Appendix A

WASTE CHARACTERIZATION STUDY

April 3, 2007

Via E-mail

Frank Doyle
Wilma Namumnart
Department of Environmental Services – Refuse Division
City and County of Honolulu
1000 Uluohia Street, Suite 212
Kapolei, Hawai‘i 96707

Subject: **Final Report - 2006 Waste Characterization Study**

Dear Mr. Doyle and Ms. Namumnart:

Attached for your use is the Final Report for the 2006 Waste Characterization Study. The report was prepared to provide a detailed account of field activities and data analysis methodologies that were completed and to present results and findings. The attached report incorporates your review comments which were received via email on April 2, 2007.

Waste characterization is comprised of a waste stream composition profile by material types (i.e. paper, plastic, etc.) and corresponding solid waste weight estimates that can be used to evaluate the current solid waste management system and assist in determining future program improvements. In this study, characterizations were provided for the waste materials received at each solid waste facility - H-POWER and Waimanalo Gulch Landfill. Additionally, residential (i.e. collected by City crews), commercial (i.e. business, industry and institutions), and convenience center waste streams were characterized and evaluated. The quantities of beverage containers that require deposit upon purchase (i.e. HI-5 containers) were also estimated within each disposed waste stream. The results of this study were compared with the data presented in the previous 1999 Waste Composition Study to identify potential changes in the waste stream.

R. W. Beck completed field sorting of a statistically significant number of samples from September 11 to September 21, 2006 for H-POWER and Waimanalo Gulch waste streams. These activities provide the basis for the composition profiles developed for each waste stream. The waste estimates presented within this report are based on materials received during Fiscal Year 2006, from July 1, 2005 to June 30, 2006. The report includes an Executive Summary for reference.

Please let us know if you have any further questions. We appreciate the opportunity to provide these services.

Sincerely,

R. W. BECK, INC.

Paul T. Johnson, P.E.
Project Manager

Robert W. Craggs
Vice President

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Final Report

2006 Waste Characterization Study

City and County of Honolulu

April 2007

R·W·BECK

List of Tables

List of Tables (continued)

List of Figures

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.

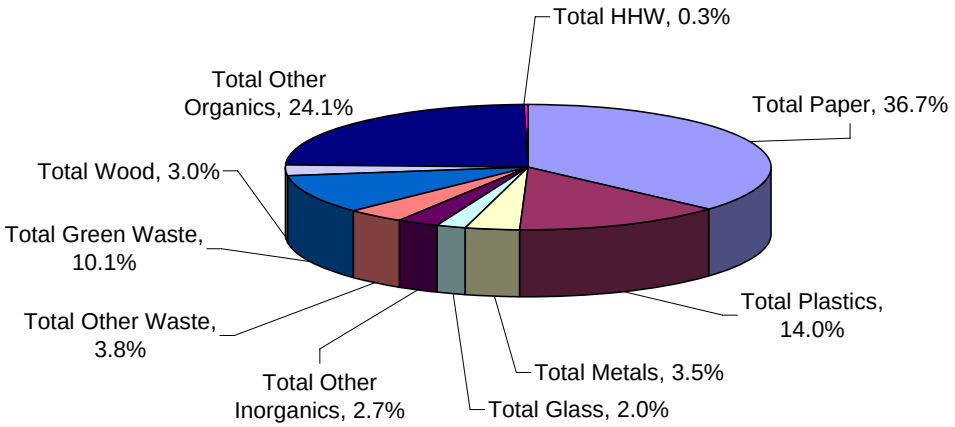
During the processing of waste at H-POWER prior to combustion, a significant amount of residue material is removed from the waste stream. The residue is not desirable for combustion and consists of an indeterminate mixture of fines typically smaller than 3 inches, including dirt, paper, plastic, mixed 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

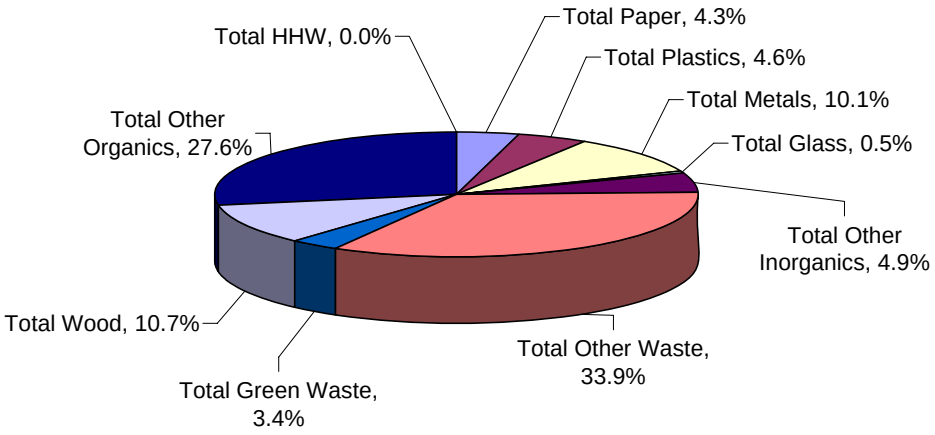


Table 3-2 presents detailed waste characterization results for the Waimanalo Gulch Landfill material composition. R. W. Beck did not sample and sort samples of wastewater sludge or autofluff that was received at the Landfill because the material within each truckload was entirely homogeneous. These material 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**	

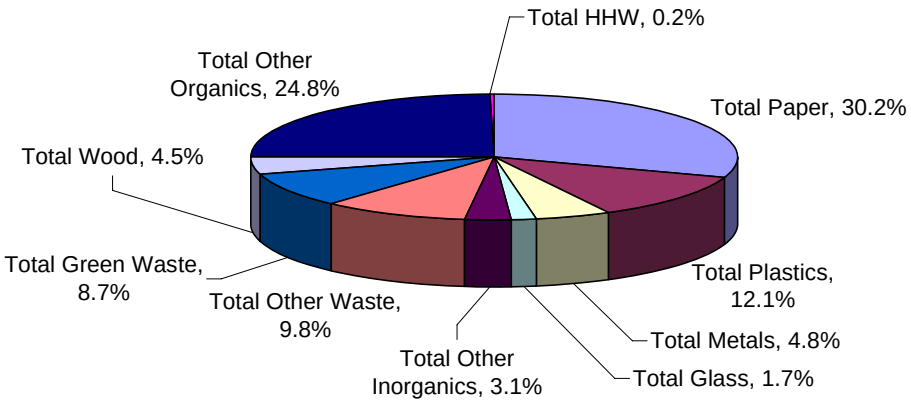
(1) There was no auto fluff or sludge in the samples sorted for this study. As such, standard deviation and the lower and upper bounds of the confidence interval are not applicable. The Waimanalo Gulch Landfill is known to accept auto fluff and sludge and therefore the average composition for these materials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

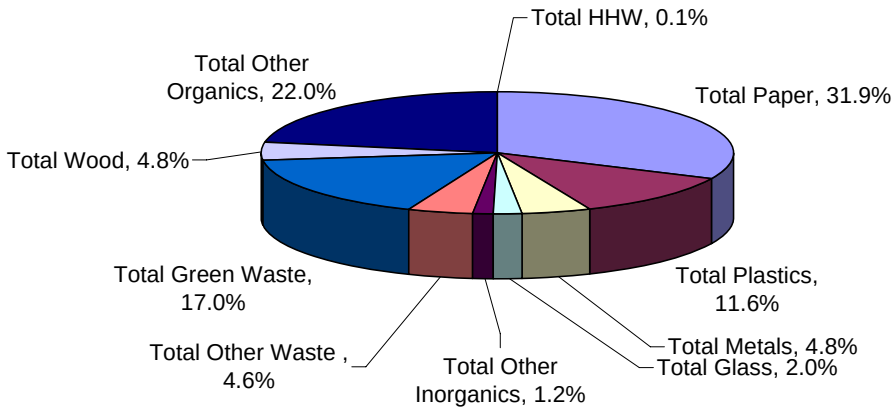


Table 3-5 presents detailed waste characterization results for the residential waste stream of the City and County of Honolulu.

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

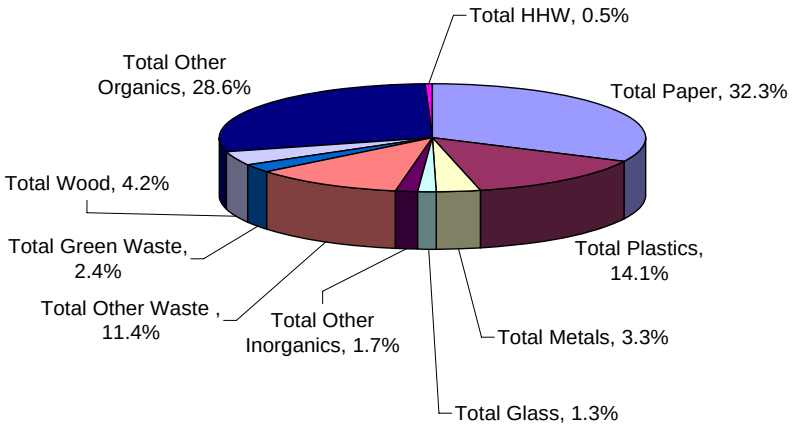


Table 3-7
Aggregate Commercial Waste Characterization Results - 2006

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

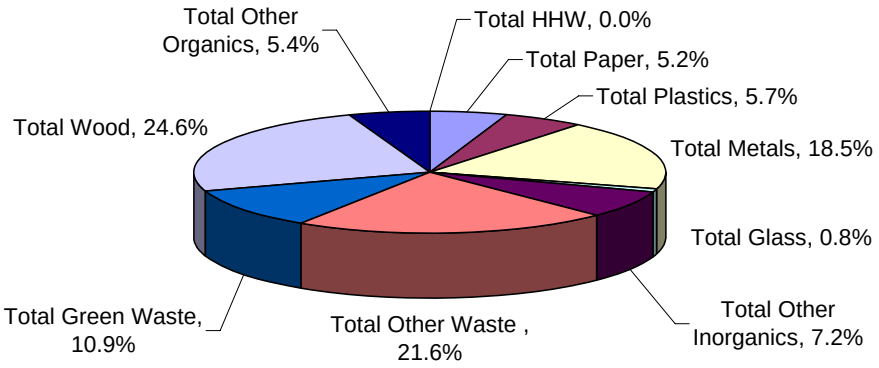


Table 3-9 presents detailed waste characterization results for the convenience center waste stream of the City and County of Honolulu.

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						

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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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		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
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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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						

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
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**

Appendix B
Examples Of State Electronic Waste Legislation

Appendix B
Examples Of State Electronic Waste Legislation

Examples of State Legislation

State	Type Of Law	Status as of 7/11/06
Arkansas	Arkansas Computer and Electronic Solid Waste Management Act, enacted 2001. Major provisions of the Act: Beginning Jan. 1, 2008, requires state agencies to develop and implement plans to manage and sell surplus computer equipment and electronics; encourages the donation of unsold equipment to Arkansas public schools; establishes a Computer and Electronics Recycling Fund; authorizes the Dept. of Environmental Quality to establish and implement rules and regulations banning the disposal of computer and electronic equipment in Arkansas landfills. Arkansas Act. 970, To Establish a Deadline for the Disposal of Computer and Electronic Waste in Landfills, and for other purposes, enacted 2005. Set deadline of Jan. 1, 2008 for disposal of computer and electronic waste in landfills; includes cell phones, cathode ray tubes and video game consoles.	Arkansas Computer and Electronic Solid Waste Management Act, enacted 2001. Arkansas Computer and Electronic Equipment Landfill Ban, enacted 2005.

Examples of State Legislation

State	Type Of Law	Status as of 7/11/06
California	This bill made California the first state in the country to impose an advance recovery fee ("Covered Electronic Waste Recycling Fee") on the sale of electronic products beginning July1, 2004. The measure requires retailers to collect a $6-to-$10 fee on cathode ray tube (CRT), liquid crystal display (LCD) and plasma devices, the price depending on size. The fees collected go into a fund to manage the recycling program. Manufacturers must submit a collection and recycling plan; retailers can retain 3% administrative fee; fines for non-compliant retailers. California Cell Phone Recycling Act makes it unlawful for a retailer to sell a cell phone after July 1, 2006, if the retailer does not have a collection, reuse and recycling program in place.	California Electronic Waste Recycling Act, enacted in 2003, amended in 2004. California Cell Phone Recycling Act, enacted 2004.
Illinois	Statute to amend the Environmental Protection Act. Creates the Computer Equipment Disposal and Recycling Commission. Requires that the Commission issue a report of its findings and recommendations related to the disposal and recycling of computer equipment on or before May 31, 2006, and beginning on May 31, 2007, evaluate the implementation of programs by the State relating to computer equipment disposal and recycling, and issue a report of its findings and recommendations on or before December 31, 2008. Effective immediately.	Report of recommendations was due May 31, 2006.

Examples of State Legislation

State	Type Of Law	Status as of 7/11/06
Maine	Beginning July 1, 2006, the landfilling or incineration of old computer monitors and television sets is prohibited. As of January 1, 2006, manufacturers were required to establish "consolidation centers" throughout Maine where towns can drop off the old computers and TVs they collect from residents. From there, manufacturers are responsible for the shipping and safe recycling of the equipment that carries their brand name. Towns may choose to opt-in or out of the system, and may charge a small "drop-off" fee to cover the costs of temporary storage and shipping to the consolidation centers. In 2004, Maine became the first state in the nation to hold manufacturers responsible for safely collecting and recycling obsolete computer monitors and televisions.	Laws enacted in 2003 and amended in 2005.
Minnesota	Cathode-ray tube prohibition. Starting July 1, 2006, CRT-containing devices are banned from landfills and need to be recycled by businesses and households. Many municipalities have established collection systems. Some retail stores provide recycling services.	Took effect 7/1/06

Examples of State Legislation

State	Type Of Law	Status as of 7/11/06
Washington	By Jan. 1, 2009, computer and television manufacturers must provide free recycling of their products throughout the state. The service will be available to households, small governments, small businesses and charities. (Large businesses must pay for recycling.) Starting Jan. 1, 2007, any individual or company that manufactures or assembles computers or televisions must label those products with a brand name in order for them to be sold in or into Washington. Each qualifying electronic-product manufacturer must be registered and pay State fees.	Enacted in 2004.

Appendix C

TRANS-SHIPMENT OF WASTE ANALYSES

MARCH 2007

Preliminary Analysis for Long Haul Export of Plastic-Wrapped MSW Bales from O‘ahu to the Mainland

City and County of Honolulu

R·W·BECK

Why City & County is Considering Long Haul Export?

- Additional processing and disposal capacity are needed in the near and intermediate term
- Cost comparison of long haul option as compared to existing processing and disposal may be relevant

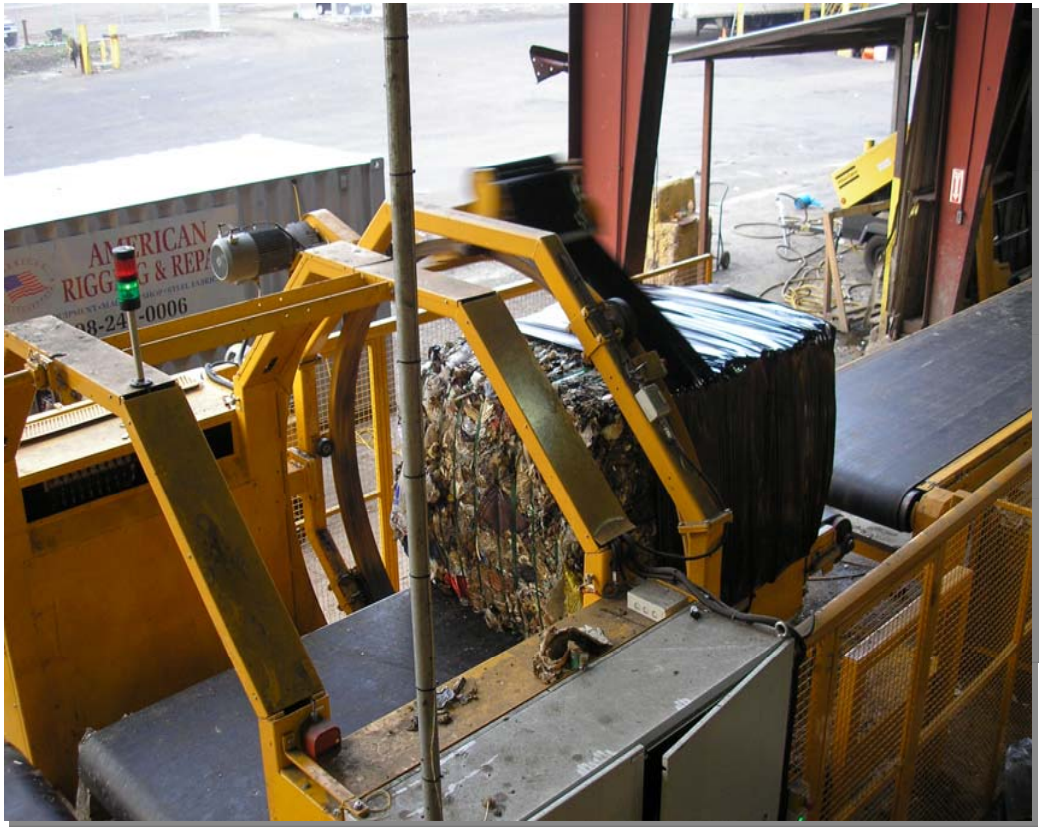
Why did the City & County previously consider this option?

- USDA Animal and Plant Inspection Service (APHIS) is the responsible federal agency
- Completed environmental assessment in May 2005
- Issued regulations in August 23, 2006 that were effective September 22, 2006

What does the regulation address?

- Addresses MSW
- Excludes yard & agricultural wastes
- Addresses particular pest risks or environmental hazards
- Requires baling, plastic wrapping, safeguarding, & proper landfilling

Plastic Wrapping MSW Bales



Risks & Limitations with Long Haul Export

- Limited port capacity on O‘ahu
- Inclement weather
- Labor strikes
- Breaking & spillage of bales
- Federal and out-of-state regulatory oversight
- Increased greenhouse gas emissions

Shipping Basis for the Analysis

- Transport & dispose 600,000 tons per year
- City & County owns new baling facility
- Private firm operates baling facility
- Locate in Campbell Industrial Park
- Maintain existing transport network
- Use break-bulk shipping of double-plastic-wrapped bales
- Use nearby Kalaeloa/Barbers Point Harbor
- Load on cargo barge for ocean line haul

Receiving Basis for the Analysis

- Cargo barge received Port of Portland, OR
- Loaded on flatbed trailers
- Over the road transport to Roosevelt, Klickitat County, Eastern WA
- Unloaded from trailers for disposal
- Tipping of bales not allowed
- Disposal at Roosevelt Regional Landfill

Long Haul Transport – How Far?

- Barbers Point Harbor to Port of Portland, OR – 2,600 miles
- Port of Portland, OR to Roosevelt WA – 300 miles

Loading Wrapped MSW Bales

Basis for Cost Analysis

- 1.9 tons per bale
- 13 bales per trailer to port
- 3,600 bales shipped per barge
- 2 barge deployments per week
- 17 bales per trailer from port
- 212 truck roundtrips per barge to landfill

Long Haul Export
Schedule and Cost Estimate Summary

Activity	Elapsed Days	Cost Range ($/ton)	
Baling	0	$ 11.93	$ 13.04
Loading Flatbed Trailers	1-3	$ 2.37	$ 2.37
Bale Transport to Port	1-3	$ 3.25	$ 3.25
Loading Flatbed Trailers at Port	1-3	$ 2.37	$ 2.37
Loading Barge	4-5	$ 13.59	$ 13.59
Port Equipment Rental	-	$ 4.28	$ 4.28
Barging [1]	6-19	$ 100.00	$ 120.00
Unloading Barge	20-21	$ 13.59	$ 13.59
Port Equipment Rental	-	$ 4.28	$ 4.28
Loading Flatbed Trailers	21-23	$ 2.37	$ 2.37
Bale Transport to Landfill	21-23	$ 29.42	$ 29.42
Landfill Disposal [2]	21-23	$ 36.26	$ 77.70
Contingency (10-20%)	-	$ 21.18	$ 54.64
TOTAL	**23**	**$ 245**	**$ 341**
Note: [1] Backhaul would reduce barging cost by 20%.			
[2] Large range reflects uncertainty as to contract rate to be offered for disposal.			

Conclusions – Long Haul Export

- Not economical compared to O‘ahu-based options
- Needed O‘ahu port improvements may limit deployment schedule
- Delays in activities sequence would adversely impact optimized schedule
- Less control than O‘ahu-based options
- Increased environmental impacts

Appendix C
TRANS-SHIPMENT OF WASTE ANALYSES

Provided below is the executive summary and feasibility study completed by Transportation-Logistics Consulting and Mainline Management, Inc., at the direction of R. W. Beck, Inc. This analysis was used as a basis for text included in the Plan. However, please note that the results included in the Plan have been adjusted to reflect a wider per ton cost range to provide the trans-shipment of MSW based on further analysis by R. W. Beck, Inc.

C.1 Executive Summary

Local cargo handling practices and industry interviews serve as the basis for the background data, analysis, and conclusions arrived at in this feasibility report.

Containerized cargo handling typically less costly than other marine transportation modes proved not to be in this case. The multiple handling of the bales combined with equipment repositioning costs proved more costly than break-bulk movement of the bales.

Break-bulk ocean barge transit from Oahu, Hawaii through the Port of Portland, OR combined with transloading of the bales to over the highway maxi-flatbed truck offered the lowest cost alternative for moving the MSW bales to the landfill at Roosevelt, Washington. The primary factors influencing this decision were:

- The receiving parameters outlined by the Roosevelt Regional Landfill management requiring the bales to be received on flatbed truck so "special handling procedures" were employed in compliance with USDA, Animal and Plant Health Inspection Service regulatory guidelines.
- Container alternatives reduced multiple bale handling but proved "too costly an alternative", given the lack of "door-to-door" container delivery and inability for "tipping" of containers at the landfill site.
- Costly equipment repositioning costs incurred when returning containers empty to Hawaii.
- Economics for intermodal rail line haul proved too costly, given minimal distance (150 miles one way) and equipment repositioning costs.
- Limited Burlington Northern Santa Fe railroad intermodal transloading locations required for handling MSW containers necessitated additional trans-loading costs.
- An empty barge in the Pacific Northwest not needing to reposition empty containers back to Hawaii presented a greater opportunity and flexibility for

generating "backhaul" cargo opportunities to Hawaii, would be a factor in negotiating lower "head haul" barge rates for the MSW bales.

- Break-bulk increases the number of Pacific Northwest receiving port candidates and opportunities for negotiating competitive rates, when container handling is not a requirement.

The break-bulk handling of the MSW bales is a more labor intensive transportation mode than containerized and has a greater exposure for bales to be damaged during the multiple handling; however it reflects the lowest cost per ton economics when equipment repositioning is taken into account and meets the landfill "bales on flatbed equipment" receiving requirement at the landfill.

Provided below are the basic logistical elements and economics in the break-bulk movement of the bales from Oahu, Hawaii to the Roosevelt Regional Landfill.

- Three days are allotted to move the bales from the MSW baling site on Oahu to the staging area on the barge terminal where the bales will be loaded. An estimated cost for this phase of the move is $7.37 per ton.
- Two days are allotted for loading the estimated 6,840 tons [3,600 bales] on to the barge. Naturally loading can commence as soon as there is sufficient bales staged to allow for a full shift of stevedore production. Four shifts; day shift [0800-1700 hours], night shift [1800-0200 hours], hoot shift [0300-0800 hours], day shift [0800-1700 hours] at an estimated cost of $13.59 per ton is projected for the barge stevedoring.
- The barge sailing time is projected to take 14 days to the Port of Portland. Cost for the ocean line haul portion is estimated at $120.00 per ton. It is anticipated that the barge service provider will be able to market this regular barge deployment and secure backhaul cargoes destined for Hawaii. As the service experiences a load balance in each direction, the economics should provide for a pricing reduction to the head haul rates.
- Similar to the stevedoring that occurred in Hawaii, two days are allotted for unloading the estimated 6,840 tons to the first place of rest on the dock at the Port of Portland. As soon as sufficient bales are staged, yard labor can commence reloading the bales to over the road flatbed trailers. A combination of four shifts is estimated at the estimated cost of $13.59 per ton for stevedoring.
- The loading of the bales to over the road flatbed equipment is expected to be accomplished over three days at a cost of $2.37 per ton. Staging empty flatbeds and loading at night, for dispatch to Roosevelt early in the morning would allow daytime unloading at Roosevelt and the return dray of the empty equipment back to the port area for evening loading.
- The over the road driver is expected to make a 300-mile round trip, Port of Portland to Roosevelt Regional Landfill and return within eight hours including the time for off loading of 17 bales at the landfill. The trip cost is $950 round trip, approximately $29.42 per ton. Two hundred and twelve roundtrips are necessary over three days to move the 3,600 bales to the landfill.

- At the landfill sufficient manning and equipment will need to be established by the landfill operator to offload the bales from 71 flatbeds daily and place the bales in the landfill. Costs for the storage of the MSW bales and handling are projected to be $77.25 per ton. Coordination and hours of operation will need alignment to support a six-day-per-week operation.
- Even with a 20% to 25% reduction in the ocean line haul rates per for backhaul adjustment, the estimated rolled up cost per ton of the principal transportation steps, costs are in the $300 to $325 per ton range. A 20% contingency is reflected in these numbers for miscellaneous other associated port charges that are reflected in the operating tariffs.

C.2 Analysis: Break-Bulk Movement Of Plastic Baled Municipal Solid Waste From Oahu, HI To Roosevelt, WA Landfill

C.2.1 Charter

Transportation-Logistics Consulting, (TLC) and Mainline Management, Inc., (MLM) were retained by R.W. Beck, Inc. to investigate the handling, transport, and economic feasibility for transporting 600,000 tons of plastic-wrapped municipal solid waste (MSW) bales by barge annually from Oahu, Hawaii to Roosevelt Regional Landfill in Eastern Washington.

In preparing this report, the team of TLC and MLM used their best professional judgment to narrow the review to ports, terminal facilities, and connecting carriers deemed to best possess the handling and infrastructure capabilities necessary to support a viable container-on-barge, door-to-door service to the Roosevelt, Washington landfill.

C.2.2 Project Overview

Two federal studies said the proposed double-plastic-wrapped MSW bale shipments to Washington posed low risks of environmental harm and pest contamination if handled appropriately. The U. S. Department of Agriculture (USDA), Animal and Plant Inspection Service (APHIS) amended regulations to allow barging MSW compressed into bales wrapped in airtight plastic from Hawaii to landfills in the Mainland United States. APHIS issued the final regulations in August 23, 2006 that were effective September 22, 2006.

At least two Pacific Northwest waste haulers have proposed baling Hawaiian MSW and barging it to Pacific Northwest landfills.

One proposal projected MSW barge movements would be economically feasible by offsetting costly “head haul” barge movements used to bring mainland construction materials to Hawaii by replacing costly empty “backhaul” movements with revenue producing containerized MSW barge backhauls.

C.2.3 Considerations

This review looked at various transportation modes for moving compressed plastic-wrapped bales of MSW in containers on container ships and barges from Kalaeloa/Barbers Point Harbor, Hawaii to the Roosevelt Regional Landfill, Roosevelt, WA site and returning to Oahu.

Initial investigation focused on consolidating the wrapped bales in containers to reduce the number of physical handlings of the bales. However, physical handling limitations at the Roosevelt Regional landfill site along with railroad site constraints,

repositioning costs, and associated findings [**EXHIBIT A-1 and A-2]** redirected the feasibility review to focus on the break-bulk handling of the wrapped MSW bales.

- The number of vessels using Barbers Point Harbor has increased considerably in the last year, with numerous reporting identifying many ships and barges without a place to unload.
- The Department of Transportation for the State of Hawaii in their 2020 Master Plan describe current and projected land requirements for cargo handling are greater than what is available and handling efficiencies will continue to be constrained.
- Seventy percent of the State's maritime cargo activity is attributed to Oahu's commercial harbors, receiving consolidating and distributing overseas cargo shipments. Oahu also caters to passenger, fishing operations, and countless requests for additional accommodations. Although the 2020 Master Plan identified requirements for ocean cargo carriers needed to be given priority, the Hawaii Harbors Users Group noted cargo operations experienced additional handling costs because cruise ships were given priority.
- Container shipments in the Barbers Point Harbor are projected to displace other cargo activities and the State Planning Committee agreed in the 2020 Master Plan that the State is not responsible for the development of any foreign MSW disposal handling facility site. No capital improvements are planned or budgeted to support this type of activity.
- Dedicated berthing, storage/handling, or private contracted service operator has not yet been identified.
- This review assumes that MSW bale staging and barge stevedoring will be accomplished at the Kalaeloa dock near Barbers Point Hawaii served by Northland Services Marine Transportation or Sause Brothers Tug and Barge.

C.2.4 Operating Overview

- Barge operator(s) and associated barge deployment schedules will be a product of MSW bale volumes, "backhaul cargo" opportunities and port "turn time" experience for each barge operator. "Turn times" are influenced by stevedoring activity, cargo availability, equipment breakdowns, weather, etc.
- This review, assumes a deployment encompassing two barge calls per week, carrying 7,000 short tons (3,600 bales) per barge in order to move 600,000 tons annually. Although cargo backhaul opportunities are expected that could reduce unit cost saving by as much as 20 to 25 percent, the analysis did not consider their impact on port turn times, handling, and water and land carriage rates.
- Barge deployment assumed a 14-day ocean transit time and 2-day port time. Northland Services Marine Transportation, who currently is working in the Hawaiian trade route, suggested the deployment projection.
- For this review, the labor manning necessary to handle the truck gate receiving functions, and yard grounding, and loading is considered in addition to the ports

daily yard compliment of employees for this activity, manning is hired at port tariff rates and cost reflected in the overall handling cost per ton.

- Barge manning for loading/unloading activity is assumed to be provided through a competitive bid process from amongst local stevedores, at rates similar to those identified in the Portland port tariff.
- Staging of 3,600 bales [1.9-ton bales, 45"W x 47" H x 51"L] adjacent to the berth, given USDA handling guidelines outlined in the May 2005 Environmental Assessment for movement of plastic-wrapped MSW bales, suggests rows of bales stacked no more than three high, handled by forklifts with lift arms or paddles.
- Operators will pick bales to load from the berth [waterside] of the row with shuttle drivers delivering bales on flatbeds being offloaded and grounded from the opposite side of the row. Traffic patterns of each operation require maintaining separation.
- No cross traffic of shuttle drivers with vessel-side operations.
- A minimum block stow ground footprint requirement to hold a barge load of 3,600 bales appears to be around 300 feet long by 70 feet deep [225 bale rows times 16 rows], excluding equipment access lanes and handling areas.
- **OAHU YARD STAGING** - Assuming 3,600 bales is required to load out twice weekly, 1,200 bales would need to be received and grounded each day at berth side.
- Thirteen bales per flatbed truck generate 92 flatbed deliveries daily.
- Twelve trucks per hour average would be loaded at the port facility.
- Unloading and ground stacking is projected to take three yardmen [longshoremen] operating 5-ton forklifts with "squeeze attachments" and masts to raise 1.9 tons ten feet in the air, block stacking the bales. Each forklift would handle an average of 31 trucks in a standard 8-hour shift. [**EXHIBIT B]**
- **OAHU BARGE LOADING** – Loading 3,600 bales is projected to require four shifts (day, night, hoot, and day) minus breaks, approximately 26 production shift hours. Two gangs, one starting forward, one starting aft, working either by forklifts driving on to the barge via a ramp or by utilizing shore-side mobile cranes.
- Distance to travel and production per hour will determine the number of laborers and forklift operators required for each gang. Each gang will need to average 70 to 75 bales loaded per hour for 26 hours in order to meet the load out requirement. If necessary, the deployment schedule may require manning levels.
- Minimum key manning projected: Shore cranes [two crane operators] lifting four bales per crane lift at a rate of no less than nineteen lifts per hour. Two forklift drivers per gang feeding two bales each at each interval to the crane every 3 minutes from the place of rest [trap zone] on the berth face. In addition, one to two forklift operators are required for repositioning bales from the yard-staging block stow to the trap zone as distances traveled increases as loading proceeds.

To position the bales on the barge a minimum of two forklift operators per gang are necessary, which could increase depending on the barge load profiles.

- Projected manning does not account for management staffing or additional support manning required under local work rules.
- Each port may also have other charges associated with varied cargo types that will need to be taken into consideration. [**EXHIBIT C]**

C.2.5 Pacific Northwest Ports

Washington and Oregon port characteristics were reviewed to identify existing port infrastructure, cargo handling equipment, and competitive economics to receive and handle MSW in containers.

The review produced three possible candidates. Washington Ports of Longview and Vancouver, and the Port of Portland, OR possess the physical attributes (i.e. dock length, berth depth, yard space, truck access, barge experience, labor availability and the shortest dray distance) to handle the projected volumes of baled MSW. Because of the projected number of over the road truck drivers needed and the distance to the landfill, the Port of Portland is selected as the most likely receiving port to model in this feasibility review.

However, further investigation showed container handling is economically not feasible because of multiple handling requirements and the cost of empty repositioning of equipment.

The most economically feasible alternative, break-bulk loading of bales to a barge, requires a greater number of individual unit handlings, but avoids costly transloading, repositioning of equipment, added drayage costs, and improves backhaul opportunity through a greater number of port candidates.

- **BARGE UNLOADING PORT OF PORTLAND** – The unloading operation is the reverse of the barge-loading scenario.
- Two gangs, one starting forward on the vessel, one starting aft, are working either by forklifts driving onto the barge via a ramp or by utilizing a shore-side mobile crane. Additional forklift operators will be required for repositioning bales from the first place of rest on the berth after unloading to the yard-staging block stow location where loading onto outbound over the road tractor-flatbed trailer will take place.
- **[EXHIBIT C]**
- **OUTBOUND LOADING AT PORT OF PORTLAND -** Outbound flatbed truck loading are accomplished by yard manning hired daily to perform loading of the bales onto flatbeds.
- The flatbed loads are expected to be secured by the over the road trucker.
- Assuming 3,600 bales will be required to load out twice a week, 1,200 bales are loaded each day, 13 bales per standard flatbed truck, generating 92 flatbed loads daily out the gate to the Roosevelt landfill.

- However, 53-foot maxi-flatbeds are recommended, similar to those used by Mitchell Brothers Trucking in Portland, with a 65,000-pound load capacity, capable of handling 17 bales per flatbed load, reducing the number of trips to 71 loads daily.
- Three yardmen [longshoremen] operating 5-ton forklifts with "squeeze attachments" handling an average of 24 trucks in a typical 8-hour shift. Two hundred and twelve over the road trips would be required to move the 3,600 bales to the landfill [**EXHIBIT B]**.
- If the volume level of outbound handling and transportation is not maintained, the bale staging area will require expansion resulting in additional wharf demurrage and incurred handling charges. It can also require repositioning of bales to make room for the next arriving barge unloading and staging.
- **TRUCKING** – Sufficient truck driver availability to handle the projected volume of activities is assumed.
- Local trucker feedback suggests the availability demand for 71 to 93 drivers on a daily basis to haul MSW bales to the Roosevelt Regional Landfill may require a contracted service or in-house contract arrangement.
- Pacific Northwest owner or operator driver/equipment availability fluctuates on a daily basis, given the number of economic variables used by the drivers in their load selection.
- Of the three Pacific Northwest ports, the Port of Portland has a greater level of activity and is geographically closer to the landfill, suggesting a better opportunity for truck driver availability.
- Maxi-flatbeds capable of carrying the projected maximum cargo weights have a current rate of $100 per hour in the local Portland area.
- A prominent and very price competitive flatbed trucking company advised they had previously quoted others for this exact same move.
- The quote for moving these bales is $3.16 per mile or approximately $950 per load, roundtrip. They also mentioned from their initial investigation of this move, that environmental concerns were raised about "leaching" from the compressed bales, which created an environmental concern for the truckers.
- Truckers stated additional equipment cleanup costs were not included in this proposed cost per mile.
- Estimated one way minimum mileage and driving time projected:
- Port of Portland to Roosevelt, WA approx. 140 miles 3 hours
- Port of Vancouver to Roosevelt, WA approx. 145 miles 3 hours
- Port of Longview to Roosevelt, WA approx. 182 miles 4 hours
- Projected cost per mile is estimated to be a minimum of $3.16/mile roundtrip.
- The Portland/Roosevelt average round trip cost projected to be $950 - $1,000.

- Since sustaining such a large daily truck driver pool will be quite difficult, it is recommended seeking appropriate government agency and landfill operator relief as soon as possible for allowing the employment of more practicable handling methodologies, such as slinging bales into open top rail/gondola cars or road equipment that can be tipped. **[EXHIBIT D]**
- This may add some additional handling costs but would reduce the trucking pool size, line haul expenses, and accidental road damage risk.
- **ROOSEVELT REGIONAL LANDFILL** – Property covers an area of 2,545 acres, has a 120-million-ton capacity and a 40-year expected waste-receiving life**.**
- The largest private landfill in the state, solid waste comes in shipping containers, mostly via rail from the Seattle area, to an intermodal yard in Roosevelt (owned by the same privately held waste company – Rabanco, which is owned by Allied Waste).
- Containers are loaded onto trucks for hauling up the hill to the landfill, and then emptied by tippers that upend the container or trailer assembly. MSW also arrives from a network of nine intermodal yards that connect the landfill to sources as far away as California and Alaska.
- Solid waste is filled into "cells" and covered daily with soil to eliminate odors and litter. The current operating hours for the landfill are Monday thru Saturday 7:00 a.m. to 3:00 p.m., closed Sundays. To accommodate the expected number of drivers arriving from the Port of Portland with loaded flatbeds, the landfill would need to expand its operating hours.
- Coordination of the ports flatbed loading and drive time along with dedicated lanes and establishing of preferential forklift unloading for these trucks would certainly help to control wait times and the extent of daily hours of operation.
- The MSW bales would fall under the Special Waste category at the landfill; ***"Material that, because of physical characteristics, chemical makeup, or biological nature requires special handling procedures and permitting, or pose an unusual threat to human health, equipment property or the environment."***
- A cost of $75.00 per ton plus 3.6% Washington State Refuse Tax is charged for tipping when the customer delivers directly to the Roosevelt landfill per the Rabanco Website. At this published rate, a flatbed of 17 bales carrying 64,600 pounds (32.3 tons) would incur a charge for unloading and placement in the landfill of approximately $2,500 per load. [$146.78/bale]
- The handling cost at the landfill represents approximately 44% of the rolled up cost per ton **[EXHIBIT D]** and may be overstated.
- The landfill general manager stated pricing for this specific handling of bales on flatbed was not finalized, nor officially published yet.

C.2.6 General Conclusions

For this operation to be economically feasible, requires efficient, reliable, and cost effective handling of the bales at each link in the logistics chain.

High probability exists for initial cargo handling inefficiencies, trucker driver unavailability and opportunities for transit delays in the logistical chain. This can easily create additional storage demands and increased handling costs. The on dock storage capacity at the ports could easily become obstacles to efficiency if throughput delays occur.

Stevedore manning costs reflect like handling for similar commodities such as bales of paper and rags. These handling costs could easily increase significantly if additional longshoremen are necessary for the operation to maintain barge deployment sailing and/or delivery schedules due to delay by weather or equipment malfunctions.

The most significant handling constraint and obstacle in the feasibility and practicality for the proposed MSW movement to the Roosevelt Regional Landfill is not seen as the securing of competitive rates for berths, manning, special forklift handling, or hours of operation. A number of ports and stevedoring companies are ready to competitively bid for the work. Some have even suggested new capital projects for building new handling sites in their ports.

The requirements that bales arrive on flatbed equipment, non-tipping of the waste bales and limited landfill operating hours are additional negative factors.

Most likely, a dedicated line-haul dispatch operation will need to maintain a roster of drivers, along with appropriate flatbed equipment, to meet the daily over the road requirement for drayage.

The rollup costs reflected in **EXHIBIT D and E** project most but not all of the charges associated with the break-bulk handling of the bales. From these costs alone, it would appear that the projected cost of $325 per ton would make this move cost prohibitive.

The moving of these 1.9-ton bales approximately 150 miles from port of entry to the Roosevelt Regional Landfill by either road or rail modes reflects higher handling and equipment costs than typically seen for agricultural commodities, raw manufacturing materials, or finished products transportation.

Cost per Ton of Waste - Various Combinations*

Portland T6 to Roosevelt

Line Haul Cost per Ton $ 3.37
Margin 35%

		Switching Per Ton		
		Low	**Medium**	**High**
	$ per ton:	$ 0.68	$ 1.05	$ 1.35
Cars - Low	$ 1.90	$ 7.13	$ 7.50	$ 7.80
Cars - Med	$ 2.84	$ 8.07	$ 8.44	$ 8.74
Cars - High	$ 3.79	$ 9.02	$ 9.39	$ 9.69

* cost per ton does not include container cost

Cost per Ton of Waste - Various Combinations*

Longview/Kalama to Roosevelt

Line Haul Cost per Ton $ 4.52
Margin 35%

		Switching Per Ton		
		Low	**Medium**	**High**
	$ per ton:	$ 0.68	$ 1.05	$ 1.35
Cars - Low	$ 1.90	$ 8.68	$ 9.05	$ 9.35
Cars - Med	$ 2.84	$ 9.62	$ 9.99	$ 10.29
Cars - High	$ 3.79	$ 10.57	$ 10.94	$ 11.24

* cost per ton does not include container cost

Exhibit A-2
ASSUMPTIONS

1. Estimated each car having three wells, 12 twenty foot containers in each car.
2. Estimated Car Per Diem: Low - $50/day, Medium - $75/day, High - $100/day. Estimated two sets of 27 cars would be required to handle loads and empties, with 20% spare factor (total of 65 cars under control).
3. Switching Cost per Ton: Low – two shifts for every loaded train; Medium – three shifts for every loaded train; High – four shifts for every loaded train. Number of shifts included switch engine work that would be required to spot empty train for unloading, and any switching required for loading.
4. Line haul cost included crew, locomotive, fuel, maintenance, miscellaneous and track lease costs.
5. Line haul costs estimated from Portland's T6 facility assumed drayage from Vancouver, Kalama or Longview. Drayage cost was not included in estimate.
6. Line haul costs estimated from Longview/Kalama assumed Longview or Kalama developed the capability to unload containers from ships and the ability to unload/load containers to/from rail cars.
7. Line haul costs for Longview/Kalama assumed empty train was moved by one crew from Roosevelt to Vancouver, with a second crew taking the train to Longview/Kalama. The second crew was assumed to deadhead back to Vancouver. The loaded train was assumed to be handled by a crew deadheading to Longview/Kalama, then taking loaded train to Vancouver, where a second crew would take the train to Roosevelt.

EXHIBIT B
IN PORT YARD BALE HANDLING COST ESTIMATES

***** Basic manning and handling equipment at departure port for grounding bales in staging area from flatbed trucks. Port of Portland Terminal Tariff NO. 7

OAHU

			Qty	Cost/hr	3 -Shift	Total
Equipment	3	Five ton forklifts with "squeeze - attachments" capable of stacking 1.9 ton bales.	3	$ 25	$ 600	$ 1,800

			Unit	Shift	Barge	
Yard crew	3	Basic longshore Forklift operators	$ 704	$ 2,112		
	1	Yard foreman	$ 1,176	$ 1,176		
Gate	1	Checker	$ 624	$ 624		
Receipt	1	Clerk Supv.	$ 880	$ 880		
					$ 4,792	per shift
				Total	$ 14,376	
					$ 16,176	**Total**

3 Shifts @ 1200 bales per shift = 3, 600 bales
Estimate = $ 4.50/bale , $ 2.37/ton

***** Basic manning and handling equipment at receiving ports for picking-up bales from staging area and loading onto flatbed trucks.

PORTLAND

			Qty	Cost/hr	3 -Shift	Total
Equipment	3	Five ton forklifts with "squeeze - attachments" capable of stacking 1.9 ton bales.	3	$ 25	$ 600	$ 1,800

			Unit	Shift	Barge	
Yard crew	3	Basic longshore Forklift operators	$ 704	$ 2,112		
	1	Yard foreman	$ 1,176	$ 1,176		
Gate	1	Checker	$ 624	$ 624		
Receipt	1	Clerk Supv.	$ 880	$ 880		
					$ 4,792	per shift
				Total	$ 14,376	
					$ 16,176	**Total**

3 Shifts @ 1200 bales per shift = 3, 600 bales
Estimate = $ 4.50/bale , $ 2.37/ton

*** Rounded off POP Tariff No.7 manhour rates projected for both for both ports.**

EXHIBIT C
STEVEDORE MANNING & EQUIPMENT COST ESTIMATE

LABOR TO LOAD BARGE

(2) Gang operation estimated for Loading & Unloading plus Extra-men as needed.
Port of Portland Tariff No.7 projected hourly labor rates **only.**

Shift manning	QUANTITY	4-shifts UNIT COST	Total EXTENSION
Crane operator	2	$ 3,554	$ 7,108
Super cargo	1	$ 4,101	$ 4,101
Basic checker	2	$ 2,512	$ 5,024
Foreman [Lead,Dock, Lash)	3	$ 4,782	$ 14,346
Longshoreman-Skill Forkjlift Oper.	12	$ 2,871	$ 34,452
* Extra Stevedores/Lashers	12	$ 2,326	$ 27,912
* Finishing shift		Total	**$ 92,943**

LABOR TO UNLOAD BARGE

(2) Gang operation estimated for Unloading plus Extra-men as needed.
Port of Portland Tariff No.7 projected hourly labor rates **only.**

Shift manning	QUANTITY	4-shifts UNIT COST	Total EXTENSION
Crane operator	2	$ 3,554	$ 7,108
Super cargo	1	$ 4,101	$ 4,101
Basic checker	2	$ 2,512	$ 5,024
Foreman [Lead,Dock, Lash)	3	$ 4,782	$ 14,346
Longshoreman-Skill Forkjlift Oper.	12	$ 2,871	$ 34,452
** Extra Stevedores/Lashers	12	$ 2,326	$ 27,912
** Starting shift			$ 92,943

Labor cost projected for Loading/unloading =	**COST PER BALE =**	**$ 25.82**
	COST PER TON =	**$ 13.59**

Estimated stevedore equipment rental charge per Port of Portland Tarifff No.7:

Description	Quantity	Cost/hr	4-shifts (29hrs) Extension	
Cranes	2	$ 345	$ 20,010	
Misc. Stevedore Gear		$ 20	$ 580	
"5" ton Forklifts with Squeeze Attach.	12	$ 25	$ 8,700	
			$ 29,290	**Total**

Cost projected for equipment rental =	**COST PER BALE =**	**$ 8.14**
	COST PER TON =	**$ 4.28**

Labor & equip.rental rollup cost combined =	**COST PER BALE =**	**$ 33.95**
	COST PER TON =	**$ 17.87**

Estimate to purchase stevedore handling equipment:

Description	Quantity	Unit price	Extension	
Mobile Harbor Crane	2	$ 2,500,000	$ 5,000,000	
Misc. Stevedore Gear		$ 200,000	$ 200,000	
"5" ton Forklifts with Squeeze Attach.	12	$ 18,000	$ 216,000	
			$ 5,416,000	**Total**

EXHIBIT D
ROLLUP COST ESTIMATE FOR ONE BARGE HANDLING

					Barge [6,840t]
			Cost	Cost	Cost per ton
	Port	Activity Description	Per Bale	Per Ton	Extended
I.	Oahu	Load bales on flatbed at baling site	$ 4.50	$ 2.37	$ 16,210
	Ohau	Local Dray flatbed loads to Barge Terminal	$ 5.00	$ 2.63	$ 17,989
	Oahu	Receiving 3,600 bales at barge dock	$ 4.50	$ 2.37	$ 16,210
II.	Oahu	Loading Barge - (4 Shifts, 2 -days)	$ 25.82	$ 13.59	$ 92,955
		Port equipment rental	$ 8.14	$ 4.28	$ 29,275
III.	In Transit	14 day sailing time Oahu-Portland	$ 228.00	$ 120.00	$ 820,800
III.	Oahu	Unloading Barge	$ 25.82	$ 13.59	$ 92,955
		Port equipment rental	$ 8.14	$ 4.28	$ 29,275
IV.	Portland	Load bales onto flatbed trucks	$ 4.50	$ 2.37	$ 16,211
V.		Round trip truck haul to Roosevelt Landfill	$ 55.88	$ 29.42	$ 210,233
			$ 370.30	$ 194.90	$ 1,333,116
VI.	Roosevelt	Unloading (tipping chg.) @ landfill	$ 146.78	$ 77.25	$ 528,390
		Subtotal	$ 517.08	$ 272.15	$ 1,861,506
		20% Contingency			$ 344,941
				TOTAL	**$ 2,206,447**
		Average Cost per bale			**$ 612.90**
		Average Cost per ton			**$ 322.58**

One barge carrying 3,600 bales, 6,840 tons =	**$ 2,206,447**	**per trip**
Eight barges per month carry a total of 28, 800 bales =	**$ 17,651,576**	**per month**
88 barges per year carry approximately 600,000 tons =	**$ 194,167,336**	**annually**

Other Costs not Reflected:

Port, wharfage and miscellaneous charges not shown.

(See Port of Portland Tariff No. 7)

EXHIBIT E

BREAK-BULK CARGO - COST PER TON WORKSHEET

GIVEN:
- **>** 3,600 BALES PER BARGE, 7,000 TONS @ 1.9 TON PER BALE
- **>** BARGE DEPLOYMENT - 14 DAY TRANSIT PLUS 2 DAYS IN EACH PORT
- **>** 300 MILES ROUNDTRIP PORTLAND/ROOSEVELT REGIONAL LANDFILL
- **>** 212 FLATBED DRAYS- PORTLAND TO ROOSEVELT

LOCATION	ELAPSED DAYS	TOTAL DAYS	ACTION ITEMS	COST/TON	
OAHU	1 - 3		LOAD BALES ON FLATBED @ BALING SITE	$	2.37
	1 - 3	3	LOCAL DRAY OF BALES TO OAHU BARGE LOADING TERMINAL	$	2.63
	1 - 3		RECEIVING BALES AT OAHU BARGE OUTBOUND YARD	$	2.37
	4 - 5	2	BARGE BREAKBULK LOADING [STEVEDORING] @ OAHU	$	13.59
			PORT EQUIPMENT RENTAL	$	4.28
IN TRANSIT	6 - 19	14	* OCEAN LINEHAUL COST	$	120.00
PORTLAND	20 - 21	2	BARGE BREAKBULK UNLOADING @ PORT OF PORTLAND TO THE 1ST PLACE OF REST IN TERMINAL YARD	$	13.59
			PORT EQUIPMENT RENTAL	$	4.28
PORTLAND	21 - 22	2	BARGE UNLOAD/RELOAD HAWAII BOUND CARGO		X
IN TRANSIT	23 - 36	14	OCEAN LINEHAUL RETURN TO HAWAII [BACKHAUL ASSUMED]		
OAHU	37 - 38	2	BARGE UNLOAD/RELOAD PORTLAND BOUND CARGO		
PORTLAND	21 - 23	3	FLATBED LOADING @ PORT OF PORTLAND YARD	$	2.37
IN TRANSIT	21 - 23	3	OVER THE ROAD LINEHAUL TO ROOSEVELT LANDFILL	$	29.42
ROOSEVELT	21 - 23	3	ROOSEVELT LANDFILL FLATBED UNLOADING & BALE DISPOSAL	$	77.25
			20% CONTINGENCY	$	50.43
			ESTIMATED COST/TON	**$**	**322.58**
			**** CONSISTENT BACK HAUL CARGO OPPORTUNITY WOULD ALLOW REDUCING BARGE HEADHAUL RATES BY 20% TO 25% PER TON.***	***$***	***(20.00)***

ESTIMATED COST RANGE $300 - $325 PER TON

Appendix D

COMPARISON OF MATERIALS RECYCLING TO ENERGY RECYCLING STUDY

MEMORANDUM

To: Frank Doyle
Wilma Namumnart
Martin Okabe

From: Robert Craggs

Subject: **Final Report: Comparison of Select Materials and Energy Recycling Scenarios**

Date: April 3, 2007

Enclosed is the finalized report. We have incorporated the minor revisions we previously discussed. The following is a summary of the findings from the report.

- Managing wastepaper using both materials recycling (i.e., remanufacture into paper products) and energy recycling (i.e., H-POWER) yield environmental benefits. Both approaches reduce environmental impacts that would have occurred had the materials not been recycled for materials or energy recovery. Specifically:
  - Generating electricity from the combustion of wastepaper at the H-POWER facility provides energy benefits by offsetting the need to generate electricity through combustion of fuel oil. This type of power generation benefits Honolulu directly by reducing fuel costs and air emissions associated with burning fuel oil; and
  - Materials recycling of wastepaper yields energy benefits because it provides alternative raw material to paper manufacturers, thereby reducing the need for logging and production of "virgin" pulp products. In contrast to the energy benefits of H-POWER, materials recycling energy benefits accrue off-island, where wood pulp and paper products are produced.
- If only <u>on-island impacts</u> are considered, energy recycling (i.e., H-POWER) provides greater energy and greenhouse gas benefits compared to materials recycling. However, if <u>off-island impacts and on-island impacts</u> are considered, materials recycling has greater benefits. The off-island energy and greenhouse gas benefits associated with substituting recycled paper for wood pulp to manufacture paper products are greater than the on-island H-POWER benefits.
- Materials recycling creates more on-island jobs than energy recycling (i.e., H-POWER). However, H-POWER generates greater overall economic value for the Honolulu economy, resulting in a larger increase in business activity from providing products and services to H-POWER.

The report's Executive Summary provides further details on the above key findings. We appreciate the opportunity to assist Honolulu with this study.

cc: Rory Tipton
Ann Hajnosz
Ed Boisson
Karen Luken
Tom Jones

1380 Corporate Center Curve, Suite 305, St. Paul, MN 55121, Phone (651) 994-8415, Fax (651) 994-8396

Final Report

Comparison of Select Materials and Energy Recycling Scenarios

City and County of Honolulu
Department of Environmental Services

April 2007

R·W·BECK

R. W. BECK, INC.
COMPARISON OF SELECT MATERIALS AND ENERGY RECYCLING SCENARIOS

Table of Contents

List of Tables

List of Figures

Background

The City and County of Honolulu, Department of Environmental Services, Refuse Division (Division), contracted with R. W. Beck, Inc. to prepare a limited comparison of the environmental and economic impacts of materials recycling of wastepaper to produce new products (Scenario 1) versus recycling wastepaper to produce electricity at Honolulu's H-POWER facility (Scenario 2). The study analyzes selected impacts associated with managing 73,555 tons of wastepaper as was recycled in Honolulu during 2005.

To provide a balanced analysis, the scenarios were analyzed in two distinct ways:

- First, a variety of environmental and economic impacts accruing on the Island of O'ahu were estimated directly; and
- Second, global life-cycle energy and greenhouse gas impacts accruing both on- and off-Island were estimated using the Waste Reduction Model (WARM), developed by the U.S. Environmental Protection Agency (EPA).

The study findings are intended to illustrate the broad differences between materials recycling and energy recycling, and to thereby inform discussion as it relates to alternative waste management practices in Honolulu. The study provides a general sense of the order of magnitude of each impact analyzed, and yields defensible qualitative conclusions regarding the relative benefits of the two study scenarios. Readers are encouraged to focus attention on these broad qualitative conclusions regarding the relative benefits of the two study scenarios, and to consider the specific numeric values as illustrative.

Key Conclusions

Following is a synopsis of the study's key conclusions.

Managing wastepaper through materials recycling (Scenario 1) and through the H-POWER facility (Scenario 2) both yield environmental benefits. This is true in part because they offset other environmental drawbacks. For example:

- Generating electricity from combustion of wastepaper at the H-POWER facility provides *on-island* energy benefits by offsetting the need to generate electricity through combustion of fuel oil; and
- Materials recycling of wastepaper yields *off-island* benefits because it provides alternative raw material to paper manufacturers, thereby reducing the need for logging and production of "virgin" pulp products.

If only on-island impacts are considered, Scenario 2 (H-POWER) provides greater energy and greenhouse gas benefits compared to Scenario 1 (materials recycling). As shown in Figure ES-1, materials recycling has a modest net energy cost due to the transportation and processing conducted on-island, while energy recycling at the H-POWER facility provides a significant energy benefit due to the generation of electricity which offsets the need for combustion of oil to produce electricity.

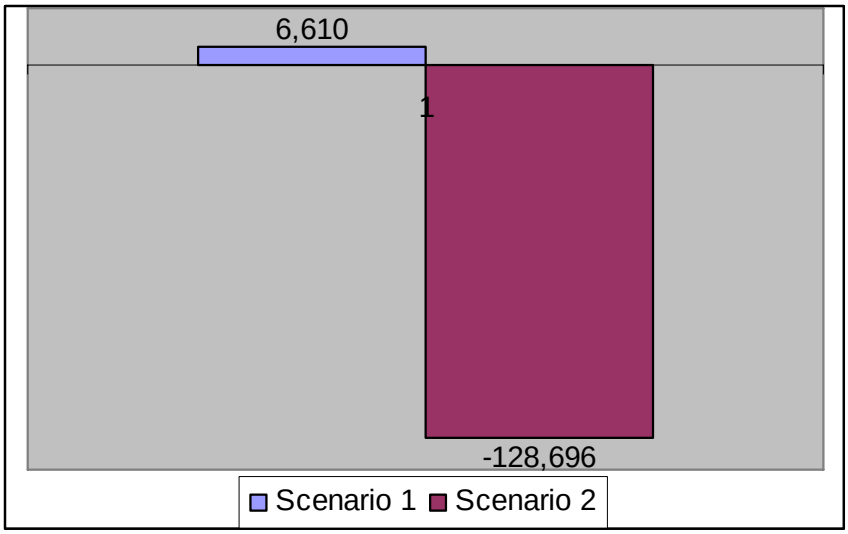


Figure ES-1 Comparison of Net On-Island Net Energy Impacts (MWh)

Likewise, the energy use associated with materials recycling produces modest amounts of greenhouse gas, as shown in Figure ES-2. While combusting wastepaper at the H-POWER facility under Scenario 2 produces greenhouse gases, this method offsets generation of significantly greater quantities of greenhouse gas from the use of fuel oil in electricity generation. This analysis does not "count" carbon dioxide emitted from combustion of paper, since it is assumed that this gas is part of a natural cycle of emission and sequestration that would occur even without processing of forestry resources into paper products. (The use of biomass for energy causes no net increase in carbon dioxide emissions to the atmosphere. This is because, as trees and plants grow, they remove carbon from the atmosphere through photosynthesis. If the amount of new biomass growth balances the biomass used for energy, then bio-energy is carbon dioxide "neutral." That is, the use of biomass for energy does not increase net carbon dioxide emissions.)

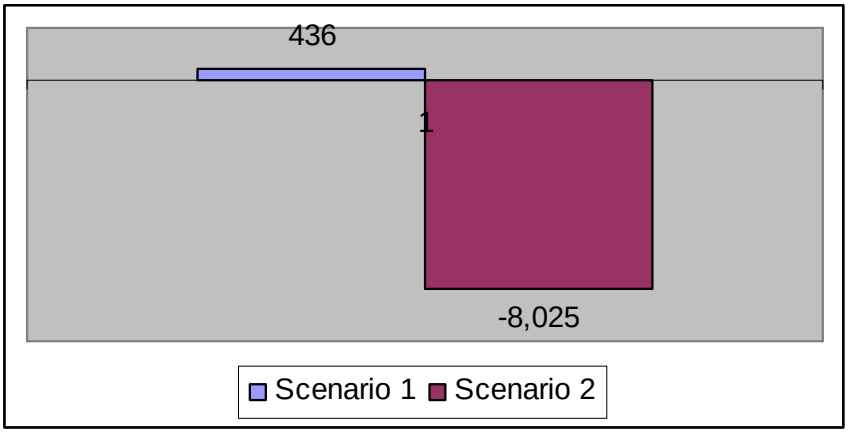


Figure ES-2 Comparison of On-Island Net Greenhouse Gas Emissions (MTCE)

The analysis does "count" nitrous oxide emissions from H-POWER, as well as estimated emissions due to transportation of ash to landfill. The magnitude of on-island energy and greenhouse gas impacts is modest. To provide some context, the net difference in energy impact is equal to about 1.75 percent of all electricity consumed on O'ahu in 2005[1], or equivalent to the electrical use of about 2,400 households for one year. The greenhouse gas benefit is less than one percent of total greenhouse gas emissions in the entire State of Hawai'i[2], or the equivalent of one year's use of about 6,700 passenger cars.

Considering only direct, on-island impacts, Scenario 1 (materials recycling) creates more on-island direct jobs than Scenario 2 (H-POWER); however Scenario 2 generates greater overall economic values, including total jobs (direct, indirect and induced), wages, and industrial output. Wastepaper materials recycling, including collection and processing activities, creates approximately 132 jobs in Honolulu with total wages of about $4.1 million, compared with about 70 jobs for H-POWER with total wages of about $4.8 million. The number of additional jobs (indirect and induced) created as a result of Scenario 2 is estimated to be 141 for a total jobs multiplier of 3.01, as compared to 103 for Scenario 1 for a total jobs multiplier of 1.78. Scenario 2 is estimated to generate $80.4 million in overall industrial output, whereas Scenario 1 is estimated to generate $31.2 million in overall industrial output. Moreover, it is estimated that an overall savings of approximately $823,000 due to lower energy production costs using waste paper as fuel, as opposed to fuel oil, could accrue to residential electric ratepayers.

Scenario 1 (materials recycling) results in larger on-island air emissions related to collection vehicles than Scenario 2, but collection emissions under both scenarios are relatively small. Scenario 2 also results in a variety of additional air emissions that do not result from Scenario 1. The relatively small amount of air emissions associated with collection and processing activities under both scenarios include carbon monoxide, nitrous oxides and particulates, with proportionately more

[1] Hawaiian Electric Company, Inc.
[2] U.S. EPA, Climate Change.

emissions from recycling collection than MSW collection due to the greater energy use associated with recycling collection activities. Some of the emissions from the H-POWER facility, similar to emissions from conventionally fueled power generation facilities, include nitrogen oxide, sulfur dioxide, carbon monoxide, lead, dioxins and furans. Based on a compliance test conducted in May 2006, H-POWER air emissions were within the limits allowed under its permit. Specific estimates of emissions due to combustion of wastepaper were not compared as part of this analysis. While wastepaper can be expected to be a cleaner fuel than MSW, wastepaper also includes bleached products that may contribute to generation of dioxin during combustion.

If all impacts are considered, both on-island and off-island, a global life-cycle inventory analysis indicates that Scenario 1 (materials recycling) has energy and greenhouse gas benefits that are greater than those of Scenario 2 (H-POWER). Both scenarios provide energy and greenhouse gas benefits from a global life-cycle perspective; however, the benefits associated with Scenario 1 (materials recycling) are greater. According to the lifecycle inventory analysis, material recycling has a net energy benefit of approximately 330,000 MWh, while energy recycling provides a net energy benefit of about 49,000 MWh. In addition, material recycling provides a net greenhouse gas benefit of about 58,000 MTCE, while energy recycling provides a net benefit of about 14,000 MCTE. The advantages of materials recycling accrue largely due to the reduced need for processing of wood pulp, as well as paper product manufacturing advantages that occur at off-island end-markets. These global life-cycle conclusions are consistent with many other studies. On a global scale, the energy and GHG benefits identified above are extremely small, with the net energy benefit equal to about 0.0002 percent of all electricity generated in the world in 2004[3] and the greenhouse gas benefit is approximately 0.0001 percent of the total greenhouse gas emissions in the world in 2005[4].

These WARM model results are based on the assumption that the recycled paper is processed at mills in the US, while much of Honolulu's recycled paper is processed at mills in Asia. Analysis of paper mill operations in Asia was beyond the scope of this study. Some Asian mills may operate at significantly less energy efficiency levels than in the U.S., which would tend to increase the amount of energy used in manufacturing recycled paper products. However, using recycled paper would still offset the need for processing of pulp from harvested wood, resulting in energy savings. Air and water emissions from Asian mills may also vary compared to U.S. mills and in some cases may be significantly higher. Detailed analysis of air and water emissions associated with recycled paper manufacturing was also beyond the scope of this study.

Summary

In summary, the choice of whether to pursue materials recycling or energy recycling can be characterized as a public policy decision that requires the weighing of subtle

[3] Based on figures from the International Energy Administration, International Energy Annual 2004 Website, accessed online. March 21, 2007.
[4] Based on 2005 figures from the US EPA, Climate Change Web Site, accessed online. March 21, 2007.

tradeoffs between local and global impacts. The key findings above reflect that recycling wastepaper to produce electricity at the H-POWER facility provides local energy, greenhouse gas and economic benefits. On the other hand, recycling wastepaper to new products provides energy and greenhouse gas benefits greater than H-POWER, but these benefits are geographically dispersed to locations off the island of O‘ahu. Determining the “optimal path forward” requires evaluating whether the local benefits of H-POWER, in the context of local conditions and perspectives, outweigh the global dispersed benefits of materials recycling.

Section 1
INTRODUCTION

1.1 Background

The City and County of Honolulu, Department of Environmental Services, Refuse Division (Division), contracted with R. W. Beck, Inc. to prepare a limited analysis comparing the environmental and economic impacts of materials recycling versus energy recycling (i.e., combustion at Honolulu's H-POWER facility to generate electricity). The study is intended to help inform discussion of the advantages and disadvantages of alternative approaches for managing Honolulu's waste stream.

1.2 Definition of the Scenarios Being Compared

The Division identified two scenarios to be compared, both focusing on the management of wastepaper. As characterized in Table 1-1, Scenario 1 is based on the wastepaper recycling that occurred in Honolulu during the study year 2005, and in Scenario 2 this same quantity of wastepaper is assumed to be processed and combusted at the H-POWER facility to generate electricity. Table 1-2 provides further details on the type of materials recycling programs used to recover wastepaper for materials recycling under Scenario 1.

Table 1-1
Scenarios Compared in the Study

Wastepaper Grade	Tons (2005)	Scenario 1: Materials Recycling	Scenario 2: Energy Recycling
Old Corrugated Containers	45,334	Wastepaper is collected, processed, and shipped to off-island recycling markets.	Wastepaper is collected with refuse, processed and combusted at Honolulu's H-POWER facility, with electricity sold to on-island customers.
Old Newspapers	18,372		
Magazines	14		
Mixed Wastepaper	5,746		
Office Pack	1,769		
Computer/Ledger	1,799		
Other	521		
Total	73,555		

Source: Honolulu Department of Environmental Services, Refuse Division

Table 1-2
Type of Materials Recycling Collection Programs Used Under Scenario 1

Type of Program	Description	Amount of Wastepaper Collected (Tons, 2005)
Drop-Off	Residents, schools and small businesses recycle materials at one of 74 drop-off locations, primarily located at schools. Under government contract, private companies pick-up, process and ship the recovered paper to off-island markets.	7,432
Retail Cardboard	Large retailers separate and bale cardboard on-site and backhaul it to off-island markets through company channels.	12,188
Commercial and Other	Private haulers pick-up wastepaper from office buildings, institutions and other locations, for processing and shipment to off-island markets.	53,935
Total		73,555

Source: Honolulu Department of Environmental Services, Refuse Division

1.3 Study Approach and Report Organization

The study includes two distinct analyses comparing the two scenarios.

The first analysis, described in Section 2, estimates impacts accruing strictly on the island of O‘ahu. Included are environmental impacts such as energy use, greenhouse gas and other air emissions, and economic impacts such as direct, indirect and induced employment and wages associated with each scenario. This on-island analysis provides information that is most directly relevant to Honolulu’s economy and environment.

The second analysis, described in Section 3, estimates energy and greenhouse gas impacts from a global, life-cycle perspective, incorporating the key activities related to the production, use and management of wastepaper, including both on-island and off-island impacts. The life-cycle analysis accounts for the key energy use and offsets throughout the production cycle, in addition to energy use and offsets associated with managing discarded waste. While more complex than the on-island analysis, this global life-cycle analysis is important because some of the most energy intensive and environmentally significant impacts associated with the paper life-cycle management accrue off-island.

The following two Sections present the methodology and results of the on-island and global life-cycle analyses, respectively. Following Section 3, Section 4 presents the study’s key conclusions, including important information on how to understand and use the study results, and a discussion of the level of confidence in the results.

Section 2
ANALYSIS OF ON-ISLAND IMPACTS

This section compares the materials recycling and energy recycling scenarios described in Section 1, focusing exclusively on impacts that accrue on the island of O‘ahu. The following sections describe the methodology used, and present the findings on environmental and economic impacts, respectively. Appendix A provides details on the assumptions and calculations underlying these findings.

2.1 Methodology

Table 2-1 identifies the key on-island roles and activities involved in materials recycling (Scenario 1) and energy recycling (Scenario 2) of wastepaper. Each activity involves associated energy use and other impacts, and also associated offsets, as shown in the table. One goal of the analysis is to determine when the offsets are positive and when they are negative. For example, as discussed below, collecting wastepaper (along with other municipal solid waste) and using it as fuel to generate electricity at the H-POWER facility requires using energy for collection vehicles and at the facility itself, but a far larger amount of energy is produced in the form of electricity, offsetting the need to generate electricity from fuel oil or other conventional fuels at other facilities. On the other hand, wastepaper recycling offsets energy used for MSW collection, but the offset is negative since the analysis reflects that recycling collection requires more energy than MSW collection.

To analyze on-island impacts, R. W. Beck, Inc. directly estimated the magnitude of key impacts related to the activities listed in Table 2-1. While Honolulu specific information was used wherever possible, in some cases it was necessary to use estimates and assumptions derived from limited samples or from national sources. Appendix A lists key assumptions and calculations used to derive the results.

Table 2-1
Range of On-Island Roles and Activities

Stage	Scenario 1: Wastepaper Materials Recycling			Scenario 2: Wastepaper Energy Recycling
	Drop-off Program	Retailer Cardboard	Commercial and Other Recycling	H-POWER
Generator	Residents, schools, small businesses.	Big box" retail stores (e.g., Wal-Mart, Costco, Sam's Club, etc.)	Commercial and governmental offices, institutions, etc.	All wastepaper generators.
	Activities: Separate paper and deliver to drop-off bins (often in combination with other tasks).	Activities: Separate paper and bale on site. Back haul to off-island markets through company channels.	Activities: Separate paper on site.	Activities: Include paper with disposal of mixed garbage.
Collector and processor	City/County-contracted hauler. Activities: Pick-up wastepaper along with other recyclables from drop-off bins according to regular schedule. Sort, bale and ship materials to off-island markets.	Handled by generator.	Private hauler. Activities: Pick up materials and sort, bale and ship materials to off-island markets.	Commercial and government haulers Activities: Pick-up mixed garbage, haul to H-POWER.
End-User	Off-Island (e.g., Mainland or Pacific Rim Recycled Paper manufacturers)	Off-Island (e.g., Mainland or Pacific Rim Recycled Paper manufacturers)	Off-Island (e.g., Mainland or Pacific Rim Recycled Paper manufacturers)	H-POWER facility. Activities: Process mixed garbage to prepare RDF. Combust RDF to produce electricity.
Recycled Product Consumer	Off-island	Off-Island	Off-Island	On-island consumers purchase electricity through grid.
On-Island Offsets	Reduces garbage hauling and landfill/WTE.	Reduces garbage hauling and landfill/WTE.	Reduces garbage hauling and landfill/WTE.	Reduces conventional electricity generation and reduces landfill.

2.2 On-Island Environmental Impacts

This section presents the study findings related to on-island environmental impacts. The environmental focus on this study is on energy use and greenhouse gas emissions. However, to illustrate the range of environmental impacts associated with the two scenarios this section also describes four additional topics – air emissions, residual waste disposal, water effluent and land use.

2.2.1 Energy Use

Table 2-2 compares on-island energy impacts. As detailed in Appendix A, the analysis includes:

- Energy used by collection vehicles;
- Energy used in processing recyclables for shipment to market, and for processing MSW for use at H-POWER;
- Energy used to operate the H-POWER facility; and
- Offset energy use reductions by the Hawaiian Electric Company, Inc. (HECO).

No energy use is included for residents' transporting wastepaper to drop-off facilities, since it was assumed that these trips would be taken as part of other trips that would have otherwise occurred. Also, no energy use is included for transportation of retailer recycling efforts, since these activities are considered backhaul of recyclables in vehicles.

The analysis reflects that, considering only on-island impacts, managing wastepaper through the H-POWER facility provides significant energy benefits compared to materials recycling, with a net difference of 135,306 MWh between the two scenarios. On a unit basis, the analysis indicates that for every ton of wastepaper combusted at H-POWER rather than being managed through material recycling programs, there is a net on-island energy benefit of 1.84 MWh. The energy benefit of H-POWER derives from the generation of power. The analysis shows that H-POWER would deliver approximately 44,944 MWh of electricity from combustion of the 73,555 tons of wastepaper under study. However, the offset is greater, since, according to operating data provided by HECO, fuel oil with an energy value content of approximately 139,722 MWh would need to be consumed to produce this quantity of electricity on O'ahu, equivalent to over 82,000 barrels of number 2 grade fuel oil. Moreover, the table also shows that the amount of energy required to collect wastepaper for combustion at H-POWER is somewhat lower than for materials recycling, since wastepaper is included with mixed garbage, requiring less energy on a per-ton basis.

To provide some context for these numbers, the net difference in energy impact between the two scenarios is equal to about 1.75 percent of all electricity consumed on O'ahu in 2005.[5]

[5] Hawaiian Electric Company, Inc.

Table 2-2
Comparison of On-Island Energy Impacts (MWh)

Stage	Drop Off Recycling	Retailer Recycling	Commercial & Other Recycling	Scenario 1 Totals	Scenario 2 Totals	Total Difference	Difference Per Ton
Collection	1,005	0	4,023	5,027	3,085	1,942	0.03
Processing	174	143	1,265	1,582	0	1,582	0.02
End-Use	*Off Island*	*Off Island*	*Off Island*	*0*	7,940	-7,940	-0.11
Offsets	*Off Island*	*Off Island*	*Off Island*	*0*	-139,722	-139,722	-1.90
Total	1,179	143	5,288	6,610	-128,696	135,306	1.84

Note: Energy associated with processing under Scenario 2 is included under end-use (i.e., energy used to operate the power production facility).

2.2.2 Greenhouse Gas Emissions

Table 2-3 summarizes on-island greenhouse gas emissions (GHG) associated with the two study scenarios. Since greenhouse gas emissions are closely tied to energy use, the GHG analysis includes the same activities as the energy analysis discussed in the previous section. The analysis shows that, considering only on-island impacts, managing wastepaper through the H-POWER facility provides greenhouse gas emission benefits compared to materials recycling of wastepaper, with a net difference of approximately 8,461 MTCE between the two scenarios.[6] Put another way, the analysis indicates that for every ton of wastepaper recycled instead of processed through H-POWER, a potential opportunity to reduce on-island emissions of greenhouse gases by 0.12 MTCE is lost. Generally, other than electricity generation, the other greenhouse gas emission estimates in Table 2-3 track the energy use estimates of the previous section, with relatively small amounts of greenhouse gases being generated through combustion of diesel in trucks used to transport wastepaper, and in rolling stock at processing facilities, as well as the combustion of oil used to generate electricity used during processing. An important note is that the estimate of greenhouse gas emissions from the H-POWER facility itself (labeled "end use" in Table 2-5) does not include carbon dioxide, since it is assumed that the raw material inputs to these paper products are managed "sustainably," and that the release of this carbon dioxide does not contribute a net increase to global greenhouse gas quantities, since it is part of a cyclical source and sink process. H-POWER greenhouse gas emissions do include relatively small generation of nitrous oxide and also small amounts of GHG generation related to transportation of ash for disposal.

To put these results in context, the net potential reduction in on-island greenhouse gas emissions associated with processing wastepaper at H-POWER is relatively small,

[6] Greenhouse gas emissions are presented in Metric Tons of Carbon Equivalent (MTCE), a commonly used reference unit that accounts for the varying heat trapping potential of different types of greenhouse gases, such as carbon dioxide, methane (CH_4), chlorofluorocarbons, and nitrous oxide (N2O).

equivalent to less than one percent of the total greenhouse gas emissions in the state of Hawai'i.[7]

Table 2-3
On-Island Greenhouse Gas Emissions (MCTE)

Stage	Drop Off Recycling	Retailer Recycling	Commercial & Other Recycling	Scenario 1 Totals	Scenario 2 Totals	Total Difference	Difference Per Ton
Collection	66	0	264	330	202	127	0.00
Processing	12	10	85	107	0	107	0.00
End-Use	*Off Island*	*Off Island*	*Off Island*	0	1,471	-1,471	-0.02
Offsets	*Off Island*	*Off Island*	*Off Island*	0	-9,698	9,698	0.13
Total	78	10	349	436	-8,025	8,461	0.12

Source: R .W. Beck, Inc.

2.2.3 Collection Emissions

Table 2-4 summarizes on-island emissions associated with collection activities for the two study scenarios. As with GHG emissions, collection transportation emissions are based on the same activities included and described for the energy analysis in Section 2.2.1 above. The analysis shows that, because of the somewhat greater transportation needs, emissions are greater for Scenario 1 (materials recycling) compared to Scenario 2 (energy recycling), with net differences of approximately 4,185 pounds of Carbon Monoxide, 25,526 pounds of Nitrogen Oxides, and 1,447 pounds of Particulate matter.

Table 2-4
On-Island Collection Emissions

Pollutant	Drop Off Recycling (lb/ton)	Retailer Recycling (lb/ton)	Commercial & Other Recycling (lb/ton)	Scenario 1 Totals (lb/ton)	Scenario 2 Totals (lb/ton)	Difference (Materials - Energy Recycling) (lb/ton)	Total Difference (lb)
Carbon Monoxide	0.031	0	0.059	0.090	0.033	0.057	4,185
Nitrogen Oxide	0.233	0	0.261	0.494	0.147	0.347	25,526
Particulate Matter (PM-10)	0.005	0	0.033	0.038	0.019	0.020	1,447

Source: R. W. Beck, Inc.

[7] US EPA, Climate Change Web Site, accessed online. December 26, 2006.

2.2.4 H-POWER Air Emissions

On-island air emission impacts are also associated with combustion of wastepaper at the H-POWER facility under Scenario 2, which are offset by reductions in similar types of emissions at other electricity generation facilities generally combusting fuel oil. As shown in Table 2-5, the H-POWER facility permit regulates 13 different types of pollutants. The table shows results of compliance tests in May of 2006 involving combustion of mixed solid waste, included in this analysis to illustrate the type and amount of emissions from the H-POWER facility. Some of the emissions from the H-POWER facility, similar to emissions from conventionally fueled power generation facilities, include nitrogen oxide, sulfur dioxide, carbon monoxide, lead, dioxins and furans. Based on a compliance test conducted in May 2006, H-POWER air emissions were within the limits allowed under its permit. Specific estimates of emissions due to combustion of wastepaper were not compared as part of this analysis. Other than greenhouse gas generation (discussed in Section Chapter 3), analysis of such emissions was beyond the scope of this study.

Table 2-5
Average Air Emissions from Honolulu's H-POWER Facility and Permit Limits

Emission Type	Average		Permit Limits	
	Value	Unit	Value	Unit
Dioxins/Furans	34.435	ng/dscm	60	ng/dscm
Cadmium	0.007	mg/dscm	0.04	mg/dscm
Mercury	<.044	mg/dscm	0.08	mg/dscm
Hydrogen Chloride	10.8035	ppm	29	Ppm
Sulfur Dioxide	13	ppm	29	Ppm
Nitrogen Oxides	182.5	ppm	250	Ppm
Carbon Monoxide	28.5	ppm	200	Ppm
Opacity	0		20	
Particulate Matter	0.004	lb/100lb RDF	0.2	lb/100lb RDF
Total Hydrocarbons	2.5395	ppm	21	Ppm
Hydrogen Fluoride	0.0319	lb/hr	2.6	lb/hr
Beryllium	ND to <7.135E-05	lb/hr	9.00E-04	lb/hr
Lead	0.0763	lb/hr	0.2	lb/hr

Source: Covanta Honolulu Resource Recovery Venture
Based on compliance tests involving combustion of mixed municipal solid waste, including materials other than wastepaper. Tests conducted in May 2006.

2.2.5 Residual Waste and Landfill Capacity

Both scenarios result in significant reductions in the amount of waste sent to landfill. Residual waste from wastepaper collection and processing under Scenario 1 is assumed to be very low, given that most of the wastepaper is collected source

separated. For illustration purposes, at a residual rate of 3 percent, Scenario 1 would generate approximately, 2,206 tons of residual waste requiring disposal. However, this is offset by the fact that the remaining 71,348 tons of wastepaper recycled reduces landfill capacity needs, for a net benefit of 69,142 tons landfill capacity saved, or approximately 138,284 cubic yards of landfill space per year.[8] Residual waste under Scenario 2 is primarily ash, a by-product of the combustion process. Residual ash under Scenario 2 is assumed to be approximately 12 percent of incoming tons (relatively low compared to mixed solid waste combustion), or 8,826 tons.[9] This results in a net benefit for Scenario 2 of 64,728 tons landfill capacity saved, or approximately 129,456 cubic yards of available space.

2.2.6 Land Use

While not a major focus of this study, land use impact is noted here for completeness. Under Scenario 1, land uses include allocation of space for collection containers at schools, stores and other locations, land used by processors and the space allocated for cardboard recycling and baling at retail stores. The primary land use under Scenario 2 is the H-POWER facility and landfill space needed for residual ash.

2.2.7 Water Effluent

As with land use, water effluent impacts are not a major focus of this study, but are noted for completeness. Water effluent is assumed to be negligible under both scenarios. Small amounts of fiber may enter the wastewater system as a result of collection and processing under both Scenarios. Water effluent related to paper manufacturing can be significant, whether recycled materials or virgin materials are used in the manufacturing process. Consideration of such off-island water impacts was considered beyond the scope of this study.

2.3 On-Island Economic Impacts

This section discusses economic impacts accruing on the Island of O‘ahu, related to the two study scenarios. *Direct* economic impacts are those immediately experienced, including employment, wages, value-added, industrial output, and costs/revenues. All industries require inputs into production – goods, services, etc. The value of those inputs supplied by Hawai‘i industries constitutes the *indirect* values. In addition, laborers in the direct industry and in the indirect suppliers to the industry convert their paychecks into household spending. These are the *induced* effects that accrue to the economy. The sum of direct, indirect, and induced effects is the total effect. The savings accruing to households from using wastepaper, as opposed to fuel oil, to generate electricity also was estimated.

[8] Assuming a density of 1,000 pounds per cubic yard for wastepaper in landfills.
[9] Honolulu Department of Environmental Services, Refuse Division.

2.3.1 Direct, Indirect, and Induced Economic Values

Table 2-6 compares estimates of direct on-island employment and total wages under the two study scenarios. The analysis generally includes the same activities described for the energy analysis in Section 2.2.1. Material recycling employment under Scenario 1 includes collection and processing activities. Energy recycling under Scenario 2 includes collection (as part of general MSW collection) and all activities undertaken at the H-POWER facility. These estimates cover both employees that handle materials as well as administrative, managerial and others who provide support services. This information was gathered through direct surveys of the relevant firms.

As shown in Table 2-6, material recycling under Scenario 1 employs nearly twice as many individuals as energy recycling under Scenario 2, with the difference largely due to employment related to processing of wastepaper. However, because of per employee higher wages in County MSW collection employment and at the H-POWER facility, total direct wages are about 15 percent less for Scenario 1 as compared to Scenario 2.

Table 2-6
Comparison of Estimated Direct Employment and Wages

Item	Employment	Wages
Scenario 1 (Materials Recycling)	132	$4,101,745
Scenario 2 (Energy Recycling)	70	$4,826,864
Difference	62	-$725,119
Difference Per Ton	0.001	-$9.86

Source: R. W. Beck, Inc.

Economic analyses of these kinds are best accomplished using detailed revenue and cost data from the industries studied. Industries, however, rarely reveal all of their cost of operation information. They generally are willing to release their labor requirements and some of their labor costs. Analysts can then use these values to scale the industry to a size indicative of those values.

2.3.2 Materials Recycling Economic Effects

The on-island recycling industry is estimated to employ 132 workers making $4.1 million. Total earnings are estimated to be approximately 28 percent higher or $5.25 million. Total earnings contain the cash value of benefits, like health and dental insurance, employer contributions to retirement and social insurance, and other components of workers' total compensation package beyond wage and salary.

The economic values are measured using an input-output (IO) model of the Hawai‘i economy, as modified for this analysis. The IO model is a compilation of all industrial activity in the Hawai‘i economy, to include all inter-industrial transactions – that is, who buys what from whom and who sells what to whom. After accounting for all inter-industry transactions, the statistical relationship between the different industries is simulated within the Hawai‘i economy as part of the analysis. Once the model is

formulated, the employment level of the recycling industry of 132 jobs is incorporated into the model, which in turn produces the already entered labor income statistic, and estimates of value added and industrial output. This statistical relationship can then be expressed as a multiplier value.

Table 2-7 reflects the model results for the on-island recycle paper industry. The model expects this industry to produce $18.5 million in *industrial output*, a figure analogous to annual sales, generate $7.54 million in value added, and pay the 132 workers a total of $5.225 million in earnings. *Value added* is composed of all labor incomes, which are payments to workers and normal returns to sole proprietors, plus all payments to investors and all indirect tax payments that are part of the production process.

Indirectly, the model expects the on-island paper recycling industry to require $7.5 million in inputs from industries in Hawai‘i, which in turn will sustain $3.2 million in value added, of which $1.83 million will be labor income for 51 jobs. Lastly, the direct and indirect workers will spend their pay and induce $5.2 million in industrial output that will need 52 additional workers making 1.7 million in labor incomes.

Table 2-7
Materials Recycling Economic Effects

Impact Summary	Direct	Indirect	Induced	Total	Total Multiplier
Industrial Output	$18,518,056	$7,510,235	$5,193,942	$31,222,233	1.69
Value Added	$7,539,423	$3,168,248	$3,081,955	$13,789,625	1.83
Labor Income	$5,255,964	$1,834,779	$1,667,590	$8,758,333	1.67
Jobs	132	51	52	235	1.78

This table also contains a column of multipliers. Multipliers are simply the total value divided by the direct value in any of the rows of measure. Thus, an output multiplier of 1.69 means that for every $1 of output in the recycling industry, $0.79 in output is supported in the remaining state economy. The value added multiplier of 1.83 means that for every dollar of value added in the paper recycling industry, $0.83 in value added is realized in the rest of the economy. A 1.67 multiplier for labor income says that for each dollar of worker earnings in recycling, there is $0.67 in labor income earnings in the rest of the economy. The jobs multiplier of 1.78 says that for every job in the paper recycling industry, there is 78/100ths of a job added to the economy.

2.3.3 Energy Recycling Economic Effects

The analysis for H-POWER (waste-to-energy) uses the same methodology as used for the recycling industry assessment. However, the simulation of the power generation sector was modified to shift the linkage of this industry away from solely purchasing refined oil products to one purchasing the value of the commodities supplied by the paper recycling industry.

The model results for H-POWER are contained in Table 2-8. The 70 jobs at the WTE plant are expected to generate $65.2 million in annual industrial output, $51.3 million in value added, and $6.1 million in labor income. The value added amount is based on expected returns to industrial output that were the average for that industry in 2005 plus a reported annual payment to governments.

Table 2-8
Energy Recycling Economic Effects

Impact Summary	Direct	Indirect	Induced	Total	Total Multiplier
Industrial Output	$65,164,348	$8,724,786	$6,564,615	$80,453,749	1.23
Value Added	$51,307,392	$4,205,537	$3,884,229	$59,397,158	1.16
Labor Income	$6,144,000	$2,834,981	$2,124,185	$11,103,166	1.81
Jobs	70	74	67	211	3.01

H-POWER is expected to require $8.7 million in state economy supplied inputs, thereby sustaining 74 additional jobs making $2.8 million in labor income. When household spending is added (the induced effects), another 67 jobs are generated requiring $2.124 million in labor incomes. In all, H-POWER operation would generate $80.4 million in industrial output, $59.4 million in value added, $11.1 million in labor incomes statewide, and 211 jobs.

The output multiplier is a low 1.23, and it is quite indicative of a large declining cost industry that buys a majority of its inputs external to the local economy. The value added multiplier is also low at 1.16 as a consequence. The labor income multiplier is 1.81 – $0.81 in additional labor income is sustained statewide per dollar paid to facility workers. Lastly, the jobs multiplier is very high at 3.01. That means that for every job in the WTE facility, there are just over 2 jobs in the rest of the economy. This high multiplier is due to the low labor requirements of this type of capital intensive firm as compared to the scope of the labor generated in the supplying sector, as well as the labor stimulated from household spending.

2.3.4 Potential Savings to Electric Ratepayers

Burning waste paper generated on the island as fuel to generate electricity, as opposed to a conventional feedstock such as fuel oil, may yield savings to residential ratepayers (i.e. households). For this segment of our analysis, we have compared the estimated costs of power production using the two different types of fuel to quantify any potential savings on a per kilowatt hour basis. The estimated energy production costs for waste paper are estimated at 10.5 cents per kWh. This assumes net processing costs at H-POWER of $70 per ton, 5000 BTU/pound of wastepaper, and 15,000 BTU/kWh. The estimated energy production costs for HECO using conventional fuels on O‘ahu were estimated to be 12.33 cents per kWh based on HECO’s reported avoided energy costs in 2006. These production costs appear to have nearly tripled since 2002.

Our analysis then assumes rates charged electricity users will reflect all of the estimated savings. The savings will result in either lower prices for consumed goods or enhanced disposable income among consumers.

The above calculations estimate the cost of producing the electricity from waste paper is $0.0183 less per kilowatt hour than from using fuel oil. Assuming 450,000 megawatts of electricity are produced from the waste paper the savings is calculated as follows:

450,000,000 kWh X $0.0183 = $823,500

The $823,500 in savings to consumers were incorporated into the I/O model simply as increased spending by households. Table 2-9 summarizes the effects of extra household spending attributable to lower electric rates from the use of waste paper for fuel instead of fuel oil. In demanding $823,500 in more consumer goods, an additional 5.7 jobs are sustained in the Hawaii economy earning $172,534 in labor incomes. The firms that are stimulated will, collectively, require additional inputs of $137,305, thereby adding 1.3 jobs and $46,293 in labor income to the supplying sector. The workers in the direct and indirect sector will, in turn, convert their pay into household consumption inducing $158,460 in sales requiring 1.6 jobs and $51,274 in labor income. In summary, $1.12 million in output, $0.497 million in value added, $0.27 million in labor income, and 8.6 jobs could be attributed to the cost savings.

Table 2-9
Energy Savings Economic Impacts

Impact Summary	Direct	Indirect	Induced	Total	Total Multiplier
Industrial Output	$823,500	$137,305	$158,460	$1,119,264	1.36
Value Added	$329,505	$73,968	$93,759	$497,232	1.51
Labor Income	$172,534	$46,293	$51,274	$270,101	1.57
Jobs	5.7	1.3	1.6	8.6	1.51

2.3.5 Transactional Costs and Revenues

A conclusive, quantitative analysis of transactional costs and revenues related to the two scenarios is beyond the scope of this study. A high degree of variability was identified within the transactions among the many players in the Honolulu waste management system. These players include:

- Residential and commercial waste generators;
- Schools which benefit from drop-off program revenue;
- County agencies and staff;
- Private waste haulers and recyclers;
- H-POWER operator Covanta ;

- The Hawai‘i Electricity Company, Inc. and its shareholders; and
- Electricity consumers

Appendix B summarizes the results of the analysis of transactional costs and revenues.

Section 3
GLOBAL LIFE-CYCLE ANALYSIS

This Section compares two environmental impacts (energy use and greenhouse gas emissions) of the two study scenarios from a global, life-cycle perspective. Whereas the analysis presented in Section 2 considers only those impacts that accrue on the Island of O'ahu, the global, life-cycle analysis presented in this section considers all activities that contribute significantly to energy or GHG emissions throughout the materials use cycle.

While the on-island analysis presented in Section 2 provides information most directly relevant to Honolulu's environment and economy, the global life-cycle analysis presented in this Section includes some impacts that may be accrue in many different locations. The following sections describe the methodology and results of the global life-cycle analysis.

3.1 Methodology

This limited Environmental Life-Cycle Analysis is used to illustrate how the waste management approaches compare from a global (on-island plus off-island impacts) point of view. The analysis is based on application of the Waste Reduction Model (WARM) developed by the U.S. Environmental Protection Agency (EPA). This model was developed and refined over many years, with input from a range of groups including industry experts, environmental organizations, government agencies and academia.

The WARM model is designed to compare the net energy use and greenhouse gas emissions of managing a specified amount of waste in different ways, for example through recycling or through waste-to-energy facilities. The model is based on unique assumptions tailored for 34 different material types. Inputs to the model include the scenarios to be compared (e.g., the amount of each material type and the method used to manage it including source reduction, recycling, landfill or waste-to-energy), and the average shipping distance of recyclables to market.

In the current study, values for the amount of each type of wastepaper managed under each study scenario were input. The average distance for materials recycling was entered as 382 miles. This is the sum of the assumed on-island average hauling distance (20 miles), the shipping distance to markets, and the hauling distance to processing facilities (20 miles). R. W. Beck, Inc. assumed that Honolulu wastepaper is most commonly shipped to markets in the Pacific Rim or on the mainland on average 3,500 miles away by container ship and used a conversion of 10.24[10] container ship miles to land truck miles to determine an appropriate input into the WARM

[10] This conversion is based on data from US EPA's Smart Way Transportation Initiative.

model. This conversion factor accounts for the difference in energy use between trucking via land and ocean freight.

The WARM model includes estimates of energy use and greenhouse gas impacts for the activities listed in Table 3-1. While the scope of included activities is broad, not all activities and impacts are included. For example, combusting wastepaper to generate electricity offsets the use of fuel oil, and the model includes fuel oil production costs but does not appear to include costs related to extracting oil resources to produce the fuel oil.

Some Honolulu local conditions do differ from assumptions in the WARM model. These differences include:

- Assumed local transport distances for MSW and ash.
- The mix of conventional fuels used to generate electricity (offset by energy recycling activities).
- Location and specific type of recycling markets used.

Table 3-1
Activities Analyzed in the WARM Model

Scenario 1: Materials Recycling	Scenario 2: Energy Recycling
Recycling collection	MSW collection
Recycling processing	Processing MSW for use in energy recycling facilities
Shipment to recycling markets	Energy used to operate energy recycling facilities
Manufacturing new products with specified percentages of recycled material inputs	Energy used to transport and dispose ash at landfills
Offset impacts of reduced use of virgin or primary materials, including energy used in resource extraction, processing and manufacturing.	Offset energy used to generate electricity using conventional fuels.

Source: US Environmental Protection Agency.

While these differences affect the numerical results, the study team determined that they are not likely to alter the WARM model's key, broad conclusions including:

- The offset impacts of energy recycling (i.e., reduced combustion of fossil fuels to produce electricity) and many types of material recycling (i.e., reduced energy used for materials extraction, processing and manufacture) generally far outweigh the energy used locally to collect and process materials.
- For many materials (including wastepaper), the net energy savings associated with manufacturing with recycled materials is greater than the net energy savings associated with energy recycling, although the energy benefits of material recycling are widely dispersed, while the benefits of energy recycling are usually local.

These two broad conclusions are consistent with the results of many other lifecycle analysis studies sponsored by groups with diverse interests, using a range of different

assumptions for the three key differences noted above. In particular, while much of Honolulu generated wastepaper may go to mills in the Pacific Rim with substantially different operating practices than mills in the US (which were specifically analyzed in building the WARM model), use of recycled wastepaper by these mills still offsets the same types of activities involving use of virgin wood pulp.

In contrast to the on-island analysis of Section 2, environmental impacts beyond energy and greenhouse gas emissions were not evaluated. These impacts include, but are not be limited to, air, water and waste discharges as a result of paper manufacturing, and effects resulting from the production and use of various chemicals in paper manufacturing and materials extraction. It is not likely that these impacts would affect the energy conclusions of this analysis. It also should be noted that this analysis does not constitute a full-fledged environmental life-cycle analysis study, but rather only an inventory of impacts based on WARM model results. The following section presents the model results.

The WARM model results are based on the assumption that the recycled paper is processed at mills in the U.S., while much of Honolulu's recycled paper is processed at mills in Asia. Analysis of paper mill operations in Asia was beyond the scope of this study. Some Asian mills may operate at significantly less energy efficiency levels than in the U.S., which would tend to increase the amount of energy used in manufacturing recycled paper products. However, using recycled paper would still offset the need for processing of pulp from harvested wood, resulting in energy savings. Air and water emissions from Asian mills may also vary compared to U.S. mills and in some cases may be significantly higher. Detailed analysis of air and water emissions associated with recycled paper manufacturing was also beyond the scope of this study.

3.2 Global Life-Cycle Environmental Impacts

The Environmental Life-Cycle Analysis Results are presented in Table 3-2. The analysis shows that, from a global life-cycle perspective, managing wastepaper through materials recycling provides substantial energy benefits compared to managing wastepaper through the H-POWER facility, with a net difference of over 280,000 MWh between the two scenarios. In other words, the analysis indicates that for every ton of wastepaper recycled, there is a net energy benefit of about 4 MWh. The most important reason for this is the significant amount of energy used during logging and wood processing involved in making pulp and paper products. This offset occurs off-island, with impacts dispersed across many locales, in contrast to the on-island energy benefits of energy recycling, which accrue directly to the County of Honolulu.

To put these numbers in context, from a global life-cycle perspective, the amount of energy saved by materials recycling in comparison to H-POWER processing is equivalent to about 3.6 percent of the total electricity consumed in Honolulu in 2005[11]

[11] Based on data from the Hawai'i Electricity Company, Inc. of 7.7 million MWh purchased.

and 0.0002 percent of the total electricity generated in the world in 2004.[12] An important note, however, is that this energy savings is dispersed, accruing in many different locales around the world.

Table 3-2
Environmental Life-Cycle Results

		GHG Impacts (MTCE)				Energy Use (MWh)			
Commodity	Tons	Scenario 1 Recycling	Scenario 2 H-POWER	Total Difference	Difference Per Ton	Scenario 1 Recycling	Scenario 2 H-POWER	Total Difference	Difference Per Ton
Corrugated Cardboard	45,334	-33,323	-8,152	-25,171	-0.57	-196,487	-29,406	-167,081	-4
Magazines/ third-class mail	14	-10	-2	-8	-0.57	0	-7	6	0
Newspaper	18,372	-17,268	-3,771	-13,497	-0.73	-85,374	-13,657	-71,716	-4
Office Paper	3,568	-2,371	-617	-1,754	-0.49	-9,887	-2,224	-7,663	-2
Phonebooks	521	-468	-107	-361	-0.69	-1,647	-387	-1,260	-2
Mixed Paper, Broad	5,746	-4,897	-1,038	-3,860	-0.67	-37,567	-3,743	-33,824	-6
Total	73,555	-58,337	-13,687	-44,651	-0.61	-330,962	-49,424	-281,538	-4

Notes:
1. Negative values indicate a net emission reduction.
2. Input transport distances assume on-island transport of 20 miles (for both materials recycling and H-POWER), and freighter transport of 3500 miles, equivalent to 362 truck miles for shipment of recyclables to market. Based on US EPA's SmartWay Transport Initiative, one truck mile is assumed to be equivalent in energy and greenhouse gas emissions to 10.24 freighter miles.

Table 3-2 also shows the net life-cycle greenhouse gas emissions of each Scenario, based on the WARM model results. The analysis shows that, *from a global life-cycle perspective*, managing wastepaper through materials recycling provides substantial greenhouse gas emission reductions compared to managing wastepaper through the H-POWER facility, with a net difference of nearly 45,000 MTCE. Both approaches have a net positive greenhouse gas impact, however, with Honolulu's materials recycling efforts in 2005 saving 58,337 MTCE in Greenhouse Gas emissions, compared with 13,687 MTCE if the same tonnage were sent to H-POWER. In other words, the analysis indicates that for every ton of wastepaper recycled, there is a net GHG emissions benefit of about 0.61 MTCE versus sending the wastepaper to H-POWER. The most important reason for this is the significant amount of GHG emissions during logging, wood processing and pulp and paper manufacturing, which is avoided due to the inclusion of recycled feed stocks. This important offset occurs off-island, accounting for the different conclusions of the on-island as compared to the off-island results.

[12] International Energy Administration, International Energy Annual 2004 Website, accessed online. March 21, 2007.

To put these numbers in context, *from a global life-cycle perspective*, the amount of energy saved by materials recycling in comparison to H-POWER processing is equivalent to about 0.2 percent of the total GHG emissions associated with Hawai'i's use of fossil fuels, and is an extremely small amount with respect to global emissions of GHG, amounting to approximately 0.0001 percent of the total world emissions. [13]

3.2.1 Sensitivity Analysis: Effects of Transportation Distance

To test the sensitivity of results to assumptions concerning the distance over which wastepaper is shipped for materials recycling, the WARM model was run again with the assumed off-island shipping distance doubled from 3,500 miles to 7,000 miles. Honolulu recyclables are shipped to either Asia (e.g., at an over-ocean distance of 3,800 miles to Japan or 4,900 miles to China) or to the U.S. mainland (e.g., at an over-ocean distance of 2,400 miles to California). On-land trucking distances at these destinations of course vary as well, so comparing results with a relatively high distance of 7,000 is intended to account for all possible variables. Under this higher transportation distance assumption, the magnitude of the benefits of materials recycling over energy recycling were reduced by a small amount; however, the qualitative conclusions of the analysis did not change. Net energy savings associated with Scenario 1 materials recycling declined by 14,202 MWh, or 4.3 percent, and net greenhouse gas savings declined by 963 MTCE, or 1.7 percent. The net energy benefit of materials recycling compared to energy recycling, on a global lifecycle basis, declined by 5.0 percent, and the net greenhouse gas benefit by 2.2 percent. This sensitivity analysis illustrates that the energy and greenhouse gas impacts associated with collection transportation are generally far-outweighed by the impacts associated with end-use, whether on-island (in the case of producing energy at the H-POWER facility under Scenario 2) or off-island (in the case of substituting recycled materials for virgin materials under Scenario 1).

[13] US EPA, Climate Change Web Site, March 21, 2007.

Section 4
CONCLUSIONS

The following two sections discuss the intended use of study findings and the level of confidence in the study results. Subsequent to that, the study's key conclusions are presented.

4.1 Understanding and Using the Study Findings

4.1.1 Intended Uses

The findings of this study are intended to illustrate the broad differences between materials recycling and energy recycling, and to thereby generally inform discussions as related to alternative waste management practices in Honolulu. The study provides a general sense of the order of magnitude of each impact analyzed, and yields defensible qualitative conclusions regarding the relative benefits of the two study scenarios. Readers are encouraged to focus attention on these conclusions and to consider the specific numeric values as illustrative.

The scenarios analyzed were not intended to represent specific proposals for adjusting Honolulu's current waste management system. For example, Scenario 2 assumes that all current wastepaper flowing to recycling markets would instead flow to the H-POWER facility. This is not a likely scenario, since much of this wastepaper recycling is collected within the private, commercial sector, and is controlled by a large number of independent decision makers.

4.1.2 Level of Confidence

In general, the study team has a high level of confidence in the qualitative conclusions presented below comparing the two study scenarios. The quantitative findings rely on many assumptions about the flow of Honolulu-generated wastepaper and of specific impacts throughout the material management chain, both on-island and off-island. Some of these assumptions are very applicable and some are less applicable. Thus, the methodology has inherent limitations in the level of confidence associated with the quantitative findings. However, the study team feels the level of uncertainty associated with quantitative results is not sufficient to weaken the study's central qualitative conclusions regarding the comparison of the two scenarios. Moreover, the general conclusions are consistent with the results of several other studies R. W. Beck, Inc. has reviewed or participated in, including studies conducted sponsored by groups with distinct and diverse interests such as industry, government and environmental advocacy organizations.

R. W. Beck, Inc. has made efforts to reduce uncertainty wherever possible, within the project's time and resource constraints. Nevertheless, due to the large number of assumptions in both the on-island and off-island analyses, there remain some potential sources of uncertainty which may affect the accuracy of quantitative findings.

4.2 Key Conclusions

Following is a synopsis of the study's key conclusions.

Managing wastepaper through materials recycling (Scenario 1) and through the H-POWER facility (Scenario 2) both yield environmental benefits. This is true in part because they offset other environmental drawbacks. For example:

- Generating electricity from combustion of wastepaper at the H-POWER facility provides *on-island* energy benefits by offsetting the need to generate electricity through combustion of fuel oil; and
- Materials recycling of wastepaper yields *off-island* benefits because it provides alternative raw material to paper manufacturers, thereby reducing the need for logging and production of "virgin" pulp products.

If only on-island impacts are considered, Scenario 2 (H-POWER) provides greater energy and greenhouse gas benefits compared to Scenario 1 (materials recycling).

As shown in Figure 4-1, materials recycling has a modest net energy cost due to the transportation and processing conducted on-island, while energy recycling at the H-POWER facility provides a significant energy benefit due to the generation of electricity which offsets the need for combustion of oil to produce electricity.

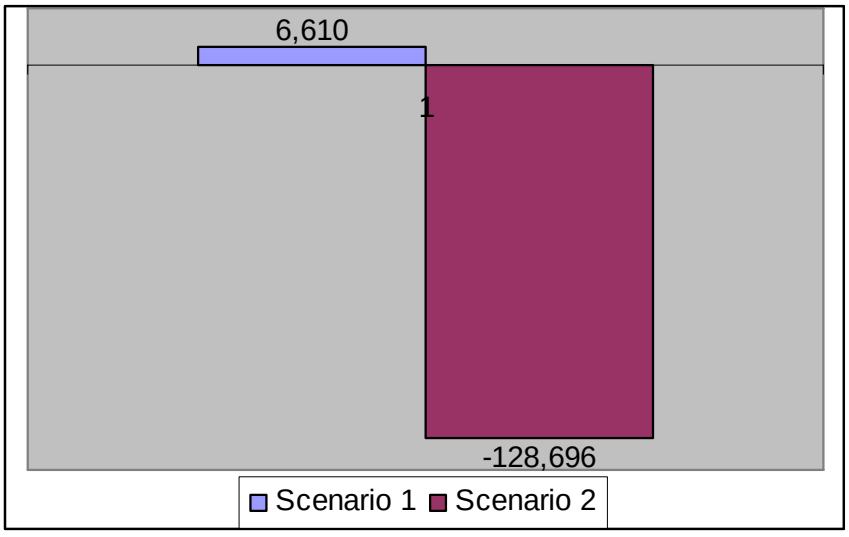


Figure 4-1 Comparison of Net On-Island Net Energy Impacts (MWh)

Likewise, the energy use associated with materials recycling produces modest amounts of greenhouse gas, as shown in Figure 4-2. While combusting wastepaper at

the H-POWER facility under Scenario 2 produces greenhouse gases, this method offsets generation of significantly greater quantities of greenhouse gas from the use of fuel oil in electricity generation. This analysis does not "count" carbon dioxide emitted from combustion of paper, since it is assumed that this gas is part of a natural cycle of emission and sequestration that would occur even without processing of forestry resources into paper products. (The use of biomass for energy causes no net increase in carbon dioxide emissions to the atmosphere. This is because, as trees and plants grow, they remove carbon from the atmosphere through photosynthesis. If the amount of new biomass growth balances the biomass used for energy, then bio-energy is carbon dioxide "neutral." That is, the use of biomass for energy does not increase net carbon dioxide emissions.)

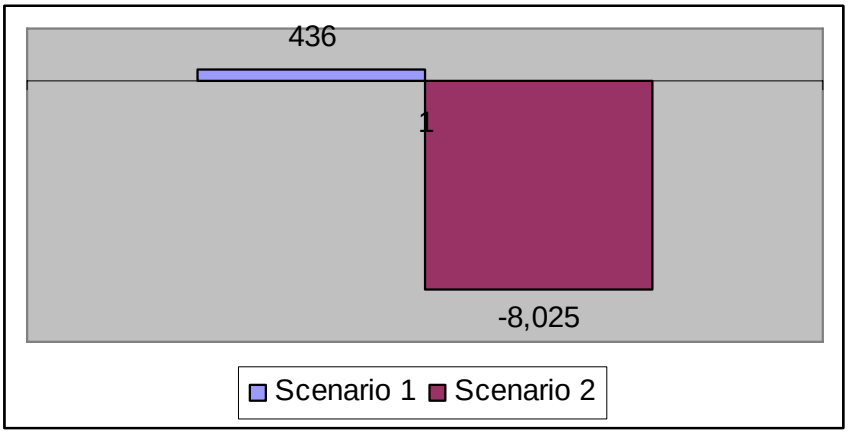


Figure 4-2 Comparison of On-Island Net Greenhouse Gas Emissions (MTCE)

The analysis does "count" nitrous oxide emissions from H-POWER, as well as estimated emissions due to transportation of ash to landfill. The magnitude of on-island energy and greenhouse gas impacts is modest. To provide some context, the net difference in energy impact between the two scenarios is equal to about 1.75 percent of all electricity consumed on O'ahu in 2005,[14] and the greenhouse gas benefit is far less than one percent of total greenhouse gas emissions in the entire State of Hawai'i.[15]

Considering only direct, on-island impacts, Scenario 1 (materials recycling) creates more on-island direct jobs than Scenario 2 (H-POWER), however Scenario 2 generates greater overall economic values, including total jobs (direct, indirect and induced), wages, and industrial output. Wastepaper materials recycling, including collection and processing activities, creates approximately 132 jobs in Honolulu with total wages of about $4.1 million, compared with about 70 jobs for H-POWER with total wages of about $4.8 million. The number of additional jobs (indirect and induced) created as a result of Scenario 2 is estimated to be 141 for a total jobs multiplier of 3.01, as compared to 103 for Scenario 1 for a total jobs multiplier of 1.78. Scenario 2 is estimated to generate $80.4 million in overall industrial output,

[14] Hawaiian Electric Company, Inc.
[15] US EPA, Climate Change Web Site.

whereas Scenario 1 is estimated to generate $31.2 million in overall industrial output. Moreover, it is estimated that an overall savings of approximately $823,000 due to lower energy production costs using waste paper as fuel, as opposed to fuel oil, could accrue to residential electric ratepayers.

Scenario 1 (materials recycling) results in larger on-island air emissions related to collection vehicles than Scenario 2, but collection emissions under both scenarios are relatively small. Scenario 2 also results in a variety of additional air emissions that do not result from Scenario 1. The relatively small amounts of air emissions associated with collection and processing activities under both scenarios include carbon monoxide, nitrous oxides and particulates, with proportionately more emissions from recycling collection than MSW collection due to the greater energy use associated with recycling collection activities. Some of the emissions from the H-POWER facility, similar to emissions from conventionally fueled power generation facilities, include nitrogen oxide, sulfur dioxide, carbon monoxide, lead, dioxins and furans. Based on a compliance test conducted in May 2006, H-POWER air emissions were within the limits allowed under its permit. Specific estimates of emissions due to combustion of wastepaper were not compared as part of this analysis. While wastepaper can be expected to be a cleaner fuel than MSW, wastepaper also includes bleached products that may contribute to generation of dioxin during combustion.

If all impacts are considered, both on-island and off-island, a global life-cycle inventory analysis indicates that Scenario 1 (materials recycling) has energy and greenhouse gas benefits that are greater than those of Scenario 2 (H-POWER). Both scenarios provide energy and greenhouse gas benefits from a global life-cycle perspective; however, the benefits associated with Scenario 1 (materials recycling) are greater. According to the lifecycle inventory analysis, material recycling has a net energy benefit of approximately 330,000 MWh, while energy recycling provides a net energy benefit of about 49,000 MWh. In addition, material recycling provides a net greenhouse gas benefit of about 58,000 MTCE, while energy recycling provides a net benefit of about 14,000 MCTE. The advantages of materials recycling accrue largely due to the reduced need for processing of wood pulp, as well as paper product manufacturing advantages that occur at off-island end-markets. These global life-cycle conclusions are consistent with many other studies. While Honolulu wastepaper may be shipped to manufacturers whose practices may vary from those assumed in the lifecycle model, using waste paper still offsets the use of wood pulp and its associated impacts. Thus, the relative energy and GHG benefits are likely to reflect similar results.

Because the energy impacts of materials recycling and energy recycling are dominated by the offsets, the global life-cycle conclusions are very robust in relation to assumptions about transportation distances. For example, doubling the assumed transportation distance to recycling markets to 7,000 miles reduces materials recycling's energy advantage by only about 4 percent, and its greenhouse gas advantage by about 2 percent. This is because the magnitude of energy and greenhouse gas impacts associated with the offsets of both materials recycling and energy recycling generally far outweigh the impacts associated with transportation,

especially local transportation involved with collection vehicles and energy used in processing activities.

4.3 Summary

In summary, the choice of whether to pursue materials recycling or energy recycling can be characterized as a public policy decision that requires the weighing of subtle tradeoffs between local and global impacts. The key findings above reflect that recycling wastepaper to produce electricity at the H-POWER facility provides local energy, greenhouse gas and economic benefits. On the other hand, recycling wastepaper to new products provides energy and greenhouse gas benefits greater than H-POWER, but these benefits are geographically dispersed to locations off the island of O‘ahu. Determining the “optimal path forward” requires evaluating whether the local benefits of H-POWER, in the context of local conditions and perspectives, outweigh the global dispersed benefits of materials recycling.

Appendix A
ASSUMPTIONS AND CALCULATED VALUES

The following tables list the quantitative assumptions and selected calculated values related to the on-island impact analyses. Assumptions related to the global life-cycle analysis are outlined in detail on the US EPA's WARM Users Guide web site at http://www.epa.gov/climatechange//wycd/waste/calculators/Warm_UsersGuide.html.

Key	Parameter	Value	Unit	Source / Calculation Notes
Recycling Tonnages				
A	Drop-Off Recycling	7,431.92	tons	Derived from ENV data.
B	Commercial Recycling	53,935.35	tons	Derived from ENV data.
C	Retail Recycling	12,188.00	tons	Derived from ENV data.
D	Total Paper in Study Scenarios	73,555.27	tons	Derived from ENV data.
Constants				
E	Energy Conversion	292.90	kwh/MMBTU	Constant
F	Barrel Volume Conversion	42.00	gallons/barrel	Constant
G	Diesel Fuel Energy Potential	5.25	MMBTU/barrel	US EPA, Inventory of Greenhouse Gas Emissions and Sinks
H	Diesel Energy Potential per Gallon	36.61	kwh/gallon	Calculated (G x E / F)
I	Oil Fuel Energy Potential	5.80	MMBTU/barrel	US EPA, Inventory of Greenhouse Gas Emissions and Sinks
J	Oil Fuel Energy Potential	1.70	MWh/barrel	Calculated (I x F / 1,000 Kwh/Mwh)
K	Diesel GHG Generation per gallon	0.0024	MTCE/gallon	US EPA, Inventory of Greenhouse Gas Emissions and Sinks
L	Diesel GHG Generation per kwh	0.0001	MTCE/kwh	Calculated (K / H)
M	Fuel Oil GHG Generation per barrel	0.1179	MTCE/barrel	US EPA, Inventory of Greenhouse Gas Emissions and Sinks
N	Fuel Oil GHG Generation per MWh	0.0694	MTCE/MWh	Calculated. Does not include efficiency of production (M / J)

Key	Parameter	Value	Unit	Source / Calculation Notes
Recycling Collection Assumptions				
O	Haul Distance	30.00	miles	R. W. Beck estimate, based on discussions with Honolulu haulers.
P	Haul Fuel Efficiency	5.00	miles/gallon	R. W. Beck estimate, based on discussions with Honolulu haulers.
Q	Commercial Route Length	10.00	miles	R. W. Beck estimate, based on discussions with Honolulu haulers.
R	Route Fuel Efficiency	2.00	miles/gallon	R. W. Beck estimate, based on discussions with Honolulu haulers.
S	Recycling Truck Utilization	0.75	Percent of truck capacity when full	R. W. Beck estimate, based on discussions with Honolulu haulers.
T	Typical Truck Size	32.00	CY	R. W. Beck estimate, based on discussions with Honolulu haulers.
U	Material Density	450.00	lb/CY	R. W. Beck estimate
Commercial Recycling Collection - Energy and Greenhouse Gas				
V	Pounds per Truck	10,800.00	lb/truck	Calculated (S x T x U)
W	Number of trips per year	9,988.03	trips	Calculated (V x B)
X	Commercial Fuel Consumption per Trip	11.00	gallons/trip	Calculated (O/P + Q/R)
Y	Total Gallons Used	109,868.31	gallons	Calculated (W x X)
Z	Commercial gallons per ton	2.04	gallons/ton	Calculated (fX / (V x 2,000 lb.s/ton))
A1	Commercial energy per ton	74.58	kwh/ton	Calculated (H x Z)
B1	Total energy used	4,022.55	MWh	Calculated (A1 x B/1,000 Kwh/Mwh)
C1	Total MTCE	263.68	MTCE	Calculated (Y x K)
Drop off Recycling - Collection Energy & GHG				
D1	Residential Fuel Consumption	6.00	gallons/trip	Calculated (O / P)
E1	Number of drop off trips	5,445.00	trips	Honolulu ENV, 2005 SCRP excel file

Key	Parameter	Value	Unit	Source / Calculation Notes
F1	Percent allocated to paper	0.84	Percent	Percent of all drop off materials collected that is paper. Based on % weight, Honolulu ENV, 2005 SCRP excel file
G1	Total gallons	27,442.80	gallons	Calculated (F1 x E1 x D1)
H1	Total energy	1,004.75	MWh	Calculated (D1 x H/1,000 Kwh/Mwh)
I1	Total MTCE	65.86	MTCE	Calculated (G1 x K)
Commercial Recycling - Processing Energy and GHG				
J1	Warehouse Unit Energy Consumption	10.75	kwh/ton	Warehouse operations. Municipal Solid Waste Management and Its Impact on Resource Conservation and Greenhouse Gas Emissions, Prepared for MN OEA, by R.W. Beck and Ecobalance, Inc., 1999.
K1	Rolling Stock Unit Fuel Consumption	0.35	gallons/ton	Warehouse and grounds rolling stock. Municipal Solid Waste Management and Its Impact on Resource Conservation and Greenhouse Gas Emissions, Prepared for MN OEA, by R.W. Beck and Ecobalance, Inc., 1999.
L1	Rolling Stock Energy Consumption	12.70	kwh/ton	Calculated (K1 x H)
M1	Combined unit energy use	23.45	kwh/ton	Calculated (J1 + L1)
N1	Total Energy	1,265.03	MWh	Calculated (M1 * B/1,000 Kwh/Mwh))
O1	MTCE Rolling Stock	44.92	MTCE	Calculated (L1 x L x B)
P1	Unit MTCE Rolling Stock	0.0008	MTCE/ton	Calculated (O1 / B)
Q1	MTCE Warehouse (assume oil)	40.24	MTCE	Calculated (J1 x B x N/1,000 Kwh/Mwh)
R1	Unit MTCE Warehouse	0.0007	MTCE/ton	Calculated (Q1 x B)
S1	Total MTCE	85.16	MTCE	Calculated (O1 + Q1)

Key	Parameter	Value	Unit	Source / Calculation Notes
Drop Off Recycling - Processing Energy and GHG				
P1	Total energy	174.31	MWh	Calculated, Assume same energy use as for commercial processing (A x M1 / 1,000 Kwh/Mwh)
Q1	MTCE	11.73	MTCE	Calculated (P1 + R1) x A
Retailer Processing Energy and GHG				
R1	Combined unit energy use	11.73	kwh/ton	Calculated. Assumes half of commercial energy rate for processing. (M1 x 0.5)
S1	Total energy	142.93	MWh	Calculated (R1 x C / 1,000 Kwh/Mwh)
T1	MTCE	9.62	MTCE	Calculated - Assumes half the combined ghg generation rate as commercial. (P1 + R1) x 0.5 x C / 1,000 Kwh/Mwh
H-POWER Collection (paper collected as a part of the MSW Collection system)				
U1	Truck Size	32.00	CY	R.W. Beck estimate, based on discussion with Honolulu haulers.
V1	Material Density	750.00	lb/CY	R.W. Beck estimate
W1	MSW collection truck utilization	0.80	percent	R.W. Beck estimate
X1	Truck weight	19,200.00	lb/truck	Calculated (U1 X V1 X W1)
Y1	Trips	7,662.01	trips/year	Calculated (D / (X1 / 2,000 lb.s/ton))
Z1	Fuel Consumption	11.00	gallons/trip	Calculated (O / P + Q / R)
A2	Unit Fuel Consumption	1.15	gallons/ton	Calculated (Z1 / X1 x 2,000 lb.s/ton)
B2	Unit Energy Consumption	41.95	kwh/ton	Calculated (H x A2)
C2	Total energy	3,085.78	MWh	Calculated (B2 x D / 1,000 Kwh/Mwh)
D2	Unit GHG Emissions	0.0028	MTCE/ton	Calculated (A2 x K)
E2	Total GHG	202.28	MTCE	Calculated (D2 x D)
H-POWER Processing and Power Generation				
F2	Wastepaper potential heat value	12.60	MBTU/ton	Honolulu ENV, Refuse Division
G2	Total potential heat value	926,796.40	MBTU	calculated (F2 x D)

Key	Parameter	Value	Unit	Source / Calculation Notes
H2	Total potential heat value	271,458.67	MWh	calculated (G2 x E / 1,000 Kwh/Mwh)
I2	Efficiency of RDF production	100.00%	percent	Estimated by R.W. Beck. Assumed for wastepaper only.
J2	Efficiency of steam production	65.00%	percent	Covanta/ENV, Refuse Division - assumed to refer to steam production efficiency.
K2	Efficiency of electricity production from steam	30.00%	percent	R.W. Beck estimate
L2	Portion of generated electricity used for facility operations	15%	percent of output electricity	R.W. Beck estimate
M2	net electricity output rate	16.5750%	Percent	Calculated (J2 x K2 x (1-L2))
N2	net output per ton	2.09	mBTU/ton	Calculated (M2 x F2)
O2	net electricity output (mBtu)	153,616.50	mBTU	Calculated (G2 x M2)
P2	net electricity output (Mwh)	44,994.27	MWh	Calculated (E x O2 / 1,000 Kwh/Mwh)
Q2	net energy use for operations	7,940.17	MWh	Calculated (P2/0.85) x 0.15
R2	total electricity generation	52,934.44	MWh	Calculated (P2 + Q2)
S2	Unit GHG Emissions	0.02	MTCE/ton	US EPA, Solid Waste Management and Greenhouse Gases, a Life Cycle Analysis of Emissions and Sinks http://www.epa.gov/climatechange//wycd/waste/SWMGHGreport.html#sections. Does not count CO2 from biogenic sources like paper.
T2	GHG emissions	1,471.11	MTCE	Calculated (S2 x D)
H-POWER Avoided Emissions (Power Generation from Fuel Oil)				
U2	No. 2 fuel oil heat content	140,000.00	Btu/gallon	R. W. Beck estimate
V2	Oil power generation electricity delivery rate (reciprocating diesel engine)	10,602.00	Btu input/ kWh delivered	HECO, based on PUC target heat rate.

Key	Parameter	Value	Unit	Source / Calculation Notes
W2	Oil power generation delivery rate (reciprocating diesel engine)	13.21	kwh delivered/ gallon input	calculated (U2 / V2)
X2	Oil power generation delivery rate (reciprocating diesel engine)	3.11	Mwh input/ Mwh delivered	calculated (V2 / 1,000,000 x E)
Y2	Offset Energy - Input energy value of fuel required to match H-POWER output	-139,721.88	MWh	Calculated (X2 x P2 x (-1))
Z2	Offset Energy (bbl)	-82,246.43	Bbl	Calculated (Y2 / J)
A3	MTCE generated from oil power offset	-9,698.01	MTCE	Calculated (Y2 x N)
Direct Employment and Wages				
B3	Commercial and Drop-Off tons per Direct Employee	781.0	ton/emp	R. W. Beck estimates, based on discussions with Honolulu haulers.
C3	Comm and drop off direct employee wages with benefits	$15.09	$/hr	R. W. Beck estimates, based on discussions with Honolulu haulers.
D3	Retail OCC Recycling tons per direct employee	556.7	ton/emp	R. W. Beck estimates, based on discussions with Honolulu retailers.
E3	Retail OCC recycling direct employee wages with benefits	$12.50	$/hr	R. W. Beck estimates, based on discussions with Honolulu retailers.
F3	Comm/Drop off tons per indirect employee	2,083.0	ton/emp	R. W. Beck estimates, based on discussions with Honolulu haulers.
G3	Comm/Drop off indirect wages with benefits	$16.25	$/hr	R. W. Beck estimates, based on discussions with Honolulu haulers.
H3	Retail tons per indirect employee	6,680.0	ton/emp	R. W. Beck estimates, based on discussions with Honolulu retailers.
I3	Retail indirect wages with benefits	$18.75	$/hr	R. W. Beck estimates, based on discussions with Honolulu retailers.
J3	Comm and Drop off tons	61,367.0	tons	Honolulu ENV
K3	Retail tons	12,188.0	tons	Honolulu ENV
L3	Hours per year	2,080	hrs	R. W. Beck Estimate

Key	Parameter	Value	Unit	Source / Calculation Notes
M3	H-POWER total employment (direct and indirect)	147	employees	Honolulu ENV
N3	H-POWER total tons handled	615,000.0		Honolulu ENV
O3	H-POWER processing and power production tons per emp	4,184	tons/emp	Calculated (N3 / M3)
P3	H-POWER processing and power production wages with benefits	$21.18	$/hr	US Department of Labor, Bureau of Labor Statistics. Mean value for occupation code 51-8099, Plan and System Operators, All Other.
Q3	Collection FTEs (all County MSW services, include indirect)	256	employees	Honolulu ENV
R3	County MSW collection tonnage	361,820	tons	Honolulu ENV
S3	Total County MSW Collection salary and wages with 39.7% benefits included	$19,933,459	$	Honolulu ENV
T3	H-POWER collection tons per employee (inc. direct and indirect)	1,413	tons/emp	Based on County residential MSW collection. Calculated. (R3 / Q3)
U3	H-POWER collection wages per ton	$55.09	$/ton	Based on County residential MSW collection. Calculated. (S3 / R3))
V3	Scenario 1 total employment	132	employees	Calculated (J3/B3 + J3/F3 + K3/D3 + K3/h3)
W3	Scenario 1 total wages	$4,101,745	$	Calculated ((J3/B3)xC3 + (J3/F3)xG3 + (K3/D3)xE3 + (K3/h3)xI3) x L3
X3	Scenario 2 total employment	70	employees	Calculated (D/O3 + D/T3)
Y3	Scenario 2 total wages	$4,826,864	$	Calculated (D/O3) x P3 x L3 + (D x U3)

Appendix B
TRANSACTIONAL COSTS AND REVENUES

As discussed in Section 2.3.2, a conclusive, quantitative analysis of transactional costs and revenues related to the two study scenarios is beyond the scope of this study, due to high variability and uncertainty among the transactions experienced by the many players in the Honolulu waste management system.

This appendix provides a partial analysis of transactional costs and revenues. And, Section 2.4 estimates the overall net economic benefit associated with producing electricity through H-POWER as compared to conventional power sources.

Table B-1 below identifies the key players in Honolulu's waste management system and summarizes the range of costs and revenues experienced by each. Following this, Table B-2 provides the assumptions and details for the quantitative conclusions presented in Table B-1.

Table B-1
Key Players and Their Transactional Costs and Revenues

Type of Program	Player	Revenues and Costs
Drop-Off Recycling	Residents and Other Participating Waste Generators	Cover county costs through County funding mechanisms.
	Schools	Revenues of $14,864 ($2/ton) from private recycler per county contract.
	County	Total costs of $654,381 ($88.05/ton). Includes operations, education, administration and other.
	Contracted Private Recycler/Processor	Undetermined profit rate and costs. Service revenue of $583,926 per county contract. Material sales revenue of $203,970 - $614,366 ($27.44 - $82.67 per ton).
Commercial Recycling	Commercial Generators	Highly variable cost of recycling services (as low as $0/ton) and avoided disposal benefits.
	Commercial Recycler/Processor	Highly variable profit rate, costs and revenues for commercial recycling services.
Retail Recycling	Retailer	Variable costs of approx. $65/ton (assumes labor is 80% of total recycling cost). Market revenue of $304,700 - $487,520 ($25 - 40 per ton). Avoided disposal benefits of $731,000 - $935,000 ($60 - $80 per ton)

Table B-1 Key Players and Their Transactional Costs and Revenues		
Type of Program	Player	Revenues and Costs
H-POWER	County	Costs for collection of residentially generated wastepaper with MSW. (County assumed to collect drop off tons from Scenario 1.) Revenue from H-POWER operations derived from tip fees and sales of electricity.
	Private Waste Haulers	Variable profit rate, costs and revenues for collection of commercial and retailer generated wastepaper with MSW. (Commercial haulers assumed to collect commercial and retailer tons from Scenario 1.)
	H-POWER Facility and Associated Operator and Holding Company	Operating cost for MSW processing and electricity production. Revenues through tip fees for delivered MSW. Revenue for sale of electricity to HECO.
	Hawaiian Electricity Company, Inc. (HECO)	Costs for purchase of electricity from H-POWER. Reduced costs through offset conventional power generation.

Table B-2
Assumptions and Calculations Supporting Transactional Cost and Revenue Estimates

Key	Parameter	Value	Unit	Source / Calculation Notes
Drop-Off Recycling Revenues and Costs				
Z3	School Revenue per Ton	$2.00	$/ton	Derived from County ENV data, revenue allocated to paper.
A4	Total Revenue to Schools	$14,864	$	Calculated (A x Z3)
B4	County Drop-Off Program Unit Cost	$88.05	$/ton	ENV, Refuse Division. Includes: operations, education, administration, and misc.
C4	Total County Costs, Drop-Off Recycling	$654,381	$	Calculated (A x B4)
D4	County Drop Off Unit Operations Costs	$78.57	$/ton	Derived from ENV, Refuse Division data - total operations for mixed containers and paper recycling assumed to cover contracted hauler services.
E4	Assumed Low Mixed Ton Recycling Market Revenue	$27.44	$/ton	RW Beck Estimate. Derived from discussions with Honolulu haulers and other data sources.
F4	Assumed High Mixed Ton Recycling Market Revenue	$82.67	$/ton	RW Beck Estimate. Derived from discussions with Honolulu haulers and other data sources.
G4	Low Drop Off Hauler Market Revenue	$203,917	$	Calculated (A x E4)
H4	High Drop Off Hauler Market Revenue	$614,366.65	$	Calculated (A x F4)
I4	Collector/Processor Service Revenue	$583,926	$	Calculated. (D4 x A)
J4	Low Drop-Off Collector/Processor Costs	$669,666	$	Calculated. (G4 + I4) x 0.85 Assumes a 15% profit margin on revenue from service fees and material sales.
K4	High Drop-Off Collector/Processor Costs	$772,086	$	Calculated (G4 + I4) x 0.98 Assumes a 2% profit margin on revenue from service fees and material sales
Retail Recycling Revenues and Costs				
L4	Retailer Recycling Cost	$800,521.71	$	Calculated. ((K3/D3)xE3 + (K3/h3)xI3) x L3 X 0.80 Assumes retailer labor costs comprise 80% of total recycling costs. Assumes transportation is "free" due to backhaul.
L41	Retailer Recycling Cost Rate	$65.68	$/ton	Calculated. (L4 / C)

Table B-2 Assumptions and Calculations Supporting Transactional Cost and Revenue Estimates				
Key	Parameter	Value	Unit	Source / Calculation Notes
M4	Assumed Low Retail OCC Market Revenue	$25.00	$/ton	RW Beck Estimate. Derived from discussions with Honolulu haulers and other data sources.
N4	Low Total Retail Revenue	$304,700.00	$	Calculated. (M4 x C)
O4	Assumed High Retail OCC Market Revenue	$40.00	$/ton	RW Beck Estimate. Derived from discussions with Honolulu haulers and other data sources.
P4	High Total Retail Revenue	$487,520.00	$	Calculated. (O4 x C)
Q4	Low Estimate - Retail Avoided Disposal Cost	$60.00	$/ton	RW Beck Estimate. Derived from discussions with Honolulu retailers.
R4	High Estimate - Retailer Avoided Disposal Cost	$80.00	$/ton	RW Beck Estimate. Derived from discussions with Honolulu retailers.
S4	Low Total Retailer Avoided Disposal Cost	$731,280.00	$	Calculated (C x Q4)
T4	High Total Retailer Avoided Disposal Cost	$975,040.00	$	Calculated (C x R4)
Commercial Recycling Revenues and Costs				
U4	Commercial Generator Recycling Cost Range	Highly Variable ($0 - NA)	$	RW Beck. Based on discussions with Honolulu haulers.
V4	Commercial Generator Avoided Disposal Cost Range	Highly Variable ($0 - NA)	$	RW Beck. Based on discussions with Honolulu haulers.
W4	Commercial Recycler/Hauler Profit Range	0% - 15%	$	RW Beck Estimate. Based on discussions with Honolulu haulers. Rate varies with customers and market conditions.
X4	Commercial Recycler Material Value - Low Estimate	$25	$	R.W. Beck Estimate. Based on data from Honolulu haulers and other sources. Weighted average based on material grade tons.
Y4	Commercial Recycler Material Value - High Estimate	$40.00	$	R.W. Beck Estimate. Based on data from Honolulu haulers and other sources. Weighted average based on material grade tons.
Z4	Total Commercial Recycler Material Value - Low Estimate	$1,348,383.75	$	Calculated. (X4 x B)
A5	Total Commercial Recycler Material Value - High Estimate	$2,157,414.00	$	Calculated. (Y4 x B)

Appendix C
ACRONYM GLOSSARY

BTU/MMBTU: British Thermal Unit/Million British Thermal Units

CY: Cubic Yard

ENV: City and County of Honolulu Department of Environmental Services

FTE: Full-Time Equivalent

GHG: Greenhouse Gas

H-POWER: Honolulu Program of Waste Energy Recovery

HECO: Hawaiian Electric Company, Inc.

IO: Input-Output

Kwh: Kilowatt-hour

MN OEA: Minnesota Office of Environmental Assistance

MSW: Municipal Solid Waste

MTCE: Metric Tons Carbon Equivalent

MWh: Megawatt-hour

OCC: old corrugated cardboard

PUC: Public Utilities Commission

RDF: Refuse Derived Fuel

US EPA: United States Environmental Protection Agency

WARM: Waste Reduction Model

WTE: Waste-to-Energy

Appendix E-1

DETAILED COST STUDY

Appendix E-1
Draft

Solid Waste Program Financial Model

Financial Planning Model

Base Case

Fiscal Years

2004-2014

Model prepared by R. W. Beck, Inc. in August 2007

for internal use by Refuse Division Staff

R. W. Beck run date: November 13, 2007

BASE CASE

Table 1
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Assumptions and General Parameters

1	**Operating Expenses/Income**	
2	General Expense Escalator (1)	3.00%
3	Fringe Benefit Rate (2)	21.88%
4		
5		
6	**Capital Expenditure Funding**	
7	Long-Term Debt (Facilities)	
8	Interest Rate (3)	5.75%
9	Repayment Period (Years)	25
10	Bond Financing Expense (3)	2.00%
11		
12		
13	**Financial Assurance Targets**	
14	Planned Debt Service Coverage (4)	1.00
15		
16		
17	**Equivalent Single Family Units (# of SFH/ unit) (5)**	
18	Apartment Units 96 gallon cart	0.67
19	Multi-Family 3-yd	4.00
20	Non-Profit/Parks 3-yd	4.00
21		
22	**Scenarios A and B**	
23	Percent of Disposed Waste that is Non-Combustible	15%
24		
25	**Scenario B**	
26	2nd Day Collection Participation Rate	50%
27		
28		

Average Annual Growth Rate Assumptions (6)

	2009 - 2014	
	Population	**Per Capita Generation**
96 Gallon Cart Service		
Manual	0.97%	1.00%
Automated	0.97%	1.00%
Apartment Units	0.97%	1.00%
3 CY Service		
Multi Family Households	0.97%	1.00%
Church / School	0.97%	1.00%
Other City / Government	0.97%	1.00%
Parks	0.97%	1.00%
Specialty Routes		
Highway	0.00%	0.00%
Stake	0.00%	0.00%
Bulky	0.97%	1.00%
Per Capita Generation		1.00%

Base Case Definition:

Landfill: Extend operating permit until May 2010. Expand landfill in May 2010.
H-POWER: Buyback takes place in FY 2010.
Collection, Transfer Station and Recycling: Maintain current level of operations. No mixed recyclable collection. Automated green waste collection rolled out according to Division plans.

Average Annual Growth (AAG) is defined as the average growth rate for each year over a specified time period. For example, to calculate the AAG in SF households between 2004-2009, shown in Table 2, the calculation is $(180{,}760/166{,}189)^{(1/5)} - 1 * 100 = 1.7\%$, where 5 is the number of years between 2004-2009.

Notes:
(1) Based on CPI for Hawai'i being higher than the national average.
(2) Based on Employee Fringe Benefit Rate of 21.88% per the City. Includes Vacation (8.08%) Sick Leave (5.02%) Holiday (5.00%) and Other (3.78%).
(3) Per Honolulu Budget and Fiscal Services.
(4) For planning purposes the Debt Service Coverage has set at 1.0.
(5) Per the 2004 Financial Plan completed by R. W. Beck. Apartment units assumption reflects reduced yard waste.
(6) Based on the average annual growth in the De Facto Population, and average annual growth in per capita generation per Section 2 of the ISWMP.

BASE CASE

TABLE 2
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Actual and Projected Number of Accounts

		Actual (1)			Projected (2)			'04 - '09 Average Annual	Projected (2)					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (3)	2010	2011	2012	2013	2014	Growth (3)
1	**96 Gallon Cart Service - Residential**													
2	Single-Family Households													
4	Manual	21,013	21,013	21,013	21,220	21,430	21,640	0.59%	21,850	22,060	22,270	22,490	22,710	0.97%
3	Automated	145,176	149,878	154,580	156,080	157,590	159,120	1.85%	160,660	162,220	163,790	165,380	166,980	0.97%
5	Subtotal Single-Family Households	166,189	170,891	175,593	177,300	179,020	180,760	1.70%	182,510	184,280	186,060	187,870	189,690	0.97%
6	Apartment Units/Other Small Schools and Churches	18,348	18,348	18,348	18,530	18,710	18,890	0.58%	19,070	19,250	19,440	19,630	19,820	0.97%
7	**Total 96 Gallon Cart Accounts**	184,537	189,239	193,941	195,830	197,730	199,650	1.59%	201,580	203,530	205,500	207,500	209,510	0.97%
8														
9	**3 Cubic Yard Bin Service - Residential**													
10	Multi-Family Households	2,682	2,682	2,682	2,710	2,740	2,770	0.65%	2,800	2,830	2,860	2,890	2,920	1.05%
11	**Total 3 CY Bin - Residential**	2,682	2,682	2,682	2,710	2,740	2,770	0.65%	2,800	2,830	2,860	2,890	2,920	1.05%
12														
13	**3 Cubic Yard Bin Service - Other**													
14	Church/School	139	139	139	140	140	140	0.14%	140	140	140	140	140	0.00%
15	Other City/Government	56	56	56	60	60	60	1.39%	60	60	60	60	60	0.00%
16	Parks	84	84	84	80	80	80	-0.97%	80	80	80	80	80	0.00%
17	**Total 3 CY Bin - Other**	279	279	279	280	280	280	0.07%	280	280	280	280	280	0.00%
18														
19	**Specialty Routes**													
20	Highway	1,956	1,956	1,956	1,960	1,960	1,960	0.04%	1,960	1,960	1,960	1,960	1,960	0.00%
21	Stake	404	404	404	400	400	400	-0.20%	400	400	400	400	400	0.00%
22	**Total - Specialty Routes**	2,360	2,360	2,360	2,360	2,360	2,360	0.00%	2,360	2,360	2,360	2,360	2,360	0.00%
23														
24	**Total Accounts**	189,858	194,560	199,262	201,180	203,110	205,060	1.55%	207,020	209,000	211,000	213,030	215,070	0.96%
25														
26														
27	**De Facto Population (4)**	951,940	960,940	969,530	978,720	988,010	997,380	0.94%	1,006,850	1,016,550	1,026,500	1,036,550	1,046,700	0.98%

Notes

(1) Source: FY 2004 and FY 2006 from HOUSECNT.XLS. FY 2005 based on an the average between FY 2004 and FY 2006.

(2) Projections based on .97% annual growth in the De Facto population. See Section 2 of the ISWMP.

(3) Average Annual Growth is defined as the average growth rate for each year over a specified time period.

(4) FY 2009 - 2014 per Section 2 of the ISWMP (Table 2-1, "Population Used for FY Waste Projections"). FY 2004 - 2008 calculated using the same methodology.

BASE CASE
TABLE 3
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Summary of Projected Waste Quantities (Tons)

		Actual			Projected			'04 - '09 Average Annual	Projected					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (1)	2010	2011	2012	2013	2014	Growth (1)
1	**Total O'ahu Generation (2)**	1,717,600	1,755,100	1,793,560	1,807,010	1,842,410	1,878,480	1.81%	1,915,280	1,954,740	1,976,370	2,017,190	2,058,650	1.82%
2	**Less Private and Unpermitted Disposal (3)**	225,000	225,000	225,000	229,400	233,900	238,480	1.17%	243,150	247,950	252,880	257,910	263,040	1.99%
3	**Total Waste Generation (4)**	1,492,600	1,530,100	1,568,560	1,577,610	1,608,510	1,640,000	1.90%	1,672,130	1,706,790	1,723,490	1,759,280	1,795,610	1.80%
4	**Less Private Haulers Recycling (5)**	340,456	360,852	411,828	419,890	428,110	436,500	5.10%	445,050	453,830	462,850	472,060	481,450	1.98%
5	**Total Waste Managed by Refuse Division**	1,152,144	1,169,248	1,156,732	1,157,720	1,180,400	1,203,500	0.88%	1,227,080	1,252,960	1,260,640	1,287,220	1,314,160	1.73%
6	**Total Waste Managed by Refuse Division - Disposal Options**													
7	Recycling (6)	222,097	216,545	216,545	220,780	225,110	229,520	0.66%	234,010	238,630	243,370	248,210	253,150	1.98%
8	Curbside Recycling Roll Out (7)	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
9	Additional Green Waste (8)	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
10	Additional Community Recycling Bin Program (9)	0	0	0	2,000	3,000	4,000		4,000	4,000	4,000	4,000	4,000	0.00%
11	Landfill (10)	313,360	329,431	337,667	324,940	342,290	359,980	2.81%	379,070	0	0	0	0	-100.00%
12	Landfill Expansion (11)	0	0	0	0	0	0	n/a	0	400,330	403,270	425,010	447,010	n/a
13	H-POWER (12)	616,687	623,272	602,520	610,000	610,000	610,000	-0.22%	610,000	610,000	610,000	610,000	610,000	0.00%
14	Additional WTE Capacity (13)	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
15	Interim Disposal Option (14)	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
16	**Total Waste Managed by Refuse Division**	1,152,144	1,169,248	1,156,732	1,157,720	1,180,400	1,203,500	0.88%	1,227,080	1,252,960	1,260,640	1,287,220	1,314,160	1.73%
17														
18														
19	**Solid Waste Transferred - Transfer Stations (15)**													
20	Trans. Stations - Refuse Div.	225,890	237,660	253,270	258,220	263,280	268,430	3.51%	273,700	279,090	284,640	290,300	296,080	1.98%
21	Trans. Stations - Other City	3,620	3,800	4,050	4,130	4,210	4,300	3.50%	4,380	4,470	4,560	4,650	4,740	1.99%
22	Trans. Stations - Non-Profit	1,690	1,780	1,890	1,930	1,970	2,010	3.53%	2,040	2,090	2,130	2,170	2,210	2.02%
23	Transfer Stations - Comm.	9,878	10,398	11,084	11,300	11,520	11,740	3.51%	11,980	12,210	12,450	12,700	12,960	1.99%
24	**Total Solid Waste Transferred**	241,078	253,638	270,294	275,580	280,980	286,480	3.51%	292,100	297,860	303,780	309,820	315,990	1.98%
25														
26	**Solid Waste Transferred - Convenience Centers (15)**													
27	Convenience Centers	26,178	26,100	36,131	36,840	37,560	38,300	7.91%	39,050	39,820	40,610	41,420	42,240	1.98%
28	**Total Solid Waste Transferred - Convenience Centers**	26,178	26,100	36,131	36,840	37,560	38,300	7.91%	39,050	39,820	40,610	41,420	42,240	1.98%

BASE CASE
TABLE 3
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Summary of Projected Waste Quantities (Tons)

		Actual			Projected			'04 - '09 Average Annual	Projected					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (1)	2010	2011	2012	2013	2014	Growth (1)
29	**Detail for Total Waste Managed by Refuse Division**													
30														
31	**Refuse Division Recycled Waste**													
32	Paper	75,056	73,555	73,555	74,040	75,500	76,970	0.51%	78,480	80,030	81,620	83,250	84,900	1.99%
33	Plastic	421	3,753	3,753	3,780	3,850	3,930	56.31%	4,000	4,080	4,160	4,250	4,330	2.00%
34	Metal	4,164	5,345	5,345	5,380	5,490	5,590	6.07%	5,700	5,820	5,930	6,050	6,170	2.00%
35	Glass	12,458	19,313	19,313	19,440	19,820	20,210	10.16%	20,610	21,010	21,430	21,860	22,290	1.98%
36	Other Inorganic	13,317	13,480	13,480	13,580	13,830	14,110	1.16%	14,390	14,680	14,970	15,250	15,570	1.99%
37	Other Wastes	32,976	29,423	29,423	29,620	30,200	30,790	-1.36%	31,390	32,010	32,650	33,300	33,960	1.99%
38	Green Waste (16)	30,000	31,000	31,000	34,000	34,670	35,350	3.34%	36,040	36,750	37,480	38,220	38,980	1.98%
39	Wood	7,403	8,229	8,229	8,280	8,450	8,610	3.07%	8,780	8,950	9,130	9,310	9,500	1.99%
40	Other Organics	46,303	32,447	32,447	32,660	33,300	33,960	-6.01%	34,620	35,300	36,000	36,720	37,450	1.98%
41	**Total Refuse Division Recycled Waste**	222,097	216,545	216,545	220,780	225,110	229,520	0.66%	234,010	238,630	243,370	248,210	253,150	1.98%
42														
43	**Curbside Recycling Roll Out**													
44	Curbside Recycling Roll Out (7)	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
45														
46	**Additional Green Waste**													
47	Additional Green Waste (8)	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
48														
49	**Additional Community Bins**													
50	Community Bin Recycling Program (9)	0	0	0	2,000	3,000	4,000	n/a	4,000	4,000	4,000	4,000	4,000	0.00%
51														
52	**Landfill (10)**													
53	Landfill - Residential	5,000	626	2,955	2,840	3,000	3,150	-8.83%	3,320	3,500	3,530	3,720	3,910	4.17%
54	Landfill - Refuse Division	107,164	119,807	119,231	114,740	120,860	127,110	3.47%	133,850	141,360	142,400	150,070	157,840	4.21%
55	Landfill - Non-Profit	4,103	3,240	3,857	3,710	3,910	4,110	0.03%	4,330	4,570	4,610	4,850	5,110	4.23%
56	Landfill - Commercial	140,779	135,604	145,188	139,720	147,180	154,780	1.91%	162,990	172,130	173,400	182,740	192,200	4.21%
57	Landfill - Other City	36,314	33,715	36,787	35,400	37,290	39,220	1.55%	41,300	43,610	43,930	46,300	48,700	4.21%
58	Landfill - Recycler	20,000	36,440	29,649	28,530	30,050	31,610	9.59%	33,280	35,160	35,400	37,330	39,250	4.21%
59	Subtotal Landfill	313,360	329,431	337,667	324,940	342,290	359,980	2.81%	379,070	400,330	403,270	425,010	447,010	4.21%
60														
61	**H-POWER (12)**													
62	H-POWER - Commercial	297,435	297,413	301,149	304,890	304,890	304,890	0.50%	304,890	304,890	304,890	304,890	304,890	0.00%
63	H-POWER - Refuse Division (17)	317,251	324,098	299,568	303,290	303,290	303,290	-0.90%	303,290	303,290	303,290	303,290	303,290	0.00%
64	H-POWER - Other City Agencies	870	785	788	800	800	800	-1.66%	800	800	800	800	800	0.00%
65	H-POWER - Non-Profit (18)	1,131	977	1,014	1,020	1,020	1,020	-2.05%	1,020	1,020	1,020	1,020	1,020	0.00%
66	Subtotal H-POWER	616,687	623,272	602,520	610,000	610,000	610,000	-0.22%	610,000	610,000	610,000	610,000	610,000	0.00%
67														
68	**Additional WTE Capacity (13)**													
69	Commercial	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
70	Refuse Division	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
71	Other City Agencies	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
72	Non-Profit	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
73	Subtotal Additional WTE Capacity	0	0	0	0	0	0	n/a	0	0	0	0	0	n/a
74														
75	**Total Waste Managed by Refuse Division**	1,152,144	1,169,248	1,156,732	1,157,720	1,180,400	1,203,500	0.88%	1,227,080	1,252,960	1,260,640	1,287,220	1,314,160	1.73%

BASE CASE
TABLE 3
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Summary of Projected Waste Quantities (Tons)

	Actual			Projected			'04 - '09 Average Annual Growth (1)	Projected					'10 - '14 Average Annual Growth (1)
	2004	2005	2006	2007	2008	2009		2010	2011	2012	2013	2014	

Notes

(1) Average Annual Growth is defined as the average growth rate for each year over a specified time period.

(2) Equals Waste Managed by Refuse Division, Private Landfill, Private Recyclers, and Unpermitted Disposal.

(3) Assumed to be 225,000 tons in FY 2006 per Section 2 of ISWMP. Projections based on FY 2006 per capita generation rate for Private and Unpermitted Disposal, the De Facto population per Section 2 of the ISWMP, and the increase in the per capita generation rate per Section 2 of the ISWMP.

(4) FY 2004 estimated based on growth between FY 2005 - 2006. FY 2005-2006 and 2010-2014 from Section 2 of ISWMP. FY 2007-2009 estimated based on Section 2 methodology and assumptions.

(5) Calculated using Total Waste Generation (less Private and Unpermitted) less Landfill, H-POWER, and Division Recycling. Consists mainly of C+D and metals, and some green waste.

(6) Recycling tonnage for FY 2004 – FY 2006 is for the calendar year, based on "Recycling Survey - 2004.xls" and "Recycling Data - 2005.xls." CY 2005 data was used as a proxy for FY 2006 data. Recycling tonnages do not include Chemical/Oils per Division email dated 1/29/2007. FY 2004 excludes 117,156 tons of metal and FY 2005 – FY 2006 excludes 154,125 tons of metal that the Division is not responsible for. Quantities also exclude green waste tonnage the Division is not responsible for. Projections based on 2006 per capita recycling rate, the De Facto population, and the increase in the per capita generation rate per Section 2 of the ISWMP.

(7) Curbside recycling program projected to increase recycling tonnage in Scenario A by 40,000 tons and in Scenario B by 30,000 tons by FY 2010 per Section 4.

(8) Additional green waste is projected to be 30,000 tons/year by FY 2009 in Scenario A and 15,000 tons/year by FY 2009 in Scenario B, for total green waste recovery in FY 2009 of 65,350 tons in Scenario A, and 50,350 tons in Scenario B. No additional green waste assumed in Base Case.

(9) Community recycling bins projected to increase from 75 to 100 bins by FY 2009. Tonnage projected to increase proportionately between FY 2007-2009. In Scenarios A & B, total community recycling bin tonnage is projected to decrease 10% due to green waste and mixed recyclable collection. This results in 1,600 fewer tons collected by community recycling bins (16,000 tons collected in FY 2006 * 10% = 1,600 tons).

(10) FY 2004 tonnage per 2004 Financial Plan. FY 2005 tonnage is per Division and does not include H-POWER ash and residue, or excavated rocks. FY 2006 tonnage taken from 2006 Waste Characterization Study completed by R. W. Beck and "Fy06-WG Landfill-Totals reports.xls". Allocation based on average of FY 2004 and FY 2005 allocation. Projections based on 2006 per capita generation rate for Refuse Division - Landfill and the De Facto population and increase in the per capita generation rate per Section 2 of the ISWMP. In the Base Case, landfill extensions are assumed through 2014.

(11) Assumes landfill expansion will be operational in May 2010. Of the tonnage sent to Landfill and H-POWER, 15% is non-combustible and must be diverted to the Landfill. In FY 2012-2014, we assume only non-combustible tonnage is sent to the Landfill, and all else is disposed of at H-POWER and additional WTE capacity.

(12) FY 2004 tonnage per 2004 Financial Plan. FY 2005 tonnage from "FY05-HPR-Totals reports.xls, FY 2006 from "FY06-REVISED-HPR-Totals reports.xls" provided by Division. Projections based on contracted amount. Tonnage does not include non-combustible waste.

(13) In Scenarios A & B, R. W. Beck assumes additional 400,000 tons/year of WTE capacity available beginning in FY 2012.

(14) In the Base Case and Scenarios A & B, interim disposal options, such as shipping waste off island, are not considered.

(15) FY 2004-2005 Sources: Kawailoa TS - FY 04-FY 06.xls, Keehi TS - FY 04-FY 06.xls and Kapaa TS - FY 04-FY 06.xls, allocation between categories based on 2004 Financial Plan. FY 2006 Source: Section 1. Projections based on growth in de facto population and per capita generation rate.

(16) FY 2006 green waste tonnage estimated using tonnage from transfer station and convenience centers (10,000 tons) per Section 1 and tons collected (21,000) per Division. Tonnage is projected to increase to approximately 34,000 tons in FY 2007, and with per capita generation and population growth thereafter.

(17) Includes Refuse, Convenience Center, and Transfer categories from FY05-HPR-Totals reports.xls and FY06-HPR-Totals reports.xls

(18) Includes Eleemosynary category from FY05-HPR-Totals reports.xls and FY06-HPR-Totals reports.xls

BASE CASE

Table 4
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Projected Billable Waste Quantities and Rates
Fiscal Years Ending June 30

		Actual (1)	Projected (2)							
		2006	2007	2008	2009	2010	2011	2012	2013	2014
	Billable Waste Percentages									
1	Convenience Centers	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2	Transfer Station - Other City	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
3	Transfer Stations - Commercial	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
4	Landfill - Residential (3)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5	Landfill - Commercial	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
6	Landfill - Other City	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
7	Landfill - Recyclers	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
8	H-POWER - Commercial	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
9	H-POWER - All City	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
10	Additional WTE - Commercial	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
11	Additional WTE - All City	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
12										
13	**Billable Waste (Tons) (4)**									
14	Convenience Centers	-	-	-	-	-	-	-	-	-
15	Transfer Station - Other City	4,050	4,130	4,210	4,300	4,380	4,470	4,560	4,650	4,740
16	Transfer Stations - Commercial	11,080	11,300	11,520	11,740	11,980	12,210	12,450	12,700	12,960
17	Landfill - Residential	-	-	-	-	-	-	-	-	-
18	Landfill - Commercial	145,190	139,720	147,180	154,780	162,990	172,130	173,400	182,740	192,200
19	Landfill - Other City	36,790	35,400	37,290	39,220	41,300	43,610	43,930	46,300	48,700
20	Landfill - Recyclers	29,650	28,530	30,050	31,610	33,280	35,160	35,400	37,330	39,250
21	H-POWER - Commercial	301,150	304,890	304,890	304,890	304,890	304,890	304,890	304,890	304,890
22	H-POWER - All City	301,370	305,110	305,110	305,110	305,110	305,110	305,110	305,110	305,110
23	Additional WTE - Commercial	-	-	-	-	-	-	-	-	-
24	Additional WTE - All City	-	-	-	-	-	-	-	-	-
25										
26	**Billing Rates ($/Ton)**									
27	Convenience Centers	-	-	-	-	-	-	-	-	-
28	Transfer Station - Other City (5)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
29	Transfer Stations - Commercial (5)	110.60	110.60	110.60	110.60	110.60	110.60	110.60	110.60	110.60
30	Landfill - Residential (3)	-	-	-	-	-	-	-	-	-
31	Landfill - Commercial (5)	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
32	Landfill - Other City	16.00	16.00	16.00	16.50	17.00	17.50	18.05	18.60	19.15
33	Landfill - Recyclers (6)	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20
34	H-POWER - Commercial (7)	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
35	H-POWER - All City (7)	45.35	45.35	45.35	45.35	45.35	45.35	81.00	81.00	81.00
36	Additional WTE - Commercial							81.00	81.00	81.00
37	Additional WTE - All City							81.00	81.00	81.00

BASE CASE

Table 4
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Projected Billable Waste Quantities and Rates
Fiscal Years Ending June 30

		Actual (1)	Projected (2)							
		2006	2007	2008	2009	2010	2011	2012	2013	2014
38	RECYCLING SURCHARGE (8)									
39	Transfer Station - Other City	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
40	Transfer Station - Commercial	13.27	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25
41	Landfill - Commercial	9.72	9.70	9.70	9.70	9.70	9.70	9.70	9.70	9.70
42	Landfill - Other City	1.92	1.90	1.90	2.00	2.05	2.10	2.15	2.25	2.30
43	Landfill - Recyclers	-	-	-	-	-	-	-	-	-
44	H-POWER - Commercial	9.72	9.72	9.72	9.72	9.72	9.72	9.72	9.72	9.72
45	H-POWER - All City	5.44	5.45	5.45	5.45	5.45	5.45	9.70	9.70	9.70
46	Additional WTE Capacity - Commercial	-	-	-	-	-	-	9.72	9.72	9.72
47	Additional WTE Capacity - All City	-	-	-	-	-	-	9.72	9.72	9.72

Notes

(1) Per www.opala.org.

(2) Based on FY 2006, and known future assumptions.

(3) The Division does not charge Residential customers for disposal at the Landfill.

(4) Based on Billable Waste Percentages times Quantities on Table 3.

(5) FY 2007 and FY 2008 based on existing rate. FY 2009 - FY 2014 assumed constant per the Division.

(6) Rate based on 20% of Landfill commercial rate paid for recyclers to dump residual materials.

(7) FY 2007 and FY 2008 based on existing rate. FY 2009 - 2014 per Division recommendation.

(8) Per Division rate schedule a 12% recycling surcharge is imposed on all tonnage paying for disposal.

BASE CASE
TABLE 5
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Historical and Projected Revenues

		Actual (1)			Budget (2)		Projected	'04 - '09 Average Annual	Projected					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (3)	2010	2011	2012	2013	2014	Growth (3)
1	REFUSE GENERAL OPERATING ACCOUNT - 250													
2	6128 - Collector Decals (4)			$800	$800	$800	$810	n/a	$810	$820	$820	$830	$840	0.91%
3	7261 - Collection-Small Business (5)			564,000	540,000	540,000	545,240	n/a	550,530	555,870	561,260	566,700	572,200	0.97%
4	7291 - Disposal													
5	Transfer Station (6)			$1,288,180	$1,297,500	$1,307,600	$1,513,400	n/a	$1,544,000	$1,573,900	$1,605,000	$1,637,100	$1,670,400	1.99%
6	Landfill (6)			10,113,506	10,389,200	10,633,200	12,537,200	n/a	13,202,200	13,942,500	14,045,400	14,801,900	15,568,200	4.21%
7	Recycling (7)			555,514	559,700	563,900	512,100	n/a	539,100	569,600	573,500	604,700	635,900	4.21%
8	Subtotal 250			$12,522,000	$12,787,200	$13,045,500	$15,108,750	n/a	$15,836,640	$16,642,690	$16,785,980	$17,611,230	$18,447,540	3.89%
9														
10	H-POWER - SOLID WASTE DISP. FAC. ACCOUNT - 885													
11	8232 - Commercial Tip Fees (6)			$24,393,097	$24,393,200	$24,393,000	$24,696,100	n/a	$24,696,100	$24,696,100	$24,696,100	$24,696,100	$24,696,100	0.00%
12	8233 - Electrical Energy (8)			34,754,477	35,787,790	29,541,000	30,427,200	n/a	31,340,000	32,280,200	33,248,700	34,246,100	35,273,500	3.00%
13	Metal Sales (9)			1,509,190	1,500,000	1,500,000	1,545,000	n/a	1,591,400	1,639,100	1,688,300	1,738,900	1,791,100	3.00%
14	8236 - City Agency Tip Fees (6, 10)			13,667,084	13,667,100	13,667,000	13,836,700	n/a	13,836,700	13,836,700	24,713,900	24,713,900	24,713,900	15.61%
15	8330 - AES Easement (11)			25,923	25,900	26,000	26,000	n/a	26,000	26,000	26,000	26,000	26,000	0.00%
16	Subtotal 885			$74,349,771	$75,373,990	$69,127,000	$70,531,000	n/a	$71,490,200	$72,478,100	$84,373,000	$85,421,000	$86,500,600	4.88%
17														
18	H-POWER Other Revenue													
19	H-POWER Mortgage (12)			$24,294,334	$21,881,500	$21,338,300	$29,400,500	n/a	$5,013,300	$0	$0	$0	$0	-100.00%
20	Subtotal H-POWER Other Revenue			$24,294,334	$21,881,500	$21,338,300	$29,400,500	n/a	$5,013,300	$0	$0	$0	$0	-100.00%
21														
22	Additional WTE Capacity Revenue													
23	Commercial Tip Fees (13)			$0	$0	$0	$0	n/a	$0	$0	$0	$0	$0	n/a
24	Electrical Energy (14)			0	0	0	0	n/a	0	0	0	0	0	n/a
25	City Agency Tip Fees (13)			0	0	0	0	n/a	0	0	0	0	0	n/a
26	Subtotal Additional WTE Capacity Revenue			$0	$0	$0	$0	n/a	$0	$0	$0	$0	$0	n/a
27														
28	GLASS RECYCLING - 206													
29	6745 - Glass Payments from DOH (11)			$500,000	$300,000	$300,000	$300,000	n/a	$300,000	$300,000	$300,000	$300,000	$300,000	0.00%
30	6746 - Admin of Glass Program			0	0	0	0	n/a	0	0	0	0	0	n/a
31	Subtotal 206			$500,000	$300,000	$300,000	$300,000	n/a	$300,000	$300,000	$300,000	$300,000	$300,000	0.00%
32														
33	RECYCLING ACCOUNT - 209													
34	7293 - Commercial Recycling Surcharge (6)			$4,217,074	$4,250,700	$4,281,000	$4,620,500	n/a	$4,703,300	$4,795,000	$4,810,500	$4,904,400	$4,999,600	1.54%
35	7294 - Division, Other City Recycling Surcharge (6)			1,646,081	1,646,100	3,210,800	1,767,100	n/a	1,773,800	1,781,300	3,081,400	3,091,600	3,100,000	14.98%
36	Additional WTE Recycling Surcharge			0	0	0	0	n/a	0	0	0	0	0	n/a
37	Community Bins - HI-5 program (15)			0	0	0	800,000	n/a	824,000	848,700	874,200	900,400	927,400	3.00%
38	Subtotal 209			$5,863,155	$5,896,800	$7,491,800	$7,187,600	n/a	$7,301,100	$7,425,000	$8,766,100	$8,896,400	$9,027,000	5.45%
39														
40	TOTAL REVENUES	$88,983,000	$96,021,000	$117,529,260	$116,239,500	$111,302,600	$122,527,900	6.61%	$99,941,200	$96,845,800	$110,225,100	$112,228,600	$114,275,100	3.41%

Notes

(1) Total Revenues per FY 2004 and FY 2005 County of Honolulu CAFR. FY 2006 from "fy 06 actual rev based on tons.xls."

(2) FY 2007 per FY 07 Revenue Revised Estimate.xls, FY 2008 per FY 08 Revenue and Future Years Estimate.xls.

(3) Average Annual Growth is defined as the average growth rate for each year over a specified time period.

(4) FY 2007-2013 projections based on "FY 07 Revenue Revised Estimate.xls" provided by Staff. FY 2014 based on growth in accounts. See Table 2 for details.

(5) Projections based on growth in De Facto population. See Table 2 for details.

(6) Projections based on Billable Waste Quantities and Billing Rates. See Table 3 for details.

(7) Projections based on Billable Waste Quantities and Billing Rates. See Table 3 for details. Equals 20% of tip fee.

(8) FY 2009 and beyond based on FY 2008 revenue/ton increasing with inflation.

(9) FY 2006 revenues per Division. FY 2007 and FY 2008 revenues projected to remain constant. FY 2009 and beyond based on previous years revenues times general inflation of 3% per year.

(10) Change in magnitude of projected revenues due to changes in projected H-POWER tipping fee in FY 2012. See table 4 for details.

(11) FY 2009 and beyond assumes flat revenues at FY 2008 levels.

(12) Source: "moneyforpurchase.xls" provided by Division. Assumes payment ceases after FY 2010.

(13) Tipping fees for additional WTE capacity for commercial and Division assumed to equal H-POWER tip fees.

(14) Includes additional electrical energy revenues based on the additional WTE capacity. Projected based on FY 2008 revenue/ton.

(15) FY 2009 - 2014 per Division recommendation.

BASE CASE

TABLE 6

CITY AND COUNTY OF HONOLULU

Department of Environmental Services

Actual and Projected Operating Expenses - Combined Program Accounts

Fiscal Years Ending June 30

		Actual (1)			Budget (2)		Projected (3)	'04 - '09 Average Annual	Projected (3)					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (4)	2010	2011	2012	2013	2014	Growth (4)
1	**ADMINISTRATION**													
2	Salaries and Wages	$734,249	$733,577	$768,153	$752,240	$769,400	$792,500	1.54%	$816,300	$840,800	$866,000	$892,000	$918,800	3.00%
3	Labor Fringe Costs - Salaries and Wages (5)	160,700	160,500	168,100	164,600	168,300	173,300	1.52%	178,500	183,900	189,400	195,100	201,000	3.01%
4	Current Expenses													
5	Supplies (6)	24,657	33,494	25,326	28,430	29,200	30,100	4.07%	31,000	31,900	32,900	33,900	34,900	3.01%
6	Services	20,533	44,678											
7	Medical Services			7,431	18,000	20,000	20,600	-	21,200	21,800	22,500	23,200	23,900	3.04%
8	Attorney Fees			0	75,000	80,000	82,400	-	84,900	87,400	90,000	92,700	95,500	2.98%
9	Advertisement of Public Notice			0	80,000	90,000	92,700	-	95,500	98,400	101,400	104,400	107,500	3.00%
10	Printing and Binding			1,259	20,000	22,000	22,700	-	23,400	24,100	24,800	25,500	26,300	2.96%
11	Miscellaneous Services (7)			17,930	3,900	40,400	41,600	-	42,800	44,100	45,400	46,800	48,200	3.02%
12	Other Contractual Services (8)	24,382	8,874											
13	Consultants			42,592	200,000	206,000	212,200	-	218,600	225,200	232,000	239,000	246,200	3.02%
14	Janitorial			6,813	7,000	7,200	7,400	-	7,600	7,800	8,000	8,200	8,400	2.53%
15	Miscellaneous			5,364	5,000	5,200	5,400	-	5,600	5,800	6,000	6,200	6,400	3.39%
16	Adjustment			4,490				-						-
17	Emergency Response Contract				100,000	-	-	-	-	-	-	-	-	-
18	Emergency Response In-place Contractor				200,000	206,000	212,200	-	218,600	225,200	232,000	239,000	246,200	3.02%
19	Kapaa LF Gas to Energy				70,000	72,100	74,300	-	76,500	78,800	81,200	83,600	86,100	3.00%
20	Solid Waste Operation Program Development				120,000			-						-
21	Disaster Debris Contractor Maintenance Fee					150,000	-	-	-	-	-	-	-	-
22	Kapalama Incinerator Offsite Rehabilitation (Soil Testing, Abatement)					100,000	103,000	-	106,100	109,300	112,600	116,000	119,500	3.02%
23	Solid Waste Education					25,000	25,800	-	26,600	27,400	28,200	29,000	29,900	2.97%
24	Subtotal - Other Contractual Services	24,382	8,874	59,259	702,000	771,500	640,300	92.25%	659,600	679,500	700,000	721,000	742,700	3.01%
25	Telephone	9,193	23,893	29,967	3,500	5,000	5,200	-10.77%	5,400	5,600	5,800	6,000	6,200	3.51%
26	Rentals	3,562	10,385	9,585	0	0	0	-	0	0	0	0	0	-
27	Refunds, Awards, and Indemnity	0	425,000	0	0	0	0	-	0	0	0	0	0	-
28	Other (9)	21,098	25,084	15,783	40,600	57,800	59,500	23.04%	61,300	63,100	65,000	67,000	69,000	3.00%
29	Equipment	7,865	2,526	1,134	0	51,000	25,000	26.02%	25,800	26,600	27,400	28,200	29,000	2.97%
30	Subtotal - ADMINISTRATION	$1,006,239	$1,468,011	$1,103,926	$1,888,270	$2,104,600	$1,985,900	14.56%	$2,045,700	$2,107,200	$2,170,600	$2,235,800	$2,303,000	3.01%
31														
32	**INSPECTION & INVESTIGATION**													
33	Salaries and Wages	$252,101	$208,940	$206,756	$302,450	$305,710	$314,900	4.55%	$324,300	$334,000	$344,000	$354,300	$364,900	2.99%
34	Labor Fringe Costs - Salaries and Wages (5)	55,200	45,700	45,200	66,200	66,900	68,900	4.53%	71,000	73,100	75,300	77,500	79,800	2.96%
35	Current Expenses													
36	Other Contractual Services (8)	0	18,000											-
37	Upgrade Computer Programs			5,407	20,000	22,000	22,700	-	23,400	24,100	24,800	25,500	26,300	2.96%
38	Printing and Binding	0	0	0	4,000	4,000	4,100	-	4,200	4,300	4,400	4,500	4,600	2.30%
39	Other (10)	10,549	11,188	13,522	17,010	18,000	18,500	11.89%	19,100	19,700	20,300	20,900	21,500	3.00%
40	Equipment	0	0	0	0	0	0	-	0	0	0	0	0	-
41	Subtotal - INSPECTION & INVESTIGATION	$317,850	$283,827	$270,885	$409,660	$416,610	$429,100	6.19%	$442,000	$455,200	$468,800	$482,700	$497,100	2.98%
42														

BASE CASE
TABLE 6
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Actual and Projected Operating Expenses - Combined Program Accounts
Fiscal Years Ending June 30

		Actual (1)			Budget (2)		Projected (3)	'04 - '09 Average Annual	Projected (3)					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (4)	2010	2011	2012	2013	2014	Growth (4)
43	**RECYCLING**													
44	Salaries and Wages	$266,295	$284,407	$306,393	$325,960	$334,330	$344,400	5.28%	$354,700	$365,300	$376,300	$387,600	$399,200	3.00%
45	Labor Fringe Costs - Salaries and Wages (5)	58,300	62,200	67,000	71,300	73,200	75,400	5.28%	77,600	79,900	82,300	84,800	87,300	2.99%
46	Current Expenses													
47	Supplies (11)	28,772	10,932	944,976	4,403,300	4,569,000	5,280,000	183.62%	800,000	800,000	800,000	800,000	800,000	0.00%
48	Services (12)	32,843	125,267	338,929	200,500	200,500	206,500	44.44%	212,700	219,100	225,700	232,500	239,500	3.01%
49	Other Contractual Services (8)	1,538,966	1,586,781											
50	Community Recycling Bins Hauling & Maintenance (13)			740,052	1,680,000	2,914,830	3,002,300	-	3,092,400	3,185,200	3,280,800	3,379,200	3,480,600	3.00%
51	Recycling Education Events			24,993	160,000	155,460	160,100	-	164,900	169,800	174,900	180,100	185,500	2.99%
52	Public Outreach			64,584	400,000	388,640	400,300	-	412,300	424,700	437,400	450,500	464,000	3.00%
53	Website server, updates				20,000	19,430	20,000	-	20,600	21,200	21,800	22,500	23,200	3.02%
54	Tire Recycling Fee			119,642	80,000	77,730	80,100	-	82,500	85,000	87,600	90,200	92,900	3.01%
55	Propane Tank Recycling Fee			234,358	260,000	252,620	260,200	-	268,000	276,000	284,300	292,800	301,600	3.00%
56	Illegal Dumping Projects			234,358	200,000	194,320	200,100	-	206,100	212,300	218,700	225,300	232,100	3.01%
57	Condo/Apartment Recycling				100,000	194,320	200,100	-	206,100	212,300	218,700	225,300	232,100	3.01%
58	Green Waste Tip Fee			234,358	2,600,000	2,526,200	2,078,200	-	2,118,500	2,160,500	2,203,300	2,246,200	2,291,500	1.98%
59	Mulch Delivery Fee				65,000	97,160	100,100	-	103,100	106,200	109,400	112,700	116,100	3.01%
60	Operating Expense Adjustment				(100,000)		0	-	0	0	0	0	0	-
61	Office Paper Recycling Program					24,290	25,000	-	25,800	26,600	27,400	28,200	29,000	2.97%
62	Curbside Recycling (14)													-
63	White Goods Freon Recycling (15)						525,000	-	540,800	557,000	573,700	590,900	608,600	3.00%
64	Rentals (16)	2,475	4,043	9,048	4,500	15,000	15,500	44.33%	16,000	16,500	17,000	17,500	18,000	2.99%
65	Other (17)	18,580	8,706	21,722	13,100	13,100	13,500	-6.19%	13,900	14,300	14,700	15,100	15,600	2.93%
66	Adjustment for Green Waste Processing (18)			(234,358)	(2,600,000)	(2,526,200)	(2,078,200)	-	(2,118,500)	(2,160,500)	(2,203,300)	(2,246,200)	(2,291,500)	1.98%
67	Adjustment for Green Waste Equipment - Carts (18)				(4,375,000)	(4,500,000)	(5,280,000)	-	(800,000)	(800,000)	(800,000)	(800,000)	(800,000)	0.00%
68	Equipment		0	0	0	0	0	-	0	0	0	0	0	-
69	Subtotal - RECYCLING	$1,946,231	$2,082,335	$3,106,056	$3,508,660	$5,023,930	$5,628,600	23.66%	$5,797,500	$5,971,400	$6,150,700	$6,335,200	$6,525,300	3.00%
70														
71	**GLASS RECYCLING**													
72	Salaries and Wages	$34,944	$38,053	$40,639	$46,400	$48,140	$49,600	7.26%	$51,100	$52,600	$54,200	$55,800	$57,500	2.99%
73	Labor Fringe Costs - Salaries and Wages (5)	7,600	8,300	8,900	10,200	10,500	10,900	7.48%	11,200	11,500	11,900	12,200	12,600	2.99%
74	Current Expenses													
75	Other Contractual Services (8)	0	98,000	0				-						-
76	Market Development				300,000	100,000	103,000	-	106,100	109,300	112,600	116,000	119,500	3.02%
77	Public Education				100,000	100,000	103,000	-	106,100	109,300	112,600	116,000	119,500	3.02%
78	Audit Glass Recycling Companies				30,000	20,000	20,600	-	21,200	21,800	22,500	23,200	23,900	3.04%
79	Demonstration Projects				300,000	300,000	309,000	-	318,300	327,800	337,600	347,700	358,100	2.99%
80	Other Fixed Charges	1,328,157	1,740,391	405,208	800,000	800,000	824,000	-9.11%	848,700	874,200	900,400	927,400	955,200	3.00%
81	Other (19)	318	164	881	100,000	50,000	51,500	176.57%	53,000	54,600	56,200	57,900	59,600	2.98%
82	Subtotal - GLASS RECYCLING	$1,371,019	$1,884,909	$455,628	$1,686,600	$1,428,640	$1,471,600	1.43%	$1,515,700	$1,561,100	$1,608,000	$1,656,200	$1,705,900	3.00%
83														
84	**GREEN WASTE**													
85	Salaries and Wages													
86	Collection (Includes Labor Fringe Costs) (20)			$2,807,000	$2,891,200	$2,725,800	$2,570,200	-	$2,698,950	$2,834,690	$2,977,730	$3,127,630	$3,285,540	5.04%
87	Current Expenses													
88	Collection (21)			$785,000	$808,600	$1,146,500	$1,476,200	-	$1,550,150	$1,628,110	$1,710,270	$1,796,370	$1,887,060	5.04%
89	Processing (22)			1,074,427	3,948,920	4,119,700	2,969,400	-	3,027,400	3,087,000	3,148,300	3,210,500	3,274,300	1.98%
90	Transfer (23)			500,000	564,800	593,200	623,000	-	654,200	687,100	721,800	758,100	796,400	5.04%
91	Adjustment for "Green Waste" line item from Collection - Rural (24)				31,250	-	-		-	-	-	-	-	-
92	Equipment													
93	Trucks (25)					1,358,000	1,398,700		1,440,700	1,483,900	1,528,400	1,574,300	0	-
94	Carts (26)			0	4,375,000	4,500,000	5,280,000	-	800,000	800,000	800,000	800,000	800,000	0.00%
95	Subtotal - GREEN WASTE	$0	$0	$5,166,427	$12,619,770	$14,443,200	$14,317,500	-	$10,171,400	$10,520,800	$10,886,500	$11,266,900	$10,043,300	-
96														

BASE CASE

TABLE 6

CITY AND COUNTY OF HONOLULU

Department of Environmental Services

Actual and Projected Operating Expenses - Combined Program Accounts

Fiscal Years Ending June 30

		Actual (1)			Budget (2)		Projected (3)	'04 - '09 Average Annual	Projected (3)					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (4)	2010	2011	2012	2013	2014	Growth (4)
97	**MIXED RECYCLABLES COLLECTION**													
98	Salaries and Wages													
99	Collection (Includes Labor Fringe Costs) (27)					-	-	-	-	-	-	-	-	-
100	Current Expenses													
101	Collection (28)					-	-	-	-	-	-	-	-	-
102	Processing (29)					-	-	-	-	-	-	-	-	-
103	Equipment													
104	Trucks													
105	Carts (30)					-	-	-	-	-	-	-	-	-
106	Subtotal - MIXED RECYCLABLES COLLECTION					$0	$0	-	$0	$0	$0	$0	$0	-
107														
108	**COLLECTION - HONOLULU**													
109	Salaries and Wages	$5,900,905	$6,134,886	$7,483,890	$7,622,470	$8,736,260	$8,998,300	8.80%	$9,268,200	$9,546,200	$9,832,600	$10,127,600	$10,431,400	3.00%
110	Labor Fringe Costs - Salaries and Wages (5)	1,291,100	1,342,300	1,637,500	1,667,800	1,911,500	1,968,800	8.80%	2,027,900	2,088,700	2,151,400	2,215,900	2,282,400	3.00%
111	Adjustment for Green Waste Collection Salaries and Wages (18)			(1,472,300)	(1,351,600)	(1,382,100)	(1,303,200)	-	(1,368,500)	(1,437,300)	(1,509,800)	(1,585,800)	(1,665,900)	5.04%
112	Current Expenses													
113	Supplies (31)	26,476	139,261	29,672	31,790	71,600	73,700	22.72%	75,900	78,200	80,500	82,900	85,400	2.99%
114	Parts - Other Equipment	0	71,299	0	388,000	316,000	325,500	-	335,300	345,400	355,800	366,500	377,500	3.01%
115	Other Contractual Services (8)	1,026,878	1,407,562					-						-
116	Curbside Recycling (14)							-						-
117	Disposal of Freon Appliances					400,000	422,330	435,000	-	448,100	461,500	475,300	489,600	504,300	3.00%
118	Janitorial Yard Services			3,852		40,000	42,620	43,900	-	45,200	46,600	48,000	49,400	50,900	3.01%
119	Guard Services			120,096		120,000	116,240	119,700	-	123,300	127,000	130,800	134,700	138,700	2.99%
120	Bulky Item Hauling			274,367		250,000	339,030	349,200	-	359,700	370,500	381,600	393,000	404,800	3.00%
121	White Goods Disposal			341,115		250,000	261,540	269,400	-	277,500	285,800	294,400	303,200	312,300	3.00%
122	Radioactive Calibration					12,000	12,400	12,800	-	13,200	13,600	14,000	14,400	14,800	2.90%
123	Overloaded Trucks					400,000	19,370	20,000	-	20,600	21,200	21,800	22,500	23,200	3.02%
124	Front End Loader Hauling					100,000	145,300	149,700	-	154,200	158,800	163,600	168,500	173,600	3.01%
125	Hazardous Waste Material Hauling					60,000	58,120	-	-	-	-	-	-	-	-
126	Tree Trimming					75,000	72,650	74,800	-	77,000	79,300	81,700	84,200	86,700	3.01%
127	Security Fencing/Lighting					150,000		0	-	0	0	173,891	0	0	-
128	Radioactive Material Disposal					54,000	52,300	53,900	-	55,500	57,200	58,900	60,700	62,500	3.01%
129	Secure Storage Containers					16,000	15,500	16,000	-	16,500	17,000	17,500	18,000	18,500	2.90%
130	Guard Shed					75,000		0	-	0	0	86,946	0	0	-
131	Services (32)	239,097	417,654	37,413	186,910	198,500	204,500	-3.08%	210,600	216,900	223,400	230,100	237,000	3.00%
132	Rentals	1,274	6,000	70,525	18,000	15,000	15,500	64.83%	16,000	16,500	17,000	17,500	18,000	2.99%
133	Other (33)	51,568	43,258	46,304	49,530	19,700	20,300	-17.01%	20,900	21,500	22,100	22,800	23,500	2.97%
134	Adjustment for Green Waste Collection Current Expenses (18)			(608,900)	(531,500)	(711,500)	(906,800)	-	(952,200)	(1,000,100)	(1,092,000)	(1,103,400)	(1,159,100)	5.04%
135	Equipment	0	0	6,354	0	0	0	-	0	0	0	0	0	-
136	Subtotal - COLLECTION - HONOLULU	$8,537,299	$9,562,220	$7,969,889	$10,083,400	$10,732,360	$10,941,000	5.09%	$11,224,900	$11,514,500	$12,029,437	$12,112,300	$12,420,500	2.56%
137														

BASE CASE

TABLE 6
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Actual and Projected Operating Expenses - Combined Program Accounts
Fiscal Years Ending June 30

		Actual (1)			Budget (2)		Projected (3)	'04 - '09 Average Annual	Projected (3)					'10 - '14 Average Annual
	2004	2005	2006	2007	2008	2009	Growth (4)	2010	2011	2012	2013	2014	Growth (4)
138	**COLLECTION - RURAL**													
139	Salaries and Wages	$5,190,612	$5,302,103	$6,784,869	$8,682,880	$8,493,720	$8,748,500	11.01%	$9,011,000	$9,281,300	$9,559,700	$9,846,500	$10,141,900	3.00%
140	Labor Fringe Costs - Salaries and Wages (5)	1,135,700	1,160,100	1,484,500	1,899,800	1,858,400	1,914,200	11.01%	1,971,600	2,030,700	2,091,700	2,154,400	2,219,000	3.00%
141	Adjustment for Green Waste Salaries and Wages (18)			(1,334,700)	(1,539,600)	(1,343,700)	(1,267,000)	-	(1,330,500)	(1,397,400)	(1,467,900)	(1,541,800)	(1,619,700)	5.04%
142	Current Expenses													
143	Supplies (34)	49,899	23,002	29,069	80,700	80,300	82,700	10.63%	85,200	87,800	90,400	93,100	95,900	3.00%
144	Parts - Other Equipment	82	0	0	288,100	316,000	325,500	424.43%	335,300	345,400	355,800	366,500	377,500	3.01%
145	Other Contractual Services (8)	874	583					-						-
146	Radioactive Calibration			50,000	12,000	12,000	12,400	-	12,800	13,200	13,600	14,000	14,400	2.99%
147	Janitorial			890				-						
148	Miscellaneous			28,464				-						
149	Adjustment			1,069				-						
150	Bulky Items Hauling				300,000	330,000	339,900	-	350,100	360,600	371,400	382,500	394,000	3.00%
151	Scales on Trucks				120,000		0	-	0	0	0	0	0	-
152	Disposal of Freon Appliances				400,000	440,000	453,200	-	466,800	480,800	495,200	510,100	525,400	3.00%
153	White Goods Disposal				20,000	44,000	45,300	-	46,700	48,100	49,500	51,000	52,500	2.97%
154	Green Waste				31,250		0	-	0	0	0	0	0	-
155	Services (35)	59,325	68,323	93,896	55,830	62,920	64,800	1.78%	66,700	68,700	70,800	72,900	75,100	3.01%
156	Rentals	205	4,335	5,373	21,000	23,100	23,800	158.80%	24,500	25,200	26,000	26,800	27,600	3.02%
157	Other (33)	46,677	62,934	58,202	66,060	23,200	23,900	-12.53%	24,600	25,300	26,100	26,900	27,700	3.01%
158	Adjustment for "Green Waste" line item (24)				(31,250)									
159	Adjustment for Green Waste Collection Current Expenses (18)			(176,100)	(277,100)	(435,000)	(569,400)	-	(598,000)	(628,000)	(618,300)	(693,000)	(728,000)	5.04%
160	Equipment	0	1,462	2,247	0	0	0	-	0	0	0	0	0	-
161	Subtotal - COLLECTION - RURAL	$6,483,374	$6,622,843	$7,027,780	$10,129,670	$9,904,940	$10,197,800	9.48%	$10,466,800	$10,741,700	$11,064,000	$11,309,900	$11,603,300	2.61%
162														
163	**MAINTENANCE AND WASTE DIVERSION**													
164	Salaries and Wages	$825,459	$892,711	$1,061,607	$1,444,540	$1,418,830	$1,461,400	12.10%	$1,505,200	$1,550,400	$1,596,900	$1,644,800	$1,694,100	3.00%
165	Labor Fringe Costs - Salaries and Wages (5)	180,600	195,300	232,300	316,100	310,400	319,800	12.11%	329,300	339,200	349,400	359,900	370,700	3.00%
166	Current Expenses													
167	Supplies (36)	4,019	7,426	40,595	7,320	14,400	14,800	29.78%	15,200	15,700	16,200	16,700	17,200	3.14%
168	Services (37)	15,091	930	6,547	12,260	26,000	26,800	12.17%	27,600	28,400	29,300	30,200	31,100	3.03%
169	Other Contractual Services (8)	155,774	19,431					-						-
170	Janitorial Yard Elevator Services			4,975	30,000	30,000	30,900	-	31,800	32,800	33,800	34,800	35,800	3.01%
171	Miscellaneous			27,388			0	-	0	0	0	0	0	-
172	Clean Drains, Lines				50,000	50,000	51,500	-	53,000	54,600	56,200	57,900	59,600	2.98%
173	Sump Pit Pumping				32,000	32,000	33,000	-	34,000	35,000	36,100	37,200	38,300	3.02%
174	Site Repairs - Pavement/Fencing				65,000	65,000	67,000	-	69,000	71,100	73,200	75,400	77,700	3.01%
175	Solid Waste Education				50,000		53,000	-	0	56,200	0	59,600	0	-
176	Utilities (38)	32,327	38,216	42,917	47,310	51,800	53,400	10.56%	55,000	56,700	58,400	60,200	62,000	3.04%
177	Other (39)	417	12,994	905	11,570	2,400	2,500	43.05%	2,600	2,700	2,800	2,900	3,000	3.64%
178	Equipment	0	0	0	0	0	0	-	0	0	0	0	0	-
179	Subtotal - MAINTENANCE AND WASTE DIVERSION	$1,213,688	$1,167,008	$1,417,234	$2,066,100	$2,000,830	$2,114,100	11.74%	$2,122,700	$2,242,800	$2,252,300	$2,379,600	$2,389,500	3.00%
180														

BASE CASE
TABLE 6
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Actual and Projected Operating Expenses - Combined Program Accounts
Fiscal Years Ending June 30

		Actual (1)			Budget (2)		Projected (3)	'04 - '09 Average Annual	Projected (3)					'10 - '14 Average Annual
	2004	2005	2006	2007	2008	2009	Growth (4)	2010	2011	2012	2013	2014	Growth (4)
181	**LANDFILL - CONTRACTOR OPERATED**													
182	Salaries and Wages	$70,955	$73,084	$78,528	$75,790	$81,650	$84,100	3.46%	$86,600	$89,200	$91,900	$94,700	$97,500	3.01%
183	Labor Fringe Costs - Salaries and Wages (5)	15,500	16,000	17,200	16,600	17,900	18,400	3.49%	18,900	19,500	20,100	20,700	21,300	3.03%
184	Current Expenses						0		0	0	0	0	0	
185	Supplies (40)	91	51	6,104	200,300	100,500	75,000	282.62%	77,300	79,600	82,000	84,500	87,000	3.00%
186	Other Contractual Services (8)	6,001,996	4,938,420				0	-	0	0	0	0	0	-
187	WG Landfill Operating Fee (41)			6,349,731	4,558,390	6,500,000	6,766,600	-	9,113,650		0	0	0	-
188	WG Landfill Operating Fee - Additional Capacity (42)						0		0	11,734,600	13,740,150	14,152,400	14,577,000	-
189	Household Hazardous Waste Disposal			88,249	100,000	100,000	103,000	-	106,100	109,300	112,600	116,000	119,500	3.02%
190	WG Landfill Liner			327,646	775,390	1,200,000	500,000	-	515,000	530,500	546,400	562,800	579,700	3.00%
191	Review of City Landfill			50,000			0	-	0	0	0	0	0	-
192	Regrassing of Slopes				761,230	762,000	375,000	-	386,300	397,900	409,800	422,100	434,800	3.00%
193	Excavation at WGSLF				800,000	1,000,000	500,000	-	515,000	530,500	546,400	562,800	579,700	3.00%
194	Leachate Control				270,000	270,000	278,100	-	286,400	295,000	303,900	313,000	322,400	3.00%
195	Covered Source Permit Fee				10,000	10,000	10,300	-	10,600	10,900	11,200	11,500	11,800	2.72%
196	Kapaa Quarry Road Culvert Repairs					200,000	0	-	0	0	0	231,900	0	-
197	Kalaheo LF Drainage Repair/Maintenance					100,000	0	-	0	0	0	115,900	0	-
198	Restore Kalaheo Green Waste Operation					200,000	0	-	0	0	0	0	0	-
199	Kapaa Landfill Road/Swale Maintenance					50,000	51,500	-	53,000	54,600	56,200	57,900	59,600	2.98%
200	Shipping Waste off Island (43)					0	0	-	0	0	0	0	0	-
201	E-Waste Disposal					1,793,000	1,846,800	-	1,902,200	1,959,300	2,018,100	2,078,600	2,141,000	3.00%
202	Services (44)	29,546	11,505	25,000	10,000	15,000	15,500	-12.10%	16,000	16,500	17,000	17,500	18,000	2.99%
203	State Disposal Surcharge (45)	110,000	113,945	117,553	169,600	170,000	175,100	9.74%	180,400	185,800	191,400	197,100	203,000	2.99%
204	Other (46)	5,247	25,288	218	0		0	-	0	0	0	0	0	-
205	Equipment		0	0	0	0	0	-	0	0	0	0	0	-
206	Subtotal - LANDFILL - CONTRACTOR OPERATED	$6,233,336	$5,178,292	$7,060,229	$7,747,300	$12,570,050	$10,799,400	11.62%	$13,267,450	$16,013,200	$18,147,150	$19,039,400	$19,252,300	9.75%
207	Landfill $/ton Total Operating Cost (47)						$30.00		$35.00	$40.00	$45.00	$44.80	$43.07	
208	**LANDFILL - CLOSED LANDFILL**													
209	Salaries and Wages													
210	Labor Fringe Costs - Salaries and Wages (5)													
211	Current Expenses													
212	Kapaa Gas Flare Maintenance			34,913		90,000	92,700	-	95,500	98,400	101,400	104,400	107,500	3.00%
213	Existing Landfill NPDES Permit Program			96,536	125,000	125,000	128,800	-	132,700	136,700	140,800	145,000	149,400	3.01%
214	Utilities (48)	36,061	44,366	63,710	34,610	38,000	39,100	1.63%	40,300	41,500	42,700	44,000	45,300	2.97%
215	General Construction		835,743	260,000			0	-	0	0	0	0	0	-
216	Equipment						0		0	0	0	0	0	-
217	Subtotal - LANDFILL - CLOSED LANDFILL	$36,061	$880,109	$455,159	$159,610	$253,000	$260,600	48.52%	$268,500	$276,600	$284,900	$293,400	$302,200	3.00%
218														

BASE CASE

TABLE 6

CITY AND COUNTY OF HONOLULU

Department of Environmental Services

Actual and Projected Operating Expenses - Combined Program Accounts

Fiscal Years Ending June 30

		Actual (1)			Budget (2)		Projected (3)	'04 - '09 Average Annual	Projected (3)					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (4)	2010	2011	2012	2013	2014	Growth (4)
219	**TRANSFER STATION**													
220	Salaries and Wages	$2,565,933	$2,913,046	$3,291,265	$3,001,520	$3,750,280	$3,862,800	8.53%	$3,978,700	$4,098,100	$4,221,000	$4,347,600	$4,478,000	3.00%
221	Labor Fringe Costs - Salaries and Wages (5)	561,400	637,400	720,100	656,700	820,600	845,200	8.53%	870,500	896,700	923,600	951,300	979,800	3.00%
222	Current Expenses						0		0	0	0	0	0	
223	Supplies (49)	73,905	204,510	68,716	183,780	212,000	218,400	24.20%	225,000	231,800	238,800	246,000	253,400	3.02%
224	Parts - Other Equipment	3,428	4,520	5,309	244,350	250,000	257,500	137.22%	265,200	273,200	281,400	289,800	298,500	3.00%
225	Services (50)	6,817	70,395	21,759	18,600	24,600	25,300	29.99%	26,100	26,900	27,700	28,500	29,400	3.02%
226	Other Contractual Services (8, 51)	2,873,934	3,047,443					-						-
227	Green Waste Tip Fee (funded from Account 209)			840,069	1,348,920	1,593,500	891,200	-	908,900	926,500	945,000	964,300	982,800	1.97%
228	Used Battery Disposal (funded from Account 209)			65,573	32,000	32,000	33,000	-	34,000	35,000	36,100	37,200	38,300	3.02%
229	Keehi Truck Wash Maintenance			25,025	30,000	35,000	36,100	-	37,200	38,300	39,400	40,600	41,800	2.96%
230	Keehi Computer/Software Maintenance Fee			22,873	21,000	21,000	21,600	-	22,200	22,900	23,600	24,300	25,000	3.01%
231	Janitorial, Yard, and Guard Services for CCs and TSs			1,093,976	1,084,580	1,120,500	1,154,100	-	1,188,700	1,224,400	1,261,100	1,298,900	1,337,900	3.00%
232	Leasing Roll-Off Trucks			387,752	538,500	600,000	618,000	-	636,500	655,600	675,300	695,600	716,500	3.00%
233	Keehi Loadout Scales			439,957	240,000		0	-	0	0	0	0	0	-
234	Emergency Rolloff Hauling (52)			392,670	310,000	310,000	310,000	-	319,300	328,900	338,800	349,000	359,500	3.01%
235	White Goods Freon Recycling (15)			168,670	169,000	174,100	-	-	-	-	-	-	-	-
236	Radioactive Waste Disposal (53)			9,308	-	-	-	-	-	-	-	-	-	-
237	Fuel Tank Replacement			115,296			0	-	0	0	0	0	0	-
238	Miscellaneous (54)			28,595		100,000	103,000	-	106,100	109,300	112,600	116,000	119,500	3.02%
239	Adjustment			257,917			0	-	0	0	0	0	0	-
240	Landscape Maintenance				45,000	50,000	51,500	-	53,000	54,600	56,200	57,900	59,600	2.98%
241	Kapaa TS Methane Gas Detection Maintenance					30,000	30,900	-	31,800	32,800	33,800	34,800	35,800	3.01%
242	Utilities (55)	115,574	132,242	171,560	156,960	194,500	200,300	11.63%	206,300	212,500	218,900	225,500	232,300	3.01%
243	Other Repairs	0	474,153	0	0	0	0	-	0	0	0	0	0	-
244	Other (56)	76,511	58,819	55,488	64,660	22,100	22,800	-21.50%	23,500	24,200	24,900	25,600	26,400	2.95%
245	Adjustment for Green Waste Processing (18)			(840,069)	(1,348,920)	(1,593,500)	(891,200)	-	(908,900)	(926,500)	(945,000)	(964,300)	(982,800)	1.97%
246	Adjustment for Green Waste Transfer (18)			(500,000)	(564,800)	(593,200)	(623,000)	-	(654,200)	(687,100)	(721,800)	(758,100)	(796,400)	5.04%
247	Equipment	0	0	562	0	0	0	-	0	0	0	0	0	-
248	Subtotal - TRANSFER STATION	$6,277,502	$7,542,529	$6,842,371	$6,231,850	$7,153,480	$7,167,500	2.69%	$7,369,900	$7,578,100	$7,791,400	$8,010,500	$8,235,300	2.81%
249														
250	**H-POWER**													
251	Salaries and Wages	$205,366	$205,800	$202,388	$388,740	$273,490	$281,700	6.53%	$290,200	$298,900	$307,900	$317,100	$326,600	3.00%
252	Labor Fringe Costs - Salaries and Wages (5)	44,900	45,000	44,300	85,100	59,800	61,600	6.53%	63,500	65,400	67,400	69,400	71,500	3.01%
253	Current Expenses													
254	Other Contractual Services (8, 57)	31,131,650	30,954,858					-						
255	Ash, Residue, Unacceptable Waste, Ferrous Landfill, Fees			1,579,370	2,418,700	2,540,000	2,616,200	-	2,694,700	2,775,500	2,858,800	2,944,600	3,032,900	3.00%
256	H-POWER Service Fee (58)			26,843,402	28,524,100	29,952,000	30,369,000	-	31,053,500	31,755,800	32,476,400	33,215,700	33,974,400	2.27%
257	Add'l WTE Capacity Service Fee (59)						0	-	0	0	0	0	0	-
258	Adjustment			5,435,181			0	-	0	0	0	0	0	-
259	Insurance on Building Pass Through				1,942,690	2,040,000	2,101,200	-	2,164,200	2,229,100	2,296,000	2,364,900	2,435,800	3.00%
260	Environmental Testing				2,065,140	2,168,000	2,233,000	-	2,300,000	2,369,000	2,440,100	2,513,300	2,588,700	3.00%
261	Rental of Buildings (60)	30,612,926	30,612,926	30,612,926	30,613,000	30,613,000	30,613,000	0.00%	30,613,000	0	0	0	0	-
262	Refuse Disposal Services (61)	14,320,889	14,023,103	14,312,933	15,000,000	15,000,000	15,450,000	1.53%	15,913,500	16,390,900	16,882,600	17,389,100	17,910,800	3.00%
263	State Disposal Surcharge	105,493	113,347	100,539	220,500	220,500	227,100	16.57%	233,900	240,900	248,100	255,500	263,200	2.99%
264	Recycling Surcharge (City)	1,268,906	1,628,648	1,471,686	1,800,000	1,800,000	1,854,000	7.88%	1,909,600	1,966,900	2,025,900	2,086,700	2,149,300	3.00%
265	Other Fixed Charges	300,000	0	0	0	0	0	-	0	0	0	0	0	-
266	Other Current Expenses	12,406	40,499	25,373	524,190	573,700	590,900	116.56%	608,600	626,900	645,700	665,100	685,100	3.00%
267	Equipment	0	481	0	0	0	0	-	0	0	0	0	0	-
268	Subtotal - H-POWER	$78,002,536	$77,624,663	$80,628,099	$83,582,160	$85,240,490	$86,397,700	2.07%	$87,844,700	$58,719,300	$60,248,900	$61,821,400	$63,438,300	-7.82%
269														

BASE CASE
TABLE 6
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Actual and Projected Operating Expenses - Combined Program Accounts
Fiscal Years Ending June 30

		Actual (1)			Budget (2)		Projected (3)	'04 - '09 Average Annual	Projected (3)					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (4)	2010	2011	2012	2013	2014	Growth (4)
270	**COST OF OPERATION**													
271	Salaries	$16,046,819	$16,786,608	$20,224,489	$22,642,990	$24,211,810	$24,938,200	9.22%	$25,686,250	$26,456,790	$27,250,530	$28,068,030	$28,909,840	3.00%
272	Labor Fringe Costs - Salaries and Wages (5)	3,511,000	3,672,800	4,425,100	4,954,400	5,297,500	5,456,500	9.22%	5,620,000	5,788,600	5,962,500	6,141,200	6,325,400	3.00%
273	Current Expenses	91,859,451	93,832,867	96,843,796	108,140,660	115,853,820	114,612,400	4.53%	118,964,500	93,146,010	97,533,857	100,331,570	102,651,760	-3.62%
274	Equipment	7,865	4,470	10,297	4,375,000	5,909,000	6,703,700	285.58%	2,266,500	2,310,500	2,355,800	2,402,500	829,000	-22.23%
275	**SUBTOTAL - COST OF OPERATION (62)**	$111,425,135	$114,296,745	$121,503,682	$140,113,050	$151,272,130	$151,710,800	6.37%	$152,537,250	$127,701,900	$133,102,687	$136,943,300	$138,716,000	-2.35%
276														
277	**Refuse Division FTEs (63)**			415	422	422		-						-
278														
279														
280	**COSTS FROM OTHER DIVISIONS**													
281														
282	**BUDGET AND FISCAL SERVICES**													
283	Accounting & Fiscal Services	$38,164	$39,626	$43,876	$97,650	$90,250	93,000	19.50%	95,800	98,700	101,700	104,800	107,900	3.02%
284	Treasury	4,800	4,800	4,800	4,800	4,800	4,900	0.41%	5,000	5,200	5,400	5,600	5,800	3.78%
285	Subtotal - BFS	42,964	44,426	48,676	102,450	95,050	$97,900	17.91%	$100,800	$103,900	$107,100	$110,400	$113,700	3.06%
286														
287	**DEPARTMENT OF INFORMATION TECHNOLOGY**													
288	Applications	$36,036	$36,036	$39,336	$47,390	$47,800	49,200	6.43%	50,700	52,200	53,800	55,400	57,100	3.02%
289														
290	**DEPARTMENT OF FACILITY MAINTENANCE**													
291	Automotive Equipment Services	$3,698,575	$4,917,253	$5,863,436	$8,304,810	$8,503,130	8,758,200	18.82%	9,020,900	9,291,500	9,570,200	9,857,300	10,153,000	3.00%
292	Administration	0	0	78,352	86,510	68,440	70,500	-	72,600	74,800	77,000	79,300	81,700	3.00%
293	Roads Maintenance	0	0	0	0	0	0	-	0	0	0	0	0	-
294	Subtotal - DFM	$3,698,575	$4,917,253	$5,941,788	$8,391,320	$8,571,570	$8,828,700	19.01%	$9,093,500	$9,366,300	$9,647,200	$9,936,600	$10,234,700	3.00%
295														
296	**DEPARTMENT OF PARKS AND RECREATION**													
297	Urban Forestry	$409,664	$0	$0	$0	$0	0	-	0	0	0	0	0	-
298														
299	**DEPARTMENT OF ENVIRONMENTAL SERVICES**													
300	Administration	$387,232	$308,479	$395,366	$358,280	$345,760	356,100	-1.66%	366,800	377,800	389,100	400,800	412,800	3.00%
301														

BASE CASE

TABLE 6

CITY AND COUNTY OF HONOLULU

Department of Environmental Services

Actual and Projected Operating Expenses - Combined Program Accounts

Fiscal Years Ending June 30

		Actual (1)			Budget (2)		Projected (3)	'04 - '09 Average Annual	Projected (3)					'10 - '14 Average Annual
		2004	2005	2006	2007	2008	2009	Growth (4)	2010	2011	2012	2013	2014	Growth (4)
302	**MISCELLANEOUS**													
303	Retirement System Contributions	$1,512,021	$2,123,144	$3,052,307	$3,045,220	$3,316,000	3,415,500	17.70%	3,518,000	3,623,500	3,732,200	3,844,200	3,959,500	3.00%
304	FICA Tax	1,337,590	1,359,690	1,593,347	1,700,290	1,829,000	1,883,900	7.09%	1,940,400	1,998,600	2,058,600	2,120,400	2,184,000	3.00%
305	Hawaii Public Employees Health Fund	4,473,467	4,951,870	4,131,723	5,691,090	5,519,000	5,684,600	4.91%	5,855,100	6,030,800	6,211,700	6,398,100	6,590,000	3.00%
306	Workers Compensation	900,000	1,000,000	800,000	900,000	1,000,000	1,030,000	2.74%	1,060,900	1,092,700	1,125,500	1,159,300	1,194,100	3.00%
307	Unemployment Compensation	0	135,600	0	4,370	8,000	8,200	-	8,400	8,700	9,000	9,300	9,600	3.39%
308	Provision for Salary Adjustment/Accrued Vacation Pay	184,106	0	1,199,032	185,500	1,356,000	1,396,700	49.97%	1,438,600	1,481,800	1,526,300	1,572,100	1,619,300	3.00%
309	Provision for Electricity	0	0	0	37,820		0		0	0	0	0	0	-
310	Provision for Other Energy Costs	0	0	0	7,296		0		0	0	0	0	0	-
311	Transfer to General Fund for Debt Service													
312	Solid Waste - Existing	6,108,578	6,064,228	6,162,108	7,361,810	7,319,250	7,834,870	5.10%	11,727,300	11,578,220	12,816,540	13,790,930	13,193,410	2.99%
313	Solid Waste - New (64)	0	0	0	0	0	1,410,000		2,380,000	3,120,000	3,860,000	4,560,000	5,260,000	21.93%
314	H-POWER - Existing (60)	25,135,695	25,098,820	25,059,204	25,018,520	24,979,830	24,928,470	-0.17%	5,824,420	0	0	0	0	-
315	H-POWER - New (65)	0	0	0	0	0	3,120,000	-	3,120,000	3,120,000	3,120,000	3,120,000	3,120,000	0.00%
316	Add'l WTE Capacity - New (66)	0	0	0	0	0	0	-	0	0	0	0	0	-
317	Transfer to General Fund for Rent	263,500	263,500	263,500	263,500	263,500	271,400	0.59%	279,500	287,900	296,500	305,400	314,600	3.00%
318	Transfer to General Fund for CASE													
319	Refuse	2,965,300	3,150,200	3,279,900	3,963,800	4,516,460	4,652,000	9.42%	4,791,600	4,935,300	5,083,400	5,235,900	5,393,000	3.00%
320	H-POWER	4,301,100	3,191,000	3,247,300	4,574,800	5,212,650	5,369,000	4.54%	5,530,100	5,696,000	5,866,900	6,042,900	6,224,200	3.00%
321	Glass	140,200	143,400	83,400	83,800	95,480	98,300	-6.85%	101,200	104,200	107,300	110,500	113,800	2.98%
322	Recycle	429,000	517,000	685,000	745,900	849,900	875,400	15.33%	901,700	928,800	956,700	985,400	1,015,000	3.00%
323	Transfer to Other Post Employment Benefits Fund	0	0	0	0	3,977,000	0	-	0	0	0	0	0	-
324	Subtotal - MISC	$47,750,557	$47,998,452	$49,556,821	$53,583,716	$60,242,070	$61,978,340	5.35%	$48,477,220	$44,006,520	$46,770,640	$49,254,430	$50,190,510	0.87%
325														
326														
327	**SUBTOTAL - COSTS FROM OTHER DIVISIONS**	$52,325,028	$53,304,646	$55,981,987	$62,483,156	$69,302,250	$71,310,240	6.39%	$58,089,020	$53,906,720	$56,967,840	$59,757,630	$61,008,810	1.23%
328														
329	**TOTAL COST**	$163,750,163	$167,601,391	$177,485,669	$202,596,206	$220,574,380	$223,021,040	6.37%	$210,626,270	$181,608,620	$190,070,527	$196,700,930	$199,724,810	-1.32%

Notes

(1) Source: 2004-2006 SAS reports provided by Division.

(2) FY 07 Budget Data Source: "FY04,05,06 Current Exp Det.PDF" and "FY 04, 05, 06 Salary Detail.PDF" provided by Division. FY 2008 per FY 2008 Operating Budget.

(3) 2009-2014 projections based on general inflation escalator of 3% unless otherwise noted.

(4) Average Annual Growth is defined as the average growth rate for each year over a specified time period.

(5) Based on Employee Fringe Benefit Rate of 21.88% per the City. Includes Vacation (8.08%) Sick Leave (5.02%) Holiday (5.00%) and Other (3.78%).

(6) Includes Office supplies, Cleaning and Toilet supplies, Computer supplies, Meals, Education Supplies, Gas, Maps and Signs, Photography supplies, Safety Supplies, Supplies not Classified, Supplies on inventory individually, Hardware, and Parts.

(7) Includes Engineering and Architecture Services, Consultant Services, Medical Services, Other Professional Services, Other Communal Services, Transportation of Things, Advertising and Publication of Notices, Printing and Binding, and Repairs and Maintenance - Motor Vehicles/Office Furniture/Other Equipment/Computer Equipment.

(8) Other Contractual Services breakout data source: "3009 breakout.xls" provided by Division. Breakout does not exactly match Other Contractual Services expense from SAS reports.

(9) Includes Service and Merit Awards, Postage, Travel Expenses, General Construction, Membership and Registration, Subscriptions, Auto Allowances, Parking Fees, and Other Fixed Charges.

(10) Includes MV-Plate Emblem, Telephone, Auto Allowances, and Parking Fees.

(11) Includes Office Supplies, Other Food, Education Supplies, Gas, Maps and Signs, Photography Supplies, Supplies not Classified, Parts, Utensils, and Postage. $1M assumed in 2009 for replacement carts.

(12) Includes Other Communal Services, Transportation of Things, Advertising and Publication of Notices, Printing and Binding, and Photography Services.

(13) This line item reflects new contract effective March 2008.

(14) Expense for curbside recycling located in Mixed Recyclables Collection for Scenarios A and B. See line 96.

(15) Not included in FY 2007 and FY 2008 budgets, but per Division, should be projected at FY 2006 levels. In FY 2009, this is moved to Recycling budget, and increases to $525,000.

(16) Includes Rentals of Motor Vehicles, and Other Rentals.

(17) Includes Travel Out of State, Bus Fare, Membership and Registration, Subscriptions, Auto Allowances, and Parking Fees.

(18) Adjustment for Green Waste costs reported here under the "Green Waste" budget category.

(19) Includes Advertising and Publication of Notices, and Auto Allowances.

(20) Collection salaries and wages expense assumed to be 85% of total collection costs for manual collection and 64% of total collection costs for automated collection. Includes fringe. Calculated based on "green waste collection - FY 2006.pdf" provided by Division.

BASE CASE

TABLE 6

CITY AND COUNTY OF HONOLULU

Department of Environmental Services

Actual and Projected Operating Expenses - Combined Program Accounts

Fiscal Years Ending June 30

	Actual (1)			Budget (2)		Projected (3)	'04 - '09 Average Annual	Projected (3)					'10 - '14 Average Annual
	2004	2005	2006	2007	2008	2009	Growth (4)	2010	2011	2012	2013	2014	Growth (4)

(21) Collection current expenses includes vehicle and equipment maintenance costs and other current expenses, but not amortized costs. Calculated based on "green waste collection - FY 2006.pdf."

(22) Processing costs per Division estimate. Starting in FY 2009, processing costs are estimated at $84/ton using green waste tonnage projections.

(23) Transfer costs from "green waste collection - FY 2006.pdf" provided by Division.

(24) "Green Waste" line item in Collection - Rural budget for FY 2007 moved to Green Waste budget.

(25) Trucks cost estimated at $97,000 per route per year by the Division, multiplied by 14 routes.

(26) Green waste carts costs for FY 2009 - 2014 per Division email dated 10/26.

(27) Mixed Recyclables Collection salaries and wages begins in FY 2008, and at island wide implementation in FY 2010, will match Green Waste Collection salaries and wages.

(28) Mixed Recyclables Collection current expenses begins in FY 2008, and at island wide implementation in FY 2010, will match Green Waste Collection current expenses.

(29) Assumes processing cost of $70/ton.

(30) Assumes $60/cart. 50,000 carts in FY 2008, 50,000 carts in FY 2009, 60,000 carts in FY 2010.

(31) Includes Office supplies, Cleaning and Toilet Supplies, Meals, Maps and Signs, Photography supplies, Safety supplies, Supplies not classified, Supplies on inventory individually, Engine, Transmission, Other motor vehicle parts, and Light bulbs.

(32) Includes Telephone, Transportation of Things, Printing and Binding, Electricity, Water, Sewer, Repair and Maintenance - Motor Vehicles/Furniture/Other Equipment, Plumbing, and Refuse Disposal Services.

(33) Includes Membership and Registration Fees, Auto Allowances, and Temp Total Disability.

(34) Includes Office Supplies, Cleaning and Toilet Supplies, Meals, Diesel, Safety Supplies, Bus Wash Soap, Supplies not Classified, Supplies on Inventory Individually, Aggregate, Bitumul, Concrete, Parts - Motor Vehicle, Postage, and Tls Implmts/Utensils.

(35) Includes Air Conditioning, Engineering and Architectural Services, Telephone, Other Communal Services, Electricity, Repair and Maintenance, Electrical, and Other Repair to Building.

(36) Includes Office Supplies, Cleaning and Toilet Supplies, Medical Dental Supplies, Meals, Education Supplies, Maps and Signs, Safety Supplies, Welding Supplies, Galv and Aluminum Sheet, Capscrews, Supplies not Classified, Supplies on Inventory Individually, Lumber, Parts-Vehicles/Furniture, Other Electric Supplies, and Tls Implmts.

(37) Includes Other Professional Services and Repairs and Maintenance.

(38) Includes Plumbing, Telephone, Electricity, Water, and Sewer.

(39) Includes Membership and Registration Fees, Auto Allowances, Parking Fees, and Temp Total Disability.

(40) Includes AV-ADJ C/E, Soil, Meals, and Safety Supplies.

(41) FYs 2009-2010 projected such that total landfill total operating cost per ton = $30 in FY 2009 and $35 in FY 2010 per the Division.

(42) Landfill expansion assumed to occur in May FY 2010 in all cases. Fee projected such that total landfill cost per ton = $40 in FY 2011 and $45 in FY 2012 per the Division. Fee increases with inflation thereafter.

(43) $5.0M per FY 2008 budget. However, based on analyses conducted for the ISWMP, this disposal method is not included.

(44) Includes Advertising and Publication of Notices, and Printing and Binding.

(45) Per "Solid Waste Disposal Tonnage Surcharge Report" provided by Division. FY 2004 estimated based on Jan - Jun 2004 data found in report.

(46) Includes Other Rentals and Auto Allowances.

(47) Landfill $/ton Total Operating Costs includes salaries and wages, labor fringe costs, and current expenses.

(48) Includes Telephone, Electricity, Water, and Sewer.

(49) Includes Office Supplies, Other Nurs Botan Supplies, Cleaning and Toilet Supplies, Hydraulic Oil, Other Fuel, Medical Dental, Meals, Unleaded Gas, Chemical Supplies, Maps and Signs, Safety Supplies, Welding Supplies, FTG and CPLG, Galvanized and Aluminum sheets, Capscrews, Paint, Supplies not Classified, Hardware, Lumber, Other Building Materials, Bitumul, Tires, Batteries, Transmission, Other Motor Vehicle Parts, Light bulbs, Other Electrical Supply, Tls Implmts, and Brake Components.

(50) Includes Masonry, Plumbing, Consultant Services, Other Professional and Non Professional Services, Transportation of Things, Repairs and Maintenance, Electrical, Painting, Plumbing, and Roofing.

(51) Includes Green waste Tip Fee, estimated at $1,349,000 in FY 2007. FY 2007 includes $538,500 for Leasing Rolloff Trucks and allotments for Yard, Janitorial and Guard Services.

(52) Not included in FY 2007 or FY 2008 budgets, but per Division, should be at projected at $310,000.

(53) Item is not included in 2007 and 2008 budget, but is projected to continue at 2006 expenditure level plus inflation.

(54) For FY 2007 budget, includes Landscaping Improvements.

(55) Includes Telephone, Electricity, Water, and Sewer.

(56) Includes Temp Total Disability, Rentals, Membership and Registration Fees, Auto Allowances, Parking Fees, Oil Waste Removal, and Other Fixed Charges.

(57) Includes HRRV Service Fee, estimated at $28,524,000 for FY 2007. FY 2007 also includes $2,065,100 for Environmental Testing.

(58) Projected years source: 2004 Financial Plan. Does not include fee for additional WTE capacity.

(59) Based on average $/ton in FY 2009 of $49.79 times the additional WTE capacity (tons) and general inflation of 3 percent per year. Additional WTE capacity not included in Base Case.

(60) Assumes payment ceases in FY 2010.

(61) Refuse Disposal Charge, estimated at $45.35 per ton (330,760 tons) in FY 2007.

(62) 2006 Total does not match SAS reports total due to addition of fringe and the variance between the SAS Other Contractual Services expense and the Other Contractual Services breakout provided by the Division. Variance not including fringe is roughly .6%.

(63) Refuse Division FTEs from Adopted Budget for corresponding year - http://www.honolulu.gov/budget/execbgt/index1.htm.

(64) New Solid Waste debt service is for all other projects in CIP not related to H-POWER and additional WTE capacity. See Table 7 for details.

(65) New H-POWER debt service is for APC retrofits.

(66) Add'l WTE Capacity debt service is for capital cost of additional WTE capacity. No additional WTE capacity is included in the Base Case.

BASE CASE

Table 7
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Projected CIP and Sources of Funds
Fiscal Years Ending June 30
($000)

		Budget (1)		Projected (2)				
		2008	2009	2010	2011	2012	2013	2014
1	**Projected Capital Expenditures ($000)**							
2	Renewals, Replacements & Additions - Equipment (3)	$6,497	$11,387	$9,000	$9,000	$9,000	$9,000	$9,000
3	Subtotal - Equipment	$6,497	$11,387	$9,000	$9,000	$9,000	$9,000	$9,000
4								
5	Renewals, Replacements & Additions - Facilities							
6	*Disposal Projects*							
7	WTE Capacity Expansion							
8	H-POWER Purchase (4)			15,000				
9	H-POWER APC	40,000						
10	*Closure Projects*							
11	Waipahu Ash Landfill Closure	10,450						
12	Waipahu Incinerator Site Closure (5)	600	500	500	500			
13	*General Facilities*							
14	Refuse Facilities: Emergency Back-Up Power Improvements	400						
15	Wahiawa Yard - Vehicle Wash Facility	125	500					
16	*Transfer Stations (TS)*							
17	Subtotal - Facilities	$51,575	$1,000	$15,500	$500	$0	$0	$0
18								
19	H-POWER Expenditures							
20	Bond Financed	$40,000	$0	$0	$0	$0	$0	$0
21	Fund Balance Financed	0	0	15,000	0	0	0	0
22	Total H-POWER Expenditures	$40,000	$0	$15,000	$0	$0	$0	$0
23	Total Operating Fund (Solid Waste) Expenditures	18,072	12,387	9,500	9,500	9,000	9,000	9,000
24	Total Additional WTE Capacity Expenditures	0	0	0	0	0	0	0
25								
26	**Total Capital Expenditures**	$58,072	$12,387	$24,500	$9,500	$9,000	$9,000	$9,000
27								
28	**Sources of Funds for Capital Expenditures**							
29	Solid Waste Improvement Bond Fund (WB)	$58,072	$12,387	$24,500	$9,500	$9,000	$9,000	$9,000
30	General Improvement Bond Fund (GI)	0	0	0	0	0	0	0
31	Less Capital Expenditure Paid by H-POWER Fund Balance	0	0	(15,000)	0	0	0	0
32	Total Bonds Issued	$58,072	$12,387	$9,500	$9,500	$9,000	$9,000	$9,000
33								
34	Cumulative Bonds Issued	$58,072	$70,459	$79,959	$89,459	$98,459	$107,459	$116,459

Notes

(1) 2008 CIP Budget source: Ordinance 07-25
FY 2009 Data Source: Six-Year CIP Budget (http://www.honolulu.gov/budget/execbgt/fy2008_cip_vol2.pdf) pages 273-292.

(2) FY 2010 - FY 2014 assumed level of capital expenditure per R.W. Beck.

(3) FY 2008 based on approved Equipment CIP per Division. FY 2009 per requested Equipment CIP. FY 2010-2014 per Division estimate.

(4) In all cases, H-POWER purchase is assumed to take place in FY 2010 at $15M, paid for by the H-POWER fund balance.

(5) FY 2009 - 2011 Source: Division estimate.

BASE CASE

Table 8
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Actual and Projected Debt Service
Fiscal Years Ending June 30
($000)

		Projected (1)						
		2008	2009	2010	2011	2012	2013	2014
1	**Existing Debt Service (1)**							
2	H-POWER Fund	$24,980	$24,928	$5,824	$0	$0	$0	$0
3	Operating Fund	7,320	7,835	11,727	11,578	12,817	13,791	13,193
4	Total Current Annual Debt Service	$32,300	$32,763	$17,552	$11,578	$12,817	$13,791	$13,193
5								
6	**New Long Term Bond Debt Service (2)**							
7	H-POWER Fund							
8	2008 Series A Issue		$3,120	$3,120	$3,120	$3,120	$3,120	$3,120
9	2009 Series A Issue			0	0	0	0	0
10	2010 Series A Issue				0	0	0	0
11	2011 Series A Issue					0	0	0
12	2012 Series A Issue						0	0
13	2013 Series A Issue							0
14	Subtotal - New H-POWER Long Term Debt Service	$0	$3,120	$3,120	$3,120	$3,120	$3,120	$3,120
15								
16	Operating Fund (Solid Waste)							
17	2008 Series A Issue		$1,410	$1,410	$1,410	$1,410	$1,410	$1,410
18	2009 Series A Issue			970	970	970	970	970
19	2010 Series A Issue				740	740	740	740
20	2011 Series A Issue					740	740	740
21	2012 Series A Issue						700	700
22	2013 Series A Issue							700
23	Subtotal - New Solid Waste Long Term Debt Service	$0	$1,410	$2,380	$3,120	$3,860	$4,560	$5,260
24								
25	Additional WTE Capacity Debt Service							
26	2008 Series A Issue		$0	$0	$0	$0	$0	$0
27	2009 Series A Issue			0	0	0	0	0
28	2010 Series A Issue				0	0	0	0
29	2011 Series A Issue					0	0	0
30	2012 Series A Issue						0	0
31	2013 Series A Issue							0
32	Subtotal - New Solid Waste Long Term Debt Service	$0	$0	$0	$0	$0	$0	$0

BASE CASE

Table 8
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Actual and Projected Debt Service
Fiscal Years Ending June 30
($000)

		Projected (1)						
		2008	2009	2010	2011	2012	2013	2014
25	**Total Debt Service**							
26								
27	Total Existing Annual Debt Service	$32,300	$32,763	$17,552	$11,578	$12,817	$13,791	$13,193
28	Total Proposed Annual Debt Service	0	4,530	5,500	6,240	6,980	7,680	8,380
29	Total Annual Debt Service	$32,300	$37,293	$23,052	$17,818	$19,797	$21,471	$21,573

Notes

(1) H-POWER and Operating Fund Debt Service from updated Debt Service Schedules ("Solid Waste debt service schedules.pdf") provided by Staff. H-POWER General Obligation Bonds issued in 1990 and 1999, Operating Fund General Obligation Bonds issued in 1992, 1993, 1997, 1999 and 2001.

(2) See Table 7 CIP for uses of bond funds. Bond issuance expense of 2% included in annual payment.

BASE CASE

Table 9
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Actual and Projected Operating Statement
Fiscal Years Ending June 30

		Actual	Projected							
		2006	2007	2008	2009	2010	2011	2012	2013	2014
1	**OPERATING REVENUES (1)**									
2	User Fee (2)	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Refuse General Operating Account - 250	$12,522,000	12,787,200	13,045,500	15,108,750	15,836,640	16,642,690	16,785,980	17,611,230	18,447,540
4	H-POWER - Solid Waste Disp. Fac. Account - 885	74,349,771	75,373,990	69,127,000	70,531,000	71,490,200	72,478,100	84,373,000	85,421,000	86,500,600
5	H-POWER Other Revenue	24,294,334	21,881,500	21,338,300	29,400,500	5,013,300	0	0	0	0
6	Additional WTE Capacity Revenue	0	0	0	0	0	0	0	0	0
7	Glass Recycling - 206	500,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
8	Recycling Account - 209	5,863,155	5,896,800	7,491,800	7,187,600	7,301,100	7,425,000	8,766,100	8,896,400	9,027,000
9	Subtotal Operating Revenues	$117,529,260	$116,239,490	$111,302,600	$122,527,850	$99,941,240	$96,845,790	$110,225,080	$112,228,630	$114,275,140
10										
11	**OTHER REVENUES**									
12	Interest Income (3)				$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
13	Subtotal Other Revenues	$0	$0	$0	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
14										
15	**TRANSFERS**									
16	Transfer from General Fund (4)	$56,957,318	$86,356,716	$109,271,780	$99,493,190	$109,685,030	$83,762,830	$78,845,447	$83,472,300	$84,449,670
17	Subtotal Transfers	$56,957,318	$86,356,716	$109,271,780	$99,493,190	$109,685,030	$83,762,830	$78,845,447	$83,472,300	$84,449,670
18										
19	**TOTAL REVENUES**	$174,486,578	$202,596,206	$220,574,380	$223,021,040	$210,626,270	$181,608,620	$190,070,527	$196,700,930	$199,724,810
20										
21	**REFUSE DIVISION OPERATING EXPENSES (5)**									
22	Administration	$1,103,926	$1,888,270	$2,104,600	$1,985,900	$2,045,700	$2,107,200	$2,170,600	$2,235,800	$2,303,000
23	Inspection and Investigation	270,885	409,660	416,610	429,100	442,000	455,200	468,800	482,700	497,100
24	Recycling	3,106,056	3,508,660	5,023,930	5,628,600	5,797,500	5,971,400	6,150,700	6,335,200	6,525,300
25	Glass Recycling	455,628	1,686,600	1,428,640	1,471,600	1,515,700	1,561,100	1,608,000	1,656,200	1,705,900
26	Green Waste	5,166,427	12,619,770	14,443,200	14,317,500	10,171,400	10,520,800	10,886,500	11,266,900	10,043,300
27	Mixed Recyclables Collection	0	0	0	0	0	0	0	0	0
28	Collection - Honolulu	7,969,889	10,083,400	10,732,360	10,941,000	11,224,900	11,514,500	12,029,437	12,112,300	12,420,500
29	Collection - Rural	7,027,780	10,129,670	9,904,940	10,197,800	10,466,800	10,741,700	11,064,000	11,309,900	11,603,300
30	Maintenance and Waste Diversion	1,417,234	2,066,100	2,000,830	2,114,100	2,122,700	2,242,800	2,252,300	2,379,600	2,389,500
31	Landfill - Contractor Operated	7,060,229	7,747,300	12,570,050	10,799,400	13,267,450	16,013,200	18,147,150	19,039,400	19,252,300
32	Landfill - Closed	455,159	159,610	253,000	260,600	268,500	276,600	284,900	293,400	302,200
33	Transfer Station	6,842,371	6,231,850	7,153,480	7,167,500	7,369,900	7,578,100	7,791,400	8,010,500	8,235,300
34	H-POWER	80,628,099	83,582,160	85,240,490	86,397,700	87,844,700	58,719,300	60,248,900	61,821,400	63,438,300
35	**TOTAL OPERATING EXPENSES**	$121,503,682	$140,113,050	$151,272,130	$151,710,800	$152,537,250	$127,701,900	$133,102,687	$136,943,300	$138,716,000
36										
37	**OTHER CITY AGENCIES EXPENSES (5)**									
38	Budget and Fiscal Services	$48,676	$102,450	$95,050	$97,900	$100,800	$103,900	$107,100	$110,400	$113,700
39	Department of Information Technology	39,336	47,390	47,800	49,200	50,700	52,200	53,800	55,400	57,100
40	Department of Facility Maintenance	5,941,788	8,391,320	8,571,570	8,828,700	9,093,500	9,366,300	9,647,200	9,936,600	10,234,700
41	Department of Parks and Recreation	0	0	0	0	0	0	0	0	0
42	Department of Environmental Services	395,366	358,280	345,760	356,100	366,800	377,800	389,100	400,800	412,800
43	Miscellaneous	49,556,821	53,583,716	60,242,070	61,978,340	48,477,220	44,006,520	46,770,640	49,254,430	50,190,510
44	**TOTAL OTHER CITY AGENCIES EXPENSES**	$55,981,987	$62,483,156	$69,302,250	$71,310,240	$58,089,020	$53,906,720	$56,967,840	$59,757,630	$61,008,810
45										
46	**TOTAL EXPENDITURES**	$177,485,669	$202,596,206	$220,574,380	$223,021,040	$210,626,270	$181,608,620	$190,070,527	$196,700,930	$199,724,810
47										
48	**NET REVENUES (Operating Reserves)**	($2,999,091)	$0	$0	$0	$0	$0	$0	$0	$0

BASE CASE

Table 9
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Actual and Projected Operating Statement
Fiscal Years Ending June 30

		Actual	Projected							
		2006	2007	2008	2009	2010	2011	2012	2013	2014
49										
50	**NUMBER OF EQUIVALENT**									
51	**SINGLE-FAMILY HOUSEHOLDS**									
52	Single-Family Households	175,593	177,300	179,020	180,760	182,510	184,280	186,060	187,870	189,690
53	Apartments (SFH Equivalent)	12,232	12,353	12,473	12,593	12,713	12,833	12,960	13,087	13,213
54	Multi-Family (SFH Equivalent)	10,728	10,840	10,960	11,080	11,200	11,320	11,440	11,560	11,680
55	Non-Profit/Parks (SFH Equivalent)	1,116	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120
56	Highway	1,956	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960
57	Stake	404	400	400	400	400	400	400	400	400
58	**Total Equivalent Single Family Households (6)**	202,029	203,973	205,933	207,913	209,903	211,913	213,940	215,997	218,063
59										
60										
61	**NET COST / HH / MONTH (7)**	$23.50	$35.30	$44.20	$39.90	$43.55	$32.95	$30.70	$32.20	$32.25
62	**Percent Change from Prior Year**		50.2%	25.2%	-9.7%	9.1%	-24.3%	-6.8%	4.9%	0.2%
63										
64										
65	**ANNUAL DEBT SERVICE (8)**	$32,421,014	$32,337,770	$32,299,830	$37,293,340	$23,051,720	$17,818,220	$19,796,540	$21,470,930	$21,573,410
66	**DEBT SERVICE COVERAGE**	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
67	**TARGET (9)**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Notes

(1) See Table 5: Summary of Projected Revenues for more detail.

(2) In the Base Case, we assume no user fee.

(3) R. W. Beck assumption.

(4) Source: 2008 City and County of Honolulu Operating Budget and Program Volume 1, page 376. FY 2006 is the actual transfer amount. FY 2007 and beyond equals the amount of additional revenues from the General Fund needed to support Division operations.

(5) See Table 6: Actual and Projected Operating Expenses for more detail.

(6) Based on Customer Accounts on Table 2 and customer equivalent assumptions from Table 1.

(7) In Scenario B, equals Transfers from General Fund net of Second Day Collection Fees divided by Total Equivalent Single Family Households and 12 months. In all other scenarios, this equals Transfers from General Fund divided by Total Equivalent Single Family Households and 12 months.

(8) Includes H-POWER debt, current and proposed solid waste debt. H-POWER debt ceases after FY 2010.

(9) Assumed to equal 1.0 per the Division.

Appendix E-2

SUMMARY OF SCENARIO A

SCENARIO A

CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Actual and Projected Operating Statement
Fiscal Years Ending June 30

		Actual	Projected							
		2006	2007	2008	2009	2010	2011	2012	2013	2014
1	**OPERATING REVENUES**									
2	User Fee (1)	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Refuse General Operating Account - 250	$12,522,000	12,787,200	13,045,500	13,296,250	13,357,140	14,112,590	7,289,680	7,437,630	7,587,840
4	H-POWER - Solid Waste Disp. Fac. Account - 885	74,349,771	75,373,990	69,127,000	70,531,000	71,490,200	72,478,100	83,119,600	78,783,400	79,781,400
5	H-POWER Other Revenue	24,294,334	21,881,500	21,338,300	29,400,500	5,013,300	0	0	0	0
6	Additional WTE Capacity Revenue	0	0	0	0	0	0	27,101,200	35,163,100	38,017,400
7	Glass Recycling - 206	500,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
8	Recycling Account - 209	5,863,155	5,896,800	7,491,800	6,968,100	7,000,500	7,117,900	9,466,300	9,679,400	9,894,300
9	Subtotal Operating Revenues	$117,529,260	$116,239,490	$111,302,600	$120,495,850	$97,161,140	$94,008,590	$127,276,780	$131,363,530	$135,580,940
10										
11	**OTHER REVENUES**									
12	Interest Income (2)				$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
13	Subtotal Other Revenues	$0	$0	$0	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
14										
15	**TRANSFERS**									
16	Transfer from General Fund (3)	$56,957,318	$86,356,716	$110,201,680	$107,404,090	$119,216,570	$89,022,930	$89,565,447	$95,583,200	$95,656,670
17	Subtotal Transfers	$56,957,318	$86,356,716	$110,201,680	$107,404,090	$119,216,570	$89,022,930	$89,565,447	$95,583,200	$95,656,670
18										
19	**TOTAL REVENUES**	$174,486,578	$202,596,206	$221,504,280	$228,899,940	$217,377,710	$184,031,520	$217,842,227	$227,946,730	$232,237,610
20										
21	**REFUSE DIVISION OPERATING EXPENSES**									
22	Administration	$1,103,926	$1,888,270	$2,284,500	$2,345,700	$2,544,000	$2,620,400	$2,699,200	$2,780,300	$2,863,800
23	Inspection and Investigation	270,885	409,660	416,610	429,100	442,000	455,200	468,800	482,700	497,100
24	Recycling	3,106,056	3,508,660	5,023,930	5,628,600	5,797,500	5,971,400	6,150,700	6,335,200	6,525,300
25	Glass Recycling	455,628	1,686,600	1,428,640	1,471,600	1,515,700	1,561,100	1,608,000	1,656,200	1,705,900
26	Green Waste	5,166,427	12,785,970	14,785,500	17,366,300	13,198,800	13,624,900	14,069,000	14,530,000	13,388,800
27	Mixed Recyclables Collection	0	0	750,000	7,400,000	10,969,440	8,079,500	8,359,600	8,651,900	8,956,900
28	Collection - Honolulu	7,969,889	10,083,400	10,732,360	9,299,800	8,433,900	8,074,800	8,436,137	8,494,700	8,711,300
29	Collection - Rural	7,027,780	10,129,670	9,904,940	8,668,100	7,862,800	7,531,400	7,757,400	7,930,300	8,136,500
30	Maintenance and Waste Diversion	1,417,234	2,066,100	2,000,830	2,114,100	2,122,700	2,242,800	2,252,300	2,379,600	2,389,500
31	Landfill - Contractor Operated	7,060,229	7,747,300	12,570,050	9,299,400	10,873,450	13,221,600	6,358,950	6,897,500	6,746,100
32	Landfill - Closed	455,159	159,610	253,000	260,600	268,500	276,600	284,900	293,400	302,200
33	Transfer Station	6,842,371	6,065,650	6,811,180	6,638,700	6,825,200	7,005,800	7,190,200	7,378,900	7,571,900
34	H-POWER	80,628,099	83,582,160	85,240,490	86,397,700	87,844,700	58,719,300	71,129,200	76,188,400	79,243,500
35	**TOTAL OPERATING EXPENSES**	$121,503,682	$140,113,050	$152,202,030	$157,319,700	$158,698,690	$129,384,800	$136,764,387	$143,999,100	$147,038,800
36										
37	**OTHER CITY AGENCIES EXPENSES**									
38	Budget and Fiscal Services	$48,676	$102,450	$95,050	$97,900	$100,800	$103,900	$107,100	$110,400	$113,700
39	Department of Information Technology	39,336	47,390	47,800	49,200	50,700	52,200	53,800	55,400	57,100
40	Department of Facility Maintenance	5,941,788	8,391,320	8,571,570	8,828,700	9,093,500	9,366,300	9,647,200	9,936,600	10,234,700
41	Department of Parks and Recreation	0	0	0	0	0	0	0	0	0
42	Department of Environmental Services	395,366	358,280	345,760	356,100	366,800	377,800	389,100	400,800	412,800
43	Miscellaneous	49,556,821	53,583,716	60,242,070	62,248,340	49,067,220	44,746,520	70,880,640	73,444,430	74,380,510
44	**TOTAL OTHER CITY AGENCIES EXPENSES**	$55,981,987	$62,483,156	$69,302,250	$71,580,240	$58,679,020	$54,646,720	$81,077,840	$83,947,630	$85,198,810
45										
46	**TOTAL EXPENDITURES**	$177,485,669	$202,596,206	$221,504,280	$228,899,940	$217,377,710	$184,031,520	$217,842,227	$227,946,730	$232,237,610
47										
48	**NET REVENUES (Operating Reserves)**	($2,999,091)	$0	$0	$0	$0	$0	$0	$0	$0

SCENARIO A

CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Actual and Projected Operating Statement
Fiscal Years Ending June 30

		Actual	Projected							
		2006	2007	2008	2009	2010	2011	2012	2013	2014
49										
50	**NUMBER OF EQUIVALENT**									
51	**SINGLE-FAMILY HOUSEHOLDS**									
52	Single-Family Households	175,593	177,300	179,020	180,760	182,510	184,280	186,060	187,870	189,690
53	Apartments (SFH Equivalent)	12,232	12,353	12,473	12,593	12,713	12,833	12,960	13,087	13,213
54	Multi-Family (SFH Equivalent)	10,728	10,840	10,960	11,080	11,200	11,320	11,440	11,560	11,680
55	Non-Profit/Parks (SFH Equivalent)	1,116	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120
56	Highway	1,956	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960
57	Stake	404	400	400	400	400	400	400	400	400
58	**Total Equivalent Single Family Households**	202,029	203,973	205,933	207,913	209,903	211,913	213,940	215,997	218,063
59										
60										
61	**NET COST / HH / MONTH (4)**	$23.50	$35.30	$44.60	$43.05	$47.35	$35.00	$34.90	$36.90	$36.55
62	**Percent Change from Prior Year**		50.2%	26.3%	-3.5%	10.0%	-26.1%	-0.3%	5.7%	-0.9%
63										
64										
65	**ANNUAL DEBT SERVICE (5)**	$32,421,014	$32,337,770	$32,299,830	$37,563,340	$23,641,720	$18,558,220	$43,906,540	$45,660,930	$45,763,410
66	**DEBT SERVICE COVERAGE**	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
67	**TARGET (6)**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Notes

(1) In Scenario A, we assume no user fee.

(2) R. W. Beck assumption.

(3) Source: 2008 City and County of Honolulu Operating Budget and Program Volume 1, page 376. FY 2006 is the actual transfer amount. FY 2007 and beyond equals the amount of additional revenues from the General Fund needed to support Division operations.

(4) In Scenario B, equals Transfers from General Fund net of Second Day Collection Fees divided by Total Equivalent Single Family Households and 12 months. In all other scenarios, this equals Transfers from General Fund divided by Total Equivalent Single Family Households and 12 months.

(5) Includes H-POWER debt, current and proposed solid waste debt. H-POWER debt ceases after FY 2010.

(6) Assumed to equal 1.0 per the Division.

Appendix E-3

SUMMARY OF SCENARIO B

SCENARIO B

CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Actual and Projected Operating Statement
Fiscal Years Ending June 30

		Actual	Projected							
		2006	2007	2008	2009	2010	2011	2012	2013	2014
1	**OPERATING REVENUES**									
2	Second Day Collection Fee (1)	$0	$0	$0	$0	$0	$0	$12,836,400	$13,348,590	$13,868,830
3	Refuse General Operating Account - 250	$12,522,000	12,787,200	13,045,500	14,021,050	14,263,440	15,036,390	7,431,280	7,581,730	7,735,240
4	H-POWER - Solid Waste Disp. Fac. Account - 885	74,349,771	75,373,990	69,127,000	70,531,000	71,490,200	72,478,100	86,114,200	78,783,400	79,781,400
5	H-POWER Other Revenue	24,294,334	21,881,500	21,338,300	29,400,500	5,013,300	0	0	0	0
6	Additional WTE Capacity Revenue	0	0	0	0	0	0	27,101,200	38,254,900	41,207,600
7	Glass Recycling - 206	500,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
8	Recycling Account - 209	5,863,155	5,896,800	7,491,800	7,055,800	7,110,400	7,230,000	9,698,100	9,916,100	10,135,700
9	Subtotal Operating Revenues	$117,529,260	$116,239,490	$111,302,600	$121,308,350	$98,177,340	$95,044,490	$143,481,180	$148,184,720	$153,028,770
10										
11	**OTHER REVENUES**									
12	Interest Income (2)				$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
13	Subtotal Other Revenues	$0	$0	$0	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
14										
15	**TRANSFERS**									
16	Transfer from General Fund (3)	$56,957,318	$86,356,716	$110,201,680	$107,895,490	$120,592,550	$90,580,230	$76,202,447	$82,917,910	$82,522,540
17	Subtotal Transfers	$56,957,318	$86,356,716	$110,201,680	$107,895,490	$120,592,550	$90,580,230	$76,202,447	$82,917,910	$82,522,540
18										
19	**TOTAL REVENUES**	$174,486,578	$202,596,206	$221,504,280	$230,203,840	$219,769,890	$186,624,720	$220,683,627	$232,102,630	$236,551,310
20										
21	**REFUSE DIVISION OPERATING EXPENSES**									
22	Administration	$1,103,926	$1,888,270	$2,284,500	$2,345,700	$2,544,000	$2,620,400	$2,699,200	$2,780,300	$2,863,800
23	Inspection and Investigation	270,885	409,660	416,610	429,100	442,000	455,200	468,800	482,700	497,100
24	Recycling	3,106,056	3,508,660	5,023,930	5,628,600	5,797,500	5,971,400	6,150,700	6,335,200	6,525,300
25	Glass Recycling	455,628	1,686,600	1,428,640	1,471,600	1,515,700	1,561,100	1,608,000	1,656,200	1,705,900
26	Green Waste	5,166,427	12,702,870	14,614,400	15,841,900	11,679,500	12,067,100	12,470,700	12,891,100	11,709,300
27	Mixed Recyclables Collection	0	0	750,000	7,050,000	10,279,920	7,379,800	7,646,100	7,924,300	8,215,900
28	Collection - Honolulu	7,969,889	10,083,400	10,732,360	10,493,900	10,217,300	9,905,000	10,346,737	10,420,900	10,686,700
29	Collection - Rural	7,027,780	10,129,670	9,904,940	9,787,900	9,533,000	9,246,100	9,523,700	9,736,700	9,990,100
30	Maintenance and Waste Diversion	1,417,234	2,066,100	2,000,830	2,114,100	2,122,700	2,242,800	2,252,300	2,379,600	2,389,500
31	Landfill - Contractor Operated	7,060,229	7,747,300	12,570,050	9,899,400	11,748,450	14,241,200	6,534,450	7,078,300	6,932,300
32	Landfill - Closed	455,159	159,610	253,000	260,600	268,500	276,600	284,900	293,400	302,200
33	Transfer Station	6,842,371	6,148,750	6,982,280	6,903,100	7,097,600	7,292,000	7,491,000	7,694,900	7,903,700
34	H-POWER	80,628,099	83,582,160	85,240,490	86,397,700	87,844,700	58,719,300	71,129,200	77,451,400	80,569,800
35	**TOTAL OPERATING EXPENSES**	$121,503,682	$140,113,050	$152,202,030	$158,623,600	$161,090,870	$131,978,000	$138,605,787	$147,125,000	$150,291,600
36										
37	**OTHER CITY AGENCIES EXPENSES**									
38	Budget and Fiscal Services	$48,676	$102,450	$95,050	$97,900	$100,800	$103,900	$107,100	$110,400	$113,700
39	Department of Information Technology	39,336	47,390	47,800	49,200	50,700	52,200	53,800	55,400	57,100
40	Department of Facility Maintenance	5,941,788	8,391,320	8,571,570	8,828,700	9,093,500	9,366,300	9,647,200	9,936,600	10,234,700
41	Department of Parks and Recreation	0	0	0	0	0	0	0	0	0
42	Department of Environmental Services	395,366	358,280	345,760	356,100	366,800	377,800	389,100	400,800	412,800
43	Miscellaneous	49,556,821	53,583,716	60,242,070	62,248,340	49,067,220	44,746,520	71,880,640	74,474,430	75,441,410
44	**TOTAL OTHER CITY AGENCIES EXPENSES**	$55,981,987	$62,483,156	$69,302,250	$71,580,240	$58,679,020	$54,646,720	$82,077,840	$84,977,630	$86,259,710
45										
46	**TOTAL EXPENDITURES**	$177,485,669	$202,596,206	$221,504,280	$230,203,840	$219,769,890	$186,624,720	$220,683,627	$232,102,630	$236,551,310
47										
48	**NET REVENUES (Operating Reserves)**	($2,999,091)	$0	$0	$0	$0	$0	$0	$0	$0

SCENARIO B
CITY AND COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
Actual and Projected Operating Statement
Fiscal Years Ending June 30

		Actual	Projected							
		2006	2007	2008	2009	2010	2011	2012	2013	2014
49										
50	**NUMBER OF EQUIVALENT**									
51	**SINGLE-FAMILY HOUSEHOLDS**									
52	Single-Family Households	175,593	177,300	179,020	180,760	182,510	184,280	186,060	187,870	189,690
53	Apartments (SFH Equivalent)	12,232	12,353	12,473	12,593	12,713	12,833	12,960	13,087	13,213
54	Multi-Family (SFH Equivalent)	10,728	10,840	10,960	11,080	11,200	11,320	11,440	11,560	11,680
55	Non-Profit/Parks (SFH Equivalent)	1,116	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120
56	Highway	1,956	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960
57	Stake	404	400	400	400	400	400	400	400	400
58	**Total Equivalent Single Family Households**	202,029	203,973	205,933	207,913	209,903	211,913	213,940	215,997	218,063
59										
60										
61	**NET COST / HH / MONTH (4)**	$23.50	$35.30	$44.60	$43.25	$47.90	$35.60	$29.70	$32.00	$31.55
62	**Percent Change from Prior Year**		50.2%	26.3%	-3.0%	10.8%	-25.7%	-16.6%	7.7%	-1.4%
63										
64										
65	**RECOMMENDED USER FEE PER EQUIVALENT**							$10.00	$10.30	$10.60
66	**S.F. HOUSEHOLD ($/Month) (1)**									
67										
68	**ANNUAL DEBT SERVICE (5)**	$32,421,014	$32,337,770	$32,299,830	$37,563,340	$23,641,720	$18,558,220	$43,906,540	$45,660,930	$45,763,410
69	**DEBT SERVICE COVERAGE**	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
70	**TARGET (6)**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Notes

(1) In Scenario B, we assume a $10/month fee for second day collection per equivalent single family household with 50% partipcation. User fee increases with inflation.

(2) R. W. Beck assumption.

(3) Source: 2008 City and County of Honolulu Operating Budget and Program Volume 1, page 376. FY 2006 is the actual transfer amount. FY 2007 and beyond equals the amount of additional revenues from the General Fund needed to support Division operations.

(4) In Scenario B, equals Transfers from General Fund net of Second Day Collection Fees divided by Total Equivalent Single Family Households and 12 months. In all other scenarios, this equals Transfers from General Fund divided by Total Equivalent Single Family Households and 12 months.

(5) Includes H-POWER debt, current and proposed solid waste debt. H-POWER debt ceases after FY 2010.

(6) Assumed to equal 1.0 per the Division.