

**Boulder City Council
STUDY SESSION**

**October 11, 2011
6 – 8 p.m.**

Update to the Zero Waste Master Plan

**1777 Broadway
Municipal Building
City Council Chambers**

Submit Written Comments to City Council
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Table of Contents

PURPOSE	3
STUDY SESSION QUESTIONS FOR CITY COUNCIL:	3
EXECUTIVE SUMMARY	4
BACKGROUND	4
A. WASTE DIVERSION RATES AND TRENDS	5
B. 2010 PARTICIPATION RATES	5
C. TOXICITY	6
D. BOULDER COUNTY'S ZERO WASTE GOAL	7
ANALYSIS: POTENTIAL NEXT STEPS IN BOULDER'S ZERO WASTE EFFORTS.....	7
A. WHAT IS STILL IN THE TRASH?	7
B. OPPORTUNITIES FOR ACHIEVING ZERO WASTE: PROGRAMS AND SERVICES	9
C. OPPORTUNITIES FOR ACHIEVING ZERO WASTE: FACILITIES	10
1. <i>Construction and demolition debris recycling facility</i>	11
2. <i>Expanding the capacity for commercial composting</i>	11
3. <i>Boulder "Resource Recovery Park"</i>	12
4. <i>Initial prioritization of potential facility investments</i>	13
D. OPPORTUNITIES FOR ACHIEVING ZERO WASTE: POTENTIAL REGULATIONS	14
1. <i>Require commercial source separation</i>	15
2. <i>Ban non-recyclable or non-compostable food takeout containers</i>	17
3. <i>Reduce the use of disposable checkout bags</i>	19
4. <i>Initial prioritization of potential regulatory approaches</i>	22
NEXT STEPS:	24

MEMORANDUM

TO: Mayor Osborne and Members of City Council

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DATE: October 11, 2011

SUBJECT: Study Session: Update to the Zero Waste Master Plan

PURPOSE

The purpose of this study session is to update City Council on the status of community waste reduction efforts and to provide a summary of the analyses and public outreach completed to date in relation to the master plan update. Additionally, the study session is an opportunity for City Council to provide feedback on its priorities for new or expanded zero waste services, facilities and potential regulations as staff develops the updated Zero Waste Master Plan (ZWMP).

After receiving City Council's input at this study session, staff will conduct further analysis, continue the stakeholder and community input process, and return to council with a draft ZWMP in the first half of 2012. Similar to all of the city's master plans, the updated ZWMP will include a fiscally constrained plan, an action plan and a vision plan. At each of these plan levels, the updated ZWMP will outline the proposed zero waste programs and services to be offered to businesses, multi-family housing, and homeowners. It will also include a description of the current and proposed zero waste facilities for which the city will plan, seek funding for, and work with private (for-profit and nonprofit) organizations to develop. In addition, the updated ZWMP will provide analyses related to potential regulations deemed necessary or appropriate for achieving Boulder's zero waste goals, and the recommended stakeholder process for developing ordinance language for subsequent council consideration and approval.

Study Session Questions for City Council:

1. Does council have questions or comments on the draft programs and services proposed for inclusion in the updated ZWMP?
2. Does council have any questions or comments on the facility or regulatory options presented for consideration? Are there any options that do not warrant further consideration or analysis?

EXECUTIVE SUMMARY

This memo provides council with a high-level prioritization of proposed services, potential facility investment, and potential regulatory approaches to guide the five-year update to the Zero Waste Master Plan (ZWMP). The analysis section of the memo includes a discussion of potential new zero waste initiatives and a matrix that shows each initiatives' ability to:

1. Divert additional materials from the waste stream;
2. Increase participation in city zero waste services;
3. Reduce toxic or potentially toxic materials in the environment;
4. Reduce greenhouse gas emissions; and
5. Be cost effective.

Based on analyses completed to date, it appears that the most effective way to make significant progress toward becoming a zero waste community may be through a combination of regulations and incentives, and to target new initiatives specifically on improving waste reduction in multi-family developments and among businesses. In short, the analysis points toward implementation strategies for the updated ZWMP that combine program improvements with effective outreach and education; targeted facility improvements; and tailored regulations that are phased in and connected to meaningful incentives and technical assistance.

The analysis section of this memo is broken into four parts:

- A. A presentation of waste composition study results, i.e., what's left in the trash;
- B. Services and incentives being considered for single- and multi-family residents and businesses to address what's left in their trash;
- C. Facilities being considered to ensure adequate zero waste processing capacity for the community; and
- D. Options for regulatory changes that can help overcome barriers to zero waste.

Based on council feedback at the study session, and continued input from stakeholders and the public, specific recommendations will be presented to the community and council in the updated ZWMP during the first half of 2012.

BACKGROUND

At its Feb. 8, 2011 study session, council received background information and provided feedback on the original Master Plan for Waste Reduction (now called the Zero Waste Master Plan), including guiding principles, priorities and goals. The Feb. 8 memo also included information on significant shifts since the original plan's acceptance, including the purchase of the "Recycle Row" property at 6400 Arapahoe Road, as well as initiatives in the original plan that have not yet been implemented (see **Attachment A**).

Since the Feb. 8 study session, staff has completed an assessment of the current materials being recycled and composted effectively. Additional information has also become available from a Boulder County waste composition study that identified the recoverable materials still in the county waste stream. Staff has also met with several business leaders to begin to identify the primary barriers to greater waste reduction and has conducted research on peer communities and their lessons learned.

The following section provides a summary of information developed since the Feb. 8 study session to provide a more complete and accurate understanding of Boulder’s current waste stream and progress towards the community’s zero waste goals.

A. Waste Diversion Rates and Trends

Overall, Boulder’s 2010 community-wide diversion rate was 46 percent, including:

- Single family residential: 57 percent
- Multi-family residential: 19 percent
- Commercial: 30 percent
- Construction and demolition: 83 percent

Figure 1 summarizes Boulder’s current diversion rates compared to previous years. Based on feedback from the February 8 study session, staff has reported construction and demolition (C&D) waste separately from overall residential and commercial tonnage, since large construction projects have skewed diversion rate calculations in the past. This was the case in 2010 as well, with 19,514 tons of C&D material diverted from a large University of Colorado project. Since this represents almost 40 percent of the total tons recycled, reporting C&D diversion separately results in a more accurate picture of Boulder residents’ and businesses’ progress towards the community’s zero waste goal.

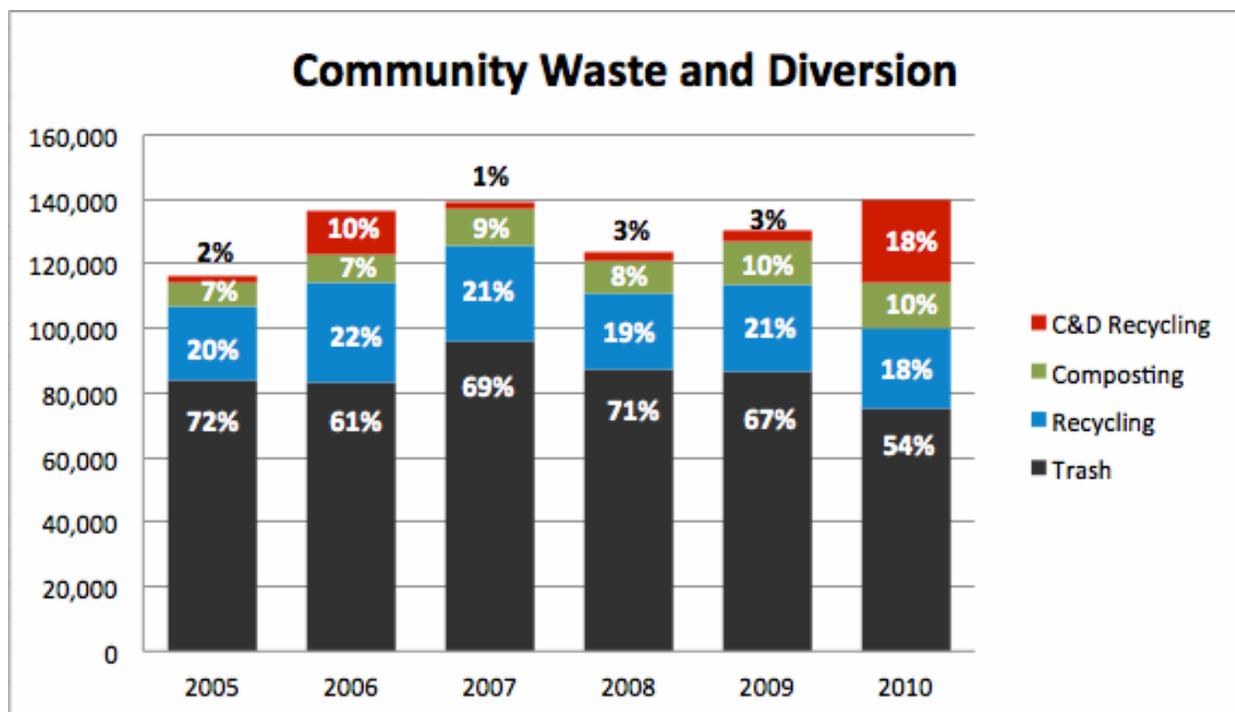


Figure 1: Diversion rates, 2005 to 2010

A graph showing the breakdown of the waste stream by sector is provided in **Attachment B**. It illustrates the percentage of Boulder’s total generation created by the commercial sector. Additional information regarding Boulder’s current community-wide diversion is provided in **Attachment C**.

B. 2010 Participation Rates

At the Feb. 8 study session, council expressed an interest in multiple criteria for evaluating progress towards zero waste goals, including overall participation in recycling and compost collection programs. Beginning in 2010, the annual hauler reporting form included a request for

the number of trash, recycling, and compost customers (by service address) by sector in addition to tonnage data. This information is reconciled with the number of trash customers reported through trash tax receipts. **Table 1** shows the most recent participation data.

One challenge of this data is the ability to translate “service addresses” into actual numbers of customers. This is because each service address can represent one single family home, one section of a multi-family complex that shares a dumpster, or one commercial dumpster that is shared by multiple businesses. The city will continue to collaborate with haulers to develop improved measures of participation, and will continue to track this information in 2011 and beyond.

	Trash	Recycling	Compost
Single Family	19,023	19,023	19,012
Multi-Family	1,118	1,108	44
Commercial, Industrial & Institutional	2,986	1,782	230

Table 1: *Total customers reported by all haulers for trash, recycling and compost collection services in 2010*

C. Toxicity

Another priority identified by City Council on Feb. 8 was reducing the toxicity of the waste stream. Accurately measuring progress toward this goal is challenging. While staff has data on the amount of hazardous materials taken to Boulder County’s Household Hazardous Waste (HHW) facility by Boulder residents, success should not necessarily be measured by an increase in this number. As residents and businesses become more educated and alternative, non-toxic products are developed, the overall amount of toxic material in the community should decrease. Therefore the amount of hazardous material recycled should also eventually decrease. The new Hazardous Materials Management Facility (HMMF), which has replaced the HHW facility with a more convenient location and expanded operating hours, will also begin to accept materials from certain classifications of businesses later this year.

Table 2 shows that the amount of toxic waste Boulder residents diverted via the HHW facility has slightly decreased since 2006. However, this number is expected to rise significantly with the new facility location, its additional hours of operation, and the addition of business waste collection.

Year	2005	2006	2007	2008	2009	2010
Tons	39	46	43	44	37.23	39.22

Table 2: *Tons of household hazardous waste collected at the Boulder County HHW facility from Boulder residents*

The most accurate way to estimate the level of toxicity in Boulder’s waste stream is to conduct periodic waste composition studies. The city has not conducted this type of study recently; however Boulder County did complete a study in December 2010. The report (see excerpts in

Attachment D) indicated that household hazardous waste composed an estimated 432 tons, or 0.2 percent, of the waste stream, with the most prevalent materials being automotive fluids; latex paint; and pharmaceuticals and syringes. In addition, electronics and appliances composed an estimated 6,848 tons, or 3.1 percent of the waste stream. There is also a growing body of research pointing to the toxicity inherent in the proliferation of disposable plastics, specifically bisphenol A (BPA), a chemical used to make most plastics and resins.¹ According to Boulder County’s waste characterization study, 52.4% of the plastics that remain in the trash are disposable (plastic bags, plastic film, plastic bottles, etc.); however the study did not classify these as “toxic” waste.

D. Boulder County’s Zero Waste Goal

Boulder County issued its Zero Waste Action Plan at the end of 2010. Boulder County’s plan outlines its recommendations to reach the county’s goal of zero waste by 2025. As of 2009, the county had reported an estimated diversion rate of 35 percent. The county’s plan outlines zero waste programs and policy recommendations for municipalities within the county to initiate in the short-term and mid-term. Of those, the City of Boulder is ahead of the curve, having 14 of the 17 short-term recommendations already in place. In addition, of the 9 mostly regulatory, mid-term recommendations from the report, the City of Boulder has two in place. The remaining 10 short- or mid-term recommendations are expected to be addressed through the recommended initiatives in the current update to the city’s ZWMP.

ANALYSIS: POTENTIAL NEXT STEPS IN BOULDER’S ZERO WASTE EFFORTS

A. What is still in the trash?

Boulder County commissioned a waste composition study in December 2010 (see excerpts in **Attachment D**). Although the waste stream studied was from the entire county, the resulting data provide a more accurate estimation than has been available to the city in the past. **Figure 2**, on the next page, represents the breakdown of major material groups for the aggregate countywide solid waste stream. As shown, organics is the largest material group, followed by paper, problem waste and plastic. “Problem waste” includes items such as large and small electronics, small appliances, carpet, tires, rubber, batteries and furniture/bulky items.

Figures 3 and 4, also on the next page, provide further information on the composition of the countywide residential and commercial waste streams. They illustrate that 74.6 percent of residential waste and 72.8 percent of commercial waste is made up of organics, paper, plastic and glass – most of which is recyclable or compostable in Boulder.

¹ “Bisphenol A (BPA) Action Plan Summary” Environmental Protection Agency
www.epa.gov/opptintr/existingchemicals/pubs/actionplans/bpa.html

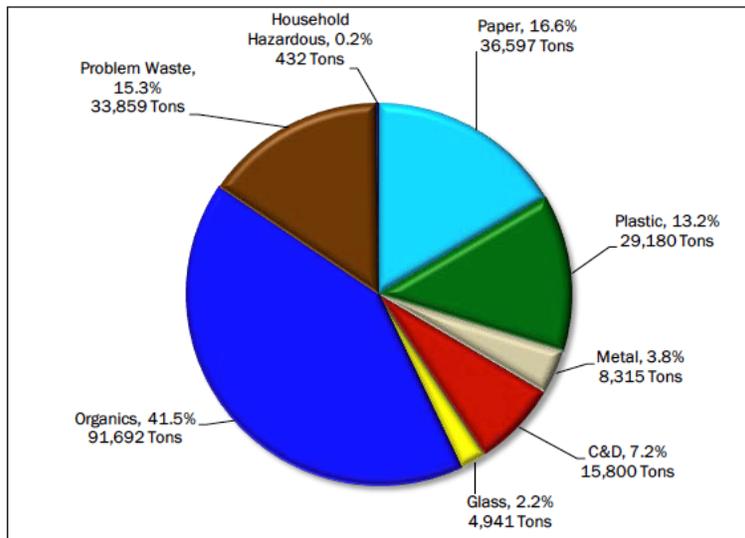


Figure 2: Boulder County's Total Municipal Solid Waste Composition, 2010

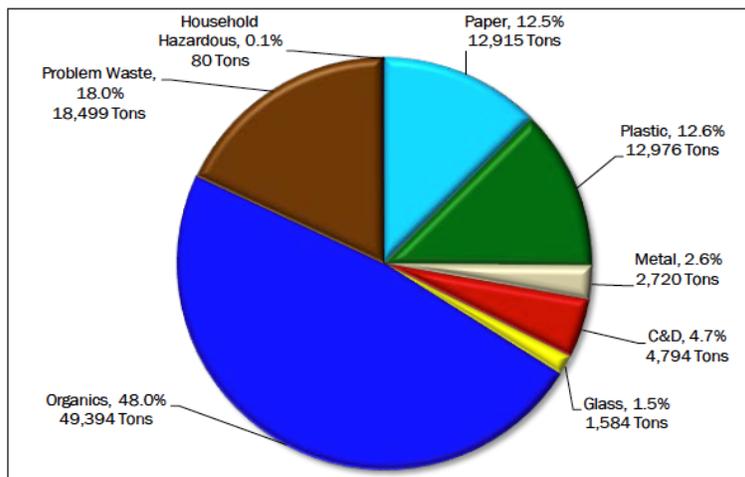


Figure 3: Boulder County Residential Waste Composition, 2010

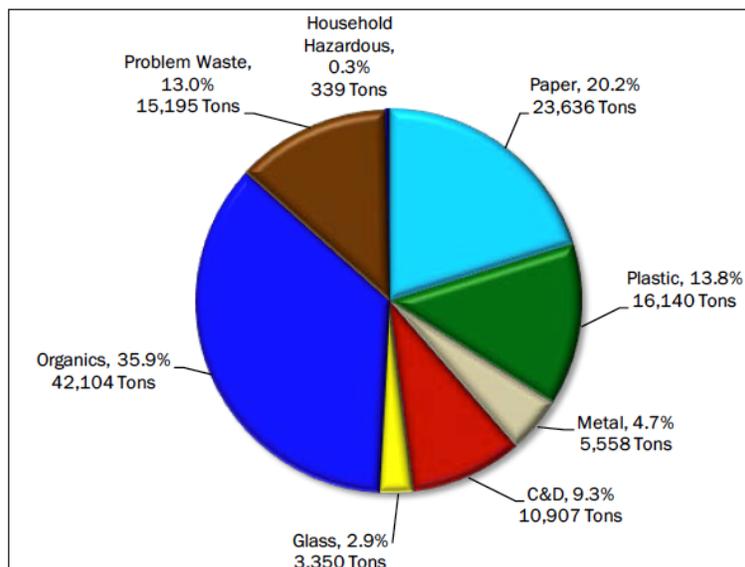


Figure 4: Boulder County's Commercial Waste Composition, 2010

B. Opportunities for Achieving Zero Waste: Programs and Services

There are a number of important opportunities for improving the reach and effectiveness of Boulder’s zero waste programs and services. These have been identified based on: analysis of Boulder’s waste stream and its current programs and services; research on peer cities that have achieved high diversion rates; and information from Eco-Cycle’s recent *Getting to Zero Waste Summit* with nationwide experts. Evaluation of these opportunities also takes into account input from City Council, the Environmental Advisory Board, a waste task force made up of industry leaders that was organized as part of the ZWMP update process², and the general public.

In summary, achieving Boulder’s zero waste goals will require a combination of aggressive education and outreach to all sectors combined with expanded services for businesses and multi-family properties. In addition, several facility development priorities remain (as discussed in subsection C, beginning on page 10), and there is a need to consider potential regulatory strategies (as discussed in subsection D, beginning on page 14).

Table 3, shown below and continuing on the next page, lists specific program and service priorities identified to date for potential inclusion in the ZWMP. Based on council feedback, staff will continue to meet with stakeholders and will complete detailed analyses on the effectiveness and cost of each potential initiative. This will include analysis of the financial feasibility of each option as well as consideration of the interface of these services with the facility priorities and potential regulatory approaches discussed later in this memo.

Proposed Programs & Services	Potential Additional Diversion	Cost Effectiveness Minimizes investment per ton (both city and private \$)	Participation	Toxicity Reduction Minimizes the quantity of toxic and potentially toxic materials in	GHG reduction Maximizes greenhouse gas reduction
Single Family Residential					
Increase materials allowed in curbside compost	••	•••	•••	n/a	•••
Seasonal increased frequency of compost collection	•	••	•	n/a	•
More aggressive pay-as-you-throw structure	•	•	•••	n/a	••

Table 3: Potential program and service improvements for the updated ZWMP

² **Waste task force members include:** Kate Bailey (Eco-Cycle), Tim Bentz (Boulder Area Rental Housing Assn.), Jennifer Bohn (Boulder County Resource Conservation Division), Jeff Callahan (Boulder County Land Use), Jack DeBell (University of Colorado), Erin Dodge (Boulder County Public Health), Allyn Feinberg (Eco-Cycle Board President), Keith Frausto (Center for Resource Conservation), Juri Freeman (SERA, Inc.), Lisa Friend (Boulder County Commissioners Office), Gary Horton (Western Disposal Services), Sheila Horton (Boulder Area Rental Housing Association), Bryce Isaacson (Western Disposal Services), Shawn LaBarre (ReSource), Eric Lombardi (Eco-Cycle), Cathy Lurie (ZeroIn), Marti Matsch (Eco-Cycle), Tom Orlando (Boulder Housing Helpers), Anne Peters (Gracestone, Inc), Dan Powers (Boulder Chamber of Commerce), Lisa Skumatz (SERA, Inc.), Choen Vogt (boulder County Public Health).

Proposed Programs & Services	Potential Additional Diversion	Cost Effectiveness Minimizes investment per ton (both city and private \$)	Participation	Toxicity Reduction Minimizes the quantity of toxic and potentially toxic materials in	GHG reduction Maximizes greenhouse gas reduction
Multifamily Residential					
Enforce requirement for property managers to provide adequate bins for recycling	••	••	••	n/a	•
Require property managers to provide compost collection	••	•	•	n/a	•••
Require property manager education of tenants	••	••	••	n/a	••
Provide MFU specific internal and external signage and guidelines	••	••	••	n/a	•
Provide model lease language for MFU property managers	•	•••	••	n/a	•
Increase outreach to MFU populations	•	•	••	n/a	••
Commercial					
Increase general outreach and information on programs available to the business sector	•	••	•••	•	•
Increase/expand technical assistance through PACE program	••	••	••	•	••
Provide model lease language for commercial property managers	••	•••	•	n/a	•
Implement revised/additional financial incentives	•••	••	••	n/a	•••
Communitywide					
Increase promotion of existing facilities (CHaRM, new HMMF)	•	•	••	•••	•
Collaborate with Boulder County on new zero waste branding and marketing campaign	••	••	•••	•	••
Lobby for product stewardship laws at the state and federal level	•	•	•	•	•
Work to obtain more accurate data from haulers	•	•	•	n/a	•

Table 3 (continued): Potential program and service improvements for the updated ZWMP

C. Opportunities for Achieving Zero Waste: Facilities

While investments by the City of Boulder and Boulder County have created a robust infrastructure for waste reduction, several specific facility needs remain in order to ensure adequate processing capacity for specific materials generated in the community. Feedback from council, stakeholders and the public will help inform consideration of these facility needs in the ZWMP. These identified

needs will be paired with an analysis of funding availability, opportunities for public-private partnership, and other regulatory options to support facility development over time. The results of these analyses will be presented in the form of recommended facility priorities and phasing, as appropriate, in the fiscally constrained, action and vision plans of the ZWMP.

The following section identifies three key opportunities for zero waste facility development, including 1) a construction and demolition debris recycling facility; 2) expanding the capacity for commercial composting; and 3) the concept of a “resource recovery park.” These facility options are compared in a prioritization matrix on page 14 at the end of this section.

1. Construction and demolition debris recycling facility

Based on the proportion of construction waste present in Boulder County’s waste composition study, a county-wide facility that is designed specifically to handle the processing of construction and demolition (C&D) debris may be needed. City staff is collaborating with the county on the analysis of options for a regional C&D facility, as the city alone does not provide the economies of scale necessary to make such a facility cost-effective. Nor is it likely that a suitable site for such a facility could be located within the city area.

To inform its planning efforts, the county recently commissioned a three-part study that is expected to be complete by the end of November 2011. The study’s scope includes:

- *Generation* – How much and what type of C&D material is generated in Boulder County and will be generated over the next 20 years?
- *Markets* – What markets already exist for these materials, what markets are developing and what materials will continue to have no market in the future?
- *Feasibility* – Given the generation and markets findings, what kind of facility is needed in Boulder County, how big should it be and where should it be located?

Next steps and general direction for C&D recycling: The city will continue to work with Boulder County to support development of a regional C&D facility, drawing on the findings and recommendations of the study currently underway. However, in terms of the city’s own facility needs, staff believes that a C&D recycling facility should be treated as a lower priority than other facility demands for potential tax dollar investment. The need to focus on other facility priorities is further underscored by the relative greenhouse gas emissions related to C&D waste (which is largely inert) as compared to other parts of the waste stream (particularly organics, which produce methane, a highly potent greenhouse gas).

2. Expanding the capacity for commercial composting

Currently, approximately 42 percent of the county waste stream is made up of organic materials. As a result, it is critical to address organic materials in moving towards zero waste. Due to the city’s curbside compost collection program, a larger portion of the city’s residential organic materials are composted than is seen in the County’s waste composition study. Compostable material collected from the city’s curbside program is taken to the only compost facility in the county, operated by Western Disposal on 63rd Street.

In the City of Boulder and throughout Boulder County, commercial compost collection is voluntary. An assumption can be made that the proportion of commercial organics still in the trash in the city is comparable to the composition found in Boulder County’s assessment (35.9%). While Western’s compost site accepts organic materials from all residential haulers, it only accepts commercially generated organic materials from its own customers (Western Disposal currently collects trash from about 50 percent of the businesses in the city; and about 62 percent of the businesses that compost in the city). Other haulers that collect compost from businesses in Boulder take this material to compost facilities outside of the county, resulting in inefficiencies that translate into higher transportation-related greenhouse gas emissions.

Through the city’s collaboration with Boulder County, two options have emerged to increase local commercial compost processing capacity:

- ***Construct a publicly owned compost facility within the county.*** The county is conducting a market study to determine if there is significant demand to warrant public investment in this type of facility.
- ***Negotiate access for other waste haulers to Western Disposal’s compost facility.*** Western Disposal has indicated to city staff that it would consider opening its facility to other commercial compost haulers if the city required source separation of compostable material from food service businesses within the city (such as restaurants, grocery stores, bars and cafeterias—see discussion beginning on page 14). While this option would not require additional public investment from the city, preliminary modeling indicates that the generating business could experience an increased cost. Based on council feedback with respect to potential regulatory approaches, the city could explore several options for helping to defray these costs, including initial incentives and/or other mechanisms.

Next steps and general direction for commercial composting: Staff is awaiting the results of Boulder County’s market study. If the study indicates that there is sufficient demand for additional compost processing capacity to warrant a new facility in the county, additional analysis will be conducted to compare the development expenses of a publicly owned compost facility with the expenses to subsidize expansion and/or increased utilization of Western Disposal’s existing compost facility. In this comparison, staff would seek to minimize the costs to the generating businesses and focus on creating an economically sustainable facility. Results of these next steps, and any related recommendations, will be presented in the draft ZWMP and staff will follow up to gather input from stakeholders and the public.

3. Boulder “Resource Recovery Park”

The vision of a zero waste community requires sufficient facilities for all materials to be collected and processed, including those whose value, at a given point in time, may not support coordinated curbside collection. The city’s purchase of 6400 Arapahoe provides an opportunity for the city to secure a home for CHaRM and ReSource today, and provides a location where future resource recovery services could be located.

Currently, the materials collected at 6400 Arapahoe and the City of Boulder/Eco-Cycle CHaRM site are a combination of reusable construction materials; residential hard-to-recycle materials; and

commercial electronics. However, there exists an emerging need in the community from businesses with “problem wastes”—reusable waste materials that do not have sufficient value to support the economics of a curbside collection program, but which require a local site where they can be sorted and prepared for shipment to market. Many Boulder businesses are looking for ways to handle these types of packaging or production waste materials. In moving towards a zero waste community, the city could support these businesses by helping recycle or eliminate this waste. Toward this end, the long-term vision for 6400 Arapahoe could include an expanded area for staging commercial and residential discarded materials for shipment to off-site markets, especially when the quantity or value of these materials do not justify curbside collection.

Consideration of the annexation application for 6400 Arapahoe is scheduled for City Council on Oct. 18. It includes a two-phased development plan for the site, as well as guiding principles for acceptable activities that might be considered in a future “Phase III.” As outlined in the proposal, Phase I entails the building and site development required by the city and budgeted with existing trash tax revenues; while Phase II includes an additional warehouse to expand the capacity for each nonprofit and to include space for value-added activities (e.g., wood furniture from pallets, art from recycled materials, etc.). The area designated as “Phase III” in the site plan is not slated for use by either Eco-Cycle or the Center for Resource Conservation for their existing activities.

Since the purchase of 6400 Arapahoe was funded by an increase in the trash tax to its maximum level approved by the voters, options for funding additional costs associated with Phase II or Phase III development include the following:

- Reallocation from existing trash tax-funded services;
- A capital campaign spearheaded by the respective nonprofit organizations;
- An increase in the trash tax beyond the current maximum level, subject to voter approval;
- A new revenue stream from user fees or taxes; or
- Partnership with a private for-profit or nonprofit organization.

Next steps and general direction for 6400 Arapahoe and Boulder’s resource recovery park: On October 18, council will consider Annexation of 6400 Arapahoe. The site review for this property includes a Phase I and Phase II site plan. Upon annexation, staff believes that it would be prudent to build to Phase I. However, to move toward the long-term vision for 6400 Arapahoe to serve as Boulder’s resource recovery park, it is desirable to seek additional funding for Phase II development within five years of completing Phase I, while the site approval for Phase II will still be valid. During this period, appropriate uses for the “Phase III” area of the site can also be explored, consistent with any covenants included in the final site review and annexation agreements for the site.

4. Initial prioritization of potential facility investments

The preceding review of potential facility investments points to key opportunities and challenges. Table 4, on the next page, summarizes three potential areas for facility investment and compares them against five criteria: ability to increase waste diversion; cost effectiveness; ability to increase customer participation; ability to reduce the amount of toxins in the environment; and ability to reduce greenhouse gas emissions.

Potential Facility Investment	Potential Additional Diversion	Cost Effectiveness Minimizes investment per ton (both city and private \$)	Participation	Toxicity Reduction Minimizes the quantity of toxic and potentially toxic materials in the environment	GHG reduction Maximizes greenhouse gas reduction
Expand commercial compost processing capacity	5 to 20%	•••	•••	n/a	•••
Expansion of 6400 Arapahoe (Phases II and III)	1 to 15%	•	••	•••*	•
Construction and demolition debris recycling	5 to 20%	•	•	•	••

* Dependent on the types of materials collected (e.g. electronics, plastics, etc.)

Table 4: Potential facility investments for the updated ZWMP

The preliminary comparison of potential facility investments in Table 4 indicates that the highest priority for additional facility investment should be focused on expanding capacity for commercial composting. This finding will be further informed—and may be modified—based on the outcome of Boulder County’s compost market study and cost analyses; negotiations with Western Disposal regarding access for other commercial waste haulers to its compost site; and the county’s three-part study of construction and demolition waste processing options. The ZWMP’s recommended investment strategy will also be informed by council’s feedback at the study session and stakeholder and public input during the remaining months of the update process.

Next steps and general direction for facility investment: Staff will continue to review, revise and/or confirm the following prioritization for additional zero waste facility investments, which will be detailed in the draft ZWMP:

1. Expand commercial compost processing capacity
2. Expand 6400 Arapahoe (Phases II and III)
3. Contribute to a facility dedicated to construction and demolition debris recycling.

D. Opportunities for Achieving Zero Waste: Potential Regulations

Experiences in other communities point to the potential impact of regulations in helping achieve zero waste goals. Even here in Boulder, the adoption of SmartRegs has helped significantly increase participation in the EnergySmart services, and resulted in many property owners going “above and beyond” the minimum requirements: they initiate action because of the requirement, but then invest in even higher levels of energy efficiency because they determine it makes economic sense for them.

This section discusses three areas of potential regulation to spur action in response to the community’s zero waste goals. They include potential ordinances to:

1. Require commercial source separation
2. Ban non-recyclable or non-compostable food take-out containers
3. Reduce the use of disposable checkout bags

These three areas for potential regulatory action were identified based on (i) the original Master Plan for Waste Reduction; (ii) feedback received at the February study session; and (iii) public input and feedback.

The analyses in this section are intended to inform council's discussion of potential priorities, not to pre-suppose a regulatory solution or action. Based on council feedback, staff will continue to meet with stakeholders and the public to more fully develop, analyze and understand these three regulatory options for possible inclusion in the updated ZWMP and further council consideration.

1. Require commercial source separation

The action plan of the original Master Plan for Waste Reduction (MPWR) included a recommendation for a "rates and dates" ordinance that would require a certain percentage [not stated in the plan] of the commercial waste stream be recycled by 2012. If this recycling rate was not met, the MPWR vision plan recommended that any business generating substantial amounts of paper and/or cardboard be required to separate it from the trash. The MPWR also provided the option to include a composting requirement for businesses generating significant quantities of organic materials. At the Feb. 8 study session, several council members also requested that staff research an option for requiring compost collection at food service establishments, such as restaurants.

Boulder's commercial diversion rate has increased slightly from 26 percent to 30 percent from 2006 to 2010 (after you take out the C&D portion of the waste stream). In addition, Boulder County's waste composition study indicated that 73 percent of the commercial waste stream was composed of potentially compostable organic material; and recyclable paper, plastic and glass. Without increasing the diversion rate for the high percentage of recyclable and compostable materials in the city's commercial waste stream, it will be difficult to achieve the community's zero waste goals. Other communities have been able to achieve higher levels of diversion, especially in the commercial sector, due to much higher trash costs and/or fines for noncompliance with state laws. In Colorado, landfill fees are among the lowest in the country, and there is no statewide waste diversion mandate. Until there is a change in state requirements, both economic incentives and legal mandates—if desired—will need to be created and implemented at the local level.

The city currently offers several zero waste incentives in the form of financial and technical assistance to the business community detailed in **Attachment E**. The ZWMP will include expanded zero waste assistance to businesses. However, based on discussions with the commercial sector (including a recent business roundtable) and experience with the existing business technical assistance program, it appears that the following barriers prevent many businesses from implementing effective zero waste programs:

- Insufficient space for additional carts or dumpsters;
- Hauler hesitation to set up shared services (due to frequent problems collecting payment from all parties); and
- The split incentive that exists for business tenants and property managers who may not share an interest in subscribing to additional recycling or compost collection services.

Taken together, these barriers have the potential to affect many, if not most businesses in the city. For leased commercial spaces, a business tenant's trash service costs are often included in its common area maintenance (CAM) charge, which is determined at the time of lease signing. Unless the property manager is willing to add recycling service and split the cost between all tenants, the business would have to add individual recycling service and absorb the entire cost. Many businesses have expressed frustrations to city and county staff that property managers are unwilling to subscribe to additional services. The barrier is more significant with compost collection since there are normally only a few businesses in a shared situation that produce large quantities of compostable food waste.

An increasing number of cities have adopted mandatory source separation requirements to address the split incentive issue and to achieve higher diversion rates, including: San Francisco, San Diego, New York City, Austin, Chicago, Minneapolis, Portland, Seattle and Fairfax. If a mandatory source separation regulation were considered in Boulder, it would be important to work with the commercial haulers to address concerns about shared service, especially in retail districts with limited space for additional collection containers.

Based on a review of requirements adopted in other communities, the following factors are typically addressed in any source separation ordinance:

- *Required materials.* Most source separation ordinances require that all businesses recycle office paper, cardboard, #1 and #2 plastics, aluminum and glass. San Diego also includes materials “for which markets exist,” such as scrap metal and food waste. New York City’s ordinance requires the recycling of different materials depending on the type of business. Exceptions to this type of ordinance structure include: (a) Chicago, which requires businesses to recycle at least three materials of their choosing, and (b) Seattle, which prohibits businesses from disposing of paper, cardboard and yard debris. In Boulder, it would make most sense to require single stream materials be recycled, as they are processed locally. Any commercial composting requirement would need to be linked to a careful review (and likely expansion) of commercial compost capacity in the city or nearby.
- *Applicable businesses.* While all of the researched ordinances applied their regulations to all business types, several ordinances phased in the requirement based on square footage of the business, with compliance of larger businesses required sooner than for smaller businesses. In most instances where the ordinance required the separation of organics, it applied to all food-generating businesses. Portland’s food scrap requirement applies to all businesses that the city determines are eligible based on an estimation of the amount of organics generated. If the decision were made to develop an ordinance for Boulder, the city could work with local trash haulers and business representatives to determine appropriate definitions based on business type, activity and size or volume. The aim would be to define appropriate thresholds that help balance *reductions* in trash collection service with *increases* recycling or compost collection service in manner that minimizes or even eliminates additional bottom line costs.
- *Exemptions.* Exemptions authorized by ordinance were found only in San Francisco and Seattle for businesses that do not have adequate space for recycling on-site and no opportunity exists for shared recycling containers with neighboring businesses, as determined by city inspection.

- *Data Collection/Reporting.* Most ordinances require all businesses to submit a report to the city, typically in the form of a recycling plan detailing what materials are to be recycled at the business; an annual/quarterly report stating volumes of materials recycled; or both.
- *Education and other requirements.* The requirements for education of business occupants and bin placement vary by city; however, most ordinances do require that a recycling plan or guidelines be distributed to new and existing employees on a routine basis. In most cases, convenient and accessible placement of interior bins and city-approved bin labeling and signs are required.
- *Enforcement.* Enforcement of source separation in most of the researched ordinances relies on a review of business reporting as well as random and complaint-based inspections. Inspection responsibilities typically lie with public works departments in instances where the city operates the waste hauling services. In other cities, inspection responsibilities lie with the fire marshal, the planning department, or public health, or are tied to the business licensing system. In Chicago, non-compliance can result in business license revocation, while in several other cities there is a period for voluntary compliance before fines are issued. For example, Seattle utilized a three year implementation approach for its ordinance: education and free assistance were the focus of the first year; educational “tagging” on non-compliant carts or dumpsters were the focus of the second year; and warnings and fines went into effect in the third year. Portland, on the other hand, allowed for a six-year voluntary compliance period. All ordinances defined a process of warnings and fines for non-compliance, ranging from \$25 to \$1,500 per violation.
- *Mandatory compost collection only.* In the research completed and cities surveyed, no ordinances were found that specifically target the collection of *only* organic materials. Rather, those that address the collection of organic materials (i.e., San Francisco, San Diego and Portland) require source separation for all recyclables in all businesses. It should be noted that in discussions about potential mandatory commercial composting with Western Disposal, the company has voiced its concern about finding adequate markets for composted materials and requested that the city would need to take on the role of facilitating material sales and/or utilizing the finished compost product in the community.

2. Ban non-recyclable or non-compostable food takeout containers

At the Feb. 8 study session, several council members requested the research of options for either banning polystyrene takeout containers or requiring the containers to be recyclable or compostable. A requirement that all take-out containers be locally recyclable or compostable can provide an umbrella ordinance that also encompasses a ban on polystyrene; but would result in higher waste diversion than if the city chose to only ban polystyrene.

Polystyrene (PS), commonly referred to as Styrofoam, is a non-biodegradable thermoplastic made from styrene, a chemical derived from petroleum and natural gas by-products. In 2009, the US disposed of 2,470,000 tons of PS products according to an EPA report on municipal solid waste.³ Boulder County’s Waste Composition Study estimated that 2,019 tons of expanded PS, which also

³ “Municipal Solid Waste in the United States, 2009 Facts and Figures” U.S. Environmental Protection Agency, Office of Solid Waste, Dec. 2010.

includes packaging material, are in the county's annual waste stream. Similar to plastic, PS photo-degrades with exposure to sunlight, but will not dissolve in a landfill. While expanded PS packaging material can be recycled at CHaRM, food-contaminated takeout containers cannot. Extensive modeling by the City of Seattle estimated that 38 PS clamshell containers were used per person per year.⁴ Based on Boulder's 2010 census results and utilizing Seattle's modeling of per capita usage, 97,385 Boulder residents use approximately 3,700,630 PS clamshell takeout containers per year.

Reducing PS use in Boulder will not contribute to a large increase in the diversion rate due to its minimal weight, but it does address other community priorities, such as the toxicity of the waste stream and public health concerns. The most significant health problems associated with PS occur with exposure during the manufacturing of the chemical styrene, and a 1986 report by the EPA ranked the manufacturing process as the fifth largest creator of hazardous waste. In addition, the US Department of Health and Human Services added styrene to the list of substances "reasonably anticipated to be carcinogens"⁵ in June 2011. According to the Department of Health and Human Services, styrene can be transferred to food from PS takeout containers, plates and cups.⁶

Strategies to reduce the use of PS and increase the use of recyclable and compostable take-out containers include education campaigns, voluntary product bans and mandatory product bans. Over fifty California municipalities have banned PS, as have Seattle and Portland. In June 2011, the state of California banned PS containers statewide, effective July 1, 2016.

Ordinance Options: Two options for an ordinance addressing takeout container use in Boulder include a PS ban or a requirement that takeout containers be recyclable or compostable.

During the research phase of this project, no examples were found of a municipality that implemented an ordinance exclusively requiring takeout containers to be recyclable or compostable. Instead, this requirement was integrated into overarching PS product bans as outlined below. If council would like to further explore this regulatory strategy, staff will consider issues similar to those identified through the review of take-out container ordinances in other communities, including: applicable businesses, affordability exemptions, incentive/transition phase, and enforcement options.

All of the communities surveyed that have taken regulatory action have established a mandatory PS product ban. Should council decide that such a ban is desirable in Boulder, a review of their ordinances has identified the following factors as important considerations:

- *Applicable Businesses.* The language of most of the ordinances used the general language of "all restaurants and retail food vendors" when describing to whom the PS ban would apply. Several cities, including Seattle and San Francisco, listed individual business types, including restaurants, delis, fast food restaurants, cafes, coffee shops, juice bars, grocery stores, vending trucks or carts, business and institutional cafeterias, vendors at fairs, or other businesses selling or providing food or beverage to the public.

⁴ "Alternatives to Disposable Shopping Bags and Food Service Items Volume II, Appendices" Seattle Public Utilities, January 2008, pg K-5.

⁵ "Report on Carcinogens, 12th Edition" National Institute of Environmental Health Sciences, June 2011.

⁶ Ibid.

- *Applicable Materials.* In addition to PS takeout containers, the communities surveyed included all disposable PS food service items (containers, bowls, plates, trays, cartons, cups, etc.). Several cities, including Monterey, Santa Cruz and Palo Alto, exempt straws, cup lids and utensils from their respective definitions. Most cities also exclude raw or butchered meats, fish and/or poultry from the ordinance definition of “prepared foods,” thereby exempting any PS materials that come with those products. Portland’s list of items that may be packaged in PS includes many items such as baked goods, eggs, fruits and vegetables if the product is packaged outside of the store. One city, San Francisco, provides a list of acceptable alternative products in addition to its list of banned products.
- *Affordability Exemptions.* Most cities surveyed include some variation of an affordability exemption; and most provide a year-long exemption for an item if there is no suitable or affordable compostable/recyclable/reusable container. San Francisco provides businesses with a list of acceptable products to purchase unless the cost of the alternative exceeds the cost of the original non-recyclable/non-compostable product by 15 percent (however, no cost exemption allows the use of PS). San Mateo County, San Francisco, Alameda and San Bruno all encourage businesses to charge a “takeout fee” to customers to cover the cost difference associated with alternative containers.
- *Additional Requirements.* San Francisco’s ordinance, which addresses all food service ware, mandates that any vendor that provides disposable items for use in the establishment must have appropriate disposal containers for use by customers. This means that food vendors must provide appropriate recycling and composting bins for customer use.
- *Incentive/Transition Phase.* Among the cities surveyed, most allowed a transition period of six months to one year to comply with the ordinance and use up existing supplies.
- *Enforcement.* Among the cities surveyed, most issue warnings to businesses for a first offense, followed by fines ranging from \$100 to \$600. In lieu of fines, Monterey allows a violator to submit receipts documenting the purchase of at least \$100 worth of biodegradable, compostable or recyclable products after the citation date.
- *Effectiveness.* Compliance with San Francisco’s ordinance reached 94 percent by the spring of 2009, two years after implementation date. This success was facilitated by San Francisco’s recycling program that accepts all types of compostable and plastic food containers.

3. *Reduce the use of disposable checkout bags*

Disposable or “single use” bags—both plastic and paper—are commonly used at retail establishments, especially at grocery stores. A number of communities around the US have made efforts to reduce the use of these bags, through either outright bans or per-bag fees. A number of Boulder residents have testified during the public participation portion of City Council meetings during the past year to voice their support for council consideration of a disposable bag fee or ban.

While reducing the use of disposable bags will not result in a significant increase in diversion by weight, it would address other council priorities such as changing the community’s “social norms,”

maximizing participation in zero waste initiatives and addressing a potentially toxic component of the waste stream. In addition, reducing the number of disposable checkout bags in circulation reduces litter pollution and can also help reduce contamination costs at the Boulder County Recycling Center and local composting facilities (where plastic bags often clog machinery and degrade the quality of the final composted product).

While some residents repurpose or properly recycle disposable checkout bags, Boulder County's Waste Composition Study indicated that 781 tons of "plastic retail bags" remained in the waste stream in 2010. This represents approximately 120 million plastic bags thrown away in the county. Although recycling infrastructure for disposable bags does exist, recycling rates nationwide are extremely low. According to EPA data from 2005, only 21 percent of paper bags and 5.2 percent of plastic bags are recycled.⁷

Many US cities and counties, as well as countries around the world, have implemented policies to reduce disposable bag use. A list of communities is provided in **Attachment F**. Both Austin and Portland are currently in the process of exploring ordinance options; the town of Basalt, CO approved a 20-cent bag fee on Sept. 27, 2011; and Aspen's City Council is expected to vote on a plastic bag ban and paper bag fee on Oct. 10, 2011.

There are currently two assessments of disposable bag issues and ordinance options specific to Boulder.

- Eco-Cycle modeled bag use and potential revenues from a 10-cent per bag fee, based on studies in Seattle, WA and San Jose, CA. This information, along with other bag pollution-related costs to the community, is provided in **Attachment G**. Eco-Cycle concludes that Boulder residents use approximately 46 million disposable bags every year.
- Skumatz Economic Research Associates, Inc. (SERA) modeled current bag use in Boulder and potential impacts from a bag reduction ordinance based on a previous study in a California county. SERA estimates that between 9 and 53 million disposable bags are distributed annually in the city (see **Attachment H**).

Ordinance options: There are three main types of ordinance structures that communities across the US have used to reduce the use of disposable bags: bag fees, bag bans, and a combination of both.

a. Fees on disposable paper and plastic bags

This approach provides customers the flexibility to pay a fee if a bag is needed. By placing a fee on all disposable bags—paper and plastic—no judgment is made regarding which type of bag is better than the other. The fee typically applies to checkout bags, not to bags that are used for produce, baked goods, meat, newspapers, purchased clothing, dry-cleaning or general trash bags. This is the structure of Washington, DC's ordinance, which implemented a fee on paper and plastic checkout bags.

- *Applicable businesses.* Washington, DC's ordinance applies to all retail establishments that sell food and/or alcohol. Some communities' ordinances include fast food and restaurants, while others do not. Additional exemptions include paper bags from restaurants and paper bags for

⁷ "Life Cycle Assessment for Three Types of Grocery Bags" Boustead Consulting & Associates, pg. 41.

pharmacy prescriptions. An option to reduce the burden on small businesses is to exclude retail establishments under a designated square footage (i.e., 10,000 sq ft) and allow them to participate on a voluntary basis.

- *Fee level and collection process.* Among the cities surveyed, bag fees are typically collected at the point of sale and a portion of the fee is remitted to the city with sales tax. Washington, DC's fee was set at five cents, while other communities' fees, such as Los Angeles County and San Jose, CA, were set at ten cents. Most communities allow the businesses to retain a portion of the fee to cover the administrative costs of tracking, collection and remitting the revenue to the city. In Washington, DC, the business retains two cents per bag, and in Toronto and Los Angeles County the business retains the entire fee but must demonstrate efforts to reduce bag use. All of the ordinances that were reviewed, designate the use of the fee in the ordinance, usually for waste reduction outreach, educational campaigns, reusable bags or cleanup events.

Modeling conducted by Eco-Cycle included revenue projections at two different fee levels (ten and twenty cents per bag). Under several different scenarios, they estimate approximately \$1.1 million annually in revenue after businesses retain two cents of the ten-cent fee. This information is provided in **Attachment G**.

- *Enforcement.* In Washington, DC the Office of the Mayor is responsible for issuing warnings, violations and fines, which range from \$100 to \$1,000. Of the communities surveyed, most violations are discovered via a public complaint hotline. Los Angeles utilizes county staff already visiting businesses for other purposes (such as public health) to enforce their ordinance.
- *Results.* Most ordinances are still too recent to determine their effectiveness. However, Washington, DC has reported a decrease in disposable bag use of almost 80 percent after the first year of its ordinance.
- *Addressing the burden on low-income populations and tourists.* It is important to consider how a possible disposable checkout bag fee might affect both tourists and low-income residents in Boulder. Other communities have addressed this issue by giving away reusable bags in specific neighborhoods before the ordinance takes effect. To meet the needs of tourists, the city could work with local hotels to place reusable bags in each hotel room for guests to use during their stay.

b. Ban on plastic bags

Several communities, such as San Francisco and many other California cities, have implemented bans on plastic checkout bags. The main reason for this is a state policy that does not allow a fee to be placed on plastic bags.

- *Applicable businesses.* San Francisco's ban applies to all large grocery stores (over \$2 million in gross annual sales) and any chain pharmacy, and requires distribution of BPI-certified compostable bags, paper bags with a minimum of 40 percent post-consumer recycled content, or reusable bags. While other cities include additional types of businesses, almost all exclude restaurants.
- *Enforcement.* The main mechanism of enforcement is public complaint, resulting in fines ranging from \$100 to \$500 per violation.
- *Results.* While a ban on plastic checkout bags is very effective in reducing their use, it is difficult to determine how many individuals would increase their use of paper bags as an

alternative. As a result, it is difficult to determine the overall effectiveness of bag bans on shifting consumer behavior towards use of reusable bags.

c. Ban on plastic bags combined with fee on paper bags

Several communities, including San Jose and Telluride, have taken the hybrid approach of banning plastic bags and levying a fee on paper bags. This approach is also currently being proposed in Aspen, and acknowledges that while both plastic and paper bags have unique impacts to the environment, paper bags are easily recyclable in curbside collection programs while plastic bags are not.

- *Applicable businesses.* Telluride’s ordinance, which targets only grocery stores, requires that all paper bags contain a minimum of 40 percent post-consumer recycled content, contain no old growth fiber, and be 100 percent recyclable. It also allows businesses to retain five cents of the ten-cent fee on paper bags; and allows other types of businesses to voluntarily opt-in and apply the paper bag fee to its businesses.
- *Enforcement.* Similar to the other types of ordinances, enforcement includes inspection of businesses and public complaints, and penalties include warnings and fines ranging from \$50 to \$300.

4. Initial prioritization of potential regulatory approaches

The preceding review of potential regulatory approaches to support Boulder’s zero waste goals points to opportunities, options and challenges associated with each approach. Table 5, below, summarizes the three approaches and compares them against five criteria: ability to increase waste diversion; cost effectiveness; ability to increase customer participation; ability to reduce the amount of toxins in the waste stream and environment; and ability to reduce greenhouse gas emissions.

Potential Regulatory Approaches	Potential Additional Diversion (tons/year)*	Cost Effectiveness Minimizes investment per ton (both city and private \$)	Participation	Toxicity Reduction Minimizes the quantity of toxic and potentially toxic materials in the environment	GHG reduction Maximizes greenhouse gas reduction
Disposable checkout bag reduction fee	200 – 350**	••	•••	•••	••
Food takeout container requirement	84	••	•••	••	••
Commercial source separation requirement – recycling	8,095	• ***	••	•	•••
Commercial source separation requirement – composting	7,181	• ***	•	•	•••

* Based on preliminary modeling by Skumatz Economic Research Associates

** Diversion range based on the level of the fee; if a ban is enacted, diverted tons will be 10 to 15 percent higher.

*** Cost-effectiveness will vary significantly based on the subset of businesses subject to the regulation

Table 5: Summary comparison of three potential regulatory approaches

The preliminary comparison of potential regulatory options in Table 5 indicates the trade-offs between each of the approaches. While commercial separation requirements have the highest potential for waste diversion and greenhouse gas reductions, they may cost significantly more than other options and may have limited impact on toxicity. Regulatory recommendations in the updated ZWMP will need to carefully consider these trade-offs, taking into account council's feedback at the study session and stakeholder and public input during the remaining months of the update process.

Next steps and general direction on regulatory strategies: Based on the preliminary discussion and comparison of potential regulatory strategies, staff will further engage community stakeholders, including the business community, in exploring each option and prepare draft recommendations for inclusion in the draft ZWMP that council will review and consider in early 2012.

Based on the preliminary analysis of options, staff believes the following approaches warrant further consideration. The prioritization listed below is based solely on each regulation's diversion and greenhouse gas reduction potential. However, these benefits must be balanced with the potential increased costs to the community; the ability of each option to reduce environmental toxins; and the potential to change social norms and increase participation in zero waste initiatives.

Feedback from council on this draft outline of potential regulatory priorities will help inform and guide the stakeholder process in the coming months as well as further staff research and analyses.

1. *Require commercial source separation:*

Continue to analyze alternative approaches and costs, and implement a stakeholder process to evaluate options in five areas:

- a) Costs and benefits of a potential single stream recycling requirement;
- b) Costs and benefits of a potential composting requirement;
- c) Diversion estimates from targeted businesses whose generation falls above the point at which an increase in recycling/composting could be paired with a comparable decrease in trash costs;
- d) Options for a voluntary incentive phase and compliance dates, including a potential multi-year incentive phase to address space constraints and the split incentive for leased properties; and
- e) Options for education, technical assistance and enforcement.

2. *Reduce the use of disposable checkout bags:*

Continue to analyze alternative approaches and costs, and implement a stakeholder process to evaluate options in the following five areas:

- a) Costs and benefits of establishing a fee on disposable paper and plastic bags, including appropriate fee levels and appropriate portion to be retained by businesses.
- b) Options for a voluntary compliance period, incentives and compliance dates.
- c) Appropriate exemptions by business type and/or size.
- d) Options for education, technical assistance and enforcement.
- e) Options for a plan to serve lower income residents and tourists.

3. *Require compostable or recyclable food take-out containers:*

Continue to analyze alternative approaches and costs, and implement a stakeholder process to evaluate options in the following five areas:

- a) Costs and benefits of requiring all takeout food containers to be recyclable or compostable.
- b) Costs and benefits of banning PS take-out containers (as a stand-alone ordinance as well as in conjunction with a requirement that alternatives to PS be compostable or recyclable)
- c) Options to allow businesses to charge and retain a fee to recover incremental costs associated with purchasing recyclable or compostable containers.
- d) Options for a voluntary incentive phase and compliance dates.
- e) Potential exemptions based on container types, business types or sizes, and/or affordability.
- f) Options for education, technical assistance and enforcement.

NEXT STEPS:

To date, the ZWMP update process has included input from five Boulder Matters events, a survey on the city's Website, a task force of local industry experts, the EAB, on-going discussions with individual businesses and a business "zero waste roundtable" focusing on the barriers to implementing a commercial recycling or compost collection program. Following council input at the Oct. 11 study session, a 2nd phase of stakeholder input will begin which will include:

- Restaurant and supermarket roundtable meetings
- Large and small retailer meetings
- Public meetings
- Continuation of the online survey
- An online Town Hall meeting

These stakeholder meetings will aim to gather feedback on the city's proposed programs and services as well as facility investment options. Additionally, staff will complete research and analysis to inform these stakeholder discussions regarding the costs and benefits of various regulatory options being considered. These stakeholder discussions will provide feedback for council on options for voluntary incentive phases to accompany any proposed ordinances; options for compliance dates; and feedback on education and enforcement.

Based on the current project timeline, staff anticipates bringing a draft Zero Waste Master Plan to council in the first half of 2012.

ATTACHMENTS:

- A. Table of Initiatives from the 2006 Master Plan for Waste Reduction Yet to be Implemented
- B. Waste Diversion by Sector Chart
- C. Communitywide Diversion Summary Table
- D. Excerpts from Boulder County 2010 Waste Composition Study (Full report available at: <http://www.bouldercounty.org/find/library/gogreen/boulder.final.wcs2010.pdf>)
- E. Summary of Current Business Waste Reduction Programs and Incentives
- F. Communities with Disposable Bag Bans or Fees
- G. Eco-Cycle Modeling of Disposable Bag Use in Boulder and Potential Fee Revenue
- H. Skumatz Economic Research Associates Modeling of Disposable Bag Use in Boulder

Table of Initiatives from the 2006 Master Plan for Waste Reduction

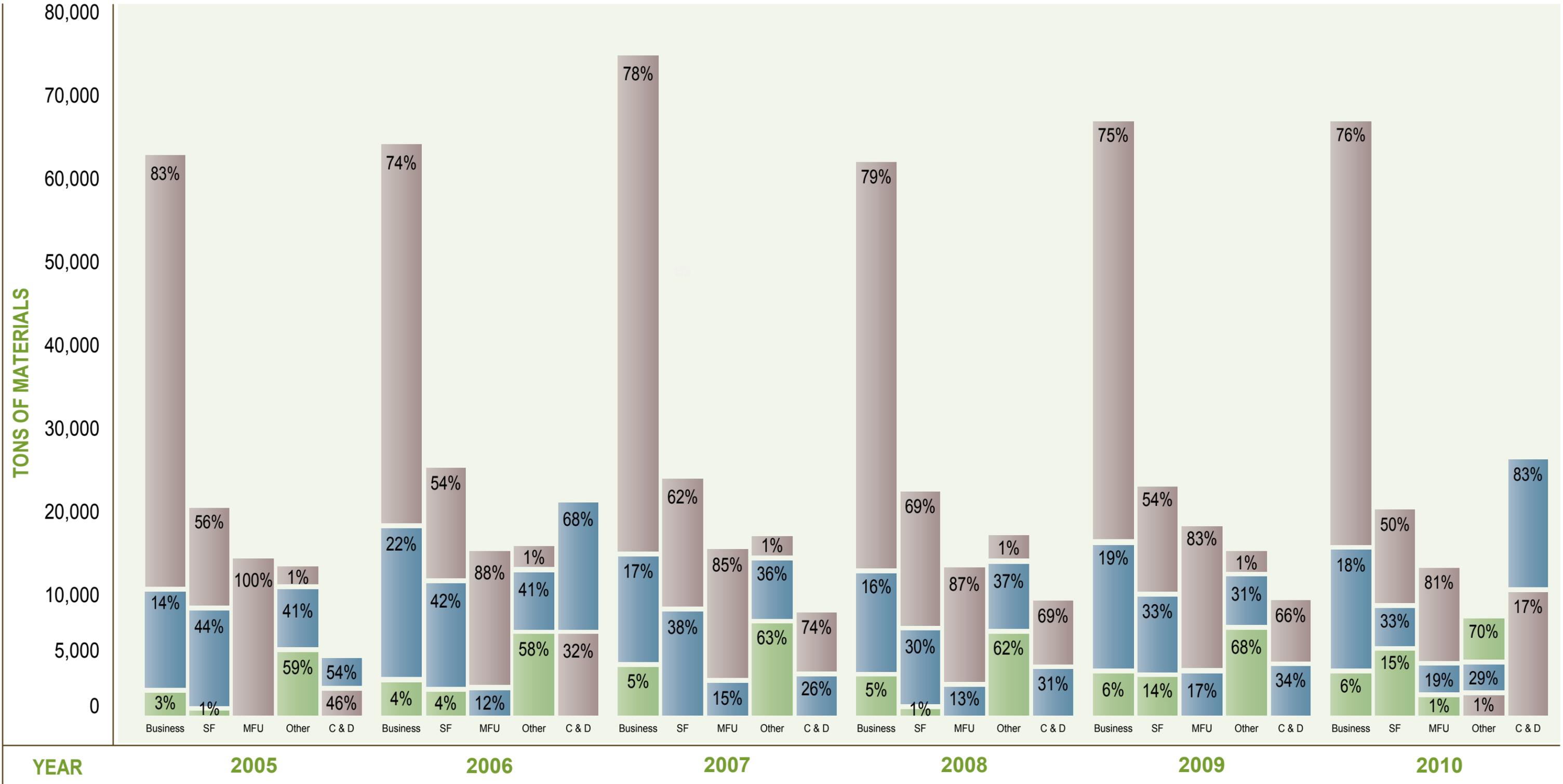
Highlighted initiatives have not yet been implemented.

Fiscally constrained Plan: 60% by Dec. 2007
Residential compost collection: 2009
Residential single stream recycling: 2009
Commercial compost collection subsidy: 2006
C & D (construction and demolition) debris recycling regulation: 2006
Expanded business assistance programs: 2008, 2010
Ban on electronic waste
City of Boulder Center for Hard-to-Recycle-Materials (CHaRM) expansion
Action Plan: 70% by Dec. 2012
Minimum recycling for multifamily units: 2009
Public place recycling: 2008
Fine for electronics disposal
C & D bond
More aggressive “pay-as-you-throw” (volume-based trash rates)
Increase or rebate business trash tax
Regulations establishing a commercial recycling goal
Vision Plan: 85% by Dec. 2017
Regulations requiring commercial recycling
Develop a mixed C & D recycling center
Establish local “take back” laws

Waste Reduction by Sector

Materials Collected by Haulers and at Facilities

	Landfilled Waste	SF = Single Family Units
	Recycled Materials	MFU = Multi-Family Units
	Organic Materials	C&D = Construction & Demolition
		Other = Community Drop-Off Centers



*MFU recycling in 2005 bus. data

Community Diversion Summary Table

Year	2005	2006	2007	2008	2009	2010
Community-wide						
Recycling	22,751	30,622	29,587	23,371	27,037	24,438
Organics	7,682	9,253	11,857	10,153	13,038	14,513
Trash	82,558	76,838	90,161	81,694	79,790	71,165
C&D Recycling	1,834	13,464	2,027	2,706	3,457	25,211
C&D Trash	1,539	6,454	5,772	5,913	6,845	5,177
Tons of Materials Generated:	116,363	136,631	139,403	123,837	130,167	140,505
Tons of Material Diverted:	32,267	53,339	43,471	36,230	43,532	64,162
Community-wide Diversion Rate:	28%	39%	31%	29%	33%	46%

Single Family Residential						
Recycling	11,374	12,386	10,795	8,697	9394.87	9194
Organics	5,829	6,752	4,133	3,704	5183.42	6034
Trash	11,584	14,623	14,927	15,823	12,738	11353
Tons of Materials Generated:	28,787	33,761	29,854	28,224	27,316	26,581
Tons of Material Diverted:	17,203	19,138	14,927	12,401	14,578	15,227
Single Family Diversion Rate:	60%	57%	50%	44%	53%	57%

Commercial						
Recycling	9,950	14,670	14,075	10,996	13,881	11,423
Organics	1,852	2,501	7,725	6,449	7,797	8,377
Trash	56,181	49,071	61,740	53,023	52,577	46,884
Tons of Materials Generated:	67,983	66,241	83,539	70,469	74,254	66,684
Tons of Materials Diverted:	11,802	17,171	21,799	17,446	21,677	19,800
Commercial Diversion Rate:	17%	26%	26%	25%	29%	30%

Multifamily Residential						
Recycling	5	1,758	2,331	1,883	2,976	2,809
Organics	1	-	-	-	58	102
Trash	14,793	13,144	13,494	12,848	14,475	12,033
Tons of Materials Generated:	14,799	14,902	15,825	14,731	17,509	14,944
Tons of Materials Diverted:	6	1,758	2,331	1,883	3,034	2,911
Multifamily Diversion Rate:	0%	12%	15%	13%	17%	19%

Construction & Demolition						
C&D Recycling	1,834	13,464	2,027	2,706	3,457	25,211
C&D Landfill	1,539	6,454	5,772	5,913	6,845	5,177
Tons of Materials Generated:	3,372	19,918	7,798	8,619	10,302	30,388
Tons of Materials Diverted:	1,834	13,464	2,027	2,706	3,457	25,211
Construction & Demolition Diversion Rate:	54%	68%	26%	31%	34%	83%



2010 WASTE COMPOSITION STUDY

Prepared for:
BOULDER COUNTY RESOURCE
CONSERVATION DIVISION

Final Report
December 29, 2010

MSWCONSULTANTS



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- ◆ Gary Horton, General Manager, Western Disposal Transfer Station;
- ◆ Larry Shea, Operations Manager, Western Disposal Waste Collection;
- ◆ Jeff Burrier, District Manager, Waste Connections, Erie Landfill;
- ◆ Chris Gronquist, Operations Manager, Waste Connections, Erie Landfill;
- ◆ Scott McDonald, Operations Manager, McDonald Farms.

Additionally, the Project Team would like to thank all of the active municipal solid waste (MSW) public and private haulers, all of which were contacted and surveyed to provide disposal data that was used to both formulate the sampling plan for the field work, and to accurately aggregate the resulting waste composition data. We would also like to thank City of Longmont for providing loads of segregated multi-family wastes to be sampled and sorted at the Erie Landfill.

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Cascadia Consulting Group

TABLE OF CONTENTS

ES.	EXECUTIVE SUMMARY.....	1
ES 1.	Introduction.....	1
ES 2.	Overview of Results.....	1
1.	INTRODUCTION.....	1-1
1.1.	Background.....	1-1
1.2.	Overview of County Waste Management System	1-1
1.3.	Report Organization	1-2
2.	METHODOLOGY	2-1
2.1.	Introduction.....	2-1
2.2.	Waste Generator Sectors	2-1
2.3.	Boulder County Waste Generation and Disposal.....	2-1
2.3.1	Waste Generation and Disposal Based on Longmont Reports.....	2-2
2.3.2	Waste Generation and Disposal Based on City of Boulder and Louisville Estimates.....	2-3
2.3.3	Waste Generation and Disposal Used in This Report	2-4
2.4.	Material categories.....	2-4
2.5.	Seasonality and Host Facilities	2-5
2.6.	Sampling Targets	2-5
2.7.	Field Data Collection Procedures.....	2-6
2.7.1	Staffing and Sorter Training Plan	2-6
2.7.2	Load Selection	2-7
2.7.3	Taking Random Samples for Manual Sorting.....	2-7
2.7.4	Manual Sorting	2-8
2.7.5	Visual Surveying of C&D Loads	2-8
2.8.	Data Recording.....	2-9
2.9.	Statistical Methods	2-10
3.	RESULTS	3-1
3.1.	Boulder County MSW Composition.....	3-1
3.2.	Residential MSW Composition	3-4
3.3.	ICI Waste Composition	3-9
3.4.	County Drop-Box Waste.....	3-12
3.5.	C&D Waste Composition	3-15
3.6.	Conclusions and Recommendations.....	3-18

LIST OF APPENDICES

Appendix A – Material Definitions

TABLE OF CONTENTS

Appendix B – Field Forms

List of Figures

Figure ES-1 Boulder County MSW Composition, 2010	2
Figure 2-1 Example of a Grab Sample Staged for Manual Sorting	2-7
Figure 2-2 Sort Table and Bins	2-8
Figure 3-1 Boulder County MSW Composition, 2010	3-1
Figure 3-2 Top 10 Most Prevalent Material Categories in Boulder County MSW	3-2
Figure 3-3 Boulder County Residential Waste Composition, 2010	3-4
Figure 3-4 Top 10 Most Prevalent Material Categories in Residential Waste	3-5
Figure 3-5 Boulder County ICI Waste Composition, 2010	3-9
Figure 3-6 Top 10 Most Prevalent Material Categories in ICI Waste	3-10
Figure 3-7 Boulder County Foothill Transfer Site Waste Composition, 2010	3-12
Figure 3-8 Top 10 Most Prevalent Material Categories in County Drop-box Waste	3-13
Figure 3-9 C&D Waste Composition, 2010	3-15
Figure 3-10 Top 10 Most Prevalent Material Categories in C&D Waste	3-16
Figure 3-11 C&D Waste Composition by C&D Material Category	3-17

List of Tables

Table ES-1 Estimated Countywide MSW Disposal by Generator Sector	2
Table ES-2 Top 5 Most Prevalent Material Categories	3
Table 2-1 Boulder County Waste Generation	2-2
Table 2-2 Estimated Countywide MSW Generation and Disposal by Generator Sector Based on Reported Longmont Data	2-3
Table 2-3 Estimated Countywide MSW Generation and Disposal by Generator Sector Based on Hauler Report Assumptions from the Cities of Boulder and Louisville	2-3
2-4 Countywide MSW Disposal Used in This Report	2-4
Table 2-5 Field Data Collection Schedule	2-5
Table 2-6 Planned vs. Actual Distribution Samples	2-6
Table 3-1 Boulder County Detailed MSW Composition	3-3
Table 3-2 Comparison of Top Ten Materials in the Single Family and Multi-Family Waste	3-6
Table 3-3 2010 Detailed Residential Waste Composition	3-7
Table 3-4 2010 Comparison of Single Family and Multi-Family Waste Composition	3-8
Table 3-5 2010 Detailed ICI Waste Composition	3-11
Table 3-6 2010 Detailed Foothill Transfer Site Waste Composition	3-14
Table 3-7 2010 Detailed C&D Waste Composition	3-16
Table 3-8 Mapping of C&D Material Categories to Groups	3-18

ES. EXECUTIVE SUMMARY

ES 1. INTRODUCTION

Boulder County has long been at the forefront of progressive waste management and recycling. To better understand the opportunities available for increasing recycling and diversion of wastes in Boulder County, the County retained the Project Team of MidAtlantic Solid Waste Consultants (MSW Consultants) and Cascadia Consulting Group (Cascadia) to conduct a statistically representative analysis of the County's disposed waste stream. This study sought to meet the following objectives:

- ◆ Quantify the amount of disposed wastes generated in Boulder County, in total and by generator sector.
- ◆ Estimate and compare the composition of wastes from individual generator sectors as well as in the aggregate.
- ◆ Provide feedback to recycling and solid waste planners in the County and within incorporated municipalities about the efficacy of existing recycling programs so that those programs can maintain or increase their effectiveness.
- ◆ Identify materials that represent future opportunities for increasing diversion in Boulder County.
- ◆ Establish a baseline so that future waste composition studies can be performed to inform the County as it makes its way towards its zero waste goal.

For solid waste and recycling planners, it is important to differentiate between the sources of wastes so that recycling and diversion programs can be properly targeted. This study defines the following sub-streams of MSW that were targeted for separate sampling and analysis:

- ◆ **Single Family Residential:** Waste generated in single family households.
- ◆ **Multi-family Residential:** Waste generated in multi-family apartments and condominiums.
- ◆ **Industrial, Commercial and Institutional (ICI):** Waste generated by industrial, commercial, institutional, and other non-residential sources.
- ◆ **Construction and Demolition (C&D):** Wastes generated as a result of construction, renovation, and demolition activities.

The study also separately obtained and analyzed samples of wastes disposed at the County's foothill transfer station sites.

ES 2. OVERVIEW OF RESULTS

Table ES-1 summarizes the estimated quantity of materials generated in Boulder County that require disposal in a landfill. This information was compiled from a combination of County reports, hauler interviews, and extrapolation of waste generation based on unit generation rates. As shown, Boulder County generated almost 221,000 tons of material that was delivered to a local transfer station or landfill for disposal.

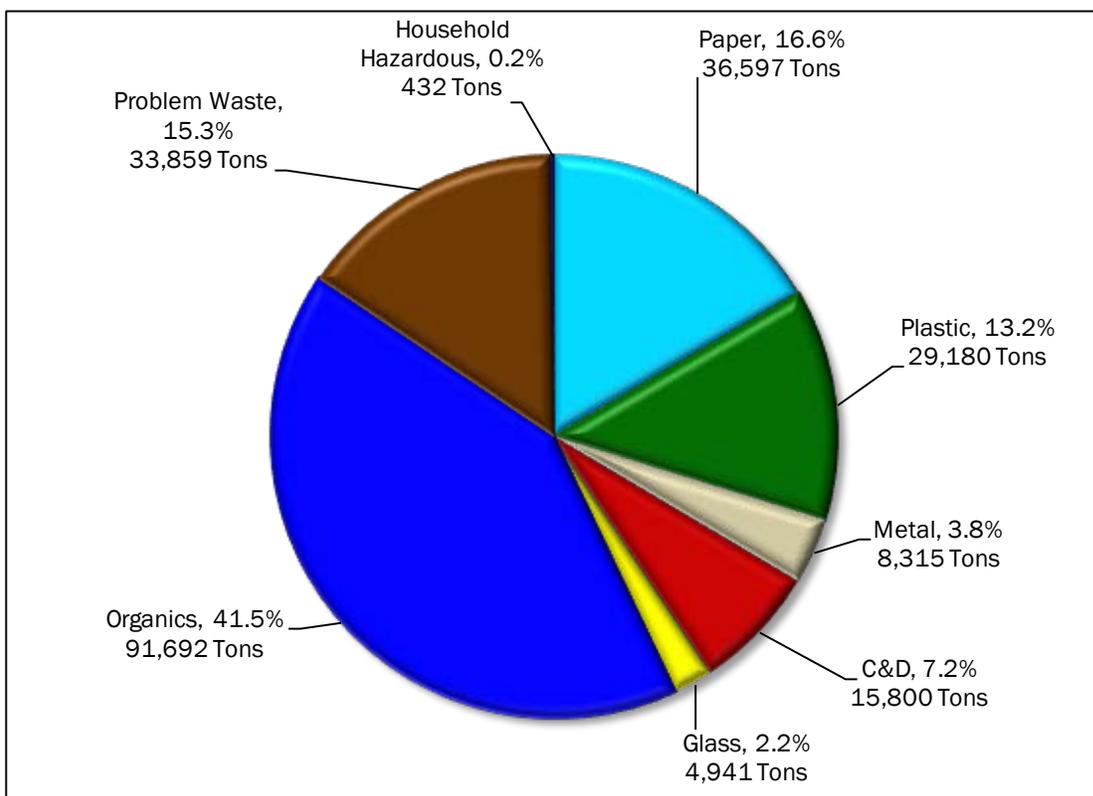
EXECUTIVE SUMMARY

Table ES-1 Estimated Countywide MSW Disposal by Generator Sector

Generator Sector	Tons	Percent
Residential	102,963	46.6%
Industrial, Commercial and Institutional (ICI)	117,228	53.1%
Mountain Drop Boxes	626	0.3%
Total MSW	220,817	100.0%

Figure ES-1 shows the breakdown of major material groups for the aggregate Boulder County waste stream (encompassing residential and ICI wastes, but excluding C&D). Results are shown in estimated percent composition disposed. As shown, Organics is far and away the largest material group, followed by Paper, Problem Waste, and Plastic.

Figure ES-1 Boulder County MSW Composition, 2010



EXECUTIVE SUMMARY

Table ES-2 shows the five most prevalent individual material categories disposed by residential, ICI, and C&D generating sectors. The percent composition is shown in the table.

Table ES-2 Top 5 Most Prevalent Material Categories

Ranking	Residential	ICI	C&D
1	Food Waste (13.1%)	Food Waste (14.9%)	Rock/Concrete/Brick (27.5%)
2	Mixed Yard Waste (12.9%)	Compostable Paper (7.1%)	Asphalt Shingles (19.1%)
3	Textiles/Leather (7.7%)	Corrugated Cardboard (6.7%)	Painted/Stained/Treated Wood (12.7%)
4	Furniture/Bulky Items (6.9%)	Other Rigid Plastics (6.2%)	Dirt/Sand (10.2%)
5	Other Rigid Plastics (6.5%)	Other plastic Film (4.4%)	Demo/Painted Drywall (8.8%)
Top 5	47.1%	39.2%	78.3%

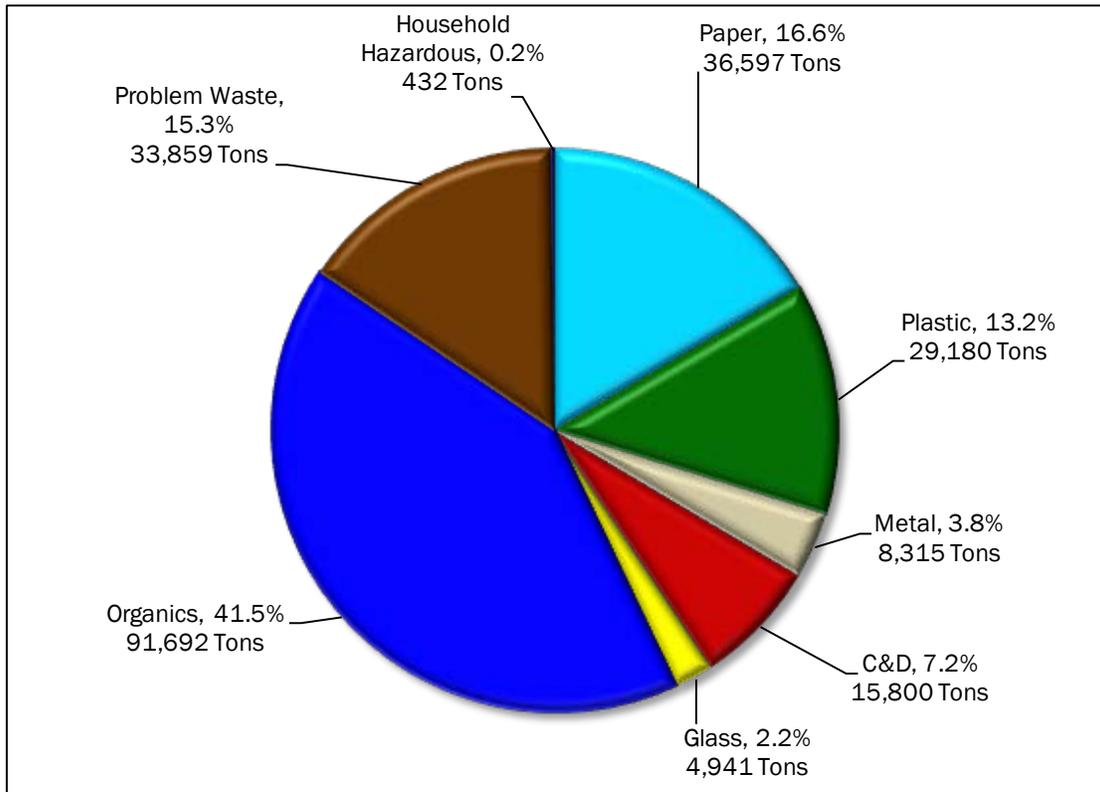
Full results for the County as a whole, as well as for individual generator sectors, is contained in the full report.

3. RESULTS

3.1. BOULDER COUNTY MSW COMPOSITION

Figure 3-1 shows the breakdown of major material groups for the aggregate countywide municipal solid waste stream (encompassing residential, ICI, and mountain box wastes). Results are shown both in percentage terms as well as the estimated mean tons disposed. As shown, Organics is far and away the largest material group, followed by Paper, Problem Waste, and Plastic.

Figure 3-1 Boulder County MSW Composition, 2010



3. RESULTS

Figure 3-2 shows the top 10 most prevalent material categories in the Boulder County MSW stream. Not surprisingly, Food Waste is the single most prevalent category. However, it is of interest that there appears to be significant fractions of yard wastes (including leaves) and compostable and recyclable papers still in disposed wastes.

Figure 3-2 Top 10 Most Prevalent Material Categories in Boulder County MSW

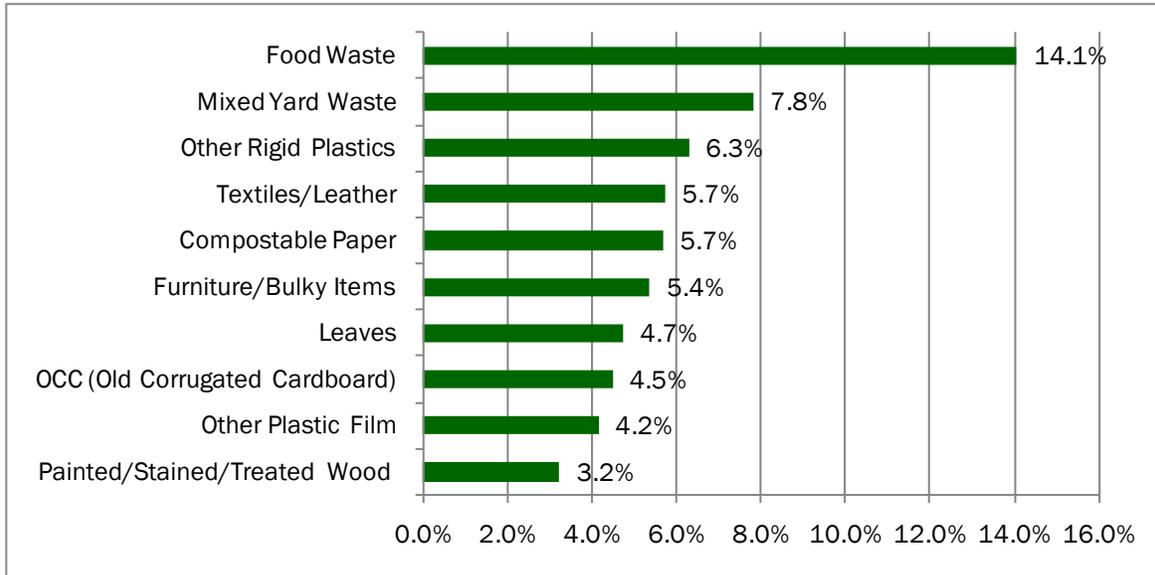


Table 3-1 on the following page provides a detailed statistical profile of Boulder County's disposed MSW stream. For each material category, the estimated disposed tons, mean percent, and lower and upper confidence intervals are shown. Confidence intervals are calculated at a 90 percent level of confidence.

3. RESULTS

Table 3-1 Boulder County Detailed MSW Composition

Material	+ / -		Est. Tons	Material	+ / -		Est. Tons
Paper	16.6%		36,597	Glass	2.2%		4,941
Newsprint	0.8%	0.2%	1,769	Glass Bottles and Jars	1.9%	0.6%	4,103
High Grade Office Paper	0.8%	0.4%	1,824	Other Glass	0.4%	0.2%	838
Shredded Paper	0.3%	0.2%	632				
OCC (Old Corrugated Cardboard)	4.5%	1.2%	9,908	Organics	41.5%		91,692
Magazines/Catalogs	0.9%	0.3%	2,091	Mixed Yard Waste including Small Branches	7.8%	2.5%	17,271
Recyclable Mixed Paper	2.1%	0.3%	4,642	Branches/Limbs and Stumps >6" Diameter	1.3%	0.6%	2,765
Polycoated/Aseptic Containers	0.1%	0.0%	278	Leaves	4.7%	1.6%	10,471
Compostable Paper	5.7%	0.8%	12,559	Food Waste	14.1%	1.7%	31,055
Unrecyclable Mixed Paper	1.3%	0.3%	2,895	Other Untreated Wood	0.5%	0.4%	1,100
				Textiles/Leather	5.7%	1.5%	12,666
Plastic	13.2%		29,180	Fines/Dirt	2.9%	0.7%	6,318
#1 PET Bottles/Jars	0.5%	0.1%	997	Pallets	2.2%	1.4%	4,769
#2 HDPE Bottles/Jars	0.4%	0.1%	908	Other Organics	2.4%	0.6%	5,277
Bottles #3-7	0.1%	0.0%	194				
Other Plastic Containers <3 Gallons	0.2%	0.1%	479	Problem Waste	15.3%		33,859
Large Plastic Containers >3 Gallons	0.3%	0.2%	732	Large Electronics (Plug-in)	2.2%	1.0%	4,874
Plastic Retail Bags	0.4%	0.1%	781	Small Electronics (Rechargeable)	0.2%	0.2%	468
Other Plastic Film	4.2%	0.6%	9,169	Small Appliances	0.7%	0.5%	1,506
Expanded Polystyrene	0.9%	0.5%	2,019	Diapers/Sanitary Products	1.7%	0.4%	3,728
Other Rigid Plastics	6.3%	1.3%	13,901	Carpet/Padding	3.2%	1.9%	7,019
				Batteries	0.2%	0.2%	482
Metal	3.8%		8,315	Rubber	0.7%	0.2%	1,524
Aluminum Containers	0.3%	0.1%	570	Tires	0.9%	0.7%	1,981
Aluminum Foil & Trays	0.2%	0.1%	369	Furniture/Bulky Items	5.4%	2.0%	11,868
Ferrous Containers	0.5%	0.1%	1,097	Other Inorganics	0.2%	0.1%	410
Other Ferrous	1.7%	0.7%	3,852				
Other Non-Ferrous	0.9%	0.4%	1,948	Household Hazardous Waste (HHW)	0.2%		432
White Goods	0.2%	0.4%	479	Fluorescent Tubes and Bulbs	0.0%	0.0%	12
				Pharmaceuticals and Syringes	0.0%	0.0%	35
C&D	7.2%		15,800	Oil-based Paint & Finishes	0.0%	0.0%	0
Aggregate/Concrete/Asphalt/Ceramics	0.5%	0.4%	1,176	Latex Paint & Finishes	0.0%	0.0%	35
Asphalt Shingles	0.0%	0.0%	60	Pesticides	0.0%	0.0%	0
Painted/Stained/Treated Wood	3.2%	1.2%	7,155	Automotive Fluids	0.0%	0.1%	87
Clean Dimensional Lumber	1.7%	1.0%	3,749	Other Household Hazardous Waste	0.1%	0.1%	263
Clean/New Drywall	0.2%	0.2%	349				
Demo/Painted Drywall	0.5%	0.5%	1,031	Totals	100.0%		220,817
Other C&D	1.0%	0.5%	2,279	Sample Count	80		

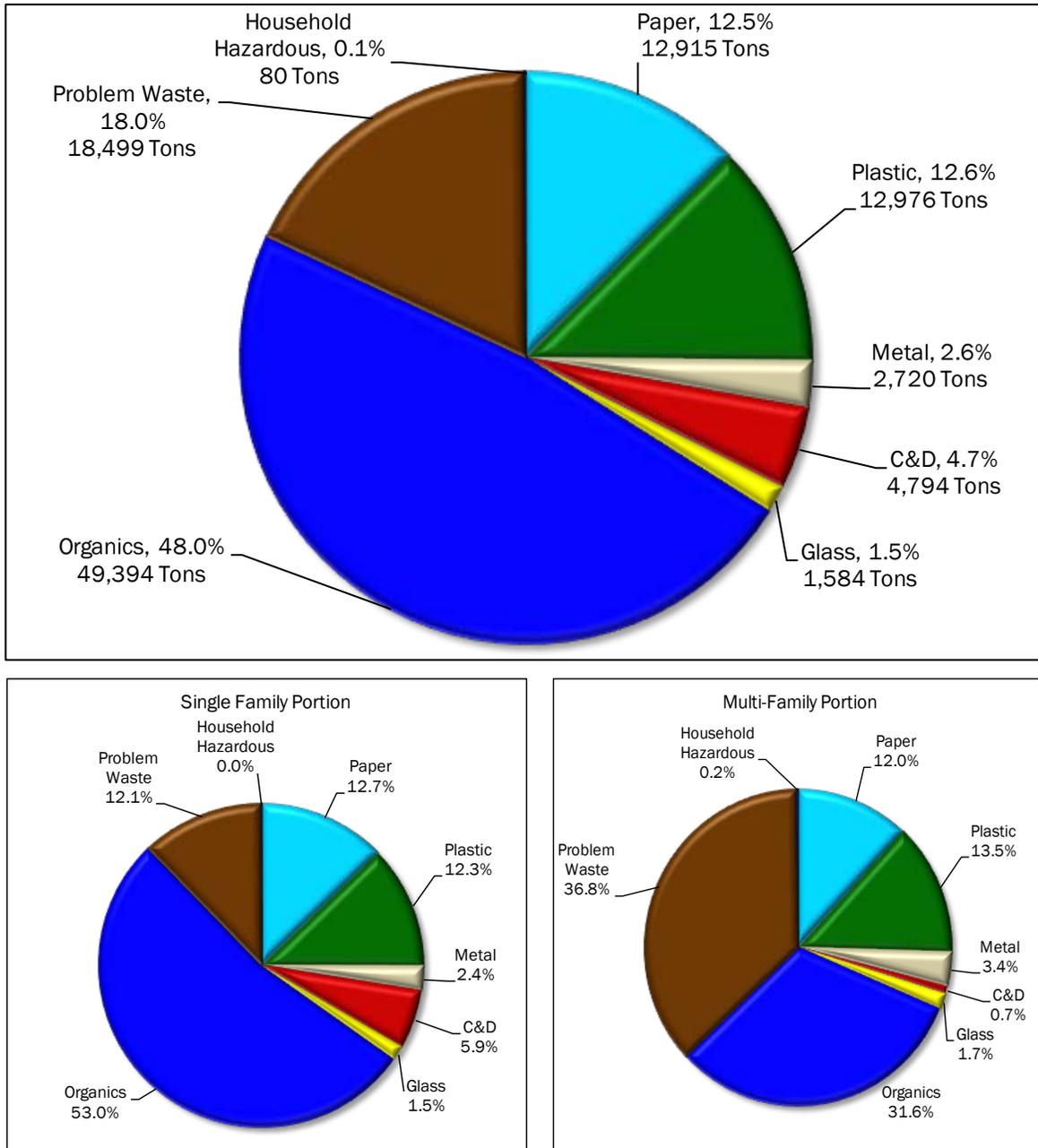
Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

3. RESULTS

3.2. RESIDENTIAL MSW COMPOSITION

Figure 3-3 presents the breakdown of residential wastes. The top pie chart shows results for all residential wastes (i.e., single family and multi-family). The bottom pie charts split out the composition of single family wastes and multi-family wastes so that the reader can see the difference in the two substreams. Because the majority of residential wastes are generated by single family households, the single family composition dominates multi-family in the overall residential waste stream.

Figure 3-3 Boulder County Residential Waste Composition, 2010



3. RESULTS

As shown in Figure 3-3, Organics make up almost half of residential wastes. However, the single family profile and the multi-family profiles are significantly different. Organics dominate single family wastes, but in the multi-family waste stream, Problem Materials are the single largest material group. Figure 3-4 shows the top 10 most prevalent material categories in Residential waste. Food waste, yard waste, and leaves are large contributors.

Figure 3-4 Top 10 Most Prevalent Material Categories in Residential Waste

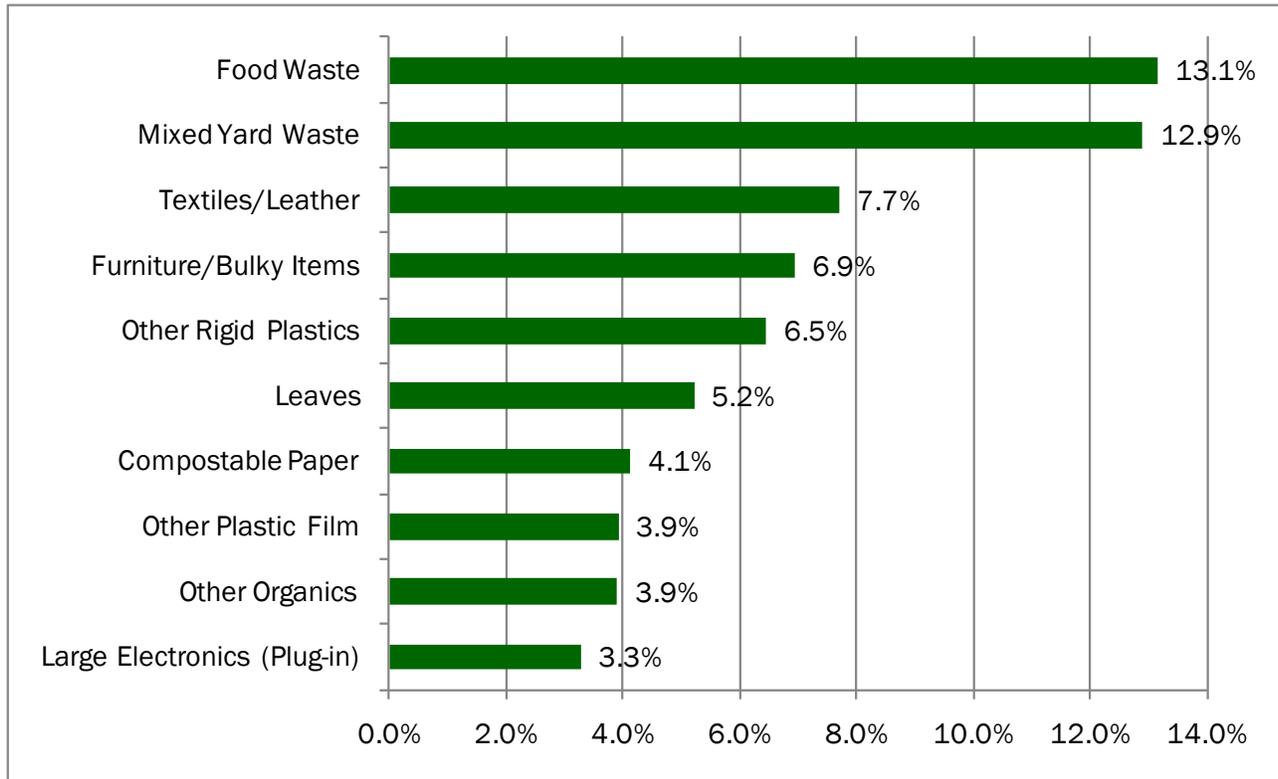


Table 3-2 compares the 10 most prevalent materials in disposed single family and multi-family wastes. This table highlights the significant differences between single family and multi-family materials. Of particular interest are the large fraction of bulky items, furniture, and small appliances in multi-family wastes. The following notable observations are made about multi-family wastes:

- ◆ Two of the eight multi-family samples contained television sets, which are categorized as Large Electronics. In both samples, the televisions weighed 30 pounds or more; which caused the relatively high reported fraction of Large Electronics in the multi-family results.
- ◆ Three of the eight multi-family samples contained a significant quantity of leaves, which caused the relatively high percentage of this material.

The Project Team notes that these findings suggest that further investigation would be informative, as the relatively low sample size (eight samples) does not provide the level of representativeness that would be needed to better analyze the prevalence of these materials in multi-family wastes. However, the fact that two televisions were found in multi-family

3. RESULTS

samples, as well as a significantly higher fraction of furniture and bulky items, suggests that the multi-family waste stream is significantly different from single family wastes.

Table 3-2 Comparison of Top Ten Materials in the Single Family and Multi-Family Waste

Single Family MSW	%	Multi-Family MSW	%
Mixed Yard Waste	16.6%	Furniture/Bulky Items	18.9%
Food Waste	14.6%	Large Electronics (Plug-in)	9.0%
Textiles/Leather	7.5%	Food Waste	8.4%
Other Rigid Plastics	5.9%	Textiles/Leather	8.3%
Leaves	4.3%	Other Rigid Plastics	8.2%
Compostable Paper	4.2%	Leaves	8.1%
Other Plastic Film	4.1%	Corrugated Cardboard	4.4%
Other Organics	4.0%	Compostable Paper	4.0%
Diapers/Sanitary	3.2%	Small Appliances	3.7%
Furniture/Bulky Items	3.2%	Other Organics	3.5%
	67.6%		76.4%

3. RESULTS

Table 3-3 provides a detailed statistical profile of the County's Residential waste stream.

Table 3-3 2010 Detailed Residential Waste Composition

Material	Est. Percent	+ / -	Est. Tons	Material	Est. Percent	+ / -	Est. Tons
Paper	12.5%		12,915	Glass	1.5%		1,584
Newsprint	0.9%	0.4%	934	Glass Bottles and Jars	1.2%	0.3%	1,280
High Grade Office Paper	0.6%	0.5%	586	Other Glass	0.3%	0.1%	304
Shredded Paper	0.4%	0.3%	409				
OCC (Old Corrugated Cardboard)	2.0%	1.4%	2,017	Organics	48.0%		49,394
Magazines/Catalogs	1.0%	0.5%	997	Mixed Yard Waste including Small Branches	12.9%	4.8%	13,284
Recyclable Mixed Paper	2.1%	0.3%	2,136	Branches/Limbs and Stumps >6" Diameter	1.6%	0.9%	1,624
Polycoated/Aseptic Containers	0.1%	0.0%	141	Leaves	5.2%	2.2%	5,366
Compostable Paper	4.1%	0.5%	4,253	Food Waste	13.1%	1.9%	13,539
Unrecyclable Mixed Paper	1.4%	0.5%	1,442	Other Untreated Wood	0.6%	0.9%	622
				Textiles/Leather	7.7%	1.9%	7,932
Plastic	12.6%		12,976	Fines/Dirt	2.6%	0.6%	2,629
#1 PET Bottles/Jars	0.4%	0.1%	426	Pallets	0.4%	0.5%	376
#2 HDPE Bottles/Jars	0.4%	0.1%	371	Other Organics	3.9%	1.1%	4,022
Bottles #3-7	0.1%	0.1%	126				
Other Plastic Containers <3 Gallons	0.2%	0.1%	191	Problem Waste	18.0%		18,499
Large Plastic Containers >3 Gallons	0.3%	0.2%	282	Large Electronics (Plug-in)	3.3%	1.9%	3,376
Plastic Retail Bags	0.4%	0.1%	422	Small Electronics (Rechargeable)	0.4%	0.4%	385
Other Plastic Film	3.9%	0.9%	4,032	Small Appliances	1.2%	0.9%	1,217
Expanded Polystyrene	0.5%	0.3%	482	Diapers/Sanitary Products	2.9%	0.8%	2,989
Other Rigid Plastics	6.5%	1.5%	6,644	Carpet/Padding	2.2%	1.4%	2,249
				Batteries	0.1%	0.1%	111
Metal	2.6%		2,720	Rubber	0.4%	0.2%	363
Aluminum Containers	0.3%	0.1%	270	Tires	0.5%	0.5%	547
Aluminum Foil & Trays	0.1%	0.0%	92	Furniture/Bulky Items	6.9%	3.4%	7,143
Ferrous Containers	0.6%	0.1%	589	Other Inorganics	0.1%	0.1%	120
Other Ferrous	1.0%	0.9%	1,069				
Other Non-Ferrous	0.2%	0.3%	223	Household Hazardous Waste (HHW)	0.1%		80
White Goods	0.5%	0.8%	477	Fluorescent Tubes and Bulbs	0.0%	0.0%	4
				Pharmaceuticals and Syringes	0.0%	0.0%	30
C&D	4.7%		4,794	Oil-based Paint & Finishes	0.0%	0.0%	0
Aggregate/Concrete/Asphalt/Ceramics	0.9%	0.9%	964	Latex Paint & Finishes	0.0%	0.0%	0
Asphalt Shingles	0.0%	0.0%	32	Pesticides	0.0%	0.0%	0
Painted/Stained/Treated Wood	1.9%	0.9%	1,993	Automotive Fluids	0.0%	0.0%	0
Clean Dimensional Lumber	0.7%	0.6%	694	Other Household Hazardous Waste	0.0%	0.0%	46
Clean/New Drywall	0.3%	0.5%	349				
Demo/Painted Drywall	0.0%	0.0%	12	Totals	100.0%		102,963
Other C&D	0.7%	0.5%	750	Sample Count	34		

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

3. RESULTS

Table 3-4 compares the single family and multi-family waste stream composition.

Table 3-4 2010 Comparison of Single Family and Multi-Family Waste Composition

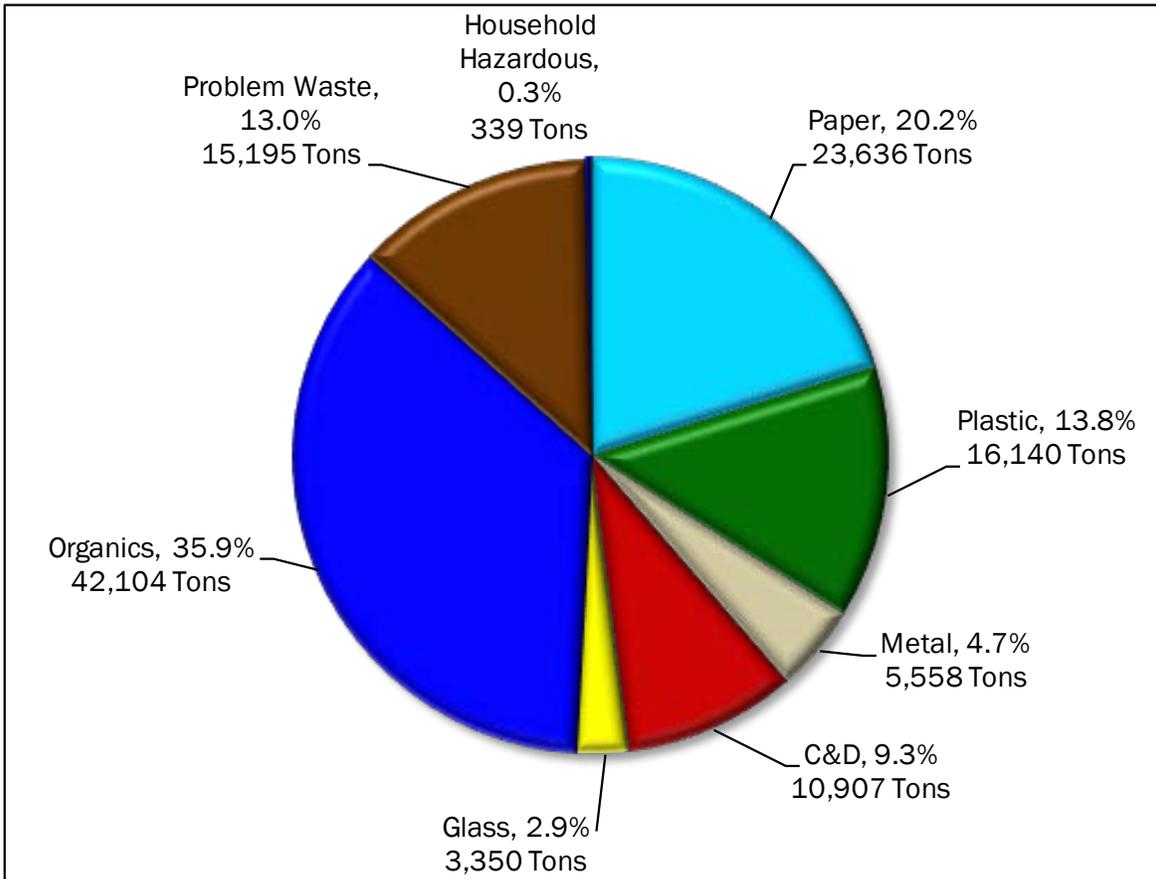
Material	Single Family		Multi-Family		Material	Single Family		Multi-Family	
	Est. Percent +/-	Est. Percent +/-	Est. Percent +/-	Est. Percent +/-		Est. Percent +/-	Est. Percent +/-	Est. Percent +/-	Est. Percent +/-
Paper	12.7%		12.0%		Glass	1.5%		1.7%	
Newsprint	1.0%	0.4%	0.7%	0.7%	Glass Bottles and Jars	1.2%	0.3%	1.3%	0.7%
High Grade Office Paper	0.7%	0.6%	0.1%	0.1%	Other Glass	0.3%	0.1%	0.4%	0.4%
Shredded Paper	0.5%	0.4%	0.0%	0.0%					
OCC (Old Corrugated Cardboard)	1.2%	0.8%	4.4%	5.4%	Organics	53.0%		31.6%	
Magazines/Catalogs	1.2%	0.7%	0.3%	0.2%	Mixed Yard Waste including Small Branches	16.6%	5.8%	1.1%	1.8%
Recyclable Mixed Paper	2.2%	0.4%	1.7%	0.6%	Branches/Limbs and Stumps >6" Diameter	2.0%	1.1%	0.1%	0.1%
Polycoated/Aseptic Containers	0.1%	0.0%	0.1%	0.1%	Leaves	4.3%	1.9%	8.1%	7.2%
Compostable Paper	4.2%	0.5%	4.0%	0.9%	Food Waste	14.6%	2.2%	8.4%	2.4%
Unrecyclable Mixed Paper	1.6%	0.6%	0.7%	0.5%	Other Untreated Wood	0.8%	1.2%	0.0%	0.0%
					Textiles/Leather	7.5%	2.3%	8.3%	3.5%
Plastic	12.3%		13.5%		Fines/Dirt	2.7%	0.7%	2.0%	1.4%
#1 PET Bottles/Jars	0.4%	0.1%	0.6%	0.5%	Pallets	0.5%	0.6%	0.0%	0.0%
#2 HDPE Bottles/Jars	0.4%	0.2%	0.3%	0.2%	Other Organics	4.0%	1.3%	3.5%	2.4%
Bottles #3-7	0.1%	0.1%	0.1%	0.1%					
Other Plastic Containers <3 Gallons	0.2%	0.1%	0.1%	0.1%	Problem Waste	12.1%		36.8%	
Large Plastic Containers >3 Gallons	0.3%	0.3%	0.1%	0.1%	Large Electronics (Plug-in)	1.5%	1.5%	9.0%	5.1%
Plastic Retail Bags	0.4%	0.1%	0.3%	0.2%	Small Electronics (Rechargeable)	0.5%	0.5%	0.0%	0.0%
Other Plastic Film	4.1%	1.0%	3.5%	1.8%	Small Appliances	0.4%	0.5%	3.7%	3.4%
Expanded Polystyrene	0.5%	0.4%	0.3%	0.2%	Diapers/Sanitary Products	3.2%	1.1%	1.8%	0.9%
Other Rigid Plastics	5.9%	1.7%	8.2%	3.1%	Carpet/Padding	2.1%	1.6%	2.5%	3.0%
					Batteries	0.1%	0.1%	0.0%	0.0%
Metal	2.4%		3.4%		Rubber	0.3%	0.1%	0.6%	0.6%
Aluminum Containers	0.2%	0.1%	0.4%	0.2%	Tires	0.6%	0.6%	0.4%	0.6%
Aluminum Foil & Trays	0.1%	0.0%	0.1%	0.1%	Furniture/Bulky Items	3.2%	3.0%	18.9%	7.7%
Ferrous Containers	0.5%	0.2%	0.7%	0.3%	Other Inorganics	0.1%	0.1%	0.0%	0.0%
Other Ferrous	1.3%	1.2%	0.2%	0.1%					
Other Non-Ferrous	0.3%	0.3%	0.1%	0.0%	Household Hazardous Waste (HHW)	0.0%		0.2%	
White Goods	0.0%	0.0%	2.0%	3.2%	Fluorescent Tubes and Bulbs	0.0%	0.0%	0.0%	0.0%
					Pharmaceuticals and Syringes	0.0%	0.0%	0.0%	0.0%
C&D	5.9%		0.7%		Oil-based Paint & Finishes	0.0%	0.0%	0.0%	0.0%
Aggregate/Concrete/Asphalt/Ceramics	1.2%	1.1%	0.1%	0.1%	Latex Paint & Finishes	0.0%	0.0%	0.0%	0.0%
Asphalt Shingles	0.0%	0.0%	0.1%	0.1%	Pesticides	0.0%	0.0%	0.0%	0.0%
Painted/Stained/Treated Wood	2.5%	1.2%	0.2%	0.4%	Automotive Fluids	0.0%	0.0%	0.0%	0.0%
Clean Dimensional Lumber	0.9%	0.8%	0.0%	0.0%	Other Household Hazardous Waste	0.0%	0.0%	0.2%	0.2%
Clean/New Drywall	0.4%	0.7%	0.1%	0.1%					
Demo/Painted Drywall	0.0%	0.0%	0.0%	0.0%					
Other C&D	0.9%	0.6%	0.3%	0.3%	Totals	100.0%		100.0%	

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

3.3. ICI WASTE COMPOSITION

Figure 3-5 presents the breakdown of ICI wastes by material group. The largest material group in the ICI sector was found to be Organics, followed by Paper, Plastics and Problem Waste.

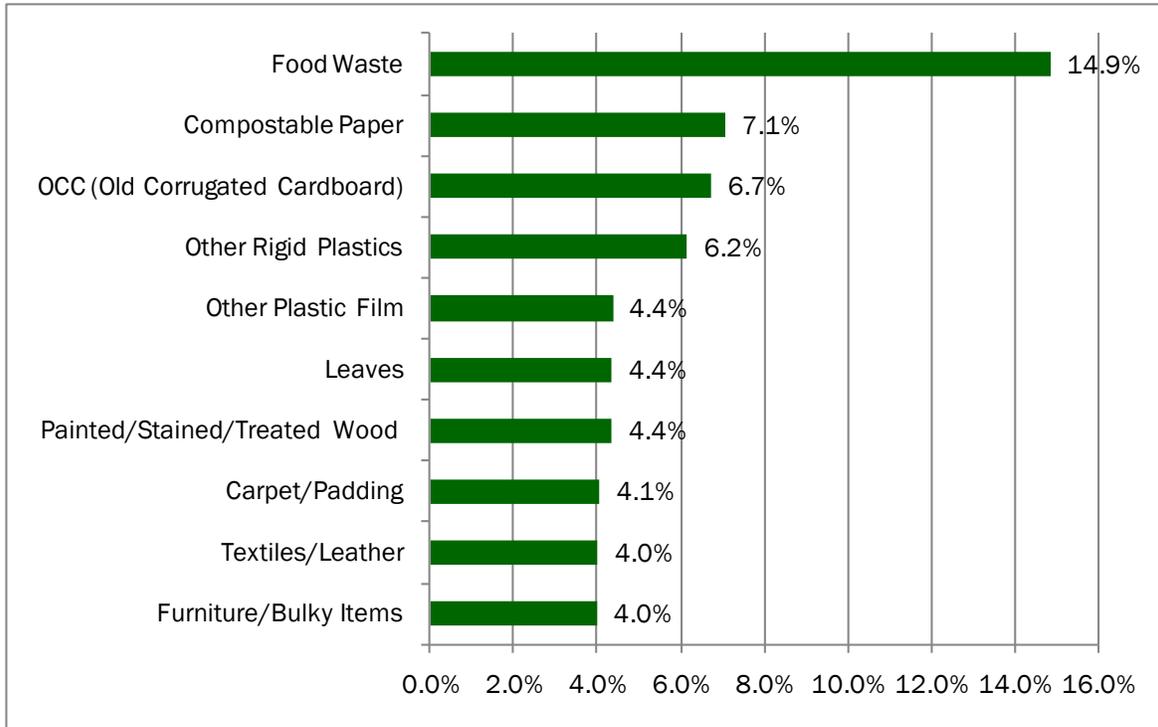
Figure 3-5 Boulder County ICI Waste Composition, 2010



3. RESULTS

Figure 3-6 compares the 10 most prevalent materials in disposed ICI waste. As in residential waste, food scraps are the most prevalent single item. However, compostable paper and corrugated cardboard are more prevalent in ICI waste compared to residential waste.

Figure 3-6 Top 10 Most Prevalent Material Categories in ICI Waste



3. RESULTS

Table 3-5 provides a detailed statistical profile of the County's ICI waste stream.

Table 3-5 2010 Detailed ICI Waste Composition

Material	Est. Percent	+ / -	Est. Tons	Material	Est. Percent	+ / -	Est. Tons
Paper	20.2%		23,636	Glass	2.9%		3,350
Newsprint	0.7%	0.2%	828	Glass Bottles and Jars	2.4%	1.2%	2,822
High Grade Office Paper	1.1%	0.7%	1,238	Other Glass	0.5%	0.4%	528
Shredded Paper	0.2%	0.2%	223				
OCC (Old Corrugated Cardboard)	6.7%	1.8%	7,889	Organics	35.9%		42,104
Magazines/Catalogs	0.9%	0.3%	1,091	Mixed Yard Waste including Small Branches	3.4%	2.1%	3,956
Recyclable Mixed Paper	2.1%	0.5%	2,498	Branches/Limbs and Stumps >6" Diameter	1.0%	0.7%	1,140
Polycoated/Aseptic Containers	0.1%	0.0%	135	Leaves	4.4%	2.4%	5,105
Compostable Paper	7.1%	1.4%	8,287	Food Waste	14.9%	2.8%	17,415
Unrecyclable Mixed Paper	1.2%	0.5%	1,445	Other Untreated Wood	0.4%	0.3%	460
				Textiles/Leather	4.0%	2.2%	4,714
Plastic	13.8%		16,140	Fines/Dirt	3.1%	1.1%	3,685
#1 PET Bottles/Jars	0.5%	0.2%	569	Pallets	3.7%	2.6%	4,381
#2 HDPE Bottles/Jars	0.5%	0.1%	535	Other Organics	1.1%	0.3%	1,249
Bottles #3-7	0.1%	0.0%	67				
Other Plastic Containers <3 Gallons	0.2%	0.1%	288	Problem Waste	13.0%		15,195
Large Plastic Containers >3 Gallons	0.4%	0.3%	450	Large Electronics (Plug-in)	1.2%	0.9%	1,445
Plastic Retail Bags	0.3%	0.2%	358	Small Electronics (Rechargeable)	0.1%	0.1%	75
Other Plastic Film	4.4%	0.7%	5,119	Small Appliances	0.2%	0.2%	286
Expanded Polystyrene	1.3%	0.8%	1,535	Diapers/Sanitary Products	0.6%	0.3%	722
Other Rigid Plastics	6.2%	2.1%	7,220	Carpet/Padding	4.1%	3.4%	4,762
				Batteries	0.3%	0.3%	369
Metal	4.7%		5,558	Rubber	1.0%	0.4%	1,156
Aluminum Containers	0.3%	0.1%	299	Tires	1.2%	1.2%	1,422
Aluminum Foil & Trays	0.2%	0.2%	277	Furniture/Bulky Items	4.0%	2.2%	4,683
Ferrous Containers	0.4%	0.2%	504	Other Inorganics	0.2%	0.2%	274
Other Ferrous	2.4%	1.0%	2,778				
Other Non-Ferrous	1.4%	0.7%	1,700	Household Hazardous Waste (HHW)	0.3%		339
White Goods	0.0%	0.0%	0	Fluorescent Tubes and Bulbs	0.0%	0.0%	8
				Pharmaceuticals and Syringes	0.0%	0.0%	4
C&D	9.3%		10,907	Oil-based Paint & Finishes	0.0%	0.0%	0
Aggregate/Concrete/Asphalt/Ceramics	0.2%	0.1%	212	Latex Paint & Finishes	0.0%	0.0%	35
Asphalt Shingles	0.0%	0.0%	25	Pesticides	0.0%	0.0%	0
Painted/Stained/Treated Wood	4.4%	2.2%	5,102	Automotive Fluids	0.1%	0.1%	87
Clean Dimensional Lumber	2.6%	1.8%	3,045	Other Household Hazardous Waste	0.2%	0.2%	205
Clean/New Drywall	0.0%	0.0%	0				
Demo/Painted Drywall	0.9%	0.9%	1,019	Totals	100.0%		117,228
Other C&D	1.3%	0.9%	1,504	Sample Count	36		

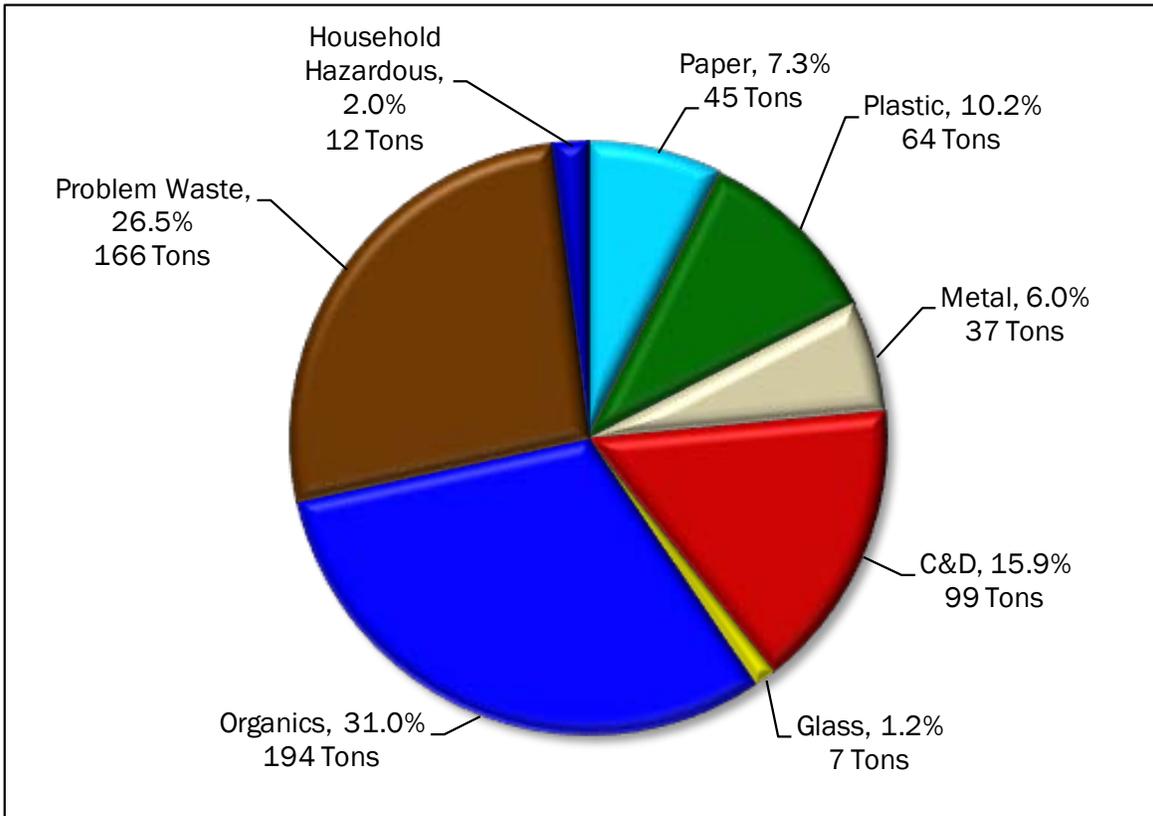
Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

3. RESULTS

3.4. COUNTY DROP-BOX WASTE

Figure 3-7 presents the breakdown of wastes collected at the Foothill Transfer sites. As shown, the waste that is deposited at these sites has significantly different composition from other residential and ICI wastes in Boulder County.

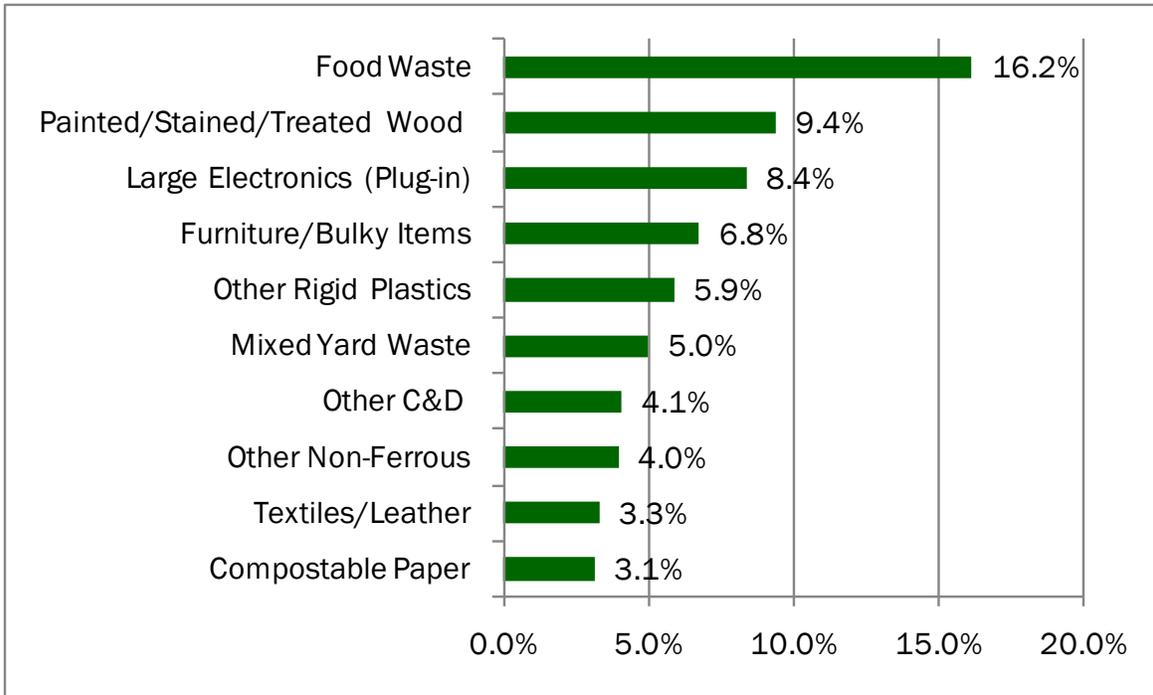
Figure 3-7 Boulder County Foothill Transfer Site Waste Composition, 2010



3. RESULTS

Figure 3-8 summarizes the 10 most prevalent materials from Foothill Transfer Sites. While Food Waste is once again the most prevalent item, a number of C&D-related material categories were also found in large fractions.

Figure 3-8 Top 10 Most Prevalent Material Categories in County Drop-box Waste



It should be noted that one of the Foothill Transfer Site samples contained two large electronic items that collectively totaled 58 pounds. An insufficient number of samples were obtained from Foothill Transfer Sites to discern if this sample was an outlier, and further investigation would be needed to determine the prevalence of large electronics.

3. RESULTS

Table 3-6 provides a detailed statistical profile of the County's Foothill Transfer Site waste.

Table 3-6 2010 Detailed Foothill Transfer Site Waste Composition

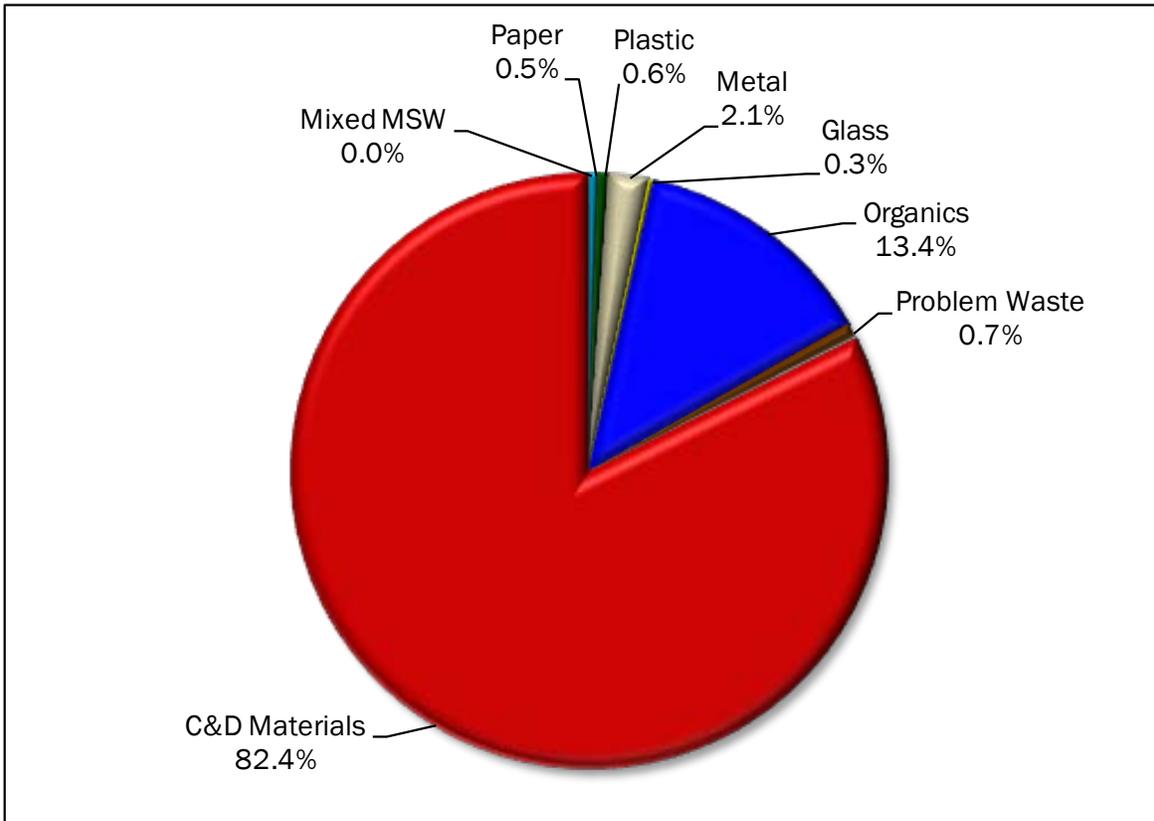
Material	Est. Percent	+ / -	Est. Tons	Material	Est. Percent	+ / -	Est. Tons
Paper	7.3%		45	Glass	1.2%		7
Newsprint	1.0%	0.5%	7	Glass Bottles and Jars	0.2%	0.2%	2
High Grade Office Paper	0.0%	0.0%	0	Other Glass	0.9%	0.7%	6
Shredded Paper	0.0%	0.0%	0				
OCC (Old Corrugated Cardboard)	0.2%	0.3%	1	Organics	31.0%		194
Magazines/Catalogs	0.4%	0.6%	2	Mixed Yard Waste including Small Branches	5.0%	0.4%	31
Recyclable Mixed Paper	1.1%	0.2%	7	Branches/Limbs and Stumps >6" Diameter	0.0%	0.0%	0
Polycoated/Aseptic Containers	0.2%	0.2%	1	Leaves	0.0%	0.0%	0
Compostable Paper	3.1%	0.6%	20	Food Waste	16.2%	1.2%	101
Unrecyclable Mixed Paper	1.2%	1.4%	8	Other Untreated Wood	2.8%	4.6%	18
				Textiles/Leather	3.3%	1.8%	21
Plastic	10.2%		64	Fines/Dirt	0.7%	0.7%	5
#1 PET Bottles/Jars	0.3%	0.1%	2	Pallets	2.0%	2.4%	12
#2 HDPE Bottles/Jars	0.3%	0.2%	2	Other Organics	1.0%	0.0%	6
Bottles #3-7	0.2%	0.0%	1				
Other Plastic Containers <3 Gallons	0.1%	0.1%	1	Problem Waste	26.5%		166
Large Plastic Containers >3 Gallons	0.0%	0.0%	0	Large Electronics (Plug-in)	8.4%	12.0%	52
Plastic Retail Bags	0.2%	0.1%	2	Small Electronics (Rechargeable)	1.2%	1.7%	7
Other Plastic Film	2.8%	0.8%	18	Small Appliances	0.5%	0.3%	3
Expanded Polystyrene	0.4%	0.1%	2	Diapers/Sanitary Products	2.8%	2.5%	17
Other Rigid Plastics	5.9%	0.6%	37	Carpet/Padding	1.2%	1.8%	7
				Batteries	0.3%	0.2%	2
Metal	6.0%		37	Rubber	0.8%	0.6%	5
Aluminum Containers	0.2%	0.3%	1	Tires	2.0%	3.4%	13
Aluminum Foil & Trays	0.1%	0.0%	1	Furniture/Bulky Items	6.8%	1.8%	42
Ferrous Containers	0.6%	0.8%	4	Other Inorganics	2.6%	3.7%	16
Other Ferrous	0.8%	0.8%	5				
Other Non-Ferrous	4.0%	4.5%	25	Household Hazardous Waste (HHW)	2.0%		12
White Goods	0.3%	0.5%	2	Fluorescent Tubes and Bulbs	0.0%	0.0%	0
				Pharmaceuticals and Syringes	0.0%	0.0%	0
C&D	15.9%		99	Oil-based Paint & Finishes	0.0%	0.0%	0
Aggregate/Concrete/Asphalt/Ceramics	0.2%	0.3%	1	Latex Paint & Finishes	0.0%	0.0%	0
Asphalt Shingles	0.5%	0.8%	3	Pesticides	0.0%	0.0%	0
Painted/Stained/Treated Wood	9.4%	6.9%	59	Automotive Fluids	0.0%	0.0%	0
Clean Dimensional Lumber	1.7%	0.7%	11	Other Household Hazardous Waste	1.9%	3.0%	12
Clean/New Drywall	0.0%	0.0%	0				
Demo/Painted Drywall	0.0%	0.0%	0				
Other C&D	4.1%	4.6%	26	Totals	100.0%		626
				Sample Count	10		

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

3.5. C&D WASTE COMPOSITION

Figure 3-9 presents the breakdown of C&D waste by material group. Unsurprisingly, C&D materials make up over 82 percent of C&D waste, with Organics contributing most of the remainder.

Figure 3-9 C&D Waste Composition, 2010



3. RESULTS

Figure 3-10 compares the 10 most prevalent materials in disposed C&D waste. Rock/Concrete, Asphalt Shingles, Painted/Stained Wood and Drywall are the most prevalent items.

Figure 3-10 Top 10 Most Prevalent Material Categories in C&D Waste

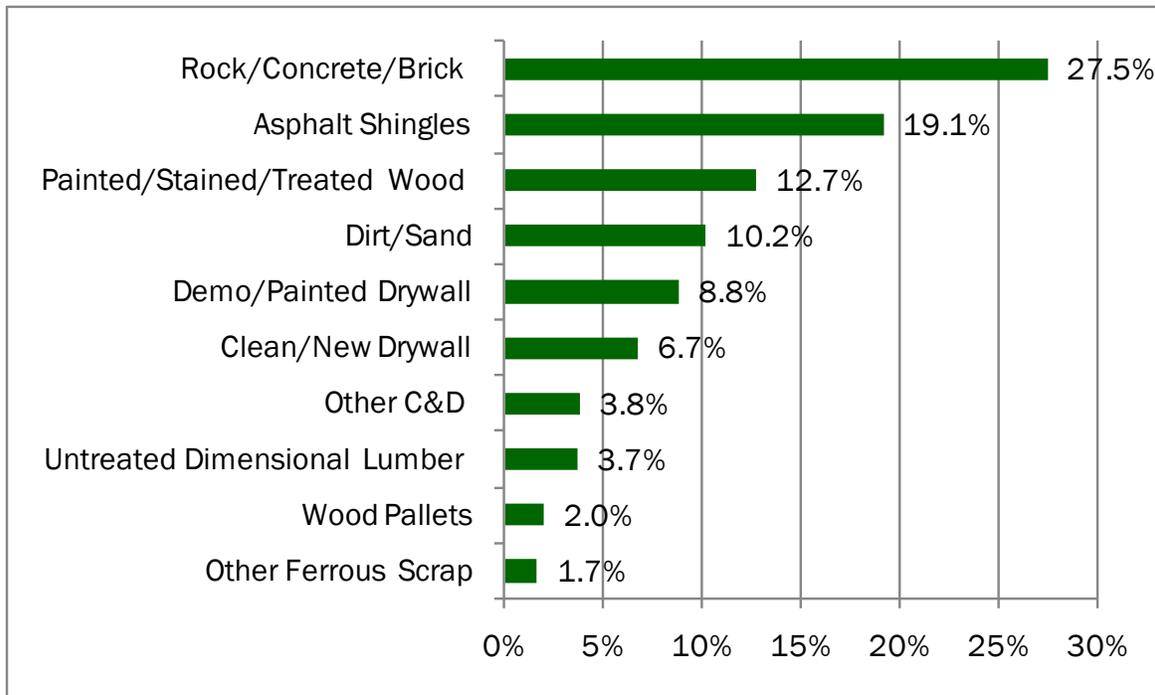


Table 3-6 provides a detailed statistical profile of the County’s C&D waste stream.

Table 3-7 2010 Detailed C&D Waste Composition

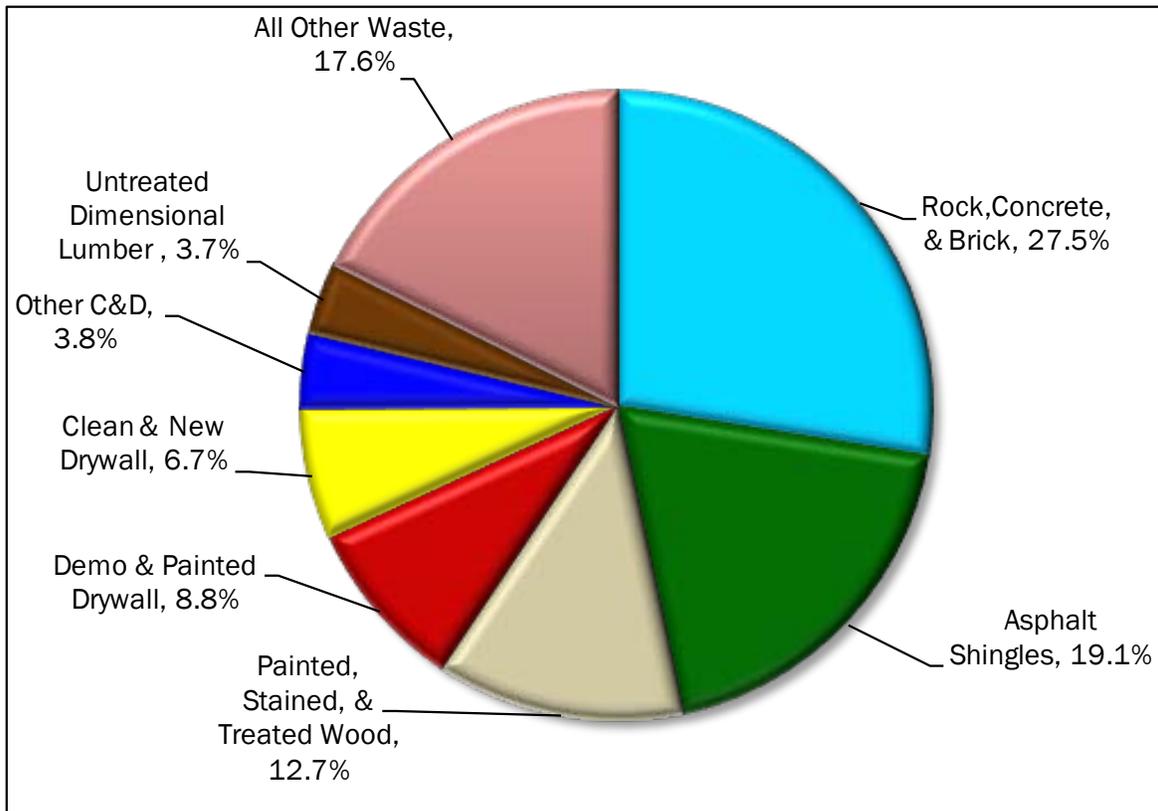
Material	Est. Percent	+ / -	Est. Tons	Material	Est. Percent	+ / -	Est. Tons
Paper	0.5%		381	Problem Waste	0.7%		559
Uncoated OCC-Recyclable	0.1%	0.0%	51	Electronics	0.0%	0.0%	0
Other Paper	0.4%	0.4%	329	Small Appliances	0.3%	0.5%	240
Plastic	0.6%		424	Carpet/Padding	0.3%	0.3%	250
PET Bottles-Beverage	0.0%	0.0%	1	Batteries	0.0%	0.0%	0
Film Packaging	0.0%	0.0%	25	Tires	0.0%	0.0%	0
Other Plastic	0.5%	0.4%	398	Furniture/Bulky Items	0.1%	0.1%	70
Metal	2.1%		1,615	Fluorescent Light Bulbs	0.0%	0.0%	0
Aluminum Containers	0.0%	0.0%	4	Household Hazardous Waste	0.0%	0.0%	0
Other Ferrous Scrap	1.7%	1.7%	1,254	C&D Materials	82.4%		62,442
Non-ferrous Metal	0.4%	0.4%	325	Rock/Concrete/Brick	27.5%	19.4%	20,861
White Goods	0.0%	0.1%	32	Asphalt Shingles	19.1%	11.5%	14,499
Glass	0.3%		226	Painted/Stained/Treated Wood	12.7%	7.3%	9,624
Glass Bottles and Jars	0.0%	0.0%	0	Untreated Dimensional Lumber	3.7%	2.1%	2,792
Glass	0.3%	0.4%	226	Clean/New Drywall	6.7%	5.8%	5,111
Organics	13.4%		10,130	Demo/Painted Drywall	8.8%	6.5%	6,670
Yard Waste	1.2%	1.4%	905	Other C&D	3.8%	3.0%	2,885
Wood Pallets	2.0%	2.5%	1,508	Mixed MSW	0.0%	0.0%	19
Dirt/Sand	10.2%	9.2%	7,716	Totals	100.0%		75,797
				Sample Count	37		

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

3. RESULTS

Figure 3-11 shows the C&D waste stream subdivided by material groups that are more closely associated with C&D waste.

Figure 3-11 C&D Waste Composition by C&D Material Category



3. RESULTS

Table 3-8 shows how individual material categories were combined to create the pie chart in Figure 3-11.

Table 3-8 Mapping of C&D Material Categories to Groups

Material Group Name	Material Categories Included	Percent
Metals	All metal categories	5.7%
Organics	All organics categories	4.3%
Wood	All wood categories including wood pallets	28.1%
Concrete/Brick/Block	Concrete/Brick/Block	13.2%
Drywall	Clean and demo drywall	5.2%
Shingles	Shingles	29.5%
Other C&D	Other C&D, ceramics and C&D PVC	6.8%
Bulky Items/Furniture	Bulky items & furniture	2.2%
Carpet/Padding	Carpet & carpet padding	0.9%
Other Waste	All paper, all plastics, all glass, all problem materials, all HHW and textiles	4.2%
Totals		100.0%

Note: Totals may not sum due to rounding discrepancies.

3.6. CONCLUSIONS AND RECOMMENDATIONS

- ◆ **Inaugural Study:** The 2010 Study served as a good first effort for Boulder County to quantify its waste stream and to estimate the composition of disposed wastes. This study provided at least an initial snapshot of residential wastes, including separate profiles for single and multi-family wastes, as well as for ICI, C&D and mountain site drop-box waste.
- ◆ **Availability of Data:** Boulder County appears to have a positive relationship with the private and public haulers that collect wastes in Boulder County, and these haulers were generally cooperative in providing the information needed to plan for and execute this study. However, even with good cooperation, there are gaps in the reported data that were filled based on reasonable estimation techniques. The Project Team especially identifies the C&D waste stream as being in need of a targeted waste generation study, as it was not possible to estimate the quantity of C&D debris generated in the County as part of this study.
- ◆ **Opportunities:** Boulder County is clearly doing a good job recycling traditional fiber and container recyclables, as evidenced by the relatively low fractions of these items in disposed waste. The County continues, however, to have opportunities to divert additional wastes from landfill disposal. Organics – and especially yard wastes – remain in the disposed waste stream in significant quantities. Food waste and compostable paper are also prevalent, which is of particular interest because there are markets for composting

3. RESULTS

these materials commercially in Boulder County. Additionally, the fraction of bulky items and furniture were high enough to suggest that incremental reuse opportunities may exist.

- ◆ **Continue Performing Countywide Studies:** Waste composition studies inform about the overall disposed waste stream for local planners. While results are helpful to compare against other municipalities in Colorado and nationally, time series waste composition data will provide the County with an informative commentary on its ongoing recycling and diversion efforts. The County should continue to perform a similar project over five to 10 year intervals.
- ◆ **Expanded Multi-family Analysis:** The multi-family sampling and sorting performed for this study was helpful in confirming that the disposed waste stream, and therefore the recycling and diversion outreach and programs that are needed, are significantly different for multi-family dwellings in Boulder County. However, the occurrence of several items in the multi-family waste stream – notably, leaves and large electronics – suggest that more study is needed to defensibly determine if these materials are truly occurring in multi-family wastes to the extent shown, or if these samples represent outliers.
- ◆ **Expanded Foothill Transfer Site Analysis:** The Foothill Transfer Site sampling and sorting performed for this study was helpful in confirming that the disposed waste stream at the Transfer Sites is significantly different compared to other waste in Boulder County. However, the occurrence of several items in this waste stream – notably, large electronics, HHW, and bulky items – suggest that more study is needed to defensibly determine if these materials are truly occurring at the drop-sites to the extent shown, or if these samples represent outliers.
- ◆ **Focus on C&D:** The generation and disposal of C&D debris follows its own unique local market drivers. Although this study was able to obtain some samples of C&D that were obtained at two facilities, spanning the County’s geographic region, it was beyond the scope of this study to defensibly document the generation and distribution of C&D debris, and to determine the composition of C&D debris. Boulder County should consider a more focused effort to characterize C&D as the County continues investigating opportunities to enhance overall recycling rates.

Current Business Waste Reduction Programs and Incentives

The city currently offers several business waste reduction programs and incentives that increase commercial waste diversion and create a new normal for waste management systems in Boulder.

- **Business Zero Waste Start-Up Rebate** – An incentive created to provide up to \$250 of financial support for the initial start-up costs of implementing new waste diversion services in businesses. This incentive is most often paired with technical assistance, employee education and new signage.
- **Business recycling coupon** – A coupon for businesses to receive three months of free recycling service if the business does not yet have recycling collection. This coupon has served 64 businesses since 2002. It has been most popular with small businesses and small recycling haulers. Recently, use of the recycling coupon has tapered off because businesses are more willing to pay for recycling service.
- **Business compost collection subsidy** – An ongoing cost buy-down where the city pays \$2.50 for each cubic yard of compostable material collected from Boulder businesses each month. City costs in 2010 were \$55,843 and 3,328 tons of organics were diverted.
- **Free technical assistance and waste audits for businesses** – The Partners for a Clean Environment (PACE) program helps businesses reduce and divert their waste. Advisors assess current waste management practices and provide technical assistance for recycling, composting, green purchasing and hazardous materials management. This service expanded significantly in the fourth quarter of 2010 to proactively seek additional diversion by businesses.
- **Free business waste reduction posters and educational resources** – Staff developed new sector-based guideline posters for business that are working with the PACE Zero Waste Advisors. These posters are customized to the businesses waste stream and assist customers and employees with their diversion efforts.

In Development:

Private commercial public place recycling container incentive – this incentive will be available to property owners and/or managers of strip malls and/or commercial spaces to help with up-front cost of the new recycling container(s). The arrangement is intended to partner with commercial property owner and/or managers to reduce upfront costs if they maintain and service the public place recycling containers.

Zero Waste Success Stories:

The City of Boulder has contracted with Boulder County Public Health (BCPH) Partners for a Clean Environment (PACE) team to provide Zero Waste Advising Services to Boulder businesses. This service involves contacting Boulder businesses proactively about Zero Waste services, answering waste reduction questions, following up with interested businesses to conduct waste audits, and provide assistance to help businesses move toward, achieve, and document 70 percent diversion rates.

Currently, more than 40 businesses are receiving zero waste advising services. This effort entails meeting with each business, surveying its waste management practices, and estimating its current diversion rates. Once completed, each business receives a customized recommendation report identifying opportunities for reducing more of its waste stream. Follow-up audits are conducted at businesses that are implementing recommendations from the report to increase its diversion rate. When a business achieves 70 percent waste diversion rates, they receive the PACE Zero Waste Area of Excellence (AOE) Award and recognition as a zero waste business. Eleven businesses in Boulder have received this PACE Zero Waste AOE Award in 2011.

Communities with Disposable Bag Bans for Fees

Plastic Bag Ban

San Francisco, CA
Fairfax, CA
Palo Alto, CA
Westport, CT
Bethel, AK
Edmonds, WA
Manhattan Beach, CA
Long Beach, CA
Kauai County, HI
Maui County, HI
Portland, OR
Northern Territory, Australia
Bangladesh
Italy
Eritrea
Ethiopia
Rwanda
Tanzania
Bhutan
China
France

Disposable Bag Fee

Washington, DC
Montgomery County, MD
Toronto, Canada
Taiwan
Ireland
United Kingdom
Denmark
South Africa
Malta
Belgium
Switzerland
Germany
Holland
Israel
NW Territories, Canada

Plastic Bag Ban and Paper Bag Fee

San Jose, CA
Los Angeles County, CA
Santa Monica, CA
Telluride, CO
Calabasas, CA
Santa Clara County, CA
Marin County, CA
Brownsville, TX
Bellingham, WA



Estimating Disposable Bag Usage in the City of Boulder

There have been no studies done in the City of Boulder or elsewhere in Colorado on the number of bags used and disposed by residents and businesses every year.

To estimate these numbers for the City of Boulder, Eco-Cycle relied upon two comprehensive studies done from the City of Seattle, WA (2008) and the City of San Jose, CA (2010). The per capita bag use estimates for Seattle and San Jose are shown below.

	Seattle, WA	San Jose, CA
# of plastic bags per person per year	511	397
# of paper bags per person per year	119	55
total # of bags per person per year	630	452

The data from San Jose, CA was chosen as the more conservative baseline on total bag consumption. Applying the San Jose per capita bag usage figures to the population of the city of Boulder (103,650 in 2009) resulted in the following estimate of the number of bags used in Boulder every year.

	City of Boulder
# of plastic bags per year	41,149,050
# of paper bags per year	5,700,750
total # of bags per year	46,849,800

Confirming the Estimate

Boulder County conducted a waste composition study in late 2010 which estimated 781 tons of disposable plastic bags were discarded by county residents in 2010. Using the standard industry weight of 0.013 pounds per bag, it was estimated Boulder County residents disposed of approximately 120.2 million plastic bags in 2010. It was then estimated that city of Boulder residents contributed to this total by disposing of 41.2 million plastic bags in 2010 based on the ratio of the city’s population to the total county population.

Because this data on the number of bags disposed does not include paper bags, bags reused or bags recycled, there is a strong indication that the estimated 46.85 million disposable paper and plastic bags used in the city of Boulder annually is a conservative figure.

KEY DATA FINDINGS ON DISPOSABLE BAG USE IN BOULDER

Estimated Annual City of Boulder Bag Use Data

Total Plastic Bags	Total Paper Bags	Total Bag Use	Bag use per capita
41,149,050	5,700,750	46,849,800	452

Estimated Number of Bags Distributed by Businesses Affected by Proposed Ordinance

Total Plastic Bags	Total Paper Bags	Total Bag Use	Bag use per capita
33,330,731	4,617,608	37,948,338	366

Assumes bag fee applies to businesses that distribute food or beverages, including supermarkets, restaurants, fast food outlets and convenience stores, which account for 81% of bag use. Assumes general merchandise/apparel retailers and other retailers are exempted from bag fee.

Revenue projections based on changes in bag use after fee on qualified businesses

	10 cent fee	20 cent fee
Best estimate	\$1,404,089	\$1,290,243
Low range	\$379,483	\$758,967
High range	\$1,897,417	\$3,794,834

Best estimate assumes bag use drops by 63% under a 10 cent fee and 83% under a 20 cent fee (based on modeling by City of San Jose, 2010). Low range estimate assumes bag use drops 90% across all fee levels. High range estimate assumes bag use drops 50% across all fee levels.

Revenue projections for city after retailers' retain two cents		
	10 cent fee	20 cent fee
Best estimate	\$1,123,271	\$1,161,219
Low range	\$303,587	\$683,070
High range	\$1,517,934	\$3,415,350

Estimated annual costs to city of Boulder to administer program, including enforcement and education:

- \$86,089 based on San Jose costs of \$0.83 per person
- \$124,298 based on Seattle costs of \$1.20 per person (based on 15-cent fee)

Estimated current annual community costs to manage disposable bags			
	Seattle data	Boulder extrapolation	Who pays these costs in Boulder
# of bags distributed	360,000,000	46,849,800	
Processing contamination costs	\$ 561,837	\$ 71,879	BCRC
Composting contamination costs	\$ 312,000	\$ 39,916	A1 Organics; Western Disposal
Collection and disposal costs	\$ 2,477,264	\$ 316,932	Residents, businesses
City street cleaning costs	\$ 503,567	\$ 64,424	Taxpayers
Future landfill liability costs	\$ 173,491	\$ 22,196	Taxpayers
TOTAL	\$ 4,028,160	\$ 515,348	\$515,348
TOTAL PER BAG	\$ 0.011	\$ 0.011	\$0.011

Reductions in environmental impacts from decreased disposable bag use

(Seattle data, not extrapolated to Boulder)

	10 cent fee	20-cent fee
Non-renewable energy use	49%	58%
GHG emissions	48%	57%
Resource depletion (abiotic)	49%	58%
Eutrophication (water pollution)	50%	59%
Litter marine diversity	47%	55%
Litter aesthetics	47%	56%
Shopping bag waste generated	50%	59%

Skumatz Economic Research Associates, Inc.
Projected effect of a bag reduction ordinance in the City of Boulder

	Low	High
Estimated number single use bags currently distributed in City of Boulder	9,333,333	52,666,667
Average weight per bag (lbs)	0.013	0.013
Estimated tons of bags currently distributed in City of Boulder	61	342
Estimate of avoided clean-up cost ¹	\$333,333	\$2,000,000
Decline in bag use in Washington, DC after five cent fee	82%	
Estimated reduction in tons of bags distributed in City of Boulder after ordinance implementation	49.7	280.7

*Estimates are based on previous work for a California county, scaled to Boulder.

¹ Based on SERA study for a proposed bag reduction ordinance in a California county.