Waste Management on the Big Island:

Mapping a vision for an economically and ecologically sustainable Hawai'i

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for the Kohala Center

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Executive Summary

With an estimated population of over 160,000 residents and another 15–17,000 persons present on the island at any given time,[1] Hawai'i County generates significant quantities of waste. Add to this the fact that the county's per capita generation rate is above the national average—over 9.4 pounds per day, compared to a US average estimated at 4.8[2] to 7.1 pounds per day.[3] The county's waste stream has also been growing far faster than the actual resident population—as much as 14.1 percent between Fiscal Year (FY) 03-04 and Fiscal Year 04-05, compared to an estimated two to three percent population growth. These factors have conspired to create a serious solid waste management problem for the county.

Exacerbating the concerns over system capacity created by ballooning generation rates, within the next two to four years the South Hilo Landfill, one of only two permitted disposal facilities on the island, will reach present capacity and be forced to close. This has left the county with the urgent need to update its solid waste management system and to look for innovative ways to reduce its waste stream, particularly the portion going to final disposal from the east side of the island. The county is currently in the process of considering several options for the management of waste in East Hawai'i, including procuring a mass burn incinerator for the purposes of waste volume reduction and energy generation. The request for proposals (RFP) process for acquiring this "waste reduction technology" is well underway—three companies were short-listed for submission of second-round proposals in early 2007 and have been engaged in discussions with the county as proposal development and final negotiations move forward.

The purpose of this report is to inform the current conversation on the best practices available to the county for reducing the amount of waste that goes to final disposal. It includes recommendations that the author believes would enhance the overall sustainability of the economic and ecological systems of the island. These recommendations are arrived at by exploring three primary questions:

1. What is the potential for East Hawai'i to reduce the amount of waste going to final disposal through reuse and recycling?

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[1] *County of Hawaii Data Book*, 2004, "Table 1.1-- Resident Population, State of Hawaii, by Counties: 1980, 1983 to 2005," and "De Facto Population, State of Hawaii, by Counties: 1970 and 1980 to 2004." Original source: U.S. Census Bureau. Available at http://www.hawaii-county.com/databook_current/dbooktoc.htm.

[2] U.S. EPA, 2003, "Municipal Solid Waste – Basic Facts," http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm.

[3] Phil Simmons et al., 2006. "The State of Garbage in America." *BioCycle Magazine*, April 2006, Vol. 27, No. 4, page 26.

2. What would the county need to do (and invest) in order to maximize its recycling rate(s)?
3. How do these recommendations compare to and integrate with the county's current plans for waste management?

Hawai'i County's recycling rate for the first half of Fiscal Year 2006 was 30 percent. Over the long term, other jurisdictions have shown that it is possible to divert over 50 percent of their waste stream through reuse and recycling efforts.[4] If Hawai'i County were to implement a comprehensive recycling program, including increased capture of traditional recyclables, reuse and recycling of construction waste, and composting of greenwaste and food waste it could feasibly divert as much as 55 percent of the current waste stream from final disposal. With efforts to shift the components of the waste stream to more recyclable materials, further increase capture rates of recyclable commodities, and establish other county policies aimed at waste reduction (such as manufacturer responsibility for packaging or end-of-life product disposal), this diversion rate could be pushed even higher.[5] Maximizing recycling rates has numerous benefits, including energy savings, reducing dependence on imported materials, reducing the need to extract/exploit natural resources, and the savings of taxpayer dollars (the price paid by the county to dispose of materials through recycling or composting is or could be significantly less per ton than for landfilling or incinerating).[6]

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[4] The City of San Francisco currently reports a 67-70 percent recycling rate, with a goal to reach 75 percent by 2010 (Macy, Jack, 2006, Recycling Coordinator, San Francisco Department of the Environment, personal communication 25 July 2006). Many towns in Massachusetts consistently report over 50 percent, and even over 60 percent recycling rates (Massachusetts Department of Environmental Protection, "Massachusetts Municipal Recycling Rates," Fiscal Years 1995-2001 and Calendar Years 2002-2004," see http://www.mass.gov/dep/recycle/reduce/munirate.pdf). Riverside, CA reached a rate of 57 percent in 2001 (California Integrated Waste Management Board, 2002, "City of Riverside: A Model for Local Government Recycling and Waste Reduction," at http://www.ciwmb.ca.gov/LGLibrary/Innovations/Riverside/). Los Angeles reported a 55 percent recycling rate for FY 2001 as a part of the 2004 New York City report "Processing and Marketing Recyclables in New York City: Rethinking Economic, Historical, and Comparative Assumptions" (see Appendix VI at http://home2.nyc.gov/html/dsny/downloads/pdf/guides/recycling/recyrpts/pmr/PMRinNYC11.app6.pdf). City of Thousand Oaks, CA reported a diversion rate of 66 percent in its 1999 Annual Report ("City of Thousand Oaks: A Model for Local Government Recycling and Waste Reduction," at http://www.ciwmb.ca.gov/LGLibrary/Innovations/ThousandOaks/). Chatham, NJ was recycling/composting 65 percent of their waste by the late 1990s (U.S. EPA, 1999, "Cutting the Waste Stream in Half: Community Record Setters Show How," researched and written for the U.S. EPA by the Institute for Local Self-Reliance).

[5] San Francisco, CA and Oakland, CA have both set a goal of 75 percent diversion from final disposal by 2010 (Gordon, Rachel, 2002, "S.F. seeks to recycle 75 percent of waste by 2010" *San Francisco Chronicle*, 1 October 2002), and Seattle has set a long-term goal of zero waste (Carlton Herrell, Debera, 2005, "'Zero waste" is Seattle's new garbage mantra," Seattle Post-Intelligencer, 18 July 2005).

[6] See Section II for more information on both the general and the locally specific benefits of recycling, as well as the relevant citations.

Successful municipal/county recycling programs tend to include a consistent set of components that can address all of the largest components of the waste stream, including not only the traditional recyclables (paper, metal, glass, plastic), but also biodegradable organics (including yard/green waste and increasingly some food wastes) and construction and demolition (C&D) wastes. In order to move quickly towards a 55 percent diversion rate Hawai'i County would need to invest in facilities for the collection of, and ideally the processing of, biodegradable organics and C&D wastes, as well as significantly increasing the diversion rates of the materials currently being recycled. To do this the County Council would first need to fully fund the proposed East Hawai'i Regional Sort Station, which would have the potential to significantly increase the capture rate of both traditional recyclables and C&D wastes. The county would also need to move forward with the construction of a composting facility (such as the one currently proposed for a site next to the existing Pu'uanahulu Landfill). The combined cost of both facilities has been estimated at $7.92 million.[7]

Hawai'i County is currently at a crossroads in the shaping of its waste management and recycling systems. There are limited funds available for the development of infrastructure to replace the system capacity currently provided by the South Hilo Landfill, and these limited funds may be directed at recycling, at other final disposal facilities (such as a mass burn incinerator or a new landfill), or at some appropriate combination of the two. Based on the research conducted for this report, recycling (including composting) is not a high priority for county waste management funding. The County Council has not funded any of the recycling components of the proposed East Hawai'i Regional Sort Station (only the tip floor and reloading area, used for movement of trash from one waste handling facility to another), and it has not come to an agreement on how to provide the needed infrastructure for consistent large-scale greenwaste composting. On the other hand, the county *is* in the process of procuring a $30–40 million dollar incineration facility to burn the waste currently being disposed of at the South Hilo Landfill.

There may be reason to be concerned that successful procurement of a small incinerator for East Hawai'i could jeopardize the expansion of recycling systems and divert waste away from the lowest-cost, most ecologically sustainable systems. Use of an incinerator will most likely require the county to commit to incinerating a fixed tonnage of waste. This type of "put-or-pay contract" will decrease the county's incentives to recycle or to reduce waste at its source, since minimum levels of disposal are prepaid through the

[7] Engineers at the Department of Environmental Management currently estimate the infrastructure costs for a composting facility at $1.5 million, and the lowest bid received by the county for construction of a full complement of recycling-related facilities to accompany the East Hawai'i Reload Facility currently under construction is approximately $6,420,000.

contract. Because the waste stream going to disposal in Hilo is very small compared to the levels of waste generally needed to make waste-to-energy (WTE) incineration plants economically viable, there may be a greater demand for the incineration of recyclable materials (such as plastics, wood and paper) than in other areas that have chosen incineration as a sustainable and affordable disposal option.

While waste incineration may be an appealing option due to the fact that it provides a seemingly simple solution to a complex problem, there are risks associated with relying on a single, capital-intensive and mechanically-complex facility for processing of the entire waste stream. This kind of centralization of the management system, especially given its high capital costs, provides little to no flexibility in the case of a waste stream that is changing in size or composition (like Hawai'i County's). As a long-lived facility it is also slow, and often unable, to respond to changes in available technology. In addition, due to poor economies of scale, costs for a small capacity facility are particularly high on a per ton basis, as well as a per capita served basis. This will leave little to no money in the solid waste management budget for expanding, improving, or even maintaining recycling and composting systems. Thus procurement of a small capacity incinerator for East Hawai'i risks locking up both the waste stream and the financial stream and may leave little or no room for creative and innovative diversion programs. Alternatives, such as a combination of aggressive recycling/reuse and composting and interim use of the island's existing landfill, may be a better fit for the island's unique needs given their flexibility, capital cost savings, and small business incubation potential. Further evaluation will be needed after the final incinerator proposals are submitted to determine whether constructing such a facility for the East Hawai'i waste stream at this time—prior to investing in maximizing recycling and waste reduction—would lead to the loss of valuable resources and unjustifiable expenditure of county funds.

I. Solid Waste Management in Hawai‘i County

System Administration

In Hawai‘i County solid waste collection and management, including recycling, is overseen by the Department of Environmental Management (DEM). The Department, along with it’s advisory body, the Environmental Management Commission, was established by the County Council in December of 2000 by amendment to the County Charter (Hawai‘i County Charter §6-5.1). Current DEM Director Barbara Bell, the Department’s first permanent Director, was hired in August of 2002.

The Department of Environmental Management consists of two divisions: Wastewater and Solid Waste. The Solid Waste Division is further divided into the “Operations Group,” responsible for solid waste collection and disposal facilities (including the county’s two landfills) and the “Special Programs Group,” responsible for management of programs relating to waste reduction and diversion (including all reuse and recycling programs). In recent years the Special Programs Group has administered about a dozen such programs, which involve roughly 70 contracts totaling over $6.7 million.[8] At the time of writing, the head of the Solid Waste Division is Chief Michael Dworsky, and the county is in the process of replacing the full-time Recycling Coordinator after the last person to hold the position, Eileen O’Hora-Weir, left in the spring of 2006. The DEM is overseen by the Mayor’s Office, while their budget is ultimately controlled by the County Council, giving both branches of county government considerable power over the department’s major actions.

Infrastructure and Disposal System

Due to historical, economic and demographic factors, Hawai‘i County still operates a largely rural waste management system. There is no public island-wide program for curb-side collection of residential trash or recyclables, which make up approximately 40 percent of the island’s waste stream. Instead an estimated 85 percent of residents haul their waste to one of 21 convenience centers (known on the island as “transfer stations”). At their most basic, these residential transfer stations consist of a large garbage chute leading down to a container/trailer. When the container fills, it is taken by county personnel to one of the island’s two landfills (generally the nearer of the two: South Hilo or Pu'uanahulu on the Kona side) and emptied. Most of the transfer stations now include separate drop-off areas for various recyclable commodities, but the recycling options differ widely from transfer station to transfer station (the most recent

[8] Schrandt, Colleen and Lane Shibata, 2006, “Audit of the County of Hawai‘i’s Recycling and Diversion Grants Program.” A report to the Finance Committee, County of Hawai‘i, conducted and submitted by the Legislative Auditor’s Office, County of Hawai‘i, June 2006.

list of which items can be recycled and where is included as Appendix A). Residents pay for disposal service through property taxes, but do not pay any per-unit or per-volume (pay-as-you-throw) charges, and thus have no economic incentive to minimize waste generation. It is illegal for commercial entities to use the transfer stations, but it is suspected by county officials that there is at least some abuse by small businesses and contractors. In Fiscal Year 2005 the residential waste collection system alone cost the county an estimated $6.5 million of taxpayer money.

The other 60 percent of waste generated on the island is considered "commercial waste," which is defined as any waste which is disposed of directly at one of the two landfills. This commercial waste generally consists of 1) business and industrial wastes, 2) rubbish from denser housing and condo-style developments that contract with private haulers for residential waste removal, and 3) a small number of bulky or special wastes that are dropped off by residents directly. The county charges a tipping fee (currently set at $65 and rising to $85 by 2008) for each ton of waste disposed of at the landfills. These tipping fees are an important source of revenue for the DEM and account for about 50 percent of the operating budget of the two landfills. The recent increase in tipping fees—from $35 in Fiscal Year 2003 to $85 in Fiscal Year 2008, rising at $10 per year increments—should provide an incentive for those generators who pay tipping fees to reduce their disposal rate. Unfortunately, the other consequences of these relatively high tipping fees[9] may include increased illegal dumping (exacerbated by ample space along empty rural roads and limited ability to enforce anti-dumping laws) and increased abuse of the taxpayer-funded transfer stations by small businesses.

The county hired its first official recycling coordinator in 2003, and has since increased its diversion rate from 12.7 percent to 25.8 percent (in Fiscal Year 2006). The County recycling program now includes recycling drop-off at 12 of the county's 21 "transfer stations." Diversion rate increases have been further bolstered by the 2002 passage of a state bottle bill. The bill requires that a five cent fee be assessed on beverages packaged in cans and certain bottles, which can then be returned to designated redemption centers for a refund of the fee. On the Island of Hawai'i there are now 10 such redemption centers being run at the transfer stations by the Association of Retarded Citizens (ARC of Hilo), as well as two private redemption centers. The Big Island currently has two major permitted recycling companies (Atlas Recycling and Business Services Hawai'i) that handle most of the traditional recycling. Of the items they accept, most are currently shipped off-island. A breakdown of estimated tonnages landfilled and recycled in Fiscal Years 2003–2004 and 2004–2005 is given in Appendix B,

[9] The U.S. national average for tipping fees was $33.70 per ton in 2002 (see Repa, Ed, "Tipping through Time," *Waste Age*, 1 Nov ember 2002, http://www.wasteage.com/mag/waste_tipping_time/index.html.)

and the commodities recycled and their primary end use markets are detailed in Appendix C. The county has set a goal of 50 percent diversion by 2008 and 80 percent by 2013.

All wastes that are not recycled/composted are sent to one of the island's two landfills for disposal (Appendix A also gives information in which transfer stations feed into which landfills. Appendix D shows transfer station locations). The South Hilo Landfill is the older of the two, in operation since the mid-1960s, and was grandfathered out of current Environmental Protection Agency permitting restrictions. Among other things this means that it is allowed to remain unlined, as long as the county does not expand its existing footprint (although the landfill *is* carefully monitored to ensure that no leachate contaminates groundwater supplies). South Hilo Landfill was originally projected to close in 1995, but numerous extensions have allowed the county to prolong its lifespan.[10] The latest of these extensions involves increasing the grade of the slopes on the sides of the landfill (this procedure is called a "sliver fill"). The funds needed for the sliver fill were approved by the County Council on April 5th, 2006, and the Department of Environmental Management is now moving forward with these plans, while still working with the state Department of Health to secure the necessary permits. Even with this new expansion, the South Hilo Landfill is likely to need to be closed in another two to four years. The second disposal facility, Pu'uanahulu Landfill, has only been in operation since 1992. It was projected in the county's 2002 Updated Integrated Solid Waste Management Plan to have sufficient capacity for approximately another 40 years.[11]

The problem of rapidly dwindling landfill space on the east side of the island has spurred the urgent need for the development of alternative plans or facilities to deal with the portion of the waste stream currently being disposed of at the South Hilo Landfill. A number of options were initially considered, including 1) transportation of all non-recycled wastes to Pu'uanahulu Landfill, 2) the construction of a new landfill (either adjacent to the current landfill in Hilo or south and west of Hilo, on the dry side of the island), 3) aerobic mixed waste composting, 4) anaerobic digestion, 5) "bio-

[10] Harding ESE, 2002, "Update to the Integrated Solid Waste Management Plan for the County of Hawai'i" and the County of Hawai'i Department of Environmental Management, 2004, "Final Environmental Impact Statement for the Construction and Operation of the East Hawai'i Regional Sort Station."

[11] This estimate assumes a population increase of 2.04 percent per year, a constant per capita rate of disposal, and a constant diversion rate of 13 percent. These assumptions may make it an unrealistically large estimate for remaining facility lifespan. While increased diversion would increase facility life, this is more than offset by the fact that per capita disposal rates are not constant, but have instead been rapidly increasing over the past several years. The county's legislative audit of the diversion grants program (cited above) cited a 13.7 percent increase in per capita generation between Fiscal Year 2003-2004 and Fiscal Year 2004-2005. This fact highlights the need to institute waste *prevention* programs, in addition to more aggressive waste *diversion* programs.

refining" of certain wastes into liquid fuels, 6) traditional "mass burn" incineration, and 7) newer incineration technologies such as gasification and "plasma arc." The option of building a new landfill was eliminated due to the expense of construction and maintenance (especially on the wet side of the island around Hilo), along with the undesirability of landfilling as a waste management option (see Section II for more on the reasons to use landfilling only as an option of last resort). The option of transporting all wastes to the west side of the island was also dismissed, under the argument that it is both unfair and undesirable to have additional garbage trucks and associated vehicles (estimated at 10-12 trucks per day) traveling from the east side of the island to the west. The remaining options would involve the construction of a facility employing some kind of "waste reduction technology" that would reduce the solid volume of the current East Hawai'i waste stream, minimizing—but not eliminating—the need to transport residual waste from a transfer point in Hilo to the Pu'uanahulu Landfill.

After three failed attempts to procure a waste reduction facility using RFPs drafted by county officials, it was eventually decided that the job of preparing the needed documents and soliciting proposals would be best accomplished by an experienced consulting firm. In 2005 the county hired consultants Hawkins Delafield and Wood LLP to prepare a two stage RFP. They simultaneously contracted with R. W. Beck, Inc. to prepare a technical assessment of the waste reduction technologies available, their likely ability to effectively and efficiently treat the waste stream now going to the South Hilo Landfill, and their current level of economic viability. The options considered include: mass burn incineration, incineration using refuse derived fuel (RDF), thermal gasification, anaerobic digestion, aerobic mixed waste composting, and bio-refining (a process that converts organic wastes into liquid fuel). Several of these options were eliminated through the technical assessment process. These included bio-refining (still in its infancy as a technology used to process mixed wastes), aerobic mixed waste composting (due to high costs, lower diversion potential, and a high risk of a contaminated final product), and anaerobic digestion (also due to the fact that it is only able to process a limited portion of the waste stream and lacks a "sufficiently commercial track record dealing with a municipal solid waste stream like that of Hawai'i"). The RFP released in 2005 therefore requested proposals for the development of facilities utilizing one of only two remaining technologies, mass burn incineration (also known as waste-to-energy or WTE) or thermal gasification.

In addition to the attempt to initiate the development of a facility employing some kind of waste reduction technology, some County Council members have demonstrated interest in having the waste bailed in plastic film and shipped to a landfill on the US mainland—either as an interim solution between the time that the landfill closes and a new facility can be built or even as a long-term substitute for the development of new

facilities. The county has already received multiple offers from companies willing to "bail and ship" to landfills in Washington or Idaho for as little as $86 to $95 per ton,[12] and given the lack of political consequences associated with shipping waste off-island this price is low enough to make it an attractive offer. As a point of comparison, trucking the waste from the east side to the west, where the landfill meets current standards and is expected to last another 40 to 45 years, would cost an estimated $65 to $70 per ton.[13]

Regulations and Planning Documents

In 1991 the state of Hawai'i enacted the "Hawai'i Integrated Solid Waste Management Act," (HRS §342G) which created the Office of Solid Waste Management within the state Department of Health (DOH). The Act also set forth goals for reducing the solid waste stream prior to disposal—25 percent by January 1, 1995 and 50 percent by January 1, 2000. In order to meet these goals the Act directed counties to develop and adopt integrated solid waste management plans and submit them to the DOH by January 1, 1993. These plans were supposed to set out a roadmap for how each county intended to reach the state's waste reduction/diversion goals through (in explicit order of priority): source reduction, recycling and bioconversion, including composting, and landfilling and incineration (with the "respective roles of landfilling and incineration…left to each county's discretion"). The state's waste reduction goals, along with several other goals and mandates set forth in the Act, are yet to be met.

The County of Hawai'i compiled its first integrated solid waste management plan in 1993 and officially adopted it in October 1994. As required by state law, the plan was then amended in December 2002. The Update to the Integrated Solid Waste Management Plan of the County of Hawai'i (UISWMP) primarily focused on "the establishment of a solid waste management system in East Hawai'i to replace South Hilo Landfill." It included a 2001 waste composition study specifically for the waste stream entering the South Hilo Landfill, [14] as well as projected costs, impacts, and volume reduction potential of various alternative scenarios, ranging from transporting all of East Hawai'i's waste to Pu'uanahulu landfill, to intensive recycling prior to transportation to Pu'uanahulu, to incineration or other technologies used for waste volume reduction. The UISWMP iterated the results of an extensive evaluation process

[12] Bell, Barbara, 2006, Director, Hawai'i County Department of Environmental Management, personal communication, 15 November 2006.

[13] ibid.

[14] Cascadia Consulting Group, 2001, "Waste Composition Study, South Hilo Landfill, County of Hawai'i," Appendix C of "Update to the Integrated Solid Waste Management Plan for the County of Hawai'i," http://www.hawaii-county.com/env_mng/iswmp_final/appendixc.pdf

undertaken by an appointed Solid Waste Advisory Committee (SWAC). The SWAC's decisions made regarding the replacement of the South Hilo Landfill were:

- Construct no new landfill in East Hawai'i;
- Emphasize the recovery of recyclable materials at the planned East Hawai'i sort station, possibly by incorporating features of a material recovery facility (MRF);
- Procure a waste reduction facility for the East Hawai'i waste stream using either waste-to-energy, thermal gasification, or anaerobic digestion technology; and
- Establish a county recycling program with a long list of elements that has the potential to increase the waste diversion significantly.

II. Patterns in Waste Generation

Historic Generation Rates

When attempting to analyze Hawai'i's waste stream and management system, one of the first things to stand out is the island's exceptionally high per capita generation rates. In Fiscal Year 2004–2005 Hawai'i County's per capita waste generation was 9.5 pounds per day, compared to a national average listed by the EPA as only 4.5 pounds per day.[15] Various theories exist as to the reason for this substantial gap, but most agree that it is related to both the island's high level of tourism and its general reliance on imported goods, both of which tend to result in the consumption and disposal of large amounts of packaging waste. It may also be related to the significant level of development taking place, particularly on the west side of the island. It is likely that there are also other factors at play, since State of Hawai'i generation rates appear to be closer to the national average than Hawai'i County rates,[16] despite other islands in the state sharing some of the same demographics related to tourism, economy, and development. In 2001 Cascadia Consulting Group conducted a waste composition study of the South Hilo Landfill, which showed that Hawai'i County's waste stream is high in biodegradable organic matter, metals, and construction wastes compared to U.S. averages.[17] Regardless of the reasons for the gap between Hawai'i County and national waste generation rates, the county's high generation rate is certainly exacerbating an already difficult disposal problem in a place where land and property values are so high.

While it is always difficult (and sometimes misleading) to compare waste generation in one place to that in another, another way to analyze the impacts of a waste system is to examine trends in waste generation over time. Looking at Hawai'i County, even more alarming than the overall high waste generation rate is the way that this rate has changed over recent years. Between Fiscal Years 2002 and 2005—just three years—overall waste generation on the island increased over 30 percent (compared to only a 4 percent growth nationwide during approximately the same time period).[18] Growth in generation from FY 2003 to FY 2004 alone was over 15 percent.[19] Since projected growth

[15] U.S. Environmental Protection Agency, 2005, "Basic Facts: Municipal Solid Waste" http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm. An annual report on waste generation, disposal and recycling published by BioCycle Magazine suggests that the national generation rate is more like 7.1 pounds per day, which is still substantially less than that of Hawai'i County (Phil Simmons et al., 2006. "The State of Garbage in America." *BioCycle Magazine*, April 2006, Vol. 27, No. 4, page 26.

[16] Ibid.

[17] Cascadia Consulting Group, 2001, "Waste Composition Study, South Hilo Landfill, County of Hawai'i," Appendix C of "Update to the Integrated Solid Waste Management Plan for the County of Hawai'i," http://www.hawaii-county.com/env_mng/iswmp_final/appendixc.pdf

[18] U.S. Environmental Protection Agency, 2006, "Municipal Solid Waste in the United States: 2005 Facts and Figures" http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm

[19] Based on data collected at the County's two landfills by Solid Waste Division officials.

in population was only about two percent during that same period, this means that growth in waste generation has been significantly outpacing the growth in actual population, leading to a substantial jump in *per capita* waste generation—each person on the island is actually (statistically) generating more waste, whether MSW or commercial/construction waste. One good way to get at the answer as to why per capita generation rates are so much higher than national averages is to ask what is it about the waste stream that is changing and growing in a way that so outpaces other areas. Unfortunately, it is very difficult to get a detailed understanding of where the growth in the waste stream is really coming from given the current tracking systems used on the island.[20] What we *can* gather is this:

- The growth is somewhat faster in what is defined as the "commercial sector," which in this case includes both businesses (large and most small) and some more densely populated and wealthier residential developments that have contracted with private waste haulers to have their trash removed curbside/locally.
- The growth is faster in areas where the trash is sent to Pu'uanahulu Landfill on the west side than in areas where it is sent to the South Hilo Landfill.

Figures 1 and 2 below show a comparison of commercial and residential growth rates and South Hilo and Pu'uanahulu growth rates respectively, over the three year period mentioned above (the time period for which the most accurate data is available). While more information would be necessary to determine the exact reasons for the astonishing rate of growth in waste generation, the information that we do have allows us to speculate that it is related to some combination of several things. First, it is possible that some amount of the apparent growth is related to changes in record-keeping procedures. Second, genuine growth may be caused by an increasing overall affluence of the resident and/or visitor population, which could result in increased consumption of imported commodities (and associated packaging wastes).[21] Third, growth in waste

[20] While some information is available about disposal of specific commodities, it was not deemed sufficiently reliable to include in this analysis by the author. First, this is because different parts of the waste stream have historically been tracked differently at each of the two landfills (for instance, greenwaste tonnages were often not being recorded during the time period in question at Pu'uanahulu, most recycled commodities are either recorded as part of the Hilo waste stream only or they are absent from the tonnage records entirely, etc.). Second, many loads come into the landfills as a mixture of commodities, in which case they are simply recorded as "commercial waste" (much of the island's greenwaste is suspected of being incorporated into "mixed loads" and thus unaccounted for in current recordkeeping). Third, little to nothing has been done to verify records that are kept, and thus there is little reason to trust the accuracy of the commodity-specific waste stream tracking that *is* done (for example, staff at both landfills include "construction debris" as a commodity line item, but list a tonnage that simple logic will tell you is wildly understated, presumably due to inclusion of the vast majority of construction waste as "commercial waste").

[21] Per capita income in Hawai'i County rose about 36 percent between 1993 and 2003 (*County of Hawaii Data Book*, 2004, "Table 12.1—Personal Income, total and per capita, by counties: 1990 to 2003." Original source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, Bureau of Economic Analysis, Table CA1-3, April 2005), available at http://www.hawaii-county.com/databook_current/dbooktoc.htm.

production may be a product of ever-increasing development on the west side of the island, which could result in large amounts of construction-related waste that would generally be classified as "commercial" waste coming into Pu'uanahulu landfill. Without historical data, even an informal study of the current waste stream would yield little information about what the *growth* in generation should be attributed to. Thus any reliable assertions about growing portions of the waste stream in immediate need of targeted waste reduction strategies will require more detailed and accurate data on the specific commodities being disposed of over time.

Figure 1: Growth in "Commercial" vs. "Residential" Waste Streams

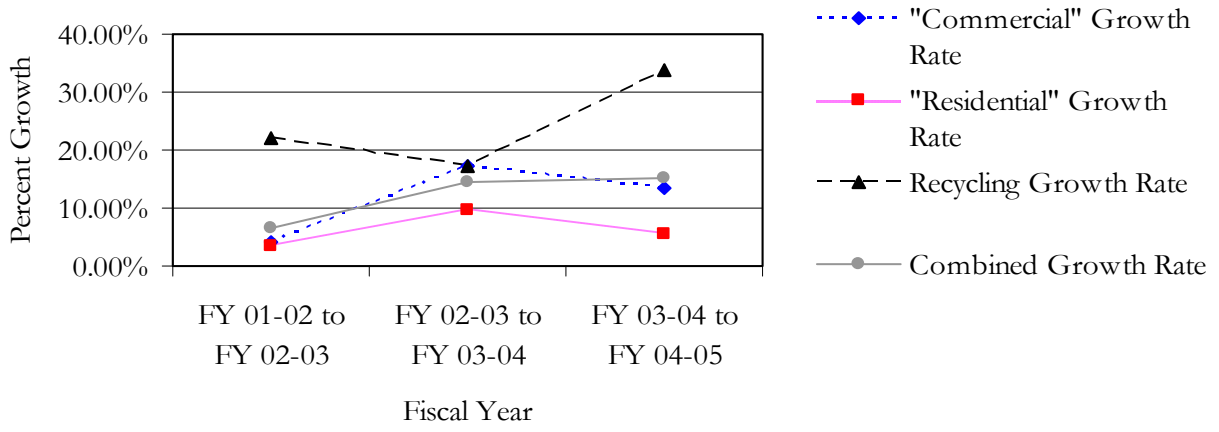
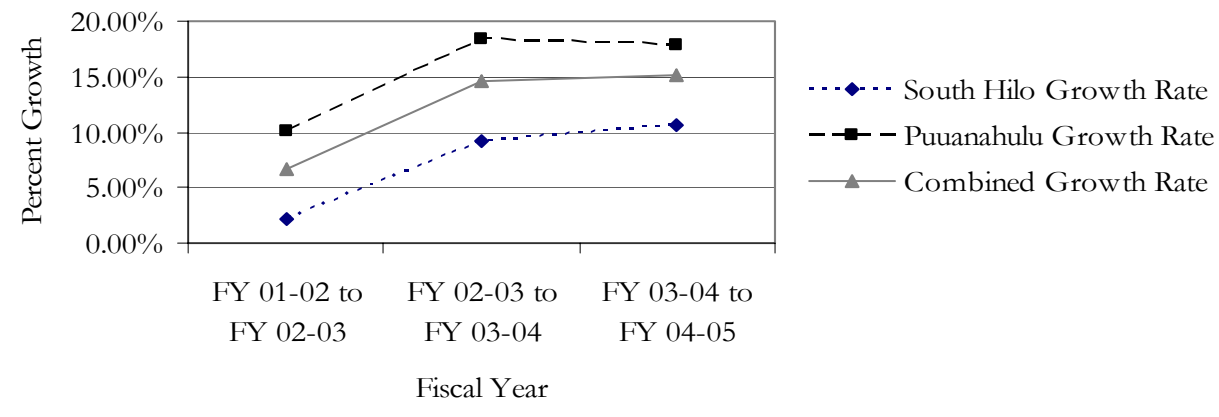


Figure 2: "South Hilo" vs. "Puuanahulu" Waste Streams



Projecting Future Generation

In addition to understanding the patterns of past growth in waste generation rates, it is important to be able to use this information to more accurately project future generation rates. These projections, and their relative accuracy, are essential to planning future

infrastructure upgrades and changes to the waste management system, as sound decisions in this area will have to be grounded in expected system capacity needs. In the Environmental Impact Statement prepared for the DEM on the East Hawai'i Regional Sort Station (EHRSS EIS), waste generation rates are based on per capita generation in 2003 (6.2 pounds per capita) increased by 1.6 percent per year—the population growth rate projected by the state Department of Business, Economic Development and Tourism. The generation rates used also assume a diversion rate that gradually increases to 45 percent by 2014. These assumptions result in an average of 182 tons per day (tpd) requiring disposal (after diversion) over a 30 year period in whatever facility is chosen as a replacement for the South Hilo Landfill.

While these assumptions seem reasonable, the dramatic increases in waste generation on the island over the past several years would suggest that they may be highly inaccurate. According to the EHRSS EIS, in 2005 the amount of waste actually buried at South Hilo Landfill should have been 74,382 tons. It was, in fact, 83,354 tons, despite a *higher* than projected recycling rate. If new generation projections are calculated, recognizing not only the growth in population, but also the growth in *per capita* generation that is actually observed, you end up with an average of 350 tpd post-diversion if you assume a 45 percent diversion rate attained by 2009 and a growth rate in generation of six percent per year until 2010, four percent until 2020, three percent until 2030, and then finally dropping off to two percent per year (the actual population growth rate). This is still a reasonably conservative estimate, given the fact that waste generation has *actually* risen at a rate closer to ten percent per annum in recent years. In fact, even a disposal need estimate of 350 tpd is likely to be overly ambitious if recycling/diversion infrastructure is not prioritized, as a diversion rate of 45 percent will be nearly impossible to achieve without additional resources being devoted to facilities and programs. The tremendous uncertainty associated with these differing waste generation scenarios will have an important impact on the recommendations found later in this report.

County Response and Planning

In the midst of this developing waste management crisis, created by escalating generation rates and the imminent loss of almost 50 percent of the island's disposal capacity, the county has remained divided on perceived causes and solutions to the problem. This lack of consensus over the best solution to the island's waste management needs has led to a decision-making paralysis as to how to proceed. While the county has been aware of the impending closure of the South Hilo Landfill for many years, those in power have continually failed to ensure that it can be safely replaced with alternative facilities and/or management plans by the time of its closure. This has led to a last-minute scramble to develop such facilities/plans and a perceived lack of

adequate time to consider an array of disposal and recycling options. The county's current rush to develop a facility employing "waste reduction technology" is an example of the situation that has resulted from the inability of previous county decision-makers to reach a cohesive vision for the future direction of waste management on the island.

One manifestation of this disagreement over best practices in island waste management is the fact that the county has not comprehensively followed the vision for waste management mapped out in the 2002 Updated Integrated Solid Waste Management Plan. The plan called for an emphasis on "the recovery of recyclable materials at the planned East Hawai'i sort station, possibly by incorporating features of a material recovery facility (MRF)" and establishing a recycling program "with a long list of elements that has the potential to increase the waste diversion significantly."[22] Again note that, as of yet, the council has not approved funding for the recycling components of the proposed sort station or taken substantive action towards any of the following elements laid out in the UISWMP:

- Banning disposal of yard trimmings at transfer stations and landfills
- Establishment of county policy(s) to restrain disposal of recyclable materials
- Phasing in of landfill bans on recyclable C&D wastes
- Instituting a new fee system for waste management.

The county also appears to be behind the agreed upon schedule for procurement of a waste reduction facility. This lack of implementation of the UISWMP indicates a general lack of consensus on the part of decision makers, which continues to impede the overall process of creating an economically and ecologically sustainable waste management system.

Instead of consensus we see various entities within the decision-making structure (the DEM, members of the County Council, county contractors, etc.) continuing to struggle to find common ground on waste management issues, and at times even battling at cross purposes. To move forward it would be advisable for the relevant decision makers to truly agree to a shared vision for the island's waste management system, even if this means drafting a new Integrated Solid Waste Management Plan. Regardless, any analysis of the island's waste management system must be understood within the context of continued disagreement among current decision makers and a lack of genuine forward movement towards a modern comprehensive waste reduction and diversion program.

[22] Harding ESE, 2002, "Update to the Integrated Solid Waste Management Plan for the County of Hawai'i," page six.

III. Developing a Vision for Sustainable Waste Management

Benefits of Waste Reduction, Reuse, and Recycling

The writers of the Hawai'i Integrated Solid Waste Management Act certainly did not invent the idea of a hierarchy of waste management priorities. The United States Environmental Protection Agency's "Municipal Solid Waste: Basic Facts" web page[23] refers to this as the "solid waste hierarchy": "EPA has ranked the most environmentally sound strategies for MSW. Source reduction (including reuse) is the most preferred method, followed by recycling and composting, and, lastly, disposal in combustion facilities and landfills."

- "Source reduction has many environmental benefits. It prevents emissions of many greenhouse gases, reduces pollutants, saves energy, conserves resources, and reduces the need for new landfills and combustors."
- "Recycling prevents the emission of many greenhouse gases and water pollutants, saves energy, supplies valuable raw materials to industry, creates jobs, stimulates the development of greener technologies, conserves resources for our children's future, and reduces the need for new landfills and combustors. In 1996, recycling of solid waste in the United States prevented the release of 33 million tons of carbon into the air—roughly the amount emitted annually by 25 million cars."

The EPA bases these claims of environmental and social benefits of recycling on extensive research conducted over the past several decades.[24] Because so many of the benefits of recycling are related to energy savings, in addition to environmental benefits recycling also offers greater financial and energy security benefits in times of high oil prices and a volatile import situation.

Discarded materials are valuable commodities.

The most obvious reason to invest in reuse and recycling is that most discarded items are still made up of valuable materials. A few of these discarded items and their associated material components include:

- yard trimmings and food discards, which as biodegradable organics can be returned to the nutrient cycle as soil and fertilizers
- used packaging such as paper wrapping/boxes, plastic containers, and glass bottles, which can be pulped/melted/crushed and used to make new packing or other useful commodities

[23] U.S. EPA, 2003, "Municipal Solid Waste – Basic Facts," http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm

[24] Two of the many examples include U.S. EPA, 2002, "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks," 2nd Edition, Publication EPA530-R-02-006 and Denison, Richard A., 1996, "Environmental Life-Cycle Comparisons of Recycling, Landfilling, and Incineration: A Review of Recent Studies," *Annual Review of Energy and the Environment*, 1996, Vol. 21, p. 191–237. Also see note 25 below.

- "outdated" and "dead" electronics, which contain specialized parts and precious metals that retain much of their value even when the product that they are built into has reached the end of its useful life.

While discarded items may appear valueless, they often embody more value than we realize. For example, take a cheap plastic bottle. Plastics are made from petroleum products. This petroleum must be extracted from the earth, using polluting and occupationally hazardous equipment, transported, often across the globe, and processed in a multitude of ways. Each of these actions entails a price, both environmentally and financially. Each plastic bottle embodies a portion of these costs, and thus some value if recycling it can avoid some of these costs. Similarly, virgin paper products embody the costs of timber extraction (including not only the labor, land, and equipment costs of logging, but also the ecological costs of habitat loss, lost ecosystem services, water pollution, etc.), transportation, pulp processing, bleaching/dying, etc. When discarded items are landfilled it is literally throwing away potential inputs to agricultural or industrial processes. In turn the value of the extraction, labor, and processing embodied in the item is lost forever. Incineration captures (some of) the *energy* embodied in a product, but can not capture the added value associated with other aspects of producing that product, while recycling often can.

Recycling saves energy over production using virgin materials.

When extraction and initial processing of materials can be eliminated from the materials use cycle it saves energy. The energy savings entailed in the use of recycled (rather than virgin) materials varies enormously, but ranges from 40 percent savings for paper and glass recycling to as high as 96 percent for aluminum recycling.[25] Even "downcycling"—the recycling of a high grade material into a material of lesser quality[26]—and the use of materials in products/processes very different form their original form (such as the use of crushed discarded glass as a base for road construction) can save energy if it eliminates the need for extraction, transportation and processing of virgin materials. This energy savings can in turn result in cost savings for material consumers, as well as helping the users of these materials to meet pollution reduction goals associated with energy consumption. It is important to note here that recycling has been shown to result in a greater energy savings than can be recovered from the combustion of the same materials.[27]

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[25] U.S. Department of Energy, Energy Information Administration, Energy Kid's Page, "Recycling Paper and Glass" and "Recycling Metals," http://www.eia.doe.gov/kids/energyfacts/saving/index.html.

[26] McDonough, William and Michael Braungart, 1998, "The NEXT Industrial Revolution," *The Atlantic Monthly*, October 1998, Vol. 282, No. 4.

[27] Morris, Jeffrey, 2005, "Comparative LCAs for Curbside Recycling Versus Either Landfilling or Incineration with Energy Recovery," *International Journal of Life Cycle Assessment*, July 2005, Vol. 10, No. 4, p. 273-84. Moberg, Å., Finnveden G., Johansson J. and Lind P., 2000, "Environmental Impacts of Landfilling of Solid Waste Compared to

Recycling creates jobs.

Recycling offers a high level economic development opportunities compared to other waste management options. This is first because, compared to landfilling or incineration, recycling tends to be a labor-intensive process, rather than a capital-intensive process—on a per tonne basis, sorting and processing recyclables can create as many as 11 jobs for every one job created by the operation of a landfill or incinerator.[28] In addition, recycling makes materials available as inexpensive feedstock for new and often innovative local industries. For example, recycled plastic lumber can be produced in relatively small-scale facilities from discarded plastic already on the island. The high level of rainfall on the Hilo side of the island creates a natural market for recycled plastic lumber because it does not rot and thus has a significantly longer lifespan than wood lumber for the applications where substitution is feasible. Another example of profitable use of discarded materials that are currently available is the use of food and yard waste in compost production. Compost is a valuable soil amendment and has a strong market on an island that is, on the dry side at least, poor in soil resources and yet contains many tourist attractions (such as golf courses and resort lawns) that require nutrient-rich soils. The Big Island currently lacks both recycled lumber and composting companies, but the presence of cheap materials would make the island a profitable place to locate such businesses *if those materials were being effectively captured through a comprehensive recycling system*. These are only two examples of ways in which recycling of materials can act as a seed for local economic development and the creation of diverse, high-skill job opportunities.

Recycling materials can contribute to the self-sufficiency of island communities.

One of the most prominent aspects of Hawai'i County's material flow profile (a snapshot of all of the materials entering, being used on, being disposed of on, and exiting the island) is the fact that it is so heavily dominated by imported goods. Roughly 76 percent of the materials used on the island in a given year are imported.[29] Very little extraction and manufacturing take place on the island, and the small amount of resources that are extracted—generally timber and agricultural products—are mostly shipped off-island to foreign markets.[30] This means several things for the island's economy and security:

Other Options," Stockholm University, Department of Systems Ecology and FOA, Swedish Defense Research Establishment, Environmental Division. Also see note 23 above.

[28] Platt, Brenda and Neil Seldman, 2000, "Wasting and Recycling in the United States," a report written for GrassRoots Recycling Network, p. 27.

[29] Houseknecht, Meleah, Choony Kim and Austin Whitman, 2006, "Material Flows on the Big Island of Hawai'i," a paper completed as coursework for the Yale School of Forestry & Environmental Studies Industrial Ecology class.

[30] The major exception to this statement is the rock and sand extracted for construction, which makes up about 60 percent of all annual extraction.

1. Island residents and businesses are at the mercy not only of the costs of consumer goods but also the cost of transportation (including fuel costs). Because almost none of the goods consumed on the island are produced on the island there is no local competition to imported goods, and ever-increasing transportation costs are continually paid by island consumers.
2. If the daily shipment of goods to the island were interrupted for any reason most goods, even essential goods, would become unavailable given the lack of local manufacturers.
3. Most money spent on commodities leaves the island and goes to foreign/off-island companies. In other words, money spent in the community rarely stays in the community in the form of local profit.

When these considerations are lined up next to the fact that thousands of tons of materials that have already been brought onto the island are landfilled in Hawai'i each year, you can see how recycling of materials, once they have already been imported as commodities, is related to overall island resource security. Every ton of materials recycled represent materials that do not need to be imported, saving money and energy, and returning dollars spent *in* the community *to* the community. Another way of looking at this is to say that materials, once imported, become local resources that can then be used in the island economy to offset the need to consume additional imported resources or wasted through landfilling or incineration.

Recycling and composting rates continue to rise nationally and internationally.
If one needs proof of the fact that recycling ultimately benefits communities through economic development, long-term cost savings, and protection of ecological resources one needs only to look at trends in solid waste management over the past two decades. Recycling rates (including composting) continue to rise throughout the United States and the rest of the developed world, while landfilling is generally declining. Even incineration, or at least mass burn incineration, has tended to stagnate in its use within the U.S.[31]

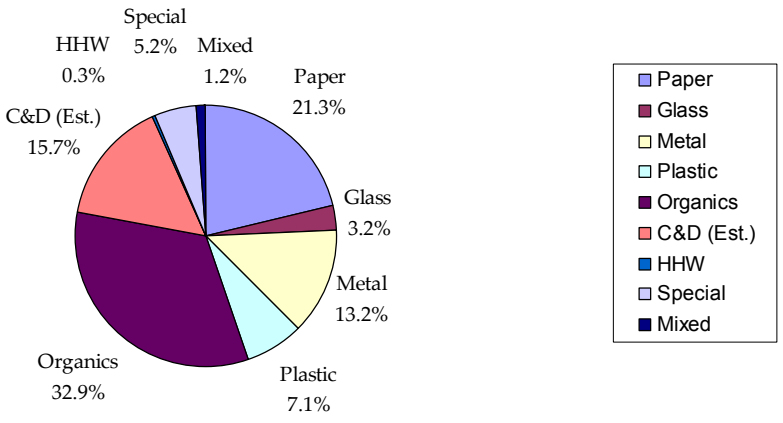
Building a Framework for Sustainable Waste Management: Waste Categories
In order to begin creating a roadmap for how to change over from a system based on waste disposal to one focused on the continuous cycling of materials through the island (and in some cases still the global) economy, we must first break the system down into manageable parts. The easiest way to do this is to think about the kinds of materials currently flowing through the waste management system, what potential there is for

[31] Since a peak in 1991, the number of Waste-to Energy plants in the US (incinerators that produce electricity through the incineration of waste) has actually declined significantly from almost 200 to a little over 100 (Phil Simmons et al., 2006. "The State of Garbage in America." *BioCycle Magazine*, April 2006, Vol. 27, No. 4, page 27).

recovery and use of those materials, and whether there is a viable local (or off-island) market for the products that can be produced from those materials. This framework rightly treats the discard stream as a complex set of elements, just as the commodity stream that ultimately becomes the discard stream is made up of a complex set of items that originate in many different places. It avoids the ultimately unsustainable and self-destructive temptation to look for a simplistic silver bullet approach to waste management; an approach which would entail lumping these complex groupings of materials into a single assemblage and disposing of them through a single system or technology.

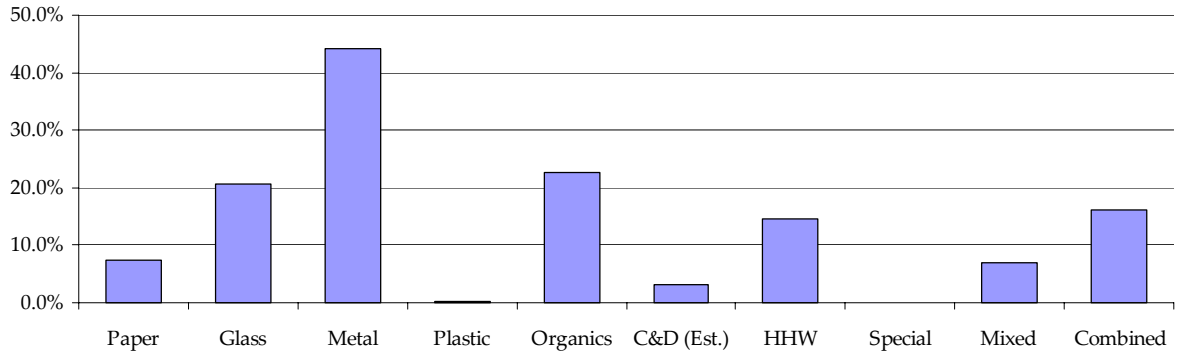
What is currently known about the composition of the waste stream?
According to calculations based on a waste composition study conducted by Cascadia Consulting Group in 2001, the materials discarded in the county that are already recyclable make up 44.8 percent of the waste stream (including all paper, glass, metal, and plastic—the true figure would be slightly less if you account for some types of paper and plastic that are not actually recyclable). Figure 3 shows the estimated relative composition of the total discard stream, based on the waste composition study (and incorporating the materials that were already being diverted for recycling).[32] At that time (2001) recycling rates for the county were still below 13 percent. Recycling rates for the Fiscal Year ending in 2005 were up to 20 percent and continued to rise into the following year. Figure 4 shows the recycling rates by commodity for 2004, the most recent year for which information considered reliable was available.

Figure 3: South Hilo Waste Stream Compositon Estimates (2001)



[32] The waste composition study can be found in Appendix C of the 2003 Updated Integrated Solid Waste Management Plan. It should be noted that this study was performed at the South Hilo Landfill Only, and thus is likely not to accurately reflect the compositional breakdown of wastes delivered to Pu'uanahulu Landfill.

Figure 4: Percentage of Discards Recycled (2004)



Packaging wastes

Packaging, including food packaging (such as plastic, glass, and metal containers and readily disposable wrappings), shipping packaging (such as wooden pallets, plastic film, cardboard, etc.), and other product packaging, can make up a significant portion of the waste stream.[33] This is particularly true when you remove the approximately 58 percent of the waste stream that is biodegradable.[34] Packaging wastes were some of the first to have been tackled by municipal recycling programs, since many of them tend to be made up of (relatively) uniform materials that can be reprocessed back into similar (if often lower quality) materials. Packaging wastes are generally composed of one of several plastics, metal (usually aluminum or steel), glass, polystyrene, or paper products (including mixed paper, paperboard, and cardboard). Processes have been established to recycle most of these materials into new products of varying qualities, although more complex packaging that mixes these components into a single piece of material can make recycling difficult. The most significant issues with packaging waste tend to be related to achieving sufficiently high sorting/capture rates and finding markets for the products made from the recycled materials.

Systems for capture of many packaging wastes already exist in most communities, either as residential curbside or as drop-off programs. Many commercial recycling services also tend to focus on this category. More sophisticated systems are often able to

[33] The EPA estimates that just over 30% of the municipal solid waste stream is made up of containers and packaging discards (U.S. Environmental Protection Agency, 2006, "Municipal Solid Waste in the United States: 2005 Facts and Figures" http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm). In East Hawai'i County, even with the inclusion of construction waste, packaging comprises almost 22 percent of the total waste stream (Harding ESE, 2002, "Update to the Integrated Solid Waste Management Plan for the County of Hawai'i," Appendix C).

[34] U.S. EPA, 2003, "Municipal Solid Waste – Basic Facts," http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm

accommodate a broader range of materials (more types of plastic for example). Policy measures can also help to increase capture rates and promote the commercial viability of packaging recycling. These policies include mandatory recycling laws, preferential purchasing of recycled products in government procurement contracts, and requiring companies whose sales activities produce packaging wastes to be responsible for the collection and recycling of those wastes (know as extended producer responsibility or take-back laws).[35]

In Hawai'i County there is already some infrastructure in place to capture and recycle packaging wastes (along with other paper discards that are a part of most basic recycling systems). As of the end of 2005, 12 of the island's 21 transfer stations had fairly extensive recycling infrastructure in place. Of these, 10 featured HI5 redemption centers (where certain beverage containers can be redeemed for the return of a five cent deposit levied at the point of sale), and three were featured as greenwaste and scrap metal drop-off locations. Another four transfer stations provide for some recycling of glass containers specifically, as a part of a state program focused on glass recovery.

Readily biodegradable organic wastes

Another large portion of the waste stream is comprised of organic wastes that, when given the biochemical ability to do so, can easily biodegrade into useable soil or soil amendment. These include what is known in Hawai'i as "greenwaste" (yard, brush, and landscaping waste comprised of both leafy and woody debris), food waste, some soiled paper discards that are not otherwise recyclable, and biosolids. The proportion of the waste stream that biodegradable organics represent varies significantly from place to places based on an area's level of development, the rainfall, the length of the growing season, and many cultural factors. In the United States overall, almost 60 percent of the municipal solid waste (including paper) is compostable material.[36] In Hawai'i County the figure is actually over 60 percent.[37]

Recycling of biodegradable organics (the food waste portion of which is also sometimes referred to as "putrescibles") is generally accomplished through aerobic composting, which involves the controlled decomposition of organic wastes, which are either carbon-rich (woody debris) or nitrogen-rich (food waste or biosolids). The resulting

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[35] Numerous countries have laws in place to require that companies to be responsible for collecting and recycling their packaging wastes. Two prominent examples are Germany (the Green Dot program) and Japan. When producers of packaging are responsible for end-of-life management of their products they have a strong incentive to reduce packaging volume and weight, as well as to design packaging that is more easily and profitably recycled.

[36] U.S. EPA, 2006, "Composting," http://www.epa.gov/msw/compost.htm.

[37] Harding ESE, 2002, "Update to the Integrated Solid Waste Management Plan for the County of Hawai'i," Appendix C

product is a crumbly dirt-like soil amendment, known as "compost," that can act as a partial replacement for conventional fertilizers. Composting of yard wastes is common in the U.S., with more than 3,200 yard trimmings composting facilities in existence nationwide,[38] and the incorporation of food wastes into these sites is increasingly common, particularly on the West Coast.[39] The nutrients in organic wastes can also be recycled through anaerobic decomposition processes, which are most sustainably managed in a closed digestion system that can capture and make productive use out of the gaseous byproducts (namely methane).

In Hawai'i County yard waste is accepted (currently free of charge for clean loads) at three locations: the South Hilo Landfill, the Kealakehe transfer station (which serves Kailua-Kona), and the Kea'au transfer station/Recycling and Reuse Center. This yard waste is then chipped and given away to county residents. It can also be delivered to sites close to the drop-off points free of charge. There is currently no commercial–scale composting facility on the island, although the DEM did negotiate a contract with a commercial composter, who now operates on Maui, to have green waste composted along with Hilo's biosolids (sewage sludge) for $57.50 a ton if the county will provide the needed site infrastructure. Compostable organics make up an estimated 54.2 percent of the eastern Hawai'i waste stream (if you include paper).

Construction and demolition (C&D) wastes

Of particular concern in areas with high development rates (such as Hawai'i County) is the volume of waste generated by the construction industry. Much of this waste is inert, such as demolished concrete, stone, brick, wood, etc., but the significant volume of these materials can be sufficient to cause concern. In addition, there may be toxic hazards lurking in otherwise innocuous materials, such as paints and coatings, industrial adhesives, fixtures containing toxic metals (such as old lead pipes), or other materials made of dangerous chemicals that were not separated in the disposal process.

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[38] U.S. EPA, 2006, "Composting," http://www.epa.gov/msw/compost.htm.

[39] San Francisco, CA includes food wastes in its curbside organics pick-up. Berkeley, CA has been providing commercial generators with the option of food waste composting through a pilot project started in 1997. Portland, OR is also actively studying the implications of incorporating food scraps into their existing yard waste composting program (Sherman, Steven. 2005. "Adding Residential Organics to Yard Trimmings Setouts." *BioCycle* November 2005, Vol. 46, No. 11, p.30). Smaller jurisdictions such as Markham, Ontario and Dakota County, MN have also committed to inclusion of food wastes (also known as household source separated organics or SSOs) in their organics diversion programs (Goldstein, Nora. 2004. "Residential Organics Diversion Moves Forward in Ontario." *BioCycle* September 2004, Vol. 45, No. 9, p.46 and Dakota County. 2003. "Final Report on the Co-collection of Household Source Separated Organics in Biodegradable Bags and Household MSW in a Single Truck." http://www.swmcb.org/studies/OrganicsBurnsFinRpt.pdf.

Much of the waste generated by construction activities is recyclable. Some C&D waste actually consists of unused building material scrap that can still be employed for its original purpose. These materials, along with reusable furniture, equipment, and hardware, can be collected and centrally distributed to builders who are able to use smaller pieces or quantities of materials. Other C&D wastes consist of materials that can not be reused but can be recycled. Most notably these include recyclable metals (rebar, pipes, etc.) and crushed concrete, which can be used as an aggregate in the production of new concrete. Recycling of C&D waste is becoming increasingly popular, particularly with the growing emphasis on green building and LEED certification in many cities.[40]

In Hawai'i County C&D waste makes up a large portion of the waste stream—it is estimated to encompass over 15 percent of the waste currently disposed of, and because much of it is illegally dumped this may even be a significant underestimate.[41] Currently no public programs exist to facilitate the reuse or recycling of C&D wastes (although as of the writing of this report the county was in discussions related to the development of a C&D recycling facility that could be constructed as a part of a public-private partnership with area organizations). In addition, only one of the island's concrete manufacturers is currently permitted to engage in concrete recycling, the most important component of C&D waste by mass, and they report the demand on the island for concrete recycling to be virtually nonexistent.[42] Given the volume of C&D wastes generated on the island and the lack of current facilities or programs for recycling of these wastes, this should be a priority area for further investigation. The first step needed to facilitate C&D waste recycling would be to provide a centralized facility where these wastes could be both dropped off and picked up by contractors, such as that proposed as a part of the East Hawai'i Regional Sort Station.

Household hazardous wastes and other consumer product wastes of concern

While they make up a relatively small percentage of the overall waste stream, product wastes such as discarded electronics, unused paint, cleaning products, personal care items, etc. can pose a serious risk to health and the environment. They contain both natural and synthetic compounds that can become toxic contaminants to drinking water if landfilled and the air if incinerated. It is important that those wastes characterized as

[40] The US Green Building Council's certification system for "green building" (LEED or Leadership in Energy and Environmental Design) requires that developers earn a certain number of points for incorporating the minimization of environmental impacts into building design. Points can be earned for the recycling of C&D wastes during the building process. Numerous U.S. cities are now requiring that public buildings over a certain size conform to LEED standards. See http://www.usgbc.org/DisplayPage.aspx?CategoryID=19 and https://www.usgbc.org/ShowFile.aspx?DocumentID=691.

[41] Jason Macy, Vice President/General Manager, West Hawaii Concrete, personal communication, 9 March 2006.

[42] *ibid*. According to Macy, West Hawai'i Concrete is the only supplier on the island certified to use recycled concrete, and only one of their customers has ever asked for this product.

hazardous (such as discarded paint), as well as those that can become hazardous after disposal (such as many electronics) be kept out of the waste stream through waste reduction, recycling, and improved collection programs.

Hazardous wastes and other potentially toxic product wastes are generally collected on special household hazardous waste days or through special collection events. Hawai'i County offers collection days twice a year on each side of the island. The Kea'au Reuse and Recycling Center is also periodically able to accept some of these products, such as discarded computers. Hazardous wastes can be expensive to dispose of, and some communities have begun to look into the possibility of requiring that manufacturers of these products be responsible for their disposal (rather than the cost being shouldered by local governments).[43]

Next Steps for Hawai'i County

The 2002 Updated Integrated Solid Waste Management Plan outlined a set of actions to be taken in order to significantly boost county recycling rates. The DEM also set the goal (codified by the County Council on June 23, 2003 in Resolution 28-03) of 50 percent diversion from disposal by 2008 and 80 percent diversion by 2013. The estimated diversion rates for specific commodities needed to add up to a cumulative 45 percent (as calculated by county analysts) is given in Table 1 below. These were based on best guesses as to what commodities showed the greatest potential for increased diversion, given current infrastructure and knowledge of what has been achieved in other jurisdictions.

Table 1: Informal Commodity-Specific County Diversion Rate Goals for Fiscal Year 2008-2009

	FY 2008-09 GOAL				
Commodity	**2009 MSW**	**Diverted Tons (Est)**	**Diversion Increase from FY 03-04. (Est)**	**Diversion Rate**	**Diversion of Total MSW (%)**
Paper	75,405	31,845	27,996	42.2%	9.00%
Glass	11,215	7,073	5,500	63.1%	2.00%
Metal	46,695	31,845	17,841	68.2%	9.00%
Plastic	25,261	1,768	1,746	7.0%	0.50%
Organics	116,554	49,547	31,630	42.5%	14.00%
C&D	55,485	31,845	30,645	57.4%	9.00%

[43] For example, New York City is considering passing legislation that would require computer and other electronics manufacturers to recycle a certain percentage of discarded products as a prerequisite of the right to sell new products in the city.

HHW	1,041	178	75	17.1%	0.05%
Special Waste	18,402	3,548	3,548	19.3%	1.00%
Mixed Wastes	4,147	1,770	1,574	29.9%	0.50%
Totals	353,611	159,418	120,554	45.0%	45.0%

For the purpose of this report a second set of goal diversion rates was calculated and is given in Figure 6. Because location-specific factors dictate both the composition and the recyclability of a given waste stream, in addition to the fact that jurisdictions do not generally make commodity-specific diversion rate information available, it is nearly impossible to extrapolate appropriate goals for the diversion of specific commodities in Hawai'i County from other jurisdictions. The rates given in Table 2 are meant to illustrate what should be possible given the infrastructure improvements and investments recommended in this report. They are based on a combination of existing diversion rates, expected changes to the system, and information about the general potential for recovery of and recyclability of various commodities. These suggested goals were vetted with and revised as per the recommendations of national recycling expert Eric Lombardi, Executive Director of Eco-Cycle (one of the nations oldest and largest non-profit recyclers, based in Boulder, CO).[44]

Table 2: Suggested Diversion Rate Goals Given Recommended County Investment in Recycling Infrastructure

Commodity	2009 MSW	Diverted Tons (Est)	Diversion Increase from FY 03-04. (Est)	Diversion Rate	Diversion of Total MSW (%)
Paper	75,405	40378	36529		11.41%
Cardboard	28,602	22882	20182	80%	6.47%
Bags	1,484	148	148	10%	0.04%
Newspaper	8,302	6641	6041	80%	1.88%
White Ledger	3,188	2551	2401	80%	0.72%
Color Ledger	332	266	242	80%	0.08%
Office	3,188	2551	2401	80%	0.72%
Magazines	4,152	3322	3122	80%	0.94%
Directories	334	267	242	80%	0.08%
Misc	9,201	920	920	10%	0.26%
R/C Paper	16,621	831	831	5%	0.23%
Glass	11,215	8972	7399		2.54%
Clear	4,110	3288	2713	80%	0.93%
Green	3,366	2693	2220	80%	0.76%

[44] Lombardi, Eric, 2006, Executive Director, Eco-Cycle, "Re: Goal Recycling Rates for Hawaii," personal communication, 6 Sept 2006.

Brown	2,992	2393	1973	80%	0.68%
Flat	374	299	247	80%	0.08%
R/C Glass	374	299	247	80%	0.08%
Metal	46,695	35164	21160		9.94%
Tin Cans	2,671	2137	2137	80%	0.60%
White Goods	4,146	3939	2935	95%	1.11%
Ferrous	30,973	26327	13327	85%	7.44%
Aluminum Cans	1,187	1128	1128	95%	0.32%
Nonferrous	890	0	0	0%	0.00%
R/C Metal	6,530	1632	1632	25%	0.46%
Plastic	25,261	8424	8402		2.38%
#2	1,499	1199	1189	80%	0.34%
#1	1,796	1436	1426	80%	0.41%
Other	893	268	266	30%	0.08%
Film	8,014	4007	4007	50%	1.13%
Durable	5,046	1514	1514	30%	0.43%
R/C Plastic	7,717	0	0	0%	0.00%
Organics	116,554	68507	50590		19.36%
Food	46,368	23184	22937	50%	6.55%
Greenwaste	41,990	39891	22221	95%	11.27%
Textiles	6,530	3265	3265	50%	0.92%
R/C Organics	21,667	2167	2167	10%	0.61%
C&D	55,485	35959	34759		10.16%
Treated Lumber	9,498	3324	3324	35%	0.94%
Concrete	4,440	3552	2752	80%	1.00%
Asphalt Paving	4,743	3794	3394	80%	1.07%
Asphalt Roofing	890	445	445	50%	0.13%
Clean Lumber	26,416	23774	23774	90%	6.72%
Gypsum Board	1,187	712	712	60%	0.20%
Rocks & Soil	594	356	356	60%	0.10%
R/C Demolition	7,717	0	0	0%	0.00%
HHW	1,041	251	148		0.07%
Paint	303	76	72	25%	0.02%
Oil	72	69	20	95%	0.02%
Batteries	364	91	45	25%	0.03%
R/C Hazardous	302	15	12	5%	0.00%
Special	18,402	7384	7384		2.09%
Industrial Sludge	6,233	0	0	0%	0.00%
Treated Medical	594	0	0	0%	0.00%
Bulky Items	7,717	3858	3858	50%	1.09%
Tires	3,562	3526	3526	99%	1.00%
R/C Special	297	0	0	0%	0.00%

Mixed	4,147	1244	1048		0.35%
Mixed Residue	4,147	1244	1048	30%	0.35%
Totals	353,612	206283	167419	58.29%	58.29%

In order to make these goals a reality the county would need to make significant investments in the island's recycling structure, as well as instituting new government policies that would promote the recycling of materials over their disposal. If waste reduction, product reuse, and materials recycling were sufficiently prioritized it would be possible to push the diversion rate well above even the 58 percent mark suggested above, given that almost all elements of the current waste stream can be recycled if properly separated and linked to appropriate markets.

Immediate Infrastructure Needs

In order to move forward towards the dramatic increase in diversion rates 1) set as goals by the DEM, 2) suggested in this report, and 3) presumed by existing county plans as indicated in the EHRSS EIS and the Waste Reduction Technology RFP, the county will need to invest in several significant changes to its current available waste management infrastructure. These include:

- funding and building the aspects of the original East Hawai'i Regional Sort Station design related to waste diversion,
- funding or in some way ensuring the development of infrastructure needed to contract with a large-scale commercial composter willing to eventually except greenwaste, biosolids, and some commercial and/or residential food wastes,
- upgrading all residential trash transfer stations to include (and promote the use of) recycling options for all major recyclable commodities, including biodegradable organics and "clean" or useable C&D wastes.

Investment in this infrastructure would be in line with the UISWMP that was already approved by the county. This plan had explicitly included the intention to:

- Upgrade Transfer Stations
    - Establish Drop-Off Centers at Transfer Stations
    - Establish Drop-Off Centers at Shopping Centers, etc.
    - Reconfigure Transfer Stations to Emphasize Recycling
- Emphasize Recycling in Design of Sort Station
- Enhance C&D Waste Recovery.

<u>Waste Diversion Components of the East Hawai'i Regional Sort Station</u>

Significantly increasing the diversion rates for materials going into the East Hawai'i waste stream will require the convenience of delivering materials for recycling and reuse to the same location as non-recyclable refuse. Also important is making use of the

physical layout of disposal sites as an opportunity to educate users on the available options for materials recycling and incentives offered for recycling (such as reduced or waived tip fees for commercial users who deliver clean loads of certain recyclables to approved recyclers). A third reason that recycling/reuse contractors need to be co-located with each other and with final disposal options is so that exchange can also take place between these entities in order to maximize the efficiency with which all materials are delivered to the end user who can assure their highest use value. Co-located recycling contractors may also be able to negotiate better shipping rates or better end-market prices through collective bargaining.

The South Hilo Landfill currently offers at least some of these benefits—it offers diversion opportunities for most categories of recyclable commodities as a part of the site around the landfill, making it convenient for most residential users to deliver sorted recyclables at the same time as other refuse. When the South Hilo Landfill closes it will need to be replaced with a facility that, at a minimum, offers this same convenience by incorporating recycling options with the non-recycling option that the county chooses. As originally designed, the sort station would have included various sections and facilities focused on materials recovery, arranged in such a way that users who chose to enter the materials recovery section of the station would pass a series of drop-off points for metals, greenwaste, discarded containers (such as HI5 beverage containers), paper products, reusable items, construction and demolition waste, etc. The accessibility of the final disposal facility to materials recyclers would also allow for additional activities, including some sorting of materials *on the tip floor* for loads that contain a high percentage of recyclable materials or materials that are easily separated, such as appliances or construction materials. This post-tip sorting would be crucial in ultimately attaining significantly higher diversion rates.

When the invitation for bids (IRB) for the East Hawai'i Regional Sort Station was released, it listed the materials recovery components of the initial station design as optional additions, rather than essential elements of the station. When proposals were received, they all contained costs that were significantly higher than the amount originally budgeted for the project. In an effort to reduce costs enough to fit within budgetary constraints all "optional" components of the station were eliminated. This meant that the funding approved for the "Sort Station" was in fact only going to cover the construction of a new tip floor and reload facility, where no sorting of materials or recovery of recyclables would take place (the facility is thus now being referred to as the "Reload Facility" rather than the "Sort Station"). This means that, according to what is currently funded, the facilities being built to replace the South Hilo Landfill will not only *not* improve recovery of recyclables, but may in fact *decrease* recovery potential by *lessening* the degree to which materials recovery facilities are co-located with other

disposal options. This will make achieving even the county's current goal of 50 percent diversion nearly impossible.

When proposals for construction of the Sort Station/Reload Facility were submitted they included bids for the materials recovery components of the facility as originally designed. While the funds needed to include these elements in the project were not approved by the council, they can act as a reasonably accurate estimate of the costs to add these parts of the facility back into the overall design. Isemoto Contracting Co. Ltd., the contractor awarded the bid for the Reload Facility, offered to construct the materials recovery aspects of the facility for approximately $6,420,000. This was somewhat less than the cost that the county agreed to pay for constructing the reload facility alone (the reload facility will cost approximately $7.5 million, but the county is still in contract and budget negotiations). This cost estimate may be something that the county could negotiate down to a lower price if it were to commit to funding the construction of the entire facility as originally proposed. Operating and maintenance costs for the facility were estimated at $471,866 a year. Much of these costs will be incurred by the county whether or not the recycling infrastructure is included, due to the proportion of the costs that are associated with the reload part of the facility and the loss of the economy of scale that centralization of system components would have afforded. To put these costs into context, the overall budget of the DEM is estimated to top $24,000,000 in 2006, and capital costs of other system components that would be used to replace the South Hilo Landfill already range as high as $35,000,000 (for a mass burn incinerator). In contrast to other system components, a fully funded East Hawai'i Regional Sort Station is designed to be flexible in its capacity (since more waste can be diverted by adding more materials recovery contractors and recycling companies), while other proposed system components would not be able to accommodate the more realistic estimates of waste generation presented earlier in this report.

Commercial Composting Facility

The second facility that would be crucial to a significant increase in waste diversion rates is a commercial-scale composting facility (or several composting facilities). As stated above, biodegradable organics comprise 54 percent of the East Hawai'i waste stream, and the most cost effective and technically feasible way to divert these organics would be to compost them.

The county is currently diverting a reasonably high proportion of its greenwaste (approximately 66 percent) through a program where it is mulched and given away to residents for free from two points (one on either side of the island). While this helps to reduce the amount of biodegradable organic material that goes to landfill, it represents a small portion of the overall biodegradable organics in the waste stream. In order to

work towards much higher organics diversion rates there will need to be infrastructure that can accommodate not only greenwaste, but also other kinds of biodegradable organics, particularly food wastes. Other jurisdictions that have achieved diversion rates over 50 percent have almost universally included a composting facility in their waste management infrastructure.[45]

The benefits of composting on the Big Island are twofold. First, it has the potential, if high capture rates for biodegradable organics can be achieved, to save more landfill space than any other single addition to the waste management system (again, see the graph on page 21 and consider that almost all paper products can be composted if they are not/can not be recycled). Saving landfill space now means significantly postponing the need to build a new landfill, hopefully until such time as new technologies are available (and affordable) that render the process of landfilling itself entirely extinct. Even incineration leaves a residue (made up of toxic ash and char) that must be landfilled, but composting results in a useable product, and thus (when done correctly) completely diverts the relevant materials from the landfill.

The second benefit of composting is that it results in the production of "compost," a nitrogen-rich dirt-like substance that can be used as a fertilizing soil amendment. Substantial demand for compost products already exists on the island, between their uses in agriculture and their potential for use as topdressing on golf courses, areas landscaped with grass and private lawns in dry areas.[46] Because of the strong local market, composting would involve the local production of a value-added product that can be sold locally. This strengthens the island's economy by creating jobs and the associated tax revenues, by reducing the cost of raw materials for the island's farmers and landscapers, and by offsetting the need to import similar products, which ultimately means sending local dollars off-island to foreign producers. According to the most recent data available, approximately 16,000 short tons of fertilizers, soil

[45] The City of San Francisco for example, well known for its well-above-average diversion rate—now over 67 percent—includes all biodegradable organics, including yard waste, food waste, and soiled paper, in its curbside recycling program. Nantucket Island off of Massachusetts reports as high as an 80 percent diversion rate thanks to a system that composts all biodegradable matter in the solid waste stream (see http://www.wasteoptions.com/nantucket.htm).

[46] Good information about the myriad benefits of compost is available from Earth 911 (http://www.earth911.org/master.asp?s=lib&a=organics/composting/comp_using.inc), The Composting Council of Canada (http://www.compost.org/pdf/sheet_7.PDF#search=%22benefits%20of%20compost%22), and the U.S. EPA (http://www.epa.gov/epaoswer/non-hw/composting/benefits.htm). One of these uses is as a way to decrease evaporation from soils, thus decreasing the need to water landscaped areas in arid climates (such as West Hawai'i).

conditioners and related products are imported onto the island each year[47] and used to treat almost 43,700 acres of land.[48]

While the Department of Environmental Management has already been pursuing the development of a commercial-scale composting site, the county government has not yet agreed on the funding mechanism for the infrastructure needed. County engineers estimated that developing a composting site on the dry side of the island would cost approximately $1.5 million. This would not include the equipment needed to compost, but simply the land and the infrastructure needed to deliver the water and electricity necessary for commercial compost production. A suitable site has been located on county land, near Pu'uanahulu Landfill, and a site plan was developed by county engineers. A contract was even negotiated through a competitive bidding process with an experienced composting company currently operating on Maui (EKO Compost), with the understanding that composting operations would commence as soon as the county developed the composting site.

The main cause for delay of this project is disagreement within the county council as to how the needed infrastructure for a composting facility should be financed. The county could spend the $1.5 million and have the benefit of owning the site and infrastructure. This would assure continuity of services (since they would not be dependent on the operational status of a single company) and would give the county more control over the company that it chooses to contract with for composting services at a given time. The county could also elect to let a private company develop its own site and simply contract with them for composting services, which would save the county from spending the $1.5 million. A third option could be a compromise between these two extremes involving a creative cost split. While all of these options have strengths and weaknesses, the important thing is that the county decision makers arrive at a consensus that the development of some commercial composting option is a priority for the waste management system and move forward with such development.

The costs associated with commercial composting of the county's biodegradable organics could vary significantly depending on the finance structure that the county chooses to pursue. If it builds the infrastructure itself, which again is the best way to assure continuity of services and control over process, the capital costs are estimated to be $1.5 million, and the operation and maintenance is estimated to be approximately

[47] Department of the Army Corps of Engineers, Institute of Water Resources, 2003, "Waterborne Commerce of the United States," Part 4—Waterways and Harbors, Pacific Coast, Alaska and Hawaii, Publication IWR-WCUS-03-4.
[48] United States Department of Agriculture, Farm Service Agency, 2006, "Programmatic Environmental Assessment, Conservation Reserve Enhancement Program," http://www.fsa.usda.gov/Internet/FSA_File/hicreppeafinal.pdf page 2-3.

$460,000 per year. The contract that the county currently has with EKO Compost involves a tip fee of $57.50 per ton, paid by the county to the contractor. Some amount of this may be offset by charges assessed by the county on those disposing of greenwaste/organics, but the current mulching service is at present free to users. Other sources suggest that a tip fee of $57.50 is unusually high (given that costs are generally closer to $30 per ton before compost sales),[49] and perhaps renegotiation of the composting contract would be advisable. In order for the county to reach 50 percent diversion (or more) it would also need to contract with a composter in East Hawai'i with the capacity to process a wide range of biodegradable materials, including food wastes, or be willing to transport these materials to the site in West Hawai'i.

Upgrading Residential Trash Transfer Stations

In order to take full advantage of other improvements to the recycling infrastructure, significant upgrades at all residential trash transfer stations are also needed. In addition to simply improving the safety and usability of transfer stations, two specific types of upgrades would be needed at all transfer stations in order to maximize the impact on diversion of the other facilities mentioned above.

1. All transfer stations should be upgraded to include a full compliment of recycling facilities and convenient, safe and clean recycling infrastructure. This includes depositories for paper, glass, plastics, biodegradable organics, scrap metal, appliances/white goods, and clean construction waste.
2. All transfer stations should also be outfitted with the *capacity* to separate biodegradable organics (wet/dry separation) for composting. This may not mean including separate collection containers for organics right now, but designing stations to include a logical and user-friendly space for future source separation.

Over the coming 10 to 20 years the county is already planning to upgrade all of its transfer stations at a cost of approximately one million dollars each,[50] which affords a perfect opportunity to drastically improve recycling and reuse infrastructure at little to no additional cost.

Policy Changes Needed

In addition to investing in significant additions to the recycling infrastructure, maximizing waste diversion will require passage of policies encouraging and in some cases even mandating separation and diversion of recyclable materials. A few such policies already laid out in the UISWMP (but not yet implemented) include:

[49] Lombardi, Eric, 2006, "Re: ANOTHER PIECE OF INFO" personal communication, 6 September 2006.

[50] Schrandt, Colleen and Lane Shibata, 2006, "Audit of the County of Hawai'i's Recycling and Diversion Grants Program." A report to the Finance Committee, County of Hawai'i, conducted and submitted by the Legislative Auditor's Office, County of Hawai'i, June 2006.

- Restraining the disposal of recyclable materials (for example through an ordinance mandating residential recycling or prohibiting the disposal of specific recyclables as trash),
- Increasing incentives for diversion of clean C&D wastes,
- The phase-in of landfill bans on recyclable C&D wastes,
- Banning yard trimmings from being disposed of as trash at transfer stations and landfills.

Other important policy options designed to control the amount of waste generated for final disposal include:

- Charging for trash disposal on a per-unit (per bag, per pound, etc.) basis,
- Offering tax or other rebates for recycling (on a per-unit basis),

While specific constraints exist that make implementation of some of these policies difficult (such as the lack of county-funded curbside pick-up, which in turn makes it difficult to implement per-unit charges on trash disposal), creative solutions must be sought that would allow the passage of policies such as those suggested above. Policies like mandatory recycling of certain materials or per-unit charges create powerful incentives for users of the waste management system to reduce their waste generation and increase recycling. Conversely, in the absence of such policies people (and companies) have little incentive to spend the minimal extra time needed to clean and separate recyclables from other trash. This puts the financial burden back on the county, which ultimately pays more per ton to landfill (currently estimated at an average of $84 per ton of commercial trash and $126 per ton of residential trash) than to recycle (estimated at about $60 per ton, depending on the commodity). Policies that require recycling or discourage waste generation through incremental charges would be a cost-effective way for the county to boost recycling and decrease waste generation.

IV. Comparing Investment Needed for Maximum Diversion to Current County Plans and Priorities.

As of the time this report was written, the investments suggested as necessary to significant increases in the county's recycling and reuse rates are not being pursued. In contrast, the Hawai'i County Council and Department of Environmental Management are working to develop a "waste reduction" facility, which at this point in the process has come to mean a small-capacity (250 tpd) mass burn incinerator. To give a relative sense of scale, while the $1.5 million needed to develop infrastructure for a composting facility has not yet been approved, in order to develop an incinerator the county is spending in the vicinity of one million dollars on the procurement process alone.

The county issued the first part of a two-stage RFP for a "Waste Reduction Technology" in late December of 2005, and issued the second part ("Request for State 2 Proposals") in October of 2006. As of the fall of 2006 (and the time of the writing of this report), three companies will be submitting Stage 2 Proposals for incineration facilities employing mass burn technology. This process is being overseen by a committee headed by William Takaba, Director of the Department of Finance, and guided with the help of legal consultants Hawkins Delafield and Wood LLP and technical consultants R. W. Beck, Inc.

The county officials who support procurement of a waste reduction facility base their reasoning on the dire need to reduce the volume of waste going to final landfill disposal. This argument is particularly grounded in the fact that, within two to four years, all waste being landfilled in the county will need to be transported to Pu'uanahulu Landfill, probably by truck. Many people (or a small group of very vocal people) on the island feel that transportation of waste from the eastern side of the island to the western side would put an unfair burden on the people (and tourist-dependant businesses) residing in communities along the route that the trash would be transported. Concerns about "trash trucking" include noise from trucks, traffic impacts on narrow congested roads, and odor issues. Perhaps the most impassioned concern expressed by island residents though, including several county council members, was that sending trash from one part of the island to the other is simply "unfair and wrong" in an abstract moral sense. It is hoped that incineration of East Hawai'i's trash will reduce the volume of waste that needs to be transported to Pu'uanahulu more than any other waste management option.

While the hoped-for benefits of a waste reduction facility should not preclude the existence of a comprehensive and efficient waste diversion/recycling and reuse

program, there are good reasons to believe that the procurement of an incinerator may interfere with current and proposed diversion systems. First one notices the fact that the waste stream currently going to disposal at the South Hilo Landfill is far smaller than those generally considered large enough to make incineration economically viable. Most incinerators currently operating in the U.S. (almost 75 percent) are built with a capacity of 500 tons per day or more and 45 percent have a capacity of over 1000 tons per day. No facility has been built in the US of comparable size in the last 20+ years, leaving one with doubts as to the potential profitability of such as facility.[51] One company that had considered submitting a proposal in response to Hawai'i County's Stage 1 RFP confided (off the record) that the plants of the size currently being proposed by Hawai'i County that they know to be operating profitably are producing/selling steam, not electricity, which is more expensive to generate.[52]

The reason to be concerned about a facility whose size would put it so close to the margin of economic viability is that it leaves very little room for changes in the available waste stream. This means that diversion rates could never rise above a level that left 200-250 tons per day[53] to be sent to the incinerator, for fear that any lower quantity of waste going for incineration would bankrupt the facility. Alternately, the county could (and is likely to have to) sign what is known as a "put-or-pay" contract, whereby it agrees to pay for a certain amount of waste to be delivered to the incineration facility. If the minimum volume requirements are not met the county is forced to pay the difference in revenues to the operator of the incinerator. This means that, even if diversion rates did rise high enough to interfere with the minimum tonnage requirements, the county would still be paying as if those additional tons of recycling were being be incinerated. This would create a perverse set of incentives, essentially encouraging the county to cap its recycling potential at a level that could not interfere with the profitability of, and the contractual obligations to, the incinerator's operators.[54]

Another way of looking at the cause for concern is by thinking about the system in terms of **uncertainty** and **flexibility**. As stated in Section II above, waste generation rates have been growing at tremendous speed, leading to notable uncertainty regarding the future capacity needs of the waste management system's various components. Incinerators tend to "lock up" the waste stream, meaning that they designate a specific

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[51] Kaiser, Jonathan and Maria Zannes, 2004, "The 2004 IWSA Directory of Waste-to-Energy Plants," Integrated Waste Services Association, http://www.wte.org/docs/IWSA%202004%20Directory.pdf

[52] Anonymous, 2006, personal communication, 6 July 2006.

[53] Depending on facility capacity and contracted minimum tonnages.

[54] For examples of communities where incinerators did interfere with recycling programs see Morris, Jeffery, 1996, "Competition Between Recycling and Incineration." Prepared for Gowling, Strathy & Henderson Toronto, Ontario, 30 September 1996 (available at http://www.mindfully.org/Plastic/Recycling-And-Incineration.htm#a) and Apotheker, Steve, "Waste-to-energy and recycling: Tango or tangle?" *Resource Recycling*, September 1994.

disposal option for a fixed portion of the waste stream, regardless of shifts in waste stream composition or size. In addition, incinerators involve large capital investments, and their capacity is generally difficult to either increase of decrease once they are built (without risking financial losses and/or additional large investments. In contrast, investing in general recycling and reuse infrastructure affords remarkable flexibility, since it is less capital dependent and does not rely on a single technology/facility but instead contains many system components that can be easily expanded (or contracted) to accommodate dramatic changes in the waste stream. A recycling system with multiple components also distributes risk within the system, whereas investment in a single facility leaves the system open to complete shut-down if mechanical problems were to arise. The issue of system **flexibility** is an important one in a place where the level of **uncertainty** about future trends in waste generation and composition is so high.

The county's current plans to build an incinerator raise other concerns, most of which are outside the scope of this report. These include concerns over public health and environmental impacts of incinerator emissions, particularly dioxin, a powerful human carcinogen that is produced when certain substances (specifically some plastics) are burned in the presence of oxygen. They also include the financial risks associated with the centralization of investment in a single mechanically complex facility (the capital costs alone are estimated at upwards of $35 million), particularly given a somewhat spotty history of mechanical failure and regulatory non-compliance. Furthermore, building an incineration facility that produces electricity on the east side of the island, when the current growth in demand is on the west side of the island, raises questions about the need for such a facility's generation capacity and the efficiency of building it in the place where it is needed least. These and other issues lead one to wonder whether the benefits of incineration, namely a reduction (*but not elimination*) of trucks transporting trash across the island to Pu'uanahulu Landfill, is worth the costs and risks associated with the development of such a facility.

An additional factor to be considered is that, while incineration is being pursued partly in the hopes that is will provide an expedient solution to the closure of the South Hilo Landfill, the process of getting an incineration facility up and running can take much longer than the development of other waste management infrastructure. This is due to numerous factors, including some logistical and some legal, but there can also be delays due to public opposition. These delays can make what seems like a quick and clean fix to a messy problem, instead become an arduous battle, with years of opportunity to save energy and natural resources through recycling lost as financial resources are diverted to fighting for the passage of an unpopular policy.

One of the most important things that the county's citizens and decision makers can ask is whether preventing a marginal amount of truck traffic through specific communities is worth the costs and risks associated with funding an incinerator (and its prerequisite proposal process). Extensive information about the potential traffic impacts associated with transporting waste from East Hawai'i to Pu'uanahulu Landfill is given in Appendix E of the Environmental Impact Statement prepared for the planning of the East Hawai'i Regional Sort Station. From traffic counts done by the state Department of Transportation in 2003 one can see that the increase in truck traffic that would result from the transportation of waste from the South Hilo Landfill site to Pu'uanahulu would be insignificant compared to the overall traffic volumes. Even the increase in truck traffic specifically would only be 2.1 to 12.3 percent for different portions of the proposed truck route,[55] which would be difficult for most observers to notice. Figures 5 and 6 show the estimated impacts to traffic volumes and truck traffic volumes respectively under a worst case scenario (all 240 tons per day of waste currently going to the South Hilo Landfill is transported across the island by truck, along with Hilo Wastewater Treatment Plant's biosolids). Figure 7 compares current average daily truck traffic volumes to estimated truck traffic volumes under three scenarios: a "no action" scenario where all waste is transported, an "incineration" scenario in which biosolids, greenwaste, and residuals from the incineration process are transported, and a "recycling" scenario in which the county attains a 55 percent diversion rate but all diverted organics are transported to a composting facility at Pu'uanahulu Landfill. The expected traffic impacts, both in absolute numbers of vehicles and in percentage changes are given in Appendix E.[56]

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[55] The transport route has been defined as SR 19 from Hilo to Waimea, SR 190 from Waimea to Waikoloa Road, Waikoloa Road to Hawaii Belt Road, and Hawaii Belt Road to Pu'uanahulu Landfill.

[56] Calculations of the total additional truck trips needed to transport waste across the island are based on the following assumptions(taken largely from the East Hawai'i Regional Sort Station Environmental Impact Statement and communications with DEM officials):

1. In the "Maximum Additional Trucks" scenario 12 round trips (for a total of 24 additional truck trips) of waste per day (transporting 87,000 tons per year) is transported after being processed at the Sort Station. An additional two truck trips each day (one round trip) are associated with transportation of biosolids/sludge from the Hilo Wastewater Treatment Plant.
2. In the "Additional Trucks Incineration" scenario it is assumed that the two truck trips per day of greenwaste and biosolids are still needed, and 25 percent of the original 24 truck trips from the Sort Station are needed to transport the residuals from the incineration process (assuming a 75 percent reduction by weight as given in the R.W. Beck Revised Draft Technical Memorandum prepared for the county in April of 2006).
3. In the "Additional Trucks Recycling" scenario it is assumed that the two truck trips per day is still needed to transport sewage sludge. It also assumes a marginal increase in recycling of 35 percent (to go from the 20 percent recycling rate the county was achieving at the time that the traffic impacts were studied (2003) to the overall diversion rate of 55 percent recommended in this report).

These assumptions are based on waste generation rates estimated in the EHRSS EIS (87,000 tons per year). If average generation rates over the next 30 years are double those estimated in the EIS, as described in Section II above, than the number of trucks needed to transport waste will be increased for all three scenarios. Even if the needed trucks increase somewhat substantially this increase would be a small percentage of total traffic volumes.

Figure 5: Maximum Impacts to Average Daily Traffic Volumes

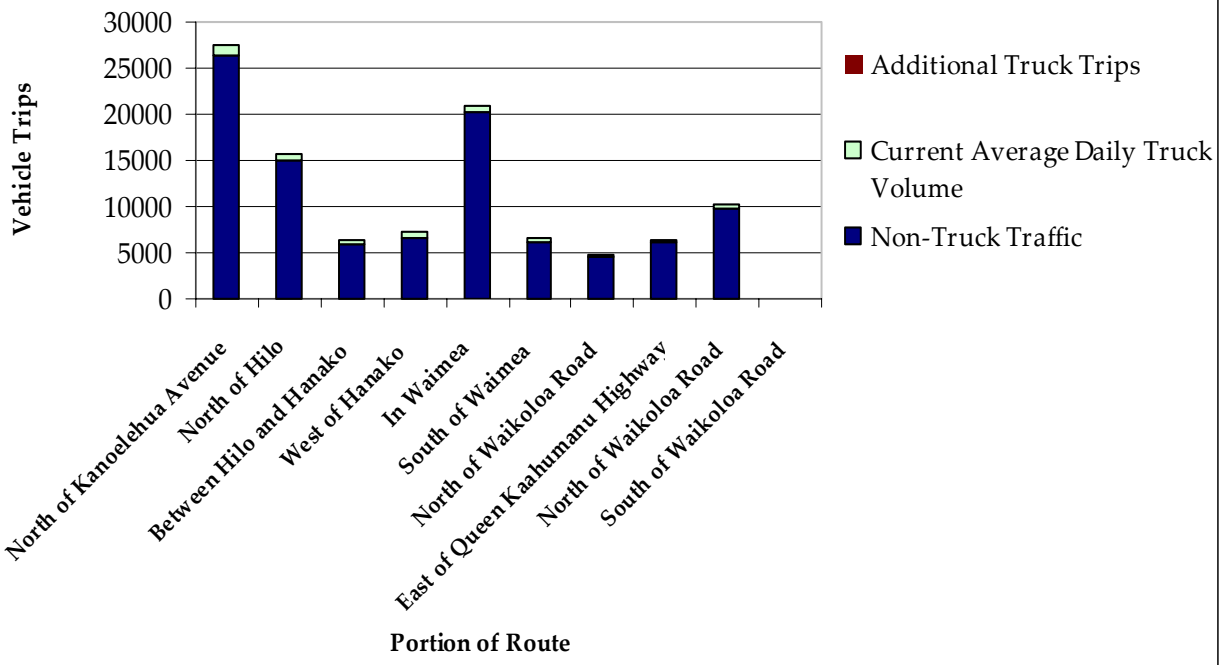
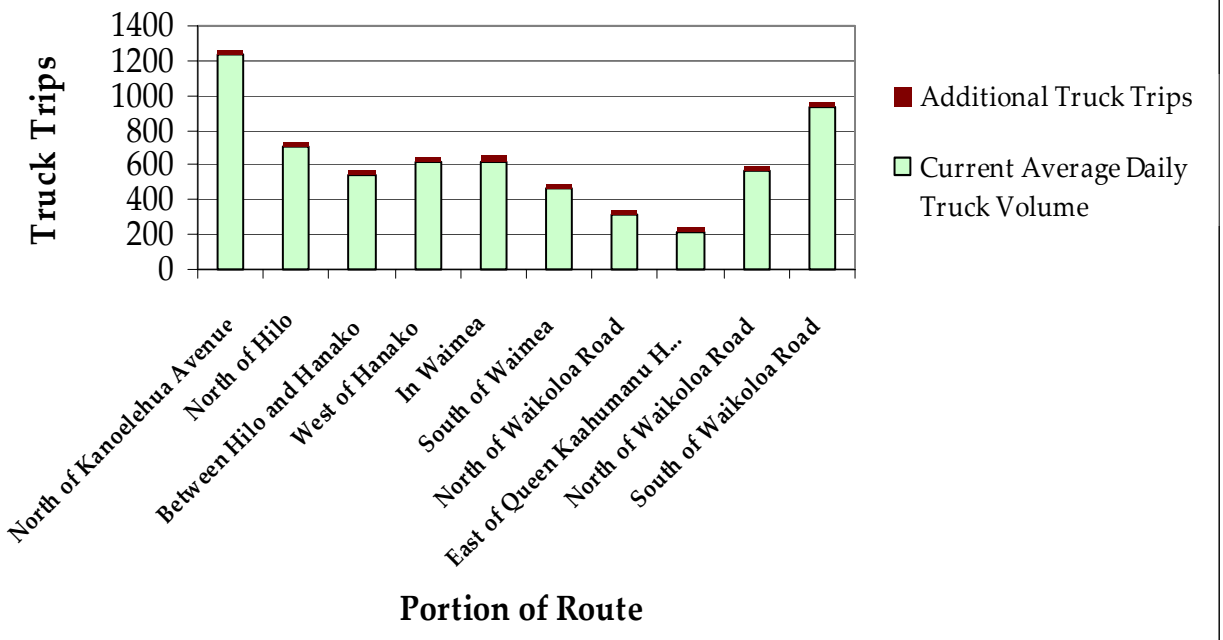
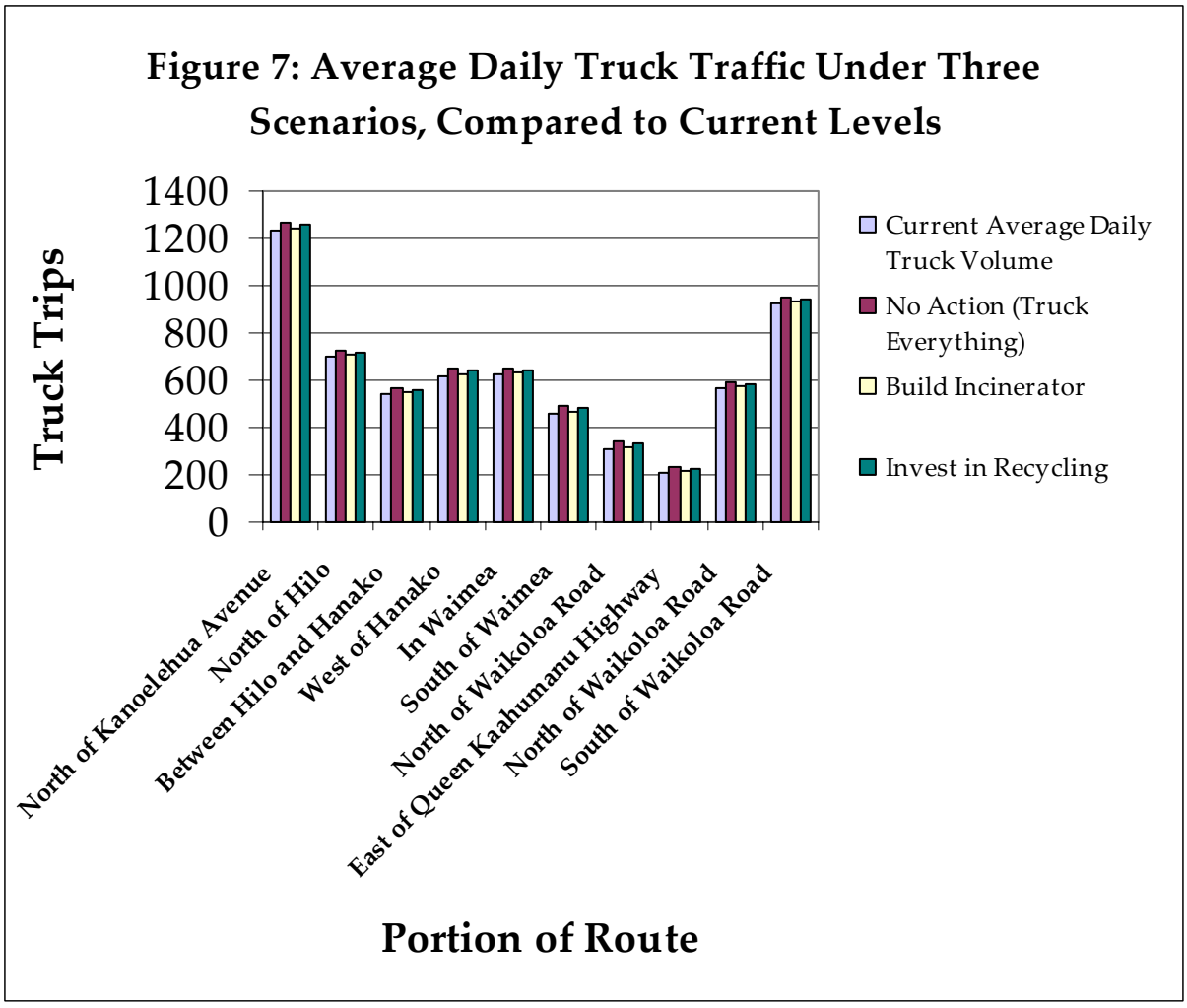


Figure 6: Max. Impacts to Average Daily Truck Traffic Volumes





**Data on traffic volumes was taken from the EHRSS EIS Traffic Impact Assessment (EHRSS EIS Appendix E), available online at http://www.hawaii-county.com/env_mng/eisfinal/feis_d_e.pdf. We have assumed that "Hanako" in the original document refers to Honoka'a.*

V. Conclusions and Further Recommendations

As an island that relies heavily on the value of its pristine ecosystems as a tourist commodity and living laboratory, Hawai‘i must carefully consider the environmental ramifications of its management decisions. This report outlines the short-term steps necessary to shift the island’s waste management system onto a track that is ultimately more sustainable, both ecologically and economically. Four important themes emerge from this report:

1) Given patchy tracking systems and as yet not fully explained jumps in generation rates, the first thing that the county must do is improve its data collection systems. This includes demanding greater accountability in reporting from vendors who provide disposal or management services, as well as diversion grant recipients and county employees. This may also require oversight by an independent party. Research is needed on the waste composition at the Pu‘uanahulu Landfill, and the disposal of specific commodities (particularly greenwaste and construction waste) need to be tracked in far more detail and with a far greater degree of accuracy.

2) Until trends in waste generation are better understood (and more easily projected into the future) the most important thing that Hawai‘i can build into its waste management system is flexibility. Recycling and composting systems are inherently more flexible than high-tech and capital-intensive waste treatment facilities (such as incinerators). Recycling systems are flexible in part because they treat waste as a complex set of materials which retain value, rather than relying on a single (fallible) silver-bullet approach to waste reduction.

3) If the development of incinerator technology on the island does indeed pose a risk to current and future diversion potential, than the county may be faced with a choice between two courses of investment: either it can reduce the quantity of waste going to landfill by investing in the changes to infrastructure, policy, and political culture necessary to dramatically increase diversion rates, or it can focus on waste volume reductions by incinerating many of those same materials.

4) Lack of a common vision for the future direction of waste management on the island has resulted in continued disagreement among county decision makers and citizens over the proper use of DEM funds and how to deal with the impending closure of the South Hilo Landfill. It had also led to the current rush to develop an incineration facility. Making *any* substantive decisions about expansion or improvement of the waste

management system will require a consensus-building process that can give those responsible for relevant decisions a sense of common goals.

Under current conditions the construction of an incinerator may appear to facilitate a waste management system with lower annual costs than could be reaped by increased investment in recycling. Yet there are several things that can be done or could happen that would change the economic calculus. For example:

- The costs associated with incineration are significantly decreased by the assumed revenues from energy generation. These revenues are based on the current high costs of electricity generation on the island, given a 50/50 revenue sharing agreement between the company chosen to operate the incinerator and the county. If the generation on the island switches over to cheaper renewable power sources and/or if energy costs associated with fossil fuel use decline these revenues could shrink significantly. Energy prices could also continue to rise, creating an even larger price bubble. In addition, there is relatively little growth in energy demand on the east side of the island compared to the west, and if an incinerator's generation costs were higher than other energy sources there may not be sufficient local demand for the energy produced. Thus the annual costs of incineration may be highly volatile and uncertain.

- Projected recycling costs are increased by the fact that, under current contracts, tip fees paid by the county to contractors for composting would be higher than those paid for landfilling, despite the fact that associated costs should be lower. Renegotiation of key contracts could decrease the costs of composting relative to landfilling, making the improvement of diversion rates more economical.

- Another factor currently making recycling costly is that the county pays an average of $60 per ton to recyclers as an incentive to deliver recycled commodities to end use markets. If the county were to put policies in place that encouraged the establishment of businesses that can use discarded materials to manufacture value-added products (such as recycled plastic lumber or recycled paper products) it could decrease or eliminate these diversion grants. Other policies that decrease the cost of delivering materials to end use markets, such as a policy that creates incentives for shipping companies to offer space to recyclers for a discounted price, would decrease the need for diversion grants.

- The cost of recycling could also be reduced if the County Council were to pass policies aimed at decreasing the amount of difficult/expensive to recycle materials that enter the island in favor of materials that are less expensive to

recycle. This could be done through changes to the county's purchasing behavior or even policies that restrict or penalize the sale of certain types of goods.

- An increasingly common policy mechanism to reduce the cost of recycling to local governments is Extended Producer Responsibility (EPR). EPR policies could involve requiring that product manufacturers pay to have their products or the packaging for their products recycled in order to sell in Hawai'i County. An example of how this type of policy can be used at the local level is New York City's recent consideration of a policy to require electronics manufacturers to be responsible for the recycling of discarded computers.

- Another way to reduce the costs associated with reduction in waste generation would be to find a way to charge residents per unit for waste disposal. This would involve either enclosing transfer stations and supervising all residential waste drop-offs or switching over to a county-funded curb-side pick-up program. While initial investment costs would be high, switching to a curb-side waste pick-up program would greatly improve the level of service offered by the county to its citizens and would also have the potential to greatly improve diversion rates overall.

In short, if a sustainable waste management system is to be achieved by the county, then the important questions for citizens and county officials to be asking right now include:

- How much will the county's plan to manage the waste going to the South Hilo Landfill cost up front, particularly compared to an investment in maximizing waste diversion
- Will all the plans under serious consideration leave room/**flexibility** for increased diversion? Will any of them jeopardize current or planned diversion programs?
- Will the plans under consideration be adequate to manage a **growing waste stream**—one that may grow to as much as twice its current size?
- Would the plans under consideration maximize the island's over-all best long-term interests, or are they being driven more by divisive politics than questions of economic or ecological sustainability? How much should the county be willing to pay for tiny marginal decreases in waste transportation over the short term?

It should be the answers to these types of questions that guide the people of Hawai'i County in a process leading towards true consensus on a vision for what the island wants to be and how its ideals as a community can be embodied in its infrastructure, its systems, and its management choices.

Glossary of Terms and Acronyms[57]

Aerobic Composting: The controlled biological decomposition of organic material in the presence of air to form a humus-like material. Controlled methods of composting include mechanical mixing and aerating, ventilating the materials by dropping them through a vertical series of aerated chambers, or placing the compost in piles out in the open air and mixing it or turning it periodically.

Anaerobic Digestion: The decomposition of organic matter by bacteria in an oxygen-free environment, resulting in partial gasification, liquefaction, and mineralization of nutrients.

Bio-refining:[58] A process that converts plant biomass into products that can be used as transportation fuels (such as ethanol), food ingredients, pharmaceuticals, industrial fibers, or feedstocks for the production of chemicals. Bio-Refining involves the use of acidic or enzymatic hydrolysis to break down large organic molecules, as well as distillation and fermentation processes.

Extended Producer Responsibility (EPR):[59] An environmental policy approach in which a producer's responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life cycle.

Incineration: A treatment technology involving destruction of waste by controlled burning at high temperatures.

Recycling: Minimizing waste generation by recovering and *reprocessing* usable materials that might otherwise become waste (.i.e. recycling of aluminum cans, paper, and bottles, etc.).

Refuse Derived Fuel:[60] Fuel produced from domestic refuse, after glass and metals have been removed from it, by compressing it to form briquettes used to fuel boilers.

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[57] Definitions taken or adapted from the U.S. EPA's Terms of Environment: Glossary, Abbreviations and Acronyms, http://www.epa.gov/OCEPAterms/, unless otherwise noted.
[58] R.W. Beck, 2006, "Revised Draft Technical Memorandum," prepared for Hawai'i County Department of Environmental Management, 10 April 2006.
[59] Organization for Economic Cooperation and Development, 2001, "Extended Producer Responsibility: A Guidance Manual for Governments," Paris: OECD Publication Service, at 18.
[60] U.S. EPA, Terminology Reference System, http://iaspub.epa.gov/trs/search$.startup.

Reuse: Using a product or component of municipal solid waste in its original form more than once; e.g., refilling a glass bottle that has been returned or using a coffee can to hold nuts and bolts.

Thermal Gasification: Conversion of solid material (in this case the mixed materials contained in solid waste) into a gas under high heat for use as a fuel.

Waste Diversion: The diversion of materials from traditional disposal such as landfilling or incineration to be recycled, composted, or re-used.

Waste Reduction: Using *source reduction* to prevent or reduce waste generation (may in some cases also include reuse and recycling).

DEM: Department of Environmental Management (Hawai'i County)
DOH: Department of Health (State of Hawai'i)
C&D: Construction and Demolition
EHRSS EIS: East Hawai'i Regional Sort Station Environmental Impact Statement
EPA: Environmental Protection Agency (United States)
EPR: Extended Producer Responsibility
HHW: Household Hazardous Waste
MRF: Materials Recovery Facility
MSW: Municipal Solid Waste
RFP: Request for Proposals
RDF: Refuse Derived Fuel
SWAC: Solid Waste Advisory Committee
tpd: tons per day
UISWMP: Updated Integrated Solid Waste Management Plan

Appendix A: List of Residential Transfer Stations and Recycling Options

Site Characteristics for Existing Transfer Stations (FY2006)

Transfer Station Name	District	Approx. Population Served[2]	Parcel Size (Acres)	Number of Chutes	'04/'05 Tonnage (Tons/Day)	Distance to Puuanahulu	Distance to Hilo Landfill	Tax Map Key	Gated Hours of Operation	glass	aluminum	plastic	paper	newspaper	cardboard	scrap metal	greenwaste	redemption centers
East Hawaii																		
Keaau	Puna	11,700	19.54	2	18.92	83.1	9	1-6-03:065	6:30am - 6:30 pm	B	x	x	x	x	x	x	x	x
Pahoa	Puna	9,400	3.77	2	16.31	94.4	20	1-5-08:007		B	x	x	x	x	x			x[1]
Kalapana	Puna	1,200	13.20	1	3.46	105.4	31	1-2-07:004										
Volcano	Puna	2,000	2.19	1	4.88	103.2	21	1-9-01:002		1								
Glenwood	Puna	**4300	1.97	1	8.63	96.1	30	1-8-08:023		1								
Hilo	S. Hilo	42,000	72.70	4	37.70	77.5	2	2-1-13:150	6:30am - 5:00pm	B	x	x	x	x	x	x	x	x
Honomu	S. Hilo	3,400	0.84	1	5.03	63.7	21	2-8-15:023		1								
Papaikou	S. Hilo	5,800	0.57	1	10.23	69.6	15	2-7-28:052	6:30am - 6:30pm	1				x				
Laupahoehoe*	N. Hilo	1,700	1.02	1	3.32	50.9	35	3-5-04:084		1	x	x	x	x	x			
Paauilo*	Hamakua	1,800	0.85	1	4.93	40.3	42	4-3-04:017										
Honokaa*	Hamakua	5,100	0.73	1	10.18	34.1	49	4-5-10:021	6:30am - 6:30 pm	2	x	x	x	x	x			x[1]
Pahala*	Ka'u	1,700	0.75	1	3.84	90.6	51	9-6-05:051		1	x	x	x	x	x			
West Hawaii																		
Kohala/Hawi	N. Kohala	6,000	17.28	1	13.20	34		5-5-02:032		B	x	x	x	x	x			x[1]
Puako	S. Kohala	5,600	8.90	1	6.74	7		6-6-02:039	6:30am - 6:30 pm	1	x	x	x	x	x			x[1]
Waimea	S. Kohala	11,700	0.31	2	20.19	19		6-6-01:050	6:30am - 6:30 pm	4	x	x	x	x	x			x
Kailua	N. Kona	21,000	30.32	3	27.63	22		7-4-20:016	6:30am - 6:30 pm	O	x	x	x	x	x	x	x	x
Keauhou	N. Kona	8,500	5.47	2	14.91	32		7-9-17:009	6:30am - 6:30 pm	2	x	x	x	x	x			x[1]
Ke'ei	S. Kona	5,600	11.60	1	8.47	44		8-3-04:011										
Waiea	S. Kona	3,300	2.28	1	9.47	46		8-6-08:011										
Milolii	S. Kona	700	0.17	1	0.44	65		8-9-04:007										
Waiohinu*	Ka'u	3,000	31.65	1	8.69	78	63	9-5-05:001		1	x	x	x	x	x			x[1]

B = 20' Blue roll-off bin with side holes
1,2,3, 4 = Number of 3 cubic yd bins
O = Open top 20' roll-off bin

* Loads from these stations are hauled to West Hawai`i landfill (Pu`uanahulu)
** Previous estimates higher than current estimates
[1] Weekend Redemption Centers
Highlight indicates services that will be in place by the end of FY 2005-06

C:\Documents and Settings\VVICTORINE\Local Settings\Temporary Internet Files\OLK2B\Site Characteristics for Transfer Stations 2006.xls

Updated 12/06/2005
by RS1

Appendix B: Tons of Waste Landfilled and Recycled in FY 03–04 and FY 04–05

SOLID WASTE DISPOSAL SUMMARY (YEAR-TO-YEAR COMPARISON)

FY03-04 and FY04-05

WITH DIVERSION PROGRAM REDEMPTIONS SEGREGATED INTO COMMODITIES

		FY 03-04		FY 04-05	
DESCRIPTION		**Volume (tons)**	**Cost**	**Volume (tons)**	**Cost**
LANDFILL					
1)	Commercial	119,386.90	See Tip Fee Sheet for est. per ton Operations costs.	137,905.39	See Tip Fee Sheet for est. per ton Operations costs.
2)	County SWD (transfer stations)	82,419.48		87,361.28	
	TOTAL LANDFILL	**201,806.38**		**225,266.67**	
RECYCLING					
1)	Greenwaste	17,669.43	$611,007.05	34,217.17	$1,251,581.85
2)	Metal/Automobiles *****	13,715.38	$1,164,962.81	11,765.01	$1,052,249.55
3)	Tires	-	$-	168.34	$40,401.60
4)	Paper	3,849.23	$158,050.71	6,230.02	$264,046.95
5)	Plastics (#1 & #2) *****	22.00	$4,400.00	196.41	$38,233.29
6)	Cooking Oil	247.48	$9,899.22	247.09	$14,825.58
7)	Glass* & *****	1,572.90	$318,048.94	2,840.48	$269,501.10
8)	Recycling Education & Outreach	N/A	$92,000.00	N/A	$122,273.00
9)	Mixed Recyclables	N/A	N/A	369.50	$44,340.00
10)	Transfer Station Recyclables Collection Svcs. ****	N/A	N/A	N/A	N/A
11)	Special Diversion Programs				
	a) Reuse Exchange/Recycling Centers	196.23	$18,000.00	170.37	$73,958.74
	b) Household Hazardous Waste	53.23	$140,036.00	86.32	$137,740.00
	c) Used Motor Oil Program**	49.34	$61,205.00	49.81	$67,500.00

	d) E-Waste	N/A	N/A	78.25	$33,000.00
	e) Latex Paint	N/A	N/A	N/A	N/A
TOTAL RECYCLING/DIVERSION		**37,375.22**	**$2,577,609.73**	**56,418.77**	**$3,409,651.66**
TOTAL LANDFILL + RECYCLING/DIVERSION		**239,181.60**	**$2,577,609.73**	**281,685.44**	**$3,409,651.66**
TOTAL BCDP TONNAGE & RECOVERY RATE		**N/A**	**N/A**	**N/A**	**N/A**
COUNTY DIVERSION RATE		**15.6%**		**20.0%**	
RECYCLING/DIVERSION COST PER TON		**$68.97**		**$60.43**	
*	State funded program managed by the County. Annual budget is $223,500 (FY05-06).				
**	State funded program managed by Recycle Hawai'i. Annual budget is $55,000 (FY05-06).				
***	Mixed Recyclables Collections may include plastics #1 & #2, misc. ferrous & non-ferrous metals, all paper fibers and etc. @ CoH SWD Facilities				
*****	Includes BCDP Redemptions by commodity & funds expended				

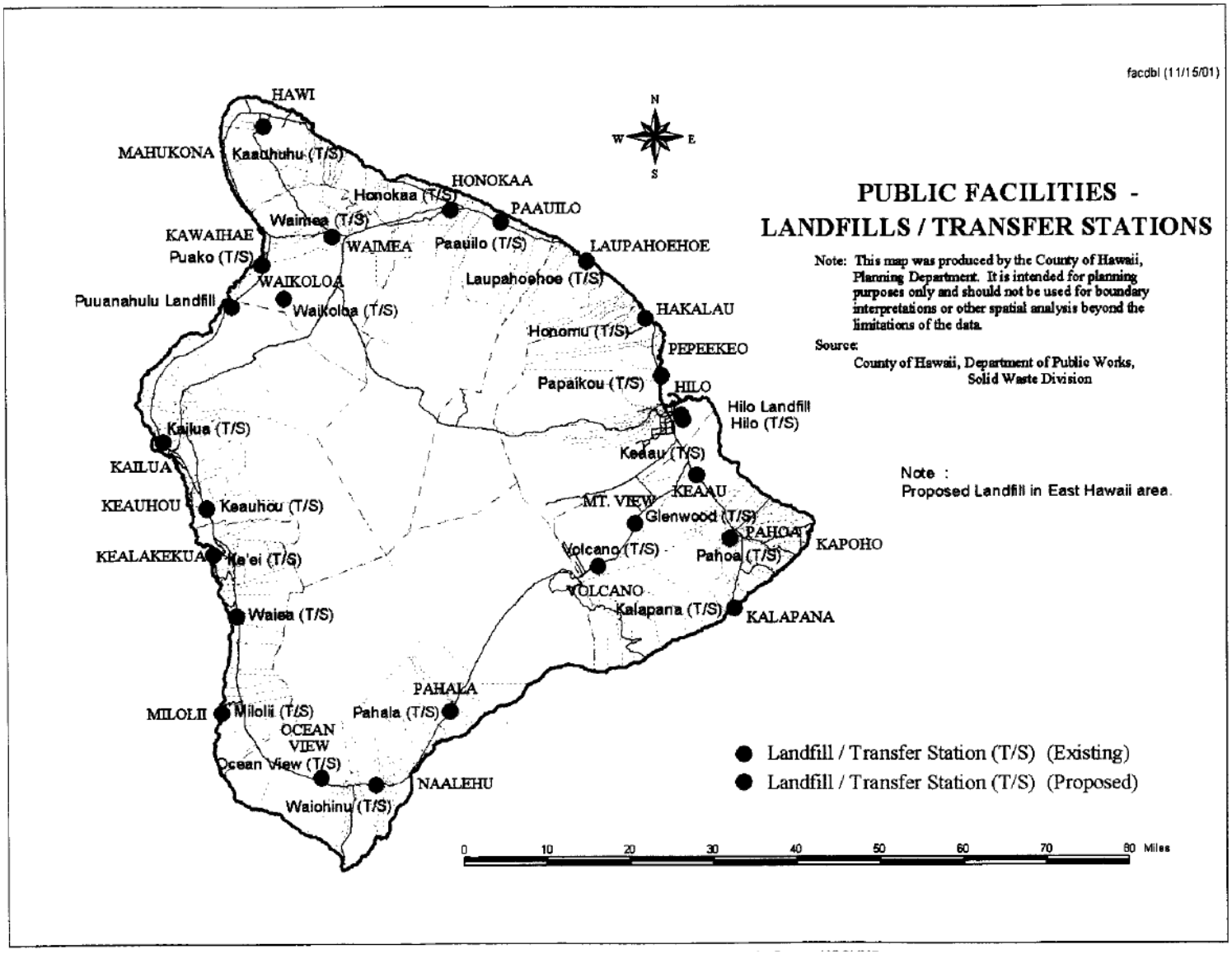
Appendix C: List of Commodities Recycled and End Use Markets

Commodity	Destination	End Use Markets:
Glass	On-Island	Crushed and used as construction fill, landscaping and some very small art/craft uses. On-Island Brewery reuses its bottles, but this is a very small percentage of overall glass recycling.
Greenwaste	On-Island	Mulch for public/private use (currently). Proposed composting facility to combine biosolids, pallets, greenwaste and grease trap waste remnants.
Latex Paint	On-Island	Local reuse/exchange - paint swap, donations to community groups for beautification projects or sale of commingled paint for reuse.
Reuse/Exchange	On-Island	Reuse/Exchange Center for people to bring/take items they want/need. Also regular fundraising auctions of "Still Good Stuff." County does not track commodities reused by private organizations such as the Salvation Army or Goodwill.
Used Motor Oil	On-Island and Off-Island	Recycled and or processed.
Paper Fibers	2.3% On-Island, 97.7% Off-Island	142 tons or 2.3% is shredded for agricultural packing. Remainder of mixed paper goes to West Coast US recyclers, and cardboard goes to Asian markets.
Cooking Oil	Off-Island	Biodiesel production within the State of Hawai'i.
E-Waste	Off-Island	West Coast US recycler deconstructs and recycles all materials in EPA compliant manner.
Household Hazardous Waste	Off-Island	Company properly disposes/recycles of hazardous materials.
Metals Scrap & Etc.	Off-Island	Scrap metal from autos, white goods & etc. goes to East Asia markets (China). Recycled food containers & etc. goes to West Coast US sort station for recycling.
Mixed Recyclables	Off-Island	West Coast US sort station.
Plastics	Off-Island	Plastics from categories #1 & #2 collected through the County of Hawai'i programs go to the West Coast US. End market not reported to County analyst.
Tires	Off-Island	Crumbed and sent to West Coast US.

Hawai'i Island currently has just two major companies (one with multiple sister companies) that handle most of the non-greenwaste recycling/diversion on the island. There are about eight other companies/organizations that deal with one or more of the recycled commodities, with most specializing in one commodity.

Source: Christopher Chin Chance, Recycling Analyst, County of Hawai'i, "Re: Question related to fate of recycled materials." Email to the author. 20 April 2006.

Appendix D: Map of Residential Transfer Stations and Landfills



Appendix E: Traffic Impacts Under Three Waste Transportation Scenarios

	SR 19					SR 190		Waikoloa Road	SR 19 (Queen K Hwy)	
	North of Kanoelehua Avenue	North of Hilo	Between Hilo and Honokaa	West of Honokaa	In Waimea	South of Waimea	North of Waikoloa Road	East of Queen Kaahumanu Highway	North of Waikoloa Road	South of Waikoloa Road
Average Daily Traffic Volume	27500	15600	6400	7300	20800	6600	4800	6400	10300	11600
Current Average Daily Truck Volume	1237.5	702	544	620.5	624	462	312	211.2	566.5	928
Non-Truck Traffic	26262.5	14898	5856	6679.5	20176	6138	4488	6188.8	9733.5	10672
Current Percentage Trucks	4.50%	4.50%	8.50%	8.50%	3.00%	7.00%	6.50%	3.30%	5.50%	8.00%
Max Additional Truck Trips	32	32	32	32	32	32	32	32	32	32
# Trucks - No Action (Truck Everything)	1269.5	734	576	652.5	656	494	344	243.2	598.5	960
Percentage of total traffic	0.12%	0.21%	0.50%	0.44%	0.15%	0.48%	0.67%	0.50%	0.31%	0.28%
Change in Trucks (Max)	2.59%	4.56%	5.88%	5.16%	5.13%	6.93%	10.26%	15.15%	5.65%	3.45%
Additional Trips - Incineration	14	14	14	14	14	14	14	14	14	14
# Trucks - Incinerator	1251.5	716	558	634.5	638	476	326	225.2	580.5	942
Percentage of total traffic	0.05%	0.09%	0.22%	0.19%	0.07%	0.21%	0.29%	0.22%	0.14%	0.12%
Change in Trucks (Incin.)	1.13%	1.99%	2.57%	2.26%	2.24%	3.03%	4.49%	6.63%	2.47%	1.49%
Additional Trips - Max Recycling	23	23	23	23	23	23	23	23	23	19
# Trucks - Invest in Recycling	1260.5	725	567	643.5	647	485	335	234.2	589.5	947
Percentage of total traffic	0.08%	0.15%	0.36%	0.31%	0.11%	0.35%	0.48%	0.36%	0.22%	0.16%
Change in Trucks (Recy)	1.86%	3.28%	4.23%	3.71%	3.69%	4.98%	7.37%	10.89%	4.06%	2.01%
Difference between Incin. and Max Recycling (Trucks)	9	9	9	9	9	9	9	9	9	5
Percentage of total traffic	0.03%	0.06%	0.14%	0.12%	0.04%	0.14%	0.19%	0.14%	0.09%	0.04%
Percentage of total trucks	0.72%	1.27%	1.63%	1.43%	1.42%	1.91%	2.80%	4.09%	1.56%	0.54%