. Ko‘olina properties are among the highest in West O‘ahu. As you move away from the site, you encounter communities with increasingly lower property values. We have not discovered a way to analyze this difference because the price of an individual residential property and the average property value in a community are based on the same variable – unit price. This suggests that the hedonic model may present problems when dealing with the impact of disamenities on residential property values.

In order to add some clarity to the situation, we developed a model for properties located in Ko‘olina alone. It was necessary to drop the “unit type” attribute because all Ko‘olina properties in our dataset were multi-family units. The results of this analysis are shown in Table 2.

Table 2: Regression Results for Ko‘olina Properties, 2008
(Addendum to Socioeconomic Impact Assessment, SMS Research)

Property Attributes	Coefficients		Significance Test Results		
	Unstandardized Coefficient B	Standardized Coefficient Beta	t-value	Sig.	Std. Error
distance from landfill in miles	267,480.96	0.663	4.32	0.000	61,962.28
age of unit	-5,300.70	-0.116	-1.23	0.227	4,306.57
unit size in square feet	134.12	0.216	1.09	0.281	122.49
date sold	0.00	0.091	1.00	0.323	0.00
number bathrooms	61,273.99	0.142	0.97	0.338	63,107.20
number bedrooms	39,571.27	0.120	0.90	0.374	43,906.19
(Constant)	-24,096,747.51		-1.00	0.325	

Dependent Variable: Price

Only one property attribute, distance from the landfill, had a statistically significant relationship with price. And that relationship was positive. That is, within the Koʻolina Resort, the farther from the landfill a property is sited, the higher the unit price.

The adjusted R-square coefficient was .629, somewhat less reliable than the prior analysis. The sample size was 41 property records, much smaller than we would have preferred for reliable estimates. This is particularly problematic because the price of Koʻolina properties has 3.5 times the variance of other properties and is strongly skewed to the higher end of the market. Equally important, the other property attributes in our Koʻolina dataset had only half the variance of the same attributes for other communities. Koʻolina properties were 2- and 3-bedrooms only; others were 1 to 4 bedrooms. Koʻolina unit sizes ranged from 653 to 1,834 square feet; other communities ranged from 407 to 1,766. The age of units varied from 2 to 14 in Koʻolina and from 2 to 35 in other areas. Regression models analyze covariance, the extent to which the dependent variable co-varies along with independent variables. The limited variance associated with property attributes other than price will make it difficult to identify statistically significant relationships with those attributes.

There is another issue with applying the hedonic model and regression analysis to the Koʻolina dataset. In this procedure, the correlations or covariances among the individual property attributes are analyzed to produce unidirectional relationships. The finding that distance from the landfill is related to property value (price) can be interpreted to mean that the distances exist first (in time) and result in the observed price level differences. But the landfill predates the resort development. Therefore we cannot easily eliminate the possibility that the price came before distance from the landfill. That might occur, for instance, if a developer were to locate less valuable units nearer the landfill and more valuable units at greater distances. Regression results for our second model could be produced by either process.

This analysis presents different results from the previous analysis. Once again, mixed results are not uncommon in the literature. Reichert, Small and Mohanty (1992) found all three possibilities – positive, negative and not significant -- within their landfill evaluations. Michaels and Smith found drastically different results for individual communities. Thayer, Albers and Rahamatian (1992) found that even when analysis shows a negative relationship with property value, the function may not be smooth. That is, the loss in value may not be the same for all neighborhoods." (SMS Research, 2008).

Summary of Findings

According to SMS Research, given the caveats described in the report, the results for the two analyses reported are clear: for properties located within six miles of the WGSL, there was no evidence that the landfill is associated with decreasing property values. As distance from the landfill deceases, however, property values tended to increase. Within the area of the Ko Olina Resort, distance from the landfill was associated with increasing property values. (SMS Research, 2008).

The authors of the report added that the interpretation of the results are subject to the limitations of the data and the use of the hedonic model. "Sample sizes for both analyses were small, and the Koʻolina model is based on only 41 cases. The available

data may exclude important variables used by property buyers in making their final decisions. And finally, there may be issues with applying the same hedonic model to both sets of property records." (SMS Research, 2008).

~~7.1.5. Socioeconomic Mitigation Measures~~

7.1.6. Socioeconomic Mitigation Measures

Mitigation measures are normally considered in anticipation of potential impacts. In the case of the WGSL, where there is history, as well as existing practices, one can observe the current impacts, and propose measures that are in addition to current practices of WMH and the City.

There are three types of mitigative measures that are proposed: (1) measures that are an improvement of current practices regarding nuisances and safety; (2) measures that improve on existing community involvement and communication; and (3) measures that commit to funding the necessary research and development into alternative solutions to the continued use of landfilling.

~~7.1.5.1. Improving Current Practices~~

7.1.6.1. Improving Current Practices

SMS Research provided the following recommendations for socioeconomic mitigation measures. These measures are indented and are followed by further discussion and mitigation that is proposed by WMH and ENV.

Views

WMH should continue to implement the on-site landscaping plans that have already been developed; especially for those areas facing south toward Ko-Olina; and

WMH should design and implement landscape screens (e.g., pines, tall hedges) along the berm and the access road that is visible from Farrington Highway, fronting the Kahe Power Plant. As an alternative, WMH might consider entering

> into a partnership with HECO to plant an effective screen of trees along Farrington Highway which would have the dual purpose of screening the landfill operations and the power plant from passing vehicles (SMS Research, 2008).

Because of its elevation, the most obvious views of the landfill are from a distance. Berms obscure much of the operations but the face of the berms are exposed dirt that is visible from within the Ko Olina view corridor and from Wai‘anae views toward the landfill above the HECO power generating station. Hydromulching has been applied to some of the exposed berms but the grass seedlings have not yet become well established. This has resulted in some portions of the landfill and landfilling operations to be readily visible.

Landscaping plans have been prepared to vegetate and screen exposed areas and views of landfill operations. Initial planting to provide screening has been started and will be augmented with new plantings or plantings of other plant types based on the results.

The west-facing stability berm along the upper access road shields views from some of the operations, but not all of it. Selected plantings, consistent with the area vegetation, such as keawe or haole koa, will be investigated for use as visual buffer.

Discussion with HECO will be undertaken to consider the use of trees or other tall vegetative cover along the HECO property boundary with the Farrington Highway to serve the needs of both the Kahe Power Generating Station and the WGSL.

Odor

> WMH and the City should continue to be vigilant in processing the sludge from the sewage treatment plants upon delivery and in taking all means to reduce any odor impacts (SMS Research, 2008).

In recent months, the combined impact of immediate processing, diversion of some of the sludge for processing at the Synagro-WTT facility, and the improved performance of the odor neutralizing mist system appears to have had a significant positive impact.

However, continued vigilance is required. While the current performance of the facility has been encouraging, WMH will pay continued attention to the performance of the Synagro system. A rapid response to any temporary resumption of disposal of untreated sewage sludge will be addressed with:

1. Immediate disposal practices that have previously been developed to remove of the source of the odor from the prevailing wind;
2. the landfill odor control misting system will be operated, if required, to reduce the potential impact of odors migrating off-site, in particular, towards Ko Olina, the adjoining residences along Nānākuli, beach parks such as at Kahe Point, and the beaches; and
3. Refuse trucks that are off loaded will be evaluated for the application of odor reducing solvent prior to allowing them to leave the site.

Litter

WMH must continue to monitor the egress and ingress of vehicles and continue to aggressively enforce the anti-littering regulations and fines; and
ENV and WMH should maintain a direct communication link with the HPD; in the case of littering, it will lead to faster, more effective response (SMS Research, 2008). Additionally, this communication linkage should expand to the community most affected by the potential loss of refuse from vehicles traveling along public thoroughfares.

WMH institutes inspection practices that monitor commercial trucks upon entering and leaving the landfill area to ensure that their loads are secured upon entry and that the trucks are free from debris before exiting. WMH policy prohibits repeat violators from entry to the landfill. These inspections are beneficial and will continue.

A potentially significant problem is from citizens and others who deliver trash, and who are not adequately securing their loads. This results in the generation of windblown litter. Further effort involving public education by ENV and WMH will be implemented to

supplement the inspections. The public education would be supported through the possible use of the WMH newsletter for distribution to the community.

A good communication link between HPD and WMH/ENV will increase the shared understanding of the problem and the ability to respond in a timelier manner. However, prior effort involving discussions with HPD were limited by the need for the police to provide community services significantly greater than the enforcement of littering along the public thoroughfare. At the same time, once refuse vehicles leave the WGSL property, both WMH and ENV have no further legal control over the activities of the operator or the vehicle. For this reason an important part of improving the problem of commercial or personal vehicles littering the roadway must include the community.

Addressing this concern will therefore involve the following:

1. WMH and ENV will seek the participation of the HPD as a participant in the WGSL Oversight Advisory Committee. This will involve coordinating how litter complaints are addressed, who should receive the complaint, important information that should be recorded at the time of the complaint, and follow-up actions, if any, that would provide closure to an incident particularly if it is serious.
2. WMH and ENV will notify the community through the WMH newsletter and the ENV website, opala.org, of the steps that the public can take to help with reporting highway littering. The community will be advised concerning procedures, who to call, what to record, and subsequent actions that can be taken by all parties (including WMH and ENV).

While the community is asked to help with this problem, WMH and ENV will continue to provide litter pick up that migrates off-site from the area of the WGSL, either as a result of landfill operations or from vehicles that are not properly secured.

~~7.1.5.2. Improving Community Involvement and Communications~~

7.1.6.2. Improving Community Involvement and Communications

Community Involvement

The City must effectively use the Oversight Advisory Committee;

The City should continue to contribute to a community benefits package for as long as the landfill exists; and

The representation on the Committee that determines the benefits package should include all directly affected communities (SMS Research, 2008).

The Oversight Advisory Committee allows for building relationships that are important in addressing community concerns. However, this requires time and the commitment of the Committee participants. Providing website information and telephone numbers help with the effort but does not replace the need for regular face-to-face meetings to build community bonds. In 2007, the Oversight Advisory Committee went through a period of difficulty establishing a quorum for its meetings. A first step toward stimulating attendance and participation will be to focus on highway and off-site littering as described above. Other measures that will be developed will include, but are not limited to:

1. Maintain and expand outreach, education, and coordination of landfill operations through regular briefings before the Makakilo-Kapolei-Honokai Hale Neighborhood Board No. 34 and Waianae Neighborhood Board No. 24. Representatives from ENV and DPP currently provide information and receive comments from both boards on the activities of WGSL. The regular presentation of information by WMH should be added to establish a closer working relationship with the neighborhood boards in both the Kapolei and Nānākuli/Waiʻanae communities to convey that the implementation of mitigation measures will require their input.
2. WMH will continue to extend and to expand the opportunity for all members of the community to visit and inspect the operation of the landfill. The City Administration, ENV, and WMH has stated their commitment to

operating a well run facility with minimal impact to the surrounding community. Maintaining the opportunity for the public to visit the site will promote an understanding of landfill operational practices while allowing for improved communication and the establishment of linkages between the parties. Potential nuisance issues associated with operation of the facility can be identified early so that adjustments or modifications to operational practices can be discussed, considered, and implemented as soon as possible, e.g., increasing the frequency of water sprinkling to control dust during dry or high wind conditions. Other measures would be implemented as required.

3. WMH will continue its outreach efforts with the (1) Ko Olina Community Association (KOCA) and the various homeowner/owner associations within Ko Olina; and (2) adjoining homeowners and residents in the surrounding area including Nānākuli and the planned Makaiwa Hills project. The outreach would provide information to the community on operational practices at the WGSL and the schedule for anticipated events, such as the temporary shutdown of H-POWER for scheduled maintenance. This would allow for further coordination and cooperation to minimize the potential for landfill related nuisance impacts that include odor, litter and dust, and site aesthetics.

The proposal for a community benefits package was initiated by the current administration in an effort to address community based concerns related to presence of the landfill within the Waimānalo Gulch and its proximate location along Coastal Wai‘anae. The value of the community benefits have been identified as $2.7 million in 2007 and ~~will be~~ $2.0 million in 2008. The specific benefits that will be distributed in the future have not yet been determined. In order to accomplish this, the City will review and establish the priorities for the content of the benefits package based on use of open community forums, surveys, and maintaining a suggestion link on the website opala.org. While this effort is ongoing the City anticipates that with the experience gained from its current work that future modifications will be implemented to improve the system.

There is a perception that the Committee that determines the benefits package does not include representation from all neighboring communities. The effort to identify the specific benefits that will be distributed and the parties that will be responsible for representing the communities involved remain on-going. Future information, including the names of participants involved will be provided by the City by website on opala.org or other agency website as appropriate.

Website

> WM/ENV should use its web-sites aggressively as educational and communication tools (SMS Research, 2008).

Uncertainty is often the cause of increasing community concern; communication is usually the most effective remedy. According to SMS Research, many of the people interviewed were unfamiliar with the location of the WGSL on the Waste Management website and did not know that there was an avenue for electronic communication. Slight improvement to what is basically a good website and greater education as to its availability of information will help to maximize its use as a communication tool (SMS Research, 2008).

The appropriate party for the addition of publicly accessible information is the ENV website, opala.org. This site undergoes regular updating of information and is regularly maintained by ENV staff. This site will be used for the dissemination of future information regarding the availability of site tours to WGSL (currently offered), the status of new technology (including recycling proposals) undergoing evaluation by ENV, and other matters involving the operation of the City's refuse management system.

~~7.1.5.3. Improving the Commitment to Alternative Solutions to Landfilling~~

7.1.6.3. Improving the Commitment to Alternative Solutions to Landfilling

Alternatives to Landfills

> The City should continue to invest in Research and Development, and where feasible, implement alternative technologies that will result in a reduction in the City's dependency on a landfill (SMS Research, 2008).

The City has remained actively involved in the investigation of feasible alternatives to landfilling and considers that a mix of different refuse management strategies will be required to reduce long-term dependency on landfilling. Some of the methods with potential for addressing O'ahu's short term needs include waste to energy, recycling, and even transshipment. While none of these current alternatives can completely remove the need for a landfill the City remains committed to research and utilization of new methods as they prove feasible for City & County of Honolulu taxpayers and the environment.

A brief summary of prior efforts by the City to promote alternative technology and waste reduction strategies include:

1/12/98	Restriction of allowable cardboard and greenwaste in refuse for disposal to no more than 10 percent of volume. These items should be recycled.
2/9/98	Restriction on construction and demolition debris was accepted at landfill to no more than 10 percent of volume. C&D waste should be disposed of at the PVT Landfill.
5/7/02	Request for Proposals for an In-vessel bioconversion facility to convert wastewater sludge from Sand Island Wastewater Treatment Plant to a beneficial reuse product. Constructed and now operational.
1/13/03	Ban on green waste and white goods. These items should be recycled.
12/14/04	Municipal Solid Waste Recycling Facility. Project subsequently cancelled.
10/1/06	Ban on construction and demolition debris waste from landfilling. C&D waste should be disposed of at the PVT Landfill.
1/16/07	Request for Proposals to Construct and Operate an Alternative Energy Facility and/or H-POWER Facility. Currently under review.
1/22/08	Request for Proposals for the Interim Shipping of City-provided Municipal Solid Waste (MSW) to a Mainland Landfill. Bid submittal to City, May 14, 2008 (extended to May 28, 2008).

Alternative Locations

The City should continue to seek an alternative site to WGSL as the primary landfill location on O‘ahu (SMS Research, 2008).

WGSL was once located in a part of O‘ahu with limited development and at the periphery of urban growth. Approximately 20 years later, WGSL is now located in the fastest growing region of O‘ahu and within a divergent mix of land uses that include resort, residential, and major urban uses such as the James Campbell Industrial Park and the HECO Kahe Power Generating Station.

Prior to the eventual closure of the proposed project the City will initiate the search for O‘ahu's next landfill site. In as much as this timeframe is envisioned to take place when the lateral expansion of the WGSL reaches its capacity in approximately 15 years, participation in this effort should be initiated within the next 10 years and include not only the potentially affected community in which the site is proposed, but all the communities of O‘ahu who would share in the use of the facility. Although it is not possible to assign the subjects or topics for this future effort, a list for future consideration should include: the relationship of the landfill to the refuse disposal needs of O‘ahu; the safety and design of the proposed landfill facility in relation to environmental and social issues; and appropriate mitigation measures to address environmental and nuisance concerns including odor, windblown litter, and visual aesthetics. Any community provided solutions that are proposed should be documented and made a part of the project record.

7.1.6.4. Summary of Potential Impacts and Mitigation Measures

The potential for primary, secondary, and/or cumulative impacts to the socioeconomic resources of the area and region are possible without implementation of the mitigative measures as provided in this EIS, and the operational and management practices employed by WMH for the proposed project. Potential impacts involve possible financial losses to area businesses, and resort and residential sales from landfill associated nuisances and environmental impacts as outlined in Section 7.1.3. Community Issues and Concerns, and Section 7.1.4. Socioeconomic Impacts.

If directly attributed to the landfill: (1) the immediate secondary potential impact could involve the loss of income, employment, sales, and tax revenues from the lowering of economic demand for the area; and (2) the cumulative potential impact could involve the long term loss of the capacity of the region to attract future business, residential, and other related economic growth.

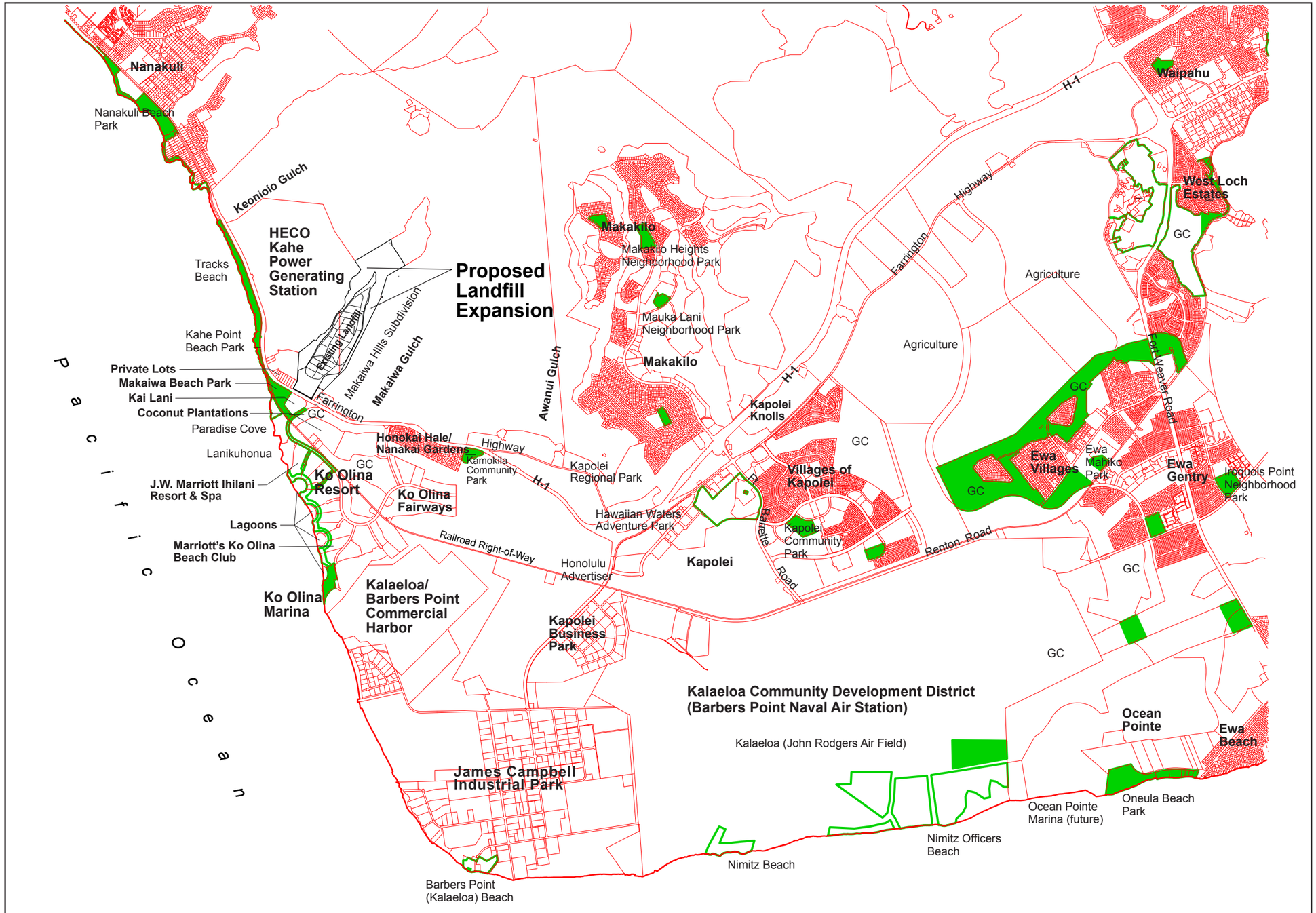
The mitigative measures as provided in this EIS to address the socioeconomic resources of the area and region have been proposed to mitigate or reduce the potential for primary impacts that could lead to the potential secondary or cumulative impacts described above. These mitigation measures are provided in this and in other sections of the EIS to maintain the environmental quality of the area and region.

7.2 Land Use and Ownership

7.2.1. Regional Land Uses

The region of ‘Ewa surrounding the WGSL is composed of a mix of multiple land uses including residential, resort, recreational, business, commercial, and industrial uses. These uses include, but are not limited to, the following (**Figure 7-3, Regional Land Uses in Ewa**):

- Hawaiian Electric Kahe Power Generating Station - This is the largest power plant on O‘ahu producing approximately 651 megawatts of electricity for residential, commercial, business, government, military and industrial uses. The power plant is located west of the WGSL.
- Kahe Point Beach Park - This is public beach park situated less than half a mile south from the landfill. The park is located makai and oceanside of the Kahe Power Generating Station and the WGSL.
- Paradise Cove - This is a private recreational facility providing luaus and entertainment on approximately 12 acres about half a mile southwest of WGSL. It is located on the shoreline adjacent to the Ko Olina Resort and serves guests of the resort, tourists with other accommodations on O‘ahu and the neighbor islands, and the residents of O‘ahu.



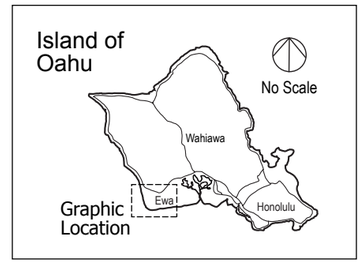


Figure 7-3
Regional Land Uses in Ewa
Waimanalo Gulch Sanitary Landfill Expansion
Department of Environmental Services

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R.M. TOWILL CORPORATION Mary 2008

- Lanikūhonua - Private property owned by the Estate of James Campbell. The site is used for recreational, cultural, and related purposes.
- Hawaiian Waters Adventure Park - This is a 25 acre water theme park located approximately 3 miles east of the WGSL. The park has served Leeward area and O‘ahu residents since May 1999.
- Ko Olina Resort - This 640 acre property is located makai of Farrington Highway and the WGSL. The Ko Olina coastline is comprised of sandy and rocky beachfront with a series of man-made lagoons along the shoreline. The site contains various resort, residential, and commercial facilities that include:
  - J. W. Marriott Ihilani Resort and Spa, is a resort hotel providing accommodation and amenities for tourists and local residents.
  - Marriott's Ko Olina Beach Club, is a timeshare resort. According to the Marriott website the facility is expanding with new construction that is scheduled to continue until July 2009. (http://www.vacationclub.com/resorts/ko/default.jsp).
  - Residential properties include: Ko Olina Kai Golf Estates and Villas, Kai Lani at Ko Olina, The Coconut Plantation, Ko Olina Fairways, Ko Olina Beach Villas, and the Ko Olina Hillside Villas.
  - Ko Olina Marina, opened in 2000, is a privately owned marina and situated on approximately 43 acres with 330 slips, maritime related facilities, and utilities.
  - Other properties and facilities associated with the Ko Olina Resort may be present at the site and it is expected that continuing resort and residential development will be planned in the future.
- Makaiwa Hills - This is a residential subdivision proposed for future development on land that is adjacent to and east of the WGSL. According to the Makaiwa Hills website, the project is a, "1,915 acre ocean view Hillside Planned Community over-looking Diamond Head with 1,875 homes, elementary school, a regional commercial center, parks, an 18-hole championship golf course, and extensive ridge and valley open spaces." (http://www.menne.com/maka.htm, Bryan Menne & Associates, website accessed 2/5/2008).
- James Campbell Industrial Park - This is a 1,267 acre commercial and industrial park with a number of businesses that include, but are not limited to, two oil refineries, a cement processing plant, 3 power

generating facilities, an aluminum fabricating company, moving and storage firms, and various other businesses. The facility was first constructed in 1958 and is located approximately 2.5 miles southeast of the landfill. The industrial park is home to H-POWER, the City's waste to energy recycling facility.

- Kalaeloa/Barbers Point Harbor - This is a commercial harbor that has become the second busiest harbor on O‘ahu. The harbor comprises 241 acres and includes facilities for container storage, ship repair, and related maritime activities. The site is located approximately 3.5 miles south of the landfill.
- Honokai Hale and Nanakai Gardens - These subdivisions are adjoining residential developments that are located less than approximately one mile southeast from the landfill.
- Makakilo - This is a residential development that was constructed prior to 1962 by Finance Realty. The subdivision is located approximately 2 to 3 miles east of the landfill. New subdivision development is presently on-going and future plans call for the construction of a Makakilo Drive bypass to relive traffic congestion.
- Villages of Kapolei - This subdivision includes a number of phased residential developments that were first constructed around 1990. The subdivision contains approximately 4,700 units on 698 acres of land. The site is located approximately 4 miles east of the landfill.
- West Loch Estates - This is a residential development initiated by the City & County of Honolulu. The site is located on the West Loch peninsula of Pearl Harbor.
- ‘Ewa Villages - This residential subdivision incorporates both new and renovated housing units that once served as sugar plantation housing for workers.
- ‘Ewa Gentry - This is a residential subdivision on land that was once under active sugar cultivation.
- Ocean Pointe - This residential development is situated on 1,100 acres of land along the ‘Ewa coastline.
- Kapolei Knolls - This is a residential subdivision located in the Kapolei area of ‘Ewa.
- Barbers Point Naval Air Station (BPNAS) - This is a closed Department of Defense facility now known as the Kalaeloa Community Development

District (July 1999). The 2,150 acre site is located 3 miles southeast of the landfill. In March 2006, the Hawai'i Community Development Authority (HCDA) published the Kalaeloa Master Plan to serve as a planning and policy guide and to coordinate the multiple entities with jurisdiction or interest in future land uses.

Other land uses including businesses, parks, schools, and other facilities also operate in the region.

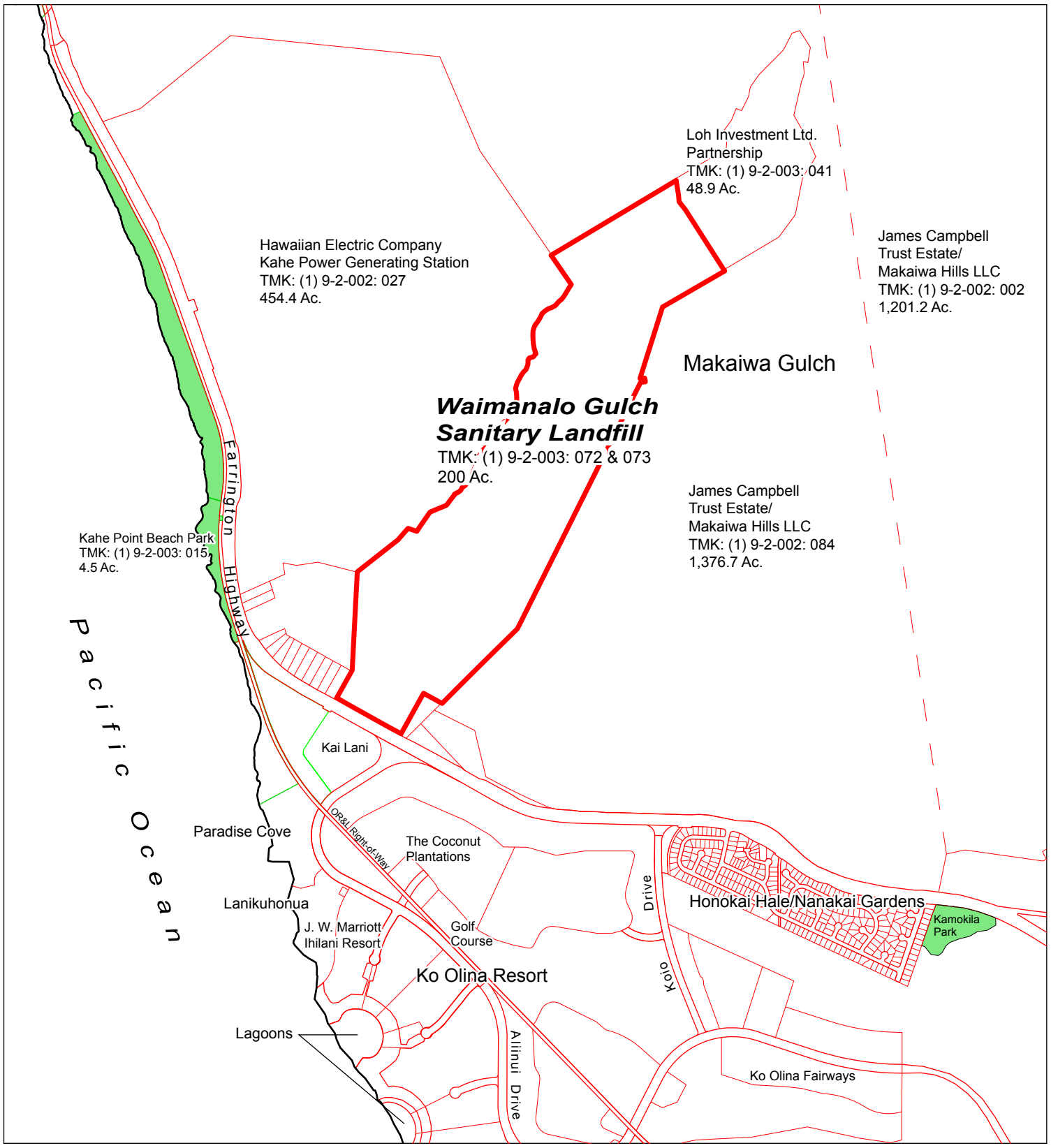
7.2.2. Properties Within Proximity to the Proposed Project

Properties adjoining WGSL include the following (see **Figure 7-4, Properties in Proximity to WGSL**):

Table 7-12
Selected Properties Adjacent to the Southwest Corner of WGSL

No.	Tax Map Key	Ownership[10]
1.	(1) 9-2-003: 030 (1.0 acres)	Haili Rachel K
2.	(1) 9-2-003: 031 (0.8 acres)	Villanueva Sergio M
3.	(1) 9-2-003: 032 (0.8 acres)	Rapoza Moses & Iris T
4.	(1) 9-2-003: 033 (0.8 acres)	Lindahl-Giron Sherri M
5.	(1) 9-2-003: 034 (0.8 acres)	Kahe Homes
6.	(1) 9-2-003: 035 (0.8 acres)	Kahe Homes
7.	(1) 9-2-003: 036 (0.8 acres)	Kahe Homes
8.	(1) 9-2-003: 037 (0.7 acres)	Kehe [sic] Homes LLC
9.	(1) 9-2-003: 038 (0.6 acres)	Kahe Homes LLC & II LLC
10.	(1) 9-2-003: 039 (0.7 acres)	Richardson Florence C
11.	(1) 9-2-003: 047 (0.9 acres)	Nakatani Irene T & Robert I
12.	(1) 9-2-003: 049 (0.8 acres)	Nakano Judith R
13.	(1) 9-2-003: 013 (21.2 acres)	Lum Betsy F S A
14.	(1) 9-2-003: 015 (4.5.0 acres)	City & County of Honolulu

[10] Property data source: Win2Data®, February 21, 2008, Tax Map Key ownership listing.



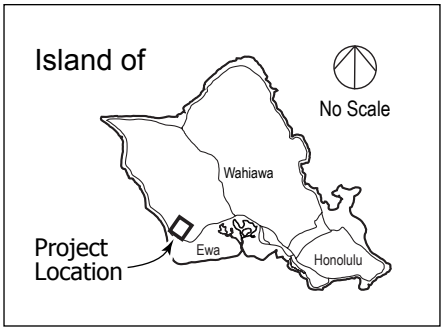


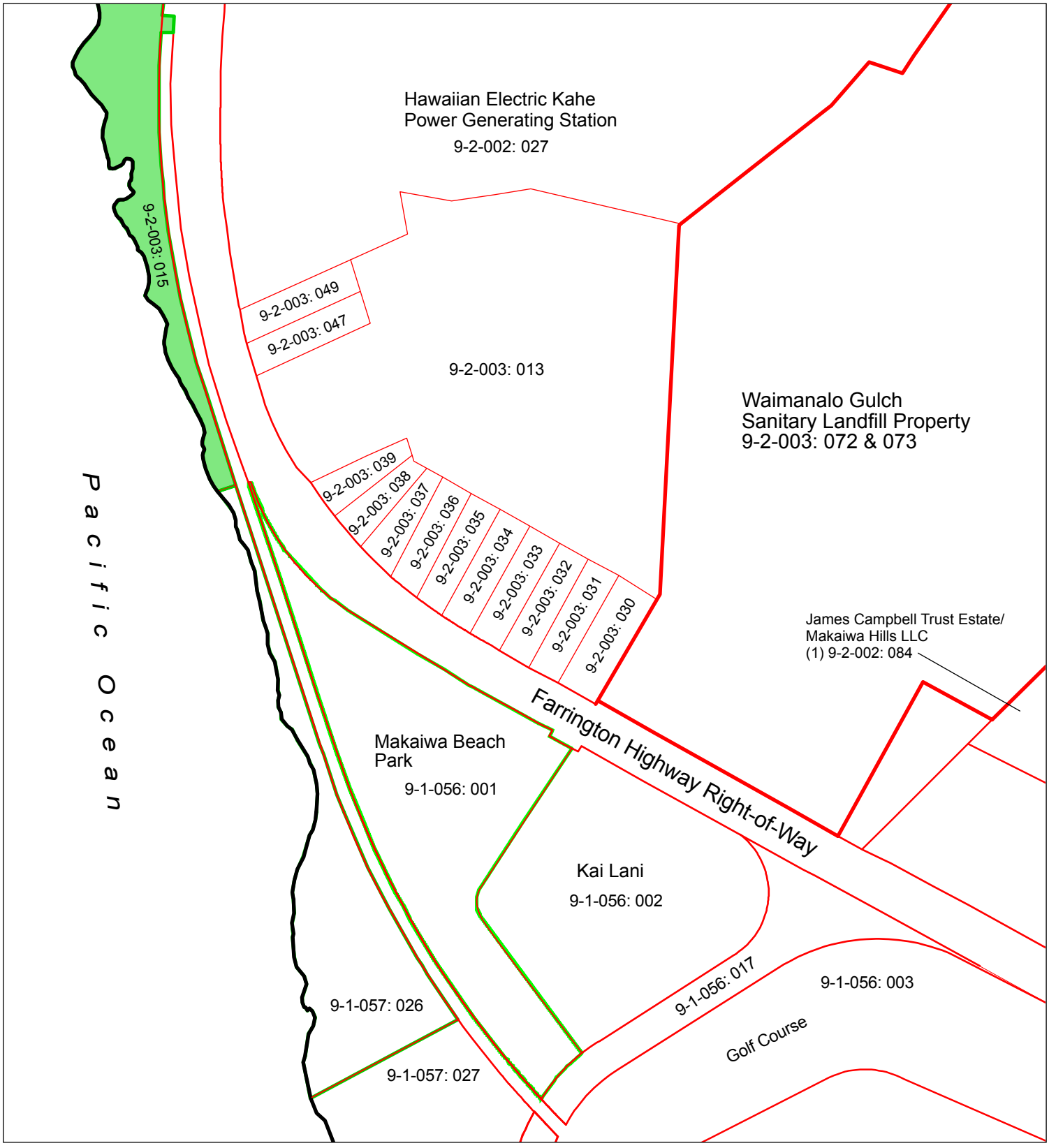
Figure 7-4
Properties in Proximity to WGSL
Waimanalo Gulch Sanitary Landfill Expansion
Department of Environmental Services

0 1500 Feet 3000

R.M. TOWILL CORPORATION May 2008

- The northernmost point of the landfill adjoins land owned by the Loh Investment Ltd. Partnership (TMK: 9-2-003: 041, 48.9 acres).
- ~~West~~ Northwest of the landfill is the Hawaiian Electric Company (HECO) Kahe Power Generating Station (TMK: (1) 9-2-041: 027, 454.4 acres). Electrical transmission lines from the power plant traverse the project site at elevations of between approximately 760 and 840 feet.
- The northwestern and east portions of the landfill are bounded by land owned by the James Campbell Trust Estate/Makaiwa Hills LLC (TMK: (1) 9-2-003: 084, 1,376.7 acres). Future plans call for the development of a residential subdivision known as Makaiwa Hills[11].
- The northwestern most boundary of the Campbell Estate Trust property, northwest of the Kahe power plant, is also the location of the Southern Cross Terminal Building, a telecommunications facility which receives and processes communications signals from submarine fiber optic cables emanating from New Zealand, Australia, Fiji, and the Continental U.S.
- South of the project site is Farrington Highway (FASP No. S-900(4)), a State DOT facility which is the main thoroughfare serving the Wai‘anae Coast and the point of entry to the WGSL.
- Along the southwest corner of the landfill, above Farrington Highway, are private parcels under various ownerships (see **Table 7-12**, and **Figure 7-5**, **Selected Properties Adjacent to the Southwest Corner of WGSL**).
- Makai of the Farrington Highway to the south and southeast is the Kahe Point Beach Park (TMK: (1) 9-2-003: 015) and Ko Olina Resort (TMK: (1) 9-2-003, 9-1-056, and 9-1-057, various parcels). Kahe Point Beach Park is a City & County of Honolulu public park.

[11] According to Campbell Estate by letter (2002 Annual Report, Docket No. A92-687), to the State LUC dated October 22, 2002, the developer is exploring various ways to develop the project and will provide the required notice to prospective buyers of the project in accordance with Condition No. 19, of the Docket which states: *“19. Petitioner shall notify all prospective buyers of property in the Project of the potential odor, noise, and dust pollution resulting from surrounding Agricultural District land, Hawaiian Electric Company’s Kahe Power Plant, and the City and County of Honolulu’s Waimānalo Gulch Sanitary Landfill.”*



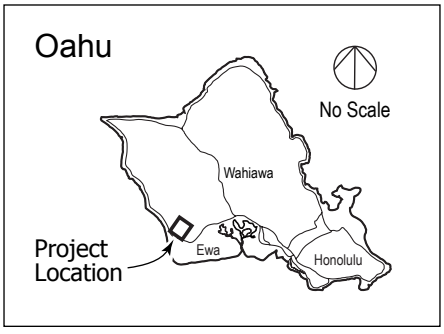


Figure 7-5
Selected Properties Adjacent to the Southwest Corner of WGSL
Waimanalo Gulch Sanitary Landfill Expansion
Department of Environmental Services

0 400 Feet 800

R.M. TOWILL CORPORATION May 2008

Across Farrington Highway and approximately 200 feet from the southern landfill boundary is the main entrance to the Ko Olina Resort. Southeast of this boundary is the northwest corner of the Ko Olina Golf Course and The Coconut Plantations residential development comprised of approximately 270 multifamily units on approximately 29 acres of land. The Ko Olina Kai Lani Subdivision, first constructed in the early 2000s, lies across the highway from the WGSL.

Additional existing and planned properties and developments within the Ko Olina Resort in proximity to the proposed landfill expansion area includes the Paradise Cove Luau, Lanikūhonua, J. W. Marriott Ihilani Resort and Spa, and other residential developments associated with the Ko Olina Resort property.

7.2.3. Potential Impacts and Mitigation Measures

While WGSL is designed to serve all communities on the Island of O‘ahu, the potential for impacts associated with the use and operation of the facility are expected to be at a localized or community level based on the nature of the project involving waste handling and disposal within the Waimānalo Gulch. The operation of the proposed project therefore, is expected to result in potential land use impacts similar to those associated with the current use of the site. These potential impacts include:

- The generation of nuisance odors during delivery and landfilling of refuse.
- Windblown litter from the landfill becoming airborne and litter from improperly secured loads from refuse delivery trucks and private self-haulers.
- Traffic impacts associated with the transit of vehicles entering and leaving WGSL.
- The tracking of mud and sediments onto Farrington Highway from vehicles exiting the landfill.
- The migration of fugitive dust from landfill operations including earthwork and vehicles transiting to and from the site.

- The modification or loss of mauka view planes toward the WGSL.

A number of mitigation measures as described in this document have been identified to address the potential impacts described above. These measures, however, as previously noted in the WGSL Expansion FSEIS, 2002, will continue to require ongoing coordination with surrounding community and landownership interests. These parties include, but are not limited to: Ko Olina; Hawaiian Electric Company; James Campbell Estate Trust/Makaiwa Hills LLC; the Wai‘anae and Kapolei Neighborhood Boards; and other community groups and organizations that may be adversely affected or with an interest in the proper operation of the landfill.

Effort by the City Administration to establish an Oversight Advisory Committee for Waimānalo Gulch was initiated in July 2006. The purpose of the Committee was to serve in an advisory capacity to the Administration on landfill operational activities and to provide recommendations, as needed, to mitigate the potential effects of landfill operations on the community. While the Oversight Advisory Committee is continuing to serve in this capacity, on-going efforts by ENV and WMH will be maintained and extended to coordinate the operation of WGSL with the surrounding community. The mitigation measures that will be implemented are previously described in Section 7, 7.1.5. Socioeconomic Mitigation Measures.

Land Use and Ownership Summary

The proposed project is anticipated to result in the potential for secondary and cumulative land use impacts similar to those associated with the existing use of the site. These potential impacts would be an outgrowth of those identified in this section, summarized as:

- The generation of nuisance odors.
- Windblown litter from the landfill becoming airborne and litter from improperly secured loads from refuse trucks and private self-haulers.

- Traffic impacts associated with the transit of vehicles entering and leaving WGSL.
- The tracking of mud and sediments onto Farrington Highway.
- The migration of fugitive dust from landfill operations.
- The modification or loss of mauka view planes toward the WGSL.

These direct impacts could potentially lead to secondary and cumulative impacts that would include the loss or impaired use of land and properties in the affected area. Mitigation to address these concerns is addressed in this section and in the following:

- 4.2.3. Environmental Controls, Litter, to address windblown litter.
- 4.4. Dust and Mud, to address tracking of mud and migration of fugitive dust.
- 5.7.3. Potential Impacts and Mitigation Measures (Air Quality), for odor control.
- 5.10.2. Potential Impacts and Mitigation Measures (Scenic and Aesthetic Environment), to address impacts to view planes toward the WGSL.

7.3 Historic and Archaeological Resources

7.3.1. Introduction

An Archaeological Inventory Survey (AIS) of the proposed project site was conducted by Cultural Surveys Hawai'i (CSH) in 2007 and 2008 (**Appendix G, Archaeological Inventory Survey**). The purpose of the AIS was to document all historic properties within the 92.5 acre area of the proposed project known as the Area of Potential Effect (APE). The following scope of work was identified to meet state and City & County of Honolulu requirements for AIS documentation in accordance with Chapter 13-13-276, HAR, and included coordination with the State Historic Preservation Division (SHPD) and City to address archaeological concerns:

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 an 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 the inventory survey report included:
    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

7.3.2. Methodology

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 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 using Global Positioning System (GPS) instruments.

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.

Document Review

Background research included a review of previous archaeological studies on file at SHPD; 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 Land Court Awards (LCAs) was accessed through the Waihona 'Āina Corporation's Māhele Data Base (www.waihona.com).

The 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.

Consultation

CSH worked with the Office of Hawaiian Affairs (OHA), SHPD, and knowledgeable cultural consultants pursuant to the requirements of HAR 13-276-5(g) and HAR 13-275/284-8(a)(2). 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 Chapter 343, HRS, and the Office of Environmental Quality Control's guidelines for assessing cultural impacts. **Table 7-13** summarizes the individuals and organizations/agencies that have been consulted.

7.3.3. Summary of Background Research and Predictive Model

Historical background research of Hono'uli'uli Ahupua'a indicated that pre-contact settlement would have been centered around the rich cultivated lands of Hono'uli'uli '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. (CSH, 2008).

Table 7-13
Cultural and/or Agency Consultations

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

By 1920, the lands of Hono‘uli‘uli were used primarily for commercial sugar 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 and remained as pasture land for grazing livestock. Historical maps indicate a lack of any significant development within the study area into the late 1920s. (CSH, 2008).

Major land use changes came to western Hono‘uli‘uli 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. (CSH, 2008).

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 (kūʻula stone and koʻa). 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). (CSH, 2008).

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. (CSH, 2008).

The background research indicates that historic properties are not expected to be encountered in the study area. This is based on review of the AIS for the proposed WGSL 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 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. (CSH, 2008).

7.3.4. Results of Fieldwork

Fieldwork for the archaeological investigation was accomplished over a one-week period from January 25, 2007 to February 2, 2007 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. (CSH, 2008).

Survey Findings

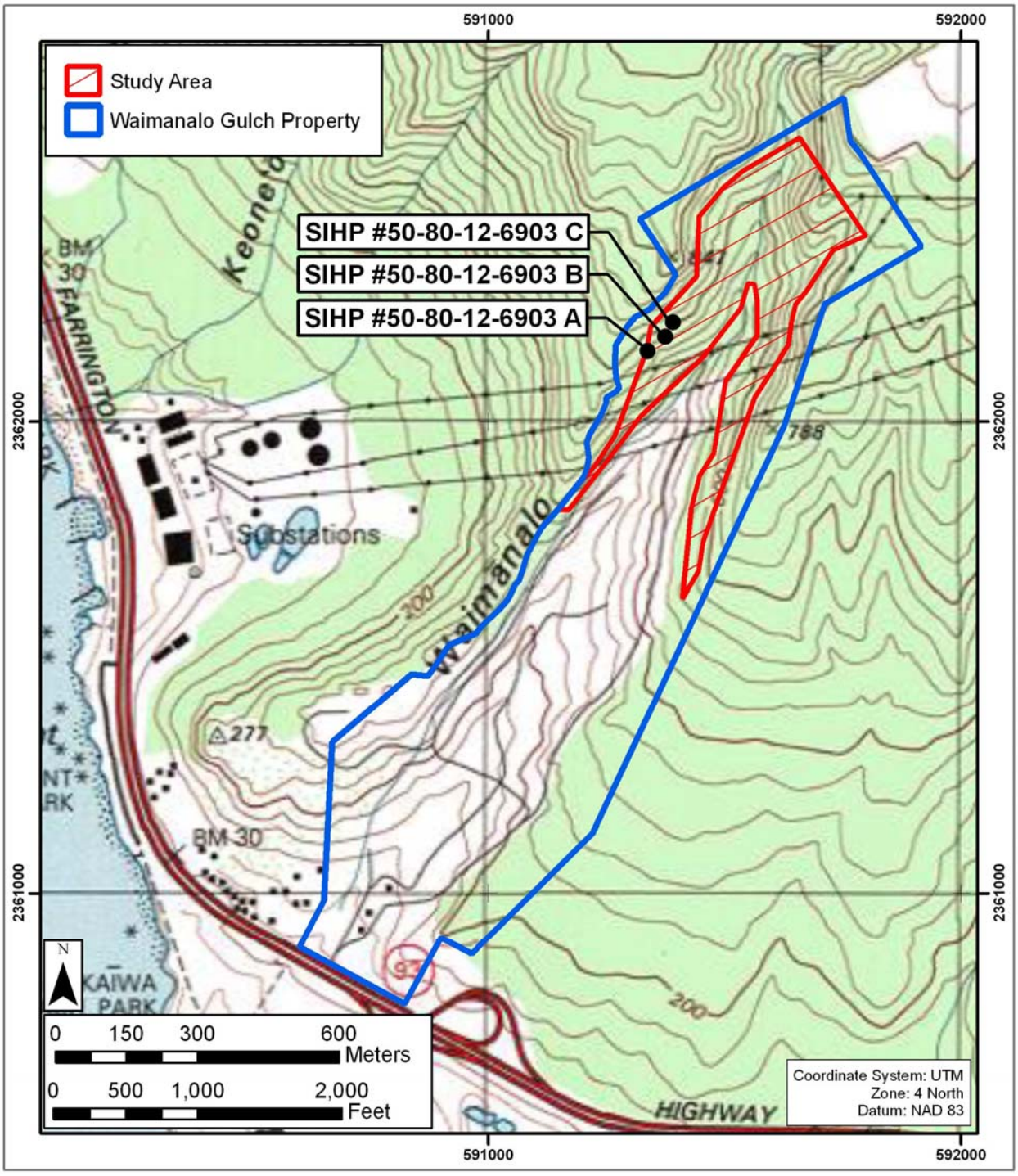
Pedestrian inspection of the study area identified one historic property, State Inventory of Historic Properties (SIHP) # 50-80-12-6903, within the study area (**Figure 7-6**). SIHP #50-80-12-6903 is of pre-contact origin, and consists of three large upright boulders potentially utilized as trail or boundary markers. A description of this historic property is presented below (see Description of Historic Property). (CSH, 2008).

Numerous natural caves and rock overhangs were observed and 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 subsurface cultural deposits were present. (CSH, 2008).

The observed topography within the study area consisted of talus slopes with an average slope of 65 degrees. The observed geology consisted of exposed basalt outcrops with minimal soil deposition. (CSH, 2008).

As of February 2, 2007, activities taking place in a 6.8 acre area included: controlled dynamite blasting of gulch walls, bulldozing, construction of roads, and removal of material. This area was not included in the pedestrian inspection due to the hazardous conditions present. The exclusion of this area was not a major concern as it was previously surveyed in 1991 by Hammatt et al. and was determined to have no historic properties present. (CSH, 2008).

**Figure 7-6, USGS 7.5 Minute Series Topographic Map,
Ewa Quadrangle (1998), showing location of SIHP #50-80-12-6903
(Features A-C) (CSH, 2008)**



Inspection of Geologic Features

Numerous natural caves and rock overhangs area were discovered and investigated in 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 GPS (**Figure 7-7)**. (CSH, 2008).

A rock alignment identified as "CSH 3", located near the northeastern edge of the study area was also discovered. 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. (CSH, 2008).

Cave 1 - Located on the western slope of Waimānalo Gulch, situated at the base of a small rock outcrop (**Figure 7-8**). The mouth of the cave opens to the northeast and measures 1.5 m high. The internal dimensions of the cave are: 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.

Cave 2 - Located on the western slope of Waimānalo Gulch, situated at the base of a pronounced rock outcrop (**Figure 7-9**). The mouth of the cave opens to the east and measures 1.3 m high. The internal dimensions of the cave are: 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. No cultural material or human skeletal remains were observed on the surface of the cave floor.

Figure 7-7
USGS 7.5 Minute Series Topographic Map, Ewa Quadrangle (1998)
Showing the Location of Documented Caves (CSH, 2008)

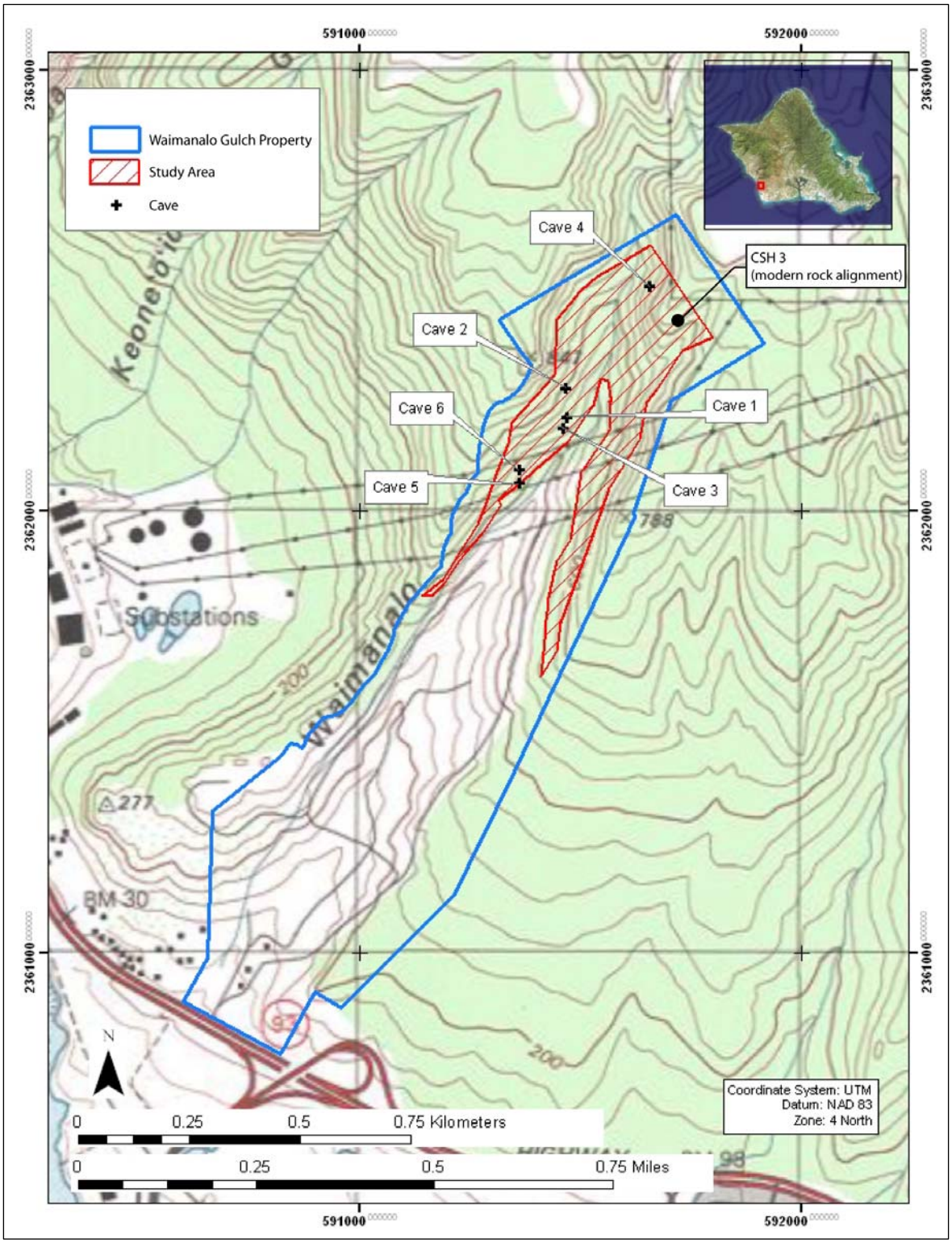


Figure 7-8, Photograph of Opening of Cave 1
View to the North (CSH, 2008)

Figure 7-9, Photograph of Opening of Cave 2
View to the Northwest (CSH, 2008)

Cave 3 - Located on the western slope of Waimānalo Gulch (**Figure 7-7**). The mouth of the cave opens to the south and measures 1.2 m high. The internal dimensions of the cave are: 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.

Cave 4 - Located on the eastern slope of Waimānalo Gulch (**Figure 7-10**). This cave consists of a rock overhang situated at the base of the large rock outcrop. The mouth of the cave opens to the west and measures 2.0 m high. The internal dimensions of the cave are: 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 7-11**). No other cultural material or human skeletal remains were observed on the surface of the cave floor.

Cave 5 - Located on the western slope of Waimānalo Gulch, situated near the southwestern end of the study area, overlooking the modern landfill (**Figure 7-7**). The mouth of the cave opens to the south and measures 1.0 m high. The internal dimensions of the cave are: 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.

Cave 6 - Located on the western slope of Waimānalo Gulch (**Figure 7-7**). The mouth of the cave opens to the east and measures 1.2 m high. The internal dimensions of the cave are: 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.

Modern Rock Alignment - A linear rock alignment (CSH 3) was located near the northeastern edge of the study area (**Figure 7-7**). The alignment is constructed of a single course of six small boulders, situated on the eastern slope of Waimānalo Gulch (**Figure 7-12** & **Figure 7-13**). It measures 1.2 m long and 0.6

**Figure 7-10, Photograph of Opening of Cave 4
View to the Northeast CSH, 2008)**

**Figure 7-11, Photograph of Skeleton Keys
From Cave 4 (CSH, 2008)**

Figure 7-12, Photograph of CSH 3
View to the West (CSH, 2008)

Figure 7-13, Photograph of CHS 3
View to the South (CSH, 2008)

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.

Historic Property Description

Designation and Formal Type:	SIHP # 50-80-12-6903, Rock uprights
Function:	Trail / boundary marker
No. of Features	3
Age:	Pre-contact
Dimensions:	80 m long (NE-SW) x 10 m wide (NW-SE)
Location:	Waimānalo Gulch
Tax Map Key:	(1) 9-2-003: 073
Land Jurisdiction:	City & County of Honolulu

SIHP #50-80-12-6903 consists of three large upright boulders (Features A-C) possibly utilized as trail or boundary markers, located approximately 1320 m (4330 ft) inland of the coast along the western edge of the study area (**Figure 7-6**). The site is situated approximately 140 m (459 ft) north of the existing WGSL 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. A description of the features indicate (CSH, 2008):

> **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 7-14** and **7-15**). 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

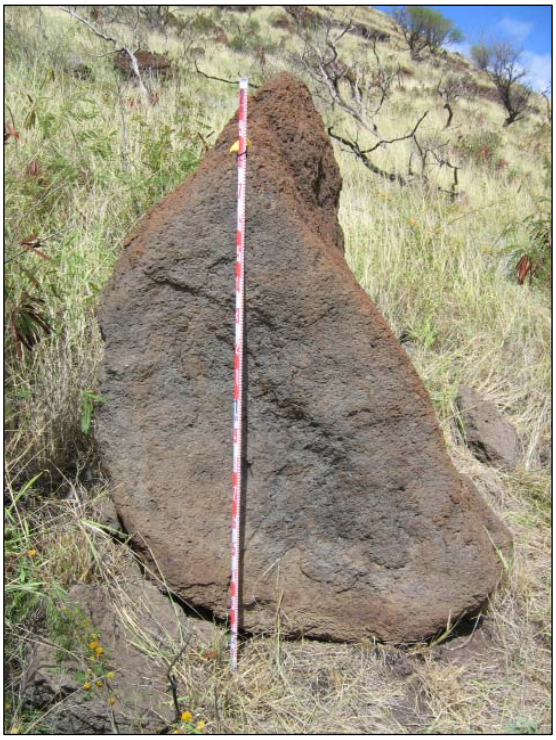


Figure 7-14, Photograph of Feature A
Upright Boulder, View to the North (CSH, 2008)

Figure 7-15, Photograph of Feature A
Upright Boulder, View to the West (CSH, 2008)

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 7-16** and **7-17**). 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 7-18** and **7-19**). 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.

7.3.5. Cultural Consultation Process

Introduction

The AIS investigation was carried out pursuant to the requirements of the Hawai‘i archaeological inventory survey regulations (HAR 13-276-5(g)) and Hawai‘i historic preservation review legislation (HAR 13-275-8(a)(2)). The cultural consultation effort focused on locating any additional cultural and/or historical land use information for the study area and focused on better establishing the age, function, cultural affiliation, and significance of the historic property identified in the study area. Mitigation measures were also developed for the significant historic property that would be affected by the proposed project. (CSH, 2008).

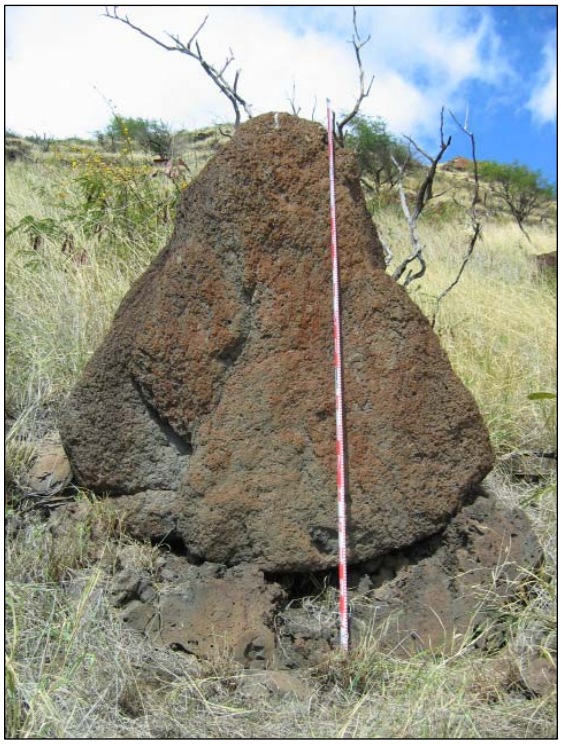


Figure 7-16, Photograph of Feature B
Upright Boulder, View to the North (CSH, 2008)

Figure 7-17, Photograph of Feature B
Upright Boulder, View to the West (CSH, 2008)

Figure 7-18, Photograph of Feature C
Upright Boulder, View to the West (CSH, 2008)

Figure 7-19, Photograph of Feature C
Upright Boulder, View to the Northwest (CSH, 2008)

Process Chronology

March 13, 2007 - During an SHPD site visit to the study area, former O‘ahu Island Archaeologist, Adam Johnson toured the location of SIHP #50-80-12-6903 and 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 the 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 Hawai‘i Register of Historic Places.

March 27, 2007 - CSH conducted a cultural consultant site visit with William Ailā (Hui Malāma I Nā Kūpuna), Eric Enos (cultural practitioner and Director of Ka‘ala Farms), Shad Kane (‘Ahahui Siwila Hawai’i O Kapolei Hawaiian Civic Club), and McD Philpotts (long-time resident of Waimānalo ‘Ili). 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 on function, all of the cultural consultants present indicated 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 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 land fill surface appears more like the surrounding hillsides.

May 1, 2007 - CSH mailed 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. A copy of the consultation letter is provided in the CSH AIS Report.

May 24, 2007 - OHA provided a response to CSH's May 1, 2007 consultation letter on May 24, 2007, and is included in the CSH AIS Report. OHA requested additional project-related cultural consultation with members of the Koa Mana organization and Nettie Tiffany associated with Lanikūhonua. Additionally, the letter queried whether or not subsurface testing was undertaken as a part of the project AIS. Finally, the OHA letter took the position that the single historic property, SIHP #50-80-12-6903, consisting of three upright stones, should be preserved through adjustment of the current study area boundaries.

CSH responded to OHA in a March 7, 2008 mitigation consultation letter. As a result of OHA's suggestions, members of the Koa Mana organization visited the SIHP #50-80-12-6903 location and vicinity and provided input. Additionally, Nettie Tiffany was included in further cultural consultation.

July 18, 2007 - CSH held another on-site visit. Glenn Kila and Alika Silva from Koa Mana were present, along with Kaleo Paik, 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 the stones were significant and that they had been used by traditional Native Hawaiian cultural practitioners in the past.

October 5, 2007 - CSH held another on-site meeting with the current SHPD O'ahu Island Archaeologists, Lauren Morawski and Teresa Davan. The AIS effort and results was discussed and the three upright stones were 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 to OHA, SHPD, William Ailā (Hui Malāma I Nā Kūpuna), Eric Enos (cultural practitioner and Director of Ka'ala Farms), Shad Kane ('Ahahui Siwila Hawai'i O Kapolei Hawaiian Civic Club), Doug "McD" Philpotts (long-time resident of Waimānalo 'Ili), Nettie Tiffany (Lanikūhonua), and Glenn Kila and Alika Silva (Koa Mana). The consultation letter included response information to the OHA May 24, 2007 letter. It included the results of the project's AIS investigation and a description of the three upright stones. It also summarized the project's cultural consultation effort to date. Finally, it described the proposed mitigation measures (See CSH AIS Report, Appendix C).

In March 2008, following the posting and emailing of the March 7, 2008 consultation letter, CSH attempted to contact the letter recipients by email and telephone to obtain feedback and comments. As a result of the effort on March 20 2008, CSH was contacted by telephone by Shad Kane ('Ahahui Siwila Hawai'i O Kapolei Hawaiian Civic Club) and McD Philpotts (long-time resident of Waimānalo 'Ili). Their comments are summarized as follows:

Doug "McD" Philpotts had four general comments:

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 Waimānalo Gulch. He said he could see the stones faintly, by knowing where to look, but that the stones did not stand out on the Waimānalo 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.

Shad Kane had five general comments:

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.

As a result of telephone follow up by CSH, Nettie Tiffany (Lanikūhonua) contacted Matt McDermott of CSH. Although Ms. Tiffany had not participated in the previous site visits, she had four general comments:

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.

March 25, 2008 - SHPD staff Kaleo Paik (Culture and History Branch) and O'ahu Island Archaeologists Lauren Morawski and Teresa Davan met with CSH to discuss the project's ongoing consultation effort results. The project proponent's proposed mitigation were also discussed. The SHPD staff had the following comments regarding the stones and their proposed mitigation:

1. 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. 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.

Summary of Consultation Effort

According to CSH the consultation effort determined no clear consensus regarding the function of the three stone uprights. However, all of the cultural consultants indicated that the stones were significant and that they were likely used by traditional Native Hawaiian cultural practitioners in the past. All cultural consultants also felt 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 not an option, most

were in favor of temporary relocation to Battery Arizona, with movement of the stones back to as near as possible to their original location once the landfill is closed. (CSH, 2008).

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. (CSH, 2008).

The cultural consultants expressed concern regarding the final appearance of the landfill once it reaches capacity and is no longer 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 hillsides. (CSH, 2008).

CSH thanks 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. (CSH, 2008).

7.3.6. Summary and Interpretation

The AIS was completed by CSH in compliance with applicable State of Hawai'i historic preservation legislation. 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 the 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. (CSH, 2008).

The archaeological survey of the project area identified one historic property designed as SIHP #50-80-12-6903, consisting of three stone uprights, and is located along the western edge of the study area, situated on the western slope of Waimānalo Gulch. The site is of pre-contact origin and is identified as Features A through C. The three upright boulders were potentially used as trail or boundary markers. (CSH, 2008).

The inventory survey fieldwork also involved a thorough inspection of caves and rock shelters observed within the study area. The 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 as a human interment site. (CSH, 2008).

A rock alignment (CSH 3) was also found located near the northeastern edge of the study area. The alignment was determined to be of modern origin. 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 rock alignment. (CSH, 2008).

The AIS findings are largely consistent with expectations based on background research. An archaeological inventory survey of the “Makaīwa Hills” development project, totaling 1,850 acres and encompassing large portions of the Makaīwa and Pālailai gulches, identified pre-contact habitation sites clustered in higher elevations above 1,000 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 feet, 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 and is consistent with the pattern observed by Hammatt et al. in 1991. Furthermore, 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). (CSH, 2008).

Both the Hammatt et al. (1991) study and the current AIS are important because they provide valuable data toward establishing a settlement pattern for the leeward gulches and ridges of the Honoʻuliʻuli Ahupuaʻa. 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 the 500 and 1,000 foot elevations and was most likely utilized for transportation between the more hospitable coast and upland forest areas. (CSH, 2008).

7.3.7. Significance Assessment

The AIS investigation provides sufficient information for an evaluation of significance in accordance with the Hawaiʻi State Registers of Historic Places (HAR 13-275-6). The criteria used to establish significance include:

> **Criteria A** - Historic property reflects major trends or events in the history of the state or nation.
> **Criteria B** - Historic property is associated with the lives of persons significant in our past.

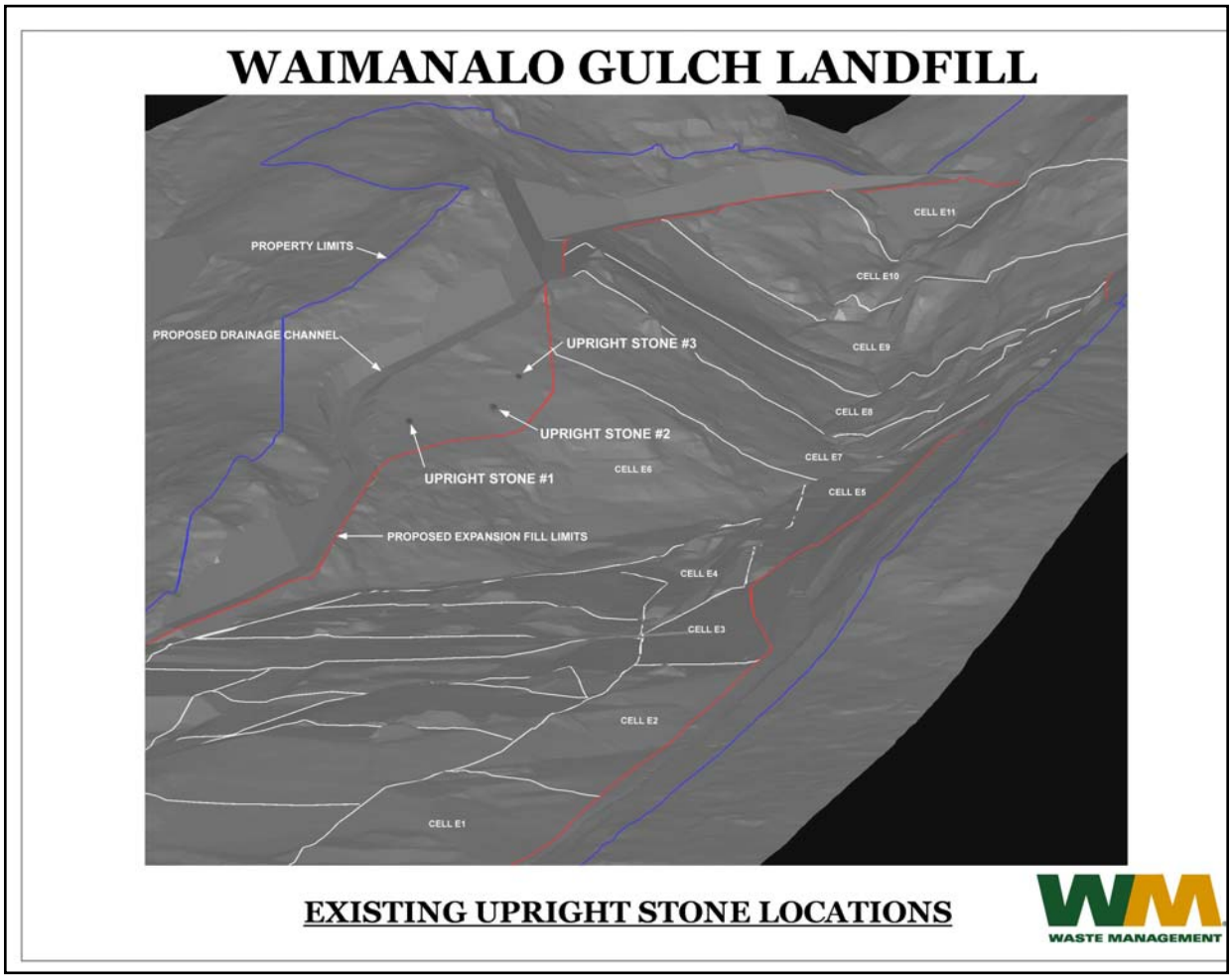
Criteria C - Historic property is an excellent example of a site type.
Criteria D - Historic property has yielded or may be likely to yield information important in prehistory or history.
Criteria E - Historic property has cultural significance to an ethnic group, including, but not limited to, religious structures and burials.

SIHP #50-80-12-6903, consisting of three rock uprights, possesses integrity of location and materials and is recommended by CSH as eligible to the Hawai‘i Register under criteria D & E.

7.3.8. Potential Impacts and Mitigation Measures

The proposed project will require excavation, mass grading, controlled blasting, and the use of heavy machinery and equipment to develop landfill cells and other structural features that will maintain the integrity and safety of the proposed area of lateral expansion. The development of a modified landfill design was considered by WMH and ENV as a means of providing further protection to the stone uprights. This consideration would avoid the location of the uprights along a steep slope to maintain and preserve the condition of the existing site. However, according to WMH the uprights are located along a ridgeline that would remain susceptible to vibration (**Figure 7-20**):

1. The safety of the stones cannot be guaranteed if they were preserved in place. Excavation, mass grading and controlled blasting in the area of the uprights and elsewhere within the WGSL would subject the stones to repeated vibration over the next 15 years of the proposed project. Vibration from construction activities could potentially be sufficient to dislodge the stones from their existing resting place, causing them to roll down the steep slope they rest on. Upon completion of construction, the original location of the uprights would also have been graded based on landfill design requirements to provide appropriate drainage and slope stability.



Note: Graphic shows the proposed landfill expansion in relation to the three stone uprights comprising SIHP # 50-80-12-6903. Note the large drainage channel upslope of the stones and the cell E6 immediately down slope. (WMH and CSH, 2008).

Figure 7-20, Proposed WGSL Expansion Project
Three-Dimensional Graphic

2. Preservation in place would require a significant reduction of the overall area and volume of the proposed facility expansion. In addition, the stone uprights would be in proximity to a proposed large storm water drainage channel and Cell E6, immediately above the location of the uprights.

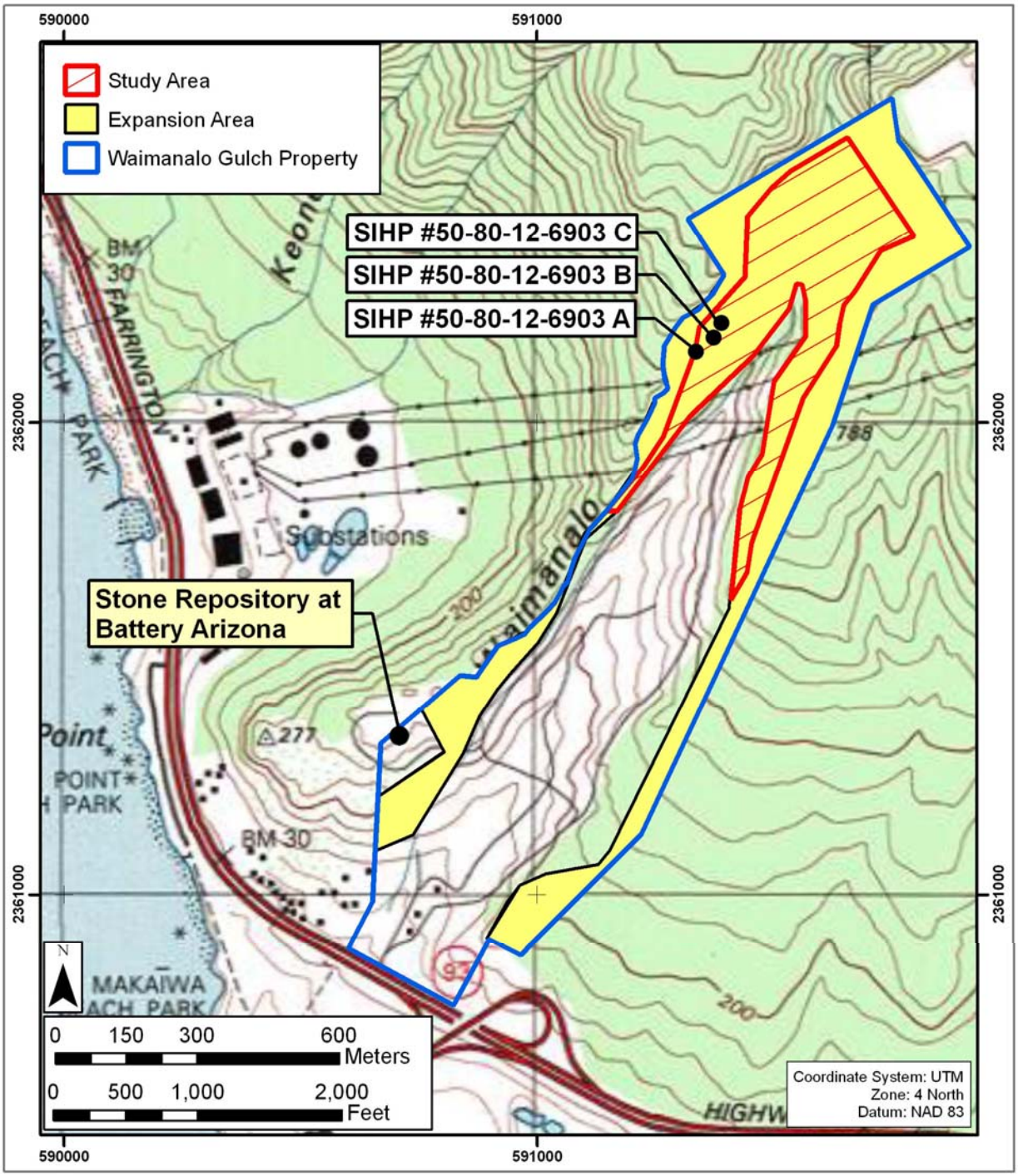
3. Considering the use of the site as a landfill, preservation in place is not thought to be an appropriate mitigation treatment for the stones, considering their cultural sensitivity.

Because of concern that construction activities could jeopardize the area of the site and potentially undermine the stability of the underlying surface of the stone uprights, or the uprights themselves, WMH and ENV have determined that the three upright stones comprising SIHP # 50-80-12-6903 cannot reasonably be preserved in place in a safe and appropriate manner. Accordingly, a project effect determination of "effect with agreed upon mitigation commitments" is proposed.

Mitigation to address the preservation of the site is recommended in the form of relocation of the three SIHP # 50-80-12-6903 upright stones to the Battery Arizona site, located in the southwestern portion of the WGSL (**Figure 7-21**). This recommendation is based on precedent that was established for three prior noteworthy stones of cultural significance to Native Hawaiians that have already been relocated based on earlier expansion of the WGSL. These stones, described by Hammatt and Shideler (1999), were relocated to the Battery Arizona site in 1988. **Figure 7-22**, shows the location of this established stone repository in relation to the Battery Arizona features. **Figures 7-23** and **7-24**, are photographs showing the proposed relocation area in relation to the already established Battery Arizona stone repository site. The proposed relocation would ensure and maintain the safety of the stones during construction activities for the proposed project, and would make them much more accessible to interested parties.

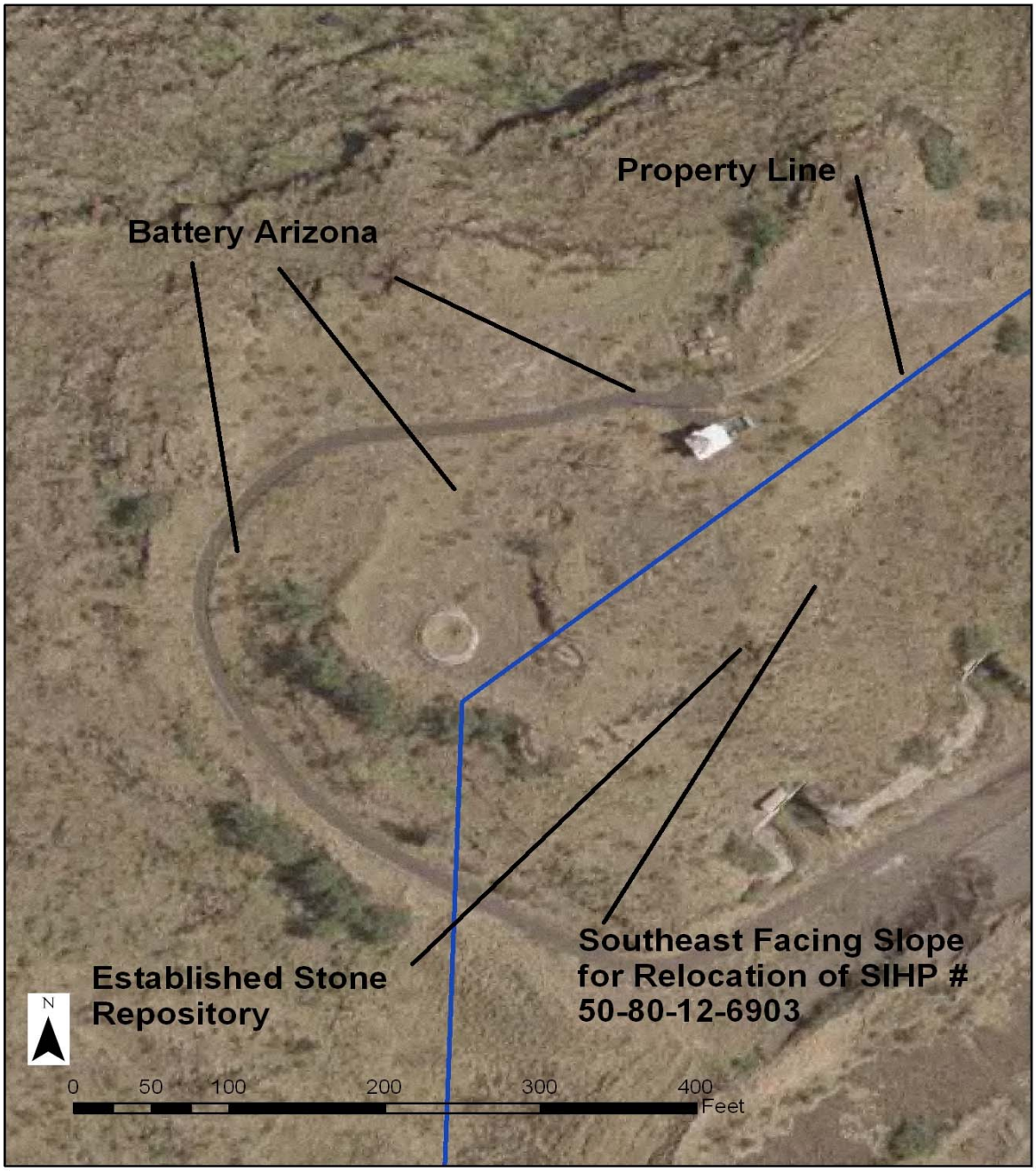
The specific actions required for the proposed relocation would be prepared as part of an Archaeological Mitigation Plan (AMP) for SIHP # 50-80-12-6903. The details would be determined based on further consultation with the cultural consultants, SHPD, ENV, and WMH. The AMP is proposed to include additional research to help better establish the function of the three stones. The option of relocating the stones back to near their original resting places would be included as a part of the discussion.

Figure 7-25 is a modified photograph showing approximately the appearance of the relocation from coastal Honoʻuliʻuli. The relocation would only take place after the planned area of lateral expansion has been completed in approximately 15 years.



Note: 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. (CSH, 2008).

Figure 7-21, Location of Proposed Stone Repository at Battery Arizona and Relationship to SIHP #50-80-12-6903



Note: Aerial photograph of Battery Arizona showing the established stone repository and the proposed relocation area for SIHP # 50-80-12-6903. (CSH, 2008).

Figure 7-22, Aerial Photograph of Proposed Battery Arizona Stone Repository

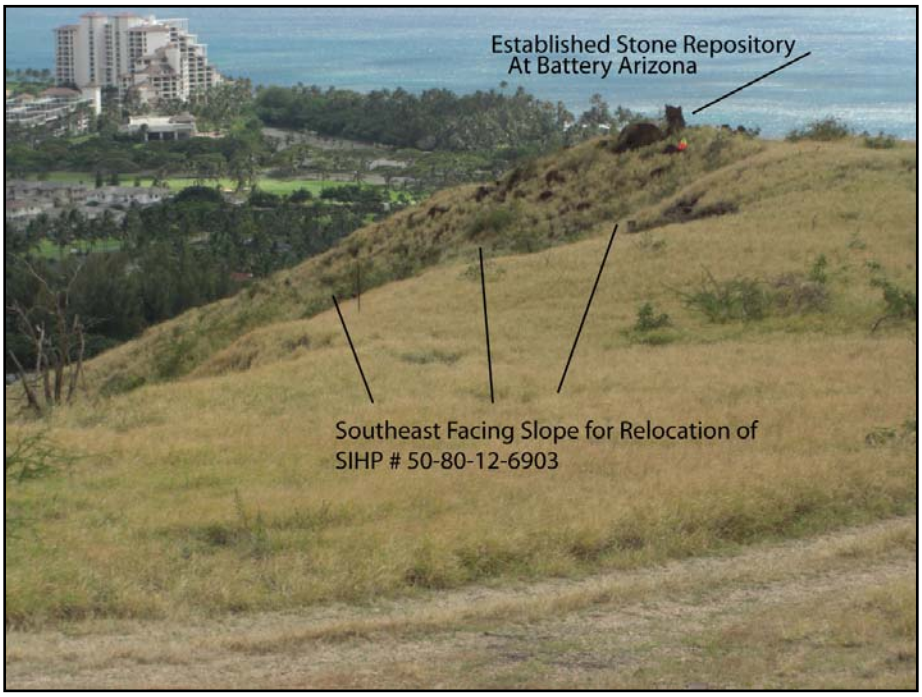


Figure 7-23, Photograph of Proposed Relocation Area at Battery Arizona for SIHP # 50-80-12-6903, View to the South

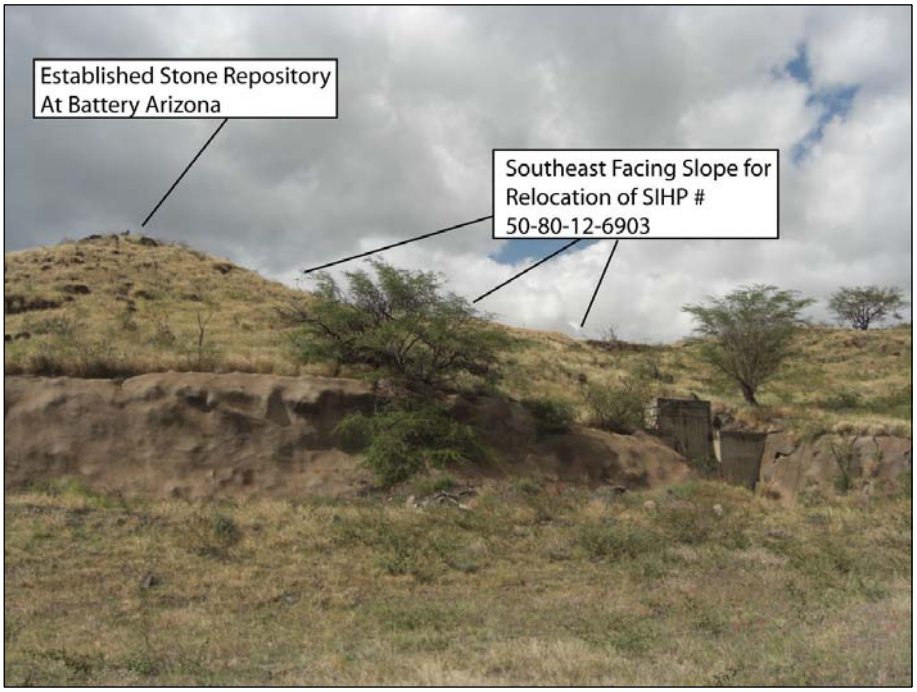
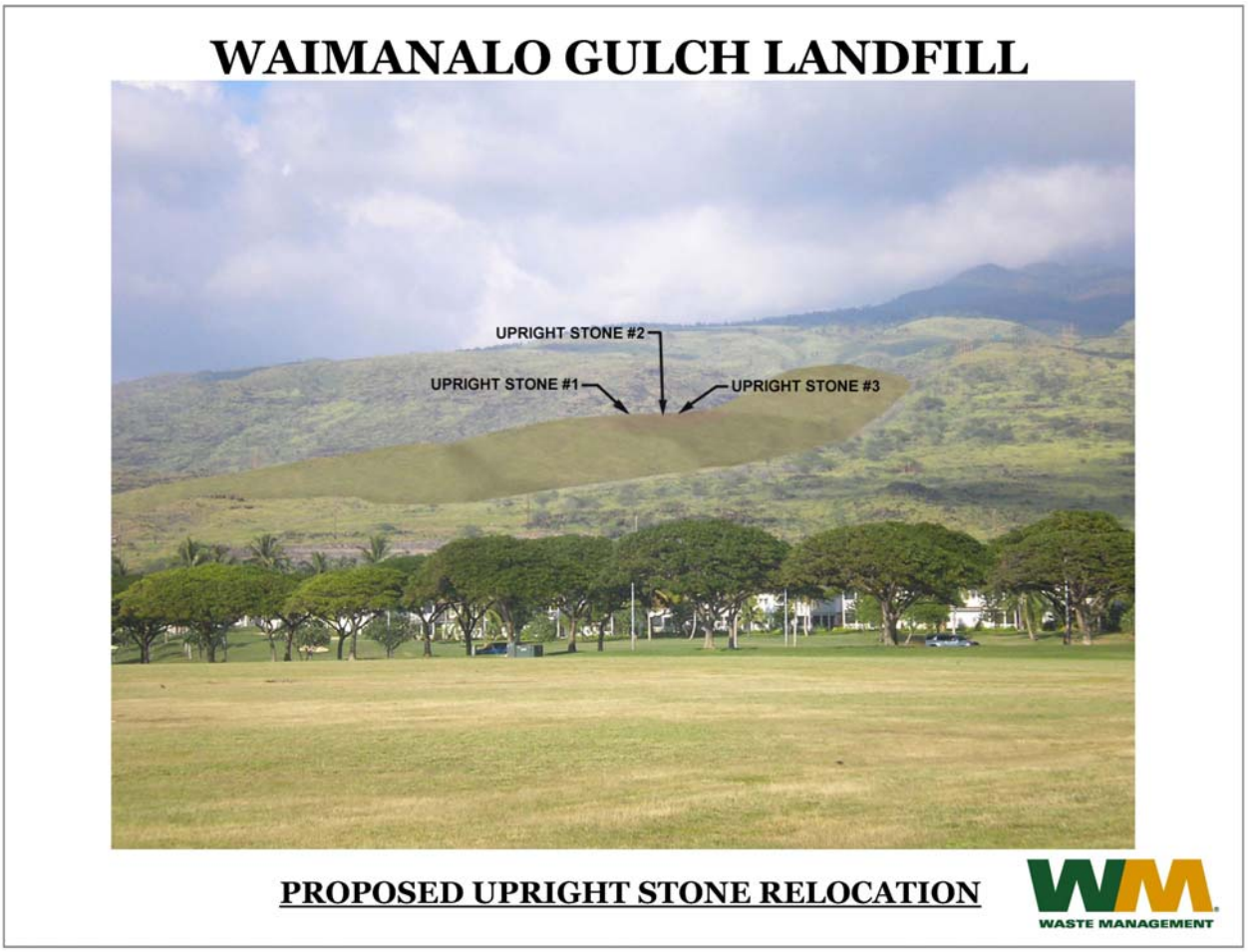


Figure 7-24, Photograph of Proposed Relocation Area at Battery Arizona for SIHP # 50-80-12-6903, View to the North



Note: 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. (CSH and WMH, 2008).

Figure 7-25, Altered Photograph
Planned Landfill Surface in Approximately 15 Years

The permanent relocation of the stones to the Battery Arizona site will also be considered as a more feasible mitigation option. Based on the results of the cultural consultation, however, 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 making public access available. (CSH, 2008).

Historic and Archaeological Resources Summary

There is potential for secondary impacts to historic and archaeological resources that may be present in the area of lateral expansion. Mitigation to address this possibility has

been provided in Section 7.3.8. Potential Impacts and Mitigation Measures (Historic and Archaeological Resources), and in Section 7.4.7. Summary and Conclusions, Potential Impacts and Mitigation Measures (Cultural Impact Assessment).

The potential for cumulative or additive impacts are not anticipated. Prior archaeological studies and reports have been prepared to ensure appropriate examination and historical review of both the existing and proposed areas of use. In addition to the examination of the site by a qualified professional archaeologist, the SHPD and cultural informants with knowledge of the site and region have also reviewed the site. As appropriate, an Archaeological Mitigation Plan (AMP) and other documentation will be prepared and coordinated with the appropriate parties to ensure against adverse effects to historic properties and resources.

7.4 Cultural Impact Assessment

7.4.1. Introduction

A Cultural Impact Assessment (CIA) of the proposed project site was conducted by Cultural Surveys Hawai‘i (CSH) in 2007 and 2008 (**Appendix H, Cultural Impact Assessment (Draft)**). The purpose of the CIA is to consider the effects the proposed project may have on traditional cultural practices and resources and: (1) comply with the Hawai‘i environmental review process (HRS, Chapter 343), which requires consideration of a proposed project’s effect on cultural practices; (2) provide an assessment of the proposed project’s impacts to cultural practices in accordance with the OEQC, Guidelines for Assessing Cultural Impacts; and (3) support the project’s historic preservation review under HRS, Chapter 6E-8 and HAR, Chapter 13-275.

The scope of work for the CIA included (CSH, 2008):

1. Examination of historical documents, Land Commission Awards (LCAs), 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 relating to traditional practices and land use. The report assesses the impact of the proposed action on the cultural practices and features identified.

7.4.2. Methodology

Historical documents, maps and existing archaeological information pertaining to the sites in the vicinity of this project were researched by CSH at the SHPD library, the Cultural Surveys Hawai‘i library, and the University of Hawai‘i (UH) Hamilton Library. The Office of Hawaiian Affairs (OHA), O’ahu Island Burial Council (OIBC), 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.

7.4.3. Traditional and Historic Background

7.4.3.1. Introduction to the Cultural Landscape

The project area is situated on the eastern side of the Wai‘anae Mountains in the Hono‘uli‘uli Ahupua‘a and is sub-divided into the ‘ili of Waimānalo in the moku or district of ‘Ewa. Hono‘uli‘uli is the largest ahupua‘a on O‘ahu and includes all the land from the western boundary of Pearl Harbor 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). The Hono‘uli‘uli Ahupua‘a includes approximately nineteen kilometers (twelve miles) of open coastline from One‘ula 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). (CSH, 2008).

The Hono‘uli‘uli Ahupua‘a includes a long coastline and four miles of waterfront along the west side of West Loch. 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 (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 the limestone plain, the shelf is overlain by alluvium deposited through a series of gulches draining the Wai‘anae Mountains. The major gulches are, from east to west: Awanui, Pālailai, Makaīwa, Waimānalo and Limaloa. The alluvium carried by the gulches 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 do not form stable water sources for traditional agriculture in the 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). (CSH, 2008).

The Hono‘uli‘uli Ahupua‘a, as a traditional land unit, had tremendous and varied resources available for exploitation by early Hawaiians that included (CSH, 2008):

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 Honoʻuliʻuli Valley in the ʻEwa 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 ahupuaʻa would have had species-diverse forest with kukui, ʻōhiʻa, sandalwood, hau, kī, banana, etc.
6. A network of trails giving access to Lualualei and Waiʻanae coastal reaches.

7.4.3.2. Main Areas of Settlement

Cultural, archaeological, and historical sources show a general pattern of three main areas of settlement within the ahupuaʻa: (1) a coastal zone, (2) inland settlement at Puʻu Kuʻua and (3) the Honoʻuliʻuli taro lands (CSH, 2008).

The Coastal Zone - Ko ʻOlina and Kalaeloa (Barbers Point)

Ko ʻOlina - There are three major studies on the Ko ʻOlina 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. (CSH, 2008).

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). A 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. (CSH, 2008).

Inland Settlement at Puʻukuʻua

It is mentioned in moʻolelo (oral history) that the area of Puʻukuʻua, on the east side of the Waiʻanae Ridge, north east of the current project area, seven miles inland of the coast, was a Hawaiian place of great importance. (CSH, 2008).

In 1899, the Hawaiian language newspaper "Ka Loea Kālaiʻāina" relates a story of Puʻukuʻua as "a place where chiefs lived in ancient times" and a "battle field," "thickly populated." This area was well known and visited by all Oʻahu chiefs. (CSH, 2008).

McAllister recorded three sites in this area: two heiau (shrines) (sites 134 Puʻu Kuina and 137 Puʻukuʻua; both destroyed) and a series of enclosures in Kukuilua which he calls "kuleana sites" (McAllister, 1933). On the opposite side of the Waiʻanae range along the trail to Pōhākea Pass, as Cordy (2002) states, “Kākuhihewa was said to have built (or rebuilt) Nīoiʻula, a poʻokanaka 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’ (CSHs') 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. Geographically, the area receives sufficient quantities of water and would have had abundant locally available forest resources. (CSH, 2008).

Honoʻuliʻuli Taro Lands

Centered around the west side of Pearl Harbor at Honoʻuliʻuli Stream and its broad outlet into the West Loch are the rich irrigated lands of the ʻili of Honoʻuliʻuli which give the ahupuaʻa its name. The major archaeological reference to this area is Dicks, Haun and Rosendahl (1987) who documented remnants of a once-widespread wetland system (loʻi and fishponds) as well as dry land cultivation of the adjacent slopes. (CSH, 2008).

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. 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, Honoʻuliʻuli was a locus of habitation for thousands of Hawaiians. (CSH, 2008).

7.4.3.3. Traditional and Legendary Accounts of Honoʻuliʻuli

Honoʻuliʻuli, Oʻahu, is associated with a number of legendary accounts. Many of these concern the actions of gods or demi-gods such as Kāne, Kanaloa, Māui, Kamapuaʻa, the pig god, Maunauna, the shark deity, Kaʻahupāhau, and the hero Palila. There are several references to chiefly lineages and references to the ruling chiefs Hilo-a-Lakapu and Kūaliʻi, (Ko ʻOlina is reported to have been a vacationing place for Kākuhihewa). Traditional and legendary accounts identified by CSH include references to the following:

- The Naming of Honoʻuliʻuli (Legend of Lepeamoʻa)

- The Pele Family at Honoʻuliʻuli
- Keahumoa, Residence of Māui's Grandfather (Legend of Māui's Flying Expedition)
- Kāne and Kanaloa and the Boundaries of ʻEwa (Simeon Nawaa Account)
- Kamapuaʻa, The Pig God, Associated with Honoʻuliʻuli
- Home of the Shark-Goddess Kaʻahupāhau (Legend of Kaʻehuikimanōo Pu'uloa)
- The Frightened Populace of Honoʻuliʻuli (He Kaʻao no Palila)
- Two Old Women Who Turned To Stone (Ka Loea Kālaiʻāina)
- The Strife of Nāmakaokapāoʻo and Pualiʻi (Kaʻao no Nāmakaokapāoʻo)
- The Story of Kaihuopalaʻai Pond, Honoʻuliʻuli (Kaʻao no Maikohā)
- The Traveling Mullet of Honoʻuliʻuli (Fish Stories)
- Honoʻuliʻuli and the Head of Hilo-a-Lakapu (Legend of the Sacred Spear-point)
- The Strife at Honoʻuliʻuli from Which Kūaliʻi Unites Hawaiʻi Nei (Moʻolelo o Kūaliʻi)
- The Last Days of Kahahana and Honoʻuliʻuli (The Land is the Sea's)
- Puʻuokapolei and the Reckoning of the Seasons (Kamakau)
- Honoʻuliʻuli in the Poetry of Halemano (Kaʻao no Halemano)

7.4.3.4. Legends and Traditional Places in Upland Honoʻuliʻuli

Kahalaopuna at Pōhākea Pass - One of the most popular legends of Oʻahu 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 Koʻolau, Oʻahu. 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. (CSH, 2008).

Moʻo at Maunauna (Kuokoa) - Moses Manu in recounting the Legend of Keaomelemele makes a reference to a moʻo (fabulous lizard, dragon, serpent) named Maunauna who lived above Līhuʻe (presumably at the landform of that

name in extreme northern Honoʻuliʻuli) and who was regarded as a bad lizard (Kuokoa April 25, 1885). (CSH, 2008).

Paupauwela and Līhuʻe - Paupauwela, also spelled Popouwela (derivation unknown), is the name of the land area in the extreme mauka section of Honoʻuliʻuli Ahupuaʻa. The land area of Līhuʻe is just makai of this land, and extends into the ahupuaʻa of Waipiʻo (adjacent to the eastern border of Honoʻuliʻuli). Both place names are mentioned in a chant recorded by Abraham Fornander, which was composed as a mele for the Oʻahu king, Kūaliʻi, as he was preparing to battle Kuiaia (Fornander 1917, Vol. IV, Part 2:384-386). The place name Līhuʻe means “cold chill" and is also cited in poem (Ka Loea Kālaiʻāina, July 22, 1899, translated in Sterling and Summers 1978:21). This explains the meaning of a Hawaiian saying “Hao na kēpā o Līhuʻe i ke anu” (The spurs of Līhuʻe dig in with cold) (Pukui 1983:#479). (CSH, 2008).

The aliʻi were closely associated with Līhuʻe, which had habitation areas and playing grounds set aside for their sports. (Ka Nūpepa Kūʻokoʻa, Aug. 26, 1865, translation in Sterling and Summers 1978:23).

Līhuʻe was also the home of a famous cannibal king-man, Kaupe, who overthrew the ruling chiefs to become the paramount power between Nuʻuanu and the sea. (Westervelt 1963:90-96).

Hill of Maunauna - The hill Maunauna lies between the lands Paupauwela and Līhuʻe. One translation of Maunauna is “mountain sent [on errands].” Two servant moʻo 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 Kūaliʻi and Kuiaia of Waiʻanae met to do battle, which was averted when a mele honoring the god Kū was chanted. (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. (CSH, 2008).

7.4.3.5. Prehistory and Early History

Various Hawaiian legends and early historical accounts indicate the ahupua‘a of Hono‘uli‘uli was once widely inhabited by pre-Contact populations. This would be attributable for the most part to 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. (CSH, 2008).

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 (Handy and Handy 1972:469). The upper valley slopes may have also been a significant resource for sporadic quarrying of basalt for the manufacturing of stone tools as evidenced in part by the existence of a probable quarrying site (50-80-12-4322) in Makaīwa Gulch at 152 m. (500 ft.) above mean sea level (Hammatt et al. 1991). (CSH, 2008).

The Hawaiian ali‘i were also attracted to the region, which is steeped in myth. (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. (CSH, 2008).

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 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). (CSH, 2008).

In 1877, James Campbell purchased most of the Hono‘uli‘uli Ahupua‘a and in 1879 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). (CSH, 2008).

In 1889, Campbell leased his property to Benjamin Dillingham, who subsequently formed the O‘ahu Railway & Land Co. (O.R. & L) in 1890. 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). (CSH, 2008).

‘Ewa Plantation Co. was incorporated in 1890 and continued in full operation up into modern times. 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). (CSH, 2008).

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. (CSH, 2008).

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. Modest construction 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. (CSH, 2008).

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. (CSH, 2008).

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 Oʻahu Coast Defense Command, a series of coastal artillery batteries designed to assist in the defense of Pearl Harbor and to prevent invasion of Oʻahu. Military installations were constructed both near the coast, as well as in the foothills and upland areas. (CSH, 2008).

In the 1950s, the Waimānalo Gulch site was used as a NIKE missile base. Palailai Military Reservation (a.k.a. Battery Palailai from 1942-1944), located atop Puʻu Palailai, was used from the 1920s and included Fire Control Station "B" (Payette 2003). (CSH, 2008).

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 Oʻahu coastline not protected by the existing batteries. Even the sunken ships at Pearl Harbor would be enlisted in Oʻahu'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 Oʻahu was set into motion. The two sites chosen were the tip of Mōkapu Peninsula at Kāneʻohe Bay, designated Battery Pennsylvania, and Kahe Point above the Waiʻanae Coast, designated Battery Arizona. (CSH, 2008).

Construction of Batteries Pennsylvania and Arizona commenced in April 1943 and continued through all of 1944 and into two-thirds of 1945. 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. (CSH, 2008).

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. (CSH, 2008).

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 a Nike-Hercules anti-aircraft missile base located at the head of Waimānalo Gulch. The Nike complex, in use 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. (CSH, 2008).

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. (CSH, 2008).

In 1985, the City 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. 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 Company 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 WGSL property.

7.4.4. Previous Archaeological Research

The ʻEwa Plain has 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 regulatory requirements. Kalaeloa, in particular, has been intensively studied. In contrast, relatively little research has been conducted in the uplands of Honoʻuliʻuli, along the southern slopes of the Waiʻanae Range. This discussion of previous archaeological research will focus on the results of this prior archaeological work at the southern end of the Waiʻanae range. (CSH, 2008).

Recent archaeological investigations in the southern Waiʻanae 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 7-14**).

Table 7-14, 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.
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. (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. 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). (CSH, 2008).

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 Nānākuli as well as Hono‘uli‘uli at the approximate height of 1,800 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).

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 1,000 ft (305 m) elevation. One archaeological feature was identified, a complex of three concrete platforms that was interpreted to be a military related structure. (CSH, 2008).

An archaeological inventory survey of the “Makaīwa Hills” development project located several traditional as well as post-contact archaeological sites (Hammatt et al. 1991). 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. (CSH, 2008).

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 Kaloʻi 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 Kaloʻi Stream channel. (CSH, 2008).

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. (CSH, 2008).

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. (CSH, 2008).

An archaeological inventory survey for the proposed University of Hawaiʻi-West Oʻahu campus was conducted by Dega et al. (1998). No traditional Hawaiian sites were located. (CSH, 2008).

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. (CSH, 2008).

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. 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 Puʻu 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 Puʻu Makakilo. (CSH, 2008).

7.4.5. Results of the Community Contact Process

Consultation 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 was undertaken by CSH by letter, e-mail, and telephone or in-person contact. In the majority of cases, letters - including a map of the project area – were mailed. The specific language requesting the information included the following (CSH, 2008):

> "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 (**Table 7-15**). 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.

Table 7-15
Summary Consultation Efforts by CSH

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 of the CIA 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 CIA, Section 6 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 CIA, Section 6 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 CIA, Section 6 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

Name	Affiliation	Comments
		huakaʻi 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 CIA, Section 6 for response.
Hoʻohuli, "Black" Jo	Waiʻanae Neighborhood Board No. 24	Mr. Hoʻohuli is concerned about caves in the *mauka* area that may contain burials.
Rezentes, Cynthia	Waiʻanae 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	Oʻahu Island Burial Council Member, Waiʻanae District	See CIA, Section for response.
Kanahele, Kamaki	President of Nānākuli Homestead	See CIA, Section 6 for response.
Kane, Shad	Member of the Makakilo, Kapolei, Honokai Hale Neighborhood Board and ʻAhahui Siwila Hawaiʻi 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 CIA, 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)
Makaiwi, Martha	Makakilo, Kapolei, Honokai Hale Neighborhood Board No. 34	Made referral to Maeda Timson and Shad Kane.
McKeague, Kawika	Oʻahu Island Burial Council member ʻEwa District	See CIA, Section 6 for response.
Momoa, Joseph	Kamaʻāina of Nānākuli and member of Kamoʻi 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.
Nāmuʻo, Clyde	Administrator at Office of Hawaiian Affairs	OHA recommended: (1) Consultation with seven specific individuals, all of whom CSH attempted to contact. (2) The project area should 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 CIA, Appendix C for OHA letter).
Philpotts, Douglas McDonald	Cultural practitioner and long time resident of Waimānalo ʻIli	Mr. Philpotts made a site visit to view the uprights within the project area. See CIA, Section 6 for response and CIA, Appendix B for complete interview.
Tiffany, Nettie	Kahu of Lanikūhonua and Former Oʻahu Island Burial Council member, ʻEwa District	See CIA, Section 6 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 *makaʻu* (scared). They also had *tī* leaf on all four corners of the house for protection.

7.4.6. Cultural Resources and Traditional Practices

The areas of Waimānalo Gulch, Makaīwa Gulch, Ko ʻOlina, Lanikūhonua and the uplands of Pālehua and Puʻukuʻua are within the ʻili of Waimānalo located in the ahupuaʻa of Honoʻuliʻuli, ʻEwa District. ʻIli is defined as "a land section, next in importance to ahupuaʻa and usually a subdivision of an ahupuaʻa" (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, koʻa (fishing grounds) and loʻi (pondfield) that sustained a fishing village. The mauka area is considered a sacred place with many heiau, myths and legends. (CSH, 2008).

Although this area has been placed in the district of ʻEwa and the ahupuaʻa of Honoʻuliʻuli, some Waiʻanae community members feel a strong connection with this place as many traverse this area frequently to get in and out of Waiʻanae. Participants also mentioned the many natural and cultural resources of the region. (CSH, 2008).

Specific aspects of traditional Hawaiian culture mentioned during information gathering interviews and "talk story" sessions are incorporated in the CIA document. 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 (ʻUhane), the "Legend of the Slain Girl", the "Legend of Two Giants", and associations with the Pueo ʻAumakua. (CSH, 2008).

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" (huakaʻi pō); in particular, the passage in the makai region close to human habitation at Lanikūhonua. The huakaʻi pō inland route is somewhat vague but appears to be up the southern ridge of Waimānalo Gulch. (CSH, 2008).

7.4.6.1. Traditional Hawaiian Beliefs

A number of kūpuna and other community members spoke of beliefs associated with Waimānalo ʻIli of Honoʻuliʻuli and the surrounding valleys. While these beliefs and traditions are interrelated, they are discussed in terms of the presence of ʻuhane (soul, spirit, ghost), traditions of huakaʻi pō (procession of the night marchers), a legend of a slain girl, a legend of two giants, and a tradition of owl ʻaumakua (ancestor gods), in addition to accounts of other mysterious and strange incidents. (CSH, 2008).

Association with ʻUhane

Several people familiar with the area mentioned that Waimānalo Gulch and Makaīwa Gulch are associated with *ʻuhane*. In *Nānā i Ke Kumu*, a source book on Hawaiian cultural practices, concepts and beliefs, *ʻuhane* are introduced as follows:

> *Says Mary Kawena Pukui of certain of her ancestral beliefs, "Some things are ʻeʻepa. Unexplainable. "Accept that, and it becomes easier to know about ʻuhane. For in Hawaiʻi's religious mystic tenets, ʻuhane was: The animating force which, present in the body, distinguished the quick from the dead. And so ʻuhane 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 ʻuhane is "spirit" in the immortal sense, and the "soul" of Christian concept. Or, as immortal spirit or soul, the ʻuhane might return to visit the living and so be termed a "ghost". (Pukui et al. Vol. I, 1972:193)*

The following is a brief summary of the traditional Hawaiian beliefs as documented by CSH (See **Appendix H**, for further detail).

Huakaʻi Pō or ʻOiʻo (Procession of the Night Marchers)

There are Hawaiian beliefs regarding the presence of what are commonly known as "night marchers" and the huakaʻi pō or the, "night procession or parade, especially the night procession of ghosts that is sometimes called ʻoiʻo" (Pukui and Elbert 1986:84). The night marchers are the souls of those who have passed on. An ʻōlelo 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).

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.

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. 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.*

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.

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.

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 Koʻolau. Enraged at accounts of her sleeping with various lovers, Kauhi leads Kahalaopuna through the uplands of south Oʻahu 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 Honoʻuliʻuli north of the project area. After being put to death, her ʻuhane flies up into an ʻōhiʻa lehua tree and calls out to travelers passing along the road asking them to inform her parents of her death.

ʻAumakua Pueo of the ʻIli 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 ʻaumakua of the ʻohana 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 ʻaumakua 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). ʻAumakua fall into the English category of totems and were typically animal or plant species. ʻAumakua could be inherited bilaterally, from both the father's and mother's kin groups (ʻohana). Each individual had the opportunity to retain multiple ʻaumakua. Mary Kawena Pukui's childhood education included memorizing the names of fifty of her family ʻaumakua (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.

7.4.6.2. Burials

Most Hawaiians in the pre-Contact period belonged to the makaʻāinana or commoner class and their bones were usually buried in their particular ʻili. Burials are commonly

reported from clean, consolidated sand deposits, which was clearly a common method of internment practiced by Hawaiians (Cleghorn 1987:42).

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. (CSH, 2008).

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. (CSH, 2008).

Aunty Arline also mentioned that if people lived in the project area, there might be a possibility of finding burials (CSH, 2008):

> *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.*

7.4.6.3. 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. (CSH, 2008).

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).

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.*

The petroglyph site described (State Inventory of Historic Properties [SIHP] # 50-80-12-2893) is located outside the southeast corner of the current project area. A mauka/makai trail, probably the one depicted on a 1914 Fire Control Map, 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. (CSH, 2008).

7.4.6.4. Gathering of Plant Resources

Given the ecosystem diversity of the 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 7-16**, 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 Honoʻuliʻuli before 1790, in addition to plant use recorded by Isabella Abbott (1992). (CSH, 2008).

Table 7-16, Native Plants in Honoʻuliʻuli

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
ʻIlima	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
Maʻo, cotton	Gossypium tomentosum Abutilon incanum	Flowers used as dye for kapa (Abbott)
ʻŪlei	Osteomeles anthyllidifolia	Branches used for fishing nets (Abbott)
ʻUhaloa	Waltheria americana	Medicine (Abbott)
Koaliʻai	Ipomoea cairica	Cordage (Abbott)
Pāʻū o Hiiaka	Jacquemontia sandwicensis	Unknown
Koʻokoʻolau	Bidens sp.	Use as tea (Abbott)
ʻUlu, breadfruit	Artocarpus incisus	Food
Kalo, taro	Colocasia esculenta	Food
Niu, coconut	Cocos nucifera	Food, liquid

The accessibility of Honoʻuliʻuli 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. By the 1870s, herds of cattle grazing across the ʻEwa 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. (CSH, 2008).

7.4.6.5. Native Gathering Practices for Plant Resources

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). (CSH, 2008).

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).

Nettie 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.”

CSH is confident that Māmaki has not grown near the landfill in recent times as it prefers wetter environments found at higher elevations. Haʻuōwī, 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 (Haʻuōwī, Pānini, Ēkoa, Kīnehe) are exotic species. CSH further perceives no adverse impact on Hawaiian utilization of these species by the proposed landfill expansion action. (CSH, 2008).

7.4.6.6. Taro in Hawaiian Culture

Taro cultivation was mentioned in two of the LCA testimonies for individual kuleana claims in the ʻili of Waimānalo of Honoʻuliʻuli Ahupuaʻa. The testimonies indicated that these LCA's contained at least two loʻi as well as house lots, sweet potato, kula-at Puʻukuua, ponds, streams and fishery. The taro cultivation here was not as intensive as the well known "Honoʻuliʻuli Taro Lands" near the mouth of Pear Harbor and the Honoʻuliʻuli Stream. Apparently Waimānalo ʻIli had sufficient water along with backshore swampy areas to provide personal loʻi on a small scale. Although these claims were not awarded they provide a wealth of information. (CSH, 2008).

The area of Lanikūhonua south of the WGSL, 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. Many maps show water filtering down from the Waimānalo and Makaīwa Gulches as well as the unnamed gulches that could have also feed the *loʻi* of this area. 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. (CSH, 2008).

Taro has an intimate connection to the Hawaiian culture. Taro (kalo; Colocassia esculenta) was probably brought to Hawaiʻi 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. (CSH, 2008).

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 *ʻohā* (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. (CSH, 2008).

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 *lūʻau* 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 *lūʻau* 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 symbiotic to taro production. (CSH, 2008).

Although taro is not grown anymore near the project area, documents prove there once was taro cultivation west of Honoʻuliʻuli. (CSH, 2008).

Due to the dry conditions on the leeward side of Oʻahu, taro was not as abundant in Waimānalo ʻIli as it was in some of the surrounding marshy areas. Though, there was a fair amount of water sources in the area. (CSH, 2008).

7.4.6.7. 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. (CSH, 2008).

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 significance of this cultural site, it has been protected and cared for in a safe area by a cultural practitioner. (CSH, 2008).

7.4.6.8. 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. (CSH, 2008).

Through the interview process, a number of ko‘a and fishing experiences were cited. 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).

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 (CSH, 2008):

> *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).*

7.4.6.9. 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 occurred. 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. (CSH, 2008).

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 moʻolelo passed down to him by his kūpuna regarding some names of the Waimānalo ʻIli. The area was referred to as five brothers who protected and cared for the island of Oʻahu; they were the “Eyes” of Oʻahu (CSH, 2008):

> *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, Makaʻike, Makaloa, Maka-lo, 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 Oʻahu 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 Oʻahu 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 Oʻahu, thus the enemies were never allowed to land upon the shores of Oʻahu.*

Douglas McDonald Philpotts also spoke about a connection between this area and the other islands through the path of the sun (CSH, 2008):

> *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 Puʻu 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 Honoʻuliʻuli 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 Molokaʻi. Reaching Oʻahu it rises from Koko Head and moves from peak to valley north through the Koʻolau's reaching its destination Mokumanamana in exactly half a year. Then on June 21st, the summer solstice, the sun sets behind Kauaʻi 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 Puʻu 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.*

7.4.7. Summary and Conclusions, Potential Impacts and Mitigation Measures

Potential Project

The WGSL was established in 1987. In addition to previous use activities, the importation of landfill material has most likely further 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. (CSH, 2008).

The accessibility of Honoʻuliʻuli 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 ʻEwa 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 ʻEwa Plantation. (CSH, 2008).

The ʻili of Waimānalo including (Makaīwa, Lanikūhonua, Ko ʻOlina, 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 ʻili 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 koʻa, kiʻi pōhaku as well as loʻi that sustained a thriving fishing village. The mauka area is covered with numerous religious cultural sites. (CSH, 2008).

Community participants have expressed great concern about the Huakaʻi 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. (CSH, 2008).

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 (CSH, 2008):

> 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 identified in the CSH Archaeological Inventory Survey for the proposed project (CSH, 2008).

Recommendations and Mitigation Measures

The Cultural Impact Assessment prepared by CSH has identified community concerns regarding the potential for cultural impacts associated with the proposed project. The following provides CSH's recommendations and the proposed mitigative measures that will be implemented by ENV/WMH:

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. (CSH, 2008).

As provided in Section 7.3.8. Potential Impacts and Mitigation Measures, ENV and WMH propose that the stone uprights be relocated based on the preparation of an Archaeological Monitoring Plan (AMP) that will be reviewed and approved by the SHPD. Guidance concerning the use of an archaeological monitor to maintain cultural sensitivity and the use of proper protocols will be sought from the SHPD and selected community informants identified by SHPD and CSH. The AMP will include a preservation plan for future cultural access that will incorporate the input of the community informants.

The primary provisions of this approach are that: (1) the period of time for the relocation of the stone uprights would coincide with the use of the area of lateral expansion, a period of approximately 15 years; and (2) although it may not be possible to relocate the stone uprights in the exact same location, ENV and WMH intends to maintain consultation with the SHPD and community for the final resting place for the stone uprights. The maintenance of access will be provided.

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. (CSH, 2008).

The mauka lands of the Waimānalo Gulch have been bisected by the Farrington Highway as the ahupua‘a transitions to makai lands along the coastline. Although it may not be possible to completely recover the traditional relationship that was once established between these lands, there are three important cultural properties described in the CIA that can be addressed with appropriate and culturally sensitive treatment. These properties include: (1) cultural site SIHP # 50-80-12-6903; (2) the legend of the huaka‘i pō (below); and (3) a series of six natural caves and rock overhangs (also below). ENV and WMH acknowledge these features as an important part of the Hawaiian landscape and will provide for their appropriate treatment as a part of the mitigative measured described in this section.

3. The huaka‘i pō (procession of the night marchers) viewplane 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. (CSH, 2008).

ENV and WMH will consult with the community informants identified in the CSH study to mitigate or reduce the potential for visual blockage of the west and east ridgelines of the Waimānalo Gulch. A starting point for this discussion would be through the WGSL Oversight Advisory Committee. However, in order to maintain cultural sensitivity, ENV and WMH would remain open to other suggested venues by the community informants to further discuss and implement appropriate measures for protection of the huaka‘i pō.

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 an 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 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. (CSH, 2008).

ENV and WMH propose the use of an archaeological monitor during construction activities that may affect the northwestern portion of the WGSL. Prior to the start of work the archaeological monitor will be tasked with (1) reviewing the construction plans for the use of the area of the caves, and (2) consultation with community informants including native Hawaiians who are familiar with the project area. Although burials were not encountered at the time of the AIS, it is always possible that burials might be discovered in the course of earthwork. In the unlikely event of the discovery of a burial work in the immediate area will cease and the SHPD will be notified by the archaeological monitor at (808) 692-8015. Instructions and guidance for future steps will be obtained from the SHPD.

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. (CSH, 2008).

ENV and WMH will comply with the requirements as provided for archaeological and cultural protection and preservation as provided in Chapter 6E, HRS, and other applicable laws and regulations.

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 & County of Honolulu's "good faith" effort to minimize the impact of the proposed project on Hawaiian culture, its practices and traditions. (CSH, 2008).

ENV and WMH will continue to consult with the community regarding archaeological, cultural, and other environmental matters involving the operation of the existing WGSL and the proposed lateral expansion project. A number of mitigative measures to provide community consultation are provided and are cited elsewhere in this EIS document. The mitigative measures as cited in this section are intended to address the potential for adverse cultural impacts.

See also Section 7.1.~~5~~6. Socioeconomic Mitigation Measures; Section 7.2.3. Potential Impacts and Mitigation Measures regarding Land Use and Ownership; and Section 7.3.8. Potential Impacts and Mitigation Measures regarding Historic and Archaeological Resources.

Cultural Impact Assessment Summary

Secondary and cumulative impacts associated with the use of the site involve the potential for the discovery of other cultural resources, artifacts, or burials that may be present at the project site. This potential however, was considered and served as one important reason for the completion of the Archaeological Inventory Survey (AIS) and Cultural Impact Assessment (CIA) for this project.

Mitigation to address the potential for impacts to archaeological and cultural resources will be coordinated between WMH, ENV, and the SHPD and community informants to develop an appropriate plan for treatment for the stone uprights (SIHP # 50-80-12-6903), huakaʻi pō (procession of the night marchers), and six caves and overhangs. The plan will consider the provision of access by cultural practicioners.

In the unlikely event of the discovery of a burial, work in the immediate area will cease until appropriate coordination with the SHPD has been completed. As required, the applicable provisions of law including HRS, Chapter 6E, and HAR, Chapter 13-300 (regarding burials) to maintain the protection of archaeological and cultural resources will be provided by WMH and ENV.

Section 8
Relationship to Land Use Plans, Policies and Controls of the Potentially Affected Area

8.1. Hawai‘i State Plan

The Hawai‘i State Plan, Chapter 226, Hawai‘i Revised Statutes (HRS), was passed into law in 1978 and revised in 1986 to reflect the future long range planning goals, objectives, and policies of the State of Hawai‘i. The proposed project maintains consistency with the provisions of the State Plan in the following:

> *Section 226-6(b) To achieve the general economic objectives, it shall be the policy of this State to:*
> *(14) Promote and protect intangible resources in Hawaii, such as scenic beauty and the aloha spirit, which are vital to a healthy economy."*

The proposed project provides for the safe and effective disposal of municipal refuse for all the communities of O‘ahu in accordance with applicable federal, state, and City & County of Honolulu laws and regulations. This waste, if not properly managed, could affect O‘ahu's islandwide "…scenic beauty and the aloha spirit, which are vital to a healthy economy." In as much as the proposed location of the project is within the Waimānalo Gulch, the provision of mitigative measures, practices, and procedures for the proper handling of refuse will be applied to the project to address the potential for adverse environmental effects. (See Sections 4 through 6 of this document).

> *Section 226-11(b) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:*
> *(1) Exercise an overall conservation ethic in the use of Hawaii's natural resources.*

The proposed project is based on the use of an existing facility and property that is under ownership of the City & County of Honolulu. The use of this existing resource represents an effort to conserve the limited and precious land resources of O‘ahu by maximizing the capacity of the site.

The practice of conservation is further supported by the City through continuing efforts to promote recycling and the generation of energy through the use of municipal solid waste at H-POWER. Future plans also call for the use of landfill gas from the Waimānalo Gulch to one day be used in the generation of electricity at the neighboring Hawaiian Electric Company (HECO) Kahe Power Generating Station.

> *Section 226-11(b) (2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.*
> *(3) Take into account the physical attributes of areas when planning and designing activities and facilities.*
> *(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.*
> *(5) Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.*
> *(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai‘i.*
> *(8) Pursue compatible relationships among activities, facilities, and natural resources.*

The natural attributes of the existing WGSL site include a relatively dry climate, the absence of drinking or potable groundwater resources that could be adversely affected by a landfill, and the absence of known threatened or endangered botanical and faunal species. These and other factors were taken into account in the assessment of the site for use as a municipal sanitary landfill.

Protection of the site to ensure against potential adverse effects that could otherwise generate "costly or irreparable environmental damage", will involve the use of mitigative measures and management practices and procedures as described in this EIS document. The protection of air, and ground and surface water quality will be provided through extensive monitoring as described in Sections 4 and 5 of this document. Air, groundwater, and surface water quality is monitored to regularly ascertain the performance of the protective features of the landfill and is an existing practice that would be extended to the proposed project. The monitoring procedures will enable early notification of any issues with the performance of the landfill and provide sufficient time to address and implement corrective actions before any issue becomes a problem.

While the WGSL was initially developed in 1989, at a time with few or limited residential, resort, commercial and business development pressures in the ‘Ewa region, there is now major growth and development of existing and new developments that include ‘Ewa, Kapolei, Makakilo, Ko Olina, the future Makaiwa Hills residential subdivision, and in various locations along Coastal Wai‘anae. Because this growth highlights the limited space available on the Island of O‘ahu for facilities such as a landfill, this EIS proposes a number of mitigative measures and other practices that are intended to reflect the stated commitment of the City and the operator of WGSL, WMH, for the operation of a well run facility that avoids the potential for adverse environmental effects on adjoining land use activities, other facilities, and the natural resources of the site.

> *Section 226-12 (b) To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:*
> *(I) Promote the preservation and restoration of significant natural and historic resources.*
> *(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.*
> *(4) Protect those special areas, structures, and elements that are an integral and functional part of Hawaii's ethnic and cultural heritage.*

(5) Encourage the design of developments and activities that complement the natural beauty of the islands.

The preservation and restoration of natural and historic resources present at the WGSL has or is currently being addressed through the conduct of special studies of flora, fauna, archaeological, and cultural resources, and through the development of mitigative measures to address the potential for adverse environmental effects. Based on the conduct of special studies no known threatened or endangered species were observed to be present at the site. An existing archaeological site was found in the form of three stone uprights located along the southwestern edge of the landfill property. To address the discovery of the uprights: (1) the SHPD was notified to report the find and to ascertain further actions or requirements to ensure no disturbance until an appropriate plan for treatment is determined; and (2) notification and coordination with appropriate parties as determined by SHPD that includes the Office of Hawaiian Affairs (OHA) and SHPD designated cultural informants from the area.

The process of coordination to develop an appropriate treatment plan and to ascertain further the purpose and function of the uprights is in progress. The owner of the site, the City & County of Honolulu, intends to work with the SHPD and the community to provide appropriate treatment to ensure protection and preservation of the stone uprights an important part of Native Hawaiian culture and heritage. All required provisions of Chapter 6E, HRS, as well as other provisions of law governing archaeological preservation and protection will be complied with to prevent the irrevocable loss of this resource.

View impacts associated with the project involve mauka views toward the landfill property that includes: (1) some views from the Waiʻanae side of the property from construction vehicles transiting the southwestern and western ridge beyond the equipment and facilities of the HECO Kahe Power Generating Station; and (2) a view corridor providing views into the Waimānalo Gulch that extends from the Kai Lani subdivision to the Ko Olina Beach Club. From this location views of construction and

refuse handling vehicles can be seen as they traverse the site to and from active areas of landfilling. Active cells located further back in the landfill cannot be seen based on the location of the cells below the completed portions of the site that are now closed from further landfilling.

While it is not possible to shield from view the location and features of the entirety of the WGSL, the potential for visual impacts during operation of the landfill will be minimized and mitigated with vegetative controls including the use of hydromulching, and plantings of grass, dryland shrubs, and trees, as provided in the project's landscaping plan.

> *Section 226-14 Objective and policies for facility systems-in general.*
> *(a) Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives. (b) To achieve the general facility systems objective, it shall be the policy of this State to:*
> *(1) Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.*

The proposed project represents a major capital project necessary for the safe, sanitary, and efficient disposal of municipal solid waste and refuse on the Island of Oʻahu. The project will serve all of Oʻahu's residents and visitors and is considered an essential part of the City's refuse management system that includes recoverable products recycling, waste to energy, and conservation of land resources for required public facilities such as landfills.

> *Section 226-14 (b)(2) Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.*

The proposed project will allow flexibility in the development and adoption of future City initiatives that will reduce dependency on landfills: (1) The future adoption of new technologies will require sufficient time for operational viability. The presence of the landfill will provide public safety and security for the disposal of refuse during periods of startup, maintenance, and for unforeseen circumstances that may require equipment repair.

(2) There are no existing refuse reduction or "elimination" technologies that do not themselves result in the generation of some refuse that cannot be further recovered, recycled, or otherwise reused. For these forms of waste, a landfill provides the most viable method of disposal.

(3) Any effort to reduce the volume of refuse being landfilled would benefit the Island of O‘ahu through an extension of the life of the landfill. Landfill capacity that is not used would forestall the need to seek a new location for a future municipal landfill.

(4) The landfill serves as a public resource in the event of a natural disaster such as a hurricane, earthquake or tsunami. A location for the disposal of cleanup and demolition debris would be required to meet public health and safety requirements during the recovery effort.

> *Section 226-14 (b)(3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.*

The proposed project represents the effort to expand an existing public facility that is owned by the City & County of Honolulu. The expansion of the facility will be supported within the existing resource capacity of the site and at reasonable taxpayer cost to all users on the Island of O‘ahu.

> *Section 226-15 Objectives and policies for facility systems-solid and liquid wastes. (a) Planning for the State's facility systems with regard to solid and liquid wastes shall be directed towards the achievement of the following objectives:*

> *(1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes. (b) To achieve solid and liquid waste objectives, it shall be the policy of this State to: (2) Promote re-use and recycling to reduce solid and liquid wastes and employ a conservation ethic, and (3) Promote research to develop more efficient and economical treatment and disposal of solid and liquid wastes.*

The proposed project will facilitate the maintenance of public health and sanitation standards with regard to the disposal of MSW and refuse.

Although the proposed project does not in itself involve recycling, the City & County of Honolulu, through its Solid Waste Integrated Management Plan identifies recycling and materials recovery efforts to reduce O‘ahu's overall dependency on the need for landfills.

The City & County of Honolulu has promoted the investigation and adoption of technology based methods that have been proven to be efficient and economic in the reduction and treatment of solid waste. Examples of City led efforts include the use of a solids digester facility at the Sand Island Wastewater Treatment Plant and recent efforts to upgrade the H-POWER facility.

> *Section 226-104 (b) Priority guidelines for regional growth distribution and land resource utilization:*
> *(2) Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.*

The proposed project involves the use of agricultural land that has not been classified by the Agricultural Lands of Importance to the State of Hawai‘i (ALISH) system as indicated in Section 8.3 of this document. The non-essential agricultural nature of the land can be considered as a use that would allow for the maintenance of more important agricultural lands in the agricultural district.

Section 226-104 (b)(9) Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized.
(12) Utilize Hawai'i's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generations.
(13) Protect and enhance Hawaii's shoreline, open spaces, and scenic resources.

The proposed project has been evaluated with regard to the potential for adverse effects to critical environmental features or habitat. There are no known threatened or endangered species present and as appropriate, mitigative measures are proposed to minimize, mitigate, or otherwise reduce the potential for adverse environmental impacts.

An important factor that supports the utilization of the proposed site involves the existing landfill use of the site, and the capacity and ability of Waimānalo Gulch to continue to support O'ahu's refuse disposal requirements for the next approximately 15 year timeframe. This use of the site would support and preempt the use of other locations on the Island of O'ahu until such time that the present site has reached capacity.

As noted, this EIS document identifies the appropriate application of mitigative measures and practices to avoid the potential for adverse environmental impacts as a result of development for the area of lateral expansion.

8.2. State Functional Plans

The State Functional Plans are mandated by Chapter 226, HRS. Together with the Hawai'i State Plan, they are intended to guide the implementation of state and county actions in the areas of agriculture, conservation lands, education, employment, energy,

health, higher education, historic preservation, housing, human services, recreation, tourism, transportation, and water resources development.

The major theme of the Functional Plans is a focus on balanced growth in the use of the state's limited resources. The plans were last subject to legislative approval in the early 1990s and have not since been subject to substantive legislative review and update. Accordingly, many of the plans' *implementing actions* are in need of revision. However, the *objectives* and *policies* contained in the functional plans reflect many of the same values that are as important today as they were in the 1990s.

The proposed project is considered to be consistent with the State Functional Plans in the areas of Energy and Recreation.

8.2.1. Energy Functional Plan

Objective B of the Energy Functional Plan calls for the displacement of oil and fossil fuels through alternate and renewable energy sources.

The WGSL is a generator of naturally occurring methane and other landfill gasses that are planned to be recovered for the generation of electricity through a landfill gas to energy (LFTGE) system. Although the landfill has been in operation since 1989, it is only recently that the landfill has matured enough to merit the recovery of combustible gas. The recent installation of a landfill gas recovery system in conjunction with the efforts of WMH and HECO will initiate the tapping of this alternative energy resource.

The proposed project also supports the displacement of oil and fossil fuels through the provision of a location for the disposal of H-POWER ash and residue that cannot be further recycled or reused. This supports the operation of H-POWER in the conversion of waste to energy and promotes the conservation of fossil fuel resources that would otherwise need to be imported for the generation of electricity.[1]

[1] The facility is capable of processing 2,160 tons-per-day of municipal solid waste into refuse derived fuel (RDF) for combustion, while generating up to 57 megawatts of energy from this renewable

8.2.2. Recreation Functional Plan

Policy I-A(4) of the Recreation Function Plan calls for the development of areas mauka of existing beach parks to increase their capacities and to diversify and encourage activities away from the shoreline.

The proposed project is anticipated to be used as a municipal sanitary landfill for a finite period of time. At the end of this period the landfill will be closed in accordance with a specified closure plan reviewed and approved by the EPA and State Department of Health. Monitoring of the landfill is mandated for a period of 30 years to ensure the environmental safety and security of the site. During this period the landfill surface will stabilize and be revegetated to blend in with the surrounding landscape.

Although several years will be required, it will be possible to recover the use of the site for other purposes that include outdoor recreation. This reuse and recovery of the land is consistent with historical practice in the recovery of former landfill sites that include the Kakaako Waterfront Park, Sand Island State Recreational Area, and portions of the Ala Moana Park.

8.3. State Land Use Law

The State Land Use Commission classifies all lands in the State of Hawai‘i into one of four land use designations: Urban, Rural, Agricultural, and Conservation. The proposed project is located within the State Agricultural District (**Figure 8-1**, **State Land Use District**).

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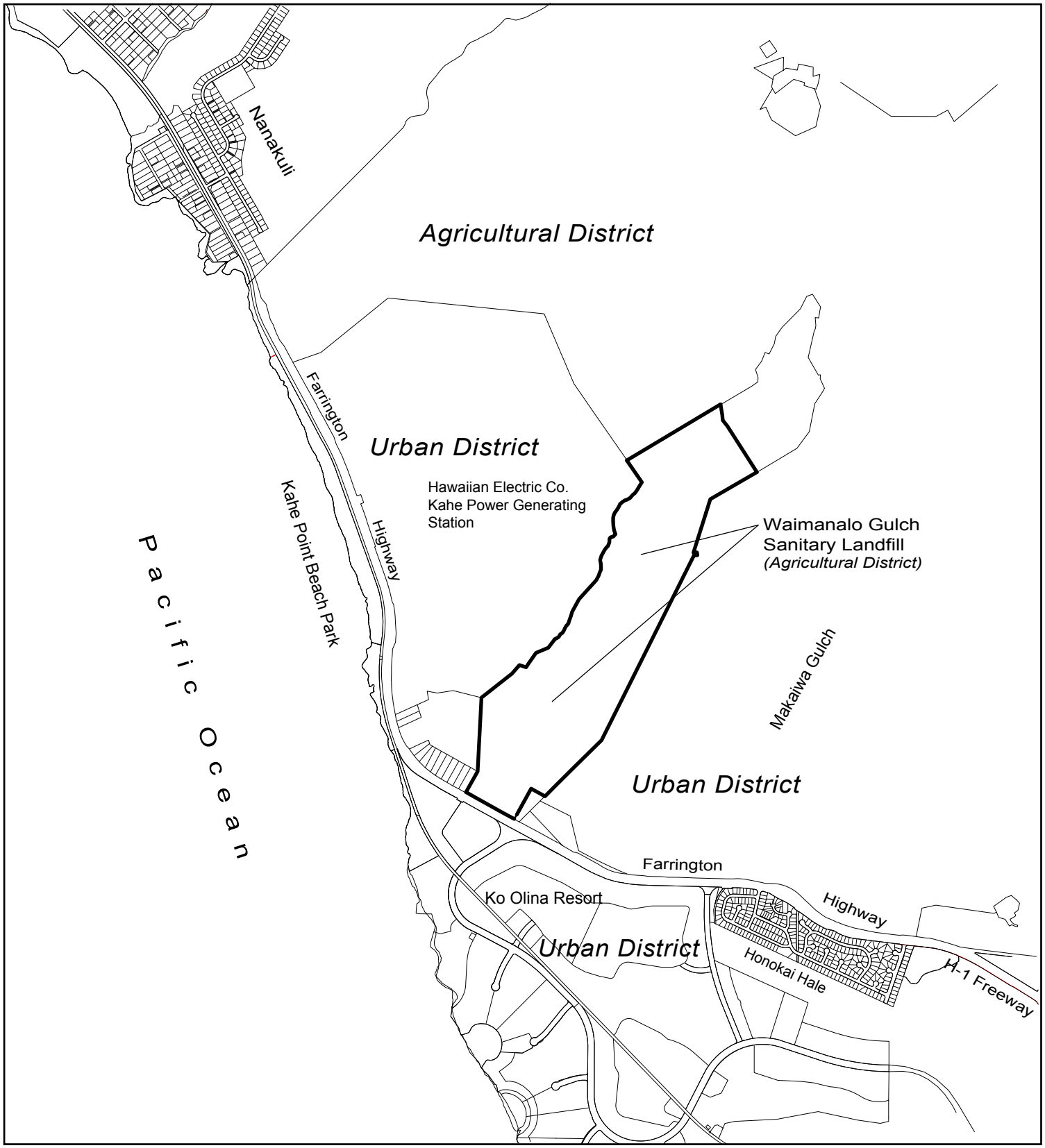
source. It has been estimated that as much as 10 million barrels of imported oil has been conserved by H-POWER (http://www.honoluluhpower.com/About.asp#Content).



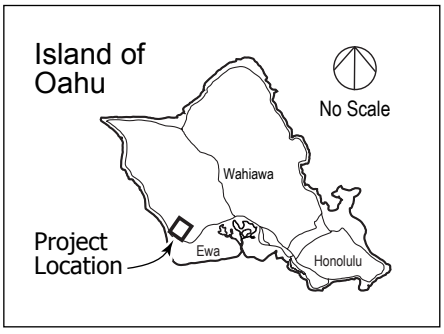


Figure 8-1
State Land Use District Map
Waimanalo Gulch Sanitary Landfill Expansion
Department of Environmental Services

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According to the Agricultural Lands of Importance (ALISH) to the State of Hawai‘i system the subject site is not classified as one of three types of agricultural land: Prime Agricultural Land, Unique Agricultural Land and Other Important Agricultural Lands. (**Figure 8-2**, **ALISH Map**).

Because of the location of the project in the State Agricultural District, if the land use designation of the subject property is not changed via a Boundary Amendment proceeding, a State Special Use Permit must be obtained for the proposed expansion through the City & County of Honolulu, Department of Planning and Permitting and the State Land Use Commission. Alternatively, a change of the State Land Use District designation from the Agricultural to the Urban District could be sought by the filing of a Land Use District Boundary Amendment proceeding with the Land Use Commission as an alternative means of obtaining the necessary land use approvals.

8.4. Special Management Area

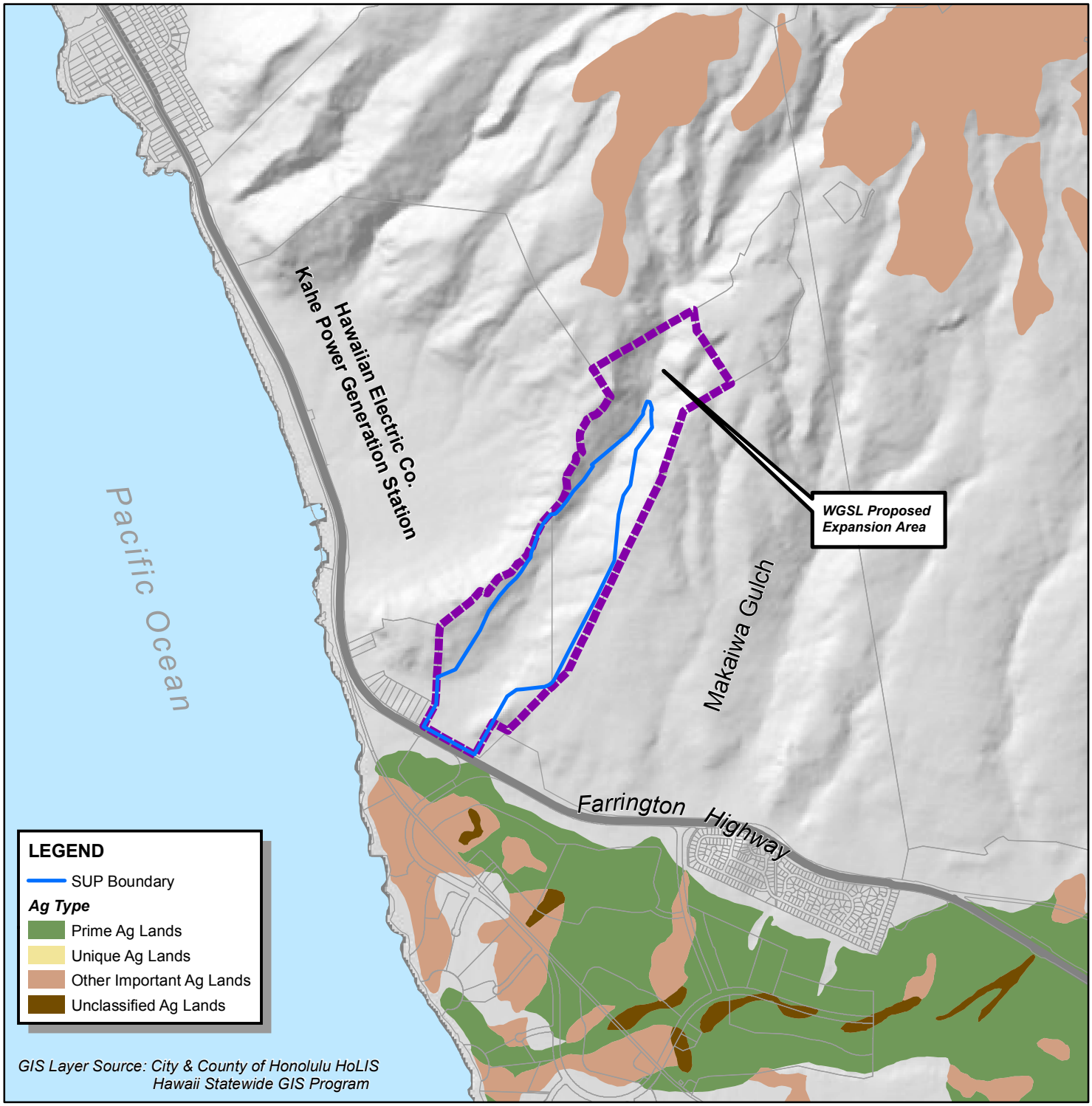
The State and City & County of Honolulu has established land use controls on development in coastal areas to avoid the permanent loss of valuable coastal resources and the foreclosure of management options. Special Management Area (SMA) boundaries have been set by the City to delineate coastal zone areas subject to regulation. According to the City & County of Honolulu's SMA Boundary Map for the Ewa area, the proposed project site is located outside of the SMA and is therefore not subject to SMA regulation.

The relationship of the SMA boundary to the project site is provided in **Figure 8-3, SMA Boundary**.

8.5. Coastal Zone Management Program

The State of Hawai‘i designates the Coastal Zone Management Program (CZMP) to manage the intent, purpose and provisions of the federal Coastal Zone Management Act, and HRS, Chapter 205(A)-2, as amended, for the areas from the shoreline to the seaward limit of the State's jurisdiction, and any other area which a lead agency may designate for the purpose of administering the Coastal Zone Management Program.

The following is an assessment of the project with respect to the CZMP objectives and policies set forth in Section 205(A)-2.



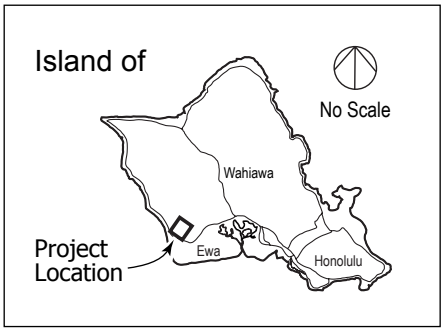


Figure 8-2
Agricultural Lands of Importance to the State of Hawaii (ALISH) Map
Waimanalo Gulch Sanitary Landfill Expansion
Department of Environmental Services

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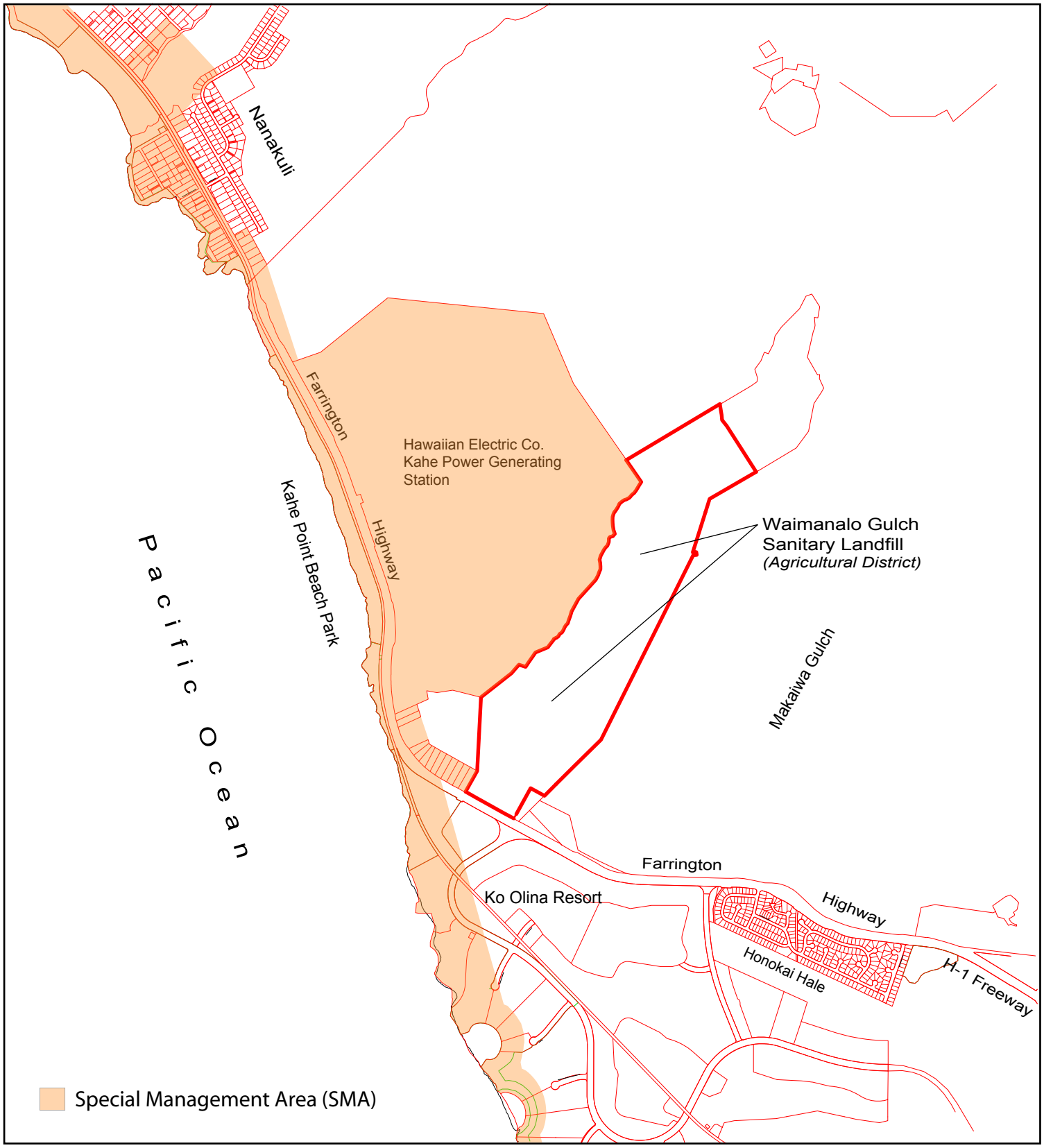

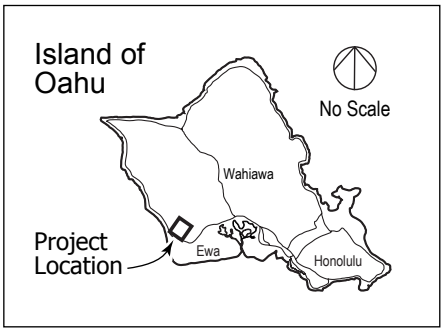

Figure 8-3
SMA Boundary
Waimanalo Gulch Sanitary Landfill Expansion
Department of Environmental Services

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1. Recreational resources

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

A) Improve coordination and funding of coastal recreational planning and management; and B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

(i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

(ii) Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;

(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

(v) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;

(vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.

Discussion:

The proposed facility is not located on the coastline or shoreline and does not involve the use of coastal resources. The site is not in a location suitable for the development of new shoreline recreational opportunities or to dedicable shoreline areas with recreational value. It is anticipated however, that with the eventual exhaustion of space within the WGSL that future recreational park opportunities may one day become available through the reclamation of the site. Although not shoreline dependent, the relative location of the site mauka and above coastal Wai‘anae, would allow open space recreational uses to complement and enhance the existing public beach and park facilities of the area.

> *2. Historic resources*
> *Objective: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.*
> *Policies:*
> *(A) Identify and analyze significant archaeological resources;*
> *(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and*
> *(C) Support state goals for protection, restoration, interpretation, and display of historic resources.*

Discussion:

Archaeological investigation of the site has been completed in accordance with the provisions of Chapter 6E, HRS. Three stone uprights were discovered in early 2007 as a result an archaeological inventory survey. The uprights were found to be in a cluster located near the southwestern edge of the WGSL in an area that would be affected by the lateral expansion. According to Cultural Surveys Hawai‘i (Cultural Surveys Hawai‘i, March 7, 2008):

> *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. 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. 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.

No other significant archaeological resources were discovered as a result of surveying the project's 92.5 acre area of potential effect.

To address the discovery of the uprights: (1) the SHPD was notified to report the find and to ascertain further actions or requirements to ensure no disturbance until an appropriate plan for treatment is determined; and (2) notification and coordination with appropriate parties as determined by SHPD that includes the Office of Hawaiian Affairs (OHA) and SHPD designated cultural informants from the area.

The process of coordination to develop an appropriate treatment plan and to ascertain further the purpose and function of the uprights is in progress. The owner of the site, the City & County of Honolulu, intends to work with the SHPD and the community to provide an appropriate level of treatment to preserve the stone uprights. All required provisions of Chapter 6E, HRS, as well as other provisions of law governing archaeological preservation and protection will be complied with.

Although the specific treatment that will be applied to the uprights has not yet been determined by the SHPD, and implemented by the City, the proposed project will address and meet the State's goals for the "…protection, restoration, interpretation, and display of historic resources." Any further actions that will be taken will be based on SHPD direction and guidance~~ will be provided in the project's forthcoming Final EIS~~.

3. Scenic and open space resources
Objective: Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.
Policies:
(A) Identify valued scenic resources in the coastal zone management area;
(B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural land forms and existing public views to and along the shoreline;
(C) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and
(D) Encourage those developments that are not coastal dependent to locate in inland areas.

Discussion:
The majority of the proposed project will not be visible from most vantage points along the Farrington Highway in the Waiʻanae or Kahe Point directions. The existing Kahe Point ridge line provides screening of views of the landfill, including the proposed expansion area.

The general area that fronts Waimānalo Gulch (i.e. from the Kai Lani subdivision to Ko Olina Beach Club) will be most impacted from the proposed project. Because this area has an unobstructed view into the gulch, continued activities will be seen from areas within this “view corridor”. Anticipated view impacts will be similar to existing conditions at the site consisting of periodic views of vehicles in transit to and from active landfill cells. Due to the existing height of the berm in the area of MSW Cell 1, the majority of daily landfill activities in the expansion area will be obstructed from view.

Mitigation to reduce visual impacts associated with existing operations has been initially implemented and will be modified to incorporate the proposed expansion area. The existing sanitary landfill has a 400-foot-wide vegetative buffer strip along the eastern portion of the site with a north-south separation of 800 to 1,000 feet. The approved

landfill area has been hydromulched to begin the growth of grasses in the filled areas. The landscaping effort, once established, will resemble vegetation on adjoining hillsides and follow similar growth cycles. In time, plant species in the surrounding areas are expected to spread into the closed areas of the landfill through the natural seeding process.

Views of Coastal Wai‘anae are not expected to be affected based on the location of the WGSL mauka and upgradient from the Farrington Highway.

> *4. Coastal ecosystems*
> *Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.*
> *Policies:*
> *(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*
> *(B) Improve the technical basis for natural resource management;*
> *(C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;*
> *(D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and*
> *(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.*

Discussion:
The proposed project is not expected to have any adverse effects on coastal or marine coastal ecosystems. This is due to the location of the project mauka of the shoreline and the Farrington Highway.

During construction, all construction activities will be covered under an NPDES permit to address proper treatment of storm water discharges. Measures to reduce and prevent sediment discharges in storm water runoff will be in place and functional before project activities begin and will be maintained throughout the construction period. Runoff and discharge pollution prevention measures will be incorporated into a site-specific Construction Stormwater BMPs plan by the project contractor. An NPDES permit application addressing discharges of storm water associated with industrial activities will also be filed with DOH for the expansion area to ensure proper operation of the facility.

5. Economic uses
Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.
Policies:
(A) Concentrate coastal dependent development in appropriate areas;
(B) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and
(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:
(i) Use of presently designated locations is not feasible;
(ii) Adverse environmental effects are minimized; and
(iii) The development is important to the State's economy.

Discussion:
Although the proposed project is not a coastal dependent facility, the location of the project site was based on selection criteria and governmental regulations that establish the suitability of the site for use as a municipal sanitary landfill.

The proposed project property is owned by the City & County of Honolulu and is designated for a landfill. The use of the site for this purpose is not expected to affect the location or expansion of future coastal dependent developments.

6. Coastal hazards
Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.
Policies:
(A) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;
(B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;
(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and
(D) Prevent coastal flooding from inland projects.

Discussion:
The potential for hazards from storm wave, tsunami, hurricane, wind, flood erosion, subsidence, and point and nonpoint source pollution will be addressed by the proposed project through adherence to the landfill site operating manual and through adherence to all required regulatory permit authorizations and controls.

The development of the project will also be in compliance with the requirements of the Federal Flood Insurance Program, the City & County of Honolulu Drainage, Grading and Development standards for Flood Hazard Districts, and the LUO, Section 21-9.10, Flood Hazard Districts.

Coastal flooding is not anticipated based on the location of the project inland and upgradient of the Farrington Highway.

7. Managing development
Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.
Policies:
(A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;
(B) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and
(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Discussion:
The project site is within the State Agricultural Land Use District. Land uses within this designation are subject to regulation by the State and City & County of Honolulu. The county's zoning designation is AG-2, Agricultural.

All improvement activities will be conducted in compliance with State and County environmental rules and regulations. This subject document is prepared to identify and, where necessary, propose mitigation measures to address the potential for impacts anticipated from the construction and operation of the project. This document will be published for public review in compliance with procedures set forth in HRS, Chapter 343.

8. Public participation;
Objective: Stimulate public awareness, education, and participation in coastal management.
Policies:

(A) Promote public involvement in coastal zone management processes;
(B) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and
(C) Organize workshops, policy dialogues, and site-specific mitigation to respond to coastal issues and conflicts.

Discussion:
Public involvement in the project will consist of public notification of the project as provided in the Office of Environmental Quality Control (OEQC) Bulletin. See Section 13, Organizations, Agencies, and Public Parties Consulted in the Environmental Impact Statement Process, for a list of agencies, organizations and individuals consulted for this project. All written public comments will be provided with a written response. Where appropriate, mitigation measures will be developed to address issues and concerns raised during public review of the project.

9. Beach protection;
Objective: Protect beaches for public use and recreation.
Policies:
(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;
(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and
(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

Discussion:
The proposed project is not located along the shoreline or beach. No structures are proposed seaward of the shoreline. Control of erosion will be based on conformance to standards of the City & County of Honolulu regulating the control of erosion.

The proposed project is anticipated to have potential impacts that include the migration of landfill associated odor, windblown litter migrating to area beaches and parks, and visual impacts. While the potential for impacts are not necessarily related to the policies associated with Item 9. Beach Protection, appropriate mitigative measures as provided in Section 6.10.2. Potential Impacts and Mitigation Measures (for Parks and Recreation) will be applied to the project to reduce the potential for adverse effects to public use and recreational activities at area beaches.

10. Marine resources
Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.
Policies:
(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;
(B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;
(C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;
(D) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and
(E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Discussion:
The proposed project does not involve or utilize marine resources. However, as required by law all necessary permit applications and environmental and building permit approvals will be secured prior to the initiation of construction activities.

8.6. City & County of Honolulu General Plan

The General Plan of the City & County of Honolulu is a comprehensive statement of objectives and policies which sets forth the long-range aspirations of O‘ahu's residents and the strategies or actions to achieve them. It is the focal point of a comprehensive planning process that addresses physical, social, economic and environmental concerns affecting the City & County of Honolulu. Since adoption of the General Plan in 1977, the last amendment to the Plan was completed in 2002. Although the Plan has sustained a number of changes since its adoption the basic themes and directions for growth remain valid[2].

The proposed project is consistent with the General Plan objectives and policies that relate to the following:

> *"I. Population*
> *Objective B: To plan for future population growth.*
> *Policy 1: Allocate efficiently the money and resources of the City and County in order to meet the needs of Oahu's anticipated future population.*
> *Policy 2: Provide adequate support facilities to accommodate future growth in the number of visitors to Oahu."*

Although the proposed project does not directly influence future population growth, it represents an important public facility serving the island of O‘ahu by providing a location and means for the disposal of municipal refuse. In this regard the project is a necessary

[2] General Plan, City & County of Honolulu. Website reference: http://honoluludpp.org/planning/GeneralPlan/GPIntro.pdf

use of City resources that will meet future population needs and accommodate growth in the number of visitors to O‘ahu.

> *"III. Natural Environment*
> *Objective A: To protect and preserve the natural environment.*
> *Policy 1: Protect Oahu's natural environment, especially the shoreline, valleys, and ridges, from incompatible development.*
> *Policy 2: Seek the restoration of environmentally damaged areas and natural resources.*
> *Policy 4: Require development projects to give due consideration to natural features such as slope, flood and erosion hazards, water- recharge areas, distinctive land forms, and existing vegetation."*

The development of the Waimānalo Gulch Sanitary Landfill occurred in 1989 prior to the rapid growth currently occurring in the ‘Ewa region. Surrounding land uses were largely limited to industrial activities including the James Campbell Industrial Park and the HECO Kahe Power Generating Station. Today, with the development of the adjoining Ko Olina Resort, Nānākuli Homesteads, Honokai Hale, Makakilo, Kapolei, and other subdivisions, the area has experienced major development and population growth. Although the proposed project will require an expansion of use of the existing facility and require transformation of the existing Waimānalo Gulch into space that will be used for landfilling, such use will be limited by the remaining space that is available at the site. With the eventual closure of the site, the land upon which the facility is located is expected to be reclaimed for other public purposes that may be considered more compatible with area surroundings. These uses may include, but are not limited to, open space for park and recreational activities not unlike the Kaka‘ako Community Park, which once served as a landfill in Honolulu. This practice will seek to restore use of the land for a public purpose and benefit.

"V. Transportation & Utilities
Objective B: To meet the needs of the people of Oahu for an adequate supply of water and for environmentally sound systems of waste disposal.
Policy 3: Encourage the development of new technology which will reduce the cost of providing water and the cost of waste disposal.
Policy 4: Encourage a lowering of the per-capita consumption of water and the per-capita production of waste.
Policy 5: Provide safe, efficient, and environmentally sensitive waste-collection and waste-disposal services.
Policy 6: Support programs to recover resources from solid-waste and recycle wastewater.
Policy 7: Require the safe disposal of hazardous waste."

The proposed project is designed to serve as an environmentally sound method for the disposal of municipal solid waste and ash. The development of new technology based solutions, while promising, have and will continue to be evaluated by the City based on feasibility and a demonstrated operating record of performance for municipalities similar to the City & County of Honolulu. At this time however, there are no new technologies with proven feasibility of performance or that would completely eliminate the generation of waste by-products that would require disposal (see **Appendix K**).

The recovery of resources from solid waste is already occurring through the recycling of waste materials into energy through the City's H-POWER facility. The operating record of H-POWER has been proven through over a decade of performance that has benefited the City in reducing the amount of waste requiring landfilling. Based on this performance, plans for the expansion of the H-POWER have been proposed by the City.

It is possible in the future that as new and emerging technologies demonstrate similar proven levels of performance and feasibility of application for the City that such

technologies will be adopted. At this time, however, there are no technology based alternatives that could by itself address the need for landfilling.

While the WGSL does not accept hazardous waste, the City supports the safe handling and disposal of all hazardous wastes.

> *"VIII. Public Safety*
> *Objective B: To protect the people of Oahu and their property against natural disasters and other emergencies, traffic and fire hazards, and unsafe conditions.*
> *Policy 2: Require all developments in areas subject to floods and tsunamis to be located and constructed in a manner that will not create any health or safety hazard.*
> *Policy 8: Provide adequate search and rescue and disaster response services."*

Waimānalo Gulch Sanitary Landfill has other important functions in addition to its daily use for a municipal sanitary landfill. In the event of a public emergency involving a natural disaster such as a hurricane, tsunami, or earthquake, the facility will serve as a repository for disposal of disaster debris. This use will promote public safety by ensuring that a facility is available to handle disposal of debris that could otherwise accumulate in populated areas throughout the island, including along communities of the Waiʻanae Coastline.

8.7. City & County of Honolulu ʻEwa Development Plan (ʻEwa Sustainable Communities Plan)

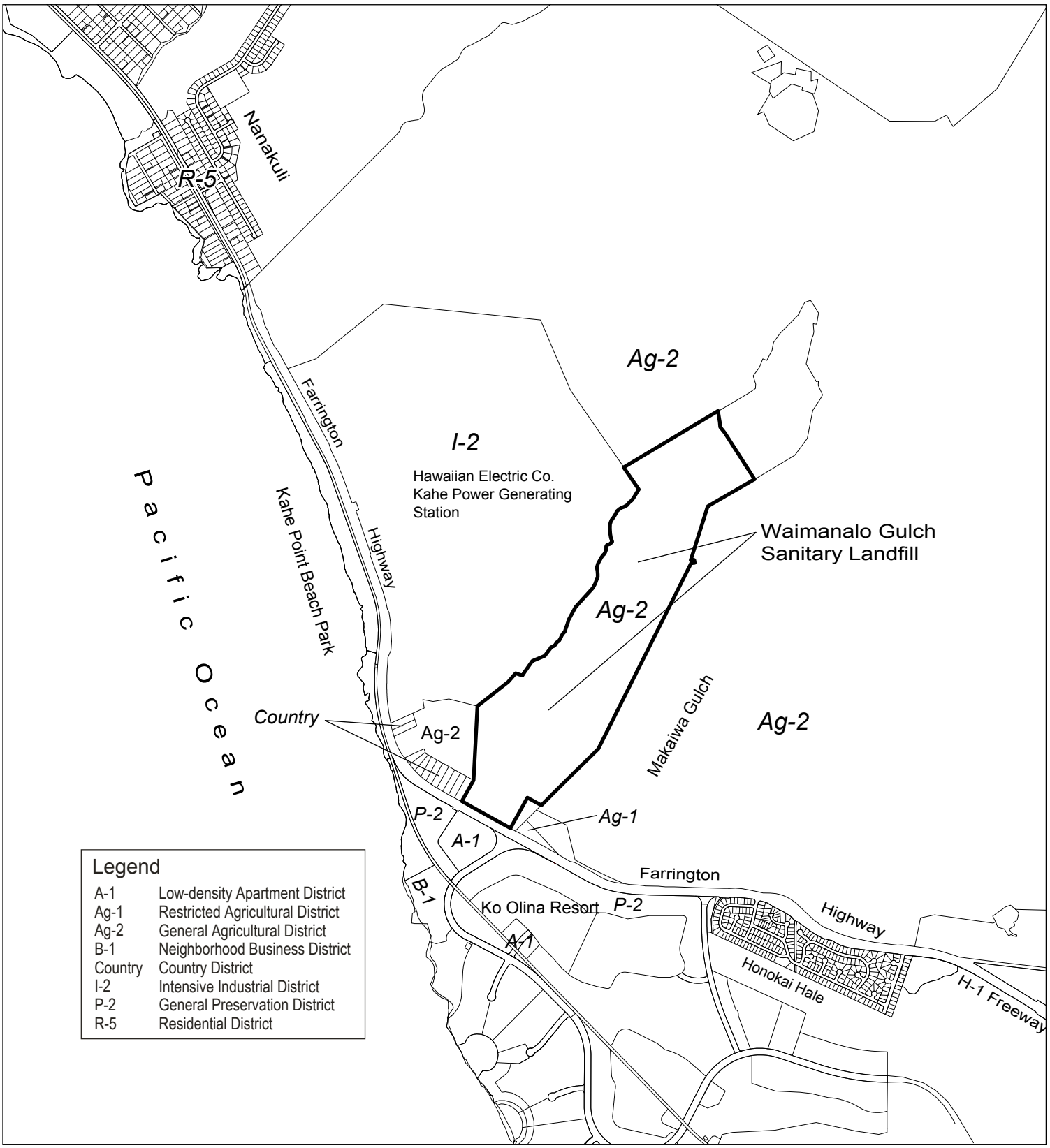
The ʻEwa Development Plan (DP), was adopted by the City in August 1997 and is currently undergoing a required five-year review and update. The date of completion of the review and update of the plan is not known at this time. As appropriate during the preparation of the project EIS, and upon completion of the five-year review, the proposed project will be evaluated for consistency with the updated ʻEwa DP.

The project site is depicted on the ‘Ewa DP within the Preservation District on the plan’s illustrative Open Space and Phasing Maps. The ‘Ewa DP discusses the analysis and recommendations of the Solid Waste Integrated Management (SWIM) Plan, prepared by the Department of Public Works and adopted by the Honolulu City Council in 1995. The Ewa DP states that the SWIM Plan identified the Waimānalo Gulch as having potential for expansion; however, siting and/or expansion of sanitary landfills should be analyzed and approved based on islandwide studies and siting evaluations (such as the Chapter 343, HRS, EIS process which is the subject of this document).

The Development Plan Public Facilities Map also depicts a symbol for the existing landfill facility, but does not delineate the boundaries of the landfill.

8.8. City & County of Honolulu Zoning Law

The zoning designation of the project site is AG-2 General Agricultural District (See **Figure 8-4**, **Zoning Map**). According to the Land Use Ordinance, development of a landfill is a permitted use in the AG-2 district. A determination of permitting requirements for this project pursuant to the zoning of the site will be completed with the Department of Planning and Permitting (DPP). It is anticipated that the existing facility and the proposed expansion will be considered a “public use” under the Land Use Ordinance. A Conditional Use Permit is not anticipated to be required.



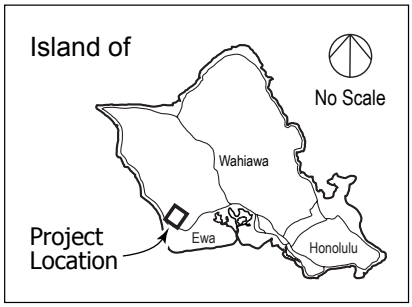


Figure 8-4
Zoning Map
Waimanalo Gulch Sanitary Landfill Expansion
Department of Environmental Services

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Section 9
Alternatives to the Proposed Action

9.1. Introduction

In March 2008, the Alternatives Analysis for Disposal of Municipal Refuse report was completed for the subject EIS by Pacific Waste Consulting Group (PWCG) (**Appendix K**). This report was subsequently updated with additional information in September 2008, which is included in this section. The following includes a summary of the report and evaluation.

~~The following alternatives to the proposed project were evaluated:~~

9.2. O‘ahu Refuse Disposal - General background information is provided pertaining to the composition of waste disposal for the Island of O‘ahu.

Alternatives to the proposed project consist of the following:

9.~~2.~~3. No Action - Landfilling at the Waimānalo Gulch Sanitary Landfill would cease on November 1, 2009, with no alternative site or technology available.

9.~~3.~~4. Delayed Action - The action on the permit would be delayed. Given the time needed to process the permits, the delayed and no action alternatives have the same effect.

9.~~4.~~5. Transshipment - O‘ahu’s MSW would be baled and transported to a mainland landfill for disposal. Even with this alternative, not all MSW can be transshipped.

9.~~5.~~6. Alternative Technologies - Technologies other than landfilling that could reduce the amount of material requiring disposal and generate electricity or another beneficial reuse product. Alternative technologies that were considered include:

- Thermal and non-thermal technologies;

- Enhanced recycling;
- Addition of a third unit to H–POWER; and
- Alternative methods of landfilling, such as co-disposal of ash and MSW and use of a bioreactor landfill.

9.~~6.~~ 7. Alternative Sites - Alternative sites on O‘ahu for the landfill. The five alternative landfill sites considered in the analysis were:

- Ameron Quarry;
- Mā‘ili Quarry;
- Makaiwa Gulch;
- Nānākuli B; and
- Waimānalo Gulch Sanitary Landfill.

The analysis was performed for each of the alternatives. The examination of alternative technologies involved a review of currently operating facilities and includes information describing the technologies.

All alternatives were compared to criteria or guidelines established by the City & County of Honolulu for alternative technologies, alternative landfill sites, and transshipment. The requirements for alternative sites are based on the work of the Mayor’s Advisory Committee on Landfill Site Selection which was concluded in December 2003. The Committee was established as an independent panel advisory to the Mayor comprised of citizens and legislators from several areas of the Island of O‘ahu.

The requirements for alternative technologies were established by the City in its January 16, 2007 Notice to Bidders.[1] The transshipment alternative requirements were established by the City in its January 22, 2008 Notice to Bidders.[2]

[1] City and County of Honolulu, Notice to Bidders, Project to Construct and Operate Alternative Energy Facility and/or H–POWER Facility. Competitive Sealed Proposals (CSP) NO. 037, January 16, 2007.

[2] City and County of Honolulu, Notice to Bidders, Shipping of City Provided MSW, Competitive Sealed Proposals (CSP No. 037). January 22, 2008.

9.2. O‘ahu Refuse Disposal

9.2.1. Introduction

Information is provided for the composition of refuse received at the City's H-POWER and WGSL facilities for general background information. Due to the preparation schedule for this EIS and the schedule for the City's Solid Waste Integrated Management Plan Update (SWIMP), data from the November 2007 draft update is provided.

9.2.2. Composition of Waste Stream

The composition of the disposed waste is based on hand-sorting randomly selected samples of the waste from garbage trucks. In 2006, the City studied the composition of the waste received at H-POWER, WGSL, and the Keehi Transfer Station. Sampling took place at H-POWER on September 18–21, 2006, WGSL on September 11–14, 2006, and at the Keehi Transfer Station on September 15–16, 2006.

Table 9-A, Aggregate Overall Waste Characterization Results - 2006, shows the composition of Oahu’s waste from H-POWER and the Waimanalo Gulch Sanitary Landfill combined.

Table 9-B, Waimanalo Gulch Landfill Waste Characterization Results - 2006, shows the composition of waste being disposed of at the WGSL. The majority of waste going into the landfill is from commercial and self-haul sources, rather than residential sources. 90 percent of the residential waste goes to H–POWER.

Table 9-A
Aggregate Overall Waste Characterization Results - 2006

Material	Mean	+/-	Mean (tons)	+/- (tons)
Total Paper	**30.2%**	**1.8%**	**284,082**	**17,040**
OCC (Recyclable)/Kraft	5.2%	1.1%	49,166	10,747
Newspaper	4.3%	1.1%	40,757	10,589
High-Grade Paper	2.6%	0.9%	24,420	7,993
Low-Grade Paper	5.1%	0.9%	48,151	8,012
Other Compostable Paper	11.7%	1.8%	110,142	16,582
Other Paper	1.2%	0.2%	11,446	1,896
Total Plastics	**12.1%**	**1.3%**	**113,821**	**11,808**
PET Bottles/Containers (Deposit)	0.3%	0.1%	2,843	578
PET Bottles/Containers (Non-Deposit)	0.3%	0.1%	2,449	646
HDPE Bottles/Containers	1.0%	0.3%	9,128	2,562
Other Bottles/Containers	1.1%	0.2%	10,142	1,818
Mixed Rigid Plastics	1.1%	0.4%	10,479	3,431
Plastic Film/Wrap	5.1%	0.7%	47,989	6,654
Polystyrene	0.8%	0.1%	7,056	1,371
Other Plastics	2.5%	0.4%	23,734	4,156
Total Metals	**4.8%**	**0.8%**	**45,448**	**7,151**
Aluminum Cans (Deposit)	0.3%	0.1%	2,626	632
Aluminum Cans (Non-Deposit)	0.3%	0.1%	2,630	1,351
Tin Cans	0.6%	0.2%	5,830	1,467
Other Ferrous	1.5%	0.4%	14,103	4,160
Other Non-Ferrous	0.4%	0.1%	4,148	1,020
Mixed Metals/Other Metals	1.7%	0.5%	16,111	4,660
Total Glass	**1.7%**	**0.4%**	**16,089**	**4,039**
HI5 Glass Bottles/Containers	0.4%	0.2%	4,158	1,589
Other Glass	1.3%	0.3%	11,930	3,102
Total Other Inorganics	**3.1%**	**1.2%**	**29,370**	**11,020**
Gypsum Board	0.3%	0.1%	2,760	1,280
Asphalt Roofing	0.5%	0.3%	4,261	2,609
Asphalt Paving	0.0%	0.0%	38	27
Concrete	0.3%	0.2%	3,078	1,535
Sand/Soil/Rock/Dirt	1.3%	0.8%	12,525	7,811
Ceramics	0.4%	0.2%	4,214	1,772
Miscellaneous Inorganics	0.3%	0.2%	2,496	1,445
Total Other Waste	**9.8%**	**1.6%**	**91,946**	**15,278**
Batteries	0.0%	0.0%	381	156
Furniture	3.4%	1.0%	31,555	9,795
Appliances	1.1%	0.7%	10,728	6,734
E-Waste	2.0%	0.7%	18,820	6,161
Auto Fluff*	3.2%	NA	30,462	NA
Total Green Waste	**8.7%**	**2.8%**	**82,041**	**26,182**
Total Wood	**4.5%**	**2.3%**	**42,273**	**21,884**
Untreated Wood	1.4%	0.5%	13,017	5,004
Treated Wood	2.1%	0.6%	19,428	5,371
Pallets	0.3%	0.1%	2,644	1,248
Stumps	0.8%	0.4%	7,185	3,473
Total Other Organics	**24.8%**	**2.1%**	**232,874**	**19,621**
Food	12.7%	1.9%	119,645	17,575
Textiles	3.1%	1.0%	28,726	9,136
Carpet	0.7%	0.3%	6,650	2,454
Tires	0.2%	0.1%	1,540	1,090
Miscellaneous Organics	3.7%	0.8%	34,569	7,578
Sludge	4.4%	NA	41,744	NA
Total HHW	**0.2%**	**0.1%**	**2,234**	**1,399**
Pesticides/Herbicides	0.0%	0.0%	0	0
Paints/Adhesives/Solvents	0.0%	0.0%	256	172
Household Cleaners	0.0%	0.0%	0	0
Automotive Products	0.2%	0.1%	1,711	1,221
Other HHW	0.0%	0.0%	277	147
TOTAL	**100.00%**		**940,187**	

* There was no auto fluff or sludge in the samples sorted for this study. As such, the standard deviation and the lower and upper bounds of the confidence interval are not applicable. The WGSL is known to accept auto fluff and sludge and therefore the average composition for these materials was obtained from sources outside the PWCG study.

Table 9-B
Waimanalo Gulch Landfill Waste Characterization Results - 2006

Material	Mean	+/-	Mean (tons)	+/- (tons)
Total Paper	**4.3%**	**1.6%**	**7,864**	**3,020**
OCC (Recyclable)/Kraft	1.6%	0.6%	2,993	1,110
Newspaper	0.3%	0.2%	504	307
High-Grade Paper	0.1%	0.1%	161	96
Low-Grade Paper	1.0%	0.5%	1,902	963
Other Compostable Paper	0.7%	0.4%	1,347	817
Other Paper	0.6%	0.3%	1,057	627
Total Plastics	**4.6%**	**1.7%**	**8,463**	**3,155**
PET Bottles/Containers (Deposit)	0.1%	0.1%	166	102
PET Bottles/Containers (Non-Deposit)	0.0%	0.0%	87	55
HDPE Bottles/Containers	0.2%	0.1%	426	248
Other Bottles/Containers	0.1%	0.0%	154	89
Mixed Rigid Plastics	1.5%	0.9%	2,811	1,664
Plastic Film/Wrap	0.7%	0.3%	1,195	632
Polystyrene	0.2%	0.1%	326	197
Other Plastics	1.8%	0.8%	3,298	1,468
Total Metals	**10.1%**	**2.8%**	**18,654**	**5,212**
Aluminum Cans (Deposit)	0.0%	0.0%	90	54
Aluminum Cans (Non-Deposit)	0.0%	0.0%	2	1
Tin Cans	0.1%	0.1%	152	96
Other Ferrous	4.6%	1.7%	8,377	3,099
Other Non-Ferrous	0.3%	0.2%	570	346
Mixed Metals/Other Metals	5.1%	2.0%	9,463	3,619
Total Glass	**0.5%**	**0.3%**	**950**	**547**
HI5 Glass Bottles/Containers	0.2%	0.1%	413	261
Other Glass	0.3%	0.2%	537	329
Total Other Inorganics	**4.9%**	**2.4%**	**8,957**	**4,452**
Gypsum Board	0.8%	0.5%	1,477	933
Asphalt Roofing	2.3%	1.4%	4,166	2,585
Asphalt Paving	0.0%	0.0%	0	0
Concrete	0.5%	0.3%	965	637
Sand/Soil/Rock/Dirt	0.0%	0.0%	0	0
Ceramics	1.2%	0.7%	2,209	1,363
Miscellaneous Inorganics	0.1%	0.1%	141	100
Total Other Waste	**33.9%**	**4.0%**	**62,267**	**7,436**
Batteries	0.0%	0.0%	62	39
Furniture	12.6%	4.4%	23,194	8,054
Appliances	1.0%	0.6%	1,832	1,164
E-Waste	4.0%	1.9%	7,393	3,582
Auto Fluff*	16.2%	NA	29,786	NA
Total Green Waste	**3.4%**	**1.5%**	**6,270**	**2,833**
Total Wood	**10.7%**	**3.3%**	**19,589**	**6,020**
Untreated Wood	2.2%	1.2%	4,053	2,148
Treated Wood	5.9%	2.1%	10,806	3,877
Pallets	0.8%	0.5%	1,381	867
Stumps	1.8%	1.2%	3,349	2,231
Total Other Organics	**27.6%**	**1.8%**	**50,788**	**3,243**
Food	1.1%	0.7%	2,075	1,206
Textiles	1.6%	0.8%	2,975	1,549
Carpet	1.6%	0.9%	2,908	1,618
Tires	0.0%	0.0%	33	23
Miscellaneous Organics	1.1%	0.6%	1,978	1,149
Sludge	22.2%	NA	40,818	NA
Total HHW	**0.0%**	**0.0%**	**64**	**44**
Pesticides/Herbicides	0.0%	0.0%	0	0
Paints/Adhesives/Solvents	0.0%	0.0%	0	0
Household Cleaners	0.0%	0.0%	0	0
Automotive Products	0.0%	0.0%	0	0
Other HHW	0.0%	0.0%	64	44
TOTAL	**100.00%**		**183,866**	

* There was no auto fluff or sludge in the samples sorted for this study. As such, standard deviation and the lower and upper bounds of the confidence interval are not applicable. The WGSL is known to accept auto fluff and sludge. The average composition for these materials was obtained from sources outside the PWCG study.

The results in **Table 9-B** are adjusted because the samples of waste for the waste characterization report were taken when H–POWER was in full operation and not diverting waste to the landfill. Waste from H–POWER is diverted to the landfill when H-POWER is unable to accept waste due to maintenance or capacity limitations. Because no waste was diverted, the composition at the landfill would have overstated the amount of some types of material. For example, if the landfill had 100 tons of material coming in and 50 tons were "X," the waste would be 50 percent "X". If an additional 30 tons of material were diverted from H–POWER, the total tonnage would have been 130 tons and "X" would have been 38 percent. The annual amount of waste received at the landfill was reduced by the amount of the material diverted from H–POWER so that the relative proportion of the remaining material was correct.

Table 9-C, H-POWER Waste Characterization Results - 2006, shows the composition of waste being disposed at H-POWER. Approximately half of the waste going into H–POWER is from residential sources and about half is commercial waste. The types and amounts of material shown reflect potential material for recycling programs.

~~9.2. No Action Alternative~~

9.3. No Action Alternative

This alternative involves taking no further action to extend the use of the site, or to select an alternative technology or new landfill site upon closure of the WGSL on or before November 1, 2009, in compliance with a State Special Use Permit amendment issued in March 2008.

The following would be expected as a result:

- There would be no landfill to accept the waste currently going to the Waimānalo Gulch Sanitary Landfill, leaving about 800 TPD of MSW requiring disposal.

Table 9-C
H-POWER Waste Characterization Results - 2006

Material	Mean	+/-	Mean (tons)	+/- (tons)
Total Paper	**36.7%**	**2.3%**	**277,570**	**17,082**
OCC (Recyclable)/Kraft	6.1%	1.4%	46,463	10,889
Newspaper	5.4%	1.4%	40,465	10,784
High-Grade Paper	3.2%	1.1%	24,390	8,143
Low-Grade Paper	6.1%	1.1%	46,462	8,103
Other Compostable Paper	14.5%	2.2%	109,368	16,874
Other Paper	1.4%	0.2%	10,423	1,821
Total Plastics	**14.0%**	**1.5%**	**150,749**	**11,585**
PET Bottles/Containers (Deposit)	0.4%	0.1%	2,689	579
PET Bottles/Containers (Non-Deposit)	0.3%	0.1%	2,373	655
HDPE Bottles/Containers	1.2%	0.3%	8,741	2,598
Other Bottles/Containers	1.3%	0.2%	10,039	1,851
Mixed Rigid Plastics	1.0%	0.4%	7,647	3,048
Plastic Film/Wrap	6.2%	0.9%	47,026	6,749
Polystyrene	0.9%	0.2%	6,760	1,382
Other Plastics	2.7%	0.5%	20,474	3,956
Total Metals	**3.5%**	**0.7%**	**26,517**	**4,936**
Aluminum Cans (Deposit)	0.3%	0.1%	2,548	642
Aluminum Cans (Non-Deposit)	0.3%	0.2%	2,642	1,377
Tin Cans	0.8%	0.2%	5,706	1,491
Other Ferrous	0.7%	0.4%	5,566	2,794
Other Non-Ferrous	0.5%	0.1%	3,585	977
Mixed Metals/Other Metals	0.9%	0.4%	6,470	2,948
Total Glass	**2.0%**	**0.5%**	**15,201**	**4,077**
HI5 Glass Bottles/Containers	0.5%	0.3%	3,756	1,597
Other Glass	1.5%	0.4%	11,445	3,142
Total Other Inorganics	**2.7%**	**1.4%**	**20,322**	**10,251**
Gypsum Board	0.2%	0.1%	1,256	884
Asphalt Roofing	0.0%	0.0%	0	0
Asphalt Paving	0.0%	0.0%	38	27
Concrete	0.3%	0.2%	2,103	1,420
Sand/Soil/Rock/Dirt	1.7%	1.1%	12,594	7,959
Ceramics	0.3%	0.2%	1,966	1,138
Miscellaneous Inorganics	0.3%	0.2%	2,365	1,469
Total Other Waste	**3.8%**	**1.8%**	**28,424**	**13,558**
Batteries	0.0%	0.0%	319	154
Furniture	1.0%	0.7%	7,879	5,568
Appliances	1.2%	0.9%	8,904	6,755
E-Waste	1.5%	0.7%	11,322	5,083
Auto Fluff	0.0%	0.0%	0	0
Total Green Waste	**10.1%**	**3.5%**	**76,048**	**26,516**
Total Wood	**3.0%**	**1.3%**	**22,363**	**9,557**
Untreated Wood	1.2%	0.6%	8,921	4,594
Treated Wood	1.1%	0.5%	8,423	3,749
Pallets	0.2%	0.1%	1,238	906
Stumps	0.5%	0.4%	3,781	2,693
Total Other Organics	**24.1%**	**2.6%**	**181,937**	**19,711**
Food	15.6%	2.4%	118,175	17,863
Textiles	3.4%	1.2%	25,825	9,172
Carpet	0.5%	0.2%	3,696	1,866
Tires	0.2%	1.0%	1,515	1,111
Miscellaneous Organics	4.3%	1.0%	32,726	7,630
Sludge	0.0%	0.0%	0	0
Total HHW	**0.3%**	**0.2%**	**2,190**	**1,425**
Pesticides/Herbicides	0.0%	0.0%	0	0
Paints/Adhesives/Solvents	0.0%	0.0%	257	176
Household Cleaners	0.0%	0.0%	0	0
Automotive Products	0.2%	0.2%	1,720	1,244
Other HHW	0.0%	0.0%	212	142
TOTAL	**100.00%**		**756,321**	

* There was no auto fluff or sludge in the samples sorted for this study. As such, standard deviation and the lower and upper bounds of the confidence interval are not applicable. The WGSL is known to accept auto fluff and sludge. The average composition for these materials was obtained from sources outside the PWCG study.

- Because the garbage could not be disposed, it could not be collected, requiring people to hold it at their homes and residences; resulting in health and safety problems.
- Ash disposal from H-POWER would cease as no other landfill on the Island of O‘ahu is permitted to accept this material.
- Eliminating ash disposal would stop the operation of H-POWER.
- Businesses would be closed to avoid health issues with improperly managed garbage.

Taken together, these actions would result in an unacceptable health, safety, and economic impact to all the communities of the island of O‘ahu.

~~9.3. Delayed Action Alternative~~

9.4. Delayed Action Alternative

The Delayed Action Alternative involves delaying further effort to extend the use of the WGSL; replace the use of the WGSL with an alternative technology based solution; or propose a new landfill site.

The Delayed Action and No Action Alternatives would have similar results. Given the complexity of the landfill permitting process in Hawai‘i and the limited time that is available, it is possible that delayed action would prevent the City from filing and processing ~~an amendment to the~~ a new State Special Use Permit (SUP) and/or a State Land Use District Boundary Amendment prior to ~~its~~ the current SUP's expiration on November 1, 2009, when the WGSL would be prohibited from accepting any further MSW. For this reason, the Delayed Action Alternative is not considered viable.

~~9.4. Transshipment of Waste Off-Island~~

~~9.4.1. Introduction~~

9.5. Transshipment of Waste Off-Island

9.5.1. Introduction

Waste transshipment involves the packaging of MSW for shipment to a disposal site located off-island.

On August 23, 2006, the U. S. Department of Agriculture (USDA) through its U. S. Animal and Plant Health Inspection Services (APHIS) announced its decision to allow the transshipment of MSW to the continental United States from Hawaii.[3] Transshipment will be allowed only under certain circumstances. Wastes by federal regulation that would be restricted from transshipment include hard-to-handle wastes, such as white goods, sewage sludge, auto fluff (auto upholstery & foam padding), and precluded waste including green and agricultural wastes (not more than three percent of the bale weight would be allowed). (PWCG, 2008).

Three transshipment firms have shown interest in shipping O‘ahu’s waste to the Roosevelt Landfill in Washington State. Two of the three have submitted initial proposals to the City to ship a portion of O‘ahu’s MSW to the mainland for disposal. Both proposals would shrink-wrap the waste prior to shipping. (PWCG, 2008).

On January 22, 2008 the City provided a notice to bidders that it would entertain proposals for transshipping waste to the mainland for disposal.

~~9.4.2. City & County of Honolulu Requirements for Transshipment of Waste~~

9.5.2. City & County of Honolulu Requirements for Transshipment of Waste

The City established the following requirements for the transshipment of MSW in its January 22, 2008 notice to bidders (PWCG, 2008):

[3] Federal Register volume 71, number 163, published August 23, 2006.

- Permits, compliance letters, certifications, environmental assessments, and other documents, related to services needed to carry out the contract, must be current for the transshipment contractor.
- The proposed methods and measures to fulfill each requirement of the contract must be identified.
- A site plan displaying existing facilities, equipment, traffic conditions, and a description of operations must be provided.
- A back-up plan for equipment maintenance, failure, or other disruption, to minimize landfill disposal must be provided.
- A back-up plan for barge-loading obstruction or other disruptions of exporting operations to minimize landfill disposal must be provided.
- A copy of facility agreements between the bidder and facility, barging, or disposal operators must be provided if the bidder is not the director/operator of each.
- The bidder must provide a property easement for the placement of a City-owned scale, scale house, and associated equipment.

~~9.4.3. Transshipment Methodology~~

9.5.3. Transshipment Methodology

Two of the three interested transshipment firms have submitted applications to the State for modifications to the transfer stations they currently have permitted to handle MSW. Modifications include adding the equipment needed to transship MSW to the Roosevelt Landfill in Washington State or a landfill in Idaho. The transshipment vendors would shrink-wrap the waste to avoid shipment of pests and control nuisance impacts. The approach is described in the risk assessment prepared by APHIS for its regulatory action.[4] (PWCG, 2008).

[4] *The Risk of Introduction of Pests to the Continental United States via Plastic-Baled Municipal Solid Waste from Hawaii,* United States Department of Agriculture, Animal and Plant Health Inspection Service, March 2006.

The process for handling the waste in Honolulu is specified in the final Compliance Agreement between the USDA and Hawaii Waste Systems, LLC (HWS). The procedures for handling the waste and transporting it to the landfill for disposal are detailed[5] as follows (PWCG, 2008):

> *"…Garbage and Regulated (domestic) Garbage collected by refuse trucks shall be delivered to the HWS facility at HWS Transfer Station …Trucks of agricultural waste shall not be accepted. Waste materials, containers, and bins associated with Foreign Garbage are strictly prohibited and shall not be accepted. The ground surface of the all areas for handling the Garbage and Regulated (domestic) Garbage should be level, solid, and impervious surface of asphalt or cement.*
>
> *The risk assessments for the movement of Garbage and Regulated (domestic) Garbage were conducted based on the specific details provided by HWS. These details included the exclusion of incinerator ash and the removal of all hazardous and liquid waste prior to baling. HWS will notify PPQ (USDA, APHIS local office) if the company plans change to include such materials so that the proper risk assessments can be conducted…*
>
> *The waste transfer station will receive only household and commercial waste acceptable for disposal at Roosevelt Regional Landfill. Collection trucks will deliver waste picked up from existing collection routes. After waste is tipped onto the tipping floor it will be inspected for unacceptable waste including yard waste, (other than incidental amounts not to exceed 3% of the total waste stream pursuant to 7 CFR Part 330), agricultural waste, industrial waste, infections waste, loads of predominantly of [C&D] waste and regulated hazardous waste. Any segregated unacceptable waste will be separated for further processing. Loads consisting predominately of [C&D] waste will be transferred to a C&D handling facility. Other waste will be drummed or otherwise contained and arrangements made for its proper transportation and disposal. Notwithstanding the foregoing, it is acknowledged and agreed that follow-up inspection of the route that was the source of the unacceptable waste will be conducted to try to locate the source and correct the waste handling process that allowed unacceptable waste to be collected.*

[5] Final Compliance Agreement between Hawaiian Waste Systems, LLC, and the United States Department of Agriculture relating to the Regulated Article "Garbage and Regulated (domestic) Garbage from Honolulu, Hawaii." January 19, 2007. Pages 4-7.

Each load of waste received at the facility will be weighed and the date, time, company, driver name, truck number (i.e., company fleet number), weight (loaded), weight (empty), and origin of load, will be recorded. Records will be kept for a minimum of three years.

Step-by-step waste receiving and processing description is as follows:

- *Waste is delivered by collection truck to the HWS Transfer Station. The truck is weighed and then proceeds to the baling facility where it tips its waste onto the tipping floor. The collection truck is weighed again as it exits the site and continues on its collection routes. A weigh ticket is generated and kept on file.*
- *A loader operator inspects the waste and segregates any non-household or on-commercial waste. Household and commercial waste is pushed onto the in-feed conveyor by the loader. Segregated waste is set aside and handled separately as described previously.*
- *Garbage and Regulated (domestic) Garbage moves along the conveyor to the intake feed of the baler. The baler operator introduces waste into the baler where it is compressed using a compactor that produces bale densities of approximately 1000 kg per cubic meter for the most waste materials.*
- *The compacted bale moves from the baler via conveyor belt to the plastic wrapper. The plastic wrapper automatically wraps the bale with a minimum of 4 layers of pre-stretched, mastic-backed polyethylene plastic, of at least 16 micrometers thickness, and extrudes it onto a roller conveyor. The baler operator or loader operator will inspect each bale for integrity of the plastic wrap. Any bale with unsatisfactory wrapping will be re-sent through the wrapper.*
- *The wrapped bale moves down the roller conveyor and is removed by a loader with a special attachment that picks up the bale by squeezing it between two hydraulically operated smooth faced arms, or another piece of equipment designed to handle the bales without tearing or damaging them in any way. The smooth faced arms prevent damage to the plastic wrap.*
- *The loader moves the bale onto the bale storage area – which has a solid, impervious (concrete or asphalt) surface that is kept free of soil or other contaminants – or directly onto a flat bed truck, if one is available.*

- *Bales that are placed onto the bale storage area will be loaded onto flat bed trucks as they become available.*
- *Flat bed trucks will haul the bales to Barber's Point where they will be unloaded and stacked in the Staging Area. The same type of loader attachment (or equivalent equipment) will be used for unloading to prevent damage to the plastic wrap. The loader operator will inspect each bale of damage to the plastic wrap. If damage is found it will be returned to a wrapping area for rewrapping.*
- *Bales cannot be loaded onto the barge until they have been staged for at least five days. After five days, the bales are considered ready for transport and the area will be designated the Transport Area. HWS will maintain a clear separation between those bales ready for transport and those bales in the staging process.*
- *Bales at the Barbers Point Harbor facility will be stored until a barge is ready to be loaded. Barge loading will occur approximately monthly. When a barge is ready for loading, the bales in the Transport Area will be transferred onto the barge, again using squeeze-arm hydraulic equipment or other comparable, appropriate lifting equipment to prevent damage to the plastic wrap. The loading supervisor will inspect each bale once the bale is loaded onto the barge. Any damaged bale will be returned to the Transfer Station for rewrapping and restaging or be rewrapped and restaged on site at Barber's Point.*
- *When the barge is fully loaded it will proceed to its destination at the Roosevelt Regional Landfill in Washington State.*

  The compression settings on the baler shall be 1,000 kg per cubic meter or more. Records indicating the size and weigh to each bale shall be maintained.

Garbage and Regulated (domestic) Garbage which has fallen apart from an unwrapped compressed bale, or has been otherwise improperly compressed shall be set aside for a subsequent compression cycle.

The unwrapped, compressed bales shall be bound with plastic or metal clamps, netting, or strapping devices to retain its shape.

Compressed bales that do not hold together shall be rejected and set aside for a subsequent compression cycle. Records of re-compressed bales shall be maintained by HWS and available for monitoring by PPQ [local office of USDA, APHIS]…"

~~9.4.4. Other Jurisdictions Using Waste Transshipment~~

9.5.4. Other Jurisdictions Using Waste Transshipment

New Jersey and other areas of the U. S. use shrink-wrapping of MSW for shipment of waste to a disposal site. It has also been used in Europe for as long as 10 years. The Roosevelt Landfill in Washington receives MSW, not only from Washington State, but from Oregon, Canada, Idaho, and Alaska.[6] However, most of these operations do not use the shrink-wrap technology. (PWCG, 2008).

~~9.4.5. Physical, Regulatory, and Environmental Requirements~~

9.5.5. Physical, Regulatory, and Environmental Requirements

The requirements for the shipping of waste from Hawaii to the mainland U. S. are established in federal regulations[7] with approval of the specific requirements promulgated in the Federal Register[8]. Waste subject to transshipment would be considered "Regulated Garbage." Any waste commingled with regulated garbage would be considered Regulated Garbage and would have to be shrink-wrapped and handled according to federal requirements. The primary regulator of transshipment is the U.S. federal government through APHIS. (PWCG, 2008).

Compliance Agreement

All parties involved with transshipment must enter into a Compliance Agreement with the USDA before any waste can be transshipped. All parties must comply with conditions within the Compliance Agreement, as well as all provisions in 7 CFR 330.400–403 and 9CFR 94.5. (PWCG, 2008).

[6] Washington State Department of Ecology, Solid Waste and Financial Assistance Program, "Solid Waste in Washington State Fifteenth Annual Status Report", December 2006.

[7] 7CFR 330.400 and 9CFR 94.5.

[8] Federal Register volume 71, number 163, published August 23, 2006.

Transshipment Regulations

The requirements for shipping waste are in the Compliance Agreement and in other federal rules and regulations relating to transportation of materials by barge. (PWCG, 2008).

Receptacles

MSW transported from Hawaii to the mainland must be stored in specified receptacles. If the MSW is to be sent by watercraft, the receptacles must be contained within the guard rails of that watercraft. Receptacles must be tight, leak-proof, and covered while being transported.[7] Removal of receptacles must be under the direction and supervision of an inspector from APHIS and taken to an approved facility.

An approved facility is a facility certified by an appropriate government official as complying with environmental protection laws. The Administrator of APHIS must deem the equipment and procedures adequate to prevent the widespread contamination of plants and livestock.

The shrink-wrap technology used to contain the MSW before it is transshipped uses plastic film wrapping material that must be impermeable and made of low density polyethylene at least 16 micrometers in thickness. It is to be coated on one side with a non-hardening mastic/adhesive. Bales are mechanically wrapped to achieve airtight seals and kill the insects and pests entrained in the bale. In a 10-month study, DEKRA Umwelt, an international service provider, determined that the filmed bale environment is made up of 1 percent oxygen and more than 50 percent methane; that within 24 hours, any insects captured during baling of the MSW died from lack of oxygen. The film contracts once it is wound around the MSW. This ensures that during transshipment and disposal no materials or insects are leaked[9].

[9] USDA, APHIS, March 2006.

Disposal

Disposal of MSW must take place at an approved facility. The Roosevelt Landfill has a permit issued pursuant to the federal Subtitle D regulations and would be considered an approved facility.

~~9.4.6. Potential Issues with Waste Transshipment~~

9.5.6. Potential Issues with Waste Transshipment

A shipping strike would create potential problems for O'ahu in the transshipment of MSW to the mainland U. S. Assuming a transit time of 14 to 21 days, even short strike would threaten to cause the shipper to exceed the 75 day time limit from baling to disposal as required by the USDA. While the USDA Compliance Order requires the company to re-wrap the bales if they are held longer than 75 days doing so would be costly and, O'ahu could be faced with the inability or significantly reduced ability to transship MSW during a shipping strike. This could potentially result in a health and safety issue, leaving O'ahu with no place to dispose of its waste. (PWCG, 2008).

According to the DOT, there is existing congestion in the harbor that would need to be addressed.[10]

According to the Chief Executive Officer of HWS,[11] bales can be stacked two high. The space they have at the port facility will allow for storage of 30,000 tons of MSW. Assuming that the company handles 100,000 TPY, it is possible to store about two months of shrink-wrapped MSW (allowing for transit time to the mainland, processing at the mainland port, transport to the landfill, and disposal). The agreement for barge services allows management of the barge company, if required, to operate the equipment needed to transship the waste in the event of a strike due to the need to maintain public health and safety (PWCG, 2008). This assumes that the management will be sufficiently trained in the operation of the equipment, and that there will be enough management personnel available to maintain a reasonable level of operation.

[10] EISPN Comment Letter from DOT, December 28, 2006.
[11] Meeting on December 14, 2006, Jim Hodge and Mark White held in Sacramento, California.

Green and agricultural wastes—as well as household hazardous wastes—are not permitted to be commingled with MSW and transshipped. Incidental amounts, less than three percent of the total amount of MSW shipped, however, are permitted (PWCG, 2008). Therefore, the MSW must first be sorted and the unpermitted waste separated from the MSW stream prior to shrink wrapping and shipment.

Transshipment of MSW makes the City &County of Honolulu dependent on external factors that could become beyond its ability to control. Transshipment would also result in the loss of high BTU value waste that would otherwise go to H–POWER. Transferring the disposal of a portion of the City's waste reduces the generating capacity of H-POWER, which currently provides power for approximately 45,000 homes.[12] To compensate for the loss of H-POWER supplied electricity, other methods of generating electricity would need to be found. The alternative is for the increased use of oil and/or coal to make up for the loss of generating capacity. (PWCG, 2008).

~~9.4.7. Impact on City Solid Waste Management System~~

9.5.7. Impact on City Solid Waste Management System

The environmental effects of transshipment through the HWS system are anticipated to include:

> Refuse transfer, baling, shrink-wrapping, and loading will be required at a permitted transfer station.
>
> The material will be contained within a system that has received approval from the federal government based on the system's ability to prevent the unexpected discharge of waste or plant pests to the environment.

The conclusion of how transshipment would affect the City's current system and financing of solid waste collection and disposal remains unclear at this time. If transshipment removes 100,000 tons per year (TPY), tip fees and revenues from

[12] H-POWER. http://www.honoluluhpower.com, March 11, 2008.

electrical production and processing of MSW at H-POWER would be lost to the City. In as much as these revenues support the refuse collection system, the City would need to find other sources of funding to offset the losses.

H-POWER currently processes approximately 600,000 TPY of solid waste. With a reduction of 100,000 TPY of MSW to fuel the facility it would effectively operate at about half of its capacity, reducing the amount of energy and homes served by the facility. This loss would affect HECO because the utility would need to make up for the electrical energy with increased use of fossil based fuels (this assumes that there is excess generation capacity available from HECO).

~~9.4.8. Consistency with City & County of Honolulu Requirements~~
9.5.8. Consistency with City & County of Honolulu Requirements

The City & County of Honolulu guidelines regarding the transshipment of MSW off-island were established in its January 22, 2008 Notice to Bidders.

In addition, not all waste can be shipped off-island. Items such as flocked Christmas trees, sewage sludge, auto fluff, out of date medicines, and other hard-to-handle wastes cannot be shipped without special arrangements to dispose of these materials. The transshipment alternative only accepts materials from a specific waste stream and does not eliminate the need for a landfill.

~~9.4.9. Global Warming Considerations~~
9.5.9. Global Warming Considerations

PWCG performed an analysis to ascertain the potential generation of greenhouse gases (GHG) from transshipment compared to landfilling the same amount of waste in the WGSL, or burning it in H-POWER (see **Appendix K, Attachment C**). The purpose of the analysis was to evaluate the potential for broader cumulative effects to the environment given growing concern over global warming and climate change. The assumptions and general conditions in the analysis included:

- The basis for the transshipment involved the transport of 100,000 TPY.
- The use of commonly accepted emission factors used to calculate the emissions.
- Where actual data was unavailable to define the logistical details of the transshipment process necessary to quantify emissions (e.g., physical considerations in port facilities, the time needed to move the wrapped waste onto and off the barge), a report prepared for the City to estimate the cost of transshipment was used as a resource.[13]
- Manufacturer's data was used to estimate electrical use by a baler and a shrink wrap machine as data was unavailable on the equipment that had been proposed for transshipment.
- Information on the fuel use on a tug boat and the time required for a load to be moved from O'ahu to the mainland was obtained from shipping industry contacts.[14]

The results of the comparison are summarized as follows:

Disposal Location	Emissions Million Tons CO_2 Equivalent
H-POWER	-28,711
WGSL	-3,686
Roosevelt Landfill	3,978

Note: The emissions at H-POWER and the WGSL are negative because GHG emissions resulting from the power they generate are more than offset by the reduction in emissions from burning coal or oil to produce the same amount of energy in other power plants on O'ahu.

The results indicate the lowest emissions of GHG would be from H-POWER, followed by WGSL, and the Roosevelt Landfill. It is expected that as with the Roosevelt Landfill, that transshipment to any landfill located on the mainland U. S., would result in similar

[13] RW Beck, Draft Integrated Solid Waste Management Plan Update, November 2007. See Appendix C Trans-Shipment of Waste Analyses.

[14] PWCG-Personal communication with a representative of Young Brothers.

GHG levels based on the need to travel long distances across the Pacific Ocean and to the landfill site.

~~9.4.10. Conclusion Regarding Transshipment~~
9.5.10. Conclusion Regarding Transshipment

Waste transshipment is a potential alternative that can reduce the need for a municipal waste sanitary landfill for the disposal of MSW, but cannot completely replace it. Major issues involved with waste transshipment include:

- Green waste and other unacceptable wastes would be excluded from transshipment. These forms of waste would require disposal in an acceptable facility such as a municipal waste sanitary landfill.
- Waste transshipment would be vulnerable to the effects of a shipping strike. If the strike were lengthy and exceed the approximately 75 day limit to hold the shrink-wrapped bales, O‘ahu would have no location for the disposal of the bales and would need to seriously consider the use of the landfill[15].
- Costs associated with transshipment would be based on a negotiated tip fee, fuel, and labor costs that would not be in the control of the City & County of Honolulu.
- Tip fees and the generation of energy from H-POWER would be reduced by the amount of waste that is transshipped. The City would have to make up the shortfall in revenues and energy provided from H-POWER. HECO would also be affected since it would have to make up the shortfall in electrical generating capacity.
- Transshipment involves an increase in the generation of greenhouse gasses when compared to landfilling and the use of H-POWER, but does

[15] The Courts could intervene in such a situation and order the parties involved to maintain the transshipment of waste based on public health and safety concerns.

have the potential to reduce the amount of capacity of the WGSL needed for landfilling.

- The loss of tip fees at WGSL would also contribute to a loss of revenue for the City and County, which is used to support the collection programs. Revenue from other sources would be needed to support the City's programs.

~~9.5. Alternative Technologies to Refuse Disposal~~

~~9.5.1. Introduction~~

9.6. Alternative Technologies to Refuse Disposal

9.6.1. Introduction

This section discusses the alternative technology approaches that may be able to reduce the demand for landfilling. There are currently no alternatives that have been proven to completely eliminate the need for a landfill. Alternative technologies reduce the demand for a landfill, but some residue will need to be disposed of in a landfill. (PWCG, 2008).

The evaluation of a combination of smaller alternative technologies was considered but not included in this EIS because the situation is similar to the evaluation of multiple smaller landfill sites with less capacity. This same issue was discussed by the 2002 Mayor's Advisory Committee on Landfill Site Selection. The Committee questioned whether the impacts of the landfill would be lessened if several smaller landfills were located around the island instead of at one location at Waimanalo Gulch. It was noted:

> "The Committee decided to limit its consideration to sites that had more than 10 years of capacity based on: the assumption that demand projections from the City remain unchanged; the City's experience with the length of time needed to implement new and feasible waste reduction technologies; and the cost and time required to identify and permit a new landfill site." (See Appendix K, Section 3.4).

The lead time and resources necessary to evaluate a combination of smaller scale technologies would be substantial and include:

- Detailed evaluation of the feasibility and cost of the technology or technologies using a different set of qualifying criteria than currently considered by the City, in that because a combination of technologies would have to be capable of processing the volume of waste accepted at the WGSL, several smaller facilities employing the same or different technologies would be used. This evaluation would need to include the detailed implementation plan identifying the planned construction scheduling and capital costs associated with the technology used.

- Several potential alternative sites would need to be identified, evaluated with the public and governmental agencies concerning environmental and land use effects, selected, and purchased. The number of alternative sites and magnitude of the public and governmental agency coordination needed would be a function of the number of technologies selected. Mitigative measures to address potential environmental effects associated with each technology would need to be developed.

- An estimate of the time needed for environmental and land use permitting would also need to be factored in to the project schedule.

In addition, for each alternative technology selected: (1) any waste by-products generated as a result of the technology process or processes used, would need to be at a scale that would not require landfilling; (2) would be required to have a market for the product resulting from the technology; and (3) be a feasible, proven, and reliable technology, used in a municipality similar in requirement to the City & County of Honolulu.

The City has the fiduciary and management responsibility to select only technologies that are proven to work on MSW with costs similar to the public cost of disposal and operations at WGSL. Factors that are not in favor of the evaluation of several smaller alternative technology facilities are:

- The expected lengthy period commitment of resources needed to research and develop a comprehensive package of small alternative technology facilities. This is reasonably expected to last more than a year and could take several years. The exhaustive process to select the technology for the third boiler at H–POWER took approximately a year to complete and was for a technology already proven in the City & County of Honolulu. The evaluation of one or more newer technologies could reasonably be expected to last much longer.

- The use of several smaller facilities is not efficient and cost effective. This is because the economies of scale normally present in an appropriately sized facility is not necessarily present at a smaller scale. This would lower the efficiency of waste disposal, potentially requiring in total size a greater combined number of facilities than would be provided by a single, appropriately sized facility.

Thus, the evaluation of a combination of alternatives is not considered feasible and would have significantly extended the time required beyond the November 1, 2009 SUP deadline to allow for the same or similar disposal capacity as available at the WGSL.

Factors important to ~~this~~ the analysis conducted by PWCG include:

The City encourages alternatives to waste disposal that includes H–POWER. This facility converts about 40 percent of the MSW produced on O‘ahu into electricity. By-products are ash, residue, and unprocessible materials that require landfilling.

The City also contracts with a private vendor to operate a sludge pelletizing facility at the Sand Island Waste Water Treatment Plant. The facility converts sewage sludge previously disposed of at the WGSL into a fertilizer product. At the current time, the fertilizer product is not being marketed.

Both facilities share several characteristics:

- All were operated for many years using waste material similar to that produced on O‘ahu.
- The risk of operational problems was minimized because of the history of operations and the availability of firms to design, build, and operate the plants that have long term demonstrated operating results.
- The environmental impacts of the technologies were well understood and all had long histories of operating in compliance with regulations.
- The total cost of the technology was well understood.
- H-POWER has resulted in the significant reduction of the volume of material disposed of in the landfill.
- The City has continued its search for additional alternatives. Other areas of the U. S. and other countries are evaluating landfill alternatives and have observed some progress. Some of the results of those evaluations are used in this analysis to identify the advantages and disadvantages of the alternatives and compare them to the City’s criteria, also listed in this section.

The alternatives fall into several categories:

- Thermal processes which use heat to reduce the waste to other reusable products or a fuel. Pyrolysis and hydrolysis are examples of thermal processes.
- Non-thermal processes that produce a material, such as compost, that is sold.
- Enhanced recycling.
- Expansion of H-POWER.

Each of these alternatives has potential for reducing the amount of waste disposed of at the WGSL. However, each process produces a residue that, at this time, can only be landfilled for disposal.

~~9.5.2. City & County Requirements for Alternative Technologies~~

9.6.2. City & County Requirements for Alternative Technologies

The consideration of alternative technologies has been ongoing by ENV for many years. Those efforts have included implementing new recycling programs, bans on disposing certain recyclable materials in the landfill, and issuance of an RFP for Alternative Technologies or the addition of another boiler at H–POWER. It has since selected the addition of a third boiler at H-POWER to increase diversion of waste from the landfill.

The City identified the following six minimum requirements[16] for the use of alternative technologies (PWCG, 2008):

- *There exists at least one (1) operational facility processing municipal solid waste that over the past two (2) years has been operating at a rate of at least five hundred (500) TPD.*
- *Such facility has been operated successfully for the past two (2) years and has been fully operational eighty five percent (85%) of this time while meeting all performance and environmental compliance requirements.*
- *The facility without major modification or equipment changes, other than for the acceptable application of good engineering practice for scale up or scale down, would substantially represent the system proposed for Honolulu.*
- *The product produced at the facility has for the past two (2) years been marketed and resulted in the beneficial reuse of energy. The Offeror shall provide descriptions and documentation of the beneficial reuse.*

  For an Offeror to be able to claim an ability to contract for electric power to a utility, the Offeror must demonstrate that it has power purchase contracts on going and that the utility or energy customer, to which the power is to be sold,

[16] City and County of Honolulu, Notice to Bidders, Project to Construct and Operate Alternative Energy Facility and/or H–POWER Facility. Competitive Sealed Proposals (CSP) NO. 037, January 16, 2007.

provides evidence in writing that it shall enter into a power purchase contract based on its understanding of the proposed facility's ability to produce such power.

- *The proposed Facility shall be commercially available such that: (1) The design is proven and the proposed facility is not the first of its kind; (2) The equipment proposed has operated successfully at least eighty-five percent (85%) of rated capacity while at the same time operating for at least eighty-five percent (85%) of the time during the past twenty-four (24) month period; (3) The equipment is regarded as being reliable and not subject to excessive maintenance, operational problems, or requires major re-designs; (4) The facility has processed a minimum of five hundred (500) TPD of municipal solid waste while operating in accordance with all environmental permits.*
- *Certification that the ash slag and residue by products from the proposed facility have met all environmental requirements for either marketing or landfill disposal including passage of the [Toxicity Characteristic Leaching Procedure (TCLP)] test and classification as non-hazardous materials, or, if deemed hazardous certification from the final disposal site that materials have been properly disposed of and how it would be disposed of for this project.*

In its RFP, the City encouraged both thermal and non-thermal technologies. With thermal technologies the by-product is steam or electricity which can be sold. The by-products of non-thermal technologies are materials that require development of a market (i.e., building material, or compost). Technologies that produce a product that must be sold into a market (other than an energy market) will be more difficult in Honolulu. For example, a market does not currently exist for an alternative technology that produces an MSW compost product. The reason is that the market for MSW compost is restricted on the mainland and has faced controversy in Honolulu.[17] The proponent of a technology that produces a solid MSW fuel would need to find a fuel user and there are only two solid fuel users, H-POWER and the AES coal fired power plant. The current H-POWER facility is operating at capacity. To handle an MSW fuel at AES would probably require a revision to its operating facility and the acquisition of new

[17] Leone, Diana. *Waianae Compost Plan Hits Turbulence*. Star-Bulletin. August 17, 2006.

permits, a lengthy and expensive process, provided AES wished to pursue it. (PWCG, 2008).

~~9.5.3. Non Thermal Technologies~~
9.6.3. Non Thermal Technologies

Non-thermal or non-combustion technologies are those that do not require or produce large quantities of heat. Non-thermal technologies evaluated for the PWCG analysis are digestion and hydrolysis.

~~9.5.3.1. Anaerobic Digestion~~
9.6.3.1. Anaerobic Digestion

Anaerobic digestion is the decomposition of MSW without the introduction of oxygen. End by-products tend to be liquid, gas, and solid materials. The organic fractions of MSW are converted into single-celled proteins, which can be used for compost and fertilizers. Due to the length of time required for anaerobic digestion, greater land area is required to process the MSW. Examples of anaerobic technologies include: ArrowBio; Orgaworld; and Organic Waste Systems' DRANCO Dry Anaerobic Digestion. (PWCG, 2008).

This section provides information obtained for the ArrowBio process. ArrowBio has an operating 200 TPD plant using naturally occurring microbes to break down the organic faction of MSW. Other anaerobic methods will have different approaches and equipment, but produce similar products. (PWCG, 2008).

Currently, Orgaworld has two operating facilities, each with a capacity of 96 TPD, while Organic Waste Systems' facilities process up to 137 TPD. Both are significantly less than the City's minimum requirements and the Orgaworld and Organic Waste Systems are not discussed further. (PWCG, 2008).

Methodology

This process uses a separation-dissolving tank to separate organic and inorganic materials based on buoyancy. Heavier inorganic materials, such as metal and glass, sink to the bottom of the tank and are taken for further separation and then are recycled or disposed. Plastics, which remain floating, are separated pneumatically, while the remaining organic fraction is shredded and more water is introduced to further the biodegrading process. The remaining organic material is treated in acetongenic and methanogenic reactors producing fertilizer and biogas. The biogas, made up of approximately 75 percent methane, can be sold as clean, green energy for use in transportation and power facilities, or used internally to power the facility. The technology vendor is responsible for the disposal of these residues. (PWCG, 2008).

A demonstration facility, located in Hadera, Israel, processed more than 30 TPD of MSW and operated from 1996 to 1999. The facility was designed to process 11 TPD of MSW. One full scale ArrowBio facility located at the Hiriya transfer station in Tel Aviv, Israel has been in operation since 2002. The facility processes approximately 210 TPD of MSW and generates biogas sufficient to produce three MW.[18] (PWCG, 2008).

Use by Other Jurisdictions

The only ArrowBio facility currently in operation is at the Hiriya transfer station in Tel Aviv, Israel. ArrowBio technology may soon be added as part of Australia's Macarthur Resource Recovery Park, a proposed integrated waste facility on the current Jacks Gully landfill site.[19] (PWCG, 2008).

Physical, Regulatory, and Environmental Requirements

The ArrowBio facility at the Hiriya transfer station in Israel has one 200 TPD module and requires approximately two acres of land, with an additional one-half to one acre for long-term storage of materials. If it were sized up to meet the 500 TPD requirement of

[18] Arrow Ecology www.arrowecology.com, March 11, 2008.

[19] Marshall, A.T. and Morris, J.M., "A Watery Solution," Chartered Institute of Waste Management Journal, August 2006.

the City & County of Honolulu, an estimated six acres of land would be needed. (PWCG, 2008).

This facility would require 0.05 MW of electricity per ton of MSW processed, which could be met with the generation of biogas. Water consumption data is not readily available; however, ArrowBio claims the consumption is low due to moisture in the MSW. Additional water is required for the separation/dissolving tank. (PWCG, 2008).

ArrowBio claims no negative environmental impacts. There is no significant odor potential as the MSW is immediately placed into the separation-dissolving tank. The treatment takes place in enclosed tanks, also reducing potential odors. Water used throughout the process is reused in the separation-dissolving tank, which results in low water consumption. A small amount of wastewater is generated from the process, but is expected to be suitable for release into the sanitary sewer system. (PWCG, 2008).

The company provided no information regarding economic benefits associated with the technology.[20]

Potential Issues

Potential issues with anaerobic digestion include (PWCG, 2008):

- There may be size-up issues unless units of the same size as the existing facility are used.
- A market will need to be developed for the MSW compost which may be difficult. MSW compost is not currently marketed on O‘ahu so it may be challenging and time consuming to develop the market.
- A market will be needed for biogas or it will need to be used to generate electricity and sold to HECO.

[20] *Evaluation of New and Emerging Solid Waste Management Technologies,* New York City Economic Development Corporation and New York City Department of Sanitation, September 16, 2004.

Consistency with City & County of Honolulu Requirements

The anaerobic digestion facilities do not meet the City's requirements (PWCG, 2008):

- The existing facilities either process less than the City's minimum waste stream (the existing ArrowBio facility 210 TPD of MSW, 300 TPD less than what the City requires) or they process source-separated organics. ArrowBio could use multiple units to meet the City requirement.
- The facility design for the ArrowBio is the first fullsize facility.
- There is no proven market for the MSW compost product.

~~9.5.3.2. Aerobic Digestion~~

9.6.3.2. Aerobic Digestion

Aerobic digestion is the decomposition of MSW with the introduction of air. Vendor examples of aerobic digestion include Mining Organics, Real Earth Technologies, and the Herhof Environmental MBT Process. Due to the lack of readily available information on Mining Organics and Real Earth Technologies, a generic explanation of the Herhof Environmental MBT Process is provided. Different vendors use different approaches and equipment, but produce similar products. (PWCG, 2008).

Methodology

The aerobic digestion process can be either wet or dry. Dry aerobic digestion is similar to in-vessel aerobic composting (New York City Economic Development Corporation and New York City Department of Sanitation, 2004). Inorganic materials, such as glass, metals, and plastics are removed from the MSW prior to recycling. The remaining material is shredded, mixed, and put into a vessel with a controlled amount of air and heat. Liquid is removed thereby reducing the volume. The mixture is aerated, mixed, and depending on the reactor used, heated.[21] (PWCG, 2008).

[21] Kumar, Surendra, Shashi and Salman Zafar. "Composting Technology." *MSW Management, The Journal for Municipal Solid Waste Professionals*. May/June 2006.

Wet aerobic digestion removes inorganic materials, such as glass, metals, and plastics, and pulps the organic materials from the MSW. The slurry is then mixed, aerated, and heated. Heating dries some of the organic material, reducing the total volume. Microbes are then introduced, which reduce the slurry to solid and liquid soil amendments for use in fertilizers (New York City Economic Development Corporation and New York City Department of Sanitation, 2004). The technology vendor is responsible for the marketing these materials. (PWCG, 2008).

Use by Other Jurisdictions

Composting of kitchen, food, and green waste scraps is well established in Europe. Germany has more than 500 biochemical treatment facilities processing more than eight million TPY of food and green wastes; the majority are aerobic compost facilities. However, these facilities are not processing MSW.[22] Vancouver, Canada has a 30 TPD demonstration plant by Herhof in operation processing separated food and other organic wastes (New York City Economic Development Corporation and New York City Department of Sanitation, 2004). There are currently seven commercial MSW Herhof plants in operation in Germany, Belgium, and Italy, with one proposed for the United Kingdom that will use the solid fuel produced by the MBT Process in a combustion plant. (PWCG, 2008).

Physical, Regulatory, and Environmental Requirements

These requirements are unknown as there are currently no aerobic facilities that meet the requirements of the City & County of Honolulu. (PWCG, 2008).

Potential Issues

The process results in compost that would have to be sold and no markets have been demonstrated in Honolulu. Even with a solid fuel by-product, Honolulu does not have an existing, market for the fuel. (PWCG, 2008).

[22] Oaktech Environmental, http://www.oaktech-environmental.com/, March 11, 2008.

The process requires source-separated organics; it does not process mixed MSW. (PWCG, 2008).

Consistency with City & County of Honolulu Requirements
None of the Herhof Environmental plants currently in operation process more than 500 TPD of MSW. However, Herhof Environmental states their MBT Process is capable of processing up approximately 1,095 TPD.[23]

~~9.5.3.3. Hydrolysis~~
9.6.3.3. Hydrolysis

Hydrolysis is a chemical reaction in which water and another substance react, forming two or more new substances. With the hydrolysis of MSW, the reaction is between water and the cellulose fraction of the waste to produce sugars. To obtain the cellulose fraction of the MSW, glass, metals, and other inorganic materials must first be removed. (PWCG, 2008).

Several types of hydrolysis technologies exist. The description by Arkenol Fuels is provided as an example for discussion. Another technology is the Masada Oxynol process. (PWCG, 2008).

Methodology
Arkenol Fuel technology, also named Concentrated Acid Hydrolysis, uses the source-separated fraction of MSW. The process first sorts out recyclable materials. The remaining material is ground for further processing. Sulfuric acid decrystallizes the material and breaks the organic fraction into its component sugars (cellulose and hemicellulose). The material is then hydrolyzed; the chemical bonds are broken, producing hexose and pentose sugars required for commercial fermentation. Insoluble materials are filtered for processing for other uses. The entire process runs on biomass, including agricultural residues, crops grown specifically for use as biomass, paper,

[23] http:// www.herhof.com/en/, March 11, 2008.

wood, and green waste (New York City Economic Development Corporation and New York City Department of Sanitation, 2004).

The pilot facility for Arkenol Fuels is in Orange, California, and processed one TPD of MSW. This facility operated for five years beginning in 1992.[24] (PWCG, 2008).

The only commercialized Arkenol Fuel facility is in Izumi, Japan. It has been in operation since 2002, using waste wood chips as feedstock.[25] (PWCG, 2008).

Use by Other Jurisdictions

There are no hydrolysis facilities currently in operation that process MSW as feedstock and none of the size that the City & County of Honolulu requires.[26] (PWCG, 2008).

Physical, Regulatory, and Environmental Requirements

A Masada Oxynol facility that could process about 600 TPD is expected to require 10-acres. The environmental impacts include emissions from the process, waste water discharges, and other impacts. The facility will need to satisfy the State's regulatory and environmental process for MSW processing plants. (PWCG, 2008).

Potential Issues

The use of MSW as feedstock has not successfully been demonstrated except at a pilot facility scale, although Masada Oxynol proposes development of a commercial facility (New York City Economic Development Corporation and New York City Department of Sanitation, 2004).

A market for the ethanol produced is expected to exist in the City & County of Honolulu, but has not been proven. According to Arnold Klann, President, and Chief Executive Officer for Arkenol, Inc., an uncertain market for ethanol is believed to be one of the reasons an Arkenol Fuel project failed (CIWMB, 2006).

[24] Arkenol Fuels, http://www.arkenol.com/, March 11, 2008.

[25] California Integrated Waste Management Board, Session Summary: Emerging Technology Forum, Brief summary of presentations by Rick Diederich prepared by CIWMB staff, April 17–18, 2006.

[26] Interstate Waste Technologies, http://www.iwtonline.com/, March 11, 2008.

Consistency with City & County of Honolulu Requirements
Hydrolysis is inconsistent with the City's requirements because there has not yet been a successful facility at the size required capable of operating on MSW. (PWCG, 2008).

~~9.5.4. Thermal Technologies~~
9.6.4. Thermal Technologies

Thermal or combustion technologies produce a significant amount of heat. During the processes, both organic and non-organic materials are combusted while the non-combustible materials can be recycled either before or after combustion. Common thermal technologies are gasification, plasma arc, pyrolysis, and incineration. Examples of thermal technologies include (PWCG, 2008):

- Covanta Energy - the City's H-POWER facility (described in this section as a proven technology currently in use by the City)
- Rigel Resource Recovery - Westinghouse Plasma Gasification
- Dynecology - Gasification with Briquetting of Refuse Derived Fuel (RFD)/Coal/Sewage Sludge
- Ebara Corporation - Fluidized Bed Gasification with Ash Vitrification
- GEM America - GEM Thermal Cracking Technology (Gasification)
- Global Energy Solutions - Thermal Converter Technology (Gasification and Vitrification)
- Interstate Waste Technologies - Thermoselect Gasification
- Pan American Resources - Destructive Distillation Lantz Converter
- Pratt Industries/VISY Paper (RDF)
- Comprehensive Resources, Recovery, & Reuse, Inc. (RDF)
- Takuma Mass Burn Renaissance System
- Resource Recycling, L.L.C. (Mass Burn)

~~9.5.4.1. Plasma Arc~~

9.6.4.1. Plasma Arc

This technology uses large carbon rods in a sealed vessel to generate a high temperature arc that converts the materials in the vessel into plasma (ionized air). Heat generated by the arc melts the inorganic fractions into a glass and vaporizes the organic fractions, which become a synthetic fuel gas. The waste glass can be disposed of in a landfill or may be used for beneficial purposes such as for replacement of imported sand for sand blasting. The synthetic gas is cleaned and burned to produce power. (PWCG, 2008).

There are several vendors of plasma systems, including Westinghouse and other project developers. A four TPD plasma system once operated near the H–POWER plant to process medical waste. (PWCG, 2008).

The City Council Public Works and Economic Development Committee heard from some plasma system representatives during its review of potential landfill sites.[27] The representatives that addressed the Committee were identified in the report as (PWCG, 2008):

> "…. the following companies with the plasma gasification technology have made presentations or submitted materials to the Committee on Public Works and Economic Development ..:
> (1) JDI/Geoplasma, LLC;
> (2) Environmental Solutions Corporation representing the Solena Group;
> (3) EnviroDyne;
> (4) Startech Environmental Corporation;
> (5) Scientific Utilization, Inc./Waste To Energy; and

[27] November 16, 2004 memorandum from Councilmember Rod Tam to Concerned Citizens of Oahu transmitting the report titled "Committee on Public Works and Economic Development's Summary Report on its Landfill Site Selection Process."

(6) Phoenix Consulting Group International, LLC, for Biomass Conversion Technology, LLC".

Methodology

Plasma arc technology gasifies MSW with high pressure air and an electric arc that produces very high temperatures (up to 8,000 degrees Fahrenheit). These temperatures virtually vaporize the waste into its elemental components creating syngas, which can be used to generate electricity. (PWCG, 2008).

Use by Other Jurisdictions

There are two operating plasma arc facilities that process MSW. The longest running, that is not a demonstration plant, is the Eco Valley Utashinai facility located in Utashinai, Japan. The facility processed more than 270 TPD of MSW and 130 TPD of automobile shredder residue and generates approximately 4,700 KWh of salable energy in fiscal year 2005.[28] (PWCG, 2008).

The City of St. Lucie, Florida has begun negotiations for a plasma arc facility. The Georgia-based company, Geoplasma, has agreed to build and operate the facility and claims the facility will process 2,000 TPD of MSW and 1,000 TPD of MSW mined from a landfill while producing 120 MW of electricity.[29] (PWCG, 2008).

Geoplasma has agreed to build and operate the facility, estimating that within the next 15 to 18 years the facility will have disposed of all the current waste in the landfill. Ron Roberts, the Assistant Solid Waste Director in St. Lucie, estimates the plant will be finished within 25 to 30 months.[30] (PWCG, 2008).

[28] Shigehiro, Michiaki, General Manager of Eco Valley Utashinai.

[29] Sladky, Lynne. "Florida county plans to vaporize landfill trash." USA Today. September 9, 2006 and Margasak, Gabriel. "Trash zapper in St. Lucie County gets shot in arm from Crist", TCPalm, November 10, 2007.

[30] Miller, Dan. "State-of-the-art plant makes trash vanish into thin air." County News Online. National Association of Counties, Washington, D.C., October 2, 2006.

A second plasma plant operating on MSW started operation in late January 2008 in Ottawa, Canada. It is a demonstration project. The information about the plant was obtained from news sources.[31] which stated (PWCG, 2008):

> "A demonstration waste-to-energy plant in Ottawa has finally turned its first load of trash into power…"
>
> "…the $27 million plant uses a process called plasma gasification to decompose waste under high heat and low oxygen into a gas mixture called syngas, and a glass-like material that can be turned into asphalt or concrete…"
>
> "Once the plant is running at full capacity, it is to divert 85 tonnes of waste a day from the city's landfills while generating enough electricity to run the facility and power 3,600 homes..."
> "Plasco hopes its demonstration plant in Ottawa will persuade other cities to buy the technology…"
>
> "Construction of the plant started in September 2006. It was to run as a two-year pilot project…"

The PLASCO plant was partially funded by the Canadian government (PWCG, 2008):

> "This brings to over C$90 million the equity invested in PlascoEnergy since August 2005. The Company had nominal debt and a modest cash position prior to this issue, and is well funded for development of commercial facilities next year," said Rod Bryden, PlascoEnergy President and CEO.
>
> "Commitment of funding from Sustainable Development Technology Canada ("SDTC") to the Ottawa demonstration project was a key factor in bringing the PlascoEnergy technology to reality and to attracting private

[31] Information from http://www.cbc.ca/technology/story/2008/02/07/ot-plasco-080207.html, March 12, 2008

capital that will fund its future commercial use around the world. SDTC has committed a non-repayable contribution of C$9.5 million," he said.[32]

Physical, Regulatory, and Environmental Requirements

The Eco-Valley Utashinai facility is the only plasma arc facility of its kind that has been operating. If a similar facility were built on O'ahu, it would have to meet the same requirements of both State and Federal regulations as any new alternative technology (PWCG, 2008).

The actual treatment record of the Utashinai plant in FY 2005 is provided in **Table 9-1, Actual Treatment Record, Utashinai, Japan**, as follows[33]:

Table 9-1, Actual Treatment Record, Utashinai, Japan

Month	Receipt of Waste (Tons)		Treatment of Waste (Tons)		Slag (Tons)	Electric Power (MWh)			Operating (day)
	MSW	SR,ASR	MSW	SR,ASR		Generation	Consumption	Sold	Line1+Line2
Apr	2,118	850	1,447	238	314	305	1,659	0	25+10
May	2,288	665	2,406	443	372	1,172	2,098	25	25+27
June	2,317	561	2,063	913	651	1,063	2,059	19	22+30
July	2,186	1,083	2,625	743	450	1,053	2,317	0	31+31
Aug	2,391	939	1,527	881	443	637	1,862	0	21+21
Sept	2,169	93	2,302	895	469	840	2,202	0	30+24
Oct	2,206	449	1,773	671	453	548	1,963	0	22+19
Nov	2,067	619	3,364	896	676	1,360	2,397	0	30+30
Dec	1,965	718	1,164	387	308	297	1,388	0	20+1
Jan	1,722	519	2,207	737	451	613	1,881	0	14+22
Feb	1,398	702	1,612	788	345	356	1,510	0	0+28
Mar	1,877	1,353	1,247	741	278	341	1,522	0	0+19
Total	24,704	8,551	23,737	8,333	5,210	8,585	22,858	44	240+262

[32] Information from PLASCO new release dated December 12, 2007, http://www.plascoenergygroup.com/?News/23/2007-12-03:First_Reserve_leads_PlascoEnergy_equity_funding, March 12, 2008.

[33] Nomura, Akira. Hitachi Metals. Actual Treatment Record for Utashinai Eco Valley. 2005. Correspondence to Wilma Namumnart, Department of Environmental Services, August 10, 2006.

Potential Issues

The experience with plasma operating on MSW has been limited to one full-scale plant. The cost of the facility is believed to be $425,000,000.[34] The actual cost of operations is not known. (PWCG, 2008).

Consistency with City & County of Honolulu Requirements

Plasma arc technology does not currently meet City & County of Honolulu requirements (PWCG, 2008):

- One of the two operating facilities has required maintenance for the furnace reflectors and the other started operations this year.[30]
- The Eco Valley Utashinai facility processes 270 TPD of MSW, 230 TPD short of the City's requirements. The Ottawa facility at 85 metric TPD is also short of the requirements.
- The facilities are the only ones operating on MSW.

~~9.5.4.2. Gasification/Pyrolysis~~

9.6.4.2. Gasification/Pyrolysis

Gasification is the process of reducing MSW to a synthesis gas. Pyrolysis is similar to gasification and often considered a type of gasification technology. The by-products of gasification are syngas and vitrified material (slag), and pyrolysis by-products are solid carbon and liquid fuel. Pyrolysis generally takes place during the first steps of gasification. Examples of gasification technologies are (PWCG, 2008):

- Dynecology - Gasification with Briquetting of Refuse Derived Fuel (RDF)/Coal/Sewage Sludge.
- Ebara Corporation - Fluidized Bed Gasification with Ash Vitrification.
- GEM America - GEM Thermal Cracking Technology (Gasification).

[34] Waste Age Magazine, September 13, 2006. “Florida county to generate energy by vaporizing solid waste”. Also their web page at http://wasteage.com/news/Geoplasma/?cid=most-popular, March 11, 2008.

- Global Energy Solutions - Thermal Converter Technology (Gasification and Vitrification).
- Interstate Waste Technologies - Thermoselect Gasification.
- Pan American Resources - Destructive Distillation Lantz Converter.

Methodology

Dynecology's Gasification with Briquetting of RDF/Coal/Sewage Sludge technology processes MSW into RDF and then blends RDF and dewatered sewage sludge together with coal making briquettes. The briquettes are then introduced to the gasifier, or high-pressure, fixed-bed reactor. The inorganic fraction melts and is removed from the bottom of the chamber as slag and the synthesis gas is removed from the top. Dynecology has no facilities currently operating on MSW. (PWCG, 2008).

GEM America's GEM Thermal Cracking technology processes unsorted MSW. Recyclable materials, such as metals, glass, and cardboard are separated and the remaining materials are shredded, dried, and granulated. The MSW is then gasified and converted into synthesis gas. The synthesis gas can be used to generate electricity. GEM America has no commercial facilities currently in operation, but has two demonstration plants processing 73 TPD that have been in operation since 2000. (PWCG, 2008).

Ebara Corporation's Fluidized Bed Gasification with Ash Vitrification technology introduces shredded MSW into a fluidized bed reactor vessel. Gasification takes place in the reactor at atmospheric pressure. The ash and synthesis gas enter into a second chamber where the materials are heated again at higher temperatures. Fine particles are collected on the walls and become molten slag collected at the bottom of the chamber and cooled to form a vitrified granulate. The synthesis gas is used to produce energy. The largest Ebara plant is the Kawaguchi City reference plant which processes 462 TPD of MSW. (PWCG, 2008).

With Global Energy Solutions' Thermal Converter technology (Gasification and Vitrification), unsorted MSW is introduced into the gasification reactor. Preheated air is then introduced and the MSW is passed to a conversion chamber and then to a second conversion chamber. The secondary chamber cleans the gases and vitrifies the residue using a bed of molten material. The synthesis gas produced is used in a boiler to produce steam or generate electricity. (PWCG, 2008).

Interstate Waste Technologies uses a waste treatment process called Thermoselect Gasification. The system compacts unsorted MSW thereby removing most of the air and evenly distributing the moisture content. The compacted waste is pushed through a high temperature chamber where the inorganic waste turns molten and the organic waste converts into gas. The organic gases enter a lower temperature chamber and are shock cooled to avoid the formation of dioxins or furans. The gases are then shuttled through scrubbers to remove sulfur, heavy metals and other toxins. The resulting synthesis gas can be used for energy production or as a base material for chemical synthesis. The molten inorganic waste is also shock cooled and results in reusable mineral substances and metals. The water condensed during the different phases of the gas treatment is fed into the water treatment chambers where it undergoes a multiple-stage treatment. The processed water is then used for cooling purposes.[35] (PWCG, 2008).

Use by Other Jurisdictions

Global Energy Solutions has 14 facilities in operation in Japan, Asia, and Europe. Two facilities operating in Japan only process MSW.

Interstate Waste Technologies has the following facilities (PWCG, 2008):

- Fondotoce, Italy, operated the demonstration Thermoselect facility for six years, with commercialization commencing in 1994, from 1992-1998. The plant was decommissioned in 1999.

[35] http://www.iwtonline.com/docs/Thermoselect_process_description.pdf, March 12, 2008.

- Karlsruhe, Germany, operated a Thermoselect facility from 1999 until 2004, when it was closed due to "general business strategy decisions." The facility processed 225,000 TPY of waste from surrounding towns and rural districts.
- Thermoselect has seven facilities operating in Japan. Three of the facilities operate on MSW. Commercialization of the Matsu facility began in 2003 and currently processes 140 TPD. The Nagasaki and Tokushima facilities commenced operations in 2005, with the Nagasaki facility processing 300 TPD and the Tokushima facility processing 120 TPD of MSW.

Physical, Regulatory, and Environmental Requirements

Global Energy Solutions states that their Thermal Converter technology exceeds all known emission standards worldwide and that there are no odors due to the storage of MSW inside a building. Global Energy Solutions also states that their technology requires less land than traditional incinerators; however, no documentation of land requirements was found.[36]

The synthesis gas produced is sufficient to power the Thermoselect facility. Water consumption is 560 gallons/ton of MSW. Wastewater is treated and reused. (PWCG, 2008).

Potential Issues

Potential issues with gasification/pyrolysis include (PWCG, 2008):

- Global Energy Solutions' Thermal Converter technology vitrified residual by-product requires a market.
- Interstate Waste Management's Thermoselect technology requires a market for the metal pellet and vitrified granulate by-products.

[36] Global Energy Solutions. http://www.teamges.com/, March 11, 2008.

Consistency with City & County of Honolulu Requirements

Global Energy Solutions' Thermal Converter technology might be consistent with the City's requirements; there is no information readily available regarding how long either of the two MSW facilities has been in operation in Japan. The by-product residual requires a market that is not proven on O'ahu. (PWCG, 2008).

Interstate Waste Management's Thermoselect technology is inconsistent with the City's requirements. Although there are seven Thermoselect facilities in Japan, only three operate on MSW and none at the size the City requires (the Matsu facility processes 140 TPD, the Nagasaki processes 300 TPD, and the Tokushima facility processes 120 TPD). All facilities have been in operation for more than two years. The market for the metal pellets and vitrified granulate by-products would have to developed on O'ahu. (PWCG, 2008).

~~9.5.5. Waste to Energy~~

9.6.5. Waste to Energy

H-POWER is a working example of the waste-to-energy (WTE) alternative technology. It is proven in long-term operation in Honolulu where it converts MSW into energy, with residues of ash, by-passed material, and unacceptable waste. An expansion of H-POWER was approved by the Mayor on January 18, 2008. The expansion is included as an alternative that will reduce but not replace the need for a landfill. (PWCG, 2008).

Methodology

There are two general approaches to WTE, mass burn and RDF. In a RDF plant (the H-POWER facility is an RDF plant) MSW is processed through shredders and screens, through which dirt, glass, and other recyclable and non-burnable materials are sorted out. The remaining material is incinerated, resulting in the creation of ash (approximately ten percent of the original volume), residue, and steam used to generate electricity. Metals are separated in the pre-combustion processing and from the ash post-combustion, and are recycled. (PWCG, 2008).

Mass burn plants combust MSW without pre-processing. Waste is introduced into the furnace after being unloaded from the collection vehicle. The waste combustion creates steam, which is used to make electricity. By-products are ash and residual waste. Metals are separated from the ash and are recycled. (PWCG, 2008).

The project host and technology vendor are responsible for the disposal of ash and residual waste. (PWCG, 2008).

The H-POWER facility in Kapolei is a RDF plant and is capable of processing 2,160 TPD of MSW. It generates approximately seven percent of O'ahu's energy, enough electricity to support 45,000 homes. Residual waste and ash are disposed at the Waimānalo Gulch Sanitary Landfill. (PWCG, 2008).

Use by Other Jurisdictions

WTE is a proven technology with facilities found throughout the United States. Covanta, the operator of H–POWER, operates plants in Alabama, California, Connecticut, Florida, Indiana, Hawaii, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Oregon, Pennsylvania, and Virginia. WTE is used in many other countries where it has been operating for more than 75 years.[37]

H-POWER has been in continuous operation since 1989.

Physical, Regulatory, and Environmental Requirements

The physical, regulatory, and environmental requirements of a third boiler at H-POWER are well understood based on the existing plant in operation. Environmental controls and regulatory requirements are met with the existing facility. Land is available at the H-POWER site for expansion. (PWCG, 2008).

[37] Covanta Holding, http://www.covantaholding.com/, March 11, 2008.

Potential Issues

WTE requires a landfill for the disposal of ash and residual waste. The market for H-POWER electricity is already contracted with HECO and the technology and environmental operating characteristics are well understood.

Consistency with City & County of Honolulu Requirements

WTE is consistent with the City's requirements as provided in Section 9.~~5.~~6.2. City & County Requirements for Alternative Technologies.

~~9.5.6. Expanded Recycling~~

9.6.6. Expanded Recycling

Expanding current recycling infrastructure within the City would not eliminate the need for landfills but can decrease the amount of refuse disposed of in landfills[38]. Expanded recycling could include the expansion of the number of sites that accept materials from the HI5 beverage container program, the addition of more sites to the school drop-off program, increasing the frequency of curbside collection of residential green waste, and adding a program to collect other recyclables from residences at curbside. (PWCG, 2008).

~~9.5.6.1. Improvements to Recycling Infrastructure~~

9.6.6.1. Improvements to Recycling Infrastructure

~~Current r~~Recycling infrastructure consists of a pilot program to evaluate weekly MSW collection with weekly curbside recycling and green waste collection, community recycling bins, recycling support for schools, HI5 redemption sites, and curbside green waste recycling. The overall goal is to reduce the amount of waste disposed at the WGSL. The community recycling bin program is supported by participating schools. The program uses a 40 cubic-yard recycling roll-off bin, divided into sections for mixed

[38] The market for recyclables is limited and not all waste products are feasible for recycling. Waste materials that cannot be recycled or reused would need to be landfilled.

containers and paper. Students, their family members, the community, and school employees drop-off their recyclable materials. The host school receives revenues for the recycled materials collected in their bin(s). Since the program began in 1990, more than $1,000,000 has been paid to the participating schools. (PWCG, 2008).

Schools are also receiving additional support through assistance programs, in which the City offers 96-gallon wheeled toters labeled for aluminum, glass, plastic, and newspaper. Fundraising materials, such as banners, graphics, lists of recycling companies, collection services, and redemption centers are also provided to help advertise a recycling event. The schools use these events as fundraisers. Currently, there are 75 to 80 schools and 35 non-profit organizations participating in this program. A new contract that began in March 2008 will add 40 additional sites for multi-material recycling. (PWCG, 2008).

The City also provides, through the contract, ten HI5 event bins. These 40 cubic yard bins are used at special school or community events for recyclables. The City's contractor removes the bin after the event and the school or community group receives the redemption value from the HI5 containers. (PWCG, 2008).

Another current effort is the expansion of the number of HI5 redemption sites. The HI5 redemption sites are privately-operated for residents to drop-off their recyclable cans, plastic, aluminum, and glass HI5 containers for a 5 cent cash refund. The City also provides curbside green waste pick-up to its residents. The City picks up green waste twice a month on the day following garbage collection days. Approximately 10,000 tons of green waste is collected annually from residences. The collected green waste is turned into mulch and offered to residents at no cost.[39]

The City established a pilot curbside recycling/green waste collection program in the fall of 2007 to evaluate the efficacy of waste collection once per week (rather than the current twice-per-week schedule) and collect either containers and paper, or green

[39] Department of Environmental Services www.opala.org, March 11, 2008.

wastes on the second collection day (that is green waste one week and containers and paper the next). That program is to be expanded island-wide starting in the fall of 2008. (PWCG, 2008).

~~9.5.6.2. Recycling to Energy~~
9.6.6.2. Recycling to Energy

Recycling materials into products, as is done with the green waste program (mulch and compost) and the collection of bottles and paper (made into new bottles and paper products) is one form of recycling that will be expanded by the City. Recycling to energy (conversion of the waste to energy) is another. (PWCG, 2008).

WTE, such as H-POWER, is a technology of choice based on direct benefits of energy production and reduction in waste disposal volume. Approximately 90 percent of the residential garbage and 77 percent of the commercial waste collected on O'ahu is disposed of at the H-POWER facility and is turned into energy that powers approximately 45,000 homes.[40] Incinerating 90 percent of the garbage that goes through the H-POWER facility means only one-tenth, by volume, remains to be landfilled. Expanding the H-POWER facility or will be most beneficial to the City in reducing the amount of waste sent to the landfill. (PWCG, 2008).

~~9.5.7. Wet Cell Landfill~~
9.6.7. Wet Cell Landfill

Wet cell, or bioreactor landfills, use accelerated decomposition to create additional landfill gas for conversion to energy and recover landfill space as the waste decomposes. The wet cell would enhance energy recovery from the landfilled waste and extend the life of the landfill. (PWCG, 2008).

[40] City and County of Honolulu Department of Environmental Services. Solid Waste Integrated Management Plan. Updated: November 2007. Table 63a, Table 63b and Table 2-7.

There are three forms of wet cell landfills: aerobic, with the presence of oxygen; anaerobic, without the presence of oxygen; or a combination of the two. Both processes accelerate the decomposition of waste. Conventional landfills take 30 to 50 years for the waste to decompose, while wet cell landfills take approximately five to ten years.[41] (PWCG, 2008).

Methodology

Aerobic wet cell landfills collect leachate from the bottom layer of the landfill and pump it into a storage unit. Water is added, if required, and the liquids are then redistributed into the landfill. Air is injected to encourage aerobic decomposition and stabilization of the waste (PWCG, 2008).

Anaerobic wet cell landfills add moisture to the landfill through re-circulated leachate and other sources to achieve optimal moisture levels, but do not add air. A biogas is produced comprised mostly of methane, carbon dioxide, and volatile organic compounds. The gas can be used to create electricity. (PWCG, 2008).

Hybrid wet cell landfills use both aerobic and anaerobic processes to rapidly accelerate biodegradation and decomposition of the landfilled waste. Biogas can also be collected from hybrid wet cell landfills; this by-product occurs much earlier than during the anaerobic process. (PWCG, 2008).

Use by Other Jurisdictions

The Environmental Protection Agency (EPA) is conducting case studies of bioreactor landfills within its Project XL, which started in 1995. Project XL provides flexibility to regulated entities to conduct pilot projects demonstrating the ability to "achieve superior environmental performance." Since September 2001, 51 pilot experiments have been implemented. Of those 51, four have been approved to operate as wet cell landfills. The landfills are Buncombe County Landfill Project, North Carolina; the Maplewood Landfill

[41] County of Yolo Planning and Public Works Department Division of Integrated Waste Management, EPA Project XL, Final Project Agreement for the Yolo County Accelerated Anaerobic & Aerobic Composting (Bioreactor) Project, September 14, 2000.

and King George County Landfill, Virginia; and the Yolo County Bioreactor Landfill, California. The EPA is evaluating the advantages and disadvantages of bioreactor landfills. The studies are expected to be completed between 2006 and 2026. (PWCG, 2008).

Physical, Regulatory, and Environmental Requirements

A wet cell landfill requires a different liner design, leachate collection system, and monitoring system than used for a conventional sanitary landfill. One concern regarding wet cell landfills is the increased of leachate to facilitate biodegradation and decomposition. Therefore, one of the EPA's requirements for their case study involves a liner design that addresses increased production of leachate.[42] The Yolo County Module D Bioreactor proposes a liner over five feet thick with earth and clay layers alone, as well as a collection system that would recycle the leachate and reintroduce it to the landfill. The permitting process for wet cell landfills is also different. Only the EPA through its XL project program grants permits for wet cell landfills. The expansion space at the WGSL could have cells that could be used for wet cell landfilling; however, major changes in site design, and potentially site life, would be required. The benefit to justify such an expense has not been shown with only four test sites in operation. (PWCG, 2008).

Potential Issues

The cost of the wet cell and potential environmental effects has not been determined for the WGSL. The wet cell technology must also be demonstrated in relation to current plans for use of the WGSL expansion area.

Consistency with City & County of Honolulu Requirements

The wet cell is a variant of traditional landfilling practice and could be consistent with City & County of Honolulu requirements. The cost and environmental implications of using the technology would have to be evaluated by the City and landfill operator. (PWCG, 2008).

[42] United States Environmental Protection Agency. http://www.epa.gov/

~~9.5.8. Co-Disposal~~

9.6.8. Co-Disposal

Co-disposal is the disposal of MSW and ash together in a landfill, where the ash replaces the dirt cover and fills the voids in the MSW. Combining the two materials would result in the more efficient use of landfill space since ash requires less space for disposal than compacted MSW and would replace the use of soil for cover. (PWCG, 2008).

Methodology

At the end of the operating day, the ash would be used as alternate daily cover to replace the soil cover now used. (PWCG, 2008).

Physical, Regulatory, and Environmental Requirements

The State DOH approved the use of H-POWER ash as ADC at the Waimānalo Gulch Sanitary Landfill provided that a number of requirements are followed[43] (PWCG, 2008):

- A six-month demonstration project to evaluate the performance of ADC in meeting the requirements of daily cover
- Ash must be used within 24 hours of its creation
- Ash must contain less than 25% moisture
- Ash can only be used between 3 and 5 p.m.
- No more than 300 tons of ash can be used per day
- Equipment must not be used on ash, a two foot depth and 15-foot buffer must be in place to protect the general public
- Equipment operators must use positive pressure cabs, while spotters must wear personal protective gear
- Warning signs must be posted to inform the general public

[43] Hawaii State Department of Health. Response to Comments on the Draft Conditions for the Use of H-POWER MST Ash as Alternative Daily Cover at the Waimānalo Gulch MSW Landfill. April 12, 2001.

- A wind shut-down trigger must be in place (to be determined from the six-month demonstration project)
- A rain shut-down trigger must be in place to prevent ash from entering the storm water system
- Total metals must be tested quarterly
- An engineering study evaluating the landfill's static and seismic stability is required
- A lime depletion study is required

Potential Issues
Operational issues associated with the DOH requirements may preclude the co-disposal option.

Consistency with City & County of Honolulu Requirements
Co-disposal is consistent with the City &County of Honolulu requirements.

~~9.5.9. Conclusion Regarding Alternative Technologies~~
9.6.9. Conclusion Regarding Alternative Technologies

The information presented for this section provides a comprehensive review and analysis of a number of alternative technologies or methods to either significantly reduce or eliminate the disposal of refuse in a municipal sanitary landfill. Major issues involved with the use of alternative technologies or methods include:

- A number of emerging new or existing technology based approaches show promise for use in the City & County of Honolulu. The approaches evaluated included thermal, nonthermal, WTE, expanded recycling, wet cell or bioreactor landfilling, and co-disposal. None of the approaches that were evaluated are capable of completely eliminating the need for a municipal landfill. Each of the processes reviewed result in the generation of waste byproducts that cannot be further reused, recycled, or otherwise

recovered for either a commercial or other beneficial public use while meeting the performance requirements of the City & County of Honolulu for demonstrated feasibility.

- Some alternative technologies, such as hydrolysis (generation of process wastewater and other byproducts), involves the potential for environmental impacts that would require further examination to ensure public and environmental safety.
- A number of the technologies that produce a secondary product, e.g., fuels for the generation of electricity or recovered plastic, metal, or glass products, do not have established commercial markets in the State of Hawai‘i. New markets and users for these products would need to be established to ensure viability of the waste technology. Failure of the technology after start up would otherwise be borne by O‘ahu's residents through: (1) financial subsidization of the alternative technology in order to avert closure of the facility; or (2) the need for additional landfill capacity to handle the MSW stream that would otherwise be processed.
- Certain alternative technologies are viable when considered as part of the City's waste management system. An existing technology, WTE, has benefited the City & County of Honolulu: (1) WTE does not completely eliminate, but does significantly reduce the volume of waste requiring landfilling by a factor of approximately 90 percent; (2) WTE provides a beneficial recyclable product in the form of electricity from refuse that would otherwise be disposed of; and (3) WTE is based on known environmental factors and potential effects which are or have been mitigated by the City as part of its existing operation of H-POWER. It is expected that other technologies and approaches will be developed as they mature and demonstrate feasible application in other municipalities.

~~9.6. Alternative Sites for a Municipal Landfill~~

~~9.6.1. Introduction~~

9.7. Alternative Sites for a Municipal Landfill

9.7.1. Introduction

This section assesses potential landfill sites as alternatives to the proposed lateral expansion of the WGSL. The alternative sites were previously identified in the December 2003 report by the Mayor's Advisory Committee on Landfill Site Selection (Advisory Committee). The alternative sites considered by the Advisory Committee is useful to this assessment based on the following (PWCG, 2008):

- It used a committee of professionals as well as residents, from the areas most likely to be the location of a future landfill, to identify the screening criteria for evaluation of the new landfill site. The Advisory Committee represented a broad range of interests and expertise and relied on the consultant and ENV staff for technical input. The Advisory Committee made all the decisions relative to inclusion or exclusion of the sites.
- The inventory of potential sites that was the starting point for the Advisory Committee analysis was comprehensive, drawn from reports and other work between two and 28 years old (at the time of the Advisory Committee work in 2003). The Advisory Committee members, were asked, but had no additional sites of sufficient capacity that could be added to the list. In fact, the list of potential sites was reduced substantially due to land use development that encroached on some sites.
- The Advisory Committee focused its evaluations on the community perspective and most of their criteria were community–based considerations. While technical issues were considered, the Committee placed most of its emphasis on potential landfill impacts on the community where the sites were located. These potential impacts are also assessed as part of this EIS.

- The Advisory Committee recommendations were submitted to the Honolulu City Council on December 1, 2003.

The work of the Advisory Committee was considered in the review of potential landfill sites by the City Council Committee on Public Works and Economic Development. The Committee Chair, Mr. Rod Tam, reported the results of his Committee's evaluation to the full Council on November 16, 2004.[44] According to the evaluation:

> "…Landfills, in my view, should no longer be considered our primary depository of unwanted waste. We should be making every effort to divert all of our solid waste to recycling and reprocessing into energy or other useful products. Our goal should be to initially process all our solid waste in some form or fashion so that what ends up in our landfills is only the by-products of that initial processing that has no current use. This will reduce significantly the volume of waste going into our landfills thereby extending its useful life…."

The Committee conducted meetings on the Leeward and Windward sides of the island to receive public input. The memorandum reporting the results[44] made no recommendation regarding a specific site, but provided background for the final site selection. Information gathered in Councilmember Tam's investigation has been used in this analysis (PWCG, 2008).

The following discusses the landfill site selection process, the features of the sites recommended by the Advisory Committee that caused them to have different scores on the evaluation process, and discuses the City's general requirements for a landfill site.

[44] November 16, 2004 memorandum from Councilmember Rod Tam to Concerned Citizens of Oahu transmitting the report titled "Committee on Public Works and Economic Development's Summary Report on its Landfill Site Selection Process."

~~9.6.2. City & County Requirements for a Landfill~~

9.7.2. City & County Requirements for a Landfill

The City & County of Honolulu has not published its "requirements" for a potential landfill site but uses the following general prerequisites (PWCG, 2008):

- Environmental - The site must not have physical features that make it more difficult to minimize environmental impacts. For example, if two sites were otherwise equal, the one with the lesser impact on wetlands would be preferred.
- Landfill capacity or life span - A site needs to accommodate at least 10 years of disposal to justify the time and expense of permitting it. A landfill with a long life also minimizes environmental impacts compared to landfilling at smaller landfill sites. The longer the life of a landfill the more waste it can accept, thus reducing disposal cost.
- Disaster debris - Having the space and equipment to mange and temporarily store disaster debris will be important. A potential landfill site needs to have space for disaster debris storage or disposal to preserve public health, safety, and welfare.
- Reasonable cost - The City provides the lowest cost, environmentally sound means for disposal of municipal refuse to benefit the taxpayer.
- Proximity to the H-POWER facility - The contract with Covanta to operate H-POWER provides for a price increase for ash transportation if the landfill is more than 12 miles from the plant site. In addition, the more miles traveled by trucks transporting ash, the greater the opportunity for accidents.

In addition to the above, the City considered (1) the use of two more landfill sites for MSW and ash and residue, as well as (2) the use of two or more landfill sites to separately handle MSW in one landfill and ash and residue in another. As in 2002 when the prior City administration sought the expansion of the WGSL, the use of two or more

landfill sites was considered by ENV for the proposed project, but was not selected for consideration based on the following (FSEIS, Waimānalo Gulch Sanitary Landfill Expansion, 2002):

1. Land resources on O'ahu are finite and limited. Use of more than one landfill site for the disposal of MSW and/or ash and residue would foreclose or limit other alternative land uses that might otherwise be provided.

2. Potential for negative environmental impacts associated with the development of any landfill requires major effort to ensure mitigation. Development of two or more landfill sites would increase potential for negative environmental impacts and costs necessary to mitigate such impacts.

3. Economies of scale from an appropriately sized facility would generally result in more efficient use of land than two smaller facilities that may not be as easily planned from a landfill development perspective. The economies of scale would also allow for lower refuse disposal costs than two or more smaller landfills.

~~9.6.3. Mayor's Advisory Committee on Landfill Site Selection~~

9.7.3. Mayor's Advisory Committee on Landfill Site Selection

The Mayor's Advisory Committee on Landfill Site Selection was formed in response to Condition No. 1, of the approved State Special Use Permit[45] calling for the formation of a "Blue Ribbon Site Selection Committee". The Committee started with the reports of studies done by the City over the past approximately 30 years to identify potential

[45] Decision and Order Approving Amendment to State Special Use Permit, Docket No. SP87-362, Waimānalo Gulch Sanitary Landfill, June 5, 2003.