Final Report

2006 Waste Characterization Study

City and County of Honolulu

April 2007

R·W·BECK

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EXECUTIVE SUMMARY

The City and County of Honolulu, Department of Environmental Services, Refuse Division (Refuse Division) has retained R. W. Beck, Inc. to complete an update of its Integrated Solid Waste Management Plan (ISWMP). An updated waste characterization was necessary to obtain detailed statistical information for use in developing the various program components of the ISWMP. This report has been prepared to present the results of the 2006 Waste Characterization Study.

The purpose of this 2006 Waste Characterization Study is to provide an estimate of the composition and quantities of solid waste material currently generated and disposed of on the island of O'ahu. Waste stream compositions for the energy recovery facility, H-POWER, and Waimanalo Gulch Landfill will be characterized and presented as part of this report. Additionally, compositions will be developed for each generator type. The three generator types used for this study include residential, commercial, and convenience center.

The Refuse Division has identified several objectives for an updated waste characterization. The data obtained in this Study will be used to evaluate the current solid waste management system and assess the effectiveness of previously implemented policies and programs. In addition, the results will be used to compare alternative collection and disposal strategies while identifying potential improvements to current recycling programs. The types and quantities of specific materials within the various waste streams directly affect the environmental and economic impacts of these considerations.

Currently, all municipal solid waste generated in Honolulu is transported to either the H-POWER waste-to-energy facility or Waimanalo Gulch Landfill (Landfill). The typical waste streams of these solid waste facilities are very different as the Landfill receives primarily materials which cannot be processed at H-POWER. Periodically throughout the year, a portion of the waste destined for H-POWER is rerouted to the Landfill because of closure due to maintenance or capacity limitations.

In order to develop meaningful, statistically accurate composition profiles of the unique waste streams, R. W. Beck collected and sorted waste material within a total of 100 samples between the dates of September 11, 2006 to September 21, 2006. Sampling activities were completed during dates when no waste was being rerouted to the Landfill from H-POWER because of closure. Waste materials received at each facility during designated sampling periods were representative of the typical waste stream. Table A presents the number of samples collected at each solid waste facility by generator type.

Table A
Sample Distribution by Generator Type

Hauler	Waimanalo Gulch Landfill	H-POWER	Totals
Residential	19	25	44
Commercial	17	25	42
Convenience Center	14	0	14
Totals	50	50	100

Data collected during the field sampling and sorting activities was used to develop the composition of each facility and generator type. For each of the 50 material categories identified by the Refuse Division, the mean and 90% confidence interval was calculated. The material category definitions are provided as Appendix A. The mean is used to estimate the annual weight of each material category. A 90% confidence interval is the solid waste industry statistically accepted standard for calculating the variation in the amount of any specific material from sample to sample. A lower number represents less variation and greater homogeneity among samples.

The Refuse Division provided the amount of solid waste material received at H-POWER and the Landfill for Fiscal Year 2006, from July 1, 2005 to June 30, 2006. This information was then proportionately integrated with the composition profiles for each facility and generator type to estimate the corresponding annual quantities of each material category within the waste stream. Material categories are presented and defined in Appendix A.

Table B provides a summary of: 1) the actual amount of solid waste received at H-POWER and the Landfill in fiscal year 2006, 2) the amount of solid waste that was destined for H-POWER but was rerouted to the Landfill throughout the fiscal year due to full or partial facility closure, and 3) the calculated amount of solid waste representative of each composition type accounting for the rerouted materials. The methodology used to calculate the amount of rerouted waste from H-POWER to the Landfill throughout the fiscal year is presented as Appendix B.

Table B
Annual Solid Waste Totals - 2006

	Actual Waste Received (tons / %)		Amount of Rerouted Waste (tons)	Waste Representative of Each Composition Type (tons / %)	
H-POWER	602,520	64.1%	+ 153,801	756,321	80.4%
Waimanalo Gulch Landfill	337,667	35.9%	- 153,801	183,866	19.6%
Total Waste	940,187	100%	0	940,187	100%

The waste tonnages representative of each composition type will be used to calculate each specific material category amount. This is necessary so that the tonnage of rerouted material is not misrepresented as Landfill-type waste.

The amount of waste by generator type was also estimated for each solid waste facility based on the annual weight data provided by the Refuse Division. Table C presents the annual waste associated with each composition type by generator type.

Table C
Annual Waste by Generator Type - 2006

Generator Type	Waste Representative of Each Composition Type (tons)		
	H-POWER	Waimanalo Gulch Landfill	Overall
Residential	371,649	40,367	412,016
Commercial	384,389	114,300	498,689
Convenience Center	283	29,199	29,482
Total Waste	756,321	183,866	940,187

As shown in the table, a majority of the residential waste is representative of H-POWER. The approximately 40,367 tons of residential waste which is disposed of at the Landfill represents bulky item collection. Commercial waste disposed of at the Landfill includes sludge and autofluff, as well as other non-combustible or bulky materials which are not desirable for energy recovery at H-POWER. Approximately 99% of the convenience center waste stream is disposed of at the Landfill because it is largely comprised of materials which are not suitable for curbside residential waste collection.

The composition profiles developed as a result of field activities performed by R. W. Beck were integrated with annual weight data to obtain estimated annual tonnages for each material category. Table D presents characterization data for each solid waste facility composition type as well as weighted aggregate overall results for the combined waste stream of the City and County of Honolulu.

It is important to note that the annual waste estimates represent the amount of material for each waste facility composition type. Approximately 20% of the waste destined for energy recovery at H-POWER is rerouted and ultimately disposed of at the Landfill due to H-POWER closures throughout the year. Additionally, these compositions due not include the ash or residue material that is produced as a result of waste processing and combustion at H-POWER. According to data provided for H-POWER, approximately 88,380 tons of ash and 79,443 tons of residue were disposed of at the Landfill from July 1, 2005 to June 30, 2006.

Table D
Waste Composition Summary by Solid Waste Facility - 2006

	H-POWER		Waimanalo Gulch Landfill		Overall Aggregate	
Material	Mean %	Annual Weight (tons)	Mean %	Annual Weight (tons)	Mean %	Annual Weight (tons)
Total Paper	36.7%	277,570	4.3%	7,864	30.2%	284,082
Total Plastics	14.0%	105,749	4.6%	8,463	12.1%	113,821
Total Metals	3.5%	26,517	10.1%	18,654	4.8%	45,448
Total Glass	2.0%	15,201	0.5%	950	1.7%	16,089
Total Other Inorganics	2.7%	20,322	4.9%	8,957	3.1%	29,370
Total Other Waste	3.8%	28,424	33.9%	62,267	9.8%	91,946
Total Green Waste	10.1%	76,048	3.4%	6,270	8.7%	82,041
Total Wood	3.0%	22,363	10.7%	19,589	4.5%	42,273
Total Other Organics	24.1%	181,937	27.6%	50,788	24.8%	232,874
Total HHW	0.3%	2,190	0.0%	64	0.2%	2,243
TOTAL	100.0%	756,321	100.0%	183,866	100.0%	940,187

Table E presents characterization data for each generator type including residential, commercial, and convenience center waste.

Updated waste characterization data will be compared within this study to the results of the previous study completed for Honolulu in 1999.

Table E
Waste Composition Summary by Generator Type - 2006

Material	Residential		Commercial		Convenience Center	
	Mean %	Annual Weight (tons)	Mean %	Annual Weight (tons)	Mean %	Annual Weight (tons)
Total Paper	31.9%	131,285	32.3%	161,257	5.2%	1,546
Total Plastics	11.6%	47,889	14.1%	70,372	5.7%	1,677
Total Metals	4.8%	19,977	3.3%	16,615	18.5%	5,462
Total Glass	2.0%	8,173	1.3%	6,572	0.8%	245
Total Other Inorganics	1.2%	4,984	1.7%	8,608	7.2%	2,124
Total Other Waste	4.6%	18,789	11.4%	56,991	21.6%	6,376
Total Green Waste	17.0%	69,913	2.4%	12,152	10.9%	3,201
Total Wood	4.8%	19,938	4.2%	21,011	24.6%	7,248
Total Other Organics	22.0%	90,721	28.6%	142,670	5.4%	1,604
Total HHW	0.1%	346	0.5%	2,441	0.0%	0
TOTAL	100.0%	412,016	100.0%	498,689	100.0%	29,482

Table F presents an estimate of the quantity of HI-5 bottles/containers by weight and number of containers. It is important to note that the HI-5 material estimates represent the amount of material for each waste facility composition type. A portion of the material within the H-POWER waste stream will be rerouted and disposed of at the Landfill due to H-POWER closure.

Table F
HI-5 Recyclables Summary - 2006

	Plastic (PET)		Aluminum		Glass	
	(tons)	(No. of Containers)	(tons)	(No. of Containers)	(tons)	(No. of Containers)
H-POWER Total	2689	89,275,000	2548	152,880,000	3756	18,029,000
Waimanalo Gulch Landfill Total	166	5,511,000	90	5,400,000	413	1,982,000
Overall Total	2843	94,388,000	2626	157,560,000	4158	19,958,000

Section 1
Introduction and Overview

1.1 Project Background

The City and County of Honolulu, Department of Environmental Services, Refuse Division (Refuse Division) has retained R. W. Beck, Inc. to complete an update of its Integrated Solid Waste Management Plan (ISWMP). An updated waste characterization was necessary to obtain detailed statistical information for use in developing the various program components of the ISWMP. This report has been prepared to present the results of the 2006 Waste Characterization Study.

A previous Waste Composition Study was completed in May 1999 by R.M. Towill Corporation and Cascadia Consulting Group. Because of evolving solid waste management policies and programs and potential changes in the solid waste stream, it is common for municipalities to complete waste characterization studies every 5-6 years. The 2006 Waste Characterization Study will provide updated data to facilitate development of the updated ISWMP and assist the Refuse Division with future solid waste management decisions and improvements. This report has been prepared to present the results of the 2006 Waste Characterization Study.

1.2 Purpose/Objectives

The purpose of this 2006 Waste Characterization Study is to provide an estimate of the composition and quantities of solid waste material currently generated and disposed of on the island of Oʻahu. Waste stream compositions for the energy recovery facility, H-POWER, and Waimanalo Gulch Landfill will be characterized and presented as part of this report. Additionally, compositions will be developed for each generator type.

The Refuse Division has identified several objectives for an updated waste characterization. The data obtained in this Study will be used to evaluate the current solid waste management system and assess the effectiveness of previously implemented policies and programs. In addition, the results will be used to compare alternative collection and disposal strategies while identifying potential improvements to current recycling programs. The types and quantities of specific materials within the various waste streams directly affect the environmental and economic impacts of these considerations.

1.3 Existing Conditions

Most all of the residential solid waste generated within the City and County of Honolulu is collected by the Refuse Division. A limited amount of waste is also collected by the Refuse Division from multi-family households and small commercial businesses. Automatic and manually loaded refuse trucks are used to serve each of the seven districts: Honolulu, Ewa, Koolaupoko, Wahiawa, Waianae, Waialua, and Koolauloa. Private haulers compete to provide collection services for other generators such as commercial and industrial facilities, military bases, and some multi-family dwellings, such as condominiums.

The Refuse Division operates three solid waste transfer stations in Kapaa, Keehi, and Kawailoa. These transfer stations serve to consolidate waste from refuse collection trucks into large transfer trailers for more efficient and economical transport to H-POWER or the landfill disposal facility. At least one additional private transfer station is operated by Honolulu Disposal Service.

The Refuse Division also operates six convenience centers throughout the County where residents can drop off up to two loads of waste material per day. There are convenience centers located in Waimanalo, Ewa, Waipahu, Wahiawa, Waianae, and Laie. Only residential waste is accepted at the convenience centers. Refuse is separated in order for it to be delivered to the appropriate disposal site:

- **Burnable refuse** belongs in the "Combustible" bin, which is sent on to the H-POWER waste-to-energy plant.
- **Non-burnable refuse** goes into the "Noncombustible" bin, which is disposed at the landfill.
- **Yard waste** goes into the "Green Waste" bin, which is delivered to mulching and composting operator.
- **Large appliances, tires and auto batteries** are put off to the side for separate collection and delivery to recycling facilities.

All municipal solid waste generated on O‘ahu, except hazardous wastes and construction and demolition materials, is currently transported to the waste-to-energy facility, H-POWER, or the Waimanalo Gulch Landfill. From July 1, 2005 to June 30, 2006, there were a total of approximately 940,200 tons of solid waste disposed on the island, with H-POWER receiving 602,500 tons, or 64% by weight, for energy recovery. Construction and demolition materials and other specific materials are collected and disposed of separately within the private PVT Landfill located in Nanakuli.

H-POWER (an acronym for Honolulu Program of Waste Energy Recovery) is located in Campbell Industrial Park, and is a waste-to-energy facility operated by Covanta Energy since 1990. H-POWER uses combustion technology to convert combustible solid waste material into energy for the City and reduce the volume of solid waste by approximately 90%. The ash waste that is produced by the combustion process is transferred for disposal to an ash monofill area at the Waimanalo Gulch Landfill.

From July 1, 2005 to June 30, 2006, H-POWER received an average of 2,160 tons of waste each day. This waste was used to generate enough electricity to power approximately 60,000 homes on the island. H-POWER uses magnetic recovery of ferrous metals from the waste stream and eddy current separators extract non-ferrous metals from the ash. Approximately 18,600 tons of ferrous metals (i.e. tin cans) and 2,100 tons of non-ferrous metals (i.e. aluminum) were recycled last year from H-POWER according to information provided by facility staff.

Noncombustible and bulky waste materials are collected separately and landfilled at the Waimanalo Gulch Landfill. Last year, approximately 337,700 tons of solid waste material was disposed of at the Landfill. Although a majority of the waste disposed of at the Landfill is unsuitable for combustion, a portion is actually destined for H-POWER but is rerouted to the Landfill due to either H-POWER equipment maintenance or capacity limitations. Bulky item pickup is free for City and County residences and includes furniture, appliances, and mattresses. These materials are disposed at the Landfill and are quantified in Section 2 of this report.

Section 2
Methodology

The purpose of this study was to estimate the quantities and types of solid waste material that are being collected throughout the City and County of Honolulu and used for energy recovery or disposed at the Landfill. The 2006 Waste Characterization Study was designed to develop solid waste compositions for the H-POWER waste-to-energy facility, Waimanalo Gulch Landfill, and combined. Additionally, the Refuse Division identified the need for composition profiles of each generator type.

Prior to engaging in any field work, it was important for R. W. Beck to understand the current solid waste management system of the City and County of Honolulu. Discussions with Refuse Division staff quickly concluded that typical waste streams of H-POWER and Waimanalo Gulch Landfill, are very different. R. W. Beck, Inc. prepared a Field Sampling Plan that was designed to develop statistically accurate methods for collecting, sorting, and analyzing samples from each of the two facilities. This sampling would provide the foundation for the waste characterization results. The Field Sampling Plan was submitted to the Refuse Division prior to performing any field activities and was approved prior to undertaking the field work. This section will provide a detailed description of the sampling, sorting, and data analysis methodology that was used by R. W. Beck, Inc.

2.1 Sampling Methodology

R. W. Beck, Inc. determined that the preferred approach for obtaining accurate characterization data while minimizing impacts to daily collection and operations would be to perform the field sampling and sorting activities at H-POWER and Waimanalo Gulch Landfill. However as identified in the Field Sampling Plan, a significant portion of the waste received at H-POWER originates from the transfer stations and arrives in transfer trailers. These loads are often considerably compacted and sorting the material is often difficult. As a result, the sorting time is longer and the data can be less useful. Therefore, we coordinated with the Refuse Division to collect and sort a number of samples at the Keehi Transfer Station. These samples were collected from refuse trucks before the waste was loaded into the transfer trailers. All of this material was eventually used for energy recovery at H-POWER and so the data obtained from transfer station sampling was integrated with the H-POWER field sampling.

Field activities including sample collection and sorting were completed by R. W. Beck between the dates of September 11, 2006 to September 21, 2006. The dates for which sampling/sorting activities were completed at each facility are presented in Table 2-1 below.

Table 2-1
Sampling Schedule

Sample Location	Start Date	End Date
Waimanalo Gulch Landfill	Sept. 11	Sept. 14
Keehi Transfer Station	Sept. 15	Sept. 16
H-POWER	Sept. 18	Sept. 21

Periodically, H-POWER does not accept waste material and the collection and transfer trucks are rerouted to the Landfill for disposal. These closures occur when the tipping floor has reached its capacity, repair of equipment is required, or there is a planned maintenance. In order to sort and sample representative solid waste, sampling activities for this study were performed on dates when waste was not being rerouted from H-POWER to the Landfill. It was confirmed with staff from all three facilities during the designated sampling periods that the overall waste delivered each day was representative of the typical waste stream.

In order to develop meaningful, statistically defensible estimates of the waste stream composition, a total of 100 samples of at least 200 lbs. each were collected by R. W. Beck staff for sorting. Fifty samples were collected from waste material used for energy recovery at H-POWER, and remaining 50 samples were collected from landfilled waste. Samples collected and sorted at the Keehi Transfer Station were classified as H-POWER waste since that was the final destination for these materials.

The number of samples to be collected from each hauler was estimated based on the incoming annual waste quantity data for each of the solid waste facilities from July 1, 2005 through June 30, 2006. A list of H-POWER shutdown dates was obtained and the incoming quantities were adjusted to estimate the sample distribution for each facility under normal operating conditions. This was considered the most defensible approach to obtain representative characterization of waste disposed of at each facility under normal operation. It was also essential when the profiles were combined to create an overall characterization.

Table 2-2 presents the number of samples collected from each waste hauler at each solid waste facility.

Table 2-2
Sample Distribution by Hauler

Hauler	Waimanalo Gulch Landfill	Keehi Transfer Station	H-POWER	Totals
ENV-Refuse Division	19	14	11	44
Convenience Center	14	--	0	14
Honolulu Disposal Service	0	--	16	16
Hawaii Metal Recycling	0	--	0	0
Rolloffs Hawaii	7	--	5	12
Other Commercial Haulers*	6	--	4	10
Self-Hauls	4	--	0	4
Totals	50	14	36	100

* - Includes Aloha Waste Services, Island Recycling, KNG Group, NCNS, and Perry Management

The sampling procedure took place in the following manner:

1. A randomly selected truck was identified by the field supervisor for sampling. This approach is often referred to as the "Nth truck" method, and was chosen to obtain unbiased results by providing a representative distribution of truck types and collection locations.
2. The R.W. Beck field supervisor interviewed the selected haulers prior to sampling their waste loads to determine the hauler name, vehicle type, waste origin, waste type (i.e. residential, industrial/commercial/institutional, military, or mixed), and final solid waste location (i.e. Landfill or H-POWER).
3. For each truck to be sampled, the R.W. Beck field supervisor asked the front-end loader operator to take a "grab" sample of waste material dumped from the selected truck and transfer the sample to a pre-designated sorting area. Samples were collected from various portions of the waste piles to reduce redundancy and achieve statistically representative results.
4. The sort team collected a minimum of 200 pounds from a randomly selected portion of the waste pile from each sampled load.

Sampling was completed using widely-accepted solid waste characterization methods and previous industry experience to maintain accuracy and reliability.

2.2 Sorting Activities

Waste material within each sample was manually sorted by the sort team into predetermined categories that were recommended by the Refuse Division. Definitions for the material categories are presented as Appendix A. These categories include those evaluated during the 1999 Waste Composition Study and add a few additional.

The sorting procedure of waste samples generally took place in the following manner:

1. The material within each sample was placed onto a table for efficiency and safety of the sort team.
2. All of the waste material within each sample was physically sorted by our trained crew (4 staff) into containers specifically designated for each predetermined category.
3. After all of the material within a sample had been sorted, the project team weighed each container and recorded the data on specially designed forms.
4. The sort team sub-sorted the deposit and non-deposit containers for each sample and recorded the data separately. This data would be used later for determining the HI 5 results.

Each sorter was responsible for certain types of waste which did not change throughout the sorting period. This method is designed to reduce the potential for error and increase sorting efficiency. Any unique characteristics of the sample, such as significant moisture or hazardous materials, were noted on the data form. The data obtained from sorting provided a basis for characterizing each of the waste streams.

2.3 Data Analysis

Waste characterization data analysis is typically comprised of two steps: 1) the development of composition profiles, and 2) the integration of annual weight data. This section describes the methodology used specifically for this study to complete the data analysis.

2.3.1 Composition Development

Data collected during the field sampling and sorting activities was used to calculate a mean and a 90% confidence interval for each material category. The mean is used to estimate the annual weight of each material category. A 90% confidence interval is the solid waste industry statistically accepted standard for calculating the variation in the amount of any specific material from sample to sample. A narrower interval represents less variation and greater homogeneity among samples. The data analysis involved the following activities:

1. Gathered data from the sort was entered into the project waste composition statistical model designed specifically for analyzing waste composition data.

2. Representative samples for each facility and generator type (i.e. H-POWER, Residential, etc.) were defined and grouped together for analysis.
3. Sort results were calculated and depicted by the mean and the 90% confidence interval by weight for each material category.

Waste compositions were developed by solid waste facility location as well as by generator type. The overall composition results were calculated based on the weighted aggregate of the material for each facility.

Three generator types were identified and defined by the Refuse Division for waste stream characterization: Residential, Commercial, and Convenience Center. For the purposes of this study, all waste collected by the Refuse Division within its refuse trucks is classified as residential waste. Table 2-3 provides a summary of the generator types used for this study.

Table 2-3
Generator Type Definitions

Generator Type	Hauler
Residential	Refuse Division Refuse Trucks, including Bulky Item Collection
Commercial	Private Haulers serving Commercial, Industrial, and Military facilities, Other City and County vehicles, various haulers from Eleemosynary facilities, and self-haul vehicles.
Convenience Center	Refuse Division Roll-Off Trucks

Other City and County waste consists primarily of sludge generated by the City wastewater treatment plants but also includes waste from the Parks, Road Maintenance, Fire, Police, and other City departments. Eleemosynary facilities are non-profit organizations including schools and charities that are not charged for waste disposal. Self-haul waste is delivered to the solid waste facility in various types of vehicles.

During the waste-to-energy process at H-POWER, ash and residue are generated as by-products. It is important to note that although these materials are disposed of at the Landfill, they are not included in the composition profiles or the tonnages calculated in the subsequent section.

2.3.2 Solid Waste Weight Calculations

This section provides a description of the weight calculations performed in order to accurately integrate the composition data. For each composition profile, an estimated annual weight will be provided for all of the specific material categories (i.e. Deposit PET bottles/containers). The Refuse Division will be able to use this information for future programs and policy decisions with the goal of improving solid waste management for Honolulu.

Data was obtained from the Refuse Division regarding the amount of solid waste material that was disposed of at the Landfill and H-POWER from July 1, 2005 to June 30, 2006. Table 2-4 summarizes the distribution of actual solid waste received by facility.

Table 2-4
Actual Annual Waste by Solid Waste Facility

	Actual Waste Received (tons / %)	
H-POWER	602,520	64.1%
Waimanalo Gulch Landfill	337,667	35.9%
Total Waste	940,187	100%

The actual waste quantities represent the historic annual amount of material received at either facility location. However, a portion of the actual annual waste received at the Landfill is material that was destined for H-POWER but rerouted to the Landfill due to periodic closures for maintenance or capacity limitations. Based on information provided by the Refuse Division, there were 47 days last year when H-POWER was closed and 54 days of partial closure. During partial closures, the facility either operates under reduced hours or accepts only specific haulers or truck types. Since the rerouted material has a composition more characteristic of H-POWER than the typical landfilled waste (i.e. bulky or non-combustibles), the quantity of rerouted waste was estimated and separated before applying the composition data.

Approximately 153,800 tons, or 20%, of the waste that was destined for H-POWER last fiscal year was rerouted to the Landfill due to H-POWER closure. Detailed methodology and calculations for estimating the amount of rerouted waste for each hauler is presented as Appendix B. Table 2-5 presents the amount of rerouted waste from H-POWER and recalculates the amount of material that is suitable for energy recovery at H-POWER compared with Landfill waste. This material is referred to as waste representative of each composition type.

Table 2-5
Annual Waste by Composition Type

	Amount of Rerouted Waste (tons)	Waste Representative of Each Composition Type (tons / %)	
H-POWER	+ 153,801	756,321	80.4%
Waimanalo Gulch Landfill	- 153,801	183,866	19.6%
Total Waste	0	940,187	100%

The waste tonnages by composition type will be used to calculate each specific material category amount. This is necessary so that the tonnage of rerouted material is not misrepresented as Landfill-type waste. For example, there is a significant amount of large, bulky furniture and non-combustible material such as sludge and autofluff within the Landfill waste stream. Multiplying the actual amount of waste disposed at the Landfill by the Landfill composition would overestimate the tonnage of this material.

The amount of waste by generator type was also estimated for each solid waste facility based on the annual weight data provided by the Refuse Division. Table 2-6 presents the annual waste representative of each composition type by generator type.

Table 2-6
Annual Waste by Generator Type

Generator Type	Waste Representative of Each Composition Type (tons)		
	H-POWER	Waimanalo Gulch Landfill	Overall
Residential	371,649	40,367	412,016
Commercial	384,389	114,300	498,689
Convenience Center	283	29,199	29,482
Total Waste	756,321	183,866	940,187

Section 3
Results and Findings

3.1 General

The purpose of this waste characterization study was to obtain current composition data for the distinctive waste streams of Waimanalo Gulch Landfill and H-POWER The compositions for each of the two solid waste facilities were combined based on the proportionate waste quantities to develop an overall aggregate composition.

The results are based on field work performed by R. W. Beck, Inc. from September 11 through September 21, 2006. The waste tonnages presented herein are based on detailed reports provided by the Refuse Division for all waste received from July 1, 2005 through June 30, 2006.

Data obtained during sampling and sorting activities was also classified by generator type and used to prepare composition profiles for residential, commercial, and convenience center waste streams. These results can be used to obtain a more detailed summary of the various waste streams.

3.2 H-POWER Results

A majority of the solid waste generated on O‘ahu is used for fuel at the H-POWER waste-to-energy facility. Although approximately 602,520 tons of waste were received at H-POWER last year, there were an estimated 756,321 tons of waste with the same composition initially destined for the facility. Approximately 153,800 tons of H-POWER destined was rerouted to the Landfill because of closure due to maintenance or capacity limitations.

Approximately 49% of the H-POWER material is residential waste with the remaining 51% consisting of commercial waste as defined in this study. There is a small amount of convenience center waste received at H-POWER.

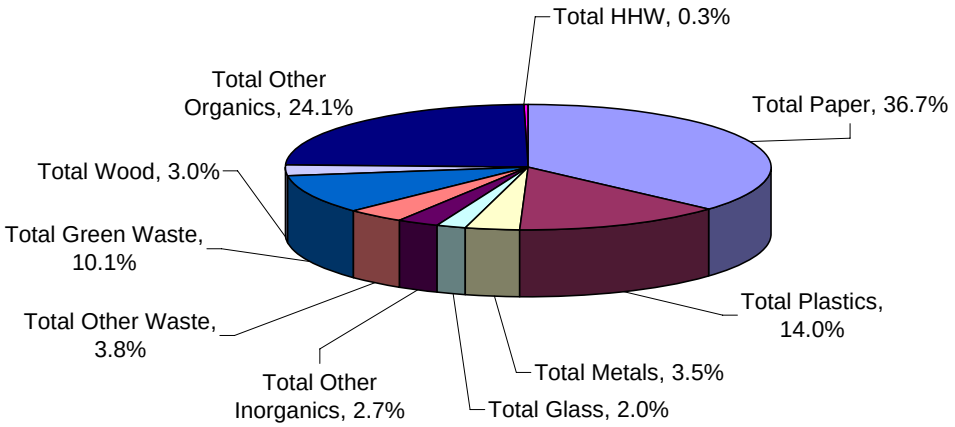
During the processing of waste at H-POWER prior to combustion, a significant amount of residue material is removed from the waste stream. The residue is not desirable for combustion and consists of an indeterminate mixture of fines typically smaller than 3 inches, including dirt, paper, plastic, mixed cullet, organics, etc. The material is periodically loaded onto transfer trailers, weighed at H-POWER, and transported to the Landfill for disposal. Based on data obtained from H-POWER, approximately 79,443 tons of residue was disposed of at the Landfill from July 1, 2005 to June 30, 2006.

Ash is a by-product of the combustion process. The ash is also periodically loaded onto transfer trailers and transported to the Landfill. However this material is disposed

of in an ash monofill area of the landfill. Approximately 88,380 tons of ash were transported from H-POWER to the Landfill last year.

Figure 3-1 presents a summary of the waste composition results based on September 2006 sampling at H-POWER and the Keehi Transfer Station. R. W. Beck sorted a total of 50 samples to develop the H-POWER composition.

Figure 3-1
H-Power Waste Composition Summary - 2006



The largest portion of the waste stream consists of the materials listed below:

- Total Paper (36.7%)
- Total Other Organics (24.1%)
- Total Plastics (14.0%)
- Total Green Waste (10.1%)

Table 3-1 presents detailed waste characterization results for the H-POWER material composition. For each material category shown, the mean and 90% confidence interval is presented along with the corresponding estimated annual tonnages. The weight data represents the total amount of waste with H-POWER composition. However as previously mentioned, approximately 20% of the materials listed are rerouted to the Landfill due to facility closure for equipment maintenance or capacity limitations.

Table 3-1
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%**	**105,749**	**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**
HI 5 Glass Bottles/Containers	0.5%	0.2%	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
Furnitures	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%	0.1%	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	**100.0%**		**756,321**	

3.3 Waimanalo Gulch Landfill Results

The Waimanalo Gulch Landfill typically receives bulky or noncombustible residential, commercial, and convenience center waste from all over the island. In 2006, there were approximately 183,866 tons of landfilled waste excluding the H-POWER material that is rerouted during closure.

The breakdown of Landfill waste by generator type is listed below:

- Residential waste – 22%
- Commercial waste – 62%
- Convenience Center waste – 16%

The sources of waste for these three generator types is provided in Table 2-3.

Figure 3-2 presents a summary of the waste composition results based on September 2006 sampling at the Waimanalo Gulch Landfill. R. W. Beck sorted a total of 50 samples to develop this composition.

Figure 3-2
Waimanalo Gulch Landfill Waste Compostion Summary - 2006

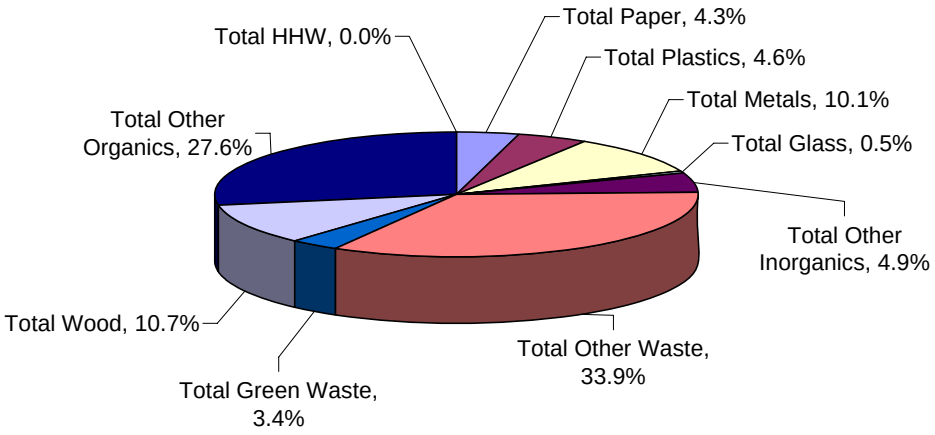


Table 3-2 presents detailed waste characterization results for the Waimanalo Gulch Landfill material composition. R. W. Beck did not sample and sort samples of wastewater sludge or autofluff that was received at the Landfill because the material within each truckload was entirely homogeneous. These material types were included based on annual tonnage data received by the Refuse Division. Weight data for the sampling period were also obtained to verify that the amount of material brought in was representative.

Table 3-2
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%	2,893	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**
HI 5 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
Furnitures	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 [(1)]	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 [(1)]	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	**100.0%**		**183,866**	

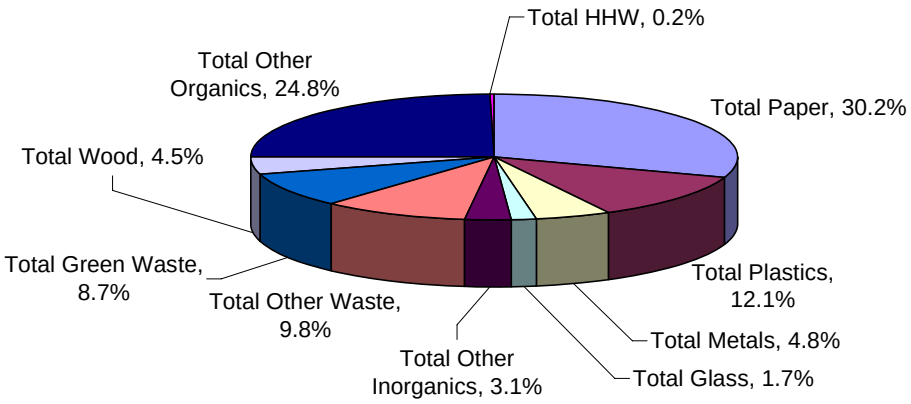
(1) There was no auto fluff or sludge in the samples sorted for this study. As such, standard deviation and the lower and upper bounds of the confidence interval are not applicable. The Waimanalo Gulch Landfill is known to accept auto fluff and sludge and therefore the average composition for these materials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

3.4 Aggregate Overall Results

The results presented in this section represent the aggregate overall waste composition based on the R. W. Beck sampling and sorting activities completed in September 2006. This composition was developed by proportionately combining the H-POWER composition data with that of Waimanalo Gulch Landfill. Approximately 80.4% of the overall island-wide solid waste is represented by the H-POWER composition, with the remaining 19.6% comprised of Landfill waste.

The overall solid waste composition summary for the City and County of Honolulu is presented as Figure 3-3. All of the 100 samples that were sorted were included to develop this composition.

Figure 3-3
Aggregate Overall Waste Composition Summary - 2006



The detailed waste characterization results presented in Table 3-3 provide estimated annual tonnages for each material category. The table presents the mean composition and 90% confidence interval as well as the corresponding estimated tonnage for each material category. As shown, these results include sludge and autofluff, but not residue and ash.

Table 3-3
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**
HI 5 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
Furnitures	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 [(1)]	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 [(1)]	4.4%	NA	41,744	NA
Total HHW	**0.2%**	**0.1%**	**2,243**	**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	**100.0%**		**940,187**	

(1) 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 Waimanalo Gulch Landfill is known to accept auto fluff and sludge and therefore the average composition for these materials was obtained from sources outside this study.

Table 3-4 provides a comparison of the updated R. W. Beck 2006 Waste Characterization Study with the previous 1999 Waste Composition Study. The subcategories of the two studies are consistent with the exception of sludge and autofluff which were not included in the previous study. Those materials account for at least a portion of the increase in Total Other Waste and Total Other Organics. Additionally, household hazardous waste (HHW) was included in Total Other Waste in the 1999 study.

It is interesting to note that the amount of Total Green Waste and Total Wood have been significantly reduced due to effective efforts by the Refuse Division to target these materials for recovery. The reduction of these materials is likely what creates the apparent increase in other categories such as Total Paper and Total Plastics.

Table 3-4
Overall Waste Comparison with 1999 Waste Composition Study

	2006 Study		1999 Study	
Material Category	Mean	Estimated Weight (tons)	Mean	Estimated Weight (tons)
Total Paper	30.2%	284,082	26.2%	215,399
Total Plastics	12.1%	113,821	7.7%	63,056
Total Metals	4.8%	45,448	6.5%	53,741
Total Glass	1.7%	16,089	1.9%	15,537
Total Other Inorganics	3.1%	29,370	5.2%	42,648
Total Other Waste*	9.8%	91,946	3.1%	25,386
Total Green Waste	8.7%	82,041	17.9%	147,047
Total Wood	4.5%	42,273	12.0%	98,899
Total Other Organics*	24.8%	232,874	19.4%	159,724
Total HHW	0.2%	2,243	NA	NA
Total		940,187		821,437

* - 2006 Study includes Autofluff in Total Other Waste and Sludge in Total Other Organics; these materials are not included in the 1999 Study. Therefore, means and estimated weights are not directly comparable.

3.5 Residential Waste Results

A large majority of the residential waste of Honolulu is collected by the Refuse Division and is transported to H-POWER for energy recovery. In 2006, there were a total of 412,016 tons of residential waste collected representing approximately 44% of all waste on the island.

Without diversion during H-POWER closure, approximately 90.2%, or 371,649 tons, of the residential waste stream is suitable for energy recovery at H-POWER as

presented earlier in Table 2-6. The remaining 40,367 tons of residential waste that is disposed of at the Landfill represents bulky item collection.

Figure 3-4 presents the summary of weighted aggregate residential waste from H-POWER and the Landfill. A total of 44 samples were evaluated to characterize the aggregate residential waste stream.

The four most predominant materials represent 82.5% of the entire residential waste stream: Paper, Other Organics, Green Waste, and Plastics.

Figure 3-4
Aggregate Residential Waste Composition Summary - 2006

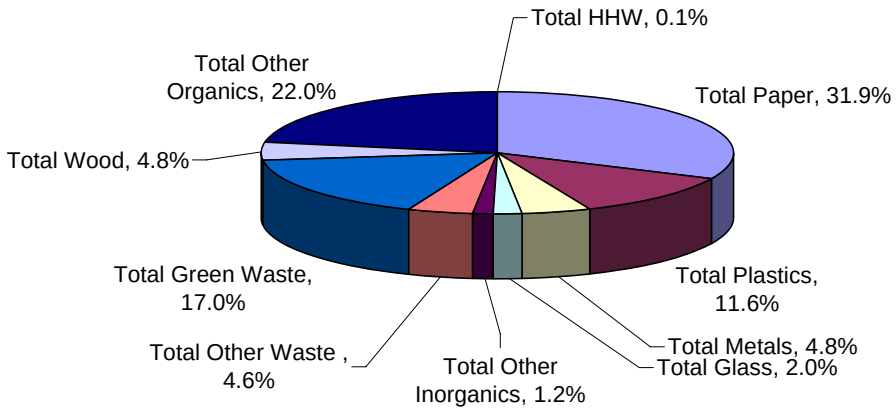


Table 3-5 presents detailed waste characterization results for the residential waste stream of the City and County of Honolulu.

Table 3-5
Aggregate Residential Waste Characterization Results - 2006

Material	Mean	+/-	Mean (tons)	+/- (tons)
Total Paper	**31.9%**	**2.4%**	**131,285**	**9,986**
OCC (Recyclable)/Kraft	6.1%	2.3%	25,048	9,327
Newspaper	6.7%	2.0%	27,423	8,376
High-Grade Paper	1.9%	0.8%	7,756	3,099
Low-Grade Paper	6.1%	1.6%	25,031	6,677
Other Compostable Paper	10.1%	2.4%	41,480	10,039
Other Paper	1.1%	0.4%	4,546	1,513
Total Plastics	**11.6%**	**2.1%**	**47,889**	**8,772**
PET Bottles/Containers (Deposit)	0.2%	0.1%	915	319
PET Bottles/Containers (Non-Deposit)	0.3%	0.1%	1,423	504
HDPE Bottles/Containers	0.8%	0.3%	3,350	1,314
Other Bottles/Containers	0.9%	0.2%	3,717	857
Mixed Rigid Plastics	1.3%	1.0%	5,503	4,190
Plastic Film/Wrap	4.3%	1.1%	17,668	4,673
Polystyrene	0.8%	0.2%	3,231	1,009
Other Plastics	2.9%	0.9%	12,082	3,726
Total Metals	**4.8%**	**1.2%**	**19,977**	**5,114**
Aluminum Cans (Deposit)	0.2%	0.1%	762	382
Aluminum Cans (Non-Deposit)	0.3%	0.3%	1,113	1,142
Tin Cans	0.8%	0.2%	3,141	913
Other Ferrous	1.8%	0.9%	7,275	3,719
Other Non-Ferrous	0.4%	0.1%	1,543	605
Mixed Metals/Other Metals	1.5%	0.7%	6,142	2,866
Total Glass	**2.0%**	**0.8%**	**8,173**	**3,478**
HI 5 Glass Bottles/Containers	0.6%	0.4%	2,289	1,472
Other Glass	1.4%	0.7%	5,884	2,789
Total Other Inorganics	**1.2%**	**0.7%**	**4,984**	**3,088**
Gypsum Board	0.0%	0.0%	75	68
Asphalt Roofing	0.4%	0.4%	1,494	1,609
Asphalt Paving	0.0%	0.0%	0	0
Concrete	0.0%	0.0%	53	59
Sand/Soil/Rock/Dirt	0.5%	0.5%	1,941	2,040
Ceramics	0.3%	0.2%	1,160	886
Miscellaneous Inorganics	0.1%	0.1%	261	324
Total Other Waste	**4.6%**	**1.8%**	**18,789**	**7,367**
Batteries	0.0%	0.0%	91	72
Furnitures	2.4%	1.1%	9,975	4,737
Appliances	0.4%	0.3%	1,527	1,309
E-Waste	1.7%	1.1%	7,195	4,404
Auto Fluff	0.0%	NA	0	NA
Total Green Waste	**17.0%**	**7.0%**	**69,913**	**28,821**
Total Wood	**4.8%**	**2.7%**	**19,938**	**11,246**
Untreated Wood	0.7%	0.5%	2,765	1,868
Treated Wood	2.3%	1.4%	9,507	5,619
Pallets	0.0%	0.0%	0	0
Stumps	1.9%	1.8%	7,665	7,320
Total Other Organics	**22.0%**	**4.0%**	**90,721**	**16,582**
Food	13.7%	3.4%	56,634	14,129
Textiles	3.1%	1.7%	12,901	6,933
Carpet	1.1%	0.8%	4,491	3,363
Tires	0.0%	0.0%	31	33
Miscellaneous Organics	4.0%	1.6%	16,664	6,590
Sludge	0.0%	NA	0	NA
Total HHW	**0.1%**	**0.1%**	**346**	**353**
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	0.1%	0.1%	346	353
TOTAL	**100.0%**		**412,016**	

Table 3-6 provides a comparison of the updated R. W. Beck 2006 Waste Characterization Study with the previous 1999 Waste Composition Study. Similar to the overall results, there is a major reduction in the amount of Total Green Waste from the previous study.

Table 3-6
Residential Waste Comparison with 1999 Waste Composition Study

	2006 Study		1999 Study	
Material Category	Mean	Estimated Weight (tons)	Mean	Estimated Weight (tons)
Total Paper	31.9%	131,285	28.1%	89,013
Total Plastics	11.6%	47,889	8.2%	26,012
Total Metals	4.8%	19,977	4.3%	13,653
Total Glass	2.0%	8,173	2.6%	8,283
Total Other Inorganics	1.2%	4,984	1.8%	5,828
Total Other Waste*	4.6%	18,789	0.8%	2,634
Total Green Waste	17.0%	69,913	28.7%	90,728
Total Wood	4.8%	19,938	2.3%	7,258
Total Other Organics*	22.0%	90,721	23.1%	73,081
Total HHW	0.1%	346	NA	NA
Total		412,016		316,491

* - 2006 Study includes Autofluff in Total Other Waste and Sludge in Total Other Organics; these materials are not included in the 1999 Study. Therefore, means and estimated weights are not directly comparable.

3.6 Commercial Waste Results

Private haulers compete on Honolulu for solid waste collection services for commercial, industrial, and military facilities. In 2006, there were a total of 498,689 tons of commercial waste collected representing approximately 53% of all waste on the island. Self-haul, Other City & County, and Eleemosynary waste was included within the commercial waste stream.

Without diversion during H-POWER closure, approximately 77.1%, or 384,389 tons, of the commercial waste stream is suitable for energy recovery at H-POWER as presented earlier in Table 2-6. Notably, approximately 35.7% and 26.1% of the commercial waste received at the Landfill consists of wastewater sludge and autofluff, respectively.

Figure 3-5 presents the summary of weighted aggregate commercial waste from H-POWER and the Landfill. A total of 13 samples were collected at the Landfill from various private haulers. Waste from commercial, industrial, and military facilities was sampled, along with that of Eleemosynary organizations. Four self-haul samples were also collected at the Landfill and included as commercial waste. These samples were proportionately combined with the 25 samples collected at H-POWER from various private haulers to characterize the aggregate commercial waste stream. Samples collected at H-POWER included waste from commercial, industrial, and military facilities and Eleemosynary organizations. No samples were collected from Other City & County vehicles as a majority of this waste material is wastewater sludge.

The three most predominant materials represent 74.2% of the entire commercial waste stream: Paper, Other Organics, and Plastics.

Figure 3-5
Aggregate Commercial Waste Composition Summary - 2006

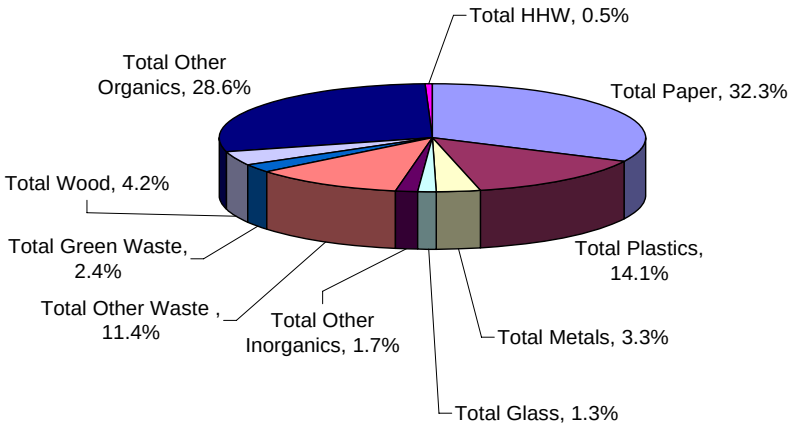


Table 3-7
Aggregate Commercial Waste Characterization Results - 2006

Material	Mean	+/-	Mean (tons)	+/- (tons)
Total Paper	**32.3%**	**3.2%**	**161,257**	**16,179**
OCC (Recyclable)/Kraft	5.9%	2.4%	29,426	11,828
Newspaper	1.6%	1.1%	8,167	5,378
High-Grade Paper	4.0%	2.6%	19,917	12,961
Low-Grade Paper	3.9%	1.2%	19,321	6,174
Other Compostable Paper	15.7%	3.5%	78,451	17,701
Other Paper	1.2%	0.4%	5,975	1,935
Total Plastics	**14.1%**	**2.4%**	**70,372**	**11,992**
PET Bottles/Containers (Deposit)	0.4%	0.1%	1,813	640
PET Bottles/Containers (Non-Deposit)	0.2%	0.1%	1,082	678
HDPE Bottles/Containers	1.4%	0.7%	6,970	3,694
Other Bottles/Containers	1.2%	0.5%	5,993	2,343
Mixed Rigid Plastics	1.1%	0.8%	5,721	3,771
Plastic Film/Wrap	6.3%	1.5%	31,665	7,270
Polystyrene	0.9%	0.3%	4,368	1,739
Other Plastics	2.6%	0.9%	12,760	4,272
Total Metals	**3.3%**	**1.0%**	**16,615**	**4,758**
Aluminum Cans (Deposit)	0.3%	0.1%	1,461	593
Aluminum Cans (Non-Deposit)	0.1%	0.1%	498	470
Tin Cans	0.3%	0.2%	1,579	895
Other Ferrous	0.7%	0.5%	3,720	2,417
Other Non-Ferrous	0.5%	0.2%	2,427	1,191
Mixed Metals/Other Metals	1.4%	0.9%	6,929	4,255
Total Glass	**1.3%**	**0.7%**	**6,572**	**3,666**
HI 5 Glass Bottles/Containers	0.4%	0.3%	1,777	1,591
Other Glass	1.0%	0.5%	4,795	2,576
Total Other Inorganics	**1.7%**	**1.2%**	**8,608**	**5,931**
Gypsum Board	0.5%	0.4%	2,277	2,143
Asphalt Roofing	0.4%	0.5%	2,070	2,714
Asphalt Paving	0.0%	0.0%	51	62
Concrete	0.3%	0.3%	1,508	1,393
Sand/Soil/Rock/Dirt	0.1%	0.2%	715	767
Ceramics	0.3%	0.3%	1,406	1,312
Miscellaneous Inorganics	0.1%	0.1%	582	576
Total Other Waste	**11.4%**	**2.8%**	**56,991**	**13,883**
Batteries	0.1%	0.0%	250	200
Furnitures	3.5%	2.5%	17,414	12,379
Appliances	0.1%	0.2%	692	922
E-Waste	1.8%	1.3%	8,829	6,455
Auto Fluff [(1)]	6.0%	NA	29,806	NA
Total Green Waste	**2.4%**	**1.8%**	**12,152**	**9,128**
Total Wood	**4.2%**	**2.4%**	**21,011**	**12,049**
Untreated Wood	2.1%	1.7%	10,336	8,416
Treated Wood	1.6%	0.9%	7,879	4,560
Pallets	0.6%	0.5%	2,796	2,431
Stumps	0.0%	0.0%	0	0
Total Other Organics	**28.6%**	**3.7%**	**142,670**	**18,453**
Food	12.4%	3.6%	61,882	17,716
Textiles	3.4%	2.3%	17,121	11,587
Carpet	0.4%	0.3%	2,111	1,697
Tires	0.4%	0.5%	2,027	2,490
Miscellaneous Organics	3.8%	1.8%	18,874	8,805
Sludge [(1)]	8.2%	NA	40,655	NA
Total HHW	**0.5%**	**0.5%**	**2,441**	**2,742**
Pesticides/Herbicides	0.0%	0.0%	0	0
Paints/Adhesives/Solvents	0.0%	0.0%	127	144
Household Cleaners	0.0%	0.0%	0	0
Automotive Products	0.5%	0.6%	2,302	2,749
Other HHW	0.0%	0.0%	13	19
TOTAL	**100.0%**		**498,689**	

(1) 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 Waimanalo Gulch Landfill is known to accept auto fluff and sludge and therefore the average composition for these materials was obtained from sources outside this study.

Table 3-7 presents detailed waste characterization results for the commercial waste stream of the City and County of Honolulu.

Table 3-8 provides a commercial waste comparison of the updated R. W. Beck 2006 Waste Characterization Study with the previous 1999 Waste Composition Study. The amount of Total Other Waste and Total Other Organics are larger due to the inclusion of autofluff and sludge, respectively.

Table 3-8
Commercial Waste Comparison with 1999 Waste Composition Study

	2006 Study		1999 Study	
Material Category	Mean	Estimated Weight (tons)	Mean	Estimated Weight (tons)
Total Paper	32.3%	161,257	26.0%	124,445
Total Plastics	14.1%	70,372	7.5%	35,794
Total Metals	3.3%	16,615	7.7%	36,977
Total Glass	1.3%	6,572	1.5%	7,087
Total Other Inorganics	1.7%	8,608	7.4%	35,588
Total Other Waste*	11.4%	56,991	3.6%	17,191
Total Green Waste	2.4%	12,152	10.8%	51,778
Total Wood	4.2%	21,011	17.8%	84,964
Total Other Organics*	28.6%	142,670	17.6%	83,946
Total HHW	0.5%	2,441	NA	NA
Total		498,689		477,770

* - 2006 Study includes Autofluff in Total Other Waste and Sludge in Total Other Organics; these materials are not included in the 1999 Study. Therefore, means and estimated weights are not directly comparable.

3.7 Convenience Center Waste Results

The City and County of Honolulu operate 6 convenience centers located around the island for residents to drop off waste. Almost all (99%) of the waste collected at the convenience centers is transported to the Landfill for disposal. This waste is mostly bulky or non-combustible. Recyclables collected at the convenience centers are sold to commercial recyclers on the island. In 2006, there were a total of 29,482 tons of waste from convenience centers, representing approximately 3% of all waste on the island.

Figure 3-6 presents the summary of convenience center waste from the Landfill. A total of 14 samples were collected at the Landfill from City and County roll-off trucks. During the September 2006 sampling period, R. W. Beck did not identify any convenience center waste disposed of at H-POWER.

The three most predominant materials represent 64.7% of the entire convenience center waste stream: Wood, Problem Materials, and Metals.

Figure 3-6
Convenience Center Waste Composition Summary - 2006

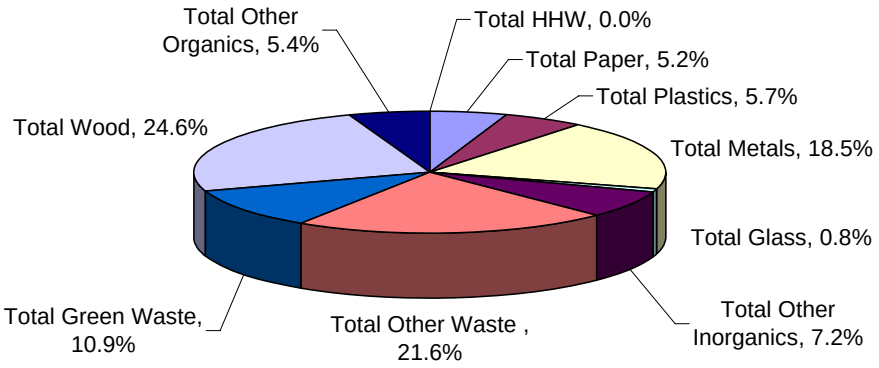


Table 3-9 presents detailed waste characterization results for the convenience center waste stream of the City and County of Honolulu.

Table 3-9
Convenience Center Waste Characterization Results - 2006

Material	Mean	+/-	Mean (tons)	+/- (tons)
Total Paper	**5.2%**	**3.5%**	**1,546**	**1,019**
OCC (Recyclable)/Kraft	2.3%	1.6%	669	460
Newspaper	0.1%	0.1%	20	29
High-Grade Paper	0.1%	0.1%	20	29
Low-Grade Paper	2.3%	2.5%	687	733
Other Compostable Paper	0.1%	0.1%	32	40
Other Paper	0.4%	0.5%	118	151
Total Plastics	**5.7%**	**3.4%**	**1,677**	**1,010**
PET Bottles/Containers (Deposit)	0.0%	0.0%	8	13
PET Bottles/Containers (Non-Deposit)	0.1%	0.1%	19	29
HDPE Bottles/Containers	0.2%	0.3%	70	95
Other Bottles/Containers	0.0%	0.0%	9	11
Mixed Rigid Plastics	0.9%	0.9%	269	270
Plastic Film/Wrap	1.4%	1.6%	417	485
Polystyrene	0.2%	0.3%	65	84
Other Plastics	2.8%	2.8%	820	819
Total Metals	**18.5%**	**6.6%**	**5,462**	**1,954**
Aluminum Cans (Deposit)	0.0%	0.1%	11	17
Aluminum Cans (Non-Deposit)	0.0%	0.0%	1	2
Tin Cans	0.0%	0.0%	4	6
Other Ferrous	8.7%	5.3%	2,551	1,572
Other Non-Ferrous	0.1%	0.2%	44	59
Mixed Metals/Other Metals	9.7%	6.6%	2,850	1,944
Total Glass	**0.8%**	**1.1%**	**245**	**318**
HI 5 Glass Bottles/Containers	0.2%	0.3%	68	91
Other Glass	0.6%	0.9%	177	275
Total Other Inorganics	**7.2%**	**7.0%**	**2,124**	**2,049**
Gypsum Board	2.5%	3.3%	742	982
Asphalt Roofing	2.4%	3.2%	699	930
Asphalt Paving	0.0%	0.0%	0	0
Concrete	0.1%	0.1%	15	24
Sand/Soil/Rock/Dirt	0.0%	0.0%	0	0
Ceramics	2.3%	3.0%	667	891
Miscellaneous Inorganics	0.0%	0.0%	0	0
Total Other Waste	**21.6%**	**7.9%**	**6,376**	**2,333**
Batteries	0.0%	0.0%	4	6
Furnitures	15.8%	10.6%	4,673	3,131
Appliances	1.3%	2.0%	373	581
E-Waste	4.5%	4.2%	1,326	1,230
Auto Fluff	0.0%	0.0%	0	0
Total Green Waste	**10.9%**	**5.5%**	**3,201**	**1,615**
Total Wood	**24.6%**	**10.0%**	**7,248**	**2,940**
Untreated Wood	7.9%	7.8%	2,325	2,294
Treated Wood	12.3%	8.0%	3,640	2,357
Pallets	1.2%	1.7%	351	494
Stumps	3.2%	4.6%	932	1,359
Total Other Organics	**5.4%**	**5.2%**	**1,604**	**1,526**
Food	0.6%	0.7%	163	211
Textiles	2.5%	2.7%	734	787
Carpet	2.3%	3.0%	685	872
Tires	0.0%	0.0%	0	0
Miscellaneous Organics	0.1%	0.1%	22	29
Sludge	0.0%	0.0%	0	0
Total HHW	**0.0%**	**0.0%**	**0**	**0**
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%	0	0
TOTAL	**100.0%**		**29,482**	

Table 3-10 provides a comparison for convenience center waste of the updated R. W. Beck 2006 Waste Characterization Study with the previous 1999 Waste Composition Study. As shown in the table, the amount of Total Metals has significantly increased since 1999.

Table 3-10
Convenience Center Waste Comparison with 1999 Waste Composition Study

	2006 Study		1999 Study	
Material Category	Mean	Estimated Weight (tons)	Mean	Estimated Weight (tons)
Total Paper	5.24%	1,546	7.10%	1,940
Total Plastics	5.69%	1,677	4.60%	1,250
Total Metals	18.53%	5,462	11.40%	3,110
Total Glass	0.83%	245	0.60%	168
Total Other Inorganics	7.20%	2,124	4.50%	1,233
Total Other Waste*	21.63%	6,376	20.50%	5,561
Total Green Waste	10.86%	3,201	16.70%	4,541
Total Wood	24.58%	7,248	24.60%	6,678
Total Other Organics*	5.44%	1,604	9.90%	2,696
Total HHW	0.00%	0	NA	NA
Total		29,482		27,176

* - 2006 Study includes Autofluff in Total Other Waste and Sludge in Total Other Organics; these materials are not included in the 1999 Study. Therefore, means and estimated weights are not directly comparable.

3.8 HI-5 Recyclables Results

This section will provide the Refuse Division with a summary of the HI-5 deposit material currently being disposed of on the island. Recovery of this material is desirable for both environmental and economic considerations.

Table 3-11 presents an estimate of the quantity of HI-5 bottles/containers by weight and number of containers. This calculation is based on composition results obtained during the R. W. Beck field sampling activities completed in September 2006.

Table 3-11
Number of HI-5 Containers in Waste Stream - 2006

	Plastic (PET) (tons)	Plastic (PET) (No. of Containers)	Aluminum (tons)	Aluminum (No. of Containers)	Glass (tons)	Glass (No. of Containers)
H-Power Total	2689	89,275,000	2548	152,880,000	3756	18,029,000
Residential	820	27,224,000	715	42,900,000	2138	10,262,000
Commercial	1751	58,133,000	1429	85,740,000	1573	7,550,000
Convenience Center	0	0	0	0	1	5,000
Waimanalo Gulch Landfill Total	166	5,511,000	90	5,400,000	413	1,982,000
Residential	96	3,187,000	47	2,820,000	151	725,000
Commercial	63	2,092,000	32	1,920,000	204	979,000
Convenience Center	8	266,000	11	660,000	67	322,000
Overall Total	2843	94,388,000	2626	157,560,000	4158	19,958,000
Residential	915	30,378,000	762	45,720,000	2289	10,987,000
Commercial	1813	60,192,000	1461	87,660,000	1777	8,530,000
Convenience Center	8	266,000	11	660,000	68	326,000

It is important to note that the HI-5 material estimates represent the amount of material for each waste facility composition type. A portion of the material within the H-POWER waste stream will be rerouted and disposed of at the Landfill due to H-POWER closure. The estimates provided may not add together exactly due to rounding during data integration.

Appendix A
Material Category Definitions

The following definitions for the 50 waste material categories identified by the Refuse Division were used during sorting and analysis for the 100 samples collected by R. W. Beck from September 11 to September 21, 2006. These definitions are consistent with those of the previous waste composition study performed in 1999 to facilitate comparison of the data.

Paper

OCC (Recyclable) /Kraft - Unwaxed/uncoated corrugated cardboard, and unbleached Kraft paper

Newspaper - Printed newsprint. (Advertising "slicks" (glossy paper) are included in this category if found mixed with newspaper; otherwise, ad slicks are included with low grade recyclable paper.)

High Grade/Office/Computer Paper - White or lightly colored sulfite/ sulfate bond, copy papers, computer print-outs, printing and writing papers, envelopes without windows, filed folders, index cards

Low Grade Recyclable Paper - Low-grade, potentially recyclable papers, including junk mail, magazines, heavy colored papers, bleached Kraft, boxboard, mailing tubes, envelopes with windows, paperback books and directories

Other Compostable Paper - Paper towels, paper plates and cups, waxed paper and cardboard, tissues

Other Paper - Polycoated and/or aseptic packaging, carbon/carbonless copy paper, carbons, hardcover books, photographs, other papers not elsewhere described

Plastics

#1 PET Bottles/Containers (Deposit) - Polythylene terephthalate bottles or containers for which a deposit was charged upon purchase, such as soda, liquor and other beverage bottles

#1 PET Bottles/Containers (Non-Deposit) - Polythylene terephthalate bottles or containers for which a deposit was not charged upon purchase, such as soda, liquor and other beverage bottles

#2 HDPE Bottles - High-density polyethylene bottles, such as milk, juice and detergent bottles

Other Bottles/Containers - Any plastic bottles/containers not included above including #3 through #7 materials

Mixed Rigid Plastics - All other plastic materials that hold a shape; rigid plastic products, such as toys and baskets

Plastic Film/Wrap - Film packaging and products, such as plastic garbage bags, bread bags and shrink wrap

Mixed Plastic and other Materials Predominately plastic, with other materials attached, such as disposable razors, pens, lighters, toys and 3-ring binders

Metals

Aluminum Cans (Deposit) - Aluminum beverage cans and bi-metal cans made mostly of aluminum for which a deposit was charged upon purchase

Aluminum Cans (Non-Deposit) - Aluminum beverage cans and bi-metal cans made mostly of aluminum for which a deposit was not charged upon purchase

Tin Cans - Tinned steel food containers, including bi-metal cans made mostly of steel

Other Ferrous Metals - All other materials composed of ferrous and alloyed ferrous scrap

Other Non-Ferrous Metals - All other materials composed of metals not derived from iron, including copper, brass, bronze, aluminum bronze, lead, pewter, zinc, and other metals to which a magnet will not adhere

Mixed Metals / Other Materials - Materials composed both of ferrous and nonferrous metals and/or have contaminants (such as wood or plastic) attached; small appliances, tools, white goods

Glass

HI-5 Glass Bottles/Containers - All glass bottles or containers, of any color, for which a deposit was charged upon purchase including beverage bottles

Other Glass - All other glass, such as light bulbs, window glass, mirrors, glassware, and bottles/containers for which a deposit was not charged upon purchase

Other Inorganics

Gypsum Wallboard - New or demolition gypsum wallboard

Asphalt Roofing - Asphalt shingles, tar paper or built-up roofing

Asphalt Paving - Asphalt paving

Concrete - Portland cement mixtures (set or unset)

Sand/Soil/Rock/Dirt - Sand, soil, rock, and dirt and mixed unidentifiable fines

Ceramics - Finished ceramic or porcelain products, such as sinks, toilets, dishes and planters

Miscellaneous Inorganics - Any other inorganic materials, such as ash, brick, kitty litter

Other Waste

Batteries – Includes vehicle batteries as well as smaller batteries such as AA, AAA, and 9 volt

Furniture - Furniture (composed of any material) and mattresses

Appliances – Large appliances including refrigerators, televisions, stereos, radios, computers

E-Waste – Includes **Brown Goods** such as microwaves, stereos, VCRs, DVD players, radios, audio/visual equipment; **Computer-related Electronics** such as processors, mice, keyboards, laptops, disk drives, printers, modems, and fax machines; and **Other Small Consumer Electronics** such as personal digital assistants (PDAs), cell phones, phone systems, phone answering machines, computer games and other electronic toys, portable CD players, camcorders, and digital cameras.

Autofluff – Fine mixed waste material (less than 1") generated by the process of pulverizing automobiles including wire, foam, mixed metal, etc.

Green Waste – Includes leaves, grass clippings, garden wastes and brush up to four inches in diameter

Wood

Untreated Wood - Unpainted dimensional lumber

Treated Wood - Lumber and wood products which have been painted or treated; or those with adhering concrete or other contaminants

Pallets – Identifying wood pallets and crates

Stumps - Stumps of trees and shrubs, with any adhering soil, and other natural wood, such as logs or branches that are greater than four inches in diameter

Other Organics

Food - Food wastes and scraps, including bone, rinds, etc. Excludes the weight of food containers, except when container weight is not appreciable compared to the food inside or container can't be opened in the field (such as a new can of food)

Textiles - Fabric materials, including natural and synthetic textiles such as cotton, wood, silk, woven nylon, rayon, polyester and other materials; without non-textile attachments

Carpet - General category of flooring applications consisting of various natural or synthetic fibers bonded to a backing material; also includes shoes, belts and handbags

Tires - Vehicle tires of all types

Miscellaneous Organics - All other organics, such as diapers, personal hygiene products, animal feces, animal bedding, sawdust, wax, soap, cigarette butts, fur, hair and vacuum cleaner bags

Sludge – Solid sludge material generated by water and wastewater treatment plants

Household Hazardous Waste (HHW)

Pesticides/Herbicides – Containers with a measurable amount of chemical pesticides or herbicides that are potentially harmful to the environment. These materials may cause handling problems or other hazards if improperly disposed of in the waste stream.

Paints/Adhesives/Solvents – Containers with a measurable amount of liquid paint, adhesives, or other solvents. This does not include dried paint, empty paint cans, or empty aerosol containers.

Household Cleaners – Containers with a measurable amount of liquid cleaners, disinfectants, or other chemical materials that may be harmful to the environment or cause other hazards if improperly disposed of in the waste stream.

Automotive Products – Containers with a measurable amount of vehicle or equipment fluid that may be harmful to the environment or cause other hazards if improperly disposed of in the waste stream. Includes used oil filters.

Other HHW – Other HHW materials not classified within any of the above categories which may be harmful to the environment or cause other hazards if improperly disposed of in the waste stream. Examples include medicines, fluorescent light bulbs, and medical waste such as sharps.

Appendix B
Calculation of Waste Rerouted to Waimanalo Gulch Landfill from H-POWER Due to Closure

This section describes the methodology used by R. W. Beck, Inc. to estimate the amount of solid waste material rerouted by each hauler to the Waimanalo Gulch Landfill (Landfill) within the last Fiscal Year, from July 1, 2005 to June 30, 2006, due to H-POWER closure. The amount of rerouted waste is assumed to have the composition representative of H-POWER instead of the Landfill.

1. R. W. Beck obtained the annual weight totals for waste received at H-POWER and the Waimanalo Gulch Landfill from each hauler. This data was combined into a single table, attached as Table B-1, for ease of comparison.
2. For each hauler, we calculated the percentage of annual waste received at H-POWER. This was obtained by dividing the waste delivered by a certain hauler to H-POWER by the total waste collected by that particular hauler. For example, the KNG Group, LLC delivered 13,729 tons of waste to H-POWER out of a total of 19,811 tons collected, representing 69%. If no waste is received at H-POWER for a particular hauler, the corresponding percentage is 0%.
3. The annual amount of waste rerouted by each hauler to the Landfill due to H-POWER closure was estimated by multiplying the percentage of waste delivered by that hauler to H-POWER (calculated in No. 2) by the total annual waste received at the Landfill by that hauler. Using our example, an estimated 4,215 tons (69% x 6,082 tons) of waste was rerouted to the Landfill by KNG Group, LLC last year. ***The calculation assumes that the amount of waste rerouted from H-POWER to the Landfill is proportionate to the amount of waste typically delivered to H-POWER. Thus, a hauler that typically delivers a small percentage of waste to H-POWER will similarly deliver a small amount of rerouted waste to the Landfill during closure.***
4. The amount of waste that each hauler disposed of at the Landfill under typical conditions (not due to H-POWER closure) was calculated by subtracting the rerouted waste from the total annual waste disposed of at the Landfill. Therefore, the KNG Group, LLC delivers 1,867 tons of waste to the Landfill that is not caused by H-POWER closure.

In order to check the assumption this method is based on, R. W. Beck calculated the actual amount of waste delivered to the Landfill that was not caused by H-POWER closure last year for O‘ahu’s two largest commercial haulers: Honolulu Disposal Service and Rolloffs Hawai‘i. The following steps were taken to perform calculations and confirm the assumption.

1. A list of full-day and partial-day H-POWER closures was provided by the Refuse Division for the fiscal year.
2. Daily totals of solid waste received at the Landfill for the entire fiscal year was provided by the Refuse Division for Honolulu Disposal Service and Rolloffs Hawai‘i.

R. W. Beck calculated the average daily amount of waste received at the Landfill for each hauler on days when no full-day or partial-day closure occurred. The average daily waste received at the Landfill from Honolulu Disposal Service was found to be 32.3 tons/day; and 29.9 tons/day from Rolloffs Hawai‘i.

3. The annual waste received at the Landfill not caused by H-POWER closure was estimated by multiplying the average daily landfilled waste by 363 days. The total for Honolulu Disposal Service was 11,725 tons; and 10,854 tons for Rolloffs Hawai‘i.
4. The calculated totals based on average daily waste for Honolulu Disposal Service and Rolloffs Hawai‘i were compared to those calculated based on H-POWER percentage and confirmed to be within 1%.

Table B-1 Appendix B
Calculation of Waste Rerouted to Waimanalo Gulch Landfill from H-POWER Due to Closure

		Commercial				Residential				Convenience Center	
Hauler Name	WGL Total (tons)	H-POWER Total (tons)	HP Percent	WGL Total due to Reroute	WGL Total typical	H-POWER Total (tons)	HP Percent	WGL Total due to Reroute	WGL Total typical	WGL Total due to Reroute	WGL Total typical
1-800-GOT-JUNK?	0		0%	0	0						
24 HOUR QUALITY CLEA	3		0%	0	3						
3 POINT RESTORATION	1		0%	0	1						
A & L LANDSCAPING &	2		0%	0	2						
A 1 A LECTRICIAN INC	1		0%	0	1						
A-1 EXTRACTION INC	0		0%	0	0						
A-AMERICAN SELF STOR	4		0%	0	4						
ABAMONGA CARE HOME	2		0%	0	2						
ABC SALES INC	2		0%	0	2						
ABC SEATING INC	20		0%	0	20						
ABRAHAM HOLDINGS LLC	2		0%	0	2						
ACCESS LOGISTICS LIM	9		0%	0	9						
ACE AUTO GLASS INC	1		0%	0	1						
ADMOR DISTRIBUTORS	36		0%	0	36						
AKAMAI IMPROVEMENTS	2		0%	0	2						
ALEXANDER BROTHERS L	3		0%	0	3						
ALL ROLLOFF SERVICES	3		0%	0	3						
ALL TREE SERVICES	13		0%	0	13						
ALL-AMERICAN MOVING	13		0%	0	13						
ALLIANCE TRUCKING	331		0%	0	331						
ALLIED BUILDERS SYST	0		0%	0	0						
ALOHA DUMP RUNS HAWA	4		0%	0	4						
ALOHA INTERNATIONAL	72	160	69%	49	22						
ALOHA STATE SERVICES	5		0%	0	5						
ALOHA WASTE SERVICES	2017	6,033	75%	1,512	505						
AMAZON CONSTRUCTION	1072		0%	0	1,072						
AMERICAN PIPING & BO	50		0%	0	50						
ANTHONY MOORE	1		0%	0	1						
ASIAN FOOD TRADING C	21		0%	0	21						
B K FLOORING	9		0%	0	9						
B&C TRUCKING CO	1005		0%	0	1,005						
BALDWIN-SANDERS PIAN	8		0%	0	8						
BARNEY'S ROLLOFF SER	284	1,913	87%	247	37						

Table B-1 Appendix B
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		Commercial				Residential				Convenience Center	
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BEKINS HAWAIIAN MOVE	16		0%	0	16						
BETTER HOME APPLIANC	5		0%	0	5						
BISHOP MUSEUM BUILDI	1		0%	0	1						
BO WAH TRADING CO	1		0%	0	1						
BRIAN R HIRAHARA	1		0%	0	1						
BUSINESS WORKS OF HA	6		0%	0	6						
C&C-DEPT OF PARKS &	444	674	60%	268	177						
C&C-EMERGENCY MED SV	0		0%	0	0						
C&C-HONOLULU FIRE DE	7		0%	0	7						
C&C-HONOLULU POLICE	11	21	65%	7	4						
C&C-PUBLIC BLDG & EL	2		0%	0	2						
C&C-ROAD MAINTENANCE	1102	75	6%	70	1032						
C&C-WWM	29951		0%	0	29,951						
C&S WHOLESALE GROCER	227		0%	0	227						
CENTRAL BOEKI HAWAII	0		0%	0	0						
CHOICE FENCE	4		0%	0	4						
CHUCK E CHEESE	1		0%	0	1						
CIRCUIT CITY	30		0%	0	30						
CITY WIDE TRANSPORTA	50		0%	0	50						
CLEAN ISLANDS COUNCI	0		0%	0	0						
COASTAL WINDOWS INC	10		0%	0	10						
CO-HA BUILDERS INC	2		0%	0	2						
COLORTYME	12		0%	0	12						
COMMERCIAL SHELVING	1		0%	0	1						
COMMONWEALTH BRANDS	2		0%	0	2						
CONCRETE CORING CO	27		0%	0	27						
CONTEMPORARY LANDSCA	2		0%	0	2						
CORNERSTONE MECHANIC	1		0%	0	1						
CORY CARPETS	2		0%	0	2						
COYNE MATTRESS CO LT	5		0%	0	5						
CREATIVE FURNITURE O	5		0%	0	5						
CRITCHFIELD PACIFIC	0		0%	0	0						
DAE HAN EXPRESS	4		0%	0	4						

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DAVIDSON, ART & ASSO	2		0%	0	2						
DISPOSABLE SOLUTIONS	503	1,628	76%	385	119						
DON QUIJOTE (USA) CO	1		0%	0	1						
DSR LOGISTICS CO	4		0%	0	4						
DUMP RUNS INC	16		0%	0	16						
ED YAMASHIRO INC	221		0%	0	221						
EDDIE'S ENTERPRISES	339	1,604	83%	280	59						
ELECTRONIC BUSINESS	12		0%	0	12						
ELITE DISPOSAL SERVI	77	350	82%	63	14						
ELITE ELECTRONICS IN	6		0%	0	6						
ENVIRONMENTAL TRANSP	4		0%	0	4						
ENVIROSERVICES & TRA	8		0%	0	8						
ENV-REFUSE BULKY LOA	3005					0	0%	0	3005		
ENV-REFUSE DIV SPECI	981					0	0%	0	981		
ENV-REFUSE HONOLULU	9895					23	0%	23	9872		
ENV-REFUSE KAPAA T.S	35611					97586	73%	26090	9521		
ENV-REFUSE KAPAA YAR	80					0	0%	0	80		
ENV-REFUSE KAWAILOA	7686					8155	51%	3957	3729		
ENV-REFUSE KEEHI T.S	23255					115165	83%	19348	3907		
ENV-REFUSE LAIE YARD	264					0	0%	0	264		
ENV-REFUSE PEARL CIT	23057					70865	75%	17397	5660		
ENV-REFUSE WAHIAWA Y	7150					21089	75%	5340	1810		
ENV-REFUSE WAIALUA Y	66					43	39%	26	40		
ENV-REFUSE WAIANAE Y	5731					16353	74%	4244	1487		
ENV-REFUSE WASTE DIV	10					0	0%	0	10		
EWA CONVENIENCE CENT	6231									0	6231
EZ ACCESS STORAGE SY	1		0%	0	1						
F K S RENTALS & SALE	1		0%	0	1						
FARMERS LIVESTOCK CO	10		0%	0	10						
FIL AM YARD SERVICE	88		0%	0	88						
FILLA MARKETING LLC	0		0%	0	0						
FINE FLOORING INC	1		0%	0	1						
FLOOR GEAR	7		0%	0	7						

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FULFILLMENT WERKS	2		0%	0	2						
FURNITURE SER&INSTAL	11		0%	0	11						
GENERAL TRADES & SER	215		0%	0	215						
GEORGE YOSHIOKA CARP	9		0%	0	9						
GIMA PEST CONTROL	1		0%	0	1						
GLASSWARE DECORATORS	0		0%	0	0						
GMI	2954	3,777	56%	1,658	1,296						
GOLDEN COIN FOOD IND	0		0%	0	0						
GOODWILL - RECYCLING	2441		0%	0	2,441						
GREEN MAGIC	4		0%	0	4						
GUO TING HUANG	1		0%	0	1						
H TANAKA TRUCKING	19		0%	0	19						
HAN KOOK MOVING COMP	1		0%	0	1						
HAWAII BIO-WASTE SYS	6		0%	0	6						
HAWAII COFFEE CO	1		0%	0	1						
HAWAII MEGA COR INC	2		0%	0	2						
HAWAII METAL RECYCLI	29853		0%	0	29,853						
HAWAII MOVERS INC	30		0%	0	30						
HAWAII STAR BAKERY I	1		0%	0	1						
HAWAII STATE & LIGHT	7		0%	0	7						
HAWAII TRANSFER CO,	145		0%	0	145						
HAWAIIAN EARTH PRODU	3		0%	0	3						
HAWAIIAN EARTH PRODU	47		0%	0	47						
HAWAIIAN ELECTRIC CO	2		0%	0	2						
HAWAIIAN ISLES VENDI	2		0%	0	2						
HAWAIIAN KING CANDIE	1		0%	0	1						
HAWAIIAN STEAM	136		0%	0	136						
HAZTECH ENVIRONMENTA	6		0%	0	6						
HELPING HANDS HAWAII	46		0%	0	46						
HENRY'S EQUIPMENT RE	60		0%	0	60						
HERC PRODUCTS INC	1		0%	0	1						
HING MAU INC	1		0%	0	1						
HOLLAND, MICHAEL	13		0%	0	13						

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HONOLULU DISPOSAL SE	53608	192630	78%	41,937	11671						
HONOLULU RECOVERY SY	600	1,041	63%	381	219						
HORIZON WASTE (RECYC	5		0%	0	5						
IIDA'S	1		0%	0	1						
IN LINE FLOORING LLC	1		0%	0	1						
INTER ISLAND CONSTRU	5		0%	0	5						
INTER ISLAND HOTEL F	10		0%	0	10						
INTERNATIONAL EXPRES	85		0%	0	85						
INTERNATIONAL RESOUR	584	944	62%	361	223						
ISLAND COMMODITIES I	5		0%	0	5						
ISLAND DEMO	3		0%	0	3						
ISLAND HERITAGE	1		0%	0	1						
ISLAND MOVERS INC	0		0%	0	0						
ISLAND PACIFIC DISTR	0		0%	0	0						
ISLAND RECYCLING INC	847	468	36%	301	545						
ISLAND RECYCLING INC	1645	1,710	51%	838	806						
ITOEN USA	90		0%	0	90						
J&M BLASTING & PAINT	47		0%	0	47						
JACK'S TRUCKING DBA	1		0%	0	1						
JOAQUIN CRISOSTOMO	2		0%	0	2						
JOHN COOK KITCHENS	1		0%	0	1						
JW MARRIOTT IHILANI	1		0%	0	1						
KAILUA FLOORING	2		0%	0	2						
KALU GLASS CO	1		0%	0	1						
KAMAAINA MAINTENANCE	11		0%	0	11						
KAMEHAMEHA SCHOOLS	268		0%	0	268						
KHNL TV	0		0%	0	0						
KING'S DISPOSAL LLC	153	34	18%	28	126						
KNG GROUP LLC, THE	6082	13,729	69%	4,215	1,867						
KOHA ORIENTAL FOODS	11		0%	0	11						
KONE INC	1		0%	0	1						
KONG ENTERPRISES INC	13		0%	0	13						
KRAFT FOODS	17		0%	0	17						

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KTM SERVICES INC	17		0%	0	17						
LAIE CONVENIENCE CEN	612									0	612
LAMUG, ROBERTO B	2		0%	0	2						
LANDSCAPE SERVICES C	3		0%	0	3						
LANDSCAPING LIKE FAT	2		0%	0	2						
LASER IMAGING PRODUC	0		0%	0	0						
LENOX METALS LLC	42		0%	0	42						
LIGGETT VECTOR BRAND	1		0%	0	1						
LION'S CLEANING & MA	1		0%	0	1						
LOOMIS FARGO	2		0%	0	2						
LOUIS VUITTON	4		0%	0	4						
LS YARD SERVICE	4		0%	0	4						
M SHIROMA PAINTING C	1		0%	0	1						
MANN STEPHEN H	2		0%	0	2						
MARIO MONI CO LLC	1		0%	0	1						
MARTIN WAREHOUSING &	17		0%	0	17						
MARUKAI HAWAII INC	1		0%	0	1						
MATTHEW MIYATA ULTIM	3		0%	0	3						
MATTRESS WAREHOUSE ,	48		0%	0	48						
MAUNALOA MACADAMIA N	17		0%	0	17						
MCA GENERAL REPAIRS	0		0%	0	0						
MCCALLISTER BEDS & F	21		0%	0	21						
MEMBRERE YARD SERVIC	3		0%	0	3						
MERCHANDISE INTERNAT	1		0%	0	1						
METRO SAMOA INC	0		0%	0	0						
MID TOWN RADIO SALES	27		0%	0	27						
MIKOSHI TRADING HAWA	14		0%	0	14						
MILILANI TOWN ASSOCI	23		0%	0	23						
MORRIS CARPET	7		0%	0	7						
NABISCO INC	1		0%	0	1						
NAKOA COMPANIES, INC	19		0%	0	19						
NATIONAL CARPET & DR	6		0%	0	6						
NCNS	2414	2,823	54%	1,301	1,112						

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NEWPORT PACIFIC CABI	5		0%	0	5						
NIKO'S YARD & HAULIN	28		0%	0	28						
NUI REFUSE	2		0%	0	2						
OAHU FIRE PROTECTION	3		0%	0	3						
OAHU FLOORING	4		0%	0	4						
OAHU PET CREMATORY	1		0%	0	1						
OAHU PLUMBING & SHEE	0		0%	0	0						
PACIFIC ALLIED PRODU	67	65	49%	33	34						
PACIFIC BRIDGES INC	1		0%	0	1						
PACIFIC BUSINESS MAC	2		0%	0	2						
PACIFIC COMMERCIAL S	242		0%	0	242						
PACIFIC ENVIRONMENTA	28		0%	0	28						
PACIFIC FLOORING DRA	1		0%	0	1						
PACIFIC POULTRY CO	2		0%	0	2						
PACIFIC RECREATION C	2		0%	0	2						
PACIFIC TANK CLEANIN	0		0%	0	0						
PACIFIC TRANSFER & W	21		0%	0	21						
PALAMA SUPER MARKET	4		0%	0	4						
PEDRO LAWN MAINTENAN	9		0%	0	9						
PERMA-FIX GOVERNMENT	1002		0%	0	1,002						
PERRY MANAGEMENT COR	3341	10,904	77%	2,557	783						
PHILIP SERVICES OF H	51		0%	0	51						
PICKUP-HOMEOWNER	3799		0%	0	3,799						
POLYNESIAN CULTURAL	89		0%	0	89						
PRECISION MOVING & S	43	29	40%	17	25						
PROPULSION CONTROLS	2		0%	0	2						
PUNAHOU SCHOOLS	190		0%	0	190						
PW 2 SPECIALIST	3		0%	0	3						
QUALITY PUMPING & MA	18		0%	0	18						
R H S LEE INC	324		0%	0	324						
R M MANAGEMENT	2		0%	0	2						
RACOMA ANTHONY	3		0%	0	3						
RAINBOW CONTINUOUS G	2		0%	0	2						

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		Commercial				Residential				Convenience Center	
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RAINBOW ROOF MAINTEN	0		0%	0	0						
RAMOS, ROMMEL S	2		0%	0	2						
RANDY'S CARPET	0		0%	0	0						
RELIABLE HAULING & R	218		0%	0	218						
RELIABLE SERVICE & G	22		0%	0	22						
RENT-A-CENTER DILLIN	6		0%	0	6						
RENT-A-CENTER-WAHIAW	0		0%	0	0						
RENT-A-CENTER-WAIANA	1		0%	0	1						
RENT-A-CENTER-WAIPAH	1		0%	0	1						
RESTAURANT EQUIPMENT	10		0%	0	10						
REY'S CONSTRUCTION	2		0%	0	2						
ROBERTS TOUR & TRANS	0		0%	0	0						
ROLLOFFS HAWAII	30059	54,913	65%	19,426	10,633						
ROSS' APPLIANCES & F	180		0%	0	180						
RRR RECYCLING SERVIC	74	218	75%	55	19						
S & D INC	1		0%	0	1						
S & S DELIVERY INC	14		0%	0	14						
S M P ENTERPRISES IN	1		0%	0	1						
S W & SONS INC	1		0%	0	1						
SALVATION ARMY	2159		0%	0	2,159						
SAN CONSTRUCTION LLC	22		0%	0	22						
SCALE - HOMEOWNER	423		0%	0	423						
SCALE-ELEEMOSYNARY	358		0%	0	358						
SCHRADER REALTY	1		0%	0	1						
SCOTTY'S CLEANING	1		0%	0	1						
SD SYSTEMS INC	231	653	74%	171	60						
SEDAN-ELEEMOSYNARY	7		0%	0	7						
SEDAN-HOMEOWNER	0										
SERTA MATTRESS CO	5		0%	0	5						
SHAFERS ROOFING	3		0%	0	3						
SHERATON MOANA SURF	1		0%	0	1						
SHIMMON RICHARD K	1		0%	0	1						
SHINCO MANAGEMENT IN	77		0%	0	77						

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SHIROKIYA	2		0%	0	2						
SHRED-IT	2		0%	0	2						
SIMMONS CO	5		0%	0	5						
SRG FIRE SERVICES	1		0%	0	1						
STATE- DLNR-WATER &	5		0%	0	5						
STATE-CENTRAL SERVIC	104		0%	0	104						
STATE-DOE-FACILITIES	9		0%	0	9						
STATE-DOE-OPERATIONS	47		0%	0	47						
STATE-HARBORS DIV-OA	263	449	63%	166	97						
STATE-HIGHWAYS DIVIS	80	21	21%	17	63						
STATE-HOUSING & COMM	275		0%	0	275						
STATE-MALUHIA HOSPIT	0		0%	0	0						
STATE-PARKS DIVISION	19		0%	0	19						
STATE-SURPLUS PROPER	4		0%	0	4						
STERLING'S CARPET	4		0%	0	4						
SUGARLAND FARMS INC	95		0%	0	95						
SUN INDUSTRIES INC	3		0%	0	3						
TAJIRI DEMOLITION &	210		0%	0	210						
TG HAULAWAY LLC	36	84	70%	25	11						
THE CHERRY COMPANY L	1		0%	0	1						
THE OFFICE DOCTOR IN	5		0%	0	5						
THE STORAGE ROOM	56		0%	0	56						
THURSTON PACIFIC INC	14		0%	0	14						
TNT EQUIPMENT RENTAL	52		0%	0	52						
TOM'S SEAFOOD LLC	1		0%	0	1						
TONYS LANDSCAPE & TR	5		0%	0	5						
TR SYSTEMS LLC	923	2,274	71%	656	266						
UH-CAMPUS OPERATIONS	388	1,123	74%	289	100						
UH-WINDWARD COMM COL	1		0%	0	1						
UNITEK SOLVENT SERVI	2691		0%	0	2,691						
UNIVERSAL MANUFACTUR	43		0%	0	43						
US-AAFES HAWAII ATTN	2		0%	0	2						
US-DIR OF RESOURCE M	3		0%	0	3						

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US-DRMO HI OFFICER I	51		0%	0	51						
US-FISH & WILDLIFE S	0		0%	0	0						
US-HOMELAND SECURITY	0		0%	0	0						
US-NAVFAC HAWAII	2		0%	0	2						
US-NAVY SPINTCOM	1		0%	0	1						
VAKAUTA, ALEKISIO F	1		0%	0	1						
VIDEO VEND INC	7		0%	0	7						
W D I CO	10		0%	0	10						
W GAYLORD & SONS MOV	40		0%	0	40						
WAHIAWA CONVENIENCE	5940									0	5940
WAHINE BUILDERS	3		0%	0	3						
WAIANAE COAST COMPRE	2		0%	0	2						
WAIANAE CONVENIENCE	5812									0	5812
WAIMANALO CONVENIENC	110									0	110
WAIPAHU CONVENIENCE	10493									0	10493
WATERHOUSE INC	0		0%	0	0						
WAYNES CARPET HUT	286		0%	0	286						
WEBCO HAWAII INC	14		0%	0	14						
WESTPAC INTERNATIONA	109	168	61%	66	43						
WOOD SHAVINGS & SUPP	1566		0%	0	1,566						
WORLD WIDE MOVING &	11		0%	0	11						
YAMATO TRANSPORT USA	2		0%	0	2						
YAN MING REN	0		0%	0	0						
YOUNG, D W SERVICES	0		0%	0	0						
Total actual waste disposed of at WGL					**191,677**				**116,791**		**29,199**
Total typical waste at WGL with no H-Power Diversions					**114,298**				**40,367**		**29,199**
Total diverted waste to WGL during H-Power closure					**77,379**				**76,424**		**0**