



CITY OF KEY WEST, FLORIDA SOLID WASTE MASTER PLAN: ESTABLISHING A PATHWAY TO ZERO WASTE

August 2012

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Solid Waste Master Plan

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Section 1

Executive Summary

The City of Key West (City) retained Kessler Consulting, Inc. (KCI) to assist in developing a Solid Waste Master Plan (Plan). The purpose of the Plan is to analyze the City's existing solid waste system, contracts, and operations; determine the composition of residential and commercial waste delivered to the City's Transfer Station; and evaluate and recommend policies, programs, and facilities to maximize recycling and put the City on a pathway toward Zero Waste. This Plan addresses these items in light of the City's unique geographic location and community dynamics.

In fiscal year (FY) 2011, City residents and businesses generated approximately 59,000 tons of solid waste, yard waste, and recyclables – enough to fill a Conch Tour train stretching the entire length of the Florida Keys. About 80% of these materials flowed through the City's Transfer Station, while the other 20% was handled by two private construction and demolition debris (C&D) facilities. The City recycled about 7% of the materials delivered to the Transfer Station and the private C&D facilities recycled about 23% of the waste they received, for an overall recycling rate of 10%.

In 2008, the Florida Legislature increased the State's recycling goal from 35% to 75% by 2020. In 2010, interim goals also were established: 40% by 2012, 50% by 2014; 60% by 2016; and 70% by 2018. The City also set the bar high by stating one of the objectives of this Plan is to establish a pathway toward Zero Waste. Either goal is a huge leap from the City's current recycling rate of 10%. If the status quo is no longer acceptable, establishing a pathway toward maximizing recycling will require commitment and determination.

1.1 Existing Solid Waste Contracts

One of the first activities was to analyze the City's Collection Agreement and Transport and Disposal Agreement, both of which are with Waste Management, Inc. (WM). Reports regarding these agreements, the services provided, and service fees were provided to the City in July 2011 (Appendix A) and December 2010 (Appendix B).

KCI identified elements of these contracts that warranted change. As stated early on in the planning process, KCI's intent was not only to develop a Solid Waste Master Plan, but also to assist the City in bringing about change during the planning process if feasible. Therefore, meetings and calls with WM were initiated in July 2011 to try to bring about several changes; the primary ones are listed below. No resolution was reached on either item.

- To create a financial incentive for businesses to recycle, adjust commercial recycling collection fees to be equal to or less than commercial garbage collection fees (not including disposal). It should be noted that in the original contract these rates were the same and City staff believes that contractually they are required to be the same.
- Provide a revenue share to the City for its recyclables. Many Florida communities currently receive \$50-\$70 per ton for their inbound recyclable materials (i.e., recyclables as delivered for processing). This revenue generally fluctuates monthly based on market prices.

Revenue received by some jurisdictions has at times exceeded \$80 per ton during the past year. Despite the hauling distance to WM's processing facility, KCI believes the City should be receiving revenue based on an industry-accepted market index.

In addition, during 2009 collection contract negotiations, WM committed to certain changes. Listed below are specific commitments that either have not been met or no measurable results have been achieved in the three years since the contract was extended:

- Mechanisms designed to make recycling more convenient for families and businesses, including increased promotional efforts along with a recycling incentive program.
- Research into the feasibility of a new composting program.
- Creating an e-waste collection program.
- Creating a monthly Household Hazardous Waste (HHW) collection program within the City limits.

During a May 2012 public meeting, KCI presented a summary of preliminary recommendations that would be included in this Plan. After that meeting, the City Utilities Director, Jay Gewin, sent WM a letter requesting cooperation with implementing several of these recommendations, at no additional cost to the City, including those listed below.

- Convert to recycling carts, with the City purchasing the carts.
- Convert to weekly collection of garbage and weekly collection of segregated yard waste.
- Transport and process yard waste, preferably by composting it.

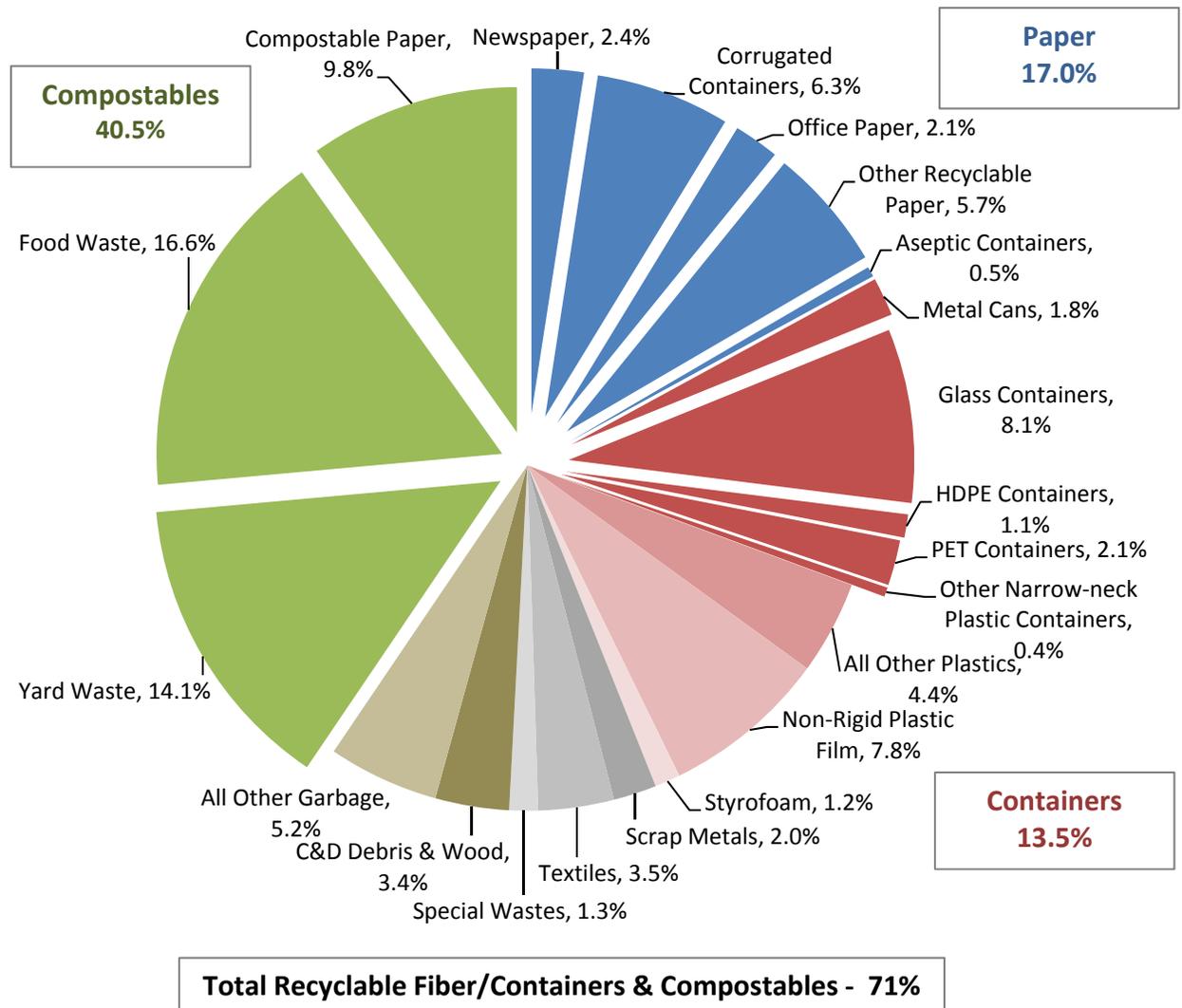
KCI again assisted the City in trying to negotiate these and previous modifications to the City's contracts with WM. While progress was made on certain items, no agreement was reached on the fundamental issue of sharing recycling revenue.

In addition to the items outlined above, this Plan contains numerous recommendations that will require a cooperative partnership between the City and its solid waste contractor. If resolution of these items cannot be reached with WM in short order, including the provision of fair revenue for recyclables, KCI recommends the City initiate a competitive procurement for the services it seeks. The existing contracts allow for termination with 180-day advance notice.

1.2 Waste Composition

Results of the waste composition study demonstrate that substantial quantities of recyclable or compostable materials are available in the City’s waste stream. Figure 1.1 depicts the overall composition of waste delivered by WM to the City’s Transfer Station. Recyclable paper (dark blue) comprises 17% of the waste stream, recyclable containers (dark red) nearly 13.5%, and compostable materials (dark green) another 40.5%. Combined, these recyclable and compostable materials comprise 71% of the waste stream.

Figure 1.1: Composition of Waste Disposed at City’s Transfer Station (% by weight)



1.3 Policy Recommendations

The first step in bringing about change is to establish a set of policies, which will lay the foundation for the future of the City’s solid waste management system. Policies provide the guiding principles by which City staff will develop solid waste programs and manage solid waste operations and contracts. Provided below is a set of policies that support and complement the program and facility recommendations included in this Plan. Further discussion of these policies is provided in Section 4. KCI recommends the City Commission immediately adopt, through resolution, the policies below to give City staff direction for moving forward.

Recommended Solid Waste Policy Statement

To develop an environmentally and economically sustainable solid waste management system that maximizes waste diversion and minimizes waste disposal, the City Commission of Key West hereby adopts the following policies and directs staff to implement these policies:



1. Hire a full-time Recycling Program Manager to provide the technical, educational, and oversight support necessary to implement effective recycling programs.
2. Adopt a tiered recycling goal starting at 25%, followed by 40%, and then 75%.
3. Establish a program to collect and process yard waste separate from other solid waste.
4. Receive compensation for City recyclables that are resources having value.
5. Become a Green City through programs that lead by example, including waste reduction, reuse, recycling, and environmentally preferable procurement (EPP) programs.
6. Establish public-private partnerships with companies that will help carry out these policies.
7. Provide periodic updates to City Commissioners and the public regarding the status of activities and accomplishments toward meeting these policies.

1.4 Program Recommendations

Programs are the systems by which recyclable and compostable materials are diverted for recovery instead of disposal. Program recommendations are organized by the following sectors: residential, commercial, special events, public areas, household hazardous waste, and construction and demolition debris. Residential and commercial program initiatives are organized in phases that align with the three-phase recycling goal. The Phase 2 and 3 initiatives may need to be implemented over time to achieve higher recycling rates. Details are provided in Section 5.

PROGRAMS		
	RESIDENTIAL	COMMERCIAL
PHASE 1	<ol style="list-style-type: none"> Carted collection of recyclables – convert to carted curbside collection of recyclables; add materials to the program, such as rigid mixed plastics. Separate yard waste collection; weekly collection of garbage (1-1-1) – implement separate yard waste collection in place of one of the garbage collection days each week (i.e., 1-1-1 collection in which garbage, yard waste, and recyclables are each collected once per week separate from each other). Multi-family recycling – implement a comprehensive multi-family recycling program; residents pay for this service, which they should be receiving. Comprehensive public outreach – implement a strategic, comprehensive public outreach program. 	<ol style="list-style-type: none"> Lower cost recycling service – set commercial recycling collection fees that are equal to or less than waste fees (collection only, not including disposal). Expanded recycling service – require collection of full range of recyclables, commingled fibers and containers (i.e., single stream). Monitor commercial recycling – require contractor to provide monthly reports. Green City Program – lead by example by ensuring all City facilities and public schools have effective waste reduction, reuse, recycling and EPP programs. Business outreach – implement an outreach program to businesses. City Ordinance – amend to require new developments to provide for recycling as required by State law. Local use of glass – continue to investigate opportunities to utilize source-separated commercial glass in the Lower Keys.
PHASE 2	<ol style="list-style-type: none"> Pilot source separated, curbside organics composting program – once a viable composting infrastructure is established, pilot the collection and processing of other compostables (i.e., food waste and non-recyclable paper) along with yard waste. This has the potential to divert up to another 17% of residential waste from disposal. Incentive program – revisit Pay-As-You-Throw or other incentive program if desired recycling rates are not achieved. 	<ol style="list-style-type: none"> Toolkit and education – develop materials to assist businesses with establishing waste diversion programs. Technical assistance – provide hands-on assistance to businesses. Incentive program – promote the Green Business Partnership program. Business group networking – partner with business groups to encourage recycling. Organics program – establish a commercial organics program.

RESIDENTIAL		COMMERCIAL	
PHASE 3	<ol style="list-style-type: none"> Enforcement of mandatory recycling – if other efforts have not sufficiently increased residential waste diversion, consider enforcing mandatory residential recycling program. Monitor innovative diversion opportunities, such as mixed waste or wet/dry processing – if such a facility is established in Southeast Florida, evaluate feasibility of delivering City waste; this option does not need to wait until Phase 3. 	<ol style="list-style-type: none"> Mandatory commercial recycling – if other efforts have not sufficiently increased commercial recycling waste diversion, consider establishing a mandatory program. Monitor innovative diversion opportunities, such as mixed waste or wet/dry processing – see residential recommendation. 	
SPECIAL EVENTS			
<ol style="list-style-type: none"> Amend City Ordinance – to require special events to establish recycling programs; consider a tiered security deposit with a higher deposit for larger events. Special Event Recycling Guide – utilize revised guide with checklist and reporting forms. Website improvements – revise special event website to be consistent with permit application and to prominently display a link to the Special Event Recycling Guide or a dedicated Special Events Recycling Program webpage. Program branding – use a consistent program logo and slogan to brand the recycling program. Monitoring and reporting – track the recycling achieved at special events to evaluate the success of the program and to better assist event organizers in the future. Technical assistance – provide direct technical assistance to event recycling coordinators or conduct workshops to provide event organizers with useful tools. Work with service providers – work with the service providers to ensure that sufficient service and appropriately labeled recycling containers are provided. Turn-key containers, signage, and collection service – develop a turn-key system where event organizers can obtain containers, signage, and collection service from one source, possibly the City or a City contractor. Volunteer network – enlist volunteers willing to assist with recycling at a variety of special events. Fantasy Fest – continue to work with Market Share Company and other Fantasy Fest event organizers to implement the specific recommendations outlined for the Duval Street Fair and Parade and other Fantasy Fest events. 			

PUBLIC AREAS

1. **Clear and branded labeling** – improve labels on the recycling cans to ensure they clearly state and depict the types of recyclables that can be placed in the can.
2. **Additional recycling cans** – place recycling cans adjacent to additional trash cans in the most highly trafficked parts of the City.
3. **Program promotion** – partner with the City Parks Department and local sports leagues to promote recycling.
4. **Monitor contamination** – work with the collection service provider and City staff to identify areas with the highest contamination and determine what additional steps, e.g., education, signage, labels, etc., could help reduce this contamination.
5. **Lower City costs** – include servicing these public containers as a no-cost service in future contracts.

HOUSEHOLD HAZARDOUS WASTE (HHW) AND ELECTRONICS (E-WASTE)

1. **Regular HHW/E-waste collection events** – within 60 days, collection contractor should begin providing monthly drop-off events at an accessible location; City should monitor events and adjust frequency if warranted.
2. **Public Outreach** – advertise events through multiple media, including newspaper, radio PSAs, and the City’s website; network with homeowner associations and organizations such as GLEE to advertise the events.

CONSTRUCTION AND DEMOLITION DEBRIS (C&D)

1. **Encourage recycling by private C&D firms** – initiate a dialogue with the two private C&D companies to identify potential opportunities to increase their recycling efforts.
2. **Enforce anti-scavenging ordinance** – enforce existing anti-scavenging ordinance to increase the flow of scrap metals through permitted facilities, which not only supports these local businesses, but also enables these materials to be counted as part of the City’s recycling rate.

1.5 Facility Recommendations

Facilities provide the infrastructure for the solid waste system. Recommendations are provided for operational improvements at the City-owned Transfer Station. In addition, the Plan addresses establishing an organics recovery program and the feasibility of developing an organics processing facility in the Lower Keys. Further details are provided in Section 6.

FACILITIES	
TRANSFER STATION	
<ol style="list-style-type: none"> 1. Overhead door – investigate procuring overhead door maintenance services; investigate alternatives to these slow and maintenance-prone doors. 2. Loader – equip main loader with a waste handler bucket to enhance speed and efficiency of loading; equip spare loader with a grapple if needed to handle bulky materials. 3. Material inventory management on Transfer Station floor – implement a managed inventory process; improve tractor-trailer loading time; discuss with WM plans to improve transfer services by providing sufficient trailers, equipment, and personnel at all times. 4. CFC-containing devices – review handling processes for CFC-containing devices; develop written handling procedures and train Transfer Station staff on proper management; require WM to mark all devices once CFCs have been removed. 5. General operational and safety recommendations – assign spotter responsibilities to loader operator; establish tipping floor safety policies; require personal protective equipment while on tipping floor; implement formal traffic control procedures; implement lock-out/tag-out procedures for equipment; prohibit City/contractor staff from sitting in/on the trailers during loading; explore safer option to allowing self-haul customers on the tipping floor. 6. Scale system – consider limiting payments to credit cards or established credit accounts to reduce potential liability of handling cash/checks; more fully utilize the capabilities of WasteWorks, the scale house software; consider an unattended scale house system. 7. Staffing and operating hours – consider altering operating hours and staffing to save money on personnel costs. 	
ORGANICS FACILITY	
<ol style="list-style-type: none"> 1. Utilize with existing yard waste processing facility – to initiate separate yard waste collection as quickly as possible, transfer yard waste to an existing processing facility. 2. Conduct a competitive procurement for organics processing – to allow private sector vendors to offer potential organics composting solutions; include co-composting of yard waste, food waste and biosolids. 3. Explore opportunities to work with the County – continue to monitor the County’s progress in establishing composting facilities and explore opportunities to partner depending on location, timing, and cost. 4. Continue to encourage backyard composting – encourage and educate residents about backyard composting. 	

1.6 Funding Recommendations

The overall financial impact of increasing waste diversion should be positive to the City and its residents and businesses. However, the City's existing disposal-based revenue model for its solid waste system is not sustainable as the City strives to maximize waste diversion. The City funds many non-disposal costs (e.g., administrative expenses and the transfer of funds to the General Fund) through its tipping fees at the Transfer Station. As less waste is disposed, tipping fee revenue and disposal costs will decrease, but these other fixed costs will not. Therefore, the following recommendations are offered to establish a more sustainable solid waste business model. Additional details are provided in Section 7.

FUNDING

1. **Recycling revenue** – The City should be receiving revenue for its recyclables. Many Florida communities currently receive \$50-\$70 per ton for their recyclables. A number of these jurisdictions, including Broward, Polk, and Seminole counties and the cities of Lakeland and Sarasota, contract with WM. According to WM, it costs approximately \$40 per ton to transport recyclables to its processing facility in Broward County. Even deducting that full amount from the revenue received in many other Florida jurisdictions, the City reasonably should expect to receive \$20-\$30 per ton for its recyclables in today's commodity marketplace.
2. **Alternative revenue source** – The City should develop a revenue source that does not rely predominantly on disposal. For example, the City could adjust its tipping fee to cover only those costs directly related to disposal (e.g., transport and disposal contractor fees, transfer station operating costs to manage garbage, and renewal and replacement costs). A separate solid waste management fee could equitably be distributed among customers to cover other system costs not directly related to disposal or not covered by collection service fees (e.g., administrative expenses, transfer of funds to the General Fund, transfer station operation costs to manage recyclables, and landfill post-closure costs). This would more closely align fees with the services provided and would ensure the City generates sufficient revenue to cover fixed system costs.

1.7 Waste Diversion Targets

This Plan outlines policies, programs and facilities intended to help the City substantially increase waste diversion and its recycling rate. Because of the large gap between the City’s existing recycling rate of 10% and its intended goals, a three-tiered recycling goal is recommended. It will provide milestones by which the City can measure its progress.

- Phase 1 (25% Goal), which KCI recommends initiating immediately, focuses on basic changes to the residential program, voluntary actions, and education.
- Phase 2 (40% Goal) will place greater emphasis on commercial program improvements, technical assistance to businesses, and expanding organics recovery.
- Phase 3 (75% Goal) will require capturing the vast majority of recyclables and organics in the waste stream. Accomplishing this likely will require some form of mixed waste or wet/dry processing system or enforcing recycling mandates.

Table 1.1 matches the three-phase recycling goal with a suggested timeline and target recycling rate increases that will be necessary to achieve each phase of the goal. In addition to the residential and commercial program initiatives included in the table, the other policy, program, and facility recommendations outlined in this report and summarized in this section will also play a role if these goals are to be achieved.

Table 1.1: Phased Program Initiatives and Target Increases in Recycling Rate

Program Recommendations	Residential	Commercial
 Phase 1 (1-2 yrs) 25%	<ul style="list-style-type: none"> • Recycling carts • Yard waste; 1-1-1 • Multi-family • Outreach & education 11%	<ul style="list-style-type: none"> • Recycling collection \$ = SW collection \$ • All recyclables • Green the City • Outreach 4%
 Phase 2 (3-5 yrs) 40%	<ul style="list-style-type: none"> • Organics • Pay-As-You-Throw/ incentive program 6%	<ul style="list-style-type: none"> • Toolkit & education • Technical assistance • Incentive program • Organics 9%
 Phase 3 (5-10 yrs) 75%	<ul style="list-style-type: none"> • Mixed waste processing • Enforcement 13%	<ul style="list-style-type: none"> • Mixed waste processing • Mandates & enforcement 22%

The City will not appreciably increase its recycling rate by continuing with the status quo and existing staffing levels. Change will be needed and a first step toward making that change is implementing the policies and Phase 1 recommendations outlined in this Plan.

Section 2

Introduction

2.1 Purpose

The City of Key West (City) retained Kessler Consulting, Inc. (KCI) to assist in developing a Solid Waste Master Plan (Plan) that meets the following requirements:

- Analyzes the City’s existing solid waste system, contracts, and operations;
- Evaluates the quantities of waste generated by residents and businesses;
- Determines the composition of the City’s solid waste stream;
- Evaluates and provides recommendations regarding policies and programs to maximize recycling;
- Establishes a pathway toward Zero Waste; and
- Incorporates the City’s unique community dynamics.

Key West is one of the most unique cities in the United States. With a resident population of approximately 24,649,¹ it is home to about one-third of Monroe County’s residents. Tourism adds at least 1 million overnight visitors and another 1 million day trippers and cruise ship passengers annually.² The City occupies an island, approximately 2 miles by 4 miles in size, located at the southernmost end of U.S. Highway 1, about 130 miles from the mainland, which adds to the challenges of managing solid waste.

In fiscal year (FY) 2011, City residents and businesses generated approximately 59,000 tons of solid waste, yard waste, and recyclables – enough to fill a Conch Tour train stretching the entire length of the Florida Keys. About 80% of these materials flowed through the City’s Transfer Station, while the other 20% was handled by two private construction and demolition (C&D) facilities. The City recycled about 7% of the materials delivered to the Transfer Station and the private C&D facilities recycled about 23% of the waste they received, for an overall recycling rate of 10%.

Disposal of waste, rather than the beneficial reuse of these materials, carries a significant cost to the economy and the environment, and represents lost opportunity.

- **Environmental opportunities:** Recycling rather than disposing of waste materials conserves natural resources, reduces the amount of energy and water used to manufacture new products, and creates less greenhouse gas (GHG) emissions. Recycling of paper, glass, aluminum and steel cans, plastic bottles, and other conventionally recovered materials consumes less energy and imposes lower environmental burdens than disposal of these materials via landfilling or incineration, even after accounting for energy that may be

¹ University of Florida Bureau of Economic and Business Research, *Florida Statistical Abstract 2011*.

² Monroe County Tourist Development Council: Smith Travel Research.

recovered at either type of disposal facility and the environmental impacts of collecting and processing these recyclables.³

- **Economic opportunities:** Recycling recovers marketable commodities from the waste stream that would otherwise be lost if disposed. Table 2.1 presents the value of various recovered commodities as of May 2012 according to an industry-accepted index. Market values fluctuate over time, but industry experts believe markets will remain strong in the near future. Based on the make-up of a typical load of residential recyclables, the overall market value of this material currently is approximately \$130-\$150 per ton. The City does not receive revenue for its recyclables, but numerous Florida communities currently earn \$50-\$70 of revenue per ton of recyclables. Recycling also creates more jobs—at higher income levels—than landfilling or incineration of waste. Employment per ton of material recycled has been reported to be almost ten times greater than employment per ton of material disposed.⁴

For the City, the economic benefit of recycling is at least \$70 per ton (the approximate fee paid for waste transport and disposal). If the City received even \$20-\$30 per ton in revenue for its recyclables (using a lower estimate than what many other communities receive because of the hauling distance to processing), the swing between recycling and disposing of waste would be a \$90-\$100 per ton financial benefit to the City.

Table 2.1: Market Value of Recovered Commodities, May 2012

Material	Index Grade	Market Index (\$/ton) *
Newspaper	PS8 - Special De-ink Quality News	\$95.00
Corrugated cardboard	PS11 - Corrugated Containers	\$145.00
Mixed paper	PS1 - Soft Mixed Paper	\$97.50
Aluminum cans	Aluminum Cans (sorted, baled, delivered)	\$1,510.00
Steel cans	Steel Cans (sorted, densified, delivered)	\$82.50
PET	Plastics PET (baled, picked up)	\$590.00
Natural HDPE	Plastics Natural HDPE (baled, picked up)	\$736.00
Colored HDPE	Plastics Colored HDPE (baled, picked up)	\$610.00
Plastics #3-7**	45% of Plastics Comingled 1-7 (baled, picked up)	\$81.00
Glass	3 Mix (\$/ton delivered)	\$0.00

* Market values are based on the first published prices in May 2012 for the Southeast USA (regional average) on the Waste & Recycling News' Secondary Fiber Pricing and Secondary Material Pricing website.

** The index used for plastics #3-#7 is 45% of index for Plastics Comingled 1-7. This is based on comparative information provided by staff at Secondary Materials Pricing.

³ Morris, Jeffrey, *Comparative LCA for Curbside Recycling Versus Either Landfilling or Incineration with Energy Recovery*, 2004.

⁴ Cascadia Consulting Group, *Recycling and Economic Development: A Review of Existing Literature on Job Creation, Capital Investment, and Tax Revenues*, April 2009.

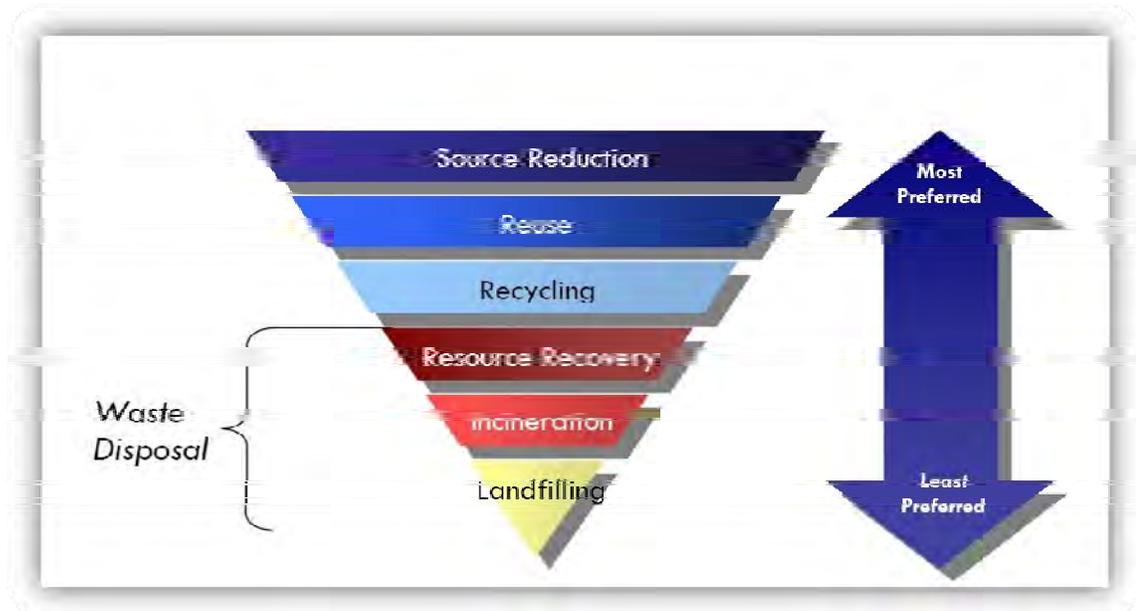
2.2 75% State Recycling Goal and Zero Waste

In 2008, the Florida Legislature set a new goal of recycling 75% of the waste stream by 2020. In 2010, interim goals also were established: 40% by 2012, 50% by 2014; 60% by 2016; and 70% by 2018.

The City set the bar even higher by stating one of the objectives of this Plan is to establish a pathway toward Zero Waste. According to the Zero Waste International Alliance, approximately 20 U.S. communities have established a Zero Waste goal.⁵

“Zero Waste” requires a fundamental change in how we perceive solid waste. It requires rethinking what we have traditionally regarded as garbage and treating all materials as valued resources instead of items to discard. Zero Waste entails shifting consumption patterns, more carefully managing purchases, and maximizing the reuse and recycling of materials at the end of their useful life. It means preventing rather than managing waste and pollution, and recommitting to the priority order of the waste management hierarchy (Figure 2.1): (1) reduce consumption, (2) reuse what is left, (3) recycle anything that is no longer usable, and (4) dispose of any residuals.

Figure 2.1: Waste Management Hierarchy



Either goal is a huge leap for the City, which currently has a recycling rate of 10% (including C&D managed by two private facilities). Establishing a pathway toward 75% recycling or Zero Waste will require commitment and determination.

This Plan focuses less on the goal and more on the route – the incremental steps – to get there. To help bridge the gap between current recycling activities and these goals, many of the recommendations provided in this Plan are structured in phases. The City and its decision-makers will need to decide whether the status quo is acceptable or make the commitment required to start bringing about change.

⁵ http://zwia.org/joomla/index.php?option=com_content&view=article&id=14&Itemid=10.

2.3 Planning Process

During the planning process, KCI and City staff sought stakeholder input through three public meetings, individual meetings with the Mayor and City Commissioners, and meetings with other stakeholders including the Chamber of Commerce, the City's Sustainability Advisory Board, Waste Management, Florida Keys Green Living and Energy Education (GLEE), Monroe County, and interested citizens. Participation in the public meetings demonstrated a high level of public interest in improving the City's recycling and waste diversion programs. Feedback received during these and other meetings was invaluable and was incorporated into this final Plan.

The first steps in the planning process were to analyze the City's existing solid waste system, contract, service fees, and operations and to evaluate the quantities and flow of waste generated by residents and businesses. In addition, a two-season waste composition study was conducted to determine the composition of the City's solid waste stream and to identify types and quantities of materials that could potentially be diverted from disposal.

This work resulted in several written reports to the City, as well as providing contract negotiation assistance. The latter included providing technical assistance to the City in bringing closure to a request from Waste Management, Inc. (WM) to increase the transport and disposal fee, to account for increased fuel costs, paid by the City to the Contractor. KCI recommended the contract be amended to include a quarterly fuel adjustment, based on a published fuel index, to avoid such requests in the future.

As stated early on in the planning process, KCI's intent was not only to develop a Solid Waste Master Plan, but also to assist the City in bringing about change during the process if feasible. KCI identified a number of modifications that appeared feasible in the short-term. Meetings and calls were held with WM to try to bring about several of these changes, including the following:

- Adjusting commercial recycling collection fees to be equal to or less than commercial garbage collection fees (not including disposal).
- Providing a revenue share to the City for recyclables.
- Initiating regular collections of household hazardous waste, which is required by the existing contract.

As of the writing of this plan, no change has resulted on any of these items.

Subsequent to the May 2012 public meeting, the City Utilities Director sent WM a letter requesting cooperation in converting to recycling carts, changing to weekly collection of garbage and weekly collection of yard waste, and transport and composting of yard waste. KCI again assisted the City in trying to negotiate these and the aforementioned items with WM. While progress was made on certain items, no agreement was reached on the fundamental issue of sharing recycling revenue.

2.4 Plan Structure

The Solid Waste Master Plan includes this document and 12 technical appendices, including reports submitted to the City during the course of the planning process. It provides an overview of the existing solid waste system and waste stream; recommends policies, programs, and facilities intended to substantially increase waste diversion; and discusses the potential need to alter the City's current disposal-based funding model.

This Plan is organized as follows:

- The Executive Summary compiles the key waste diversion recommendations outlined throughout the Plan.
- This section, Section 2, provides an introduction to the Plan, including the purpose of the Plan, discussion of Zero Waste and the State recycling goal, and an overview of the planning process.
- Section 3 provides an overview of the existing solid waste management system, references various reports previously submitted to the City, and summarizes results of a two-season waste composition study. It summarizes “what is.”
- Section 4 outlines a set of policy recommendations that will lay the foundation for substantially increasing waste diversion and for making other enhancements to the City’s solid waste management system. These policies will provide the guiding principles by which City staff will develop solid waste programs and manage solid waste operations and contracts.
- Section 5 discusses programmatic initiatives. It identifies the opportunities and potential for waste diversion, discusses programs that have helped increase waste diversion in other locations, and addresses the applicability to the City. It is organized based on sources or types of waste generation, including residential, commercial, special events, public areas, household hazardous waste, and construction and demolition debris.
- Section 6 evaluates operations at the City’s Transfer Station and also discusses the feasibility of developing an organics processing facility.
- Section 7 addresses the potential financial implications to the City of increased waste diversion, and the potential need to alter the disposal-based revenue model on which the City currently relies.

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Section 3

Current Waste System and Composition

3.1 System Overview

Residential and commercial solid waste and residential recyclable materials are collected by the City's franchise service provider, Waste Management of Florida, Inc. (WM). Non-franchised collection services that are open market to all licensed haulers include construction and demolition (C&D) debris, yard waste, and commercial recyclables.

The City owns and operates a Transfer Station, which is located on Rockland Key at MM 9 on U.S. Highway 1, for receipt of solid waste and recyclables collected by the City's franchisee, as well as any other individuals or private companies wishing to deliver solid waste or recyclables to the facility. Table 3.1 and Figure 3.1 summarize the tons of material delivered to and leaving the facility in FY 2011. Based on outbound tonnages, 7.3% of the materials were recycled.

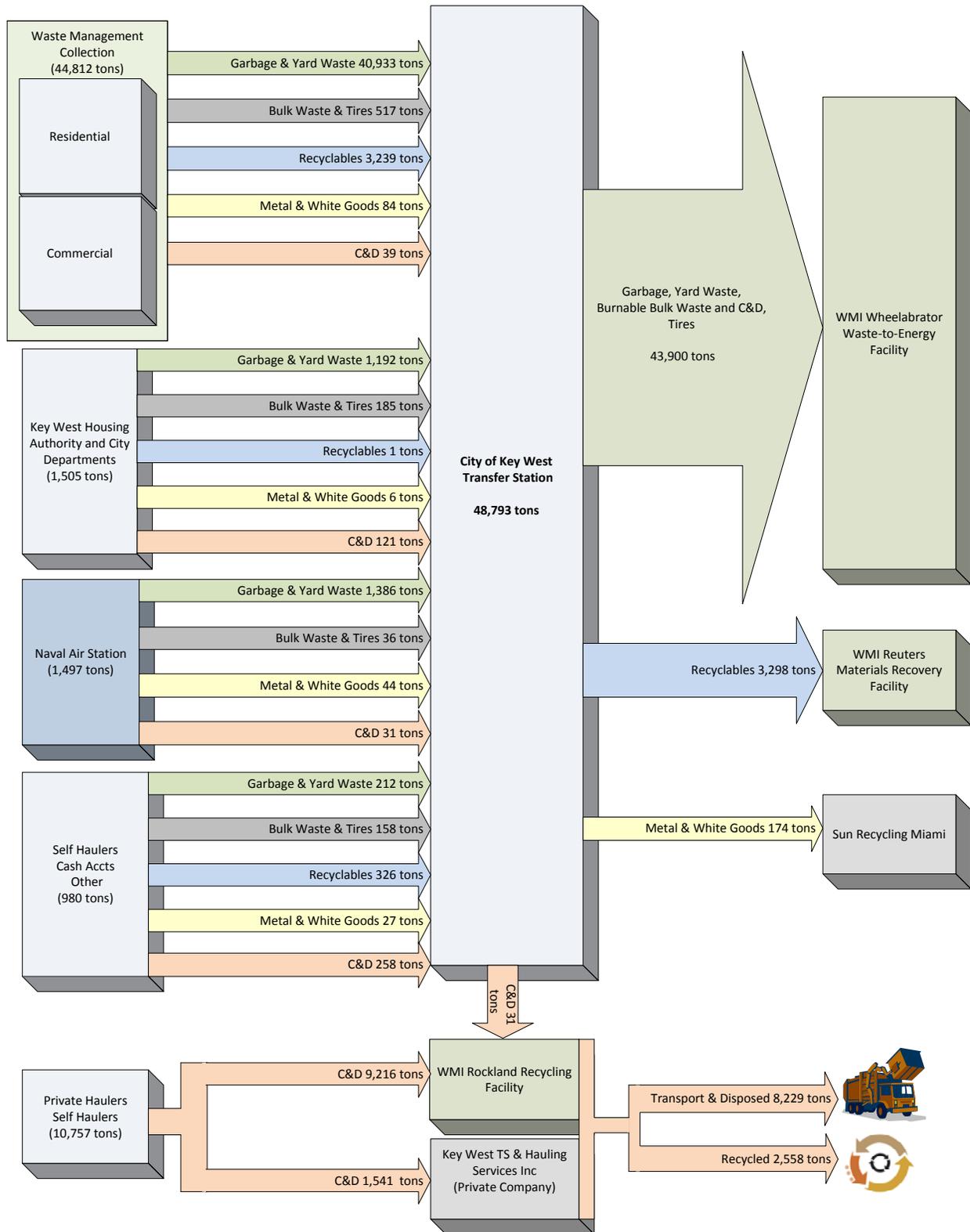
Table 3.1: Transfer Station Inbound and Outbound Materials, FY 2011

Inbound Materials	Tons	% of Total Tons
Trash/Garbage	42,696.79	87.5%
Yard Waste	1,026.44	2.1%
Residential Bulk Waste	815.54	1.7%
C&D Debris	448.04	0.9%
Tires	80.37	0.2%
Total for Disposal	45,067.18	92.4%
Recyclables Delivered by WM	3,239.21	6.6%
Recyclables Delivered by Others	326.71	0.7%
Metals	108.83	0.2%
White Goods	51.20	0.1%
Total for Recycling	3,725.95	7.6%
TOTAL	48,793.13	100.0%

Outbound Materials	Tons	% of Total Tons
To Waste-to-Energy	43,900.60	92.6%
To Landfill	31.18	0.1%
Total Disposed	43,931.78	92.7%
Commingled Recyclables	3,298.31	7.0%
Metals and White Goods	174.33	0.4%
Total Recycled	3,472.64	7.3%
TOTAL	47,404.42	100.0%

Note: Total inbound and outbound tonnages are not equal due to a variety of reasons, including flow lag times and variability in vehicle tare weights.

Figure 3.1: Solid Waste Flow, 2011



Note: 1. Key West City Departments include Parks & Recreation, DOT, and Public Works.
 2. Private facility C&D facility tonnages are based on the assumption that 65% of C&D received by WM and 75% of C&D received by KWTS are generated in the City.
 3. Total inbound and outbound tonnages are not equal due to a variety of reasons, including flow lag times and variability in tare weights.

Pursuant to the Collection Agreement, WM transports, processes, and markets recyclable materials. Currently, WM transports metals and white goods to a recycler in Miami and processes all other recyclables at its Reuters facility in Broward County.

Under a separate Transportation and Disposal (T&D) Agreement with the City, WM transports and disposes of solid waste received at the Transfer Station. Currently, WM disposes of waste that can be incinerated at its Wheelabrator waste-to-energy (WTE) facilities in Broward County; however, the T&D Agreement allows WM to divert waste to alternate facilities for up to two weeks or longer with the City's approval. Solid waste that cannot be incinerated is disposed of in WM's Central Landfill, also located in Broward County.

Two private C&D debris facilities also receive waste generated in the City: WM's Rockland Recycling Center, located on Rockland Key, and Key West Transfer Station & Hauling Services, located on Stock Island. According to WM, an estimated 65% of the C&D debris received at its facility is generated in the City. Repeated attempts were made to obtain a similar estimate from Key West Transfer Station & Hauling Services, but no response was received. Therefore, because of its closer proximity to the City, KCI used a conservative estimate that 75% of waste received at this facility was generated in the City. As noted in Figure 3.1, 24% of the C&D debris managed by these facilities in calendar year (CY) 2011 was recycled. When included in the City's recycling calculations, the City's 2011 recycling rate increases from 7% to 10%.

According to WM personnel, other haulers are collecting commercial cardboard or scavenging residential and commercial recyclables, especially white goods and cardboard. This is not regulated or controlled by the City; therefore, these tonnages could not be quantified.

3.2 Collection

The City entered into an exclusive Collection Agreement with WM for residential and commercial solid waste and residential recycling collection on January 1, 2000. The Agreement does not give WM the exclusive right to collect yard waste, C&D debris, or commercial recyclables, nor does it preclude the U.S. Navy from collecting solid waste on its facilities located within the City.

The City and WM renewed the Agreement in 2005 and again in 2009, each for additional five-year terms. The Agreement expires on December 31, 2014, but also has a clause that allows termination for convenience with a 180-day written notice.

As a condition of the 2009 extension, WM agreed to negotiate with the City on the following concepts if the five-year extension was approved:

- Mechanisms designed to make recycling more convenient for families and businesses, including increased promotional efforts along with a recycling incentive program.
- Improved customer service and response, including a local call center.



- Research into the feasibility of a new composting program.
- The incorporation of Best Management Practices.
- Creating an e-waste collection program.
- Creating a monthly Household Hazardous Waste (HHW) collection program within the City limits.
- Feasibility of incorporating a Pay-As-You-Throw solid waste customer billing system.

An analysis of the Collection Agreement and service fees was submitted to the City in July 2011 and is provided in Appendix A. The report also provided initial recommendations for increasing recycling, which are incorporated into later sections of this document.

3.2.1 Residential Collection

The uniform, or base, level of residential service is twice per week garbage collection, once per week recyclable materials collection, and once per week bulk waste collection. Residents are provided wheeled carts (either 64-gallon or 95-gallon) for garbage collection, but may also place additional bags or cans of garbage or yard waste curbside for collection at no additional charge. The Agreement calls for collection of an unlimited amount of residential solid waste. Collection of bulk waste, such as furniture, white goods (appliances), tires (off the rim), and wood, is included in the uniform service; residents must call in advance for pickup.



Table 3.2 summarizes the monthly fees charged to residents during the last three years.

Table 3.2: Residential Monthly Solid Waste Service Fees, 2010-2012

Service	2010	2011	2012
Recycling	\$2.26	\$2.29	\$2.37
Solid Waste	<u>\$10.12</u>	<u>\$10.24</u>	<u>\$10.60</u>
Collection Fee	\$12.38	\$12.53	\$12.97
Disposal Fee	\$13.46	\$14.07	\$13.63
Total Monthly Fee	\$25.84	\$26.60	\$26.60
Tipping Fee (\$/ton)	\$161.26	\$165.97	\$165.97
Calculated Tons/Unit/Year	1.00	1.02	0.99

Note: For multi-family residences that receive commercial-type service, the City bills them the residential rate per unit and WM bills them any difference in price between the residential rate and the commercial rate for the type of service they receive.

Yard waste is not collected separately, but is commingled with garbage for disposal. The Agreement (Section 4.B.3(ii)) does require WM to develop a procedure for the separation of yard waste if the City begins a composting program. Pursuant to the City's Code of Ordinances (Chapter 58, Article II), residents may set out an unlimited amount of containerized yard waste with their garbage for no additional fee. Residents may also set out non-containerized yard waste on the right-of-way for collection; however, the property owner is responsible for making arrangements directly with WM or a non-franchised hauler for special collection of loose yard waste.

The City currently bills 14,264 residential units (13,121 in the City and 1,143 on the Navy Base) for solid waste and recycling services on their monthly utility bills. The City remits the collection fee to WM and retains the disposal fee. Nonpayment by residents has been an ongoing issue for the City.⁶ To address this issue, the City recently hired a Collections Manager and the City Commission directed staff to develop a non-ad valorem solid waste assessment in lieu of billing residents on monthly utility bills.

The City previously estimated that each residential unit generates 1.21 tons of solid waste annually. As can be seen in Table 3.2, the City has been billing residents for less than that amount of garbage based on the stated tipping fees at the Transfer Station. A decision was made to draw from the City's solid waste reserve fund rather than to increase the disposal fee to residents.

In January 2009, the City began mandating residential recycling. Per ordinance (Article IV, Section 58-83), each owner, occupier, caretaker or tenant of a residential dwelling unit is to separate all designated recyclable materials from other refuse; however, this requirement is not actively enforced.

As part of the Collection Agreement, WM collects residential recyclables curbside once per week. WM provides residents with an 18-gallon bin and collects recyclables in a single stream (i.e., containers and paper may be placed in the same recycling bin). Residents also may use other containers for recycling as long as they weigh less than 50 pounds when full. Recycling stickers to label such containers for recycling are available at City Hall.

WM delivers residential recyclables to the City's Transfer Station where they are loaded by City staff into transfer trailers and transported by WM to its Reuters Materials Recovery Facility (MRF) in Pembroke Pines, Florida for processing and marketing. The Reuters MRF is approximately 162 miles from the City. Pursuant to the Collection Agreement, there is no charge for the transport of recyclables and no revenue share to the City.

3.2.2 Commercial Collection

The Collection Agreement also gives WM the exclusive right to collect commercial solid waste. Commercial collection services vary depending on the needs of each individual business, but collection must be provided at least once per week. Commercial businesses, with the exception of at-home businesses, must demonstrate they subscribe for solid waste collection before they are able to obtain a



⁶ The City pays the collection fee to WM for all 14,264 units regardless of whether or not payment has been made by the resident to the City.

business license (tax receipt) from the City. However, anecdotal information indicates that some businesses utilize public garbage cans, paid for by the City, in lieu of subscribing and paying for solid waste services.

Commercial service fees are based on the size of the collection container and frequency of collection. WM bills commercial customers directly for both collection and disposal. WM retains the collection portion and remits the disposal portion to the City. This disposal portion is based on a waste density of 163 pounds per cubic yard for non-compaction containers and is calculated as noted below. The waste density for compaction containers is assumed to be triple that of non-compaction, or 489 pounds per cubic yard.

$$\text{Disposal Fee} = \text{Container Size (cy)} \times \# \text{ Pick-ups/Month} \times 163 \text{ lbs/cy} \times 1 \text{ ton}/2000 \text{ lbs} \times \$165.97/\text{ton}$$

Unlike residential recycling, the City does not mandate commercial recycling. Per Florida law (Section 403.7046 (3), F.S.), a local government may not give any company the exclusive right to collect commercial recyclables; therefore, commercial recycling is open market. However, the law does not preclude local governments from establishing not-to-exceed fees for collecting commercial recyclables in collection contracts.

The City accepts commercial recyclables at its Transfer Station at no tipping fee and no revenue share. Commercial recyclables are also transported by WM pursuant to the Collection Agreement as noted above.



3.2.3 Public Areas

WM also services garbage and recycling containers located along public sidewalks. WM currently services approximately 350 containers daily at a fee of \$1.21 per container per collection. During periods of peak tourism activity, containers in high traffic areas along Duval Street are serviced twice per day.

City crews service trash and recycling cans at City parks and ball fields, and deposit the materials in roll-off containers that are then serviced by WM.



3.2.4 Household Hazardous Waste and Electronic Waste

Although not a City-operated program, household hazardous waste (HHW) and electronic waste (e-waste) can be taken to locations designated by Monroe County (County), the closest one to the City being the County's Cudjoe Key Transfer Station at MM 21.5. Batteries, waste oil, and e-waste are accepted at Cudjoe Key during normal operating hours (Monday-Saturday 8 a.m. - 4 p.m.). HHW is accepted the first and third Wednesdays of each month from 10 a.m. to 2 p.m.

Provided below is a list of HHW and e-waste accepted by the County:

- Paint, stains, strippers, wood preservers
- Roof tar & patching compounds
- Adhesives, putty, and caulk
- Auto/marine maintenance & care products
- Fiberglass, epoxy resins
- Solvents (acetone, mineral spirits, etc)
- Hydraulic fluids, anti-freeze, gasoline
- Corrosives (muriatic acid, lye, etc)
- Pesticides, fertilizers, and weed killer
- Household and drain cleaners
- Pool cleaning products
- Lighter fluid/lighters with fluid
- Televisions, monitors, and computers
- Fax machines, printers, and copiers
- Discs, video cassettes, DVDs and VCRs
- Fluorescent bulbs



Charges for HHW and e-waste drop off vary by material and generator. County residents are charged only for fluorescent bulbs (\$0.50/bulb) and contaminated gas (\$0.78/gallon). In addition to these fees, businesses are also charged for HHW (\$0.60/pound) and e-waste (\$.06175/pound).⁷

According to the Collection Agreement, WM is to provide drop-off services for HHW four times annually at no additional charge to residents of the City. As noted in Section 3.2 above, during the 2009 Agreement extension negotiations, WM committed to creating a monthly HHW collection program within the City limits. No HHW collection events have been held since the City's solid waste facility was moved from Stock Island to Rockland Key in 2009.

3.2.5 Special Events

Special event organizers are required to submit an adequate recycling plan as part of their application for a special event permit. A recycling deposit of \$1,000 is charged and refunded when the event organizers provide a recycling report at the end of the event. The City has developed sample recycling plans for small, medium, and large special events. City staff reviews submitted plans and reports, but does not evaluate the overall effectiveness of each program.

⁷ Monroe County Special Waste Disposal Website: <http://www.monroecounty-fl.gov/index.aspx?nid=239>.

Fantasy Fest is the largest public event held in the City. During the Street Parade, servicing solid waste and recycling containers becomes difficult, if not impossible, because of the size of the crowd. During Fantasy Fest 2010, Coca-Cola provided recycling containers; however, sufficient containers were not provided for the volume of materials generated. In some cases, the opening in the containers was not large enough to accommodate the size of the beverage containers typically used at the event and the openings quickly became obstructed.



3.3 Transfer and Disposal

The City owns and operates the City of Key West Solid Waste Transfer Station (Transfer Station) located on Rockland Key. The facility is permitted to handle a maximum of 350 tons per day. In FY 2011, an average of about 160 tons per day of solid waste and recyclables were received at the facility.

The current tipping fee at the Transfer Station is \$165.97 per ton, which covers the costs of transfer and disposal, as well as other operating and administrative costs. Recyclables are tipped at no fee.

The City contracts with WM to transport and dispose of solid waste received at the Transfer Station. The T&D Agreement was awarded in 2004, renewed in 2011 for an additional seven-year term, and also has the option for a second renewal term of six years (total of 20 years).



Per the T&D Agreement, WM transports the solid waste to either of its two WTE facilities in Broward County. Alternatively, WM is allowed to divert waste to one of its landfills, if necessary, for no more than two consecutive weeks without City approval. WM subcontracts for transport of waste and recyclables, and it is generally believed that transfer trailers are used to backhaul other materials to the Lower Keys.

WM requested a one-time extraordinary circumstances rate increase due to the rising cost of fuel. City staff negotiated with WM to reach an increase agreeable to both parties, which was approved by the City Commission in February 2011. The contract also was amended to allow for a quarterly fee adjustment based on a fuel index and to no longer allow requests for extraordinary rate increases due to fuel costs. The current transport and disposal fee is \$71.55 per ton.



A comparative analysis of the transport and disposal fee was conducted in December 2010, a copy of which is provided in Appendix B.

As mentioned previously, WM transports and processes recyclables received at the Transfer Station at no cost to the City and with no revenue share. WM also transports metals and white goods (appliances) received at the Transfer Station to a recycler in Miami. Pursuant to the Collection Agreement, the City pays WM \$21.60 per ton for this service.

3.4 Outreach and Education

WM produced a flyer on single stream recycling that informs residents and businesses of what materials are accepted. The City posts WM's single stream recycling flyer on its website, as well as the following information:

- Recycle Center location and hours of operation.
- Transfer Station location and hours of operation.
- Residential garbage information including acceptable materials, and pick up schedules.
- Recycling information including acceptable materials, protocol, and pickup schedules.



According to WM, the company also produces and runs print ads in local periodicals; advertises at trade shows, lodging establishments and with the Key West Chamber of Commerce; gives 15-minute presentations at schools; and has supplied a recycling education curriculum for students throughout Monroe County.

A non-profit, volunteer-based organization, Florida Keys Green Living and Energy Education (GLEE), also educates residents and businesses about recycling. GLEE hosts a website (www.KeysGLEE.com), participates in public events, and has gone door-to-door to promote recycling. To many individuals in the community, GLEE has become the “go-to” organization for information pertaining to recycling.

Monroe County's Recycling Coordinator also conducts outreach and education that benefits the City, including promoting recycling in public schools.

3.5 Financial Summary

As noted in Figure 3.2, nearly half of the City's solid waste revenue comes from residential service fees and the other half from commercial tipping fees. Figure 3.3 provides a breakdown of solid waste expenditures in FY 2011. The largest expenditures were to WM for transport and disposal of solid waste and residential solid waste collection.

In FY 2011, the value of the WM Collection Agreement was approximately \$5 million – \$1.96 million for residential solid waste collection and \$0.39 million for residential recyclables collection (both noted in Figure 3.3), as well as an estimated \$2.66 million for commercial collection. Because WM

bills commercial customers directly, these fees do not run through the City and the latter figure was estimated based on the commercial disposal fees remitted to the City.

In FY 2011, the value of the T&D Agreement was \$3 million. Combined, these contracts total approximately \$8 million annually, representing one of the City’s largest contractual agreements. This does not include the revenue WM receives for collecting commercial recyclables, which is a non-franchised service.

Figure 3.2: Solid Waste Revenue, FY 2011

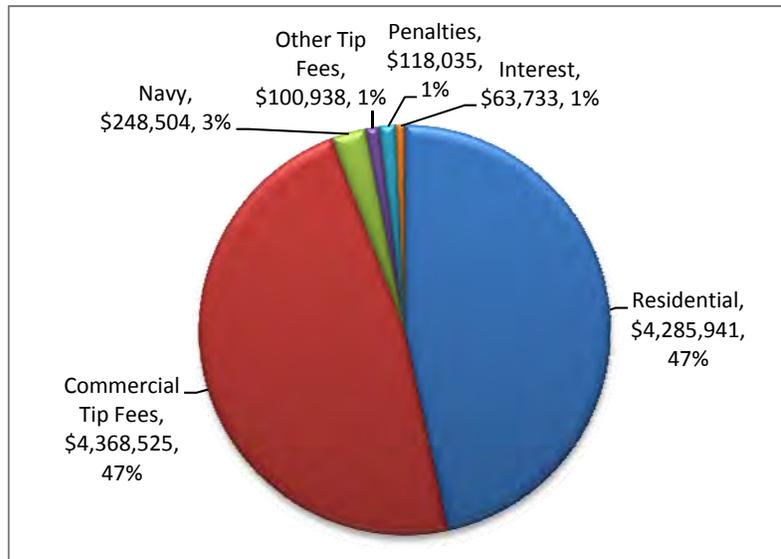
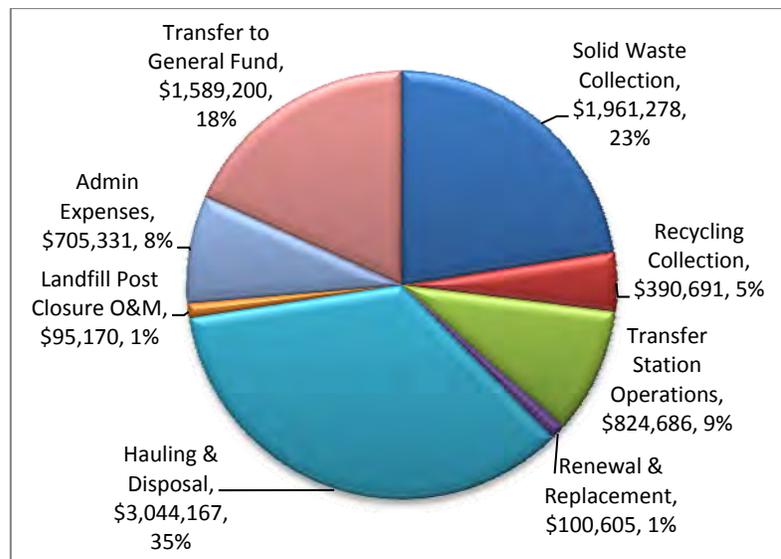


Figure 3.3: Solid Waste Expenditures, FY 2011



3.6 Waste Composition

KCI conducted a two-season Waste Composition Study (WCS) to determine the composition of solid waste (single-family residential, multi-family residential, and commercial waste) delivered to the City of Key West Transfer Station. Two five-day sorting events were conducted on November 15-19, 2010 and April 4-8, 2011 to account for seasonal variability in the waste stream.



Figure 3.4 depicts the overall composition (combined composition of the three generator sectors) of waste disposed at the City’s Transfer Station. Recyclable paper (dark blue) comprises 17% of the waste stream, recyclable containers (dark red) nearly 13.5%, and compostable materials (dark green) another 40.5%. Combined, these recyclable and compostable materials comprise 71% of the waste stream.

Figure 3.4: Composition of Waste Disposed at City’s Transfer Station (% by weight)

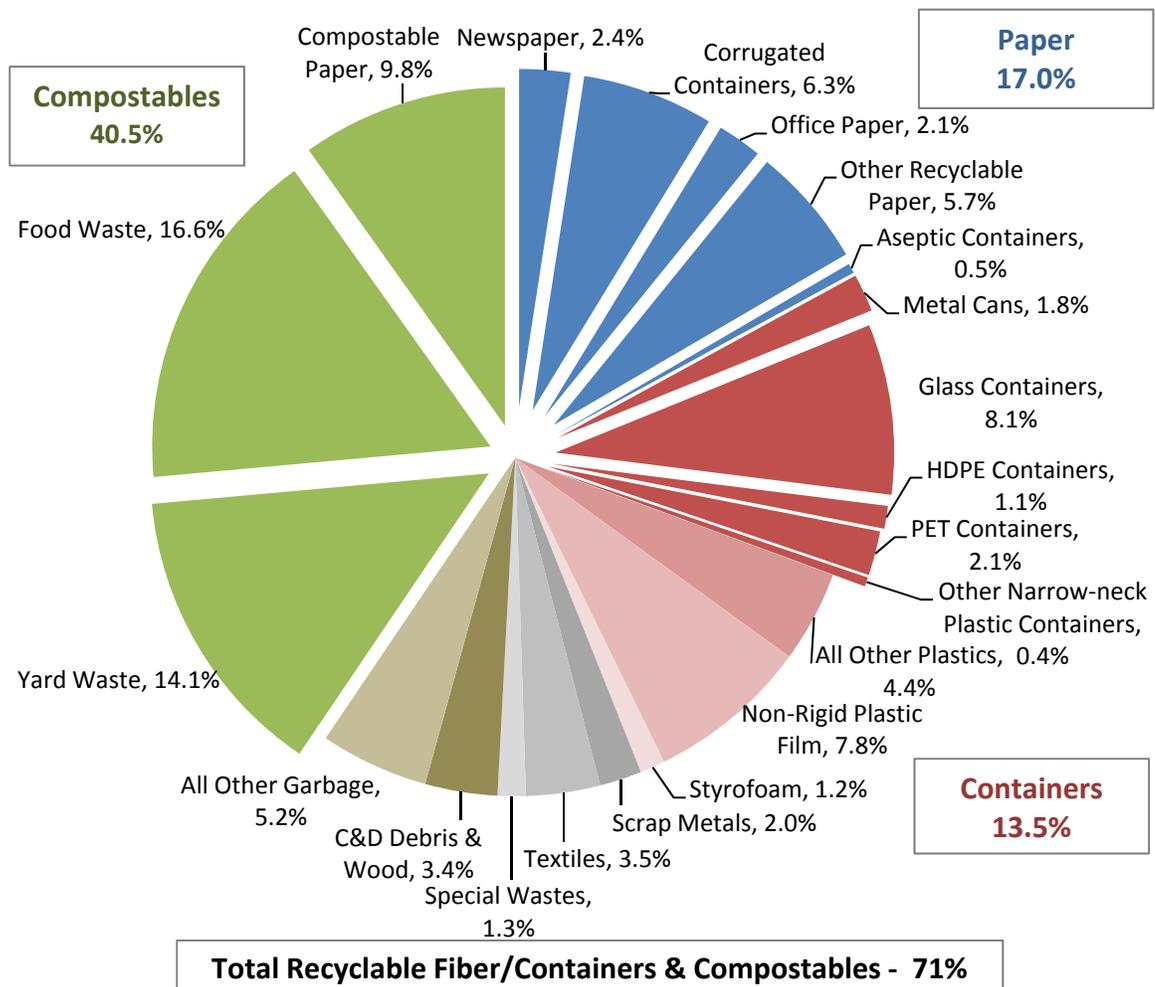


Table 3.3 provides the percentages of recyclable paper, recyclable containers, and compostables in each of the generator sector waste streams, and Table 3.4 converts these percentages to tons based on the quantity of garbage (42,699 tons not including segregated yard waste, bulk waste, or C&D debris) received at the Transfer Station in FY 2011. A copy of the complete WCS report is provided in Appendix C. The WCS data is utilized throughout this Plan to evaluate waste diversion opportunities with the greatest potential impact.

During the April event, KCI also interviewed individuals self-hauling recyclable materials to the Transfer Station. KCI staff interviewed 21 of 32 (66%) of incoming self-haul recycling loads. The goal of the survey was to understand who currently self-hauls, why they self-haul, and what materials are being delivered. Analysis of the survey results revealed the following:



- Self-hauling represents 50% of incoming recycling loads but only 9.5% of recyclables received by weight.
- 19 (90%) of the self-haulers were businesses and 2 (10%) were residents.
- Corrugated cardboard was the most commonly self-hauled material with 15 (71%) of the incoming loads being comprised of nearly 100% cardboard.
- Only 4 (19%) of the self-hauled recycling loads were comprised primarily of commingled containers, and 3 of these were comprised of nearly 100% glass bottles.
- The reasons given by residents for self-hauling were (1) live in an apartment with no access to recycling and (2) want to be sure recyclables are actually being recovered.
- Of the businesses self-hauling recyclables to the transfer station:
 - 7 (37%) never requested a quote from WM for recycling service.
 - 7 (37%) self-haul because it is free.
 - 3 (16%) self-haul because it is convenient.
 - 4 (21%) self-haul because they have always recycled this way.
 - 2 (11%) thought this was the only place to recycle.
 - 2 (11%) stated the quote received from WM for service was too expensive.
 - 1 (5%) has recycling service, but generates an overflow of material.

Businesses that self-haul recyclables demonstrate a commitment to recycling, but their responses to the survey also are indicative of the commercial sector's perceptions of recycling and its availability. Lack of knowledge or understanding about the recycling program and commercial recycling fees that are too high are barriers to commercial recycling.

Table 3.3: Recyclable or Compostable Materials in Waste Disposed (% by weight)

Material Categories	Citywide	SF Residential	MF Residential	Commercial
Newspaper	2.4%	1.6%	5.1%	2.9%
Corrugated Containers	6.3%	4.3%	2.1%	7.8%
Office Paper	2.1%	1.9%	0.7%	2.3%
Other Recyclable Paper	5.7%	6.1%	10.8%	5.3%
Aseptic Containers	0.5%	0.6%	0.7%	0.4%
TOTAL RECYCLABLE PAPER	17.0%	14.5%	19.4%	18.7%
PET Containers	2.1%	1.9%	5.6%	2.1%
HDPE Containers	1.1%	1.0%	1.4%	1.1%
Other Narrow-Neck Plastic Containers	0.4%	0.5%	0.6%	0.4%
Tin/Steel Cans	0.9%	1.0%	1.4%	0.9%
Aluminum Cans	0.9%	0.9%	0.9%	0.8%
Glass Containers	8.1%	6.3%	13.0%	9.3%
TOTAL RECYCLABLE CONTAINERS	13.5%	11.6%	22.9%	14.6%
TOTAL RECYCLABLES	30.5%	26.1%	42.3%	33.3%
Yard Waste	14.1%	27.4%	12.3%	5.0%
Food Waste	16.6%	9.0%	11.6%	22.0%
Other Non-Recyclable Paper	9.8%	7.7%	11.0%	11.2%
TOTAL COMPOSTABLES	40.5%	44.1%	34.9%	38.2%
COMBINED TOTAL	71.0%	70.2%	77.2%	71.5%

Table 3.4: Recyclable or Compostable Materials in Waste Disposed, FY 2011 (tons)

Material Categories	Citywide	SF Residential	MF Residential	Commercial
Newspaper	1,025	273	44	718
Corrugated Containers	2,690	734	18	1,932
Office Paper	897	324	6	570
Other Recyclable Paper	2,434	1,042	92	1,313
Aseptic Containers	213	102	6	99
TOTAL RECYCLABLE PAPER	7,259	2,475	166	4,632
PET Containers	897	324	48	520
HDPE Containers	470	171	12	272
Other Narrow-Neck Plastic Containers	171	85	5	99
Tin/Steel Cans	384	171	12	223
Aluminum Cans	384	154	8	198
Glass Containers	3,458	1,076	111	2,303
TOTAL RECYCLABLE CONTAINERS	5,764	1,981	196	3,615
TOTAL RECYCLABLES	13,023	4,456	362	8,247
Yard Waste	6,020	4,680	105	1,238
Food Waste	7,088	1,537	99	5,448
Other Non-Recyclable Paper	4,184	1,315	94	2,774
TOTAL COMPOSTABLES	17,292	7,532	298	9,460
COMBINED TOTAL	30,315	11,988	660	17,707

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Section 4

Policies

With a current recycling rate of only 10%, the City will need the demonstrated commitment of its leaders to achieve even a 50% recycling rate, let alone 75% or Zero Waste. The City Commission should adopt a set of policies that will pave the way for sustainable, cost-effective programs that encourage and incentivize waste reduction and recycling. The City needs to be the driving force, not an observant spectator. In discussions between KCI and private waste hauling or processing companies in communities with high recycling rates, the reason given by most private entities for such ambitious recycling programs is government policies.

Policies are the heart of the program. They provide the guiding principles by which City staff will develop solid waste programs and manage solid waste operations and contracts. Provided below is a set of policies recommended for the City Commission’s review and approval. These policies support and complement the program initiatives and facility recommendations included in this Plan. They should be established and implemented as soon as possible if the City is committed to improving its recycling rate.

Recommended Solid Waste Policy Statement

To develop an environmentally and economically sustainable solid waste management system that maximizes waste diversion and minimizes waste disposal, the City Commission of Key West hereby adopts the following policies and directs staff to implement these policies:



1. Hire a full-time Recycling Program Manager to provide the technical, educational, and oversight support necessary to implement effective recycling programs.
2. Adopt a tiered recycling goal starting at 25%, followed by 40%, and then 75%.
3. Establish a program to collect and process yard waste separate from other solid waste.
4. Receive compensation for City recyclables that are resources having value.
5. Become a Green City through programs that lead by example, including waste reduction, reuse, recycling, and environmentally preferable procurement (EPP) programs.
6. Establish public-private partnerships with companies that will help carry out these policies.
7. Provide periodic updates to City Commissioners and the public regarding the status of activities and accomplishments toward meeting these policies.

Provided below is further discussion of these recommended policies.

1. **Full-time Recycling Program Manager** – To establish effective recycling programs, the City will need a knowledgeable, committed individual to develop, implement, and monitor them. Recycling programs do not just “happen,” and local governments cannot rely on private contractors to develop comprehensive programs that are in the government’s best interest. Without an individual to implement them, the recommendations outlined in this Plan will not come to fruition. Existing City staffing is insufficient to implement the recommendations outlined in this Plan.
2. **Adopt a tiered recycling goal of 25%, 40%, and 75%** – Because the large gap between the City’s existing recycling rate of 10% and its intended goals, a three-tiered recycling goal is recommended. It will provide milestones by which the City can measure its progress. Provided below is a general summary of the focus during each of the three phases:
 - 25% Goal (Phase 1) – basic changes to residential program, voluntary actions, and education.
 - 40% Goal (Phase 2) – commercial program improvements and technical assistance, organics expansion, and incentives.
 - 75% Goal (Phase 3) – all organics, technological innovations, and/or mandates and enforcement.
3. **Collect and process yard waste separate from other solid waste** – Yard waste comprises 27% of the residential waste stream, is commonly collected separate from other solid waste, and can be put to beneficial reuse. Further discussion of this program is provided in Section 5.
4. **Receive compensation for City recyclables** – Recyclables are commodities that have value and the City should be receiving fair revenue, based on current market values, for these materials. Many communities throughout Florida currently are receiving revenue for recyclable materials; Table 4.1 provides examples of several such communities.

Table 4.1: Examples of Recycling Revenue in Other Florida Jurisdictions, June 2012

Jurisdiction	Revenue/Ton	Program Type	Service Provider
Broward County	\$58.50	single stream	WM
Indian River County (pending contract)	\$69.95	dual stream	ReCommunity
Jacksonville/Duval County	\$41.07	dual stream	Republic
Lakeland (City)	\$60.53	single stream	WM
Okaloosa County	\$30.00	single stream	WM
Polk County (RFP)	\$64.03	single stream	WM
Sarasota (City)	\$58.77	dual stream	WM
Sarasota County	\$45.74	dual stream	ReCommunity
Seminole County	\$63.90	dual stream	WM
Tallahassee (City)	\$60.00	dual stream	Recycled Fiber

Note: Revenue typically is paid for each inbound ton of recyclables (i.e., tons delivered for processing, not outbound from the processing facility). Comparisons between jurisdictions are difficult because of differences in the services provided, materials accepted, local market competition, and contract provisions. In most jurisdictions, revenue fluctuates over time based on commodity values.

Table 4.1 provides a snapshot view of recycling revenue received by these communities in June 2012. In most of these jurisdictions, revenue fluctuates over time based on market prices (usually as reflected by an industry-accepted market index). Revenue received by some jurisdictions at times exceeded \$80 per ton during the past year.

Despite the transport of recyclables out of the Keys for processing, the City should be receiving revenue for its recyclables given current market values. Since July 2011, City staff has requested WM to provide a revenue sharing proposal, but no proposal has been received that would provide, in KCI's opinion, compensation to the City that is on par with many other Florida communities.

5. **Become a Green City** – The City should lead by example by ensuring its facilities, departments, and buildings have effective waste reduction, reuse, recycling, and environmentally preferable procurement (EPP) programs. Further discussion is provided in Section 5.2.
6. **Establish public-private partnerships that will help carry out these policies** – The City will need private sector partners who are committed to helping the City achieve its goals and objectives.

Many of the recommendations made throughout this Plan are related to the City's Collection Agreement and Transport and Disposal Agreement. During the 2009 Collection Agreement extension negotiations, WM committed to working with the City to:

- Develop mechanisms to make recycling more convenient for residents;
- Increase promotional efforts;
- Consider the feasibility of a composting program; and
- Establish an HHW/e-waste collection program.

In addition, City and KCI staff met with WM on several occasions to:

- Negotiate revenue sharing for recyclables; and
- Lower commercial recycling collection fees to match commercial solid waste collection fees (disposal not included).

No measurable accomplishments have been made in the three years since the City extended the Collection Agreement or in the past year that KCI has assisted City staff with negotiations. Therefore, unless acceptable terms are reached immediately on these and other issues related to recycling, KCI recommends the City provide notice of its intent to terminate the Agreement and initiate a competitive procurement for a new contract that will enable the City to accomplish its objectives and that provides recycling revenue to the City.

7. **Provide periodic updates to City Commissioners and the public** – Solid waste staff should keep the Commission and public apprised of the status of activities and accomplishments toward meeting these policies and the City's solid waste goals.

The policies outlined above should be reviewed and revised periodically as advancements are made in the City's solid waste management system to incorporate additional opportunities for improvements.

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Section 5

Programs

This section describes specific program options and initiatives to assist the City in achieving the recycling goals and policy objectives outlined in Section 4. Program initiatives are organized as follows:

- Residential
- Commercial
- Special events
- Public areas
- Household hazardous waste
- Construction and demolition debris (C&D)

The residential and commercial program initiatives are outlined in phases that align with the three-phased recycling goal. The Phase 2 and 3 initiatives are more aggressive programs that may need to be implemented over time to achieve higher recycling rates. Supporting information and analysis regarding the options presented in this section are provided in appendices. The recommendations provided do not preclude the City from partnering with Monroe County on various initiatives should circumstances warrant; in fact, such partnership likely would be mutually beneficial. However, KCI recommends that the City proceed with these recommendations and not rely on County action.

5.1 Residential

5.1.1 Residential Waste Diversion Potential

In FY 2011, an estimated 2,100 tons of residential recyclables were collected by WM, or approximately 295 pounds per household.⁸ Based on the waste composition results, opportunity exists to substantially increase this amount.

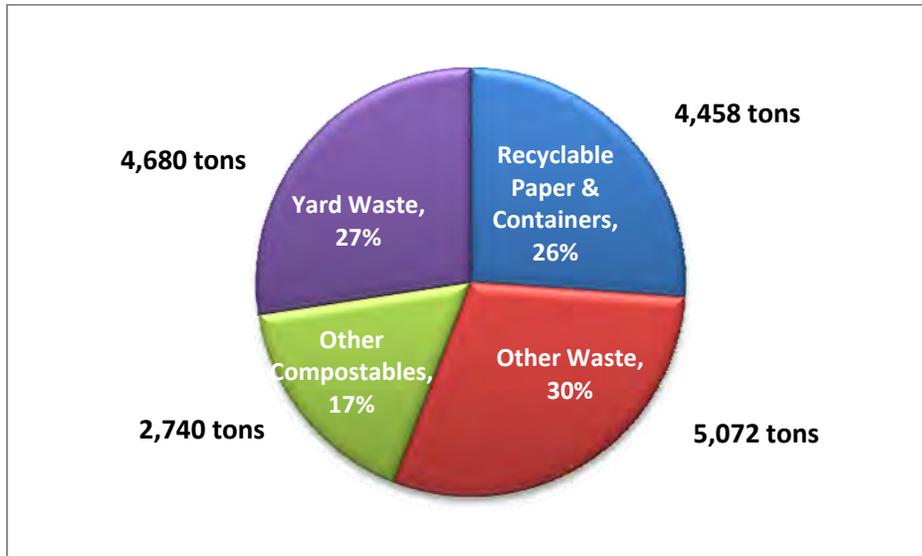
Approximately 40% – or about 17,000 tons in FY 2011 – of the garbage delivered to the City’s Transfer Station is from single-family residences. Approximately 26% of this garbage consists of recyclable materials that could be recovered in the



⁸ Because residential and commercial recyclables are collected in the same vehicles, the actual tonnage of each is not known. WM delivered 3,239 tons of residential and commercial recyclables to the City’s Transfer Station in FY 2011, and WM estimates that 60-70% of these recyclables were from residents. For the purposes of this analysis, it was assumed that 65% of these recyclables was generated by residents.

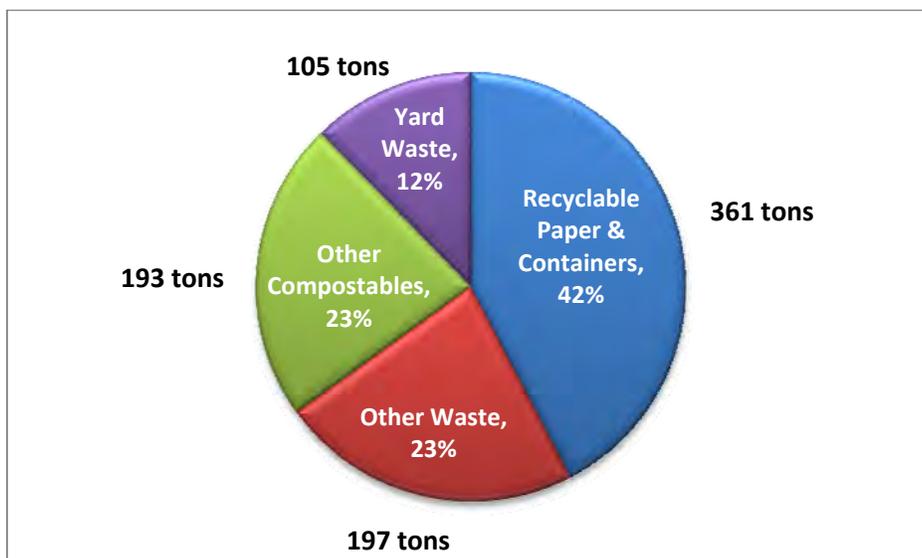
existing curbside recycling program (see Figure 5.1). Approximately 27% is yard waste and an additional 17% consists of other compostable materials (i.e., food waste and non-recyclable paper).

Figure 5.1: Single-Family Residential Garbage Disposed (% by weight)



Multi-family residential garbage is generally collected with single-family garbage (in carts) or commercial garbage (in dumpsters); therefore, estimating the quantity generated is challenging. However, at least 2% – or 850 tons in FY 2011 – of the garbage delivered by WM to the City’s Transfer Station is from multi-family residences. Although multi-family residents pay for recycling service, not all receive this service reportedly because of issues such as space limitations. This is reflected in the waste composition data. About 42% of multi-family garbage consists of recyclable paper and containers that are accepted in the City’s recycling program (see Figure 5.2). Yard waste comprises about 12% of multi-family garbage, and other compostables comprise 23%.

Figure 5.2: Multi-Family Residential Garbage Disposed (% by weight)



5.1.2 Residential Program Recommendations

Based on the status of the City's existing residential recycling program, options that present the greatest opportunity to increase diversion of residential waste from disposal were evaluated. Appendix D provides a discussion and analysis of these options in general and as they might apply to the City.

Based on this analysis, provided below are recommendations to maximize residential waste diversion. These recommendations are organized in the three phases outlined in Section 4.

Phase 1 Residential Recommendations

1. **Carted collection of recyclables** – convert to carted curbside collection of recyclables to increase the volume and convenience to residents; add materials to the program, such as rigid mixed plastics.

The City's 2012 solid waste budget includes the purchase of carts.⁹ KCI recommends purchasing 65-gallon recycling carts, with the option of a 95-gallon cart upon request. Because garbage is already collected in carts, no additional equipment would be required. Preliminary discussions with WM indicate a willingness to convert to carts at no additional cost to the City other than paying for and distributing the carts. Conversion to carts also should enable the City to include additional recyclables, such as rigid mixed plastics.

2. **Separate yard waste collection; weekly collection of garbage (1-1-1)** – implement separate yard waste collection in place of one of the garbage collection days each week.

Separate collection of City residential yard waste has the potential to divert up to 27% of residential waste from disposal. Based on preliminary discussions, WM is willing to convert to 1-1-1 service with separate collection of yard waste at no additional cost to the City. Because yard waste processing infrastructure does not currently exist in the Keys, WM proposes transporting yard waste to its facility in Pompano Beach where it would be ground and used as landfill cover. Currently, FDEP allows the use of ground yard waste as final landfill cover to count as recycling, but proposed rule changes would allow its use for any landfill cover (daily, intermediate, or final) to count as recycling, but only for that amount that FDEP considers necessary to perform cover functions. If approved by the City, processing of yard waste to be used for landfill cover should be considered only a short-term solution. The City immediately should begin work to identify or conduct a bid process for a yard waste processing alternative that puts yard waste to a more beneficial reuse (e.g., compost). This type of processing facility is discussed further in Section 6.

3. **Multi-family recycling** – develop and implement a comprehensive multi-family recycling program that requires property owners to provide recycling opportunities for residents, provides technical assistance to property owners/managers with onsite program implementation, and offers toolkits and educational materials.

City Ordinance requires residents to recycle (Section 58-83) and requires owners or managers of multi-family dwellings with 11 or more units to submit a written recycling plan and provide an area for residents to deposit their recyclable materials (Section 58-85). The City has the legal tools in place to require multi-family recycling and the services are

⁹ At \$50 per cart, the total cost is estimated at \$715,000 for 14,300 carts.

already paid for. What is lacking is oversight and technical assistance, which would be provided by a Recycling Program Manager.

A concerted effort is needed to meet with multi-family property owners or managers and to provide technical assistance to help them overcome obstacles, whether real or perceived, to establishing an effective recycling program. A toolkit should be provided that lays out the steps they need to take to set up the program and provides sample educational materials for tenants. Ongoing monitoring and assistance likely will be required for some complexes.

4. **Comprehensive public outreach** – develop and implement a strategic, comprehensive public outreach program that includes consistent, current messaging through various media outlets; offer reliable, easy-to-access information on the City’s website; engages the public; and utilizes social networking. Key elements of an effective public education campaign are outlined in Appendix D, Section 6.

Phase 2 Residential Recommendations

1. **Pilot a source separated, curbside organics composting program** – Once a viable composting infrastructure is established, the City should pilot the collection and processing of other compostable materials (i.e., food waste and non-recyclable paper) along with yard waste. This has the potential to divert up to 17% of residential waste from disposal.
2. **Incentive program** – Pay-As-You-Throw (PAYT) programs can be very effective at encouraging both waste reduction and recycling. Although few Florida communities have implemented such a program, Alachua County and Gainesville have established a very successful PAYT program. A number of factors exist in the City that would make implementation of a PAYT program challenging (see Appendix D, Section 3). These include the large number of seasonal residents, current practice of unlimited garbage collection, and historical problems with illegal dumping. For these reasons, PAYT is not recommended in Phase 1. However, the City may wish to revisit this option if desired recycling rates are not achieved.

Phase 3 Residential Recommendations

1. **Enforcement of mandatory recycling** – If other efforts have not sufficiently increased residential waste diversion, the City could develop an enforcement program with fines for repeat offenses. Local decision-makers are often reluctant to implement a strong enforcement policy for recycling ordinances. The City likely will want to implement other waste diversion recommendations outlined in this section before considering enforcement measures.
2. **Monitor innovative diversion opportunities** – This does not necessarily need to wait until Phase 3. If an innovative waste diversion facility, such as a mixed waste materials recovery facility (MRF) or wet/dry processing facility, is established in Southeast Florida, the City should evaluate the feasibility and cost-effectiveness of delivering its waste to such a facility.

Mixed waste processing and wet/dry processing are becoming more widely utilized, especially on the West Coast. For example, Green Waste operates a state-of-the-art mixed waste processing facility in San Jose, California and reportedly diverts 75% of inbound

waste from disposal – 50% through composting and 25% through recycling. Although no such facilities currently exist in Florida, at least one company has proposed establishing a mixed waste facility in Broward County. If the company does proceed with the facility, it could be operational as early as next year.

5.2 Commercial

5.2.1 Commercial Waste Diversion Potential

Commercial recycling in the City is extremely low. WM delivers an estimated 1,300 tons of commercial recyclables to the Transfer Station.¹⁰ An additional 436 tons of recyclables (including metals) were delivered to the Transfer Station, primarily from commercial sources, for a total of about 1,700 tons of commercial recyclables.

Of the garbage delivered to the Transfer Station in FY 2011, an estimated 58% – or approximately 24,700 tons – was from commercial businesses. At least another 1,000 tons of segregated commercial waste, such as yard waste and C&D debris was delivered to the Transfer Station, resulting in a commercial recycling rate of less than 7%.¹¹

The opportunity to increase commercial recycling is more than evidenced by the waste composition study. Approximately 33% of commercial garbage consists of recyclable materials that could be recovered in the City's existing recycling program (see Figure 5.3). Approximately 38% consists of compostable materials (food waste, non-recyclable paper, and yard waste).

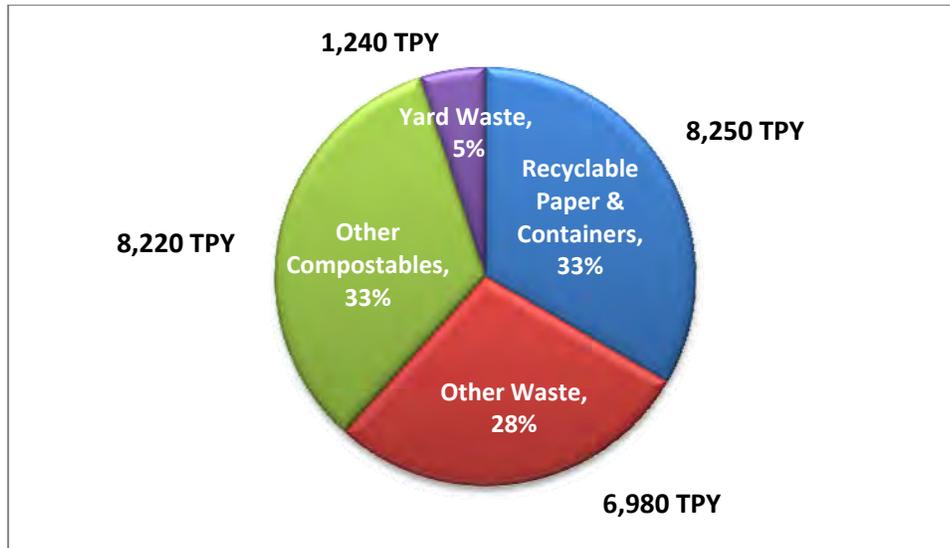
Many recycling programs throughout the State and across the nation focus the majority of their efforts on residential single-family customers. While this is important, high diversion targets cannot be met without substantial recovery of commercial waste.



¹⁰ As mentioned in previous footnote, exact quantities of residential and commercial recyclables are not known because the two streams are collected in the same vehicles. Of the 3,329 ton of recyclables WM delivers to the Transfer Station, WM estimates that 30-40% is from businesses. For the purposes of this analysis, an average of 35% was assumed.

¹¹ This does not include C&D debris and commercial recyclables collected and delivered to other facilities. A discussion of this is provided Section 3.1.

Figure 5.3: Commercial Garbage Disposed (% by weight)



During the course of this planning process, several things occurred that warrant mentioning since they relate to the current state of commercial recycling in the City and recommendations provided in this section.

- City and KCI staff attempted to achieve initial advancements in commercial recycling by trying to negotiate lower commercial recycling fees with the City’s existing collection contractor, WM. When the Collection Agreement was initially established, commercial recycling collection fees were the same as commercial solid waste collection fees (collection only, not including disposal). City staff believes the intent was to maintain this parity throughout the term of the agreement, but WM disagrees with this interpretation. As noted in Table 5.1, commercial recycling collection fees currently are 27-71% higher than solid waste collection fees. Negotiations with WM were unsuccessful. Overcoming this obstacle is critical to the future success of commercial recycling in the City.

Table 5.1: Commercial Solid Waste and Recycling Collection Fees, FY 2012

Container Size	Recycling Collection	Garbage Collection	% Difference
18-Gallon Bins, per pickup	\$0.55	NA	NA
32-Gallon Carts, per pickup	\$2.68	\$1.57	71%
64-Gallon Carts, per pickup	NA	\$3.31	NA
95-Gallon Carts, per pickup	\$8.03	\$4.71	71%
Dumpsters, per cubic yard*	\$11.0939	\$7.72 - \$8.76	27-44%

* Cardboard only for recycling NA = Not Applicable

- WM is required to provide the City a monthly computer list of commercial accounts billed. Although the list includes the address and account number of each customer receiving service, the size and number of containers, and the number of pickups, it is not provided in

a format that can be easily utilized by staff. The reports should be provided in Excel and in a format specified by the City that will allow easier evaluation of the data.

- During the WCS, KCI interviewed individuals who self-hauled recyclables to the Transfer Station, 90% of whom were businesses. Reasons given for self-hauling recyclables included because it is free and/or convenient, they thought it was the only way to recycle, the quote received from WM was too expensive, or they have recycling service but generated an overflow of materials. Lack of knowledge or understanding about the recycling program and recycling service fees that are too high are clearly barriers to commercial recycling within the City.
- Another challenge to commercial recycling is a perceived lack of space for recycling containers. This can be overcome by promoting single stream recycling, which combines all recyclables into one container, and by assisting businesses with “right-sizing” their solid waste collection service once recycling is established, which should not only conserve space, but also reduce costs. These activities would be just part of the Recycling Program Manager’s responsibilities.

5.2.2 Commercial Waste Diversion Recommendations

A variety of approaches can be used to increase commercial waste diversion, ranging from outreach and education to voluntary incentives to mandates. To provide examples of how these various approaches have successfully been implemented, KCI compiled case studies of commercial recycling programs established in eight jurisdictions in the United States. Appendix E summarizes these case studies and also highlights the commonalities between them.

The case studies include four Florida counties (Sarasota, Alachua, Lee and Collier) that have reported some of the highest recycling rates in the State. The other four communities are outside of Florida; several of them have reported some of the highest recycling rates in the country. Three are in California (San Francisco, San Jose, and Poway) and the fourth is Falls Church, Virginia. These eight communities demonstrate the variety of approaches that have been used when developing a commercial recycling program.

Based on this analysis and KCI’s recycling program development experience, provided below are recommendations to maximize commercial waste diversion. Because of the currently low rate of commercial recycling in the City, these recommendations are organized in the three phases outlined in Section 4.

Phase 1 Commercial Recommendations

1. **Lower cost recycling service** – set commercial recycling collection fees in the City’s collection contract that are equal to or less than waste collection fees (collection only, not including disposal).

All businesses care about their financial bottom line. To incentivize recycling, businesses should be able to save money by recycling. This occurs by not having to pay a disposal fee and by “right-sizing” garbage collection service (either by reducing container size or frequency of collection) after recycling is implemented.

2. **Expanded recycling service** – require the City’s collection contractor to collect the full range of recyclables, commingled fibers and containers (i.e., single stream), from businesses.

Comprehensive commercial recycling programs must go beyond collecting just corrugated cardboard. The City has a single stream recycling program; therefore, all commercial recyclables can be commingled, making it more convenient for businesses. WM has indicated that it has provided single stream recycling containers to several businesses, but this should be the norm rather than the exception.

3. **Monitoring commercial recycling** – require City’s collection contractor to provide a monthly list of businesses receiving commercial recycling in a format specified by the City.

Tracking participation is critical for City staff to effectively focus recycling outreach and technical assistance to businesses.

4. **Green City Program** – lead by example by ensuring all City facilities and public schools have effective recycling programs, engaging employees and students through creation of “green teams,” implementing environmentally preferable procurement policies, and establishing equipment reuse programs.

The Recycling Program Manager will play a key role in facilitating and coordinating the efforts of various City departments and facilities. Incentives can be provided by creating competition between departments.

5. **Business outreach** – develop and implement an outreach program to inform businesses about available recycling services, rates, and the potential to save money through recycling.

6. **City Ordinance** – amend City Ordinance and building codes to comply with State law. HB 7243, which passed in 2010, states “(i)n accordance with applicable local government ordinances, newly developed property receiving a certificate of occupancy, or its equivalent, on or after July 1, 2012, that is used for multifamily residential or commercial purposes, must provide adequate space and an adequate receptacle for recycling by tenants and owners of the property.” (Section 403.706(2)(c), F.S.)

City staff should ensure the City Planning Board is aware of this requirement. The City should enforce this provision and its collection contractor should proactively work with new developments to establish and provide recycling service.

7. **Local use of glass** – continue to investigate opportunities to utilize source-separated glass in the Lower Keys.

To take advantage of a local end-use market, glass would need to be separated from other recyclables. Because residential recyclables are collected in a single stream, the commercial sector, especially bars and restaurants, offers the most likely source of segregated glass. Appendix F provides a summary of the most viable alternative uses for recovered glass in the Keys. These uses include beach renourishment, aggregate materials, and glass mulch.

Phase 2 Commercial Recommendations

1. **Toolkit and education** – develop and post on the City’s website a toolkit and materials to assist businesses with establishing waste reduction and recycling programs.

The toolkit should include step-by-step instructions for setting up a recycling program, waste audit instructions, a list of recyclables to target, waste reduction opportunities, a list of local reuse and recycling businesses, information on setting up an environmentally preferable procurement (EPP) program, and sample education and promotion materials. Toolkits should be available printed or on-line.

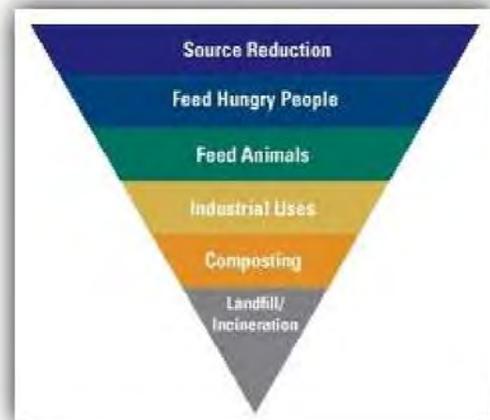
2. **Technical assistance** – starting with businesses that generate the most waste, provide assistance to businesses in establishing recycling programs, such as onsite waste assessments, identification of container locations, distribution of education materials, employee training, custodial staff training, etc. Onsite education and audits should also identify opportunities for waste reduction and reuse.
3. **Incentive program** – embrace and promote the Green Business Partnership (GBP) program initiated by GLEE, which acknowledges businesses that operate in an environmentally sustainable manner.

The GBP program is a voluntary program that encompasses waste reduction, recycling, and water and energy conservation. It provides a positive incentive for businesses to green their operations. The City should promote the program on its website and include a list of certified GBP Partners.

4. **Business group networking** – work with business groups, such as the Chamber of Commerce and Green Business Partners, to actively engage business owners.

Working with stakeholders and getting business buy-in can be critical to the success of a commercial recycling program. Focusing on cost savings and right-sizing service typically resonates with business groups. Case studies should be developed of local businesses that have implemented successful recycling programs.

5. **Organics program** – establish a commercial organics program that follows the organics hierarchy, including promoting source reduction and donating edible food to local food banks or soup kitchens, such as St Mary’s Soup Kitchen. When a viable composting facility is established or identified, pilot a source-separated food waste program for select commercial businesses. Based on pilot results, expand and establish an ongoing program.



Phase 3 Commercial Recommendations

1. **Mandatory commercial recycling** – If commercial recycling rates achieved through the above actions are not sufficient, the City should consider a mandatory program. The program would specify what materials need to be included in the recycling program, identify a grace period for businesses to comply, establish a system for site visits and notices of violation, and set fees for businesses that ultimately do not comply.

A commonality between jurisdictions with the highest recycling rates is that most require, at a minimum, that all businesses recycle traditional recyclables, such as corrugated cardboard, office paper, containers, etc. The most successful programs also target commercial organics and require that businesses segregate organics for composting. Most of these programs were phased in over time, preferring to use notifications and technical assistance to encourage compliance first. After an initial grace period, they then utilize Code Enforcement staff to monitor compliance and have the ability to impose fines or fees on non-participating businesses.

2. **Monitor innovative diversion opportunities, such as mixed waste processing** – As noted in the residential recommendations, this option does not necessarily need to wait until Phase 3. If an innovative waste diversion facility, such as mixed waste MRF or wet/dry processing facility, is established in Southeast Florida, the City should evaluate the feasibility and cost-effectiveness of delivering its waste to such a facility.

5.3 Special Events

Establishing an effective Special Events Recycling Program is an important element of the City's solid waste management system – local residents and out-of-town visitors want the opportunity to recycle at these events, it sends the right message, and it enhances the City's image. However, recycling at special events, especially large events, can be challenging. These are temporary events that attract a diverse group of people who are focused on having fun. The City has the framework for a Special Events Recycling Program, which is described below, but opportunities exist to improve this program.

5.3.1 Existing Special Events Recycling Program

Between 60 and 80 permitted public events (special events) are held in the City each year. These include a wide variety of events, many of which are truly unique to the City. Events often offer music, food and drink, and celebrate holidays, the City's history, theater and the arts, sports, and social culture. Some are single-day events and others take place over several days and occupy large areas that require street closings. For example, Fantasy Fest takes place during the Halloween season, lasts for 10 days, and is nationally renowned, attracting over 45,000 people.

Chapter 6 (Ordinance No. 02-29) of the City's Code of Ordinances, "Amusements and Entertainment," stipulates the requirements that special event organizers must meet, but it does not specifically mention recycling. The City's website has a Special Events page that lists eight "Rules and Regulations for Use of City of Key West Property for Special Events," but recycling is not one of those mentioned.



The Special Events webpage has a link to the “Application for a Special Event Permit.” This 31-page document includes, in addition to the application form and other permit-related information, an expanded list of 18 “Rules and Regulations for Use of City of Key West Property for Special Events” and a “Complete Checklist for Event Recycling City of Key West” (Checklist).

Rule #17 states that “Special Event organizers must submit an adequate recycle plan for the size of the event being requested.” It also directs event organizers to the City’s website for helpful hints and recycling requirements for special events. Sample recycling plans for small, medium, and large events can be found on the website. A recycling plan must be reviewed and approved by the City prior to submission of a special event permit application.

The Checklist is a two-page document that serves two functions. First, it provides the City with information about the event’s recycling program, such as contacts, materials to be recycled, number and capacity of containers needed, and who will arrange for recycling collection service. In addition, it provides event organizers with a list of action items to be accomplished prior to, on the day of, and after the event.

A recent change to the Checklist is to require that when recyclables are used throughout the event, one recycling container should be provided for every trash can. Prior to this change, one recycling container was required for every three trash cans. The Checklist also suggests that event organizers contact WM for recycling containers and for more information about event recycling and waste reduction. The Checklist is submitted with the recycling plan, along with a \$1,000 security deposit, which is returned following receipt by the City of a recycling program report after the event.

City staff reviews the recycling plans and reports, but, because of limited resources, does not track overall program progress. A special event permit has never been denied because of lack of a recycling plan, but the City has withheld refunding the security deposit to one event organizer (Victoria’s Secret) for not implementing recycling at its event held on Mallory Square.

Fantasy Fest is a 10-day celebration held in October typically the days leading up to Halloween and includes multiple events. An estimated 45,000 people visit the City to enjoy Fantasy Fest, almost double the City’s resident population. Guests occupy approximately 7,000 rooms available for lodging in hotels, motels, bed and breakfasts, resort condos, and vacation rentals in and around the City.

Some Fantasy Fest events, such as Pretenders in Paradise, are on private property and do not require a City special event permit. Others, such as the Goombay Festival, must obtain a permit. Fantasy Fest culminates in a mile-long Duval Street Fair and Parade, which are organized by Market Share Company (Market Share).

In lieu of a special event permit, the City has a five-year contract with Market Share. Also unlike other events, City crews collect trash and recyclables generated during the Street Fair and Parade. Recycling containers are stationed at every main intersection along Duval Street from Mallory Square to United Street. At some point during the festivities, the event becomes too congested for City crews to access and service the trash and recycling containers. In addition, vendors are required to recycle.



The existing Special Events Recycling Program has resulted in each event organizer developing its own recycling system. Recycling containers are often not well labeled, are not located adjacent to trash cans, and are frequently overflowing.

5.3.2 Special Events Waste Diversion Recommendations

The responsibility of establishing recycling at a special event primarily lies with the event organizer; however, the City, through a Recycling Program Manager, can play a significant role in encouraging and facilitating effective recycling programs.

1. **Amend City Ordinance:** Although the structure of the City’s Special Events Recycling Program suggests that it is mandatory, no ordinance appears to exist to support that. The City should amend its Code of Ordinances to require special events to establish recycling programs. In addition, the City should consider a tiered security deposit, with a higher deposit for larger events, to create a greater financial incentive for recycling.
2. **Special Event Recycling Guide:** KCI developed a Special Event Recycling Guide that revises and consolidates all instructions, checklists, and forms into one Guide. A copy of this Guide, which has been reviewed by City solid waste staff, is provided in Appendix G. The checklist includes recommendations for waste reduction, recycling, and EPP. The revised forms are intended to be easier for event organizers to utilize and to result in more consistent and accurate reporting to the City.
3. **Website improvements:** The Special Events Rules and Regulations published on the website should be consistent with those included in the permit application, including the requirement to have a recycling program. This webpage should prominently display a link to the Special Event Recycling Guide or to a dedicated webpage about the Special Events Recycling Program. A dedicated webpage should explain the purpose and benefits of a special event recycling program, provide an overview of the program elements, and include links to the Guide and other resources.
4. **Program branding:** A program logo and slogan can deliver and reinforce the program’s message in a simple and clear manner. All program materials, including forms, web pages, containers, and printed materials should carry the program symbols. Organizers can use the program brand on stickers, banners, and signs to advertise the Green nature of the event.
5. **Monitoring and reporting:** Maintaining accurate records and monitoring the recycling program is critical to evaluate progress and identify any necessary changes or improvements. The City should maintain a spreadsheet database to compile the results of each event recycling program and track waste diversion.
6. **Technical assistance:** The City should provide direct technical assistance to event recycling coordinators or conduct workshops to provide event organizers with useful tools. Workshops provide an opportunity for organizers to discuss event recycling challenges and share solutions, as well as provide valuable feedback to the City. Workshops can be used to



“train the trainer” – to help event organizers provide more effective training to event recycling staff and volunteers.

7. **Work with service providers:** The City should work with the service provider to ensure that sufficient service and appropriately labeled recycling containers are provided.
8. **Turn-key containers, signage, and collection Service:** A turn-key system where event organizers can obtain containers, signage, and collection service would make recycling program planning more convenient for event organizers. The City could facilitate this by providing recycling containers on loan or at subsidized prices and by establishing a recycling contract that event organizers could utilize. The contract could specify the types of recycling containers and how they must be labeled, as well as set not-to-exceed collection service fees.
9. **Volunteer network:** The City could enlist volunteers who are willing to assist with and monitor recycling activities at a variety of special events. Event organizers could then draw on these volunteers as needed.



Education and outreach is the cornerstone of any Special Event recycling program. Event sponsors, vendors, and attendees must be educated to understand why and how they can participate. The message must be consistent across all media and be reinforced by regular and periodic reminders. This is reflected in the recommendations above and many of the changes included in the Special Event Recycling Guide.

5.3.3 Fantasy Fest Waste Diversion Recommendations

Prior to the Fantasy Fest 2011, KCI staff contacted Market Share, the entity responsible for the Duval Street Fair and Parade. KCI provided recommendations for improving recycling at Fantasy Fest 2011, but since planning activities were already well underway, few of the action items were implemented. Some improvement was noted at the Children’s Day event, but other events saw minimal improvement.

Following Fantasy Fest 2011, KCI developed specific recommendations for developing a more effective recycling program for Fantasy Fest 2012 and provided them to Market Share and City staff in December 2011. These recommendations focus primarily on the Street Fair and Parade. After review and discussion, the recommendations were modified and are provided in Appendix H.

Provided below is a summary of the key recommendations for Fantasy Fest 2012. Market Share has agreed to make an effort to implement these recommendations.



1. Increase the number of clearly marked, color-coded recycling and trash containers along major event thoroughfares and common areas.
2. Increase “behind the scenes” recycling efforts and public access to recycling opportunities at commercial bars and restaurants.
3. Obtain from the City Transfer Station the weight ticket for recyclable materials recovered from the Fantasy Fes Parade and Street Fair.
4. Coordinate City staff and hauler efforts to obtain material weight or volume information.
5. Utilize large, wheeled recycling carts and designate a drop-off site for these materials.
6. Add recycling information and support materials to the Fantasy Fes website.
7. Provide recycling information to attendees and local businesses including Code of Conduct information cards with a recycling protocol for Fantasy Fes events.
8. Stress recycling in conventional and social media (i.e., press releases and PSAs with information about recycling at Fantasy Fes events).
9. Provide recycling collection bags to all parade floats and designate an on-route drop-off for collection.
10. Support Event Coordinators and participating businesses by assuring they have well-marked recycling containers and “Fantasy Fes Recycling Partner” stickers, designed and supplied by Fantasy Fes organizers.
11. Utilize volunteers to monitor garbage/recycling stations.
12. Require vendors to use and maintain separate collection containers for recyclable materials.
13. Request vendors to reduce packaging brought to the site.

In addition, KCI recommends a visual waste assessment be performed during Fantasy Fest 2012 to obtain valuable information for identifying additional recycling and waste reduction opportunities. Appendix H also provides more detailed recommendations for future Fantasy Fest events, including a recommended timeline leading up to the event.

Traffic congestion (both vehicular and pedestrian) and increased waste production become major obstacles to providing solid waste and recyclables material collection during the Street Fair and Parade. Therefore, in addition to the front-end recycling recommendations outlined above, the City also may want to explore post-collection sorting of trash at the Transfer Station to recover recyclables.

5.4 Public Areas

5.4.1 Existing Public Areas Recycling

Placing recycling cans adjacent to trash cans in public areas demonstrates the City’s commitment to providing recycling opportunities where people live, work and play. Contamination is often an issue with recycling containers placed in public areas, and the City is no exception.

Currently, the City has placed and WM services trash cans along public sidewalks, some of which are paired with recycling cans. Approximately 350 trash/recycling cans are in use. The City pays WM \$1.21 each time a trash or recycling can is serviced, which totals over \$150,000 annually.

City crews service trash and recycling cans at City parks and ball fields, and deposit the materials in roll-off containers that are serviced by WM. The City pays WM based on the number of times these containers are serviced, with an annual cost of approximately \$50,000.

5.4.2 Public Areas Recycling Recommendations

The following recommendations are intended to encourage additional recycling in public areas, minimize contamination issues, and potentially lower the City's costs.

1. **Clear and branded labeling** – improve labels on the recycling cans to ensure they clearly state and depict the types of recyclables that can be placed in the can, as well as to “brand” the cans with the City's recycling logo.
2. **Additional recycling cans** – consider placing recycling cans adjacent to additional trash cans in the most highly trafficked parts of the City.
3. **Program promotion** – partner with the City Parks Department and local sports leagues to promote recycling.
4. **Monitor contamination** – work with the collection service provider and City staff to identify areas with the highest contamination and determine what additional steps, e.g., education, signage, labels, etc., could help reduce this contamination.
5. **Lower City costs** – in the next collection contract, consider including servicing these public area garbage and recycling cans at no additional cost to the City. Many communities include servicing municipal containers in collection contracts at no charge. They consider it a benefit to the community as a whole and, therefore, require vendors to absorb this cost through other service fees.

5.5 Household Hazardous Waste and Electronics

5.5.1 Existing HHW and E-Waste Collection

Proper management of household hazardous waste (HHW) and end-of-life electronics (e-waste) is important because of the potential harm to waste collection personnel and City staff at the Transfer Station if these materials are mixed with garbage. If these materials are not disposed of correctly, they also have potentially harmful impacts on human health and the environment.

The City's Collection Agreement requires WM to provide drop-off services for HHW four times annually at no additional charge to the City or its residents. During the 2009 Agreement extension negotiations, WM committed to providing monthly HHW collection events within the City limits and also to create a collection program for e-waste. WM has not conducted an HHW collection event since the City's solid waste facility was relocated from Stock Island to Rockland Key in 2009.

Therefore, the only options for City residents are to take HHW and e-waste to the County's collection site at the Cudjoe Key Transfer Station, stockpile them until a more convenient option is available, or dispose of them with their garbage.

WM expressed interest in piggybacking on the County's HHW contract; however, as a private company, it is not able to do so. WM requested the City to enter into an Inter-Local Agreement (ILA) with the County in order to piggyback on the HHW contract. The City would reimburse the County for conducting HHW collection events in the City and properly packaging and disposing of the HHW and e-waste collected. In turn, WM would reimburse the City for these costs.

City staff previously reviewed and rejected an ILA proposed by the County because it also included fees for allowing City residents to drop off HHW and e-waste at the Cudjoe Key Transfer Station. City staff currently is reviewing a second ILA proposed by the County to conduct six HHW collection events in the City during the coming year. This ILA process does not relinquish WM's contractual responsibility to provide HHW and e-waste collection events.

5.5.2 HHW and E-Waste Recommendations

Resolution of the HHW collection issue is long overdue. It is time to put an end to the delay in implementing an HHW/e-waste collection program. The following recommendations should be implemented immediately.

1. **Regular HHW/e-waste collection events** – If the County's ILA is not acceptable to the City, WM should be notified and given no more than 60 days to conduct an HHW/e-waste collection event for City residents and businesses at an accessible location within the City, such as Indigenous Park. As agreed upon during the 2009 negotiations, events should be held monthly. Events should be the same weekend day each month, e.g., first Saturday of the month. WM should provide material quantities to the City for each event, and the frequency of events should be adjusted if warranted.
2. **Public outreach** – HHW collection events should be advertised through multiple media, including newspaper, radio PSAs, and the City's website. The website should provide detailed information regarding what materials are accepted, how they should be prepared, and any quantity limits. The City should also network with homeowner associations and organizations such as GLEE to advertise the events.

5.6 Construction and Demolition Debris

5.6.1 Current C&D Management

Because of lower tipping fees, two private facilities (WM's Rockland Recycling Center, located on Rockland Key, and Key West Transfer Station & Hauling Services, located on Stock Island) receive most of the C&D generated in the City.¹²

WM estimates that 65% of the C&D it receives is generated in the City, with the remainder generated in unincorporated Monroe County. Because the private facility on Stock Island is closer

¹² WM charges \$22/cubic yard. Key West Transfer Station & Hauling Services did not respond to requests for tipping fee information.

to the City, KCI assumed that 75% of the materials it receives are generated in the City.¹³ Table 5.2 estimates the quantity of C&D generated within the City and received at all three facilities in 2011. Based on this information, an estimated 23% of the C&D generated in the City was recycled in 2011. When combined with solid waste and recyclable tonnages delivered to the City Transfer Station in FY 2011, C&D represented approximately 19% of the waste/recyclables generated in the City that year.

Table 5.2: Estimated C&D Generation and Management, 2011

Facility	C&D Received (tons)	C&D Disposed (tons)	C&D Recycled (tons)	Recycled Materials (tons)				% Recycled
				Land Clearing Debris	Concrete	Paper	Metals	
City Transfer Station	417	417	0	0	0	0	0	0%
Key West Transfer Station (private)	1,541	1,062	479	0	296	0	184	31%
WM Rockland Recycling Center	9,247	7,167	2,079	1,019	807	16	237	22%
Totals	11,205	8,646	2,558	1,019	1,102	16	421	23%

Note: City tonnages are for FY 2011, less the 31 tons that were taken to WM's facility. Private facility tonnages are as reported to FDEP for CY 2011. Assumes 75% of Key West Transfer Station tonnage and 65% of WM Rockland Recycling Center tonnage was generated in the City. Numbers may not appear to total correctly due to rounding.

According to WM, metals and concrete are pulled out of the C&D at its transfer station before the material is transported out of the Keys. The recovered concrete is delivered to Toppino & Sons, Inc., also located on Rockland Key, and metals are shipped to Sun Recycling in Miami. After the remaining C&D reaches WM's disposal facility, wood is pulled out and the remainder is landfilled. WM also accepts vegetative waste at its transfer station on Rockland Key, which is shipped to the company's Central Landfill in Broward County to be ground for daily landfill cover.

5.6.2 C&D Waste Diversion Recommendations

C&D recycling has been expanding nationally and, more recently, within Florida. For example, Sun Recycling operates ten C&D facilities in Palm Beach, Broward, and Dade counties and is reportedly recycling up to 90% of materials received at these facilities.

Policy and program options to encourage the recycling of C&D generally fall into one of three categories: regulation, economic incentives, or education. Table 5.3 provides examples of mechanisms in each of these categories. Appendix I provides examples of effective C&D recycling programs implemented by local governments that have achieved substantial C&D diversion rates.

¹³ Repeated attempts were made to obtain additional information from Key West Transfer Station & Hauling Services, but no response was received. Therefore, because of its closer proximity to the City, KCI used a conservative estimate that 75% of waste received at this facility was generated in the City.

Table 5.3: Mechanisms Utilized to Increase C&D Debris Recycling

Regulation	Economic Incentives	Education
<ul style="list-style-type: none"> • Disposal bans • Mandatory recycling • Permit requirement • Facility regulations - require processors to meet recycling targets • Mandatory Green Building standards 	<ul style="list-style-type: none"> • Diversion security deposits • Differential tip fees for segregated materials • Material exchanges • Grants or low interest loans 	<ul style="list-style-type: none"> • Education and technical assistance • Educate by example through government building projects • Voluntary Green Building programs

In 2010, the Florida legislature enacted HB 7243, which requires C&D to be processed prior to disposal; however, the law does not include any reporting or enforcement mechanisms. The law is as follows:

“ ... to the extent economically feasible, all construction and demolition debris must be processed prior to disposal, either at a permitted materials recovery facility or at a permitted disposal facility. This paragraph does not apply to recovered materials, any materials that have been source separated and offered for recycling, or materials that have been previously processed.” (Section 403.707(9)(g), F.S.)

C&D is currently being recycled at a rate of about 23%, which is substantially higher than the recycling rate for other waste generated in the City. In addition, the City’s ability to incentivize or require contractors to separate C&D at the jobsite for reuse or recycling is limited by the apparent lack of local markets other than the two private C&D facilities. The City also is limited in its ability to place recycling requirements on the two private C&D facilities, neither of which is located within the City limits.

Therefore, the following approach is recommended.

1. **Encourage recycling by private C&D firms** – initiate a dialogue with the two private C&D companies to identify potential opportunities to increase recycling efforts in the future.
2. **Enforce anti-scavenging ordinance** – enforcing this ordinance (Section 58-86) should increase the flow of scrap metals through permitted facilities, which not only supports these local businesses, but also enables these materials to be counted as part of the City’s recycling rate. Scrap metal scavenging has been noted as a problem in discussions with WM staff.

Section 6

Facilities

The solid waste facilities currently owned by the City are the Transfer Station located on Rockland Key and the closed landfill located on Stock Island. This section focuses on the Transfer Station, which is currently operational, and also discusses the feasibility of developing an organics processing facility.

6.1 Transfer Station

The City's Transfer Station is uniquely located and affected by the environment and geography of the Florida Keys, factors that do impact operating costs. Located at MM9 on U.S. Highway 1, the facility is considered remote from the City by Key West standards. The City began operating the Transfer Station in 2009 when it moved its operations from the former waste-to-energy plant on Stock Island. The facility was designed and constructed to manage 350 tons of material per day. In 2011, the Transfer Station processed, on average, 158 tons per day, operating at 45% of permitted capacity. During that same period, the facility was operated with a full complement of staff during 100% of its permitted hours of operation.

An analysis of Transfer Station operations was conducted and a summary report with recommendations was submitted to the City on June 16, 2011 (see Appendix J). Provided below is a summary of these recommendations, which are intended to improve efficiencies, reduce expenses, and improve facility safety and overall operating performance.

1. **Overhead door:**
 - a. Investigate competitively procuring overhead door maintenance services with a list of standard replacement parts in order for staff to expedite repairs via a single service provider.
 - b. Investigate alternatives to these slow and maintenance-prone doors while meeting the intent of the Operating and Maintenance (O&M) Plan. Alternatives that could be investigated include plastic curtains to contain litter and eliminate birds or more durable sliding track doors. Any alternative will need to comply with permit requirements.
2. **Loader:** Consider equipping the main loader with a waste handler bucket rather than a grapple to enhance the speed and efficiency of loading. If a grapple is needed to handle scrap metals or other bulky materials, equip the spare loader with a grapple and utilize this loader when needed.



3. Material inventory management on the Transfer Station floor:

- a. Load and ship at least the same amount of waste received each day through a managed inventory process. At some point in time, and periodically thereafter, the tipping floor should be completely cleared of solid waste, recyclables, and scrap metal to establish a baseline. From that day forward, inbound and outbound reports should be compared to maintain a current and accurate waste inventory.
- b. Improve tractor-trailer loading time and enhance loader operator training to enable the City to meet the transfer vehicle demand necessary to empty the Transfer Station each day. Additional personnel training may be available from the loader manufacturer or by arranging for onsite training (at the City's Transfer Station or another transfer station) with a more experienced loader operator.
- c. Discuss with WM plans to improve transfer services by providing sufficient trailers, equipment, and personnel at all times. Discuss the reason for limiting the shipping time for recyclables. Work directly with WM rather than its transport subcontractor.

- 4. CFC-containing devices:** Review current handling processes for CFC-containing devices, both by the City and WM, to insure devices are correctly evacuated and that CFC releases are not occurring. Develop written handling procedures and train Transfer Station staff on proper management. Require WM to mark all devices once CFCs have been removed.



5. General operational and safety recommendations:

- a. Assign spotter responsibilities to the loader operator rather than an individual on the tipping floor. A safer work environment is provided when the spotter is positioned in the cab of a machine rather than walking on the tip floor, exposed to vehicle traffic.
- b. Establish and enforce tipping floor safety policies.
- c. Require staff to wear standard personal protective equipment while on the tipping floor, such as high-visibility clothing or safety vests, eye protection, and respirators.
- d. Establish and implement formal traffic control procedures. Install stop signs and/or speed bumps to control speed limits and ensure stopping before pulling on or off the truck scales.
- e. Establish and implement Lock-Out Tag-Out (LOTO) procedures for all equipment.
- f. Prohibit transfer trailer drivers or other City or contractor staff from sitting in or on the open trailers during the loading process. Drivers should remain in their vehicle cabs or in a designated safe area at all times.

- g. Explore alternatives to allowing self-haul customers to deposit recyclables on the tipping floor. The City should determine if a fully enclosed storage container located outside of the building for use by these small generators meets the intent of the permit. A roll-off container could be located away from the facility on City property, or possibly within the structure that was designed to store cardboard.



6. **Scale system:**

- a. Consider discontinuing accepting cash and checks as a means of payment, limiting payments to credit cards or established credit accounts to reduce potential liability.
- b. More fully utilize the capabilities of WasteWorks, the scale house software, by understanding its full range of features and capabilities; populating additional data cells; generating customer billing, financial, and daily accounting reports; and training staff in its use. Consider establishing remote access to the system for on-demand access.



- c. Consider an unattended scale house system to eliminate the need for scale operators or facilitate the elimination of the split shift. A dual-line (inbound and outbound) unattended scale house system that is compatible with WasteWorks, the software system currently utilized by the City, would cost \$40,000-\$50,000, including software licenses. Equipping the system with radio frequency identification (RFID) readers would cost approximately \$10,000 more, but would allow the system to automatically read tags encoded with account information rather than requiring drivers to manually enter this information into the system upon entry. (See Appendix J, pages 14-15 for additional information.)

7. **Staffing and operating hours:** By improving operational efficiencies, the City could potentially reduce facility operating hours and staffing.

- a. Evaluate and, if feasible, establish an alternative to having a dedicated mechanic at the Transfer Station. This is a costly position given the limited amount of equipment on site and the acquisition of a new loader. The facility may be able to share mechanic services with other City departments as long as such services can be provided expeditiously so as not to interfere or delay facility operations.

- b. Consider reducing the Transfer Station hours of operation. Based on operating hours and daily throughput of other publicly operated transfer stations, the City should be able to reduce hours by 1 to 2 hours daily while continuing to manage the same quantity of solid waste and recyclables. Any change in operating hours would necessitate an amendment to the O&M Plan, approval by FDEP, and modification of the Collection and T&D Agreements. The O&M Plan should note the operating hours for which the facility is permitted rather than when it will specifically operate, and that current hours of operation will always be posted. An amendment to the O&M Plan should not restrict or reduce the City's ability to return to the permitted hours of operation if waste volumes warrant.
- c. Potentially eliminate one of the scale house positions by either reducing the daily hours of waste receipt to no more than 8.5 or utilizing an automated scale system. The facility manager or one of the operators could relieve the scale operator for a 30-minute lunch break. If the City converts to a full-time automated scale system, both scale house positions could be reassigned or eliminated.
- d. Review all remaining personnel position descriptions to insure that all essential facility functions are incorporated and that safety protocols are adhered to. This will require personnel assessments and employee cross-training to insure a level of staff redundancy exists for the uninterrupted operation of the facility. All personnel should be cross-functional and have the ability to conduct scale house activities, loader operations and tipping floor spotter duties, and general facility upkeep, including the facility manager or supervisor. Such cross-training will ensure that all essential facility functions are covered at all times.
- e. Review work hours for all personnel to minimize overtime while insuring adequate staffing during peak waste delivery times.



In addition to the safety recommendations included above, a draft Transfer Station Tipping Floor Safety Policy was prepared and is provided in Appendix K.

6.2 Organics Processing Facility

6.2.1 Diversion Potential

Composting organics in lieu of disposal will not only reduce the City's disposal costs and increase its recycling rate, but will also produce a valuable soil amendment and reduce the environmental impacts of managing this material.

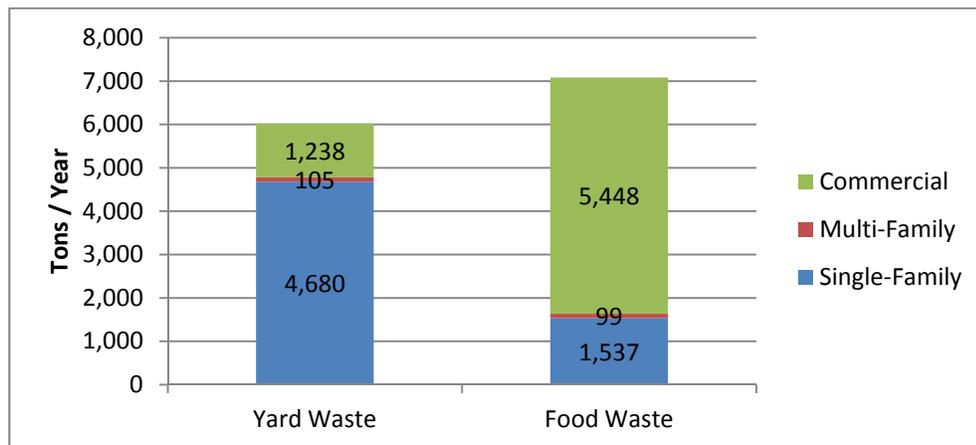
Based on the waste composition study, yard waste comprises 14.1% of the solid waste disposed by City residents and businesses and food waste makes up an additional 16.6%. Combined, these materials represent more than 30% of the City waste that is disposed at the Transfer Station, making them prime targets for recycling. Table 6.1 provides the breakdown of these organic materials between residents and businesses and also estimates the tonnage disposed annually.

Table 6.1: Estimated Yard Waste and Food Waste Disposed, FY 2011

	Residential & Commercial Combined	Single-Family	Multi-Family	Commercial
Waste Collected by WM (tons/yr)	42,697	17,079	854	24,764
% of Total Waste	100%	40%	2%	58%
Yard Waste %	14.1%	27.4%	12.3%	5.0%
Yard Waste (est. tons/yr)	6,020	4,680	105	1,238
Food Waste %	16.6%	9.0%	11.6%	22.0%
Food Waste (est. tons/yr)	7,088	1,537	99	5,448
Organics %	30.7%	36.4%	23.9%	27.0%
Organics (est. tons/yr)	13,108	6,217	204	6,686

Based on this information and as depicted in Figure 6.1, single-family residents generate the overwhelming majority of yard waste and the commercial sector generates the majority of food waste. Therefore, residents should be the first target for diverting yard waste from disposal and businesses are the first target for food waste diversion.

Figure 6.1: Primary Generators of Yard Waste and Food Waste



The potential also exists to co-compost organics from the solid waste stream with biosolids, which are wastewater treatment residuals. Biosolids are rich in nutrients and contain a significant amount of water, making them an ideal feedstock for blending with yard waste. South Florida’s characteristically woody and dry yard waste contains a substantial amount of palm fronds, which have a high lignin content and are resistant to degradation. Biosolids, however, contain nitrogen,

which balances the carbon to nitrogen (C:N) ratio, allowing the microorganisms responsible for composting to work much more efficiently in breaking down resistant compounds.

Biosolids composting has become a widely accepted practice across the United States, with over 265 operating programs nationally, including at least six in Florida. The closest is operated by Miami-Dade, which only processes biosolids from its own system. Biosolids composting is a proven method for pathogen reduction, provides considerable volume reduction, and produces a valuable end-product.

The City's wastewater treatment facility generates approximately 6,800 tons (8,500 cubic yards) of biosolids annually and currently pays about \$70 per ton to transport and dispose of these biosolids. Although not considered part of the municipal solid waste stream, including biosolids in the composting program should provide additional cost savings to the City. It would also enhance the soil structure and nutrient value of the resulting compost, thereby creating a more valuable end-product.

A successful organics recovery program requires the infrastructure to collect segregated organics, a processing facility, and viable end-markets for the resulting product. The collection element is addressed in the residential and commercial program recommendations outlined in Section 5. This section focuses on options for a processing facility and potential end markets.

6.2.2 Organics Processing Options

Various methods of organics processing are in use today, ranging from no or low technology options to comprehensive and technologically advanced systems.

- **Windrow composting** involves piling feedstock materials into elongated rows either outside or in a building, and turning them periodically based on time and temperature factors. This is by far the most common method of composting in the United States and Canada for yard waste and source-separated food waste. Windrow composting is fairly flexible and can be accomplished with turning equipment ranging from a front-end loader to specialized windrow turning machines.
- **Aerated static pile composting** involves placing air blowers and/or ducts under a pile of organic materials in order to maintain aerobic conditions. The pile is capped with an insulating blanket of wood chips or other material and not disturbed until the active composting process is complete.
- **The Modified Static Aerobic Pile (MSAP) method** combines both static pile and windrow composting methods, which minimizes the need for mechanical turning while still maintaining aerobic conditions and excellent pathogen kill. This method accelerates the process with the use of an organic catalyst and creates a high quality compost product. The MSAP method was developed by Harvest Quest International, Inc. and is currently being applied in a yard and food waste composting operating in numerous locations throughout



the U.S., including Florida. This method has received EPA approval for meeting regulatory requirements for biosolids composting.

- **In-vessel composting** refers to enclosed systems such as large rotating tubes or elongated bays with mechanical turning machines and forced aeration systems. Such systems are typically used to compost manures, food waste, and biosolids; with very large systems also used to process municipal solid waste. They are not conducive to composting solely yard waste. Benefits of in-vessel composting include the ability to contain feedstocks, such as food waste and biosolids that might attract birds or generate odors. In-vessel systems tend to be more technologically advanced and therefore have higher capital and operational costs.
- **Anaerobic digestion (AD)** is a biological process that takes place in the absence of oxygen. AD produces methane, which can be recovered for use as a biogas fuel. The solid digestate typically undergoes subsequent aerobic composting. Numerous different AD technologies are available. Historically, AD has been used primarily for wastewater treatment and manure. With regard to source-separated organics from solid waste, dozens of AD facilities operate in Europe and several are currently under development in the United States.

The costs and complexity of organics management systems substantially increase as the move is made from windrows to in-vessel composting, to anaerobic digestion. In general, aerobic in-vessel systems generally cost twice as much to implement, operate and maintain as windrows, and anaerobic systems can cost three times as much.

As mentioned previously, including biosolids in the composting operation can be advantageous operationally. Biosolids provide moisture and nitrogen, while yard waste provides carbon and serves as a bulking agent to increase porosity. Composting options that are appropriate for biosolids include windrow composting, MSAP, aerated static pile composting, and in-vessel composting. Aerated static pile and windrow are the most commonly utilized methods, representing 72% of the programs in the United States, and all six Florida programs.¹⁴ Depending on the method utilized, biosolids compost can be ready for use with 3 to 4 weeks of active composting followed by one month curing.¹⁵

Numerous successful composting operations exist throughout the country. The challenge in Key West is to develop an organics collection and processing operation that is cost-effective. To achieve this, the processing facility would ideally be located in the Lower Keys, with the primary use of the end-product also in the Keys.

The Monroe County Board of County Commissioners recently directed the County's Climate Change Action Committee to develop a plan for mulching, composting or otherwise recycling yard waste instead of disposing of it. The County has received proposals from the South Dade Soil and Water Conservation District (SDSWCD) and WM, which currently operates the County's three transfer stations.

SDSWCD proposes using two 96-cubic yard in-vessel composters at each of the County's three transfer stations. The estimated cost for purchase, delivery and installation is \$763,000 per transfer station, or a total of \$2.3 million. This does not include operating and maintenance costs.

¹⁴ *Biocycle*, "Biosolids Composting in the United States – 2010 Update."

¹⁵ US EPA, *Biosolids Generation, Use & Disposal in the United States* (US EPA530-R-99-009), 1999.

As demonstrated by these cost estimates, in-vessel composting requires substantial capital investment and limits the tonnage that can be processed. Bulking agents, such as yard waste, often need to be considerably reduced in size to avoid blocking the vessel or tunnels.

Windrow composting and the MSAP method are less expensive, easier to implement, and more flexible than other composting processes. If managed correctly, odors and vectors are not an issue. In addition, land acreage requirements are similar for in-vessel and windrow composting. A vessel provides initial treatment, but does not produce a finished compost; additional windrowing and curing is required.

A more detailed analysis of windrow composting and the MSAP method was conducted, including discussion of site criteria and space requirements, identification of potential sites for further evaluation, equipment needs, and potential end-markets. A summary report of this analysis is provided in Appendix L.

The cost of producing compost will vary greatly depending on the methodology used. In Key West, local composting will provide a cost-effective alternative to disposal if production costs remain lower than transport and disposal costs, which should be attainable. The sale and use of locally produced compost may also provide additional benefits to the City in the form of increased waste diversion and revenue.

Preliminary conversations with industry specialists have indicated that the windrow or MSAP methods best suit Key West's unique environmental parameters. Production costs for windrow composting ranges from \$16-25 per ton of inbound material, and for the MSAP process the range is \$28-44 per ton. Either would be far less than current transport and disposal fees (currently \$71.55 per ton). Revenue for finished compost is generally in the range of \$8-15 per cubic yard.¹⁶



One potential consumer for locally produced compost could be Key West Golf Course. Compost is used by golf courses for both construction and maintenance purposes. A standard 18-hole golf course can typically consume 250 to 300 cubic yards of compost, or 500 to 600 cubic yards of 50/50 compost-sand blend per year for maintenance purposes. Use at the Key West Golf Course would also increase product exposure. The City could also sell finished compost to local businesses and make it available to residents at no charge. A more detailed analysis of financial implications would be needed once a composting site is identified.

6.2.3 Organics Processing Recommendations

To enable the City to immediately begin diverting organics from disposal despite the lack of processing infrastructure in the Florida Keys, a phased approach is recommended.

¹⁶ Per conversation with Darren Midlane, Technical Director at Harvest Quest International.

1. **Utilize an existing yard waste processing facility** – To initiate separate collection of residential yard waste as quickly as possible, the City should transfer yard waste to an existing processing facility. The City has initiated discussions with its current contractor, WM, to transport yard waste to WM’s landfill in Broward County where it would be ground and used for landfill cover.¹⁷ However, if approved by the City, this should be considered only a short-term solution. The City immediately should work to identify or conduct a bid process for a yard waste composting alternative. In addition, WM could be asked to backhaul some of the mulch to offer at-no-charge to City residents and businesses. A convenient location would need to be identified for distribution of the mulch.
2. **Conduct a competitive procurement for organics processing** – A competitive procurement would allow private sector vendors to offer potential organics composting solutions to the City. If the City identifies a suitable location for a composting facility, the site could be made available to a private contractor for facility development. While the facility would initially process primarily yard waste, the intent would be to expand the City’s organics program to commercial and possibly residential food waste and biosolids.
3. **Explore opportunities to work with the County** – The City should continue to monitor the County’s progress in establishing composting facilities and explore opportunities to partner in this endeavor depending on location, timing, and cost.
4. **Continue to encourage backyard composting** – The City should continue to encourage and educate residents about backyard composting.

¹⁷ According to existing FDEP policy, use of ground yard waste as landfill cover is counted as recycling only when used as final cover. Under proposed revisions to Section 62-716, F.A.C., use of ground yard waste for any landfill cover (daily, intermediate, or final) will count as recycling, but only for that amount that FDEP considers necessary to perform cover functions. Anything in excess of that will not count.

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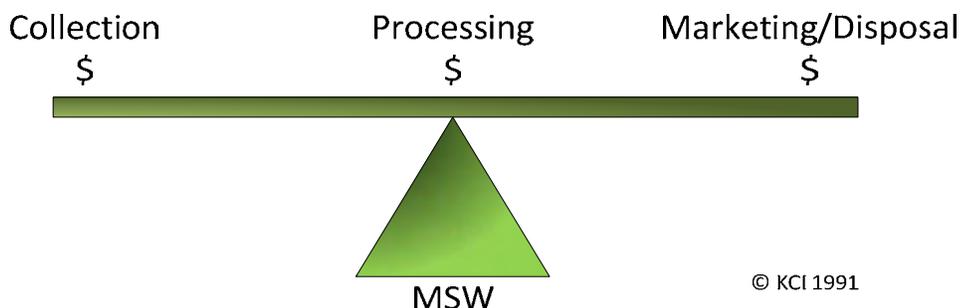
Section 7

Funding

7.1 Existing Financial Model

Collection, processing, and marketing/disposal are interrelated elements of a solid waste management system (see Figure 7.1). The collection segment consists of public and/or private entities that collect materials generated by residents, businesses, and institutions. Processing includes sorting and recovering recyclable materials, as well as transferring solid waste for disposal. Recovered materials are then marketed, or solid waste is disposed in a landfill or waste-to-energy facility. All three elements have a cost and are critical to maintaining a balanced, sustainable solid waste management system. Changes to one of these elements will impact the others. Therefore, all three need to be looked at together to ensure a viable future solid waste management system for the City.

Figure 7.1: Balancing the Business Components of Solid Waste Management



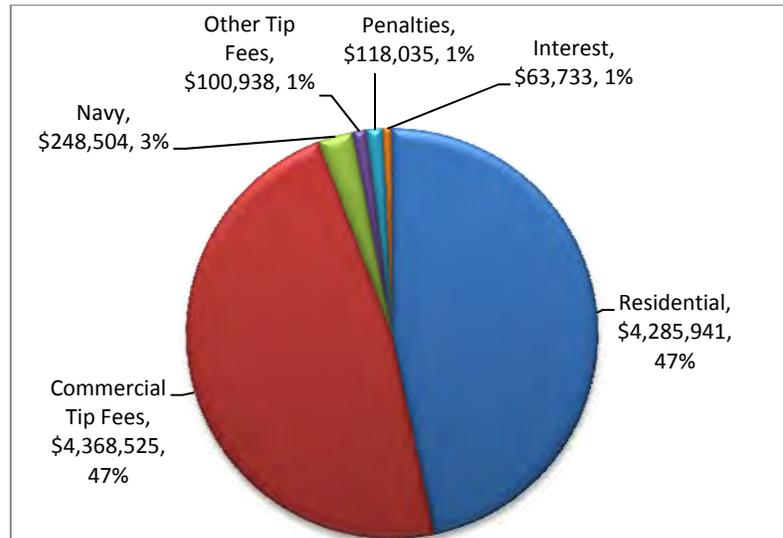
As the City increases diversion of waste from disposal, whether through waste reduction, recycling or composting, it may be necessary to modify the current business model for the solid waste management system. While the costs of transferring and disposing of waste will decrease and additional revenue should be generated from recyclables,¹⁸ the City will also lose some of the revenue that would have been generated through Transfer Station tipping fees. As further explained in this section, these tipping fees pay for a variety of solid waste expenses not directly related to disposal. The City will need to ensure that this loss of revenue is offset by reducing expenses and increasing revenue, which may require altering its existing solid waste financial model.

Revenue

About half of the City's solid waste revenue is from residential service fees and about half from commercial waste disposal fees (see Figure 7.2). Of the \$4.285 million of residential fees collected by the City in FY 2011, \$2.353 million was remitted to WM for collection services and the remainder (\$1.934 million) was used to cover disposal and other services.

¹⁸ Assuming the City takes steps to ensure it receives fair revenue for its recyclables.

Figure 7.2: Solid Waste Revenue, FY 2011



The City bears the risk of non-payment of residential service fees, meaning that the City pays WM for all residential collection service even if all residents have not remitted payment to the City. Non-payment by some residents has been an ongoing issue; as of April 2012, solid waste payments in arrears totaled over \$685,000. To address this issue, the City recently hired a Collections Manager and the City Commission directed staff to develop a non-ad valorem solid waste assessment in lieu of billing residents on monthly utility bills. Because of the legal process to establish a non-ad valorem assessment, the earliest it would take effect is 2014.

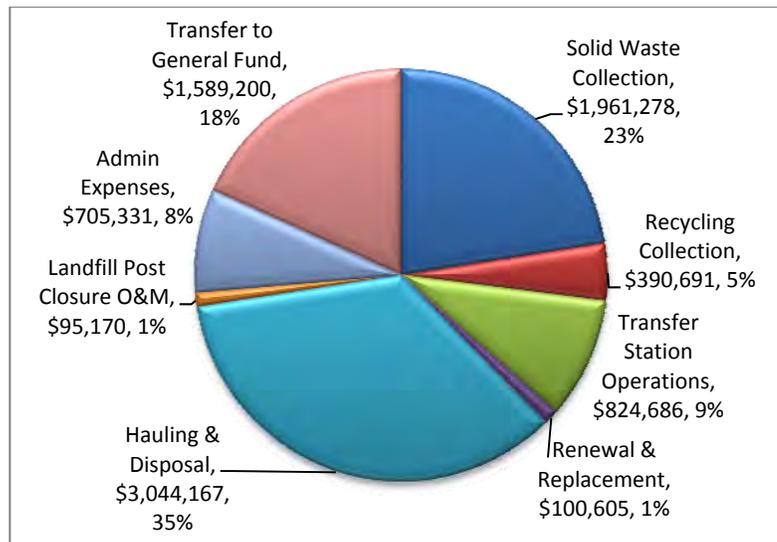
The disposal portion of the residential service fee is based on a residential waste generation rate of 1.21 tons per residential unit per year. At the City’s current tipping fee of \$165.97 per ton, this would equate to \$16.74 per unit per month; however, the City currently charges residents only \$13.63 per month for disposal. The City chose not to increase residential services fees, but to instead rely on other revenue sources.

WM bills commercial customers for solid waste service, retains the collection portion of the fee, and remits the disposal portion to the City. The risk of non-payment is borne by both WM (for collection) and the City (for disposal). WM can and does cease service if payment is not received. This also is a code enforcement issue for the City since Section 58-68 of the City Ordinance requires all commercial units to subscribe for solid waste collection service.

Expenditures

Figure 7.3 provides a breakdown of solid waste expenditures in FY 2011. The Transfer Station tipping fee (currently \$165.97 per ton) is calculated to cover all non-collection solid waste expenses, including Transfer Station operations, transport and disposal of solid waste, the required annual transfer to the General Fund, administrative expenses, landfill post-closure care, and repair and maintenance. This type of disposal-based revenue to support non-disposal expenses might not be sustainable as the City strives to divert additional waste from disposal.

Figure 7.3: Solid Waste Expenditures, FY 2011



Based on a recent cost allocation analysis, the amount that must be transferred from Solid Waste to the General Fund will decrease in the future. For FY 2012, this amount is \$1.44 million and in FY 2013, it will be \$1.39 million.

7.2 Potential Financial Impacts of Waste Diversion

The overall financial impact of increased waste diversion should be positive to the City and its residents and businesses. However, the City’s disposal-based revenue model will need to be altered.

Residential Waste Diversion: For each ton of residential waste diverted from disposal, the City will save approximately \$70.¹⁹ Although not currently the case, the City should also receive revenue for residential recyclables, since these commodities have a market value (see discussion below). Unless the City chooses to adjust the fee it charges residents, the net financial impact to the City will be positive.

Commercial Waste Diversion: As the amount of commercial solid waste disposed decreases, the City will save about \$70 per ton diverted (the contract fee for transport and disposal). If businesses reduce their solid waste services commensurate with the increased recycling, the City potentially will lose approximately \$165.97 per ton in revenue (City’s current tipping fee at its Transfer Station).²⁰ The difference between these two figures is revenue currently used by the City to fund non-disposal solid waste expenses. The City will need to identify an alternative revenue source to offset this loss.

¹⁹ This cost fluctuates quarterly based on fuel prices and annually based on CPI. The current fee is \$71.55 per ton.

²⁰ The \$165.97 per ton figure is an estimate. The actual loss will depend on the extent to which a business reduces its garbage service (e.g., container size or frequency of collection) as it increases recycling. For every cubic yard decrease in garbage collection capacity, the City currently would lose \$13.53 (based on waste density of 163 pounds/cubic yard and the current tipping fee).

Recycling Revenue: The City should be receiving revenue for recyclables that flow through its Transfer Station, but currently this is not the case.

The value of recovered materials fluctuates over time. In late 2007/early 2008, market values for most commodities reached the highest they had been in more than a decade, but dropped in 2008 during the economic downturn. Within a year they climbed back to levels that many industry experts believe are more sustainable, although future fluctuations are inevitable.

Based on the typical make-up of recyclables collected in curbside programs, the combined market value of these materials currently is about \$130-\$150 per ton. Table 7.1 provides a snapshot view of recycling revenue received by various Florida communities in June 2012. In most of these jurisdictions, revenue fluctuates over time based on market prices (usually as reflected by an industry-accepted market index). Revenue received by some jurisdictions at times exceeded \$80 per ton during the past year.

Table 7.1: Examples of Recycling Revenue in Other Florida Jurisdictions, June 2012

Jurisdiction	Revenue/Ton	Program Type	Service Provider
Broward County	\$58.50	single stream	WM
Indian River County (pending contract)	\$69.95	dual stream	ReCommunity
Jacksonville/Duval County	\$41.07	dual stream	Republic
Lakeland (City)	\$60.53	single stream	WM
Okaloosa County	\$30.00	single stream	WM
Polk County (RFP)	\$64.03	single stream	WM
Sarasota (City)	\$58.77	dual stream	WM
Sarasota County	\$45.74	dual stream	ReCommunity
Seminole County	\$63.90	dual stream	WM
Tallahassee (City)	\$60.00	dual stream	Recycled Fiber

Note: Revenue typically is paid for each inbound ton of recyclables (i.e., tons delivered for processing, not outbound from the processing facility). Comparisons between jurisdictions are difficult because of differences in the services provided, materials accepted, local market competition, and contract provisions. In most jurisdictions, revenue fluctuates over time based on commodity values.

7.3 Recommendations for a Sustainable Business Model

The City’s existing disposal-based revenue model for its solid waste system is not sustainable as the City strives to maximize waste diversion. The following recommendations are offered to establish a more sustainable solid waste business model.

1. **Recycling revenue** – The City should be receiving revenue for its recyclables. As demonstrated in Table 7.1, many Florida communities, including several serviced by WM, currently are receiving revenue for their recyclables. According to WM, it costs approximately \$40 per ton to transport recyclables to its processing facility in Broward County. Even deducting that full amount from the revenue received in many other Florida jurisdictions, the City reasonably should expect to receive some amount of revenue.

If the City received even \$20-\$30 per ton for its recyclables, combined with the transport and disposal fee savings (approximately \$70 per ton), the swing between recycling and disposal would be a \$90-\$100 per ton financial benefit to the City. Doubling the City's current recycling rate would provide about a \$300,000 benefit to the City.

2. **Alternative revenue source** – The City should develop a revenue source that does not rely predominantly on disposal.

For example, the City could adjust its tipping fee to cover only those costs directly related to disposal (e.g., transport and disposal contractor fees, transfer station operating costs to manage garbage, and renewal and replacement costs). A separate solid waste management fee could be equitably distributed among customers to cover other system costs not directly related to disposal or not covered by collection service fees (e.g., administrative expenses, transfer of funds to the General Fund, transfer station operating costs to manage recyclables, and landfill post-closure costs). This would more closely align fees with the services provided and would ensure the City generates sufficient revenue to cover fixed system costs.



TECHNICAL MEMORANDUM

TO: Jay Gewin
Key West Utilities Manager

FROM: Robin Mitchell
Project Manager

DATE: July 13, 2011

SUBJ: **Analysis of Collection Agreement, Services and Fees;
Identification of Recycling Opportunities**

PROJ #: 120-00.00

Per Task 2 of Task Order 1, Kessler Consulting, Inc. (KCI) reviewed the existing agreement for the collection of residential and commercial solid waste and residential recyclables (Agreement) between the City of Key West (City) and Waste Management (WM). Per Task 3, KCI also compared solid waste and recycling collection fees with those in other jurisdictions. This memorandum provides general comments on the existing Agreement, presents a comparative analysis of WM's residential and commercial collection fees, and identifies initial opportunities to increase recycling in the near-term working in partnership with WM and within the parameters of the existing Agreement. These recycling opportunities do not take the place of the broader and more substantive waste diversion opportunities that are being evaluated as part of Task 6 for inclusion in the Solid Waste Master Plan.

Collection Agreement Background

In 1999, the City issued a Request for Qualifications to which three large waste hauling firms responded. The City Commission ranked WM highest and City staff negotiated a contract and pricing structure. The City entered into an exclusive Agreement with WM for residential and commercial solid waste and residential recycling collection on January 1, 2000. The City and WM renewed the agreement in 2005 and again in 2009, each for additional five-year terms. The current Agreement expires on December 31, 2014, but also has a clause that allows termination for convenience with a 180-day written notification.

WM received the following fee increase, when the Agreement was renewed in April 2005, to be used as a direct housing allowance to its 34 employees. This was in addition to the CPI increase allowed in the Agreement.

- \$1.05 per residential unit per month
- \$0.30 per cubic yard per month for commercial collection

During the 2009 extension negotiations and according to a Memorandum from Jay Gewin, Utilities Director, dated November 3, 2009, WM agreed to negotiate with the City on the following concepts if the five-year extension was approved:

- Mechanisms designed to make recycling more convenient for families and businesses, including increased promotional efforts along with a recycling incentive program.
- Improved customer service and response, including a local call center.
- Research into the feasibility of a new composting program.
- The incorporation of Best Management Practices.
- Creating an e-waste collection program.
- Creating a monthly Household Hazardous Waste (HHW) collection program within the City limits.
- Feasibility of incorporating a pay-as-you-throw solid waste customer billing system.

Opportunities to Increase Recycling

As mentioned above, during the 2009 extension negotiations, WM agreed to negotiate with the City regarding mechanisms designed to make recycling more convenient for residents and businesses. The recycling opportunities outlined below present a starting point and framework for such negotiations. The City has contracted with KCI to develop a Solid Waste Master Plan; however, the City could proceed with implementing many of the items listed below prior to completion of the plan. With assistance from KCI, the City and WM could begin discussing these various recycling opportunities and working cooperatively to establish a more effective program for capturing residential and commercial recyclables. Some of these opportunities can be pursued immediately, while others may require additional planning or resources.

1. **Commercial Recycling:** The greatest opportunities to increase recycling are in the commercial sector. Some businesses self-haul recyclables to the City's Transfer Station because they are not aware that WM offers this service or believe it is too expensive. Businesses should be able to partially offset the cost of recycling through savings in garbage collection. Specific actions to begin to increase commercial recycling include the following:

- a. **Negotiate and establish not-to-exceed commercial recycling fees** in the Agreement that are equal to or less than comparable fees to collect solid waste (disposal not included). Exhibit B of the Agreement states the commercial recycling fees at that time, which are identical to the commercial solid waste collection fees, indicating the intent of the Agreement for these fees to be equivalent to each other during the term of the Agreement.

These fees are no longer equivalent, as noted in Table 1, which provides a comparison of WM's current commercial solid waste and recycling collection fees. Fees for commercial recycling dumpsters are 27 percent greater than comparable fees for solid waste collection, and fees for recycling cart service are 71 percent greater than the cost of commercial solid waste cart collection. Because WM also receives revenue from marketing the recovered commodities, collection fees for recyclables should arguably be lower given the current marketplace for recovered commodities.

Table 1: Comparison of Commercial Collection Fees for Solid Waste and Recyclables

Container Type	Solid Waste		Recyclables		% Difference
	Per Pickup	Per CY	Per Pickup	Per CY	
18-Gallon Bins	NA	NA	\$0.53	\$7.66	NA
Dumpsters (OCC)	Varies	\$7.46 - \$8.47	Varies	\$10.72	27%
32-Gallon Carts	\$1.52	\$9.57	\$2.59	\$16.33	71%
95-Gallon Carts	\$4.55	\$9.67	\$7.76	\$16.50	71%

OCC = Old Corrugated Cardboard NA = Not Applicable

KCI analyzed the fee for collecting commercial cardboard in dumpsters. One ton of flattened, uncompacted cardboard takes up about 20 cubic yards of space, which at \$10.72 per cubic yard, would cost \$214 for collection. The current market value of cardboard is approximately \$170 per ton, for potential gross revenue to WM of about \$384 per ton. Assuming an actual cost for collection of \$6 per cubic yard, a cost of \$37 per ton to transport recyclables from Key West to WM's MRF in Broward County, and a processing cost of \$50 per ton, WM would potentially net more than \$175 per ton from recovering commercial cardboard. Therefore, the collection fees for commercial cardboard seem high and warrant further discussion with WM. Cardboard is only one of many recyclable materials, and different commodities have different market values.

- b. **Require WM to offer collection of the same types of recyclable materials from businesses as it does from residents**, including all grades and types of recyclable paper and containers. Section 5.B (Commercial Recycling, page 12) of the Agreement requires WM to offer a commercial recycling program equal to residential service; however, it appears that commercial dumpster service is available only for corrugated cardboard. A fee structure should be established to collect recyclable fiber and recyclable containers in all types of collection containers typically utilized by commercial businesses.
- c. **Develop an outreach campaign to promote commercial recycling and a technical assistance program to assist businesses in establishing programs.** The City and WM should work cooperatively on this mutually beneficial campaign and assistance program. Businesses should be made aware of available recycling services and fees, as well as the potential savings of right-sizing their waste collection services once recycling is established.
- d. **Explore opportunities to collect source-separated glass from bars and restaurants and process for local use.** Glass is one of the heaviest recyclable materials and one of the lowest in value. If collected separately, it could potentially be processed for recycling in a non-container use, such as construction aggregate, paving material, or other alternative application.
- e. **Request WM to track and report on businesses to which it offers recycling services** and, if such services are refused, the reasons for refusal.
- f. **Amend City Ordinance and building codes, as appropriate, to comply with recently passed State legislation (2010 HB 7243):** "(i)n accordance with applicable local government ordinances, newly developed property receiving a certificate of occupancy, or its equivalent, on or after July 1, 2012, that is used for multifamily residential or commercial purposes, must provide adequate space and an adequate receptacle for recycling by tenants and owners of the property." (Section 403.706(2)(c), F.S.) In addition, WM should proactively work with new developments to establish and provide recycling service.

2. **Residential Recycling:** Residential recycling is more established than commercial recycling, but opportunities exist for improvement. KCI will be evaluating the feasibility of Pay-As-You-Throw and other incentive programs as part of our ongoing work, but more immediate suggested actions include the following:
 - a. **Eliminate the annual 5 percent cap on WM’s purchase and distribution of new recycling containers** as established in Section 5.A.32 (page 12) of the Agreement. According to City staff, the 5 percent cap has not been exceeded in the past few years; however, the inability to obtain sufficient recycling containers can be a deterrent to recycling. The limit should be eliminated or, at a minimum, WM should offer and deliver additional containers to residents at cost and recycling stickers to place on customer-provided containers at no cost. Residents should not be required to pick up recycling stickers at City Hall.
 - b. **Require WM to provide current and accurate recycling information to customers**, as well as non-collection notices that clearly explain the reason materials were not collected with recyclables. Anecdotal information indicates the recycling information currently distributed with new recycling bins has not been updated to include the additional materials now being accepted by WM.
 - c. **Develop a customer education campaign with WM’s assistance.** Section 5.A.1 (Educational Information, page 12) of the Agreement requires WM to provide educational information related to recycling, sponsor Public Service Announcements, and provide at least \$6,000 of educational support annually. WM should annually provide the City with a list of proposed educational information and activities, with monthly updates on activities performed.
 - d. **Require WM to provide sufficient recycling containers and service to all multifamily dwelling units**, and to report on any complexes that refuse such service and the reasons for refusal. According to Section 5.A.2 (page 12) of the Agreement, WM is to provide appropriate-sized recycling containers to multifamily dwelling units up to a “maximum” capacity of 18 gallons multiplied by the number of residential units in the multifamily dwelling unit. Since single-family residential units are allowed to place multiple recycling containers curbside for collection and multifamily dwelling units pay the same fee for recycling as single-family units, this “maximum” capacity limit should be eliminated or turned into a “minimum” capacity. The City should request from and review with WM a list of multifamily dwelling units to identify those without sufficient recycling capacity.
 - e. **Convert to recycling carts instead of bins.** Recycling carts provide greater capacity and are found to increase recycling rates. Any change in service or containers will require upfront public education to introduce and explain the new system.
3. **Recycling at Special Events and in Public Areas:** The Agreement can also be utilized to ensure that special event planners can obtain recycling services at a reasonable rate, as well as to expand recycling in public areas. Suggested actions include the following:
 - a. **Negotiate not-to-exceed service fees for providing recycling at special events** and incorporate these fees into the Agreement. Fees should be provided for various container types and sizes.
 - b. **Discuss with WM the placement and servicing of recycling containers in public areas.** According to Exhibit B (page 8) of the Agreement, WM is to provide and maintain recycling containers for use at public sites as directed by the City.
4. **Organics Recovery:** Diversion of organics, especially yard waste, offers a significant opportunity to increase the City’s recycling rate, but requires the infrastructure to process the materials

once collected. As part of our ongoing work, KCI will be working with the City to explore opportunities to establish or pilot a composting operation. Section 4.B.3.(ii) of the Agreement requires WM to develop procedures for the separation of yard waste if the City begins a composting program. At that time, the City should also consider converting to weekly solid waste collection to avoid a fee increase.

The recycling opportunities outlined above do not replace the more in-depth research and analysis of waste reduction strategies that KCI will be conducting in future tasks. Rather, they represent initial actions that can start to boost recycling in the near-term and lay the foundation for future efforts.

Comments Regarding Collection Agreement

KCI noted differences between what is required in the Agreement and the services currently provided by WM. KCI assumes that the City approved these changes, but no documentation was available, nor was it clear whether the City received any benefit or compensation, in terms of reduced fees, for these changes. Provided below are comments regarding the Agreement, some of which warrant review and discussion with WM.

1. The following items were noted in the Definitions section, which warrant revision during the next Agreement amendment:
 - Section 3.BB, definition of Garbage Receptacle (page 4) – The definition refers to a garbage can rather than the solid waste carts that are currently used. This definition should be revised and/or a definition added for Solid Waste Cart.
 - Section 3.RR, definition of Refuse Regulations (page 5) – The last sentence of this definition appears to belong to the definition of Roll-Off Container Collection Services rather than Refuse Regulations.
 - Section 3.UU, definition of Bio-Hazardous Wastes (page 6) – This is not a full definition and should be combined with the earlier definition of Bio-Hazardous Waste in Section 3.C.
 - Section 3.HHH (page 7) – It does not state what term is being defined.
2. Section 4.B.3.(iii), Items Collected (page 8) – Contractor is required to remove refrigerant from White Goods curbside. WM is currently removing refrigerant from white goods after they are delivered to the City's Transfer Station. This clause should be revised to reflect the current management procedures.
3. Section 4.B.3.(iii), Items Collected (page 8) – This section also references a Metals Marketing and Management Plan in Attachment A (appears that reference should be Attachment B), which states that WM will load, transport, and market metals and white goods received at the City's Waste-to-Energy plant at a cost to the City of \$20 per ton. The City assumed the responsibility of loading metals and white goods when operations moved to the City's Transfer Station; however, the City continues to pay WM \$21.60 per ton to transport and market these materials. The City should receive some level of compensation (or reduction in fees) for providing the loading services for WM. WM retains any revenue for these commodities when marketed; the current market value of white goods in the southeast U.S. is approximately \$150 per ton.¹
4. Section 4.E(i) (page 10) – Contractor is required to provide drop-off services for household hazardous waste four times per year at no additional charge to Residential Customers. This service is not being provided and no apparent compensation was provided to the City for

¹ Source: Secondary Materials Pricing index (<http://www.wasterecyclingnews.com>).

eliminating this requirement. City staff should discuss with WM the reasons for eliminating this service and the feasibility of re-establishing it. This clause should be revised to reflect what is agreed upon between the parties.

5. Section 4.E(iii) (page 10) – Contractor is required to collect construction and demolition (C&D) debris, but this is not a service exclusive to the Contractor. This provision should be modified to reflect changes to Florida law requiring, as of January 1, 2012, processing of C&D debris prior to disposal if economically feasible (Section 403.707(9)(g), F.S).
6. Section 4.F, Recyclable Materials (page 10) – Contractor is required to operate the recycling area at the City's facility, which was then located on Stock Island at the Waste-to-Energy plant. Contractor was to maintain and repair all associated equipment and facilities for this service. As with metals and white goods, when solid waste operations were moved to the City's Transfer Station on Rockland Key, the City took over this responsibility and should have received compensation for this. This section should be revised to reflect current operations, the types of materials currently accepted for recycling, and the existing location of the Transfer Station. In addition, given the current market value of recovered commodities, the City should also be receiving a share of the revenue from these commodities.
7. Section 4.H.1, Schedule and 4.H 3, Holidays (page 11) – These two sections contain conflicting information regarding holidays. Section 4.H.1 states that the Contractor shall collect solid waste on the business day following a holiday and Section 4.H.3 states that such collection shall be on the next regularly scheduled collection day following a holiday. The incorrect text should be deleted.
8. Section 4.K, Load Separation (page 12) – Contractor is required to collect commercial solid waste separately from yard waste and separately from residential solid waste that is collected in commercial style as long as there are different charges for different classes of material or as long as separation is required by regulation. Such separation is no longer occurring. This provides operational efficiencies for WM, but the City should have received compensation from WM for this change.
9. Section 5.C, Data Gathering (page 13) – Contractor is required to track residential recycling participation based on weekly setout rates and report monthly to the City. In addition, Contractor is to report to the City details on rejected materials in Recycling Containers on a weekly basis. Neither reporting is currently occurring. The City should determine what types and level of reporting would be most useful, discuss this with WM, and amend this provision accordingly. In lieu of tracking residential recycling participation, KCI recommends that WM be required to track residential recycling setout rates over a one-month period twice per year, in months specified by the City.
10. Section 6.A(ii)(b), Compensation for Commercial Collection Service (page 14) – Contractor is required to provide the City with a monthly computer list of commercial accounts billed. WM should be requested to submit such list in a Microsoft Excel format that enables the City to easily evaluate the data and verify payment of commercial disposal fees.
11. Section 13.B, Reports and Records (page 22) – Contractor is to maintain and provide information, reports, or records to the City as set forth in Exhibit F. According to Exhibit F, the Contractor is to provide the following reports:
 - a. Weekly report detailing rejected recycle materials.
 - b. List of complaints received (monthly).

- c. Monthly report to include (1) residential unit, (2) special pickups, (3) commercial fees, (4) recycle bins delivered, (5) recycling tons, (6) recycling education, (7) hazardous material, and (8) safety.
- d. Biannual report on residential tonnage and commercial tonnage, based on one-week collection routes that isolate residential waste from commercial waste.
- e. Annual report on recyclable weight by month.
- f. Annual report on collection of solid waste and fees from commercial customers.

WM is currently reporting some but not all of this information. The City should determine the reporting and report format it desires, discuss with WM, and revise Exhibit F accordingly.

Comparative Analysis of Collection Fees

KCI conducted a comparative analysis of WM's CY 2011 service fees. Provided below is a discussion of residential and commercial fees in the City, and a comparative analysis with other selected Florida jurisdictions. KCI cautions against making direct comparisons between jurisdictions because of differences in service level, location, market competition, and various other factors. All markets are local, and Key West is a unique community, especially in terms of geographic location. A comparative analysis with multiple jurisdictions can, however, provide an indication of whether the City's service fees are reasonable within the current South Florida marketplace.

Residential Service Fees

WM currently charges the City \$10.24 per residential unit per month for solid waste collection and \$2.29 per month for recyclable materials collection, for a combined fee of \$12.53 per month. Solid waste is collected twice per week, recyclable materials once per week, and yard trash is collected with solid waste, not separately.

Table 2 provides a summary of contractor fees for residential collection services in selected Florida jurisdictions, and Figure 1 depicts a comparison of these fees. For information purposes, Table 2 includes fees not only in South Florida jurisdictions, but also in several jurisdictions around the state that have other service levels, such as weekly solid waste collection, separate yard waste collection, and a Pay-As-You-Throw (PAYT) program (Alachua County).

The City's residential service fee seems reasonable given the location, and appears to be the lowest in the Florida Keys. It is, however, higher than contracted services in several other South Florida jurisdictions of comparable size and service level. The City could potentially receive additional services (e.g., separate yard waste collection) or achieve more favorable rates through contract negotiations or a competitive procurement process.

Should the City decide to conduct a competitive procurement, provided below is a preliminary list of companies that currently provide service in South Florida or are large firms that provide service throughout Florida. This is not an exhaustive list of companies that might be interested in providing collection service in the City.

- Keys Sanitary Services
- Marathon Garbage
- Veolia
- All Service Refuse
- Choice Environmental (recently acquired by Swisher Hygiene)
- Republic
- Waste Pro
- Advanced Disposal
- Waste Services
- Waste Management

Table 2: Single-Family Residential Collection Fees and Services in Selected Florida Jurisdictions

Note: Data provided in this table are based on information provided by city or county personnel or included in each respective contract. Direct comparisons between jurisdictions are cautioned because of differences in the level of services provided, contract terms, and various other local circumstances.

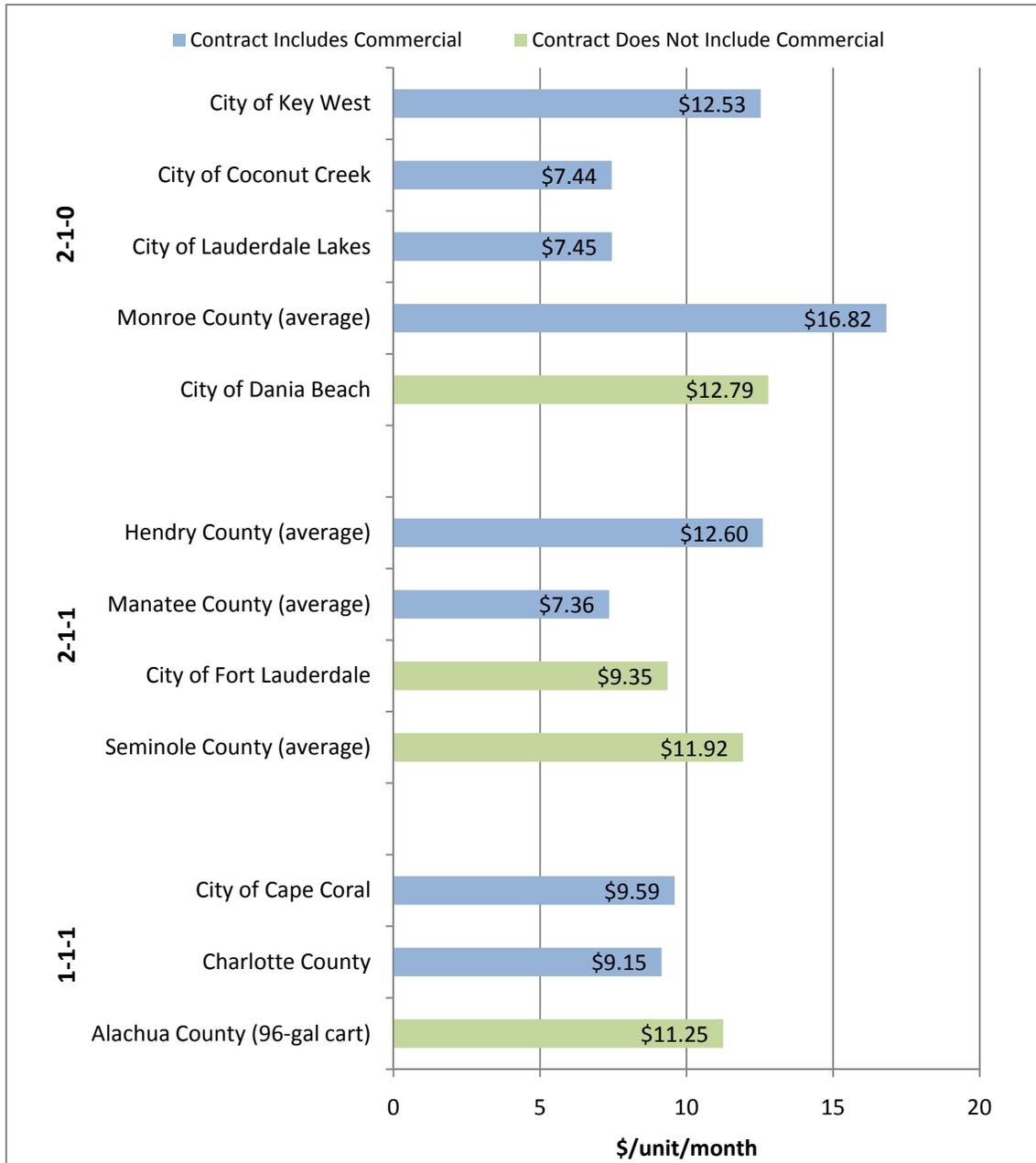
JURISDICTION	HAULER(S)	CONTRACTOR COLLECTION FEES ¹ (\$/unit/month)	BILLING RATE (\$/unit/year)	COLLECTION FREQUENCY ² (x/week)	TYPE OF COLLECTION	# OF UNITS	CONTRACT INCLUDES COMMERCIAL COLLECTION?
Monroe County							
City of Key West	Waste Management	\$12.53	\$319.17	2-1-0 Monthly bulk	Automated SW Manual Recycling	14,264	Yes
Monroe County	Waste Management Marathon Garbage Keys Sanitary Services Ocean Reef Club	\$17.51 \$16.94 \$16.99 \$15.85	\$396.00	2-1-0	Manual	31,535	Yes
Village of Islamorada	Veolia	\$27.08 (includes disposal)	\$347.55	2-1-1 On call bulk	Manual	4,200	Yes
Miami-Dade County							
City of Miami Beach	Choice Environmental (SW) World Waste (recycling)	\$27.23 (includes disposal)	\$478.32	2-1-0 On call bulk, 4x/yr	Manual SW Automated Recycling	6,500	No
Broward County							
City of Coconut Creek	All Service Refuse	\$7.44	\$298.56	2-1-0 Every other month bulk	Manual SW Automated Recycling	10,000	Yes
City of Dania Beach	Waste Management	\$12.79	\$269.40	2-1-0 Monthly bulk	Automated	9,000	No
City of Fort Lauderdale	Choice Environmental (2 districts)	\$8.85 \$9.85	\$347.40	2-1-1 Monthly bulk	Manual SW & YW Automated Recycling	36,323	No
City of Lauderdale Lakes	Waste Management	\$7.45	\$280.08	2-1-0 Monthly bulk	Manual & Automated	4,791	Yes
Other Jurisdictions							
City of Cape Coral	Waste Pro	\$9.59	\$168.00	1-1-1	Automated SW	69,175	Yes
Alachua County (PAYT)	Emerald Waste Services	96-gallon - \$11.25 64-gallon - \$10.80 35-gallon - \$10.30 20-gallon - \$10.20	\$366.41 \$265.35 \$202.80 \$167.88	1-1-1 On call bulk	Manual	20,232	No
Charlotte County	Waste Management	\$9.15	\$148.04	1-1-1 On call bulk	Automated	82,000	Yes
Hendry County	Waste Services Choice Environmental	\$12.49 \$15.68	\$221.00	2-1-1 On call bulk	North - Manual & Automated South - Manual	6,675 240	Yes
Manatee County	Waste Pro Waste Management	\$7.95 \$6.72	\$155.52	2-1-1 On call bulk for extra fee	Manual	63,800 54,000	Yes
Seminole County	Waste Pro Veolia Waste Pro	\$11.92 \$11.14 \$12.85	\$199.00	2-1-1 On call bulk	Manual	21,650 21,200 22,450	No

¹ CONTRACTOR COLLECTION FEE only includes the fee charged for collection. It does not include disposal, franchise or billing fees unless otherwise noted.

² COLLECTION FREQUENCY indicates number of solid waste, recycling, and yard waste collections weekly. For example, 2-1-0 means twice weekly collection of solid waste, weekly collection of recyclables, and no separate collection of yard waste (i.e., yard waste is collected with solid waste).

Figure 1: Comparison of Contractor Fees for Residential Collection by Level of Service

Note: Data provided in this figure are based on information provided by city or county personnel or included in each respective contract. Direct comparisons between jurisdictions are cautioned because of differences in the level of services provided, contract terms, and various other local circumstances.



KCI was also requested to address the feasibility of establishing a municipally run solid waste collection system. This would entail substantial start-up costs for vehicles, equipment, and personnel experienced in running collection operations. In addition, municipal collection operations are generally not run as efficiently or cost-effectively as private operations, which usually have a higher level of asset utilization. In fact, the trend is toward increased privatization. For example, in Broward County, the Cities of Fort Lauderdale and Hollywood have privatized waste hauling services and the City of Deerfield Beach is seriously considering doing so.

KCI also evaluated the City's residential billing rate of \$26.60 per month for solid waste services, which includes the \$12.53 collection fee and \$14.07 for disposal. The City previously estimated that the average residential household disposes of 1.21 tons of solid waste annually. Based on KCI's previous research in other Florida communities, 1.21 tons per household per year of combined solid waste and yard waste is somewhat low, but may not be unreasonable given that some City residents are seasonal. However, based on the current tipping fee of \$165.97 per ton, the \$14.07 per month collected for disposal pays for only 1.02 tons of solid waste annually rather than 1.21 tons. The reason for this is that residential billing rates are increased based on a percentage of the previous year's rate, rather than on increases in the tipping fee.

KCI recommends that the City (1) update the per-unit waste generation figure by conducting a residential waste generation study and (2) calculate annual billing rate increases by adjusting the collection portion based on changes in the contract collection fee and the disposal portion based on changes in the tipping fee.

Commercial Solid Waste Service Fees

The 2011 service fees charged by WM in the City for various types of commercial solid waste collection and disposal are provided in the following tables:

- Table 3 – commercial dumpster service
- Table 4 – commercial container and cart service
- Table 5 – commercial compactor service

Table 6 provides a comparison of WM's commercial billing fees for various types of containers by converting the collection and disposal components to a cubic yard basis. The disposal fee for non-compaction containers is based on a waste density of 163 pounds per cubic yard; that density is tripled for compaction containers. The disposal fee per cubic yard for containers and carts is higher than that for non-compaction dumpsters, likely based on the assumption that containers tend to have less empty air space when serviced than dumpsters. KCI will be conducting a commercial waste generation study during a future task to evaluate the density of waste generated by various commercial sectors.

Comparisons of commercial fees between jurisdictions are generally more difficult than residential rate comparisons because many fee structures include the cost of disposal, which may vary significantly between jurisdictions. Table 7 provides the range of collection fees per cubic yard for non-compaction containers in those selected jurisdictions that were able to break out commercial collection fees separate from disposal. Figure 2 presents a comparative analysis of the fees for selected levels of non-compaction container service in those same jurisdictions. For consistency, the fees in Table 7 and Figure 2 include container rental and maintenance, but do not include disposal, franchise fees, or other administrative fees.

Table 3: Fees for Commercial Dumpster Service, CY 2011

Monthly Charge for Collection - Dumpsters							
Container Size (cy)	Pickups per Week						
	1	2	3	4	5	6	7
1	\$36.66	\$69.56	\$100.66	\$132.92	\$164.63	\$195.71	\$226.14
2	\$73.32	\$139.12	\$201.32	\$265.84	\$329.26	\$391.42	\$452.28
3	\$109.98	\$208.68	\$301.98	\$398.76	\$493.89	\$587.13	\$678.42
4	\$146.64	\$278.24	\$402.64	\$531.68	\$658.52	\$782.84	\$904.56
6	\$219.96	\$417.36	\$603.96	\$797.52	\$987.78	\$1,174.26	\$1,356.84
8	\$293.28	\$556.48	\$805.28	\$1,063.36	\$1,317.04	\$1,565.68	\$1,809.12
10	\$366.60	\$695.60	\$1,006.60	\$1,329.20	\$1,646.30	\$1,957.10	\$2,261.40
Monthly Charge for Disposal - Dumpsters							
Container Size (cy)	Pickups per Week						
	1	2	3	4	5	6	7
1	\$58.58	\$117.17	\$175.75	\$234.34	\$292.92	\$351.51	\$410.09
2	\$117.17	\$234.34	\$351.51	\$468.68	\$585.85	\$703.02	\$820.19
3	\$175.75	\$351.51	\$527.26	\$703.02	\$878.77	\$1,054.53	\$1,230.28
4	\$234.34	\$468.68	\$703.02	\$937.36	\$1,171.70	\$1,406.04	\$1,640.38
6	\$351.51	\$703.02	\$1,054.53	\$1,406.04	\$1,757.55	\$2,109.06	\$2,460.57
8	\$468.68	\$937.36	\$1,406.04	\$1,874.72	\$2,343.40	\$2,812.08	\$3,280.75
10	\$585.85	\$1,171.70	\$1,757.55	\$2,343.40	\$2,929.25	\$3,515.09	\$4,100.94
Total Monthly Charge for Collection and Disposal - Dumpsters							
Container Size (cy)	Pickups per Week						
	1	2	3	4	5	6	7
1	\$95.24	\$186.73	\$276.41	\$367.26	\$457.55	\$547.22	\$636.23
2	\$190.49	\$373.46	\$552.83	\$734.52	\$915.11	\$1,094.44	\$1,272.47
3	\$285.73	\$560.19	\$829.24	\$1,101.78	\$1,372.66	\$1,641.66	\$1,908.70
4	\$380.98	\$746.92	\$1,105.66	\$1,469.04	\$1,830.22	\$2,188.88	\$2,544.94
6	\$571.47	\$1,120.38	\$1,658.49	\$2,203.56	\$2,745.33	\$3,283.32	\$3,817.41
8	\$761.96	\$1,493.84	\$2,211.32	\$2,938.08	\$3,660.44	\$4,377.76	\$5,089.87
10	\$952.45	\$1,867.30	\$2,764.15	\$3,672.60	\$4,575.55	\$5,472.19	\$6,362.34

Table 4: Fees for Commercial Container and Cart Service, CY 2011

Commercial Charges - Containers and Carts			
Container Size (gallon)	Charges per Container per Pickup		
	Collection	Disposal	Total
32	\$1.5163	\$4.51	\$6.0263
64	\$3.1989	\$9.12	\$12.3189
95	\$4.5488	\$13.53	\$18.0788

Table 5: Fees for Commercial Compactor Service, CY 2011

Compacting Containers - Monthly Fees for 1 Pull/Week				
Size (CY)	Haul	Disposal	Rent	Total
3	\$235.13	\$527.26	\$304.80	\$1,067.20
4	\$313.52	\$703.02	\$304.80	\$1,321.34
5	\$391.91	\$878.77	\$304.80	\$1,575.49
6	\$470.29	\$1,054.53	\$304.80	\$1,829.62
Roll-off Compactors - Monthly Fees for 1 Pull/Week				
Size (CY)	Haul	Disposal	Rent	Total
5	\$1,466.41	\$878.77	\$596.85	\$2,942.04
10	\$1,491.20	\$1,757.55	\$596.85	\$3,845.60
15	\$1,515.99	\$2,636.32	\$596.85	\$4,749.16
20	\$1,540.77	\$3,515.09	\$596.85	\$5,652.72
30	\$1,590.34	\$5,272.64	\$596.85	\$7,459.84
40	\$1,639.91	\$7,030.19	\$596.85	\$9,266.96

Table 6: Comparison of Commercial Service Fees, CY 2011

Container Type	Collection		Disposal		Total
	Per Pickup	Per CY	Per Pickup	Per CY	Per CY
Dumpsters	NA	\$7.46 - \$8.47	NA	\$13.53	\$20.99 - \$22.00
32-Gallon Carts	\$1.5163	\$9.57	\$4.51	\$28.47	\$38.04
64-Gallon Carts	\$3.1989	\$10.10	\$9.12	\$28.78	\$38.88
95-Gallon Carts	\$4.5488	\$9.67	13.53	\$28.77	\$38.44
Compacting Containers	Varies	\$18.10	Varies	\$40.59	\$58.69
Small Roll-off Compactors	Varies	\$23.34 - \$67.73	Varies	\$40.59	\$63.93 - \$108.32
Large Roll-off Compactors	Varies	\$9.47 - \$17.79	Varies	\$40.59	\$50.06 - \$58.38

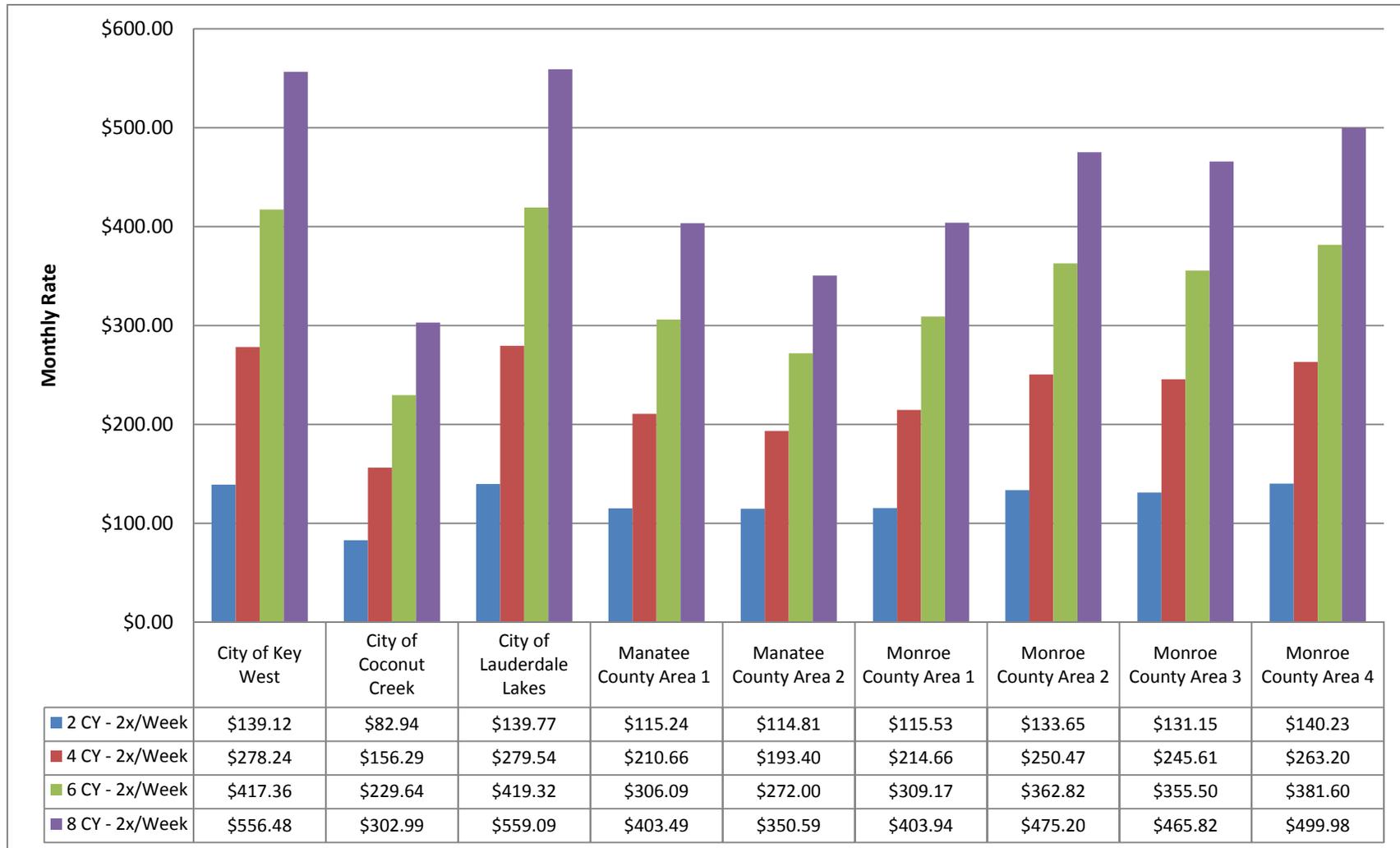
NA = Not Applicable

Table 7: Commercial Non-Compaction Container Collection Fees in Selected Jurisdictions, 2011

Jurisdiction	Fee per Cubic Yard
City of Key West	\$7.46 - \$8.47
City of Coconut Creek	\$4.27 - \$5.34
City of Lauderdale Lakes	\$8.07
Manatee County	
Area 1	\$5.44 - \$10.77
Area 2	\$4.69 - \$12.90
Monroe County	
Area 1	\$5.57 - \$9.18
Area 2	\$6.59 - \$10.24
Area 3	\$6.45 - \$10.10
Area 4	\$6.80 - \$10.77

Note: Fees include container rental and maintenance, but do not include disposal, franchise fees, or other fees.

Figure 2: Comparison of Commercial Collection Fees in Selected Florida Jurisdictions, 2011



Note: Fees include collection and container rental and maintenance, but do not include disposal, franchise fees or other fees.

The commercial collection fees charged by WM in the City fall within the range of fees charged in Monroe County, with the low end of the range not quite as low and the high end of the range not as high. However, as noted in Figure 2, the City's commercial rates for the service levels included in the chart are consistently higher than all but one of the jurisdictions surveyed (Lauderdale Lakes). Considering the number and density of commercial businesses, the potential exists to achieve more favorable fees during future contract negotiations or through a competitive procurement.

The City sets the disposal rates for commercial solid waste service, and WM bills the customer and makes payment to the City. Disposal rates are based on a formula established in the Agreement (container size x number of pickups per month x 163 pounds per cubic yard) rather than the actual weight tipped. Because the City has not enforced the requirement in Section 4.K to collect residential and commercial waste in separate loads, an accurate accounting of residential versus commercial tonnage is not available. Therefore, KCI compared disposal revenue received by the City in FY 2009/10 for residential and commercial solid waste collected pursuant to the Agreement with the amount that should have been received based on the FY 2009/10 tipping fee. As can be seen in Table 8, this analysis reveals a discrepancy of approximately \$360,700, some of which is a result of customer nonpayment. This discrepancy will be further evaluated when KCI looks at commercial waste generation and the billing structure in a future task.

Table 8: Comparison of Estimated Actual and Calculated Disposal Revenue, FY 2009/10

	FY2009/10 Est. Actual Revenue	Less Est. Payment to WM for Collection	FY2009/10 Est. Actual Revenue for Disposal
SW - Residential	\$ 4,108,400	\$ 2,119,060	\$ 1,989,340
SW - Commercial	\$ 4,341,100		\$ 4,341,100
Total	\$ 8,449,500		\$ 6,330,440
Calculated Disposal Revenue (41,493 tons @ \$161.26/ton)			\$ 6,691,156
Difference Between Est. Actual and Calculated Disposal Revenue			\$ (360,716)

*Based on "FY 09/10 Estimated Actual" figures provided in the City's *Budget for FY 10/11*.

Commercial Recycling Service Fees

The Agreement does not give WM the exclusive right to collect commercial recyclables,² but does require WM to provide recycling services to commercial customers requesting such service. The FY 2010/11 service fees provided by WM to the City for collection of commercial recyclables are as follows:

- Recycling bins - \$2.30 per month per bin for once per week collection.
- 32-gallon cart - \$11.20 per month per container times number of pickups per week.
- 95-gallon cart - \$33.61 per month per container times number of pickups per week.
- Cardboard Collection in Dumpsters - \$10.7187 per cubic yard.
- Cardboard Bale Collection - \$50.00 per month for unlimited bale collection. Bales are dropped at the City's Transfer Station where they are broken and combined with single stream recyclables for transport to WM's MRF.

² Per Florida Statute (Section 403.7046 (3), F.S.), a local government may not give any company the exclusive right to collect commercial recyclables.

WM's stated fee for servicing a commercial recycling bin weekly (\$2.30/month) is comparable to the fee for residential curbside recycling (\$2.29/month). A comparison of WM's other fees for commercial recycling with its fees for commercial solid waste collection is provided in Table 1 (page 2) of this document, as well as recommendations for negotiating more favorable fees.

Fees for Collection of Solid Waste in Public Areas

Per the Collection Agreement, WM services garbage containers located along City sidewalks daily. In peak tourism season, the containers along Duval Street are serviced twice per day. WM charges the City \$1.16 per container per collection, which amounts to more than \$12,000 per month. The cities surveyed by KCI service public trash containers using city crews; therefore, a rate comparison was not possible. Options to reduce collection costs include exploring the use of solar compacting containers to reduce the frequency of collection, structuring future collection contracts so this is a service provided to the City at no additional charge, and/or negotiating lower rates with WM.

In conclusion, KCI recommends that the City, with KCI's assistance, meet with WM to discuss and implement the various recommendations outlined in this document. In particular, we believe that opportunities exist within the parameters of the existing Agreement to establish a more effective program for capturing residential and commercial recyclables. This is in keeping with the concepts agreed to by WM, during the 2009 extension negotiations, to negotiate with the City regarding mechanisms designed to make recycling more convenient for residents and businesses. Furthermore, this document identifies inconsistencies between the Agreement and what is currently occurring pursuant to the Agreement. These differences should be corrected either by the Contractor or through an Agreement amendment. As mentioned previously, the recommendations provided herein do not replace the more in-depth analysis of waste reduction strategies that KCI is conducting in other tasks, but rather represent practical, results-oriented solutions that can start to boost recycling in the near-term and lay the foundation for future efforts.



TECHNICAL MEMORANDUM

TO: Jay Gewin
Key West Utilities Director

FROM: Robin Mitchell
Project Manager

DATE: December 3, 2010

SUBJ: **Comparative Analysis of Transport and Disposal Fee**

PROJ #: 120-00.00

Per Task 3 of Task Order 1, Kessler Consulting, Inc. (KCI) reviewed the proposed Service Fee for transport and disposal of the City's solid waste and compared this fee with other appropriate jurisdictions and industry standards.

Background

Waste Management (WM), the City's transport and disposal contractor, requested a Service Fee increase, in addition to the annual Consumer Price Index (CPI) adjustment provided for in the Transportation and Disposal (T&D) Agreement, to account for fuel cost increases. Based on the CPI adjustment in the T&D Agreement, the FY 2010/11 fee would be \$66.63 per ton. WM requested an additional \$2.15 for a total fee of \$68.78 per ton; however, City staff negotiated a reduced adjustment of \$67.70 per ton. WM indicated that it pays its transport subcontractor \$32.76 per ton, leaving \$34.94 per ton for disposal.

KCI conducted a comparative analysis of the \$67.70 per ton fee. We first compiled transport and disposal information for municipalities in the same South Florida watershed as the City. Because comparable transport information was not available, KCI ran a standard analysis using industry knowledge to determine a fair price for transport of solid waste from the City's Transfer Station on Rockland Key to WM's Wheelabrator South Waste-to-Energy (WTE) Facility in Broward County, a one-way distance of 183 miles.

Disposal Fee Analysis

Table 1 provides the fees for transfer station operation, transport and disposal in various South Florida jurisdictions. As mentioned above, jurisdictions were selected that are in the same watershed as the City. In addition to Monroe County and Miami-Dade County, the table includes Broward County, which operates a Resource Recovery System (RRS) in which most municipalities in the county participate. A

Resource Recovery Board contracts for disposal services for all members of the RRS. Both the current RRS fee and a negotiated fee, which goes into effect in August 2011, are provided in the table. The table also includes several cities that do not participate in the RRS, but instead contract independently for disposal services.

When reviewing this information, it is important to bear in mind that direct comparison of fees between jurisdictions is difficult because of various factors that make each location unique, such as differences in services and competition in the local marketplace. For example, the existence of the RRS makes the marketplace in Broward County somewhat atypical.

Table 1: Transport and Disposal Fees in South Florida Jurisdictions

Jurisdiction	Current Broward County RRS	Renegotiated Broward County RRS	Hallandale Beach (new contract)	Pompano Beach	Miami-Dade County	Monroe County
Contract Transfer Station Operation Fee (\$/ton)	N/A	N/A	\$62.50	N/A	N/A	\$80.09
Contract Transport Fee (\$/ton)	N/A	N/A		N/A	N/A	
Contract Disposal Fee (\$/ton)	\$65.93	\$47.75 ⁽¹⁾		\$74.76	\$60.30 ⁽²⁾	
One-way Distance from Transfer Station to Disposal (miles)	N/A	N/A	180	N/A	N/A	140 ⁽³⁾
Transfer Station Owner/Operator	N/A	N/A	Choice Environ.	N/A	County	County/WM
Transport Contractor	N/A	N/A	Choice Environ.	N/A	County	WM
Disposal Facility and Owner	WM WTE/LF	WM WTE/LF	WSI JED LF	WM Central LF	County WTE (Covanta operates)	WM WTE

⁽¹⁾ There will be a one-time adjustment on 8/4/11 by (1) 100% of the Adjustment Factor from 10/2009 through 4/2011 plus (2) 33.3% of the Adjustment Factor from 4/2010 through 4/2011.

⁽²⁾ Rate available only to permitted haulers and municipalities with long-term disposal contracts. Non-contract disposal rate per ton is \$79.50.

⁽³⁾ This is average distance from the three transfer stations (Cudjoe Key - 180, Long Key - 140 and Key Largo - 100).

N/A = Not Applicable WTE = Waste-to-Energy LF = Landfill

WM = Waste Management WSI = Waste Services, Inc.

The average solid waste tipping fee in Florida is approximately \$40 per ton, and disposal fees in South Florida are typically higher as evidenced in Table 1. Therefore, a disposal fee of \$34.94 per ton is reasonable in the current marketplace.

Transport Fee Analysis

Those jurisdictions listed in Table 1 that contract for transport and disposal were unable to break out the fees for each service; therefore, KCI utilized industry knowledge to develop a reasonable cost estimate for transporting solid waste from the City's Transfer Station to WM's Wheelabrator South WTE Facility.

Including the cost of labor; fuel; equipment amortization; equipment maintenance and repair; insurance, license and taxes; and reasonable contractor overhead and profit, KCI believes that \$92 per hour is a reasonable rate assumption for over-the-road trucking of solid waste in transfer trailers.

Additional assumptions used in this analysis are as follows:

- Roundtrip travel distance of 366 miles
- Average speed of 45 miles per hour
- 22 tons of solid waste transported per load

Based on the above assumptions, a reasonable fee to transport solid waste from Rockland Key to the Wheelabrator South Facility is approximately \$34 per ton. Therefore, a transport fee of \$32.76 per ton seems reasonable, especially since the contractor achieves some level of operational efficiencies by backhauling materials down to the Lower Keys.

Conclusion

The analysis provided herein indicates that a transport and disposal fee of \$67.70 per ton seems reasonable in today's marketplace based on the City's location, travel distance to disposal, and regional tipping fees.

KCI offers the following recommendations related to this analysis:

- KCI has provided the City with a suggested methodology for adjusting the Service Fee quarterly to account for fluctuations in fuel prices in lieu of allowing WM to request extraordinary rate increases in the future for this reason. These fee adjustments would be based on the price for No. 2 diesel fuel in the Lower Atlantic area published by the U.S. Energy Information Administration.
- Should the contractor achieve cost reductions as a result of backhauling materials, the City should be able to benefit from this as well. Language to that effect should also be incorporated into the T&D Agreement.



CITY OF KEY WEST, FLORIDA
2010/2011 WASTE COMPOSITION STUDY

May 2011



Prepared for:

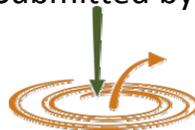
City of Key West, Florida

Utilities – Solid Waste

3140 Flagler Avenue

Key West, FL 33040

Submitted by:



Kessler Consulting, Inc.

innovative waste solutions

14620 N. Nebraska Ave., Bldg. D

Tampa, FL 33613

Kessler Consulting, Inc. is a proud member of or was awarded the following:



City of Key West, Florida 2010/2011 Waste Composition Study

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City of Key West, Florida 2010/2011 Waste Composition Study Executive Summary

The City of Key West (City) contracted Kessler Consulting, Inc. (KCI) to conduct a two-season Waste Composition Study (WCS) to determine the composition of solid waste (single-family residential, multi-family residential, and commercial waste) delivered to the City of Key West Transfer Station. Two five-day sorting events were conducted on November 15-19, 2010 and April 4-8, 2011 to account for seasonal variability in the waste stream.

Figure ES.1 depicts the overall composition (combined composition of the three generator sectors) of waste disposed at the City's Transfer Station. To visually identify the most common types of recyclable or compostable materials, all grades of recyclable paper are in dark blue, recyclable containers are in dark red, and organics (yard waste and food waste) are in dark green.

Figure ES.1: Composition of Citywide Waste Disposed at Transfer Station (% by weight)

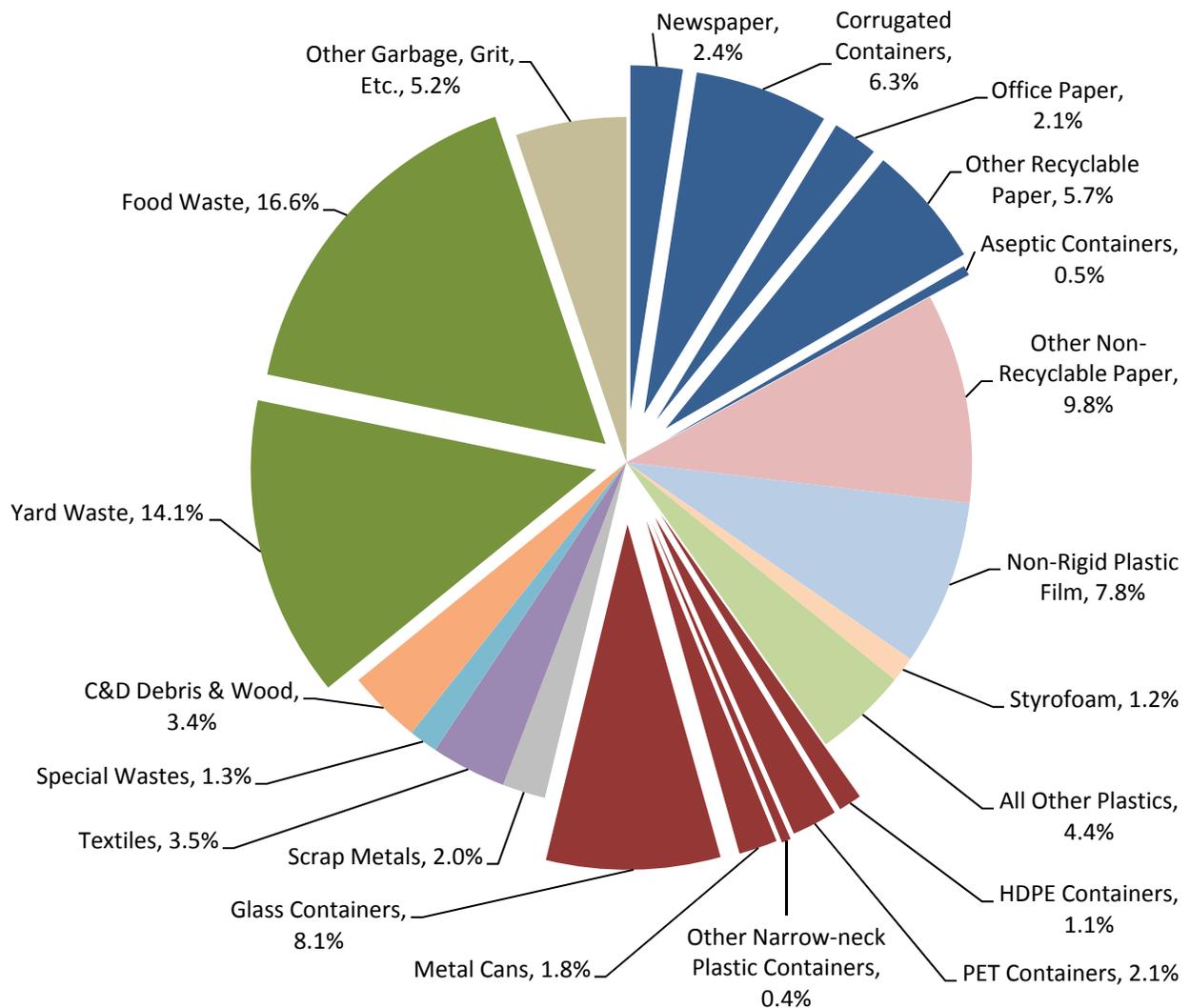


Table ES.1 presents the WCS results, starting with the overall composition of waste disposed at the City’s transfer station, followed by the composition of waste disposed by the three generator sectors.

Table ES.1: Composition of Waste Disposed at City’s Transfer Station (percent by weight)

Material Category		Citywide	Generator Sectors		
			Single-Family Residential	Multi-Family Residential	Commercial
1	Newspaper	2.4%	1.6%	5.1%	2.9%
2	Corrugated Containers	6.3%	4.3%	2.1%	7.8%
3	Office Paper	2.1%	1.9%	0.7%	2.3%
4	Other Recyclable Paper	5.7%	6.1%	10.8%	5.3%
5	Other Non-Recyclable Paper	9.8%	7.7%	11.0%	11.2%
6	Aseptic Containers	0.5%	0.6%	0.7%	0.4%
7	PET Containers	2.1%	1.9%	5.6%	2.1%
8	HDPE Containers	1.1%	1.0%	1.4%	1.1%
9	Other Narrow-neck Plastic Containers	0.4%	0.5%	0.6%	0.4%
10	Non-Rigid Plastic Film	7.8%	6.0%	9.1%	8.9%
11	Styrofoam	1.2%	0.7%	1.4%	1.5%
12	All Other Plastics	4.4%	3.2%	1.9%	5.3%
13	Tin/Steel Cans	0.9%	1.0%	1.4%	0.9%
14	White Goods	0.0%	0.0%	0.0%	0.0%
15	Other Ferrous	1.2%	1.3%	1.1%	1.1%
16	Aluminum Cans	0.9%	0.9%	0.9%	0.8%
17	Other Non-Ferrous	0.8%	0.6%	0.6%	0.9%
18	Glass Containers	8.1%	6.3%	13.0%	9.3%
19	Other Glass	0.4%	0.5%	0.3%	0.2%
20	Textiles	3.5%	5.0%	3.4%	2.5%
21	Household Hazardous Waste	0.0%	0.0%	0.1%	0.0%
22	Electronics	1.0%	1.4%	0.1%	0.8%
23	Household Batteries	0.0%	0.1%	0.0%	0.0%
24	Wood Waste	1.7%	2.7%	1.4%	1.0%
25	C&D Debris	1.7%	2.4%	1.6%	1.3%
26	Tires and Rubber	0.3%	0.3%	0.1%	0.2%
27	Yard Waste	14.1%	27.4%	12.3%	5.0%
28	Food Waste	16.6%	9.0%	11.6%	22.0%
29	All Other Garbage	3.3%	4.3%	1.3%	2.7%
30	Liquids	1.0%	0.7%	0.3%	1.3%
31	Grit	0.5%	0.5%	0.1%	0.5%
TOTALS		100.0%	100.0%	100.0%	100.0%

Table ES.2 identifies materials in the waste disposed that offer the greatest potential for recycling or composting. More than 70 percent of the waste currently disposed consists of recyclable or compostable materials, offering significant opportunities for the City to divert waste from disposal. The challenge is to establish effective programs to capture and process these materials in lieu of disposing of them.

Table ES.2: Potentially Recyclable or Compostable Materials in Waste Disposed (% by weight)

Material Categories	Citywide	Generator Sectors		
		Single-Family Residential	Multi-Family Residential	Commercial
Newspaper	2.4%	1.6%	5.1%	2.9%
Corrugated Containers	6.3%	4.3%	2.1%	7.8%
Office Paper	2.1%	1.9%	0.7%	2.3%
Other Recyclable Paper	5.7%	6.1%	10.8%	5.3%
Aseptic Containers	0.5%	0.6%	0.7%	0.4%
TOTAL RECYCLABLE PAPER	17.1%	14.5%	19.5%	18.7%
PET Containers	2.1%	1.9%	5.6%	2.1%
HDPE Containers	1.1%	1.0%	1.4%	1.1%
Other Narrow-neck Plastic Containers	0.4%	0.5%	0.6%	0.4%
Tin/Steel Cans	0.9%	1.0%	1.4%	0.9%
Aluminum Cans	0.9%	0.9%	0.9%	0.8%
Glass Containers	8.1%	6.3%	13.0%	9.3%
TOTAL RECYCLABLE CONTAINERS	13.6%	11.6%	22.9%	14.6%
Yard Waste	14.1%	27.4%	12.3%	5.0%
Food Waste	16.6%	9.0%	11.6%	22.0%
Other Non-Recyclable Paper	9.8%	7.7%	11.0%	11.2%
TOTAL COMPOSTABLES	40.5%	44.1%	35.0%	38.2%
COMBINED TOTAL	71.2%	70.2%	77.4%	71.6%

Recyclable paper and containers that are commonly included in recycling programs comprise nearly 31 percent of the waste disposed at the Transfer Station. Yard waste, which is segregated for mulching or composting in numerous communities throughout the State, makes up 14 percent of the waste disposed. Other types of organics (food waste and non-recyclable paper) contribute an additional 28 percent. Recovery of organics other than yard waste is not common in Florida, although programs for source separating organics prior to collection or separating them after collection through mixed waste processing have been implemented in a number of communities in the United States.

As part of the April field work, KCI also conducted visual audits of 14 of the 30 loads (47 percent) of bulk waste and construction and demolition debris (bulk/C&D) received at the Transfer Station during the 5-day event. Although bulk/C&D represents a relatively small amount of the materials received at the Transfer Station (1,220 tons in FY 2010, or 2.5 percent of all materials received), KCI conducted the visual audits to obtain a more complete understanding of the waste stream managed by the City at the Transfer Station.

Table ES.3 summarizes the results of the visual audits. Using industry data for the average density of these various material categories, the percentage by volume of each material category was converted to percentage by weight. The largest components of this stream, both by volume and by weight, are dimensional lumber (wood) and furniture.

Table ES.3: Composition of Bulk/C&D Delivered to Transfer Station, Based on Visual Audits

Material Category	Weighted Average (% by volume)	Volume (cy)	Density (lbs/cy)	Estimated Weight (lbs)	Weighted Average (% by weight)
Corrugated Cardboard, Kraft Paper	1.4%	1.5	53	79	0.5%
Other Ferrous	1.0%	1.1	225	241	1.7%
Other Metal	2.3%	2.6	225	576	4.0%
Other Plastic	4.0%	4.4	50	220	1.5%
Carpet padding	0.9%	1.0	62	63	0.4%
Prunings & Trimmings	1.7%	1.8	127	232	1.6%
Leaves & Grass	3.7%	4.1	312	1,269	8.8%
Dimensional Lumber/Pallets	39.9%	43.7	169	7,382	51.1%
Engineered & Other Recyclable Wood	1.1%	1.2	268	313	2.2%
Painted/Stained Wood	1.3%	1.4	169	241	1.7%
E-waste	0.3%	0.3	405	112	0.8%
Furniture	42.5%	46.5	80	3,721	25.7%
Tires	0.0%	0.0	200	0	0.0%
Mixed MSW	0.0%	0.0	250	9	0.1%
TOTAL	100.0%	109.5	-	14,458	100.0%

During the April event, KCI also interviewed individuals self-hauling recyclable materials to the Transfer Station. KCI staff interviewed 21 of 32 (66 percent) of incoming self-haul recycling loads. The goal of the survey was to understand who currently self-hauls, why they self-haul, and what materials are being delivered. Analysis of the survey results revealed the following:

- Self-hauling represents 50 percent of incoming recycling loads but only 9.5 percent of recyclables received by weight.
- 19 (90 percent) of the self-haulers were businesses and 2 (10 percent) were residents.
- Corrugated cardboard was the most commonly self-hauled material with 15 (71 percent) of the incoming loads being comprised of nearly 100 percent cardboard.
- Only 4 (19 percent) of the self-hauled recycling loads were comprised primarily of commingled containers, and 3 of these were comprised of nearly 100 percent glass bottles.
- The reasons given by residents for self-hauling were (1) live in an apartment with no access to recycling and (2) want to be sure recyclables are actually being recovered.
- Of the businesses self-hauling recyclables to the transfer station:
 - 7 (37 percent) never requested a quote from WMI for recycling service.
 - 7 (37 percent) self-haul because it is free.
 - 3 (16 percent) self-haul because it is convenient.
 - 4 (21 percent) self-haul because they have always recycled this way.
 - 2 (11 percent) thought this was the only place to recycle.
 - 2 (11 percent) stated the quote received from WMI for service was too expensive.
 - 1 (5 percent) has recycling service, but generates an overflow of material.

The survey results provide useful information, especially as it relates to commercial recycling. Businesses that self-haul recyclables demonstrate a commitment to recycling, but their responses to the survey are also indicative of the commercial sector's perceptions of recycling and its availability. Lack of knowledge or understanding about the recycling program and commercial recycling fees that are too high are clearly barriers to commercial recycling within the City.

The WCS is part of a larger project to develop a Solid Waste Master Plan for the City. The resulting data will be utilized by KCI throughout the remainder of the project, both to identify near-term recommendations to enhance material recovery, as well as in the continuing development of longer-term waste diversion recommendations and a Solid Waste Master Plan.

1.0 Introduction

1.1 Scope and Purpose

The City of Key West (City) contracted Kessler Consulting, Inc. (KCI) to conduct a two-season Waste Composition Study (WCS) to determine the composition of solid waste (residential and commercial waste) delivered to the City of Key West Transfer Station.

The study consisted of sampling and sorting municipal solid waste delivered by Waste Management collection vehicles to determine the types and percentages of solid waste currently disposed. A two-season approach was used to account for the effects of seasonal impacts, such as the growing season, tourism, transient residents, and consumer habits. During the second sorting event, KCI also conducted visual audits of bulk waste and C&D debris loads, as well as interviewed individuals self-hauling recyclable materials to the Transfer Station.

The WCS is part of a larger project to develop a Solid Waste Master Plan for the City. The purpose of the study is to identify the types and quantities of materials in the waste stream that could potentially be diverted from disposal.

1.2 Acknowledgements

KCI would like to acknowledge and thank City staff members who assisted with this study, in particular Jay Gewin and the staff of the transfer station. KCI would also like to thank Waste Management (WM) for providing a loader and operator during the sorting events. Their cooperation throughout the study enabled us to successfully and effectively complete our work.

2.0 Methodology

2.1 General Considerations

The WCS focused on residential and commercial waste delivered by WM, the City's franchised waste collection service provider, to the City's Transfer Station. Three generator sectors were evaluated during the study:

- Single-Family Residential;
- Multi-Family Residential; and
- Commercial.

Two sorting events were conducted to account for seasonal variability in the waste stream. The events were conducted on the following dates:

- November 15-19, 2010
- April 4-8, 2011

The methodology for this study followed industry-accepted standards for statistical sampling, as outlined in the *ASTM Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste (D5231-92; reapproved 2003)*.

During the second event, KCI also conducted visual audits of bulk waste and construction and demolition debris (bulk/C&D) loads. Bulk/C&D comprised less than 3 percent of the solid waste delivered to the Transfer Station for disposal in FY 2010; however, an understanding of the typical composition of this waste stream will be valuable for future planning. Visual audits were conducted because bulk/C&D is not generally conducive to manual sorting.

During the second event, KCI also interviewed individuals self-hauling recyclable materials to the Transfer Station to understand who is self-hauling and why they are not contracting for collection.

2.2 Material Categories

KCI worked with City staff to develop a list of 31 material categories into which waste would be sorted (see Appendix A). To develop this list of material categories, KCI reviewed the following information:

- FDEP Annual Solid Waste Management Report forms – All of the material categories used in the WCS can be correlated to those required by FDEP in the annual reporting by counties.
- Recyclable materials accepted in the City's curbside program – The WCS results will help identify the amounts of City-accepted recyclables still being disposed.

Bulk/C&D loads were visually categorized into the 35 material categories defined in Appendix B.

2.3 Locations, Equipment and Labor

Each one-week sorting event of the study was conducted during the hours of 6:00 am to 3:00 pm Monday through Friday. KCI provided a Sampling Supervisor, Sorting Supervisor, all sorting equipment, and safety gear. The City coordinated with WM to provide a loader and operator to gather samples and remove waste upon completion of sorting activities. All sort labor was provided by KCI, through an agreement with Labor Ready of Miami.

KCI prepared and City staff reviewed and approved a site safety plan that was followed throughout the sorting events. KCI worked closely with City staff to organize the setup of each location to ensure worker safety. City and facility staff set up barricades where needed, to cordon off the sorting and sample areas to protect workers from incoming and outgoing collection vehicles. Each morning of the events, sorters were given thorough safety instructions by one of KCI's Supervisors to ensure safety and proper sorting. No injuries or emergencies occurred during the sorting events.

2.4 Sampling Schedule and Procedures

Sample selection was organized by generator sectors to ensure a sufficient number of samples would be sorted for each generator sector to achieve statistically valid results. The number of samples sorted for each generator sector is presented below.

Generator Sectors	November	April
1 Single-Family Residential	15	15
2 Multi-Family Residential	4	4
3 Commercial	21	22
Total Samples	40	41

Ideally, a greater number of multi-family residential samples would have been sorted; however, waste from this generator sector is typically collected on the same routes as commercial waste. To ensure samples from the multi-family residential sector contained only waste from apartments and condominiums, KCI sampled only compactors from such dwellings. During the November sorting event, WMI ran a special collection route of only multi-family establishments, which was also sampled.

KCI worked with WM staff to understand the geographic areas serviced each day. Route information was combined with City tonnage data to ensure that the loads selected for sampling were geographically distributed. Using this information, KCI developed a sampling schedule detailing the total number of incoming vehicles and number of samples needed for each generator on each day.

As vehicles waited for permission to enter the Transfer Station, KCI's Sampling Supervisor interviewed drivers to identify the generator sector and origin of the waste. If the vehicle matched KCI's sampling criteria and was selected for sampling, the Sampling Supervisor noted the following information on the data recording form:

- Hauler name and truck number,
- Date and time,
- Generator sector and geographic origin,

- Scalehouse transaction number and net weight.

The Sampling Supervisor then directed the vehicle driver to tip the load in a designated area and a representative sample of 200-300 pounds was pulled and placed on a tarp to await sorting. Figure 2.1 depicts typical samples ready for sorting.



Figure 2.1: Typical Waste Samples

2.5 Sorting Procedures

Selected samples were sorted into the previously defined material categories. Figure 2.2 depicts the sorting activities. After the entire sample was sorted, the Sorting Supervisor weighed and recorded the weights of each container on a data recording form. Tare weights of empty containers, recorded prior to sorting, were subtracted from the weights of the containers after sorting to obtain the net weight of each material category.



Figure 2.2: Waste Sorting Activities

2.6 Analytical Procedures

After each sorting event, KCI calculated the weighted average of each material category for each generator sector. Confidence intervals were calculated for each material category using a standard statistical t-test.

To obtain the composition of all waste disposed at the City's facility, the three generator sectors (i.e., single-family residential, multi-family residential, and commercial) were combined based upon the amount of waste each generator sector contributes to the overall waste stream. To estimate the percentage that each contributes to the citywide solid waste stream delivered by WM to the transfer station, KCI reviewed tonnage data for the week of November 15-20, 2010. The percentages below were used to combine the three generator sectors.

- Single-family residential – 40 percent
- Multi-family residential – 2 percent (represents only multi-family waste delivered in separate loads; the remainder of multi-family solid waste is collected with commercial waste)
- Commercial – 58 percent

To estimate the average year-round waste composition, the same analytical procedures outlined above were conducted to combine the results from the summer and winter sorting events for each generator sector.

3.0 Results

3.1 Introduction to Results

All results presented in this section are expressed in percentage by weight. The percentages included in the tables and figures are the mean values for each material category. Where appropriate, the tables also provide the 90 percent confidence intervals for each material category. The confidence interval indicates that, with a 90 percent level of confidence, the actual arithmetic mean (the arithmetic mean obtained if an infinite number of samples were sorted) is within the upper and lower limits shown. This provides an understanding of how much variation occurred in the quantity of that material category found in the samples sorted. Generally, the more homogeneous the waste stream and the greater the number of samples sorted, the higher the level of accuracy achieved and the narrower the margin between the upper and lower bounds of the confidence interval.

3.2 Citywide Waste

Data for the three generator sectors (single-family residential, multi-family residential, and commercial) from both sorting events (November 2010 and April 2011) were combined to calculate the overall composition of waste delivered to the Transfer Station for disposal (not including bulk/C&D). Figure 3.1 depicts the composition of this citywide waste stream, and Table 3.1 presents the contribution of the three generator sectors. Table 3.2 compares the results of the November and April sorting events.

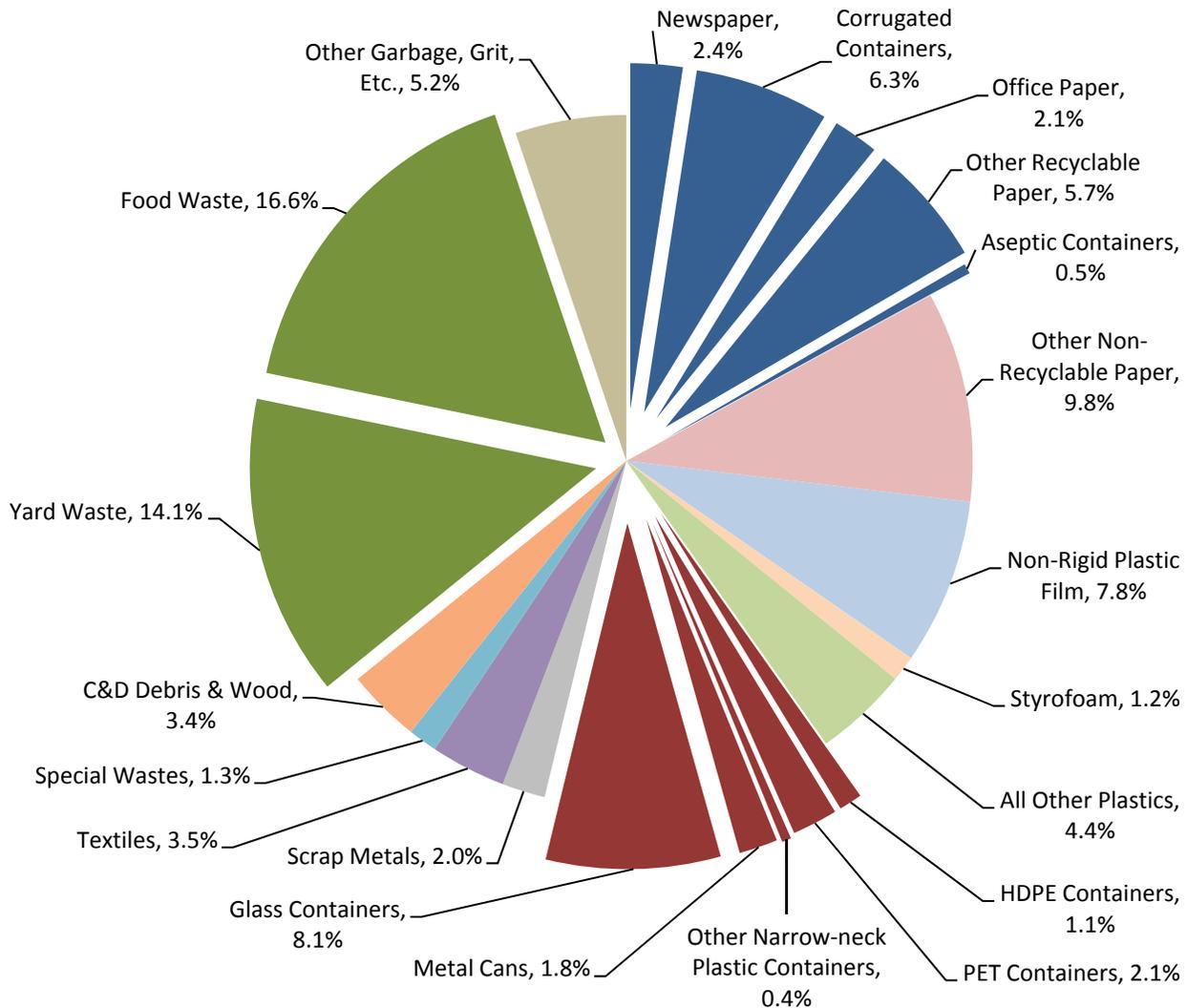
The main types of potentially recyclable or compostable materials are noted below. Substantial opportunities exist to increase waste diversion, with recyclable paper and containers comprising more than 30 percent of the waste stream, and organics (yard waste, food waste, and non-recyclable paper) contributing an additional 40 percent.

Material Categories	Percent by Weight
Recyclable Paper	17.1%
Recyclable Containers	13.6%
Yard Waste	14.1%
Food Waste	16.6%
Other Non-Recyclable Paper	9.8%
Subtotal	71.2%

All garbage is local; however, a cursory comparison between the City's waste stream with waste composition studies KCI has conducted during the last few years reveals the following:

- The percentage of recyclable paper is lower than the typical range of 20-26 percent.
- The percentage of recyclable containers is higher than the typical range of 8-12 percent, primarily because of the higher percentage of glass (8 percent versus 3-5 percent).
- The percentage of yard waste is higher than the typical range of 2-9 percent, which is anticipated since the City has no recovery program in place for yard waste.

Figure 3.1: Composition of Citywide Waste Disposed at Transfer Station (% by weight)



Note: For the purpose of this chart, Special Wastes includes the categories of Household Hazardous Waste, Electronics, Household Batteries, and Tires and Rubber; Metal Cans includes the categories of Aluminum and Tin/Steel Cans; Scrap Metals includes the categories of Ferrous and Non-Ferrous Metals; and Other Garbage, Grit, Etc. includes the categories of All Other Garbage, Grit, Liquids, and Other Glass.

Table 3.1: Composition of Citywide Waste Disposed, by Generator Sector (% by weight)

Material Category	Single-Family	Multi-Family	Commercial	Citywide
	Weighted Average	Weighted Average	Weighted Average	Weighted Average
1 Newspaper	1.6%	5.1%	2.9%	2.4%
2 Corrugated Containers	4.3%	2.1%	7.8%	6.3%
3 Office Paper	1.9%	0.7%	2.3%	2.1%
4 Other Recyclable Paper	6.1%	10.8%	5.3%	5.7%
5 Other Non-Recyclable Paper	7.7%	11.0%	11.2%	9.8%
6 Aseptic Containers	0.6%	0.7%	0.4%	0.5%
7 PET Containers	1.9%	5.6%	2.1%	2.1%
8 HDPE Containers	1.0%	1.4%	1.1%	1.1%
9 Other Narrow-neck Plastic Containers	0.5%	0.6%	0.4%	0.4%
10 Non-Rigid Plastic Film	6.0%	9.1%	8.9%	7.8%
11 Styrofoam	0.7%	1.4%	1.5%	1.2%
12 All Other Plastics	3.2%	1.9%	5.3%	4.4%
13 Tin/Steel Cans	1.0%	1.4%	0.9%	0.9%
14 White Goods	0.0%	0.0%	0.0%	0.0%
15 Other Ferrous	1.3%	1.1%	1.1%	1.2%
16 Aluminum Cans	0.9%	0.9%	0.8%	0.9%
17 Other Non-Ferrous	0.6%	0.6%	0.9%	0.8%
18 Glass Containers	6.3%	13.0%	9.3%	8.1%
19 Other Glass	0.5%	0.3%	0.2%	0.4%
20 Textiles	5.0%	3.4%	2.5%	3.5%
21 Household Hazardous Waste	0.0%	0.1%	0.0%	0.0%
22 Electronics	1.4%	0.1%	0.8%	1.0%
23 Household Batteries	0.1%	0.0%	0.0%	0.0%
24 Wood Waste	2.7%	1.4%	1.0%	1.7%
25 C&D Debris	2.4%	1.6%	1.3%	1.7%
26 Tires and Rubber	0.3%	0.1%	0.2%	0.3%
27 Yard Waste	27.4%	12.3%	5.0%	14.1%
28 Food Waste	9.0%	11.6%	22.0%	16.6%
29 All Other Garbage	4.3%	1.3%	2.7%	3.3%
30 Liquids	0.7%	0.3%	1.3%	1.0%
31 Grit	0.5%	0.1%	0.5%	0.5%
Sector Generation Rates	40.0%	2.0%	58.0%	100.0%

Table 3.2: Composition of Citywide Waste Disposed, by Seasonal Sorting Event (% by weight)

Material Category	November 2010	April 2011	Combined
	Weighted Average	Weighted Average	Weighted Average
1 Newspaper	2.6%	2.3%	2.4%
2 Corrugated Containers	6.4%	6.2%	6.3%
3 Office Paper	2.1%	2.1%	2.1%
4 Other Recyclable Paper	7.1%	4.3%	5.7%
5 Other Non-Recyclable Paper	9.4%	10.2%	9.8%
6 Aseptic Containers	0.3%	0.6%	0.5%
7 PET Containers	1.9%	2.3%	2.1%
8 HDPE Containers	1.2%	1.0%	1.1%
9 Other Narrow-neck Plastic Containers	0.3%	0.5%	0.4%
10 Non-Rigid Plastic Film	6.8%	8.8%	7.8%
11 Styrofoam	1.0%	1.3%	1.2%
12 All Other Plastics	4.4%	4.4%	4.4%
13 Tin/Steel Cans	1.1%	0.8%	0.9%
14 White Goods	0.0%	0.0%	0.0%
15 Other Ferrous	1.1%	1.4%	1.2%
16 Aluminum Cans	0.9%	0.9%	0.9%
17 Other Non-Ferrous	0.5%	1.2%	0.8%
18 Glass Containers	8.5%	7.7%	8.1%
19 Other Glass	0.5%	0.2%	0.4%
20 Textiles	3.2%	3.9%	3.5%
21 Household Hazardous Waste	0.0%	0.0%	0.0%
22 Electronics	1.0%	1.1%	1.0%
23 Household Batteries	0.0%	0.1%	0.0%
24 Wood Waste	1.9%	1.6%	1.7%
25 C&D Debris	1.6%	1.8%	1.7%
26 Tires and Rubber	0.2%	0.3%	0.3%
27 Yard Waste	11.9%	16.3%	14.1%
28 Food Waste	17.6%	15.5%	16.6%
29 All Other Garbage	4.4%	2.2%	3.3%
30 Liquids	1.4%	0.7%	1.0%
31 Grit	0.7%	0.2%	0.5%
TOTALS	100.0%	100.0%	100.0%

3.3 Single-Family Residential Waste

Figure 3.2 depicts the composition of waste disposed by single-family residences within the City, and Table 3.3 compares the results of the summer and winter sorting events for single-family residential waste.

The main types of potentially recyclable or compostable materials in the single-family residential waste stream are noted below. Recyclable paper and containers comprise more than 26 percent of the waste stream and yard waste makes up an additional 27 percent. These categories alone represent more than half the single-family residential waste stream. Other organics (food waste and non-recyclable paper) contribute an additional 17 percent.

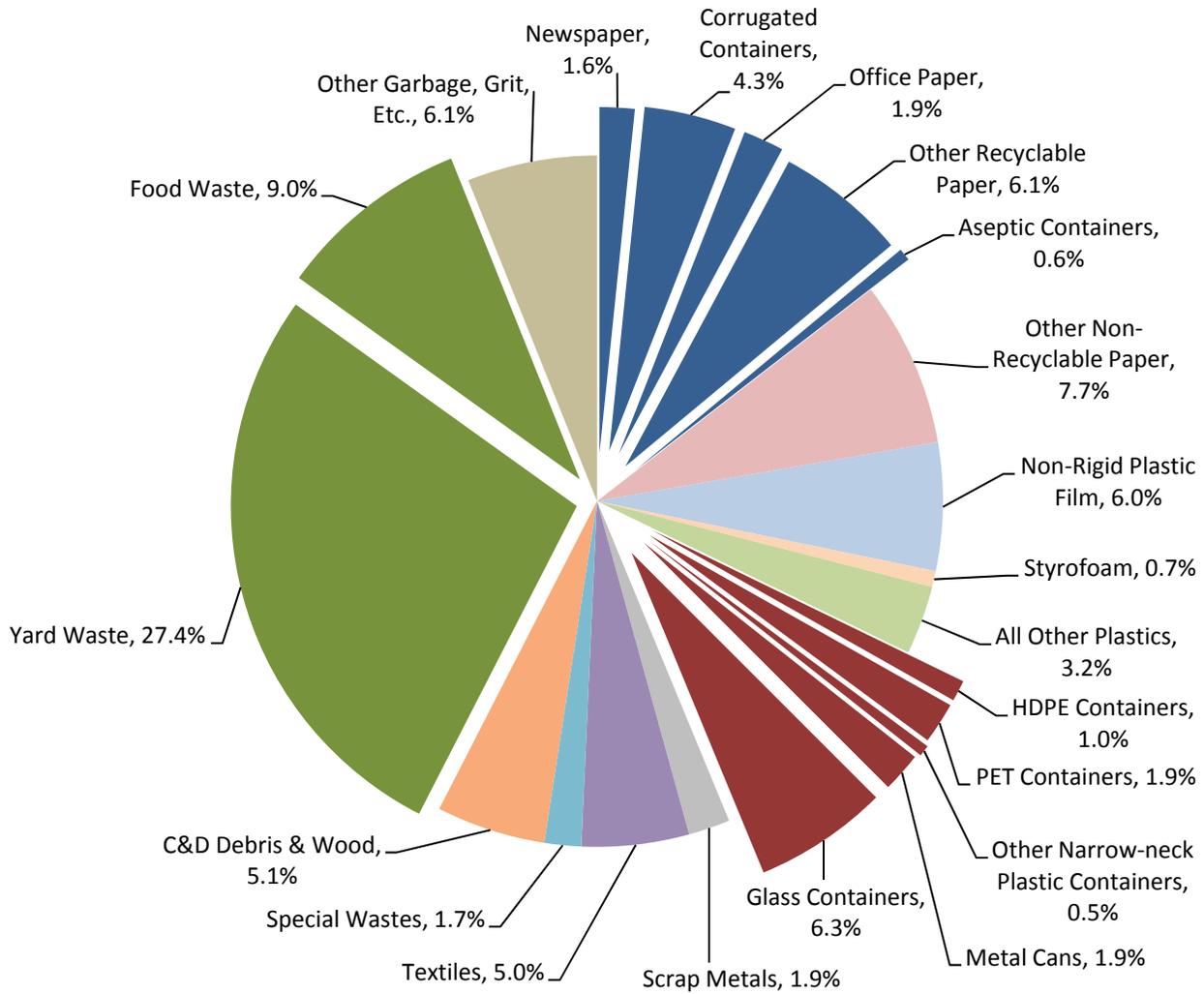
Material Categories	Percent by Weight
Recyclable Paper	14.5%
Recyclable Containers	11.6%
Yard Waste	27.4%
Food Waste	9.0%
Other Non-Recyclable Paper	7.7%
Subtotal	70.2%

The most significant seasonal variation was in Yard Waste, which represented a higher percentage of single-family residential waste in April (32.7 percent) than in November (22.6 percent), reflective of both the growing season and increased activity during peak tourist season. The percentage of Non-Rigid Plastic Film was also higher in April (7.2 percent) than in November (4.9 percent). The most significant percentage decreases between the November and April events were seen in Other Recyclable Paper and Food Waste.

The percentage of yard waste is significantly higher in the City than in other jurisdictions in which KCI recently conducted WCSs. In jurisdictions with separate yard waste collection, the percentage of yard waste in single-family residential waste has ranged from 3-5 percent; and in jurisdictions without separate yard waste collection, it has increased to 10-14 percent. The percentage of yard waste in the City's single-family residential waste is nearly double the high end of the latter range, making this a prime target to increase waste diversion.

Because a program is already in place to recover single-family residential recyclable paper and containers, these materials also offer opportunities for additional waste diversion through incentive programs and education.

Figure 3.2: Composition of Single-Family Residential Waste Disposed (% by weight)



Note: For the purpose of this chart, Special Wastes includes the categories of Household Hazardous Waste, Electronics, Household Batteries, and Tires and Rubber; Metal Cans includes the categories of Aluminum and Tin/Steel Cans; Scrap Metals includes the categories of Ferrous and Non-Ferrous Metals; and Other Garbage, Grit, Etc. includes the categories of All Other Garbage, Grit, Liquids, and Other Glass.

Table 3.3: Composition of Single-Family Residential Waste Disposed, by Seasonal Sorting Event (% by weight)

Material Category	November 2010			April 2011			Combined		
	Weighted Average	90% Confidence Interval		Weighted Average	90% Confidence Interval		Weighted Average	90% Confidence Interval	
		Lower Bounds	Upper Bounds		Lower Bounds	Upper Bounds		Lower Bounds	Upper Bounds
1 Newspaper	1.7%	1.2%	2.1%	1.6%	1.1%	2.1%	1.6%	1.3%	2.0%
2 Corrugated Containers	4.5%	2.5%	6.4%	4.1%	2.5%	5.7%	4.3%	3.1%	5.5%
3 Office Paper	2.1%	1.4%	2.9%	1.7%	1.1%	2.2%	1.9%	1.5%	2.3%
4 Other Recyclable Paper	7.2%	5.3%	9.1%	4.9%	3.2%	6.6%	6.1%	4.9%	7.4%
5 Other Non-Recyclable Paper	7.2%	6.2%	8.3%	8.3%	5.9%	10.7%	7.7%	6.5%	9.0%
6 Aseptic Containers	0.2%	0.2%	0.3%	0.9%	0.2%	1.7%	0.6%	0.2%	0.9%
7 PET Containers	1.8%	1.3%	2.3%	2.0%	1.6%	2.5%	1.9%	1.6%	2.3%
8 HDPE Containers	1.1%	0.8%	1.4%	0.9%	0.6%	1.1%	1.0%	0.8%	1.1%
9 Other Narrow-neck Plastic Containers	0.4%	0.3%	0.6%	0.6%	0.2%	1.1%	0.5%	0.3%	0.7%
10 Non-Rigid Plastic Film	4.9%	4.2%	5.6%	7.2%	5.7%	8.6%	6.0%	5.2%	6.8%
11 Styrofoam	0.8%	0.6%	1.1%	0.6%	0.4%	0.9%	0.7%	0.6%	0.9%
12 All Other Plastics	3.3%	2.8%	3.9%	3.1%	2.2%	3.9%	3.2%	2.8%	3.7%
13 Tin/Steel Cans	1.3%	1.0%	1.6%	0.6%	0.4%	0.8%	1.0%	0.8%	1.2%
14 White Goods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15 Other Ferrous	1.0%	0.4%	1.5%	1.7%	0.5%	2.9%	1.3%	0.7%	1.9%
16 Aluminum Cans	0.8%	0.6%	1.0%	1.0%	0.5%	1.5%	0.9%	0.7%	1.1%
17 Other Non-Ferrous	0.6%	0.4%	0.7%	0.7%	0.2%	1.2%	0.6%	0.4%	0.8%
18 Glass Containers	7.1%	4.8%	9.4%	5.3%	3.9%	6.8%	6.3%	5.0%	7.5%
19 Other Glass	0.7%	-0.2%	1.5%	0.4%	0.2%	0.6%	0.5%	0.1%	0.9%
20 Textiles	4.1%	2.8%	5.5%	6.0%	3.9%	8.1%	5.0%	3.8%	6.2%
21 Household Hazardous Waste	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
22 Electronics	1.6%	0.4%	2.9%	1.1%	0.4%	1.7%	1.4%	0.7%	2.0%
23 Household Batteries	0.0%	0.0%	0.1%	0.1%	0.0%	0.2%	0.1%	0.0%	0.1%
24 Wood Waste	2.7%	1.6%	3.9%	2.7%	1.2%	4.2%	2.7%	1.8%	3.6%
25 C&D Debris	3.0%	1.3%	4.7%	1.7%	0.6%	2.8%	2.4%	1.5%	3.3%
26 Tires and Rubber	0.4%	-0.3%	1.1%	0.2%	-0.1%	0.4%	0.3%	-0.1%	0.6%
27 Yard Waste	22.6%	16.6%	28.5%	32.7%	26.8%	38.6%	27.4%	23.2%	31.5%
28 Food Waste	10.7%	7.9%	13.4%	7.2%	5.7%	8.7%	9.0%	7.5%	10.6%
29 All Other Garbage	6.3%	5.1%	7.5%	2.0%	1.1%	2.9%	4.3%	3.3%	5.3%
30 Liquids	0.8%	0.5%	1.2%	0.7%	0.3%	1.0%	0.7%	0.5%	1.0%
31 Grit	0.8%	0.2%	1.4%	0.2%	0.0%	0.4%	0.5%	0.2%	0.8%
TOTALS	100.0%			100.0%			100.0%		

3.4 Multi-Family Residential Waste

Figure 3.3 depicts the composition of waste disposed by multi-family residents within the City, and Table 3.4 compares the results of the summer and winter sorting events for multi-family residential waste. The 90 percent confidence intervals for the various material categories are generally wider than those for the single-family residential results. This is because multi-family waste is typically collected on commercial routes and, therefore, fewer loads of multi-family residential waste were available for sampling.

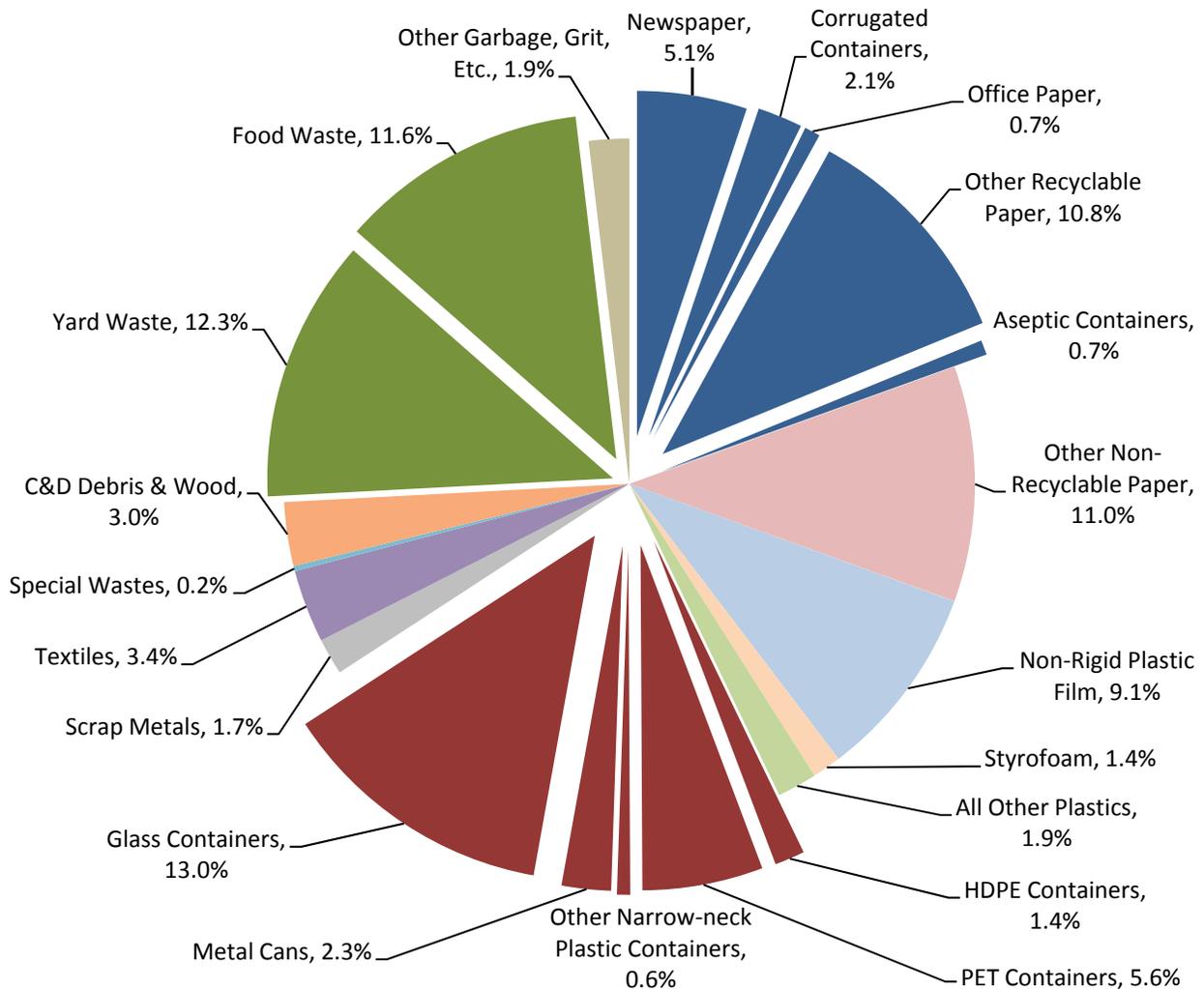
The main types of potentially recyclable or compostable materials in the multi-family residential waste stream are noted below. Recyclable paper and containers comprise more than 42 percent of the waste stream. Yard waste makes up 12 percent, and other organics (food waste and non-recyclable paper) contribute an additional 23 percent.

Material Categories	Percent by Weight
Recyclable Paper	19.5%
Recyclable Containers	22.9%
Yard Waste	12.3%
Food Waste	11.6%
Other Non-Recyclable Paper	11.0%
Subtotal	77.4%

The most significant seasonal variations were in Yard Waste, Glass Containers, and Corrugated Cardboard. The percentage of Yard Waste was substantially higher in April (13.9 percent) than in November (4.1 percent). An increase in the percentage of Glass Containers from November (9.9 percent) to April (13.6 percent) was also noted: however, a drop in the percentage of Corrugated Cardboard was seen from November (7.6 percent) to April (1.1 percent).

The most notable difference when compared with multi-family residential waste composition in other recent WCSs is the relatively high percentage of yard waste. Multi-family residential waste typically has low percentages of yard waste, ranging from 1-6 percent. The reason the City's percentage is more than double the high end of this range may be because samples were pulled primarily from multi-family complexes having individual compactors. These complexes may be more likely to have lush subtropical vegetation or to have in-house staff for groundskeeping rather than contracting out this service (in-house staff would utilize the facility compactor whereas contractors would typically be responsible for hauling and disposing of the yard waste).

Figure 3.3: Composition of Multi-Family Residential Waste Disposed (% by weight)



Note: For the purpose of this chart, Special Wastes includes the categories of Household Hazardous Waste, Electronics, Household Batteries, and Tires and Rubber; Metal Cans includes the categories of Aluminum and Tin/Steel Cans; Scrap Metals includes the categories of Ferrous and Non-Ferrous Metals; and Other Garbage, Grit, Etc. includes the categories of All Other Garbage, Grit, Liquids, and Other Glass.

Table 3.4: Composition of Multi-Family Residential Waste Disposed, by Seasonal Sorting Event (% by weight)

Material Category	November 2010			April 2011			Combined		
	Weighted Average	90% Confidence Interval		Weighted Average	90% Confidence Interval		Weighted Average	90% Confidence Interval	
		Lower Bounds	Upper Bounds		Lower Bounds	Upper Bounds		Lower Bounds	Upper Bounds
1 Newspaper	3.6%	0.8%	6.3%	5.4%	1.1%	9.8%	5.1%	3.2%	7.1%
2 Corrugated Containers	7.6%	1.0%	14.1%	1.1%	-2.3%	4.5%	2.1%	-1.0%	5.2%
3 Office Paper	0.8%	0.0%	1.5%	0.7%	-0.6%	2.0%	0.7%	0.0%	1.4%
4 Other Recyclable Paper	7.3%	6.1%	8.5%	11.5%	6.5%	16.5%	10.8%	8.9%	12.8%
5 Other Non-Recyclable Paper	10.3%	8.8%	11.8%	11.2%	6.8%	15.5%	11.0%	9.3%	12.8%
6 Aseptic Containers	0.8%	-0.3%	2.0%	0.7%	0.1%	1.3%	0.7%	0.2%	1.2%
7 PET Containers	3.3%	2.2%	4.5%	6.1%	3.3%	8.9%	5.6%	4.5%	6.8%
8 HDPE Containers	1.7%	1.4%	2.1%	1.3%	-0.4%	3.1%	1.4%	0.7%	2.1%
9 Other Narrow-neck Plastic Containers	0.5%	0.2%	0.7%	0.6%	0.3%	1.0%	0.6%	0.5%	0.8%
10 Non-Rigid Plastic Film	8.3%	4.9%	11.7%	9.3%	2.6%	15.9%	9.1%	6.3%	11.9%
11 Styrofoam	1.6%	0.6%	2.5%	1.3%	-1.1%	3.7%	1.4%	0.4%	2.3%
12 All Other Plastics	3.8%	2.2%	5.4%	1.5%	-0.3%	3.3%	1.9%	0.8%	2.9%
13 Tin/Steel Cans	1.9%	1.5%	2.4%	1.2%	-0.1%	2.6%	1.4%	0.8%	1.9%
14 White Goods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15 Other Ferrous	0.6%	-0.7%	2.0%	1.2%	0.5%	2.0%	1.1%	0.6%	1.7%
16 Aluminum Cans	1.7%	0.7%	2.7%	0.8%	0.4%	1.2%	0.9%	0.5%	1.4%
17 Other Non-Ferrous	0.9%	-0.8%	2.7%	0.5%	0.2%	0.8%	0.6%	-0.1%	1.3%
18 Glass Containers	9.9%	6.2%	13.5%	13.6%	6.9%	20.2%	13.0%	9.9%	16.0%
19 Other Glass	0.1%	-0.2%	0.5%	0.3%	-1.5%	2.1%	0.3%	-0.6%	1.1%
20 Textiles	2.9%	-0.6%	6.4%	3.5%	1.6%	5.4%	3.4%	1.9%	4.9%
21 Household Hazardous Waste	0.1%	0.0%	0.3%	0.1%	-1.3%	1.5%	0.1%	-0.5%	0.7%
22 Electronics	0.1%	0.0%	0.2%	0.1%	-0.5%	0.7%	0.1%	-0.2%	0.3%
23 Household Batteries	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
24 Wood Waste	4.3%	-4.9%	13.6%	0.9%	-3.5%	5.2%	1.4%	-2.5%	5.3%
25 C&D Debris	2.6%	-0.9%	6.1%	1.4%	-13.8%	16.6%	1.6%	-4.4%	7.6%
26 Tires and Rubber	0.4%	-0.5%	1.2%	0.0%	-0.1%	0.1%	0.1%	-0.3%	0.4%
27 Yard Waste	4.1%	-2.6%	10.9%	13.9%	8.9%	18.8%	12.3%	7.4%	17.2%
28 Food Waste	14.4%	9.9%	19.0%	11.1%	6.7%	15.6%	11.6%	9.1%	14.2%
29 All Other Garbage	4.6%	0.9%	8.4%	0.7%	-0.9%	2.2%	1.3%	-0.5%	3.0%
30 Liquids	1.7%	0.4%	2.9%	0.0%	-0.1%	0.2%	0.3%	-0.5%	1.0%
31 Grit	0.0%	0.0%	0.0%	0.1%	-0.8%	1.0%	0.1%	-0.3%	0.4%
TOTALS	100.0%			100.0%			100.0%		

3.5 Commercial Waste

Figure 3.4 depicts the composition of commercial waste disposed by businesses within the City, and Table 3.5 compares the results of the summer and winter sorting events for commercial waste.

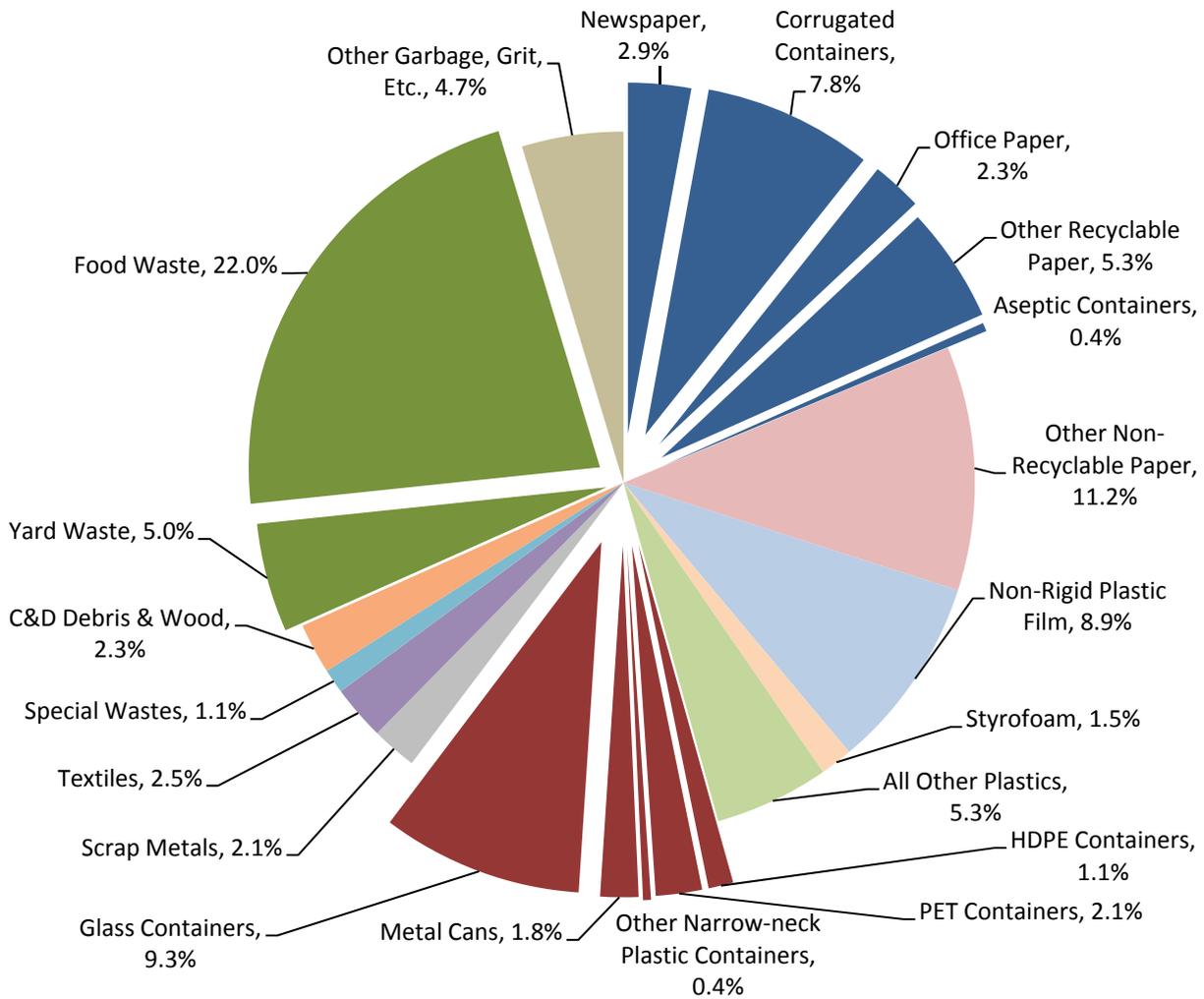
The main types of potentially recyclable or compostable materials in the commercial waste stream are noted below. Recyclable paper and containers comprise more than 33 percent of the waste stream. Yard waste represents only 5 percent of commercial waste, as anticipated, but food waste contributes 22 percent and non-recyclable paper an additional 11 percent.

Material Categories	Percent by Weight
Recyclable Paper	18.7%
Recyclable Containers	14.6%
Yard Waste	5.0%
Food Waste	22.0%
Other Non-Recyclable Paper	11.2%
Subtotal	71.6%

Little seasonal variation was noticed between the November and April sorting events, meaning that although the quantity of commercial waste generated is greater during periods of higher tourism, the overall composition of the commercial waste stream does not significantly fluctuate seasonally. Commercial waste typically contains relatively small quantities of yard waste; therefore, seasonal fluctuations in this material category did not impact the overall composition of this waste stream. The largest variation observed was a decrease in Other Recyclable Paper from 7.0 percent in November to 3.6 percent in April.

The differences between the City's commercial waste stream and that found in other recent WCSs conducted by KCI are indicative of the role that tourism plays in the City. The percentage of recyclable paper in the City's commercial waste is lower than the typical range of 21-28 percent, but the percentage of recyclable containers is higher than the typical range of 7-10 percent, primarily because of a higher percentage of glass containers. In addition, the percentage of food waste is at the high end of the typical range for commercial waste of 13-23 percent.

Figure 3.4: Composition of Commercial Waste Disposed (% by weight)



Note: For the purpose of this chart, Special Wastes includes the categories of Household Hazardous Waste, Electronics, Household Batteries, and Tires and Rubber; Metal Cans includes the categories of Aluminum and Tin/Steel Cans; Scrap Metals includes the categories of Ferrous and Non-Ferrous Metals; and Other Garbage, Grit, Etc. includes the categories of All Other Garbage, Grit, Liquids, and Other Glass.

Table 3.5: Composition of Commercial Waste Disposed, by Seasonal Sorting Event (% by weight)

Material Category	November 2010			April 2011			Combined		
	Weighted Average	90% Confidence Interval		Weighted Average	90% Confidence Interval		Weighted Average	90% Confidence Interval	
		Lower Bounds	Upper Bounds		Lower Bounds	Upper Bounds		Lower Bounds	Upper Bounds
1 Newspaper	3.2%	2.1%	4.3%	2.6%	1.4%	3.7%	2.9%	2.1%	3.7%
2 Corrugated Containers	7.7%	5.1%	10.3%	7.9%	4.3%	11.4%	7.8%	5.7%	9.9%
3 Office Paper	2.2%	1.0%	3.4%	2.4%	1.1%	3.8%	2.3%	1.5%	3.2%
4 Other Recyclable Paper	7.0%	5.6%	8.5%	3.6%	2.7%	4.6%	5.3%	4.4%	6.2%
5 Other Non-Recyclable Paper	10.9%	9.3%	12.6%	11.6%	9.8%	13.4%	11.2%	10.1%	12.4%
6 Aseptic Containers	0.3%	0.2%	0.5%	0.4%	0.3%	0.6%	0.4%	0.3%	0.5%
7 PET Containers	1.8%	1.4%	2.3%	2.4%	1.5%	3.3%	2.1%	1.7%	2.6%
8 HDPE Containers	1.3%	1.1%	1.5%	1.0%	0.7%	1.3%	1.1%	0.9%	1.3%
9 Other Narrow-neck Plastic Containers	0.3%	0.1%	0.4%	0.5%	0.0%	0.9%	0.4%	0.1%	0.6%
10 Non-Rigid Plastic Film	8.0%	7.1%	8.9%	9.9%	8.2%	11.5%	8.9%	8.0%	9.9%
11 Styrofoam	1.2%	0.6%	1.7%	1.8%	0.0%	3.6%	1.5%	0.6%	2.4%
12 All Other Plastics	5.2%	3.6%	6.7%	5.3%	4.3%	6.4%	5.3%	4.4%	6.1%
13 Tin/Steel Cans	0.9%	0.6%	1.3%	0.9%	0.7%	1.2%	0.9%	0.7%	1.1%
14 White Goods	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15 Other Ferrous	1.1%	0.3%	2.0%	1.1%	-0.5%	2.8%	1.1%	0.2%	2.0%
16 Aluminum Cans	0.9%	0.6%	1.1%	0.8%	0.6%	1.0%	0.8%	0.7%	1.0%
17 Other Non-Ferrous	0.4%	0.3%	0.5%	1.5%	-0.1%	3.2%	0.9%	0.1%	1.8%
18 Glass Containers	9.4%	6.9%	11.8%	9.2%	6.5%	11.8%	9.3%	7.6%	11.0%
19 Other Glass	0.3%	0.0%	0.7%	0.1%	0.0%	0.2%	0.2%	0.1%	0.4%
20 Textiles	2.5%	0.8%	4.2%	2.5%	1.1%	3.9%	2.5%	1.5%	3.6%
21 Household Hazardous Waste	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
22 Electronics	0.5%	0.1%	0.9%	1.1%	-0.8%	3.0%	0.8%	-0.1%	1.8%
23 Household Batteries	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%
24 Wood Waste	1.2%	0.2%	2.1%	0.9%	0.2%	1.7%	1.0%	0.5%	1.6%
25 C&D Debris	0.7%	-0.1%	1.4%	1.9%	0.5%	3.2%	1.3%	0.5%	2.0%
26 Tires and Rubber	0.0%	0.0%	0.0%	0.5%	-0.1%	1.1%	0.2%	-0.1%	0.5%
27 Yard Waste	4.8%	1.1%	8.6%	5.2%	2.0%	8.4%	5.0%	2.7%	7.3%
28 Food Waste	22.5%	17.2%	27.9%	21.4%	16.2%	26.7%	22.0%	18.5%	25.5%
29 All Other Garbage	3.0%	2.1%	3.9%	2.4%	1.3%	3.5%	2.7%	2.0%	3.4%
30 Liquids	1.8%	1.4%	2.3%	0.7%	0.2%	1.3%	1.3%	0.9%	1.6%
31 Grit	0.6%	0.2%	1.1%	0.3%	0.0%	0.5%	0.5%	0.2%	0.7%
TOTALS	100.0%			100.0%			100.0%		

3.6 Bulk Waste and C&D Debris Visual Audit

In FY 2010, bulk/C&D waste comprised only 2.5 percent of the total material received at the City's Transfer Station. C&D debris is not included in the City's exclusive collection franchise and, therefore, does not need to be delivered to the Transfer Station. Because other facilities offer lower tipping fees, most C&D debris is delivered elsewhere. However, to obtain a more complete understanding of the waste stream managed by the City at its Transfer Station, KCI conducted visual audits of 14 of the 30 loads (47 percent) of bulk/C&D delivered to the facility during the five-day April WCS event.

Table 3.6 summarizes the results of the visual audits, and Appendix F contains the individual load results. As can be seen by the confidence intervals in Table 3.6, and as expected, significant variability exists in the types of materials found in bulk/C&D.

Using industry data for the average density of these various material categories, the percentage by volume of each material category was converted to percentage by weight. The largest components of this stream, both by volume and by weight, are dimensional lumber (wood) and furniture.

3.7 Composition of All Incoming Waste

As mentioned previously, significant variability was found in the composition of bulk/C&D delivered to the Transfer Station, and a relatively small number of visual audits were conducted as part of this study. However, to estimate the overall composition of waste delivered to the City's Transfer Station, the results of the sorting events and visual audits were applied to the tonnage of materials received at the facility during FY 2010 and combined along with recycling tonnage. Table 3.7 provides the estimated composition of all incoming materials received at the Transfer Station. This includes all solid waste from residents and businesses; bulk/C&D; and source-separated yard waste, tires, and recyclables.

Table 3.6: Composition of Bulk/C&D Delivered to Transfer Station, Based on Visual Audits

Material Category	Weighted Average (% by volume)	90% Confidence Interval		Volume (cy)	Density (lbs/cy)	Estimated Weight (lbs)	Weighted Average (% by weight)
		Lower Bounds	Upper Bounds				
Corrugated Cardboard, Kraft Paper	1.4%	-1.8%	4.6%	1.5	53	79	0.5%
Other Ferrous	1.0%	0.5%	1.5%	1.1	225	241	1.7%
Other Metal	2.3%	1.7%	2.9%	2.6	225	576	4.0%
Other Plastic	4.0%	2.9%	5.1%	4.4	50	220	1.5%
Carpet padding	0.9%	0.4%	1.4%	1.0	62	63	0.4%
Prunings & Trimmings	1.7%	0.9%	2.5%	1.8	127	232	1.6%
Leaves & Grass	3.7%	1.8%	5.7%	4.1	312	1,269	8.8%
Dimensional Lumber/Pallets	39.9%	26.2%	53.5%	43.7	169	7,382	51.1%
Engineered & Other Recyclable Wood	1.1%	0.6%	1.6%	1.2	268	313	2.2%
Painted/Stained Wood	1.3%	0.7%	2.0%	1.4	169	241	1.7%
E-waste	0.3%	-0.2%	0.7%	0.3	405	112	0.8%
Furniture	42.5%	30.0%	54.9%	46.5	80	3,721	25.7%
Tires	0.0%	0.0%	0.0%	0.0	200	0	0.0%
Mixed MSW	0.0%	-0.1%	0.1%	0.0	250	9	0.1%
TOTAL	100.0%	-	-	109.5	-	14,458	100.0%

Table 3.7: Estimated Composition of All Incoming Materials Received at Transfer Station

Material Category	Municipal Solid Waste		Bulk/C&D		Source Separated Materials (tons)	Total Incoming Materials (tons)	Composition of Incoming Materials (% by weight)	Recycling Rate
	Composition (% by weight)	Applied to FY 2010 Tonnage (tons)	Composition (% by weight)	Applied to FY 2010 Tonnage (tons)				
1 Newspaper	2.4%	1,039.1			3,272.64	16,161.3	33.1%	20.2%
2 Corrugated Containers	6.3%	2,678.3	0.5%	6.1				
3 Office Paper	2.1%	904.6						
4 Other Recyclable Paper	5.7%	2,453.1						
6 Aseptic Containers	0.5%	200.0						
7 PET Containers	2.1%	905.1						
8 HDPE Containers	1.1%	462.8						
13 Tin/Steel Cans	0.9%	404.1						
16 Aluminum Cans	0.9%	365.0						
18 Glass Containers	8.1%	3,470.5						
5 Other Non-Recyclable Paper	9.8%	4,197.7				4,197.7	8.6%	0.0%
9 Other Narrow-neck Plastic Containers	0.4%	184.9				184.9	0.4%	0.0%
10 Non-Rigid Plastic Film	7.8%	3,311.9				3,311.9	6.8%	0.0%
11 Styrofoam	1.2%	507.5				507.5	1.0%	0.0%
12 All Other Plastics	4.4%	1,865.5	1.5%	18.3		1,883.8	3.9%	0.0%
14 White Goods	0.0%	3.8			139.39	1,072.3	2.2%	13.0%
15 Other Ferrous	1.2%	514.7	1.7%	20.7	195.09			
17 Other Non-Ferrous	0.8%	344.9	4.0%	48.8				
19 Other Glass	0.4%	150.5				150.5	0.3%	0.0%
20 Textiles	3.5%	1,507.5				1,507.5	3.1%	0.0%
21 Household Hazardous Waste	0.0%	9.3				9.3	0.0%	0.0%
22 Electronics	1.0%	436.4	0.8%	9.8		446.2	0.9%	0.0%
23 Household Batteries	0.0%	18.9				18.9	0.0%	0.0%
24 Wood Waste	1.7%	735.2	54.9%	669.8		1,405.0	2.9%	0.0%
25 C&D Debris	1.7%	736.0	26.1%	318.4		1,054.5	2.2%	0.0%
26 Tires and Rubber	0.3%	109.1			80.41	189.5	0.4%	0.0%
27 Yard Waste	14.1%	6,015.5	10.4%	126.9	1,433.19	7,575.6	15.5%	0.0%
28 Food Waste	16.6%	7,079.7				7,079.7	14.5%	0.0%
29 All Other Garbage	3.3%	1,410.1	0.1%	1.22		1,411.3	2.9%	0.0%
30 Liquids	1.0%	444.5				444.5	0.9%	0.0%
31 Grit	0.5%	202.3				202.3	0.4%	0.0%
TOTALS	100.0%	42,668.6	100.0%	1,220.0	5,120.72	48,814.2	100.0%	7.0%

3.8 Self-Haul Recycling Survey

During the April sorting event, KCI staff took the opportunity to survey residents and businesses that self-haul recyclables to the City's Transfer Station. During the five-day sorting event, KCI staff interviewed 21 of 32 (66 percent) of incoming self-haul recycling loads. The goal of the survey was to understand who currently self-hauls, why they self-haul, and what materials are being delivered.

Complete survey responses are provided in Appendix G. Analysis of the survey results revealed the following:

- Self-hauling represents 50 percent of incoming recycling loads but only 9.5 percent of recyclables received by weight.
- 19 (90 percent) of the self-haulers were businesses and 2 (10 percent) were residents.
- Corrugated cardboard was the most commonly self-hauled material with 15 (71 percent) of the incoming loads being comprised of nearly 100 percent cardboard.
- Only 4 (19 percent) of the self-hauled recycling loads were comprised primarily of commingled containers, and 3 of these were comprised of nearly 100 percent glass bottles.
- The reasons given by residents for self-hauling were:
 - Lives in an apartment with no access to recycling.
 - Wants to be sure recyclables are actually being recovered.
- Of the businesses self-hauling recyclables to the transfer station:
 - 7 (37 percent) never requested a quote from WMI for recycling service.
 - 7 (37 percent) self-haul because it is free.
 - 3 (16 percent) self-haul because it is convenient.
 - 4 (21 percent) self-haul because they have always recycled this way.
 - 2 (11 percent) thought this was the only place to recycle.
 - 2 (11 percent) stated the quote received from WMI for service was too expensive.
 - 1 (5 percent) has recycling service, but generates an overflow of material.

The survey results provide useful information, especially as it relates to commercial recycling. Businesses that self-haul recyclables demonstrate a commitment to recycling, but their responses to the survey are also indicative of the commercial sector's perceptions of recycling and its availability. Lack of knowledge or understanding about the recycling program and commercial recycling fees that are too high are clearly barriers to commercial recycling within the City.

3.9 Waste Diversion Opportunities

Table 3.8 summarizes the materials in the citywide waste disposed at the Transfer Station, as well as in the waste from the three main generator sectors, that offer the greatest potential for recycling or composting. More than 70 percent of the waste currently disposed consists of recyclable or compostable materials. The challenge is to establish effective programs to capture and process these materials in lieu of disposing of them.

Recyclable paper and containers that are commonly included in recycling programs comprise nearly 31 percent of the waste disposed at the Transfer Station. Yard waste, which is segregated for mulching or composting in numerous communities throughout the State, makes up 14 percent of the waste disposed. Other types of organics (food waste and non-recyclable paper) contribute an additional 28 percent. Recovery of organics other than yard waste is not common in Florida, although programs for source separating organics prior to collection or separating them after collection through mixed waste processing are being done in a number of communities in the United States.

Table 3.8: Potentially Recyclable or Compostable Materials in Waste Disposed (% by weight)

Material Categories	Single-Family Residential	Multi-Family Residential	Commercial	Citywide
Newspaper	1.6%	5.1%	2.9%	2.4%
Corrugated Containers	4.3%	2.1%	7.8%	6.3%
Office Paper	1.9%	0.7%	2.3%	2.1%
Other Recyclable Paper	6.1%	10.8%	5.3%	5.7%
Aseptic Containers	0.6%	0.7%	0.4%	0.5%
TOTAL RECYCLABLE PAPER	14.5%	19.5%	18.7%	17.1%
PET Containers	1.9%	5.6%	2.1%	2.1%
HDPE Containers	1.0%	1.4%	1.1%	1.1%
Other Narrow-neck Plastic Containers	0.5%	0.6%	0.4%	0.4%
Tin/Steel Cans	1.0%	1.4%	0.9%	0.9%
Aluminum Cans	0.9%	0.9%	0.8%	0.9%
Glass Containers	6.3%	13.0%	9.3%	8.1%
TOTAL RECYCLABLE CONTAINERS	11.6%	22.9%	14.6%	13.6%
Yard Waste	27.4%	12.3%	5.0%	14.1%
Food Waste	9.0%	11.6%	22.0%	16.6%
Other Non-Recyclable Paper	7.7%	11.0%	11.2%	9.8%
TOTAL COMPOSTABLES	44.1%	35.0%	38.2%	40.5%
COMBINED TOTAL	70.2%	77.4%	71.6%	71.2%

This study provides the City with extensive information regarding the composition of waste disposed at its Transfer Station. The data will be utilized by KCI throughout the remainder of the project, both to identify near-term recommendations to enhance material recovery, as well as in the continuing development of longer-term waste diversion recommendations and a Solid Waste Master Plan.

Appendix A: Material Category Descriptions

Table A-1: Material Category Descriptions

#	Material Categories	Description of Categories
1	Newspaper	Newspaper (loose, tied or shredded) including other paper normally distributed inside newspaper such as ads, flyers, etc.
2	Corrugated Cardboard (OCC)	Uncoated brown "cardboard" boxes with a wavy core (no plastic liners, waxy coatings).
3	Office Paper	Printed or unprinted paper typically generated in an office environment including white, colored, coated and uncoated papers, manila and pastel colored file folders.
4	Other Recyclable Paper	All magazines, catalogs, paperboard, chipboard, brown paper bags, telephone books and other printed material on glossy and non-glossy paper.
5	Non-recyclable Paper	All remaining paper not categorized in other paper categories, including waxed cardboard and contaminated paper (i.e. napkins, pizza boxes, paper towels, fast-food wrappers, etc.).
6	Aseptic Containers	Gable top milk cartons, juice boxes, and other similar containers.
7	Polyethylene terephthalate (PET) Containers (SPI #1)	Clear and colored bottles or containers coded PET #1 such as soda bottles, water bottles, etc.
8	High-density polyethylene (HDPE) Containers (SPI #2)	Clear/natural and pigmented bottles or containers coded HDPE #2 such as milk jugs, detergent bottles, etc.
9	Other Recyclable Plastic Containers (SPI #3-7)	Plastic containers coded #3 through #7, with the triangle label symbol.
10	Non-rigid Plastic Film	Grocery bags, garbage bags, plastic sheeting, clear plastic wrap, re-sealable plastic bags, etc.
11	Expanded Polystyrene Foam (EPS) (Styrofoam®)	Disposable coffee cups, coolers or packaging material, which are typically white and are made of expanded polystyrene beads. Also includes food service trays and egg cartons.
12	All Other Plastics	All remaining plastics not categorized with the triangle label symbol, including buckets, flower pots, laundry baskets, toys, large children's play equipment, plastic cups, plastic utensils, fast-food drink lids, straws, clamshell containers and plastic plates.
13	Tin/Steel Cans	Tin-plated steel cans, usually food containers, and aerosol cans.
14	White Goods	Household appliances, such as refrigerators, stoves, and salvageable items such as machinery.

Table A-1: Material Category Descriptions (continued)

#	Material Categories	Description of Categories
15	Other Ferrous	Steel, clothes hangers, sheet metal products, pipes, miscellaneous metal scraps, and other magnetic metal items.
16	Aluminum Cans	Aluminum soft drink, beer, and some food cans.
17	Other Non-Ferrous	Scrap aluminum, aluminum foil and catering trays, and other non-magnetic metal, copper wiring and tubing, brass fixtures.
18	Glass Containers	Clear, brown, and green glass bottles and containers.
19	Other Glass	Window panes, mirrors, ceramics, and drinking glasses.
20	Textiles	Clothing apparel, rags, leather, blankets, curtains, shoes, wallets, purses, belts, scrap leather.
21	Special Wastes	Items usually associated with household hazardous waste collection centers, such as cleaners, oil and oil filters, pool chemicals, fluorescent lights, medical waste, solvents etc.
22	Electronics (E-waste)	Electronic devices such as televisions, computers, cell phones, cordless telephones, PDAs, handheld devices, rechargeable batteries, etc.
23	Household Batteries	Household batteries including AA, AAA, C, D, 9-volt, and button types.
24	Wood Waste	Treated and untreated lumber, pallets and wood furniture including chairs, cabinets, dressers, etc.
25	C&D Debris	Construction and demolition debris that includes concrete, carpet, drywall, insulation, and roofing materials
26	Tires and Rubber	Small and large tires and other items made of rubber.
27	Yard Waste	Shrub and brush prunings, household bedding plants, weeds, leaves, grass clippings, and other landscaping and gardening wastes.
28	Food Waste	Meat and vegetable waste (includes coffee grinds and tea bags).
29	All Other Garbage	All other wastes not included in the above categories, including diapers, and products that are composite of materials such as frozen juice cans, binders, Pringle's can, chip bags, etc.
30	Liquids	All liquids within recyclable containers will be emptied into this category.
31	Grit	Indistinguishable items less than 1-inch square.

Appendix B: Bulk Waste and C&D Debris Material Category Descriptions

Table B-1: Bulk Waste and C&D Debris Material Category Descriptions

#	Material Categories	Description of Categories
1	OCC, Kraft Paper	Uncoated Corrugated Cardboard usually has three layers. The center wavy layer is sandwiched between the two outer layers. It does not have any wax coating on the inside or outside. Examples include entire cardboard containers, such as shipping and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. This type does not include chipboard. And Paper Bags means bags and sheets made from Kraft paper. Examples include paper grocery bags, fast food bags, department store bags, empty Kraft cement bags (without plastic liners), and heavyweight sheets of Kraft packing paper.
2	Other Paper	Other Paper means any recyclable or non-recyclable paper material that is not corrugated cardboard or Kraft paper.
3	Major Appliances	Major Appliances means discarded major appliances of any color. These items are often enamel-coated. Examples include washing machines, clothes dryers, hot water heaters, stoves, refrigerators, furnaces and heating and cooling equipment. This subtype does not include electronics, such as televisions and stereos.
4	HVAC Ducting	HVAC Ducting means sheet metal tubing, typically galvanized, used for conveying ventilation air.
5	Other Ferrous	Other Ferrous means any iron or steel that is magnetic or any stainless steel item. This subtype does not include "tin/steel cans." Examples include structural steel beams, boilers, metal clothes hangers, metal pipes, stainless steel cookware, security bars, and scrap ferrous items and galvanized items such as nails and flashing.
6	Other Metal	Other Metal means any metal item, other than aluminum cans, that is not stainless steel and that is not magnetic. These items may be made of aluminum, copper, brass, bronze, lead, zinc, or other metals. Examples include aluminum window frames, aluminum siding, copper wire, shell casings, brass pipe, and aluminum foil.
7	Film	Non-Bag Commercial and Industrial Packaging Film means film plastic used for large-scale packaging or transport packaging. Examples include shrink-wrap, mattress bags, furniture wrap, and film bubble wrap. And Film Products means plastic film used for purposes other than packaging. Examples include agricultural film (films used in various farming and growing applications, such as silage greenhouse films, mulch films, and wrap for hay bales), plastic sheeting used as drop cloths, and building wrap/Tyvek® packaging.

Table B-1: Bulk Waste and C&D Debris Material Category Descriptions (continued)

#	Material Categories	Description of Categories
8	Polystyrene Packaging/Insulation	Expanded Polystyrene Packaging and Insulation means items marked with a PS or #6. Examples include packaging peanuts, meat and vegetable packaging trays, and clamshell containers. This type also includes expanded polystyrene packaging blocks and insulation.
9	Other Plastic	Durable Plastic Items means plastic objects other than containers and film plastic. This type also includes plastic objects other than containers or film that bear the numbers 1 through 7 in the triangular recycling symbol. These items are usually made to last for more than one use.
10	Carpet	Carpet means flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material. Does not include carpet padding.
11	Carpet padding	Carpet Padding means plastic, foam, felt, and other materials used under carpet to provide insulation and padding.
12	Branches and stumps	Branches and Stumps means woody plant material, branches, and stumps that exceed 4 inches in diameter from any public or private landscape.
13	Prunings and Trimmings	Prunings and trimmings means woody plant material up to 4 inches in diameter from any public or private landscape.
14	Leaves and Grass	Leaves and Grass means plant material, except woody material, from any public or private landscapes. Examples include leaves, grass clippings, sea weed, and plants. This subtype does not include woody material or material from agricultural sources.
15	Other organic	Other Organic means organic material that cannot be put in any other type or subtype. This type includes items made mostly of organic materials but combined with other materials. Examples include leather items, cork, hemp rope, garden hoses, rubber items, hair, cigarette butts, diapers, feminine hygiene products, wood products (Popsicle sticks and toothpicks), wood chips, sawdust, and animal feces.
16	Large Concrete	Large Concrete means a hard material made from sand, gravel, aggregate, cement mix, and water. Large pieces are defined as being greater than one foot in its largest dimension. Examples include pieces of building foundations, concrete paving, and cinder blocks. This category includes concrete with a steel internal structure composed of reinforcing bars (re-bar) or metal mesh.
17	Small Concrete	Small Concrete means a hard material made from sand, gravel, aggregate, cement mix, and water. Small pieces are defined as being less than one foot in its largest dimension. Examples include pieces of building foundations, concrete paving, and cinder blocks.

Table B-1: Bulk Waste and C&D Debris Material Category Descriptions (continued)

#	Material Categories	Description of Categories
18	Large Asphalt Paving	Large Asphalt Paving means a black or brown, tar-like material mixed with aggregate used as a paving material. Large pieces are defined as being greater than one foot in its largest dimension.
19	Small Asphalt Paving	Small Asphalt Paving means a black or brown, tar-like material mixed with aggregate used as a paving material. Small pieces are defined as being less than one foot in its largest dimension.
20	Composite Roofing	Composition Roofing means composite shingles composed of fiberglass or organic felts saturated with asphalt and covered with inert aggregates as well as attached roofing tar and tar paper. Commonly known as three tab roofing. Examples include asphalt shingles and attached roofing tar and tar paper. Does not include built-up roofing.
21	Other Aggregates	Other Aggregates means aggregates other than concrete and asphalt paving such as bricks, masonry tile, ceramics, porcelain toilets, and clay roofing tiles.
22	Dim. Lumber/Pallets	Clean Dimensional Lumber means unpainted new or demolition dimensional lumber. Includes materials such as 2 x 4s, 2 x 6s, 2 x 12s, and other residual materials from framing and related construction activities. May contain nails or other trace contaminants. And Pallets and Crates means unpainted wood pallets, crates, and packaging made of lumber/engineered wood.
23	Eng. And Other Recyclable Wood	Clean Engineered Wood means unpainted new or demolition scrap from sheeted goods such as plywood, particleboard, wafer board, oriented strand board, and other residual materials used for sheathing and related construction uses. May contain nails, paint, or other trace contaminants.
24	Painted/Stained Wood	Painted/Stained Wood means wood that has had an external coating applied like handrails or finished furniture.
25	Gypsum Board	Clean Gypsum Board means unpainted gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples: This type includes used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypboard, gyproc, or wallboard.
26	Large Rock	Large Rock means large pieces of mineral matter or rock greater than 1 foot in its longest dimension. Examples include landscaping rock and paving stones.

Table B-1: Bulk Waste and C&D Debris Material Category Descriptions (continued)

#	Material Categories	Description of Categories
27	Small Rock/Gravel	Small Rock/Gravel means rock pieces less than 1 foot in its longest dimension. Examples include pathway gravel and other natural or mechanically crushed materials.
28	Dirt and Sand	Dirt and Sand means nutrient rich decayed organic matter mixed with very fine pieces of mineral matter, often left over from land clearing activities. This subtype also includes non-hazardous contaminated soil.
29	Other C&D	Other C&D means construction and demolition material that cannot be put in any other type or subtype. This type may include items from different categories combined, which would be very hard to separate. This type may also include demolition debris that is a mixture of materials such as non-porcelain sinks, synthetic counter tops, fiber or composite acoustic ceiling tiles, plate glass, wood, tiles, gypsum board, and aluminum scrap.
30	Glass	Glass means clear, brown, and green glass bottles and containers as well as window panes, mirrors, ceramics and drinking glasses.
31	E-waste	Electronic waste means devices such as televisions, computers, cell phones, cordless telephones, PDAs, handheld devices, rechargeable batteries, etc.
32	HHW	Household Hazardous Waste means cleaners, oil and oil filters, pool chemicals, fluorescent lights, medical waste, solvents, etc.
33	Furniture	Furniture means large hard to handle items that are not defined separately, including mattresses, and other large items. Examples include all sizes and types of furniture, mattresses, box springs, and base components.
34	Tires	Tires means truck and passenger car tires. (On and off Rim)
35	Mixed MSW	Mixed MSW means items that are associated with normal residential and business waste and not associated with bulky waste and C&D debris.

Appendix C: Individual Sample Results, Single-Family Residential

Table C-1: November 2010 Individual Sample Results, Single-Family Residential (% by weight)

Hauler/Location		WM - RL Old Town	WM - RL Old Town	WM - RL Old Town	WM - RL Central	WM - RL Central	WM - RL Central
Material Categories	sample #	2	5	6	11	14	15
1	Newspaper	0.39%	1.18%	0.85%	0.43%	2.85%	1.63%
2	Corrugated Containers	2.79%	1.32%	8.39%	1.47%	0.64%	4.56%
3	Office Paper	3.79%	3.68%	2.20%	0.03%	1.09%	3.50%
4	Other Recyclable Paper	9.40%	2.59%	2.67%	3.65%	6.79%	7.99%
5	Other Non-Recyclable Paper	9.27%	3.61%	5.60%	4.31%	7.65%	6.43%
6	Aseptic Containers	0.30%	0.00%	0.24%	0.26%	0.00%	0.12%
7	PET Containers	3.20%	0.77%	1.26%	0.79%	4.18%	1.42%
8	HDPE Containers	1.47%	0.02%	0.30%	1.11%	0.57%	0.77%
9	Other Containers (#3-#7)	0.78%	0.81%	0.64%	0.41%	0.18%	0.13%
10	Non-Rigid Plastic Film	6.47%	2.20%	5.36%	3.93%	6.87%	4.62%
11	Styrofoam	1.21%	0.26%	0.28%	0.32%	1.60%	0.79%
12	All Other Plastics	4.29%	1.52%	2.26%	4.15%	2.48%	4.14%
13	Tin/Steel Cans	1.52%	0.36%	1.56%	2.69%	0.90%	1.22%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.80%	0.00%	0.38%	1.59%	2.69%	4.23%
16	Aluminum Cans	1.67%	0.38%	0.58%	0.25%	0.80%	0.98%
17	Other Non-Ferrous	0.71%	0.70%	0.21%	0.39%	0.95%	0.47%
18	Glass Containers	7.10%	6.35%	23.44%	6.61%	7.75%	10.59%
19	Other Glass	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
20	Textiles	4.50%	1.22%	2.20%	9.65%	1.54%	2.41%
21	Special Wastes	0.09%	0.00%	0.00%	0.00%	0.00%	0.00%
22	Electronics	0.00%	0.00%	0.00%	0.00%	0.00%	2.01%
23	Household Batteries	0.52%	0.00%	0.00%	0.00%	0.00%	0.00%
24	Wood Waste	0.56%	6.43%	0.62%	3.34%	9.44%	4.01%
25	C&D Debris	0.37%	0.00%	2.07%	1.76%	0.00%	0.95%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.00%	5.87%	0.16%
27	Yard Waste	21.80%	51.50%	0.51%	36.66%	14.04%	21.63%
28	Food Waste	10.78%	9.85%	31.94%	8.60%	7.63%	7.10%
29	All Other Garbage	4.16%	3.97%	5.70%	6.33%	10.96%	3.33%
30	Liquids	1.26%	0.00%	0.75%	0.32%	2.52%	0.64%
31	Grit	0.80%	1.30%	0.00%	0.96%	0.00%	4.16%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table C-1: November 2010 Individual Sample Results, Single-Family Residential (continued)

Hauler/Location		WM - RL New Town	WM - RL Old Town				
Material Categories	sample #	18	19	21	22	23	28
1	Newspaper	2.89%	3.23%	1.63%	2.90%	1.24%	0.30%
2	Corrugated Containers	3.25%	3.38%	7.65%	5.65%	0.78%	5.37%
3	Office Paper	2.05%	5.29%	0.56%	4.96%	1.60%	0.28%
4	Other Recyclable Paper	19.03%	9.25%	8.72%	9.89%	3.95%	2.65%
5	Other Non-Recyclable Paper	4.73%	11.16%	6.55%	8.17%	7.07%	7.30%
6	Aseptic Containers	0.52%	0.37%	0.14%	0.15%	0.29%	0.19%
7	PET Containers	1.88%	2.14%	1.06%	2.51%	1.55%	1.30%
8	HDPE Containers	1.15%	1.41%	2.01%	1.12%	0.82%	1.67%
9	Other Containers (#3-#7)	0.33%	0.80%	0.18%	0.17%	0.61%	0.35%
10	Non-Rigid Plastic Film	4.52%	4.96%	6.06%	4.92%	2.65%	3.22%
11	Styrofoam	1.86%	1.00%	0.79%	0.29%	0.71%	0.95%
12	All Other Plastics	5.19%	5.87%	3.44%	3.29%	2.38%	2.53%
13	Tin/Steel Cans	0.57%	1.02%	1.09%	1.67%	0.93%	0.46%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.21%	0.00%	0.00%	1.79%	0.34%	0.37%
16	Aluminum Cans	0.44%	0.71%	1.21%	0.88%	0.90%	0.83%
17	Other Non-Ferrous	1.03%	0.26%	0.36%	0.42%	0.10%	0.61%
18	Glass Containers	6.53%	3.57%	3.04%	8.63%	5.57%	5.12%
19	Other Glass	0.27%	0.00%	0.79%	0.00%	0.00%	0.94%
20	Textiles	3.52%	9.16%	8.72%	1.71%	1.61%	2.50%
21	Special Wastes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
22	Electronics	1.55%	1.26%	0.56%	0.29%	10.32%	1.04%
23	Household Batteries	0.00%	0.00%	0.00%	0.02%	0.02%	0.00%
24	Wood Waste	1.36%	1.08%	2.15%	4.22%	0.65%	2.75%
25	C&D Debris	5.02%	1.93%	0.00%	2.72%	1.26%	11.96%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.04%	0.00%	0.00%
27	Yard Waste	15.72%	14.45%	26.68%	17.92%	36.03%	35.56%
28	Food Waste	10.49%	12.52%	9.75%	7.01%	8.56%	7.32%
29	All Other Garbage	4.90%	5.18%	6.85%	6.53%	7.70%	4.42%
30	Liquids	0.29%	0.00%	0.00%	1.73%	1.77%	0.00%
31	Grit	0.73%	0.00%	0.00%	0.40%	0.59%	0.00%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table C-1: November 2010 Individual Sample Results, Single-Family Residential (continued)

Hauler/Location		WM - RL Old Town	WM - RL Central	WM - RL Central	
Material Categories	sample #	31	35	39	Weighted Avg.
1	Newspaper	3.04%	1.12%	1.70%	1.65%
2	Corrugated Containers	17.01%	4.86%	1.13%	4.46%
3	Office Paper	1.03%	1.86%	0.64%	2.13%
4	Other Recyclable Paper	8.14%	8.21%	7.85%	7.23%
5	Other Non-Recyclable Paper	7.81%	9.29%	11.61%	7.25%
6	Aseptic Containers	0.40%	0.58%	0.00%	0.24%
7	PET Containers	1.60%	0.72%	3.89%	1.83%
8	HDPE Containers	2.11%	1.22%	1.00%	1.10%
9	Other Containers (#3-#7)	0.14%	0.16%	1.06%	0.44%
10	Non-Rigid Plastic Film	7.99%	5.42%	6.02%	4.92%
11	Styrofoam	0.40%	1.59%	0.74%	0.84%
12	All Other Plastics	3.78%	2.82%	2.59%	3.35%
13	Tin/Steel Cans	1.91%	1.57%	1.86%	1.29%
14	White Goods	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.00%	1.57%	0.83%	1.00%
16	Aluminum Cans	0.75%	0.46%	1.40%	0.80%
17	Other Non-Ferrous	0.86%	0.83%	0.59%	0.56%
18	Glass Containers	2.01%	4.36%	4.84%	7.11%
19	Other Glass	0.00%	7.01%	0.63%	0.66%
20	Textiles	2.65%	5.80%	5.55%	4.15%
21	Special Wastes	0.00%	0.00%	0.00%	0.01%
22	Electronics	1.57%	0.00%	5.21%	1.61%
23	Household Batteries	0.01%	0.01%	0.11%	0.04%
24	Wood Waste	1.06%	2.52%	0.13%	2.74%
25	C&D Debris	0.00%	7.20%	8.77%	2.99%
26	Tires and Rubber	0.05%	0.00%	0.00%	0.40%
27	Yard Waste	15.46%	11.77%	10.37%	22.58%
28	Food Waste	12.33%	7.68%	9.23%	10.66%
29	All Other Garbage	3.15%	10.78%	10.87%	6.32%
30	Liquids	1.23%	0.59%	1.39%	0.82%
31	Grit	3.51%	0.00%	0.00%	0.82%
TOTALS		100.00%	100.00%	100.00%	100.00%

Table C-2: April 2011 Individual Sample Results, Single-Family Residential (% by weight)

Hauler/Location		WM - RL Old Town	WM - RL Old Town	WM - RL Old Town	WM - RL Central	WM - RL Central	WM - RL Central
Material Categories	sample #	3	6	7	10	12	13
1	Newspaper	1.64%	1.25%	1.48%	0.88%	0.94%	4.23%
2	Corrugated Containers	1.89%	0.16%	3.67%	2.81%	0.67%	6.45%
3	Office Paper	0.00%	0.00%	0.88%	2.48%	2.87%	0.80%
4	Other Recyclable Paper	2.45%	15.78%	7.97%	5.63%	0.17%	8.06%
5	Other Non-Recyclable Paper	22.08%	1.29%	15.53%	7.48%	6.18%	7.96%
6	Aseptic Containers	0.00%	1.24%	0.21%	0.26%	6.59%	0.34%
7	PET Containers	2.75%	1.19%	1.30%	1.78%	1.78%	2.98%
8	HDPE Containers	0.45%	0.11%	1.04%	0.62%	0.86%	0.66%
9	Other Containers (#3-#7)	0.00%	0.62%	1.11%	0.38%	3.76%	0.41%
10	Non-Rigid Plastic Film	7.29%	4.47%	11.52%	2.89%	5.87%	8.97%
11	Styrofoam	0.31%	0.17%	0.48%	0.48%	0.63%	0.44%
12	All Other Plastics	4.07%	6.10%	2.24%	1.96%	1.19%	2.49%
13	Tin/Steel Cans	0.19%	0.72%	2.11%	0.49%	0.91%	0.39%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.00%	1.89%	0.00%	1.10%	0.40%	0.09%
16	Aluminum Cans	1.10%	0.52%	0.85%	0.77%	0.40%	0.80%
17	Other Non-Ferrous	0.66%	0.15%	0.45%	0.20%	3.15%	0.05%
18	Glass Containers	3.04%	1.47%	12.52%	4.57%	3.67%	7.18%
19	Other Glass	1.17%	0.00%	0.30%	1.11%	0.41%	0.00%
20	Textiles	1.14%	5.98%	2.76%	10.20%	4.65%	3.19%
21	Special Wastes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
22	Electronics	0.00%	0.14%	0.00%	2.13%	0.72%	0.86%
23	Household Batteries	0.56%	0.04%	0.15%	0.00%	0.00%	0.00%
24	Wood Waste	7.25%	2.47%	0.00%	2.85%	3.84%	0.00%
25	C&D Debris	0.00%	6.00%	7.99%	1.20%	0.00%	1.07%
26	Tires and Rubber	0.00%	2.31%	0.00%	0.00%	0.00%	0.00%
27	Yard Waste	33.63%	42.65%	15.36%	41.64%	42.21%	36.04%
28	Food Waste	7.66%	1.78%	9.56%	4.65%	3.07%	6.07%
29	All Other Garbage	0.25%	0.09%	0.24%	1.42%	2.68%	0.45%
30	Liquids	0.41%	1.41%	0.28%	0.00%	2.38%	0.00%
31	Grit	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table C-2: April 2011 Individual Sample Results, Single-Family Residential (continued)

Hauler/Location		WM - RL Central	WM - RL Central	WM - RL New Town			
Material Categories	sample #	15	17	20	21	22	24
1	Newspaper	0.12%	1.09%	2.15%	1.27%	0.39%	3.56%
2	Corrugated Containers	0.88%	3.64%	2.64%	3.28%	1.28%	5.54%
3	Office Paper	0.26%	0.42%	1.38%	1.91%	2.59%	3.11%
4	Other Recyclable Paper	3.29%	4.38%	4.01%	3.83%	1.23%	2.86%
5	Other Non-Recyclable Paper	4.16%	12.87%	7.81%	9.28%	6.76%	7.47%
6	Aseptic Containers	1.14%	0.68%	0.32%	0.14%	0.15%	0.91%
7	PET Containers	3.79%	3.76%	1.06%	3.72%	1.79%	1.26%
8	HDPE Containers	0.38%	1.23%	0.72%	1.38%	1.22%	1.80%
9	Other Containers (#3-#7)	0.07%	0.59%	1.01%	0.12%	0.00%	0.00%
10	Non-Rigid Plastic Film	7.11%	10.49%	4.04%	9.42%	2.01%	10.49%
11	Styrofoam	1.93%	0.92%	0.41%	0.72%	0.28%	0.49%
12	All Other Plastics	0.85%	2.33%	6.99%	2.20%	3.36%	2.00%
13	Tin/Steel Cans	0.49%	0.00%	0.83%	0.78%	0.06%	0.79%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.96%	9.54%	0.09%	4.46%	4.86%	0.18%
16	Aluminum Cans	0.60%	4.33%	1.47%	1.54%	0.08%	1.10%
17	Other Non-Ferrous	0.24%	0.23%	0.19%	3.17%	0.07%	0.27%
18	Glass Containers	6.76%	5.70%	1.05%	2.89%	1.89%	6.57%
19	Other Glass	0.00%	0.00%	0.18%	0.00%	0.10%	0.32%
20	Textiles	2.02%	11.55%	0.63%	5.04%	12.11%	3.12%
21	Special Wastes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
22	Electronics	0.00%	1.92%	0.76%	1.64%	0.00%	0.04%
23	Household Batteries	0.00%	0.00%	0.00%	0.20%	0.09%	0.00%
24	Wood Waste	1.59%	0.29%	1.05%	8.22%	10.53%	0.00%
25	C&D Debris	0.00%	0.00%	3.12%	0.66%	0.00%	0.49%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
27	Yard Waste	53.28%	9.30%	44.82%	24.84%	42.40%	30.58%
28	Food Waste	6.26%	6.28%	10.12%	8.38%	4.85%	14.62%
29	All Other Garbage	1.35%	7.82%	3.16%	0.93%	1.07%	2.45%
30	Liquids	1.61%	0.00%	0.00%	0.00%	0.84%	0.00%
31	Grit	0.88%	0.62%	0.00%	0.00%	0.00%	0.00%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table C-2: April 2011 Individual Sample Results, Single-Family Residential (continued)

Hauler/Location		WM - RL New Town	WM - RL Old Town	WM - RL Old Town	
Material Categories	sample #	25	26	33	Weighted Avg.
1	Newspaper	1.02%	2.75%	1.36%	1.62%
2	Corrugated Containers	4.27%	9.73%	13.49%	4.11%
3	Office Paper	3.21%	1.43%	3.09%	1.65%
4	Other Recyclable Paper	6.80%	4.53%	2.21%	4.88%
5	Other Non-Recyclable Paper	11.15%	3.01%	3.68%	8.29%
6	Aseptic Containers	0.22%	0.79%	0.12%	0.94%
7	PET Containers	1.58%	1.10%	1.08%	2.05%
8	HDPE Containers	1.38%	0.70%	0.42%	0.85%
9	Other Containers (#3-#7)	0.00%	0.21%	0.49%	0.62%
10	Non-Rigid Plastic Film	11.63%	7.49%	4.81%	7.18%
11	Styrofoam	1.48%	0.80%	0.12%	0.63%
12	All Other Plastics	2.00%	5.57%	2.57%	3.05%
13	Tin/Steel Cans	0.26%	0.55%	0.41%	0.59%
14	White Goods	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.26%	0.00%	1.45%	1.69%
16	Aluminum Cans	0.33%	0.51%	0.70%	1.00%
17	Other Non-Ferrous	0.26%	0.69%	0.19%	0.68%
18	Glass Containers	7.82%	6.85%	8.46%	5.33%
19	Other Glass	1.06%	0.00%	0.74%	0.36%
20	Textiles	11.87%	14.12%	1.56%	5.97%
21	Special Wastes	0.00%	0.00%	0.00%	0.00%
22	Electronics	0.37%	5.47%	1.87%	1.08%
23	Household Batteries	0.41%	0.00%	0.07%	0.10%
24	Wood Waste	0.33%	0.00%	2.22%	2.69%
25	C&D Debris	1.12%	1.73%	2.60%	1.71%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.17%
27	Yard Waste	13.62%	22.26%	35.06%	32.68%
28	Food Waste	12.10%	8.92%	5.53%	7.20%
29	All Other Garbage	3.00%	0.80%	4.08%	2.03%
30	Liquids	0.73%	0.00%	1.63%	0.65%
31	Grit	1.72%	0.00%	0.00%	0.20%
TOTALS		100.00%	100.00%	100.00%	100.00%

Appendix D: Individual Sample Results, Multi-Family Residential

Table D-1: November 2010 Individual Sample Results, Multi-Family Residential (% by weight)

Hauler/Location		WM - Compactor West Isle Apts.	WM - FEL Special Route	WM - Compactor Shipyard Condos	WM - Compactor Galleon Condos	
Material Categories	sample #	7	8	16	38	Weighted Avg.
1	Newspaper	1.44%	6.85%	2.63%	3.22%	3.59%
2	Corrugated Containers	5.91%	15.38%	2.34%	6.26%	7.56%
3	Office Paper	1.70%	0.64%	0.34%	0.39%	0.76%
4	Other Recyclable Paper	8.04%	6.40%	8.29%	6.37%	7.27%
5	Other Non-Recyclable Paper	11.23%	8.45%	10.46%	11.10%	10.28%
6	Aseptic Containers	0.65%	0.09%	0.36%	2.33%	0.84%
7	PET Containers	4.51%	2.16%	3.54%	3.25%	3.35%
8	HDPE Containers	1.91%	1.63%	1.99%	1.32%	1.71%
9	Other Containers (#3-#7)	0.76%	0.49%	0.29%	0.39%	0.48%
10	Non-Rigid Plastic Film	6.96%	6.70%	7.03%	12.67%	8.30%
11	Styrofoam	1.91%	0.54%	1.49%	2.40%	1.57%
12	All Other Plastics	3.19%	2.87%	5.79%	3.33%	3.80%
13	Tin/Steel Cans	1.95%	2.44%	1.60%	1.72%	1.93%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.00%	2.33%	0.00%	0.06%	0.62%
16	Aluminum Cans	1.84%	0.56%	1.86%	2.66%	1.71%
17	Other Non-Ferrous	3.25%	0.19%	0.31%	0.12%	0.95%
18	Glass Containers	8.44%	6.67%	10.74%	13.81%	9.87%
19	Other Glass	0.00%	0.00%	0.59%	0.00%	0.15%
20	Textiles	7.37%	2.08%	1.00%	1.26%	2.90%
21	Special Wastes	0.24%	0.23%	0.00%	0.00%	0.12%
22	Electronics	0.00%	0.00%	0.20%	0.10%	0.08%
23	Household Batteries	0.00%	0.00%	0.00%	0.00%	0.00%
24	Wood Waste	0.00%	15.98%	0.00%	0.69%	4.33%
25	C&D Debris	0.18%	0.00%	5.74%	4.58%	2.60%
26	Tires and Rubber	0.00%	1.46%	0.00%	0.00%	0.38%
27	Yard Waste	3.35%	0.00%	12.44%	0.70%	4.12%
28	Food Waste	20.07%	13.82%	11.55%	12.33%	14.41%
29	All Other Garbage	2.73%	1.33%	6.64%	8.06%	4.65%
30	Liquids	2.37%	0.69%	2.79%	0.88%	1.68%
31	Grit	0.00%	0.00%	0.00%	0.00%	0.00%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%

Table D-2: April 2011 Individual Sample Results, Multi-Family Residential (% by weight)

Hauler/Location		WM - Compactor West Isle Apts.	WM - Compactor Shipyard Condos	WM - Compactor Harbor Place	WM - Compactor Key West Senior Citizens Plaza	
Material Categories	sample #	8	14	23	32	Weighted Avg.
1	Newspaper	0.60%	5.88%	0.51%	7.76%	5.44%
2	Corrugated Containers	5.25%	0.53%	6.41%	1.29%	1.08%
3	Office Paper	2.23%	0.48%	1.90%	3.15%	0.74%
4	Other Recyclable Paper	6.85%	12.58%	2.73%	4.60%	11.48%
5	Other Non-Recyclable Paper	13.49%	11.35%	5.19%	12.40%	11.16%
6	Aseptic Containers	1.41%	0.66%	0.20%	0.61%	0.66%
7	PET Containers	4.00%	6.64%	0.89%	3.22%	6.08%
8	HDPE Containers	1.64%	1.20%	1.27%	4.26%	1.35%
9	Other Containers (#3-#7)	0.43%	0.67%	0.12%	0.74%	0.64%
10	Non-Rigid Plastic Film	7.67%	9.40%	3.05%	16.66%	9.29%
11	Styrofoam	1.02%	1.10%	5.15%	1.18%	1.31%
12	All Other Plastics	4.52%	1.31%	1.91%	1.46%	1.49%
13	Tin/Steel Cans	2.48%	1.18%	0.25%	2.74%	1.25%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.00%	1.41%	0.12%	0.29%	1.23%
16	Aluminum Cans	1.44%	0.76%	0.66%	1.19%	0.80%
17	Other Non-Ferrous	0.44%	0.54%	0.32%	0.00%	0.50%
18	Glass Containers	5.89%	15.06%	4.03%	2.38%	13.56%
19	Other Glass	0.74%	0.00%	3.57%	1.45%	0.28%
20	Textiles	2.67%	3.79%	0.00%	2.97%	3.51%
21	Special Wastes	0.00%	0.00%	0.00%	2.40%	0.10%
22	Electronics	0.67%	0.00%	0.00%	1.01%	0.07%
23	Household Batteries	0.00%	0.00%	0.06%	0.00%	0.00%
24	Wood Waste	0.00%	0.54%	7.59%	0.00%	0.87%
25	C&D Debris	0.00%	0.00%	25.97%	0.37%	1.37%
26	Tires and Rubber	0.22%	0.00%	0.00%	0.00%	0.01%
27	Yard Waste	17.00%	13.62%	18.70%	9.23%	13.86%
28	Food Waste	15.66%	10.99%	7.16%	14.21%	11.12%
29	All Other Garbage	3.41%	0.32%	2.25%	2.86%	0.66%
30	Liquids	0.27%	0.00%	0.00%	0.00%	0.01%
31	Grit	0.00%	0.00%	0.00%	1.55%	0.06%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%

Appendix E: Individual Sample Results, Commercial

Table E-1: November 2010 Individual Sample Results, Commercial (% by weight)

Hauler/Location		WM - Compactor Jarro Café	WM - Compactor A&B Lobster House	WM - Compactor Southernmost Hotel	WM - Compactor Marriott Hotel	WM - Compactor La Concha Hotel	WM - FEL Old Town
Material Categories	sample #	1	3	4	9	10	12
1	Newspaper	0.46%	0.00%	2.55%	4.86%	9.45%	6.21%
2	Corrugated Containers	2.15%	3.24%	4.20%	11.40%	0.64%	2.64%
3	Office Paper	0.38%	1.71%	1.23%	0.35%	0.71%	6.11%
4	Other Recyclable Paper	1.73%	4.60%	7.44%	6.39%	8.33%	8.65%
5	Other Non-Recyclable Paper	9.05%	17.84%	13.82%	11.56%	11.90%	11.00%
6	Aseptic Containers	0.42%	0.22%	0.43%	0.30%	0.26%	0.00%
7	PET Containers	0.85%	1.16%	3.74%	4.57%	3.19%	2.86%
8	HDPE Containers	0.25%	1.49%	1.10%	0.37%	1.21%	2.21%
9	Other Containers (#3-#7)	0.38%	0.49%	0.00%	0.15%	0.67%	0.07%
10	Non-Rigid Plastic Film	11.17%	8.47%	11.05%	8.84%	7.52%	2.59%
11	Styrofoam	0.00%	1.26%	0.00%	0.70%	0.55%	4.57%
12	All Other Plastics	1.29%	6.17%	7.50%	5.03%	3.91%	4.84%
13	Tin/Steel Cans	0.00%	1.79%	0.61%	0.47%	0.81%	1.31%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.00%	7.82%	1.43%	0.22%	0.00%	0.80%
16	Aluminum Cans	0.25%	1.91%	1.21%	0.74%	1.11%	0.93%
17	Other Non-Ferrous	0.54%	0.31%	0.26%	0.26%	0.73%	0.77%
18	Glass Containers	9.24%	11.79%	16.79%	7.93%	9.61%	15.82%
19	Other Glass	0.69%	0.00%	0.00%	0.00%	0.00%	2.23%
20	Textiles	0.10%	1.95%	1.67%	4.07%	20.53%	0.65%
21	Special Wastes	0.00%	0.00%	0.82%	0.00%	0.00%	0.00%
22	Electronics	0.00%	0.00%	0.00%	0.00%	0.00%	2.85%
23	Household Batteries	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
24	Wood Waste	0.00%	0.22%	0.00%	0.00%	0.00%	0.11%
25	C&D Debris	0.00%	0.00%	0.00%	0.00%	4.15%	0.00%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
27	Yard Waste	0.00%	6.76%	0.56%	0.00%	0.00%	0.08%
28	Food Waste	60.84%	18.77%	19.15%	24.72%	9.90%	15.05%
29	All Other Garbage	0.21%	0.88%	2.27%	4.66%	1.21%	6.31%
30	Liquids	0.00%	0.45%	2.16%	1.61%	2.90%	1.33%
31	Grit	0.00%	0.69%	0.00%	0.79%	0.73%	0.00%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table E-1: November 2010 Individual Sample Results, Commercial (continued)

Hauler/Location		WM - RL Old Town	WM - FEL Old Town	WM - FEL Downtown	WM - FEL Old Town	WM - FEL Downtown	WM - Compactor Albertson's
Material Categories	sample #	13	17	20	24	25	26
1	Newspaper	4.01%	0.25%	4.25%	0.94%	3.06%	2.21%
2	Corrugated Containers	15.07%	6.71%	3.36%	10.97%	17.88%	11.02%
3	Office Paper	8.89%	0.23%	1.80%	0.34%	0.74%	2.04%
4	Other Recyclable Paper	9.13%	3.73%	7.16%	6.10%	20.99%	6.04%
5	Other Non-Recyclable Paper	12.86%	6.40%	8.11%	14.45%	10.23%	11.31%
6	Aseptic Containers	0.29%	0.12%	0.20%	0.36%	0.35%	2.04%
7	PET Containers	0.48%	0.81%	2.11%	2.11%	2.89%	1.44%
8	HDPE Containers	0.76%	2.36%	1.43%	0.83%	1.55%	1.48%
9	Other Containers (#3-#7)	0.00%	1.46%	0.05%	0.75%	0.15%	0.27%
10	Non-Rigid Plastic Film	5.48%	8.65%	6.29%	7.09%	9.75%	9.02%
11	Styrofoam	0.86%	0.25%	1.18%	1.05%	0.72%	6.12%
12	All Other Plastics	4.00%	2.61%	20.35%	2.37%	3.59%	4.06%
13	Tin/Steel Cans	1.25%	4.15%	1.32%	1.96%	0.26%	0.08%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.94%	0.00%	1.20%	0.49%	0.00%	0.25%
16	Aluminum Cans	0.44%	0.25%	0.30%	1.09%	0.50%	0.31%
17	Other Non-Ferrous	0.07%	0.13%	0.54%	0.62%	0.42%	0.00%
18	Glass Containers	1.32%	15.02%	5.73%	9.11%	11.67%	0.35%
19	Other Glass	0.00%	0.00%	0.77%	0.00%	0.00%	0.00%
20	Textiles	0.88%	0.00%	6.73%	5.68%	0.83%	0.00%
21	Special Wastes	0.00%	0.00%	0.00%	0.11%	0.09%	0.00%
22	Electronics	0.00%	0.17%	0.39%	1.00%	0.00%	0.71%
23	Household Batteries	0.00%	0.00%	0.39%	0.09%	0.00%	0.00%
24	Wood Waste	0.78%	0.00%	1.43%	4.33%	1.77%	0.35%
25	C&D Debris	8.41%	0.00%	0.30%	0.00%	0.79%	0.00%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.00%	0.20%	0.00%
27	Yard Waste	0.00%	0.12%	3.73%	6.27%	0.35%	4.10%
28	Food Waste	18.99%	41.61%	9.61%	16.05%	6.28%	33.11%
29	All Other Garbage	4.54%	3.29%	9.43%	3.69%	1.63%	0.08%
30	Liquids	0.56%	0.94%	1.07%	2.13%	3.32%	3.60%
31	Grit	0.00%	0.73%	0.75%	0.00%	0.00%	0.00%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table E-1: November 2010 Individual Sample Results, Commercial (continued)

Hauler/Location		WM - Compactor Hog's Breath Saloon	WM - RL Duval	WM - FEL Downtown	WM - RL Duval	WM - FEL Downtown	WM - Compactor Sloppy Joe's
Material Categories	sample #	27	29	30	32	33	34
1	Newspaper	2.85%	0.77%	7.15%	1.67%	10.23%	0.35%
2	Corrugated Containers	27.71%	3.08%	8.16%	4.17%	6.10%	4.14%
3	Office Paper	0.00%	9.60%	0.93%	0.33%	8.60%	0.60%
4	Other Recyclable Paper	4.66%	8.71%	3.19%	4.59%	8.32%	7.20%
5	Other Non-Recyclable Paper	7.41%	6.14%	1.24%	8.40%	17.87%	14.74%
6	Aseptic Containers	0.11%	0.15%	0.15%	0.27%	0.26%	0.00%
7	PET Containers	0.75%	1.50%	0.81%	1.60%	2.96%	0.38%
8	HDPE Containers	1.84%	1.67%	1.41%	1.03%	1.84%	1.33%
9	Other Containers (#3-#7)	0.00%	0.00%	0.25%	0.14%	0.23%	0.02%
10	Non-Rigid Plastic Film	7.01%	8.30%	5.53%	4.00%	10.80%	10.27%
11	Styrofoam	0.17%	0.42%	0.68%	0.36%	0.90%	0.56%
12	All Other Plastics	7.36%	4.34%	1.45%	1.31%	3.13%	8.23%
13	Tin/Steel Cans	1.02%	0.69%	0.61%	0.70%	0.60%	0.91%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.00%	0.00%	0.06%	7.33%	0.00%	0.00%
16	Aluminum Cans	2.63%	0.77%	0.46%	0.44%	0.71%	0.30%
17	Other Non-Ferrous	0.00%	0.46%	0.26%	0.27%	0.18%	0.80%
18	Glass Containers	2.78%	22.13%	3.01%	5.71%	1.70%	20.81%
19	Other Glass	0.00%	0.81%	0.00%	0.11%	0.00%	0.00%
20	Textiles	0.00%	0.71%	0.56%	1.00%	1.35%	0.40%
21	Special Wastes	0.00%	0.00%	0.00%	0.00%	0.09%	0.00%
22	Electronics	0.00%	0.55%	4.41%	0.00%	1.09%	0.00%
23	Household Batteries	0.00%	0.00%	0.12%	0.01%	0.00%	0.01%
24	Wood Waste	0.13%	0.11%	0.00%	11.22%	0.00%	1.43%
25	C&D Debris	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
27	Yard Waste	0.07%	1.28%	5.46%	35.59%	1.04%	0.00%
28	Food Waste	27.09%	23.96%	46.39%	5.85%	15.13%	21.06%
29	All Other Garbage	0.61%	2.04%	4.30%	1.61%	2.11%	1.06%
30	Liquids	1.73%	1.79%	3.43%	2.29%	4.76%	0.85%
31	Grit	4.06%	0.00%	0.00%	0.00%	0.00%	4.56%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table E-1: November 2010 Individual Sample Results, Commercial (continued)

Hauler/Location		WM - Compactor Mallory Sq.	WM - RL Duval	WM - FEL Downtown	
Material Categories	sample #	36	37	40	Weighted Avg.
1	Newspaper	0.51%	1.26%	4.15%	3.21%
2	Corrugated Containers	15.21%	0.74%	2.01%	7.72%
3	Office Paper	0.36%	1.07%	0.97%	2.19%
4	Other Recyclable Paper	9.11%	7.18%	3.94%	7.05%
5	Other Non-Recyclable Paper	10.31%	19.08%	6.98%	10.91%
6	Aseptic Containers	0.00%	0.00%	1.46%	0.34%
7	PET Containers	1.80%	1.48%	1.60%	1.85%
8	HDPE Containers	0.49%	0.38%	1.85%	1.28%
9	Other Containers (#3-#7)	0.07%	0.06%	0.23%	0.26%
10	Non-Rigid Plastic Film	11.00%	8.99%	6.35%	7.99%
11	Styrofoam	1.69%	0.67%	2.62%	1.16%
12	All Other Plastics	9.05%	4.14%	2.65%	5.18%
13	Tin/Steel Cans	0.10%	0.00%	0.98%	0.93%
14	White Goods	0.00%	0.63%	0.00%	0.03%
15	Other Ferrous	0.00%	0.00%	2.55%	1.12%
16	Aluminum Cans	0.98%	0.46%	2.62%	0.87%
17	Other Non-Ferrous	0.28%	0.53%	0.49%	0.38%
18	Glass Containers	12.21%	12.86%	2.08%	9.36%
19	Other Glass	0.00%	0.00%	3.09%	0.34%
20	Textiles	0.45%	1.91%	2.46%	2.52%
21	Special Wastes	0.00%	0.32%	0.00%	0.07%
22	Electronics	0.00%	0.00%	0.00%	0.53%
23	Household Batteries	0.00%	0.00%	0.01%	0.03%
24	Wood Waste	0.01%	0.43%	0.39%	1.16%
25	C&D Debris	0.00%	0.00%	0.70%	0.68%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.01%
27	Yard Waste	1.88%	0.00%	32.63%	4.84%
28	Food Waste	18.99%	35.55%	7.55%	22.55%
29	All Other Garbage	4.91%	1.48%	7.30%	3.01%
30	Liquids	0.58%	0.77%	1.59%	1.82%
31	Grit	0.00%	0.00%	0.75%	0.63%
TOTALS		100.00%	100.00%	100.00%	100.00%

Table E-2: April 2011 Individual Sample Results, Commercial (% by weight)

Hauler/Location		WM - Compactor Mallory Sq.	WM - Compactor	WM - Commercial FEL	WM - Compactor Southernmost Hotel	WM - Commercial FEL	WM - Compactor Pier House Hotel
Material Categories	sample #	1	2	4	5	9	11
1	Newspaper	4.84%	2.13%	1.60%	0.00%	2.98%	7.18%
2	Corrugated Containers	10.38%	6.92%	0.32%	2.14%	9.06%	0.96%
3	Office Paper	0.37%	1.10%	1.08%	0.00%	3.08%	15.54%
4	Other Recyclable Paper	2.66%	0.65%	11.94%	4.62%	4.58%	4.13%
5	Other Non-Recyclable Paper	7.90%	17.25%	14.84%	9.80%	10.63%	11.70%
6	Aseptic Containers	0.15%	0.16%	1.27%	1.90%	0.11%	0.52%
7	PET Containers	3.21%	2.22%	1.84%	2.84%	0.76%	3.04%
8	HDPE Containers	1.44%	0.12%	0.00%	2.40%	0.30%	0.58%
9	Other Containers (#3-#7)	0.07%	0.16%	5.62%	0.17%	0.52%	0.08%
10	Non-Rigid Plastic Film	6.12%	7.41%	5.92%	10.89%	9.03%	4.58%
11	Styrofoam	0.38%	0.00%	0.11%	3.65%	0.20%	1.01%
12	All Other Plastics	11.02%	3.10%	0.42%	4.28%	6.46%	7.28%
13	Tin/Steel Cans	0.77%	0.96%	0.31%	0.94%	1.73%	0.39%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.17%	0.00%	21.17%	3.00%	0.00%	0.20%
16	Aluminum Cans	0.78%	0.14%	0.78%	1.17%	0.73%	1.60%
17	Other Non-Ferrous	0.57%	1.27%	1.05%	3.14%	0.16%	0.00%
18	Glass Containers	6.36%	9.37%	5.68%	11.46%	15.93%	9.35%
19	Other Glass	0.00%	0.00%	0.37%	0.08%	0.00%	0.00%
20	Textiles	1.86%	1.38%	4.46%	1.49%	3.47%	1.29%
21	Special Wastes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
22	Electronics	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
23	Household Batteries	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
24	Wood Waste	2.67%	0.00%	0.51%	0.00%	0.00%	0.00%
25	C&D Debris	1.25%	0.00%	2.37%	0.00%	14.80%	4.17%
26	Tires and Rubber	0.00%	0.00%	6.87%	0.00%	0.00%	0.00%
27	Yard Waste	3.39%	20.54%	3.50%	0.05%	0.00%	3.87%
28	Food Waste	25.35%	24.84%	6.21%	23.66%	15.02%	22.15%
29	All Other Garbage	5.07%	0.26%	0.00%	11.16%	0.23%	0.13%
30	Liquids	3.23%	0.00%	0.00%	1.16%	0.21%	0.26%
31	Grit	0.00%	0.00%	1.78%	0.00%	0.00%	0.00%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table E-2: April 2011 Individual Sample Results, Commercial (continued)

Hauler/Location		WM - Compactor Casa Marina Hotel	WM - Commercial REL Duval Street	WM - Commercial FEL	WM - Compactor Albertson's	WM - Compactor Hogs Breath Saloon	WM - Compactor City Marina
Material Categories	sample #	16	18	19	27	28	29
1	Newspaper	10.61%	0.20%	5.37%	0.52%	2.83%	1.09%
2	Corrugated Containers	0.98%	4.00%	3.63%	18.48%	15.29%	2.26%
3	Office Paper	1.52%	7.84%	0.83%	1.83%	0.17%	4.05%
4	Other Recyclable Paper	7.89%	3.54%	3.26%	1.14%	0.70%	2.24%
5	Other Non-Recyclable Paper	15.77%	15.05%	8.25%	14.14%	13.97%	7.06%
6	Aseptic Containers	1.02%	0.40%	0.73%	0.17%	0.20%	0.37%
7	PET Containers	11.03%	3.77%	0.19%	1.17%	0.62%	4.83%
8	HDPE Containers	0.88%	0.37%	1.47%	1.14%	1.94%	4.07%
9	Other Containers (#3-#7)	0.30%	0.06%	0.15%	0.96%	0.06%	0.19%
10	Non-Rigid Plastic Film	8.84%	9.88%	7.26%	9.01%	9.55%	9.65%
11	Styrofoam	0.97%	0.62%	0.61%	0.45%	0.16%	0.03%
12	All Other Plastics	5.35%	2.99%	9.56%	5.90%	11.32%	4.41%
13	Tin/Steel Cans	2.09%	0.69%	1.34%	0.67%	0.09%	0.42%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.49%	0.32%	0.00%	0.00%	0.00%	0.00%
16	Aluminum Cans	0.90%	0.79%	0.79%	0.12%	0.85%	0.72%
17	Other Non-Ferrous	0.60%	0.00%	0.34%	0.62%	0.12%	0.02%
18	Glass Containers	7.59%	18.88%	4.40%	0.81%	5.00%	2.13%
19	Other Glass	0.60%	0.00%	1.01%	0.00%	0.10%	0.02%
20	Textiles	4.84%	4.06%	16.15%	0.21%	0.16%	9.64%
21	Special Wastes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
22	Electronics	0.00%	0.00%	0.73%	0.00%	0.00%	24.01%
23	Household Batteries	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%
24	Wood Waste	0.00%	0.36%	7.14%	1.95%	7.41%	0.55%
25	C&D Debris	0.00%	0.20%	3.12%	0.29%	0.00%	9.64%
26	Tires and Rubber	0.00%	0.00%	3.83%	0.00%	0.00%	0.00%
27	Yard Waste	3.25%	0.00%	4.60%	1.44%	0.63%	5.34%
28	Food Waste	12.52%	25.46%	8.58%	37.21%	26.89%	3.18%
29	All Other Garbage	1.95%	0.50%	6.66%	1.79%	1.93%	0.73%
30	Liquids	0.00%	0.00%	0.00%	0.00%	0.00%	2.59%
31	Grit	0.00%	0.00%	0.00%	0.00%	0.00%	0.29%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table E-2: April 2011 Individual Sample Results, Commercial (continued)

Hauler/Location		WM - Commercial FEL Downtown	WM - Compactor Airport	WM - Compactor Sloppy Joe's	WM - Compactor Duval Square	WM - Compactor Galleon	WM - Compactor Bight Marina
Material Categories	sample #	30	31	34	35	36	37
1	Newspaper	0.37%	3.97%	0.00%	0.35%	0.66%	1.51%
2	Corrugated Containers	3.72%	13.07%	1.37%	9.99%	3.79%	2.90%
3	Office Paper	3.53%	3.49%	0.00%	0.14%	0.29%	0.19%
4	Other Recyclable Paper	3.36%	4.02%	4.17%	0.88%	1.33%	1.03%
5	Other Non-Recyclable Paper	8.70%	16.90%	22.94%	14.82%	5.79%	11.73%
6	Aseptic Containers	0.33%	0.30%	0.79%	0.00%	0.19%	0.25%
7	PET Containers	1.21%	4.30%	0.97%	0.29%	2.02%	2.39%
8	HDPE Containers	0.41%	0.66%	0.82%	0.85%	1.07%	1.17%
9	Other Containers (#3-#7)	0.18%	0.68%	0.00%	0.28%	0.19%	0.50%
10	Non-Rigid Plastic Film	11.58%	11.93%	18.43%	5.83%	6.74%	12.31%
11	Styrofoam	2.04%	1.04%	0.49%	0.52%	0.60%	2.00%
12	All Other Plastics	2.26%	4.61%	4.54%	5.04%	5.35%	6.53%
13	Tin/Steel Cans	1.01%	0.82%	0.54%	2.29%	0.37%	1.07%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.12%	0.00%	0.00%	0.10%	0.00%	0.00%
16	Aluminum Cans	0.23%	0.81%	1.07%	0.39%	1.70%	1.82%
17	Other Non-Ferrous	0.27%	3.13%	0.00%	0.00%	0.55%	0.39%
18	Glass Containers	4.80%	4.30%	30.56%	8.27%	16.89%	15.35%
19	Other Glass	0.65%	0.00%	0.24%	0.00%	0.00%	0.00%
20	Textiles	0.45%	5.20%	0.00%	0.00%	0.20%	1.15%
21	Special Wastes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
22	Electronics	0.19%	0.00%	0.00%	0.00%	0.00%	0.00%
23	Household Batteries	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%
24	Wood Waste	0.00%	0.00%	0.00%	0.00%	0.55%	0.25%
25	C&D Debris	2.04%	0.00%	0.00%	0.00%	0.22%	0.00%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.00%	0.00%	0.45%
27	Yard Waste	21.11%	2.73%	0.00%	0.00%	33.85%	0.00%
28	Food Waste	21.11%	12.62%	12.34%	49.66%	13.55%	34.79%
29	All Other Garbage	9.31%	0.92%	0.73%	0.29%	2.49%	2.21%
30	Liquids	0.99%	4.45%	0.00%	0.00%	0.00%	0.00%
31	Grit	0.00%	0.00%	0.00%	0.00%	1.60%	0.00%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table E-2: April 2011 Individual Sample Results, Commercial (continued)

Hauler/Location		WM - Compactor Westin	WM - Commercial FEL Downtown	WM - Compactor Duval Square	WM - Compactor Sears	
Material Categories	sample #	38	39	40	41	Weighted Avg.
1	Newspaper	9.82%	0.31%	2.24%	0.25%	2.59%
2	Corrugated Containers	19.53%	0.07%	3.55%	42.52%	7.86%
3	Office Paper	0.42%	0.34%	5.97%	2.52%	2.45%
4	Other Recyclable Paper	4.09%	4.54%	5.59%	5.06%	3.63%
5	Other Non-Recyclable Paper	12.48%	3.42%	7.23%	3.14%	11.57%
6	Aseptic Containers	0.31%	0.00%	0.49%	0.00%	0.44%
7	PET Containers	2.51%	1.49%	2.34%	0.00%	2.40%
8	HDPE Containers	0.84%	0.33%	1.24%	0.00%	1.00%
9	Other Containers (#3-#7)	0.00%	0.57%	0.00%	0.00%	0.47%
10	Non-Rigid Plastic Film	13.18%	2.48%	23.41%	11.96%	9.86%
11	Styrofoam	0.51%	0.19%	0.87%	23.58%	1.81%
12	All Other Plastics	6.36%	1.68%	1.34%	8.71%	5.34%
13	Tin/Steel Cans	1.13%	0.16%	2.00%	0.00%	0.92%
14	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%
15	Other Ferrous	0.00%	0.23%	0.51%	0.00%	1.13%
16	Aluminum Cans	0.80%	0.63%	0.71%	0.00%	0.79%
17	Other Non-Ferrous	0.00%	21.39%	1.02%	0.19%	1.51%
18	Glass Containers	11.62%	0.46%	11.83%	0.00%	9.15%
19	Other Glass	0.00%	0.00%	0.00%	0.00%	0.14%
20	Textiles	2.21%	0.00%	0.39%	0.00%	2.52%
21	Special Wastes	0.00%	0.00%	0.00%	0.00%	0.00%
22	Electronics	0.00%	0.00%	0.52%	0.00%	1.11%
23	Household Batteries	0.00%	0.00%	0.00%	0.12%	0.03%
24	Wood Waste	0.00%	0.00%	0.00%	0.50%	0.95%
25	C&D Debris	0.00%	3.99%	0.00%	1.41%	1.86%
26	Tires and Rubber	0.00%	0.00%	0.00%	0.00%	0.46%
27	Yard Waste	0.00%	0.00%	5.76%	0.00%	5.17%
28	Food Waste	7.17%	56.53%	21.46%	0.00%	21.44%
29	All Other Garbage	1.74%	0.00%	1.53%	0.05%	2.39%
30	Liquids	3.60%	0.00%	0.00%	0.00%	0.75%
31	Grit	1.69%	1.19%	0.00%	0.00%	0.27%
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%

Appendix F: Bulk Waste and C&D Debris Visual Audits

Table F-1: Bulk Waste and C&D Debris Visual Audits (% by volume)

Sample Number:	2	3	4	5
Date:	4/4/2011	4/4/2011	4/4/2011	4/4/2011
Hauler:	Mattingly Construction	Housing Authority	Resident	Keys Construction
Type of Vehicle:	Pickup truck	Box truck	Pickup truck	Truck/trailer
Source:	C&D	HA	C&D	C&D
Time of Day:	8:30 AM	9:28 AM	10:30 AM	12:15 PM
Vehicle Capacity (cy):	1.575	9.1	0.48	2.314
Percent Full:	100%	40%	70%	65%
Estimated Cubic Yards:	1.6	3.6	0.3	1.5
Net Weight:	680	580	320	520
Truck Number:	na	na	na	na
OCC, Kraft Paper	0%	0%	0%	0%
Other Paper	0%	0%	0%	0%
Major Appliances	0%	0%	0%	0%
Other Ferrous	0%	0%	0%	0%
Other Metal	0%	0%	0%	0%
Other Plastic	0%	0%	0%	0%
Carpet padding	0%	0%	0%	0%
Branches and stumps	0%	0%	0%	0%
Prunings and Trimmings	0%	0%	0%	0%
Leaves and Grass	0%	0%	0%	0%
Dim. Lumber/Pallets	99%	0%	100%	100%
Eng. And Other Recyclable Wood	0%	0%	0%	0%
Painted/Stained Wood	0%	0%	0%	0%
Small Rock/Gravel	0%	0%	0%	0%
E-waste	0%	0%	0%	0%
Furniture	0%	100%	0%	0%
Tires	0%	0%	0%	0%
Mixed MSW	1%	0%	0%	0%
TOTAL	100%	100%	100%	100%

Table F-1: Bulk Waste and C&D Debris Visual Audits (continued)

Sample Number:	6	9	11	14
Date:	4/4/2011	4/5/2011	4/5/2011	4/5/2011
Hauler:	Business	WM	WM	Housing Authority
Type of Vehicle:	Van	Crane truck	Crane truck	Box truck
Source:	Commercial	City	City	City
Time of Day:	12:18 PM	9:36 AM	11:45 AM	1:20 PM
Vehicle Capacity (cy):	5.5	20	20	9.1
Percent Full:	100%	100%	90%	80%
Estimated Cubic Yards:	5.5	20.0	18.0	7.3
Net Weight:	880	3560	3720	2620
Truck Number:	na	673426	673426	na
OCC, Kraft Paper	0%	0%	0%	0%
Other Paper	0%	0%	0%	0%
Major Appliances	0%	0%	0%	0%
Other Ferrous	0%	6%	0%	0%
Other Metal	0%	4%	5%	0%
Other Plastic	0%	10%	0%	0%
Carpet padding	0%	0%	0%	0%
Branches and stumps	0%	0%	0%	0%
Prunings and Trimmings	0%	0%	0%	0%
Leaves and Grass	0%	0%	0%	0%
Dim. Lumber/Pallets	100%	32%	19%	100%
Eng. And Other Recyclable Wood	0%	0%	6%	0%
Painted/Stained Wood	0%	8%	0%	0%
Small Rock/Gravel	0%	0%	0%	0%
E-waste	0%	0%	0%	0%
Furniture	0%	40%	70%	0%
Tires	0%	0%	0%	0%
Mixed MSW	0%	0%	0%	0%
TOTAL	100%	100%	100%	100%

Table F-1: Bulk Waste and C&D Debris Visual Audits (continued)

Sample Number:	15	19	21	22
Date:	4/5/2011	4/6/2011	4/6/2011	4/6/2011
Hauler:	Business	WM	WM	Business
Type of Vehicle:	Pickup truck	Crane truck	Crane truck	Van
Source:	C&D	City	City	C&D
Time of Day:	2:34 PM	11:30 AM	2:10 PM	2:00 PM
Vehicle Capacity (cy):	0.82	20	20	5.5
Percent Full:	100%	90%	90%	100%
Estimated Cubic Yards:	0.8	18.0	18.0	5.5
Net Weight:	400	3640	3380	300
Truck Number:	na	673426	673426	na
OCC, Kraft Paper	0%	0%	5%	25%
Other Paper	0%	0%	0%	0%
Major Appliances	0%	0%	0%	0%
Other Ferrous	0%	0%	0%	0%
Other Metal	0%	5%	0%	0%
Other Plastic	0%	5%	10%	0%
Carpet padding	0%	0%	6%	0%
Branches and stumps	0%	0%	0%	0%
Prunings and Trimmings	0%	10%	0%	0%
Leaves and Grass	0%	0%	24%	0%
Dim. Lumber/Pallets	100%	20%	15%	75%
Eng. And Other Recyclable Wood	0%	0%	0%	0%
Painted/Stained Wood	0%	0%	0%	0%
Small Rock/Gravel	0%	0%	0%	0%
E-waste	0%	0%	0%	0%
Furniture	0%	60%	40%	0%
Tires	0%	0%	0%	0%
Mixed MSW	0%	0%	0%	0%
TOTAL	100%	100%	100%	100%

Table F-1: Bulk Waste and C&D Debris Visual Audits (continued)

Sample Number:	24	27
Date:	4/6/2011	4/7/2011
Hauler:	Housing Authority	Individual
Type of Vehicle:	Box truck	Pickup truck
Source:	City	Bulky
Time of Day:	2:45 PM	8:30 AM
Vehicle Capacity (cy):	9.1	2.1
Percent Full:	80%	100%
Estimated Cubic Yards:	7.3	2.1
Net Weight:	1100	140
Truck Number:	na	na
OCC, Kraft Paper	5%	0%
Other Paper	0%	0%
Major Appliances	0%	0%
Other Ferrous	0%	0%
Other Metal	0%	0%
Other Plastic	0%	0%
Carpet padding	0%	0%
Branches and stumps	0%	0%
Prunings and Trimmings	0%	0%
Leaves and Grass	0%	0%
Dim. Lumber/Pallets	0%	0%
Eng. And Other Recyclable Wood	0%	0%
Painted/Stained Wood	0%	0%
Small Rock/Gravel	0%	0%
E-waste	5%	0%
Furniture	90%	100%
Tires	0%	0%
Mixed MSW	0%	0%
TOTAL	100%	100%

Appendix G: Self-Haul Recycling Survey Results

Table G-1: Self-Haul Recycling Survey Results

Sample Number:	1	2	3
Date:	4/4/2011	4/4/2011	4/5/2011
Load Weight (lbs):	360	160	100
Vehicle Type:	Pickup truck	Van	Box truck
Residential or Commercial:	Commercial	Commercial	Commercial
Business Name:	Small bar	Croissants De France	Stock Island Mission
Avg. Number of Deliveries:	2-3 times per month	every week	2 times per week
Reason for Self-Haul:	Never got a quote, just always brought recyclables to TS.	Never got a quote, just always brought recyclables to TS.	Never got a quote, just store the OCC in the box truck until full or need truck for pick-ups or deliveries, then bring material to TS.
PAPER	10%	100%	100%
NEWSPAPER			
OCC	100%	100%	100%
OFFICE PAPER			
MIXED PAPER			
COMMINGLED	90%	0%	0%
PLASTICS			
PET			
HDPE			
OTHER PLASTIC			
ALUMINUM			
STEEL/TIN			
GLASS	100%		
TOTAL	100%	100%	100%
<i>Comments</i>	(8) 30-gallon garbage cans full of glass	Van full of OCC	

Table G-1: Self-Haul Recycling Survey Results (continued)

Sample Number:	4	5	6
Date:	4/5/2011	4/5/2011	4/5/2011
Load Weight (lbs):	660	80	220
Vehicle Type:	Big moving truck	Mini-van	Pickup truck
Residential or Commercial:	Commercial	Commercial	Commercial
Business Name:	Sunset Moving	Niles Sales Service	Ft. Zack Retailer
Avg. Number of Deliveries:	2 times per week	2 times per week	every week or two
Reason for Self-Haul:	Just workers, no idea why they self-haul. Don't believe they have ever gotten a quote.	Stated that this was the only place to recycle.	Stated that this was the only place to recycle.
PAPER	95%	100%	100%
NEWSPAPER			
OCC	70%	100%	100%
OFFICE PAPER			
MIXED PAPER	30%		
COMMINGLED	0%	0%	0%
PLASTICS			
PET			
HDPE			
OTHER PLASTIC			
ALUMINUM			
STEEL/TIN			
GLASS			
TOTAL	100%	100%	100%
<i>Comments</i>	about 5% contamination, wood and plastic		

Table G-1: Self-Haul Recycling Survey Results (continued)

Sample Number:	7	8	9
Date:	4/5/2011	4/6/2011	4/6/2011
Load Weight (lbs):	160	40	180
Vehicle Type:		Pickup truck	Budget rental truck
Residential or Commercial:	Commercial	Residential	Commercial
Business Name:	Love in Bloom Florist	na	Keys Business Solutions
Avg. Number of Deliveries:	1 time per week	1 time per month	
Reason for Self-Haul:	Landlord tried to get service; he was not sure why they didn't.	He is not sure why he doesn't use his curbside bin. Likes to know it actually gets recycled. He owns his own blue cart.	Stated that the TS is close and convenient.
PAPER	100%	10%	100%
NEWSPAPER			
OCC	100%	50%	100%
OFFICE PAPER			
MIXED PAPER		50%	
COMMINGLED	0%	90%	0%
PLASTICS			
PET			
HDPE		mix of all types	
OTHER PLASTIC			
ALUMINUM			
STEEL/TIN			
GLASS			
TOTAL	100%	100%	100%
<i>Comments</i>			

Table G-1: Self-Haul Recycling Survey Results (continued)

Sample Number:	10	11	12
Date:	4/6/2011	4/6/2011	4/6/2011
Load Weight (lbs):	620	2120	160
Vehicle Type:	Pickup truck	Flat bed truck	Van
Residential or Commercial:	Commercial	Commercial	Commercial
Business Name:	Don's Bar	Downtown restaurants and bars	Hammock Shop
Avg. Number of Deliveries:	1 time per day	weekly	weekly
Reason for Self-Haul:	All glass, never got a quote, figured it was too much money.		Convenient, said WMI will pick up baled OCC for free, but he just brings it to TS.
PAPER	0%	100%	100%
NEWSPAPER			
OCC		100%	100%
OFFICE PAPER			
MIXED PAPER			
COMMINGLED	100%	0%	0%
PLASTICS			
PET			
HDPE			
OTHER PLASTIC			
ALUMINUM			
STEEL/TIN			
GLASS	100		
TOTAL	100%	100%	100%
<i>Comments</i>	Husband and wife, came in Monday also.		

Table G-1: Self-Haul Recycling Survey Results (continued)

Sample Number:	13	14	15
Date:	4/6/2011	4/7/2011	4/7/2011
Load Weight (lbs):	20	200	200
Vehicle Type:	Car	Box truck	Van
Residential or Commercial:	Residential	Commercial	Commercial
Business Name:	na	Stock Island Mission	Bobalu's
Avg. Number of Deliveries:	monthly	2 times per week	every few weeks
Reason for Self-Haul:	Lives in apartment and doesn't think he gets recycling there.	Never got a quote, just store the OCC in the box truck until full or need truck for pick-ups/deliveries, then bring material to TS.	Says he pays for an OCC dumpster, but still has too much OCC.
PAPER	50%	100%	100%
NEWSPAPER			
OCC	50%	100%	100%
OFFICE PAPER			
MIXED PAPER	50		
COMMINGLED	50%	0%	0%
PLASTICS			
PET			
HDPE	mix of all types		
OTHER PLASTIC			
ALUMINUM			
STEEL/TIN			
GLASS			
TOTAL	100%	100%	100%
<i>Comments</i>			

Table G-1: Self-Haul Recycling Survey Results (continued)

Sample Number:	16	17	18
Date:	4/7/2011	4/7/2011	4/7/2011
Load Weight (lbs):	200	300	680
Vehicle Type:	Truck	Pickup truck	Pickup truck
Residential or Commercial:	Commercial	Commercial	Commercial
Business Name:	Duncan Ford	Hog's Breath Saloon	Don's Bar
Avg. Number of Deliveries:	weekly	1-2 times per month	1 time per day
Reason for Self-Haul:	Said WMI wants to charge and this is a free alternative.	Worker didn't know why, just always done it this way.	All glass, never got a quote, figured it was too much money.
PAPER	100%	100%	40%
NEWSPAPER			
OCC	100%	100%	100%
OFFICE PAPER			
MIXED PAPER			
COMMINGLED	0%	0%	60%
PLASTICS			
PET			
HDPE			
OTHER PLASTIC			
ALUMINUM			10%
STEEL/TIN			
GLASS			90%
TOTAL	100%	100%	100%
<i>Comments</i>			

Table G-1: Self-Haul Recycling Survey Results (continued)

Sample Number:	19	20	21
Date:	4/7/2011	4/8/2011	4/8/2011
Load Weight (lbs):	620	160	320
Vehicle Type:	Truck	Pickup truck	Truck
Residential or Commercial:	Commercial	Commercial	Commercial
Business Name:	Key's Construction	Audio Video in Paradise	State Park
Avg. Number of Deliveries:	when needed	once per month	na
Reason for Self-Haul:	Only come in when needed, building a house and all appliances/cabinets came in OCC.	Tries to reuse as many boxes as possible, donating some. Says she was quoted \$100 per month for OCC dumpster, this is free.	Says he pays \$500 a month for once a week garbage, if he had to pay more to recycle he would just throw it all in the garbage dumpster. This is free.
PAPER	90%	100%	0%
NEWSPAPER			
OCC	100%	100%	
OFFICE PAPER			
MIXED PAPER			
COMMINGLED	0%	0%	100%
PLASTICS			
PET			
HDPE			mix of all types
OTHER PLASTIC			
ALUMINUM			
STEEL/TIN			
GLASS			
TOTAL	100%	100%	100%
<i>Comments</i>	10% contamination of wood and plastic.	Willing to talk, Kelly Friend, 305-296-9099.	(6) 30 gallon cans.

Appendix D

Residential Waste Diversion Options

Based on the status of the City's existing residential recycling program, options that present the greatest opportunity to increase diversion of residential waste from disposal include the following:

1. Cart collection of recyclables
2. Separate yard waste collection; conversion to 1-1-1¹
3. Pay-As-You-Throw (PAYT)
4. Reward programs, such as Recyclebank
5. Multi-family recycling
6. Comprehensive public outreach
7. Enforcement of mandatory ordinance
8. Mixed waste processing

This appendix includes a discussion and analysis of these various options.

1. Cart Collection of Recyclables

The City's conversion from dual stream recycling (paper and commingled containers collected in separate recycling bins) to single stream (collection of fiber and commingled containers together) in 2008 was a first step toward encouraging recycling by making it more convenient for residents. However, utilizing wheeled recycling carts (usually 65 or 95 gallons in size) rather than 18-gallon bins to collect those single stream recyclables would help the City capture additional recyclable paper and containers that make up 26 percent of the residential waste stream that is disposed.

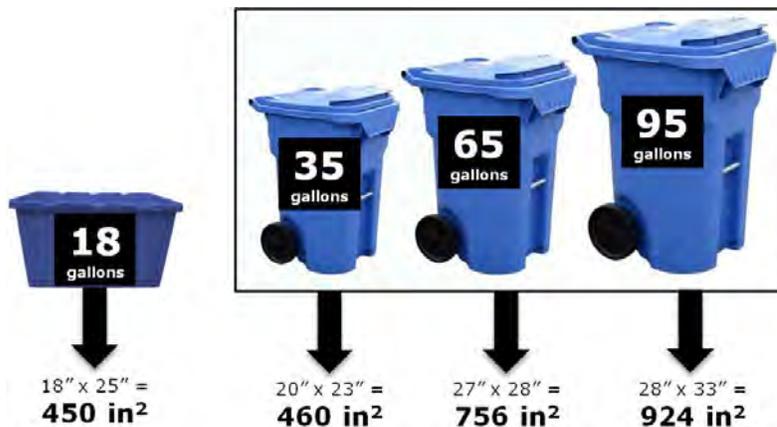
Recycling carts provide the following advantages:

- Two to five times the capacity of an 18-gallon recycling bin (depending on the cart size) – encourages greater participation and increased materials recovery.
- Convenient for residents – only one trip to the curb and no lifting required.
- Improved aesthetics – larger, standardized containers eliminate the current mix of various customer-owned containers or overflowing bins.
- Lidded carts – help control vectors, protect recyclables from the rain, and eliminate “nosey neighbor” concerns.
- Small footprint – provides increased volume without increasing storage requirements.
- Allows for program expansion – sufficient space to handle additional materials, such as rigid mixed plastics.

¹ 1-1-1 means once per week collection of solid waste, yard waste, and recyclable materials.

A common misconception with cart collection is that carts take up substantially more space than bins. Figure 1 demonstrates that the footprint of a 35-gallon cart is nearly identical to that of an 18-gallon bin, but provides double the capacity. Many residents use two or more recycling bins. A 95-gallon cart has about the same footprint as two recycling bins, but provides more than 2½ times the capacity. Conversion to carts can eliminate the need for residents to store multiple bins to increase their recycling.

Figure 1: Cart vs. Bin Volume and Footprint Comparison



Most communities that convert from bins to carts do so at the same time they switch from dual stream to single stream recycling, and may also expand the materials they accept as well. For example, Miami-Dade County, Florida converted from dual stream bin collection to carted single stream recycling collection in 2008 and realized nearly a 100 percent increase in recycling tonnage in the first year.² During a recent pilot study conducted with KCI's assistance, Charleston County, South Carolina saw a 115 percent increase in the pounds per household recycling rate after conversion to cart-based single stream collection.

Applicability to the City

Limited data is available regarding the impact that cart conversion alone has on recycling tonnages. Two communities that converted to recycling carts independent of the switch to single stream collection are Terrace Park, Ohio and Alexandria, Virginia. They experienced recycling tonnage increases of 54 percent and 42 percent, respectively, as a result of converting to carts.^{3,4} It is reasonable to expect similar results if the City converts to cart collection of recyclables.

To convert to carts, the City would need to purchase the carts and negotiate a collection change with WM. The City's 2012 solid waste budget includes the cost of carts.⁵ Because garbage is already collected in carts, no additional equipment would be required by WM; therefore, the City should expect no or negligible change in collection fees. Conversion to carts should also enable the City to include additional recyclables, such as rigid mixed plastics.

² Larry Dalla Betta, *Sustainability & Single Stream Recycling in Florida*, Presentation to Lake County, 2011.

³ <http://www.hamiltoncountyrecycles.org/index.php?page=increase-your-community-recycling-rate#containers>

⁴ <http://alexandriava.gov/uploadedFiles/tes/solidwaste/2011-8-15%20City%20of%20Alexandria%20State%20of%20Recycling%20FY%202011.pdf>

⁵ At \$50 per cart, the total cost is estimated at \$715,000 for 14,300 carts.

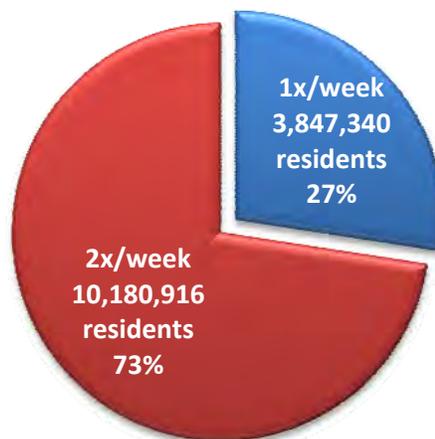
2. Separate Collection of Yard Waste; Weekly Collection of Garbage

Separate collection and processing of yard waste offers the opportunity to divert up to 27 percent of residential waste from disposal. Composting yard waste would be a more beneficial use than burning it for energy, as is currently done. In addition, collecting and processing yard waste in the Keys should be less costly than transporting and disposing of it, which currently costs the City over \$70 per ton. The City could negotiate separate yard waste collection at little or no additional cost by converting the second garbage collection day to yard waste collection (i.e., garbage would be collected weekly and yard waste would be collected weekly).

Conversion from twice per week to once per week collection of garbage is an increasing trend in Florida. It improves collection efficiencies and reduces cost. In jurisdictions that have twice per week collection as well as weekly collection of recyclables and yard waste, many residents typically do not fully utilize the second collection day. With increased recycling, in part brought about by the shift from bin collection to carted single stream collection of recyclables, many jurisdictions have responded by reducing garbage collection service to once per week. Concerns regarding increased vectors are unfounded. Weekly collection has long been the standard in the Western United States, and is now gaining popularity in the East.

A recent review of 79 Florida cities and counties, which are home to approximately 14 million of the State's nearly 18.7 million residents, found that almost 4 million Florida residents (27 percent) receive once per week garbage collection service (see Figure 2). The increasing number of communities converting to weekly collection is a strong indicator that this practice is quickly becoming a viable option to make programmatic changes to increase diversion, while continuing to provide quality service to residents.⁶

Figure 2: Once per Week vs. Twice per Week Garbage Collection in Florida



Note: Based on review of 79 jurisdictions, representing 14 million residents.

⁶ In 2008, KCI estimated that at least 2.5 million Florida residents received weekly solid waste collection.

Converting to weekly garbage collection also provides an incentive for increased recycling. For example, Polk County, Florida converted from twice to once per week garbage collection in October 2010 and realized an 18 percent increase in recycling tonnage the first year.

Applicability to the City

Separate collection of City residential yard waste has the potential to divert up to 27 percent of residential waste from disposal. The City could negotiate separate yard waste collection at little or no cost by converting the second garbage collection day to yard waste collection. Residents will need to use separate containers for garbage and yard waste. Some communities opt to collect all material streams on the same day of the week, but to avoid confusion between garbage and yard waste, KCI recommends the City collect the two streams on different days of the week. Recyclables should be collected on either the same day as garbage or yard waste.

Currently, no infrastructure to compost organics exists in the Keys. Until such time that a yard waste processing facility is established in the Keys, the City should be able to negotiate a yard waste transport and processing contract that is comparable to the \$71.55 per ton it currently pays for transport and disposal of solid waste. Operational changes would need to be made at the Transfer Station to accommodate receipt, possible grinding, and transfer of segregated yard waste. Alternatively, yard waste could be managed at a different location. As the program and organics processing infrastructure evolves, the City can consider collecting additional compostable materials, including food waste and non-recyclable paper.

3. Pay-As-You-Throw

PAYT, also known as unit-based pricing, is a system that charges a household based on the amount of garbage it disposes, instead of utilizing a fixed rate per household regardless of the quantity of waste set at the curb. It treats solid waste services like other utilities, such as water and electricity, by basing fees on usage. PAYT has traditionally been used in commercial waste collection where service fees are based on container size and frequency of collection (i.e., cubic yards of waste collected). PAYT is generally seen as equitable – you pay for what you throw away and are rewarded for reducing waste at the source and recycling (see Figure 3). Residents who recycle and prevent waste no longer subsidize their neighbors' wastefulness.

Figure 3: Equitability of PAYT



The U.S. Environmental Protection Agency (EPA) and FDEP actively endorse PAYT because it provides an economic incentive and sustainable system to reduce waste and increase recycling. According to EPA, since its introduction to residential collection in the early 1990s, PAYT has been successfully implemented by approximately 7,100 jurisdictions in the United States.⁷ In 2007, thirty of the largest 100 U.S. cities, representing 25 percent of the U.S. population, used PAYT. PAYT has been slow to catch on in Florida; programs currently exist in Alachua County/Gainesville, Plantation, and Lakeland.

Communities with PAYT programs have reported significant increases in recycling and reductions in garbage. Provided below are a few examples:

- Alachua County, Florida, which implemented its PAYT program in 1994, reported an 18 percent decrease in solid waste and 25 percent increase in recycling tonnage in the first year.⁸
- A recent study of 228 communities in New England found that the 110 non-PAYT municipalities generated an average of 49 percent more garbage per capita than the 118 municipalities with PAYT programs.⁹
- The State of Massachusetts currently has 134 PAYT communities.¹⁰ According to studies by the state's Department of Environmental Protection, PAYT has been shown to reduce solid waste tonnage by 25-50 percent and increase recycling by 15-20 percent.¹¹ The average resident in a Massachusetts' community with a PAYT program disposed of 44 percent less waste than residents in communities without a unit-based structure for waste disposal.¹²
- Other studies of U.S. PAYT programs indicate recycling increases of 30-100 percent, with an average of about 50 percent.¹³

Generally, about one-third of the waste reduction impact of PAYT is attributed to increased recycling, about one-third to increased organics diversion, and about one-third to source reduction or waste prevention.

Various approaches can be used to implement a PAYT residential program. Most current PAYT programs are cart-based with varying sizes, usually 35, 65, and 95 gallons. Some programs utilize a combination of various cart sizes and bags or stickers for excess waste disposal. In combination programs, residents are responsible for purchasing preprinted garbage bags or stickers from the jurisdiction and/or participating retailers to dispose of excess waste (see Figure 4). For example, in Alachua County, residents can purchase five 20-gallon yellow overflow bags for \$11.25, which includes the extra cost of collection and disposal.

⁷ <http://www.epa.gov/epawaste/conservetools/payt/states/06comm.htm>

⁸ www.epa.gov/osw/conservetools/payt/pdf/ssgaines.pdf

⁹ Green Waste Solutions, *Unit-Based Garbage Charges Create Positive Economic and Environmental Impact*, 2010.

¹⁰ <http://www.mass.gov/dep/recycle/reduce/paytfact.htm>

¹¹ As reported by MA DEP to KCI, April 2009.

¹² MA DEP, *Pay-As-You-Throw: An Implementation Guide for Solid Waste Unit-Based Pricing Programs*, January 2004.

¹³ Lisa Skumatz, et. al., "Recycling Incentives: Part 1," *Resource Recycling*, February 2011.

Figure 4: Combined Cart and Bag PAYT Program in Fayetteville, AR



For a PAYT program to be effective in encouraging source reduction and recycling, the fee differential between cart sizes must be sufficient. The 80 percent rule is a standard guiding tool for structuring PAYT rates – increase the cost for each cart size by approximately 80 percent to effectively encourage source reduction and recycling (see Figure 5).

Figure 5: The 80% Rule in Structuring PAYT Rates



Applicability to the City

Implementing a PAYT system in the City would require introducing carts of varying sizes (typically 35, 64 and 95 gallons) from which residents could choose based on the amount of garbage they typically generate in a week. Service fees would be based on the size of the cart selected. The fee structure would need to provide differential fees sufficient to provide a financial incentive for residents to increase recycling and source reduction, but also to generate sufficient revenue to cover solid waste costs, including the costs of complementary programs such as recycling and composting. The City or its contractor would need to provide space to store an inventory of carts.

The City could face a number of challenges in implementing a PAYT program, including the following:

- **Transient tenancy** –The City has a large number of seasonal residents and tourists, which may make it difficult to properly educate about the PAYT program.¹⁴ In communities with highly transient populations, the responsibility of educating tenants becomes that of the property owners or managers. In addition, a system would need to be established that would avoid changes in cart size with each new tenant, such as setting a limit on the number of exchanges annually per residential unit.
- **Unlimited garbage collection** – Currently, residents may place an unlimited amount of garbage curbside, using bags or other containers for waste that will not fit in their garbage carts. In a PAYT system, collection would be limited to what will fit in the cart, forcing residents to select the appropriate cart size for the amount of waste they generate. A substantial amount of waste generated by residents is yard waste. If yard waste is collected and managed separate from garbage, limiting the amount of garbage might not be an issue. If a 95-gallon cart is not sufficient for some residents, they would be able to subscribe and pay for an additional cart or pay for special bags in which to place the overflow waste.
- **Illegal dumping** – Studies indicate there is no conclusive evidence that PAYT has resulted in increased illegal dumping. However, illegal dumping, including the placement of residential waste in commercial or public waste containers, has historically been an issue in the City.
- **Billing and accounting restructuring** – Because of the high level of residential non-payments, the City Commission recently directed staff to develop a non-ad valorem assessment that would be placed on the tax bill in lieu of billing residents for solid waste services through monthly utility bills. Because of the statutory process that must be followed to establish such an assessment, the earliest year it could appear on tax bills is 2014. This type of billing would not prohibit establishing a PAYT program. Alachua County bills residents through a non-ad valorem assessment and has set up a system that bills residents during the year if they switch to a larger cart size and lowers the next assessment if they request a smaller cart size. In addition, Alachua County residents can purchase overflow bags from the County or at local retail stores. The cost of the bags includes the additional cost of disposal.

These challenges are not insurmountable; however, establishing a PAYT program would require upfront public education about the program and residents' responsibilities. Given the City's existing collection system, variable cart sizes with the ability to purchase bags for overflow waste would be the most appropriate PAYT program type to consider. Costs for additional carts would be incurred; however, some larger carts that are no longer needed for garbage collection could potentially be converted to recycling carts by replacing the lids with a different color lid.

4. Reward Programs

A number of "reward" programs exist that provide financial incentives for residents to recycle. One of the most common rewards program is Recyclebank, which is offered through a private company. Recyclebank rewards residents for recycling with coupons to local stores and

¹⁴ Only 41% of housing units in Key West are owner occupied. (U.S. Census Bureau: <http://factfinder.census.gov>).

restaurants. The company claims to have 3 million members in the U.S. and United Kingdom, with access to many more customers since its recent partnership with WM.¹⁵

Recyclebank offers three program options.

- **Weight-based (original program)** – Residential recyclables are weighed at the curb in carts that are outfitted with radio frequency identification (RFID) tags that allow the tonnage to be recorded to the address associated with the RFID tag. Points are awarded based on the amount recycled. Residents can log into their account on the Recyclebank website to view recycling activity and cash in their points for coupons to stores and restaurants. This program has become unpopular because of the high startup cost and numerous technical problems with the onboard truck scales.
- **Community weight-based (most popular program)** – Due to the problems noted above with the weight-based program, Recyclebank developed a lower cost community weight-based program that distributes points to registered participants by address based on the tonnage collected per route. Users are identified as participants by RFID and/or GPS. According to a Recyclebank representative, this program type has become Recyclebank’s most popular program, accounting for approximately 75 percent of Recyclebank users.
- **Self reporting (newest program)** – A new program being rolled out by Recyclebank is labeled “self reporting.” Users register on Recyclebank’s website using their qualified address and are distributed points based on the total weight of recyclables per route. Residents then log on and “self report” that they recycled and are given their portion of allotted points that they can then trade for coupons.



Factors to consider when evaluating the feasibility of Recyclebank include the following:

- **Cost** – Recyclebank’s fees vary based on the program type, services provided, and a jurisdiction’s negotiating skills. Pricing models vary and may include a flat annual fee, recycling revenue share, disposal avoidance share, or a combination of the three. Based on conversations with a Recyclebank representative and the Utilities Manager in Oviedo, Florida, the average cost for Recyclebank is \$.50 per household per month, or \$6 per household per year, for Recyclebank’s standard program.¹⁶ A broader survey of Recyclebank programs revealed fees ranging from \$0.30 to \$4.00 per household per month, depending on the services included.¹⁷
- **Effectiveness** – Questions have arisen regarding whether the “incentive” actually increases diversion, or if diversion increases because of the increased public education

¹⁵ <http://www.recyclebank.com/corporateinfo/index/presscoveragearticle/id/299>.

¹⁶ Conversations with Recyclebank staff, and Josef Grusauskas, Utilities Manager, Oviedo, FL.

¹⁷ Lisa Skumatz, et. al., “Recycling Incentives: Part 1,” *Resource Recycling*, February 2011, page. 20.

and other programmatic changes that may have accompanied implementation of the incentive program. For example, Oviedo, Florida converted from unlimited twice-a-week manual garbage collection to once-a-week automated carted garbage collection in 2008, maintaining dual stream bin collection of recyclables under both programs. Recycling tonnage increased over 100 pounds per household per year by limiting disposal capacity through this conversion.¹⁸ As a reward to residents, the city implemented Recyclebank's self reporting program in 2010 through the city's franchise agreement with Republic Services. According to Oviedo's Utilities Manager, approximately 30 percent of residential customers currently participate in Recyclebank; however, no significant increases in recycling tonnage have been realized.¹⁹ In addition, he feels that the self-reporting program is cumbersome for some residents and believes that the community weight-based program is a better option.

- **Counter-productive to source reduction** – Programs that reward residents with coupons to purchase more products have been accused of encouraging consumption rather than conservation. Additionally, these programs only encourage recycling, unlike PAYT, which also encourages source reduction and composting.
- **Perpetuates idea that recycling should be free and/or residents should be paid to recycle** – This is a longstanding hurdle of recycling program managers. There is a cost to collecting recyclables, and that message has not been effectively communicated to residents in the history of recycling.

Numerous comparisons have been made between PAYT and Recyclebank. For example, three Massachusetts cities worked simultaneously to increase recycling, one using PAYT and two implementing Recyclebank. The PAYT community realized three times the diversion increase over the communities who implemented Recyclebank.²⁰ According to a nationwide study, the relative cost per ton diverted for a PAYT program ranges from \$0.10 to \$10.00, but the cost per ton diverted for a Recyclebank program ranges from \$6.00 to \$300.00.²¹

As a lower cost option to Recyclebank, some communities have developed in-house incentive programs, which are effective for securing free advertising through public media such as local newspapers, radio, and television. For example, the Summit/Akron Solid Waste Management Authority (SASWMA) in Ohio created the "Get Caught Green Handed" program that rewards residents who are caught recycling correctly. Program rewards include coupons/gift cards to local businesses. SASWMA and participating cities usually run month-long "Get Caught Green Handed" campaigns to raise awareness about recycling.



¹⁸ Conversation with Josef Grusauskas, Utilities Manager, Oviedo, FL.

¹⁹ Ibid.

²⁰ U.S. EPA, *Pay-As-You-Throw Spring 2009 Bulletin*, pg. 5.

²¹ Lisa Skumatz, et. al., page 20.

Applicability to the City

Given the cost and questionable effectiveness of Recyclebank, KCI believes the City would be better served at this time to focus on implementing a comprehensive education and outreach program, with the possible phase-in of its own rewards program.

5. Multi-family Recycling

Multi-family dwellings also offer an opportunity to increase recycling in the City. More than 42 percent of the multi-family waste stream consists of recyclable paper and containers accepted in the City's existing recycling program. Additionally, multi-family residents already pay for recycling, but many do not have access to the program because the building or complex in which they reside has not set up a program.



Potential challenges of establishing recycling at a multi-family complex include the following:

- **Space limitations** – Some multi-family buildings were not built to accommodate multiple waste and recycling containers. To help address such space limitations in future construction projects, State legislation was passed in 2010 that requires that “newly developed property receiving a certificate of occupancy, or its equivalent, on or after July 1, 2012, that is used for multi-family residential or commercial purposes, must provide adequate space and an adequate receptacle for recycling by tenants and owners of the property.”²² The City should incorporate this in its building codes.
- **Property management resistance** – Property owners may think that recycling is going to cause extra work for maintenance staff and that managing a recycling program will add to their responsibilities.
- **Education barriers** – Multi-family dwellings often have a high number of transient residents, which requires ongoing re-education of tenants. In addition, multi-family dwelling tenants might not receive the solid waste bill directly or individual recycling bins. This limits the direct contact the City has with these residents and reduces the visibility of the City's recycling program.
- **Aesthetics** – Multi-family buildings often suffer from the “tragedy of the commons” problem, where no one takes responsibility for shared garbage and recycling areas.

These issues may make multi-family recycling more challenging, but they are not insurmountable. In fact, having an established recycling program can be used as a selling point to prospective tenants. This is especially true for out-of-town residents who are accustomed to recycling in their hometowns.

²² Section 403.706(2)(c), F.S. This provision applies to counties and municipalities that have an established residential, including multi-family or commercial, recycling program that provides recycling receptacles to residences and businesses and regular pick-up services for those receptacles.

Applicability to the City

City Ordinance requires residents to recycle (Section 58-83) and requires owners or managers of multi-family dwellings with 11 or more units to submit a written recycling plan and provide an area for residents to deposit their recyclable materials (Section 58-85). The City has the legal tools in place to require multi-family recycling and the services are already paid for. What is lacking is oversight and technical assistance.

A concerted effort is needed to meet with multi-family property owners or managers and to provide technical assistance to help them overcome obstacles, whether real or perceived, to establishing an effective recycling program. A toolkit should be provided that lays out the steps they need to take to set up the program and provides sample educational materials for tenants. Ongoing monitoring and assistance will likely be required for some complexes.

6. Comprehensive Public Outreach Program

A comprehensive public education and outreach program is an essential component of an effective recycling program. Key to a successful public education program is having at least one full-time staff member – a Recycling Program Coordinator – dedicated to this task. Recycling Coordinators are the backbone of America’s recycling programs. They oversee city and county recycling programs, contracts, and public education; provide technical assistance, especially to multi-family complexes and businesses; ensure recycling programs are run effectively; and work to maximize waste diversion.

When asked about barriers to residential recycling during several public meetings, City residents expressed confusion about what materials are accepted for recycling and frustration over limited bin distribution. This is indicative of inadequate resources being allocated to properly inform residents about the recycling program.

Applicability to the City

To overcome communication barriers, residents and businesses must be communicated to clearly and often. This requires a comprehensive education program with consistent messaging. Three entities currently publish information about the City’s recycling program (the City, WM, and GLEE). A Recycling Program Manager would help ensure the messages provided by all entities are accurate and consistent.

Key elements of an effective public education campaign include the following:

- **Pre-planning** – To ensure a campaign is focused and effective, pre-planning is essential. It helps prevent misallocation of time and monetary resources on ineffective efforts.
- **Target audience and stakeholders** – First identify the intended audience (i.e., single-family residents, multi-family property managers, Navy base residents, etc.) so the message can be targeted to them. Determine whether multi-lingual education materials are needed.
- **Branding** – Branding recycling program information, signs, and labels with the same logo and consistent graphical layouts makes it easy for residents and businesses to quickly recognize and identify with the program. For example, the adjacent logo is used on the City’s website.

- **Messaging** – Develop succinct, action-oriented messages and keep the messages consistent in all outreach materials. To minimize confusion, prioritize and limit the number of key messages conveyed at one time, e.g., accepted materials, cart request, and City’s website for additional information. Use simple conversational language, not technical terms, accompanied by photos or graphics.
- **Website** – Web presence is now a critical part of any successful education campaign.²³ Residents want quick, easy access to information. Create an easy-to-remember, uncomplicated web address, such as keywestrecycles.com, and publish it on all public education materials, press releases, recycling bins and carts, utility bills, etc. Modify the City’s recycling website so that it is easier to navigate, comprehensive, and addresses questions typically asked by residents and businesses. Update the website regularly to reflect any program changes and to keep citizen interest.
- **Media relations plan** – Create a media relations plan that cost-effectively utilizes local media outlets and focuses on target audiences. Develop and foster effective communication between the City recycling staff and media outlets.
- **Community involvement** – Being involved and visible in the community is important. Give presentations at local schools, neighborhood association meetings, etc. Participate in community events. Be accessible to answer questions about the recycling.
- **Social media** – Social media is an inexpensive, effective way to inform and engage residents. Social networking sites such as Facebook, Twitter, LinkedIn, YouTube and others have become platforms to disseminate information about services, garner resident feedback, and promote a sense of community through active involvement. Full utilization of social media requires proper set up and ongoing maintenance. Facebook is currently the king of social networking and, therefore, the best first venture into social media for the City. The City’s Facebook page should include information on solid waste and recycling services, holiday notifications, contacts, events, a link to the City’s recycling website and a discussion area for residents to provide feedback. Like the City’s recycling website, its Facebook page would need to be updated regularly to maintain user interest and to disseminate current information.



7. Enforcement of Mandatory Recycling

The City does not actively enforce its mandatory residential recycling ordinance (Section 58-83). Enforcement of such ordinances typically involves code enforcement spot-checking residential garbage cans, tagging those that contain more than a specified percentage of recyclables, and

²³ The average American spends more than 60 hours a month online, which is equivalent to 30 days per year (http://visualeconomics.creditloan.com/how-the-world-spends-its-time-online_2010-06-16/).

leaving the container for the resident to remove the recyclables before it will be serviced. Repeated offenses would result in fines. Recycling mandates are not effective if no attempt is made to enforce them.

Applicability to the City

Local decision-makers are often reluctant to implement a strong enforcement policy for recycling ordinances. The City will likely want to implement other waste diversion recommendations outlined in this section, such as cart-based recycling, separate yard waste collection, technical assistance to multi-family complexes, and a comprehensive education program, before considering enforcement measures.

8. Mixed Waste Processing

Even the most effective recycling program will not capture 100 percent of the residential recyclables; therefore, mixed waste processing has gained attention in recent years as communities strive to achieve high recycling goals. Unlike the materials recovery facility (MRF) at which the City's recyclables are currently processed, a mixed waste MRF recovers recyclables from the solid waste stream.

Because of technological advancements in processing equipment, today's mixed waste MRF is a far cry from the "dirty MRF" of the past. Historically, mixed waste MRFs recovered 5-45 percent of incoming material as recyclables. Newer mixed waste MRFs reportedly are diverting 25-75 percent of waste from disposal.²⁴ MRFs achieving higher waste diversion rates are recovering a significant percentage of materials in the form of organics that are then composted.

Mixed waste MRFs can process the entire waste stream or just a portion of it, such as commercial waste. They often complement existing recycling programs rather than replace them.

An example of an effective use of a mixed waste MRF is the mixed waste MRF operated by Green Waste in San Jose, California. The city had a PAYT curbside recycling system, as well as a commercial recycling program; however, it was not making headway with multi-family residential recycling. Utilizing state-of-the-art processing equipment, Green Waste constructed a combined mixed waste and single stream MRF that opened in 2008. Residential and commercial single stream recyclables are processed in the single stream area of the MRF. Multi-family and some commercial wastes are processed in the mixed waste area of the MRF. San Jose reported a citywide 2010 diversion rate of 74 percent.²⁵ That year, the Green Waste facility reported a 98 percent diversion rate for single stream recyclables and a 75 percent diversion rate of MSW processed, for an overall diversion rate, 78 percent.²⁶ Of that 75 percent MSW diversion, approximately 50 percent



²⁴ Kessler Consulting, Inc., *Materials Recovery Facility Technology Review*, September 2009.

²⁵ <http://greenvision.sanjoseca.gov/ZeroWaste.aspx>

²⁶ Hanson, Emily, "From Multi-family to Clean Streams," *Resource Recycling*, June 2011, pgs. 20-25.

consisted of compostable materials and 25 percent was recyclable materials, both of which were marketed.²⁷

Applicability to the City

Key West does not currently generate sufficient tonnage to justify the capital expense of a mixed waste MRF. However, the City should monitor any future developments in a regional mixed waste MRF in South Florida, which could provide a viable, cost-effective option to current disposal practices.

²⁷ Kessler Consulting, Inc., *Materials Recovery Facility Technology Review*, September 2009.

Appendix E

Commercial Waste Diversion Options

A variety of approaches can be used to increase commercial waste diversion, ranging from outreach and education to voluntary incentives to mandates. To provide examples of how these various approaches have successfully been implemented, KCI compiled case studies of commercial recycling programs established in eight jurisdictions in the United States.

Four are Florida counties (Sarasota, Alachua, Lee, and Collier) that have reported some of the highest recycling rates in the State. All four counties rank in the top seven counties in terms of 2010 recycling rates. These four counties have specifically focused on increasing commercial recycling, each using a slightly different approach.

The other four communities are outside of Florida; several of them have reported some of the highest recycling rates in the country. Three are in California (San Francisco, San Jose, and Poway) and the fourth is Falls Church, Virginia. They also help demonstrate the variety of approaches that have been used when developing a commercial recycling program.

A commonality between all eight communities is that they each, to some degree, hold businesses and property owners responsible for recycling. The following summary highlights common best practices of the commercial recycling programs in these and other communities.

- Recycling staff (i.e., recycling coordinators, recycling program managers) – Communities with high-performing commercial recycling programs nearly always have in-house staff (some also have contracted staff) dedicated to implementing the commercial recycling program.
- Technical assistance to businesses – These staff people provide technical assistance to business owners. Various types of assistance can be provided, including education and outreach, onsite waste audits, development of in-house collection logistics, and employee training.
- “Toolkits” for recycling program development – A good toolkit can complement recycling staff’s efforts. It should include step-by-step instructions for setting up a recycling program, as well as waste audit instructions, a list of recyclables to target, a list of service providers, and sample education and promotion materials. Toolkits can be printed or available on-line.
- Full range of commercial recyclables – Effective commercial recycling programs must go beyond collecting just corrugated cardboard. Many communities encourage or require collection of all types of recyclables – fiber and containers – and sometimes organics from commercial businesses.
- Lead by example – Local governments should have comprehensive recycling programs in all government facilities to serve as models to other businesses. These facilities can be testing grounds for identifying new or expanded waste diversion opportunities.
- Economic incentives – All businesses care about their financial bottom line; therefore, many commercial recycling programs are structured so businesses reduce costs through

recycling. Typically, a lower fee is charged for commercial recycling than for commercial garbage collection. If a business implements an effective recycling program, it should be able to reduce its garbage collection service (either container size or frequency of service) and save money.

- Leverage collection contracts – Florida law does not allow a local government to grant any entity the exclusive right to collect commercial recyclables; however, an increasing number of Florida communities are requiring their collection contractor to provide commercial recycling service upon request and at established service fees. This ensures that businesses have access to recycling services and at a reasonable cost. Such a provision requires oversight by the local government to ensure compliance by the contractor, as well as education to ensure businesses know the service is available.
- Stakeholder involvement – Working with stakeholders (e.g., Chamber of Commerce and other business organizations) and getting business buy-in can be critical to the success of a commercial recycling program.
- Green business programs – A number of communities have established green business programs that acknowledge businesses that operate in a sustainable manner. Waste reduction and recycling are usually part of the requirements to achieve certification. Within Monroe County, GLEE has an established Green Business Partnership program that was modeled after a similar program developed in Sarasota County.
- Organics collection and processing – Including organics (yard waste, food waste and non-recyclable paper) in commercial recycling programs is becoming more common, especially in programs on the West Coast. These materials typically represent a substantial percentage of the commercial waste stream (38% in Key West). Two of the California jurisdictions researched mandate organics collection from commercial establishments.
- Mandates – All jurisdictions included in this appendix require, at a minimum, that all businesses recycle traditional recyclables, such as corrugated cardboard, office paper, containers, etc. The most successful programs (San Francisco and San Jose) also target commercial organics and require that businesses segregate organics for composting. Most of these programs were phased in over time, preferring to use notifications and technical assistance to encourage compliance first. After an initial grace period, they then utilize Code Enforcement staff to monitor compliance and have the ability to impose fines or fees on non-participating businesses.
- Mixed waste processing – Mixed waste processing is becoming more widely utilized to capture commercial recyclables. Green Waste, in San Jose, operates a state-of-the-art mixed waste processing facility that processes commercial and multi-family waste. It reports a 75% diversion rate – 50% diversion to composting and 25% diversion to recycling.

The remainder of this appendix summarizes the eight commercial recycling program case studies compiled by KCI. Four are Florida counties (Sarasota, Alachua, Lee, and Collier) that have reported some of the highest recycling rate in the State. All four counties rank in the top seven counties in terms of 2010 recycling rates. KCI is also aware that these four counties have specifically focused on increasing commercial recycling, each using a slightly different approach.

The other four communities are outside of Florida, but have reported some of the highest recycling rates in the country. Three are in California (San Francisco, San Jose, and Poway) and the fourth is Falls Church, Virginia. They also help demonstrate the variety of approaches that have been used when developing a commercial recycling program.

1. Sarasota County, Florida

Approximately 16,000 business establishments¹

Sarasota County's mandatory recycling program was requested and voted on by a referendum proposed by citizens. The referendum passed in 1991 with a 65 percent majority vote. Sarasota County's mandatory program was the first in the State of Florida and applies to residents and businesses.

Sarasota County's recycling ordinance requires the recycling of Program Paper and Program Containers:

- Program Paper – cardboard, writing and office paper, junk mail, envelopes, newspapers, catalogs, phonebooks, and brown paper bags/Kraft paper
- Program Containers – aluminum cans/foil trays, steel and tin cans with lids, empty aerosol cans, #1-2 plastic bottles, metal jar lids, drink boxes, milk/juice cartons, and glass bottles and jars

Sarasota County offers free waste assessments and assistance for commercial businesses setting up recycling programs. Waste assessments help businesses determine what to target for recycling and to develop baseline data for garbage and recyclables generation to measure future progress. Additionally, the county assists businesses with setting up in-house programs by fostering an employee-centered recycling program. This involves employee education, recycling bin procurement and placement, janitorial staff education, and program promotional material distribution. To promote employee participation, the county offers solid waste and recycling presentations to commercial businesses, public information posters, and brochures for businesses to promote their in-house recycling programs. The county also provides a list of recycling service providers.

County Solid Waste Program Specialists monitor program compliance. They are tasked with visiting businesses to ensure compliance, monitoring recycling practices, and providing educational materials and guidance to businesses and property owners upon request or based on observed need. The county prefers education and positive incentives rather than fines and enforcement actions to encourage businesses to participate in the program. However, the county has the authority to assess fines of up to \$500 on businesses that do not recycle.

To complement its mandatory commercial recycling program, the county established the Green Business Partnership (GBP) Program in 2006 to use positive messaging to encourage sustainable, environmentally sound business practices. The GBP Program assists, certifies, recognizes, and promotes environmentally responsible businesses. An onsite assessment is required for certification. Benefits to businesses include the following:

¹ http://appprod.dep.state.fl.us/www_rcra/reports/WR/Recycling/2010AnnualReport/AppendixB/13B.pdf.

- Cost savings through implementation of more sustainable waste management, water and energy practices,
- A healthier and more productive work environment,
- Recognition as a community leader,
- Listing in the GBP directory, and
- Permission to use the GBP logo in advertisements and company literature.



In addition to the county's Recycling Program Coordinator, two full-time Program Specialists are dedicated to the commercial recycling program. They complete waste audits and assist businesses with setting up in-house recycling programs. Approximately \$140,000 is budgeted annually for the commercial recycling program. Sarasota County reports a 60 percent commercial recycling rate and 87 percent participation in the commercial recycling program.²

2. Alachua County, Florida

Approximately 5,000 business establishments³

Alachua County's mandatory commercial recycling ordinance, passed in 2001, requires all businesses, including commercially collected residential properties (i.e., multi-family housing) to offer and maintain recycling programs. The county's Office of Waste Alternatives manages the program. From the following list of eight materials, each business must select at least three that comprise the largest portion of the waste stream to target for recycling:

- Steel cans
- Aluminum cans with a volume up to 2.5 gallons
- Glass containers with a volume up to 2.5 gallons
- Plastic containers (PETE, HDPE, and PVC) with a volume up to 2.5 gallons
- Magazines
- Newspapers
- Office paper
- Corrugated cardboard

Commercial property owners may request an exemption if a business:

- Produces less than four cubic yard of solid waste per week, or
- Produces designated recyclables that constitute less than 15 percent of the business's solid waste.

Although Alachua County assesses commercial businesses for waste disposal, the assessment covers only the fixed costs of disposal, which represent 60-70 percent of the total disposal cost. Variable disposal costs are covered by the \$42.00 per ton tipping fee, which provides a financial incentive for businesses to recycle.

Alachua County offers a complimentary waste survey to help businesses learn how to produce less waste and possibly save money on their solid waste disposal costs. During the waste survey, an Alachua County Waste Alternatives Specialist collects information on the amount and type of

² Tom Franklin, "Sarasota County Increases Business Recycling," *Renewable News*, (Winter 2009): 8.

³ http://appprod.dep.state.fl.us/www_rcra/reports/WR/Recycling/2010AnnualReport/AppendixB/13B.pdf.

materials comprising the business's waste stream and evaluates any existing recycling and/or waste reduction practices. After analyzing the information, a report is produced and presented to the business that outlines ways to establish a recycling and waste reduction program or how to enhance an existing program.

The county utilizes Code Enforcement staff to enforce the mandatory recycling ordinance. If a business is found to be out of compliance during the initial inspection visit, Code Enforcement will notify the business of the county's mandatory ordinance and provide them with educational materials about setting up an in-house recycling program. If the business is still out of compliance during a follow-up visit, Code Enforcement will issue a warning. If the business is still out of compliance on the third visit, fines of up to \$1,000 per day may be assessed for first-time offenders and up to \$5,000 per day for repeat offenders.

The county employs one full-time Code Enforcement officer that deals solely with commercial recycling. In addition, half of the county's Recycling Programs Coordinator's time is devoted to the commercial recycling program. The Code Enforcement officer also reports contamination and improper recycling procedures to the county Recycling Programs Coordinator so that a Waste Alternative Specialist can be sent to educate the business and property owner about proper recycling procedures and the ability to save money by right-sizing waste containers.

From the beginning of the program in 2001 until 2007, the county focused mainly on educating businesses about the program and assisting them with implementation. In 2007, the ordinance was amended to allow for enforcement action, which has been used successfully in conjunction with education to substantially increase the commercial recycling rate. Since the adoption of enforcement actions in 2007, county staff reports the commercial recycling rate has increased from 27 percent to 44 percent.

3. Lee County, Florida

Approximately 14,000 business establishments⁴

To increase recycling, Lee County adopted a mandatory business and construction and demolition (C&D) debris recycling ordinance in September 2007, with an effective date of January 1, 2008.

The ordinance requires all business owners in the unincorporated areas of the county to establish an onsite recycling program. The program must include a service agreement for recycling collection, internal collection containers, documented education program, and documentation that a minimum of one recyclable material that makes up the largest portion of the business' waste stream is being recycled. Collection agreements must provide no less than one collection every other week. New businesses are required to maintain documentation of their recycling program onsite for review by the county within 14 days of beginning operations.

To ensure commercial recycling collection is available at a reasonable cost, the county included a fee structure in its collection franchise contract. Businesses requesting front-end load recycling cans pay \$1.50 per cubic yard of service, while those requesting recycling carts pay \$2.85 per cubic yard of service. While these rates are available to all businesses, businesses are not required to utilize the recycling services of the franchised contractor.

⁴ http://appprod.dep.state.fl.us/www_rcra/reports/WR/Recycling/2010AnnualReport/AppendixB/13B.pdf.

To monitor participation, franchised haulers are required to provide a monthly statement of businesses served and are required to report to the county when service changes or cancellations occur. During the implementation phase of the program, county staff inventoried businesses served by non-franchise recycling haulers, and continues to periodically survey them to confirm participation.

If a business is found to be out of compliance with the ordinance, county staff will issue a warning and provide educational material and assistance in setting up a recycling program. If the business is found to be out of compliance during the follow-up visit, advance disposal fees (ADFs) may be assessed monthly until the business is compliant. ADFs are assessed based on the business' Florida Department of Revenue (DOR) classification and associated solid waste generation rates (see Table 1). Since 2008, Lee County has had great success getting businesses to initiate recycling programs, with nearly 100 percent of the businesses in compliance. Primarily, it is only new businesses that are not in compliance. To date, the county has not had to assess ADF charges on non-compliant businesses.

Table 1: Lee County Advance Disposal Fees

Solid Waste Generation Rate Category	ADF Fine
A, B	\$100
C	\$250
D, E	\$500

County ordinance also requires all covered (certain projects excluded) construction projects to recycle at least 50 percent of the waste generated at the permitted site, and recycled materials must be taken to county-approved facilities.

The success of the program has much to do with the staff dedicated to ensuring compliance. The county hired one staff person to assist the county's Recycling Coordinator in managing the commercial recycling program by maintaining the commercial recycling database, reconciling data with haulers, and managing the C&D debris recycling component. In addition, the county has six field inspectors who provide oversight of the franchise hauling contracts. The field staff is responsible for meeting with all new businesses, conducting necessary follow-up visits and ensuring overall compliance with the mandatory ordinance. The field inspectors successfully incorporated program compliance monitoring into their daily duties, eliminating the need to increase staff. When developing the commercial recycling program, the county strived for minimal staff requirements and structured the ordinance to place the majority of the reporting burden on the individual businesses.

The county estimates it took approximately one year from inception of the program to when the ordinance was adopted. It took an additional year to fully implement the program. Elected officials and business groups, such as the Chamber of Commerce, were supportive of the program from the start of the process. Through cooperation of the haulers and county staff, nearly 100 percent of the commercial businesses in Lee County are compliant with the mandatory recycling program.

4. Collier County, Florida

Approximately 4,600 business establishments⁵

The Collier County Board of County Commissioners issued a “no new landfill” directive, forcing the Solid Waste Management Department to develop innovative solutions to maximize the available landfill space that remained. With historical evidence that recycling was working in the residential sector, the Board of County Commissioners directed solid waste management staff to develop an ordinance that required non-residential (commercial) establishments to recycle. The county estimated that commercial waste accounted for 60 percent of total waste generated in the county, and that 50 percent of that waste was recyclable.

To test the effects that a mandatory commercial recycling program would have, Collier County launched a pilot commercial recycling program in 2001 that tracked cost fluctuations for participating businesses. The preliminary results of the pilot program indicated that the majority (three out of four) of businesses realized a cost savings through recycling and reduced disposal costs. Staff recommended that the mandatory commercial recycling program be implemented countywide, but because of opposition from businesses and citizen groups, the Board of County Commissioners approved only a voluntary commercial recycling program. After 18 months of monitoring participation and diversion rates under the voluntary program, it was evident to staff and the Board that a voluntary program was not producing the results the county anticipated or desired.

In preparation for adopting a mandatory commercial recycling ordinance, the county further researched best practices of successful mandatory programs and outlined the following guiding principles. These principles were used to develop the county’s mandatory commercial recycling ordinance:

- Recycle more than one item,
- Include an educational component,
- Limit regulatory impact on businesses,
- Provide a proper balance of both incentive and regulation, and
- Address the impact on land development codes.⁶

The county’s mandatory commercial recycling ordinance, which was adopted in July 2004, requires the following:

- Businesses, temporary events, venue facilities, and institutions must segregate and recycle as many designated recyclable materials as possible.
- Multi-family properties must provide collection containers and recycling services to residents.
- Businesses and property owners must establish onsite recycling education programs.
- The county will provide education materials and assistance, incentives, and award programs that will make recycling more attractive to businesses, multi-family properties, temporary events, venue facilities, and institutions in the county.

⁵ http://appprod.dep.state.fl.us/www_rcra/reports/WR/Recycling/2010AnnualReport/AppendixB/13B.pdf.

⁶ Denise Kirk and Daniel Dietch, “Mandatory Non-Residential Recycling Ordinance,” *Government Engineering*, (November-December 2004): 19-21.

- Upon request, businesses and property owners are required to provide the county with documentation (i.e., hauler service agreement, self-hauling certificate, etc.) that demonstrates there is an onsite recycling program.

When the ordinance was first enacted, staff was required to visit all businesses in the county within five years to document participation. To monitor the ongoing compliance rate and success of the program, staff is required to re-inspect businesses in order of business type (i.e., hotels, schools, government facilities, etc.). This is an ongoing improvement process. Currently, there are no fines or penalties for noncompliance with the ordinance. They are currently amending the ordinance to include a C&D debris component based on that in use by Lee County and also adding penalties for noncompliance.

The county's Solid Waste Management Department has a Waste Reduction and Recycling Manager, three full-time staff members, and one part-time staff member that manage the recycling program, which includes the mandatory commercial recycling program. In addition, Public Utilities staff distributes education materials to businesses and Code Enforcement manages and handles all enforcement actions.

The county's annual budget for the mandatory commercial recycling program is \$204,300 for operating expenses and \$558,000 for personnel expenses.

The mandatory commercial program was phased in over one year and fully implemented within approximately three years. The ordinance was amended in 2009 to include temporary events, venue facilities, and multi-family properties. Commercial recycling participation increased from approximately 20 percent before the mandatory ordinance was enacted to about 75 percent since recovering from a precipitous decline due to the economic downturn in 2008. The countywide recycling rate increased from 30 percent to 41 percent. County staff estimates that the county recycling rate has increased approximately 1 percent per year since initiating the mandatory commercial recycling program.

Although Collier County's commercial recycling has been successful, staff members noted that the following elements could and will be improved.

- Increase staff resources for new/modified program implementation.
- Increase ongoing education and marketing efforts and for new/modified program implementation.
- Require a more aggressive enforcement program per county ordinance.
- Develop a management plan that assesses businesses more frequently for compliance.
- Require private haulers doing business in the county to provide single stream recycling collection service.

5. San Francisco, California

Population: 805,235 (2010 Census)

San Francisco, California has the highest citywide diversion rate in the nation at 77 percent. As of August 2011, 85 percent of commercial accounts participated in recycling and 50% participated in organics collection.⁷

In the late 1990s, the city's Department of the Environment (SF Environment) and the city's sole permitted refuse hauler and processor (Recology) developed a three-stream collection system for all customers – residential and commercial. The program includes blue carts or dumpsters for commingled recyclables, green carts or dumpsters for compostable materials and black carts or dumpsters for trash. To increase diversion, a mandatory recycling and composting ordinance was adopted in April 2009. The ordinance requires businesses to:



- Subscribe and pay for adequate refuse service.
- Separate recyclables (including all fiber materials, commingled containers, and rigid plastics) and compostables (including food scraps and soiled paper) from trash going to the landfill.
- Provide appropriate size, color-coded and labeled (see Figure 3) containers for all tenants and employees, and adequate education and training for all new employees and tenants, including janitorial staff. Education efforts must be repeated annually for all employees.

Figure 1: San Francisco Container Labels



The city provides an incentive for businesses to increase recycling efforts by offering a “diversion discount.” The diversion discount is equal to recycling and composting volume divided by the total volume generated. For example, if a business had a 96-gallon garbage cart, a 96-gallon organics cart, and a 96-gallon recycling cart, the total discount would be 67 percent (see Figure 4).⁸

⁷ Julie Bryant, et. al., “The Story of Zero Waste,” *Resource Recycling*, August 2011, pgs. 26-30.

⁸ https://www.norcalrecycles.com/rate_calculator/rate_calculator.php.

Figure 2: San Francisco Diversion Discount



$$\begin{aligned} \text{Recycling and organics volume} &= 96+96 = \mathbf{192} \\ \text{Total volume generated} &= 96+96+96 = \mathbf{288} \\ &= \mathbf{67\% \text{ diversion discount}} \end{aligned}$$

Business and property owners found out of compliance with the mandatory recycling and composting ordinance are subject to citations, fines, property liens and not having their refuse collected.

The city leads by example, having diverted more than 85 percent of waste generated within municipal facilities. The city also has an environmentally preferable purchasing program that requires all paper purchased be 100 percent post-consumer recycled paper and prohibits the purchase of bottled water. The city also promotes electronic communication and defaults all printers to double-sided. Surplus government equipment is re-used via a virtual warehouse managed by SF Environment. Each department has a zero waste coordinator responsible for assessing opportunities to increase recycling, conducting waste audits, locating bins in prime locations to maximize use, and to act as an information resource to train employees on how to recycle properly and to encourage them to recycle more.

SF Environment provides substantial resources to the business community to promote and assist with diversion program implementation. Technical assistance includes targeted guidance for large businesses, food establishments and multi-family properties lacking composting or recycling. The city contracts with Environmental Science Associates, a consulting firm, to provide the following to large businesses:

- Onsite waste assessments
- Logistical set-ups
- Multi-lingual training
- Troubleshooting

City staff focuses on small businesses by checking trash bins for recyclables and compostables and providing immediate onsite technical assistance to set up a recycling and composting program if not already in place or training on proper recycling and/or composting procedures.

Public education materials are available to all businesses via the city's website.

6. San Jose, California

Population: 945,924 (2010 Census)

San Jose, California has a 70 percent overall municipal diversion rate and a commercial diversion rate of 25 percent. With an ambitious goal of diverting 100 percent of the city's waste from

landfilling by 2022, the city realized the need to target commercial recyclables and compostables to increase the city's overall diversion rate.

The city announced a new waste collection and processing system starting July 1, 2012 that will enable all businesses to meet the state's mandatory commercial recycling requirements and divert 80 percent of waste from the landfill. After issuing a Request for Proposals, a 15-year exclusive franchise was granted to Republic Services to collect most standard garbage, recycling, and organics from businesses in the county.

The city hopes that Republic's innovative "wet/dry" system will triple the business recycling rate from the current 25 percent to 80 percent. All businesses will receive wet collection service, which includes organics collection such as food waste and food contaminated paper products. Businesses will also receive dry waste collection service, which includes recyclables and everything else. This new system views waste as a resource. All the material collected, wet and dry, will be processed locally at Republic's Newby Island Resource Recovery Park.

To ensure material recovery, the contract with Republic has recovery goals that Republic must meet to avoid penalties and no material may be brought directly to a landfill. All material must be processed, including the wet material, which will then be delivered to Zero Waste Energy Development (ZWED) for composting via anaerobic digestion.



The city also provides technical assistance and free supplies to businesses to assist with setting up commercial recycling programs. The city utilizes its website to provide a comprehensive education toolkit for businesses.

7. Poway, California

Population: 47,811 (2010 Census)

Poway, California, which is located in San Diego County, has an overall diversion rate of 62 percent. The city mandates that businesses must be serviced weekly for waste and recycling collection.

Poway has a single franchise agreement for residential, commercial, and roll off solid waste and recycling services. The city leverages its relationship with its contractor to provide compliance monitoring of businesses and recycling technical assistance and education to businesses.

Poway financially incentivizes businesses to participate in the mandatory recycling program through contractually established recycling fees that are substantially lower than solid waste collection fees (see Table 2).

Table 2: Poway, CA Commercial Service Fees

FY 2011 COMMERCIAL SERVICES	FEE
3-cubic yard trash bin (collection weekly)	\$102.00
3-cubic yard recycling bin (collection weekly)	\$38.26

The contract provides the contracted hauler a financial incentive to encourage businesses to recycle by (1) charging a 10 percent franchise fee for waste services but not recycling and (2) allowing the contractor to retain revenue from the recycled commodities.

The city offers recycling collection of commingled materials (fibers and containers), source separated cardboard and green waste. The city does not currently collect segregated food waste; however, San Diego County is currently exploring segregated organics processing and collection options.

As part of the city's franchise agreement, the city's contractor has to provide recycling containers and collection services to all city facilities free-of-charge. City staff works to educate employees and custodial staff about the recycling program and proper handling procedures.

The city's contractor is actively involved in the local chamber of commerce, which provides a forum to actively engage business owners.

8. Falls Church, Virginia

Population: 12,332 (2010 Census)

Falls Church, Virginia requires businesses or business complexes that have more than 200 employees or generate more than 100 tons of trash annually to establish a recycling collection system. Businesses are required to submit an annual recycling report that lists the types and amounts of materials recycled.

Currently, the city does not actively enforce the mandatory ordinance; however, the ordinance may be changed in 2012 to require all businesses, large and small, to implement a commercial recycling program. The city intends to actively enforce the 2012 expansion of the mandatory recycling requirements using the assessments already in place for non-compliance. They include a \$100 fee for the first violation and \$150 for each subsequent violation, which can be fined every 10 days until the business is in compliance or up to \$3,000.

Financial incentives are not provided for haulers or businesses by the city. The city believes the positive financial incentives of open market competition provide businesses with financially advantageous pricing for commercial recycling collection. It is a highly competitive market with numerous recycling facilities and haulers.

The city utilizes Fairfax County's education and "toolkit" materials to distribute to business and property owners.

The city also sends out an annual reminder to all businesses, via the business license database, to complete the annual waste assessment form and includes education materials in those mailings. Since multiple business license holders may be located in a multi-tenant building, the city makes sure to note the following in the mailing: "if you are in a multi-tenant building, make sure your property manager receives this information." The city also provides information on training custodial staff.

Appendix F

Alternative Uses of Recovered Glass

1. Existing Management of Recovered Glass

Currently, glass is collected as part of residential single stream recyclables, collected from some commercial businesses that contract for recycling, or delivered by some businesses and individuals that self-haul recyclables to the City's Transfer Station. At the Transfer Station, all glass, whether collected separately or with other recyclables, is loaded into a transfer trailer with all types of recyclable fiber and containers for transport to WM's Reuters MRF in Broward County. The City does not pay for transport and processing, nor does it receive any revenue for recyclables. According to WM staff, most of the glass processed at the Reuters MRF is used as road base at a WM landfill.

Glass is a comparatively dense material and, therefore, typically comprises about 20-25 percent by weight of residential recyclables. The value of recovered glass as a commodity tends to rank lower than that of other materials. Finding an end-use for recovered glass in the Keys could potentially put it to better use than landfill cover, and would also reduce WM's transport and processing costs. The primary benefit to the City would be the ability to encourage increased glass recovery from local businesses and the resulting reduction in waste transport and disposal costs (currently at \$71.55 per ton).

To take advantage of a local end-use market, glass would need to be separated from other recyclables. Because residential recyclables are collected in a single stream, the commercial sector, especially bars and restaurants, offers the most likely source of segregated glass.

2. Potential Recovery of Source-Separated Glass

Based on the recent waste composition study, glass comprises approximately 9.3 percent of commercial waste delivered to the City's Transfer Station. Based on FY 2011 tonnage, this equates to approximately 2,300 tons per year or about 200 tons per month (see Table 1). Achieving a 25 percent recovery rate would equate to about 50 tons per month, and a 50 percent recovery rate would amount to nearly 100 tons per month.

Table 1: Estimated Disposal of Glass by Businesses

Commercial Glass FY 2011	
Total garbage (tons/year)	42,697
Commercial garbage, 58% of total (tons/year)	24,764
Glass, 9.3% of commercial (tons/year)	2,303
Glass (tons/month)	192

3. Potential End-Uses for Recovered Glass in the Keys

Numerous uses for recovered glass exist other than bottle to bottle recycling; however, due to the limited number of manufacturers in the Keys, the most viable options for local utilization are (1) for beach renourishment, (2) for construction uses, and (2) as recycled glass mulch.

Through discussion with Florida Department of Transportation (FDOT) staff, KCI has confirmed that the use of recycled crushed glass in aggregate materials and construction activities is an acceptable practice.¹ Toppino & Sons, Inc., a local contractor specializing in the production, use and sale of construction materials including concrete aggregates, was initially contacted to gauge the company's interest in utilizing recovered glass. Toppino & Sons is located adjacent to the City's Transfer Station, making it a prime candidate for such a partnership.

Beach Renourishment

Recycled pulverized glass (cullet) has considerable advantages as potential beach fill material in that it provides a use for a material that is difficult to market as a recyclable commodity, and may provide a benefit in addressing the critical issue of beach erosion. Additional advantages to the use of cullet include: (1) the ability to select for color, size, and shape characteristics similar to those of natural sands,² (2) similar chemical, mechanical, and geologic properties as natural sands,³ and (3) readily available supply. As such, recycled glass has been used in beach renourishment projects across the globe, including in Curacao; Lake Hood, New Zealand; Fort Bragg, California; and Kauai, Hawaii.⁴

Despite the use of recycled glass as renourishment material elsewhere, use in Florida has been limited, primarily due to permitting concerns. The Florida Department of Environmental Protection (FDEP) is the primary state regulatory agency that oversees beach management in Florida. Requirements for beach nourishment permits are listed in FDEP Chapter 62B - Section 41.007, Rules and Procedures for Application for Coastal Construction Permits, and stipulate material grain size, composition, and color. Prior to a FDEP-funded project in Broward County from 2004 to 2007, the use of glass cullet for beach reconstruction had not been permitted. To date, no other permits have been issued. However, the use of other alternative materials similar to glass, namely aragonitic oolite, have been approved.⁵

Regardless of the material used, if placed seaward of the mean high water line, a permit issued by the U.S. Army Corps of Engineers (USACE) is required per Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Use of material landward of the mean high water line may require approval by the U.S. Fish and Wildlife Service, as provided by the Endangered Species Act, due to the perception of potential effects on marine turtles nests.⁶ However, multiple studies indicate that different types of sands have little to no impact on turtle nesting success. In a multi-year study conducted on Miami Beach, Florida, no significant difference was found in hatching and emergence success between nests composed of carbonate, aragonitic, or

¹ John Shoucair, P.E., FDOT, State Materials Office, personal communication, August, 2011.

² L. Kerwin, *Potential Applications for Recycled Glass in Beach Management: Emergency Stabilization of "Hot Spots" in Broward County Florida*, (M.S. thesis, Florida Atlantic University, 1997).

³ G.G. Thompson et. al. for the Broward County Office of Integrated Waste Management, Broward County Department of Planning & Environmental Protection, *Broward County Beach Demonstration Project Literature Review*, January 2005, page 1.

^{4,5,6} G.G. Thompson, et al., pages 6-10.

silicate sands⁷ (silicate sands being native material, and the most chemically similar to manufactured glass sands). Additionally, no significant difference in sex ratio between nests of different sand types was found, though variability of the sex ratio within each nest was high.⁸ A more recent study published in 2008 found that recycled glass cullet maintains the oxygen saturation and temperature levels required in nesting chambers for successful sea turtle embryo development. No significant differences were found among nests composed of native sands and those composed with significant portions of glass cullet.⁹

As noted above, FDEP did approve the use of recycled glass for use in the Broward County Beach Demonstration Project, which commenced in 2004. The intent of this project was to demonstrate the feasibility of using recycled glass cullet as emergency beach renourishment material for erosion “hot spots.” Phase I of the study included geotechnical comparisons of beach sand and processed glass cullet in which samples were analyzed to compare grain size distribution and color, carbonate content, and grain angularity. For all tests, recycled glass cullet was found to be geologically compatible. Additionally, the recycled glass cullet samples were analyzed for bio-contaminants including fecal coliform and other bacteria, lead, mercury, semi-volatile organics (VOCs), petroleum hydrocarbons, and salt. All contaminants were found to be within acceptable regulatory limits specified for beach renourishment materials.¹⁰ To address sea turtle nesting concerns, test plots of glass-sand blends were constructed in upland beach areas of Hollywood Beach, and monitored through spring and summer of 2006. Monitoring results were compared with natural sand plots, and demonstrated little to no abiotic differences between plots of glass-sand blends and natural sands. As in other studies, these results provide further evidence the glass and sand mixtures offer nesting environments equal to those of native sands.

Phase II of the Broward demonstration project included the placement of 3,000 tons of recycled glass cullet directly onto the shoreline. Construction was slated for 2010; however the project faced a series of challenges. Initial material requirements for Phase II represented nearly a month’s supply of glass collected within Broward County and processed by the County’s recyclable materials processor, Waste Management. No storage facility for this amount of material was identified prior to the study. In addition, once glass was delivered to the MRF, ownership transferred from the County to Waste Management.¹¹ Obtaining glass from other sources increased total projects costs to approximately \$1.5M, nearly double the amount of funding available through grants from the FDEP, the Resource Recovery Board (RRB) and Broward County. After two years of failed discussions with glass processors to secure local or regional processing and supply, the Broward County Board of Commissioners approved reversion of remaining project funds.¹² Together, these challenges put a halt to the Broward

⁷ S.M. Blair, et al., “Evaluation of quartz, aragonite, and carbonate beach compatible sand on nest temperature and success parameters of *Caretta caretta* nests in southeastern Florida, USA,” *Proceedings of the 18th International Sea Turtle Symposium* (US Dept. of Commerce, NOAA Technical Memo NMFS-SEFSC-436), 2000, pages 170-180.

⁸ D.A. Nelson, et al., “Preliminary Assessment of loggerhead turtle (*Caretta caretta*) nest sex ratios of nests incubated in aragonite sands,” *Proceedings of the 16th Annual Symposium on Sea Turtle Biology and Conservation* (US Dept. of Commerce, NOAA Technical Memorandum NMFS-SEFSC-412), 1998, pages 110-112.

⁹ Christopher Makowski, et al., “Abiotic suitability of recycled glass cullet as an alternative sea turtle nesting substrate,” *Journal of Coastal Research*, June, 2008, pages 771-779.

¹⁰ Peter Foye, “Beach in a Bottle,” *Waste Age*, July, 2005, pages 20-22.

¹¹ Phil Bresee, “Beached Glass,” *Resource Recycling*, February 2007, pages 1-3.

¹² Broward County Commission Regular Meeting (September 14, 2010)1-2.

County Demonstration Project. However, the project did succeed in proving the environmental feasibility of recycled glass use as beach renourishment material. Despite the recent lapse of the project permit provided by FDEP, local interest in the project has picked up. Broward County is currently in the process of procuring recyclables processing with a new service provider, and as such may find a solution to the processing and supply issues that ultimately doomed the Broward County Demonstration Project.

Currently, beach renourishment in Key West is performed by private contractors permitted by the FDEP. Recent renourishment projects in Key West utilized sands from the Ortona sand mine located in Moore Haven, Florida and owned by E.R Jahna. The material is transported and applied by American Earth Movers.¹³ The use of recycled glass as beach renourishment material in Key West offers the potential for increased waste diversion for the City, and savings in transport costs for the County's contractor. Because the City does not own processing equipment or have readily available storage space, a public-private partnership would likely be required. An agreement with Waste Management or Toppino & Sons could provide a local solution to processing and storage problems, while the sale of recycled materials for renourishment materials could provide incentive for the private sector in the form of revenue. Using glass cullet produced locally as beach renourishment material would also serve to increase local "green" branding efforts.

Construction Uses

Glass is a product of the supercooling of a melted liquid mixture consisting primarily of sand (silicon dioxide) and soda ash (sodium carbonate) to a rigid condition, in which the supercooled material does not crystallize and retains the organization and internal structure of the melted liquid. When waste glass is crushed to sand-like particle sizes, similar to those of natural sand, it exhibits properties of an aggregate material.¹⁴

Type S Asphalt Concrete is a specific aggregate concrete in which a bituminous mixture replaces cement as a binding agent. Per FDOT specifications, recycled crushed glass may be used as a component of the bituminous mixture if it meets certain criteria. However, based on discussions with City staff, asphalt is not manufactured in the Keys.

Embankment fill comprises the lowest zone of construction material in roadway projects and is generally made of sandy soils with some silt or clay. While crushed glass would not be suitable for use in the sub grade or base layers, FDOT has confirmed that waste glass is a viable material for embankment fill.¹⁵ Supporting research conducted by the Florida Institute of Technology (FIT) demonstrates that crushed waste glass is an acceptable highway fill material as it can be cleaned at a reasonable cost with negligible environmental impact, and has excellent highway engineering properties. In this study, crushed waste glass was successfully mixed with limerock, cemented coquina and reclaimed subgrade, all of which exhibited adequate highway engineering characteristics.¹⁶ FDOT concurs with this conclusion per results from repeat load

¹³ Jay Gewin, Utilities Manager City of Key West, communication via email, May 2012.

¹⁴ U.S. Department of Transportation Federal Highway Administration, *User Guidelines for Waste and Byproduct Materials in Pavement Construction, Waste Glass* (FHWA-RD-97-148), 2011, page 1.

¹⁵ John Shoucair, P.E., FDOT State Materials Office, personal communication August, 2011.

¹⁶ P.J. Cosentino et. al., "Developing Specifications for Waste Glass, Municipal Waste Combustor Ash & Waste Tires as Highway Fill Materials Final Report Volume 2," *National Technical Information Service*, April 1998, pages 29-37.

testing via Resilient Modulus testing (AASHTO T 307). It should be noted that FIT's research cautioned against the inhalation of glass dust during roadway construction.

Glass cullet can be used for utility trench bedding and backfill, as well as for construction of drainage facilities such as drainage blankets, french drains, foundation drains, and behind retaining walls. Cullet content up to 100 percent can be used for backfill up to the last two feet below the final grade. Depending on the loading conditions on the backfill area, the last two feet of the backfill may have cullet contents varying from 15 to 100 percent. Conventional materials include granular soils and geosynthetics (geotextiles and geonets). Design considerations for these conventional materials and glass cullet include compaction, permeability, thermal conductivity, filtration, and puncture resistance. In drainage applications, a geotextile filter should be used to separate glass cullet from the surrounding soil and to prevent clogging of the drain, similar to conventional aggregate filtration requirements. The 1991 National Standard Plumbing Code allows the use of glass crushed to 3/4-inch as aggregate in storm drains, which are used to drain water away from the parts of the buildings that are below ground.¹⁷

Processing Requirements

When used in construction or beach applications, glass must be crushed and screened to produce an appropriate design gradation. Glass crushing equipment normally used to produce a cullet is similar to rock crushing equipment including hammermills, rotating breaker bars, rotating drum and breaker plate, and impact crushers.¹⁸ Because MRF glass crushing equipment has been primarily designed to reduce the size or density of cullet for transportation purposes and for use as a glass production feedstock material, the crushing equipment used in MRFs is typically smaller and uses less energy than conventional aggregate or rock crushing equipment. Successful production of glass aggregate using recycled asphalt pavement (RAP) processing equipment (crushers and screens) has been reported.¹⁹ Magnetic separation and air classification may also be required to remove any residual ferrous materials or paper still mixed in with the cullet. Additionally, pulverized glass intended for beach application requires decontamination, usually via high temperature exposure in a burner or dryer, and subsequent screening.

Due to the relatively low glass-generation rates from small communities, stockpiles of sufficient size need to be accumulated to provide a consistent supply of material in order for glass use to be practical in large-scale construction applications.²⁰ However, the infrequent nature of beach renourishment activities may provide the necessary time to acquire sufficient stockpiles to mitigate erosion "hot spots."

Recycled Glass Mulch

As public awareness concerning recycled consumer products increases, "Greenscaping" has become a popular trend. Greenscaping encompasses a set of landscaping practices that can improve the health and appearance of lawns and gardens while protecting and preserving

¹⁷ HDR Engineering, "Glass Cullet Utilization in Civil Engineering Application," *Civil Engineering Applications Nebraska State Recycling Association*, June, 1997, pages 12-13.

^{18,18,19} FHWA-RD-97-148, 2011, page 1.

natural resources.²¹ One Greenscaping method includes the use of glass mulch for landscaping purposes on a variety of scales.

The sharp edges of the glass are eliminated when producing glass mulch. The glass is processed with pulverizing equipment that produces cullet with rounded edges, or with crushing equipment and subsequent tumbling. Depending on the size of the cullet, it can be used as fill in golf sand traps or as decorative material in residential or public spaces. Currently, landscaping companies market glass mulch from \$0.80 - \$4.32 per pound, depending on color and quantity.²² When used as a landscape cover, glass mulch touts some benefits over traditional materials including increased water permeability. As such, less water is required to maintain landscape plants. However, it should be noted that unlike traditional organic mulch, glass mulch provides no nutrient benefits to soils.

Municipal production of recycled glass mulch occurs in a number of regions throughout the United States. Two Florida programs and one North Carolina program are discussed below.

Polk County: Polk County previously processed glass to produce a glass mulch product. First, glass was sorted from other materials at the county's Recovered Materials Processing Facility (RMPF) using a trammel with 1-inch openings, after which the county used a G.A.M.E. Manufacturing glass crusher to reduce the cullet in size from 1-inch minus down to the size of beach sand with little or no sharp edges. The glass crusher was rated at 10 ton per hour, though with regular use this rate decreased to 6-8 tons per hour depending on the quality of the material input. The crusher required maintenance after every 8-10 hours of use, which involved cleaning, lubrication, and screen inspection. Screen replacement was needed after every 20-30 hours of use. Screens made out of high wear-resistant metal alloys for longer screen life are available, but the screen life to cost ratio for these was such that it was more cost-effective to utilize cheaper screens and change them more regularly. Polk County processed approximately 500 tons of glass per month, of which residents utilized 1 to 2.5 tons of glass mulch per month for landscaping purposes and the rest was used as landfill road base material.²³

Sumter County: A project was developed by Sumter County to demonstrate the benefits of processing mixed color glass at the local level to help divert a recyclable material from disposal, and to eliminate the costs of transporting a low-value material to distant markets. Sumter County purchased a G.A.M.E. model GM-1 system, which produces a consistently sized aggregate product in a "one-pass" operation that promotes efficiency and lowers maintenance costs. The unit had interchangeable screens (3/8" and 3/16") to control product size, with RPM adjustments to the sander unit shaft allowing for additional size control. Some operational problems were encountered with the GM-1 glass processing system. These included material jams in the hopper, debris falling from the conveyor, the trommel causing a glass material diversion and loss of material, dust collection system malfunctions, and excessive wear on tines and screens. It was determined that moisture in the glass was a major problem and was causing some of the excessive wear on the equipment. Sumter County constructed a pole barn over the crushing unit and glass storage bunker to substantially reduce moisture problems. The manufacturer made several modifications and upgrades and also provided additional instruction in proper equipment maintenance. Specific modifications included installation of ball vibrators

²¹ EPA Greenscapes (www.epa.gov).

²² American Specialty Glass Pricelist (www.americanspecialtyglass.com).

²³ Ed Sparks, Polk County Waste Resource Management Division, personal communication, January 2012.

to shake loose and prevent buildup of clumps of moist crushed glass in the screens and tines. Additionally, a portable compressor unit was procured for pressure cleaning the equipment as needed. Because of the limited volume of glass collected, traditional construction material markets were not feasible due to the need for consistently large quantities. Therefore, Sumter County screened a portion of the material for in-house sandblasting operations and utilized the remainder for landscaping on county property.²⁴

Dare County, North Carolina: A program provided by the Dare County Public Works Recycling Division of North Carolina, was initiated in response to state legislation that requires bars and restaurants which serve alcoholic beverages to prepare glass bottles for recycling. The county’s recycling center processes about 600 tons per year of glass, which is used by local residents and governments as supplementary material for parking areas, for use in flower beds, and as roadbed material. An economic motive for the program is the area’s disposal rate of about \$70 per ton.²⁵

For such a program to be feasible for Key West, location, storage and equipment concerns must be addressed. One possible location for processing equipment and production is a small building located at the City’s Transfer Station, previously used for cardboard recycling. Further research is needed to evaluate whether this building contains adequate space for processing equipment and storage. Equipment necessary to produce glass mulch is available with a variety of processing capacities. Table 2 provides examples of single-step processing equipment model specifications and costs; however, used equipment is also generally available.

Table 2: Examples of Glass Recycling Equipment Models

Model:	Cost*	Capacity	Products	Operation Time**	Size:
Andela GP05	\$ 82,000	1-2 tons/hr	3/8" non-sharp gravel	4.5 hr, 5 days per week or 8 hrs, 3 days per week	7'5" x 5'8" Adjustable height
Andela GP05L	\$ 91,000	1-2 tons/hr	3/8" non-sharp gravel 1/8" sand	4.5 hr, 5 days per week or 8 hrs, 3 days per week	8'8" x 5'8" Adjustable height
Andela GPT-1	\$ 154,000	5 tons/hr	3/8 – 1/8" non-sharp gravel 1/8" sand	1 hr, 5 days per week or 5 hr, once weekly	14'x 5'4"x 9'

* Cost includes installation supervision, startup and maintenance training.

**Operation time is the time that would be required to process commercial glass if 50% of commercial glass generated in the City were recovered (1,200 tons per year).

4. Next Steps

As mentioned previously, glass would need to be separated from other recyclables to take advantage of a local end-use market. Because residential recyclables are collected in a single stream, the commercial sector, especially bars and restaurants, offers the most likely source of

²⁴ TIA Solid Waste Management Consultants, *Processing Mixed Cullet for Local Alternative Markets*, December 2000.

²⁵ Resource Recycling, *Glass Recycling Undergoes Change* (<http://resource-recycling.com/node/1100>), March 2011.

segregated glass. The City does not have direct control over this recycling stream because State law does not allow local governments to give any company the exclusive right to collect commercial recyclables. However, because of location, the City's collection service provider likely collects most, if not all, of the commercial glass currently recycled.

Glass is one of the lowest value recyclable commodities, but diverting it from disposal is beneficial to the City. It is one of the heaviest (i.e., densest) recyclable materials, and for every ton diverted from disposal, the City saves approximately \$70 in transport and disposal fees. Finding a local end-use for glass would benefit the City's collection contractor, which no longer would have to pay to transport glass collected for recycling out of the Keys to be processed. Therefore, it is mutually beneficial for the City and its collection contractor to further explore a local end-use for recovered glass.

Because of its proximity, a partnership with Toppino & Sons is worth exploring. Further communication is needed to determine if the company has the capacity to process recovered glass to specifications for use in local projects requiring FDOT or FDEP approval. In addition, further discussion is needed to determine if the amount of recovered glass that might be provided by the City is sufficient for Toppino & Sons to utilize this material in construction or beach renourishment applications.

Alternatively, a more detailed analysis could be conducted of the cost-effectiveness of investing in a glass crushing system to produce glass mulch, as well as to assess local demand for this product.



City of Key West Special Event Recycling Guide and Forms

Before applying for a City Special Event Permit, the event organizer must demonstrate that a plan is in place for an effective recycling program at the event. This Guide provides a blueprint for event organizers to develop such a program. It walks through the steps needed to plan, design and implement an effective recycling program. It also provides the necessary recycling forms and checklists to submit to the City before and after the event.

Why Recycle?

Recycling is good for the environment

The environmental benefits of recycling are well documented. Manufacturing products from recovered materials requires less energy and water, and conserves natural resources. It also creates significantly less greenhouse gases.

Recycling can save you money

The cost of hauling waste up the Keys and disposing of it is substantial. Because recyclable materials have a value, no fee is charged to process these materials. Therefore, by setting up and promoting an effective event recycling program and reducing the amount of garbage service, organizers can save money.

Recycling is good for the City

Key West is a beautiful place to live, work and play – and we need to keep it that way. Recycling helps demonstrate our commitment to preserving the beauty of our City by operating special events in a sustainable manner and reducing their environmental footprint. Many guests to our City are used to recycling at home and will welcome the opportunity to recycle here as well.

What to Recycle?

Special Events produce significant amounts of easily separated recyclable materials, including those listed below. Because the City has a single stream recycling program, just about all types of recyclables can be combined in one recycling bin. Event organizers should think about the types of recyclables that might be generated at the event. If you're not sure whether something can be recycled, contact the City's Solid Waste Department, Recycling Coordinator, or the recycling company you're working with.

- Cardboard:** Cardboard boxes will be generated primarily by vendors.
- Mixed Paper:** If it rips and it's dry, you can recycle it. This includes any type of office paper, paperboard and boxboard, newspaper, magazines, programs, brochures, flyers and handouts. Does not include waxed paper, paper towels, tissue paper, bound books, or used paper plates or cups.



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- ❑ **Metal Cans:** Aluminum, steel or bimetals (tin) cans that do not contain pesticides or other hazardous or toxic materials. Be sure to include steel/bimetal cans generated by food vendors.
- ❑ **Plastic Containers:** The most common types generated at Special Events are plastic beverage bottles, but most types of plastic containers can be recycled.
- ❑ **Glass Bottles:** Clear, green and brown glass bottles, but not other types of glass, such as stemware.
- ❑ **Scrap Metal:** Any type of metal such as old displays, scaffolding, and other large metal objects. Not all events will generate scrap metal, but if your event will, contact the recycling company since scrap metal may need to be collected separate from other recyclables.
- ❑ **Wood Waste:** Includes wood pallets, discarded lumber, and other scrap wood from event set-up and take down projects that are not painted or treated. Again, not all events will generate wood waste, but if your event does, contract the recycling company since this material will need to be collected separate from other recyclables. Reusable pallets may be returned to product distributors.

Plan your event with recycling in mind. Request or require vendors to sell products in containers that can be recycled. Be creative and look for or create recycling opportunities!

Minimum City Requirements

1. Recycling bins for cans and bottles must be placed within 50 feet of all drink or sales locations; must be immediately adjacent to each garbage pail.
2. Recycling bins for cans and bottles must be placed behind each drink or sales location so vendor recycles empties.
3. Recycling bins must be placed throughout the event area adjacent to each trash bin.
4. Cardboard from event vendors and organizers must be recycled. Collection points may be behind the scenes. Cardboard should be flattened or prepared as required by the recycling contractor, if one is hired.
5. All recycling bins and locations must be properly and clearly marked, and must be monitored to ensure recyclables are not contaminated by waste. This will reduce the time organizers need to spend sorting out trash from the recycling bins.
6. All recyclables should be delivered to the City's Transfer Station on Rockland Key, either by an event staff person or by a recycling contractor, unless other recycling arrangements have been made.



How to Recycle?

This Guide includes two checklists that walk you through the process of planning and implementing an effective recycling program.

Recycling Program Planning Checklist

An effective recycling program requires planning, organization, and forethought. From the event management team to vendors to attendees – understanding the responsibilities of each party facilitates a smooth and successful process. **A completed copy of this checklist must be submitted with the Special Event Recycling Plan Form.**

Recycling

- Designate a Recycling Coordinator (RC):** The RC will be responsible for oversight of the recycling program from development through execution. This person should be familiar with all aspects of the special event including administration, maintenance, and types of vendors. The RC should be a member of the event management team.
- Designate a Recycling Team:** A Recycling Team will be needed to support the RC, especially for larger events. Team member responsibilities might include educating vendors and attendees, overseeing recycling bins to minimize contamination and ensure they are emptied when needed, and documenting program success.
- Engage event sponsors and vendors in recycling program development:** Sponsors may be willing to provide support for the program to help advertise their participation in the event. Sponsors can also be tapped for technical assistance if they have recycling experience. Including vendors, who are a large – if not the largest – source of recyclables and waste generated at the event, in program development will help encourage their buy-in.
- Identify the recyclable materials that will be generated:** This includes both by the public and behind the scenes. Talk with vendors to find out what types of products they plan to distribute and in what containers, as well as the type of packaging in which these products will be delivered to the vendor. **Work with vendors to select reusable or recyclable containers and packaging.**
- Estimate quantities of recyclables:** Quantities may be estimated based on past experience, by information provided by vendors, or by the past experience of your recycling contractor, if one is utilized.
- Select and lease/purchase recycling bins and supplies:** Remember that a recycling bin must be matched with every trash bin. Two types of recycling bins may be necessary – small bins that attendees and vendors use throughout the event and one or more larger containers at consolidation areas. If you plan to work with a recycling contractor, work with them to determine if consolidation areas are necessary, and what type and how many containers should be used there. The contractor may also be able to supply bins for use throughout the event.

When selecting recycling bins, they should be:

- Easily distinguished from trash bins – using different colors is a good idea.
- Lidded with holes or slots for the desired recyclables in order to avoid contamination.
- Clearly labeled as recycling bins showing the recyclables accepted – words & pictures work best.





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Folding stands with plastic liners are commonly used for event recycling because they are collapsible and portable, easy to set up and take down, re-usable, and self-advertise which materials should be placed in them when used with clear liners. Appendix A provides additional sources of information.



- Arrange for collection and removal of recyclables/select a recycling contractor:** Develop a plan for consolidating recyclables collected throughout the event area, and for removal of recyclables from these consolidation points. This may be done by the Recycling Team, volunteers, vendors, and/or a hired contractor. If using a contractor, contact the company well in advance of the event to discuss available recycling bin/container types, recommended placement of these bins/containers, service level and frequency, and collection fees. The City's franchised waste hauler, Waste Management (305-296-2825), is a local service provider.
- Arrange for tracking the quantity of recyclables collected:** Request the recycling contractor or staff to record the recyclables collected by weight, volume, or container count, as well as any contamination issues.
- Submit this completed checklist with the Special Event Recycling Plan Form and the \$1,000 security deposit to the City.**

Waste Reduction

Reducing the amount of waste generated is even better than recycling. To strive for a low or zero waste event, organizers should strive to reduce the amount of waste generated and request vendors to do so as well.

One of the easiest ways to reduce waste is to not create it at all.

- Use double-sided printing for promotional materials and handouts.
- Avoid mass distribution of handouts; distribute information electronically. Vendors can have sign-up sheets to transmit information via e-mail following the event.
- Sell or serve beverages in reusable rather than single-use containers.
- Purchase condiments in bulk quantities rather than single-serving packets.
- Choose/request products that use little or no packaging.
- Donate excess food to charitable organizations or allow attendees or staff to take extra servings home with them.
- Be sure catering staff is trained to implement environmental procedures.
- Encourage re-usable displays that are not disposed after each event.

Environmentally Preferable Purchasing (EPP)

EPP incorporates environmental principles and criteria into the selection and procurement of goods and services. Event organizers should implement EPP practices, including the purchase of recycled-content products, whenever possible, and encourage vendors to do so as well. Purchasing recycled-content products helps to close the recycling loop. Appendix A lists sources of information about EPP.



Recycling Program Implementation Checklist

This checklist lists steps that will help ensure the recycling program runs smoothly and is successful. **This checklist must be submitted with the Post-Event Recycling Form.**

- Clear and simple written recycling procedures:** Written instructions should be simple and unambiguous, and should include what materials will be recycled, how and where they should be placed, how to encourage attendee participation, and who to contact for any questions. Pictures of targeted recyclables can be helpful. When describing recycling procedures, be sure to identify not only targeted items but also list contaminants.
- Recycling bin delivery and placement adjacent to every trash bin:** Delivery and placement of recycling bins should occur prior to other event setup activities to enable recycling during event setup. Vendors typically generate large quantities of cardboard. Paired sets of recycling and trash bins should be placed in the areas where attendees will be concentrated, in the vendor/exhibit areas, and in highly visible and trafficked areas such as on main thoroughfares and entry and exit points. Order liners for the recycling and trash bins that are equal to or larger than the bins. Recycling liners should be clear so recyclables are not confused with trash.
- Clearly and accurately labeled recycling bins:** Both lists and pictures of accepted recyclables are most effective.
- Signs:** Order and place signs to inform attendees of recycling. Signs should be placed at point-of-purchase locations and recycling bins. Recycling signs should have a consistent theme and color so they are easily recognized by attendees. At the end of the event, signs should be removed and saved for future events, if feasible, or recycled.
- Recyclables consolidation and collection:** Whether using custodial staff, event staff, or volunteers, those who will be handling recyclable materials will need proper training to ensure all understand the recycling procedures. Consolidation also provides an opportunity to remove additional contaminants, such as food and plastic film, and to flatten all cardboard boxes.
- Event staff training:** All event staff should be well educated on recycling procedures so they can advise vendors and attendees if needed.
- Vendor training and assistance:** Written recycling procedures should be included in vendor packets. Let vendors know whether recycling bins will be provided to them or if they are responsible for obtaining such bins for their own recyclables. If your event enters into contracts with vendors, specific requirements for recycling at the event should be included in the contract. Encourage and ask for their support. Ask vendors to promote recycling to event attendees.
- Recycling monitors:** Staff or volunteers should be assigned to monitor recycling bins in specific areas of the event to ensure no comingling of recyclables and trash. Full recycling and trash bins should be emptied as regularly as needed to avoid cross-contamination.
- Photos:** Take photos of recycling bins and behavior during the event to document the program and for future program improvements.



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- Attendee education:** Attendee education can occur through multiple channels, including clearly marked recycling bins; signage; verbal communication via event staff, volunteers, and vendors; information in event programs; announcements in opening remarks and over a loud speaker; etc. Use multiple methods to achieve the most success.
- Removal of recyclables:** At the end of the event, make sure all recycling bins have been emptied and all recyclables have been removed from the consolidation/pickup areas.
- Tracking and reporting:** Ensure the entity responsible for tracking recycling, whether the recycling contractor or event staff, records the weight, volume, or number of containers of recyclables that are collected, as well as any contamination issues. This information must be included on the Post-Event Recycling Form. If your event occurs annually, you can work toward increasing your success every year!
- Vendor, staff, and volunteer feedback:** Solicit feedback in order to improve the recycling program at your next event.
- Share the results with vendors, staff, and volunteers.**
- Post-Event Recycling Report:** Complete the Post-Event Report provided in this Guide, along with any supplemental information. Accurate reporting, along with candid feedback from event organizers, will help the City evaluate and improve on its Special Events Recycling Program. **Following approval of your Post-Event Recycling Report, the \$1,000 security deposit will be returned.**



Special Event Recycling Plan Form

Event organizer must submit this application, along with a completed Special Event Planning Checklist and a \$1,000 recycling security deposit to _____. The application must be reviewed and approved prior to submitting a Special Event Application to the City Manager’s Office.

Event/Venue Name: _____

Date(s): _____

Sponsoring Organization: _____

Primary Event Contact: _____

Phone: _____ Email: _____

Event Recycling Coordinator: _____

Phone: _____ Email: _____

Description of Event: _____

Estimated Number and Types of Vendors: _____

Estimated Number of Attendees (daily and total): _____

Recyclable Materials Targeted for Recovery:

- | | | |
|--|---|--|
| <input type="checkbox"/> Aluminum/Steel Cans | <input type="checkbox"/> Plastic Containers | <input type="checkbox"/> Glass Bottles |
| <input type="checkbox"/> Cardboard | <input type="checkbox"/> Other Paper | <input type="checkbox"/> Wood; Pallets |
| <input type="checkbox"/> Other: _____ | | |

Estimated Type and Number of Recycling and Trash Containers (1 recycling for every trash container):

	Recycling	Trash
32-Gallon		
64-Gallon		
95-Gallon		
Dumpster-___ cy		
Dumpster-___ cy		
Roll-off - ___ cy		



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Recycling Collection Service Provider: _____

Contact Person: _____ Phone: _____

Describe Service (e.g., Frequency): _____

Garbage Collection Service Provider: _____

Contact Person: _____ Phone: _____

Describe Service (e.g., Frequency): _____

Attach a copy of the written recycling procedures and other waste reduction and environmentally preferable purchasing procedures that will be used during your event.



Post-Event Recycling Report

This report must be completed and submitted to _____, along with a completed copy of the Special Event Implementation Checklist, in order to be reimbursed the \$1,000 recycling security deposit.

Event/Venue Name: _____

Permit Number: _____ Dates: _____

Sponsoring Organization: _____

Primary Event Contact: _____

Phone: _____ Email: _____

Event Recycling Coordinator: _____

Phone: _____ Email: _____

Estimated Number of Attendees each day: _____

Recyclable Materials Recovered:

- Aluminum/Steel Cans Plastic Containers Glass Bottles
- Cardboard Other Paper Wood; Pallets
- Other: _____

Total Recyclable Materials Collected: _____ lbs/tons or _____ cubic yards

Total Trash Collected: _____ lbs/tons or _____ cubic yards

Recycling Rate (recyclable material/ (recyclable material + trash): _____%

Estimate of contamination:

- Mild Moderate Severe

Describe contamination and how it was handled: _____

Vendor Feedback: _____



**City of Key West
Special Event Recycling Guide**

Recycling Contractor Feedback: _____

Problems/Challenges Encountered and Resolution: _____

Attach additional information and photos to fully explain your recycling program and its effectiveness.



Appendix A: Additional Information

Local Resources

- City of Key West: <http://www.keywestcity.com/department/division.asp?fDD=15-204>
- Waste Management: www.wm.com Email: cssouthfl@wm.com Phone: 305-296-8297

Container Vendors

- Recycling Supply Co.: www.recyclingsupply.com
- Harbor Freight Tools: www.harborfreight.com
- Clear Stream Recycling: www.clearstreamrecycler.com
- Keptidy : www.Keptidy.com
- ULINE: www.uline.com
- The Ultimate Recycling Bins: www.RecyclingBin.com
 - One Earth Corporation: www.oneearthrecycle.com

Other Resources

- EPA Comprehensive Procurement Guidelines: www.epa.gov/cpg
- Comprehensive Procurement Guidelines – Supplier Database: <http://www.epa.gov/osw/conserves/tools/cpg/database.htm>
- Database of Environmental Information for Products and Services: yosemite1.epa.gov/oppt/epstand2.nsf
- Environmentally Preferable Purchasing: www.epa.gov/oppt/epp
- Pollution Prevention: <http://www.dep.state.fl.us/green/>
- FL Green Building Coalition: www.floridagreenbuilding.org/
- FL Organics Recycling Center for Excellence: www.floridaforce.org/
- Florida Statutes: www.flsenate.gov/Statutes
- Recycle Florida Today, Inc.: www.recyclefloridatoday.org/



City of Key West, Florida Fantasy Fest Waste Reduction and Recycling Program Recommendations June 2012

Key Program Partners

Linda O'Brien, Executive Director, Market Share Company
Jay Gewin, Utilities Manager, City of Key West
Greg Veliz, Community Services Director, City of Key West

Introduction

Fantasy Fest (FF) is a celebration held annually in late October in the City of Key West (City). Attendees often dress in costume while enjoying a variety of events and activities. The celebration begins with a parade on the Saturday evening before Halloween, and concludes the following Sunday with the Children's Day celebration at Bayview Park. The 10-day event also includes the Goombay Festival, Captain Morgan Fantasy Fest Parade (FF Parade), Duval Street Fair (Street Fair), Pretenders in Paradise, Fantasy Façade Decoration Contest, and a multitude of party events hosted by private businesses and bars. Market Share Company (MSC) has a five-year contract with the City to organize the two largest events – the FF Parade and Street Fair. Local groups or private entities are responsible for others.

FF provides an economic boost for the City and local businesses during a lull in seasonal tourism. An estimated 45,000 people visit the City to enjoy FF, almost double the City's resident population. Guests occupy approximately 7,000 rooms available for lodging in hotels, motels, bed and breakfasts, resort condos, and vacation rentals in and around the City. As the population of the City doubles, traffic congestion (both vehicular and pedestrian) and increased waste production become major challenges to providing solid waste and recyclables material collection during FF.

Through discussions with key program partners and review of information provided by these partners, a series of recommendations regarding potential waste reduction, recycling and environmentally preferable purchasing (EPP) activities for FF have been developed. Many of these recommendations were provided to the City and MSC to be implemented at FF 2012.

Historical Information

Historically, City crews collect both solid waste and recyclable materials generated during the FF Parade and Street Fair. They transport these materials to larger consolidation containers in the downtown area that are provided by Waste Management (WM) or to the City's Transfer Station. WM provides "on-call" service of the consolidation containers or in the event the City needs assistance. At some point during the festivities, the event becomes too congested for collection crews to access and service the trash and recycling containers. During FF 2011, approximately 70 tons of solid waste was generated, in addition to FF-related solid waste that was collected from businesses as part of regular commercial collection service.

In addition to the recycling containers normally located along Duval Street, the City also places recycling containers at every main intersection along Duval Street from Mallory Square to United Street. In 2011, Coca-Cola donated 120 recycling containers for use at FF and other special events in the City. Flag-signs were fitted to these containers in an effort to increase awareness by FF attendees.

Materials targeted for recycling include the following:

- Aluminum and steel cans
- Glass
- Plastics #1 and #2
- Paper products
- Corrugated cardboard

Recycling at large events such as the FF Parade and Street Fair presents challenges. MSC believes the following are the greatest challenges to improving recycling at FF:

- Dense crowds, which make it impossible to access dumpsters with front-end load vehicles or even, at times, to service or maintain smaller containers and carts.
- Need of additional recycling containers along the parade route and elsewhere in Old Town.
- Widespread use of single-use plastic "to-go" beverage cups.
- Inability to control recycling activities and contamination in a non-gated event.
- Need for additional technical assistance from the City.

MSC does not maintain data regarding the amount of garbage or recyclables collected at FF, citing difficulty obtaining data with current staff levels. The company has three full-time employees to oversee FF preparation and operations. MSC has not yet developed a formal waste reduction and recycling program plan or goals.

MSC does report that the cost for City services, including solid waste and recyclable materials collection, is approximately \$60,000 per year under the current five-year contract with the City.¹ If more detailed information pertaining to garbage and recycling collection and disposal costs were available, the potential cost savings and benefits to MSC of establishing a comprehensive waste reduction and recycling program plan could be evaluated. Benefits to the City include a \$70 per ton cost savings from every ton of waste diverted from disposal and an enhanced recycling rate.

¹ This cost includes services provided by the City other than solid waste collection, including Fire and Police support.

Solid Waste and Recycling Program Recommendations for 2012

City, MSC, and KCI staff discussed the following action items in the fall of 2011. Unfortunately, this was too late to be implemented in FF 2011. As such, MSC agreed to make an effort to implement these recommendations during FF 2012.

1. Increase the number of clearly marked, color-coded recycling and trash containers along major event thoroughfares and common areas.
2. Increase “behind the scenes” recycling efforts and public access to recycling opportunities at commercial bars and restaurants.
3. Obtain from the City Transfer Station the weight ticket for recyclable materials recovered from the FF Parade and Street Fair.
4. Coordinate City staff and hauler efforts to obtain material weight or volume information.
5. Utilize large, wheeled recycling carts and designate a drop-off site for these materials.
6. Add recycling information and support materials to the FF website.
7. Provide recycling information to attendees and local businesses including Code of Conduct information cards with a recycling protocol for FF events.
8. Stress recycling in conventional and social media (i.e., press releases and PSAs with information about recycling at FF events).
9. Provide recycling collection bags to all parade floats and designate an on-route drop-off for collection.
10. Support Event Coordinators and participating businesses by assuring they have well-marked recycling containers and “FF Recycling Partner” stickers, designed and supplied by FF organizers.
11. Utilize volunteers to monitor garbage/recycling stations.
12. Require vendors to use and maintain separate collection containers for recyclable materials.
13. Request vendors to reduce packaging brought to the site.

In addition, a visual waste assessment should be performed during a future FF to obtain valuable information for identifying additional recycling and waste reduction opportunities.

Recommended Planning Timeline

Provided below is a recommended annual planning timeline for FF event planners to prepare and implement a waste reduction and recycling program. The use of this timeline requires leadership from a City Recycling Program Management (RPM), who will play a key role in maintaining a partnership between the City and MSC necessary for a successful program.

Countdown to FF	Recommendation
10 months prior	<ul style="list-style-type: none"> • City and MSC meet to discuss event plans, set recycling goals, and establish a Volunteer Green/Recycling Team (GT) • Begin development of a recycling policy • Initiate a souvenir “one-cup” program to decrease the number of the cups disposed during the event
9 months prior	<ul style="list-style-type: none"> • Identify and address unique FF recycling and solid waste issues • Delegate responsibilities pertaining to containers, collection, processing, marketing/outreach and reporting
8 months prior	<ul style="list-style-type: none"> • Review status of action items, problems, and solutions
7 months prior	<ul style="list-style-type: none"> • Identify recycling volunteer needs and event assignments • Draft notice for recycling volunteers • Quantify volunteer time in 2 hour slots; 1 volunteer per station
6 months prior	<ul style="list-style-type: none"> • MSC, City, and GT meet to discuss container, collection, and operational needs
5 months prior	<ul style="list-style-type: none"> • Procure container quantities and collection services • Map container distribution and collection points • Design recycling logo and memorabilia (buttons, bags, t-shirts) with an emphasis on procuring recycled content products
4 months prior	<ul style="list-style-type: none"> • Update task status • Seek community support for volunteers and program sponsorship (Business Community) • Procure printing services for memorabilia, specifying recycled content
3 months prior	<ul style="list-style-type: none"> • Ensure all website information about FF’s recycling program is current
2 months prior	<ul style="list-style-type: none"> • Finalize all program planning and volunteer action items; regroup or redirect where necessary
1 month prior	<ul style="list-style-type: none"> • Notify local media of recycling program • Conduct volunteer training event #1
2 weeks prior	<ul style="list-style-type: none"> • Reaffirm program plans, volunteer count • Develop volunteer schedule
1 week prior	<ul style="list-style-type: none"> • Finalize volunteer schedule
1 day prior	<ul style="list-style-type: none"> • Receive/distribute containers and signage throughout event site • Set-up volunteer headquarters • Consolidate and pack all necessary volunteer equipment/supplies/first aid kit • Conduct volunteer training #2
During the Event	<ul style="list-style-type: none"> • Maintain communication with volunteers • Monitor contamination
Post Event	<ul style="list-style-type: none"> • Collect recycling and solid waste tonnage data; calculate recycling rate

Elements of a Comprehensive Program Plan

This section outlines the components of a broader, more comprehensive waste reduction and recycling plan for all FF events. The comprehensive plan incorporates multiple program elements and may require a phased approach overseen by the RPM. Through dedicated efforts on the part of the RPM, the City and other key program partners, the comprehensive plan should be established within a five-year period.

Targeted Events

Events in which large waste reduction and recycling efforts can be targeted:

- Goombay
- Parade
- Street Festival Fair
- Pretenders in Paradise
- Children's Day
- Private Events at Bars

Event Partners

Administration and management partners available to facilitate waste reduction and recycling efforts:

- Event Managers
- Local Business Community
- Sponsors
- Parking and Transportation
- Media (TV, radio, paper, social media)
- Green Team

Green Team

Most large festival events that achieve recycling and waste reduction goals do so with the help of a Green Team. The Green Team is a volunteer committee formed by event coordinators or managers with a designated chairperson to help oversee program efforts. The purpose of this team is to provide assistance and support to event planners with the development and implementation of a successful recycling program. Green Teams generally consist of 3-10 people, each with specific task responsibilities. These responsibilities may include, but are not limited to, mapping recycling stations; coordinating volunteer efforts; and providing support to sponsors, event partners, and local businesses. Members of Florida Keys Green Living and Energy Education (GLEE) may be able to provide a wealth of information and assistance with establishing a coordinated and planned volunteer team.

Garbage and Recycling Containers

The following recommendations serve to increase public awareness, increase materials recovery, and reduce contamination concerning garbage and recycling containers:

- Increase the number of recycling containers along major event thoroughfares and common areas
- Provide access to recycling containers at commercial bars and restaurants along major event thoroughfares
- Provide recycling containers alongside garbage containers to prevent contamination
- Clearly label and color-code garbage and recycling containers
- Create garbage and recycling stations that are flagged, under tents, or that stand out
- Use volunteers to monitor contamination

Education and Outreach Materials

The success of any waste reduction and recycling program is heavily dependent on program awareness. Education and outreach material provided to attendees should inform them of proper recycling protocol. Consider the following when preparing education and outreach materials:

- Brand the recycling and/or environmental program: A GREEN Fantasy Fest
- Create a FF recycling logo or use the City's recycling logo on all printed materials (flags, banners, merchandise)
- Identify a GREEN FF Mascot/Ambassador to distribute reusable promotional materials (i.e., bracelets promoting the GREEN message)
- Create a GREEN FF Program website/Facebook/Google+ page with waste reduction and recycling information including pictures of what to recycle and where
- Use social media messenger services (i.e., Twitter, Google+ or Facebook Messenger) to distribute recycling information
- Develop business FF Recycling Partner window stickers for local businesses
- Conduct PSAs on TV, radio, and in local papers
- Include recycling program information in event press releases
- Conduct announcements during events
- Display a "Recycling Thermometer" with estimates of recycling rates at events

Merchandise

- Market t-shirts or other textile products produced with recycled content
- For all printed materials, use paper with at least 35% post-consumer recycled content
- Ensure promotional materials are re-useable or recyclable

Parades

- Provide clearly marked recycling collection bags for parade floats; designate a drop-off point at the end of the route where floats pass to drop the bags
- Inform parade participants to encourage patrons to recycle with a slogan
- Create a FF Green Team or float to participate in parades

Street Fair/Local Businesses

- Identify how many businesses are located in event areas and which ones recycle
- Provide a recycling kit with information on how to recover more material, steps on how to start a recycling program, collection service providers, EPP, and a FF Recycling Partner window sticker
- Encourage businesses to agree to use/sell/honor re-useable souvenir cups or recyclable cups (plastic #1)

Hotel, Motels, Bed & Breakfasts

- Encourage local hospitality businesses to procure recycling services at their location (if they do not already); provide them with the local business recycling kit mentioned above
- Create and provide a postcard-sized "point of purchase" (POP) stand for check-in desks that promotes recycling to FF guests

Volunteers

- Develop and coordinate a dedicated recycling volunteer team
- Prepare volunteer action plans for:
 - Public education
 - Vendor and sponsor education
 - Local business support including the distribution of recycling information materials
 - Recycling station monitoring
 - Post event garbage and recyclable material sorting
- Train volunteers prior to the event and the day of the event
- Provide incentives for volunteers to participate with t-shirts, food/beverages, credit for student volunteers, stipend (\$5/hour or FF memorabilia) or free admission tickets/gift certificates

Sponsors/Vendors/Suppliers

- Provide a Sponsor or Vendor packet including information on:
 - Waste reduction applications for promotional items
 - Buying recycled-content material and EPP
- Notify sponsors of opportunities to support FF recycling efforts by providing recycling containers, signage, media/press, volunteer t-shirts, and memorabilia
- Request or require vendors and suppliers reduce packaging brought to the site
- Request or require vendors and suppliers purchase items packaged in recyclable materials
- Request or require vendors and sponsors utilize permanent or re-useable displays

Mandatory Participation

At large events such as FF, the ability to leverage partnerships through contracts with vendors, suppliers, and sponsors make mandatory recycling and waste reduction possible. Consider making the waste reduction and recycling program mandatory with the following elements:

- Mandatory requirements for participating vendors/sponsors:
 - Environmentally preferable purchasing (EPP)
 - Recyclable packaging materials only
 - Behind the counter recycling containers
 - Reusable merchandise only (cups, bags)
 - All printed materials contain recycled paper content
- Mandatory recycling requirements for businesses/restaurants on the parade routes:
 - Coordinate with the recycling vendor to provide discounted commercial recycling services 30 days before and one week after FF
 - Organics collection once a processing infrastructure is in place

Post FF Garbage Sort

- One option to increase recyclables recovery and reduce the amount of garbage disposed is a post-event sort. Work with collection haulers to consolidate garbage daily, and deliver it to a

City location. Volunteers or temporary labor can sort recyclables from the garbage collected daily, periodically, or after the final event day. Post-sorting provides maximum recovery potential for non-gated events.

Conclusion

These program recommendations are intended to assist the City and FF with planning and improving waste reduction and recycling efforts at future Fantasy Fests. Both the annual timeline and the comprehensive plan incorporate multiple program elements and seek to build upon the accomplishments of previous events. To implement these recommendations, dedicated oversight by a City Recycling Program Manager is critical. The RPM also plays a key role in maintaining a productive partnership between the City and event planners and staff to help work toward maximizing recycling at all FF events.

Appendix I

C&D Debris Waste Diversion

Construction and demolition debris (C&D) recovery generally occurs in three ways:

- Direct reuse of materials, which recoups the highest value, occurs when a structure is deconstructed (taken apart piece by piece) rather than demolished, or salvaged in usable form. Items such as windows, decorative hardware, and clean wood can be used in new construction. No C&D reuse or salvage businesses were identified in or near Key West.
- Reuse after undergoing physical alteration, such as crushed brick or concrete used in roadbeds or drainage. Of the C&D debris generated in the City, approximately 43% of what was recycled was concrete. According to WM, concrete recovered at its facility is delivered to Toppino & Sons, Inc. on Rockland Key.
- Remanufacturing products from C&D, such as land clearing debris that is chipped to produce mulch or metals that are reconditioned and marketed. Land clearing debris received at the WM facility is shipped to the Pompano Landfill, where it is ground and used as cover. Metals recovered at the WM facility are shipped to Sun Recycling in Miami for recycling.

C&D recycling has been expanding nationally and, more recently, within Florida. For example, Sun Recycling operates ten C&D facilities in Palm Beach, Broward, and Dade counties and is reportedly recycling up to 90% of materials received at these facilities.

Policy and program options to encourage the recycling of C&D generally fall into one of three categories: regulation, economic incentives, or education. Table 1 provides examples of mechanisms in each of these categories that have been used by local governments. This appendix provides examples of effective C&D recycling programs implemented by several local governments that have achieved substantial C&D diversion rates.

Table 1: Mechanisms Utilized to Increase C&D Debris Recycling

Regulation	Economic Incentives	Education
<ul style="list-style-type: none"> • Disposal bans • Mandatory recycling • Permit requirement • Facility regulations - require processors to meet recycling targets • Mandatory Green Building standards 	<ul style="list-style-type: none"> • Diversion security deposits • Differential tip fees for segregated materials • Material exchanges • Grants or low interest loans 	<ul style="list-style-type: none"> • Education and technical assistance • Educate by example through government building projects • Voluntary Green Building programs

Historically, state and local governments have sought to stimulate voluntary C&D recycling by employing education and economic incentives before adopting direct regulatory methods. In 2010, the Florida legislature enacted HB 7243 that states:

“ ... to the extent economically feasible, all construction and demolition debris must be processed prior to disposal, either at a permitted materials recovery facility or at a permitted disposal facility. This paragraph does not apply to recovered materials, any materials that have been source separated and offered for recycling, or materials that have been previously processed.” (Section 403.707(9)(g), F.S.)

The law, however, does not include any reporting or enforcement mechanisms.

Provided below are several examples of effective C&D recycling programs implemented by local governments. They demonstrate the use of a variety of approaches, and all have achieved substantial C&D diversion rates.

Lee County, Florida

In 2008, Lee County began requiring at least 50 percent diversion of debris generated by a C&D project. Contractors must submit a C&D management plan prior to construction and proof of recycling prior to the final building inspection. If the 50 percent target is not met, the contractor incurs a diversion fee based on the type and size of the project. As of July 2011, Lee County reported that 75 percent of finalized projects participated rather than paid the fee, resulting in a 70 percent diversion rate.¹

San Jose, California

San Jose employs a two part program: (1) all builders must send C&D to a certified processing facility and (2) to become certified, a facility must divert 90 percent of all inert solids accepted (e.g., concrete, brick) and 50 percent of all mixed C&D. Builders pay an advance deposit when applying for a building permit, which is refunded upon providing proof that materials were delivered to a certified facility. San Jose has achieved 98-100 percent recovery of inert materials and 70 percent recovery of mixed debris. The city is currently exploring the possibility of raising its recycling targets to 90 percent for inert materials, 90 percent for green waste, and 60 percent for mixed debris.²

Chicago, Illinois

In Chicago, building contractors are required to recycle 50 percent of C&D and must submit proof of recycling within 30 days after completion. If the target is not met, the contractor is fined for each percent it falls below the recycling target. All documents must be submitted and fines paid before the city will issue an occupancy permit.

¹ Keith Howard, Lee County Solid Waste Division, telephone interview, July 2011.

² Mr. Jordan Ciprian, Program Manager, San Jose Construction and Demolition Diversion and Deposit Program, telephone interview, Spring 2008.

King County, Washington

King County requires all public building projects to achieve LEED® Gold certification. The county provides technical assistance, hands-on training, and incentives to create and sustain green buildings and developments through its Green Tools program. Incentives include grants for commercial projects seeking LEED® certification and residential projects achieving 4 or 5 star Built Green certification.

San Francisco, California

San Francisco's ordinance requires all C&D in amounts of one cubic yard or greater generated in the course of a construction, demolition, or remodeling project to be transported offsite by a registered transporter or the owner of the property where the C&D was generated, and taken to a registered facility. Registered facilities are required to demonstrate they recover at least 65 percent of all C&D debris received. Any person applying for a permit for full demolition of an existing structure must submit a waste diversion plan that provides for a minimum of 65 percent diversion of C&D from landfills, including materials source separated for reuse or recycling. The plan must be submitted to and approved before a full demolition permit will be issued. Violators may be fined a civil penalty of up to \$1,000 for each day in which the violation occurs for the first violation, and a civil penalty between \$1,000 and \$5,000 per day for the second violation. San Francisco cites its mandatory C&D recycling ordinance as a key factor in achieving a citywide recycling rate of 72 percent.

While programs implemented in these communities are exemplary of what can be accomplished with proactive C&D recycling policies, the City of Key West faces unique challenges. The City's ability to incentivize or require contractors to separate C&D at the jobsite for reuse or recycling is limited by the apparent lack of local markets other than two private C&D facilities: WM's Rockland Recycling Center, located on Rockland Key, and Key West Transfer Station & Hauling Services, located on Stock Island. The City also is limited in its ability to place recycling requirements on these two private C&D facilities because neither is located within the City limits. Therefore, the City's approach likely will need to focus on cooperative working relationships with the two private C&D firms, as well as encouraging development of reuse opportunities.



TECHNICAL MEMORANDUM

TO: Jay Gewin
Key West Utilities Manager

FROM: Robin Mitchell, Project Manager
Don Ross, Senior Consultant

DATE: June 16, 2011

SUBJ: **Analysis of Staffing and Transfer Station Operations**

PROJ #: 120-00.00

Per Task 4 of Task Order 1, Kessler Consulting, Inc. (KCI) evaluated the staffing level of the City of Key West's (City) solid waste operations and conducted an operational analysis of the City's Transfer Station located on Rockland Key. This memorandum provides general comments on the appropriateness of current staffing levels, observations and findings regarding current operation of the Transfer Station, comparison with other publicly operated transfer stations, and recommendations the City can leverage for a more efficient transfer facility operation.

Solid Waste Staffing Levels

The City's FY 2010/11 solid waste budget includes funding for 4.15 full-time equivalent (FTE) administrative/management positions, as listed below:

- Utilities Manager (1.0 FTE)
- Code Compliance Inspector (1.0 FTE)
- Collection/Customer Service Representative (0.8 FTE)
- Contract and Permit Engineer (0.4 FTE)
- Administrative Aide/Utilities (0.4 FTE) – position not filled
- General Services Director (0.3 FTE) – position not filled
- Assistant City Manager (0.2 FTE)
- Revenue/Customer Service Supervisor (0.05 FTE)

The City also employs six people at the Transfer Station. Staffing levels for the Transfer Station will be discussed later in this document.

It is our understanding that the City is currently reviewing the allocation of administrative/management positions between departments to ensure the budgetary apportionments are consistent with how actual staff time is expended. For example, the Utilities Manager position is funded entirely through solid waste, but the position responsibilities also include managing sewer and stormwater operations. In addition, the Contract and Permit Engineer position has assisted with landfill issues in the past, but likely does not spend 40 percent of an FTE on solid waste issues at the present time.

Two positions are currently unfilled. Because of reorganization, City staff has suggested eliminating the General Services Director position and instead using some of the funds from that position for a Revenue Collections Manager. This position would help address the City's high level of delinquent payments of residential solid waste billings. The Utilities Manager has also proposed altering the Administrative Aide position to include Recycling Coordinator responsibilities.

Comparing staffing levels between jurisdictions is extremely difficult because of differences in the types of services provided, how they are provided (public versus contracted), whether facilities are publicly owned and/or operated, and how costs are allocated. KCI reviewed the FY 2010/11 budgets of three cities of comparable size to Key West: Naples (pop. 21,121), Temple Terrace (pop. 23,906), and Venice (pop. 21,846). Naples and Venice provide collection using city crews, but Table 1 lists the positions that could best be identified as administrative or management (i.e., equipment operators, crew leaders, and service workers are not included). The number of administrative/management positions allocated to solid waste in these three cities ranges from 2.65 to 4.50 FTE. All have a full-time manager, but none of them specifically include city management, code compliance, or engineering positions in their lists of solid waste positions. Two cities specifically designate a Recycling Coordinator or Foreman.

Table 1: Solid Waste Administrative/Management Positions, FY 2010/11 Budgets (FTE)

Similarly Titled Position	Key West	Naples	Temple Terrace	Venice
Manager/Supervisor/Foreman	1.00	1.00	1.00	1.00
Code Compliance	1.00	-	-	-
Collections/Customer Service	0.80	0.50	0.70	-
Customer Service Supervisor	0.05	-	-	-
Contract & Permit Engineer	0.40	-	-	-
Administrative Aide	0.40	1.00	0.40	-
General Manager/Superintendent	0.30	1.00	0.55	1.00
Assistant City Manager	0.20	-	-	-
Recycling Coordinator/Foreman	-	1.00	-	1.00
Total	4.15	4.50	2.65	3.00

The City's 4.15 administrative/management solid waste FTEs does not seem unreasonable; however, the City should review and adjust the FTE positions apportioned to solid waste based on the results of the allocation review currently being conducted. This reallocation could potentially "free up" sufficient FTE time to either establish or redefine positions for a full-time Revenue Collections person and a full-time Recycling Coordinator. If the City is serious about substantially expanding recycling, a full-time coordinator will be needed to provide technical assistance, outreach, monitoring and tracking, etc. – in other words, to be an overall champion for the program.

Transfer Station Site Visit

KCI staff conducted a site visit of the Transfer Station on February 28 and March 1, 2011, specifically to observe and evaluate facility operations. City staff members working at the facility were very cooperative and helpful in orienting KCI staff with the operation and answering questions. In addition to touring the facility, KCI staff observed scale house processes, inbound waste deliveries, and outbound waste loading; conducted facility and equipment inspections; and interviewed a number of employees and customers to elicit feedback on facility operations.

General Observations

The Transfer Station is a recently constructed facility, opening in 2009 after moving operations from the former waste-to-energy plant on College Road. The facility includes fully paved ingress and egress roads, scale house, administration building including maintenance garage, stand-alone two-bay garage, and waste transfer building, all located within a fully fenced perimeter. The facility is designed to process 350 tons of solid waste per day. The waste transfer tipping floor is located above grade to provide for loading bays slightly below grade. The facility has two drive-through outbound loading bays located to the east and west ends of the tipping floor. Once a tare weight is recorded, transfer tractor-trailers enter the loading bay from the rear through overhead doors. Once loaded, transfer tractor-trailers exit the front of loading bay and proceed to the scale for outbound weighing.

The tipping floor is fully enclosed, utilizing two 25-foot overhead doors for entry and exit of waste delivery vehicles. According to the facility Operations and Maintenance (O&M) Plan approved by the Florida Department of Environmental Protection (FDEP), these doors must remain closed at all times, and can only be opened when a vehicle enters or exits the tipping floor. The purpose of keeping these doors closed is to prevent the attraction of birds that could interfere with U.S. Navy aircraft operations in the immediate area.

Generally, the Transfer Station facility exterior areas were very clean. There was no litter or waste spills observed outside of the tipping floor and the property was well kept and maintained. This is a direct result of the permit requirement for loading bay doors to remain closed unless a vehicle is entering or exiting. Staff was observed mowing and raking the property as well.

Figure 1: Transfer Station – Exterior View



One of the two tipping floor doors (east) was out of service during the site visit, requiring all waste deliveries to occur through the west door. The door had been out of service for at least four months. City purchasing policy requires three quotes before proceeding with repairs, and the Transfer Station

manager indicated that he was experiencing delays in obtaining a third quote. The door has since been repaired, as evidenced by KCI staff conducting the second waste composition study event during the week of April 4-8, 2011.

As a result of excessive use due to the permit requirement, staff indicated that door failures are common. A broken door limits access to the tipping floor by 50 percent. The City should investigate the possibility of competitively procuring overhead door maintenance services with a list of standard replacement parts in order for staff to expedite repairs via a single service provider.

Opening and closing of these bay doors slow the waste delivery process and can impact operations by up to one hour each day as it takes approximately one minute to fully open a door.

In KCI's experience, this type of large, overhead roll door, as most commonly used in transfer stations and recycling facilities, is typically opened at the beginning of the shift and then closed at the end of the shift. It does not cycle open and close as frequently as the doors at the City's facility. Based on current demand, each tipping floor door at the City's Transfer Station could open and close over 25 times each day. The City should investigate alternatives to these slow and maintenance-prone doors while meeting the intent of the O&M Plan. One alternative could be to test the use of plastic curtains to contain litter and eliminate birds; however, research should be conducted to insure that any alternative complies with permit requirements.

A number of self-haul vehicles deliver residential and commercial recyclables and small volumes of waste. The tipping floor is a busy and dynamic work environment designed for large self-unloading vehicles. It is dangerous for residents, who may be unfamiliar with the operation, to drive personal vehicles into the facility and exit their vehicle to dump a recycling bin or trash can. The City should determine if a fully enclosed storage container, located outside of the building for use by these small generators, meets the intent of the permit. A roll-off container could be located away from the facility on City property, or possibly within the structure that was designed to store cardboard. Redirecting smaller vehicle traffic away from the tipping floor will provide for a safer and more productive tipping floor.

Hours of Operation

The facility operates between the hours of 6:00 AM and 4:00 PM Monday through Friday, and 6:00 AM until 2:00 PM on Saturdays. According to the O&M Plan, the facility does not accept waste after 3:00 PM during the work week, and after 1:30 PM on Saturdays. According to staff, this extra hour of operation is designed to allow for facility clean-up and machine maintenance. In order to control manpower overtime, the operating hours Monday through Friday require a split-shift staffing model. Two operators (scale and machine) open the facility at 6:00 AM and work until 2:30 PM, each taking a 30-minute break for a total of 8 hours worked. The second set of operators (scale and machine) start work at 7:30 AM and work until 4:00 PM, each taking a 30-minute break for a total of 8 hours worked. Operators overlap in the middle of the day for lunch break coverage, to conduct facility groundskeeping around the property, and for other duties as assigned. The operating hours are also included in the City's solid waste collection agreement and waste transport and disposal agreement.

Staffing

The facility is currently staffed with six employees: a manager, an equipment mechanic, two scale operators, and two machine operators. The scale and equipment operators are cross-trained to operate both the scale house and the rubber tire wheel loaders. The equipment mechanic was not present during the site visit so it was difficult to assess skills and workload; however, based on KCI's knowledge of scale house operations, a full-time mechanic is atypical for an operation of this size. City staff indicated that the mechanic was out for a period of time due to illness, and that obtaining reliable equipment maintenance service during that time was a challenge because of the remote location of the Transfer Station.

The facility manager was available throughout the day for questions and was periodically observed in the scale house and on the tipping floor. The manager noted that the remote location of his office contributed to his limited availability. Since the site visit, the manager's work space has been relocated to the first floor of the administration building, which should enhance management oversight of the facility.

After 7:30 AM, two machine operators are available to conduct loading operations and spotter duties. One employee was observed in the wheel loader the majority of the time moving waste and loading outbound tractor-trailers. The second operator was observed sitting in a chair operating the overhead door controls, but did not consistently inspect loads for unacceptable waste or control vehicle traffic.

Despite the permit requirement that bay doors must remain closed, the west delivery door was left open between 6:00 and 7:00 AM. It appeared the door was left open while the lone machine operator loaded an outbound tractor-trailer and deliveries could still be accepted, although a number of Waste Management (WM) drivers were seen operating the overhead door.

In an effort to minimize overtime, the scale and equipment operators rotate schedules each week. One scale operator and one machine operator open the facility at 6:00 AM Monday through Saturday, and then shift their starting hours to 7:30 AM the following week, working only Monday through Friday. The two employees that work on Saturday earn overtime when working the six-day rotation.

Processing Capacity

Although the Transfer Station is designed and permitted to accept up to 350 tons of solid waste per day, the O&M Plan indicates the facility processes 195 tons per day on average. Based on FY 2010 tonnage records, approximately 158 tons per day were processed, including recyclables, which means the facility is operating, on average, at 45 percent of its permitted capacity.

The six-employee staffing model currently in use is designed to operate the facility 58 hours per week, as outlined in the O&M Plan. However, since the facility is not operating at capacity, an opportunity exists to reduce the facility's hours of operation and subsequent operating expenses. Any change in facility hours of operation would require an update to the O&M Plan, approval from FDEP, and modification of the Collection Agreement and Transfer and Disposal Agreement with WM.

Daily Activity Analysis

KCI reviewed detailed scale transaction data for the weeks of February 21-26, 2011 and April 4-9, 2011 to analyze facility activity on an hour-by-hour basis. Scale transaction data included the inbound gross weight and time stamp for waste delivery arrivals and transfer truck waste shipment departures. Any reduction in hours of operation would likely occur either at the beginning or end of the day. Therefore, to further analyze the transfer activity, KCI segmented the hours between 6:00 AM and 7:00 AM, and 2:00 PM and 3:00 PM in half hour increments. Tables 2 and 3 provide the total number of scale

transactions that occurred daily within these time periods during the two weeks that were analyzed, as well as the total tons, including recyclables, received at the facility each day.

Based on a 58-hour operating week, the facility generated, on average, 5.4 inbound tickets per hour, or about 1 ticket every 11 minutes. Both weeks were during peak tourist season in Key West, yet the average tons received per day for the two weeks were 172 and 152, respectively. The greatest tonnage received in any single day was 232 tons.

Table 2: Scale Transactions per Operating Hour, February 21-26, 2011

Operating Hours	Mon 2/21	Tue 2/22	Wed 2/23	Thu 2/24	Fri 2/25	Sat 2/26	Average
6:00 - 6:30 AM	2	1	1	1	1	1	1.2
6:30 - 7:00 AM	4	4	3	2	3	1	2.8
7:00 - 8:00 AM	5	7	4	7	4	5	5.3
8:00 - 9:00 AM	10	10	6	10	8	3	7.8
9:00 - 10:00 AM	7	8	11	6	9	3	7.3
10:00 - 11:00 AM	12	8	7	4	10	4	7.5
11:00 - 12:00 PM	6	7	4	7	9	1	5.7
12:00 - 1:00 PM	6	7	10	8	8	3	7.0
1:00 - 2:00 PM	3	5	8	4	6	0	4.3
2:00 - 2:30 PM	2	4	8	1	3	closed	3.6
2:30 - 3:00 PM	1	2	0	2	2	closed	1.4
3:00 - 4:00 PM	1	0	0	1	2	closed	0.8
Total Transactions	59	63	62	53	65	21	53.8
Tons per Day	218	202	186	147	191	87	172

Table 3: Scale Transactions per Operating Hour, April 4-9, 2011

Operating Hours	Mon 4/4	Tue 4/5	Wed 4/6	Thu 4/7	Fri 4/8	Sat 4/9	Average
6:00 - 6:30 AM	2	2	1	1	1	2	1.4
6:30 - 7:00 AM	1	3	3	3	1	3	2.2
7:00 - 8:00 AM	4	7	4	4	5	2	4.8
8:00 - 9:00 AM	8	6	9	13	7	4	8.6
9:00 - 10:00 AM	5	8	5	7	8	5	6.6
10:00 - 11:00 AM	7	4	6	6	8	1	6.2
11:00 - 12:00 PM	7	5	8	6	4	8	6.0
12:00 - 1:00 PM	7	6	4	11	4	2	6.4
1:00 - 2:00 PM	8	4	7	6	10	0	7.0
2:00 - 2:30 PM	3	4	1	2	2	closed	2.4
2:30 - 3:00 PM	4	4	4	1	3	closed	3.2
3:00 - 4:00 PM	0	1	0	1	0	closed	0.4
Total Transactions	56	54	52	61	53	27	46.0
Tons per Day	232	163	169	171	173	52	152

As noted in Table 4, the majority of waste deliveries (88.1 percent) occurred between the hours of 7:00 AM and 2:30 PM Monday through Friday. Only 2.2 percent of activity occurred during the first half hour of operation (6:00 – 6:30 AM) and 5.0 percent in the last half hour (2:30 – 3:00 PM) or shortly thereafter (six deliveries were accepted after 3:00 PM).

Table 4: Activity by Major Time Periods (Monday - Friday), February 21-26 and April 4-9, 2011

Operating Hours		Mon	Tue	Wed	Thu	Fri	Average
6:00 - 6:30 AM	Transactions	4	3	2	2	2	2.6
	% of Total	3.5%	2.6%	1.8%	1.8%	1.7%	2.2%
6:30 - 7:00 AM	Transactions	5	7	6	5	4	5.4
	% of Total	4.3%	6.0%	5.3%	4.4%	3.4%	4.7%
7:00 AM - 2:30 PM	Transactions	100	100	102	102	105	101.8
	% of Total	87.0%	85.5%	89.5%	89.5%	89.0%	88.1%
2:30 - 3:00 PM (or later)	Transactions	6	7	4	5	7	5.8
	% of Total	5.2%	6.0%	3.5%	4.4%	5.9%	5.0%

A similar analysis was completed for transactions that occurred on Saturday of the two weeks analyzed. As illustrated in Table 5, the majority of waste deliveries (75.0 percent) occurred between 7:00 AM and 12:00 PM. No inbound transactions occurred after 1:00 PM.

Table 5: Activity by Major Time Periods (Saturday), February 21-26 and April 4-9, 2011

Operating Hours		Sat
6:00 - 6:30 AM	Transactions	3
	% of Total	6.3%
6:30 - 7:00 AM	Transactions	4
	% of Total	8.3%
7:00 AM - 12:00 PM	Transactions	36
	% of Total	75.0%
12:00 - 1:00 PM	Transactions	5
	% of Total	10.4%
1:00 - 1:30 PM	Transactions	0
	% of Total	0.0%

Based on this analysis, the City could potentially reduce the Transfer Station operating hours with minimal impact to haulers. Changing the weekday hours to 6:30 AM to 3:30 PM, or even 7:00 AM to 3:00 PM, should still provide sufficient time to manage the quantity of waste received daily. Likewise, Saturday hours could be shortened to 6:30 AM to 1:30 PM or even 7:00 AM to 1:00 PM. A reduction in hours could reduce or eliminate the need for overtime. Further discussion regarding staffing is provided in the recommendations at the end of this document.

Loading Equipment and Machinery

The facility is equipped with two Case 721C rubber-tired, wheeled bucket loaders, a 2001 unit and a 1995 unit. The 1995 unit was out of service for a failed engine. The City has decided that repairs to this machine are cost-prohibitive due to the age and nature of the maintenance required. The City is currently in the process of procuring a replacement unit. As part of the procurement process, the City should review the specifications of the proposed machine to insure that the machine purchase is specified correctly, including the size and loading capacity. Although lifting height is important, proper reach of the loading bucket is also critical. During loading, the tractor-trailers are positioned on truck scales, which limit how close the trailer can be positioned to the “knee wall.”

The “knee wall” is a four-foot section of concrete protected by steel guards and a rubber pad designed as fall protection from the tipping floor to the loading bay. The knee wall protects the trailer from impacts from the loader tires and prevents waste from being pushed into the loading bay area. The top of the trailer can be as far as four feet away from the inner edge of the knee wall when parked on the scale, making it difficult for smaller loaders to reach the far side of the trailer, which is important to evenly load waste and balance the weight. An extended reach machine facilitates an evenly distributed load in the transfer trailer, making the transportation and unloading process as productive and as safe as possible.

Figure 2: Loader positioned at Knee Wall (red)



Both loaders are equipped with aftermarket loading buckets with Pemberton grapple attachments. These attachments can be helpful when moving scrap metal, bulky materials, or yard waste; however, they see limited use in transfer stations handling municipal solid waste (MSW). Grapples can slow the loading process of MSW because of the delay in closing and opening the grapple tines and can add weight to the machine. Aftermarket equipment should be reviewed to insure its use does not void a machine warranty.

An alternative to a grapple bucket is a waste handler bucket. Caterpillar manufactures a loading bucket specifically designed for handling MSW. The “Waste Bucket” is an open, high-capacity bucket that is well-suited for loading, sorting, and other transfer station work.¹ A large volume bucket can speed the loading of waste and improve facility production.

¹ <http://www.cat.com/cmms/17275910?x=7>

The bucket was also equipped with a sacrificial rubber cutting edge. This is a highly recommended option for MSW handling and should be specified when purchasing the new machine. The cutting edge protects the upper surface of the concrete floor. This top protective layer of concrete can be compromised by sharp objects, containers, and other heavy equipment and material, resulting in the concrete aggregate eroding at a faster than normal rate. The edge also serves as a wiping device, clearing the floor of any liquids, much like a large squeegee.

Both loaders had badly worn solid rubber tires. Replacement wheel and tire sets for both machines were in stock at the station. A review of the procurement documents for the new machine indicates that the City will purchase a similar wheel and tire with the new unit. The City should determine whether the wheel and tire sets in stock will correctly fit the new machine and, if so, order the new machine without wheels and tires. The second set of wheels and tires should be installed on the 2001 machine as soon as possible.

A cursory inspection of the 2001 loader was conducted. In addition to the need for replacement wheels and tires, the unit did not have an operating backup warning device and significant wear was evident throughout. Backup and work lights were either not on or not functioning, contributing to an unsafe tipping floor environment. These lights and warning devices should be working at all times, and the City should also consider equipping its loaders with rear vision cameras to improve operator visibility.

Material Handling and Loading

The main tipping floor is separated into three sections for storage of scrap metal, recyclables, and MSW. In addition, a small bunker was constructed in a corner for what appeared to be dirt or clean fill. Concrete barriers are used to maintain separation between the different waste materials being delivered. Maintaining materials in their source-separated delivered condition is difficult when waste volumes are not transferred in a timely fashion or if inbound volumes are higher than expected. Some commingling of materials was observed when waste was pushed into the already full bunker area. Recyclables were spilling into the MSW and scrap metal storage areas.

During the site visit, an accumulation of MSW, recyclables, and scrap metal was observed on the tipping floor. The manager could not accurately determine the actual waste inventory because no baseline had been established. At some point in time, and periodically thereafter, the tipping floor should be completely cleared and that day should be established as the baseline. From that day forward, inbound and outbound reports should be compared to accurately assess the current waste inventory.

Maintaining an accurate waste inventory is an important management tool. It can be used to evaluate daily operations by the City and its contractor and also helps ensure permit compliance.

The open-top transfer trailer loading process used by the City is commonly used in transfer stations across the country, and is a productive and cost-effective method of waste transfer. Aside from the facility building structure itself, the only capital assets required to operate a top-load station is rolling stock (heavy equipment and tractor-trailers). No compactors, pre-crushers, balers, specialized trailers, or other waste compaction and handling assets are required. The open-top trailers are not exclusively designed for waste hauling, and provide flexibility to haul other bulk materials. In fact, the long-haul contractor was observed delivering sand and gravel to a nearby construction operation and, once emptied, that same vehicle was loaded at the City's Transfer Station with outbound MSW for transport.

To evaluate the time to load outbound trailers, KCI analyzed the outbound waste shipment transactions for the weeks of February 21-26 and April 4-9, 2011. During the week of February 21-26, 37 outbound tractor-trailers were loaded with MSW and shipped, with an average loading time, from inbound tare weight time stamp to outbound gross weight time stamp, of 1 hour and 6 minutes. No loads of

outbound recyclables were noted on the scale house sheet for that week. During the week of April 4-9, 47 loads of outbound MSW or recyclables were shipped, with an average load time of 43 minutes from inbound time stamp to outbound time stamp.

In a typical top-load transfer station similar to the City's operation, the average time to load a trailer to a legal gross weight should range between 15 and 20 minutes, depending on the type of material. MSW has a greater density than recyclables and therefore reaches maximum weight in fewer bucket loads. The transfer trailer driver should spend approximately 15 minutes covering the load and readying the vehicle for safe operation.

With the correctly sized and equipped loader and a properly trained operator, the City could potentially improve its loading capabilities by 10-30 minutes per load. Improving turnaround time should enable the City to meet the transfer vehicle demand necessary to empty the station each day.

Bulk Express, and its owner operators, is the long-haul subcontractor to WM, the City's contracted transfer hauler. Waste and recyclables are hauled to WM's disposal and processing facilities in Broward County. On a daily basis, the scale operator or manager contacts Bulk Express to order a predetermined number of tractor-trailers for the following day. Currently, this order ranges between seven and nine, and includes ordering for both outbound MSW and recyclable loads.

During the week of February 21-26, the total inbound waste exceeded the total outbound by approximately 200 tons, the equivalent of approximately 9 outbound tractor-trailer loads. The Transfer Station evidently fell behind in the transfer operation and processed less waste than was received. When questioned, staff indicated a difficulty in consistent tractor-trailer service from WM and subsequently Bulk Express. Although the City places an order for a certain number of trailers, delivery of that amount is not always consistent. During the week of April 4-9, outbound tons exceeded inbound by only 19 tons.

Section 4.2 of the City's Transfer and Disposal (T&D) agreement with WM states the service requirement as follows:

The Contractor shall have a sufficient number of trailers, equipment and personnel available at the Transfer Station at all times to ensure that the operation of the Transfer Station is not delayed or interrupted and the requirements of this Agreement are satisfied. The Contractor shall have trailers, equipment and personnel available to properly handle and transport the first load and the last load of Acceptable Waste received each day at the Transfer Station.

Although operation of the Transfer Station has not been delayed or interrupted and, according to the O&M Plan, the tipping floor has an emergency storage capacity of 900 tons, any excess waste stored on the floor does impact machine movement and can slow the waste delivery and transfer process. It was not evident during our site visit that the Contractor had any trailers or equipment staged at the facility; tractor-trailers arrived periodically throughout the day on an unscheduled basis. The T&D agreement clearly places the responsibility of providing sufficient equipment and personnel so as not to delay or interrupt service on the contractor.

Staff indicated that the transfer and hauling of recyclables operated on a different schedule. Apparently a Bulk Express subcontractor has indicated that recycling trailers must be loaded by a certain time each morning in order to arrive at the designated processing facility for a specified appointment time. It was indicated that this specific schedule, and the inability to adhere to it, was the reason that the tipping floor contained between four and five tractor-trailer loads of recyclables waiting for transfer. In fact, none of the outbound transactions from the week of February 21-26, 2011 was for recyclables.

Recyclables transfer and processing are covered by the City's collection contract with WM. According to Section 4.F of this contract, WM was to operate a recycling area at the City's previous waste-to-energy facility and market recyclables delivered by the City. When the Transfer Station at Rockland Key was opened and the waste-to-energy facility closed, the City assumed the responsibility of loading recyclables for WM.

WM should be contacted to discuss plans to improve transfer and disposal/processing services at the City's facility, and work with transfer staff to eliminate the excess inventories of waste and recyclables. Staff should no longer contact WM's subcontractor directly, but rather work through WM as the authorized contractor when requesting transfer and disposal services. Doing so insures WM has full knowledge of any service issues, providing the company with the opportunity to respond to City requests immediately. Additionally, the WM contract with Bulk Express is scheduled to expire on December 31, 2011, so developing a line of communication directly with WM is important to insure no disruption of City operations.

Finally, Transfer Station staff should focus on loading and shipping at least the same amount of waste received each day through a managed inventory process. Maintaining any amount of tipping floor waste inventory limits the facility's ability to operate in extraordinary circumstances (e.g., emergency or natural disaster conditions).

CFC-Containing Devices

During the site visit, KCI observed refrigerators, chlorofluorocarbon (CFC)-containing devices, being stored on the tipping floor (Figure 3). Upon further inspection, it appeared that at least one of the devices had refrigerant tubing that had been damaged, and that refrigerant gas was no longer contained. The device was not marked as having been properly evacuated, as is typically required of CFC recovery companies. None of the appliances staged inside the Transfer Station had been marked as evacuated.

Figure 3: Unmarked CFC-Containing Appliances



The City's collection contract with WM requires that CFC-containing appliances be evacuated before being collected curbside and delivered to the transfer station. Subsequent to the site visit, KCI learned that WM subcontracts with a company to evacuate CFC-containing devices after delivery to the Transfer Station. These devices should be properly marked once evacuation is completed.

Safety

In addition to safety items already discussed, a number of other safety-related issues were observed during the site visit and facility inspection:

- No observed tipping floor safety policies were in place.
- No personal protective equipment (PPE) in use – City employees were not observed using the standard PPE for waste transfer operations, such as high-visibility clothing or safety vests, eye protection, and respirators (Figure 4).

Figure 4: No Personal Protective Equipment



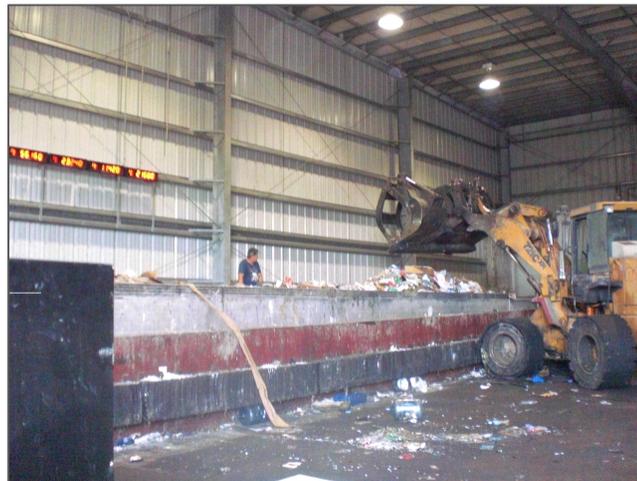
- No formal traffic control was observed.
- Speed limits are not observed, in general, and many vehicles did not stop before pulling on or off truck scales. This severe movement of the scale plate can cause catastrophic load cell damage. Stops signs and/or speed bumps should be installed before and after truck scales.
- Lock-Out Tag-Out (LOTO) procedures were not being utilized. For example, the stored energy in a hydraulic grapple device had not been released, creating a potential hazard. Specifically, a spare payload bucket was positioned outside the station with one of its grapple tines in the open or elevated position. The tine was held in place by stored hydraulic pressure. An unexpected release would allow the tine to fall uncontrolled by means of gravity. Anything in the path of the falling tine would be impacted without warning (Figure 5).

Figure 5: No Lock-Out Tag-Out Procedures; Grapple Tines in Elevated Position



- Subcontractor drivers are allowed to sit in the open trailers on top of waste during the loading process in order to direct operations for an even load distribution (Figure 6). This is extremely dangerous, and should be immediately prohibited. Subcontract drivers were also observed on the tipping floor, manually pulling metal and other materials from the MSW. Drivers should remain in their vehicle cabs or in a designated safe area at all times.

Figure 6: Transfer Trailer Driver Sitting on Trailer during Loading



KCI has provided the City, under separate cover, a bulleted list of recommended Transfer Station tipping floor safety policies for review and implementation.

Scale System

The tipping fee at the Transfer Station is \$165.97, and is charged to all inbound MSW except for that delivered by WM pursuant to the City's collection contract (disposal fees are as specified in the contract). Recycling is accepted free-of-charge. The scale house accepts cash, check, and credit cards for non-account holders. These are all defined as "cash" customers in the scale system. During the week of February 21-26, 2011, 24 transactions defined as "cash" occurred. These transactions were 8.4 percent of all inbound scale transactions that week, but only totaled \$801.67, or less than 1 percent of all transaction values. Cash transactions averaged just \$33.41 each while inbound charge transactions averaged \$550.06 each.

Scale operators are charged with maintaining a \$250.00 balanced cash drawer, and must arrange for change and the associated banking required to maintain this cash system. Because of the liability and security concerns of handling cash, many municipal and privately operated transfer stations have shifted away from handling cash and have limited transactions to credit-approved accounts or credit card transactions only. Because of the small quantity of cash transactions occurring, and the potential liability surrounding it, the City should consider discontinuing accepting cash and checks as a means of payment, limiting payments to credit cards or established credit accounts.

The inbound and outbound Mettler/Toledo truck scales interface with a third-party scale software package to track scale activity, compile data, and generate the permit-required reports for proper facility management. The software, WasteWorks, also has the ability to generate customer billing and financial reports. WasteWorks provides a robust feature list, although one scale operator, when asked to generate reports, appeared to have limited knowledge of the product's capabilities.

The City does not appear to be fully utilizing the WasteWorks system. Certain fields are not populated, including tonnage pricing for outbound waste. Utilizing this field makes reconciling a long-haul contractor invoice a quick and error-free process as total dollars on an outbound waste report by waste type should match the invoice and can be used as supporting documentation for invoice payments. Further system training is recommended to leverage the system's full feature list.

The manager, when requested, provided a set of reports via Microsoft Excel. It appeared as though these reports were being used as part of the daily accounting report process. KCI cautions the use of Excel-type reports for financial recordkeeping because of their ability to be edited. They are valuable for analytical purposes, but a non-editable report type should be used to report and track facility financial records. If this is already happening, it was not clearly evident during our visit. KCI recommends reviewing the regular reporting process to insure it meets City audit requirements.

Additionally, WasteWorks is compatible with a number of wide area and local area network (LAN/WAN) configurations that can provide remote access to the system. For example, remote access can provide the Utilities Manager or other remote stakeholders with live visibility to the system for reporting or monitoring on an on-demand basis, without having to interrupt facility staff.

The use of unattended scale systems is becoming widespread in the industry and should not be overlooked as an option for the City. An unattended scale system conducts the weighing and load ticketing process through a self-serve, automated device mounted in close proximity to the inbound and outbound scales. Unattended scale systems do not require transfer station personnel to be present during the weighing and ticketing process. Both public and privately operated facilities are transitioning to this new technology in an effort to reduce operating expenses, reduce data entry errors, and provide flexible staffing alternatives and extended hours of operation without the need for personnel. Although there are a number of unattended scale systems currently available, the City's existing WasteWorks software system provider does offer an unattended system fully compatible with the City's scale software in use today.

In an effort to illustrate the potential budgetary impact of this type of system, KCI conducted cursory research with Carolina Software, the developer of WasteWorks. A dual-lane system (inbound and outbound scales) would cost between \$40,000 and \$50,000, including software licenses. This would equip both scales with an unattended hardware device where drivers would be responsible for entering their own data (driver and vehicle ID) and waste type on the inbound scale and then would receive a printed receipt on the outbound scale. The device photographs the driver and simultaneously records the scale information, account information, and picture into the scale record.

Although many locations have had success with manual driver entry, these units can also be equipped with radio frequency identification (RFID) readers. Similar to automated toll readers (e.g., SunPass), trucks are equipped with a permanently mounted tag that is associated with an account number on the scale system. When the truck stops on the scale, the weight is recorded and automatically associated with the account number, eliminating any data entry error factor. The RFID feature is approximately a \$10,000 option and is recommended. Vehicle tags are a one-time expense estimated at \$30 each and can be passed through to the hauler as a cost of doing business at the City facility. Having the hauler pay for tags is a common practice in the industry. An RFID reader reduces waiting time, and will be reflected in a cost savings to the hauler.

An unattended system can also be equipped with secure credit card reader devices, to accommodate customers without pre-established accounts.

The use of an unattended scale system does not eliminate the responsibility for waste screening required by permit. This process should be handled by the tipping floor operator at the point of unloading. Although unattended scale systems have been implemented for all-day facility use, they have also been used to augment staffing during early or late hours.

Comparative Analysis of Other Publicly Owned and Operated Transfer Stations

KCI also surveyed other publicly owned and operated transfer stations in Florida. Direct comparisons are not possible because of the wide variations between facility size, operation, and cost allocations. Those facilities that receive greater daily tonnages are generally able to achieve economies of scale and operate more cost-effectively. Table 6 provides a summary of those jurisdictions that provided information about their transfer station operations. These are provided as examples of other publicly owned and operated facilities, but not necessarily as examples of high-performing operations.

In looking at operating hours as compared to the average tonnage received at each of these facilities, the information suggests that the City could reduce its operating hours while continuing to manage the current tonnage throughput. In turn, reducing operating hours could reduce or eliminate a staff position. None of these other facilities mentioned having a dedicated mechanic. All of them stated that the loader operator also served as the spotter, at least one mentioning safety as one of the primary reasons.

The City's budgeted Transfer Station per-ton operating cost (labor, fuel, and O&M) is substantially higher than the two facilities that provided this information. This is in part due to economies of scale; the other two facilities receive 4-5 times the daily tonnage as the City's Transfer Station. However, improved operating efficiencies with reduced operating hours and staffing should also improve the cost-effectiveness of the facility.

The City could also consider privatizing operation of the Transfer Station and include this service as part of the T&D agreement. Even if operation of the facility were privatized, the City should retain control of the scale house. Further evaluation is warranted if the City decides to explore this option.

Table 6: Summary of Other Publicly Operated Transfer Stations

Jurisdiction	Average Tons Per Day	Operating Hours	Operating Hours/ Week	# of FTE	FTE Positions	Cost/Ton (not including trailer transport)
Key West	160	M-F 6:00 AM - 4:00 PM Sat 6:00 AM - 2:00 PM	58	6	1 manager; 1 mechanic; 2 operators; 2 scale house	\$11.88 (2011 budget; without equipment or depreciation)
Alachua County	450	M-F 7:00 AM - 5:00 PM Sat 7:00 AM - 12:00 PM	55	11	1 manager; 1 asst. manager; 1 staff assistant; 3 operators; 3 service workers; 2 scale house	not available
Lee/Hendry County	70 at each of 2 TSs	M-F 7:00 AM - 4:00 PM Sat 7:00 AM - 12:00 PM	50	4.15 for 2 TSs	0.15 manger; 2 operators; 2 scale house	not available
Leon County	750	M-F 3:00 AM - 4:30 PM Sat 8:00 AM - 12:00 PM	71.5	9	1 manager; 5 operators; 2 scale house; 1 service worker	\$3.50 (estimated)
Seminole County	980	M-Sat 7:30 AM - 5:30 PM	60	7.5	0.5 manager; 4 operators (cross-trained to transport, usually have 3 on floor); 3 scale house	\$2.49/ton (includes labor, fuel, O&M and equipment depreciation)

Note: Direct comparisons are not possible because of the wide variations between facility size, operations, cost allocations, and economies of scale.

Recommendations

This report outlines KCI's observations as a result of a site visit, facility inspection, and subsequent data analysis of the City's Transfer Station operation. As previously described in greater detail, provided below is a summary of recommendations to improve efficiencies, reduce expenses, and improve facility safety and overall transfer station operating performance.

1. Overhead door:

- a. Investigate competitively procuring overhead door maintenance services with a list of standard replacement parts in order for staff to expedite repairs via a single service provider.
- b. Investigate alternatives to these slow and maintenance-prone doors while meeting the intent of the O&M Plan. Alternatives that could be investigated include plastic curtains to contain litter and eliminate birds or more durable sliding track doors. Any alternative will need to comply with permit requirements.

2. Loader Acquisition:

- a. Review the specifications of the loader to insure the machine is specified correctly, including size, loading capacity, lifting height, and reach of the loading bucket.

- b. Determine whether the wheel and tire sets in stock will correctly fit the new machine and, if so, order the new machine without wheels and tires.
 - c. Equip the main loader with a waste handler bucket rather than a grapple to enhance the speed and efficiency of loading. If a grapple is needed to handle scrap metals or other bulky materials, equip the spare loader with a grapple and utilize this loader when needed.
- 3. Existing Loader:** Replace the wheels and tires with those currently in stock. Repair or replace backup lights and warning device, and consider equipping the loaders with rear vision cameras to improve operator visibility.
- 4. Material Inventory Management on the Transfer Station Floor:**
- a. Load and ship at least the same amount of waste received each day through a managed inventory process. At some point in time, and periodically thereafter, the tipping floor should be completely cleared of MSW, recyclables, and scrap metal to establish a baseline. From that day forward, inbound and outbound reports should be compared to maintain a current and accurate waste inventory.
 - b. Improve tractor-trailer loading time with a correctly sized and equipped loader and a properly trained operator, which will enable the City to meet the transfer vehicle demand necessary to empty the Transfer Station each day.
 - c. Discuss with WM plans to improve transfer services by providing sufficient trailers, equipment, and personnel at all times. Discuss the reason for limiting the shipping time for recyclables. Work directly with WM rather than its subcontractor, Bulk Express.
- 5. CFC-Containing Devices:** Immediately review current handling processes for CFC-containing devices, both by the City and WM, to insure devices are correctly evacuated and that releases are not occurring. Develop written handling procedures and train Transfer Station staff on proper management. Require WM to mark all devices once CFCs have been removed.
- 6. General Operational and Safety Recommendations:**
- a. Assign spotter responsibilities to the loader operator rather than an individual on the tipping floor. A safer work environment is provided when the spotter is positioned in the cab of a machine rather than walking on the tip floor, exposed to vehicle traffic.
 - b. Establish and enforce tipping floor safety policies.
 - c. Require staff to wear standard personal protective equipment while on the tipping floor, such as high-visibility clothing or safety vests, eye protection, and respirators.
 - d. Establish and implement formal traffic control procedures.
 - e. Establish and implement Lock-Out Tag-Out (LOTO) procedures for all equipment.
 - f. Install stop signs and/or speed bumps to control speed limits and ensure stopping before pulling on or off the truck scales.
 - g. Prohibit transfer trailer drivers or other City or contractor staff from sitting in or on the open trailers during the loading process. Drivers should remain in their vehicle cabs or in a designated safe area at all times.
 - h. Explore alternatives to allowing self-haul customers to deposit recyclables on the tipping floor. The City should determine if a fully enclosed storage container located outside of the building for use by these small generators meets the intent of the permit. A roll-off

container could be located away from the facility on City property, or possibly within the structure that was designed to store cardboard.

7. Scale System:

- a. Consider discontinuing accepting cash and checks as a means of payment, limiting payments to credit cards or established credit accounts to reduce potential liability.
- b. More fully utilize the capabilities of WasteWorks, the scale house software, by understanding its features and capabilities; populating additional data cells; generating customer billing, financial, and daily accounting reports; and training staff in its use. Consider establishing remote access to the system for on-demand access.
- c. Consider an unattended scale house system to eliminate the need for scale operators or facilitate the elimination of the split shift.

8. Staffing and Operating Hours: By improving operational efficiencies, the City should be able to reduce facility operating hours and staffing.

- a. Evaluate and, if feasible, establish an alternative to having a dedicated mechanic at the Transfer Station. This is a costly position given the limited amount of equipment on site and the acquisition of a new loader. The facility may be able to share mechanic services with other City departments as long as such services can be provided expeditiously so as not to interfere or delay facility operations.
- b. Consider reducing the Transfer Station hours of operation. Based on operating hours and daily throughput of other publicly operated transfer stations, the City should be able to reduce hours by 1 to 2 hours daily while continuing to manage the same quantity of solid waste and recyclables. Any change in operating hours would necessitate an amendment to the O&M Plan, approval by FDEP, and modification of the collection and T&D agreements. The O&M Plan should note the operating hours for which the facility is permitted rather than when it will specifically operate, and that current hours of operation will always be posted. An amendment to the O&M Plan should not restrict or reduce the City's ability to return to the permitted hours of operation if waste volumes warrant.
- c. Potentially eliminate one of the scale house positions by either reducing the daily hours of waste receipt to no more than 8.5 or utilizing an automated scale system. The facility manager or one of the operators could relieve the scale operator for a 30-minute lunch break. If the City converts to a full-time automated scale system, both scale house positions could be eliminated or reassigned.
- d. Review all remaining personnel position descriptions to insure that all essential facility functions are incorporated and that safety protocols are adhered to. This will require personnel assessments and employee cross-training to insure a level of staff redundancy exists for the uninterrupted operation of the facility. All personnel should be cross-functional and have the ability to conduct scale house activities, loader operations and tipping floor spotter duties, and general facility upkeep, including the facility manager or supervisor. Such cross-training will ensure that all essential facility functions are covered at all times.
- e. Review work hours for all personnel to minimize overtime while insuring adequate staffing during peak waste delivery times.

- f. Redefine one of the eliminated positions to be the City Recycling Coordinator. To achieve the City's stated goal of maximizing waste diversion and developing a path toward "zero waste," the City will require a dedicated Recycling Coordinator position.

To provide an indication of the potential savings that could result from staff reductions, Table 7 provides the estimated labor savings that might be realized by eliminating 1, 2, or 3 staff positions and reducing the hours of operation to minimize overtime hours. Scenario 1 involves outsourcing equipment maintenance responsibilities. In addition to this outsourcing, Scenario 2 would require reducing scale house hours to eliminate the split shift (and 1 scale house position) or Scenario 3 would require automating the scale system (eliminating both scale house positions). These savings would need to be balanced against the costs that would be incurred in these various scenarios, such as the cost of outsourcing equipment maintenance or purchasing an automated scale system. In addition, and as mentioned above, KCI recommends that one of these positions be retained in solid waste and redefined as a Recycling Coordinator.

Table 7: Potential Savings (Labor and Benefits)

Labor	Current	Scenario 1: Eliminate 1 Position	Scenario 2: Eliminate 2 Positions	Scenario 3: Eliminate 3 Positions
Manager Wages:	\$58,900	\$58,900	\$58,900	\$58,900
Maintenance Technician Wages:	\$50,500	\$0	\$0	\$0
Operators' Wages:	\$134,400	\$134,400	\$100,800	\$67,200
Estimated Overtime per Week:	16	16	7	5
Overtime Wages:	\$13,400	\$13,400	\$5,900	\$4,200
Total Wages:	\$257,200	\$206,700	\$165,600	\$130,300
Estimated Benefits as % of Wages:	35.0%	35.0%	35.0%	35.0%
Total Wages and Benefits:	\$347,200	\$279,000	\$223,600	\$175,900
Potential Labor Savings:		\$68,200	\$123,600	\$171,300

In conclusion, the City's Transfer Station is uniquely located and affected by the environment and geography of the Florida Keys, factors that do impact operating costs. Located at MM9 on U.S. Highway 1, the facility is considered remote from the City by Key West standards. The facility was designed and constructed to manage 350 tons of material per day. In 2010, the Transfer Station processed, on average, 158 tons per day, operating at 45 percent of permitted capacity. During that same period, the facility was operated with a full complement of staff during 100 percent of its permitted hours of operation. KCI's research and analysis has identified a number of best management practices (BMPs) the City can implement to improve operational efficiency and safety. Implementing these BMPs would also provide the City an opportunity to "right size" its operation while continuing to meet the current material processing demand and to subsequently reduce operating costs. KCI is available and looks forward to further discussing these BMPs and opportunities with the City.

**CITY OF KEY WEST
PROPOSED TRANSFER STATION TIPPING FLOOR SAFETY POLICY**

It is imperative that all persons entering the site know, understand and abide by these safety rules. *This list is not intended to be all-inclusive and may be modified by the City without notice.*

1. Hardhat, high visibility clothes/reflective safety vest (ANSI II minimum), safety shoes, eye protection, and work gloves are to be worn when outside the vehicle.
2. All vehicles must comply with the posted traffic signs, with special attention to the posted speed limit.
3. All vehicles must come to a full stop before proceeding onto the scales.
4. Upon entering the facility, all collection vehicles must yield to any transfer trailer traffic going to the inbound scale.
5. A minimum distance of 10 feet must be maintained between all personnel, trucks, rolling stock and heavy equipment within the facility. A 15-foot safety zone must be maintained between heavy equipment and trucks working on the tipping floor.
6. All commercial solid waste vehicles entering the facility shall be equipped with external audible back up alarms; a minimum 85 dBa alarm must sound whenever the machine is in reverse.
7. Loads must be tarped prior to entering the facility scale. Tarps are to be removed in designated tarp removal areas only. Under no circumstances are tarps to be removed before entering the facility scale.
8. Drivers preparing to enter tipping areas must await directions from the Traffic Coordinator and/or Heavy Equipment Operator. Driver is to maintain eye contact with operating personnel.
9. Blind side backing is not to be attempted without guidance.
10. Passengers, helpers and pets must remain in the vehicle. Drivers must stay within 6 feet of their vehicle when outside of their vehicle. When out of vehicle, drivers must keep clear of tipping area bay door(s) as loader may be backing out.
11. Transfer trailer operators should remain in the cab of vehicle during loading.
12. Riding on the outside of the vehicle or standing on the vehicle rear step is forbidden when vehicle is moving on site.
13. Cleaning out from behind the blade of a vehicle (truck cleanouts) must be done in designated clean out areas separate from the work zone.
14. Drivers will only back into an area to dump prepared by a Heavy Equipment Operator only after instructed by the Operator or Traffic Coordinator. The driver is responsible for being certain the truck is parked on a firm and level surface before disposal.
15. While dumping the load, stay clear of the back of the vehicle. Never stand under the open tailgate or raised hopper.

16. Tailgates, bodies and hoists should be lowered before exiting the building to ensure compliance with permit and to avoid overhead obstructions. Equipment should not be moved around with the tailgates, doors, hoist or bodies open or in the extended position. All open top trucks must be completely empty and lowered before exiting the tipping floor.
17. The backs of packer trucks and roll-off containers must be opened and closed on the tipping floor.
18. Driver of a vehicle needing to be pulled shall hook and unhook the towing equipment. Pull hooks should be mounted on the front and rear of all refuse vehicles.
19. Engine retarders or "Jake (Jacobs) Brakes" may not be used on site at any time.
20. Heavy Equipment Operators have the right-of-way on the tipping floor. All vehicles are to yield to operating machinery and pedestrians.
21. Conforming safety chains must be used to hold open roll-off container doors while unloading. Use of bungee cords, wire, ropes, etc. will not be permitted.
22. Do not pass moving vehicles.
23. To increase visibility, it is recommended that headlights and 4-way flashers be operated during disposal.
24. Report all injuries/accidents to a transfer station employee or at the scale house.
25. Smoking is prohibited while outside your vehicle.
26. Scavenging, salvaging or picking through the loads is strictly forbidden.
27. Horseplay is strictly forbidden.
28. Firearms and/or weapons of any type are not allowed on the property for any reason.
29. The use of intoxicating beverages or any other restricted substance on the facility is strictly prohibited.
30. Photography is prohibited unless written permission from the Facility Manager is obtained.
31. All visitors must check in at the scale house and/or main office.
32. Drivers are not to use cell phones or two-way radios while driving on the transfer station property, especially during a backing maneuver.
33. Radio, tape or CD player earphones are not to be worn.

I have read, understand and agree to comply with these procedures.

Printed Name

Company

Signed Name

Date

Appendix L

Organics

1. Diversion Potential

Composting organics in lieu of disposal will not only reduce the City’s disposal costs, but will also produce a valuable soil amendment and reduce the environmental impacts of managing this material.

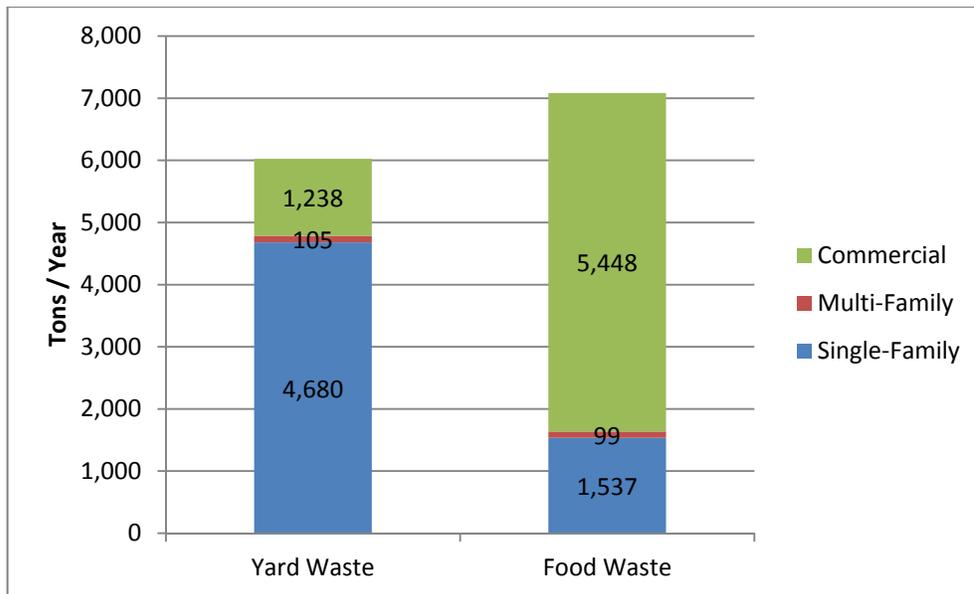
Based on the Waste Composition Study, yard waste comprises approximately 14.1% of the solid waste disposed by City residents and businesses and food waste makes up an additional 16.6%. Combined, these materials represent more than 30% of the residential and commercial waste delivered to the Transfer Station, making them prime targets for recycling. Table 1 provides the breakdown of these organic materials between residents and businesses and also estimates the tonnage disposed annually.

Table 1: Estimated Yard Waste and Food Waste Disposed, FY 2011

	Residential & Commercial Combined	Single- Family	Multi- Family	Commercial
Waste Collected by WM (tons/yr)	42,697	17,079	854	24,764
% of Total Waste	100%	40%	2%	58%
Yard Waste %	14.1%	27.4%	12.3%	5.0%
Yard Waste (est. tons/yr)	6,020	4,680	105	1,238
Food Waste %	16.6%	9.0%	11.6%	22.0%
Food Waste (est. tons/yr)	7,088	1,537	99	5,448
Organics %	30.7%	36.4%	23.9%	27.0%
Organics (est. tons/yr)	13,108	6,217	204	6,686

Based on this information and as depicted in Figure 1, single-family residents generate the overwhelming majority of yard waste and the commercial sector generates the majority of food waste. Therefore, residents should be the first target for diverting yard waste from disposal and businesses are the first target for food waste diversion. A successful organics recovery program requires the infrastructure to collect segregated organics, a processing facility, and viable end-markets for the resulting product.

Figure 1: Primary Generators of Yard Waste and Food Waste



Backyard composting is commendable and should be encouraged. During a Green Living Expo at the Botanical Gardens in November 2010, City staff distributed more than 100 backyard composting bins to City residents and Extension Service staff provided training on backyard composting. However, a backyard composting program will not achieve the level of waste diversion needed to achieve even a 25% recycling rate.

Prior to November 2010, Florida law banned the placement of yard waste in a lined (Class I) landfill and currently bans such placement unless the landfill has an active gas-collection system and the landfill gas is put to beneficial use.¹ Because of this law, Florida communities that utilize landfills have been successfully collecting residential yard waste separate from other residential garbage for many years. Yard waste diversion rates in these communities have typically exceeded 90% because of the landfill ban.

Food waste diversion programs are gaining momentum as communities strive to achieve higher recycling rates. More than 180 communities nationwide have food waste collection programs, the vast majority implemented since 2004.²

The potential also exists to co-compost organics from the municipal solid waste (MSW) stream with biosolids, which are wastewater treatment residuals. Biosolids are rich in nutrients and contain a significant amount of water, making them an ideal feedstock for blending with yard waste. South Florida's characteristically woody and dry yard waste contains a substantial amount of palm fronds, which have a high lignin content and are resistant to degradation. Biosolids, however, contain nitrogen, which balances the carbon to nitrogen (C:N) ratio, allowing the microorganisms responsible for composting to work much more efficiently in breaking down resistant compounds.

¹ Section 403.708(12)(c)1, F.S., which was amended in November 2010. Because the City's solid waste is disposed in a waste-to-energy facility, the City has not had to separate its yard waste from other solid waste.

² US EPA Region 5, *Best Management Practices in Food Scraps Programs*, 2011.

Biosolids composting has become a widely accepted practice across the United States, with over 265 operating programs nationally, including at least six in Florida (private facilities in Ocala, Okahumpka, and Reedy Creek, as well as public facilities in Lee County, Sarasota, and Miami-Dade. The closest is operated by Miami-Dade, which only processes biosolids from its own system. Biosolids composting is a proven method for pathogen reduction, provides considerable volume reduction, and produces a valuable end-product.

The City's wastewater treatment facility generates approximately 6,800 tons (8,500 cubic yards) of biosolids annually and currently pays about \$70 per ton to transport and dispose of these biosolids. Although not considered part of the MSW stream, including biosolids in the composting program should provide additional cost savings to the City. It would also enhance the soil structure and nutrient value of the resulting compost, thereby creating a more valuable end-product.

2. Organics Collection

An increasing trend in Florida is to convert to once per week, separate collection of residential garbage, yard waste, and recyclables. Approximately 27% of Florida residents currently have weekly collection of solid waste. Communities that have made this conversion typically realize cost savings and increase recycling tonnages. The City should be able to convert one of its weekly garbage collections to yard waste collection and implement this program with little or no additional cost. Residents would need to be educated about the program, its potential impacts, and how to separate yard waste for collection.

Food waste diversion and composting is common in some parts of the country, and is of increasing interest to Florida communities as they strive to achieve the State's 75% recycling goal. To divert commercial food waste for processing, the City should first target those businesses that generate the most food waste, such as grocery stores and restaurants. Separate collection containers would need to be provided for food waste, which would need to be collected separate from other solid waste. While there is a cost associated with this, the processing cost should be less than for solid waste disposal. Many communities choose to first conduct a pilot program to demonstrate the viability of the program and to work out any logistical or operational issues.

3. Regulatory Requirements for Organics Processing

The rules governing organics processing and recycling facilities are found in Chapter 62-709, FAC. Whether or not a composting facility requires a State solid waste permit depends on the location of the operation and the types and quantities of materials being processed. Backyard composting, composting as part of normal farming operations, or composting of less than 100 cubic yards of material onsite at any time are exempt from regulation.

Facilities that process only the following materials may operate without a permit under an annual registration issued by the Florida Department of Environmental Protection (FDEP):

- Source-separated vegetative materials, including vegetables, fruits, or breads from commercial and institutional generators;
- Source-separated animal by-products, including meat, fats, dairy, or eggs from commercial and institutional generators but excluding butchers and abattoirs;

- Manure; and
- Yard trash.

Such registered facilities must meet all other design, operating, and product quality criteria required of permitted facilities.

Certain projects that do not qualify to operate under registration rules may apply for a special pilot permit. To be eligible to operate under a special pilot permit, the project must accept less than 10,000 cubic yards of feedstock in total and plan to operate initially for no more than 18 months, with an option to extend for an additional 18 months. The design, operating, and product quality criteria are modified from those of facilities operating under a full permit. The project must submit a progress report within nine months of permitting and a final report within 60 days of permit expiration.

All other composting facilities require a permit issued by the FDEP.

If biosolids are included in the composting system, the process and end-product are subject to additional Federal and State regulation. Federal regulations (40 CFR Part 503) divide biosolids into two classes – Class A and Class B – based on pathogen levels. Class A biosolids must undergo treatment that reduces pathogens below detectable levels. Biosolids compost that meets pollutant concentration and pathogen limits corresponding to Class A specifications can be bagged and marketed for public consumption and applied without restriction. Class B biosolids ensure that pathogens have been reduced to levels that protect public health and the environment, but application must comply with site restrictions that minimize potential for human and animal contact until environmental factors have reduced pathogens to very low levels. Class B biosolids can be used in bulk at appropriate types of land application sites including agricultural lands, forests, and reclamation sites.³

Florida regulations (Chapter 62-640, FAC) stipulate management criteria, use, and land application site requirements. Pollutant and pathogen levels, reporting, monitoring, and minimum staffing requirements set forth in Chapter 62-640 are in accordance with Federal levels. Biosolids treatment facility permits are submitted on FDEP Department Form 62-620.910(2) Application Form 2A, Permit for Domestic Wastewater Treatment & Reuse or Disposal Facility. Additionally, a current Florida DEP NPDES Permit is required as a part of the FDEP Department Form 62-620.910(2) Application Form 2A.

4. Organics Processing Options

Various methods of organics processing are in use today, ranging from no or low technology options to comprehensive and technologically advanced systems.

Windrow composting involves piling feedstock materials into elongated rows either outside or in a building, and turning them periodically based on time and temperature factors. This is by far the most common method of composting in the United States and Canada for yard waste and source-separated food waste. Windrow composting is fairly flexible and can be accomplished with turning equipment ranging from a front-end loader to specialized windrow turning machines.

³ US EPA, *Biosolids Generation, Use & Disposal in the United States* (US EPA530-R-99-009), 1999.

Aerated static pile composting involves placing air blowers and/or ducts under a pile of organic materials in order to maintain aerobic conditions. The pile is capped with an insulating blanket of wood chips or other material and not disturbed until the active composting process is complete.

The Modified Static Aerobic Pile (MSAP) method combines both static pile and windrow composting methods, which minimizes the need for mechanical turning while still maintaining aerobic conditions and excellent pathogen kill. This method accelerates the process with the use of an organic catalyst and creates a high quality compost product. The MSAP method was developed by Harvest Quest International, Inc. and is currently being applied in a yard and food waste composting operating in numerous locations throughout the U.S., including Florida. This method has received EPA approval for meeting the 503 requirements for biosolids.

In-vessel composting refers to enclosed systems such as large rotating tubes or elongated bays with mechanical turning machines and forced aeration systems. Such systems are typically used to compost manures, food waste, and biosolids; with very large systems also used to process municipal solid waste. They are not conducive to composting solely yard waste. Benefits of in-vessel composting include the ability to contain feedstocks, such as food waste and biosolids, that might attract birds or generate odors. In-vessel systems tend to be more technologically advanced and therefore have higher capital and operational costs.

Anaerobic digestion (AD) is a biological process that takes place in the absence of oxygen. AD produces methane, which can be recovered for use as a biogas fuel. The solid digestate typically undergoes subsequent aerobic composting. Numerous different AD technologies are available. Historically, AD has been used primarily for wastewater treatment and manure. With regard to source-separated organics from solid waste, dozens of AD facilities operate in Europe and several are currently under development in the United States.

The costs and complexity of organics management systems increase substantially as the move is made from windrows to in-vessel composting, to anaerobic digestion. In general, aerobic in-vessel systems generally cost twice as much to implement, operate and maintain compared to windrows. Anaerobic systems can cost upwards of three times as much.⁴

As mentioned previously, including biosolids in the composting operation can be advantageous operationally. Biosolids provide moisture and nitrogen, while yard waste provides carbon and serves as a bulking agent to increase porosity. Composting options that are appropriate for biosolids include windrow composting, MSAP, aerated static pile composting, and in-vessel composting. Aerated static pile and windrow are the most commonly utilized methods, representing 72% of the programs in the United States, and all six Florida programs.⁵ Depending on the method utilized, biosolids compost can be ready for use with 3 to 4 weeks of active composting followed by one month curing.⁶

5. Feasibility of Organics Composting

Numerous successful composting operations exist throughout the country. The challenge in Key West is to develop an organics collection and processing operation that is cost-effective. To

⁴ Per conversation with Darren Midlane, Technical Director at Harvest Quest International.

⁵ *Biocycle*, "Biosolids Composting in the United States – 2010 Update."

⁶ US EPA, *Biosolids Generation, Use & Disposal in the United States* (US EPA530-R-99-009), 1999.

achieve this, the processing facility would ideally be located in the Lower Keys, with the primary use of the end-product also in the Keys.

The Monroe County Board of County Commissioners recently directed the County's Climate Change Action Committee to develop a plan for mulching, composting or otherwise recycling yard waste instead of disposing of it. The County has received a draft proposal from the South Dade Soil and Water Conservation District (SDSWCD) and expects to also receive a proposal from Waste Management, which currently operates the County's three transfer stations.

SDSWCD proposes using two 96-cubic yard in-vessel composters at each of the County's three transfer stations. The estimated cost for purchase, delivery and installation is \$763,000 per transfer station, or a total of \$2.3 million. This does not include operating and maintenance costs.

As demonstrated by these cost estimates, in-vessel composting requires substantial capital investment and limits the tonnage that can be processed. Bulking agents, such as yard waste, often need to be considerably reduced in size to avoid blocking the vessel or tunnels.

Windrow composting and the MSAP method are less expensive, easier to implement, and more flexible than other composting processes. If managed correctly, odors and vectors are not an issue. In addition, land acreage requirements are similar for in-vessel and windrow composting. A vessel provides initial treatment, but does not produce a finished compost product; additional windrowing and curing is required.



Given the potential cost difference to the City and nature of yard waste in the Florida Keys, this discussion regarding the feasibility of processing organics focuses on windrow composting or the MSAP method.

Site Criteria and Space Requirements

Criteria to be considered for a composting site include location, size, accessibility, soil drainage, topography, and buffers. The site must be adequately sized to receive, mix, and compost all of the current and future material that will be received at the facility. The facility land requirement is dependent upon the volume of organics collected for processing.

Investing in a suitable all-weather surface is important, ensuring access and operation of heavy equipment during periods of wet weather. For yard waste and food waste composting, a crushed aggregate base-layer is sufficient. Limerock or recycled crushed concrete is generally utilized (12 to 18 inches in depth). The site design must also include adequate plans for storm water management.

If biosolids are included, additional site design requirements must be met, including an impervious surface and storm water and leachate collection controls. With Florida's inclement weather, the simplest method to avoid dealing with large volumes of runoff or leachate is to erect a canopy roof structure over the compost pad.

Based on the estimated volumes of yard waste, commercial food waste, and biosolids that are potentially available and utilization of windrow composting techniques, Table 2 estimates the land requirements depending on the types and percentages of materials diverted for composting. Of note, the inclusion of food waste and/or biosolids into yard trash does not increase the volume and space requirements as much as additional yard waste. Yard waste is coarsely ground and bulky with countless voids that would be filled in with food waste or biosolids. The table is based only on yard waste, food waste, and biosolids generated in the City. Economies of scale potentially could be realized if the City partnered with Monroe County.

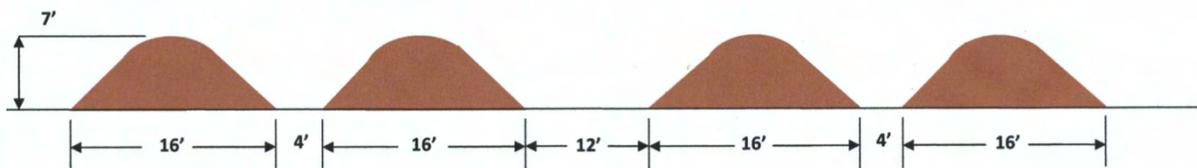
Table 2: Land Requirements for Organics Composting

Organic Waste Capture Rate		Volume (cubic yds/yr)	Space Required	
			Square Feet	Acres
Yard Waste Only	100%	24,081	78,760	1.81
	75%	18,061	59,070	1.36
	50%	12,041	39,380	0.90
Yard Waste + Comm. Food	100%	25,285	82,698	1.90
	75%	18,964	62,024	1.43
	50%	12,643	41,349	0.95
Yard Waste + Comm. Food + Biosolids	100%	26,549	86,833	2.00
	75%	19,912	65,125	1.50
	50%	13,275	43,416	0.99

Note: Based on the waste composition results and converted to cubic yards.
Assumptions: Yard waste density of 500 lbs/cy; food waste and biosolids density of 1,600 lbs/cy; 5% volume increase with the addition of food waste, 10% with subsequent addition of biosolids, assuming a 3:1 mix of yard waste to food waste or biosolids; reprocessing of bulk material provides up to an additional 7,225 yards of carbon-based materials.

The calculations in Table 2 assume four composting cycles per year (three months per cycle) and windrows 7 feet in height and 16 feet wide at the base. Windrows would be constructed in pairs 4 feet apart with 12 feet wide aisles between each pair, as depicted in Figure 2.

Figure 2: Windrow Construction Diagram



Concerns have been raised regarding attraction of vectors and birds. The composting facility design can include parameters to eliminate vector attraction. In particular, the receiving and mixing area of the facility could be enclosed to eliminate any potential exposure to food waste.

Fabric structures, which are rapidly gaining popularity, are both inexpensive and exceptionally strong. A framework of galvanized steel tubing covered with UVI treated and weather resistant fabric provides an ideal structure that can withstand hurricane force winds.

To further reduce attraction of animals, as well as to speed up the degradation process, food waste can be macerated or ground. Initial composting can be performed within the enclosed structure and the material relocated outside after approximately 5 to 7 days.



Potential Composting Sites

Based on discussions with City and County staff, finding a location to compost organics could be challenging because of the density of development and existing land uses. Discussions with City staff resulting in identification of the following sites for further exploration.

- **Rockland Key** – Property owned by Toppino, Kemp, or Monroe County. Siting of a facility on Rockland Key would require coordination with the U.S. Naval Air Station on Boca Chica Key to ensure that operations would not create a bird hazard for aircraft using the air station.⁷
- **Fleming Key** – U.S. Navy property. The City currently operates a wastewater treatment facility on Fleming Key, which would make it a convenient location for co-composting with biosolids. The U.S. Naval Air Station’s Business Manager expressed concern regarding increased traffic to this site because of the burden on security forces and additional wear and tear on the access bridge.
- **Old Boca Chica Road** – County property located south of the Naval Air Station on Boca Chica Key. As with Rockland Key, siting of a facility on Rockland Key would require coordination with the U.S. Naval Air Station on Boca Chica Key to ensure that operations would not create a bird hazard for aircraft using the air station.⁸ Access to this site is provided via Boca Chica Road (County Road 941) at mile marker 11 on Big Coppitt Key.
- **Closed Stock Island Landfill site** – The footprint of the landfill itself is not conducive to a composting operation and the other areas of the property are slated to be used as a transportation facility for the City.

^{7,8} FAA Advisory Circular 150/5200-33, Hazardous Wildlife Attractants on or Near Airports, Section 3-4 Composting Operations on Airports provides guidance regarding locating composting facilities on or near airports. This section recommends against locating composting operations within 1,200 feet from an aircraft movement area, loading ramp, or parking space. Section 3-4.a specifies that the components of the compost should never include any municipal solid waste; however, non-food waste such as leaves, lawn clippings, branches, and twigs generally are not considered a wildlife attractant. Further, sewage sludge, wood chips, and similar material are not considered municipal solid waste and may be used as bulking agents. Section 3-4.b provides for an airport operator to reserve the right to stop any operation that creates unsafe, undesirable, or incompatible conditions at the airport.

- **Monroe County property** – possibly on Long Key or Cudjoe Key. As mentioned previously, the Board of County Commissioners recently tasked the Climate Change Action Committee with developing a yard waste diversion plan. Based on discussions with County staff, the primary sites under consideration are the three County transfer stations, one of which is located on Cudjoe Key.

Equipment Requirements

Regardless of the composting method selected, equipment is needed to process incoming material (size reduction) and handle pile construction, turning, watering, screening, and monitoring of the material. Provided below is a summary of the types of equipment needed and the uses of each.

A composting facility could be owned and/or operated by the City or a private contractor. If the City contracts for service, the contractor would likely provide some or all of the equipment.

Grinder



Size-reducing yard waste to a suitable particle size for composting is a crucial initial step. The characteristics of the City's yard waste, predominantly palms, will make it difficult to grind, requiring a high horsepower unit to handle the tough fibrous material. Therefore, the most likely option will be to utilize a private grinding contractor on a periodic basis.

Front-End Loader



The loader is the all purpose workhorse responsible for all forms of material movement:

- Windrow construction,
- Windrow turning,
- Feeding grinders, screeners, etc., and
- Loading out finished compost.

Screener



The use of a screener provides uniform fine-grade compost suitable for numerous horticultural applications. Screened compost also has a value and can be sold or traded to residents, landscapers, nurseries, and golf courses. A small trommel screen (14 foot drum) would be adequate, or alternatively a rental unit could be utilized periodically.

Water Truck or Hose Setup



During the drier periods of the year, composting yard waste can be a water intensive process. Ground yard waste can have very low moisture content and requires the addition of water to raise the moisture level to a minimum of 50% to facilitate optimum composting. Therefore, having an adequate water source is an

important consideration when determining a suitable facility location. Biosolids, if co-composted with yard waste, can provide substantial moisture.

Monitoring Equipment

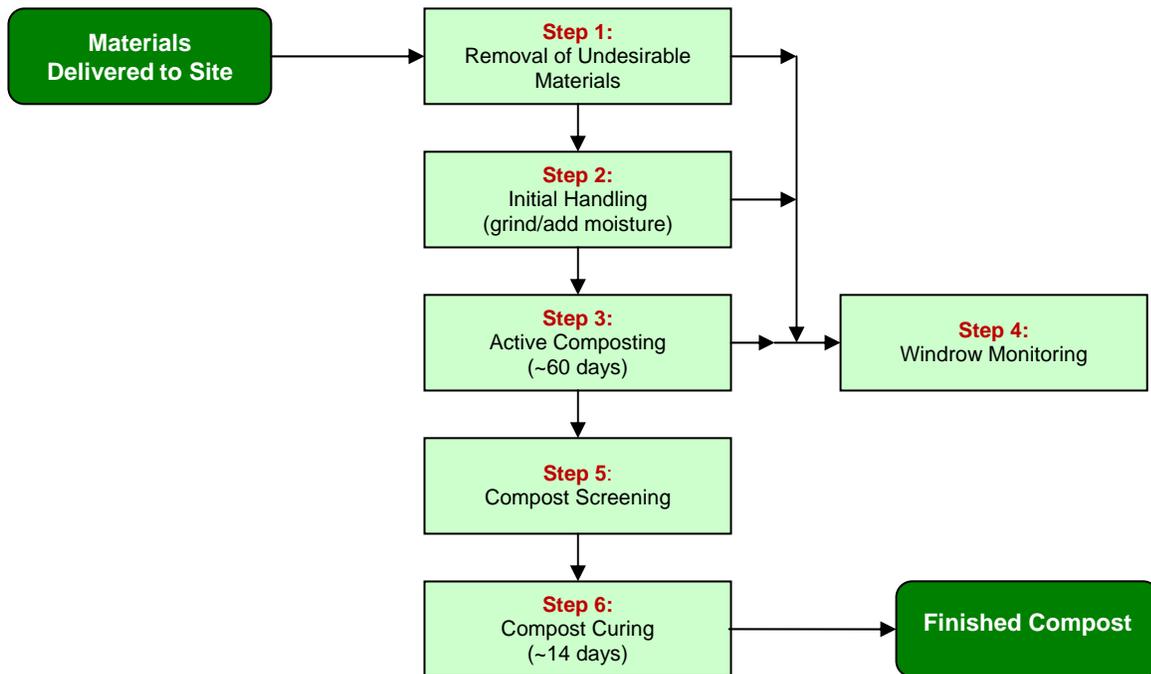


Thermometers are necessary to monitor temperature and to keep a temperature log to meet regulations. The temperature of a compost pile is a good indicator of how well the microbes are working. Heat produced through the composting process is an indicator of microbial activity.

Six-Step Operational Process Flow

A composting process entails six basic steps, which are summarized below and depicted in Figure 3.

Figure 3: Six-Step Composting Process



Step 1: Removal of Undesirable Materials – At the receiving point of the facility, a protocol is needed to reject loads containing excessive contamination. Once accepted, compostable material is separated from non-compostable material and other contaminants. For example, removing non-compostable materials from yard waste (e.g., leaves, brush and yard trimmings) might involve removing contaminants such as pieces of metal, garden hoses, used vehicle oil and air filters, aerosol cans, concrete and rocks, and plastic bags. Eliminating non-compostable material can occur at various stages of the process. For example, if bags are to be used for collection, it is advantageous to debug at the curb or require the use of paper bags. This type of bag can be

shredded and mixed into the compost, while non-biodegradable plastic bags must be removed prior to composting.

Step 2: Initial Handling – Incoming materials are then physically processing (ground) and other materials that improve composting efficiency are added. Materials preparation also includes the following:

- (a) Blending of carbon and nitrogen sources by mixing two or more materials to establish a desired ratio of carbon to nitrogen to promote efficient composting.
- (b) Adjusting initial porosity to satisfy requirements for airspace and mitigate odor generation.
- (c) Adding water to the materials to adjust the moisture levels to a desirable range.
- (d) Mixing to homogenize the starter materials, to distribute water uniformly, and to break down clumps or oversized particles.
- (e) Constructing windrows.

Step 3: Active Composting – The natural biological degradation process (composting) is controlled and accelerated at a composting facility. Composting is the transformation of biologically decomposable material through a controlled process that results in production of stabilized organic matter (compost).

Step 4: Windrow Monitoring – Monitoring is necessary to ensure optimum conditions, such as porosity, ample oxygen, and moisture level, which are highly favorable to active composting microbes. Windrows are monitored for temperature, moisture content, odors, and evidence of leachate. Samples are sent for laboratory analysis to ensure a quality product. All monitoring data is recorded for process management and evaluation.

Step 5: Compost Screening – Screening is required to remove contaminants such as oversized materials, stones, plastic film, and hard plastic. Screening also enables size classification to suit customer needs. Some customers may require that essentially all man-made inert material is removed from compost to enhance its aesthetic acceptability.

Step 6: Compost Curing – Customers that require a very mature product may specify a greater degree of product stability. Curing is the last stage of composting that occurs after much of the readily metabolized material has been decomposed. Following the active composting phase, when temperatures within the windrows have declined to around 100°F and screening (if required) has been carried out, the resultant compost should be allowed to cure before final use. Curing has no defined time; however, common practices in commercial composting operations usually allow a period of two to four weeks.



Marketing: End-Use Options

Numerous uses exist for compost. As a soil amendment, it improves the texture, porosity, water holding capacity, and organic content of the soil. Compost is often distributed in bulk with pickup at the composting facility by the end-use market. The product can also be bagged and sold.

While some facilities give end-product compost to the public at no cost, other facilities enjoy revenue from both public and professional markets. The market value of mature yard waste compost in Florida currently ranges from \$10.00 to \$26.00 per cubic yard.⁹

The volume and quality of the compost produced will impact which end-users will be targeted and their acceptance of the product. Potential users of compost include the following:

- **City facilities, parks, and recreation areas** – Use of compost on City property not only closes the loop, but can offset costs by reducing or eliminating the need to purchase comparable landscaping material.
- **Golf courses** (see photo) – Over 75 golf courses are located within 130 miles of the City, including the Key West Golf Club located on College Road.
- **Local landscapers and gardeners** – Sale of compost to commercial landscapers offsets costs and provides revenue. Compost can be offered for bulk pickup or distributed in bags.
- **Nearby military base and related properties**
- **Resorts** – Over 100 resorts and lodges are located in the Keys, many of which have landscaped property.
- **Farmers** – Farmers might not present a significant end-market for Key West compost, as evidenced by the relatively small value of agricultural products sold in Monroe County.¹⁰
- **Residents** – Compost can be offered free or sold to residents for use in home gardens and landscaping.



A market research study would identify the realistic geographic boundary of the market for Key West compost and assess the potential demand for it by end-users within that boundary. In addition, a marketing strategy would be necessary to target the most promising end-users. A program to market the compost to the local public might include branding and a logo, a demonstration garden at the facility pickup site, and promotion on the City website and at events.

Financial Implications

As noted above, the cost of producing compost will vary greatly depending on the methodology used. In Key West, local composting will provide a cost effective alternative to disposal if production costs remain lower than transport and disposal costs, which should be attainable. The

⁹ *Composting News*, April 2012, page 6.

¹⁰ In 2007, farmers in Monroe County sold only \$2 million worth of products. Of those published, all but four other counties sold more (Florida Department of Agriculture and Consumer Services, Division of Marketing and Development).

sale and use of locally produced compost may also provide additional benefits to the City in the form of increased waste diversion and revenue.

Preliminary conversations with industry specialists have indicated that the windrow or MSAP methods best suit Key West's unique environmental parameters. Production costs for windrow composting ranges from \$16-25 per ton of inbound material, and for the MSAP process the range is \$28-44 per ton. Either would be far less than current transport and disposal fees (currently \$71.55/ton). Revenue for finished compost is generally in the range of \$8-15 per cubic yard.¹¹

One potential consumer for locally produced compost could be Key West Golf Course. Compost is used by golf courses for both construction and maintenance purposes. A standard 18-hole golf course can typically consume 250 to 300 cubic yards of compost, or 500 to 600 cubic yards of 50/50 compost-sand blend per year for maintenance purposes. Use at the Key West Golf Course will also increase product exposure. The City could also sell finished compost to local businesses and make it available to residents at no charge. A more detailed analysis of financial implications will be needed once a composting site is found.

¹¹ Per conversation with Darren Midlane, Technical Director at Harvest Quest International.