




Final Report

Countywide Waste Composition Study

November 25, 2019

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2019 BOULDER COUNTY WASTE COMPOSITION STUDY

1. INTRODUCTION

1.1 BACKGROUND

Boulder County conducted an inaugural waste composition study in 2010 (2010 Study). Since that time, the County has continued to advance sustainability and waste diversion policies, programs and infrastructure. The County's 2012 Sustainability Plan devotes a full chapter to achieving "Zero Waste or Darn Near," as stated in the County's 2005 zero waste resolution. Further, many of the incorporated jurisdictions in the County have established their own zero waste programs and continue to expand recycling and composting access.

There have been numerous changes since 2010 that have impacted the composition of the County's waste stream. At a macro-economic level, the shift from print media to digital media and the ongoing conversion to lighter-weight packaging have impacted recycling programs not just in Boulder County but nationally. Since 2010, ongoing public education as well as advancement of recycling instruction in the school systems continues to shape public participation in diversion programs. Further, expansion of single stream recycling as well as source-separated organics collection programs have begun to target previously disposed materials for composting.

Boulder County retained MSW Consultants to perform a comprehensive update to the County's waste composition study. The Cities of Boulder and Lafayette, and the Town of Superior, also sponsored targeted data collection and analysis as part of this update. This report presents the 2019 Waste Composition Study (2019 WCS), including the methodology and results.

1.2 OBJECTIVES

The objectives of the 2019 Study were to:

- ◆ Update the countywide composition profile of residential and commercial wastes destined for disposal.
- ◆ Update the countywide composition of construction and demolition (C&D) debris through an expanded visual survey of C&D loads.
- ◆ Obtain composition profile data for additional material streams that were not captured in the 2010 Study, including single stream recyclables and source-separated organics. In particular, this study sought to evaluate the contamination rates for recyclables and organics.
- ◆ Update 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.

1.3 2019 AND 2010 STUDY COMPARISON

At the outset of the project, the objective of comparing the results of this update with the 2010 Study was also cited. However, due to: significant differences in the sampling distribution; material improvements to the accuracy of underlying waste generation data in 2019; and significantly expanded surveying of C&D debris in the 2019 Study, comparisons between the 2010 and 2019 Studies are impaired. Similarities and differences are described below and include:

- ◆ **Same Generator Sectors:** The 2019 Study retained separate analysis of the residential, industrial/commercial/institutional (ICI), and construction and demolition (C&D) debris generators sectors.

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- ◆ **Same Material Categories:** The list of material categories used in the 2019 Study was virtually the same as the previous study to allow for detailed comparisons.
- ◆ **Same Sampling Protocols:** The protocol for obtaining samples of wastes remained unchanged. Both studies used standard grab sampling techniques for municipal solid waste (MSW), and both studies used visual volumetric surveying for C&D loads.
- ◆ **Same Sorting Protocol:** The sorting protocol was largely unchanged from the 2010 Study. Samples were pre-weighed, loaded on a sort table, and processed into labeled bins so they could be weighed for analysis.
- ◆ **Same Statistical Methods:** The same statistical methods were used in both the 2010 and 2019 Studies.

There were a number of differences in the 2019 Study compared to the 2010 Study, primarily associated with expanded sampling and sorting and improving the accuracy of waste generation data. Differences include:

- ◆ **Improved Waste Generation Data:** Since 2010, the County has implemented a waste quantity reporting system to record disposal, recycling, composting and C&D tons generated in the County. In 2010, waste generation was estimated. This system was used to derive the overall County waste generation. In the 2019 Study, waste generation was obtained through a more robust reporting system in use throughout the County. Reported waste generation in 2019 was different enough from the 2010 estimates that it created meaningful differences in data aggregation and weighting factors.
- ◆ **Shifted Seasonal Data Collection:** Both studies performed field data collection in a summer season and a winter season event. However, the 2019 Study winter season occurred in January, which is the middle of winter, while the 2010 winter season occurred in late October. Further, the 2019 summer season was at the beginning of summer in early June, while the 2010 Study occurred in the middle of summer (mid-July).
- ◆ **Addition of Material Streams:** The 2019 Study added single stream recyclables and source-separated organics to the material streams that were analyzed. These recovered materials were tested for composition and contamination levels.
- ◆ **New Generator Sector:** Street basket refuse, recyclables and organics were added to the 2019 Study to evaluate the effectiveness of capturing targeted recyclables and organics in public spaces.
- ◆ **Handheld App for C&D Visual Estimation:** Although both the 2010 and 2019 Studies relied on visual estimates for C&D loads, the 2019 Study applied a tablet computer with a visual estimation app.
- ◆ **Expanded C&D Surveying:** Due to the app, the County was able to take responsibility for visual surveying of C&D loads. As a result, significantly more loads were captured in the 2019 Study compared to 2010.
- ◆ **Changes in Host Facilities:** Both the 2019 and 2010 Studies collected samples at the Western Disposal Transfer Station. However, the 2019 Study captured samples from certain generators at the Front Range Landfill, while the 2010 Study targeted the Erie Landfill. The 2019 Study also captured recycling and organics samples at the Boulder County Recycling Center, which was not part of the 2010 Study.
- ◆ **Individual Municipality Participation:** In the 2010 Study, the primary focus was to obtain a representative snapshot of Boulder County's aggregate waste stream, and samples were distributed from incorporated and unincorporated areas of the County in proportion to the generation of wastes. In the 2019 Study, three incorporated municipalities guided the sample distribution to obtain a snapshot of selected waste streams. Because of the focus on specific substreams, the distribution of samples in the 2019 Study may have been slightly less representative than in the 2010 Study. Municipal participation included:

- ◆ **City of Boulder:** The City manages waste streams from the residential sector and also provides street basket (public bin) collection of refuse, recyclables and organics from within the City, City parks and City Open Space areas. All of these substreams were targeted at the direction of the City.
- ◆ **City of Lafayette:** Lafayette provides residential refuse, recycling, and organics collection through its contracted hauler, Republic Services. Collections are conducted on a Tuesday through Friday schedule with collection of recyclables and collection of organics occurring on alternating weeks
- ◆ **Town of Superior:** The Town is divided into two distinct neighborhoods whose refuse and recyclables were separately characterized. The two areas of the Town were termed the HOA, or Rock Creek area, and the Old Town area.

As a consequence of the significant number of differences between the 2010 and 2019 studies, no attempt has been made in the 2019 Study update to compare and contrast the results of the 2010 Study.

1.4 REPORT ORGANIZATION

The remainder of this report contains the following chapters:

- ◆ **Section 2 – Methodology**, describes the sampling, sorting, and data aggregation methods used. This section also provides an overview of Boulder County’s waste generation and the sampling targets.
- ◆ **Section 3 – Results**, provides graphical and tabular composition data from the 2019 Study.
- ◆ **Section 4 – Conclusions and Recommendations**, offers noteworthy observations about the County’s waste stream and makes several recommendations for future consideration.

There are also several appendices containing supplementary data and information.

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2. METHODOLOGY

2.1 GENERATOR SECTORS AND MATERIAL STREAMS

Similar to the 2010 Study, this project analyzed the composition of the County’s aggregate waste stream, as well as individually from the following generator sectors:

- ◆ **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, as well as a number of samples of materials collected in public bins.

In addition to sampling and sorting refuse, the 2019 Study also characterized single stream recyclables and source separated organics, both from residential and commercial generators.

2.2 BOULDER COUNTY WASTE GENERATION AND DISPOSAL

Boulder County’s tonnage reporting system was used to compile the quantities of refuse, recyclables, and organics collected from within Boulder County and disposed or processed in or adjacent to the County. This system contains detailed information about the origin of material. In particular, the data set identifies the jurisdiction of origin. Table 2-1 summarizes the generation of refuse, recyclables and organics in Boulder County, totaling just over half a million tons, and Appendix A contains a more detailed breakdown of wastes by generator type.

Table 2-1 Boulder County Waste Generation Summary (2018 Tons)

Area	Refuse	Recycling	Organics	Total
City of Boulder	59,171	59,209	41,217	159,597
City of Lafayette	6,961	4,826	1,086	12,873
Town of Superior	5,941	1,174	653	7,767
Rest of County	162,143	76,354	3,973	242,470
Grand Total MSW	234,216	141,563	46,929	422,707

Source: Boulder County

2.3 HOST FACILITIES

The following facilities hosted sampling and sorting of refuse, recyclables and all organics:

- ◆ **Western Disposal Transfer Station** to obtain the majority of refuse samples and organics samples,
- ◆ **Boulder County Recycling Center** to obtain single stream recyclables samples, and
- ◆ **Front Range Landfill** to capture refuse samples from the Town of Superior, the Superior HOA, and samples from other areas of Boulder County outside of the Cities of Boulder, Lafayette and the Town of Superior.

The Western Disposal Transfer Station and Front Range Landfill also accommodated the C&D visual surveying.

2.4 SEASONALITY

Data collection was performed over two seasons, similar to the 2010 Study. Table 2-3 summarizes the dates on which sampling, sorting and visual surveying took place for the 2019 Study.

Table 2-2 Seasonal Data Collection Schedule

	Winter Season	Summer Season
Refuse Sampling	Dec 11-14, Dec 17	Jun 5-7, Jun 10-11
Recyclables Sampling	Dec 10, Dec 18	Jun 3-4
Organics Sampling	Dec 11, Dec 13-14	Jun 6, Jun 11
C&D Visual Surveying	Dec 5-7	Jun 19-21

2.5 SAMPLE ALLOCATION

Boulder County and the participating municipalities had a wide range of material streams to be targeted. Sampling and sorting resources were deployed with the objective of capturing at least some samples from all of the streams identified by the project sponsors. Table 2-4 summarizes the sampling targets for the study, and also shows the actual number of samples obtained.

Table 2-4 highlights several details. First, the sponsors designed a complex sampling plan, given that refuse is delivered to several disposal locations, and in some cases is only collected on a certain day of the week. For example, all Town of Superior waste is collected on Mondays and recycling collection is conducted on alternate Mondays. HOA waste and recycling are collected each Monday. Delivery of Superior HOA recyclables to the Boulder County Recycling Center tended to happen late in the day. The Winter Season samples were missed because they were not held overnight for sorting the next day. A second observation is that the complexity of the sampling plan proved to be challenging to achieve precisely. As shown, most targeted samples were captured. However, unforeseen schedule changes in both seasons impacted the ability to obtain every sample for manual sorting. This resulted in a slight shortfall.

The two instances that led to unexpected holes in targeted sample numbers were the last-minute decision of the Superior HOA to refuse to have its waste included in the study during the Winter Season and the inability to get Republic Trucks diverted from their usual dumping location to the Western Disposal Transfer Station for the Summer Season. Both of these issues were caused by breakdowns in communication between the many participating stakeholders necessary to coordinate the sampling.

Conversely, the C&D visual surveying vastly exceeded the original plan. This was due to the County taking on the task of deploying visual surveyors and using a tablet computer to aid in the estimation of visual surveying. The C&D sample size was dramatically higher than the 2010 Study as well. As a result, C&D composition results have a greater degree of precision compared to the prior study. Table 2-4 summarizes the targeted samples and also shows the actual number of samples obtained.

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Table 2-3 Sampling Targets

Source	Stream	Sector	Targeted	Actual
Boulder	Refuse	Single-family	6	4
		Multi-family	4	4
		Commercial	6	8
		Public Bins	5	5
	Recycling	Single-family	4	6
		Multi-family	6	2
		Commercial	4	5
		Public Bins	5	5
	Organics	Single-family	4	4
		Multi-family	4	4
		Commercial	4	4
		Public Bins	5	5
Lafayette	Refuse	Single-family	4	2
		Commercial	2	2
	Recycling	Single-family	4	4
	Organics	Single-family	4	1
Superior	Refuse	Single-family	8	7
		SF HOA	10	4
	Recycling	Single-family	6	6
		SF HOA	6	3
Rest of County	Refuse	Single-family	14	14
		Multi-family	4	2
		Commercial	14	12
		Self-Haul - Foothills	4	4
	Organics	Single-family	4	4
	C&D	C&D	30	175
Total			171	296

Table 2-6 further drills down into the single-family refuse sample allocation for the 2019 Study. In particular, this table shows that sample allocation was somewhat inverse to the tonnage of refuse actually disposed. Single-family refuse tonnage from the City of Boulder and the Rest of County areas comprised about 85 percent of the County total single-family disposed refuse. However, less than 60 percent of the single-family disposed refuse samples were obtained from these jurisdictions. Conversely, more than one-third of the single-family refuse samples were obtained from the Town of Superior, despite the Town generating only about 9 percent of the single-family disposed refuse.

Table 2-4 Comparison of Single-Family Sample Distributon to Disposed Refuse Tonnage (2018)

Origin	# of Samples	% of Samples	Single Family Tons	% of Tons
City of Boulder	4	12.9%	11,972	20.8%
City of Lafayette	2	6.5%	3,497	6.1%
Town of Superior	11	35.5%	3,956	6.9%
Rest of County	14	45.2%	37,999	66.2%
Total	31	100.0%	57,424	100.0%

Similar imbalances to sample allocation exist in other generator sectors and in the single family and multi-family relative weighting, although the issue is most pronounced in the single-family residential sector. As sample allocation diverges from the actual proportion of underlying tonnage, it creates greater potential for aggregated results to over- or under-represent one or more generator sectors or geographic areas of the County. Additionally, the confidence intervals calculated for the composition estimates assume that samples are proportionally distributed amongst the population through random sampling. Due to the differences between the distributions of the allocated samples and the County tonnages, the condition of random sampling may not be met in this study, and therefore, the 90 percent confidence level used in calculating confidence intervals may not reflect the true likelihood of capturing the population mean.

2.6 SAMPLE WEIGHTS

The amount of each sample is based on the homogeneity of the sampled material and the particle size. Consistent with industry literature, the sample weights ranged as follows:

- ◆ **Refuse:** 200-250 pounds,
- ◆ **Recyclables:** 125-150 pounds,
- ◆ **Organics:** 125-150 pounds.

2.7 MSW MATERIAL CATEGORIES AND DIVERTIBILITY

Each sample of refuse, recyclables and organics was sorted into 62 material categories, almost all of which were the same as the 2010 Study. The 2019 Study added plastic thermoforms, marijuana waste, non-compostable coffee cups, and BPI certified compostable items; and also consolidated leaves and pumpkin waste into existing yard waste or other organics categories, respectively. Table 2-7 shows the breakdown of the material categories within their respective material groups. Detailed definitions for each of these categories is shown in Appendix A.

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Table 2-5 Material Categories (with Divertibility Reference)

Paper		Problem Materials	
Newsprint	1	Large Electronics (Plug-in)	4
High Grade Office Paper	1	Small Electronics (Recharge)	4
Shredded Paper	4	Small Appliances	4
Old Corrugated Cardboard	1	Diapers/Sanitary Products	7
Magazines/Catalogs	1	Textiles/Leather	4
Mixed Recyclable Paper	1	Carpet/Padding	7
Polycoated/Aseptic Containers	2	Batteries	6
Compostable Paper	3	Rubber	7
Unrecyclable Paper	7	Tires	4
Plastic		Furniture/Bulky Items	7
#1 PET Bottles/Jars	2	Other Inorganics	7
#2 HDPE Bottles/Jars	2	Marijuana Waste	7
Bottles #3-7	2	Household Hazardous Waste	
Other Plastic Tubs/Cups <3 Gal	2	Fluorescent Tubes and Bulbs	6
Large Plastic Containers >3 Gal	2	Pharmaceuticals and Syringes	7
Plastic Bags	7	Oil-based Paint & Finishes	6
Other Plastic Film	7	Latex Paint & Finishes	6
Thermoforms	2	Pesticides	6
Expanded Polystyrene	4	Automotive Fluids	6
Other Rigid Plastics	2	Other HHW	6
Metal		Construction & Demolition Debris (C&D)	
Aluminum Cans	2	Aggregate/Asphalt/Ceramics	5
Aluminum Foil & Trays	2	Asphalt Shingles	5
Ferrous Containers	2	Painted/Stained/Treated Wood	7
Other Ferrous	4	Clean Wood	5
Other Non-Ferrous	4	Wood Pallets	5
White Goods	4	Clean/New Drywall	5
Glass		Demo/Painted Drywall	7
Glass Bottles and Jars	2	Other C&D	7
Other Glass	7	Other	
Organic		Fines / Dirt	7
Yard Waste	3	Coffee Cups Non-Compostable	7
Branches, Limbs, Stumps	3	BPI Certified Compostables	3
Food Waste	3	Bagged Material (BCRC Only)	7
Other Organics	3		

It should be noted that the sort of recyclables included a category for “Bagged Materials.” Film plastic bags (and other plastic films) adversely impact the sorting of recyclables are not allowable in the recycling stream. The Bagged Material category captured the fraction of inbound recyclables that were nonetheless contained in plastic bags.

One of the objectives of this study was to identify constituents that could be diverted from landfill through locally available means. Accordingly, each material was assigned a “divertibility class” which included:

1. **Targeted Fiber:** All cardboard and paper targeted in the curbside collection programs in the County.
2. **Targeted Containers:** Metal, glass, plastic and aseptic containers and packaging targeted in the curbside collection programs in the County.
3. **Targeted Compostables:** Yard wastes, leaves, food wastes, compostable papers, and compostable plastics targeted in residential and commercial organics collection programs.
4. **Recyclable by Third Party:** Materials which are not currently targeted in the curbside collection programs in the County but can be recycled or diverted by third-party processors.

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5. **Potentially Recyclable C&D:** C&D debris constituents which can be recovered through commercial processing of mixed C&D loads.
6. **Accepted at HHW Facility:** Items that can and should be segregated from the MSW stream for disposal in the HHW program.
7. **Not Currently Recoverable:** Materials for which there are no readily available outlets for recycling, composting, or other diversion from landfill. It should be noted that this number is likely overstated. This is because there are many items that can be diverted, but which are infrequently generated and for which no sort category was included in this (or the prior) study.

2.8 C&D MATERIAL CATEGORIES

For the visual survey of C&D loads, a different set of material categories was used to more accurately characterize C&D debris, which is inherently different than MSW. As shown in Table 2-9, a total of 30 C&D categories were used in the study. Definitions for these categories are also contained in Appendix A.

Table 2-6 C&D Material Categories for Visual Surveys

Paper	Organics	Problem Materials
Uncoated OCC - Recyclable	Yard Waste	Electronics
Other Paper	Wood Pallets	Small Appliances
Plastic	Dirt and Sand	Carpet/Padding
PET Bottles - Beverage	C&D	Batteries
Film Packaging	Rock, Concrete, Brick, and Clay	Tires
Other Plastic	Asphalt Shingles	Bulky Wastes/Furniture
Glass	Painted/Stained/Treated Wood	Fluorescent Light Bulbs
Glass Bottles/Jars	Untreated/Unpainted Lumber	All HHW
Other Glass	Demo/Painted Drywall	Mixed MSW
Metal	Clean/New Drywall	Mixed MSW
Aluminum Containers	Other C&D	
Other Ferrous Scrap		
Non-ferrous Metal		
White Goods		

2.9 LOAD SELECTION

Due to the large number of substreams targeted by the project sponsors, it was necessary to communicate with each participating city and with several of the haulers serving the County in order to identify the days on the week and disposal/processing facilities to which materials were delivered. As a consequence, the majority of the refuse, recycling and organics loads were pre-selected. For public bin materials, the participating municipalities in some cases arranged for special collection (i.e., “milk runs”) of one or several bins for delivery to the sorting location.

The Field Supervisor interviewed the drivers of selected loads to confirm the geographic origin and type of waste, as well as any other pertinent data. This information was noted on a handheld tablet computer, along with a unique identifying number associated with that vehicle on that day.

C&D loads were sampled by County staff at several facilities based on the order of inbound loads.

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2.10 GRAB SAMPLING

Selected loads of waste designated for sorting were tipped in the designated area at each host facility. From each selected load, one sample of material was selected based on systematic “grabs” from the perimeter of the load. For example, if the tipped pile is viewed from the top as a clock face with 12:00 being the part of the load closest to the front of the truck, the first samples was taken from 3 o’clock, 6 o’clock, 9 o’clock, 12 o’clock, and then from 1, 4, 7, and 10 o’clock, and so-on.

Once the area of the tipped load was selected, the Field Supervisor coordinated with a facility-provided loader operator to take a “grab” sample of wastes from that point in the tipped load. The loader operator removed a sample of waste that exceeded the targeted sample weight, and placed the grab sample in a secure area to await sorting. This is shown in Figure 3-2.

It should be notes that only one sample was obtained from single-family residential and ICI truckloads. Either one or two samples were taken from the foothill transfer site drop boxes. At the two host disposal facilities, the Project Team arranged with Western Disposal and the City of Longmont to have segregated loads of multi-family wastes delivered for sampling and sorting. Because these loads were specially arranged, the Project Team acquired two grab samples from each load. Because of unforeseen weather challenges during the second season, one of the pre-arranged multi-family loads could not be delivered.

Samples were deposited in barrels to contain the sample and to enable the sampling team to pre-weigh the sample according to sample mass targets. Each sample was labeled by its identifying number using a white board, and in some cases, cardboard. Most samples were photographed. The white board for sample identification stayed with the sample until sorting and weigh out was completed.

2.11 MANUAL SORTING

Once each sample had been acquired, the material was manually sorted into the prescribed component categories. Plastic 18-gallon bins with sealed bottoms were used to contain the separated components. Sorters were asked to specialize in certain material groups, with someone handling the paper categories, another the plastics, another the glass and metals, and so on. In this way, sorters were able become highly knowledgeable in a short period of time as to the definitions of individual material categories.

After the entire sample had been sorted into the correct bins, each bin containing sorted materials would be carried over to a digital scale. Sorting laborers assisted with carrying and weighing the bins of sorted material and a professional Crew Chief recorded all data. The Crew Chief used a rugged tablet computer synched to the cloud to record composition weights. Each sample was cross-referenced against the Field Supervisor’s sample sheet to assure accurate tracking of the samples each day. The electronic tablet provided real-time quality control calculations to assure each sample was completed in its entirety.

2.12 VISUAL SURVEYING

Similar to the 2010 Study, visual surveying of a load of C&D waste involved detailed volumetric measurements of the truck and load dimensions, followed by the systematic observation of the major material components in the tipped load. MSW Consultants provided a day of training to selected County staff using a tablet-based estimating tool. County staff subsequently performed the C&D load surveys over both seasons of the study.

The basic steps used to visually survey these loads were:

- ◆ Dimensions of the incoming load were measured and (if possible) the percent full of the vehicle was estimated and recorded.
- ◆ If entire load was not visible and it was operationally feasible, a loader was asked to spread out the material so that it was possible to discern dense materials such as block, brick, and dirt that tend to sink to the bottom of the pile.

- ◆ A first pass was made around the load marking the major material categories that are present in the load—Fibers, Metals, C & D materials, etc., estimating the percentage of the load made up of these major materials.
- ◆ A second pass was made around the load, noting the secondary material categories contained in the load, estimating and recording the percentage of the load made up of these materials.
- ◆ The estimated percentages were verified to sum up to 100 percent, and that the estimated major material categories were realistic given the overall truck dimensions and volume.

Usage of the MSW Consultants’ visual surveying app provides real-time QA/QC on the accuracy of the volumetric estimates, and also compares the estimated weight with the actual weight of the load based on the scale ticket. The visual surveyor thereby has immediate feedback to adjust the weight-based estimate to accurately reflect the weight of the loads.

2.13 DATA RECORDING

The weigh-out and data recording process is the most critical process of the sort. The Crew Chief oversaw all weighing and data recording of each sample. Once each sample was sorted, and fines swept from the table, the weigh-out was performed. Each bin containing sorted materials from the just-completed samples was carried over to the scale. The sorting crew assisted with carrying and weighing the bins of sorted material, and the Crew Chief recorded all data.

The Crew Chief used a rugged tablet computer to record the composition weights. The tablet allowed for samples to be tallied in real time so that field data collection could immediately identify and rectify errors associated with light sample weights. The tablet synchronizes with the cloud via internet, providing excellent data security. Each sample was cross-referenced against the Field Supervisor’s sample sheet to assure accurate tracking of the samples each day. The real-time data entry offered several important advantages:

- ◆ The template contains built-in logic and error checking to prevent erroneous entries.
- ◆ The template sums sample weights in real time so the Crew Chief can confirm achievement of weight targets for each and every sample.

2.14 DATA ANALYSIS

A statistical analysis was performed to calculate the mean composition for each of the material categories and for each material stream in this study. However, the calculations are slightly different for manually sorted samples compared to visually surveyed samples.

Manually sorted samples are first normalized by converting the sample data from weight to percentage. Then, the sample mean has been determined by averaging the percent composition of each material across all samples.

Conversely, the visual volumetric survey data is analyzed with a more elaborate approach. First, volumetric estimates of each surveyed load are converted to weight based on density factors. The density factors have been accumulated by MSW Consultants from industry resources and supplemented with real-world densities obtained in other waste characterization studies. The density factors (and other inputs to the calculation) can also be adjusted in real time through use of the MSW Consultants data collection app. The calculated load weights were then compared against the actual reported weights as presented on the ticketing information obtained for each load.

Once visual sample data were converted to estimated weights, the sample mean composition was determined for each material category by (i) summing the weight of each material in each sample; (ii) summing the total weight of all samples, and (iii) dividing the first value by the second value to determine the percent-by-weight composition.

COUNTYWIDE WASTE COMPOSITION STUDY

For both manually sorted and visually surveyed samples, the confidence intervals are provided for each material category as well as for major material groups (e.g., "paper", "plastic", etc.). Confidence intervals have been calculated at a 90 percent level of confidence, meaning that we can be 90 percent sure that the upper and lower bounds of a confidence interval successfully capture its respective population mean. (The converse is also true: that there is a 10 percent chance that a confidence interval will fail to capture its population mean.) However, it should again be noted that due to the differences between the distributions of the allocated samples and the County tonnages, this study may not meet the random sampling assumption of confidence intervals, and therefore, the 90 percent confidence level used in the calculations may not accurately reflect the true likelihood of capturing the population means. In general, as the number of samples increases, the width of the confidence intervals decreases, although the more variable the underlying waste stream composition, the less noticeable the improvement for adding incremental samples.

3. RESULTS

Numerous material streams were analyzed during the 2019 Study. This section summarizes the aggregate, County-wide composition for the primary material streams and generator sectors included in the study:

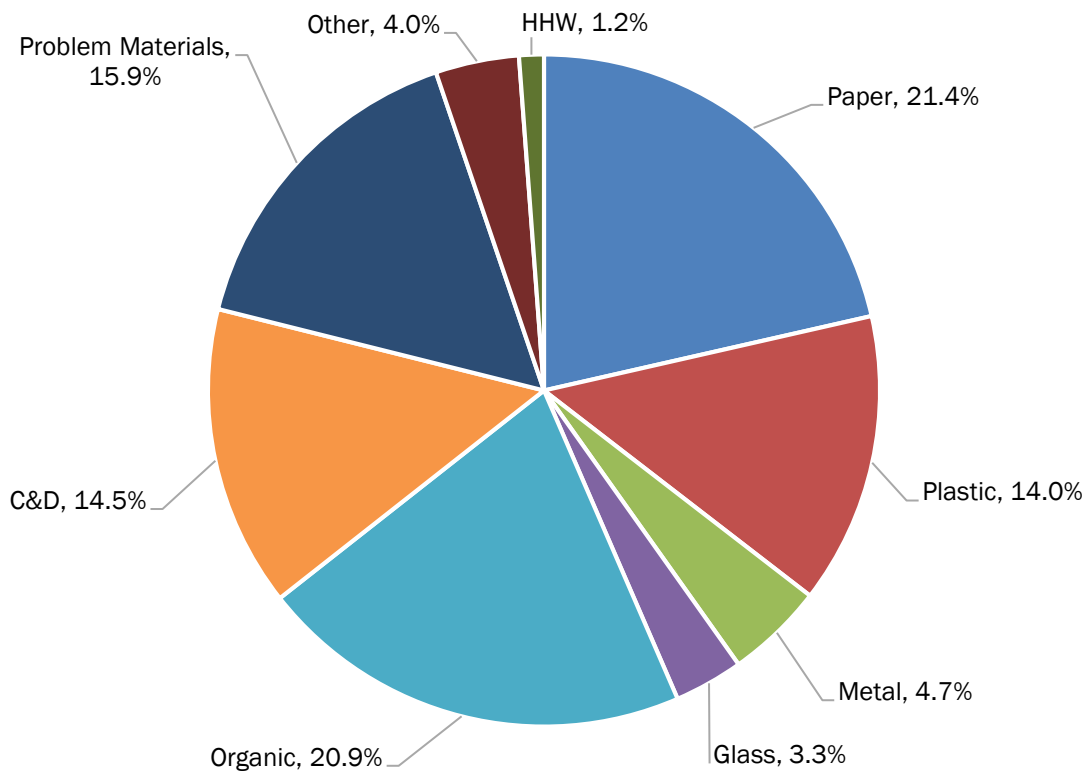
- ◆ Aggregate Refuse destined for disposal,
- ◆ Residential Refuse disposed,
- ◆ ICI Refuse disposed,
- ◆ Construction and Demolition Debris disposed,
- ◆ Single Stream Recyclables, and
- ◆ Source Separated Organics.

Results to each of these Countywide material streams are shown in the following subsections.

3.1 AGGREGATE DISPOSED REFUSE

Figure 3-1 summarizes the major material groups contained in the aggregate disposed refuse. As shown, Organics and Paper were found to be the most prevalent groups, followed by Problem Materials, Plastic and C&D debris.

Figure 3-1 Aggregate Refuse Composition Summary



COUNTYWIDE WASTE COMPOSITION STUDY

Figure 3-3 provides the divertibility of the aggregate disposed refuse stream. This graphic shows that the majority of the materials being disposed could be diverted through existing recycling programs, composting programs, and third-party recovery programs. It should be noted that this graphic omits the impact of contamination, and as a practical matter it is not possible for all of the divertible materials to actually be diverted. Nonetheless, this chart suggests that almost two-thirds of disposed refuse could theoretically be diverted from disposal.

Figure 3-2 Divertibility of Disposed Aggregate Refuse

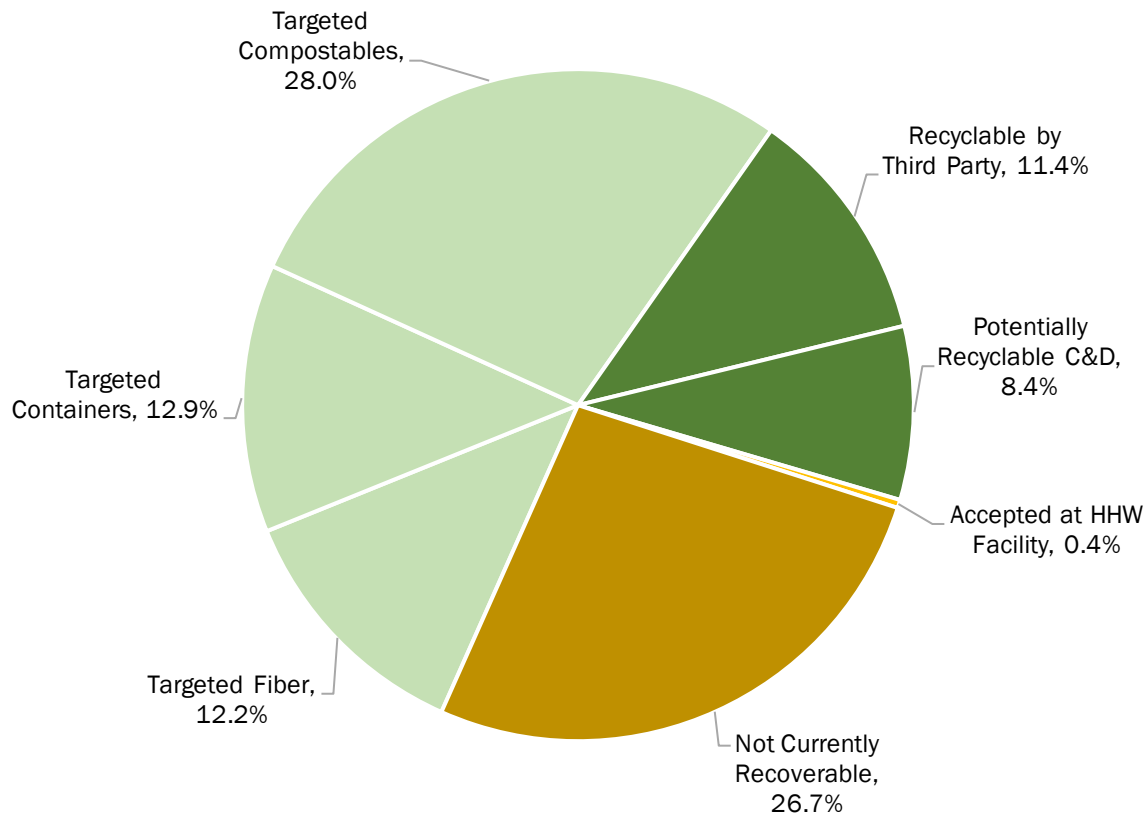


Table 3-1 provides the detailed composition of the aggregate refuse stream, including the mean composition and confidence intervals calculated at a 90 percent level of confidence. As mentioned previously, due to the differences between the distributions of the allocated samples and the underlying tonnages of the County, the condition of random sampling may not be met in this study, and therefore, the 90 percent confidence level used in calculating confidence intervals may not reflect the true likelihood of capturing the population mean. This table also allocates aggregate disposed refuse tonnage across the material categories.

COUNTYWIDE WASTE COMPOSITION STUDY

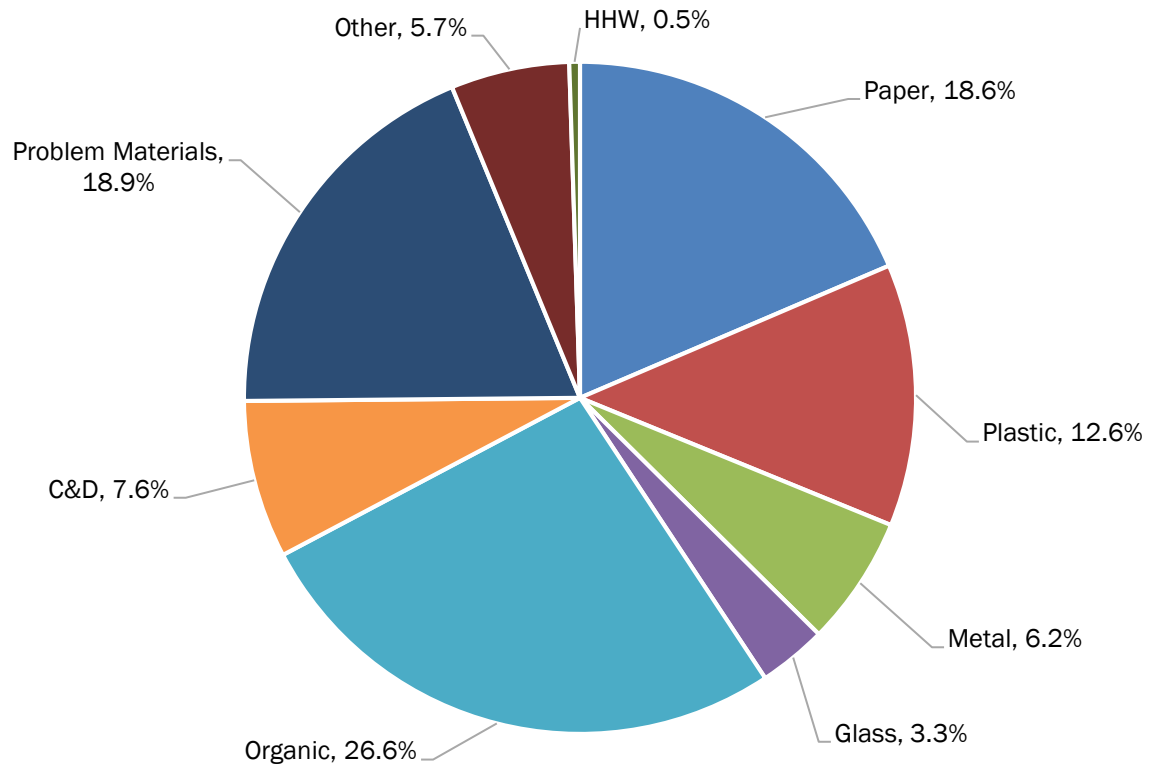
Table 3-1 Detailed Composition of Boulder County Disposed Aggregate Refuse

Material Category	Est.	Conf.	Tons	Material Category	Est.	Conf.	Tons
	Percent	Int (+/-)			Percent	Int (+/-)	
Paper	21.4%	1.5%	50,217	Problem Materials	15.9%	2.3%	37,214
Newsprint	0.6%	0.1%	1,498	Large Electronics (Plug-in)	2.1%	0.8%	4,842
High Grade Office Paper	1.3%	0.2%	2,945	Small Electronics (Recharge)	0.3%	0.2%	808
Shredded Paper	0.3%	0.2%	641	Small Appliances	0.5%	0.3%	1,217
Old Corrugated Cardboard	6.3%	1.1%	14,703	Diapers/Sanitary Products	1.3%	0.5%	3,140
Magazines/Catalogs	1.2%	0.3%	2,755	Textiles/Leather	3.6%	0.7%	8,494
Mixed Recyclable Paper	2.9%	0.4%	6,702	Carpet/Padding	0.8%	1.0%	1,830
Polycoated/Aseptic Containers	0.3%	0.0%	589	Batteries	0.1%	0.1%	207
Compostable Paper	7.0%	0.6%	16,370	Rubber	1.8%	0.5%	4,164
Unrecyclable Paper	1.7%	0.4%	4,016	Tires	0.7%	0.5%	1,570
Plastic	14.0%	1.1%	32,829	Furniture/Bulky Items	3.6%	1.7%	8,451
#1 PET Bottles/Jars	0.8%	0.1%	1,775	Other Inorganics	1.0%	0.7%	2,370
#2 HDPE Bottles/Jars	0.7%	0.1%	1,629	Marijuana Waste	0.1%	0.0%	121
Bottles #3-7	0.1%	0.0%	267	HHW	1.2%	0.5%	2,791
Other Plastic Tubs/Cups <3 Gal	0.9%	0.1%	2,117	Fluorescent Tubes and Bulbs	0.1%	0.1%	247
Large Plastic Containers >3 Gal	1.0%	0.6%	2,431	Pharmaceuticals and Syringes	0.9%	0.4%	2,072
Plastic Bags	1.9%	0.2%	4,524	Oil-based Paint & Finishes	0.0%	0.0%	0
Other Plastic Film	3.3%	0.6%	7,663	Latex Paint & Finishes	0.1%	0.1%	164
Thermoforms	0.6%	0.1%	1,306	Pesticides	0.0%	0.0%	0
Expanded Polystyrene	0.4%	0.1%	923	Automotive Fluids	0.0%	0.0%	19
Other Rigid Plastics	4.4%	0.9%	10,192	Other HHW	0.1%	0.1%	289
Metal	4.7%	0.8%	11,037	C&D	14.5%	2.7%	33,973
Aluminum Cans	0.3%	0.0%	812	Aggregate/Asphalt/Ceramics	0.5%	0.2%	1,130
Aluminum Foil & Trays	0.2%	0.0%	501	Asphalt Shingles	0.0%	0.0%	0
Ferrous Containers	0.6%	0.1%	1,407	Painted/Stained/Treated Wood	2.7%	0.7%	6,252
Other Ferrous	3.2%	0.8%	7,453	Clean Wood	3.9%	1.8%	9,100
Other Non-Ferrous	0.4%	0.2%	864	Wood Pallets	3.2%	1.1%	7,480
White Goods	0.0%	0.0%	0	Clean/New Drywall	0.8%	0.6%	1,854
Glass	3.3%	0.5%	7,781	Demo/Painted Drywall	0.3%	0.3%	595
Glass Bottles and Jars	3.1%	0.5%	7,221	Other C&D	3.2%	1.2%	7,563
Other Glass	0.2%	0.1%	559	Other	4.0%	0.9%	9,415
Organic	20.9%	3.0%	48,959	Fines/Dirt	3.4%	0.9%	7,981
Yard Waste	2.5%	1.6%	5,953	Coffee Cups Non-Compostable	0.5%	0.1%	1,274
Branches, Limbs, Stumps	0.1%	0.4%	305	BPI Certified Compostables	0.1%	0.0%	160
Food Waste	15.8%	2.4%	37,039	Bagged Material (BCRC Only)	0.0%	0.0%	0
Other Organics	2.4%	1.5%	5,663				
				Total	100.0%		234,216
				<i>No. of Samples</i>		<i>63</i>	

3.2 DISPOSED RESIDENTIAL REFUSE

There were 92,070 tons of residential refuse disposed in the County in 2018. Figure 3-4 summarizes the composition of the residential refuse stream by major material group.

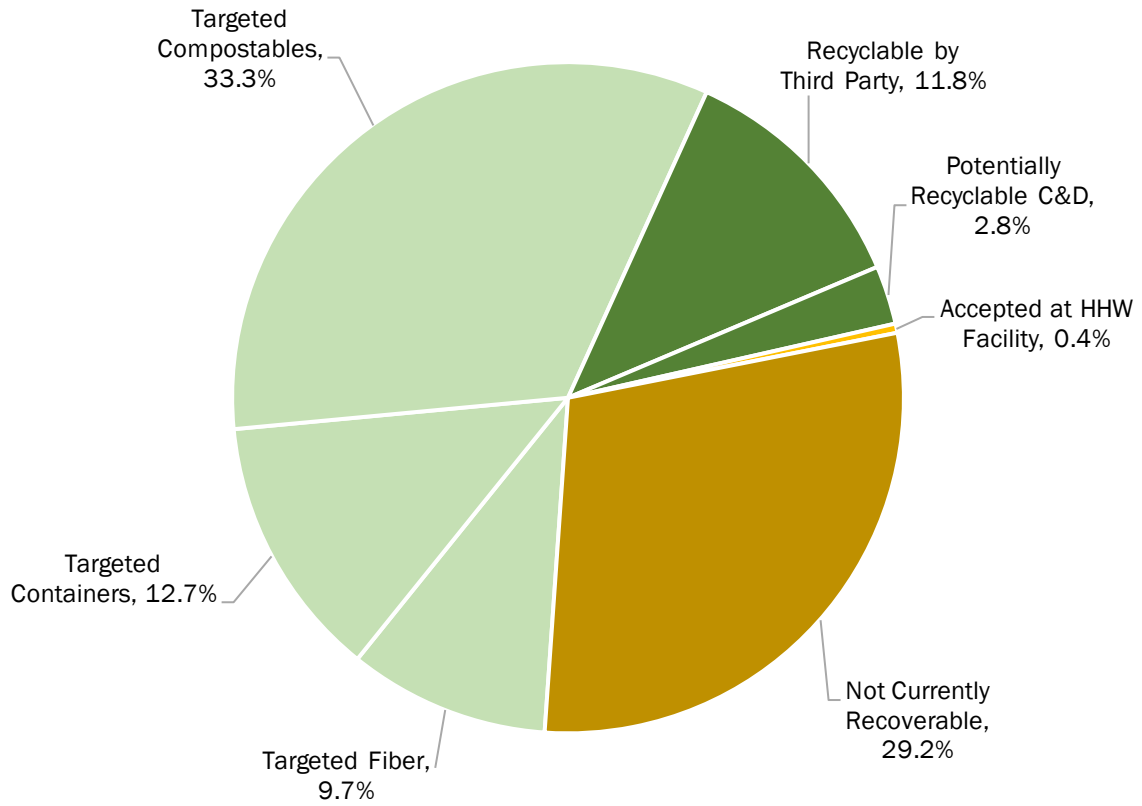
Figure 3-3 Residential Refuse Composition Summary



COUNTYWIDE WASTE COMPOSITION STUDY

Figure 3-6 illustrates the divertibility of the residential refuse stream. As shown, roughly two-thirds of the waste disposed could be diverted from landfill.

Figure 3-4 Divertibility of Disposed Residential Refuse



COUNTYWIDE WASTE COMPOSITION STUDY

Table 3-2 provides the detailed composition of the residential refuse stream, including the mean composition, confidence intervals, and allocated tonnage.

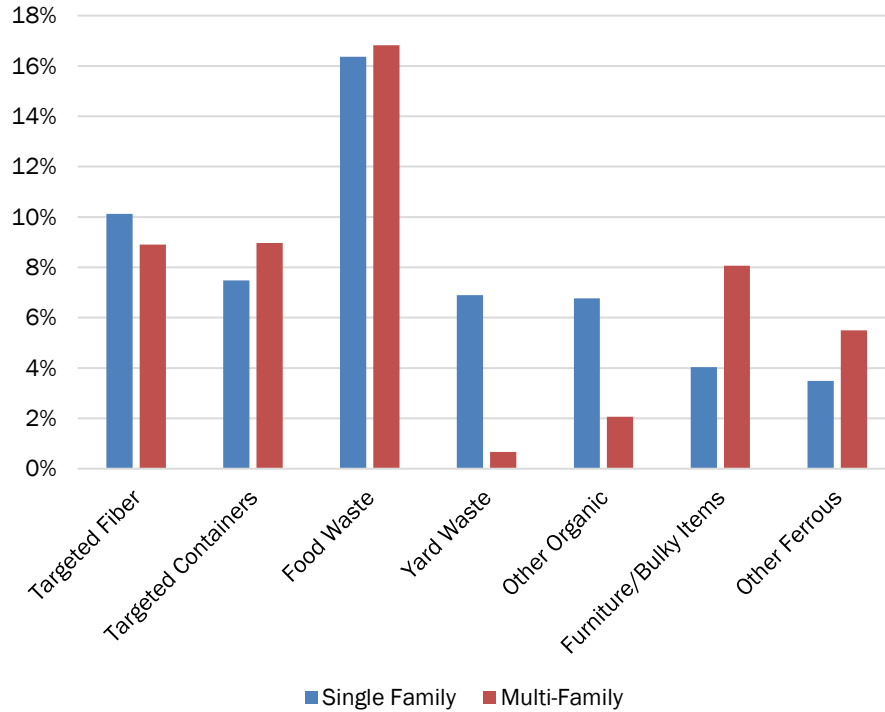
Table 3-2 Detailed Composition of Boulder County Disposed Residential Refuse

Material Category	Est.	Conf.	Tons	Material Category	Est.	Conf.	Tons
	Percent	Int (+/-)			Percent	Int (+/-)	
Paper	18.6%	1.8%	17,096	Problem Materials	18.9%	2.8%	17,427
Newsprint	0.6%	0.1%	569	Large Electronics (Plug-in)	1.3%	0.9%	1,190
High Grade Office Paper	1.1%	0.2%	1,024	Small Electronics (Recharge)	0.4%	0.2%	339
Shredded Paper	0.3%	0.2%	275	Small Appliances	0.2%	0.2%	200
Old Corrugated Cardboard	3.6%	0.9%	3,334	Diapers/Sanitary Products	2.8%	0.6%	2,580
Magazines/Catalogs	1.8%	0.4%	1,633	Textiles/Leather	4.3%	0.8%	3,940
Mixed Recyclable Paper	2.6%	0.5%	2,354	Carpet/Padding	1.7%	1.3%	1,530
Polycoated/Aseptic Containers	0.3%	0.0%	255	Batteries	0.2%	0.1%	181
Compostable Paper	6.7%	0.6%	6,179	Rubber	1.1%	0.6%	1,017
Unrecyclable Paper	1.6%	0.5%	1,474	Tires	0.1%	0.2%	47
Plastic	12.6%	1.4%	11,614	Furniture/Bulky Items	5.5%	2.2%	5,064
#1 PET Bottles/Jars	1.0%	0.1%	877	Other Inorganics	1.4%	1.0%	1,249
#2 HDPE Bottles/Jars	0.7%	0.1%	609	Marijuana Waste	0.1%	0.0%	90
Bottles #3-7	0.1%	0.0%	105	HHW	0.5%	0.4%	471
Other Plastic Tubs/Cups <3 Gal	0.8%	0.1%	695	Fluorescent Tubes and Bulbs	0.0%	0.0%	10
Large Plastic Containers >3 Gal	0.2%	0.2%	219	Pharmaceuticals and Syringes	0.3%	0.2%	243
Plastic Bags	1.4%	0.2%	1,280	Oil-based Paint & Finishes	0.0%	0.0%	0
Other Plastic Film	2.7%	0.8%	2,498	Latex Paint & Finishes	0.2%	0.2%	140
Thermoforms	0.7%	0.1%	646	Pesticides	0.0%	0.0%	0
Expanded Polystyrene	0.4%	0.2%	363	Automotive Fluids	0.0%	0.0%	0
Other Rigid Plastics	4.7%	1.1%	4,322	Other HHW	0.1%	0.1%	77
Metal	6.2%	1.1%	5,741	C&D	7.6%	1.9%	6,993
Aluminum Cans	0.3%	0.0%	274	Aggregate/Asphalt/Ceramics	0.4%	0.2%	343
Aluminum Foil & Trays	0.2%	0.1%	217	Asphalt Shingles	0.0%	0.0%	0
Ferrous Containers	0.8%	0.1%	695	Painted/Stained/Treated Wood	2.9%	0.9%	2,661
Other Ferrous	4.2%	1.0%	3,884	Clean Wood	2.1%	1.1%	1,968
Other Non-Ferrous	0.7%	0.3%	671	Wood Pallets	0.3%	0.4%	289
White Goods	0.0%	0.0%	0	Clean/New Drywall	0.0%	0.0%	2
Glass	3.3%	0.5%	3,028	Demo/Painted Drywall	0.6%	0.5%	588
Glass Bottles and Jars	3.0%	0.5%	2,793	Other C&D	1.2%	0.7%	1,143
Other Glass	0.3%	0.1%	235	Other	5.7%	1.0%	5,255
Organic	26.6%	2.9%	24,445	Fines/Dirt	5.5%	1.0%	5,051
Yard Waste	4.6%	2.3%	4,260	Coffee Cups Non-Compostable	0.2%	0.0%	198
Branches, Limbs, Stumps	0.3%	0.6%	304	BPI Certified Compostables	0.0%	0.0%	6
Food Waste	16.5%	2.2%	15,226	Bagged Material (BCRC Only)	0.0%	0.0%	0
Other Organics	5.1%	2.1%	4,656				
				Total	100.0%		92,070
				No. of Samples	41		

COUNTYWIDE WASTE COMPOSITION STUDY

Figure 3-7 provides a comparison of the single-family and multi-family disposed waste composition. This figure highlights differences in the residential streams. Appendix B contains composition profiles for residential refuse from each participating municipality. It should be noted that additional sampling in proportion to the generation of single family and multi-family refuse may improve the ability to compare the composition of these streams.

Figure 3-5 Comparison of Single-Family and Multi-Family Refuse Composition



COUNTYWIDE WASTE COMPOSITION STUDY

Table 3-3 provides a detailed comparison of single-family and multi-family disposed wastes in Boulder County.

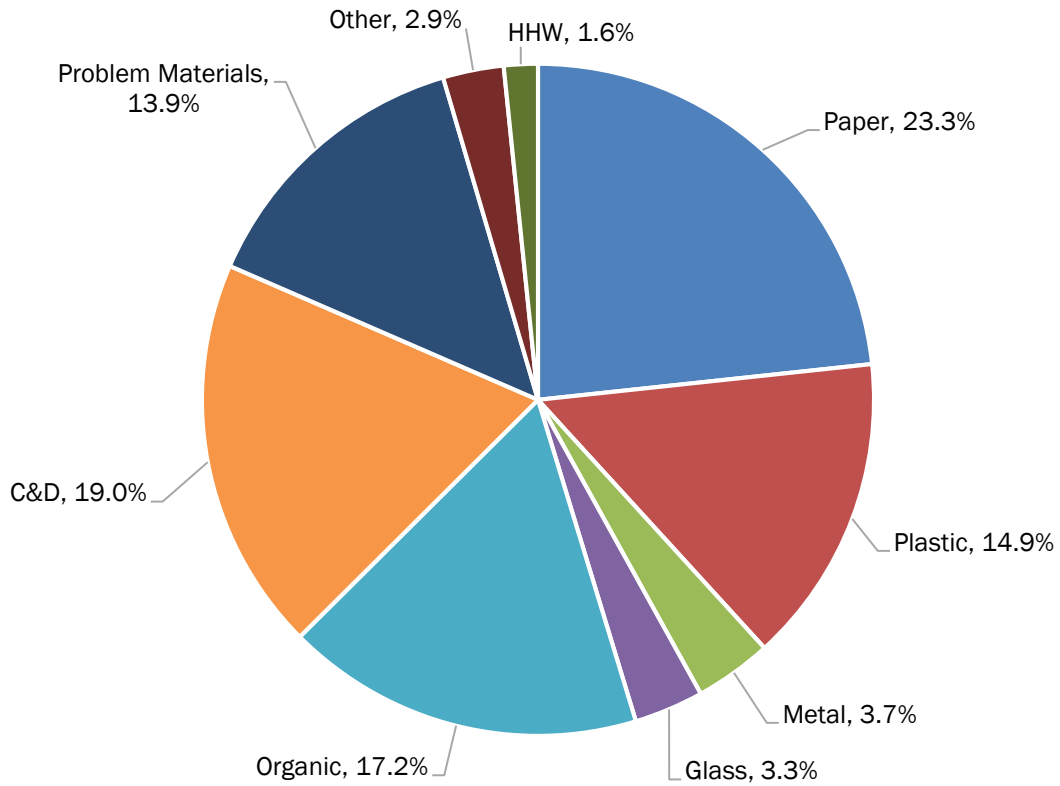
Table 3-3 Comparison of Single-Family and Multi-Family Residential Refuse Composition

Material Category	Single Family		Multi-Family		Material Category	Single Family		Multi-Family	
	Est. Percent	Est. Tons	Est. Percent	Est. Tons		Est. Percent	Est. Tons	Est. Percent	Est. Tons
Paper	19.2%	11,214	17.5%	5,882	Problem Materials	18.2%	10,667	20.1%	6,760
Newsprint	0.6%	335	0.7%	234	Large Electronics (Plug-in)	1.6%	914	0.8%	276
High Grade Office Paper	1.1%	642	1.1%	381	Small Electronics (Recharge)	0.3%	178	0.5%	161
Shredded Paper	0.5%	275	0.0%	0	Small Appliances	0.0%	0	0.6%	200
Old Corrugated Cardboard	4.1%	2,425	2.7%	909	Diapers/Sanitary Products	2.6%	1,517	3.2%	1,064
Magazines/Catalogs	1.7%	971	2.0%	662	Textiles/Leather	3.9%	2,277	5.0%	1,663
Mixed Recyclable Paper	2.7%	1,554	2.4%	800	Carpet/Padding	2.4%	1,386	0.4%	144
Polycoated/Aseptic Containers	0.3%	154	0.3%	101	Batteries	0.1%	74	0.3%	107
Compostable Paper	6.6%	3,853	6.9%	2,326	Rubber	1.5%	884	0.4%	133
Unrecyclable Paper	1.7%	1,006	1.4%	468	Tires	0.1%	47	0.0%	0
Plastic	12.0%	7,007	13.7%	4,607	Furniture/Bulky Items	4.0%	2,359	8.1%	2,705
#1 PET Bottles/Jars	0.8%	486	1.2%	391	Other Inorganics	1.7%	1,000	0.7%	248
#2 HDPE Bottles/Jars	0.6%	379	0.7%	230	Marijuana Waste	0.1%	30	0.2%	60
Bottles #3-7	0.1%	35	0.2%	70	HHW	0.8%	449	0.1%	23
Other Plastic Tubs/Cups <3 Gal	0.7%	405	0.9%	290	Fluorescent Tubes and Bulbs	0.0%	10	0.0%	0
Large Plastic Containers >3 Gal	0.2%	132	0.3%	87	Pharmaceuticals and Syringes	0.4%	241	0.0%	3
Plastic Bags	1.4%	840	1.3%	440	Oil-based Paint & Finishes	0.0%	0	0.0%	0
Other Plastic Film	3.2%	1,889	1.8%	609	Latex Paint & Finishes	0.2%	140	0.0%	0
Thermoforms	0.7%	434	0.6%	212	Pesticides	0.0%	0	0.0%	0
Expanded Polystyrene	0.5%	284	0.2%	79	Automotive Fluids	0.0%	0	0.0%	0
Other Rigid Plastics	3.6%	2,121	6.6%	2,201	Other HHW	0.1%	58	0.1%	20
Metal	5.3%	3,091	7.9%	2,651	C&D	7.3%	4,272	8.1%	2,721
Aluminum Cans	0.2%	140	0.4%	134	Aggregate/Asphalt/Ceramics	0.4%	239	0.3%	105
Aluminum Foil & Trays	0.2%	132	0.3%	85	Asphalt Shingles	0.0%	0	0.0%	0
Ferrous Containers	0.7%	404	0.9%	291	Painted/Stained/Treated Wood	2.2%	1,315	4.0%	1,346
Other Ferrous	3.5%	2,040	5.5%	1,843	Clean Wood	2.2%	1,276	2.1%	692
Other Non-Ferrous	0.6%	375	0.9%	297	Wood Pallets	0.5%	289	0.0%	0
White Goods	0.0%	0	0.0%	0	Clean/New Drywall	0.0%	2	0.0%	0
Glass	3.1%	1,795	3.7%	1,232	Demo/Painted Drywall	0.4%	242	1.0%	346
Glass Bottles and Jars	2.9%	1,674	3.3%	1,119	Other C&D	1.6%	910	0.7%	233
Other Glass	0.2%	121	0.3%	113	Other	3.7%	2,151	9.3%	3,104
Organic	30.5%	17,875	19.6%	6,570	Fines/Dirt	3.5%	2,045	9.0%	3,005
Yard Waste	6.9%	4,036	0.7%	224	Coffee Cups Non-Compostable	0.2%	104	0.3%	94
Branches, Limbs, Stumps	0.5%	296	0.0%	7	BPI Certified Compostables	0.0%	1	0.0%	5
Food Waste	16.4%	9,580	16.8%	5,646	Bagged Material (BCRC Only)	0.0%	0	0.0%	0
Other Organics	6.8%	3,963	2.1%	693					
					Total	100.0%	58,521	100.0%	33,549
					No. of Samples		35		6

3.3 DISPOSED ICI REFUSE

There were 142,146 tons of ICI refuse disposed in the County in 2018. Figure 3-8 shows the breakdown by major material group in the ICI waste stream.

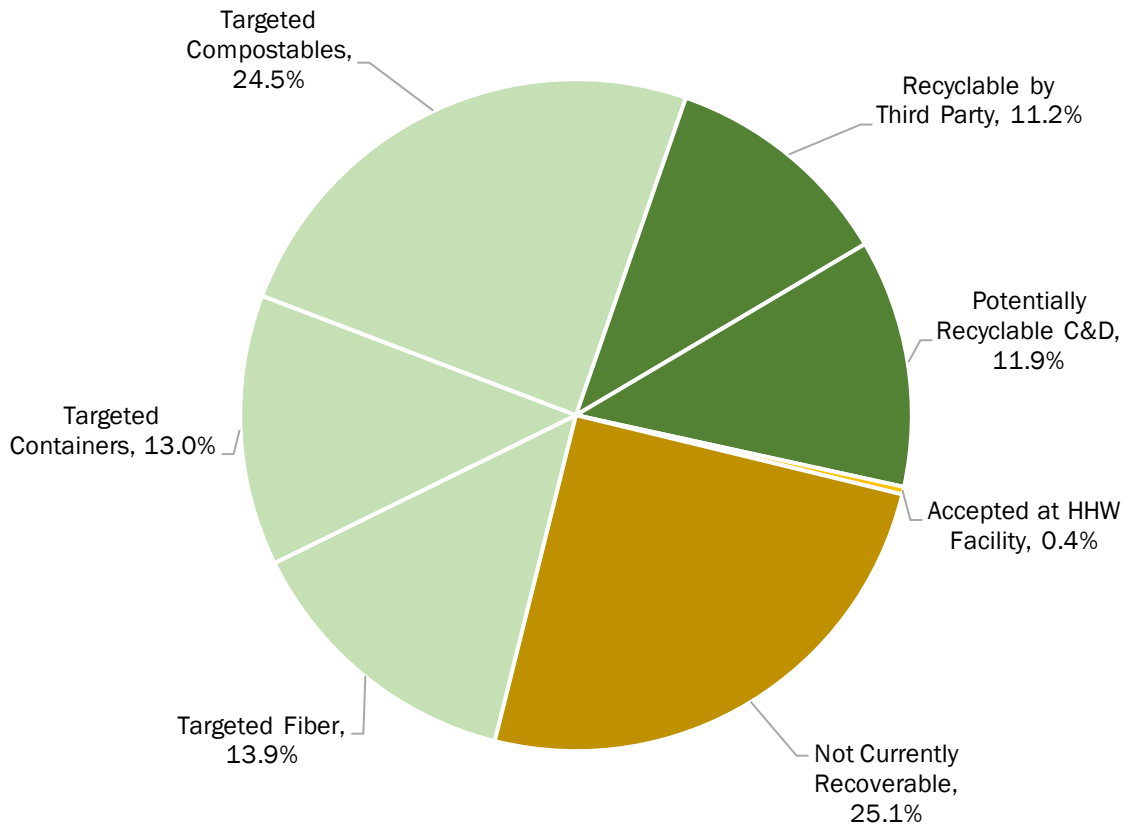
Figure 3-6 ICI Refuse Composition Summary



COUNTYWIDE WASTE COMPOSITION STUDY

Figure 3-10 illustrates the divertibility of the ICI waste stream. As shown, about 75 percent of the stream could theoretically be diverted from landfill.

Figure 3-7 Divertibility of Disposed ICI Refuse



COUNTYWIDE WASTE COMPOSITION STUDY

Table 3-4 provides the detailed composition of the ICI refuse stream, including the mean composition, confidence intervals, and allocated tonnage.

Table 3-4 Detailed Composition of Boulder County Disposed ICI Refuse

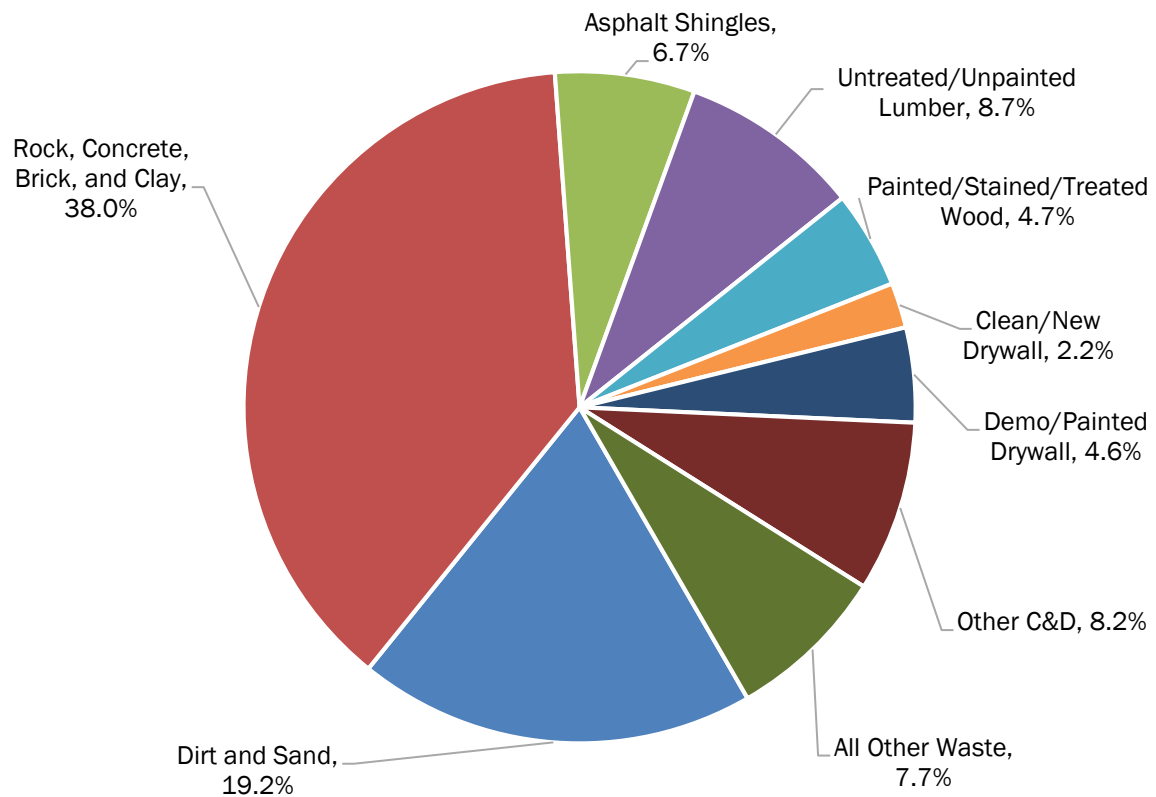
Material Category	Est.	Conf.	Tons	Material Category	Est.	Conf.	Tons
	Percent	Int (+/-)			Percent	Int (+/-)	
Paper	23.3%	2.7%	33,122	Problem Materials	13.9%	4.1%	19,788
Newsprint	0.7%	0.3%	929	Large Electronics (Plug-in)	2.6%	1.6%	3,651
High Grade Office Paper	1.4%	0.5%	1,921	Small Electronics (Recharge)	0.3%	0.6%	469
Shredded Paper	0.3%	0.3%	366	Small Appliances	0.7%	0.7%	1,017
Old Corrugated Cardboard	8.0%	2.2%	11,369	Diapers/Sanitary Products	0.4%	0.4%	560
Magazines/Catalogs	0.8%	0.4%	1,122	Textiles/Leather	3.2%	1.4%	4,554
Mixed Recyclable Paper	3.1%	0.8%	4,347	Carpet/Padding	0.2%	1.3%	300
Polycoated/Aseptic Containers	0.2%	0.1%	334	Batteries	0.0%	0.0%	26
Compostable Paper	7.2%	1.4%	10,191	Rubber	2.2%	0.8%	3,148
Unrecyclable Paper	1.8%	0.5%	2,542	Tires	1.1%	1.4%	1,523
Plastic	14.9%	2.0%	21,215	Furniture/Bulky Items	2.4%	2.8%	3,387
#1 PET Bottles/Jars	0.6%	0.1%	898	Other Inorganics	0.8%	0.5%	1,122
#2 HDPE Bottles/Jars	0.7%	0.2%	1,020	Marijuana Waste	0.0%	0.0%	31
Bottles #3-7	0.1%	0.1%	162	HHW	1.6%	1.1%	2,319
Other Plastic Tubs/Cups <3 Gal	1.0%	0.3%	1,422	Fluorescent Tubes and Bulbs	0.2%	0.2%	236
Large Plastic Containers >3 Gal	1.6%	1.6%	2,213	Pharmaceuticals and Syringes	1.3%	1.0%	1,828
Plastic Bags	2.3%	0.4%	3,245	Oil-based Paint & Finishes	0.0%	0.0%	0
Other Plastic Film	3.6%	0.8%	5,165	Latex Paint & Finishes	0.0%	0.0%	25
Thermoforms	0.5%	0.1%	660	Pesticides	0.0%	0.0%	0
Expanded Polystyrene	0.4%	0.2%	560	Automotive Fluids	0.0%	0.0%	19
Other Rigid Plastics	4.1%	1.7%	5,870	Other HHW	0.1%	0.2%	212
Metal	3.7%	1.2%	5,295	C&D	19.0%	6.6%	26,980
Aluminum Cans	0.4%	0.1%	538	Aggregate/Asphalt/Ceramics	0.6%	0.3%	787
Aluminum Foil & Trays	0.2%	0.1%	284	Asphalt Shingles	0.0%	0.0%	0
Ferrous Containers	0.5%	0.3%	712	Painted/Stained/Treated Wood	2.5%	1.2%	3,590
Other Ferrous	2.5%	1.1%	3,569	Clean Wood	5.0%	5.0%	7,133
Other Non-Ferrous	0.1%	0.1%	193	Wood Pallets	5.1%	2.8%	7,191
White Goods	0.0%	0.0%	0	Clean/New Drywall	1.3%	1.6%	1,851
Glass	3.3%	1.1%	4,753	Demo/Painted Drywall	0.0%	0.0%	7
Glass Bottles and Jars	3.1%	1.1%	4,429	Other C&D	4.5%	3.0%	6,421
Other Glass	0.2%	0.3%	324	Other	2.9%	1.6%	4,160
Organic	17.2%	5.9%	24,514	Fines/Dirt	2.1%	1.6%	2,930
Yard Waste	1.2%	0.8%	1,693	Coffee Cups Non-Compostable	0.8%	0.2%	1,076
Branches, Limbs, Stumps	0.0%	0.0%	1	BPI Certified Compostables	0.1%	0.0%	154
Food Waste	15.3%	5.7%	21,813	Bagged Material (BCRC Only)	0.0%	0.0%	0
Other Organics	0.7%	0.4%	1,007				
				Total	100.0%		142,146
				No. of Samples		22	

COUNTYWIDE WASTE COMPOSITION STUDY

3.4 C&D DEBRIS

There were 85,034 tons of C&D debris disposed in the County in 2018. Figure 3-11 presents the breakdown of C&D debris, which shows, not surprisingly, that inert materials such as rock, concrete, brick, clay and dirt are the most prevalent materials.

Figure 3-8 C&D Debris Composition Summary



COUNTYWIDE WASTE COMPOSITION STUDY

Table 3-5 provides the detailed composition of the C&D stream, including the mean composition, confidence intervals, and allocated tonnage.

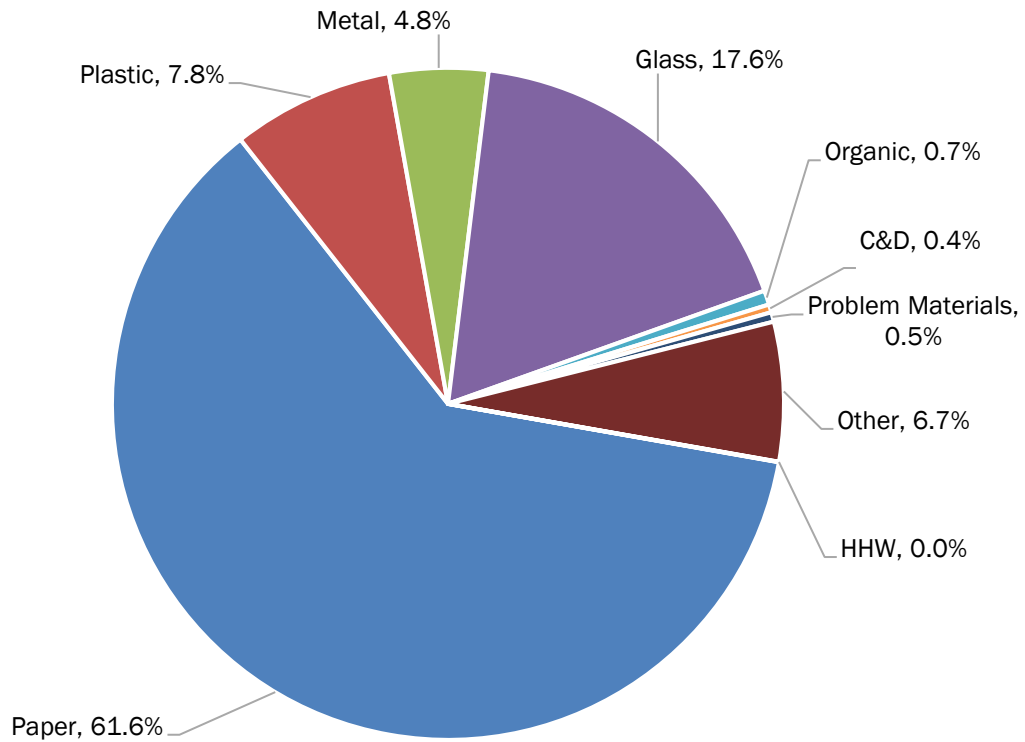
Table 3-5 Detailed Composition of Boulder County C&D Debris

Material Category	Est. Percent	Conf. Int (+/-)	Tons	Material Category	Est. Percent	Conf. Int (+/-)	Tons
Paper	0.8%	0.3%	676	C&D	73.1%	16.2%	62,189
Uncoated OCC - Recyclable	0.7%	0.3%	592	Rock, Concrete, Brick, and Clay	38.0%	15.5%	32316
Other Paper	0.1%	0.1%	84	Asphalt Shingles	6.7%	4.8%	5719
Plastic	0.4%	0.2%	364	Painted/Stained/Treated Wood	4.6%	1.3%	3877
PET Bottles - Beverage	0.0%	0.0%	7	Untreated/Unpainted Lumber	8.7%	1.8%	7435
Film Packaging	0.1%	0.1%	126	Demo/Painted Drywall	4.7%	1.8%	4004
Other Plastic	0.3%	0.1%	231	Clean/New Drywall	2.2%	1.4%	1845
Glass	0.2%	0.1%	128	Other C&D	8.2%	2.7%	6994
Glass Bottles/Jars	0.0%	0.0%	0	Problem Materials	1.8%	0.8%	1,567
Other Glass	0.2%	0.1%	128	Electronics	0.1%	0.1%	104
Metal	1.9%	0.5%	1,637	Small Appliances	0.0%	0.0%	11
Aluminum Containers	0.0%	0.0%	4	Carpet/Padding	1.0%	0.6%	826
Other Ferrous Scrap	1.1%	0.5%	938	Batteries	0.0%	0.0%	0
Non-ferrous Metal	0.8%	0.2%	651	Tires	0.1%	0.1%	118
White Goods	0.1%	0.1%	44	Bulky Wastes/Furniture	0.5%	0.4%	453
Organics	20.9%	14.1%	17,814	Fluorescent Light Bulbs	0.0%	0.0%	8
Yard Waste	1.0%	0.5%	842	All HHW	0.1%	0.0%	46
Wood Pallets	0.8%	0.4%	686	Mixed MSW	0.8%	0.4%	659
Dirt and Sand	19.2%	14.1%	16287	Mixed MSW	0.8%	0.4%	659
				Total	100.0%		85,034
				<i>No. of Samples</i>	175		

3.5 SINGLE STREAM RECYCLING

The County reported 141,563 tons of recyclables. Figure 3-13 estimates the composition of these recyclables, which include residential and commercial mixed recyclables. Note that the pie pieces in this chart include both targeted and non-targeted materials (for example, the Paper category includes recyclable papers as well as non-recyclable paper like tissues or napkins).

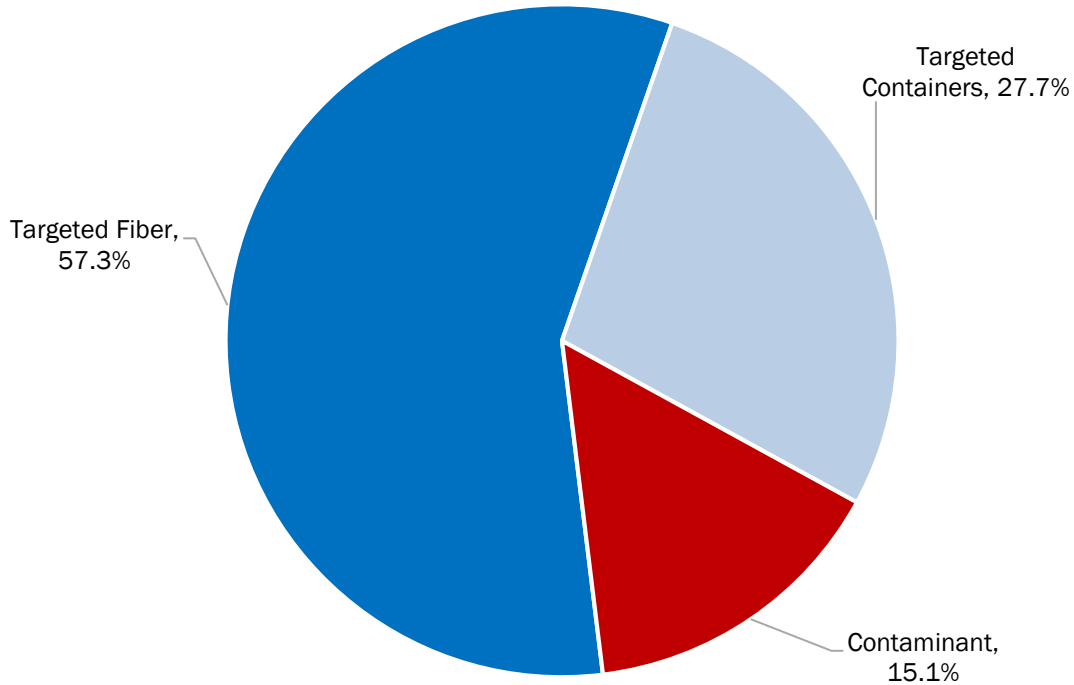
Figure 3-9 Single Stream Recycling Composition Summary



COUNTYWIDE WASTE COMPOSITION STUDY

Figure 3-14 provides a more informative view of the County's recyclables in terms of whether they are targeted in the regional recycling programs. As shown, roughly 85 percent of the recyclables were properly separated into recycling receptacles, leaving only a 15 percent contamination rate. This contamination level is lower than the national average.

Figure 3-10 Targeted Recyclables and Contamination

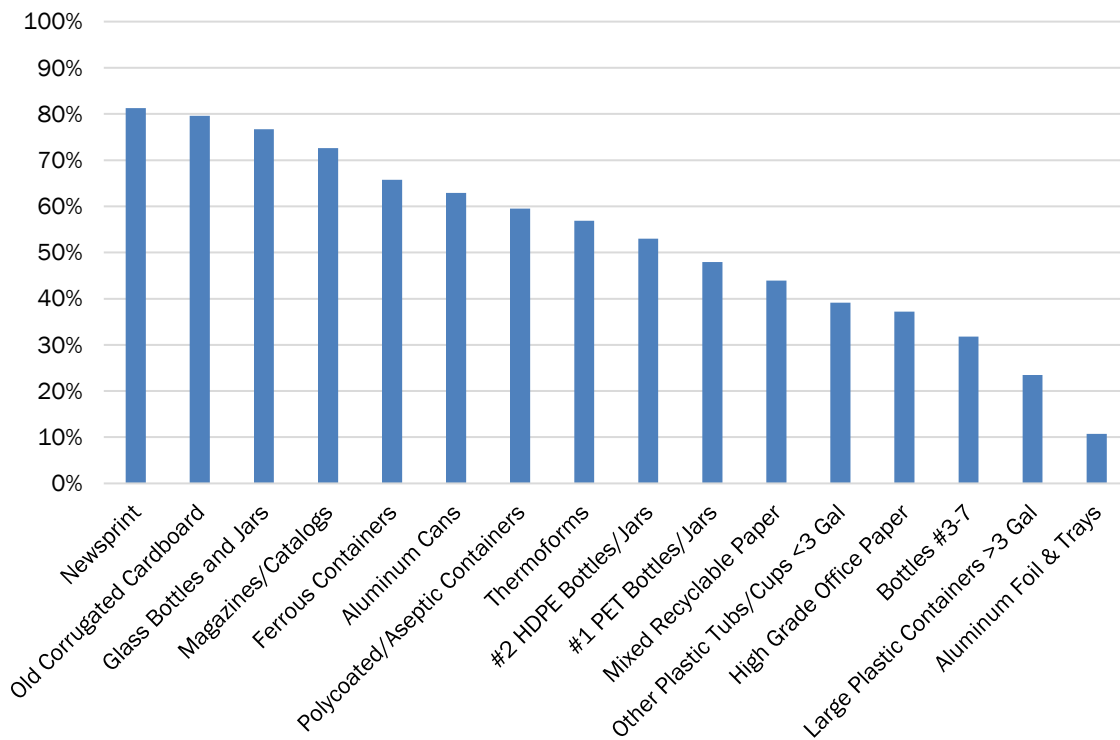


COUNTYWIDE WASTE COMPOSITION STUDY

An important metric for recycling programs is the Capture Rate. The Capture Rate is defined as the percentage of a targeted recyclable material that is actually diverted in the recycling program. High capture rates indicate that the majority of available recyclables are being correctly recycled; conversely, low capture rates identify materials that are not being effectively recycled in the existing recycling program.

Figure 3-15 shows the capture rates for the materials targeted in regional recycling programs. As shown, some constituents are captured at a high rate which suggests wide awareness around the County with the availability of recycling for those items. Other materials have lower capture rates, which suggests that recycling could increase within the current program parameters simply through wider participation in the program for all targeted materials.

Figure 3-11 Recycling Capture Rates



COUNTYWIDE WASTE COMPOSITION STUDY

Table 3-6 provides the detailed composition of the mixed recycling stream, including the mean composition, confidence intervals, and allocated tonnage.

Table 3-6 Detailed Composition of Boulder County Single Stream Recycling

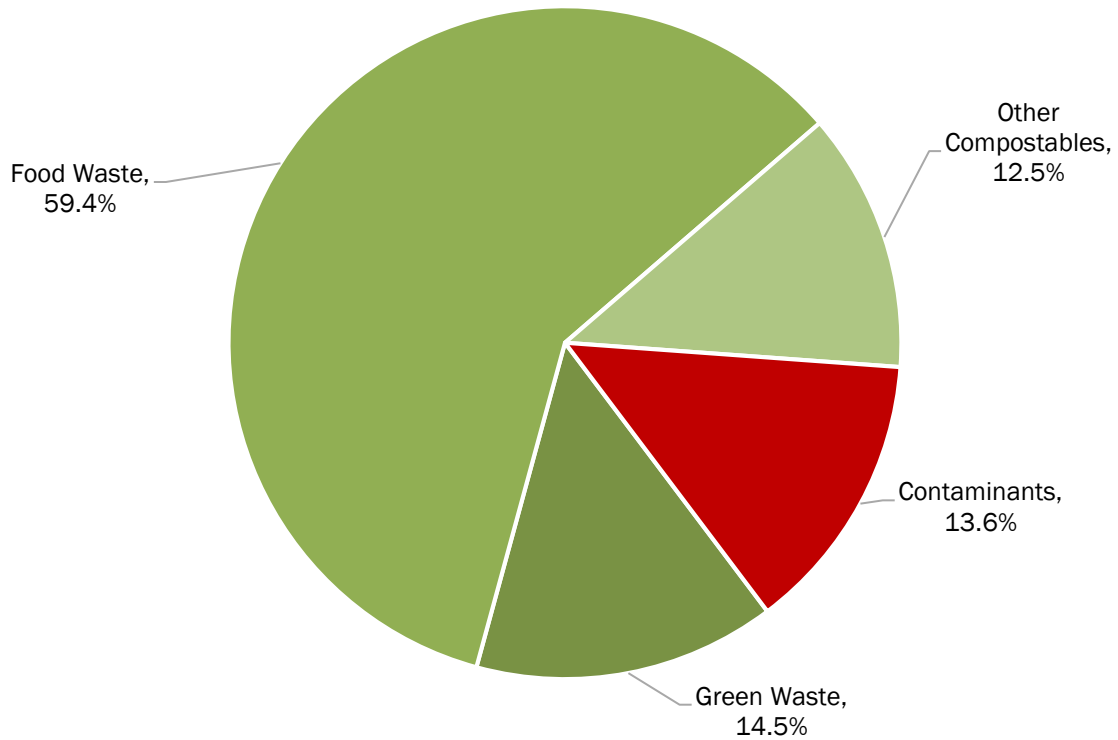
Material Category	Est. Percent	Conf. Int (+/-)	Tons	Material Category	Est. Percent	Conf. Int (+/-)	Tons
Paper	61.6%	3.9%	87,241	Problem Materials	0.5%	1.5%	651
Newsprint	4.6%	1.3%	6,562	Large Electronics (Plug-in)	0.1%	1.2%	192
High Grade Office Paper	1.4%	0.7%	1,922	Small Electronics (Recharge)	0.0%	0.0%	40
Shredded Paper	0.0%	0.1%	11	Small Appliances	0.0%	0.0%	0
Old Corrugated Cardboard	42.2%	5.4%	59,806	Diapers/Sanitary Products	0.0%	0.1%	6
Magazines/Catalogs	5.2%	1.7%	7,308	Textiles/Leather	0.2%	0.4%	246
Mixed Recyclable Paper	3.9%	2.1%	5,459	Carpet/Padding	0.0%	0.0%	37
Polycoated/Aseptic Containers	0.7%	0.1%	963	Batteries	0.0%	0.1%	8
Compostable Paper	2.2%	0.5%	3,183	Rubber	0.1%	0.0%	87
Unrecyclable Paper	1.4%	0.6%	2,027	Tires	0.0%	0.0%	0
Plastic	7.8%	1.4%	11,011	Furniture/Bulky Items	0.0%	0.0%	0
#1 PET Bottles/Jars	1.2%	0.5%	1,657	Other Inorganics	0.0%	0.1%	5
#2 HDPE Bottles/Jars	1.3%	0.5%	1,905	Marijuana Waste	0.0%	0.0%	29
Bottles #3-7	0.1%	0.0%	130	HHW	0.0%	0.0%	24
Other Plastic Tubs/Cups <3 Gal	1.0%	0.3%	1,420	Fluorescent Tubes and Bulbs	0.0%	0.0%	0
Large Plastic Containers >3 Gal	0.5%	0.2%	757	Pharmaceuticals and Syringes	0.0%	0.0%	24
Plastic Bags	0.6%	0.2%	885	Oil-based Paint & Finishes	0.0%	0.0%	0
Other Plastic Film	0.6%	0.4%	879	Latex Paint & Finishes	0.0%	0.0%	0
Thermoforms	1.3%	0.3%	1,770	Pesticides	0.0%	0.0%	0
Expanded Polystyrene	0.1%	0.1%	155	Automotive Fluids	0.0%	0.0%	0
Other Rigid Plastics	1.0%	0.3%	1,453	Other HHW	0.0%	0.0%	0
Metal	4.8%	1.0%	6,727	C&D	0.4%	0.5%	541
Aluminum Cans	1.0%	0.3%	1,433	Aggregate/Asphalt/Ceramics	0.1%	0.1%	183
Aluminum Foil & Trays	0.1%	0.0%	71	Asphalt Shingles	0.0%	0.0%	0
Ferrous Containers	1.9%	0.5%	2,709	Painted/Stained/Treated Wood	0.2%	0.3%	246
Other Ferrous	1.4%	0.7%	2,031	Clean Wood	0.0%	0.0%	1
Other Non-Ferrous	0.3%	0.2%	482	Wood Pallets	0.0%	0.0%	0
White Goods	0.0%	0.0%	0	Clean/New Drywall	0.0%	0.0%	0
Glass	17.6%	2.9%	24,916	Demo/Painted Drywall	0.0%	0.1%	69
Glass Bottles and Jars	17.5%	3.0%	24,739	Other C&D	0.0%	0.2%	42
Other Glass	0.1%	0.1%	177	Other	6.7%	2.3%	9,478
Organic	0.7%	0.4%	975	Fines/Dirt	1.6%	0.6%	2,314
Yard Waste	0.0%	0.0%	0	Coffee Cups Non-Compostable	0.0%	0.4%	28
Branches, Limbs, Stumps	0.0%	0.0%	0	BPI Certified Compostables	0.0%	0.0%	10
Food Waste	0.7%	0.3%	952	Bagged Material (BCRC Only)	5.0%	2.4%	7,126
Other Organics	0.0%	0.0%	23				
				Total	100.0%		141,563
				No. of Samples		26	
				Contaminants	15.1%		21,344

Composition of single stream recycling for participating communities are contained in Appendix B.

3.6 ORGANICS

The County reported 46,929 tons of source separated organics. Figure 3-17 focuses on the specific targeted and unallowable materials found in mixed organics. As shown, the organics stream was found to be almost 85 percent clean. Food waste makes up the largest fraction of the targeted organics, followed by green wastes. Other compostables, which include low grade paper and compostable plastics, were also found to be significant in the stream at almost nine percent.

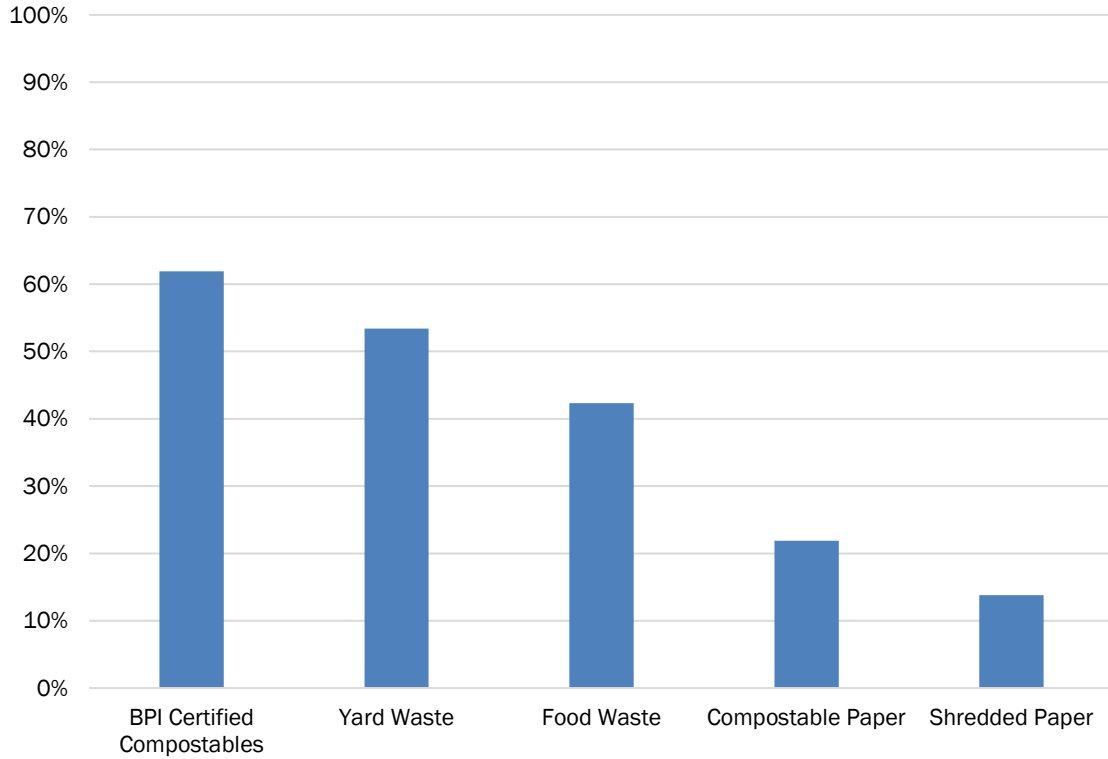
Figure 3-12 Targeted Organics and Contamination



COUNTYWIDE WASTE COMPOSITION STUDY

Figure 3-18 shows the capture rates for organic materials targeted in regional composting programs. Broadly, organics capture rates are lower than curbside recycling capture rates, although a similar range exists. Yard wastes are captured at the highest rate, with compostable papers at the low end.

Figure 3-13 Organics Capture Rate



COUNTYWIDE WASTE COMPOSITION STUDY

Table 3-7 provides the detailed composition of the organics stream, including the mean composition, confidence intervals, and allocated tonnage.

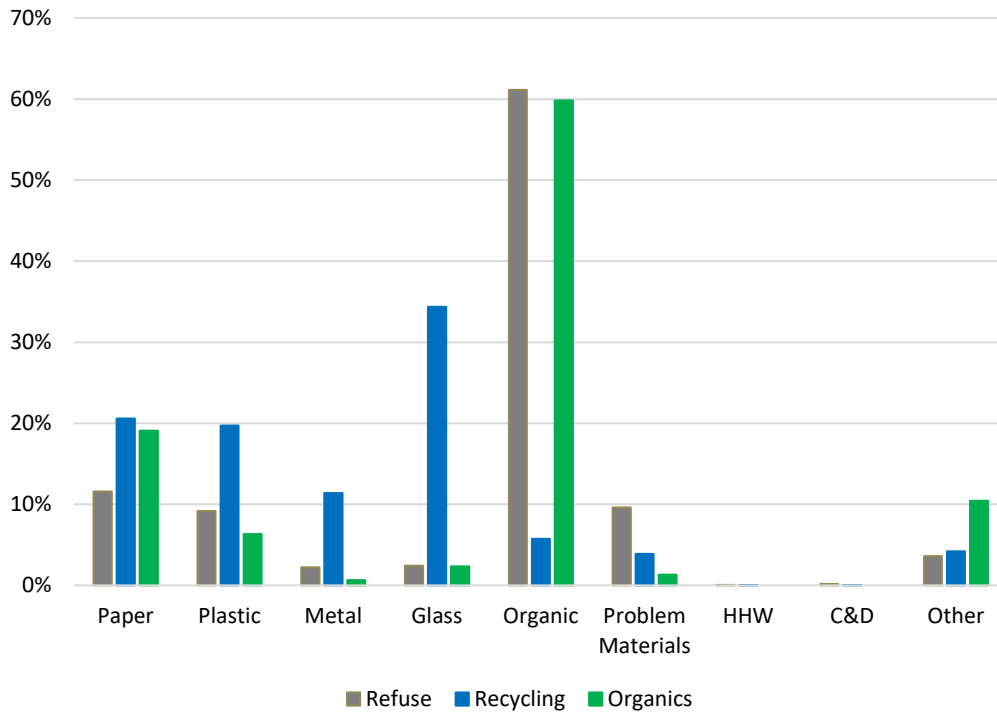
Table 3-7 Detailed Composition of Boulder County Organics

Material Category	Est. Percent	Conf. Int (+/-)	Tons	Material Category	Est. Percent	Conf. Int (+/-)	Tons
Paper	15.0%	3.1%	7,063	Problem Materials	1.9%	0.7%	909
Newsprint	0.0%	0.1%	16	Large Electronics (Plug-in)	0.0%	0.0%	0
High Grade Office Paper	0.6%	0.3%	299	Small Electronics (Recharge)	0.0%	0.0%	3
Shredded Paper	0.2%	0.2%	104	Small Appliances	0.0%	0.0%	0
Old Corrugated Cardboard	1.3%	1.0%	598	Diapers/Sanitary Products	0.0%	0.0%	21
Magazines/Catalogs	0.0%	0.0%	1	Textiles/Leather	1.7%	0.5%	793
Mixed Recyclable Paper	0.6%	0.1%	277	Carpet/Padding	0.0%	0.0%	0
Polycoated/Aseptic Containers	0.1%	0.1%	66	Batteries	0.0%	0.0%	0
Compostable Paper	11.7%	2.9%	5,478	Rubber	0.1%	0.0%	47
Unrecyclable Paper	0.5%	0.2%	224	Tires	0.0%	0.0%	0
Plastic	3.3%	0.7%	1,525	Furniture/Bulky Items	0.0%	0.0%	0
#1 PET Bottles/Jars	0.1%	0.0%	24	Other Inorganics	0.1%	0.0%	45
#2 HDPE Bottles/Jars	0.1%	0.1%	59	Marijuana Waste	0.0%	0.1%	0
Bottles #3-7	0.0%	0.0%	12	HHW	0.0%	0.0%	0
Other Plastic Tubs/Cups <3 Gal	0.2%	0.1%	90	Fluorescent Tubes and Bulbs	0%	0.0%	0
Large Plastic Containers >3 Gal	0.1%	0.2%	36	Pharmaceuticals and Syringes	0%	0.0%	0
Plastic Bags	1.2%	0.3%	577	Oil-based Paint & Finishes	0%	0.0%	0
Other Plastic Film	1.1%	0.3%	529	Latex Paint & Finishes	0%	0.0%	0
Thermoforms	0.1%	0.0%	34	Pesticides	0%	0.0%	0
Expanded Polystyrene	0.2%	0.1%	114	Automotive Fluids	0%	0.0%	0
Other Rigid Plastics	0.1%	0.0%	50	Other HHW	0%	0.0%	0
Metal	1.1%	0.3%	503	C&D	0.4%	0.9%	188
Aluminum Cans	0.1%	0.0%	34	Aggregate/Asphalt/Ceramics	0.0%	0.0%	0
Aluminum Foil & Trays	0.2%	0.1%	90	Asphalt Shingles	0.0%	0.0%	3
Ferrous Containers	0.0%	0.0%	3	Painted/Stained/Treated Wood	0.1%	0.2%	33
Other Ferrous	0.4%	0.2%	203	Clean Wood	0.3%	0.8%	151
Other Non-Ferrous	0.4%	0.2%	173	Wood Pallets	0.0%	0.0%	0
White Goods	0.0%	0.0%	0	Clean/New Drywall	0.0%	0.0%	0
Glass	0.7%	0.8%	307	Demo/Painted Drywall	0.0%	0.0%	0
Glass Bottles and Jars	0.6%	0.6%	298	Other C&D	0.0%	0.0%	1
Other Glass	0.0%	0.0%	10	Other	1.0%	0.3%	463
Organic	76.6%	4.2%	35,970	Fines/Dirt	0.2%	0.3%	78
Yard Waste	14.5%	11.4%	6,814	Coffee Cups Non-Compostable	0.2%	0.1%	109
Branches, Limbs, Stumps	0.0%	1.3%	0	BPI Certified Compostables	0.6%	0.2%	276
Food Waste	59.4%	8.7%	27,890	Bagged Material (BCRC Only)	0.0%	0.0%	0
Other Organics	2.7%	3.8%	1,266				
				Total	100.0%		46,929
				No. of Samples	17		
				Contaminants	13.6%		6,367

3.7 PUBLIC BIN COMPOSITION

Public bin wastes, targeting refuse, recyclables and organics, were captured with the assistance of “milk runs” in various location within the City of Boulder. Figure 3-19 compares the composition of refuse, recycling and organics as deposited in these bins. This graphic suggests that organic materials could be readily shifted from the refuse bins to the organics bins. Although not shown in the graphic, the contamination rates for recyclables and organics were 16.2 and 15.6 percent, respectively.

Figure 3-14 Public Bin Composition by Material Stream



4. AGGREGATE DISPOSED SOLID WASTE

Figure 4-1 summarizes the major material groups contained in the aggregate disposed solid waste which consists of the aggregate disposed refuse and disposed C&D debris for all of Boulder County. As expected, C&D debris contributes a significant share of the County’s disposed tons at slightly more than 30 percent. Following C&D debris, organics is the second-largest material group at nearly 21 percent.

COUNTYWIDE WASTE COMPOSITION STUDY

Figure 4-1 Aggregate Disposed Solid Waste Composition Summary

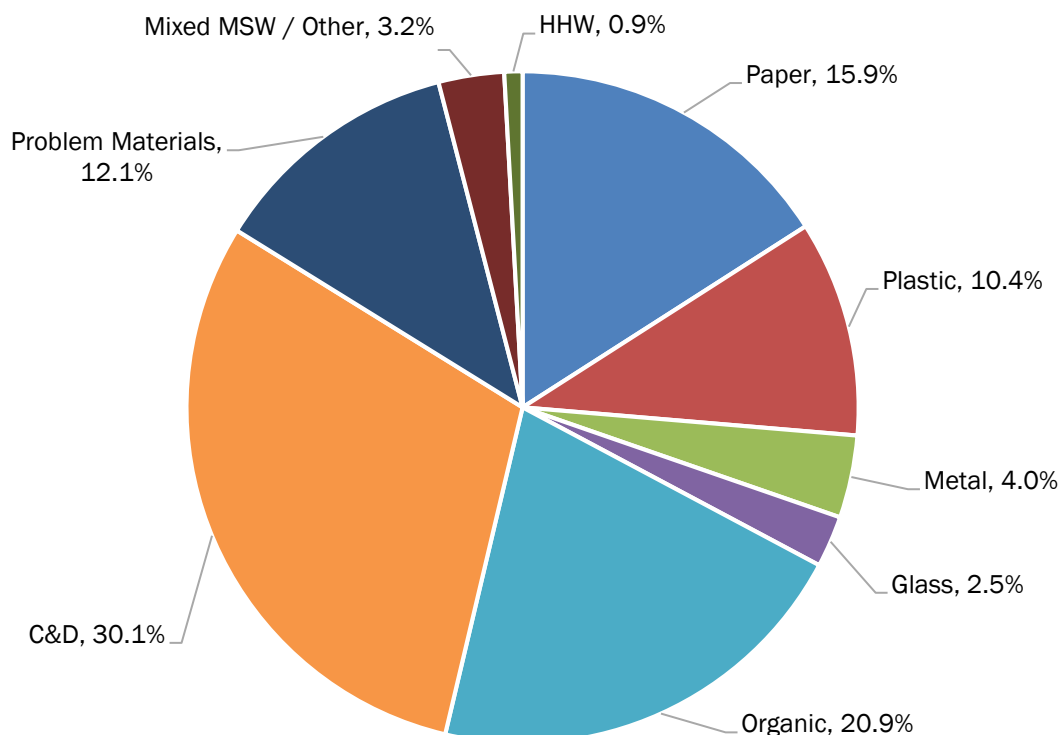


Table 4-1 provides an overview of the composition of the aggregate disposed solid waste. It is important to note that the categories used in the manual sorting of materials and the visual surveying of C&D are not completely identical. For example, the manual sort material group HHW is a material category in Problem Materials for the C&D visual survey material groups consisting of 46 tons. Detailed definitions for these categories can be found in Appendix A.

Table 4-1 Composition of Aggregate Disposed Solid Waste

Material Group	Disposed		Total Tons
	MSW	C&D	
Paper	50,217	676	50,893
Plastic	32,829	364	33,193
Metal	11,037	1,637	12,674
Glass	7,781	128	7,909
Organic	48,959	17,814	66,773
C&D	33,973	62,189	96,163
Problem Materials	37,214	1,567	38,781
Mixed MSW / Other	9,415	659	10,074
HHW	2,791	0	2,791
Total	234,216	85,034	319,250

5. CONCLUSIONS AND RECOMMENDATIONS

MSW Consultants offers the following conclusions and recommendations regarding the Boulder County 2019 Waste Composition Study.

5.1 CONCLUSIONS

- ◆ **Improved Waste Generation Data:** The 2019 Study benefited from the establishment of a Countywide waste generation reporting system. Although this is valuable from a planning standpoint, it should be noted that the availability of this data reduces the comparability of the 2019 Study results against the 2010 Study. This is due to the 2010 Study relying on waste generation estimates which differ from the actual waste generation reports that are now available. Assuming waste and recycling stakeholders continue to use this system, it should provide a valuable time series view of the County's waste stream over time and make subsequent waste characterization studies more comparable.
- ◆ **Expansion of Project Scope:** The 2019 Study significantly expanded the scope of the material composition analysis that was performed in 2010. Where 2010 focused strictly on landfill bound MSW and C&D, the 2019 Study also targeted recyclables and organics from both residential and commercial processors, as well as public bin samples. Finally, one of the study participants contributed additional funds to expand sampling and sorting of their wastes and recyclables, which added logistical complexity to the project.
- ◆ **Allocation of Samples:** The County and its local government partners who sponsored this study cast a wide net in examining many different material streams. The result was a study that expanded the level of effort devoted to sampling and sorting from the 2010 Study. However, in the pursuit of composition snapshots of so many different substreams within a finite sampling budget, it is possible that the allocation of samples to certain substreams may have differed enough from a stratified random distribution of samples to achieve full representativeness for a County wide study. For example, 15 samples were obtained from public bin wastes, recyclables and organics, which make up only a small fraction of the Countywide waste stream. Another four samples were obtained from the Foothill Transfer Station, a very small fraction of the waste stream. The body of the report identifies the impact of the sampling allocation on the residential and aggregate refuse composition results.
- ◆ **Changes in the Waste Stream:** Since 2010, there have been major changes in the waste stream which have been documented in other waste characterization time series data. Although some of this impact may be obscured in Boulder County since 2010 (see previous bullet), there is a commensurate impact on the refuse and recycling streams in Boulder County. In particular, the increase in cardboard used in shipping and home delivery may have caused an uptick of this recyclable material being disposed. However, some trends may not be as verifiable in the County-wide data.
- ◆ **Aggressive and Effective Recycling Program:** Boulder County targets a wide variety of materials in its recycling program. In other communities across the country, this has led to higher contamination rates due to "wish-cycling," caused by system users who place unwanted items in their recycling cart in hopes that the items will get recycled somehow. Boulder County's recyclables were found to have just 15.1 percent contamination, which is at least 25 percent below the national average.
- ◆ **Establishment of Routine Organics Collection:** A significant quantity of organics are collected and diverted to composting in Boulder County. The existence of routine collection programs and public bins targeting this material suggests the County is moving aggressively towards further diversion from landfill, and the contamination rate is low by recycling program standards. Capture rates for organics other than yard waste leave room for improvement and this may be a means to continue increasing the County's diversion rate in the years to come.
- ◆ **Improved Accuracy of C&D Composition Estimates:** The 2019 Study captured many more samples than the 2010 Study, and also made use of a tablet-based app that enabled visual estimates to

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be calibrated against the actual scale weight of inbound C&D debris loads. These two factors contribute to a more robust analysis of the C&D waste stream in 2019.

- ◆ **Extensiveness of Data:** Because of the sheer number of substreams sampled for this study, it was not possible to comprehensively analyze and compare the composition of materials among the municipalities. However, Appendix B provides the granular composition for each substream, and Appendix C provides the estimated annual tonnage that could be used as a weighting factor should the County or any project participants wish to aggregate their individual material composition.

5.2 RECOMMENDATIONS

An overarching observation from the 2019 Waste Composition Study is that as the scope of any composition analysis expands, the requisite number of samples to be obtained must also increase if statistical representativeness is to be achieved for all substreams. It is recommended that Boulder County continue updating a countywide waste characterization study at regular intervals in the future, as such data can be invaluable to solid waste and sustainability planners. However, in future studies, a primary recommendation is that the County and its municipal partners consider available budget and prioritize the study objectives so that the desired outcomes can be achieved.

Other recommendations stemming from the 2019 Study include:

- ◆ **Expand Countywide Tonnage Reporting:** This system provided a comprehensive snapshot of the County's waste stream, which was critical for use in aggregating composition data. The County should take steps to use and enhance, if necessary, this data platform as a valuable planning tool. In particular, reported recycling and organics quantities should be further segregated between mixed and source-separated generators to improve the aggregation of residential and commercial material composition.
- ◆ **Maintain Focus on Clean Recyclables and Organics:** Boulder County's recyclables and organics were found to have below average contamination. This is a credit to the region's program messaging and outreach, as well as to the haulers and processors who manage the material. It will be important to maintain this focus on low contamination within the County solid waste management system, and there are services emerging that enable local governments and their processors to implement more routine monitoring of inbound material composition from each supplier that may be of interest to recycling stakeholders.
- ◆ **Target Outreach on Under-captured Materials:** Although County recycling programs are functioning effectively, there are opportunities to improve the capture of certain materials that are allowable in the existing program. Recycling planners can use the capture rate data found in this study to focus messaging on the materials which, if captured to a higher degree, would most improve the diversion rate and/or the revenue profile of the recycled material stream.
- ◆ **Focus on C&D Diversion:** The C&D waste stream was found to contain many constituents which can be diverted from disposal. The County may wish to further investigate the potential to increase C&D processing capacity and/or establish policies to provide an incentive for C&D diversion.

APPENDIX A

MATERIAL DEFINITIONS

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Exhibit A-1 Municipal Solid Waste (MSW) Material Category Definitions (Manual Sort)

Class	#	Material Category	Definition
Paper	1	Newsprint	Consists of all paper products printed in daily or weekly newspapers, including inserts. Includes other newsprint.
Paper	2	High Grade Office Paper	High grade ledger paper, such as typing and copy paper. Computer paper includes outputs from printers that may have green bars.
Paper	3	Shredded Paper	Low or high grade paper that has been mechanically shredded.
Paper	4	Old Corrugated Cardboard	Paperboard containers consisting of Kraft (brown) linerboard with corrugated (fluted medium) fillings. Includes Kraft paper such as bags or wrapping paper.
Paper	5	Magazines/Catalogs	Publications which are printed on glossy paper. This does not include magazines, catalogs, etc., which do not consist of glossy paper throughout (e.g., comic books.)
Paper	6	Mixed Recyclable Paper	All other recyclable paper not covered such as uncoated paperboard, direct mail, molded pulp, phone books, and paperback books.
Paper	7	Polycoated/Aseptic Containers	Aseptic juice boxes and gable top cartons made of coated paperboard.
Paper	8	Compostable Paper	Soiled and used fiber such as tissues and paper including OCC that are soiled with food, such as paper plates, paper cups, pizza boxes, popcorn bags and paper towels. Includes wax coated OCC.
Paper	9	Unrecyclable Paper	All paper that doesn't fit into the categories specified above and items that are primarily paper but include other materials such as plastic or metal. Examples paper or boxboard coated with plastic or metal foil, photographs, laminated paper.
Plastic	10	#1 PET Bottles/Jars	Clear or colored blow molded plastic bottles and jars labeled as #1 PET. Examples include plastic beverage bottles (i.e., bottles with a narrow necks) and plastic jars (open mouth jars) such as peanut butter jars.
Plastic	11	#2 HDPE Bottles/Jars	Natural or pigmented blow molded plastic bottles and jars labeled as #2 HDPE. Examples include plastic detergent bottles (i.e., bottles with a narrow necks) and plastic jars (open mouth jars) such as sanitizing wipes.
Plastic	12	Bottles #3-7	All plastic bottles labeled 3-7. Examples include amber plastic pill bottles, cosmetic bottles, and all unmarked narrow neck bottles. Includes #7 PLA bottles, even though these bottles may not be accepted by local recycling processors.

APPENDIX A

Class	#	Material Category	Definition
Plastic	13	Other Plastic Tubs and Cups <3 Gallons	Tubs, buckets, and packaging cups that are less than 3 gallons (<3) in size. Examples in this category include margarine, cottage cheese, and yogurt tubs, plastic buckets <3 gallons.
Plastic	14	Large Plastic Containers >3 Gallons	Tubs and buckets that are greater than 3 gallons (>3) in size.
Plastic	15	Plastic Bags	Plastic film bags used to transport retail merchandise. Includes retail bags, newspaper sleeves, dry cleaner bags and the like.
Plastic	16	Other Plastic Film	All other plastic film includes garbage bags, shrink wrap, bubble packing film, construction film, agricultural film, and food packaging film such as bread sacks.
Plastic	17	Thermoforms	Plastic containers labeled 1-7 formed by shaping a plastic sheet through heat application. Commonly used in packaging of food products and consumer goods. Examples include berry containers, and rigid plastic packaging. Excludes expanded plastics such as expanded polystyrene.
Plastic	18	Expanded Polystyrene	Expanded plastic polymer used for protecting items during shipping, storage, or cold or heat. Includes expanded foam trays, packing peanuts, packing blocks, food clamshells, and coolers.
Plastic	19	Other Rigid Plastics	All other rigid plastic not elsewhere classified. Items such as food service, cup lids, toothbrushes, toys, and composite items that are made of 50% or more plastic. May include bioplastics.
Metal	20	Aluminum Cans	Aluminum beverage and food containers
Metal	21	Aluminum Foil & Trays	Aluminum foil, trays and pie pans
Metal	22	Ferrous Containers	Fabricated, magnetizable metal containers such as steel or bimetal designed to hold food or beverage products such as soups, vegetables, pet food and juices. Includes two piece containers with aluminum tops other empty spray cans.
Metal	23	Other Ferrous	Ferrous and alloyed ferrous scrap materials originated from residential commercial, or institutional sources which are attracted to a magnet. This category includes wire coat hangers auto parts and composite materials that are made of 50% more ferrous.
Metal	24	Other Non-Ferrous	Non-magnetic metals such as brass, bronze, silver, lead copper, aluminum, zinc and composite non-ferrous materials that are made of 50% or more metal. Items such as insulated wiring or plumbing parts. Stainless steel house wares are also part of this category.

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Class	#	Material Category	Definition
Metal	25	White Goods	Large household appliances such as refrigerators, stoves, air conditioners, and washing machines.
Glass	26	Glass Bottles and Jars	Clear, green, and brown glass food and beverage containers.
Glass	27	Other Glass	All other glass items such as plate glass such as window and door glass, table-tops; auto glass; heat resistant cookware (Pyrex); pottery; drinking glasses; and any other glass that was not used for containing food or drinks.
Organics	28	Yard Waste	Grass clippings, leaves, flowers, small potted plant roots, and branches less than 2" in diameter.
Organics	29	Branches, Limbs, Stumps	Branches, limbs and logs greater than 2" in diameter
Organics	30	Food Waste	Putrescible organic materials which are the by-products of activities connected with the growing, preparation, cooking, processing, or consumption of food by humans or pets. This also includes liquids from beverage contains.
Organics	31	Other Organics	Organic material that doesn't fit into the categories specified above, and items that are primarily organic but include other materials such as plastic or metal. Examples include cotton balls, hair, Q-tips, wax, soap, kitty litter, animal feces, and animal carcasses.
Problem Materials	32	Large Electronics (Plug-in)	Any plug-in item that contains a circuit board including, televisions, radio, stereo, computer, and CRT.
Problem Materials	33	Small Electronics (Recharge)	Small Consumer Electronics that are rechargeable or contains a replaceable battery these include cell phones, iPods, PDAs, portable handheld calculators, portable digital assistants or other similar devices.
Problem Materials	34	Small Appliances	Small household appliances such as fans, vacuum cleaners, irons, electrical kitchen ware, corded hand drills, and hair driers.
Problem Materials	35	Diapers/Sanitary Products	Diapers and sanitary products.
Problem Materials	36	Textiles/Leather	Woven natural or manmade fibers used to make items such as clothing, bedding, curtains, blankets, stuffed animals, cotton diapers, other cloth material. Natural animal skin used to make shoes, belts and other leather goods.
Problem Materials	37	Carpet/Padding	Natural or manmade fibers woven to make floor covering or floor covering under laments items such as carpets, rugs or padding from residential or commercial buildings, including carpet backing.

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Class	#	Material Category	Definition
Problem Materials	38	Batteries	Any type of battery including lead acid (automotive) batteries. Examples include household batteries such as AA, AAA, D, button cell, 9 volt, and rechargeable batteries used for flashlights, small appliances, tools, watches, and hearing aids.
Problem Materials	39	Rubber	Natural or manmade rubber used to make shoes, hoses, and automobile parts. This category excludes tires.
Problem Materials	40	Tires	Solid or pneumatic rubber or steel belted tires. Includes motorized vehicle and bicycle tires.
Problem Materials	41	Furniture/Bulky Items	Chairs, couches, mattresses, desks, and other oversized items made of multiple materials.
Problem Materials	42	Other Inorganics	All other inorganic items not elsewhere classified
Problem Materials	43	Marijuana Waste	Marijuana clippings, plants, products and paraphernalia typically associated with marijuana usage.
Hazardous Waste	44	Fluorescent Tubes and Bulbs	Fluorescent light tubes and compact light bulbs. This category does not include fixtures.
Hazardous Waste	45	Pharmaceuticals and Syringes	All prescription and non-prescription medicine, medicated ointments, mouth wash, lancets, and syringes. Does not include items such as ordinary dandruff shampoo or hand lotions.
Hazardous Waste	46	Oil-based Paint & Finishes	Finishes for wood, metal, or other surfaces that have a volatile organic base or solvent. Products such as lacquers, stains, paints, and urethanes.
Hazardous Waste	47	Latex Paint & Finishes	Water based lacquers, stains, paints, and urethanes.
Hazardous Waste	48	Pesticides	Poisons used to eradicate pests such as insects, fungus, or vegetative growth.
Hazardous Waste	49	Automotive Fluids	Used or unused automotive fluids such as motor oil, anti-freeze, brake or hydraulic fluids.
Hazardous Waste	50	Other HHW	All other household or commercial products not categorized elsewhere characterized as "toxic", "corrosive", "flammable", "ignitable", "radioactive", "poisonous", and "reactive". Items such as lye, untreated medical waste, oven cleaner, some detergents, and solvents.
C&D Debris	51	Aggregate/Asphalt/Ceramics	Concrete, brick, stones, cut stone, cement, rocks, ceramic tile and fixtures.
C&D Debris	52	Asphalt Shingles	Asphalt composite shingles and other roofing material made with asphalt. Examples include asphalt shingles and attached roofing tar and tar paper

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Class	#	Material Category	Definition
C&D Debris	53	Painted/Stained/Treated Wood	Wood that contains an adhesive, paint, stain, fire retardant, pesticide or preservative. Painted or stained lengths of wood from construction or woodworking activities, particle board, OSB, and plywood.
C&D Debris	54	Clean Wood	Any wood such as dimensional lumber which does not contain an adhesive, paint, stain, fire retardant, pesticide or preservative; May contains metal items such as screws and nails.
C&D Debris	55	Wood Pallets	Wood pallets and crating materials commonly used for industrial and commercial packaging and shipping.
C&D Debris	56	Clean/New Drywall	Means unpainted or untreated interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples include unused, broken or whole sheets of sheetrock, drywall, gypsum board, plasterboard, gypsum board, gyproc, and wallboard
C&D Debris	57	Demo/Painted Drywall	Means painted or treated interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples include unused, broken or whole sheets of sheetrock, drywall, gypsum board, plasterboard, gypsum board, gyproc, and wallboard
C&D Debris	58	Other C&D	Material generated from construction and demolition activities. Items such as PVC pipe, HVAC ducting, caulking or adhesive tubes, used paint brushes, ceiling tiles, ash, and other C&D material not elsewhere classified.
Other	59	Fines/Dirt	Small fragments that pass through the ¼" sort screen, and miscellaneous fines and dirt.
Other	60	Coffee Cups Non-Compostable	Single-use, disposable containers intended for coffee or similar beverages, excluding containers identified as BPI compostable certified. All containers fitting this description without BPI certification are placed in this category, regardless of other claims found on the containers themselves.
Other	61	BPI Certified Compostables	Containers, cutlery and any other similar materials identified to be BPI compostable certified, typically identified with the BPI certification logo or text identifying said material as BPI certified.
Other	62	Bagged Material (BCRC Only)	Bagged material found in the Boulder County Recycling Center recycling stream. This material is commonly disposed in trash bags or grocery/retail bags and is therefore unable to be processed at the county's recycling center. Material can be either targeted recyclables or contamination.

Exhibit A-2 Construction & Demolition (C&D) Material Category Definitions (Visual Survey)

Class	No.	Material Category	Definition
PAPER	1	Uncoated OCC - Recyclable	Paperboard containers consisting of Kraft (brown) linerboard with corrugated (fluted medium) fillings. Includes yellow and waxed corrugated boxes and Kraft paper such as bags or wrapping paper. Does not include non-corrugated paperboard products such as cereal, shoe, or gift boxes.
	2	Other Paper	Consists of all other paper products.
PLASTIC	3	PET bottles - Beverage	Clear or colored blow molded plastic bottles and jars labeled as #1 PET. These can be clear or colored. Examples include plastic beverage bottles (i.e., bottles with a narrow necks) and plastic jars (open mouth jars) such as peanut butter jars.
	4	Film Packaging	Film plastic wrap, bags, tarps, and other film
	5	Other Plastic	All other plastic.
METAL	6	Aluminum Containers	Aluminum containers used for holding beverages, or food.
	7	Other Ferrous Scrap	Fabricated, magnetizable metal containers such as steel or bimetal designed to hold food or beverage products such as soups, vegetables, pet food and juices. Includes two piece containers with aluminum tops other empty spray cans. Ferrous and alloyed ferrous scrap materials originated from residential commercial, or institutional sources which are attracted to a magnet. This category includes wire coat hangers auto parts and composite materials that are made of 50% more ferrous.
	8	Non-ferrous Metal	Non-magnetic metals such as brass, bronze, silver, lead copper, aluminum, zinc and composite non-ferrous materials that are made of 50% or more metal. Items such as insulated wiring or plumbing parts. Stainless steel house wares are also part of this category.
	9	White Goods	Large household appliances such as refrigerators, stoves, air conditioners, and washing machines.
GLASS	10	Glass Bottles/Jars	Clear, green, and brown glass food and beverage containers.
	11	Other Glass	All other glass items such as plate glass such as window and door glass, table-tops; auto glass; heat resistant cookware (Pyrex); pottery; drinking glasses; and any other glass that was not used for containing food or drinks.
ORGANIC	12	Yard Waste	Grass clippings, leaves, flowers, small potted plant roots, and branches less than <1/4' in diameter.
			Branches, limbs and logs greater than 6 (>6) inches in diameter
			Leaves from trees and shrubs. Does not include clippings or trimins.
	13	Wood Pallets	Wood pallets and crating materials commonly used for industrial and commercial packaging and shipping.
14	Dirt/Fines	Small fragments that pass through the 1/4" sort screen, and miscellaneous fines and dirt.	

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Class	No.	Material Category	Definition
PROBLEM MATERIAL	15	Electronics	Any plug-in item that contains a circuit board including, televisions, radio, stereo, computer, and CRT. Small Consumer Electronics that are rechargeable or contains a replaceable battery these include cell phones, iPods, PDAs, portable handheld calculators, portable digital assistants or other similar devices.
	16	Small Appliances	Small household appliances such as fans, vacuum cleaners, irons, electrical kitchen ware, corded hand drills, and hair driers.
	17	Carpet/Padding	Natural or manmade fibers woven to make floor covering or floor covering under laments items such as carpets, rugs or padding from residential or commercial buildings, including carpet backing.
	18	Batteries	Any type of battery including lead acid (automotive) batteries. Examples include household batteries such as AA, AAA, D, button cell, 9 volt, and rechargeable batteries used for flashlights, small appliances, tools, watches, and hearing aids.
	19	Tires	Solid or pneumatic rubber or steel belted tires.
	20	Bulky Wastes/Furniture	Chairs, couches, mattresses, desks, and other oversized items made of multiple materials.
	21	Fluorescent Light Bulbs	fluorescent light tubes and compact light bulbs. This category does not include fixtures.
	22	ALL HHW	Pharmaceuticals and syringes: All prescription and non-prescription medicine, medicated ointments, mouth wash, lancets, and syringes. Does not include items such as ordinary dandruff shampoo or hand lotions. Oil-based paint & finishes: Finishes for wood, metal, or other surfaces that have a volatile organic base or solvent. Products such as lacquers, stains, paints, and urethanes. Latex paint & finishes: Water based lacquers, stains, paints, and urethanes. Pesticides: Poisons used to eradicate pests such as insects, fungus, or vegetative growth. Automotive fluids: Used or unused automotive fluids such as motor oil, anti-freeze, brake or hydraulic fluids.
			Household Hazardous: Waste means all household or commercial products not categorized elsewhere characterized as "toxic", "corrosive", "flammable", "ignitable", "radioactive", "poisonous", and "reactive". Items such as lye, untreated medical waste, oven cleaner, some detergents, and solvents.
CONSTRUCTION & DEMOLITION	23	Rock, Concrete, Brick, and Clay	Concrete, brick, stones, cut stone, clay, cement, rocks, ceramic tile and fixtures.
	24	Asphalt Shingles	Asphalt composite shingles and other roofing material made with asphalt. Examples include asphalt shingles and attached roofing tar and tar paper
	25	Painted/Stained/Treated Wood	Wood that contains an adhesive, paint, stain, fire retardant, pesticide or preservative. Painted or stained lengths of wood from construction or woodworking activities, particle board, OSB, and plywood.
	26	Clean Dimensional Lumber	Any dimensional lumber which does not contain an adhesive, paint, stain, fire retardant, pesticide or preservative; includes such items as 2x4s, 2x6s, 4x4s, etc. May contains metal items such as screws and nails.

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Class	No.	Material Category	Definition
	27	Clean/New Drywall	Means unpainted or untreated interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples include unused, broken or whole sheets of sheetrock, drywall, gypsum board, plasterboard, gypsum board, gyproc, and wallboard
	28	Demo/Painted Drywall	Means painted or treated interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples include unused, broken or whole sheets of sheetrock, drywall, gypsum board, plasterboard, gypsum board, gyproc, and wallboard
	29	Other C&D	Material generated from construction and demolition activities. Items such as PVC pipe, HVAC ducting, caulking or adhesive tubes, used paint brushes, ceiling tiles, ash, and other related C&D material.
MSW	30	Mixed MSW	Bagged waste and/or loose wastes that appear to be mixed residential or commercial waste

APPENDIX B
COMPOSITION RESULTS BY STREAM

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Appendix B – Composition Results by Stream

Material Category	City of Origin	Boulder	Rest of County	Lafayette	Superior	Superior	Boulder	Rest of County	Rest of County	Boulder
	Material Stream Generator Type	Refuse Single-Family	Refuse Single-Family	Refuse Single-Family	Refuse Town	Refuse HOA	Refuse Multi-Family	Refuse Multi-Family	Refuse Self-Haul FH	Refuse Commercial
					[1]	[1]		[2]		
Paper		23.7%	18.6%	10.6%	16.8%	18.3%	14.6%	19.4%	23.9%	23.3%
Newsprint		0.5%	0.6%	0.3%	0.3%	1.0%	0.6%	0.8%	0.0%	0.3%
High Grade Office Paper		1.5%	1.0%	0.8%	1.0%	0.7%	0.8%	1.3%	0.7%	2.4%
Shredded Paper		1.0%	0.4%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.7%
Old Corrugated Cardboard		5.1%	4.1%	1.2%	3.1%	5.4%	2.9%	2.6%	2.5%	7.1%
Magazines/Catalogs		3.4%	1.2%	1.8%	0.5%	0.7%	1.5%	2.3%	1.3%	1.5%
Mixed Recyclable Paper		3.4%	2.6%	0.6%	1.6%	2.3%	2.2%	2.5%	8.0%	2.2%
Polycoated/Aseptic Containers		0.3%	0.3%	0.3%	0.2%	0.1%	0.2%	0.4%	0.3%	0.4%
Compostable Paper		6.9%	6.7%	3.9%	7.0%	5.9%	5.3%	8.0%	9.3%	7.1%
Unrecyclable Paper		1.7%	1.6%	1.7%	3.1%	2.0%	1.2%	1.5%	1.8%	1.6%
Plastic		12.5%	12.2%	6.0%	12.1%	12.6%	14.2%	13.5%	18.7%	13.6%
#1 PET Bottles/Jars		0.9%	0.8%	0.8%	0.9%	0.3%	1.2%	1.2%	0.9%	0.5%
#2 HDPE Bottles/Jars		0.4%	0.7%	0.9%	0.4%	0.4%	0.6%	0.7%	0.5%	0.8%
Bottles #3-7		0.1%	0.1%	0.1%	0.0%	0.0%	0.2%	0.2%	0.2%	0.0%
Other Plastic Tubs/Cups <3 Gal		0.6%	0.8%	0.3%	0.6%	0.4%	0.5%	1.1%	0.3%	0.9%
Large Plastic Containers >3 Gal		0.0%	0.3%	0.0%	0.5%	0.0%	0.7%	0.0%	0.4%	0.5%
Plastic Bags		1.8%	1.4%	1.6%	1.4%	0.7%	1.1%	1.4%	1.7%	2.5%
Other Plastic Film		3.6%	3.2%	0.8%	4.9%	3.2%	1.3%	2.1%	7.6%	3.1%
Thermoforms		1.0%	0.7%	0.6%	0.8%	0.5%	0.6%	0.7%	0.3%	0.5%
Expanded Polystyrene		0.4%	0.5%	0.1%	0.4%	1.1%	0.2%	0.2%	0.3%	0.1%
Other Rigid Plastics		3.8%	3.7%	0.7%	1.9%	6.1%	7.8%	5.8%	6.5%	4.7%
Metal		5.2%	5.5%	3.9%	4.6%	5.1%	12.1%	5.3%	4.1%	2.4%
Aluminum Cans		0.3%	0.2%	0.2%	0.3%	0.1%	0.5%	0.3%	0.5%	0.3%
Aluminum Foil & Trays		0.3%	0.2%	0.4%	0.3%	0.1%	0.2%	0.3%	0.2%	0.2%
Ferrous Containers		0.6%	0.8%	0.5%	0.9%	0.2%	0.8%	0.9%	1.1%	0.3%
Other Ferrous		3.3%	3.6%	2.6%	2.8%	4.4%	8.4%	3.7%	2.3%	1.5%
Other Non-Ferrous		0.8%	0.7%	0.2%	0.3%	0.2%	2.1%	0.1%	0.0%	0.1%
White Goods		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Glass		4.5%	2.7%	2.4%	3.0%	2.2%	5.0%	2.9%	4.9%	3.0%
Glass Bottles and Jars		4.3%	2.6%	2.1%	2.7%	1.8%	4.3%	2.7%	4.1%	3.0%
Other Glass		0.2%	0.2%	0.3%	0.3%	0.5%	0.7%	0.1%	0.8%	0.0%
Organic		23.3%	32.5%	37.4%	41.6%	21.7%	22.3%	17.9%	23.1%	27.0%
Yard Waste		1.0%	7.6%	18.3%	11.3%	6.7%	1.2%	0.3%	3.6%	0.6%
Branches, Limbs, Stumps		0.0%	0.5%	0.0%	1.1%	3.4%	0.0%	0.0%	0.0%	0.0%
Food Waste		20.5%	16.0%	6.2%	24.2%	11.1%	17.9%	16.2%	17.2%	25.3%
Other Organics		1.8%	8.5%	13.0%	4.8%	0.5%	3.2%	1.4%	2.4%	1.1%
Problem Materials		25.4%	14.3%	29.2%	15.1%	29.7%	14.6%	23.6%	8.4%	20.8%
Large Electronics (Plug-in)		1.1%	1.0%	7.3%	0.5%	4.9%	2.2%	0.0%	0.0%	1.6%
Small Electronics (Recharge)		0.0%	0.3%	0.3%	0.5%	1.1%	0.7%	0.3%	0.8%	1.1%
Small Appliances		0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	1.0%
Diapers/Sanitary Products		2.9%	2.5%	3.1%	2.8%	2.0%	1.2%	4.4%	0.6%	0.5%
Textiles/Leather		4.6%	3.5%	4.1%	3.1%	5.6%	4.8%	5.0%	4.3%	4.3%
Carpet/Padding		0.2%	3.1%	0.0%	6.0%	2.8%	1.1%	0.0%	0.0%	0.0%
Batteries		0.2%	0.1%	0.0%	0.2%	0.0%	0.8%	0.0%	0.0%	0.0%
Rubber		2.4%	1.2%	1.3%	0.6%	3.2%	0.7%	0.2%	0.8%	2.3%
Tires		0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%	0.3%
Furniture/Bulky Items		11.4%	1.3%	12.2%	0.7%	2.4%	0.0%	13.1%	0.0%	7.6%
Other Inorganics		2.5%	1.2%	0.8%	0.7%	6.2%	1.4%	0.4%	1.8%	2.0%
Marijuana Waste		0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.0%	0.1%
HHW		0.3%	1.0%	0.1%	1.0%	0.1%	0.2%	0.0%	0.1%	0.9%
Fluorescent Tubes and Bulbs		0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pharmaceuticals and Syringes		0.1%	0.6%	0.1%	0.2%	0.1%	0.0%	0.0%	0.1%	0.8%
Oil-based Paint & Finishes		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Latex Paint & Finishes		0.0%	0.4%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.1%
Pesticides		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Automotive Fluids		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Other HHW		0.1%	0.1%	0.0%	0.4%	0.0%	0.2%	0.0%	0.0%	0.0%
C&D		1.8%	9.1%	6.8%	3.8%	9.2%	14.4%	4.2%	12.1%	5.6%
Aggregate/Asphalt/Ceramics		0.0%	0.4%	1.3%	0.3%	0.9%	0.6%	0.2%	0.3%	0.3%
Asphalt Shingles		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Painted/Stained/Treated Wood		0.7%	2.7%	3.3%	2.8%	1.1%	6.7%	2.3%	1.1%	1.7%
Clean Wood		0.6%	2.7%	1.9%	0.0%	3.3%	2.7%	1.7%	2.5%	1.8%
Wood Pallets		0.1%	0.7%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	1.6%
Clean/New Drywall		0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
Demo/Painted Drywall		0.2%	0.5%	0.0%	0.0%	0.0%	2.7%	0.0%	3.5%	0.0%
Other C&D		0.3%	1.9%	0.2%	0.5%	3.8%	1.7%	0.1%	4.8%	0.1%
Other		3.3%	4.1%	3.5%	2.1%	1.1%	2.7%	13.3%	4.7%	3.6%
Fines/Dirt		3.1%	3.9%	3.3%	1.7%	0.9%	2.3%	13.1%	4.5%	2.3%
Coffee Cups Non-Compostable		0.2%	0.2%	0.2%	0.4%	0.2%	0.4%	0.2%	0.2%	1.1%
BPI Certified Compostables		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Bagged Material (BCRC Only)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Number of Samples		4	14	2	7	4	4	2	4	8
Tons		11,972	37,356	3,497	2,021	3,031	12,825	20,724	643	34,374

Appendix B – Composition Results by Stream

Material Category	City of Origin	Rest of County	Lafayette	Boulder	Lafayette	Superior	Superior	Boulder	Boulder	Boulder
	Material Stream Generator Type	Refuse Commercial	Refuse Commercial	Recycling Single-Family	Recycling Single-Family	Recycling Town	Recycling HOA	Recycling Multi-Family	Recycling Commercial	Recycling Single-Family
		[3]		[4]		[5]	[5]	[6]	[7]	
Paper		23.5%	18.5%	62.9%	49.7%	58.9%	64.9%	50.6%	66.3%	8.8%
Newsprint		0.8%	0.1%	8.9%	7.9%	4.1%	4.1%	3.5%	2.2%	0.0%
High Grade Office Paper		1.0%	1.4%	2.8%	2.5%	4.3%	3.0%	0.5%	0.7%	0.0%
Shredded Paper		0.1%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
Old Corrugated Cardboard		8.2%	9.9%	30.3%	23.5%	28.9%	28.2%	29.2%	57.3%	4.4%
Magazines/Catalogs		0.5%	1.3%	11.4%	4.7%	8.7%	7.2%	3.0%	1.9%	0.0%
Mixed Recyclable Paper		3.4%	1.0%	5.4%	5.1%	7.3%	16.8%	6.2%	1.4%	0.1%
Polycoated/Aseptic Containers		0.2%	0.1%	0.8%	0.6%	0.5%	0.7%	1.3%	0.3%	0.0%
Compostable Paper		7.3%	2.8%	1.4%	2.6%	1.9%	2.5%	4.9%	1.6%	3.8%
Unrecyclable Paper		1.8%	1.8%	1.8%	2.7%	3.1%	2.1%	2.1%	0.8%	0.5%
Plastic		15.5%	12.2%	7.7%	14.5%	9.7%	8.4%	9.8%	6.7%	1.7%
#1 PET Bottles/Jars		0.7%	0.3%	1.5%	3.4%	2.7%	2.4%	1.3%	0.8%	0.1%
#2 HDPE Bottles/Jars		0.7%	0.5%	0.7%	4.2%	1.7%	1.1%	1.5%	1.6%	0.0%
Bottles #3-7		0.1%	0.1%	0.1%	0.2%	0.1%	0.0%	0.1%	0.1%	0.0%
Other Plastic Tubs/Cups <3 Gal		1.1%	0.3%	1.5%	0.6%	0.9%	0.4%	1.6%	0.4%	0.1%
Large Plastic Containers >3 Gal		1.7%	7.0%	0.2%	0.8%	0.2%	0.6%	1.3%	0.4%	0.6%
Plastic Bags		2.2%	1.6%	0.5%	0.4%	0.4%	0.7%	0.5%	0.7%	0.6%
Other Plastic Film		3.9%	1.3%	0.2%	1.1%	1.3%	0.6%	0.5%	0.9%	0.1%
Thermoforms		0.5%	0.3%	2.1%	2.1%	1.3%	1.6%	1.6%	0.5%	0.2%
Expanded Polystyrene		0.5%	0.3%	0.1%	0.4%	0.1%	0.1%	0.0%	0.2%	0.0%
Other Rigid Plastics		4.1%	0.7%	0.7%	1.2%	1.0%	0.9%	1.3%	1.1%	0.1%
Metal		4.2%	3.7%	3.6%	6.2%	3.6%	2.9%	8.1%	3.9%	0.0%
Aluminum Cans		0.4%	0.2%	1.4%	3.1%	1.4%	1.5%	1.5%	0.5%	0.0%
Aluminum Foil & Trays		0.2%	0.1%	0.1%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%
Ferrous Containers		0.6%	0.1%	1.4%	1.4%	1.8%	1.0%	5.0%	0.8%	0.0%
Other Ferrous		2.8%	2.7%	0.3%	1.5%	0.2%	0.2%	1.6%	2.1%	0.0%
Other Non-Ferrous		0.1%	0.7%	0.5%	0.1%	0.2%	0.1%	0.0%	0.4%	0.0%
White Goods		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Glass		3.5%	0.9%	20.4%	9.2%	16.1%	12.8%	22.6%	13.6%	0.0%
Glass Bottles and Jars		3.2%	0.8%	20.4%	9.2%	16.1%	12.8%	22.0%	13.6%	0.0%
Other Glass		0.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%
Organic		14.1%	14.5%	0.9%	1.0%	0.2%	0.0%	0.2%	0.8%	85.9%
Yard Waste		1.3%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	61.5%
Branches, Limbs, Stumps		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Food Waste		12.3%	8.9%	0.8%	0.9%	0.2%	0.0%	0.2%	0.8%	22.5%
Other Organics		0.5%	2.7%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	1.9%
Problem Materials		11.1%	29.5%	0.7%	8.3%	2.6%	0.1%	0.2%	0.2%	0.0%
Large Electronics (Plug-in)		2.9%	1.1%	0.2%	5.0%	1.8%	0.0%	0.0%	0.0%	0.0%
Small Electronics (Recharge)		0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Small Appliances		0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diapers/Sanitary Products		0.3%	2.6%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Textiles/Leather		3.0%	0.1%	0.4%	2.3%	0.7%	0.0%	0.2%	0.0%	0.0%
Carpet/Padding		0.0%	8.7%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Batteries		0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Rubber		2.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Tires		1.1%	6.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Furniture/Bulky Items		0.4%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other Inorganics		0.4%	0.4%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Marijuana Waste		0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
HHW		1.8%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fluorescent Tubes and Bulbs		0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pharmaceuticals and Syringes		1.4%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Oil-based Paint & Finishes		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Latex Paint & Finishes		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pesticides		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Automotive Fluids		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other HHW		0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C&D		23.9%	5.3%	0.4%	1.7%	0.3%	1.1%	0.8%	0.1%	2.5%
Aggregate/Asphalt/Ceramics		0.6%	0.6%	0.0%	0.4%	0.0%	0.1%	0.6%	0.0%	0.0%
Asphalt Shingles		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Painted/Stained/Treated Wood		2.9%	0.0%	0.1%	1.2%	0.1%	0.1%	0.2%	0.1%	0.5%
Clean Wood		6.2%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	2.0%
Wood Pallets		6.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Clean/New Drywall		1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Demo/Painted Drywall		0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other C&D		6.0%	4.6%	0.1%	0.1%	0.1%	0.8%	0.0%	0.0%	0.0%
Other		2.4%	12.3%	3.5%	9.3%	8.7%	9.8%	7.7%	8.3%	1.0%
Fines/Dirt		1.6%	12.1%	2.7%	3.7%	3.5%	2.0%	1.9%	0.7%	0.8%
Coffee Cups Non-Compostable		0.7%	0.2%	0.0%	0.1%	1.0%	0.0%	0.1%	0.0%	0.1%
BPI Certified Compostables		0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bagged Material (BCRC Only)		0.0%	0.0%	0.7%	5.5%	4.2%	7.8%	5.7%	7.6%	0.0%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Number of Samples		12	2	6	4	6	3	2	5	4
Tons		104,313	3,459	43,891	1,653	156	984	30,596	64,282	6,428

Appendix B – Composition Results by Stream

Material Category	City of Origin Material Stream Generator Type	Rest of County	Lafayette	Boulder	Boulder	Boulder	Boulder	Boulder
		Organics Single-Family [8]	Organics Single-Family	Organics Multi-Family [9]	Organics Commercial [10]	Refuse Public Bins	Recycling Public Bins	Organics Public Bins
Paper		5.3%	4.5%	6.7%	17.7%	11.6%	20.6%	19.1%
Newsprint		0.4%	0.0%	0.1%	0.0%	0.3%	5.9%	1.6%
High Grade Office Paper		0.0%	0.0%	0.0%	0.9%	0.2%	0.8%	0.0%
Shredded Paper		0.2%	1.2%	0.2%	0.2%	0.0%	0.0%	0.0%
Old Corrugated Cardboard		1.2%	2.9%	0.6%	0.7%	1.0%	3.5%	1.1%
Magazines/Catalogs		0.0%	0.0%	0.1%	0.0%	0.2%	2.4%	1.2%
Mixed Recyclable Paper		0.2%	0.0%	0.4%	0.7%	1.5%	2.8%	0.6%
Polycoated/Aseptic Containers		0.0%	0.0%	0.0%	0.2%	0.2%	0.4%	0.3%
Compostable Paper		3.3%	0.4%	4.8%	14.4%	6.1%	2.6%	13.2%
Unrecyclable Paper		0.1%	0.0%	0.5%	0.5%	2.1%	2.3%	1.1%
Plastic		0.7%	0.2%	2.2%	3.9%	9.2%	19.7%	6.4%
#1 PET Bottles/Jars		0.0%	0.1%	0.2%	0.0%	1.2%	11.0%	0.3%
#2 HDPE Bottles/Jars		0.1%	0.0%	0.7%	0.1%	0.2%	1.4%	0.0%
Bottles #3-7		0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%
Other Plastic Tubs/Cups <3 Gal		0.0%	0.1%	0.2%	0.2%	1.3%	2.2%	0.3%
Large Plastic Containers >3 Gal		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%
Plastic Bags		0.3%	0.0%	0.8%	1.5%	1.4%	0.5%	2.5%
Other Plastic Film		0.2%	0.0%	0.2%	1.5%	1.7%	0.6%	0.6%
Thermoforms		0.0%	0.0%	0.1%	0.1%	0.7%	1.4%	0.4%
Expanded Polystyrene		0.0%	0.0%	0.0%	0.3%	0.2%	0.2%	0.2%
Other Rigid Plastics		0.1%	0.0%	0.0%	0.1%	2.4%	2.1%	1.4%
Metal		0.0%	0.0%	0.4%	1.4%	2.2%	11.4%	0.6%
Aluminum Cans		0.0%	0.0%	0.3%	0.1%	0.7%	9.0%	0.1%
Aluminum Foil & Trays		0.0%	0.0%	0.0%	0.3%	0.3%	0.3%	0.4%
Ferrous Containers		0.0%	0.0%	0.2%	0.0%	0.2%	1.0%	0.1%
Other Ferrous		0.0%	0.0%	0.0%	0.6%	1.0%	1.1%	0.0%
Other Non-Ferrous		0.0%	0.0%	0.0%	0.5%	0.1%	0.0%	0.0%
White Goods		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Glass		1.5%	0.0%	1.8%	0.7%	2.4%	34.4%	2.4%
Glass Bottles and Jars		1.5%	0.0%	1.8%	0.6%	2.1%	34.4%	2.4%
Other Glass		0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%
Organic		91.5%	94.1%	87.6%	72.7%	61.1%	5.8%	59.8%
Yard Waste		64.8%	41.6%	24.9%	0.0%	4.0%	0.0%	0.1%
Branches, Limbs, Stumps		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Food Waste		24.9%	45.1%	38.9%	70.6%	15.6%	4.3%	51.7%
Other Organics		1.8%	7.4%	23.7%	2.2%	41.5%	1.5%	8.0%
Problem Materials		0.0%	0.0%	0.1%	2.6%	9.6%	3.9%	1.3%
Large Electronics (Plug-in)		0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%
Small Electronics (Recharge)		0.0%	0.0%	0.0%	0.0%	0.8%	0.1%	0.0%
Small Appliances		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diapers/Sanitary Products		0.0%	0.0%	0.0%	0.1%	1.7%	0.1%	0.7%
Textiles/Leather		0.0%	0.0%	0.0%	2.3%	4.1%	1.8%	0.0%
Carpet/Padding		0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%
Batteries		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rubber		0.0%	0.0%	0.0%	0.1%	0.8%	0.2%	0.5%
Tires		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Furniture/Bulky Items		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other Inorganics		0.0%	0.0%	0.0%	0.1%	0.8%	0.0%	0.0%
Marijuana Waste		0.0%	0.0%	0.0%	0.0%	0.2%	0.2%	0.1%
HHW		0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
Fluorescent Tubes and Bulbs		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pharmaceuticals and Syringes		0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
Oil-based Paint & Finishes		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Latex Paint & Finishes		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pesticides		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Automotive Fluids		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other HHW		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C&D		0.4%	1.1%	0.3%	0.0%	0.2%	0.0%	0.0%
Aggregate/Asphalt/Ceramics		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Asphalt Shingles		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Painted/Stained/Treated Wood		0.0%	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%
Clean Wood		0.4%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Wood Pallets		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Clean/New Drywall		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Demo/Painted Drywall		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other C&D		0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%
Other		0.5%	0.2%	0.8%	1.1%	3.6%	4.2%	10.4%
Fines/Dirt		0.4%	0.1%	0.8%	0.0%	1.9%	1.1%	1.6%
Coffee Cups Non-Compostable		0.0%	0.0%	0.0%	0.3%	1.5%	1.9%	7.0%
BPI Certified Compostables		0.0%	0.0%	0.0%	0.8%	0.2%	0.2%	1.8%
Bagged Material (BCRC Only)		0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Number of Samples		4	1	4	4	5	5	5
Tons		3,408	929	1,073	35,091			
								121
								422,707

Appendix B – Composition Results by Stream

- [1] The total Single-Family and Multi-Family Residential Refuse for the Town of Superior was allocated proportionally based on County-provided tonnage data.
- [2] Includes 5 tons from City of Lafayette Multi-Family Residential Refuse
- [3] Includes 888 tons from Town of Superior - HOA Commercial Refuse
- [4] Includes 29,155 tons from Rest of County Single-Family Residential Recycling
- [5] The total Single-Family and Multi-Family Residential Recycling for the Town of Superior was allocated proportionally based on County-provided tonnage data.
- [6] Includes 1,887 tons from City of Lafayette Mutli-Family Residential Recycling and 21,725 tons from Rest of County Multi-Family Residential Recycling
- [7] Includes all tons from Commercial Recycling
- [8] Includes 653 tons from Town of Superior Single-Family Residential Organics
- [9] Includes all tons from Multi-Family Organics
- [10] Includes all tons from Commercial Organics

Combined quantities shown in the above table notes were required in cases where an insufficient number of samples were obtained during manual sorting to reasonably characterize a particular material stream from a particular geographic origin.

APPENDIX C
COMPOSITION RESULTS BY STREAM

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Appendix C – Summary Tonnage Table

	MSW				C&D	Generated Waste
	Single-Family Residential	Multi-Family Residential	Commercial	Aggregate	Aggregate	
Refuse						
City of Boulder	11,972	12,825	34,374	59,171	26,235	85,406
City of Lafayette	3,497	5	3,459	6,961	15,295	22,256
Town of Superior	3,956	1,096	888	5,941	281	6,221
Rest of County*	37,999	20,719	103,425	162,143	33,533	195,676
Total	57,424	34,645	142,146	234,216	75,344	309,559
Recycling						
City of Boulder	14,736	6,984	37,489	59,209	7,925	67,134
City of Lafayette	1,653	1,887	1,286	4,826	581	5,407
Town of Superior	1,107	33	33	1,174	0	1,174
Rest of County	29,155	21,725	25,474	76,354	1,185	77,539
Total	46,651	30,629	64,282	141,563	9,691	151,253
Organics						
City of Boulder	6,428	1,051	33,738	41,217	0	41,217
City of Lafayette	929	6	151	1,086	0	1,086
Town of Superior	653	0	0	653	0	653
Rest of County	2,755	16	1,202	3,973	0	3,973
Total	10,765	1,073	35,091	46,929	0	46,929
Grand Total	114,841	66,347	241,519	422,707	85,034	507,742

* Rest of County Single-Family Residential includes 643 tons from Self-Haul Foothills



