



## 4.0 Recycling, Bioconversion, and Markets

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### 4.1 Introduction

Recycling and bioconversion involves taking materials that would have otherwise been disposed of as solid waste, and instead, reprocesses the materials into new and marketable products. Common recycled materials include beverage containers, paper products, scrap metal, and green waste. Bioconversion consists of processing organic materials such as grass, leaves, branches, untreated wood, or food to produce new products, such as compost and fertilizer, using biological means.

This section describes existing recycling and bioconversion activities within Hawai`i County, identifies current issues and concerns with respect to current recycling and bioconversion practices, and presents options for achieving the County's recycling and bioconversion goals.

### 4.2 Background

As discussed in Section 3.0, Source Reduction, the State of Hawai`i prioritizes solid waste management practices and processing methods for each county as per Chapter 342-2 of the Hawai`i Revised Statutes. The second priority, as discussed in this chapter, consists of recycling and bioconversion (including composting). Recycling and bioconversion practices were first detailed in the original Integrated Solid Waste Management plan created in 1993 and in the subsequent updated plan drafted in 2002. In 2003, the County of Hawai`i passed a resolution with a goal to divert 50 percent of the solid waste from landfills by 2008 and 80 percent by 2013.

#### 4.2.1 Zero Waste

In 2007, The County of Hawai`i further enhanced solid waste practices and concepts by adopting Resolution 356-07, a Zero Waste philosophy toward solid waste management, and in 2008 contracted through Recycle Hawai`i to have a zero waste implementation study conducted. The purpose of that study was to evaluate recycling options that may help the County achieve its waste reduction goals.

The zero waste implementation study included public meetings held in September, 2008 at multiple locations in the County to present zero waste concepts, and receive input from local residents and business owners about ways to turn currently-discarded materials into resources.

The recommendations of the Zero Waste study have been incorporated to this IRSWMP update where applicable based on consensus of the SWAC, Solid Waste Division staff, and other stakeholders.

## 4.2.2 Review of 2002 Plan Update

The following is a summary of the recommendations put forth in the 2002 Plan update relative to recycling, bioconversion, and marketing, and a description of the actions taken to achieve each recommendation.

2002 Plan Update Recommendation	Status
<b>Recycling</b>	
Hire County Recycling Coordinator	The County hired a full time Recycling Coordinator in mid 2003 responsible for directing other County staff and vendors engaged in waste reduction and recycling efforts.
Increase Budget for Promotion and Education	Substantial budget increase for Promotion and Education.
Ban Yard Trimmings at Recycling and Transfer Stations and Landfills	No ban has been established to date. In order to establish such a ban, it is necessary to provide an alternative process for disposal of yard trimmings. The County has established green waste facilities in Hilo, Kona, and Kea`au with plans to expand to other sites through a request for proposals. Additionally, a request for proposal will be issued for compost and biodiesel.
Establish Dropoff Centers at Transfer Stations for Source-Separated Recyclable Materials	All Transfer stations contain a two-bin system, one bin for glass and the other bin with mixed recyclables (paper, plastic, and metal).
Establish Dropoff Centers at Locations Other Than Transfer Stations (Shopping and Community Centers, Schools)	There are HI-5 Certified Redemption Centers at some transfer stations and private facilities conveniently located to shopping areas. Other recycling dropoff centers outside of transfer stations have not been implemented.
Reconfigure Transfer Stations to Emphasize Recycling	The County is currently in the process of re-designing the transfer stations to enhance recycling efforts, provide better signage, and allow commercial recycled materials.
Increase Funding for the Existing Diversion Grant Program	No longer a grant program – now done using request for proposals. Increased funding underway.
Establish a County Policy that Restrains Disposal of Recyclable Materials	In 2007, City Council passed a resolution to request Mayor Harry Kim to issue a directive mandating recycling at County offices recycling. The Mayor has not issued a directive to date.
Increase the Tipping Fee at Landfills	The tipping fee has been increased to \$85/ton at the landfills.
Enhance C&D Waste Recovery	Kea`au Transfer Station has accepted construction debris (residential only). Private contractors are also providing assistance with C&D waste recovery.
Emphasize Recycling in the Design of Sort Station	Designed but not implemented.
Increase the Incentives for Alternatives to Disposal of C&D Waste	Not implemented.
Phase-in Landfill Bans on Recyclable C&D Wastes	The County is currently focused on Public Education and facilitating private entities that can create programs or facilities that provide incentives for diversion of clean C&D wastes. In 2007 Arc of Hilo opened a C&D waste re-use center and is promoting this to local contractors.

2002 Plan Update Recommendation	Status
Institute New Fee System for Waste Management	Not implemented yet.
<b>Bioconversion</b>	
No Recommendation(s) Addressed	In 2008, a request for proposal was issued for potential contractors to furnish and implement an organics diversion program at the future West Hawai'i Compost and Biodiesel Facility.
<b>Marketing</b>	
Enhance Local Markets for Recyclable Materials	The County encourages state or on-island reuse and end-markets for recycled materials. Currently, green waste, glass, paper, and tires are used locally.

### 4.3 Existing Conditions

According to the Hawai'i County Department of Environmental Management, the waste diversion rate, signifying the quantity of recycled materials taken as a percentage of total waste generation, has more than doubled from approximately 14 percent in FY 00-01 to over 29 percent in FY 07-08. Exhibit 4-1 provides yearly data of waste generation, recycling, and disposal activities.

EXHIBIT 4-1  
Diversion Rate Trends in Hawai'i County

Year	Tons			Diversion Rate
	Generation	Recycling	Disposal	
FY 00-01	190,241	26,416	163,825	13.9%
FY 01-02	190,764	24,139	166,625	12.7%
FY 02-03	200,300	30,991	169,309	15.5%
FY 03-04	239,217	37,375	201,842	15.6%
FY 04-05	281,855	56,422	225,433	20.0%
FY 05-06	300,121	77,734	222,387	25.9%
FY 06-07	290,865	69,117	221,748	23.8%
FY 07-08	296,473	86,443	210,030	29.2%
<b>Percent Change FY 00-01 – FY 07-08</b>				
<b>Total</b>	56%	227%	28%	
<b>Average Annual</b>	6.5%	18.5%	3.6%	

Source: Hawai'i County Department of Environmental Management.

The 2008 diversion rate may be divided into categories to characterize the amount of recycling and disposal by material. The two highest waste diversion rates occur in glass and metal recycling, at 57.8 and 59.8 percent, respectively, which may be due to the HI-5

Beverage Container Deposit Program instituted by the State of Hawai`i. Exhibit 2-18 presents the 2008 diversion rate by waste category.

Although the current diversion rate is over 29 percent, there is a large amount of recycling being conducted independently by private businesses that is presently not being tracked or measured by Hawai`i County. These recycling efforts from the private sector significantly increase the overall diversion rate, especially in the paper and plastic waste categories. The current status of recycling, bioconversion, and marketing efforts in Hawai`i County is described below.

### **4.3.1 Hawai`i County/State of Hawai`i Programs**

Hawai`i County offers recycling services through various state and county programs. The County utilizes recycling and transfer stations as collection points for the majority of recycled material from residents. Recycled material accepted at these locations includes paper products, green waste, scrap metal, glass, and redeemable beverage containers through the State of Hawai`i Beverage Container Deposit Program. The County has also initiated programs for tire disposal, disposal of fats, oils, and greases (FOGs), and composting.

To encourage recycling and bioconversion activities, Hawai`i County provides public education and awareness programs for residents. These education programs are discussed in Section 5.0, Public Education and Information. Another part of recycling involves proper diversion of household hazardous wastes and household appliances and electronics. Household hazardous waste and electronics recycling programs will be discussed in Section 6.0, Household Hazardous Waste and Electronic Waste.

#### **4.3.1.1 County Recycling and Transfer Stations**

The County operates 21 recycling and transfer stations for residents to drop off recyclable materials and garbage. A new recycling and transfer station is currently being proposed for Ocean View near the southern end of the island. Most of the recycling and transfer stations currently have a Two-Bin Recycling Area which consists of dropoff bins for mixed recyclables (paper, plastic, and metal), and a separate bin for glass. Some of these recycling and transfer stations also serve as collection points for other types of recyclable materials. Exhibit 4-2 lists the recycling and transfer stations and the type of recyclable materials accepted at each location.

The County is presently expanding recycling activities at the recycling and transfer stations by creating recycling and reuse centers (RRCs). The Kea`au Recycling and Transfer Station, referred to as the KRRC, was the first to be developed into a full-time recycling and reuse center. New full or part-time reuse centers will be developed at recycling and transfer stations in Hilo, Kealakehe, Pahoa, Waimea, Laupahoehoe, Keauhou, Waiohinu, Hawi, and Volcano. In addition, the County is in the process of a complete redesign of the recycling and transfer stations by reconfiguring the site area and improving signage to promote recycling activities by residents. The County is also evaluating the potential of commercial recycled material being accepted at all recycling and transfer stations.

## EXHIBIT 4-2

## Hawai'i County Site Characteristics for Existing Recycling and Transfer Stations

Recycling and Transfer Station	Glass	Mixed Recyclables	Scrap Metal	Green Waste	Reuse Center	HI-5 Redemption Center
<b>East Hawai'i</b>						
Kea`au (KRRC)	X	X	X	X	X	X
Hilo	X	X	X	X		X
Pahoa	X	X				X
Laupahoehoe	X	X			X	
Honoka`a	X	X				X
Kalapana	X	X				
Volcano	X	X				
Glenwood	X	X				
Honomu	X	X				
Papaikou	X	X				
Pa`auilo						
Pahala	X					
<b>West Hawai'i</b>						
Kealakehe (Kailua)	X	X	X	X		X
Keauhou	X	X			X	X
Ka`auhuhu (Hawi)	X	X				X
Puako	X	X				X
Waimea	X	X				X
Ke`ei	X	X				
Waiea	X	X				
Miloli`i						
Waiohinu	X	X				X

Note: Hilo, Kea`au, and Kealakehe Recycling and Transfer Stations contain separate bins for newspaper and cardboard

#### 4.3.1.2 HI-5 Beverage Container Deposit Program

The State of Hawai'i enacted a new Beverage Container Deposit Program in late 2004. Otherwise known as the "Bottle Bill," a 5¢ redeemable deposit is placed on each beverage container, as defined under the law. Consumers may then return the container to redeem their 5¢ at any redemption center. Other details of the Program include the following:

- A 1¢ non-refundable container fee is assessed to support the costs of recycling and program administration.
- Redeemable containers are marked with a “HI 5¢” or “Hawai`i 5¢” label.
- The container size is limited to 68 ounces (2 liters) or smaller.
- The beverage type consists of non-alcoholic drinks (soda, water, coffee, tea, juice) and limited alcoholic drinks (beer, malt beverages, mixed spirits, and mixed wine).
- The container material includes aluminum, glass, bi-metal, and plastic (#1 and #2 only).

The annual redemption rate for the fiscal year 2008 (FY 07-08) in the state of Hawai`i (June 1, 2007 through June 30, 2008) was at 72 percent, which represents approximately 680 million recycled beverage containers. This was a 4 percent increase from the prior year rate of 68 percent. In FY 08, Hawai`i County’s HI-5 estimated annual redemption rate reached an all time high of 90 percent, up from 81 percent last year<sup>1</sup>. Redemption Centers report that approximately 116 million containers were redeemed on the Big Island last year.

Hawai`i County provides Certified Redemption Centers (CRCs) for consumers to redeem their HI-5 beverage containers at select recycling and transfer stations (see Exhibit 4-3 for locations). Additionally, Hawai`i County offers free recycling bins for collection of HI-5 beverage containers special events. The recycling bins consist of an easy-to-transport, lightweight steel frame that uses a clear bag to hold HI-5 beverages. Reservations are required and the County makes the recycling containers available on a first come, first serve basis.

#### 4.3.1.3 Green Waste Mulching and Dropoff Opportunities

Hawai`i County designated sites at the South Hilo Landfill and Kealakehe Recycling and Transfer Station for processing green waste and untreated wood pallets. The Kea`au Recycling and Transfer Station also includes a roll-off bin for residents to deposit green waste; the green waste is then hauled to a mulching facility located at the South Hilo Landfill site for processing. The County contracts with a private business to process the green waste into mulch for planting, gardening, and farming applications. Consumers, including both residents and commercial entities, may drop off their green waste and pick up mulch at the Hilo Landfill and Kealakehe locations. Currently, dropoff is free and the mulch is made available for consumers at no charge.

Future actions planned by the County involve soliciting proposals from private companies to operate island-wide green waste recycling collection sites. The proposed green waste collection sites would be conveniently located at or in close proximity to current recycling and transfer stations. Residential green waste disposal would continue without incurring a disposal fee; however commercial green waste would be charged a fee, as set by the County or the selected contractor(s).

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<sup>1</sup> The redemption rate is estimated using data from the Department of Health on the number of deposit containers redeemed on the Big Island from July 1, 2007 to June 30, 2008 and the County’s estimates on number of deposit containers sold based on defacto population.

#### 4.3.1.4 Home Composting

Hawai'i County promotes and educates residents on composting through Recycle Hawai'i, a tax-exempt, educational organization. Recycle Hawai'i and the County Department of Environmental Management initiated a program to furnish multiple Hawai'i schools and residents with composting bins called Earth Machines. Based on availability, residents may request Earth Machines for their homes; various workshops and educational programs are provided to the participants in the program.

#### 4.3.1.5 Recent Bioconversion Requests for Proposals

The County issued two requests for proposals (RFPs) during 2008 for projects that would dramatically increase the quantity of organics diverted from landfill. The first is for a 10-acre composting and biodiesel production that has been designed by the County and is located at the West Hawai'i Landfill. The plan is that the selected contractor will process collected green waste, untreated wood, biosolids, and/or organic materials into mulch, compost, soil amendments and/or other landscaping products. The second is a request for proposals for contractors to develop drop off facilities for green waste and possibly other organics at or near each of its 21 recycling and transfer stations. As of the second quarter of 2009, the County has not funded either of these projects. The ultimate schedule for implementation of these projects will depend on the availability of funds in upcoming budgets.

#### 4.3.1.6 Scrap Metal

Scrap metal may be dropped off at Hilo, Kealakehe, and Kea`au Recycling and Transfer Stations. The Kea`au Recycling and Transfer Station only accepts residential scrap metal, but the Hilo and Kealakehe recycling and transfer stations accept both commercial and residential scrap metal. The scrap metal is sorted by a County-approved contractor and sold to brokers for shipment to the mainland or Asian markets.

To assist with the removal of abandoned vehicles, Hawai'i County developed an Abandoned Vehicle Removal Program. Under the program, abandoned vehicles may be hauled by a contractor to either the Hilo or Kealakehe Recycling and Transfer Stations after certain procedures have been followed by the Police and Department of Environmental Management.

#### 4.3.1.7 Tire Program

Hawai'i County approved an ordinance in 2008 prohibiting all tires and parts of tires being disposed of at the South Hilo and West Hawai'i landfills. Consumers may drop off used tires at select tire company locations, and companies generating tire waste are required to recycle. Recycling options include baling and then shipping the tires to the West Coast to be ground or crumbed, or shipping the tires to the AES power plant in Oahu and utilized for fuel. Tire recycling contractors may also assist in tire collection and disposal.

#### 4.3.1.8 Fats, Oils, and Grease Program

The Hilo and Kealakehe Recycling and Transfer Stations accept waste cooking oil and FOGs from permitted haulers. The waste cooking oil and FOGs are placed in 300- to 500-gallon totes and shipped to either Oahu or Maui for processing at a biodiesel facility.

As a component of the composting request for proposal, Hawai'i County will be soliciting proposals to operate the biodiesel operation of West Hawai'i Compost and Biodiesel Facility. The biodiesel operation would accept cooking oil, FOGs, and grease trap waste from the County and other private sources. The waste would be processed into clean burning biodiesel and sold as a fuel to consumers.

### **4.3.2 Private Sector Programs**

Many businesses in the private sector develop in-house recycling programs. These programs are often not tracked by Hawai'i County but may constitute a large percentage of recycled materials. Some larger businesses have sophisticated systems to document the amount of recycled material generated, while smaller businesses sometimes do not carefully track the amount of materials that they recycle. In general, however, most businesses are willing to document and share the data that they collect with the County.

#### **4.3.2.1 Curbside Collection of Recyclables**

Private contractors provide HI-5 beverage container redemption services at their business locations, community centers, and schools, or through mobile redemption units. Contractors and nonprofit groups also pick up paper products, such as mixed office paper, newspapers, and cardboard. The recycled materials are generally sold to brokers on the mainland.

No island wide or large-scale curbside recycling program is currently implemented in Hawai'i County. Although pilot curbside recycling programs have previously been implemented by private waste haulers, they have not been sustained due to various logistical, technical, and financial challenges.

#### **4.3.2.2 Large Retail Business Recycling**

Large retailers, such as Wal-mart, Kmart, Costco, Home Depot, and others maintain in-house recycling programs at their stores. Cardboard and plastic (plastic bags and shrink wrap) constitute the majority of the materials recycled at these large retailers. Recycling quantities may range from a couple of bales of combined cardboard and plastic per week up to twenty bales per week for the largest retailers; each bale averages approximately 800 to 1,000 pounds. Depending on the retailer, HI-5 beverage containers, mixed paper, wood pallets, batteries, and light bulbs are also recycled at the stores.

Data provided during interviews conducted with many of the retailers indicates that most of the materials, especially cardboard and plastic, are shipped either to the West Coast to third party brokers or to the retailer's distribution center. Other recycled materials are picked up by permitted haulers.

#### **4.3.2.3 Composting**

Several private businesses operate composting facilities on the island. Generally, these facilities accept green waste from local residents at no charge, and offer mulch and compost products to consumers. One operator is reported to process as much as 350 cubic yards of green waste per month. Some of the challenges facing such businesses include cost of operation, and lack of public education about the benefits of recycling green waste and using the resulting products. There is a significant existing and potential market for the mulch and compost products generated from such facilities.

#### 4.3.2.4 Metals Recycling

In general, metals (ferrous and nonferrous) are recycled and sorted by a County contractor at the Hilo, Kealakehe, and Kea`au recycling and transfer stations. However, there is also a booming scrap metal business in the private sector, spurred on by the current spike in scrap metal prices. Certain contractors have obtained solid waste permits to collect and sort scrap metal at their facilities. The metal is sold to brokers for markets in the mainland and Asia.

#### 4.3.2.5 Tires

Multiple haulers collect and bale tires and tire parts for shipment to the West Coast or Oahu for processing into ground and crumbed materials for use as fuel at the H-Power waste to energy facility. One contractor utilizes the tires to make concrete tire blocks used in decorative walls. The contractor is currently attempting to gain approval from the State of Hawai`i to allow contractors to use the tire blocks as a component in structural walls.

### 4.3.3 Current Material Markets and Market Development Initiatives

Currently the primary markets for various types of recycled materials generated within Hawai`i County include local businesses, and larger manufacturing or recycling facilities in the U.S. Mainland and Asia. The majority of recycled materials generated within the County are either sold to brokers or shipped directly to buyers in the U.S. Mainland and Asia. A small percentage of materials are processed and reused locally. Some examples of local and mainland markets are described below.

#### 4.3.3.1 Mulch and Compost Products

Local businesses including landscapers, contractors, and public agencies utilize mulch and composted materials produced locally. Residents use compost and mulch in both residential and agricultural applications. It is likely that 100 percent of the materials produced through recycling of green waste can be utilized locally. One local composting business reported that they are selling compost for \$3 per cubic yard. The County offers mulch free to residents at the South Hilo Landfill and the Kealakehe Recycling and Transfer Station.

#### 4.3.3.2 Cooking Oil, Fats, Oils and Grease

During the past 5 years several commercial businesses in Hawai`i have been established to recycle used cooking oil and FOGs in the production of biodiesel. Several commercial ventures are currently evaluating the construction of facilities within Hawai`i County. As noted above, the County plans to contract for the operation of a biodiesel production facility at the West Hawai`i Landfill. It is likely that a large percentage of these waste materials generated locally could eventually be utilized in the production of alternative fuels. Data were not available for the value of used FOGs; however, the biodiesel produced using such materials is currently selling at a price slightly higher than that of refined diesel fuel.

#### 4.3.3.3 Paper

Currently much of the recycled paper and cardboard generated on the island is either shipped to the U.S. mainland or Asia for reuse. Several local businesses accept newspaper for recycling, and produce shredded paper products used primarily by the local agriculture businesses. Businesses interviewed indicated that 100 percent of the materials that they

produce through recycling are purchased by local farmers for use in growing and shipping of agricultural products and flowers.

#### 4.3.3.4 Plastics

Plastic containers (#1 and #2) are included in the HI-5 Redemption Program. Other plastics including plastic shopping bags are baled and shipped to overseas markets. There is a local business that has conducted successful pilot tests of a process that processes film plastics into growing medium for orchids.

#### 4.3.3.5 Glass

Currently, glass is both recycled (or reused) in the county and shipped to the U.S. mainland or Asia for remanufacturing. A significant amount of glass is crushed for use in local construction projects. The County Solid Waste Division often specifies glasscrete (10 percent of aggregate is replaced with crushed glass), and uses crushed glass for backfill behind retaining walls. More could be done to use glass for County construction projects.

Several smaller businesses exist within the County that use recycled glass for the production of artistic, architectural, or educational products: the market for these products is somewhat limited.

The potential exists to develop local markets serving the construction industry that would recycle most or all of the glass containers generated in the County. Doing so would require marketing and promotion efforts, changing specifications and regulations, and developing additional processing infrastructure. Products such as glassphalt or reflective materials used in signage could potentially be produced on the island, but require development of infrastructure, equipment, and/or facilities to accommodate the manufacture of these materials.

The State Department of Health recently changed the handling fee paid to redemption center operators. The fee was lowered from 3 cents per container to 2 cents per container for on-island use, and was increased to 4 cents per container for remanufacturing, which translates to shipping and off-island processing because there are no glass remanufacturers on the island. County solid waste division staff believe that paying more for off-island reuse and remanufacturing than for on-island use is a barrier to developing local markets for glass. Developing local markets for glass has a number of benefits including: saving natural resources by not having to mine raw materials, eliminating diesel fuel use associated with shipping glass to off-island markets, and creating local jobs.

#### 4.3.3.6 Metals

There are limited facilities on the Big Island for processing scrap metal. The bulk of the scrap metal generated in the County is shipped either to Oahu for processing and subsequent shipment to the U.S. mainland or Asian markets, or shipped directly to those markets. Scrap metal value has increased dramatically over the past decade, and has been reported to be as high as \$400 per ton for scrap steel. Other metals may have a higher value than steel. Due to the weight of scrap metal, processing is required for economical shipment to the markets, and the rising costs of shipping will likely continue to impact the economics of selling scrap metal.

#### 4.3.3.7 Market Development Initiatives

The County helps provide incentives for recycling through its diversion incentive program. In this program, the County issues requests for proposals for companies to process and market and/or collect recyclable materials. Currently, it has contracts with companies for processing paper, metals, plastics, glass, FOG, latex paint and green waste. It also contracts with a company for collecting and processing mixed recyclables and glass at its recycling and transfer stations.

#### 4.3.4 Hawai`i County Staffing Levels

Successful delivery of local government waste reduction programs requires devoting an appropriate amount of resources including staffing. Hawai`i County has demonstrated its commitment to waste reduction and recycling by assigning the following staff to County waste reduction and recycling programs:

- One full-time recycling coordinator
- Two FTE recycling specialists for the HI-5 recycling program
- Two FTE recycling specialists
- One part-time student helper

In addition, using funds provided by the County of Hawai`i, Recycle Hawai`i employs three part-time education specialists, who are responsible for educating the public about waste reduction and recycling programs on the north, west and east portions of the island, respectively. Recycle Hawai`i also has other personnel that do education at KRRC and other various workshops & community events.

### 4.4 Issues and Concerns

As described above, a number of recycling, bioconversion, and marketing activities have been recently conducted in the County of Hawai`i, including programs and initiatives by both the County as well as other organizations. In spite of these efforts, the County recycling rate is just under 30 percent, which is well below its 2008 target of 50 percent. There is more that could be done by the County and waste generators to treat materials as resources and further reduce landfill garbage. The need to implement additional programs and policies is further established by the County's commitment to Zero Waste.

### 4.5 Options for Improvement

Pursuant to HRS 342G-26, an overview of various options that could be implemented to improve recycling and bioconversion and solidify markets follows. These options were developed based on successful initiatives implemented in other jurisdictions that may be applicable and appropriate for Hawai`i County. Note that the options focus on recycling and bioconversion; waste reduction and reuse are discussed in Section 3.0, Source Reduction, and public education is discussed in Section 5.0, Public Education and Information.

### 4.5.1 Increase Green Waste Drop-off Opportunities at Recycling and Transfer Stations

As discussed above, green waste can be dropped off at the Hilo, Kealakehe, and Kea`au Recycling and Transfer Stations. The County plans to issue a request for proposals for private firms to provide green waste collection sites for materials at or near each of the other 18 recycling and transfer stations.

**Diversion Potential.** Using results from the County's 2008 waste composition study, assuming 50 percent of the green waste currently being disposed at recycling and transfer stations could be diverted through a drop off program, this green waste collection program might result in additional recycling of 4,900 tons. This estimate assumes no green waste curbside collection program is implemented and recycling and transfer stations remain open legally only to residents. Additional quantities could be captured with rigorous enforcement of a green waste disposal ban and/or by allowing small commercial customers to participate in the program.

**Estimated Cost.** The current cost of green waste processing is approximately \$37 per ton. Extending the program to all stations that are further from County mulching facilities and that have less frequent traffic would probably increase this cost by 20 to 40 percent for a total annual cost increase of approximately \$650,000 to \$800,000.

### 4.5.2 Residential Curbside Collection and Processing of Recyclables

In this option, the County would collect recyclables from single family residents or contract with a private collection firm for the service. There is a wide variety of curbside recycling programs in use in North America today. They can generally be grouped into two types: multi-stream and single stream systems. A third type, co-collection, in which bags of garbage and recycling are collected in a single vehicle, is becoming less popular because of contamination concerns and low participation rates. A brief discussion of multi-stream and single stream recycling and some other important considerations follows.

#### 4.5.2.1 Multi-Stream Recycling

With multi-stream systems, households place recyclables into rectangular containers, bags, or bundles and place them at the curb. The collector lifts materials by hand into multiple compartments on the collection vehicle. Glass is often separated from other materials in order to avoid high contamination of fiber and fiber processing difficulties that can result when broken glass is present. Most programs sort materials into two or three types of commodities, but 5 to 7 materials sorts are done in some programs.



#### Advantages

- More thoroughly separating differing types of materials generally results in higher recycled material quality and market prices.

- Can reinforce zero waste principles by raising consumer awareness that sorted materials are valuable resources.

### Disadvantages

- Requires more effort by householders to sort materials.
- Requires a higher level of effort by haulers, resulting in higher collection costs.

### 4.5.2.2 Single-Stream Recycling

In recent years, there has been a movement towards single-stream recycling systems in which all dry recyclables are placed into a single rolling cart<sup>2</sup>. The cart is lifted using a hydraulic lifting arm attached to a collection vehicle. This more automated type of system lowers collection costs. The lowest cost per ton of material recycled is typically achieved by single stream recycling with fully automated collection in which a single driver can collect material from many stops without leaving the cab of the truck (see photo below).

### Advantages

- Generally results in the highest rate of diversion of materials from landfill.
- Simpler system for participants to use because all materials are combined in a single bin and no sorting is necessary.
- Lower cost per ton of material recycled because of higher resident participation rates combined with automated collection efficiency (lower collection costs).
- Results in fewer injuries to collection workers and corresponding workers compensation claims because no lifting or handling of materials is required.



### Disadvantages

- Higher contamination of recyclables: significant effort is required to ensure that residents maintain material quality.
- Requires sophisticated materials processing facilities and equipment, as well as good communication with processors and end-use markets to ensure that manufacturing (raw material quality) requirements are met.
- Higher initial capital cost because of the cost of carts (\$45 to \$60 each on the U.S. Mainland).
- Fully automated systems require higher initial and long-term capital costs because mechanically complex trucks are needed, that have more rigorous long-term maintenance requirements.

<sup>2</sup> MSW Management Magazine (July/August 2007) reports the results of a 2005 study that indicated single stream collection was used in 27 percent of U.S. recycling programs in 2005 compared with 10 percent in 2000.

### 4.5.2.3 Service Standards

Curbside collection is generally offered on a subscription basis, or made mandatory for some or all single-family residents within a jurisdiction. Hawai`i County is predominantly rural in character with relatively small urban and suburban areas in Hilo, Kona, Waimea, and a few other locations. Many of the rural areas within the County have steep, unimproved roads not suitable for collection vehicles. Thus, mandatory curbside collection for all County residents is likely to be impractical. Further, longer distances between collection stops will occur in many of the geographically dispersed small communities in the County. A voluntary subscription service, for which not all residents would sign up, would potentially make the distance between collection stops even longer. For program cost efficiency, it is recommended that this option should include designated zones where curbside service would be mandatory.

For the purpose of developing diversion and cost estimates, a rough analysis of housing units in Census Designated Places was conducted. The result was an estimate of 37,000 households that would be served by the program, which is about 73 percent of the estimated 51,300 occupied single family households in Hawai`i County<sup>3</sup>.

Collection frequency could be weekly or bi-weekly. Weekly collection generally is more costly, but can potentially result in somewhat higher diversion from landfill. The collection frequency could be evaluated during a pilot program and determined at a later date.

### 4.5.2.4 Processing

The processing requirements for the collection program would need to be determined. The economics of material recovery facilities are characterized by substantial economies of scale. It is likely that the County's most cost-effective strategy to bale commingled recyclables and ship them to the U.S. Mainland for processing (as is currently done with mixed recyclables collected at County recycling and transfer stations). The resulting requirements for a County processing facility would consist of a covered building with space to store incoming materials, one or more balers for densifying materials, and equipment and facilities to load shipping containers for transportation to markets.

It is likely that one or more new processing facilities would be needed to support this program. The cost of developing and operating several smaller storage and baling facilities would need to be weighed against the costs and other impacts of trucks hauling materials long distances to a central facility. The most likely potential locations for such facilities would be in East Hawai`i (Hilo), one in West Hawai`i (Kona) and one in the Waimea area.

### 4.5.2.5 Other Considerations

There are a number of other factors that should be considered when evaluating curbside recycling:

- Collection is typically performed through a contracting mechanism with a private service provider, although many cities and counties collect recyclables using municipal workers. This decision would need to be made with State contracting laws in mind.

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<sup>3</sup> Based on data from U.S. Census 2006 *Selected Housing Characteristics* (single-family was counted as dwellings with 1 to 4 units), and 2000-2006 annual growth rate used to project 2008 total occupied housing units (63,347).

- There are many different ways of organizing the collection of garbage, recyclables, and green waste/organics. The program must be integrated with other collection programs. If curbside recyclable collection were implemented in Hawai'i County, it would be costly to collect both at curbside and at all 21 of the County's recycling and transfer stations.
- Pilot programs and consumer research should be conducted prior to full-scale implementation to develop data that can be used to refine and tailor the program to the needs of the various communities within the County.
- Education and promotion of the program would be critical to success.

**Diversion Potential.** Curbside recycling has the potential to divert significant quantities of material from County landfills. The extent of diversion could vary significantly depending on the type of program that is instituted and other factors such as those presented in Exhibit 4-3. Some of the more successful curbside recycling programs in the United States report collection rates of 500 to 1,000 pounds of recyclable materials per participating single-family household per year. For example, Seattle reported dry recyclables collection of 876 pounds per participating household per year in 2007<sup>4</sup>. A 2007 analysis of 134 curbside recycling programs in Ontario found a collection rate of 339 pounds per participating household per year<sup>5</sup>.

EXHIBIT 4-3  
Factors Affecting Curbside Recycling Rates

Program Feature	Estimated Recycling Rate Impact (in percentage points)
Variable garbage collection rates	+5 to 6
Weekly recycling collection	+2 to 4
Add additional materials	+2 to 4
Commingled collection	+1 to 3

Sources: California Integrated Waste Board. 2002. *Curbside Recycling, the Next Generation: A Model for Local Government Recycling and Waste Reduction*. Accessed at <http://www.ciwmb.ca.gov/publications/default.asp?pubid=969>

In FY 08, 5,557 tons of dry recyclables were collected from County recycling and transfer stations, which is approximately 175 pounds per household per year. Using results from the County's 2008 waste composition study, assuming 37,000 households would be served and material capture rates of 80 percent for most recyclables (like paper, cardboard, and containers), a recycling program would result in additional recycling of 8,800 tons, which is about 460 pounds per participating household per year, or about 635 pounds per participating household per year including materials currently being collected from County recycling and transfer stations.

<sup>4</sup> See [http://www.seattle.gov/util/stellent/groups/public/@spu/@usm/documents/webcontent/spu01\\_003756.pdf](http://www.seattle.gov/util/stellent/groups/public/@spu/@usm/documents/webcontent/spu01_003756.pdf)

<sup>5</sup> Wilson, Bruce. *A Comparative Analysis of Ontario's Recycling Programs*. 2007. Proceedings, Papers, and PowerPoint presentations of the ISWA World Congress.

**Estimated Cost.** The cost of curbside recycling ranges significantly for different programs. Factors that influence costs are similar to those that affect the amount of recycling such as

- Costs increase with the frequency of collection (for example, weekly versus bi-weekly). One recent study estimated only a small reduction in diversion, but as much as a 40 percent reduction in collection costs by moving from weekly to bi-weekly service<sup>6</sup>.
- Subscription versus mandatory service (mandatory collection has a higher total cost but lower cost per household because the travel distance between stops is reduced).
- If recyclable materials are separated versus commingled, more collection time is required at each stop, thus increasing costs.
- Costs are higher in more rural the service areas (because of longer distances and increased travel time between stops).
- Shipping costs increase with distance to markets.

Information about the extent to which various factors affect the cost of recycling are shown in Exhibit 4-4.

EXHIBIT 4-4  
Factors Affecting Curbside Recycling Costs

Program Feature	Estimated Cost Increase or Decrease
Commingled collection	20 to 35% decrease
Less than weekly collection	20 to 40% decrease
Mandatory recycling	10 to 25% decrease
Long program history	10 to 25% decrease
Automating collection	5 to 15% increase
Adding variable rates	10 to 20% increase
Adding new materials	15 to 35% increase

Source: California Integrated Waste Board. 2002. *Curbside Recycling, the Next Generation: A Model for Local Government Recycling and Waste Reduction*. Accessed at <http://www.ciwmb.ca.gov/publications/default.asp?pubid=969>

The EPA reports that typical costs for curbside recycling range from \$2.75 to \$5 per household per month<sup>7</sup>. However, costs can be considerably higher. For example, the City of Calgary, Alberta's new curbside collection program costs residents \$8 per month<sup>8</sup>. All of these costs assume that there is a curbside garbage service in place. Should the County of Hawai'i implement curbside recycling in the absence of curbside garbage or green waste

<sup>6</sup> Skumatz Economic Research Associates. 2008. *Roadmap for Moving Recycling and Diversion Forward in Colorado: Strategies, Recommendations, and Implications*.

<sup>7</sup> <http://www.epa.gov/osw/conservation/localgov/economics/collection.htm>

<sup>8</sup> <http://content.calgary.ca/CCA/City+Hall/Business+Units/Waste+and+Recycling+Services/City+Initiatives/Curbside+Recycling+Program/Calgary+Launches+Curbside+Recycling+Program+in+2009.htm>

collection, costs would be relatively high because administration, billing, overhead, vehicle maintenance, training, and other costs would be applied only to recycling and would not be spread over the cost of multiple services.

Depending on the types of issues discussed above, the cost of curbside recycling could vary significantly. A curbside recycling only system, without garbage or yard waste, but including material processing and marketing, would require development of significant collection infrastructure and would probably cost \$20 to \$30 per household per month. The costs would likely be significantly less if the service was combined with curbside garbage and/or green waste collection.

### 4.5.3 Residential Curbside Collection and Processing of Green Waste

In this option, the County would collect green waste from single-family residents or contract with a private collection firm for the service. The choice of County collection versus private collection would need to be made with State contracting laws in mind.



In this type of program, materials are typically collected in bags or plastic bins provided by residents or the local government. While some systems are used for bulk collection without containers, these are typically only used seasonally in the fall for leaf collection<sup>9</sup>. Types of bags or containers and associated advantages and disadvantages of each type of container follow.

- Plastic bags. Relatively inexpensive, convenient, but a significant problem for processors because the cost of removing all plastic from the organics results either in contaminated low quality feedstock, extremely high-cost bag removal methods, or both. Grass in plastic bags can go anaerobic and become odorous when opened at the compost facility. Most green waste collection programs now prohibit collection of green waste in plastic bags.
- Compostable bags. Somewhat less convenient than plastic bins and expensive over the long-term for households which is likely to lower recovery rates. Bags cost \$0.50 to \$1.00 per bag. The bags compost well and avoid the contamination issues associated with plastic bags.
- Plastic bins. Most programs now use plastic containers provided by the local government, or in some cases by the user, and use rolling 30- to 90-gallon carts that are easier to get to the curb than non-wheeled bins. Bin contents are either loaded by hand (manual) or hydraulically (semi- or fully-automated) into the truck. Most programs use trucks equipped with hydraulic loaders to limit lifting by collection workers thus reducing injuries and workers compensation claims.



#### 4.5.3.1 Service Standards

Like curbside collection, it is recommended that any green waste collection program should be a mandatory program for more densely populated single family neighborhoods to

<sup>9</sup> U.S. Environmental Protection Agency. 1994. *Composting Yard Trimmings and Municipal Solid Waste*. Accessed at <http://www.epa.gov/osw/conservation/rrr/composting/pubs/cytmw.pdf>

increase efficiency and reduce operating costs. Further, it is recommended that the program include rolling carts loaded using semi-automated or fully-automated equipment.

#### 4.5.3.2 Processing Requirements

The County currently contracts for green waste processing (into mulch) at sites at the South Hilo Landfill and the Kealakehe Recycling and Transfer Station, and it is currently in the process of contracting for development and operation of a composting facility at the West Hawai'i Landfill. To minimize transportation costs, it would be advantageous to develop another processing facility in the Waimea area. If that facility is developed, there will be sufficient capacity to process the material. However, mulching produces a relatively low value product that is less desirable than compost or soil products made from compost. After the West Hawai'i compost facility is operational, the County should evaluate the costs and benefits of developing a similar facility in East Hawai'i and possibly in the Waimea area. This is recommended regardless of whether or not curbside green waste collection is implemented.

#### 4.5.3.3 Other Considerations

The other considerations that apply to curbside recycling also apply to curbside green waste:

- A decision would need to be made if collection would be provided by County workers or under a contract with a private service provider consistent with State contracting laws.
- The program must be integrated with other collection programs and with the current green waste services provided at County recycling and transfer stations.
- Pilot programs and consumer research should be conducted prior to full-scale implementation to develop data that can be used to refine and tailor the program to the needs of the various communities within the County.
- Education and promotion of the program would be critical to success.

**Diversion Potential.** Using results from the County's 2008 waste composition study, assuming about 37,000 households would be served and a 90 percent capture rate, a green waste collection program might result in additional recycling of 5,600 tons. This estimate assumes no extra green waste from collection at recycling and transfer stations.

**Estimated Cost.** The factors affecting the cost of curbside recycling discussed above would also help determine the cost of green waste collection. Costs would depend on what other curbside services are provided (for example, garbage, recycling). Curbside collection of green waste including processing and material marketing would probably cost between \$20 and \$30 per household per month.

#### 4.5.4 Add Food and Other Organics to a Residential Curbside Recycling and Green Waste Collection Program

Throughout the United States, Canada, and elsewhere, many large and small communities with a commitment to zero waste are modifying their waste collection programs to include

food and other organics such as food-spoiled paper. Some examples of existing programs and how they are organized follow:

- San Francisco: Weekly collection of garbage, recyclables, and organics in plastic 32-gallon rolling carts. Fully-automated collection with garbage and recyclables in a dual collection truck (separate compartments for each material), organics in a separate truck. Variable rate for garbage. No curbside green waste collection.
- Seattle: Starting in 2009, service will be same as San Francisco with variable rates and can sizes for both garbage and organics. Major difference is that all streams are collected in separate trucks (no dual collection trucks).
- Toronto: Weekly collection of organics in 20-gallon rolling carts, and recyclables and garbage collected on alternating weeks in 32-gallon rolling cart. Variable rate for garbage.



These three basic types of systems have been implemented in a number of communities, both large and small. They require residents to learn new ways of managing food and other organics and program managers must clearly communicate to residents what materials must go in each bin. Most of these systems have some type of variable rate to encourage behavior that minimizes garbage. In general, after initial pilot testing and consumer research, these programs have typically been well received by residents. Current research efforts are focusing on ways to increase participation by residents: many programs report less than 30 percent of residents participate in organics recycling<sup>10</sup>. Implementation of aggressive pay-as-you throw rates is one method communities are using to improve participation rates.

#### 4.5.4.1 Processing

These programs require more sophisticated composting systems. Once food is added to the organics stream, composting must be done with some type of covered system with managed air flows to minimize odors and prevent unsanitary feeding by birds, rodents and other vermin. See Chapter 4.5.7 for more information about processing systems appropriate for food and other organics.

**Diversion Potential.** Using results from the County's 2008 waste composition study, assuming 37,000 households would be served and a 50 percent capture rate of food and wet or food-soiled paper, it is estimated that 4,400 tons of food and other organics would be collected. When combined with recyclables and green waste, the combined system is estimated to result in additional diversion of 18,800 tons, or an amount equivalent to 23 percent of the 81,300 total tons of waste delivered to transfer stations in 2008. When the 4,800 tons currently being recycled at transfer stations are included, the program would result in an increase in diversion equivalent to 27 percent of total current waste delivered to recycling and transfer stations.

<sup>10</sup> Goldstein, Nora. *Source Separated MSW Composting in the U.S.* BioCycle December 2005, Vol. 46, No. 12, p. 20

Note that this is considerably lower than the 50 to 70 percent diversion rates reported by other three-stream programs. This is the result of the following two factors:

- Residents who live in multi-family dwellings and in very rural single family dwelling would not be covered by the three-stream program, but do deliver materials to the recycling and transfer stations.
- The materials arriving at County transfer stations include materials rarely set out at the curb by single-family residents on a routine basis such as construction and demolition waste, metals other than containers, textiles, and special wastes.

In order to make an equivalent comparison to other residential communities, we adjusted for these two factors. Including only the 37,000 participating households and typical curbside commodities, the three-stream system would result in the diversion of 68 percent of the wastes generated by those residents away from County landfills.

**Estimated Cost.** Rates for three-stream collection service depend on the size of containers residents subscribe to. As examples, San Francisco and Seattle both charge approximately \$25 per month for service with 32-gallon discard and organics carts: costs are higher if larger containers are desired. These costs include disposal, processing/composting, administration, education, and other costs, including the cleanup and long-term monitoring of closed landfill sites. Based on data from the City of Seattle, it is estimated that costs for the collection portion (excluding processing or other system charges) of the residential monthly rate are perhaps one-third of total costs or about \$7.50 per month<sup>11</sup>.

It is estimated that the cost of a three-stream collection service in Hawai`i County, including and recyclables and organics processing and material marketing/sales (but excluding disposal, administration, transfer stations, and other solid waste programs), would probably range between \$50 and \$60 per month for each participating household.

#### 4.5.5 Source Separation Ordinance (Mandatory Recycling) and/or Disposal Bans with Differential Tip Fees

A growing number of local governments are adopting policies and legislation that prohibit disposal of recyclable products and/or mandate source separation and/or recycling of those materials. For example, in January 2006, the City of Seattle began enforcing a policy that all waste generators recycle. As a result of this policy, residents can lose pickup services temporarily if their garbage contains more than 10 percent recyclable materials.

Once recycling opportunities for select materials are in place, some policies the County could consider include:

- Require residents and businesses to participate in recycling and composting programs. An ordinance could be developed that either requires residents and businesses to source-separate recyclables, or bans the combination of designated recyclable or compostable materials with the garbage.
- Ban readily-recyclable and reusable materials and products from landfills and/or any future energy from waste facility.

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<sup>11</sup> [http://www.seattle.gov/util/About\\_SPU/Garbage\\_System/Garbage\\_Rate\\_Structure/FINANCING\\_200312020939564.asp](http://www.seattle.gov/util/About_SPU/Garbage_System/Garbage_Rate_Structure/FINANCING_200312020939564.asp)

- Ban single-use disposable products from public events and festivals and as many other places as possible.

A good discussion of mandatory recycling policies recently prepared by Portland Metro<sup>12</sup> included the following lessons learned from communities that have implemented such policies:

- Required recycling programs have the potential to divert a significant portion of the waste stream and help communities meet recovery goals.
- Education and technical assistance are key factors to the implementation of mandatory recycling requirements. Virtually all of the program managers stressed the importance of education as a key element to a successful program.
- Using a cooperative approach with haulers, business owners, and community organizations can build program support for required recycling and influence participation.
- Strong commodity markets ultimately determine what is recyclable and influence participation. It is not practical to mandate materials recycling unless the markets exist for the materials. Therefore, any program mandating recycling should only include recyclables with developed and stable markets in order to avoid having to change policies in the future.
- A number of programs require the recycling of materials for which the cost of recycling is less than or equal to the costs of proper disposal at a solid waste facility.
- Enforcement is a key component of mandatory recycling requirements and disposal bans. The most common enforcement measures used in the profiled programs include random business inspections and landfill load inspections. Penalties for noncompliance include warnings and fines that range from \$25 to \$10,000. The majority of the programs offer an assistance period to help businesses meet the requirements.
- Adequate resources need to be budgeted to support required recycling programs. A major impediment for communities implementing effective mandatory recycling requirements or disposal bans is sufficient resources for enforcement measures. Five of the nine programs noted lack of resources for enforcement measures as an obstacle to the program's success.
- Program managers stressed that businesses will not adhere to required recycling policies unless they fear the potential repercussions of noncompliance. In contrast, programs that have full-time enforcement officers stated that strong enforcement can boost both the quantity and quality of participation.
- Landfill bans can spur the market development for some materials. For example, landfill bans of yard debris have led to the development of composting infrastructure at the local and regional levels. In Vancouver, B.C. the ban on drywall has enabled recyclers

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<sup>12</sup> *Required Recycling and Incentive Program Survey, Summary of Findings*. 2002. Portland Metro Regional Environmental Management Department.

and salvagers to competitively bid on the demolition of buildings, which has led to an increase in construction and demolition diversion from the local landfill.

- Disposal bans require extensive promotion and education campaigns targeting the affected parties. Durham, North Carolina conducted a 2-year education period before enforcement of a disposal ban, although the city noted that a concentrated 6-month campaign prior to enforcement would likely be sufficient.
- Local government can influence the marketplace by the way it structures its garbage collection rates, franchise fees, and permit fees. A number of the surveyed communities utilize multiple incentives to reward recycling over disposal. Program managers indicated that one of the best voluntary incentives for businesses to recycle is an economic incentive.
- Diversion deposits provide sufficient incentive to encourage businesses to recycle. A number of communities in California have adopted diversion or recycling deposit systems to encourage the recovery of construction and demolition materials. Program approaches vary and deposits range from a flat fee based on a project's total cost to fees based on square footage and the type of project.
- The largest barrier to a diversion deposit system is the administration of the transaction and refund process. Program managers commented that the refund turn-around process is slow and managing the financial components of the program requires additional resources and time. For example, San Jose's Construction and Demolition Diversion Deposit Program's refund process takes approximately 3 weeks, which is longer than the city originally anticipated.

The County now has mixed-material and glass-only recycling bins available at all but one of its recycling and transfer stations. Thus, residents currently have ample opportunity to recycle these materials. If the County is successful in implementing green waste collection points at or near most of its recycling and transfer stations, the situation will be similar for green waste.

These materials would be good candidates for inclusion in a source separation ordinance or disposal ban. Enforcement would be the main challenge because there is relatively little monitoring and no enforcement authority currently in place at recycling and transfer stations. Prior to enacting the ordinance, the County should conduct an extensive education and promotion program that highlights the reasons for the ordinance and the recycling options available to residents. For a period of 6 months to a year before enacting the ordinance, the County should have signage prominently displayed at each station that announces the pending ordinance and clarifies recycling options.

Once enacted, it is recommended that initial enforcement should be less stringent (that is, encourage, but not strictly enforce compliance so as to minimize conflicts and the potential for illegal dumping). More strict enforcement, such as fining those not in compliance, would require significant changes to the authority and role of environmental management or transfer station security employees, or subcontracting this function to a suitable security provider. Such changes could be considered if less stringent enforcement proves ineffective.

For the commercial sector, the County could consider a similar ordinance that would apply at its landfills to readily recyclable materials such as cardboard, green waste, and metals. At its landfills, it should make opportunities for drop-off of all banned materials. Drop-off would be free (like at the transfer stations) except the County could charge a fee for green waste and metals that is less than the fee for garbage. This would help encourage on-site use of green waste and diverting metals to private recyclers. The ordinance could be enforced by banning these materials from landfill, with a penalty of two times the regular disposal rate if loads are found containing the banned materials.

**Diversion Potential.** A nationwide study of recycling and green waste programs indicated that mandatory participation<sup>13</sup> resulted in a 4 to 5 percentage point increase in green waste diversion but no statistically significant increase in recyclables diversion. Similar results would probably result for Hawai`i County, although it may be that some increase in recycling would occur.

**Estimated Cost.** Costs would include a one-time cost for the education and promotion campaign and for signage at all transfer stations. This would probably cost between \$30,000 and \$100,000 depending on implementation details. Enforcement costs could be relatively small if little action is taken, or they could be substantial if additional staff or subcontracted security personnel are assigned to each recycling and transfer station during the initial implementation period.

#### 4.5.6 Commercial Recycling and Green Waste Program

While there are some businesses and institutions that currently recycle, there is considerable opportunity to increase recycling from the non-residential sector. Because current markets for most recyclables are in Asia or the U.S. Mainland, the cost of shipping recyclables to markets makes recycling less cost-effective for businesses than it is in most U.S. Mainland communities. Much of the non-residential recycling currently results from backhaul opportunities, or generation of large quantities of valuable materials such as metals which are currently experiencing record high prices. It is likely that in order to increase the rate of non-residential recycling, the County will need to take regulatory steps to drive the process. Regulatory measures may include the following elements:

1. **Mandatory Recycling/Source Separation Ordinance.** Adopt a mandatory recycling ordinance that requires all businesses and institutions to recycle an approved list of commodities. That list could include cardboard, metals, green waste, and perhaps other select commodities.
2. **Business Recycling at Recycling and Transfer Stations.** Mandatory recycling could be expensive for smaller firms that do not generate much waste (such as small offices or retail operations). Thus, the County should change the permits that govern its recycling and transfer stations to allow small businesses and institutions to drop off materials. Businesses would still be prohibited from disposing of waste at stations. At stations where space is available, the County should provide additional bins for source separated cardboard to accommodate small business recycling efforts.

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<sup>13</sup> Skumatz, Lisa. 1996. *Nationwide Diversion Rate Study, Quantifying Effects of Program Choices on Recycling and Green Waste Diversion: Beyond Case Studies*. Reason Foundation Policy Study, No. 214. Accessed at: <http://www.reason.org/ps214.html>

If accommodating small business recycling at the stations is not acceptable or feasible, the mandatory recycling ordinance should provide an exemption for businesses with less than a certain threshold number of employees (for example small businesses employing less than 20 persons).

3. **Require Collection Firms to Provide Recycling Services Through Licensure.** License all garbage collection companies with a condition of the license that stipulates they must provide an approved recycling collection service. The required service should be tied to the list of mandatory recyclables. If all firms are required to provide a recycling service, competition should lead to competitive rates for hauling both recyclables and garbage.
4. **Develop and Contract for New Processing Facilities.** As discussed above for residential recycling, the County would need to ensure that processing and marketing opportunities are available for these materials. The same processing facilities could be used for residential and non-residential recyclables. This would probably include the County issuing an RFP for these services either at County owned sites and/or allowing contractors to propose sites. Facilities would probably be needed in West Hawai'i, East Hawai'i, and possibly in the Waimea area.

#### 4.5.6.1 Implementation Considerations

This option would require significant outreach to the business community, and a marketing and technical assistance program. The option should include a reasonable phase-in period so that collection firms can ramp up for the changed requirements. The County should consider implementing an incentive program and/or recognition program for businesses that meet the recycling requirements.

If this program is to apply to state and federal government institutions such as schools, negotiations and consultation with agencies will need to take place. For schools, collection contracts would need to be revised to allow for recycling in addition to garbage collection.

**Diversion Potential.** Using results from the County's 2008 waste composition study, assuming 80 percent of business and institutions would participate and a 60 percent capture rate for readily recyclable materials and green waste, this program could result in additional recycling of approximately 13,400 tons per year.

**Estimated Cost.** If the County continues its current policy of making incentive payments for processing and marketing materials, 13,400 tons of material would cost the County approximately \$540,000 per year (assuming \$40 per ton). Alternatively, this cost could be passed on directly to the businesses and institutions by charging a tipping fee at the processing facility.

The County would need to dedicate staff to draft ordinances and to follow through with the required legislative process to enact them, and set aside funds for the promotion and education of the program.

#### 4.5.7 Bioconversion of Food and Other Organics from Businesses/Institutions

The County's 2008 waste composition study estimated that discarded food makes up 34,000 tons, or 16 percent, of disposal at County landfills. The putrescible nature of food

requires more costly and sophisticated collection and processing infrastructure than green waste; however, there are many successful examples in the U.S. and elsewhere of organics management programs that incorporate food and other organics as feedstock. This option focuses on options for collection (from non-residential sources) and processing of this waste stream (residential collection is discussed in Chapter 4.5.4).

As an option, the County could issue a request for proposals for development and operation of organics processing facilities designed to accept food and other organics as part of the incoming feedstock. It's likely that individual facilities would be necessary in West and East Hawai'i (and possibly in Waimea). The County would need to take the following steps to attract material to the facility:

- Price the tip fee at the facility less than the tip fee at its landfills to provide a financial incentive for businesses to separate food (perhaps \$30 per ton less).
- Develop an outreach program that would work with collection firms and major food generators to encourage participation well in advance of the facility operation date.
- Be prepared to establish an ordinance preventing food from disposal at major food generators should the first two steps not be sufficient to attract material to the processing facilities.



#### 4.5.7.1 Collection from Businesses and Institutions

Food and other organics, such as waxed cardboard or wet or food-soiled paper, could be collected from businesses and institutions that discard reasonably large quantities of food. Existing hauling routes and schedules would need to be altered to provide a separate service for food and other organics.

Businesses and institutions would need to change work practices to separate food and other organics from garbage. Other communities have found that one significant challenge for businesses and institutions has been finding space on the premises to set out a separate collection bin for organics. Addressing these challenges would require effective communication between County staff, the collection company, and businesses and institutions.

#### 4.5.7.2 Processing

Compared to a green waste processing operation, processing food requires additional design and operational features to prevent odors and the attraction of birds, rodents and other vermin. This is typically accomplished as follows:

- Receiving collection trucks and preparing/mixing feedstocks in an enclosed building with biofilters and other features to manage air flow and prevent odors.
- Mixing and moving feedstock daily (unlike green waste where under certain circumstances material can be stored for days at a time).

- The bioconversion process requires either more sophisticated electronic controls and/or more sophisticated and meticulous daily operations. Many systems conduct this step in enclosed buildings or vessels.
- A brief overview of four commonly used bioconversion technologies for food follows.

**Covered Forced Air.** Some relatively recent innovations have taken place in an attempt to lower the cost of bioconversion with food. These systems include engineered fabric buildings with aluminum frames, air control, and biofilters for receiving and feedstock preparation. The buildings typically range in size from 2,000 to 10,000 square feet.

Once feedstocks are prepared, the material is placed into outdoor windrows with a fabric membrane covers (for example, Gore or Ag-Bag) and aeration systems, or into roofed pole buildings with concrete bunkers, aeration systems, and organic covers (typically finished product). After approximately 30 days, the feedstock is cured in windrows or piles either outdoors or under a covered structure.

These systems have lower capital costs than other systems, but may require more knowledgeable, experienced operators to maintain final product quality and minimize nuisance odors.



Membrane covered system (Everett, WA.)



Bunker with Roof (Latah Co., ID.)

#### 4.5.7.3 Bays, Beds, and Tunnels

Bays, beds, and tunnel systems are normally constructed inside buildings, and are essentially a variant of a turned windrow system. The feedstock is placed either in a bay formed by two long parallel walls, or in a four-sided reactor bed. The walls of the bay or bed are generally about 6 feet high.

The material is turned down the length of the bay or bed by a machine that is suspended above or rides on rails along the top of the bay or bed. Turning aerates the material, and additional aeration may be provided by a forced air system in the floor of the bay or bed. The turning machine gradually moves the material down the length of the bay or bed, and is timed so that by the time the material reaches the end, the primary composting process is largely completed. The product is cured in turned windrows or aerated static piles. As with static piles, the mixture must be perfectly balanced when it is added, as there is no further opportunity for amendments to



Bed Composting System

be added. However, odors can be easily controlled, since bays and beds are usually constructed inside buildings. Bays and bed systems typically are more expensive than turned windrows and static piles, but less expensive than in-vessel systems.

#### 4.5.7.4 In-Vessel Systems

In-vessel systems offer the greatest degree of control over the composting environment. In-vessel systems also have the smallest land requirements, although they are the most expensive technology to design, construct and operate. An in-vessel system is defined as one in which the composting process is conducted inside some type of sealed container (the vessel) where the environment is highly controlled and access is restricted.



In-vessel system (Mariposa Co., CA.)

In-vessel systems can be either flow or batch reactors. Larger systems consist of permanent chambers installed within a building. Mechanisms are in place to load raw waste into and to remove compost from the chambers. At a minimum, the system includes monitoring systems for temperature and oxygen content and an aeration system. Smaller systems involve the use of portable containers. Modular vessels, which are similar in appearance to international shipping containers, are filled with raw organic waste, sealed, and attached to aeration manifolds and monitoring equipment. At the end of the primary composting process, the container is disconnected, emptied and the material is formed into turned windrows or static piles to complete the composting process (curing). The vessel is then available for the next batch of feedstock.

#### 4.5.7.5 Energy Recovery with Wet and Dry Anaerobic Digestion

Significant amounts of energy are contained in food and other organics currently sent to landfills. Recent increases in energy prices and concerns over global climate change have led to the development of anaerobic digestion systems for food and other organics. Anaerobic digestion is a proven technology that has been used in the wastewater field for years. The process converts food and other organics to biogas (that can be used to produce electricity or to power vehicles) and dewatered digestate that can be composted and sold for agricultural uses.

In a wet system, incoming materials are loaded into an enclosed building for tipping, pre-sorting, and a series of pre-processing activities to remove recyclable and non-recyclable inorganic elements from the material. Feedstocks are then fed into a hydropulper, which is designed to separate the remaining inorganics from the biodegradable elements and to convert the organics into an organic



Wet anaerobic system (Germany)

suspension. The biodegradable organic elements are pumped from the hydropulper to a grit removal system to further remove unwanted materials that may have passed through the hydropulper sieve. The grit-free suspension is then pumped to the anaerobic digester where the digestible material is converted into methane-rich biogas. Non-digestible material is segregated for final curing and stabilization into compost.

Dry systems allow solid materials to be mixed into the biomass, whereas traditional wet digesters make only minimal use of solids. In a dry system, up to 50 percent of the biomass can be solids such as green waste, wood chips, or papers. Biogas is then transformed in block-type thermal power stations into electrical energy and heat. Like the wet system, the digestate residual is cured in order to convert it into compost or other agricultural products.



Dry anaerobic system (Germany)

The dry systems have the advantage of being relatively cost-effective organics management solutions for relatively small waste streams (as small as approximately 6,000 tons per year). A key to the cost effectiveness of wet or dry systems is proximity to a power user, and/or relatively high prices paid for electricity generation or fuels. The relatively high cost of electricity in Hawai'i County provides an advantage for this technology locally compared to other areas of the country.

**Diversion Potential.** Using results from the County's 2008 waste composition study, and assuming capture rates of 50 percent for food, 50 percent for wet- and food-soiled paper, and 10 percent for wood, this program could result in additional diversion of 21,600 tons. Additional carbon may need to be obtained from green waste, wood chips, or other sources depending on the type of processing system selected.

**Estimated Cost.** The cost of processing food and other organics will vary depending on the type of technology, market conditions, contract terms, permitting requirements, power purchase agreements, and other factors. Estimated cost ranges for various processing technologies in Hawai'i County are presented in Exhibit 4-5. These costs were developed using information from the construction of actual facilities in the United States and Canada, which were adjusted based on estimated construction cost differentials for Hawai'i County.

EXHIBIT 4-5  
Estimated per-ton Cost<sup>a</sup> Range for Food and Other Organics Processing in  
Hawai'i County

Technology	Low	High
Covered Forced Air	\$70	\$80
Bays, Beds, Tunnels	\$80	\$90
In-Vessel	\$90	\$170
Wet and Dry Anaerobic Digester	\$90	\$170

<sup>a</sup>Includes amortized capital, operations, and maintenance less product sales. Costs adjusted from U.S. Mainland to Hawai'i County using estimated construction cost differentials for Hawai'i County.  
Source: CH2M HILL.

#### 4.5.8 Establish a County “Buy Recycled” Policy

This option, also discussed in the draft source reduction section, is important to promoting markets for recycled materials. The County could change its procurement practices to require the use of recycled glass, organics, and other materials to the extent practicable. This would help support the development of local markets for readily recyclable materials. The County should work with local businesses to identify materials that can be reused and recycled as part of County operations.

**Diversion Potential.** Difficult to quantify: this is a program that would support additional recycling.

**Estimated Cost.** The County may need to pay a higher price for some recycled products, and would need to devote staff resources to refining its procurement policies.

#### 4.5.9 Marketing Partnership with Other Hawai`i Counties

The County’s geographic isolation makes it expensive to ship recyclables to most existing markets. The County could team with the other Hawai`i counties and the State government to investigate joint marketing and market development opportunities. This could include improved pricing for backhauling containers to the mainland and overseas markets, funding pilot programs for new local end uses, or joint marketing of materials to improve market prices and/or lower transportation costs.

**Diversion Potential.** Difficult to quantify: this is an initiative that could result in long-term benefits.

**Estimated Cost.** The County would need to dedicate additional staff to develop and participate in potential studies or pilot programs.

#### 4.5.10 Establish Opportunity to Recycle Legislation

The County could consider developing new requirements for owners and managers of multi-family dwellings and multi-tenant commercial buildings that ensure that all tenants have reasonable access to recycling services and premises-based facilities comparable to single-family dwellings and small businesses. Any such requirements would be best implemented following consultation with the local building industry.

**Estimated cost:** There would be some cost associated with industry consultation and modifying building codes to support the new requirements. The cost of buildings affected by the legislation could increase somewhat, but after builders become familiar with the new requirements, impacts on construction project cost should be modest.

#### 4.5.11 Maintain Active State and Regional Profile on Zero Waste Public Policy

The County could work with State and Federal legislators and encourage other communities in the region to adopt similar Zero Waste goals and plans. This effort could include a coordinated effort with regional cooperation, to support state and national efforts to adopt:

- Extended producer responsibility
- Deposit programs

- Funding of Zero Waste initiatives through statewide or regional landfill surcharges and product charges
- Change school collection contracts to include recycling
- Full cost accounting for waste disposal
- Packaging levies (for example, on plastic bags)
- Minimum recycled content standards for additional products
- Design for the environment programs
- Green procurement and green building guidelines for the public sector
- National measuring, monitoring and reporting in achieving Zero Waste goals
- New mechanisms for financial assurance for post-closure liabilities for landfills.

Estimated cost: There would be little cost associated with this option beyond some staff time spent on Zero Waste advocacy, and modest expenses for supplies.

#### 4.5.12 Other Potential Recycling Opportunities

There are other initiatives that the County could adopt to support recycling, including:

- **Improve Recycling Opportunities in County Parks.** The County should consider developing a program for providing recycling opportunities in all County parks. This could mirror the two-bin system used at recycling and transfer stations by placing small mixed-material bins and glass-only bins adjacent to all garbage bins at each park. The effectiveness and cost of this program should be first tested with a pilot program.
- **Improve Recycling Opportunities on Downtown Streets.** The County Public Works Department collects trash in downtown areas of communities like Hilo and Kailua-Kona. A pilot program, similar to the one suggested above for County Parks could be implemented to test the effectiveness and cost of providing recycling opportunities at all trash collection locations.
- **Expand the Promotion of Event Recycling.** The County currently provides technical assistance to event coordinators looking to recycle at major events. This program could be expanded by developing a list of major recurring events, contacting event coordinators, and working with those coordinators to develop plans to improve recycling. The County should consider providing financial assistance for recycling bins and/or developing an ordinance that requires event recycling and possibly the use of compostable or reusable cutlery. The County could also consider requiring waste reduction and recycling plans for event and facility rental permits.
- **Establish a Recycle Art Campaign.** The County could establish a “Recycle Art” campaign, similar to the Art of Recycling School Competition, with the goal of coordinating the efforts of business and public offices and schools to organize and conduct recycle art contests at various venues once per quarter. Examples of places where recycle art could be displayed include bank lobbies, grocery stores, government offices, libraries, schools, airports and museums.
- **Expand Visitor Industry Recycling.** Hotels, resorts, and other businesses that service the Hawai‘i County visitor industry are major waste generators. The County could increase its efforts to work with this sector to improve recycling opportunities.

- **Explore Opportunities to Develop an Eco-Industrial Park.** Eco-industrial parks are clusters of complementary businesses that can make beneficial use of currently discarded materials and products produced by others. Candidates are organics, building deconstruction, salvage, reuse, and repair. Actions by the County could include passing favorable zoning ordinances and/or tax relief to spur on this type of activity.
- **Source Reduction Options that could Increase Recycling.** The source reduction section discussed a number of options that could also help increase recycling in addition to reducing waste. Four options discussed in Section 3.0, Source Reduction, are construction and demolition waste reduction plans, extended producer responsibility, establishing a pay-as-you-throw system, and establish a zero waste fund.

## 4.6 Recommendations

On the basis of the analysis presented above and discussions with stakeholders, this Plan recommends several types of actions to improve the County recycling program. The operating expenditures associated with the recommended actions would be funded by a PAYT program, property taxes, and tipping fees, and the capital expenditures would be financed by general obligation bonds.

The recommendations presented here include requiring waste collection firms to establish recycling programs as part of the licensing requirements, and establishing a marketing partnership with other Hawai'i counties. Those two recommendations are also discussed in further detail in Section 8.0, Collection and Transfer.

The recommendations are divided into two categories, those relating to recycling of non-organic materials (Recycling) and those relating to diversion of organics from landfills (Organics).

### Recycling

1. **Develop County policies or ordinances that mandate certain actions be taken to improve recycling rates.** In many communities nationwide, experience has shown that updated policies and ordinances are necessary to support new programs designed to treat discarded materials as resources and keep them out of landfills. After reviewing various options, the following are those that appear best suited to the specific conditions in Hawai'i County:
  - Establish a differential tip fee ordinance that would encourage landfill users to recycle targeted types of materials by charging higher fees if their loads contain these recyclable materials.
  - Establish an ordinance that mandates source separation and recycling and that requires all businesses and institutions to recycle selected types of materials.
  - Develop legislation requiring owners and managers of multi-family dwellings and multi-tenant commercial buildings to ensure that all tenants have reasonable access to recycling services and premises-based facilities comparable to single-family dwellings and small businesses.

- Change County procurement policies to require the use of recycled glass, organics, and other materials to the extent practicable.

**2. Work with County and State legislators and encourage other communities in the region to adopt Zero Waste goals and plans.** The geographic separation of the counties on the main Hawaiian Islands presents constraints and opportunities not faced by Mainland counties. With a very modest expense in resources, the County could explore potential benefits from increased collaboration with other counties and the State. Two recommendations for this Plan follow:

- Conduct research and coordinate with legislators and waste managers within Maui, Kauai, and Honolulu Counties, to evaluate the potential for combining efforts to develop a statewide zero waste strategy.
- Lobby the State to change school waste collection contracts for schools within the County to mandate that recycling services are included.

**3. Complete capital projects to facilitate implementation of expanded recycling programs.** A common theme expressed during discussions with SWAC and other stakeholders is that the County needs additional facilities to manage recyclables. Recommended added facilities to support new zero waste programs include the following:

- Expand recycling opportunities at recycling and transfer stations by modifying infrastructure to accommodate recycling processes.
- Improve signage at recycling and transfer stations to provide the public with comprehensive information about recycling opportunities and procedures.
- Enhance materials recovery capabilities in East Hawai`i by making improvements to the existing reload facility.
- Construct a new materials recovery (baling and storage) facility for West Hawai`i.

**4. Expand the opportunities for commercial recycling.** The results of the waste stream assessment conducted for this Plan update (Section 2) demonstrated clearly that commercial businesses and institutions currently dispose of large quantities of potentially-recyclable materials. After deliberation with SWAC and reviewing programs implemented by other jurisdictions, the following actions are recommended to increase commercial recycling:

- Allow small businesses (using trucks 1 ton or smaller, with a daily load limit) to use the recycling and transfer stations to recycle selected materials.
- Work with the HDOH Solid Waste Division to modify the operating permits of the recycling and transfer stations to accommodate expanded recycling services (currently in process).
- Hire one full-time staff member to serve as a commercial recycling specialist.
- Expand education and outreach programs for both large and small businesses to foster participation in commercial recycling programs.

**5. Expand opportunities to recycle in public areas and during public events.** Providing recycling bins in public places and at public events is a very visible way for the County to demonstrate its commitment to zero waste and to divert materials from landfills.

Recommended public area and event recycling programs follow:

- Install recycling bins in parks and other public areas.
- Conduct additional recycling events within the community each year.
- Implement and expand the Recycle Art campaign in public schools.

## Organics

Waste stream studies conducted previously and, as part of this project, have determined that organics comprise a relatively large fraction of the waste entering County landfills annually. Diversion of organics was identified as a priority by SWAC, and the following recommendations were developed:

**1. Promote both large- and small-scale private organics composting operations by:**

- Modifying zoning rules and County codes to relax restrictions on, and clarify operational requirements for composting on agricultural lands.

**2. Improve education and outreach programs that promote improved management of organics.** Composting has many benefits and is one area where education and outreach has been shown to be effective at reducing the amount of organics households and businesses send to landfills. After considering various options, the following education and outreach programs are recommended for implementation:

- Hire one full-time staff member to serve as the coordinator for the organics program.
- Expand and further develop a master composter program.
- Develop a training program and guidance materials for farmers.
- Implement a “stop wasting food” program with local food banks.
- Partner with other local groups to establish compost demonstration gardens at recycling and transfer stations or at other visible locations in the community.

**3. Initiate an on-site composting program for residents and businesses by distributing subsidized units to both residences and businesses.** Data from similar communities indicates that the lowest cost method of keeping organics out of landfills is to manage them on-site. This eliminates the need for costly collection or transfer of organics. This is particularly true for Hawai`i County with many homes in rural areas that cannot be served cost-effectively by collection truck routes. This program would fund subsidized bins for on-site composting of green waste and food waste.

**4. Conduct a study to evaluate the potential for implementation of a landfill ban on organics.**

**5. Implement added organics management facilities and equipment.** While on-site programs are beneficial, more centralized infrastructure is also needed to provide

opportunities for those residents and businesses that are not interested in managing organics on-site. After reviewing many options with SWAC and other stakeholders, the following programs are recommended for implementation:

- Add green waste dropoff locations at recycling and transfer stations where there is space to do so.
- Purchase or contract for a mobile tub grinder that would be used at recycling and transfer stations to grind green waste into mulch that could be distributed to residents. This is less expensive than hauling waste from individual stations to a central facility and will foster community ownership of the program.
- Develop an organics composting facility at the West Hawai`i Landfill.
- Investigate opportunities for pilot food waste demonstration projects with the potential for eventual expansion into full-scale food waste management programs.

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