Prepared for

Missouri Department of Natural Resources

Statewide Waste Composition Study

FINAL REPORT

January 5, 2018

MSW CONSULTANTS

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- Black Oak Recycling and Disposal Facility,
- Bridgeton Transfer Station,
- Central Missouri Landfill,
- Columbia Landfill,
- O'Fallon Regional Waste Transfer Station,
- Courtney Ridge Recycling & Disposal Facility,
- F.W. Disposal Transfer Station,
- MO Champ Landfill,
- Timber Ridge Landfill,
- Lee's Summit Sanitary Landfill,
- Lemons Sanitary Landfill,
- Maple Hill Sanitary Landfill,
- Pink Hill Acres Demolition Landfill,
- Prairie View Regional Waste Facility,
- Springfield Sanitary Landfill,
- St. Joseph Landfill,
- St. Louis Waste Transfer Station,
- Town and Country Disposal Transfer Station,
- Waste Corp of MO – Ozark Transfer Station,
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- Missouri Department of Natural Resources Solid Waste Management Program (MDNR SWMP)

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E. EXECUTIVE SUMMARY

E 1. INTRODUCTION

The Missouri Department of Natural Resources Solid Waste Management Program (Department) exists to oversee waste management to protect both public health and the environment. Its main goal is reducing the amount of solid wastes generated. To keep abreast of materials constituting the waste stream, the Department conducts periodic waste composition studies. The state's twenty Solid Waste Management Districts work closely with the Department and use the study results to target waste generation and support diversion programs in their respective regions.

The Department has sponsored statewide waste characterization study (WCS) projects on two previous occasions dating back to 1996. This Executive Summary highlights notable findings from the 2016-2017 Missouri Statewide Waste Composition Study (2017 Study).

E 2. STUDY OBJECTIVES

In updating Missouri's waste composition data set, the 2017 Study sought to achieve multiple important objectives, many of which were performed to provide comparative results to prior Studies:

- Gather waste flow data to determine statewide generator sector breakdown into Municipal Solid Waste (MSW) as well as non-MSW categories of waste including Construction, Demolition, Industrial, Special and Other wastes;
- Gather waste composition data using a proven, transparent methodology that is statistically representative of the State's disposed waste streams;
- Capture representative samples of MSW originating from the Residential and Commercial/Institutional (CI) sectors for the purpose of differentiating composition from each of these sectors;
- Capture representative composition data for non-MSW, including Construction, Demolition, and Industrial waste sectors for the purpose of differentiating composition from each of these sectors;
- Capture representative samples of wastes originating from rural, small metro and large metro areas of the state in a manner that allows for aggregating a statewide composition in proportion to the contribution from each demographic stratum;
- Determine the types and quantities of potentially recoverable recyclable and compostable materials found in the disposed waste stream; and
- Have the final study methodology and results serve as a comprehensive update, allowing for comparison with previous studies, while also incorporating best practices for waste characterization studies that have evolved since the prior study.

E 3. MISSOURI SOLID WASTE DISPOSAL

The sampling plan for the 2017 Study sought to capture samples representatively from across the state. As a starting point, the state's disposal facilities were grouped by demographic region. Table E-1 details the breakdown of disposal facilities and the respective tonnages in the state's Large Metro, Small Metro and Rural areas. The tonnages were derived from 2016 Sanitary Landfill Tonnage reports in conjunction with information provided by the Department with respect to imported and exported wastes by facility. The characterization results obtained over two seasons (2016 and 2017) are applied to the 2016 disposal tonnage and the report is referenced as the 2017 Study throughout.

Table E-1 Missouri Solid Waste Disposal by Demographic Region

Demographic Region	# Disposal Facilities	2016 Tonnage	Percent of Total	2007 Tonnage	Percent of Total
Rural	43	1,568,051	27.2%	2,243,995	36.7%
Small Metro	9	919,531	16.0%	688,098	11.3%
Large Metro	30	3,277,072	56.8%	3,177,499	52.0%
Total	**82**	**5,764,654**	**100.0%**	**6,109,592**	**100.0%**

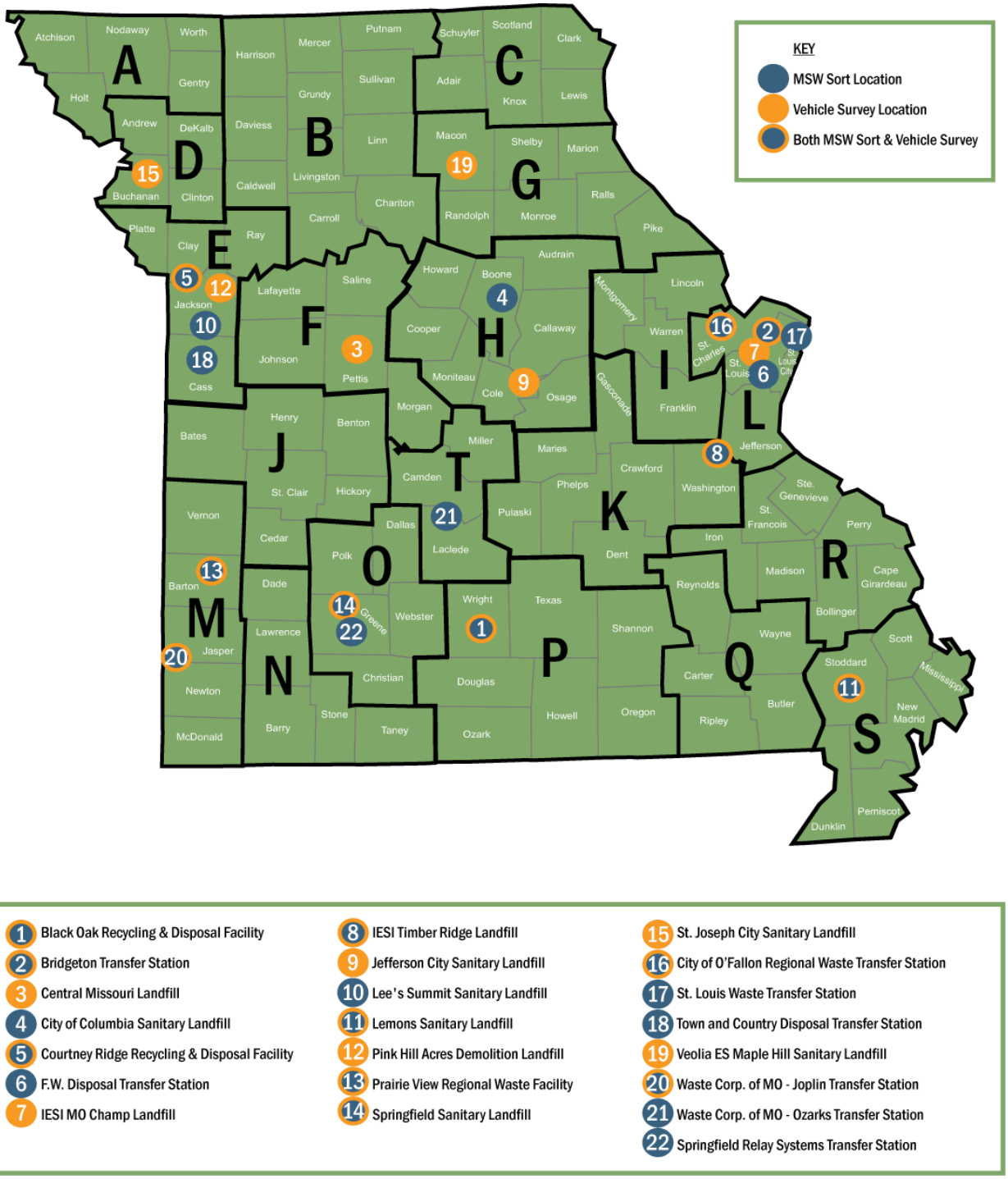
E 4. METHODOLOGY OVERVIEW

This study captured samples of disposed waste at twenty-two facilities in Missouri. This includes sixteen facilities that hosted sampling and manual sorting of municipal solid waste (MSW), and fifteen facilities which hosted the gate surveys of all inbound vehicles followed by visual volumetric surveying of non-MSW loads. Figure E-1 plots the location of the host facilities.

Manually sorted samples of MSW were collected during two seasonal field data collection events in the fall of 2016 (Sept. 15 – Oct. 7) and again in summer of 2017 (May 17 – June 14). The gate surveys and visual surveying of non-MSW were performed in spring of 2017 (Mar. 23 – Apr. 13).

Over 1,200 trucks were surveyed at host facilities to determine waste types. A total of 254 samples of MSW were manually sorted from across the state, and another 345 loads of non-MSW (weighing a combined 1,452 tons) were visually surveyed to estimate composition.

Figure E-1 Waste Characterization Host Facilities



E 5. FINDINGS

E 5.1 GATE SURVEY RESULTS

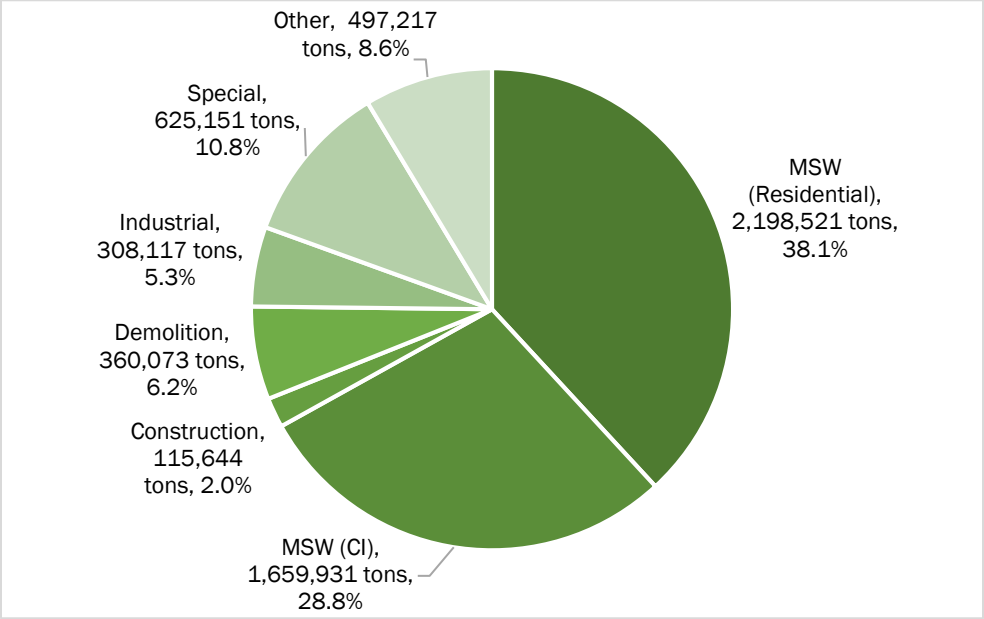
Gate surveys at each host facility were performed to provide a representative distribution of inbound wastes for use in estimating Missouri's overall disposed waste stream, and consisted of interviewing and

cataloging all inbound loads of waste for one full day at each participating host facility Given that the participating landfills collectively disposed of 82-83 percent of the state's disposed waste, the gate survey findings are believed to be reasonable for use in estimating and aggregating statewide quantities of the various material types included in the study. Limitations to the representativeness of gate surveys are discussed in the body of this report.

Gate survey results were analyzed individually by demographic region, and aggregated to create a statewide estimate of the quantity of each of the targeted waste types of MSW, Construction, Demolition, Industrial, Special and Other

The 2016 total Statewide tonnage, 5,764,654 tons derived as described earlier, was applied to the breakdown of gate surveys to extrapolate waste type tonnages. The results of the gate survey are shown in Figure E-2. As shown, almost exactly two-thirds (67 percent) of all disposed waste was found to be municipal solid waste (MSW), with smaller fractions of non-MSW waste types. The MSW waste is further detailed as Residential and Commercial/Institutional (CI) as displayed.

Figure E-2 Missouri Solid Waste Disposal by Waste Type



E 5.2 STATEWIDE AGGREGATE SOLID WASTE COMPOSITION

Figure E-3 shows the composition and tonnage of all disposed solid waste in 2016. As shown, Organics is the most prevalent group, but there are also significant fractions of Non-MSW, Paper, Inorganic materials and Plastics in the waste stream.

Figure E-3 Missouri Statewide Waste Composition and Quantities Disposed (tons)

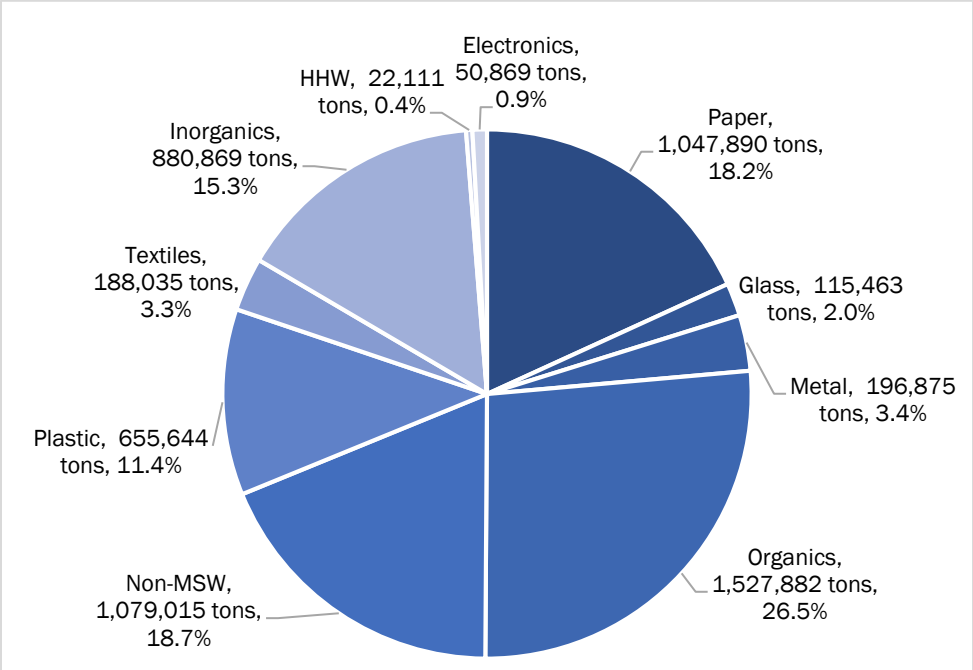


Figure E-4 shows the top 10 most prevalent materials in the Missouri statewide disposed solid waste stream. As shown, Contaminated Soil and Food Waste were found to be the most commonly disposed materials, each at just over 10 percent. Corrugated Cardboard also made the list.

Figure E-4 Top 10 Most Prevalent Materials Statewide

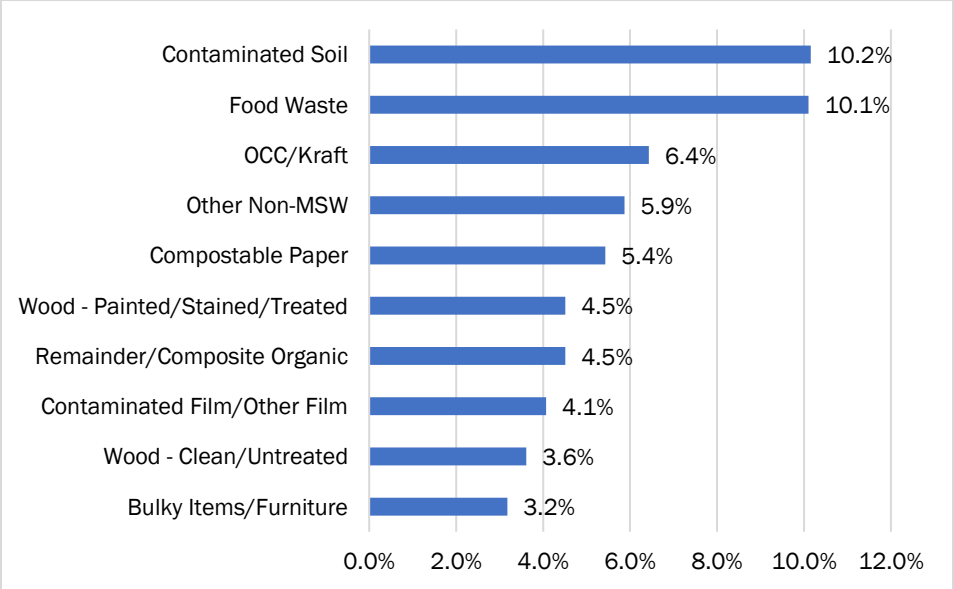
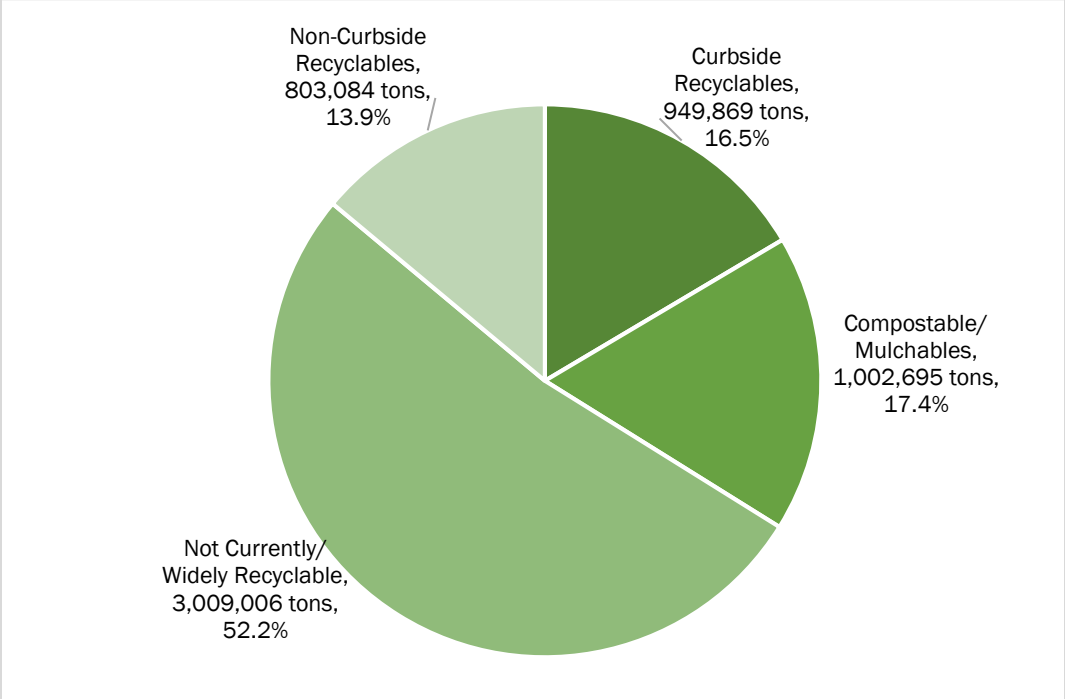


Figure E-5 presents the composition of disposed waste in terms of the potential for diverting materials from disposal. This figure was developed by assigning a "Diversion Strategy" to each individual

constituent in the waste stream. Specifically, each material was defined as one of the four categories listed below.

- **Curbside Recyclables:** Includes recyclable fiber (e.g., newsprint, corrugated cardboard, magazines, paperboard, office paper and other mixed paper), recyclable containers (e.g., metal, plastic and glass containers).
- **Compostables/Mulchables:** Includes compostable/mulchable organics – food waste, compostable paper and yard waste.
- **Non-Curbside Recyclables:** Includes recyclables other than curbside recyclables that can typically be accepted at third party recyclers, reuse/donation centers, or retailers (e.g., clean film/film bags, other non-container (scrap) metals, clean wood, C&D debris, HHW, textiles/leather products, computer/electronics, tires, etc.).
- **Not Currently/Widely Recyclable:** Includes all other materials that are not currently recyclable (or are recycled only minimally) in Missouri (e.g., mattresses/boxsprings, expanded polystyrene, non-container glass, disposable diapers/sanitary products, and composite materials). There may be some recovery of certain of these materials, but it is not believed recycling of these materials is widespread.

Figure E-5 Statewide Divertibility of Disposed Wastes



As shown, over 52 percent of statewide materials are not commonly divertible. As previously mentioned, a significant portion of the state's waste stream consists of Contaminated Soils and other industrial byproducts. However, almost half of the disposed waste stream could conceivably be diverted.

Detailed results for the composition of the statewide composition of all Solid Waste combined can be found in Section 6 of this report.

E 5.3 MSW COMPOSITION

Figure E-6 shows the composition of all disposed MSW in 2016, aggregating the Residential and CI generator sectors. As shown, Organics and Paper are the most common material groups and comprise almost two-thirds of the disposed waste stream.

Figure E-6 Missouri Statewide Municipal Solid Waste Composition

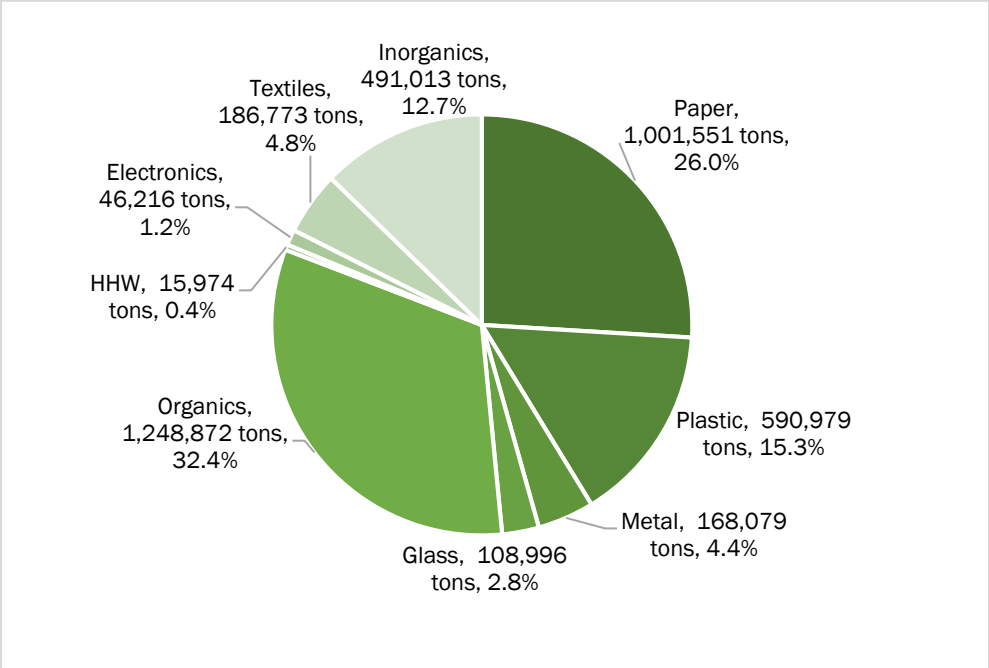


Figure E-7 shows the top 10 most prevalent materials in the MSW stream. As shown, Food Waste was found to be the most prevalent material at 15 percent of the stream. Several other compostable items also made the top 10 list. The 2017 Study also shows a meaningful amount of corrugated cardboard and mixed recyclable paper being in the disposed MSW stream.

Figure E-7 Top 10 Most Prevalent Materials in Statewide MSW Stream

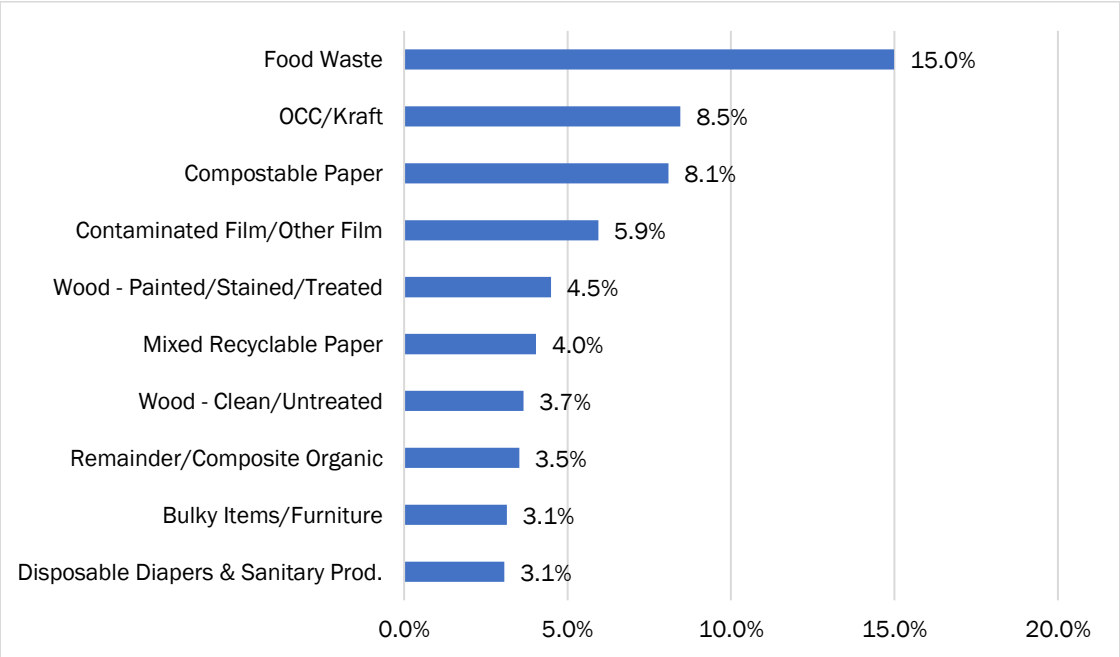


Figure E-8 presents the composition of disposed MSW in terms of the potential for diverting materials from disposal using the "Diversion Strategy" assignments listed above.

Figure E-8 Divertibility of Disposed MSW

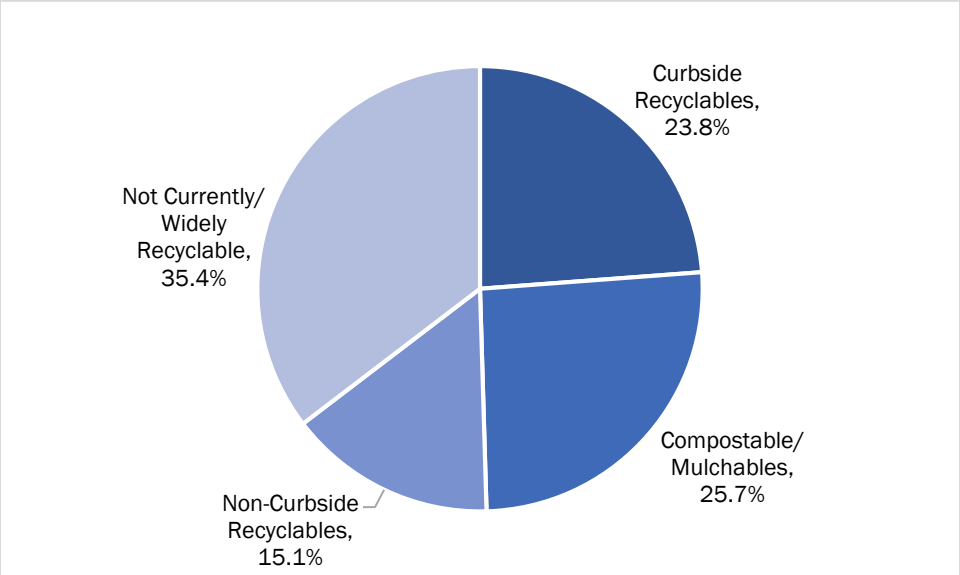


Figure E-9 compares composition of MSW from Residential and Commercial/Institutional (CI) sources.

Figure E-9 Comparison of MSW Composition by Generator Sector

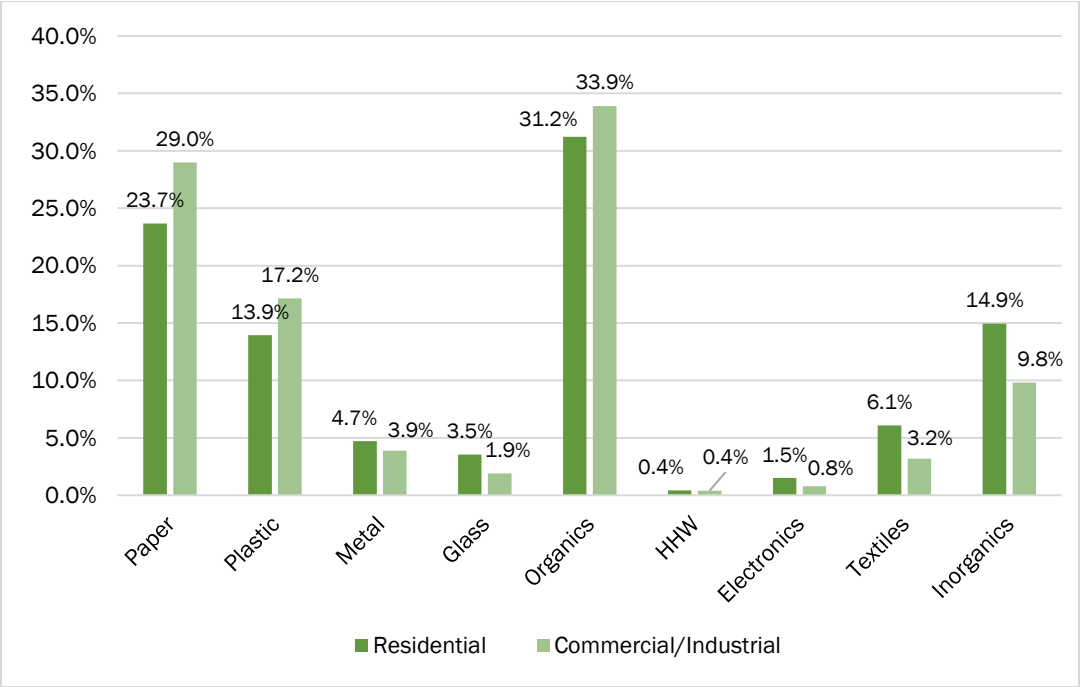
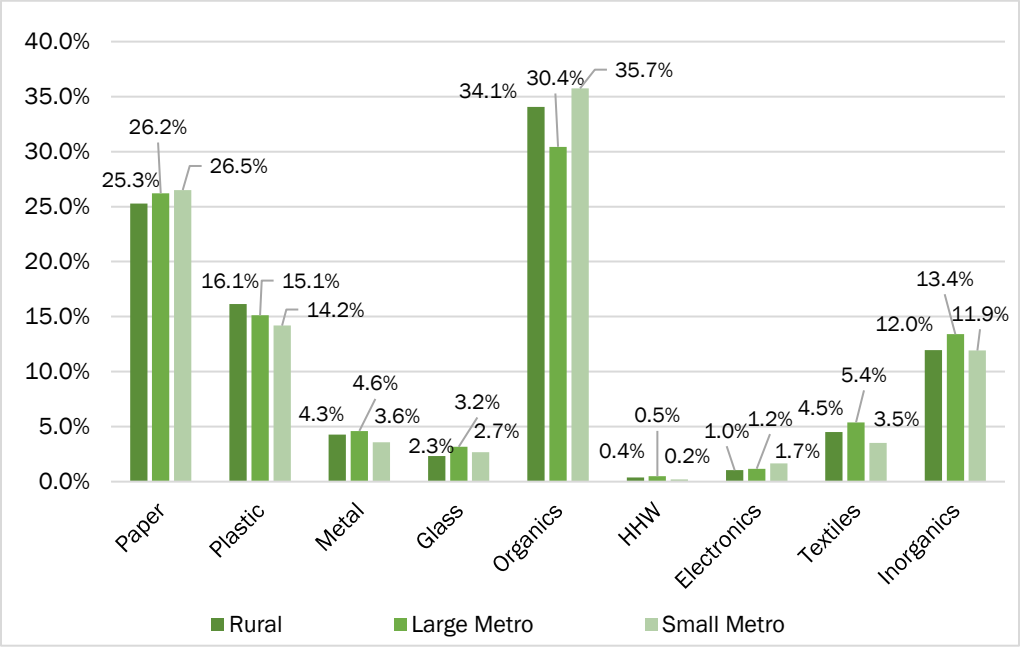


Figure E-10 compares the percentage composition of MSW for wastes originating in Large Metro, Small Metro and Rural areas.

Figure E-10 Comparison of Aggregate MSW by Demographic Area



Section 4 of this report contains extensive data about MSW composition by demographic area, by generator sector, and in the aggregate for Missouri.

E 5.4 CONSTRUCTION WASTE COMPOSITION

The 2017 Study compiled gate survey and visual load survey data to estimate the composition of the non-MSW waste types (Construction, Demolition, Industrial, Special and Other) that were defined for this study and comparable to the 2008 Study. Figure E-11 summarizes the composition of Construction waste in Missouri, and Figure E-12 provides the ten most prevalent constituents in Construction waste.

Figure E-11 Construction Waste Composition

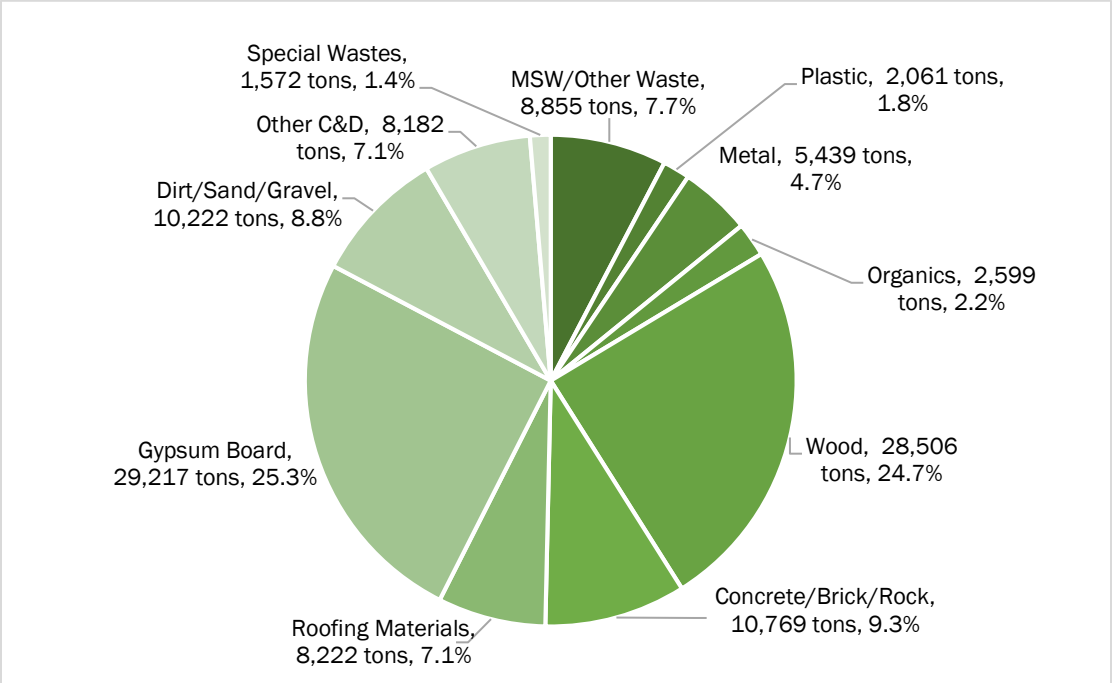
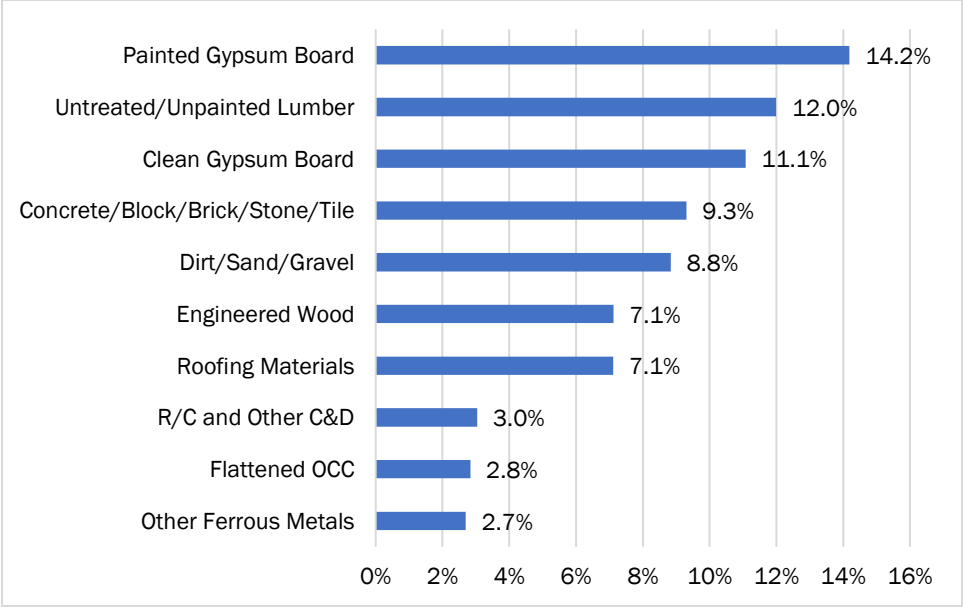


Figure E-12 Top 10 Most Prevalent Materials in Construction Waste



Detailed results for the composition of Construction waste by demographic region and in the aggregate can be found in Section 5 of this report.

E 5.5 DEMOLITION WASTE COMPOSITION

Figure E-13 summarizes the composition of Demolition waste in Missouri, and Figure E-14 provides the ten most prevalent constituents in Demolition waste.

Figure E-13 Demolition Waste Composition

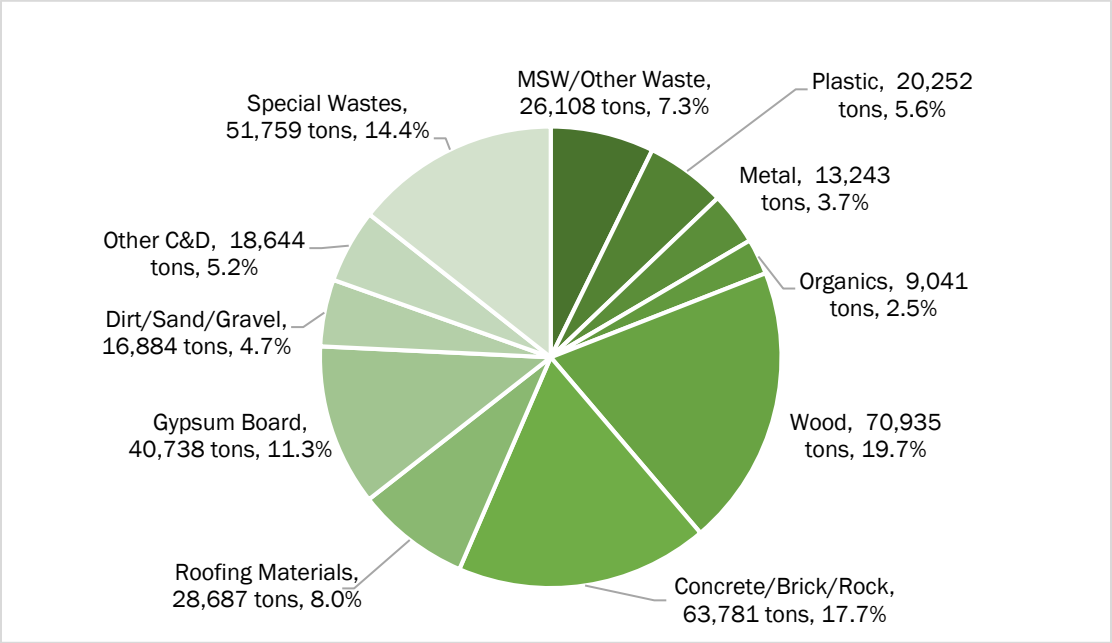
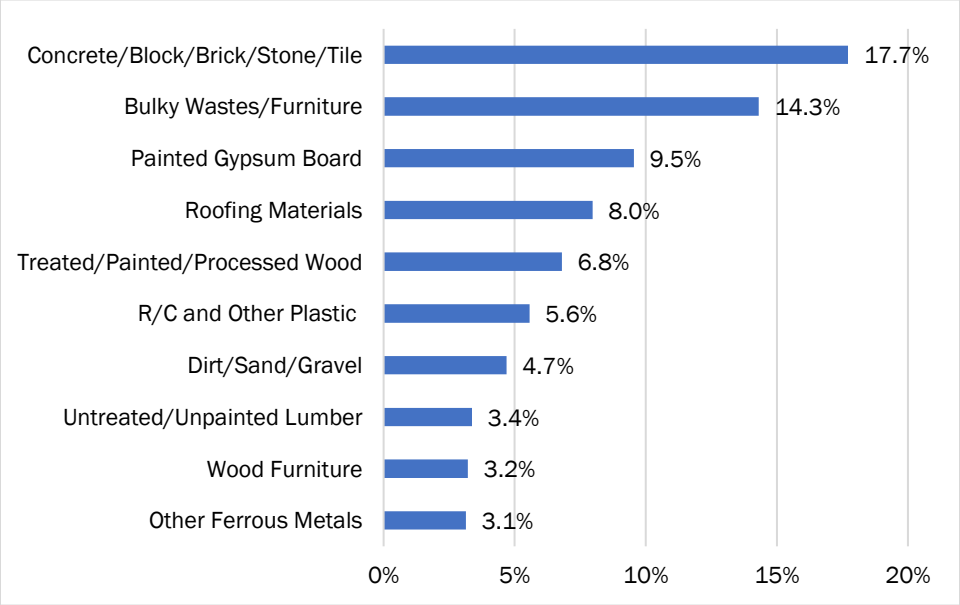


Figure E-14 Top 10 Most Prevalent Materials in Demolition Waste



E 5.6 INDUSTRIAL WASTE COMPOSITION

Figure E-15 summarizes the composition of Industrial waste in Missouri, and Figure E-16 provides the ten most prevalent constituents in Industrial waste.

Figure E-15 Industrial Waste Composition

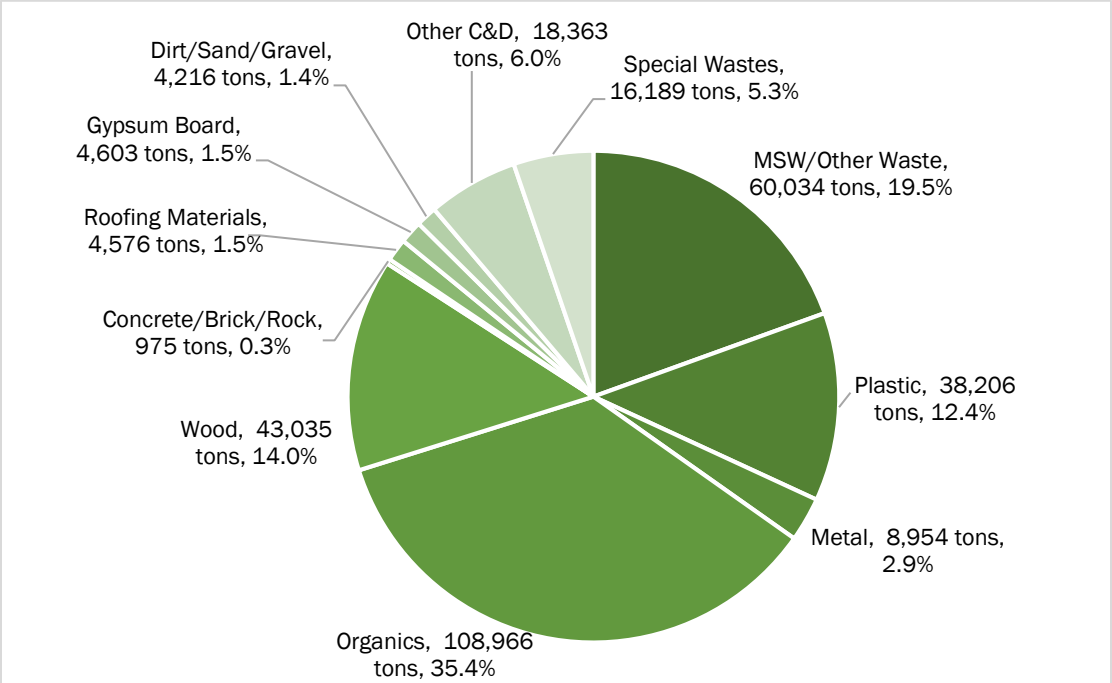
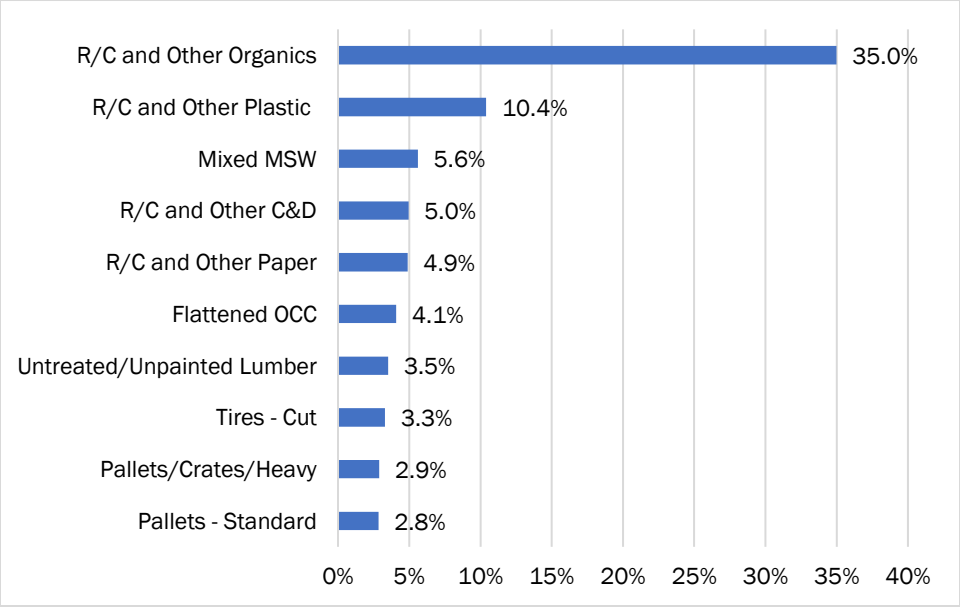


Figure E-16 Top 10 Most Prevalent Materials in Industrial Waste



Detailed results for the composition of Industrial waste by demographic region and in the aggregate can be found in Section 5 of this report.

E 5.7 SPECIAL AND OTHER WASTE COMPOSITION

Two non-MSW waste streams were characterized based strictly on the gate survey. Figure E-17 summarizes the composition of Special wastes in Missouri, and Figure E-18 shows the same breakdown

for Other wastes. Further results for the composition of Special and Other wastes can be found in Section 5 of this report.

Figure E-17 Special Waste Composition

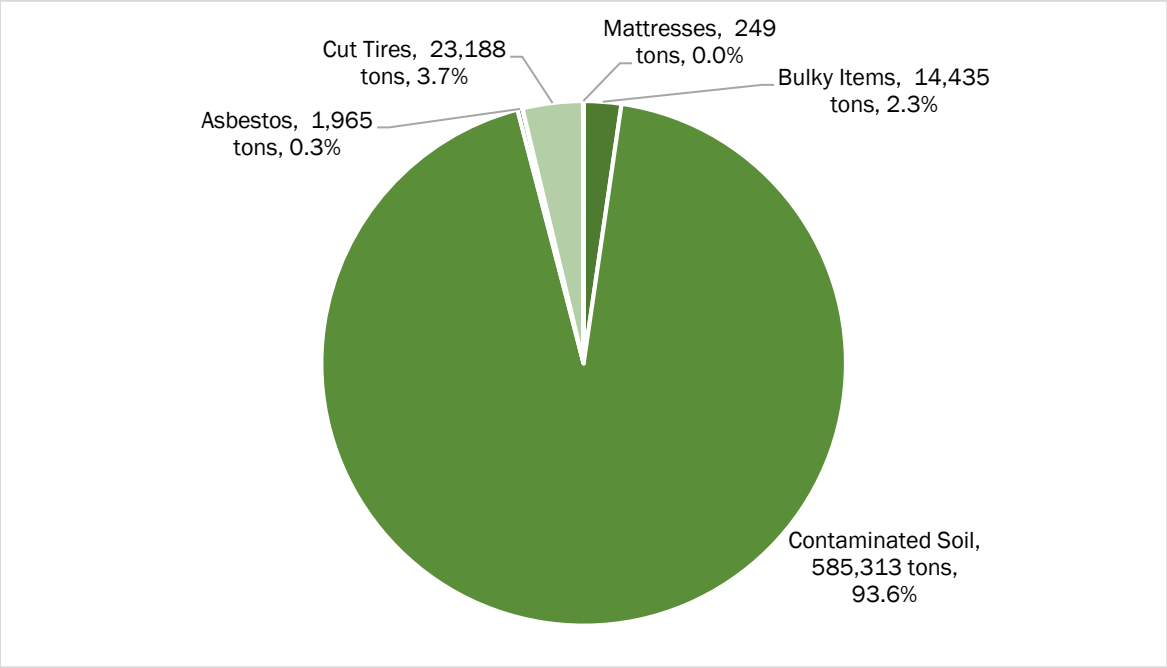
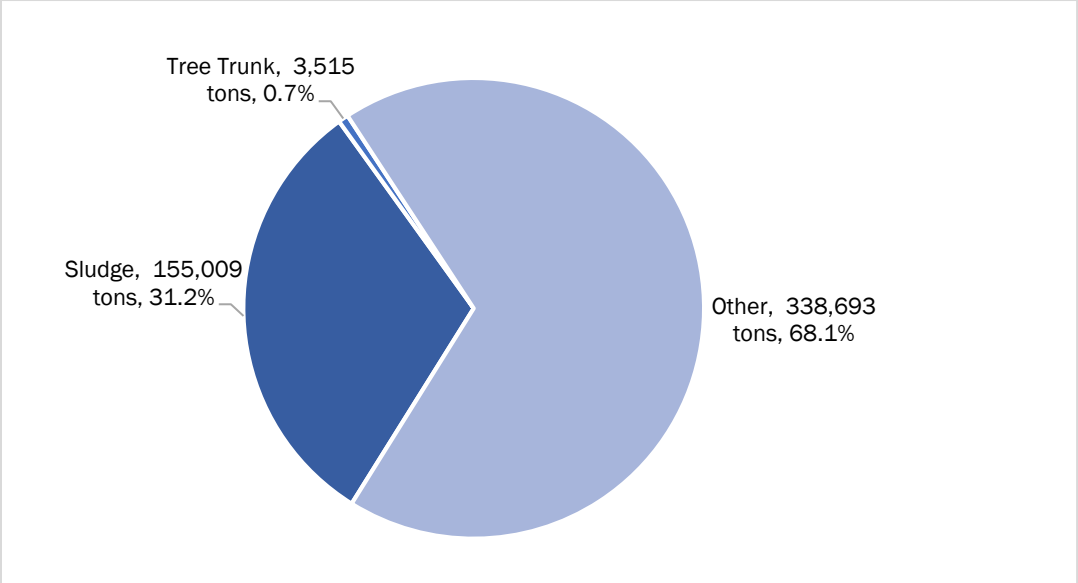


Figure E-18 Other Waste Composition



E 5.8 COMPARISONS WITH 2008 STUDY RESULTS

The body of this report contains comparisons for most results sets between the 2017 Study and the 2008 Study. It should be noted that the waste composition methodology in the 2017 Study did not follow the

2008 Study methodology, and at least some of the apparent changes in the waste stream may be caused by methodological differences. Although the methodology differences limit some of the ability to compare, the 2017 Study reasonably reflects a number of expected changes to Missouri's overall waste stream that are consistent with changes found in other waste characterization time series data that have used entirely similar methodologies.

E 6. CONCLUSIONS

The 2017 Study provides a comprehensive update to prior statewide waste characterization research, and also updates the research methodology to better apply best practices associated with representative sampling of both MSW and non-MSW loads of waste, as well as visual surveying of C&D and bulky loads. The 2017 Study captured good representation of both Residential wastes and CI wastes, as well as all MSW in the aggregate, and the statewide results for Residential, CI and aggregate disposed MSW are in line with the results experienced by other states that have performed similar large-scale studies. Further, the gate survey and visual analysis of non-MSW waste streams provides Missouri with a more comprehensive snapshot of disposed wastes compared to many states that only analyze the MSW stream.

The 2017 Study also found:

- Single Stream Recycling: The incidence of recyclable fibers and containers continues to diminish in the disposed MSW stream.
- Cardboard: There appears to be a meaningful amount of corrugated cardboard being disposed rather than recycled in Missouri.
- Organic Wastes: While not all organics are compostable, over one-fourth of the state's disposed waste stream is made up of organic materials, including 15 percent of Food Waste, Clean Wood and Yard Waste combined. Additionally, industrial food manufacturing waste contains a significant fraction of organics that could likely be composted if separated from other industrial waste constituents.
- Hard-to-Recycle Wastes: The 2017 Study also found that just over half of the entire disposed solid waste stream cannot be readily recycled, composted or diverted without significant investments in processing infrastructure, development of new recycled material markets, and adoption of new diversion programs in all generator sectors.
- Demographic Differences: There are differences in waste composition depending on geographic region. The highest proportion of wastes are generated in Large Metro areas, and consequently the statewide waste composition is weighted toward the Large Metro areas.

Section 6 of this report also contains a list of recommendations for future study or for the next statewide waste characterization update.

1. INTRODUCTION

1.1 BACKGROUND

The Missouri Department of Natural Resources Solid Waste Management Program (Department) exists to oversee waste management to protect both public health and the environment. Its main goal is reducing the amount of solid wastes generated. To keep abreast of materials constituting the waste stream, the Department conducts periodic waste composition studies. The state's twenty Solid Waste Management Districts work closely with the Department and use the study results to target waste generation and support diversion programs in their respective regions.

The Department has sponsored statewide waste characterization study (WCS) projects on two previous occasions dating back to 1996.

- 1996-98 Waste Characterization Study: Over a three-year period from 1996 to 1998, the Department conducted a series of data collection projects, with the results published in 1998 (1998 Study).
- 2006-08 Waste Characterization Study: The second iteration of the statewide waste characterization occurred over the time period from 2006 to 2008, with two separate reports being published. The 2006-07 phase analyzed the MSW waste stream with manual sorting of residential and commercial/institutional loads. In 2008, the non-MSW Visual Surveying phase was completed. The results of the 2006-07 MSW WCS were incorporated in the 2008 report to represent the breakdown of the MSW fraction determined for the overall waste stream (2008 Study).

MSW Consultants was retained to conduct a comprehensive update to the prior studies during 2016 and 2017 (2017 Study). The field data collection for this update occurred in the fall 2016 and spring 2017. The Department can use the 2017 Study to provide current technical assistance to the Districts to identify and pursue greater diversion opportunities throughout their communities.

1.2 OBJECTIVES

In updating Missouri's waste composition data set, the 2017 Study sought to achieve multiple important objectives, many of which were performed to provide comparative results to prior Studies:

- Gather waste flow data to determine statewide generator sector breakdown into Municipal Solid Waste (MSW) as well as non-MSW categories of waste including Construction, Demolition, Industrial, Special and Other wastes;
- Gather waste composition data using a proven, transparent methodology that is statistically representative of the State's disposed waste streams;
- Capture representative samples of MSW originating from the Residential and Commercial/Institutional (CI) sectors for the purpose of differentiating composition from each of these sectors;
- Capture representative composition data for non-MSW, including Construction, Demolition, and Industrial waste sectors for the purpose of differentiating composition from each of these sectors;
- Capture representative samples of wastes originating from rural, small metro and large metro areas of the state in a manner that allows for aggregating a statewide composition in proportion to the contribution from each demographic stratum;
- Determine the types and quantities of potentially recoverable recyclable and compostable materials found in the disposed waste stream; and
- Have the final study methodology and results serve as a comprehensive update, allowing for comparison with previous studies, while also incorporating best practices for waste characterization studies that have evolved since the prior study.

1.3 COMPARISONS WITH PRIOR STUDIES

From the outset, it was DNR's intent that the 2017 Study be performed so that the results could be reasonably compared to prior study results. Such comparability will provide the greatest insight to solid waste and recycling planners in evaluating changes to the disposed waste stream.

It should be noted that the Project Team's approach for this update contained some new approaches to obtain the desired data. Readers should be aware of both the similarities and the differences (some minor and some potentially significant) between the two studies. These are summarized below and addressed in greater detail in the body of the report.

1.3.1 SIMILARITIES

Because of the need to compare results with prior studies, and because DNR has historically performed such comprehensive studies of the state's waste stream, there were a number of important, over-arching similarities between the 2017 Study and prior studies.

- **Definitions of Municipal Solid Waste (MSW) and non-MSW**: The 2017 Study, like the prior studies, reports on the composition of the state's entire solid waste stream destined for disposal. The study therefore includes both municipal solid waste (MSW) as well as non-MSW, which includes Construction, Demolition, Industrial, Special and Other wastes, all of which are consistently defined with prior studies.
- **Focus on Wastes Generated In-State:** Like prior studies, the 2017 Study focused only on wastes generated within the borders of Missouri. No imported wastes were included in the data collection. Also, consistent with prior studies, all data was collected from in-state disposal facilities (i.e., no data collection was performed in surrounding states that may receive wastes transferred from Missouri).
- **Seasonality of Manual Sorting:** During the MSW portion of the 2008 study, two sampling seasons took place in the fall and spring, whereas the 2017 Study's two periods of sorting occurred in the fall and late spring/early summer.
- **Breadth of Data Collection:** Similar to previous studies, fifteen facilities were initially selected for MSW manual sampling, five of which were participants in the 2008 Study.[1] Fifteen facilities were also selected for Visual Surveying activities, twelve of which hosted data collection during the previous study. Overall, twenty-two facilities were involved in hosting activities for 2017, compared to twenty-five in the previous study. Facility name reference for the report was discussed with the Department and it was determined to use the "commonly known as" facility names.
- **Combination of Manual and Visual Data Collection:** Like the previous studies, the 2017 Study utilized both manual sampling of MSW, combined with visual surveys of non-MSW loads of waste, in order to characterize the entire disposed waste stream. However, certain aspects of both manual sampling/sorting and visual surveying were updated in the 2017 Study (see next section).
- **Sample Sizes:** Consistent with previous studies, MSW sample sizes are targeted at 200-250 pounds each; and non-MSW loads selected for the study were visually assessed in their entirety (i.e., the entire load was characterized).

[1] Between the first and second season it was determined it would be beneficial to sample an upstream transfer station (Springfield Relay) rather than a second season at the receiving landfill (Prairie View) to capture additional direct haul loads, so a sixteenth facility was ultimately added in the 2017 Study

1.3.2 DIFFERENCES

Importantly, the 2017 Study served to update the data collection and analytical protocols to enhance the accuracy of the study results and to integrate best practices in the field of waste characterization that have evolved since prior studies.

- **More Material Categories:** As plastics, fibers and C&D related markets have expanded substantially over the past decade, material categories used for the 2017 Study were similarly expanded. Forty-eight material categories were used in the MSW characterization activity, an increase from the 28 used in the 2008 Study. For the non-MSW waste characterization activities, the 2017 study incorporated forty-two material categories, also a substantial increase over the previous study.
- **Seasonality of Visual Characterization:** The 2008 study's non-MSW one sampling season took place in the summer and early fall, contrary to the 2017 Study's non-MSW segment, which occurred for three weeks in the spring.
- **Obtaining Representative Samples of Waste:** Whereas previous studies tended to allocate sampling with a primary goal of distributing samples across the state geographically, the 2017 Study allocated samples more in line with the quantity of wastes generated within regions of the state. Specifically, more samples were targeted in the regions with greater tonnage. The Department agreed to this approach and the sampling plan integrated a heavier weighting of wastes from large metro regions. Even with this sampling allocation approach, a statistically significant number of samples were obtained from all regions of the state.
- **Segregation of Residential and CI Wastes:** Although prior studies identified the percentage of each sorted MSW load that originated from the Residential and Commercial/Institutional (CI) sectors, the samples were not analyzed by this sector distinction. The 2017 Study differentiates MSW between Residential waste and CI wastes and provides composition data for each generator type.
- **Updated MSW Sampling Protocol:** While all previous studies have attempted to obtain randomly selected samples from tipped loads, the 2017 Study relied on random selection of the location within each load from which samples were taken, and also relied on mechanical grab sampling (i.e., use of a bobcat or loader) rather than manual removal of a portion of the tipped load as was used in the 2008 Study. Industry standards recommend mechanical grab sampling because the heavy equipment is better able to remove a portion waste from a heavy, tipped load compared to manual strength. Additionally, the mechanical grab samples minimize human judgment in determining what items to include in the sample.
- **Gate Surveying:** At each of the host disposal facilities, the 2017 Study incorporated full days of gate surveying of inbound deliveries to better estimate the proportion of each type of waste being disposed. These surveys took place at the scalehouse and captured feedback from both the driver and the scalehouse operator to give the best classification of the load's contents. The gate survey results were subsequently used in developing weighting factors to aggregate statewide waste characterization. In the 2008 Study, surveying of loads was performed from a distance and characterization was based only on a visual assessment of the tipped load (i.e., no driver or scalehouse input was captured to validate visual observations), and was supplemented by a compilation of daily scale ticket reports.
- **Improved Visual Characterization Protocol for Non-MSW:** The 2017 Study integrated industry-standard advances in the use of visual, volumetric surveying of non-MSW loads of waste. Consistent with best practices for visual surveying, non-MSW loads were disaggregated into forty-two material categories using a protocol that involved walking around the tipped load at a close-up range. The 2017 Study is also the first large statewide study to incorporate real-time, density-to-weight converted composition calculations using MSW Consultants' proprietary data management platform installed on a rugged tablet computer. This characterization tool dramatically improves the accuracy of visual composition estimates compared to paper-based forms analyzed after the fact. Previous studies relied on visual estimates recorded on paper forms, and were made at a distance rather than up close next to the tipped load.

- **Increase in Overall Samples Taken:** Additional samples were taken at a few locations during the course of the MSW sampling activity. This occurred during both seasonal startup days at the Columbia Landfill, where two days were scheduled at the site to allow for labor training and startup activities. Extra samples were taken at four additional facilities when conditions were favorable with loads arriving well within time allotment, etc., as a safeguard against future inclement weather or other unforeseen circumstances. There were no sites that failed to reach the minimum number of targeted samples. This will have the impact of increasing the precision of the statewide results of the 2017 Study compared to prior studies, as confidence intervals will be narrower.

The similarities and differences are addressed in further detail where appropriate throughout this report.

1.4 REPORT ORGANIZATION

In addition to this Introduction and an Executive Summary, the report is divided into the following sections:

- **Methodology:** This section presents an overview of waste generation and disposal data available from disposal facility reports, and used for the purpose of aggregating waste composition results. This section also discusses demographic regions and solid waste districts, and summarizes the sampling plan that was developed to guide the study process and to provide statistically defensible data. Finally, this section summarizes the field data collection methods and analytical methods applied in the study.
- **Gate Survey Results:** This section presents results of the gate surveys, which were used to estimate the quantity of each waste stream (MSW, Construction, Demolition, Special and Other waste), and also the contribution from three demographic strata (Rural, Small Metro and Large Metro) in the state.
- **MSW Composition:** This section provides extensive and detailed composition and quantity data for MSW generated in Missouri. Results are provided for aggregate MSW, as well as individually for the Residential and CI sectors. Results are also presented by demographic strata, and where applicable, the 2017 Study results are compared to the 2008 Study results to identify differences. Results are presented in both tabular and graphical format to highlight findings of interest. Results are also provided for comparison to the previous study.
- **Non-MSW Composition:** This section contains composition data for the non-MSW waste streams captured in the study. Composition estimates are provided individually for Construction, Demolition, Industrial, Special and Other wastes, both in the aggregate state-wide and also for the three demographic strata included in the analysis. Results are presented in both tabular and graphical format, and comparisons to the 2008 Study are included where applicable.
- **Conclusions and Recommendations:** This section combines the MSW composition and non-MSW composition results to present a snapshot of the composition of Missouri's entire solid waste stream. These results are summarized in graphs and tables, and compared to 2008 Study results where applicable. This section also presents conclusions that can be drawn from the 2017 Study as well as recommendations for usage of the data and for future study.
- **Appendices:** Supplemental data and analysis are contained in several appendices, one for each participating facility.

2. METHODOLOGY

2.1 INTRODUCTION

This section provides the statewide disposal data that is used throughout the study to develop weighting factors and also to which the resulting composition estimates are applied to determine the tonnage of all constituents in the waste stream. This section also describes the field data collection and analytical methods used.

2.2 REPORTED STATEWIDE MSW DISPOSAL

2.2.1 STATE REPORTS

Missouri disposal facilities are required to report disposal quantities to the Department. Landfills must report the tonnage of all wastes disposed that originated in Missouri. Transfer stations must report the quantity of wastes exported for disposal in an adjacent state. Combining these two figures provides an excellent accounting of the total waste that is generated in Missouri and destined for disposal. Table 2-1 summarizes this tonnage by disposal district.

Table 2-1 Missouri Waste Disposal by District

District	District Name	No. of Disposal Facilities	2016 Tonnage	Percent of Total	2007 Tonnage	Percent of Total
A	Northwest Missouri SWMD	3	27,666	0.5%	21,098	0.3%
B	North Missouri SWMD	3	0	0.0%	2,244	0.0%
C	Northeast Missouri SWMD	1	20,744	0.4%	22,778	0.4%
D	Region D Recycling & Waste Mgt. Dist.	1	112,701	2.0%	136,964	2.2%
E	Mid-America Reg. Council SWMD	11	812,183	14.1%	695,409	11.4%
F	West Central Missouri SWMD	4	488,817	8.5%	364,658	6.0%
G	Mark Twain SWMD	3	261,113	4.5%	324,998	5.3%
H	Mid-Missouri SWMD	5	340,757	5.9%	396,469	6.5%
I	East Central SWMD	2	27,681	0.5%	30,301	0.5%
J	Quad-Lakes SWMD	3	12,519	0.2%	10,289	0.2%
K	Ozark Rivers SWMD	5	290,831	5.0%	226,071	3.7%
L	St. Louis-Jefferson SWMD	19	2,182,889	37.9%	2,482,090	40.6%
M	Region M SWMD	3	412,991	7.2%	529,812	8.7%
N	Southwest Missouri SWMD	3	0	0.0%	0	0.0%
O	Ozark Headwaters Recycling and Materials Mgmt. Dist.	3	254,776	4.4%	103,107	1.7%
P	South Central SWMD	2	279,300	4.8%	362,725	5.9%
Q	Ozark Foothills Regional SWMD	0	0	0.0%	209,169	3.4%
R	Southeast Missouri SWMD	7	42,562	0.7%	82,756	1.4%
S	Bootheel SWMD	2	197,124	3.4%	108,654	1.8%
T	Lake of the Ozarks SWMD	2	0	0.0%	0	0.0%
Total		**82**	**5,764,654**	**100.0%**	**6,109,592**	**100.0%**

As shown, over 5.7 million tons were generated in the state in 2016. Table 2-1 also reflects the waste disposal tonnage by District along with the comparable 2007 tonnage, the annual period utilized for the 2008 study. Although there have been minor changes and a slight decrease in the state's waste generation, the distribution of wastes has remained relatively unchanged over time.

2.2.2 DEMOGRAPHIC REGIONS

According to the U.S. Census, the 2016 Missouri population was estimated to be just over six million. Consistent with the 2008 Study, this update grouped disposal facilities into three distinct demographic divisions. The waste generation regions are identified as follows:

- **Large Metro Region**: The two Large Metro Regions in Missouri are Kansas City and St. Louis.
- **Small Metro Region**: The Small Metro Regions are Columbia, Jefferson City, Joplin, Springfield and St. Joseph.
- **Rural Region**: The remaining facilities hosting study activities are in lesser populated, Rural Regions of the state.

Table 2-2 summarizes the number of disposal facilities and waste disposal by demographic region. This table also shows the same data from the 2008 Study for reference.

Table 2-2 Missouri Waste Dispersion by Demographic Region

Demographic Region	# Disposal Facilities	2016Tonnage	Percent of Total	2007 Tonnage	Percent of Total
Rural	43	1,975,051	34.3%	2,243,995	36.7%
Small Metro	9	794,531	13.8%	688,098	11.3%
Large Metro	30	2,995,072	52.0%	3,177,499	52.0%
Total	**82**	**5,764,654**	**100.0%**	**6,109,592**	**100.0%**

2.2.3 ADJUSTMENTS TO WASTE GENERATION BY DEMOGRAPHIC REGION

At the current time, Missouri transfer stations are not required to report which in-state landfills receive their transferred wastes. However, in Missouri (as in most regions of the country) waste tends to flow from more densely populated Regions to less populated Regions. In particular, disposal facilities in Rural Regions receive wastes generated in Large Metro and Small Metro Regions.

Although it was beyond the scope of this study to exhaustively survey the state's disposal facilities, several of the host facilities (introduced in the following section) reported intrastate transfers from Large or Small Metro Regions to Rural Regions.[1] Table 2-3 displays the flow of these wastes.

Table 2-3 Estimated Waste Transfer between Demographic Regions

	Estimated Annual Tons Leaving Demographic Region	Transferred From	Transferred To
O'Fallon TS	78,000	Large Metro	Rural
Springfield Relay TS	125,000	Small Metro	Rural
Town & Country TS	204,000	Large Metro	Rural
	407,000		

[1] Town & Country Landfill transfers waste to Central Missouri Landfill in Sedalia, Springfield Relay transfers to Prairie View Landfill in Lamar, and O'Fallon transfers a portion of inbound waste to Eagle Ridge Landfill in Bowling Green.

Table 2-4 adjusts 2016 waste generation to correct for the reported intrastate transfers. Not surprisingly, this adjustment shifts additional tonnage back to the Large and Small Metro Regions. The adjusted tonnage in this table is used as a basis for aggregating individual facility data into regional and then statewide totals.

Table 2-4 Adjusted Missouri Waste Dispersion by Demographic Region

Demographic Region	# Disposal Facilities	2016 Tonnage	Percent of Total	2007 Tonnage	Percent of Total
Rural	43	1,568,051	27.2%	2,243,995	36.7%
Small Metro	9	919,531	16.0%	688,098	11.3%
Large Metro	30	3,277,072	56.8%	3,177,499	52.0%
Total	**82**	**5,764,654**	**100.0%**	**6,109,592**	**100.0%**

2.3 HOST FACILITY SELECTION AND SAMPLING TARGETS

Because the state's waste generation patterns have remained relatively static, and to maximize comparability with the 2008 Study, it was attempted to recruit as many of the same host facilities as in the 2008 Study. However, the 2017 Study modified the host facility selection to more heavily weight the Districts that generate more waste.

2.3.1 HOST FACILITIES FOR MSW SAMPLING AND SORTING

Samples were allocated across two seasons and 16 host facilities. Table 2-5 presents the host facilities selected for host sampling and manual sorting of MSW in the 2017 Study. This table also contains the sampling targets and an accounting of the actual samples obtained. As shown, the study successfully met or exceeded sampling targets, capturing 254 samples of MSW in total.

Table 2-5 Sort Facilities Samples and District

District	Demo Region	Facility	Planned Samples	Actual Samples: Resi-dential	Actual Samples: Com'l/ Inst'l	Actual Samples: Total	Differ-ence
P	Rural	Black Oak Recycling & Disposal Facility	16	14	3	17	+1
L	Small Metro	Bridgeton Transfer Station	24	12	13	25	+1
H	Small Metro	City of Columbia Sanitary Landfill	16	16	10	26	+10
L	Large Metro	City of O'Fallon Transfer Station	16	10	6	16	0
E	Large Metro	Courtney Ridge Recycling & Disposal Facility	24	10	15	25	+1
L	Large Metro	F. W. Disposal, LLC Transfer Station	16	8	8	16	0
K	Rural	IESI Timber Ridge Landfill	8	3	5	8	0
E	Large Metro	Lee's Summit Sanitary Landfill	16	9	7	16	0
S	Rural	Lemons Sanitary Landfill, LLC	8	4	4	8	0
M	Rural	Prairie View Regional Waste Facility	16	2	6	8	-8
O	Small Metro	Springfield Relay Transfer Station	0	4	4	8	8
O	Small Metro	Springfield Sanitary Landfill	16	10	6	16	0
L	Large Metro	St. Louis Waste Transfer Station	16	5	11	16	0
E	Large Metro	Town and Country Disposal Transfer Station	16	9	7	16	0
M	Small Metro	Waste Corporation of Missouri - Joplin Transfer Station	16	10	7	17	+1
T	Rural	Waste Corporation of Missouri - Ozarks Transfer Station	16	11	5	16	0
		Total	**240**	**137**	**117**	**254**	**+14**

It is important to note that the host facilities shown in the above table proportionately distribute the manual sampling and sorting across Districts where the waste is generated. Table 2-6 compares the distribution of samples by District with the percentage of the state's disposed waste reported to be disposed in that district. As shown in this table, the distribution of sampling targets closely matches the distribution of statewide waste disposal.

Table 2-6 Percentage of Waste Contribution by Participating Districts

			Tons (CY16)		Samples		
District	District Name	No. of Facilities Sampled	Tons	Percent of Total	No.	Percent of Total	Statewide Tons - Percent
A	Northwest Missouri SWMD	0	0	0.0%	0	0.0%	0.5%
B	North Missouri SWMD	0	0	0.0%	0	0.0%	0.0%
C	Northeast Missouri SWMD	0	0	0.0%	0	0.0%	0.4%
D	Region D Recycling & Waste Mgt. Dist.	0	0	0.0%	0	0.0%	2.0%
E	Mid-America Reg. Council SWMD	3	812,183	24.3%	57	22.4%	14.1%
F	West Central Missouri SWMD	0	0	0.0%	0	0.0%	8.5%
G	Mark Twain SWMD	0	0	0.0%	0	0.0%	4.5%
H	Mid-Missouri SWMD	1	340,757	6.6%	26	10.2%	5.9%
I	East Central SWMD	0	0	0.0%	0	0.0%	0.5%
J	Quad-Lakes SWMD	0	0	0.0%	0	0.0%	0.2%
K	Ozark Rivers SWMD	1	290,831	7.4%	8	3.1%	5.0%
L	St. Louis-Jefferson SWMD	4	2,182,889	17.6%	73	28.7%	37.9%
M	Region M SWMD	2	412,991	17.8%	25	9.8%	7.2%
N	Southwest Missouri SWMD	0	0	0.0%	0	0.0%	0.0%
O	Ozark Headwaters Recycling and Materials Mgmt. Dist.	2	254,776	8.7%	24	9.4%	4.4%
P	South Central SWMD	1	279,300	9.9%	17	6.7%	4.8%
Q	Ozark Foothills Regional SWMD	0	0	0.0%	0	0.0%	0.0%
R	Southeast Missouri SWMD	0	0	0.0%	0	0.0%	0.7%
S	Bootheel SWMD	1	197,124	7.8%	8	3.1%	3.4%
T	Lake of the Ozarks SWMD	1	0	0.0%	16	6.3%	0.0%
	Totals	16	4,770,851	100.0%	254	100.0%	100.0%

2.3.2 HOST FACILITIES FOR GATE SURVEYING AND VISUAL SURVEYING

Table 2-7 summarizes the 15 solid waste facilities that were recruited to host two days each of visual and gate surveying for this project.

Table 2-7 Visual Survey Facilities by District

District	Demographic Region	Facility Name
D	Small Metro	St. Joseph Landfill
E	Large Metro	Courtney Ridge Landfill
E	Large Metro	Pink Hill Acres Demolition Landfill
F	Rural	Central Missouri Landfill
G	Rural	Maple Hill Landfill
H	Small Metro	Jefferson City Landfill
K	Rural	Timber Ridge Landfill
L	Large Metro	O'Fallon Transfer Station
L	Large Metro	Champ Landfill
L	Large Metro	Bridgeton Transfer Station
M	Small Metro	Joplin Transfer Station
M	Rural	Prairie View Landfill
O	Small Metro	Springfield Sanitary Landfill
P	Rural	Black Oak Landfill
S	Rural	Lemons Landfill

Table 2-8 compares the percentage of waste received in these facilities with the total waste generated by District. This table shows also tonnage data from 2015. It was developed prior to the field data collection and was included in the 2017 Study Design, and is shown here for reference. As shown, the selected host facilities receive waste roughly in proportion to the waste generated by district.

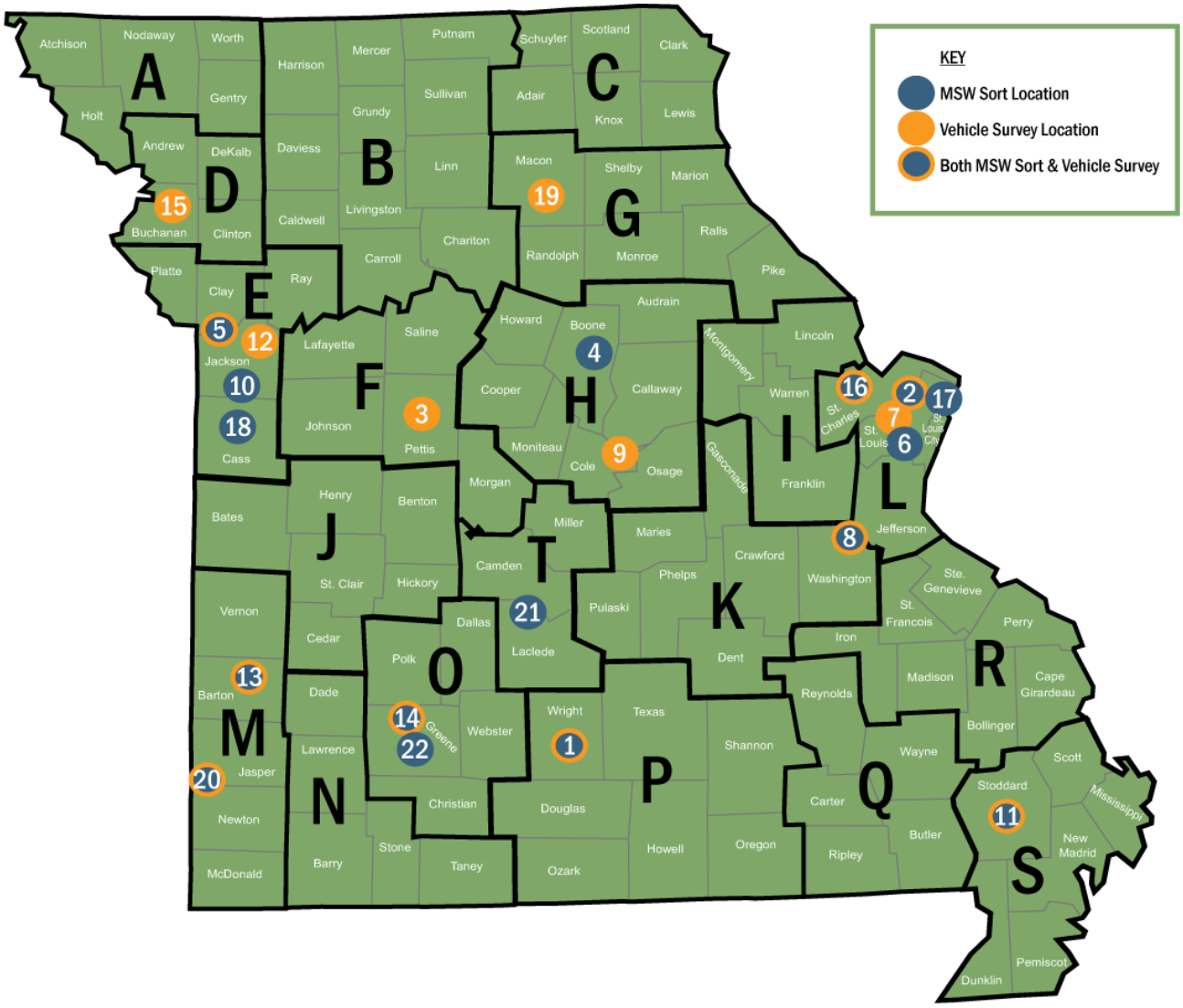
Table 2-8 Facilities Hosting Visual Surveys

District	District Name	No. of Disposal Facilities	Tons CY2015	Percent of Total	Statewide Distribution of Disposed Waste
D	Region D Recycling & Waste Mgt. Dist.	1	102,633	2.6%	1.9%
E	Mid-America Reg. Council SWMD	2	563,900	14.5%	12.9%
F	West Central Missouri SWMD	1	312,491	8.0%	7.2%
G	Mark Twain SWMD	1	130,485	3.4%	3.8%
H	Mid-Missouri SWMD	1	329,155	8.5%	6.0%
K	Ozark Rivers SWMD	1	195,926	5.0%	5.0%
L	St. Louis-Jefferson SWMD	3	1,096,493	28.2%	38.6%
M	Region M SWMD	2	467,249	12.0%	8.8%
O	Ozark Headwaters RMMD	1	228,538	5.9%	4.2%
P	South Central SWMD	1	259,978	6.7%	4.7%
S	Bootheel SWMD	1	204,227	5.2%	3.7%
	All Others	N/A	N/A	0.0%	2.2%
	Totals	15	3,891,075	100.0%	96.8%

2. METHODOLOGY

Figure 2-1 identifies all disposal facilities that hosted the various data collection activities for the 2017 Study.

Figure 2-1 Waste Characterization Host Facilities



MSW Consultants believes that the 2017 Study provided a comprehensive and highly representative data set for use in characterizing the statewide waste stream.

2.4 DATA COLLECTION APPROACH

Consistent with the 2008 study, there were three main components to the field data collection for the 2017 Study:

- **Gate Survey**: A survey of inbound loads was performed at fifteen landfills and transfer stations across the state to determine the originating generator sector of wastes and to identify certain waste types and subtypes.
- **Sampling and Sorting of MSW**: Two seasons of MSW load sampling and manual sorting was conducted at fifteen landfills and transfer stations, characterizing the materials into forty-eight categories.
- **Visual Surveying of Non-MSW**: To determine the materials comprising the Industrial, Construction and Demolition waste streams, fifteen facilities were visited and loads visually characterized into forty-two categories utilizing electronic field forms developed integrating material densities for real-time balancing of load weights and volumes.

These field data collection components are described in the sections below.

2.5 GATE SURVEY

2.5.1 WASTE TYPES

Consistent with prior studies, wastes were classified into the following major waste types:

- **Municipal Solid Waste (MSW)**: Routinely generated wastes from residential, commercial and institutional waste generators, commonly collected in commercial compacting collection vehicles (including compactor roll-offs). Includes MSW delivered by self-haulers.
- **Construction**: Wastes generated at construction sites, including renovation projects. May be collected by commercial haulers in open top containers, or by contractors self-hauling their debris.
- **Demolition**: Wastes generated from demolition activities. Although hauled and delivered in a manner similar to Construction waste, Demolition waste is more attached to each other, pulverized, or unable to be easily separated.
- **Industrial**: Wastes that are byproducts of industrial or manufacturing processes. Industrial waste is normally homogeneous, containing a single waste product and/or its packaging. This waste is normally delivered to the waste facility in open top roll-off containers or compactor units.
- **Special**: Defined based on the 2008 Study, and includes contaminated soils, asbestos, bulky items, tritium and e-scrap.
- **Other**: Defined based on the 2008 Study, and consists primarily of sludge/biosolids and tree trunks and limbs. May include other wastes not elsewhere classified.

Subsets of material categories for MSW, Construction, Demolition, and Industrial wastes are described in the following sections.

2.5.2 DATA COLLECTION SCHEDULE

Table 2-9 identifies the facilities hosting field data collection by District and indicates the date(s) on which the major data collection efforts occurred. Consistent with the 2008 Study, MSW was sampled and sorted in two seasons (September 15 to October 7, 2016; and May 17 to June 14, 2017).

Table 2-9 Field Data Collection Schedule by Host Facility

District	Facility Name	MSW Season 1 Dates (2016)	Visual Survey Dates (2017)	MSW Season 2 Dates (2017)
D	St. Joseph City Sanitary Landfill		Mar.27-28	
E	Courtney Ridge Recycling & Disposal Facility	Sep.26-27	Mar.29-30	Jun.14
E	Lee's Summit Sanitary Landfill	Sep.29		Jun.12
E	Pink Hill Acres Demolition Landfill		Mar.31, Apr.3	
E	Town and Country Disposal Tr. St.	Sep.28		Jun.13
F	Central Missouri Landfill, Inc.		Apr.4-5	
G	Veolia ES Maple Hill Sanitary Landfill		Apr.6-7	
H	Columbia Sanitary Landfill	Sep.15-16		May 17-18
H	Jefferson City Sanitary Landfill		Apr.6-7	
K	IESI Timber Ridge Landfill		Apr.10-11	May 19
L	Bridgeton Transfer Station	Oct.3	Apr.12-13	Jun.8-9
L	City of O'Fallon Regional Waste Tr. St.	Oct.4	Apr.10-11	Jun.7
L	F.W. Disposal LLC, Transfer Station	Oct.6		Jun.5
L	IESI MO Champ Landfill, LLC		Apr.12-13	
L	St. Louis Waste Transfer Station	Oct.5		Jun.6
M	Prairie View Regional Waste Facility	Sep.19	Apr.4-5	
M	Waste Corporation of Missouri-Joplin Tr. St.	Sep.20	Mar.29-30	May 22
O	Springfield Relay Transfer Station			May 24
O	Springfield Sanitary Landfill	Sep.21	Mar.27-28	May 23
P	Black Oak Recycling & Disposal Facility	Sep.22	Mar.31, Apr.3	May 25
S	Lemons Sanitary Landfill, LLC	Oct.7	Mar.23-24	
T	Waste Corporation of Missouri-Ozarks Tr. St.	Sep.23		May 26

Table 2-10 details the facilities where the Gate Survey was conducted.

Table 2-10 Gate Survey Facilities Details

Observation Date	Facilities	2016 Tonnage*	Included in 2008 Study	Owner
4/1/2017	Black Oak Landfill	279,300	Yes	Waste Corp.
4/12/2017	Bridgeton Transfer Station	307,637	No	Republic
4/5/2017	Central MO Landfill	402,980	No	Waste Corp.
3/29/2017	Courtney Ridge Landfill	627,250	Yes	Republic
4/13/2017	Champ Landfill	1,053,580	No	Waste Conn.
4/10/2017	Timber Ridge Landfill	200,940	Yes	Waste Conn.
4/6/2017	Jefferson City Landfill	160,780	Yes	Republic
3/24/2017	Lemons Landfill	197,124	Yes	Republic
4/6/2017	Maple Hill Landfill	138,017	Yes	Advanced
4/10/2017	O'Fallon Transfer Station	78,000	No	Municipal
4/5/2017	Prairie View Landfill	326,694	Yes	Republic
4/3/2017	Pink Hill Acres Demolition Landfill	48,755	Yes	Bowen
3/27/2017	Springfield Landfill	254,776	Yes	Municipal
3/27/2017	St. Joseph City Landfill	112,701	Yes	Municipal
3/29/2017	Joplin Transfer Station	65,872	No	Waste Corp.

**Only Exported Waste Reported by Transfer Stations*

2.5.3 SURVEY METHODOLOGY

Inbound vehicles were surveyed at fifteen host facilities to identify the type of waste contained in the load. One full day (eight hours) of surveying was performed at each facility. For each inbound vehicle arriving at the scalehouse, MSW Consultants recorded information about the vehicle, scale data obtained from the scalehouse, and also interviewed the driver to ascertain details about the type(s) of waste contained in the load. At the conclusion of each day, survey results were compiled. The gate survey field form used for data collection in this task is included in Appendix W.

Table 2-11 summarizes the gate survey coverage on the scheduled survey days. As shown in the table, the survey was an effective method to capture comprehensive data about wastes arriving on the given day. Although it is possible that the waste flow and origin of delivered wastes varies somewhat by day, in combination the gate surveys from these 15 facilities provide a robust profile of the mix of waste types being disposed in Missouri.

Table 2-11 Gate Survey Summary

Facility Name	Loads Observed	Hours Observed	Tons Observed
Black Oak Landfill	82	8	1246.8
Bridgeton Transfer Station	103	8	576.0
Central MO Landfill	71	8	1256.3
Courtney Ridge Landfill	164	8	1731.4
IESI MO Champ Landfill	144	8	1786.0
IESI Timber Ridge Landfill	51	8	594.8
Jefferson City Landfill	62	8	405.1
Lemons Landfill	99	8	1297.2
Maple Hill Landfill	40	8	460.4
O'Fallon Transfer Station	86	8	396.2
Prairie View Landfill	70	8	1403.4
Pink Hill Acres Demolition Landfill	10	8	55.2
Springfield Sanitary Landfill	96	8	867.3
St. Joseph Landfill	130	8	461.5
Joplin Transfer Station	43	8	209.1
Totals	**1,251**	**120**	**12,746.5**

For purposes of comparison, Table 2-12 compares the load survey metrics from the 2008 and 2017 Studies. In 2008, inbound loads were surveyed from afar (i.e., there was no interview of the driver nor input from scalehouse personnel to confirm the waste type and origin of the loads). However, the 2008 Study captured a larger number of loads. The 2017 Study sought to apply a more streamlined approach to arrive at largely comparable estimates to the 2008 Study.

Table 2-12 Gate Survey

Study	Loads Surveyed via Scale Report	Loads Surveyed from Scale House	Tons Surveyed
2008	7,771		67,364
2017		1,251	12,747

2.5.4 LIMITATIONS

The gate survey methodology implies that the distribution of inbound loads on a given day is generally representative of the distribution of inbound loads over a longer period of time. Given that waste generation is ongoing and that collection routes are typically balanced across the work week, this assertion seems reasonable for most waste types which are collected routinely from the wastesheds served by the host facilities.

However, there may be some waste types and collection patterns in evidence on the day of the gate survey that are not representative of the monthly or annual waste flow. For example, special projects that generate large volumes of certain special waste types on a temporary basis may be over represented. Examples

include large demolition projects, contaminated site clean-up (contaminated soils) and other unique instances that cause a short-term spike in waste disposal patterns. To the extent any such variations in normal waste disposal patterns occurred during the day of the gate survey at a particular host facility, the resulting variance could propagate through to the statewide waste characterization results.

In the absence of such a gate survey, there would be no way to identify, much less quantify, certain waste types disposed within the state. Because the participating landfills collectively disposed of 82-83 percent of the state's disposed waste, MSW Consultants believes the findings of the gate surveys are appropriate for use in estimating statewide quantities of the various material types included in the study.

2.6 COMPOSITION ANALYSIS

2.6.1 OVERVIEW

Composition data was collected for disposed wastes using:

- **Grab Sampling and Manual Sorting** for MSW was conducted at fourteen facilities in Season 1, fourteen facilities in Season 2, with sixteen different facilities hosting the activity overall. Three of the facilities only hosted Manual Sorting for one of the two seasons.
- **Visual Volumetric Surveying** of non-MSW loads (C&D, Industrial, Bulky, etc.) was completed at fifteen different facilities.

The respective facilities and completed schedule are depicted in Table 2-12 above. Detailed data collection methods are described in the next two sections.

2.7 MSW COMPOSITION METHODOLOGY

2.7.1 GENERATOR TYPES

Municipal solid wastes (MSW) were delineated between the following generator types:

- **Residential**: Includes waste generated in single family and multi-family residential households. Residential wastes are predominantly delivered by commercial rearload, sideload and potentially frontloading collection trucks. Some multi-family wastes may be delivered in compactor boxes.
- **Commercial/Institutional (CI):** Includes waste generated in commercial and institutional establishments. CI wastes are typically collected in frontload and rolloff compactors. Some CI waste may be collected in rearloaders as well as open top containers.

It is important to note that loads containing less than 80% of either residential or CI waste were not sampled. This means that transfer trailer waste was omitted from the sampling and sorting (although they were captured in the gate surveys). This is because it is not possible to discern the generator sector from transfer trailer wastes.

2.7.2 DEMOGRAPHIC REGIONS

Sampling locations were also classified by their demographic regions. The number of Residential and CI samples taken by demographic region is summarized in Table 2-13.

Table 2-13 MSW Samples by Demographic Region

Demographic Region	Residential	CI	Total
Rural	43	30	73
Small Metro	40	27	67
Large Metro	54	60	114
Total	**137**	**117**	**254**

2.7.3 SAMPLING AND SORTING METHODOLOGY

Elements of the MSW composition study design are summarized below.

- **Sample Weights**: Consistent with industry standards and RFP specifications, samples were collected targeting 200 to 250 pounds. The average of the 254 samples spanning both seasons was just over 217 pounds.
- **Material Categories**: A total of 48 material categories were defined for this project. These are summarized in Table 2-14. Complete definitions are contained in Appendix X. The Remainder/Composite categories refer to items in various material groups which do not otherwise fall in more specific categories. Materials characterized as Remainder/Composite (R/C) may be primarily one material, but combined with other materials. Typically, there is no market or recyclable outlet for these categories.

Table 2-14 Material Categories for Manual Sorting of MSW

Paper	**Glass**
Corrugated Cardboard/Kraft Paper (Uncoated)	Clear Glass Containers
Newsprint	Brown Glass Containers
Magazines	Green/Blue Glass Containers
(High Grade) Office Paper	Other Glass
Mixed Recyclable Paper	**Organics**
Compostable Paper	Food Waste
Remainder/Composite Paper	Wood – Clean/Untreated
Metal	Wood – Painted/Stained/Treated
Aluminum Cans	Disposal Diapers and Sanitary Products
Other Aluminum	Yard Waste
Ferrous Food Cans	Remainder/Composite Organic
Other Ferrous	**Household Hazardous Wastes (HHW)**
Other Non-ferrous	HHW
Oil Filters	
Plastics	**Inorganics**
#1 PET Bottles	Fines
#1 PET Non-Bottle Containers	Gypsum Drywall
#2 HDPE Containers – Natural	Asphalt, Concrete, Brick and Rock
#2 HDPE Containers – Colored	Carpet and Carpet Padding
Clean Film Bags	Other Construction & Demolition Debris
Clean Industrial/Commercial Film (Non-bag)	Bulky Items/Furniture
Contaminated Film/Other Film	Mattresses/Boxsprings
Plastic Containers #3 through #7	Tires
#6 Expanded Polystyrene	Other/Not Elsewhere Classified
Bulky Durable Plastics	**Textiles**
Remainder/Composite Plastic	Textiles – Clothing
Electronics	Textiles – Non-Clothing
Electronic Waste (E-Waste)	Shoes/Belts/Leather

- **Vehicle Selection**: A systematic selection procedure was used to select inbound loads for sampling. Each day at each facility, the sampling interval was calculated by dividing the total expected number of loads arriving at the facility by the number of samples needed that day. The resulting number is the sampling frequency, which determines whether every third vehicle, every sixth vehicle, or every 20th vehicle is selected for sampling.
- **Grab Sampling**: Selected loads of waste designated for sorting were tipped in the designated area at each host facility. From each selected load, one representative and random sample of waste 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 sample 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. This concept of systematically rotating around subsequent loads is shown in Figure 2-2. Pictures of sampling are shown in Figure 2-3.

Figure 2-2 Systematic Sampling Guide for Tipped Loads

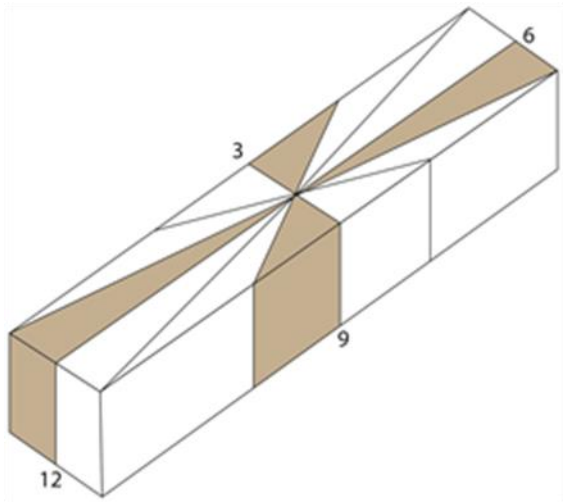


Figure 2-3 Photos of Inbound MSW

Once the area of the tipped load was selected, a photograph was taken of the sample area with the sample placard and identification number visible in the picture. The Field Supervisor coordinated with the 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 from which the Field Supervisor could fill barrels for the hand-sorting activity.

The sample weighing at least 200 pounds was extracted from the pile and pre-weighed (to verify that the minimum sample weight had been achieved and to prevent sorting overly large samples, which would diminish sorting productivity). Pre-weighed samples were loaded into barrels for placement on the sort table, and bulky items were weighed and recorded separately (thereby eliminating the need to sort them at the sort table).

Depending upon the availability of host facility personnel and equipment, the Field Supervisor either collected the sample directly from the bucket of the front-end loader, or took direct sample from where the load was dumped. When collecting samples directly from the loader bucket, 35-gallon waste cans were arranged side-by-side, with the loader bucket positioned directly overhead. The Field

Supervisor collected the sample systematically, by working from one side of the bucket to the other, emptying all of the contents from the front of the bucket to the back, until the desired sample weight was achieved. To help minimize sample collection bias, samples were collected from the loader bucket in an alternating fashion, that is, working from the left side of the bucket to the right side for one sample, and then from right to left on the next sample.

- **Sorting**: In Figure 2-4 below, the photograph presents the typical layout of the sorting table and bins into which each targeted material is to be sorted. At some facilities, the sort area was inside a transfer station bay, at others it was nearby the transfer station, and it was near the working face at the landfills. In each scenario, the table was set up similarly with bins by material groups set up on the same side each time for sorting crew familiarity and efficiency. Maintaining a consistent sort area also improves safety by establishing boundaries for all workers to follow consistently.

Figure 2-4 Layout of Sorting Table and Bins

Once the sample was acquired and placed on the sorting table, the material was sorted by hand into the prescribed component categories. Plastic 18-gallon bins with sealed bottoms were used to contain the separated components.

Samples were manually sorted into pre-labeled bins. Sorting was performed by a dedicated traveling team of sorters managed by a professional Crew Chief. Sorting is shown in Figure **2-5**.

Figure 2-5 Sorting and Weigh-out/Data Recording

The Crew Chief conducted QA/QC duties, reviewing the contents of the component bins as they accumulated, rejecting materials that may have been improperly classified. Open bins allowed the Crew Chief to see the material at all times and verify the purity of each component as it was weighed, before recording the weight into the database. The materials were sorted to particle size of 2 inches or less by hand, until no more than a small amount of homogeneous fine material (—mixed residual) remained. Any remaining items in the mixed 2-inch-minus material was then allocated to the appropriate categories based on the best judgment of the Crew Chief — most often a combination of Other Paper, Other Organics, Food Waste or Fines. The overall goal was to sort each sample directly into component categories in order to reduce the amount of indistinguishable fines or miscellaneous categories.

2.7.4 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 offers 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.

2.8 NON-MSW COMPOSITION METHODOLOGY

2.8.1 SAMPLING TARGETS

As discussed in the Gate Survey section 2.2, six Waste Types were assigned to haulers during the gate survey: MSW, Construction, Demolition, Industrial, Special and Other. For the visual volumetric surveying day at the same facility, the Field Supervisor identified incoming vehicles hauling Construction, Demolition or Industrial waste to further characterize. In some locations where traffic flow was slow, loads of Other or Special waste types, such as Bulky/Furniture or Agricultural waste, for instance, were characterized. The daily target was to complete 20 to 30 visual volumetric surveys which was possible at all locations except for a few with low traffic flow. Table 2-15 below shows the number of loads and tons surveyed at each facility.

Table 2-15 Loads and Tons Visually Surveyed by Facility

Facility Name	Visually Surveyed Loads	Tons Visually Surveyed
Lemons Sanitary Landfill, LLC	28	160.8
St. Joseph City Sanitary Landfill	30	103.2
Springfield Sanitary Landfill	30	84.8
Courtney Ridge Recycling & Disposal Facility	25	85.8
Waste Corporation of Missouri - Joplin Transfer Station	18	62.0
Pink Hill Acres Demolition Landfill	4	18.5
Black Oak Recycling & Disposal Facility	19	115.8
Central Missouri Landfill, Inc.	25	100.0
Prairie View Regional Waste Facility	12	90.7
Veolia ES Maple Hill Sanitary Landfill	25	126.2
Jefferson City Sanitary Landfill	28	92.6
IESI Timber Ridge Landfill	11	121.7
City of O'Fallon Regional Waste Transfer Station	30	83.5
IESI MO Champ Landfill, LLC	30	103.3
Bridgeton Transfer Station	30	103.9
Totals	**345**	**1,452.9**

2.8.2 VISUAL VOLUMETRIC SURVEY METHODOLOGY

- **Material Categories**: For the visual volumetric survey, the six waste types used in the gate survey (MSW, Construction, Demolition, Industrial, Special and Other) were further characterized into 42 waste subtypes. These are summarized in Table 2-16. Complete definitions are contained in Appendix X. As described previously, the Remainder/Composite categories refer to items in various material groups which do not otherwise fall in more specific categories. Materials characterized as Remainder/Composite (R/C) may be primarily one material, but combined with other materials. Typically, there is no market or recyclable outlet for these categories.

Table 2-16 Material Categories for Visual Volumetric Surveying

Paper	**Construction & Demolition (C&D)**
Corrugated Cardboard/Kraft Paper (Uncoated)	Carpet
Remainder/Composite Paper	Carpet Padding
Plastic	Concrete/Block/Brick/Stone/Tile
Plastic Bottles (Recyclable)	Asphalt Paving
HDPE Buckets	Roofing Materials
Clean Recoverable Film	Ceiling Tiles
Remainder/Composite and Other Plastic	Clean Gypsum Board
Glass	Painted Gypsum Board
All Glass	Dirt/Sand/Gravel
Metal	Insulation
Appliances	R/C and Other C&D
Other Ferrous Metals	**Other Wastes**
Other Non-ferrous Metals	Bio-Solids (Sewage and other Sludges)
Organics	Agricultural Waste
Yard Waste	Tritium-Containing Products
Remainder/Composite and Other Organics	Asbestos Containing Materials
Wood	Contaminated Soil
Pallets and Crates	**Special Wastes**
Untreated/Unpainted Lumber	Bulky Wastes/Furniture
Treated/Painted/Processed Wood	Tree Trunks
Engineered Wood	Tires
Wood Furniture	All Household Hazardous Waste (HHW)
Other Wood	Fines/Mixed Residue
Electronics	Mixed MSW
Electronics	
Items with CRTs	

- **Load Characterization**: Compared to the 2008 study, MSW Consultants uses current best practices for visual characterization of bulky and homogeneous waste loads. Further, MSW Consultants uses a rugged tablet with built-in logic to validate visual volume and weight estimates in real time based on scale weight data for each visually surveyed load. Visual surveying of a load of waste involves detailed volumetric measurements of the truck and load dimensions, followed by the systematic observation of the major material components in the tipped load. 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 were present in the load—Fibers, Metals, C & D materials, etc. Percentage estimates were then entered, indicating the breakdown of the load by 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 comprised of these materials.

- The estimated percentages were verified to sum up to 100 percent, and the estimated major material categories were confirmed realistic given the overall truck dimensions and volume.

Usage of the MSW Consultants' electronic field form provides real-time QA/QC on the visual 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. A copy of the visual survey forms are included in Appendix W.

2.9 DATA ANALYSIS

A statistical analysis has been 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 are converted to estimated weights, the sample mean composition has been 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.

The standard deviation, as well as confidence intervals at a 90 percent level, are provided for each material category, as statistically appropriate, as well as 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 population mean falls within the upper and lower confidence intervals shown. (The converse is also true: that there is a 10 percent chance that the population mean falls outside of the sample mean.) 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.

The Study Design provided to the Department at the onset of the study activities is included as Appendix Y.

3. GATE SURVEY RESULTS

3.1 INTRODUCTION

This section summarizes Missouri state waste disposal data to which the composition results from this study can be applied. As previously explained in the Methodology section, MSW professional staff spent a full day at fifteen facilities to survey all deliveries. Data was recorded about vehicles hauling materials to the site for disposal, classifying the loads into one of six categories: MSW, Construction, Demolition, Industrial, Special and Other. This section applies the results of the gate survey to reported disposal quantities as explained in the Methodology section.

3.2 RESULTS

Gate survey results are subdivided by demographic region of the state. Results are presented separately for Large Metro, Small Metro and Rural areas.

3.2.1 LARGE METRO DISPOSAL FACILITIES

Figure 3-1 presents the breakdown of waste types found in the Large Metro areas. These estimates are based on gate surveys conducted at five disposal facilities which collectively disposed of 56.8 percent of waste from Large Metro areas. As shown, almost 63 percent of the wastes disposed were MSW (Residential and CI combined), with smaller fractions of other waste types.

Figure 3-1 Composition at Large Metro Host Facilities

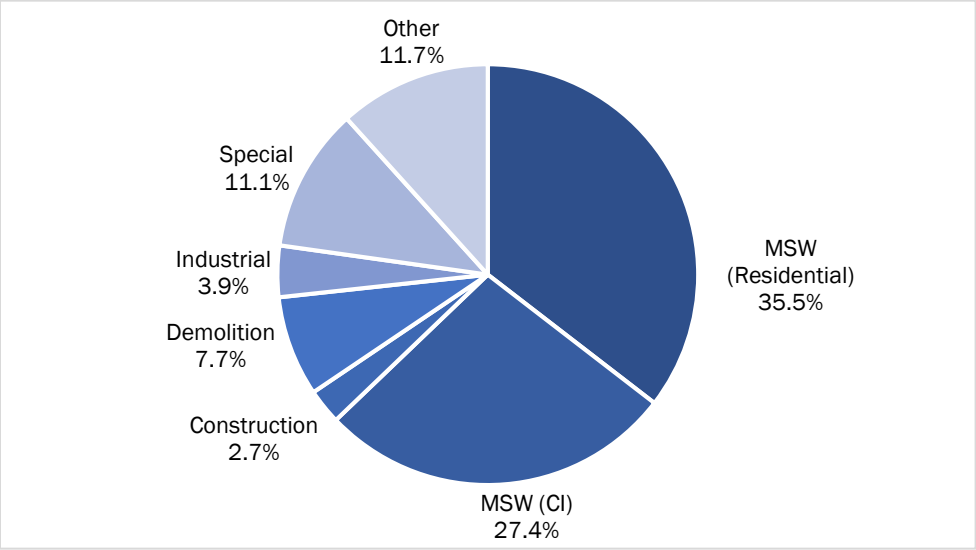


Table 3-1 provides the tabular details that form the basis for the above figure. This table reflects the gate survey results for each facility applied to the annual tonnage reported at that facility. The summation of this calculation for all Large Metro facilities is used as the basis for the Large Metro breakdown by waste type. Note that the Champ Landfill and the Courtney Ridge Landfill, as the two largest in this demographic sector to be gate surveyed, have a commensurate influence on the regional totals.

Table 3-1 Large Metro Tonnage by Waste Sector

Facility	MSW (Residential)	MSW (CI)	Construc-tion	Demo-lition	Industrial	Special	Other	Total
Courtney Ridge LF	226,068	210,047	0	38,645	31,863	0	120,629	627,250
Pink Hill Acres Dem	0	0	3,197	45,558	0	0	0	48,755
Bridgeton TS	120,867	105,145	27,148	21,850	32,628	0	0	307,637
O'Fallon TS	26,997	22,506	12,135	7,364	7,498	1,500	0	78,000
Champ LF	375,928	241,796	14,836	49,906	11,556	232,865	126,694	1,053,580
Total	**749,860**	**579,493**	**57,315**	**163,322**	**83,544**	**234,365**	**247,322**	**2,115,222**
Percent	*35.5%*	*27.4%*	*2.7%*	*7.7%*	*3.9%*	*11.1%*	*11.7%*	*100.0%*

3.2.2 SMALL METRO DISPOSAL FACILITIES

The composition of waste generated in the Small Metro areas of Missouri is displayed in Figure 3-2. These estimates are based on gate surveys conducted at four host facilities that collectively dispose of 16 percent of all waste from Small Metro areas. As shown in the figure, 59 percent of wastes disposed at these facilities was found to be MSW.

Figure 3-2 Composition at Small Metro Host Facilities

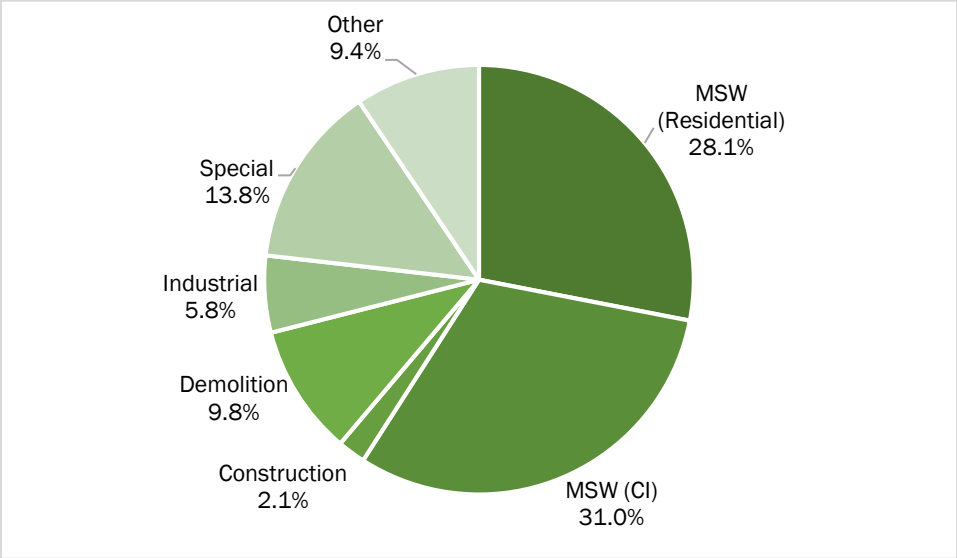


Table 3-2 provides the detailed estimates that form the basis for the figure above. The landfills in this region process comparable amounts, with the Joplin Transfer Station processing a relatively smaller quantity.

Table 3-2 Small Metro Tonnage by Waste Sector

Facility	MSW (Residential)	MSW (CI)	Construc-tion	Demo-lition	Industrial	Special	Other	Total
St. Joseph LF	28,492	3,543	0	40,177	6,687	161	33,642	112,701
Jefferson City LF	53,145	81,613	6,442	639	15,758	3,183	0	160,780
Springfield LF	66,946	62,494	3,651	15,643	5,252	78,396	22,393	254,776
Joplin TS	18,099	36,653	2,420	2,026	6,674	0	0	65,872
Total	**166,682**	**184,302**	**12,513**	**58,485**	**34,371**	**81,740**	**56,035**	**594,129**
Percent	*28.1%*	*31.0%*	*2.1%*	*9.8%*	*5.8%*	*13.8%*	*9.4%*	*100.0%*

3.2.3 RURAL DISPOSAL FACILITIES

Figure 3-3 presents the estimated breakdown by waste type for Rural areas based on the results of the gate surveys. These estimates are based on gate surveys conducted six disposal facilities, which collectively disposed of over 27.2 percent of waste from Rural areas. As shown, Rural areas disposal facilities have disposed of a relatively higher fraction of MSW relative to the Large Metro and Small Metro areas, with a majority of the MSW originating from the Residential sector. MSW was found to comprise 80 percent of the disposed waste stream in Rural areas.

Figure 3-3 Composition at Rural Host Facilities

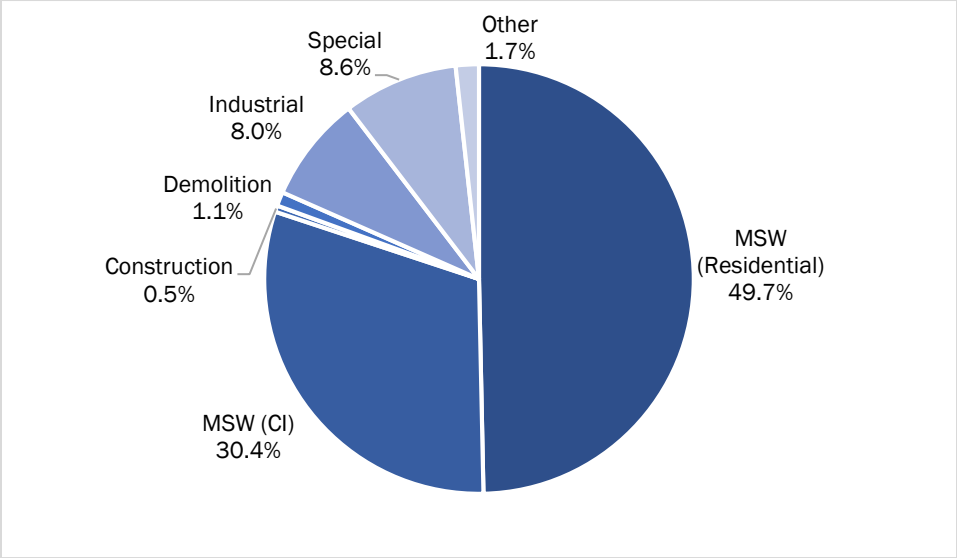


Table 3-3 provides the detailed estimates that form the basis for the figure above. The landfills in this region were relatively comparable in terms of throughput, so no single landfill gate survey result outweighs the others.

Table 3-3 Rural Tonnage by Waste Sector

Facility	MSW (Residential)	MSW (CI)	Construc-tion	Demo-lition	Industrial	Special	Other	Total
Central MO LF	231,027	142,028	776	2,922	26,226	0	0	402,980
Maple Hill LF	68,120	57,655	2,644	857	8,741	0	0	138,017
Timber Ridge LF	63,828	72,305	2,821	6,429	32,710	22,848	0	200,940
Prairie View LF	196,920	71,345	0	0	38,351	1,737	18,342	326,694
Black Oak LF	171,311	90,138	1,129	1,420	12,682	199	2,422	279,300
Lemons LF	36,179	36,425	0	4,653	4,939	108,772	6,156	197,124
Total	**767,384**	**469,896**	**7,370**	**16,282**	**123,647**	**133,557**	**26,919**	**1,545,055**
Percent	*49.7%*	*30.4%*	*0.5%*	*1.1%*	*8.0%*	*8.6%*	*1.7%*	*100.0%*

3.2.4 STATEWIDE AGGREGATE RESULTS

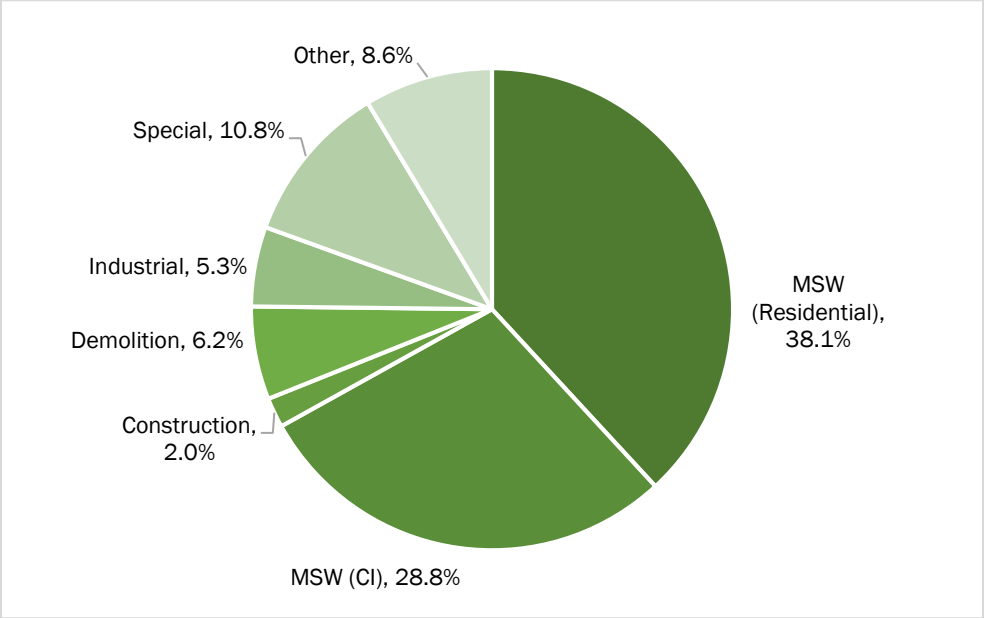
The gate survey results from each demographic region, as shown above, were aggregated to calculate the statewide breakdown by waste type. Table 3-4 applies the regional waste type composition to the total regional tonnage reported by all disposal facilities in the region. Because of the distribution of wastes by demographic region, it is important to note that the Large Metro area composition is the most heavily weighted, followed by the Rural areas. Small Metro waste type composition is the lowest weighted.

Table 3-4 Statewide Tonnage by Demographic Region and Waste Sector

Demographic Region	MSW (Residential)	MSW (CI)	Construc-tion	Demo-lition	Industrial	Special	Other	Total
Large Metro	1,161,743	897,797	88,798	253,032	129,434	363,097	383,172	3,277,072
Small Metro	257,973	285,244	19,367	90,517	53,196	126,509	86,725	919,531
Rural	778,805	476,890	7,480	16,524	125,488	135,544	27,320	1,568,051
Total	**2,198,521**	**1,659,931**	**115,644**	**360,073**	**308,117**	**625,151**	**497,217**	**5,764,654**
Percent	*38.1%*	*28.8%*	*2.0%*	*6.2%*	*5.3%*	*10.8%*	*8.6%*	*100.0%*

Figure 3-4 summarizes the statewide aggregate breakdown by waste type based on the results of the gate survey. As shown, MSW (Residential and CI) was found to make up almost exactly two-thirds (67 percent) of all disposed wastes, followed by Special waste at almost 11 percent. Special waste includes bulky items, contaminated soil, asbestos, mattresses, and cut tires.

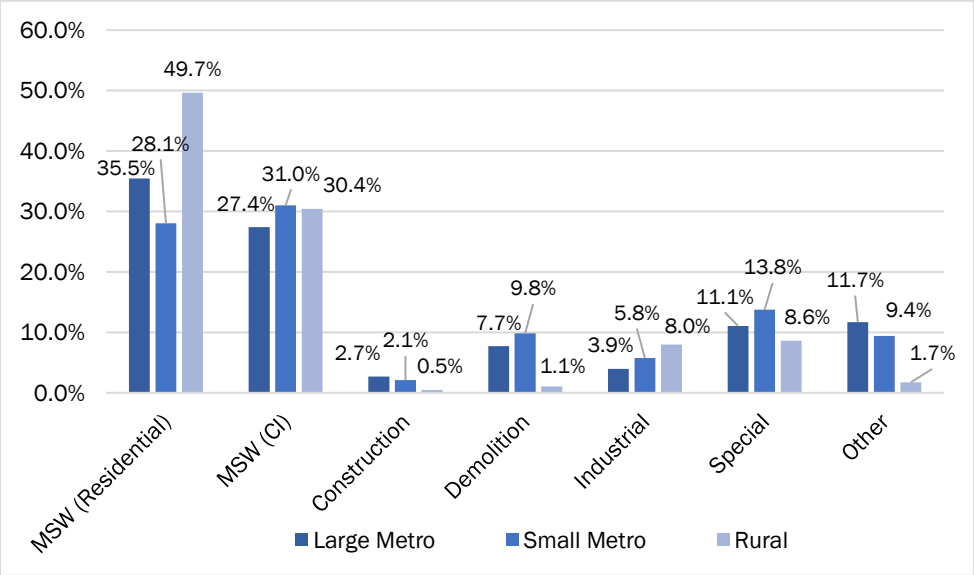
Figure 3-4 Statewide Waste Breakdown



3.2.5 Comparison by Demographic Region

Figure 3-5 compares the overall disposed waste composition across the three demographic areas defined for this study. As shown, Residential MSW is especially prevalent in Rural areas relative to other waste types, far outweighing Large Metro or Small Metro's share with 50%. On the other hand, Small Metro and Large Metro experienced more Construction and Demolition waste disposal than Rural areas, speaking to the fact that there is more development in these regions.

Figure 3-5 Comparison of Waste Composition by Demographic Region



3.3 COMPARISON TO 2008 STUDY

The 2017 Missouri Waste Characterization Study was designed to tabulate waste types consistently with the definitions used in prior studies. Figure 3-6 and Figure 3-7 compare the statewide overall waste composition between the 2017 and 2008 Studies, respectively.

Figure 3-6 2017 Statewide Waste Breakdown

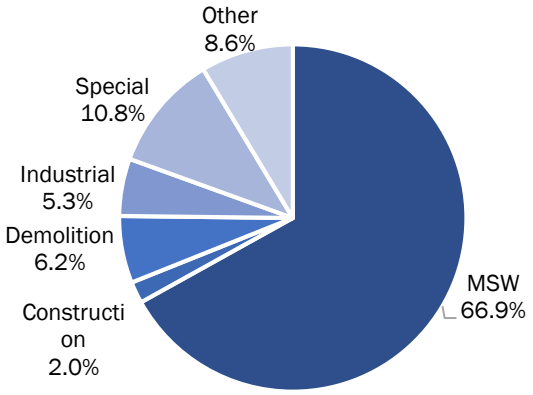
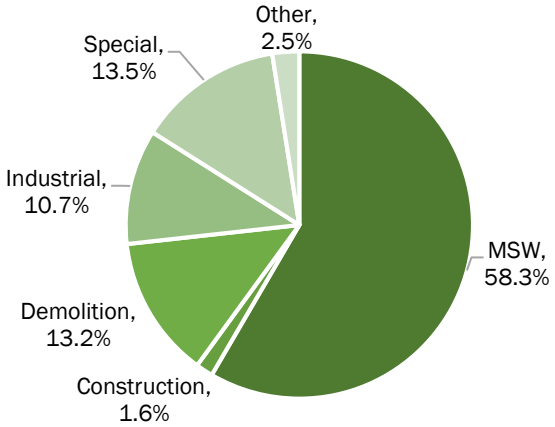


Figure 3-7 2008 Statewide Waste Breakdown



As shown in these figure, it appears that the proportion of MSW has increased and the percentage of other waste types has decreased. Anecdotally, the field data collection for the 2008 Study was performed at the tail-end of nationwide housing boom, when construction-related activities were at an historical high. Although it was beyond the scope of this study to analyze such waste indicators, the changes illustrated above in Missouri's 2017 waste stream appear reasonable in light of anecdotal evidence. However, it should also be noted that there were methodological differences in the two studies, which may account for some of the variation.

In the professional opinion of MSW Consultants, the relative consistency in the results suggests that both data sets likely have captured a reasonable estimate for the breakdown of major waste types in Missouri's disposed waste stream. Further, the 2017 gate survey methodology was able to provide such results at a lower level of effort compared to the 2008 Study, and could establish a basis for more cost-effective future updates to this statewide study.

4. MSW COMPOSITION

4.1 STATEWIDE AGGREGATE MSW COMPOSITION

This section provides extensive data about the composition of disposed MSW in Missouri. Detailed results of the MSW manual sorting phases are shown in the following sections.

4.1.1 RESULTS

As determined through the Gate Surveys, 66.9 percent of the overall waste stream was MSW. Applied to the 2016 tonnage, this is a total of 3.86 million tons of MSW. Figure 4-1 shows the composition of all disposed MSW, aggregating the Residential and Commercial/Institutional (CI) generator sectors. As shown, Organics and Paper are the most common material groups and comprise almost two-thirds of the disposed waste stream.

Figure 4-1 Missouri Statewide Municipal Solid Waste Composition

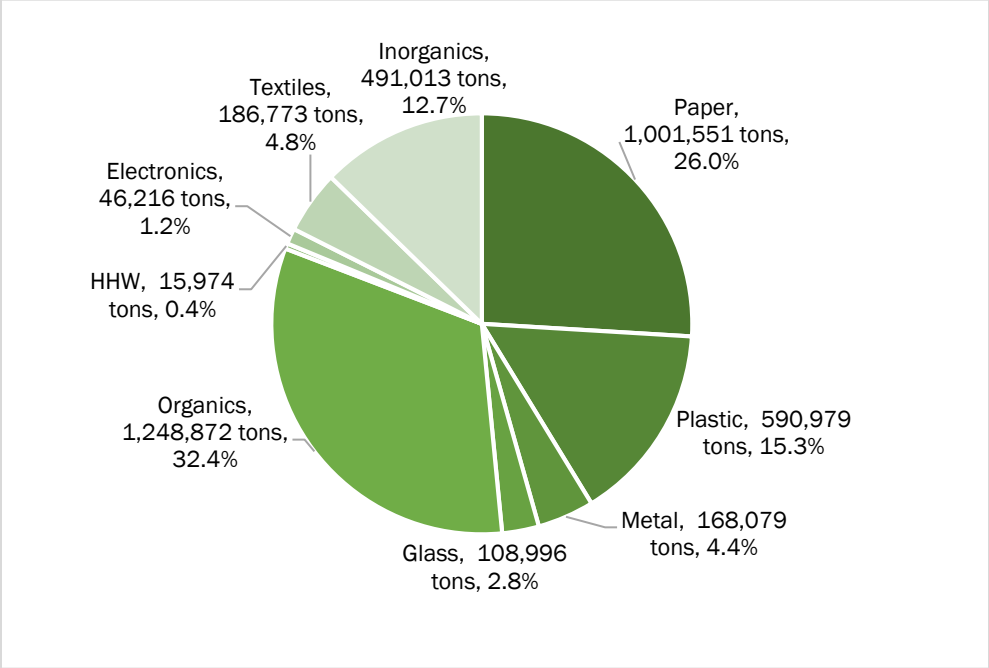


Table 4-1 provides a detailed statistical profile of the statewide aggregate disposed MSW stream. For each material category, the mean percent and confidence intervals are shown. Confidence intervals are calculated at a 90 percent level of confidence. It should be noted that the sum of the mean percentages for all of the individual materials within a material group sum to the mean percentage shown for the group. For example, the sum of all of the paper materials is the same as the 26.4 percent shown for Paper as a material group. However, the same does not hold true for the confidence intervals. Confidence intervals are calculated individually for each row in this table; the sum of the confidence intervals for each individual material will not equal the confidence interval for the material group as a whole.

Table 4-1 Detailed Statewide Aggregate MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**26.0%**	**1.4%**	**1,001,551**	**Plastic**	**15.3%**	**2.8%**	**590,979**
OCC/Kraft	8.5%	1.1%	326,094	PET (#1) Bottles/Jars	1.4%	0.1%	54,764
Newsprint	1.5%	0.5%	56,588	PET (#1) Non-Bottle Containers	0.2%	0.1%	8,321
Magazines	0.9%	0.2%	35,327	HDPE (#2) Natural Containers	0.4%	0.0%	15,399
High Grade Office Paper	1.3%	0.3%	51,027	HDPE (#2) Colored Containers	0.5%	0.1%	19,462
Mixed Recyclable Paper	4.0%	0.4%	155,827	Clean Film Bags	0.3%	0.1%	11,948
Compostable Paper	8.1%	0.5%	312,127	Clean Ind'l/Com'l Film	0.7%	0.3%	26,524
Remainder/Composite Paper	1.7%	0.6%	64,562	Contaminated Film/Other Film	5.9%	0.8%	229,256
Glass	**2.8%**	**0.3%**	**108,996**	Plastic Containers #3 thru #7	1.0%	0.1%	38,140
Clear Glass Containers	1.4%	0.2%	53,206	Expanded Polystyrene #6	0.7%	0.1%	27,908
Brown Glass Containers	0.8%	0.2%	32,428	Bulky Durable Plastic Products	1.9%	0.3%	72,746
Green Glass Containers	0.2%	0.0%	8,310	Remainder/Composite Plastic	2.2%	0.4%	86,510
Remainder/Composite Glass	0.4%	0.1%	15,052	**Textiles**	**4.8%**	**1.2%**	**186,773**
Metal	**4.4%**	**0.5%**	**168,079**	Textiles - Clothing	2.3%	0.4%	87,347
Aluminum Cans & Containers	0.6%	0.1%	24,498	Textiles - Non-Clothing	1.9%	0.3%	73,652
Other Aluminum	0.3%	0.0%	11,985	Shoes/Belts/Leather	0.7%	0.1%	25,775
Tin/Steel Containers	1.0%	0.1%	39,365	**Inorganics**	**12.7%**	**0.9%**	**491,013**
Other Ferrous	1.8%	0.4%	70,018	Fines	1.7%	0.2%	65,106
Other Non-Ferrous	0.5%	0.2%	20,802	Drywall/Gypsum Board	0.6%	0.3%	23,013
Oil Filters	0.0%	0.0%	1,411	Asphalt, Brick, Concrete & Rocks	0.5%	0.2%	18,639
Organics	**32.4%**	**0.6%**	**1,248,872**	Carpet & Carpet Padding	2.6%	0.7%	100,713
Food Waste	15.0%	1.3%	578,315	Other Construction & Demolition	1.6%	0.5%	60,431
Wood - Clean/Untreated	3.7%	1.2%	141,024	Bulky Items/Furniture	3.1%	0.6%	121,343
Wood - Painted/Stained/Treated	4.5%	1.0%	173,266	Mattresses/Boxsprings	0.7%	0.3%	26,118
Disposable Diapers & Sanitary Prod.	3.1%	0.4%	118,429	Tires	0.8%	0.4%	31,399
Yard Waste	2.6%	0.7%	101,921	Other/Not Classified	1.1%	0.9%	44,249
Remainder/Composite Organic	3.5%	0.6%	135,918	**HHW**	**0.4%**	**0.1%**	**15,974**
Electronics	**1.2%**	**0.4%**	**46,216**	Household Hazardous Waste	0.4%	0.1%	15,974
Electronic Waste	1.2%	0.4%	46,216				
				Grand Total	**100%**		**3,858,452**
				No. of Samples	***254***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 4-2 shows the top 10 most prevalent materials in the MSW stream. As shown, Food Waste was found to be the most prevalent material at 15 percent of the stream. Several other compostable items also made the top 10 list. The 2017 Study also shows a meaningful amount of corrugated cardboard and mixed recyclable paper being in the disposed MSW stream.

Figure 4-2 Top 10 Most Prevalent Materials in Statewide MSW Stream

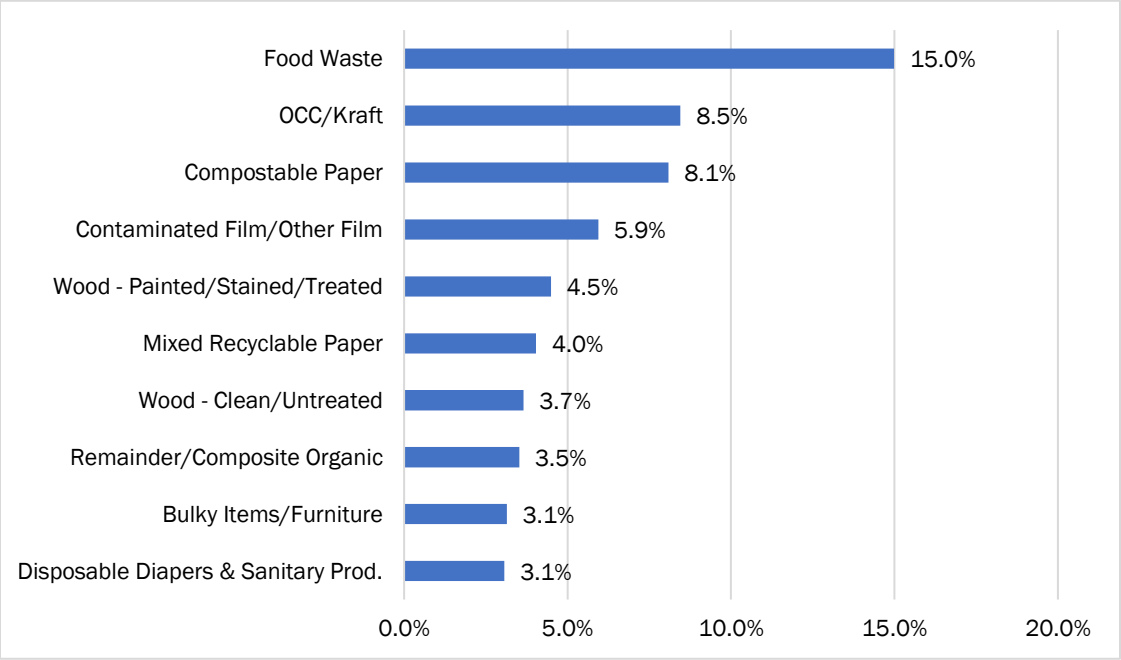


Figure 4-3 presents the composition of disposed waste in terms of the potential for diverting materials from disposal. This figure was developed by assigning a "Diversion Strategy" to each individual constituent in the waste stream. Specifically, each material was defined as one of the four categories listed below.

- **Curbside Recyclables**: Includes recyclable fiber (e.g., newsprint, corrugated cardboard, magazines, paperboard, office paper and other mixed paper), recyclable containers (e.g., metal, plastic and glass containers).
- **Compostables/Mulchables**: Includes compostable/mulchable organics – food waste, compostable paper and yard waste.
- **Non-Curbside Recyclables**: Includes recyclables other than curbside recyclables that can typically be accepted at third party recyclers, reuse/donation centers, or retailers (e.g., clean film/film bags, other non-container (scrap) metals, clean wood, C&D debris, HHW, textiles/leather products, computer/electronics, tires, etc.).
- **Not Currently/Widely Recyclable**: Includes all other materials that are not currently recyclable (or are recycled only minimally) in Missouri (e.g., mattresses/boxsprings, expanded polystyrene, non-container glass, disposable diapers/sanitary products, and composite materials). There may be some recovery of certain of these materials, but it is not believed recycling of these materials is widespread.

As shown, roughly one quarter of the disposed MSW stream can be recycled via curbside programs, and another quarter could be composted if separated from the rest of the MSW. However, of equal interest, more than one third of the MSW stream could not be readily recycled due to lack of markets and programs that accept these materials.

Figure 4-3 Divertibility of Disposed MSW

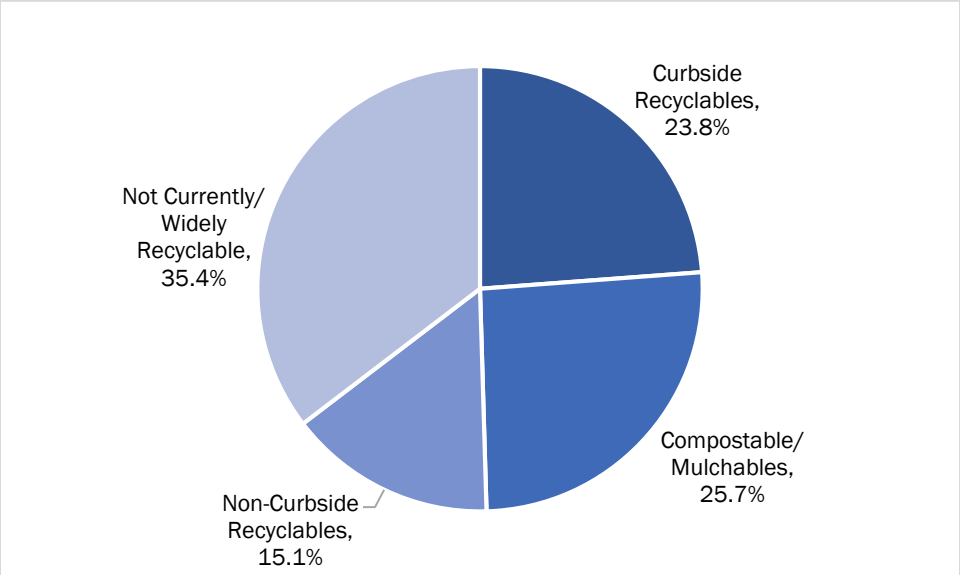


Table 4-2 indicates how the individual material categories were combined to create the Divertibility profile in Figure 4-3.

Table 4-2 Divertibility of MSW Material Categories

Curbside Recyclables	
Newsprint	HDPE (#2) Natural Containers
Corrugated Cardboard/Kraft Paper (Uncoated)	HDPE (#2) Colored Containers
Magazines	Plastic Containers #3 thru #7
Paperboard	Aluminum Cans & Containers
High Grade Office Paper	Tin/Steel Containers
Mixed Recyclable Paper	Clear Glass Containers
PET (#1) Bottles/Jars	Brown Glass Containers
PET (#1) Non-Bottle Containers	Green Glass Containers
Non-Curbside Recyclables	
Clean Industrial/Commercial Film (non-bag)	Asphalt, Brick, Concrete & Rocks
Clean Film Bags	Household Hazardous Waste
Other Aluminum	Electronic Waste
Other Non-Ferrous	Textiles & Leather Products
Other Ferrous	Tires
Wood - Clean/Untreated	Oil Filters
Compostables/Mulchables	
Compostable Paper	Yard Waste
Food Waste	
Not Currently/Widely Recyclable	
Non-Recyclable Paper	Drywall/Gypsum Board
Other Construction & Demolition	Carpet & Carpet Padding
Expanded Polystyrene #6	Bulky Durable Plastic Products
Contaminated Film/Other Film	Mattresses/Boxsprings
Remiander/Composite Plastic	Bulky Items/Furniture
Remiander/Composite Glass	Disposable Diapers & Sanitary Products
Remiander/Composite Organic	Other/Not Elsewhere Classified
Wood - Painted/Stained/Treated	Fines
Non-C&D Wood	

4.1.2 Comparison by Demographic Region

MSW composition results were also calculated individually by demographic regions of the state. Figure 4-4 provides a comparison of the composition by major material group for the Large Metro, Small Metro and Rural areas of the state.

Figure 4-4 Comparison of Aggregate MSW by Demographic Region

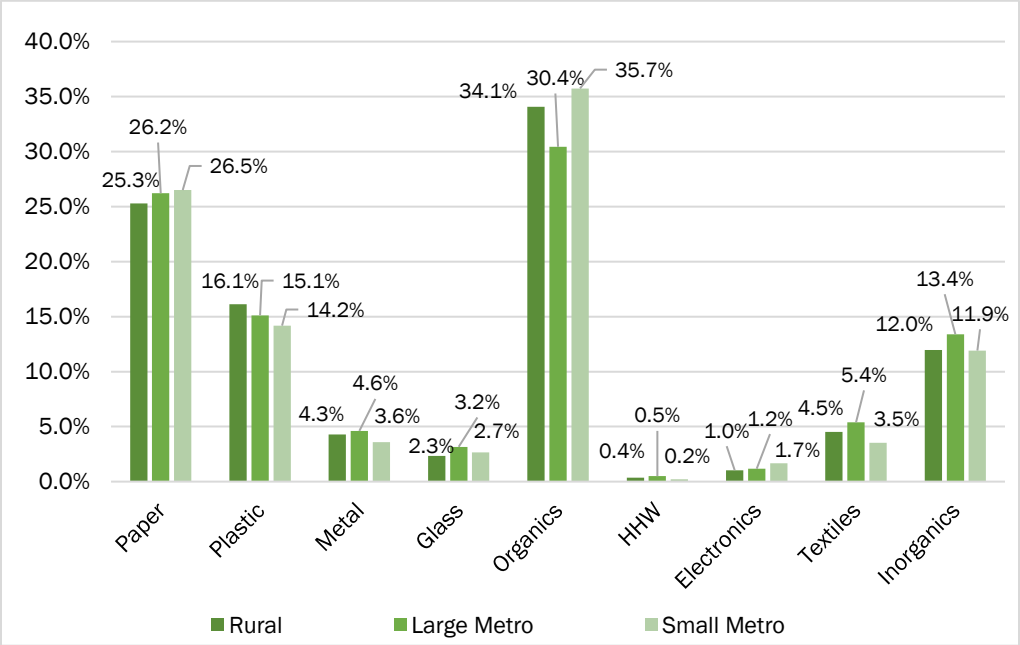


Table 4-3 provides the detailed composition of Large Metro, Small Metro, and Rural MSW. Detailed results tables by facility, including confidence intervals, are included in Appendices A-V.

Table 4-3 Comparison of Aggregate MSW Composition by Demographic

	Large Metro		Small Metro		Rural		Aggregate (Weighted)	
Material Category	Percent	Tonnage	Percent	Tonnage	Percent	Tonnage	Percent	Tonnage
Paper	**26.2%**	**540,026**	**26.5%**	**143,978**	**25.3%**	**317,548**	**26.0%**	**1,001,551**
OCC/Kraft	9.2%	189,941	9.7%	52,528	6.7%	83,625	8.5%	326,094
Newsprint	1.7%	34,414	1.1%	5,765	1.3%	16,409	1.5%	56,588
Magazines	0.7%	13,603	1.1%	6,003	1.3%	15,722	0.9%	35,327
High Grade Office Paper	1.0%	19,687	1.4%	7,544	1.9%	23,796	1.3%	51,027
Mixed Recyclable Paper	3.9%	81,296	3.2%	17,273	4.6%	57,258	4.0%	155,827
Compostable Paper	8.6%	176,275	8.4%	45,826	7.2%	90,027	8.1%	312,127
Remainder/Composite Paper	1.2%	24,812	1.7%	9,039	2.4%	30,710	1.7%	64,562
Glass	**3.2%**	**65,202**	**2.7%**	**14,514**	**2.3%**	**29,280**	**2.8%**	**108,996**
Clear Glass Containers	1.4%	29,354	1.2%	6,401	1.4%	17,451	1.4%	53,206
Brown Glass Containers	1.1%	22,275	0.7%	4,028	0.5%	6,125	0.8%	32,428
Green Glass Containers	0.3%	5,480	0.2%	884	0.2%	1,946	0.2%	8,310
Remainder/Composite Glass	0.4%	8,093	0.6%	3,201	0.3%	3,758	0.4%	15,052
Metal	**4.6%**	**94,906**	**3.6%**	**19,491**	**4.3%**	**53,682**	**4.4%**	**168,079**
Aluminum Cans & Containers	0.6%	12,793	0.5%	2,564	0.7%	9,141	0.6%	24,498
Other Aluminum	0.4%	7,898	0.3%	1,418	0.2%	2,669	0.3%	11,985
Tin/Steel Containers	0.9%	18,250	1.1%	5,804	1.2%	15,312	1.0%	39,365
Other Ferrous	2.1%	43,514	1.6%	8,759	1.4%	17,745	1.8%	70,018
Other Non-Ferrous	0.6%	11,864	0.1%	436	0.7%	8,502	0.5%	20,802
Oil Filters	0.0%	587	0.1%	510	0.0%	314	0.0%	1,411
Plastic	**15.1%**	**311,326**	**14.2%**	**77,039**	**16.1%**	**202,614**	**15.3%**	**590,979**
PET (#1) Bottles/Jars	1.3%	27,158	1.4%	7,405	1.6%	20,201	1.4%	54,764
PET (#1) Non-Bottle Containers	0.2%	3,315	0.3%	1,687	0.3%	3,319	0.2%	8,321
HDPE (#2) Natural Containers	0.4%	7,685	0.4%	1,986	0.5%	5,728	0.4%	15,399
HDPE (#2) Colored Containers	0.5%	9,987	0.5%	2,712	0.5%	6,764	0.5%	19,462
Clean Film Bags	0.3%	5,308	0.2%	965	0.5%	5,675	0.3%	11,948
Clean Ind'l/Com'l Film	0.7%	14,583	0.6%	3,338	0.7%	8,603	0.7%	26,524
Contaminated Film/Other Film	5.7%	118,039	5.2%	28,445	6.6%	82,772	5.9%	229,256
Plastic Containers #3 thru #7	1.2%	24,314	0.8%	4,435	0.7%	9,391	1.0%	38,140
Expanded Polystyrene #6	0.7%	14,124	0.8%	4,470	0.7%	9,314	0.7%	27,908
Bulky Durable Plastic Products	2.2%	45,916	1.2%	6,510	1.6%	20,321	1.9%	72,746
Remainder/Composite Plastic	2.0%	40,897	2.8%	15,085	2.4%	30,528	2.2%	86,510
Organics	**30.4%**	**626,856**	**35.7%**	**194,173**	**34.1%**	**427,843**	**32.4%**	**1,248,872**
Food Waste	14.3%	294,955	17.1%	92,625	15.2%	190,735	15.0%	578,315
Wood - Clean/Untreated	2.7%	54,717	4.8%	26,218	4.8%	60,089	3.7%	141,024
Wood - Painted/Stained/Treated	4.4%	90,643	4.4%	23,857	4.7%	58,766	4.5%	173,266
Disposable Diapers & Sanitary Prod.	3.0%	62,589	2.5%	13,800	3.3%	42,040	3.1%	118,429
Yard Waste	2.8%	58,250	3.7%	20,223	1.9%	23,447	2.6%	101,921
Remainder/Composite Organic	3.2%	65,702	3.2%	17,450	4.2%	52,766	3.5%	135,918
Textiles	**5.4%**	**110,960**	**3.5%**	**19,143**	**4.5%**	**56,670**	**4.8%**	**186,773**
Textiles - Clothing	2.8%	58,284	0.9%	4,864	1.9%	24,199	2.3%	87,347
Textiles - Non-Clothing	1.8%	37,695	1.9%	10,521	2.0%	25,436	1.9%	73,652
Shoes/Belts/Leather	0.7%	14,981	0.7%	3,758	0.6%	7,035	0.7%	25,775
Inorganics	**13.4%**	**276,004**	**11.9%**	**64,717**	**12.0%**	**150,292**	**12.7%**	**491,013**
Fines	1.8%	36,846	1.1%	6,191	1.8%	22,069	1.7%	65,106
Drywall/Gypsum Board	0.6%	11,869	0.3%	1,473	0.8%	9,672	0.6%	23,013
Asphalt, Brick, Concrete & Rocks	0.4%	8,879	0.6%	3,126	0.5%	6,635	0.5%	18,639
Carpet & Carpet Padding	2.5%	50,535	2.6%	14,143	2.9%	36,035	2.6%	100,713
Other Construction & Demolition	1.4%	28,277	2.7%	14,525	1.4%	17,630	1.6%	60,431
Bulky Items/Furniture	4.8%	98,933	0.4%	2,436	1.6%	19,974	3.1%	121,343
Mattresses/Boxsprings	0.9%	18,935	0.4%	1,979	0.4%	5,204	0.7%	26,118
Tires	0.6%	12,158	1.4%	7,778	0.9%	11,463	0.8%	31,399
Other/Not Classified	0.5%	9,572	2.4%	13,067	1.7%	21,611	1.1%	44,249
Electronics	**1.2%**	**24,131**	**1.7%**	**9,018**	**1.0%**	**13,068**	**1.2%**	**46,216**
Electronic Waste	1.2%	24,131	1.7%	9,018	1.0%	13,068	1.2%	46,216
HHW	**0.5%**	**10,130**	**0.2%**	**1,145**	**0.4%**	**4,698**	**0.4%**	**15,974**
Household Hazardous Waste	0.5%	10,130	0.2%	1,145	0.4%	4,698	0.4%	15,974
Grand Total	**100.0%**	**2,059,540**	**100.0%**	**543,217**	**100.0%**	**1,255,695**	**100.0%**	**3,858,452**
No. of Samples		***114***		***67***		***73***		***254***

Percentages for materials may not exactly equal category subtotals due to rounding.

4.1.3 COMPARISON WITH 2008 STUDY RESULTS

Figure 4-5 compares the MSW composition from the 2017 Study with the same results set for the 2008 Study.

Figure 4-5 Comparison of Aggregate MSW Composition Percentage 2017 vs. 2008

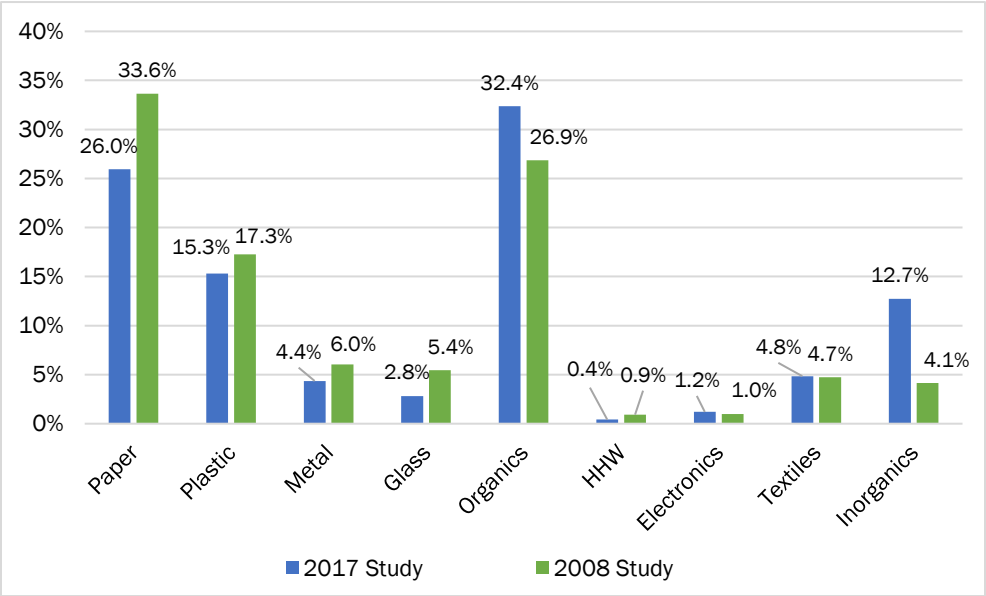
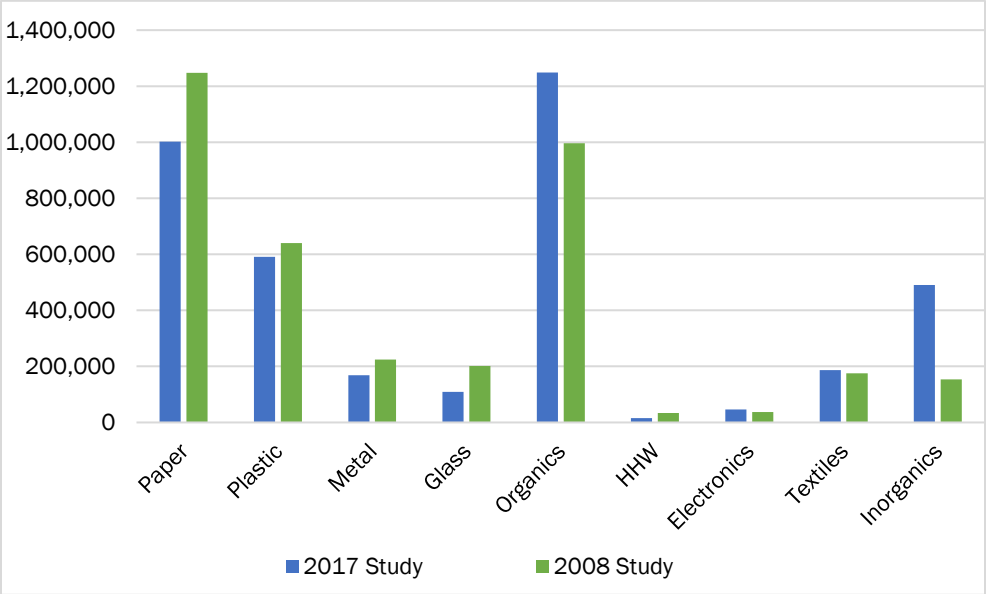


Figure 4-6 shows the same comparison as the figure above, but based on disposed tonnage. Whether evaluated by percentage composition or by tonnage, the comparison of results between 2008 and 2017 are very similar.

Figure 4-6 Comparison of Aggregate MSW Tonnage 2017 vs. 2008



As previously noted in this report, the waste composition methodology in the 2017 Study did not follow the 2008 Study methodology, and some differences may be caused by methodological differences. However, the following observations are offered on changes to the MSW stream:

- **Paper**: The decline of printed paper due to the shift to digital has been widely documented. The decrease in paper in the waste stream is consistent with this trend and also with other MSW composition time series data.
- **Metal and Glass**: These largely recyclable material groups appear to have decreased. One potential cause for this decrease would be expansion of recycling of these materials.
- **E-Waste**: The volume of e-waste has likely increased since 2008; however, e-waste recovery programs ideally should also have expanded. More e-waste is present in 2017.
- **Organics**: Organic wastes have increased. Although it is more difficult to pinpoint the cause, this finding is consistent with other studies and may suggest that heightened recycling of other materials leaves a relatively higher percentage of organic material in the disposed MSW stream.
- **HHW**: HHW appears to have decreased meaningfully. Ideally this is a result of both greater environmental awareness and also of wider access to HHW programs for residents and businesses in Missouri.
- **Inorganics**: This is a catch-all material group. There is no clear reason for this significant change based on market or economic changes, and it may be that the methodology differences contribute to this change.

Table 4-4 provides a detailed comparison of the composition of MSW between the 2008 and 2017 Studies. The following observations can be made about this table and all subsequent comparisons between 2008 and 2017 MSW Composition results:

- There were fewer material categories in the 2008 Study. Table 4-4 maps the material categories between the studies, although it is possible there may be slight discrepancies within certain mappings.
- The 2008 Study used a significantly different sampling and sorting methodology, and consequently some of the differences between the study results may be driven by these methodology differences, rather than by changes in the waste stream. However, the trends that emerge in this comparison are consistent with other large-scale waste composition studies for which time series data are available, including statewide studies in Connecticut, Delaware, Rhode Island, Massachusetts, California, and many large county and city studies.

Table 4-4 Detailed Comparison of Statewide MSW Composition 2017 vs. 2008

	2017 Study		2008 Study	
Material Category	Percent	Tonnage	Percent	Tonnage
Paper	**26.0%**	**1,001,551**	**33.6%**	**1,247,854**
OCC/Kraft	8.5%	326,094	8.2%	304,264
Newsprint	1.5%	56,588	5.2%	191,835
Magazines	0.9%	35,327	3.7%	135,806
High Grade Office Paper	1.3%	51,027	6.4%	237,474
Mixed Recyclable Paper	4.0%	155,827		
Compostable Paper	8.1%	312,127	10.2%	378,475
Remainder/Composite Paper	1.7%	64,562		
Glass	**2.8%**	**108,996**	**5.4%**	**201,853**
Clear Glass Containers	1.4%	53,206	2.7%	100,556
Brown Glass Containers	0.8%	32,428	1.8%	65,677
Green Glass Containers	0.2%	8,310	0.6%	23,376
Remainder/Composite Glass	0.4%	15,052	0.3%	11,874
Metal	**4.4%**	**168,079**	**6.0%**	**224,116**
Aluminum Cans & Containers	0.6%	24,498	1.6%	58,998
Other Aluminum	0.3%	11,985	0.3%	12,616
Tin/Steel Containers	1.0%	39,365	2.9%	108,719
Other Ferrous	1.8%	70,018	0.9%	32,282
Other Non-Ferrous	0.5%	20,802	0.2%	8,534
Oil Filters	0.0%	1,411	0.1%	2,968
Plastic	**15.3%**	**590,979**	**17.3%**	**640,068**
PET (#1) Bottles/Jars	1.4%	54,764	2.6%	94,619
PET (#1) Non-Bottle Containers	0.2%	8,321		
HDPE (#2) Natural Containers	0.4%	15,399	1.9%	70,500
HDPE (#2) Colored Containers	0.5%	19,462		
Clean Film Bags	0.3%	11,948		
Clean Ind'l/Com'l Film	0.7%	26,524	4.8%	178,848
Contaminated Film/Other Film	5.9%	229,256		
Plastic Containers #3 thru #7	1.0%	38,140		
Expanded Polystyrene #6	0.7%	27,908	8.0%	296,472
Bulky Durable Plastic Products	1.9%	72,746		
Remainder/Composite Plastic	2.2%	86,510		
Organics	**32.4%**	**1,248,872**	**26.9%**	**996,650**
Food Waste	15.0%	578,315	17.2%	638,954
Wood - Clean/Untreated	3.7%	141,024	1.2%	44,155
Wood - Painted/Stained/Treated	4.5%	173,266		
Disposable Diapers & Sanitary Prod.	3.1%	118,429	5.5%	203,337
Yard Waste	2.6%	101,921	3.0%	110,203
Remainder/Composite Organic	3.5%	135,918		
Textiles	**4.8%**	**186,773**	**4.7%**	**175,508**
Textiles - Clothing	2.3%	87,347		
Textiles - Non-Clothing	1.9%	73,652	4.7%	175,508
Shoes/Belts/Leather	0.7%	25,775		
Inorganics	**12.7%**	**491,013**	**4.1%**	**34,508**
Fines	1.7%	65,106	0.9%	34,508
Drywall/Gypsum Board	0.6%	23,013		
Asphalt, Brick, Concrete & Rocks	0.5%	18,639		
Carpet & Carpet Padding	2.6%	100,713		
Other Construction & Demolition	1.6%	60,431	3.2%	119,108
Bulky Items/Furniture	3.1%	121,343		
Mattresses/Boxsprings	0.7%	26,118		
Tires	0.8%	31,399		
Other/Not Classified	1.1%	44,249		
Electronics	**1.2%**	**46,216**	**1.0%**	**36,734**
Electronic Waste	1.2%	46,216	1.0%	36,734
HHW	**0.4%**	**15,974**	**0.9%**	**34,137**
Household Hazardous Waste	0.4%	15,974	0.9%	34,137
Grand Total	**100.0%**	**3,858,452**	**100.0%**	**3,591,429**
No. of Samples	***254***		***240***	

Percentages for materials may not exactly equal category subtotals due to rounding.

4.2 STATEWIDE RESIDENTIAL WASTE COMPOSITION

This section presents the estimated composition of Missouri's Residential waste stream.

4.2.1 RESULTS

Figure 4-7 shows the composition of Residential wastes in 2017. As shown, Organics and Paper are the most common material groups.

Figure 4-7 Residential MSW Composition

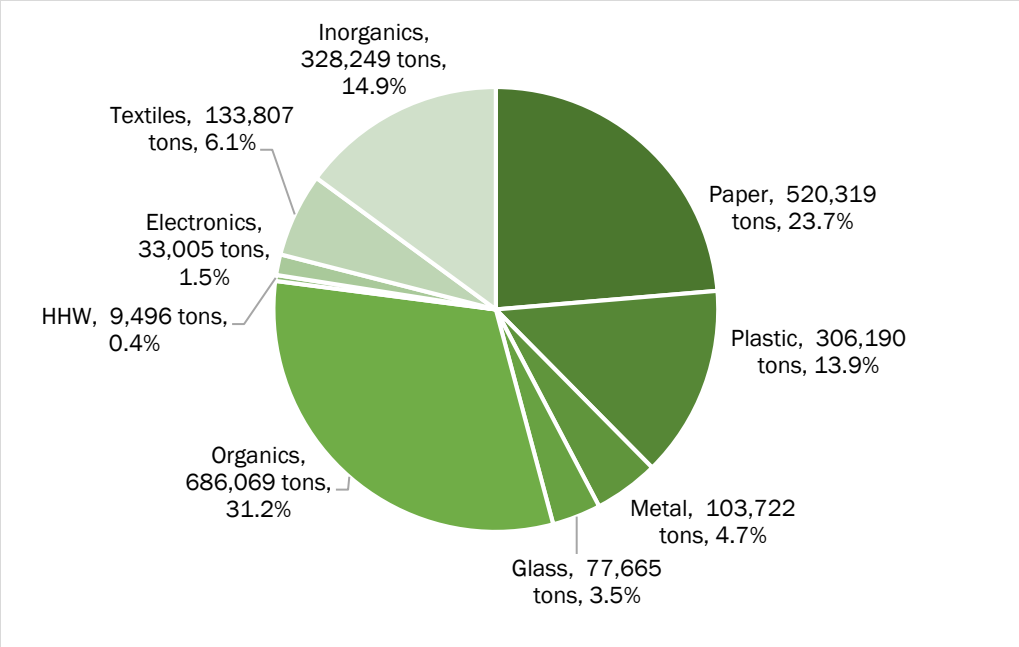


Table 4-5 provides the detailed statistical profile of the Residential MSW stream in Missouri.

Table 4-5 Detailed Residential MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**23.7%**	**1.2%**	**520,319**	**Plastic**	**13.9%**	**0.7%**	**306,190**
OCC/Kraft	4.6%	0.7%	100,873	PET (#1) Bottles/Jars	1.7%	1.7%	36,556
Newsprint	1.5%	0.2%	33,529	PET (#1) Non-Bottle Containers	0.2%	0.2%	4,951
Magazines	1.2%	0.3%	25,933	HDPE (#2) Natural Containers	0.4%	0.4%	9,519
High Grade Office Paper	1.3%	0.4%	29,255	HDPE (#2) Colored Containers	0.6%	0.6%	12,499
Mixed Recyclable Paper	4.8%	0.4%	105,738	Clean Film Bags	0.3%	0.3%	6,961
Compostable Paper	8.9%	0.5%	195,567	Clean Ind'l/Com'l Film	0.0%	0.0%	971
Remainder/Composite Paper	1.3%	0.3%	29,423	Contaminated Film/Other Film	4.9%	4.9%	**106,643**
Glass	**3.5%**	**0.5%**	**77,665**	Plastic Containers #3 thru #7	1.1%	1.1%	23,737
Clear Glass Containers	1.9%	0.2%	40,880	Expanded Polystyrene #6	0.8%	0.8%	17,313
Brown Glass Containers	1.0%	0.3%	21,867	Bulky Durable Plastic Products	2.1%	2.1%	46,695
Green Glass Containers	0.3%	0.1%	6,051	Remainder/Composite Plastic	1.8%	1.8%	40,346
Remainder/Composite Glass	0.4%	0.2%	8,868	**Textiles**	**6.1%**	**0.8%**	**133,807**
Metal	**4.7%**	**0.5%**	**103,722**	Textiles - Clothing	2.9%	2.9%	62,706
Aluminum Cans & Containers	0.8%	0.1%	16,996	Textiles - Non-Clothing	2.4%	2.4%	52,682
Other Aluminum	0.4%	0.1%	8,225	Shoes/Belts/Leather	0.8%	0.8%	18,419
Tin/Steel Containers	1.2%	0.1%	26,214	**Inorganics**	**14.9%**	**2.0%**	**328,249**
Other Ferrous	1.8%	0.5%	40,599	Fines	2.1%	2.1%	45,361
Other Non-Ferrous	0.5%	0.2%	10,711	Drywall/Gypsum Board	0.7%	0.7%	16,386
Oil Filters	0.0%	0.0%	976	Asphalt, Brick, Concrete & Rocks	0.4%	0.4%	8,615
Organics	**31.2%**	**1.7%**	**686,069**	Carpet & Carpet Padding	3.9%	3.9%	85,049
Food Waste	14.7%	1.2%	323,337	Other Construction & Demolition	1.3%	1.3%	29,248
Wood - Clean/Untreated	1.4%	0.8%	31,420	Bulky Items/Furniture	4.3%	4.3%	94,802
Wood - Painted/Stained/Treated	3.4%	0.8%	74,548	Mattresses/Boxsprings	0.7%	0.7%	16,015
Disposable Diapers & Sanitary Prod.	4.2%	0.5%	93,406	Tires	1.1%	1.1%	23,398
Yard Waste	3.6%	1.1%	80,128	Other/Not Classified	0.4%	0.4%	9,375
Remainder/Composite Organic	3.8%	0.6%	83,228	**HHW**	**0.4%**	**0.4%**	**9,496**
Electronics	**1.5%**	**0.5%**	**33,005**	Household Hazardous Waste	0.4%	0.4%	9,496
Electronic Waste	1.5%	0.5%	33,005				
				Grand Total	**100%**		**2,198,521**
				No. of Samples	***137***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 4-8 identifies the ten most prevalent material categories in Missouri Residential MSW. As shown, Food Waste was found to be the most prevalent material at almost 15 percent of the stream.

Figure 4-8 Top 10 Most Prevalent Materials in Residential Waste

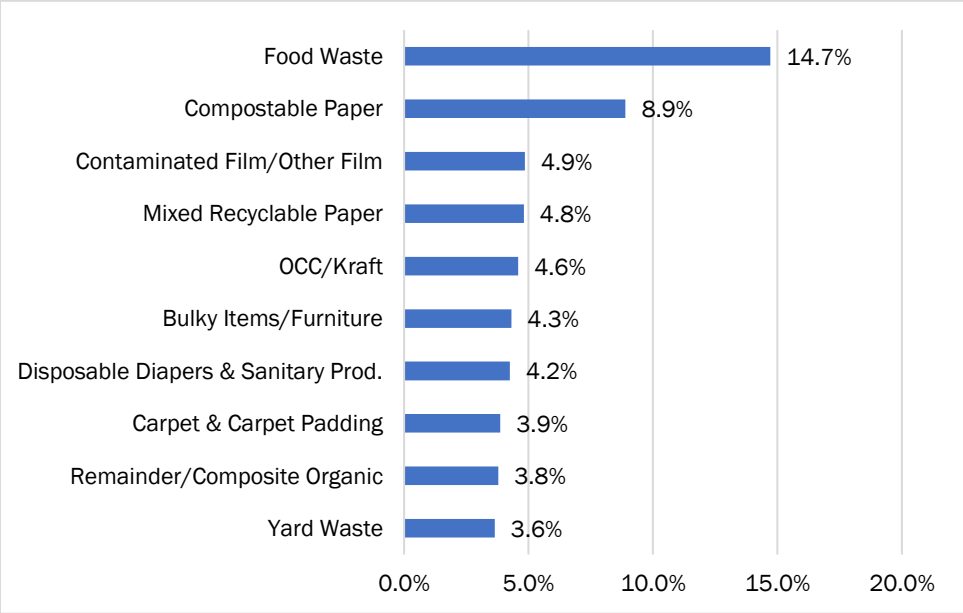
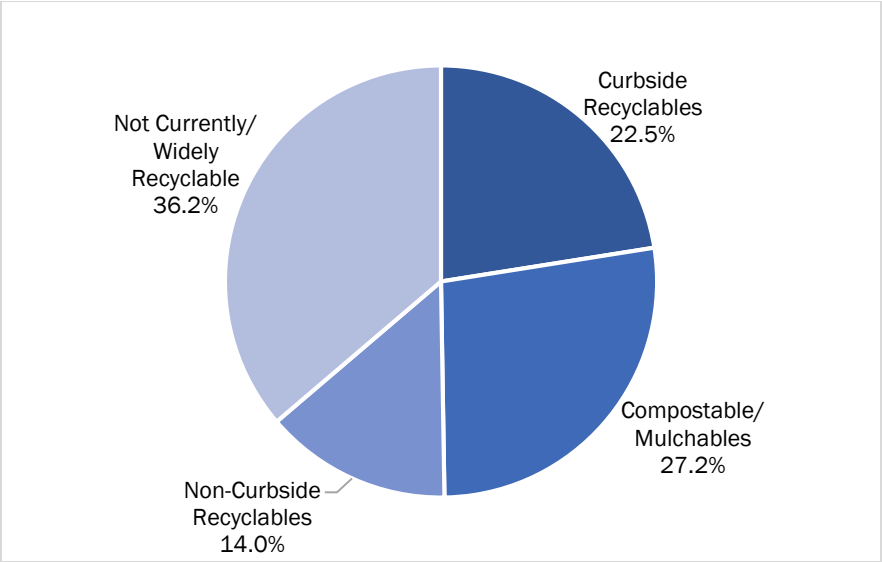


Figure 4-9 presents the composition of disposed Residential waste in terms of the potential for diverting materials from disposal using the "Diversion Strategy" assignments listed in Section 4.1.

Figure 4-9 Divertibility of Disposed Wastes from the Residential Sector



As shown, almost 65 percent of the materials could feasibly be recycled or composted if diverted to recyclable or compostable/mulchable outlets prior to disposal.

4.2.2 COMPARISON BY DEMOGRAPHIC REGION

Residential MSW composition results were also calculated individually by demographic region of the state. Figure 4-10 provides a comparison of the composition by major material group for the Large Metro, Small Metro and Rural areas of the state.

Figure 4-10 Comparison of Residential MSW by Demographic Region

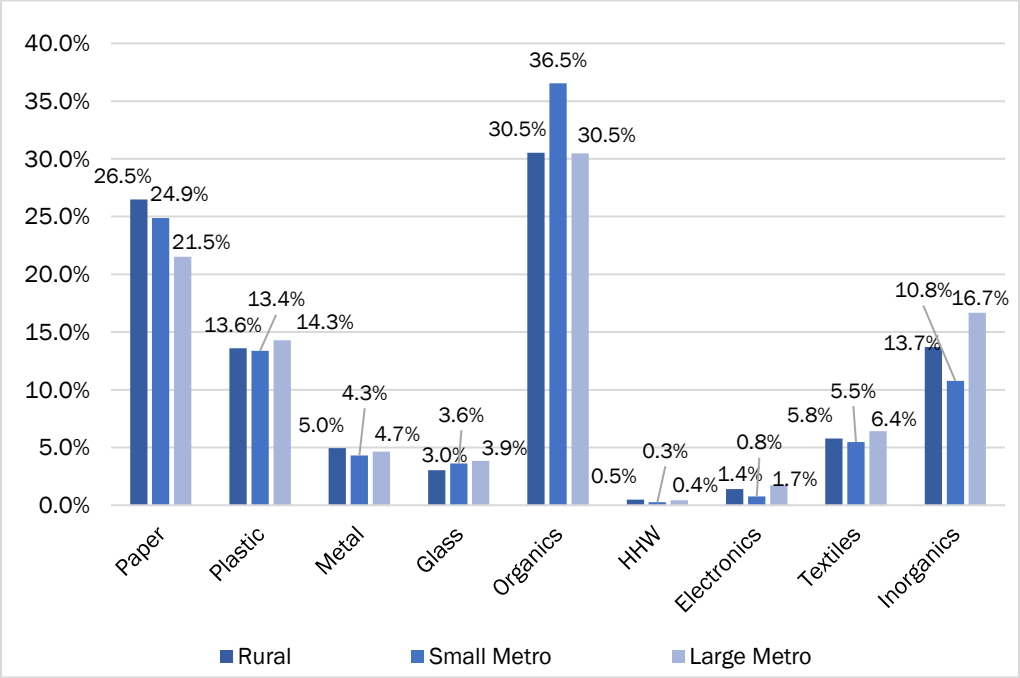


Table 4-6 provides the detailed composition of Residential MSW in Large Metro Small Metro and Rural areas. Detailed results tables by facility, including confidence intervals, are included in Appendices A-V.

Table 4-6 Comparison of Residential MSW Composition by Demographic Region

	Large Metro		Small Metro		Rural		Aggregate (Weighted)	
Material Category	Percent	Tonnage	Percent	Tonnage	Percent	Tonnage	Percent	Tonnage
Paper	**21.5%**	**249,869**	**24.9%**	**64,193**	**26.5%**	**206,257**	**23.7%**	**520,319**
OCC/Kraft	3.7%	43,028	5.2%	13,540	5.7%	44,305	4.6%	100,873
Newsprint	1.5%	17,086	1.2%	3,147	1.7%	13,296	1.5%	33,529
Magazines	0.8%	9,284	1.4%	3,678	1.7%	12,971	1.2%	25,933
High Grade Office Paper	0.6%	6,988	1.5%	3,852	2.4%	18,415	1.3%	29,255
Mixed Recyclable Paper	4.7%	54,428	3.8%	9,715	5.3%	41,594	4.8%	105,738
Compostable Paper	9.1%	105,834	9.9%	25,509	8.2%	64,224	8.9%	195,567
Remainder/Composite Paper	1.1%	13,221	1.8%	4,751	1.5%	11,451	1.3%	29,423
Glass	**3.9%**	**44,744**	**3.6%**	**9,341**	**3.0%**	**23,581**	**3.5%**	**77,665**
Clear Glass Containers	1.9%	22,136	1.6%	4,197	1.9%	14,547	1.9%	40,880
Brown Glass Containers	1.2%	14,445	1.1%	2,761	0.6%	4,662	1.0%	21,867
Green Glass Containers	0.3%	3,785	0.2%	525	0.2%	1,741	0.3%	6,051
Remainder/Composite Glass	0.4%	4,378	0.7%	1,858	0.3%	2,631	0.4%	8,868
Metal	**4.7%**	**54,027**	**4.3%**	**11,139**	**5.0%**	**38,556**	**4.7%**	**103,722**
Aluminum Cans & Containers	0.7%	8,299	0.7%	1,691	0.9%	7,007	0.8%	16,996
Other Aluminum	0.5%	5,338	0.3%	756	0.3%	2,131	0.4%	8,225
Tin/Steel Containers	1.0%	12,104	1.4%	3,566	1.4%	10,543	1.2%	26,214
Other Ferrous	1.9%	22,015	1.8%	4,617	1.8%	13,967	1.8%	40,599
Other Non-Ferrous	0.5%	5,683	0.1%	348	0.6%	4,680	0.5%	10,711
Oil Filters	0.1%	587	0.1%	161	0.0%	227	0.0%	976
Plastic	**14.3%**	**165,842**	**13.4%**	**34,505**	**13.6%**	**105,844**	**13.9%**	**306,190**
PET (#1) Bottles/Jars	1.5%	16,912	1.8%	4,645	1.9%	14,999	1.7%	36,556
PET (#1) Non-Bottle Containers	0.2%	2,087	0.5%	1,163	0.2%	1,700	0.2%	4,951
HDPE (#2) Natural Containers	0.4%	4,412	0.4%	1,150	0.5%	3,958	0.4%	9,519
HDPE (#2) Colored Containers	0.6%	6,431	0.5%	1,347	0.6%	4,721	0.6%	12,499
Clean Film Bags	0.3%	3,985	0.3%	763	0.3%	2,213	0.3%	6,961
Clean Ind'l/Com'l Film	0.0%	411	0.1%	132	0.1%	428	0.0%	971
Contaminated Film/Other Film	5.1%	58,685	4.8%	12,278	4.6%	35,680	4.9%	106,643
Plastic Containers #3 thru #7	1.3%	15,137	0.8%	2,171	0.8%	6,429	1.1%	23,737
Expanded Polystyrene #6	0.8%	9,105	0.8%	2,102	0.8%	6,106	0.8%	17,313
Bulky Durable Plastic Products	2.5%	28,532	1.2%	3,086	1.9%	15,077	2.1%	46,695
Remainder/Composite Plastic	1.7%	20,146	2.2%	5,667	1.9%	14,532	1.8%	40,346
Organics	**30.5%**	**353,985**	**36.5%**	**94,236**	**30.5%**	**237,847**	**31.2%**	**686,069**
Food Waste	14.6%	169,618	16.9%	43,685	14.1%	110,035	14.7%	323,337
Wood - Clean/Untreated	0.7%	8,647	0.4%	906	2.8%	21,867	1.4%	31,420
Wood - Painted/Stained/Treated	3.2%	36,979	3.9%	9,969	3.5%	27,600	3.4%	74,548
Disposable Diapers & Sanitary Prod.	4.4%	51,323	3.8%	9,891	4.1%	32,193	4.2%	93,406
Yard Waste	3.7%	43,529	7.4%	19,147	2.2%	17,452	3.6%	80,128
Remainder/Composite Organic	3.8%	43,889	4.1%	10,639	3.7%	28,700	3.8%	83,228
Textiles	**6.4%**	**74,561**	**5.5%**	**14,126**	**5.8%**	**45,119**	**6.1%**	**133,807**
Textiles - Clothing	3.2%	37,394	1.4%	3,599	2.8%	21,713	2.9%	62,706
Textiles - Non-Clothing	2.3%	26,318	3.1%	8,042	2.4%	18,322	2.4%	52,682
Shoes/Belts/Leather	0.9%	10,850	1.0%	2,485	0.7%	5,084	0.8%	18,419
Inorganics	**16.7%**	**193,676**	**10.8%**	**27,808**	**13.7%**	**106,766**	**14.9%**	**328,249**
Fines	2.3%	26,217	1.6%	4,066	1.9%	15,078	2.1%	45,361
Drywall/Gypsum Board	0.5%	5,538	0.5%	1,297	1.2%	9,551	0.7%	16,386
Asphalt, Brick, Concrete & Rocks	0.3%	3,751	0.5%	1,182	0.5%	3,681	0.4%	8,615
Carpet & Carpet Padding	3.3%	38,302	4.3%	11,218	4.6%	35,529	3.9%	85,049
Other Construction & Demolition	1.3%	15,292	1.5%	3,795	1.3%	10,161	1.3%	29,248
Bulky Items/Furniture	6.5%	75,865	0.5%	1,194	2.3%	17,743	4.3%	94,802
Mattresses/Boxsprings	1.2%	14,036	0.8%	1,979	0.0%	0	0.7%	16,015
Tires	0.9%	9,877	0.8%	2,058	1.5%	11,463	1.1%	23,398
Other/Not Classified	0.4%	4,799	0.4%	1,018	0.5%	3,559	0.4%	9,375
Electronics	**1.7%**	**20,055**	**0.8%**	**1,962**	**1.4%**	**10,989**	**1.5%**	**33,005**
Electronic Waste	1.7%	20,055	0.8%	1,962	1.4%	10,989	1.5%	33,005
HHW	**0.4%**	**4,984**	**0.3%**	**664**	**0.5%**	**3,847**	**0.4%**	**9,496**
Household Hazardous Waste	0.4%	4,984	0.3%	664	0.5%	3,847	0.4%	9,496
Grand Total	**100.0%**	**1,161,743**	**100.0%**	**257,973**	**100.0%**	**778,805**	**100.0%**	**2,198,521**
No. of Samples		***54***		***40***		***43***		***137***

Percentages for materials may not exactly equal category subtotals due to rounding.

4.3 STATEWIDE COMMERCIAL/INSTITUTIONAL (CI) WASTE COMPOSITION

This section presents the estimated composition of Missouri's Commercial and Institutional (CI) waste stream.

4.3.1 RESULTS

Figure 4-11 shows the composition and tonnage of CI wastes in 2017. Similar to the Residential stream, Paper and Organics are the most commonly occurring material groups in the CI stream.

Figure 4-11 CI Waste Composition

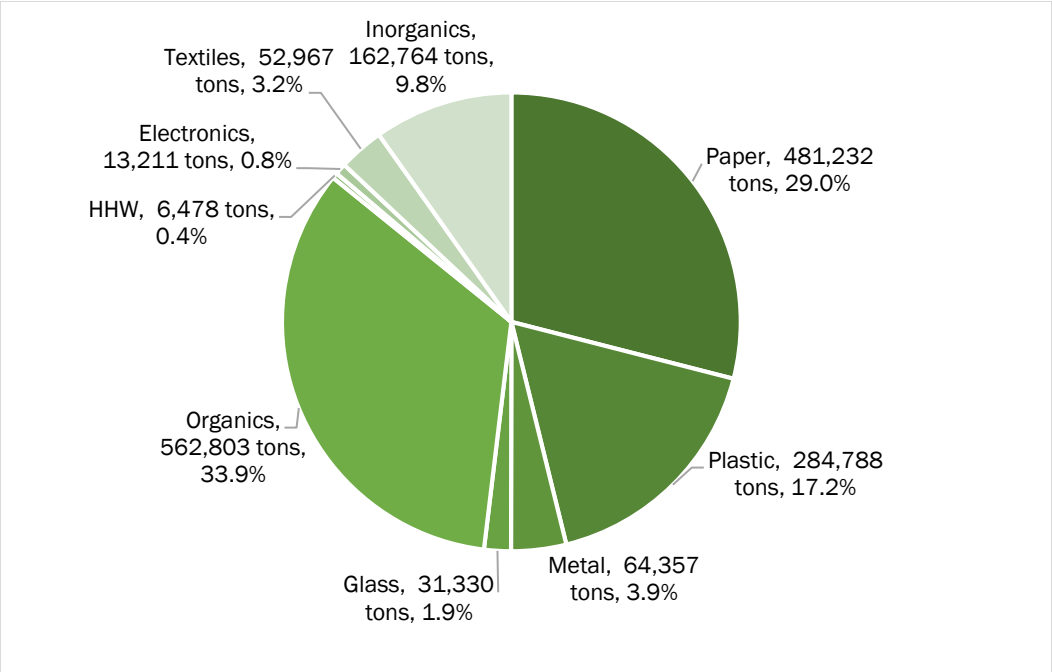


Table 4-7 provides a detailed statistical profile of the statewide disposed Commercial/Institutional waste stream.

Table 4-7 Detailed CI MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**29.0%**	**2.6%**	**481,232**	**Plastic**	**17.2%**	**2.2%**	**284,788**
OCC/Kraft	13.6%	2.0%	225,221	PET (#1) Bottles/Jars	1.1%	0.2%	18,208
Newsprint	1.4%	1.1%	23,059	PET (#1) Non-Bottle Containers	0.2%	0.1%	3,370
Magazines	0.6%	0.2%	9,394	HDPE (#2) Natural Containers	0.4%	0.1%	5,879
High Grade Office Paper	1.3%	0.4%	21,772	HDPE (#2) Colored Containers	0.4%	0.1%	6,964
Mixed Recyclable Paper	3.0%	0.6%	50,088	Clean Film Bags	0.3%	0.2%	4,987
Compostable Paper	7.0%	0.8%	116,560	Clean Ind'l/Com'l Film	1.5%	0.7%	25,553
Remainder/Composite Paper	2.1%	1.3%	35,139	Contaminated Film/Other Film	7.4%	1.7%	122,613
Glass	**1.9%**	**0.5%**	**31,330**	Plastic Containers #3 thru #7	0.9%	0.1%	14,404
Clear Glass Containers	0.7%	0.2%	12,326	Expanded Polystyrene #6	0.6%	0.1%	10,595
Brown Glass Containers	0.6%	0.2%	10,560	Bulky Durable Plastic Products	1.6%	0.5%	26,051
Green Glass Containers	0.1%	0.1%	2,260	Remainder/Composite Plastic	2.8%	0.7%	46,164
Remainder/Composite Glass	0.4%	0.2%	6,184	**Textiles**	**3.2%**	**1.0%**	**52,967**
Metal	**3.9%**	**0.9%**	**64,357**	Textiles - Clothing	1.5%	0.7%	24,641
Aluminum Cans & Containers	0.5%	0.1%	7,501	Textiles - Non-Clothing	1.3%	0.3%	20,970
Other Aluminum	0.2%	0.1%	3,759	Shoes/Belts/Leather	0.4%	0.2%	7,356
Tin/Steel Containers	0.8%	0.1%	13,151	**Inorganics**	**9.8%**	**2.5%**	**162,764**
Other Ferrous	1.8%	0.8%	29,419	Fines	1.2%	0.3%	19,745
Other Non-Ferrous	0.6%	0.4%	10,090	Drywall/Gypsum Board	0.4%	0.4%	6,627
Oil Filters	0.0%	0.0%	436	Asphalt, Brick, Concrete & Rocks	0.6%	0.4%	10,025
Organics	**33.9%**	**2.7%**	**562,803**	Carpet & Carpet Padding	0.9%	0.6%	15,664
Food Waste	15.4%	2.3%	254,977	Other Construction & Demolition	1.9%	0.8%	31,184
Wood - Clean/Untreated	6.6%	2.2%	109,604	Bulky Items/Furniture	1.6%	0.7%	26,541
Wood - Painted/Stained/Treated	5.9%	1.9%	98,717	Mattresses/Boxsprings	0.6%	0.4%	10,103
Disposable Diapers & Sanitary Prod.	1.5%	0.5%	25,023	Tires	0.5%	0.5%	8,001
Yard Waste	1.3%	0.7%	21,792	Other/Not Classified	2.1%	2.0%	34,874
Remainder/Composite Organic	3.2%	1.1%	52,690	**HHW**	**0.4%**	**0.3%**	**6,478**
Electronics	**0.8%**	**0.5%**	**13,211**	Household Hazardous Waste	0.4%	0.3%	6,478
Electronic Waste	0.8%	0.5%	13,211				
				Grand Total	**100%**		**1,659,931**
				No. of Samples	***117***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 4-12 shows the top ten most prevalent materials in the Missouri CI waste stream. Food Waste is the most commonly disposed material category at 15.4 percent. It is noteworthy that more than 13 percent of CI waste was found to be corrugated cardboard is also prevalent in the CI stream.

Figure 4-12 Top 10 Most Prevalent Materials in Commercial/Institutional Waste

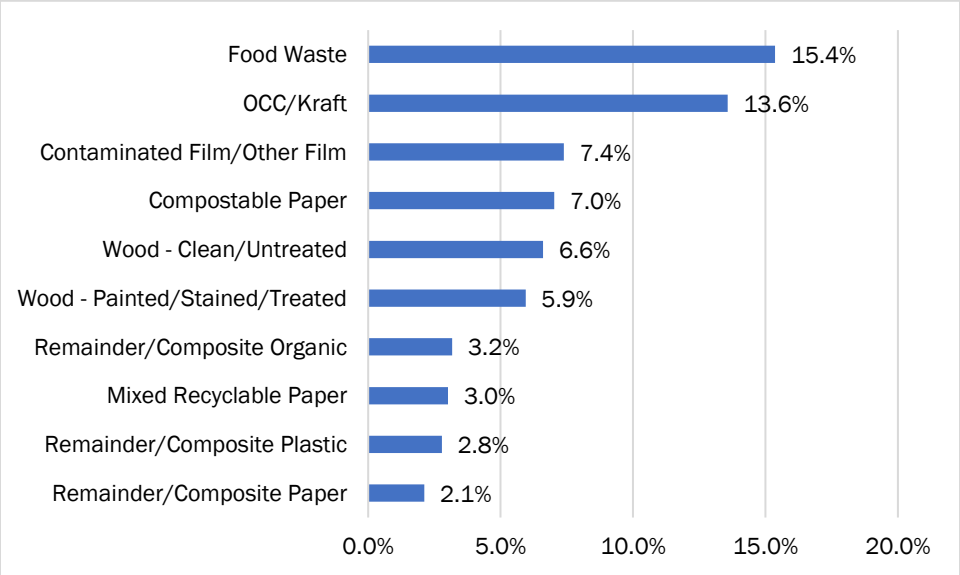
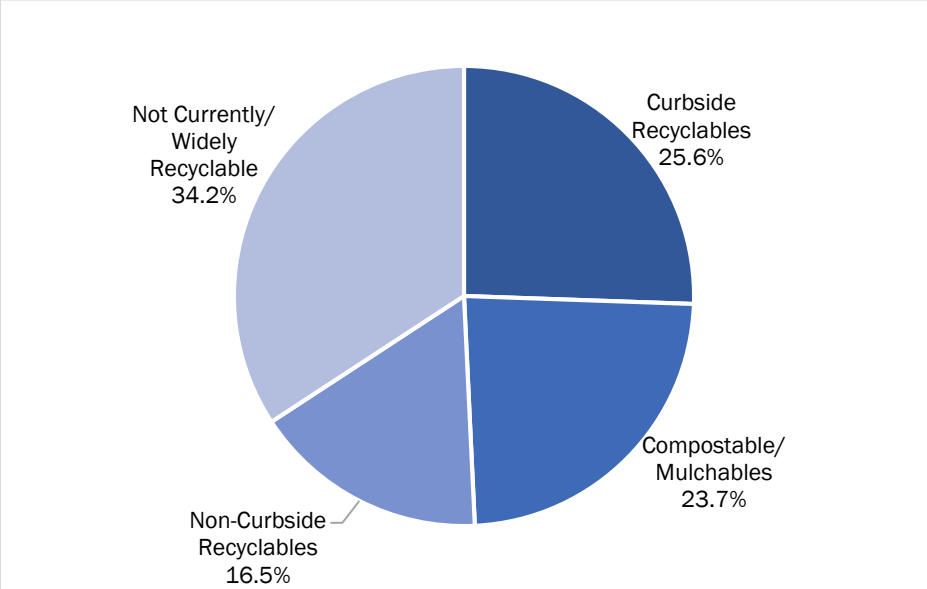


Figure 4-13 presents the composition of disposed CI waste in terms of the potential for diverting materials from disposal using the "Diversion Strategy" assignments listed in Section 4.1. Considering the recyclables and compostable/mulchables, over 65 percent is identified as Divertible.

Figure 4-13 Divertibility of CI Disposed Wastes



4.3.2 Comparison by Demographic Region

Commercial/Institutional MSW composition results were also calculated individually by demographic region of the state. Figure 4-14 provides a comparison of the composition by major material group for the Large Metro, Small Metro and Rural areas of the state.

Figure 4-14 Comparison of CI MSW by Demographic Region

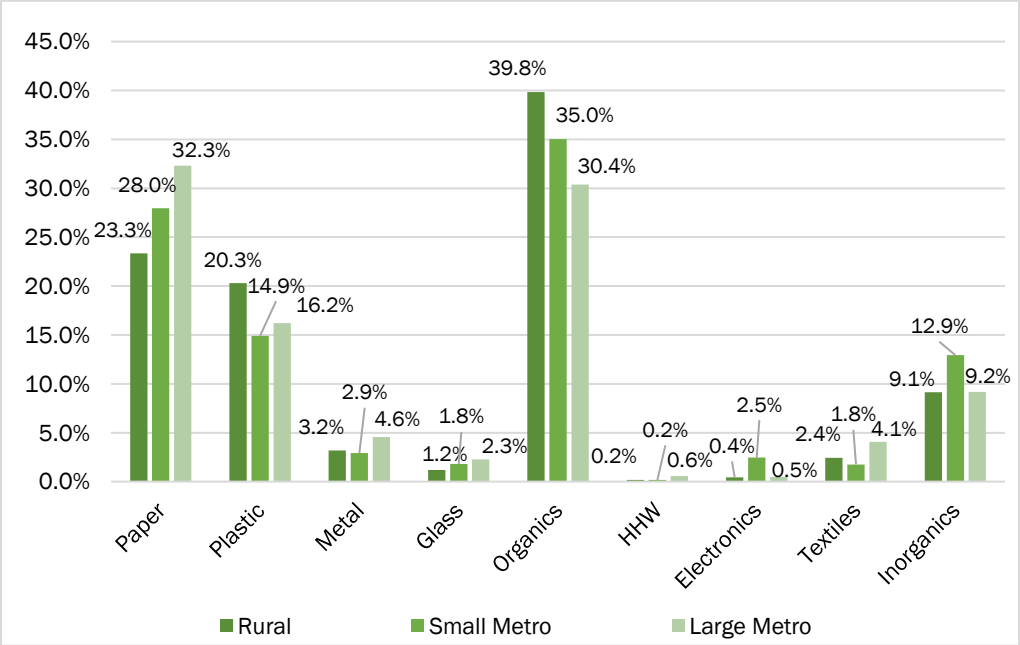


Table 4-8 provides the detailed composition of Commercial/Institutional MSW waste from Large Metro, Small Metro and Rural areas.

Table 4-8 Comparison of CI MSW Composition by Demographic Region

	Large Metro		Small Metro		Rural		Aggregate (Weighted)	
Material Category	Percent	Tonnage	Percent	Tonnage	Percent	Tonnage	Percent	Tonnage
Paper	**32.3%**	**290,157**	**28.0%**	**79,785**	**23.3%**	**111,291**	**29.0%**	**481,232**
OCC/Kraft	16.4%	146,913	13.7%	38,989	8.2%	39,320	13.6%	225,221
Newsprint	1.9%	17,327	0.9%	2,618	0.7%	3,114	1.4%	23,059
Magazines	0.5%	4,319	0.8%	2,324	0.6%	2,751	0.6%	9,394
High Grade Office Paper	1.4%	12,698	1.3%	3,692	1.1%	5,382	1.3%	21,772
Mixed Recyclable Paper	3.0%	26,867	2.6%	7,557	3.3%	15,664	3.0%	50,088
Compostable Paper	7.8%	70,441	7.1%	20,317	5.4%	25,802	7.0%	116,560
Remainder/Composite Paper	1.3%	11,592	1.5%	4,288	4.0%	19,259	2.1%	35,139
Glass	**2.3%**	**20,458**	**1.8%**	**5,173**	**1.2%**	**5,699**	**1.9%**	**31,330**
Clear Glass Containers	0.8%	7,219	0.8%	2,204	0.6%	2,903	0.7%	12,326
Brown Glass Containers	0.9%	7,830	0.4%	1,267	0.3%	1,463	0.6%	10,560
Green Glass Containers	0.2%	1,695	0.1%	359	0.0%	205	0.1%	2,260
Remainder/Composite Glass	0.4%	3,715	0.5%	1,342	0.2%	1,127	0.4%	6,184
Metal	**4.6%**	**40,879**	**2.9%**	**8,352**	**3.2%**	**15,126**	**3.9%**	**64,357**
Aluminum Cans & Containers	0.5%	4,494	0.3%	873	0.4%	2,134	0.5%	7,501
Other Aluminum	0.3%	2,560	0.2%	662	0.1%	537	0.2%	3,759
Tin/Steel Containers	0.7%	6,146	0.8%	2,237	1.0%	4,768	0.8%	13,151
Other Ferrous	2.4%	21,499	1.5%	4,143	0.8%	3,777	1.8%	29,419
Other Non-Ferrous	0.7%	6,180	0.0%	88	0.8%	3,822	0.6%	10,090
Oil Filters	0.0%	-	0.1%	349	0.0%	87	0.0%	436
Plastic	**16.2%**	**145,484**	**14.9%**	**42,534**	**20.3%**	**96,770**	**17.2%**	**284,788**
PET (#1) Bottles/Jars	1.1%	10,246	1.0%	2,759	1.1%	5,202	1.1%	18,208
PET (#1) Non-Bottle Containers	0.1%	1,228	0.2%	524	0.3%	1,619	0.2%	3,370
HDPE (#2) Natural Containers	0.4%	3,273	0.3%	836	0.4%	1,770	0.4%	5,879
HDPE (#2) Colored Containers	0.4%	3,556	0.5%	1,365	0.4%	2,042	0.4%	6,964
Clean Film Bags	0.1%	1,323	0.1%	202	0.7%	3,462	0.3%	4,987
Clean Ind'l/Com'l Film	1.6%	14,173	1.1%	3,206	1.7%	8,174	1.5%	25,553
Contaminated Film/Other Film	6.6%	59,354	5.7%	16,167	9.9%	47,092	7.4%	122,613
Plastic Containers #3 thru #7	1.0%	9,178	0.8%	2,265	0.6%	2,962	0.9%	14,404
Expanded Polystyrene #6	0.6%	5,019	0.8%	2,368	0.7%	3,208	0.6%	10,595
Bulky Durable Plastic Products	1.9%	17,384	1.2%	3,424	1.1%	5,244	1.6%	26,051
Remainder/Composite Plastic	2.3%	20,751	3.3%	9,418	3.4%	15,996	2.8%	46,164
Organics	**30.4%**	**272,871**	**35.0%**	**99,936**	**39.8%**	**189,996**	**33.9%**	**562,803**
Food Waste	14.0%	125,337	17.2%	48,940	16.9%	80,701	15.4%	254,977
Wood - Clean/Untreated	5.1%	46,070	8.9%	25,312	8.0%	38,222	6.6%	109,604
Wood - Painted/Stained/Treated	6.0%	53,664	4.9%	13,887	6.5%	31,166	5.9%	98,717
Disposable Diapers & Sanitary Prod.	1.3%	11,267	1.4%	3,909	2.1%	9,847	1.5%	25,023
Yard Waste	1.6%	14,721	0.4%	1,076	1.3%	5,995	1.3%	21,792
Remainder/Composite Organic	2.4%	21,813	2.4%	6,812	5.0%	24,066	3.2%	52,690
Textiles	**4.1%**	**36,399**	**1.8%**	**5,017**	**2.4%**	**11,551**	**3.2%**	**52,967**
Textiles - Clothing	2.3%	20,891	0.4%	1,265	0.5%	2,485	1.5%	24,641
Textiles - Non-Clothing	1.3%	11,377	0.9%	2,479	1.5%	7,114	1.3%	20,970
Shoes/Belts/Leather	0.5%	4,131	0.4%	1,273	0.4%	1,951	0.4%	7,356
Inorganics	**9.2%**	**82,328**	**12.9%**	**36,909**	**9.1%**	**43,527**	**9.8%**	**162,764**
Fines	1.2%	10,630	0.7%	2,125	1.5%	6,991	1.2%	19,745
Drywall/Gypsum Board	0.7%	6,331	0.1%	176	0.0%	121	0.4%	6,627
Asphalt, Brick, Concrete & Rocks	0.6%	5,128	0.7%	1,943	0.6%	2,954	0.6%	10,025
Carpet & Carpet Padding	1.4%	12,232	1.0%	2,925	0.1%	506	0.9%	15,664
Other Construction & Demolition	1.4%	12,985	3.8%	10,730	1.6%	7,468	1.9%	31,184
Bulky Items/Furniture	2.6%	23,068	0.4%	1,242	0.5%	2,231	1.6%	26,541
Mattresses/Boxsprings	0.5%	4,899	0.0%	0	1.1%	5,204	0.6%	10,103
Tires	0.3%	2,282	2.0%	5,719	0.0%	0	0.5%	8,001
Other/Not Classified	0.5%	4,773	4.2%	12,050	3.8%	18,052	2.1%	34,874
Electronics	**0.5%**	**4,076**	**2.5%**	**7,056**	**0.4%**	**2,079**	**0.8%**	**13,211**
Electronic Waste	0.5%	4,076	2.5%	7,056	0.4%	2,079	0.8%	13,211
HHW	**0.6%**	**5,146**	**0.2%**	**482**	**0.2%**	**850**	**0.4%**	**6,478**
Household Hazardous Waste	0.6%	5,146	0.2%	482	0.2%	850	0.4%	6,478
Grand Total	**100.0%**	**897,797**	**100.0%**	**285,244**	**100.0%**	**476,890**	**100.0%**	**1,659,931**
No. of Samples		***60***		***27***		***30***		***117***

Percentages for materials may not exactly equal category subtotals due to rounding.

4.4 COMPARISON BY GENERATOR SECTOR

Table 4-9 shows a detailed comparison of the percentages and tons for Residential and CI wastes. Whereas both sectors had similar occurrences of Food waste, the Commercial/Institutional sector consisted of nearly 9% more in the OCC/Kraft material, a material which is commonly recyclable.

Table 4-9 Detailed Comparison of Residential and CI Waste Composition

	Residential		Com'l/Inst'l		Aggregate (Weighted)	
Material Category	Percent	Tonnage	Percent	Tonnage	Percent	Tonnage
Paper	**23.7%**	**520,319**	**29.0%**	**481,232**	**26.0%**	**1,001,551**
OCC/Kraft	4.6%	100,873	13.6%	225,221	8.5%	326,094
Newsprint	1.5%	33,529	1.4%	23,059	1.5%	56,588
Magazines	1.2%	25,933	0.6%	9,394	0.9%	35,327
High Grade Office Paper	1.3%	29,255	1.3%	21,772	1.3%	51,027
Mixed Recyclable Paper	4.8%	105,738	3.0%	50,088	4.0%	155,827
Compostable Paper	8.9%	195,567	7.0%	116,560	8.1%	312,127
Remainder/Composite Paper	1.3%	29,423	2.1%	35,139	1.7%	64,562
Glass	**3.5%**	**77,665**	**1.9%**	**31,330**	**2.8%**	**108,996**
Clear Glass Containers	1.9%	40,880	0.7%	12,326	1.4%	53,206
Brown Glass Containers	1.0%	21,867	0.6%	10,560	0.8%	32,428
Green Glass Containers	0.3%	6,051	0.1%	2,260	0.2%	8,310
Remainder/Composite Glass	0.4%	8,868	0.4%	6,184	0.4%	15,052
Metal	**4.7%**	**103,722**	**3.9%**	**64,357**	**4.4%**	**168,079**
Aluminum Cans & Containers	0.8%	16,996	0.5%	7,501	0.6%	24,498
Other Aluminum	0.4%	8,225	0.2%	3,759	0.3%	11,985
Tin/Steel Containers	1.2%	26,214	0.8%	13,151	1.0%	39,365
Other Ferrous	1.8%	40,599	1.8%	29,419	1.8%	70,018
Other Non-Ferrous	0.5%	10,711	0.6%	10,090	0.5%	20,802
Oil Filters	0.0%	976	0.0%	436	0.0%	1,411
Plastic	**13.9%**	**306,190**	**17.2%**	**284,788**	**15.3%**	**590,979**
PET (#1) Bottles/Jars	1.7%	36,556	1.1%	18,208	1.4%	54,764
PET (#1) Non-Bottle Containers	0.2%	4,951	0.2%	3,370	0.2%	8,321
HDPE (#2) Natural Containers	0.4%	9,519	0.4%	5,879	0.4%	15,399
HDPE (#2) Colored Containers	0.6%	12,499	0.4%	6,964	0.5%	19,462
Clean Film Bags	0.3%	6,961	0.3%	4,987	0.3%	11,948
Clean Ind'l/Com'l Film	0.0%	971	1.5%	25,553	0.7%	26,524
Contaminated Film/Other Film	4.9%	106,643	7.4%	122,612	5.9%	229,256
Plastic Containers #3 thru #7	1.1%	23,737	0.9%	14,404	1.0%	38,140
Expanded Polystyrene #6	0.8%	17,313	0.6%	10,595	0.7%	27,908
Bulky Durable Plastic Products	2.1%	46,695	1.6%	26,051	1.9%	72,746
Remainder/Composite Plastic	1.8%	40,346	2.8%	46,164	2.2%	86,510
Organics	**31.2%**	**686,069**	**33.9%**	**562,803**	**32.4%**	**1,248,872**
Food Waste	14.7%	323,337	15.4%	254,977	15.0%	578,315
Wood - Clean/Untreated	1.4%	31,420	6.6%	109,604	3.7%	141,024
Wood - Painted/Stained/Treated	3.4%	74,548	5.9%	98,717	4.5%	173,266
Disposable Diapers & Sanitary Prod.	4.2%	93,406	1.5%	25,023	3.1%	118,429
Yard Waste	3.6%	80,128	1.3%	21,792	2.6%	101,921
Remainder/Composite Organic	3.8%	83,228	3.2%	52,690	3.5%	135,918
Textiles	**6.1%**	**133,807**	**3.2%**	**52,967**	**4.8%**	**186,773**
Textiles - Clothing	2.9%	62,706	1.5%	24,641	2.3%	87,347
Textiles - Non-Clothing	2.4%	52,682	1.3%	20,970	1.9%	73,652
Shoes/Belts/Leather	0.8%	18,419	0.4%	7,356	0.7%	25,775
Inorganics	**14.9%**	**328,249**	**9.8%**	**162,764**	**12.7%**	**491,013**
Fines	2.1%	45,361	1.2%	19,745	1.7%	65,106
Drywall/Gypsum Board	0.7%	16,386	0.4%	6,627	0.6%	23,013
Asphalt, Brick, Concrete & Rocks	0.4%	8,615	0.6%	10,025	0.5%	18,639
Carpet & Carpet Padding	3.9%	85,049	0.9%	15,664	2.6%	100,713
Other Construction & Demolition	1.3%	29,248	1.9%	31,184	1.6%	60,431
Bulky Items/Furniture	4.3%	94,802	1.6%	26,541	3.1%	121,343
Mattresses/Boxsprings	0.7%	16,015	0.6%	10,103	0.7%	26,118
Tires	1.1%	23,398	0.5%	8,001	0.8%	31,399
Other/Not Classified	0.4%	9,375	2.1%	34,874	1.1%	44,249
Electronics	**1.5%**	**33,005**	**0.8%**	**13,211**	**1.2%**	**46,216**
Electronic Waste	1.5%	33,005	0.8%	13,211	1.2%	46,216
HHW	**0.4%**	**9,496**	**0.4%**	**6,478**	**0.4%**	**15,974**
Household Hazardous Waste	0.4%	9,496	0.4%	6,478	0.4%	15,974
Grand Total	**100.0%**	**2,198,521**	**100.0%**	**1,659,931**	**100.0%**	**3,858,452**
No. of Samples	***137***		***117***		***254***	

Percentages for materials may not exactly equal category subtotals due to rounding.

4.5 RESULTS BY DEMOGRAPHIC REGION

This section provides detailed statistical results for Residential and CI wastes from the Rural, Small Metro and Large Metro regions of the state. Table 4-10 provides a count of the number of samples obtained for each combination of generator sector and demographic origin.

Table 4-10 Rural, Small Metro and Large Metro MSW Sample Counts

Demographic Region	Residential Samples	CI Samples	Total
Rural	43	30	73
Small Metro	40	27	67
Large Metro	54	60	114
Total	**137**	**117**	**254**

As shown in the table, a significant number of samples were obtained from each demographic area. Comparisons between demographic regions should show statistically relevant similarities and differences in MSW.

4.5.1 RURAL AREAS

Figure 4-15 shows the composition of Rural wastes in 2017. As shown, Organics was over one-third of the material, with Paper comprising over 25 percent.

Figure 4-15 Rural Waste Composition

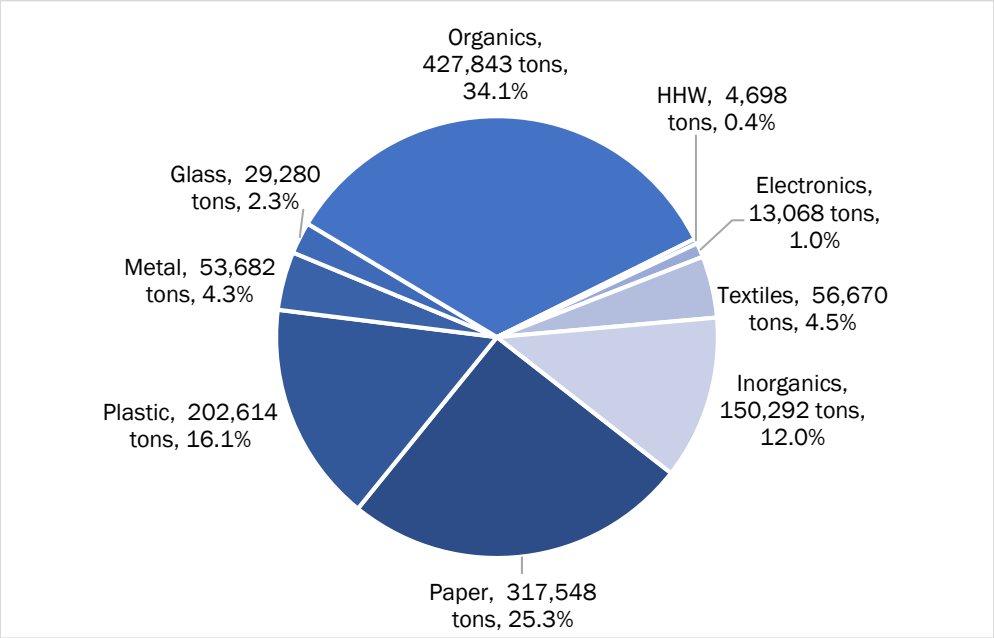


Table 4-11 provides the detailed statistical profile of the Rural waste stream in Missouri.

Table 4-11 Detailed Rural MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**25.3%**	**2.7%**	**317,548**	**Plastic**	**16.1%**	**2.9%**	**202,614**
OCC/Kraft	6.7%	1.3%	83,625	PET (#1) Bottles/Jars	1.6%	0.2%	20,201
Newsprint	1.3%	0.3%	16,409	PET (#1) Non-Bottle Containers	0.3%	0.2%	3,319
Magazines	1.3%	0.5%	15,722	HDPE (#2) Natural Containers	0.5%	0.1%	5,728
High Grade Office Paper	1.9%	0.8%	23,796	HDPE (#2) Colored Containers	0.5%	0.1%	6,764
Mixed Recyclable Paper	4.6%	0.9%	57,258	Clean Film Bags	0.5%	0.3%	5,675
Compostable Paper	7.2%	0.8%	90,027	Clean Ind'l/Com'l Film	0.7%	0.7%	8,603
Remainder/Composite Paper	2.4%	2.0%	30,710	Contaminated Film/Other Film	6.6%	2.3%	82,772
Glass	**2.3%**	**0.6%**	**29,280**	Plastic Containers #3 thru #7	0.7%	0.1%	9,391
Clear Glass Containers	1.4%	0.3%	17,451	Expanded Polystyrene #6	0.7%	0.1%	9,314
Brown Glass Containers	0.5%	0.2%	6,125	Bulky Durable Plastic Products	1.6%	0.6%	20,321
Green Glass Containers	0.2%	0.1%	1,946	Remainder/Composite Plastic	2.4%	0.9%	30,528
Remainder/Composite Glass	0.3%	0.1%	3,758	**Textiles**	**4.5%**	**1.1%**	**56,670**
Metal	**4.3%**	**0.9%**	**53,682**	Textiles - Clothing	1.9%	0.7%	24,199
Aluminum Cans & Containers	0.7%	0.1%	9,141	Textiles - Non-Clothing	2.0%	0.6%	25,436
Other Aluminum	0.2%	0.1%	2,669	Shoes/Belts/Leather	0.6%	0.2%	7,035
Tin/Steel Containers	1.2%	0.2%	15,312	**Inorganics**	**12.0%**	**3.0%**	**150,292**
Other Ferrous	1.4%	0.7%	17,745	Fines	1.8%	0.5%	22,069
Other Non-Ferrous	0.7%	0.4%	8,502	Drywall/Gypsum Board	0.8%	0.6%	9,672
Oil Filters	0.0%	0.0%	314	Asphalt, Brick, Concrete & Rocks	0.5%	0.4%	6,635
Organics	**34.1%**	**3.1%**	**427,843**	Carpet & Carpet Padding	2.9%	1.2%	36,035
Food Waste	15.2%	2.5%	190,735	Other Construction & Demolition	1.4%	0.7%	17,630
Wood - Clean/Untreated	4.8%	2.9%	60,089	Bulky Items/Furniture	1.6%	0.7%	19,974
Wood - Painted/Stained/Treated	4.7%	1.8%	58,766	Mattresses/Boxsprings	0.4%	0.4%	5,204
Disposable Diapers & Sanitary Prod.	3.3%	0.9%	42,040	Tires	0.9%	1.1%	11,463
Yard Waste	1.9%	0.9%	23,447	Other/Not Classified	1.7%	2.2%	21,611
Remainder/Composite Organic	4.2%	1.5%	52,766	**HHW**	**0.4%**	**0.1%**	**4,698**
Electronics	**1.0%**	**0.7%**	**13,068**	Household Hazardous Waste	0.4%	0.1%	4,698
Electronic Waste	1.0%	0.7%	13,068				
				Grand Total	**100%**		**1,255,695**
				No. of Samples	***73***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 4-16 identifies the ten most prevalent material categories in Rural waste. Food Waste was found to be the most prevalent material at about 15 percent of the stream.

Figure 4-16 Top 10 Most Prevalent Materials in Rural Waste

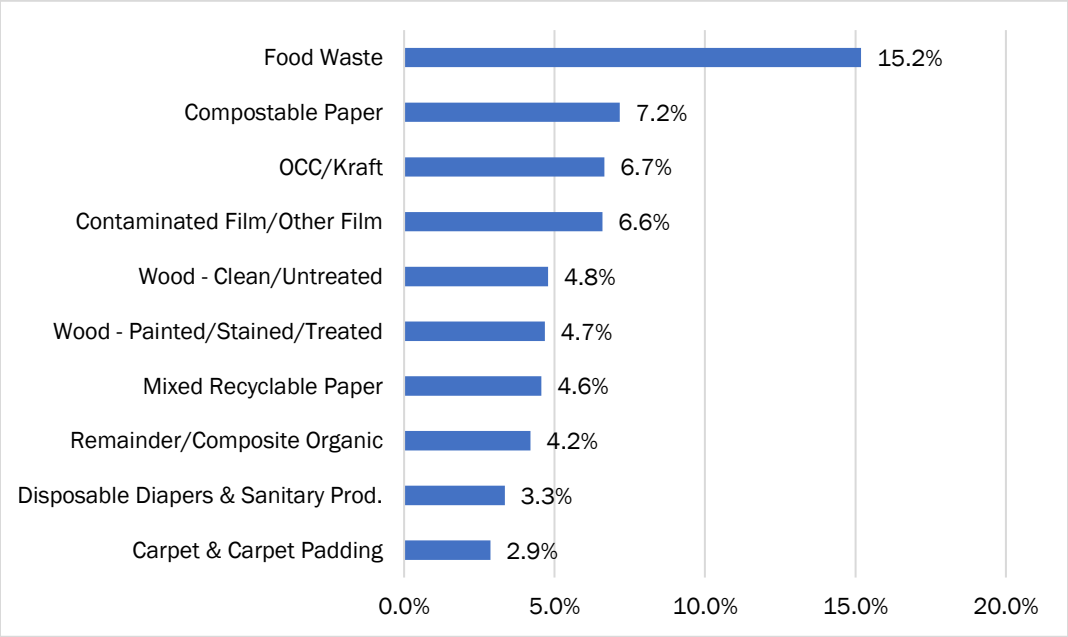


Figure 4-17 presents the composition of disposed Residential waste in terms of the potential for diverting materials from disposal using the "Diversion Strategy" assignments listed in Section 4.1. As shown, a little over 37% was identified to be the materials not easily divertible with current programs.

Figure 4-17 Divertibility of Disposed Wastes from Rural Areas

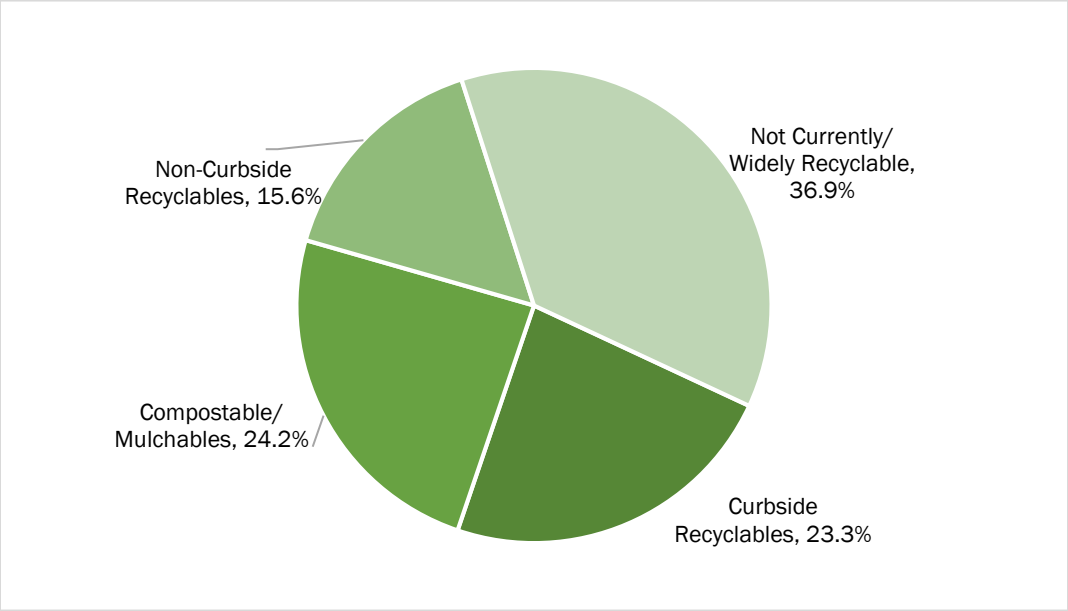


Figure 4-18 compares the composition of Residential and CI wastes from Rural areas. Whereas there is more paper from the Rural Residential generators, there is over 9 percent more Organic material in the Rural CI sector than Rural Residential.

Figure 4-18 Comparison of Residential and CI Wastes from Rural Areas

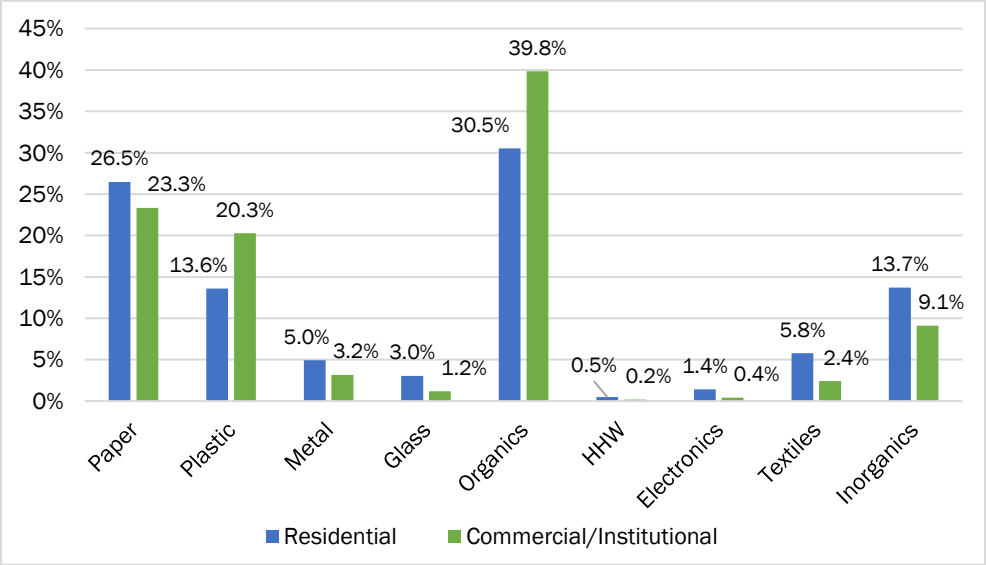


Table 4-12 provides the detailed statistical profile of the Rural waste stream in Missouri.

Table 4-12 Residential and CI Waste Composition in Rural Areas

	Residential			Com'l/Inst'l		
Material Category	Est. Percent	Conf Int (+/-)	Tonnage	Est. Percent	Conf Int (+/-)	Tonnage
Paper	**26.5%**	**2.6%**	**206,257**	**23.3%**	**5.5%**	**111,291**
OCC/Kraft	5.7%	1.5%	44,305	8.2%	2.5%	39,320
Newsprint	1.7%	0.4%	13,296	0.7%	0.4%	3,114
Magazines	1.7%	0.7%	12,971	0.6%	0.4%	2,751
High Grade Office Paper	2.4%	1.2%	18,415	1.1%	0.6%	5,382
Mixed Recyclable Paper	5.3%	0.9%	41,594	3.3%	1.5%	15,664
Compostable Paper	8.2%	0.8%	64,224	5.4%	1.3%	25,802
Remainder/Composite Paper	1.5%	0.5%	11,451	4.0%	4.9%	19,259
Glass	**3.0%**	**0.9%**	**23,581**	**1.2%**	**0.5%**	**5,699**
Clear Glass Containers	1.9%	0.5%	14,547	0.6%	0.2%	2,903
Brown Glass Containers	0.6%	0.3%	4,662	0.3%	0.2%	1,463
Green Glass Containers	0.2%	0.2%	1,741	0.0%	0.1%	205
Remainder/Composite Glass	0.3%	0.2%	2,631	0.2%	0.1%	1,127
Metal	**5.0%**	**1.2%**	**38,556**	**3.2%**	**1.2%**	**15,126**
Aluminum Cans & Containers	0.9%	0.2%	7,007	0.4%	0.1%	2,134
Other Aluminum	0.3%	0.1%	2,131	0.1%	0.0%	537
Tin/Steel Containers	1.4%	0.2%	10,543	1.0%	0.3%	4,768
Other Ferrous	1.8%	1.1%	13,967	0.8%	0.4%	3,777
Other Non-Ferrous	0.6%	0.4%	4,680	0.8%	0.8%	3,822
Oil Filters	0.0%	0.0%	227	0.0%	0.0%	87
Plastic	**13.6%**	**1.3%**	**105,844**	**20.3%**	**6.6%**	**96,770**
PET (#1) Bottles/Jars	1.9%	0.2%	14,999	1.1%	0.3%	5,202
PET (#1) Non-Bottle Containers	0.2%	0.1%	1,700	0.3%	0.3%	1,619
HDPE (#2) Natural Containers	0.5%	0.1%	3,958	0.4%	0.2%	1,770
HDPE (#2) Colored Containers	0.6%	0.1%	4,721	0.4%	0.2%	2,042
Clean Film Bags	0.3%	0.1%	2,213	0.7%	0.8%	3,462
Clean Ind'l/Com'l Film	0.1%	0.1%	428	1.7%	1.6%	8,174
Contaminated Film/Other Film	4.6%	0.5%	35,680	9.9%	5.5%	47,092
Plastic Containers #3 thru #7	0.8%	0.1%	6,429	0.6%	0.2%	2,962
Expanded Polystyrene #6	0.8%	0.1%	6,106	0.7%	0.2%	3,208
Bulky Durable Plastic Products	1.9%	0.9%	15,077	1.1%	0.8%	5,244
Remainder/Composite Plastic	1.9%	0.4%	14,532	3.4%	2.2%	15,996
Organics	**30.5%**	**3.0%**	**237,847**	**39.8%**	**5.6%**	**189,996**
Food Waste	14.1%	2.1%	110,035	16.9%	5.3%	80,701
Wood - Clean/Untreated	2.8%	2.5%	21,867	8.0%	5.9%	38,222
Wood - Painted/Stained/Treated	3.5%	1.8%	27,600	6.5%	3.6%	31,166
Disposable Diapers & Sanitary Prod.	4.1%	0.9%	32,193	2.1%	1.6%	9,847
Yard Waste	2.2%	1.1%	17,452	1.3%	1.5%	5,995
Remainder/Composite Organic	3.7%	1.1%	28,700	5.0%	3.3%	24,066
Textiles	**5.8%**	**1.5%**	**45,119**	**2.4%**	**1.4%**	**11,551**
Textiles - Clothing	2.8%	1.0%	21,713	0.5%	0.4%	2,485
Textiles - Non-Clothing	2.4%	0.7%	18,322	1.5%	0.9%	7,114
Shoes/Belts/Leather	0.7%	0.3%	5,084	0.4%	0.2%	1,951
Inorganics	**13.7%**	**3.2%**	**106,766**	**9.1%**	**5.8%**	**43,527**
Fines	1.9%	0.6%	15,078	1.5%	0.8%	6,991
Drywall/Gypsum Board	1.2%	0.9%	9,551	0.0%	0.0%	121
Asphalt, Brick, Concrete & Rocks	0.5%	0.5%	3,681	0.6%	0.7%	2,954
Carpet & Carpet Padding	4.6%	2.0%	35,529	0.1%	0.1%	506
Other Construction & Demolition	1.3%	0.9%	10,161	1.6%	1.1%	7,468
Bulky Items/Furniture	2.3%	1.1%	17,743	0.5%	0.6%	2,231
Mattresses/Boxsprings	0.0%	0.0%	0	1.1%	1.0%	5,204
Tires	1.5%	1.8%	11,463	0.0%	0.0%	0
Other/Not Classified	0.5%	0.3%	3,559	3.8%	5.4%	18,052
Electronics	**1.4%**	**1.2%**	**10,989**	**0.4%**	**0.4%**	**2,079**
Electronic Waste	1.4%	1.2%	10,989	0.4%	0.4%	2,079
HHW	**0.5%**	**0.2%**	**3,847**	**0.2%**	**0.1%**	**850**
Household Hazardous Waste	0.5%	0.2%	3,847	0.2%	0.1%	850
Grand Total	**100.0%**		**778,805**	**100.0%**		**476,890**
No. of Samples			***43***			***30***

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

4.5.2 SMALL METRO AREAS

Figure 4-19 shows the composition of Small Metro wastes in 2017. As shown, Organics and Paper are the most common material groups.

Figure 4-19 Small Metro Waste Composition

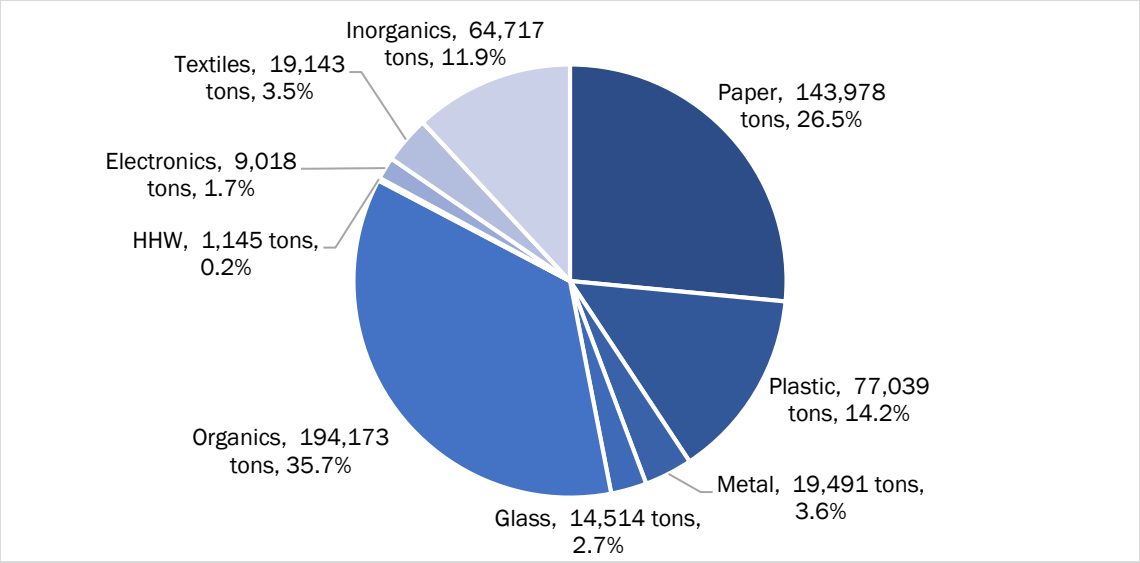


Table 4-13 provides the detailed statistical profile of the Small Metro waste stream in Missouri.

Table 4-13 Detailed Small Metro MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**26.5%**	**2.8%**	**143,978**	**Plastic**	**14.2%**	**1.9%**	**77,039**
OCC/Kraft	9.7%	2.6%	52,528	PET (#1) Bottles/Jars	1.4%	0.2%	7,405
Newsprint	1.1%	0.4%	5,765	PET (#1) Non-Bottle Containers	0.3%	0.1%	1,687
Magazines	1.1%	0.3%	6,003	HDPE (#2) Natural Containers	0.4%	0.1%	1,986
High Grade Office Paper	1.4%	0.4%	7,544	HDPE (#2) Colored Containers	0.5%	0.2%	2,712
Mixed Recyclable Paper	3.2%	0.6%	17,273	Clean Film Bags	0.2%	0.1%	965
Compostable Paper	8.4%	1.0%	45,826	Clean Ind'l/Com'l Film	0.6%	0.5%	3,338
Remainder/Composite Paper	1.7%	0.7%	9,039	Contaminated Film/Other Film	5.2%	1.2%	28,445
Glass	**2.7%**	**0.6%**	**14,514**	Plastic Containers #3 thru #7	0.8%	0.1%	4,435
Clear Glass Containers	1.2%	0.2%	6,401	Expanded Polystyrene #6	0.8%	0.2%	4,470
Brown Glass Containers	0.7%	0.2%	4,028	Bulky Durable Plastic Products	1.2%	0.4%	6,510
Green Glass Containers	0.2%	0.1%	884	Remainder/Composite Plastic	2.8%	0.7%	15,085
Remainder/Composite Glass	0.6%	0.4%	3,201	**Textiles**	**3.5%**	**0.9%**	**19,143**
Metal	**3.6%**	**0.8%**	**19,491**	Textiles - Clothing	0.9%	0.3%	4,864
Aluminum Cans & Containers	0.5%	0.1%	2,564	Textiles - Non-Clothing	1.9%	0.7%	10,521
Other Aluminum	0.3%	0.1%	1,418	Shoes/Belts/Leather	0.7%	0.3%	3,758
Tin/Steel Containers	1.1%	0.2%	5,804	**Inorganics**	**11.9%**	**3.1%**	**64,717**
Other Ferrous	1.6%	0.7%	8,759	Fines	1.1%	0.4%	6,191
Other Non-Ferrous	0.1%	0.1%	436	Drywall/Gypsum Board	0.3%	0.4%	1,473
Oil Filters	0.1%	0.1%	510	Asphalt, Brick, Concrete & Rocks	0.6%	0.4%	3,126
Organics	**35.7%**	**2.6%**	**194,173**	Carpet & Carpet Padding	2.6%	1.5%	14,143
Food Waste	17.1%	2.6%	92,625	Other Construction & Demolition	2.7%	1.1%	14,525
Wood - Clean/Untreated	4.8%	1.8%	26,218	Bulky Items/Furniture	0.4%	0.3%	2,436
Wood - Painted/Stained/Treated	4.4%	1.3%	23,857	Mattresses/Boxsprings	0.4%	0.6%	1,979
Disposable Diapers & Sanitary Prod.	2.5%	0.6%	13,800	Tires	1.4%	0.9%	7,778
Yard Waste	3.7%	2.0%	20,223	Other/Not Classified	2.4%	2.4%	13,067
Remainder/Composite Organic	3.2%	1.1%	17,450	**HHW**	**0.2%**	**0.1%**	**1,145**
Electronics	**1.7%**	**0.8%**	**9,018**	Household Hazardous Waste	0.2%	0.1%	1,145
Electronic Waste	1.7%	0.8%	9,018				
				Grand Total	**100%**		**543,217**
				No. of Samples	***67***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 4-20 identifies the ten most prevalent material categories in Small Metro waste. As shown, Food Waste was found to be the most prevalent material at about 17 percent of the stream.

Figure 4-20 Top 10 Most Prevalent Materials in Small Metro Waste

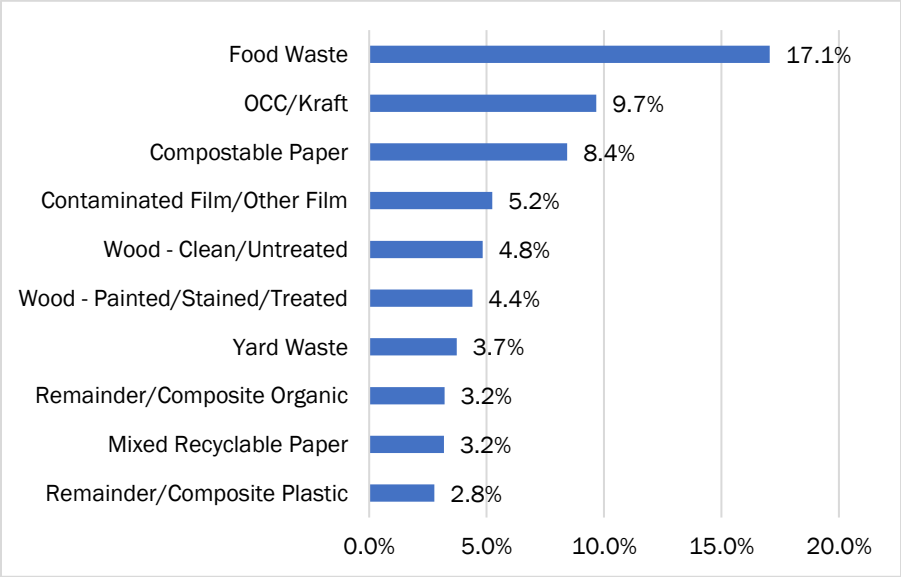


Figure 4-21 presents the composition of disposed Small Metro waste in terms of the potential for diverting materials from disposal using the "Diversion Strategy" assignments listed in Section 4.1.

Figure 4-21 Divertibility of Disposed Wastes from Small Metro Areas

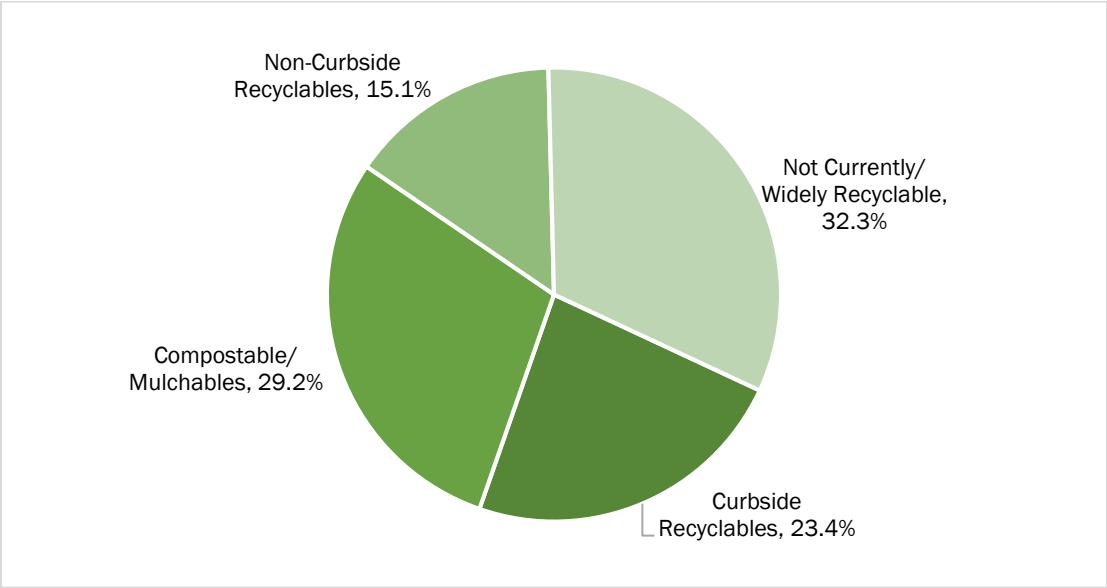


Figure 4-22 compares the composition of Residential and CI wastes from Small Metro areas.

Figure 4-22 Comparison of Residential and CI Wastes from Small Metro Areas

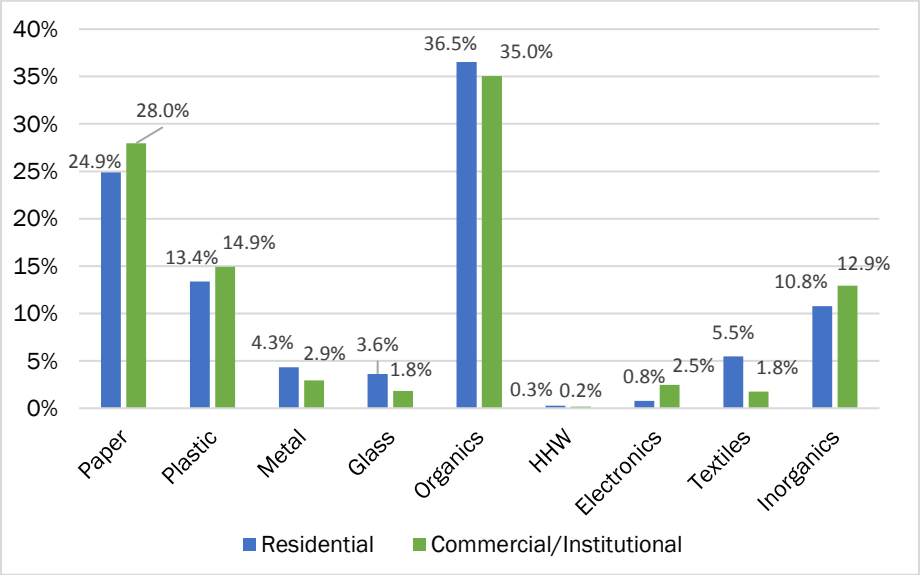


Table 4-14 provides the detailed statistical profile of the Small Metro waste stream in Missouri.

Table 4-14 Residential and CI Waste Composition in Small Metro Areas

	Residential			Com'l/Inst'l		
Material Category	Est. Percent	Conf Int (+/-)	Tonnage	Est. Percent	Conf Int (+/-)	Tonnage
Paper	**24.9%**	**2.5%**	**64,193**	**28.0%**	**5.9%**	**79,785**
OCC/Kraft	5.2%	1.1%	13,540	13.7%	5.8%	38,989
Newsprint	1.2%	0.3%	3,147	0.9%	0.8%	2,618
Magazines	1.4%	0.5%	3,678	0.8%	0.4%	2,324
High Grade Office Paper	1.5%	0.6%	3,852	1.3%	0.5%	3,692
Mixed Recyclable Paper	3.8%	0.7%	9,715	2.6%	0.9%	7,557
Compostable Paper	9.9%	1.2%	25,509	7.1%	1.7%	20,317
Remainder/Composite Paper	1.8%	0.8%	4,751	1.5%	1.3%	4,288
Glass	**3.6%**	**0.8%**	**9,341**	**1.8%**	**0.8%**	**5,173**
Clear Glass Containers	1.6%	0.3%	4,197	0.8%	0.4%	2,204
Brown Glass Containers	1.1%	0.3%	2,761	0.4%	0.2%	1,267
Green Glass Containers	0.2%	0.1%	525	0.1%	0.1%	359
Remainder/Composite Glass	0.7%	0.6%	1,858	0.5%	0.5%	1,342
Metal	**4.3%**	**0.8%**	**11,139**	**2.9%**	**1.5%**	**8,352**
Aluminum Cans & Containers	0.7%	0.1%	1,691	0.3%	0.1%	873
Other Aluminum	0.3%	0.1%	756	0.2%	0.1%	662
Tin/Steel Containers	1.4%	0.2%	3,566	0.8%	0.3%	2,237
Other Ferrous	1.8%	0.7%	4,617	1.5%	1.4%	4,143
Other Non-Ferrous	0.1%	0.1%	348	0.0%	0.0%	88
Oil Filters	0.1%	0.1%	161	0.1%	0.1%	349
Plastic	**13.4%**	**1.3%**	**34,505**	**14.9%**	**4.3%**	**42,534**
PET (#1) Bottles/Jars	1.8%	0.3%	4,645	1.0%	0.3%	2,759
PET (#1) Non-Bottle containers	0.5%	0.1%	1,163	0.2%	0.1%	524
HDPE (#2) Natural Containers	0.4%	0.1%	1,150	0.3%	0.1%	836
HDPE (#2) Colored Containers	0.5%	0.1%	1,347	0.5%	0.4%	1,365
Clean Film Bags	0.3%	0.1%	763	0.1%	0.0%	202
Clean Ind'l/Com'l Film	0.1%	0.1%	132	1.1%	1.3%	3,206
Contaminated Film/Other Film	4.8%	0.6%	12,278	5.7%	2.8%	16,167
Plastic Containers #3 thru #7	0.8%	0.1%	2,171	0.8%	0.3%	2,265
Expanded Polystyrene #6	0.8%	0.2%	2,102	0.8%	0.4%	2,368
Bulky Durable Plastic Products	1.2%	0.4%	3,086	1.2%	0.8%	3,424
Remainder/Composite Plastic	2.2%	0.5%	5,667	3.3%	1.6%	9,418
Organics	**36.5%**	**3.6%**	**94,236**	**35.0%**	**3.7%**	**99,936**
Food Waste	16.9%	2.5%	43,685	17.2%	5.3%	48,940
Wood - Clean/Untreated	0.4%	0.2%	906	8.9%	3.9%	25,312
Wood - Painted/Stained/Treated	3.9%	1.5%	9,969	4.9%	2.4%	13,887
Disposable Diapers & Sanitary Prod.	3.8%	0.8%	9,891	1.4%	0.8%	3,909
Yard Waste	7.4%	3.2%	19,147	0.4%	0.6%	1,076
Remainder/Composite Organic	4.1%	1.4%	10,639	2.4%	1.6%	6,812
Textiles	**5.5%**	**1.3%**	**14,126**	**1.8%**	**0.6%**	**5,017**
Textiles - Clothing	1.4%	0.5%	3,599	0.4%	0.3%	1,265
Textiles - Non-Clothing	3.1%	1.1%	8,042	0.9%	0.4%	2,479
Shoes/Belts/Leather	1.0%	0.4%	2,485	0.4%	0.2%	1,273
Inorganics	**10.8%**	**2.5%**	**27,808**	**12.9%**	**6.8%**	**36,909**
Fines	1.6%	0.6%	4,066	0.7%	0.5%	2,125
Drywall/Gypsum Board	0.5%	0.6%	1,297	0.1%	0.1%	176
Asphalt, Brick, Concrete & Rocks	0.5%	0.3%	1,182	0.7%	0.8%	1,943
Carpet & Carpet Padding	4.3%	2.3%	11,218	1.0%	1.2%	2,925
Other Construction & Demolition	1.5%	0.8%	3,795	3.8%	2.2%	10,730
Bulky Items/Furniture	0.5%	0.5%	1,194	0.4%	0.5%	1,242
Mattresses/Boxsprings	0.8%	0.9%	1,979	0.0%	0.0%	0
Tires	0.8%	0.8%	2,058	2.0%	1.8%	5,719
Other/Not Classified	0.4%	0.2%	1,018	4.2%	6.0%	12,050
Electronics	**0.8%**	**0.5%**	**1,962**	**2.5%**	**1.9%**	**7,056**
Electronic Waste	0.8%	0.5%	1,962	2.5%	1.9%	7,056
HHW	**0.3%**	**0.1%**	**664**	**0.2%**	**0.1%**	**482**
Household Hazardous Waste	0.3%	0.1%	664	0.2%	0.1%	482
Grand Total	**100.0%**		**257,973**	**100.0%**		**285,244**
No. of Samples			***40***			***27***

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

4.5.3 LARGE METRO AREAS

Figure 4-23 shows the composition of Large Metro wastes in 2017. Consistent with the other two regions, Organics and Paper are the most commonly occurring material groups.

Figure 4-23 Large Metro Waste Composition

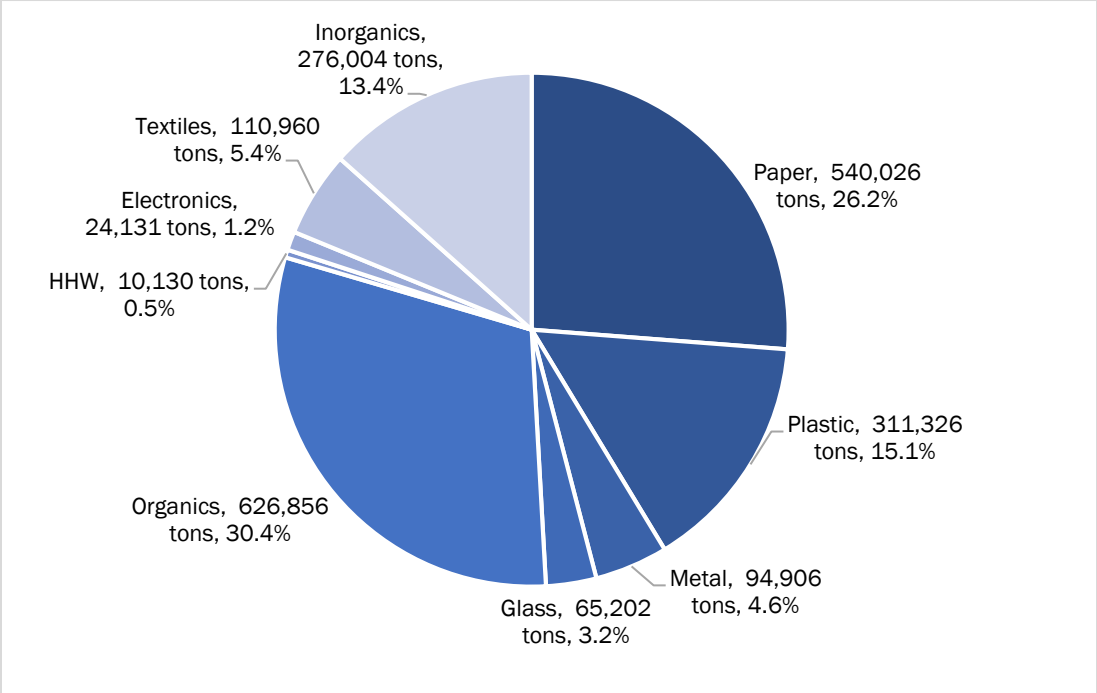


Table 4-15 provides the detailed statistical profile of the Large Metro waste stream in Missouri.

Table 4-15 Detailed Large Metro MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**26.2%**	**2.0%**	**540,026**	**Plastic**	**15.1%**	**1.1%**	**311,326**
OCC/Kraft	9.2%	1.7%	189,941	PET (#1) Bottles/Jars	1.3%	0.1%	27,158
Newsprint	1.7%	1.1%	34,414	PET (#1) Non-Bottle Containers	0.2%	0.0%	3,315
Magazines	0.7%	0.1%	13,603	HDPE (#2) Natural Containers	0.4%	0.1%	7,685
High Grade Office Paper	1.0%	0.4%	19,687	HDPE (#2) Colored Containers	0.5%	0.1%	9,987
Mixed Recyclable Paper	3.9%	0.5%	81,296	Clean Film Bags	0.3%	0.0%	5,308
Compostable Paper	8.6%	0.8%	176,275	Clean Ind'l/Com'l Film	0.7%	0.5%	14,583
Remainder/Composite Paper	1.2%	0.4%	24,812	Contaminated Film/Other Film	5.7%	0.7%	118,039
Glass	**3.2%**	**0.5%**	**65,202**	Plastic Containers #3 thru #7	1.2%	0.1%	24,314
Clear Glass Containers	1.4%	0.2%	29,354	Expanded Polystyrene #6	0.7%	0.1%	14,124
Brown Glass Containers	1.1%	0.4%	22,275	Bulky Durable Plastic Products	2.2%	0.6%	45,916
Green Glass Containers	0.3%	0.1%	5,480	Remainder/Composite Plastic	2.0%	0.3%	40,897
Remainder/Composite Glass	0.4%	0.2%	8,093	**Textiles**	**5.4%**	**1.0%**	**110,960**
Metal	**4.6%**	**0.8%**	**94,906**	Textiles - Clothing	2.8%	0.8%	58,284
Aluminum Cans & Containers	0.6%	0.1%	12,793	Textiles - Non-Clothing	1.8%	0.3%	37,695
Other Aluminum	0.4%	0.1%	7,898	Shoes/Belts/Leather	0.7%	0.2%	14,981
Tin/Steel Containers	0.9%	0.1%	18,250	**Inorganics**	**13.4%**	**2.3%**	**276,004**
Other Ferrous	2.1%	0.8%	43,514	Fines	1.8%	0.3%	36,846
Other Non-Ferrous	0.6%	0.4%	11,864	Drywall/Gypsum Board	0.6%	0.4%	11,869
Oil Filters	0.0%	0.0%	587	Asphalt, Brick, Concrete & Rocks	0.4%	0.3%	8,879
Organics	**30.4%**	**2.2%**	**626,856**	Carpet & Carpet Padding	2.5%	1.0%	50,535
Food Waste	14.3%	1.7%	294,955	Other Construction & Demolition	1.4%	0.7%	28,277
Wood - Clean/Untreated	2.7%	1.4%	54,717	Bulky Items/Furniture	4.8%	1.2%	98,933
Wood - Painted/Stained/Treated	4.4%	1.7%	90,643	Mattresses/Boxsprings	0.9%	0.6%	18,935
Disposable Diapers & Sanitary Prod.	3.0%	0.6%	62,589	Tires	0.6%	0.5%	12,158
Yard Waste	2.8%	0.8%	58,250	Other/Not Classified	0.5%	0.1%	9,572
Remainder/Composite Organic	3.2%	0.6%	65,702	**HHW**	**0.5%**	**0.3%**	**10,130**
Electronics	**1.2%**	**0.5%**	**24,131**	Household Hazardous Waste	0.5%	0.3%	10,130
Electronic Waste	1.2%	0.5%	24,131				
				Grand Total	**100%**		**2,059,540**
				No. of Samples	***114***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 4-24 identifies the ten most prevalent material categories in Large Metro waste. As shown, Food Waste was found to be the most prevalent material at just over 14 percent of the stream.

Figure 4-24 Top 10 Most Prevalent Materials in Large Metro Waste

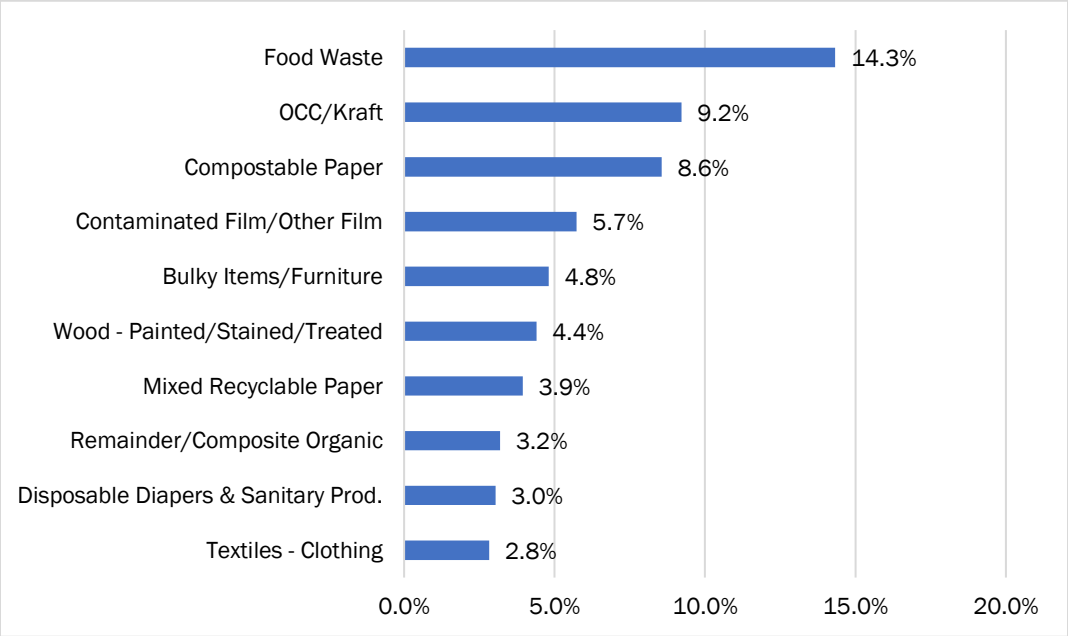


Figure 4-25 presents the composition of disposed Large Metro waste in terms of the potential for diverting materials from disposal using the "Diversion Strategy" assignments listed in Section 4.1. Just over 35 percent of the materials were identified as not commonly divertible.

Figure 4-25 Divertibility of Disposed Wastes from Large Metro Areas

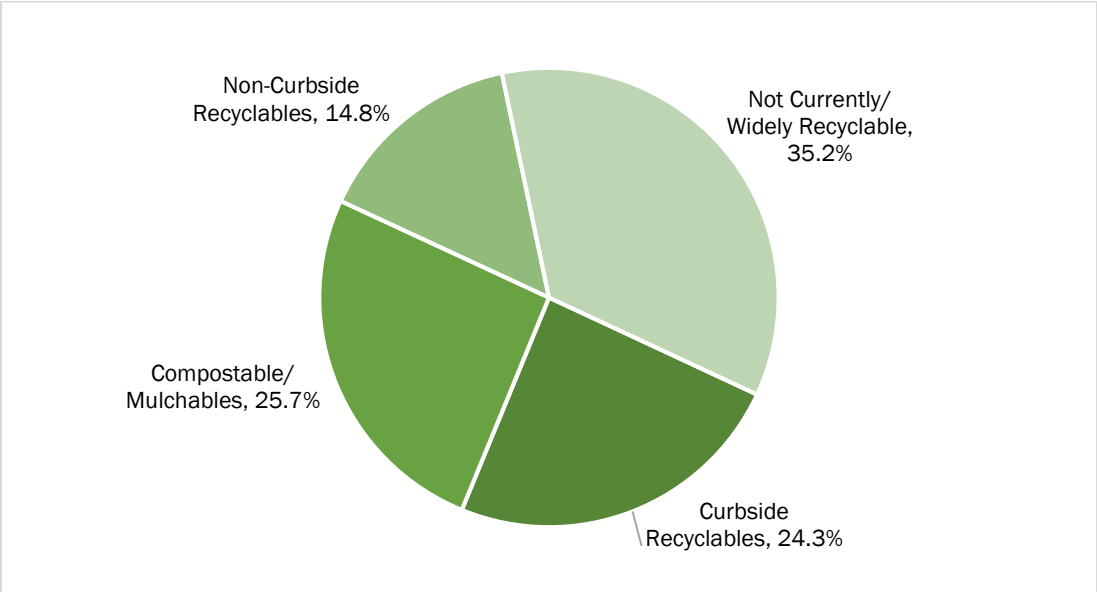


Figure 4-26 compares the composition of Residential and CI wastes from Large Metro areas.

Figure 4-26 Comparison of Residential and CI Wastes from Large Metro Areas

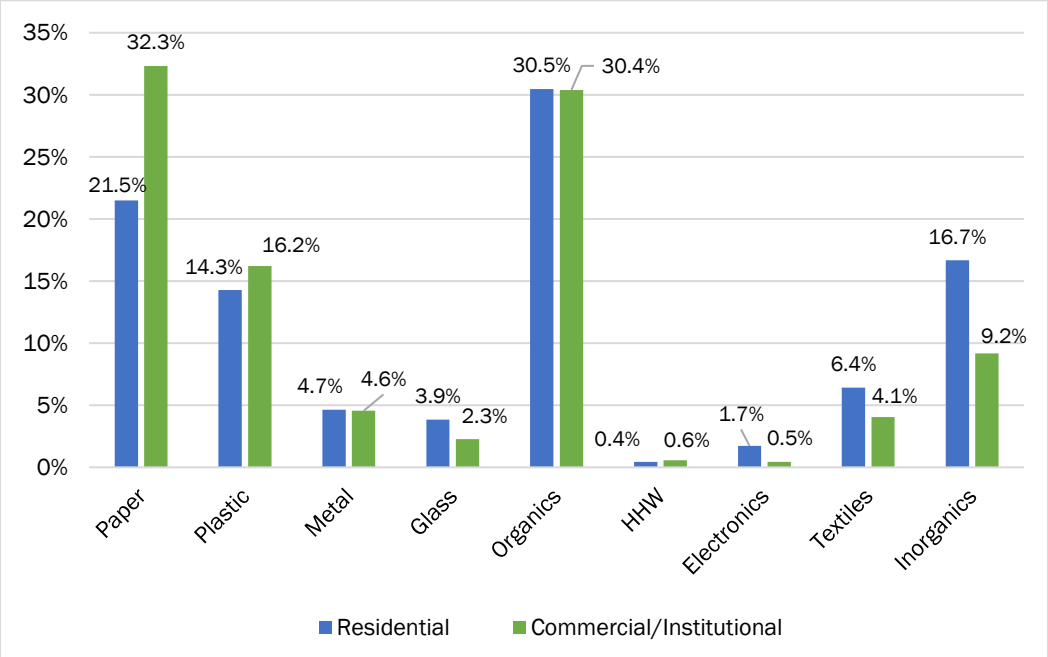


Table 4-16 provides the detailed statistical profile of the Large Metro waste stream in Missouri. The CI sector consisted of over 16 percent OCC/Kraft materials, as compared to 3.7 percent in the Residential sector.

Table 4-16 Residential and CI Waste Composition in Large Metro Areas

	Residential			Com'l/Inst'l		
Material Category	Est. Percent	Conf Int (+/-)	Tonnage	Est. Percent	Conf Int (+/-)	Tonnage
Paper	**21.5%**	**1.3%**	**249,869**	**32.3%**	**3.3%**	**290,157**
OCC/Kraft	3.7%	0.8%	43,028	16.4%	2.5%	146,913
Newsprint	1.5%	0.4%	17,086	1.9%	2.1%	17,327
Magazines	0.8%	0.2%	9,284	0.5%	0.2%	4,319
High Grade Office Paper	0.6%	0.2%	6,988	1.4%	0.7%	12,698
Mixed Recyclable Paper	4.7%	0.6%	54,428	3.0%	0.8%	26,867
Compostable Paper	9.1%	0.8%	105,834	7.8%	1.2%	70,441
Remainder/Composite Paper	1.1%	0.3%	13,221	1.3%	0.8%	11,592
Glass	**3.9%**	**0.7%**	**44,744**	**2.3%**	**0.8%**	**20,458**
Clear Glass Containers	1.9%	0.3%	22,136	0.8%	0.3%	7,219
Brown Glass Containers	1.2%	0.6%	14,445	0.9%	0.4%	7,830
Green Glass Containers	0.3%	0.1%	3,785	0.2%	0.1%	1,695
Remainder/Composite Glass	0.4%	0.1%	4,378	0.4%	0.3%	3,715
Metal	**4.7%**	**0.7%**	**54,027**	**4.6%**	**1.5%**	**40,879**
Aluminum Cans & Containers	0.7%	0.1%	8,299	0.5%	0.1%	4,494
Other Aluminum	0.5%	0.1%	5,338	0.3%	0.1%	2,560
Tin/Steel Containers	1.0%	0.1%	12,104	0.7%	0.2%	6,146
Other Ferrous	1.9%	0.6%	22,015	2.4%	1.4%	21,499
Other Non-Ferrous	0.5%	0.3%	5,683	0.7%	0.7%	6,180
Oil Filters	0.1%	0.0%	587	0.0%	0.0%	0
Plastic	**14.3%**	**1.0%**	**165,842**	**16.2%**	**1.8%**	**145,484**
PET (#1) Bottles/Jars	1.5%	0.2%	16,912	1.1%	0.2%	10,246
PET (#1) Non-Bottle containers	0.2%	0.1%	2,087	0.1%	0.0%	1,228
HDPE (#2) Natural Containers	0.4%	0.1%	4,412	0.4%	0.1%	3,273
HDPE (#2) Colored Containers	0.6%	0.2%	6,431	0.4%	0.1%	3,556
Clean Film Bags	0.3%	0.0%	3,985	0.1%	0.0%	1,323
Clean Ind'l/Com'l Film	0.0%	0.0%	411	1.6%	1.0%	14,173
Contaminated Film/Other Film	5.1%	0.5%	58,685	6.6%	1.2%	59,354
Plastic Containers #3 thru #7	1.3%	0.1%	15,137	1.0%	0.2%	9,178
Expanded Polystyrene #6	0.8%	0.1%	9,105	0.6%	0.1%	5,019
Bulky Durable Plastic Products	2.5%	0.8%	28,532	1.9%	0.8%	17,384
Remainder/Composite Plastic	1.7%	0.2%	20,146	2.3%	0.6%	20,751
Organics	**30.5%**	**2.1%**	**353,985**	**30.4%**	**3.7%**	**272,871**
Food Waste	14.6%	1.6%	169,618	14.0%	2.8%	125,337
Wood - Clean/Untreated	0.7%	0.4%	8,647	5.1%	2.6%	46,070
Wood - Painted/Stained/Treated	3.2%	1.1%	36,979	6.0%	3.1%	53,664
Disposable Diapers & Sanitary Prod.	4.4%	0.9%	51,323	1.3%	0.5%	11,267
Yard Waste	3.7%	1.3%	43,529	1.6%	1.0%	14,721
Remainder/Composite Organic	3.8%	0.8%	43,889	2.4%	0.9%	21,813
Textiles	**6.4%**	**1.2%**	**74,561**	**4.1%**	**1.7%**	**36,399**
Textiles - Clothing	3.2%	0.9%	37,394	2.3%	1.3%	20,891
Textiles - Non-Clothing	2.3%	0.5%	26,318	1.3%	0.4%	11,377
Shoes/Belts/Leather	0.9%	0.3%	10,850	0.5%	0.3%	4,131
Inorganics	**16.7%**	**4.0%**	**193,676**	**9.2%**	**2.3%**	**82,328**
Fines	2.3%	0.5%	26,217	1.2%	0.4%	10,630
Drywall/Gypsum Board	0.5%	0.3%	5,538	0.7%	0.8%	6,331
Asphalt, Brick, Concrete & Rocks	0.3%	0.2%	3,751	0.6%	0.5%	5,128
Carpet & Carpet Padding	3.3%	1.7%	38,302	1.4%	1.0%	12,232
Other Construction & Demolition	1.3%	0.9%	15,292	1.4%	0.9%	12,985
Bulky Items/Furniture	6.5%	2.1%	75,865	2.6%	1.2%	23,068
Mattresses/Boxsprings	1.2%	1.0%	14,036	0.5%	0.5%	4,899
Tires	0.9%	1.0%	9,877	0.3%	0.3%	2,282
Other/Not Classified	0.4%	0.2%	4,799	0.5%	0.2%	4,773
Electronics	**1.7%**	**0.9%**	**20,055**	**0.5%**	**0.4%**	**4,076**
Electronic Waste	1.7%	0.9%	20,055	0.5%	0.4%	4,076
HHW	**0.4%**	**0.2%**	**4,984**	**0.6%**	**0.6%**	**5,146**
Household Hazardous Waste	0.4%	0.2%	4,984	0.6%	0.6%	5,146
Grand Total	**100.0%**		**1,161,743**	**100.0%**		**897,797**
No. of Samples			**54**			**60**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

4.6 FACILITY-SPECIFIC MSW COMPOSITION

The sample size for individual facilities for this study was small enough that facility-specific results exhibit a higher degree of uncertainty compared to the statewide results, which are based on a large sample size. Consequently, facility-specific results are contained in a series of appendices to the report. Please see Appendix A through V to review facility-specific composition results.

5. NON-MSW COMPOSITION

5.1 INTRODUCTION

This section provides extensive data about the composition of the non-MSW waste streams. As determined during the Gate Surveys, 33.1 percent of the overall waste stream is non-MSW. These streams are consistently defined with the 2008 study and have been retained to enable comparisons in the following categories:

- Construction
- Demolition
- Industrial
- Special
- Other

The results in this section further defining these five categories are based on the visual volumetric surveying of the Construction, Demolition and Industrial loads and the gate-surveyed information on the Special and Other loads. Detailed results are shown in the following sections.

5.2 CONSTRUCTION WASTE COMPOSITION

Figure 5-1 shows the composition of Construction wastes.

Figure 5-1 Construction Waste Composition

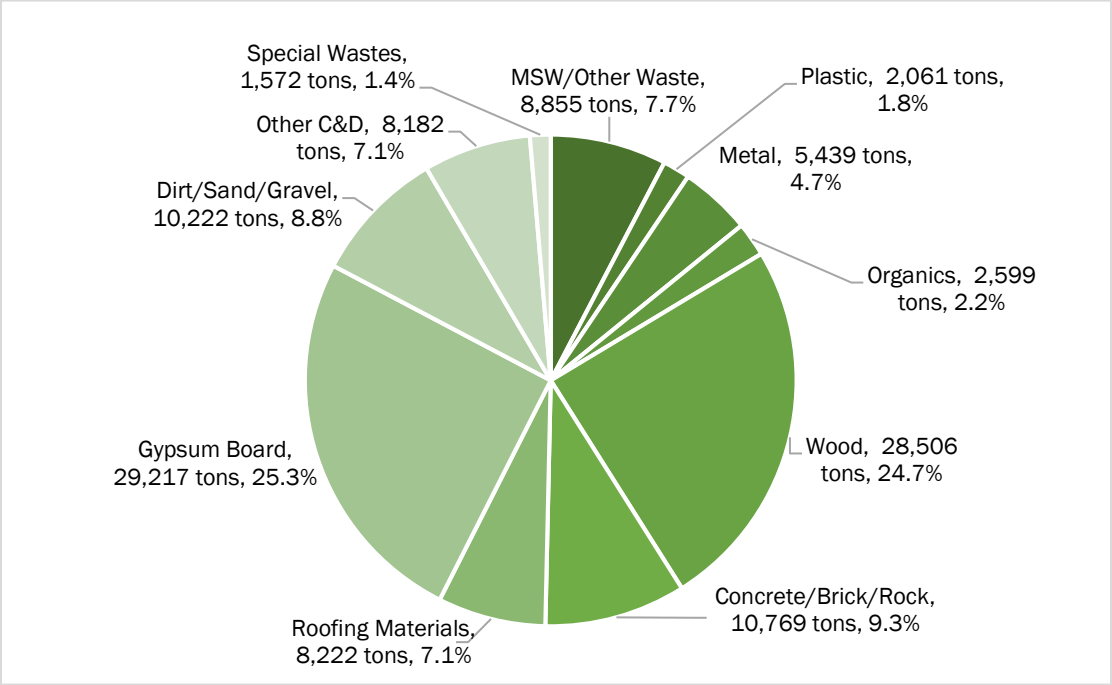


Table 5-1 provides a detailed statistical profile of Construction waste. For each material category, the mean percent, confidence intervals, and estimated tonnage are shown. Confidence intervals are calculated at a 90 percent level of confidence.

Table 5-1 Detailed Construction Waste Composition

Material Category	Est. Percent	Conf. Int (+/-)	Est. Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Est. Tonnage
MSW/Other Waste	**7.7%**	**2.1%**	**8,855**	**Roofing Materials**	**7.1%**	**2.2%**	**8,222**
Flattened OCC	2.8%	0.3%	3,278	Roofing Materials	7.1%	2.2%	8,222
Unflattened OCC	0.7%	0.1%	803	**Dirt/Sand/Gravel**	**8.8%**	**5.2%**	**10,222**
R/C and Other Paper	0.6%	0.1%	679	Dirt/Sand/Gravel	8.8%	5.2%	10,222
All Glass	0.1%	0.0%	104	**Other C&D**	**7.1%**	**2.6%**	**8,182**
Electronics	0.0%	0.1%	48	Carpet	2.5%	0.5%	2,928
Items with CRTs	0.0%	0.0%	37	Carpet Padding	0.1%	0.0%	82
Tree Trunks		*Not Found*		Asphalt Paving		*Not Found*	
Fines/Mixed Residue	1.4%	0.5%	1,639	Ceiling Tiles	0.1%	0.0%	139
Mixed MSW	2.0%	0.3%	2,266	Insulation	1.3%	0.2%	1,517
Agricultural Waste		*Not Found*		R/C and Other C&D	3.0%	0.9%	3,517
Plastic	**1.8%**	**0.4%**	**2,061**	**Special Wastes**	**1.4%**	**0.9%**	**1,572**
Plastic Bottles (Recyclable)	0.0%	0.0%	15	Bulky Wastes/Furniture	1.3%	0.2%	1,485
HDPE Buckets (stacked)	0.0%	0.0%	57	Tires - Cut	0.1%	0.3%	82
HDPE Buckets (unstacked)	0.1%	0.0%	75	Tires - Whole		*Not Found*	
Clean Recoverable Film	0.2%	0.0%	228	All HHW	0.0%	0.0%	5
R/C and Other Plastic	1.5%	0.2%	1,685	Contaminated Soil		*Not Found*	
Metal	**4.7%**	**0.8%**	**5,439**	**Wood**	**24.7%**	**4.5%**	**28,506**
Appliances	0.1%	0.0%	61	Pallets - Standard	2.3%	0.2%	2,710
Other Ferrous Metals	2.7%	0.3%	3,120	Pallets/Crates/Heavy	1.3%	0.4%	1,557
Other Non-ferrous Metal	1.9%	0.3%	2,203	Untreated/Unpainted Lumber	12.0%	1.2%	13,865
HVAC Ducting	0.0%	0.0%	55	Treated/Painted/Processed Wood	1.5%	0.3%	1,789
Organics	**2.2%**	**1.2%**	**2,599**	Engineered Wood	7.1%	0.8%	8,232
Leaves/Grass/Mixed Yard Waste	0.5%	0.4%	571	Wood Furniture	0.2%	0.0%	218
Branches/Limbs	0.0%	0.0%	3	Other Wood	0.1%	0.0%	134
R/C and Other Organics	1.8%	0.6%	2,025	**Concrete/Brick/Rock**	**9.3%**	**9.4%**	**10,769**
Gypsum Board	**25.3%**	**4.1%**	**29,217**	Concrete/Block/Brick/Stone/Tile	9.3%	9.4%	10,769
Clean Gypsum Board	11.1%	1.7%	12,811				
Painted Gypsum Board	14.2%	2.4%	16,406	**Grand Total**	**100.0%**		**115,644**
				No. of Samples	***60***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 5-2 shows the top 10 most prevalent materials in the Construction waste stream. As shown, Gypsum board and Untreated/Unpainted lumber comprise over 37 percent of Construction waste.

Figure 5-2 Top 10 Most Prevalent Materials in Construction Waste

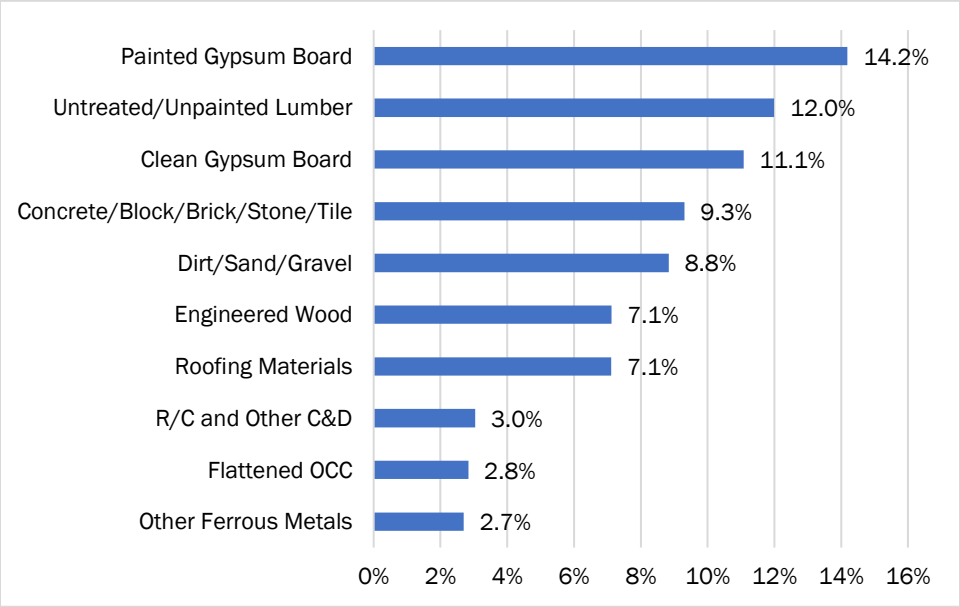


Figure 5-3 compares the composition of Construction waste by demographic region.

Figure 5-3 Construction Waste Composition by Demographic Region

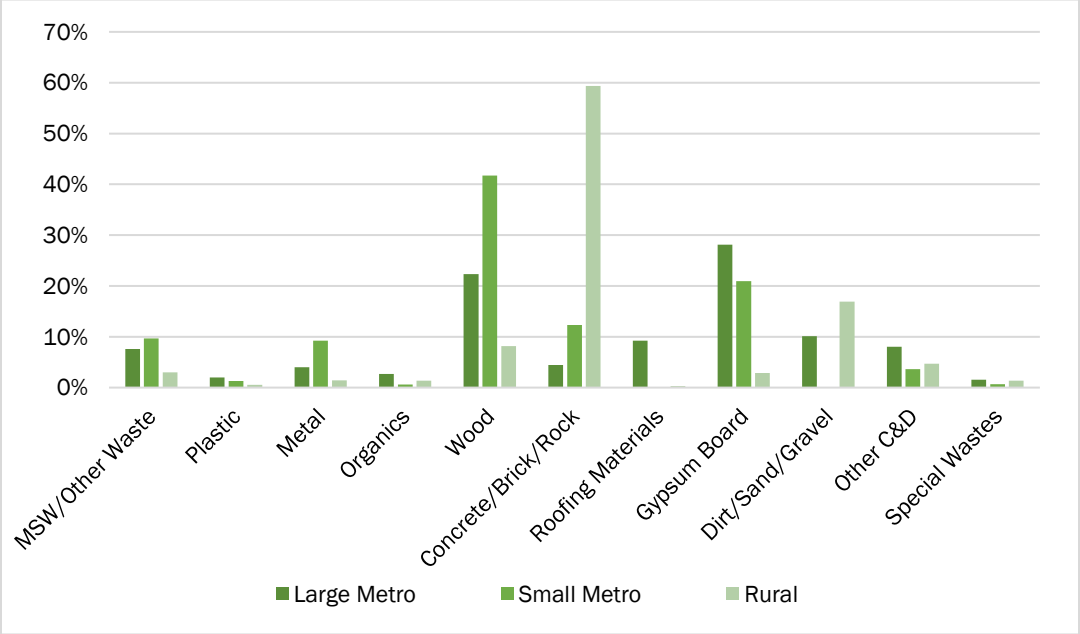


Table 5-2 provides detailed composition data for Construction waste by demographic region.

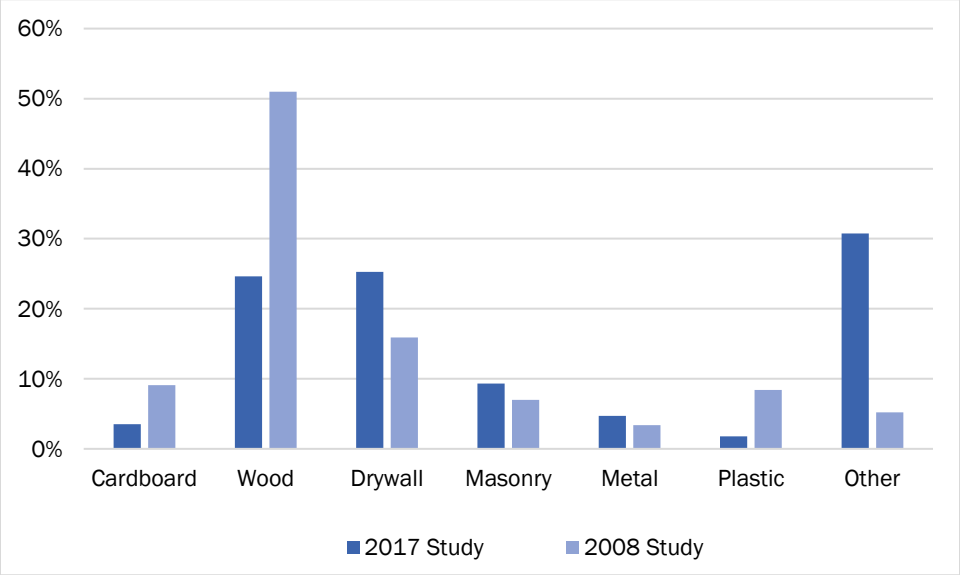
Table 5-2 Construction Waste Composition by Demographic Origin

Material Category	Large Metro		Small Metro		Rural	
	Percent	Tons	Percent	Tons	Percent	Tons
MSW/Other Waste	**7.6%**	**6,766**	**9.6%**	**1,867**	**3.0%**	**222**
Flattened OCC	2.7%	2,428	4.3%	840	0.1%	9
Unflattened OCC	0.8%	667	0.7%	131	0.1%	4
R/C and Other Paper	0.8%	673	*Not Found*		0.1%	6
All Glass	*Not Found*		0.5%	92	0.2%	12
Electronics	0.0%	29	*Not Found*		0.3%	19
Items with CRTs	0.0%	35	*Not Found*		0.0%	2
Tree Trunks	*Not Found*		*Not Found*		*Not Found*	
Fines/Mixed Residue	1.8%	1,588	*Not Found*		0.7%	51
Mixed MSW	1.5%	1,344	4.1%	803	1.6%	118
Agricultural Waste	*Not Found*		*Not Found*		*Not Found*	
Plastic	**2.0%**	**1,776**	**1.3%**	**246**	**0.5%**	**39**
Plastic Bottles (Recyclable)	0.0%	6	0.0%	9	*Not Found*	
HDPE Buckets (stacked)	0.1%	49	0.0%	8	*Not Found*	
HDPE Buckets (unstacked)	0.1%	59	0.1%	15	0.0%	1
Clean Recoverable Film	0.2%	211	0.0%	8	0.1%	9
R/C and Other Plastic	1.6%	1,451	1.1%	206	0.4%	28
Metal	**4.0%**	**3,545**	**9.2%**	**1,785**	**1.4%**	**108**
Appliances	0.1%	61	*Not Found*		*Not Found*	
Other Ferrous Metals	2.4%	2,100	4.8%	926	1.3%	94
Other Non-ferrous Metal	1.5%	1,330	4.4%	859	0.2%	13
HVAC Ducting	0.1%	54	*Not Found*		0.0%	1
Organics	**2.7%**	**2,378**	**0.6%**	**119**	**1.4%**	**102**
Leaves/Grass/Mixed Yard Waste	0.4%	358	0.6%	119	1.3%	94
Branches/Limbs	*Not Found*		*Not Found*		0.0%	3
R/C and Other Organics	2.3%	2,020	*Not Found*		0.1%	4
Gypsum Board	**28.1%**	**24,948**	**20.9%**	**4,054**	**2.9%**	**216**
Clean Gypsum Board	13.6%	12,063	3.8%	739	0.1%	9
Painted Gypsum Board	14.5%	12,885	17.1%	3,315	2.8%	206
Roofing Materials	**9.2%**	**8,199**	**0.0%**	**0**	**0.3%**	**24**
Roofing Materials	9.2%	8,199	*Not Found*		0.3%	24
Dirt/Sand/Gravel	**10.1%**	**8,956**	**0.0%**	**0**	**16.9%**	**1,266**
Dirt/Sand/Gravel	10.1%	8,956	*Not Found*		16.9%	1,266
Other C&D	**8.0%**	**7,126**	**3.6%**	**706**	**4.7%**	**350**
Carpet	3.1%	2,739	0.9%	169	0.3%	20
Carpet Padding	0.1%	76	*Not Found*		0.1%	5
Asphalt Paving	*Not Found*		*Not Found*		*Not Found*	
Ceiling Tiles	0.2%	139	*Not Found*		*Not Found*	
Insulation	1.4%	1,241	1.1%	205	0.9%	70
R/C and Other C&D	3.3%	2,930	1.7%	332	3.4%	255
Special Wastes	**1.5%**	**1,347**	**0.6%**	**124**	**1.3%**	**100**
Bulky Wastes/Furniture	1.5%	1,342	0.6%	124	0.2%	18
Tires - Cut	*Not Found*		*Not Found*		1.1%	82
Tires - Whole	*Not Found*		*Not Found*		*Not Found*	
All HHW	0.0%	5	*Not Found*		*Not Found*	
Contaminated Soil	*Not Found*		*Not Found*		*Not Found*	
Wood	**22.3%**	**19,815**	**41.7%**	**8,080**	**8.2%**	**612**
Pallets - Standard	2.4%	2,098	3.0%	584	0.4%	29
Pallets/Crates/Heavy	1.8%	1,557	*Not Found*		*Not Found*	
Untreated/Unpainted Lumber	9.7%	8,635	24.9%	4,820	5.5%	410
Treated/Painted/Processed Wood	1.1%	953	4.0%	772	0.9%	64
Engineered Wood	7.1%	6,297	9.5%	1,831	1.4%	105
Wood Furniture	0.2%	214	*Not Found*		0.1%	4
Other Wood	0.1%	61	0.4%	73	*Not Found*	
Concrete/Brick/Rock	**4.4%**	**3,942**	**12.3%**	**2,386**	**59.4%**	**4,441**
Concrete/Block/Brick/Stone/Tile	4.4%	3,942	12.3%	2,386	59.4%	4,441
Grand Total	**100.0%**	**88,798**	**100.0%**	**19,367**	**100.0%**	**7,480**
No. of Samples	***38***		***7***		***15***	

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 5-4 provides a comparison of Construction wastes from the 2008 Study. For this comparison, the 45 material categories used across-the-board for the 2017 non-MSW waste stream were mapped into one of the seven categories used for Construction waste characterization in 2008.

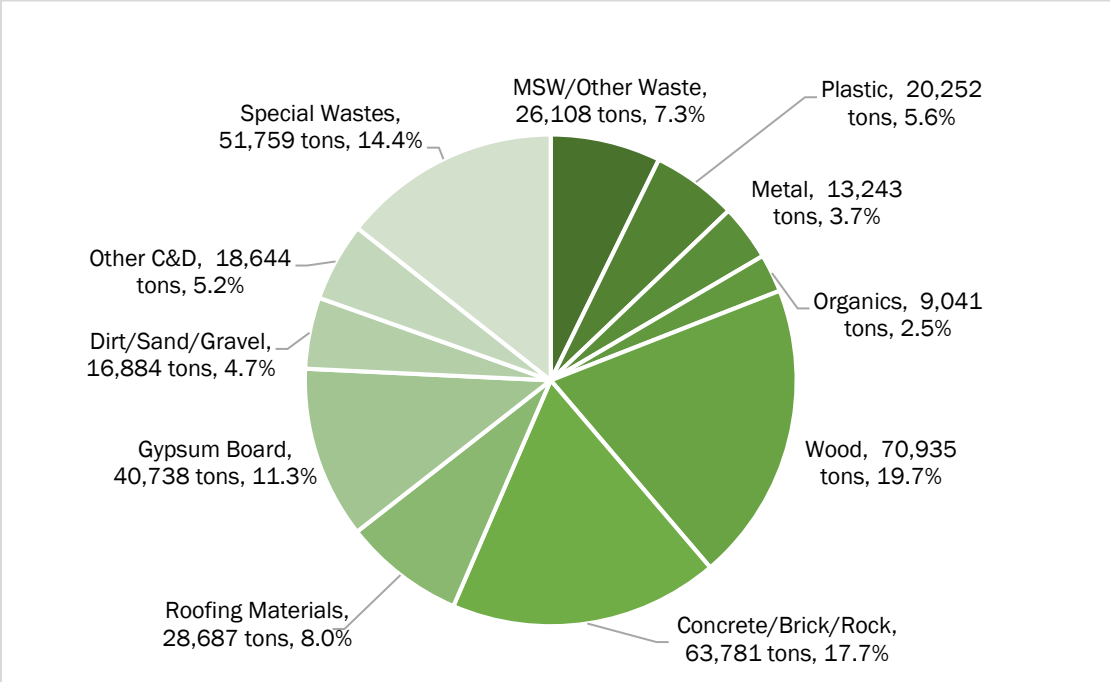
Figure 5-4 Construction Waste Material Category Comparison 2017 vs. 2008



5.3 DEMOLITION WASTE COMPOSITION

Figure 5-5 shows the composition of Demolition wastes. The Special Wastes indicated were predominantly Bulky Wastes/Furniture.

Figure 5-5 Demolition Waste Composition



5. NON-MSW COMPOSITION

Table 5-3 provides a detailed statistical profile of Demolition waste. For each material category, the mean percent, confidence intervals, and estimated tonnage are shown. Confidence intervals are calculated at a 90 percent level of confidence.

Table 5-3 Detailed Demolition Waste Composition

Material Category	Est. Percent	Conf. Int (+/-)	Est. Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Est. Tonnage
MSW/Other Waste	**7.3%**	**3.9%**	**26,108**	**Roofing Materials**	**8.0%**	**2.5%**	**28,687**
Flattened OCC	0.7%	0.2%	2,533	Roofing Materials	8.0%	2.5%	28,687
Unflattened OCC	0.1%	0.0%	514	**Dirt/Sand/Gravel**	**4.7%**	**3.0%**	**16,884**
R/C and Other Paper	0.2%	0.2%	888	Dirt/Sand/Gravel	4.7%	3.0%	16,884
All Glass	0.5%	0.2%	1,668	**Other C&D**	**5.2%**	**1.6%**	**18,644**
Electronics	0.9%	0.2%	3,194	Carpet	2.5%	0.5%	8,951
Items with CRTs	0.3%	0.1%	1,025	Carpet Padding	0.3%	0.1%	959
Tree Trunks		*Not Found*		Asphalt Paving	0.6%	0.3%	2,144
Fines/Mixed Residue	2.4%	1.1%	8,659	Ceiling Tiles	0.3%	0.1%	930
Mixed MSW	2.1%	0.3%	7,626	Insulation	0.8%	0.2%	2,892
Agricultural Waste		*Not Found*		R/C and Other C&D	0.8%	0.3%	2,768
Plastic	**5.6%**	**5.6%**	**20,252**	**Special Wastes**	**14.4%**	**5.5%**	**51,759**
Plastic Bottles (Recyclable)		*Not Found*		Bulky Wastes/Furniture	14.3%	2.3%	51,526
HDPE Buckets (stacked)		*Not Found*		Tires - Cut	0.0%	0.0%	135
HDPE Buckets (unstacked)	0.0%	0.0%	62	Tires - Whole	0.0%	0.0%	30
Clean Recoverable Film	0.0%	0.0%	139	All HHW	0.0%	0.0%	68
R/C and Other Plastic	5.6%	2.5%	20,051	Contaminated Soil		*Not Found*	
Metal	**3.7%**	**1.7%**	**13,243**	**Wood**	**19.7%**	**6.8%**	**70,935**
Appliances	0.1%	0.1%	314	Pallets - Standard	1.0%	0.3%	3,449
Other Ferrous Metals	3.1%	0.8%	11,306	Pallets/Crates/Heavy	0.0%	0.0%	92
Other Non-ferrous Metal	0.3%	0.1%	951	Untreated/Unpainted Lumber	3.4%	0.9%	12,134
HVAC Ducting	0.2%	0.1%	672	Treated/Painted/Processed Wood	6.8%	1.4%	24,490
Organics	**2.5%**	**5.8%**	**9,041**	Engineered Wood	3.0%	0.7%	10,783
Leaves/Grass/Mixed Yard Waste	0.3%	0.1%	1,110	Wood Furniture	3.2%	0.9%	11,586
Branches/Limbs	0.1%	0.1%	302	Other Wood	2.3%	1.4%	8,401
R/C and Other Organics	2.1%	3.3%	7,629	**Concrete/Brick/Rock**	**17.7%**	**4.5%**	**63,781**
Gypsum Board	**11.3%**	**3.3%**	**40,738**	Concrete/Block/Brick/Stone/Tile	17.7%	4.5%	63,781
Clean Gypsum Board	1.8%	0.8%	6,358				
Painted Gypsum Board	9.5%	2.2%	34,380	**Grand Total**	**100.0%**		**360,073**
				No. of Samples	***109***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 5-6 shows the top 10 most prevalent materials in the Demolition waste stream. As shown, nearly 18 percent was very common building materials represented in the Concrete/Block/Brick/Stone/Tile grouping.

Figure 5-6 Top 10 Most Prevalent Materials in Demolition Waste

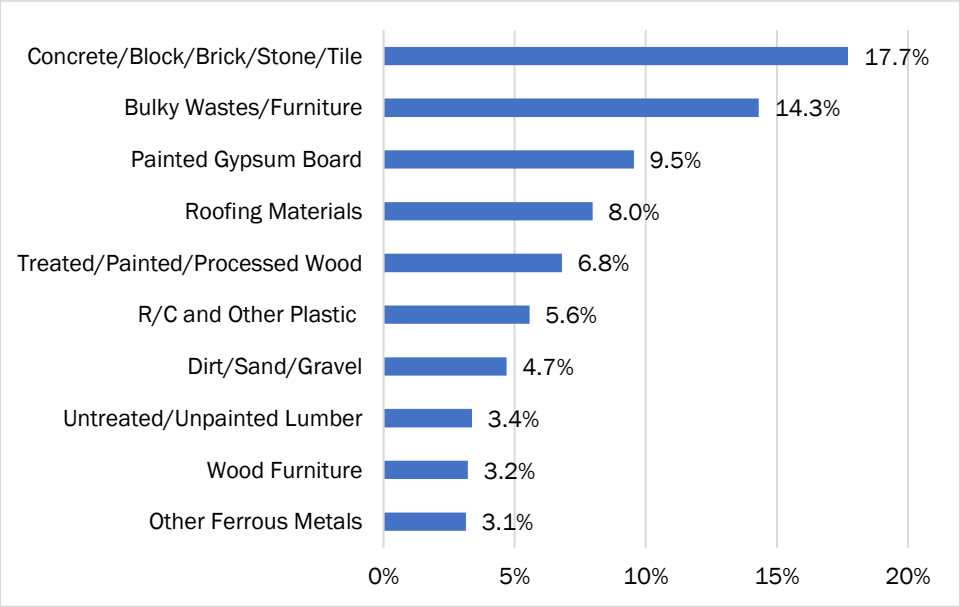


Figure 5-7 compares the composition of Demolition waste by demographic region.

Figure 5-7 Demolition Waste Composition by Demographic Origin

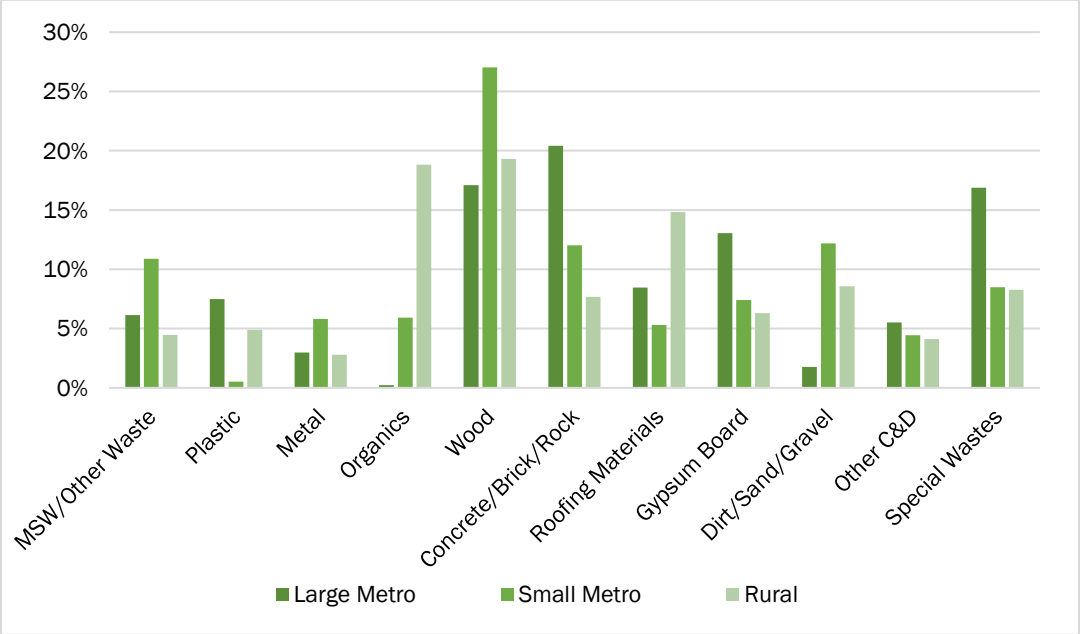


Table 5-4 provides detailed composition data for Demolition waste by demographic region.

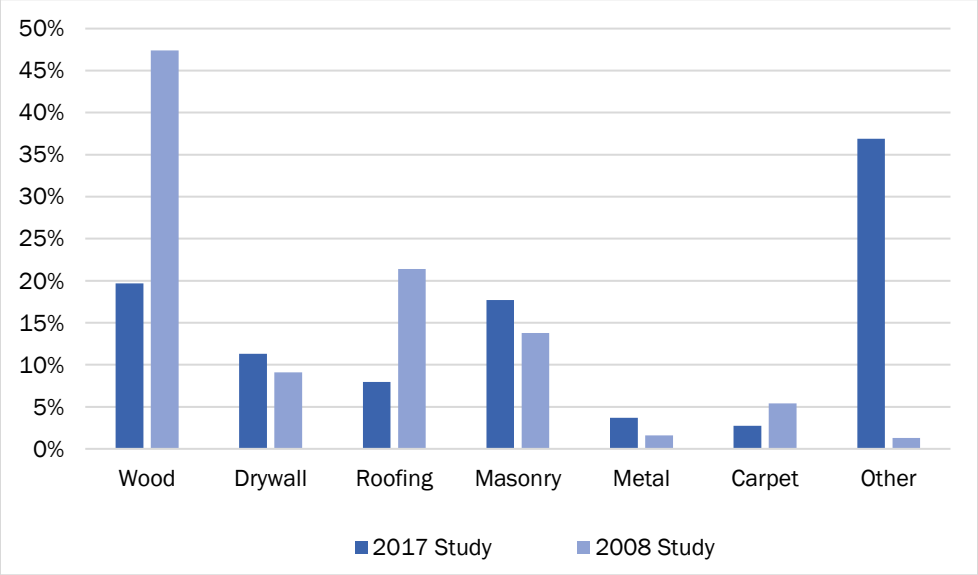
Table 5-4 Demolition Waste Composition by Demographic Origin

	Large Metro		Small Metro		Rural	
Material Category	Percent	Tons	Percent	Tons	Percent	Tons
MSW/Other Waste	**6.1%**	**15,518**	**10.9%**	**9,852**	**4.5%**	**738**
Flattened OCC	0.8%	2,133	0.3%	314	0.5%	86
Unflattened OCC	0.1%	296	0.2%	165	0.3%	53
R/C and Other Paper	0.3%	676	0.0%	39	1.1%	174
All Glass	0.4%	945	0.8%	709	0.1%	14
Electronics	0.8%	2,099	1.1%	1,033	0.4%	62
Items with CRTs	0.1%	190	0.9%	785	0.3%	50
Tree Trunks	*Not Found*		*Not Found*		*Not Found*	
Fines/Mixed Residue	1.7%	4,295	4.8%	4,364	*Not Found*	
Mixed MSW	1.9%	4,885	2.7%	2,442	1.8%	299
Agricultural Waste	*Not Found*		*Not Found*		*Not Found*	
Plastic	**7.5%**	**18,977**	**0.5%**	**467**	**4.9%**	**807**
Plastic Bottles (Recyclable)	*Not Found*		*Not Found*		*Not Found*	
HDPE Buckets (stacked)	*Not Found*		*Not Found*		*Not Found*	
HDPE Buckets (unstacked)	0.0%	31	0.0%	26	0.0%	6
Clean Recoverable Film	0.0%	107	0.0%	18	0.1%	15
R/C and Other Plastic	7.4%	18,840	0.5%	424	4.8%	787
Metal	**3.0%**	**7,531**	**5.8%**	**5,252**	**2.8%**	**461**
Appliances	*Not Found*		0.3%	313	0.0%	1
Other Ferrous Metals	2.5%	6,242	5.1%	4,651	2.5%	414
Other Non-ferrous Metal	0.2%	617	0.3%	288	0.3%	46
HVAC Ducting	0.3%	672	*Not Found*		*Not Found*	
Organics	**0.2%**	**570**	**5.9%**	**5,362**	**18.8%**	**3,109**
Leaves/Grass/Mixed Yard Waste	0.1%	355	0.8%	756	*Not Found*	
Branches/Limbs	*Not Found*		0.3%	291	0.1%	11
R/C and Other Organics	0.1%	216	4.8%	4,315	18.7%	3,098
Gypsum Board	**13.0%**	**32,988**	**7.4%**	**6,708**	**6.3%**	**1,042**
Clean Gypsum Board	2.3%	5,764	0.7%	589	0.0%	5
Painted Gypsum Board	10.8%	27,224	6.8%	6,119	6.3%	1,037
Roofing Materials	**8.5%**	**21,430**	**5.3%**	**4,808**	**14.8%**	**2,450**
Roofing Materials	8.5%	21,430	5.3%	4,808	14.8%	2,450
Dirt/Sand/Gravel	**1.8%**	**4,438**	**12.2%**	**11,032**	**8.6%**	**1,415**
Dirt/Sand/Gravel	1.8%	4,438	12.2%	11,032	8.6%	1,415
Other C&D	**5.5%**	**13,956**	**4.4%**	**4,010**	**4.1%**	**678**
Carpet	2.8%	7,207	1.8%	1,672	0.4%	73
Carpet Padding	0.2%	402	0.6%	547	0.1%	11
Asphalt Paving	0.8%	2,144	*Not Found*		*Not Found*	
Ceiling Tiles	0.3%	633	0.3%	273	0.1%	24
Insulation	0.7%	1,788	1.1%	968	0.8%	136
R/C and Other C&D	0.7%	1,783	0.6%	551	2.6%	434
Special Wastes	**16.9%**	**42,711**	**8.5%**	**7,680**	**8.3%**	**1,368**
Bulky Wastes/Furniture	16.8%	42,613	8.3%	7,545	8.3%	1,368
Tires - Cut	*Not Found*		0.1%	135	*Not Found*	
Tires - Whole	0.0%	30	*Not Found*		*Not Found*	
All HHW	0.0%	68	*Not Found*		*Not Found*	
Contaminated Soil	*Not Found*		*Not Found*		*Not Found*	
Wood	**17.1%**	**43,284**	**27.0%**	**24,461**	**19.3%**	**3,190**
Pallets - Standard	1.0%	2,631	0.8%	704	0.7%	114
Pallets/Crates/Heavy	*Not Found*		0.1%	80	0.1%	12
Untreated/Unpainted Lumber	3.6%	9,147	2.7%	2,468	3.1%	519
Treated/Painted/Processed Wood	4.6%	11,647	12.8%	11,605	7.5%	1,238
Engineered Wood	2.7%	6,742	3.3%	3,004	6.3%	1,038
Wood Furniture	3.3%	8,374	3.3%	2,989	1.4%	223
Other Wood	1.9%	4,744	4.0%	3,610	0.3%	47
Concrete/Brick/Rock	**20.4%**	**51,628**	**12.0%**	**10,886**	**7.7%**	**1,267**
Concrete/Block/Brick/Stone/Tile	20.4%	51,628	12.0%	10,886	7.7%	1,267
Grand Total	**100.0%**	**253,032**	**100.0%**	**90,517**	**100.0%**	**16,524**
No. of Samples	***31***		***45***		***33***	

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 5-8 provides a comparison of Demolition wastes from the 2008 Study. For this comparison, the 45 material categories used across-the-board for the 2017 non-MSW waste stream were mapped into one of the seven categories used for Demolition waste characterization in 2008.

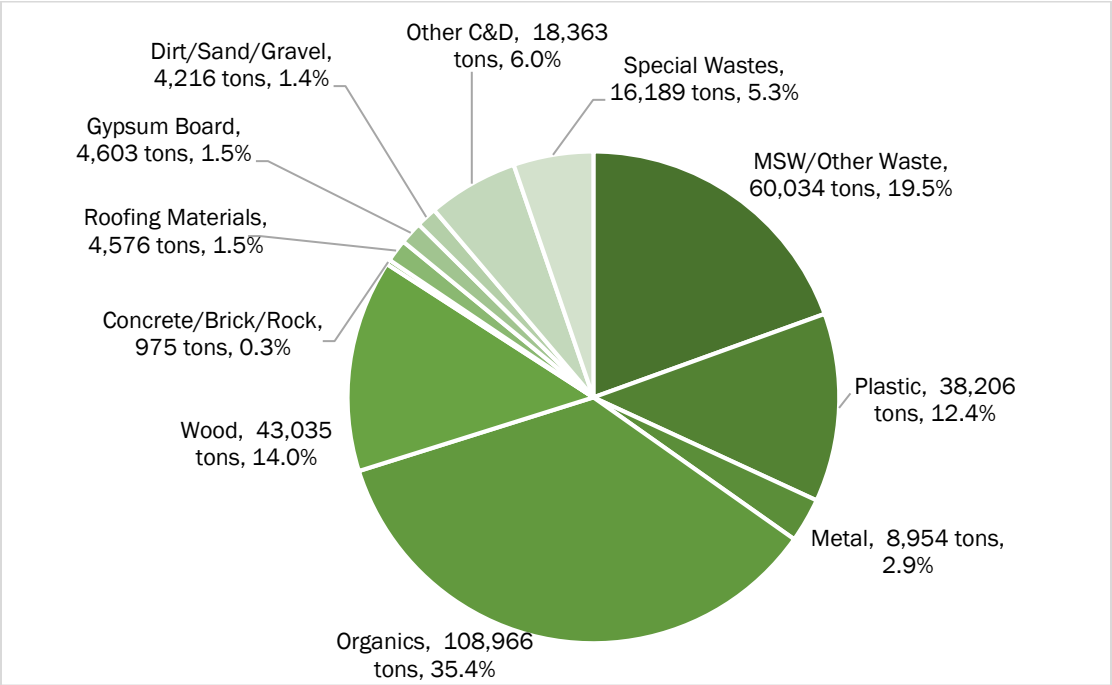
Figure 5-8 Demolition Waste Material Category Comparison 2017 vs. 2008



5.4 INDUSTRIAL WASTE COMPOSITION

Figure 5-9 shows the composition of Industrial wastes as identified in the non-MSW Visual Surveying activities. As exhibited, a considerable percentage of MSW/Other Waste was identified in the Industrial loads. Cardboard, Other Paper and Mixed MSW comprised the majority of this.

Figure 5-9 Industrial Waste Composition



5. NON-MSW COMPOSITION

Table 5-5 provides a detailed statistical profile of Industrial waste. For each material category, the mean percent, confidence intervals, and estimated tonnage are shown. Confidence intervals are calculated at a 90 percent level of confidence.

Table 5-5 Detailed Industrial Waste Composition

Material Category	Est. Percent	Conf. Int (+/-)	Est. Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Est. Tonnage
MSW/Other Waste	**19.5%**	**7.6%**	**60,034**	**Roofing Materials**	**1.5%**	**0.4%**	**4,576**
Flattened OCC	4.1%	0.4%	12,610	Roofing Materials	1.5%	0.4%	4,576
Unflattened OCC	0.9%	0.1%	2,804	**Dirt/Sand/Gravel**	**1.4%**	**0.9%**	**4,216**
R/C and Other Paper	4.9%	1.4%	15,067	Dirt/Sand/Gravel	1.4%	0.9%	4,216
All Glass	1.3%	1.1%	3,941	**Other C&D**	**6.0%**	**2.5%**	**18,363**
Electronics	0.0%	0.0%	36	Carpet	0.8%	0.2%	2,482
Items with CRTs		*Not Found*		Carpet Padding	0.1%	0.0%	428
Tree Trunks		*Not Found*		Asphalt Paving		*Not Found*	
Fines/Mixed Residue	1.6%	0.5%	4,840	Ceiling Tiles		*Not Found*	
Mixed MSW	5.6%	1.1%	17,299	Insulation	0.1%	0.0%	178
Agricultural Waste	1.1%	0.9%	3,436	R/C and Other C&D	5.0%	1.0%	15,274
Plastic	**12.4%**	**5.4%**	**38,206**	**Special Wastes**	**5.3%**	**10.6%**	**16,189**
Plastic Bottles (Recyclable)	0.3%	0.2%	812	Bulky Wastes/Furniture	0.6%	0.2%	2,002
HDPE Buckets (stacked)	0.2%	0.1%	606	Tires - Cut	3.3%	4.7%	10,180
HDPE Buckets (unstacked)	0.1%	0.0%	426	Tires - Whole	0.0%	0.0%	13
Clean Recoverable Film	1.4%	0.5%	4,312	All HHW	1.3%	0.4%	3,994
R/C and Other Plastic	10.4%	2.2%	32,049	Contaminated Soil		*Not Found*	
Metal	**2.9%**	**2.8%**	**8,954**	**Wood**	**14.0%**	**5.2%**	**43,035**
Appliances		*Not Found*		Pallets - Standard	2.8%	0.5%	8,755
Other Ferrous Metals	2.3%	1.3%	6,985	Pallets/Crates/Heavy	2.9%	0.7%	8,929
Other Non-ferrous Metal	0.6%	0.4%	1,934	Untreated/Unpainted Lumber	3.5%	0.8%	10,832
HVAC Ducting	0.0%	0.0%	35	Treated/Painted/Processed Wood	1.9%	0.9%	5,754
Organics	**35.4%**	**14.8%**	**108,966**	Engineered Wood	1.5%	1.1%	4,568
Leaves/Grass/Mixed Yard Waste	0.4%	0.1%	1,184	Wood Furniture	0.9%	0.4%	2,648
Branches/Limbs		*Not Found*		Other Wood	0.5%	0.4%	1,550
R/C and Other Organics	35.0%	7.8%	107,783	**Concrete/Brick/Rock**	**0.3%**	**0.2%**	**975**
Gypsum Board	**1.5%**	**0.9%**	**4,603**	Concrete/Block/Brick/Stone/Tile	0.3%	0.2%	975
Clean Gypsum Board	0.6%	0.6%	1,832				
Painted Gypsum Board	0.9%	0.3%	2,770	**Grand Total**	**100.0%**		**308,117**
				No. of Samples	***95***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 5-10 shows the top 10 most prevalent materials in the Industrial waste stream. By far, the Organics was the most prevalent material observed in the Industrial loads. Several landfills receive consistent loads from various large-scale food processing/production plants.

Figure 5-10 Top 10 Most Prevalent Materials in Industrial Waste

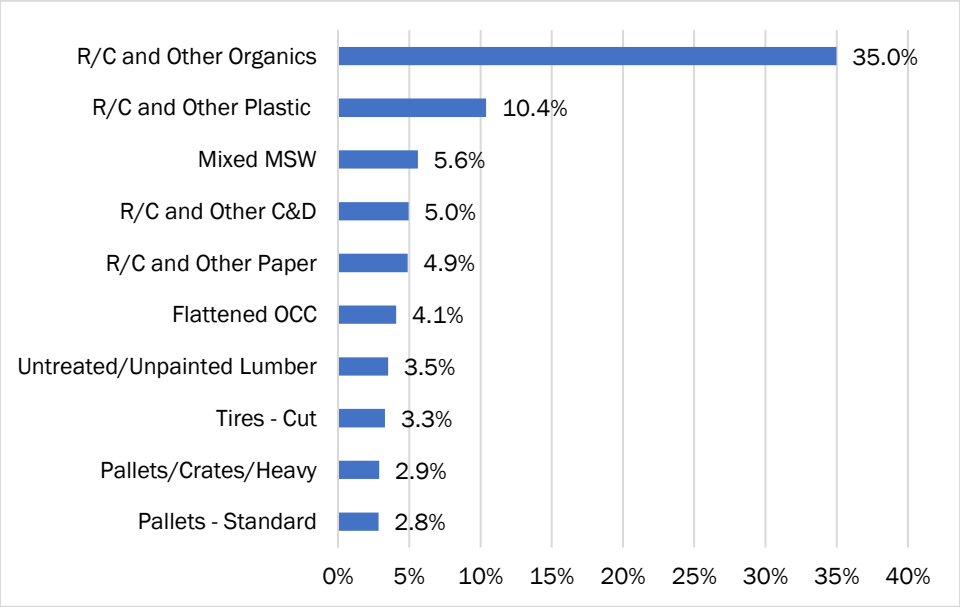


Figure 5-11 compares the composition of Industrial waste by demographic region.

Figure 5-11 Industrial Waste Composition by Demographic Origin

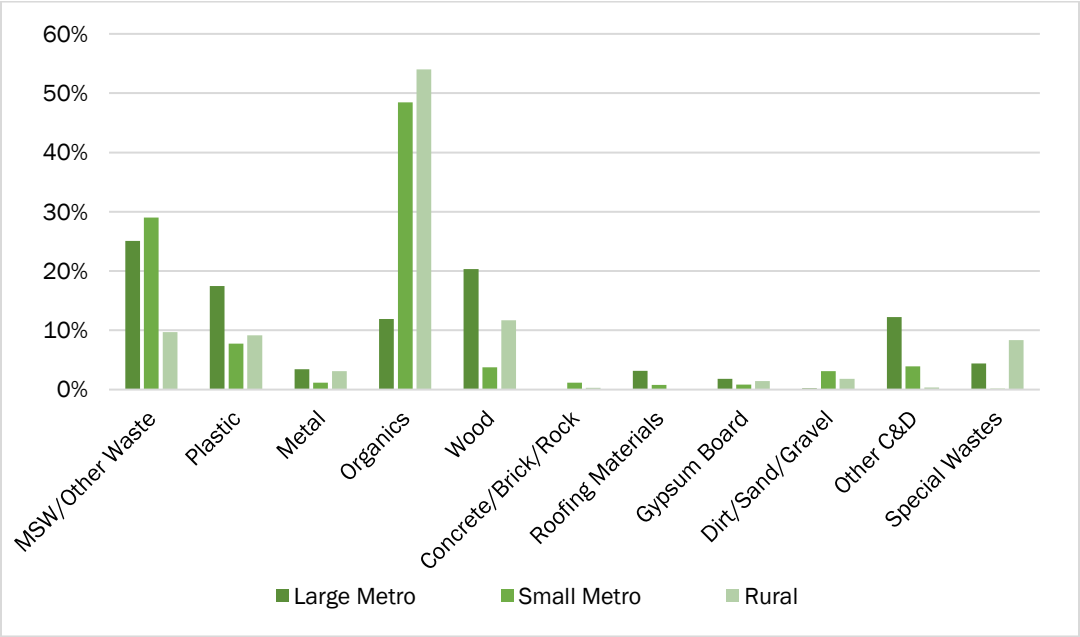


Table 5-6 provides detailed composition data for Industrial waste by demographic region. As mentioned previously, Organics is a very common material in this stream. Organics represent over 48 percent of the Industrial material at Small Metro facilities surveyed, 54 percent at the Rural facilities.

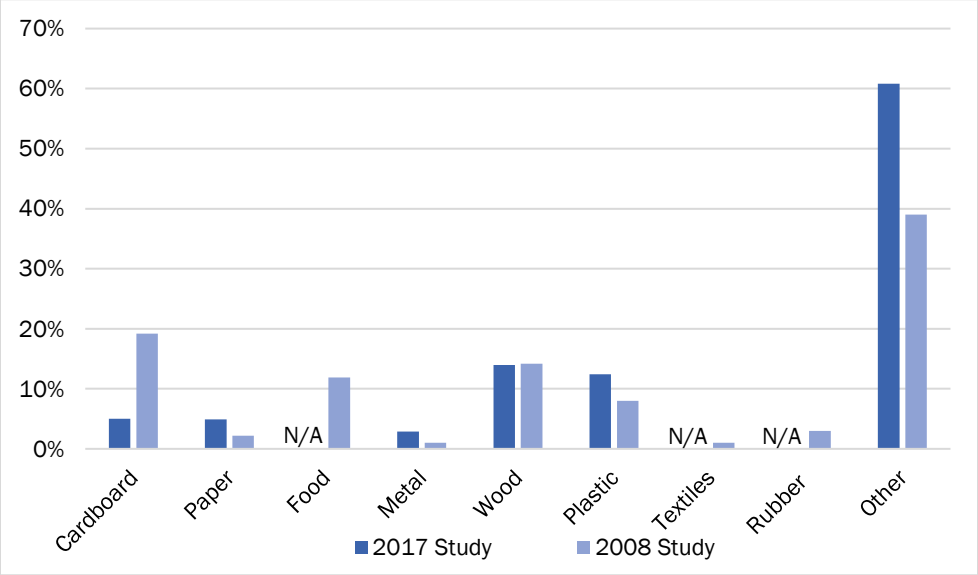
Table 5-6 Industrial Waste Composition by Demographic Origin

Material Category	Large Metro		Small Metro		Rural	
	Percent	Tons	Percent	Tons	Percent	Tons
MSW/Other Waste	**25.1%**	**32,430**	**29.0%**	**15,423**	**9.7%**	**12,181**
Flattened OCC	7.3%	9,484	4.2%	2,213	0.7%	913
Unflattened OCC	1.4%	1,794	1.4%	721	0.2%	289
R/C and Other Paper	7.0%	9,040	1.5%	806	4.2%	5,221
All Glass	*Not Found*		0.4%	219	3.0%	3,721
Electronics	*Not Found*		*Not Found*		0.0%	36
Items with CRTs	*Not Found*		*Not Found*		*Not Found*	
Tree Trunks	*Not Found*		*Not Found*		*Not Found*	
Fines/Mixed Residue	3.7%	4,840	*Not Found*		*Not Found*	
Mixed MSW	5.6%	7,271	15.1%	8,028	1.6%	2,000
Agricultural Waste	*Not Found*		6.5%	3,436	*Not Found*	
Plastic	**17.5%**	**22,617**	**7.8%**	**4,136**	**9.1%**	**11,453**
Plastic Bottles (Recyclable)	0.0%	7	1.5%	799	0.0%	6
HDPE Buckets (stacked)	0.4%	566	0.0%	27	0.0%	13
HDPE Buckets (unstacked)	0.2%	300	0.2%	94	0.0%	32
Clean Recoverable Film	1.2%	1,549	4.4%	2,336	0.3%	427
R/C and Other Plastic	15.6%	20,195	1.7%	879	8.7%	10,975
Metal	**3.4%**	**4,415**	**1.2%**	**614**	**3.1%**	**3,926**
Appliances	*Not Found*		*Not Found*		*Not Found*	
Other Ferrous Metals	2.6%	3,374	1.1%	585	2.4%	3,026
Other Non-ferrous Metal	0.8%	1,006	0.1%	28	0.7%	900
HVAC Ducting	0.0%	35	*Not Found*		*Not Found*	
Organics	**11.9%**	**15,399**	**48.4%**	**25,766**	**54.0%**	**67,802**
Leaves/Grass/Mixed Yard Waste	0.9%	1,123	0.1%	48	0.0%	13
Branches/Limbs	*Not Found*		*Not Found*		*Not Found*	
R/C and Other Organics	11.0%	14,276	48.3%	25,718	54.0%	67,789
Gypsum Board	**1.8%**	**2,331**	**0.8%**	**439**	**1.5%**	**1,832**
Clean Gypsum Board	*Not Found*		*Not Found*		1.5%	1,832
Painted Gypsum Board	1.8%	2,331	0.8%	439	*Not Found*	
Roofing Materials	**3.2%**	**4,117**	**0.8%**	**412**	**0.0%**	**46**
Roofing Materials	3.2%	4,117	0.8%	412	0.0%	46
Dirt/Sand/Gravel	**0.2%**	**275**	**3.1%**	**1,644**	**1.8%**	**2,297**
Dirt/Sand/Gravel	0.2%	275	3.1%	1,644	1.8%	2,297
Other C&D	**12.2%**	**15,833**	**3.9%**	**2,082**	**0.4%**	**448**
Carpet	1.9%	2,455	0.1%	28	*Not Found*	
Carpet Padding	0.3%	393	0.1%	35	*Not Found*	
Asphalt Paving	*Not Found*		*Not Found*		*Not Found*	
Ceiling Tiles	*Not Found*		*Not Found*		*Not Found*	
Insulation	*Not Found*		0.3%	175	0.0%	3
R/C and Other C&D	10.0%	12,985	3.5%	1,844	0.4%	445
Special Wastes	**4.4%**	**5,676**	**0.1%**	**66**	**8.3%**	**10,447**
Bulky Wastes/Furniture	1.3%	1,668	0.1%	66	0.2%	267
Tires - Cut	*Not Found*		*Not Found*		8.1%	10,180
Tires - Whole	0.0%	13	*Not Found*		*Not Found*	
All HHW	3.1%	3,994	*Not Found*		*Not Found*	
Contaminated Soil	*Not Found*		*Not Found*		*Not Found*	
Wood	**20.4%**	**26,341**	**3.8%**	**1,996**	**11.7%**	**14,699**
Pallets - Standard	4.2%	5,458	1.6%	839	2.0%	2,458
Pallets/Crates/Heavy	5.7%	7,322	*Not Found*		1.3%	1,607
Untreated/Unpainted Lumber	6.1%	7,847	1.3%	686	1.8%	2,299
Treated/Painted/Processed Wood	2.4%	3,058	0.3%	170	2.0%	2,526
Engineered Wood	0.6%	818	0.3%	154	2.9%	3,596
Wood Furniture	1.4%	1,780	*Not Found*		0.7%	868
Other Wood	0.0%	59	0.3%	145	1.1%	1,345
Concrete/Brick/Rock	***Not Found***		**1.2%**	**619**	**0.3%**	**356**
Concrete/Block/Brick/Stone/Tile	*Not Found*		1.2%	619	0.3%	356
Grand Total	**100.0%**	**129,434**	**100.0%**	**53,196**	**100.0%**	**125,488**
No. of Samples	***27***		***22***		***46***	

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure 5-12 provides a comparison of Industrial wastes from the 2008 Study. For this comparison, the 45 material categories used across-the-board for the 2017 non-MSW waste stream were mapped into one of the nine categories used for Industrial waste characterization in 2008.

Figure 5-12 Industrial Waste Material Category Comparison 2017 vs. 2008



5.5 SPECIAL WASTE COMPOSITION

Figure 5-13 shows the composition of Special wastes. These include:

- Bulky Items
- Contaminated Soil
- Asbestos
- Mattresses
- Cut Tires
- Tritium and
- E-Scrap

At nearly 94 percent, Contaminated Soil is the vast majority of materials classified as Special waste for the study.

Figure 5-13 Special Waste Composition

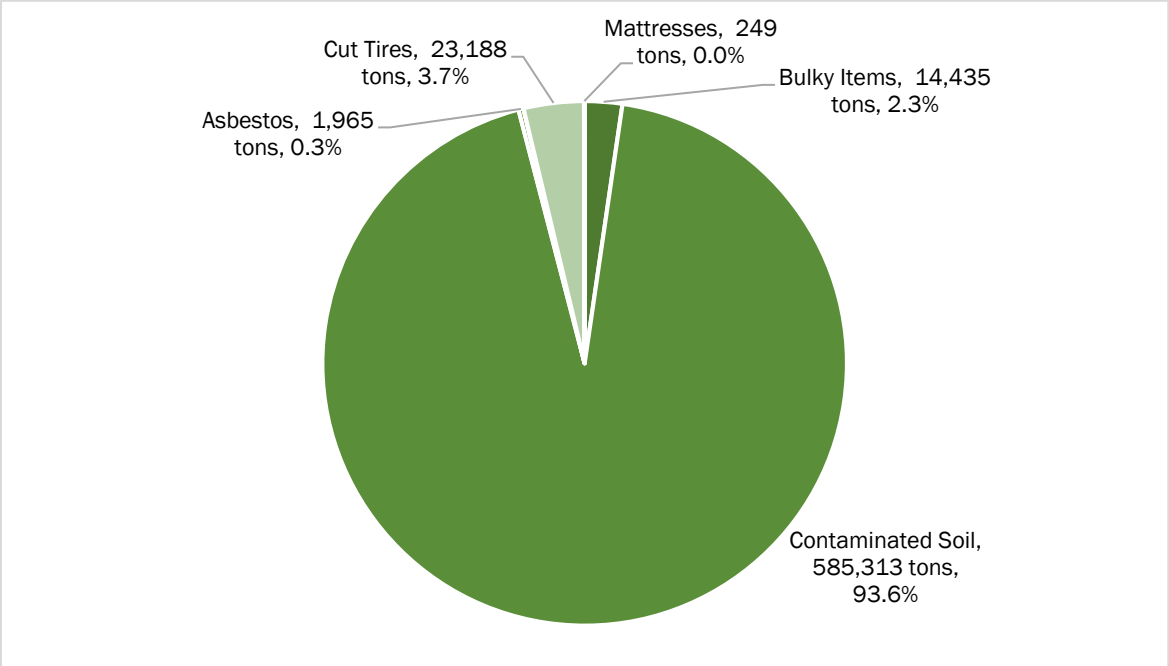


Figure 5-14 compares the composition of Special waste by demographic region.

Figure 5-14 Special Waste Composition by Demographic Origin

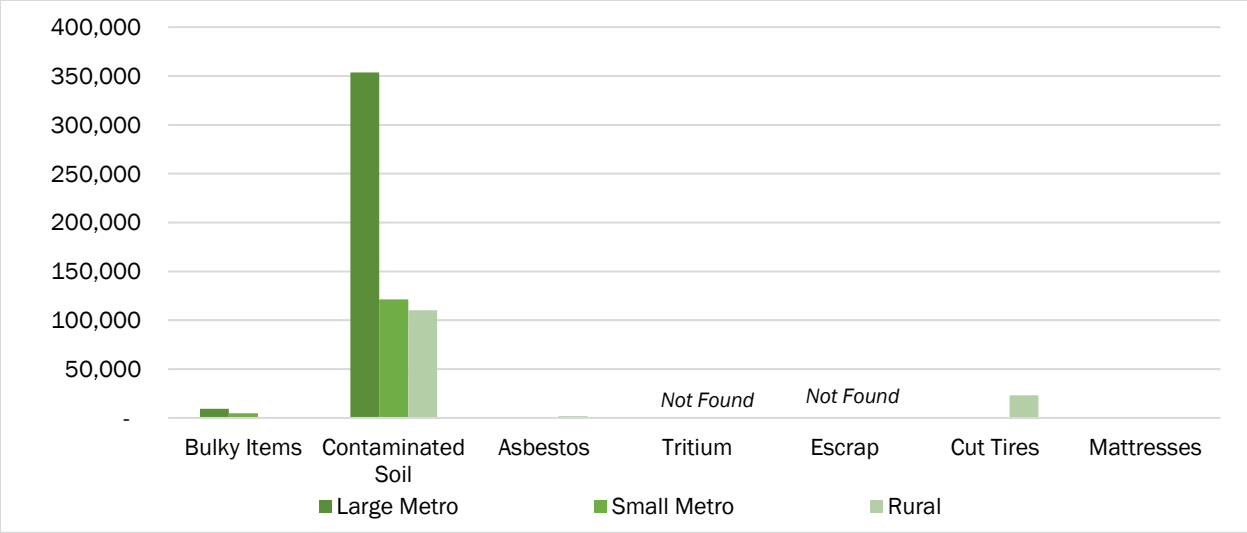
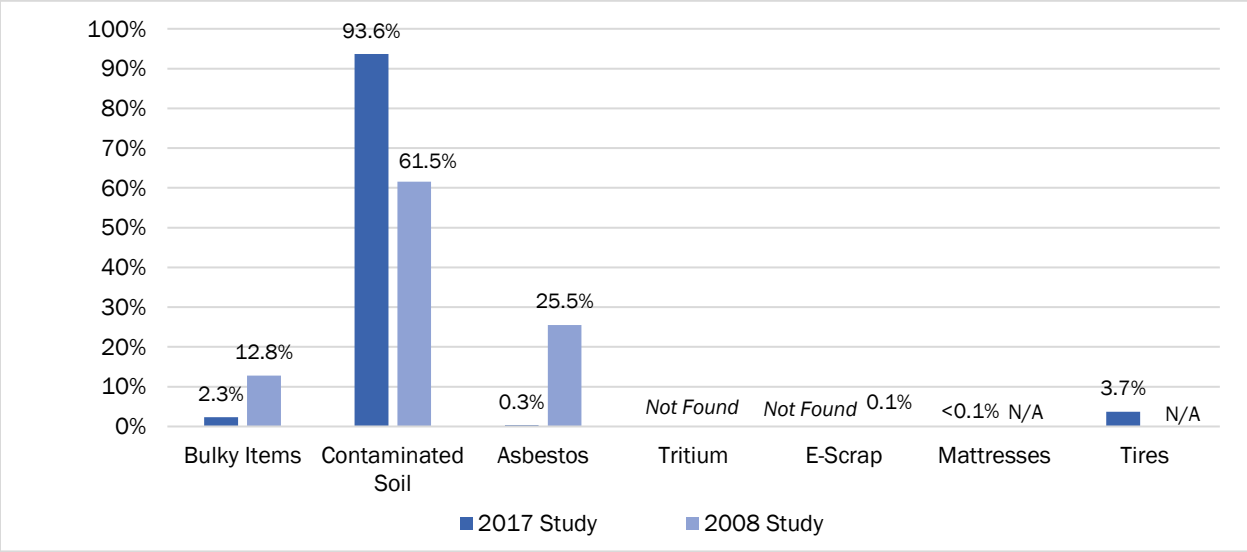


Figure 5-15 provides a comparison of Special wastes from the 2008 Study. The categories were the same as 2008 with the exception of adding Tires and Mattresses, as special items of interest in today's disposal operations.

Figure 5-15 Special Waste Composition Comparison 2017 vs. 2008



5.6 OTHER WASTE COMPOSITION

Figure 5-16 shows the composition of Other wastes. These include:

- Sludge
- Tree Trunks and Limbs
- Other (not otherwise captured elsewhere)

The "Other" material category was not used in previous studies under this waste sector. During the gate survey portion of the non-MSW phase of the study, a substantial number of loads were received at multiple facilities, predominantly Large Metro, such as auto fluff, solidification materials, and other items that may have unique uses or applications and were not identified in previous studies.

Figure 5-16 Other Waste Composition

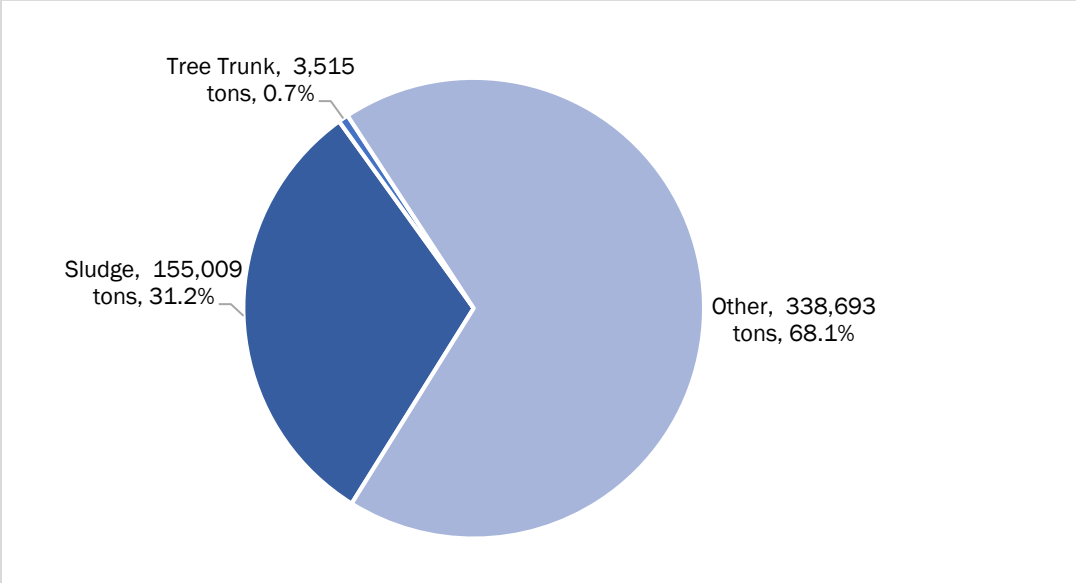


Figure 5-17 compares the composition of Other waste by demographic region. As shown, the vast majority of this material is being received at Large Metro facilities.

Figure 5-17 Other Waste Composition by Demographic Origin

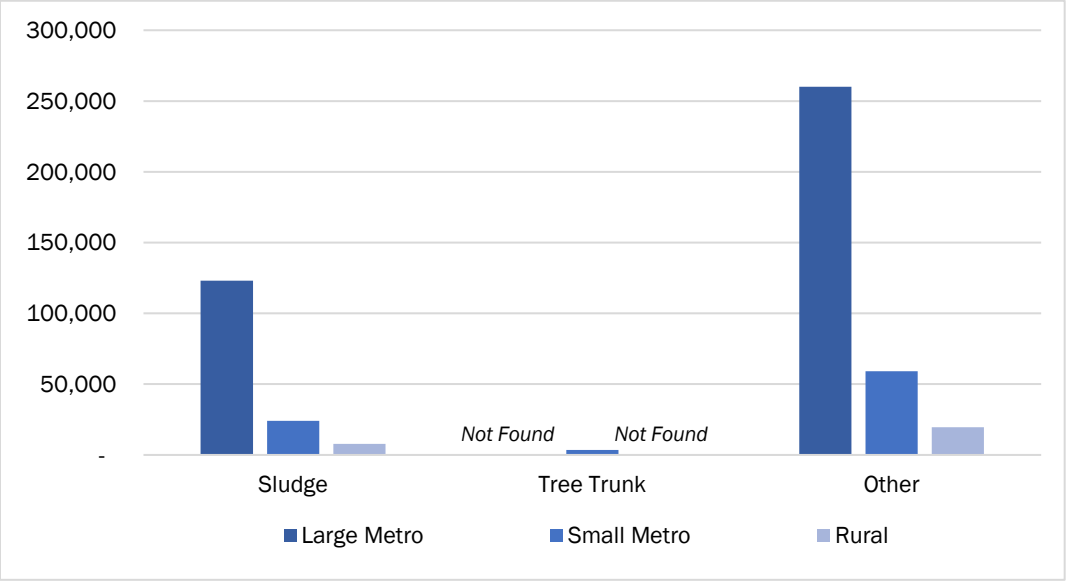
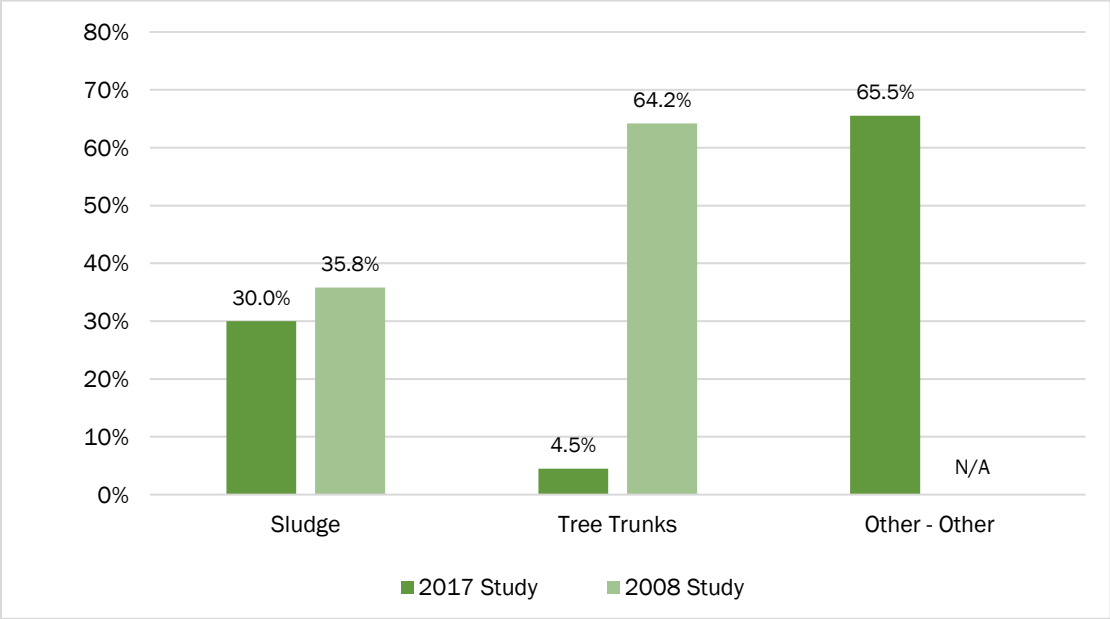


Figure 5-18 provides a comparison of Other wastes from the 2008 Study.

Figure 5-18 Other Waste Composition Comparison 2017 vs. 2008



6. CONCLUSIONS & RECOMMENDATIONS

6.1 COMBINING MSW AND NON-MSW COMPOSITION

The previous sections provide extensive detail about the composition and quantity of MSW and non-MSW waste streams in Missouri. As a final step in the analysis, these results are combined to present a snapshot of Missouri's entire solid waste stream destined for disposal.

6.1.1 DISPOSED SOLID WASTE COMPOSITION

Because of the nature of MSW and non-MSW wastes, slightly different material categories were used to describe the composition of each. To combine MSW and Non-MSW, a first step is to create a coherent, combined list of material categories. Table 6-1 illustrates the mapping that was used to merge non-MSW categories into the MSW categories, which were used as a starting point. Several additional line items were also added to the final list of Solid Waste categories.

Table 6-1 Visual Survey Material Categories Mapped to MSW for Statewide Results

Visual Survey Material Categories →	Solid Waste Categories
Flattened OCC	OCC/Kraft
Unflattened OCC	OCC/Kraft
R/C and Other Paper	Remainder/Composite Paper
Plastic Bottles (Recyclable)	PET (#1) Bottles/Jars
HDPE Buckets (stacked)	HDPE (#2) Colored Containers
HDPE Buckets (unstacked)	HDPE (#2) Colored Containers
Clean Recoverable Film	Clean Ind'l/Com'l Film
R/C and Other Plastic	Remainder/Composite Plastic
All Glass	Remainder/Composite Glass
Appliances	Other Ferrous - Magnetic
Other Ferrous Metals	Other Ferrous - Magnetic
Other Non-ferrous Metal	Other Non-Ferrous
HVAC Ducting	Other Ferrous - Magnetic
Leaves/Grass/Mixed Yard Waste	Yard Waste
Branches/Limbs	Yard Waste
R/C and Other Organics	Remainder/Composite Organic
Pallets - Standard	Wood - Clean/Untreated
Pallets/Crates/Heavy	Wood - Clean/Untreated
Untreated/Unpainted Lumber	Wood - Clean/Untreated
Treated/Painted/Processed Wood	Wood - Painted/Stained/Treated
Engineered Wood	Wood - Painted/Stained/Treated
Wood Furniture	Wood - Painted/Stained/Treated
Other Wood	Wood - Painted/Stained/Treated
Carpet	Carpet & Carpet Padding
Carpet Padding	Carpet & Carpet Padding
Concrete/Block/Brick/Stone/Tile	Asphalt, Brick, Concrete & Rocks
Asphalt Paving	Asphalt, Brick, Concrete & Rocks
Roofing Materials	Roofing Materials
Ceiling Tiles	Other Construction & Demolition
Clean Gypsum Board	Drywall/Gypsum Board
Painted Gypsum Board	Drywall/Gypsum Board
Dirt/Sand/Gravel	Other Construction & Demolition
Insulation	Other Construction & Demolition
R/C and Other C&D	Other Construction & Demolition
Electronics	Electronic Waste
Items with CRTs	Electronic Waste
Bulky Wastes/Furniture	Bulky Items/Furniture
Tree Trunks	Remainder/Composite Organic

Visual Survey Material Categories →	Solid Waste Categories
Tires - Cut	Tires
Tires - Whole	Tires
All HHW	Household Hazardous Waste
Fines/Mixed Residue	Fines
Agricultural Waste	Remainder/Composite Organic
Contaminated Soil	Contaminated Soil
Bulky Items	Bulky Items/Furniture
Asbestos	Household Hazardous Waste
Tritium	Household Hazardous Waste
E-scrap	Electronic Waste
Cut Tires	Tires
Mattresses	Mattresses/Boxsprings
Sludge	Bio-Sludge
Tree Trunk	Remainder/Composite Organic
Other	Other Non-MSW

Statewide Solid Waste composition was subsequently calculated by summing the MSW and non-MSW tonnages by material category. Figure 6-1 shows the resulting aggregated composition of disposed wastes in 2017. Organics remains the prevailing category, although Non-MSW, Paper and Inorganics make up sizable portion of the solid waste stream.

Figure 6-1 2017 Missouri Statewide Solid Waste Composition

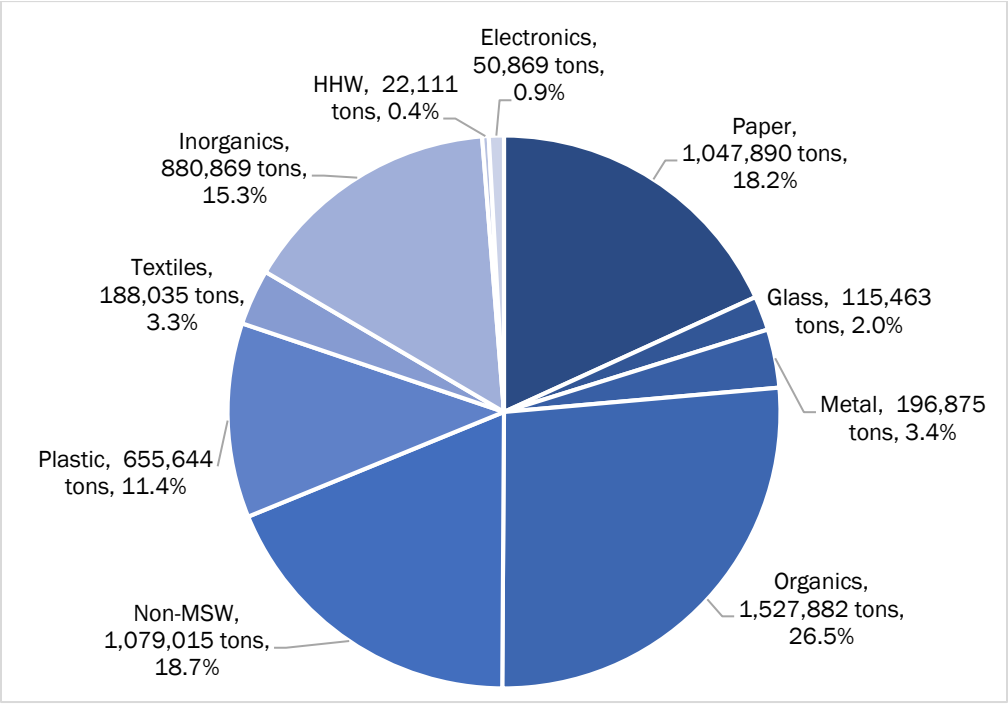


Table 6-2 provides a detailed profile of the 2017 statewide aggregate disposed stream.

Table 6-2 Detailed Statewide Waste Composition

Material Category	Est. Percent	Tonnage	Material Category	Est. Percent	Tonnage
Paper	**18.2%**	**1,047,890**	**Organics**	**26.5%**	**1,527,882**
OCC/Kraft	6.1%	351,047	Food Waste	10.1%	582,470
Newsprint	1.0%	56,975	Wood - Clean/Untreated	3.5%	204,378
Magazines	0.6%	35,584	Wood - Painted/Stained/Treated	4.4%	254,666
High Grade Office Paper	0.9%	51,399	Disposable Diapers & Sanitary Prod.	2.1%	119,225
Mixed Recyclable Paper	2.7%	156,879	Yard Waste	1.8%	105,884
Compostable Paper	5.5%	314,340	Remainder/Composite Organic	4.5%	261,258
Remainder/Composite Paper	1.4%	81,665	**Textiles**	**3.3%**	**188,035**
Glass	**2.0%**	**115,463**	Textiles - Clothing	1.5%	87,900
Clear Glass Containers	0.9%	53,565	Textiles - Non-Clothing	1.3%	74,179
Brown Glass Containers	0.6%	32,652	Shoes/Belts/Leather	0.5%	25,955
Green Glass Containers	0.1%	8,365	**Inorganics**	**15.3%**	**880,869**
Remainder/Composite Glass	0.4%	20,881	Fines	1.4%	80,676
Metal	**3.4%**	**196,875**	Drywall/Gypsum Board	1.7%	97,725
Aluminum Cans & Containers	0.4%	24,664	Asphalt, Brick, Concrete & Rocks	1.7%	96,445
Other Aluminum	0.2%	12,065	Carpet & Carpet Padding	2.0%	117,250
Tin/Steel Containers	0.7%	39,646	Roofing Materials	0.7%	41,485
Other Ferrous	1.6%	93,056	Other Construction & Demolition	2.1%	119,420
Other Non-Ferrous	0.5%	26,022	Bulky Items/Furniture	3.3%	191,485
Oil Filters	0.0%	1,423	Mattresses/Boxsprings	0.5%	26,540
Plastic	**11.4%**	**655,644**	Tires	1.1%	65,253
PET (#1) Bottles/Jars	1.0%	55,977	Other/Not Classified	0.8%	44,589
PET (#1) Non-Bottle Containers	0.1%	8,386	**HHW**	**0.4%**	**22,111**
HDPE (#2) Natural Containers	0.3%	15,507	Household Hazardous Waste	0.4%	22,111
HDPE (#2) Colored Containers	0.4%	20,824	**Electronics**	**0.9%**	**50,869**
Clean Film Bags	0.2%	12,029	Electronic Waste	0.9%	50,869
Clean Ind'l/Com'l Film	0.5%	31,399	**Non-MSW**	**18.7%**	**1,079,015**
Contaminated Film/Other Film	4.0%	230,868	Contaminated Soil	10.2%	585,313
Plastic Containers #3 thru #7	0.7%	38,398	Sludge	2.7%	155,009
Expanded Polystyrene #6	0.5%	28,106	Other Non-MSW	5.9%	338,693
Bulky Durable Plastic Products	1.3%	73,223			
Remainder/Composite Plastic	2.4%	140,927	**Grand Total**	**100.0%**	**5,764,654**
			No. of Samples	***599***	

Confidence intervals calculated at the 90% confidence level. Percentages and tonnages for materials may not exactly equal category subtotals due to rounding.

Figure 6-2 shows the top 10 most prevalent materials in the Missouri statewide Solid Waste stream. Contaminated Soils and Food Waste top the list, at just over 10 percent each. Whereas Contaminated Soils are taken to landfills randomly for various cleanup projects and periodic industrial-type operations, Food Waste is routinely generated from all generator sectors. OCC/Kraft materials represent 6.4 percent of the waste stream, providing another key target for diversion.

It should be noted that the incidence of Contaminated Soils may be overstated due to limitations of the gate survey used to identify this waste type. In particular, three of the fifteen facilities gate surveyed received a large volume of Contaminated Soils on the days of the survey. To the extent these deliveries were occurring for a short time period in response to a localized remediation project, it is possible the statewide quantity is lower than what was estimated from this study. However, if contaminated soils are generated on an ongoing basis (for example, from septic tank or fuel tank remediation programs), then the estimated quantity of soil may be fully representative. It was beyond the ability of this study to adjust for the impacts of localized waste delivery variations at these three host facilities. Gate survey limitations are described in Section 2.5.4.

Figure 6-2 Top 10 Most Prevalent Materials in Statewide Waste Stream

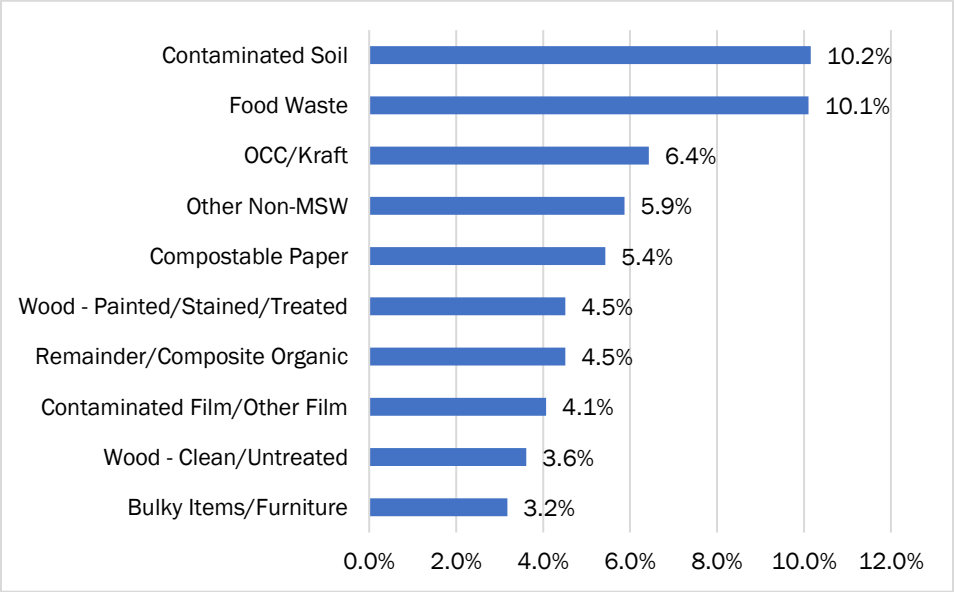
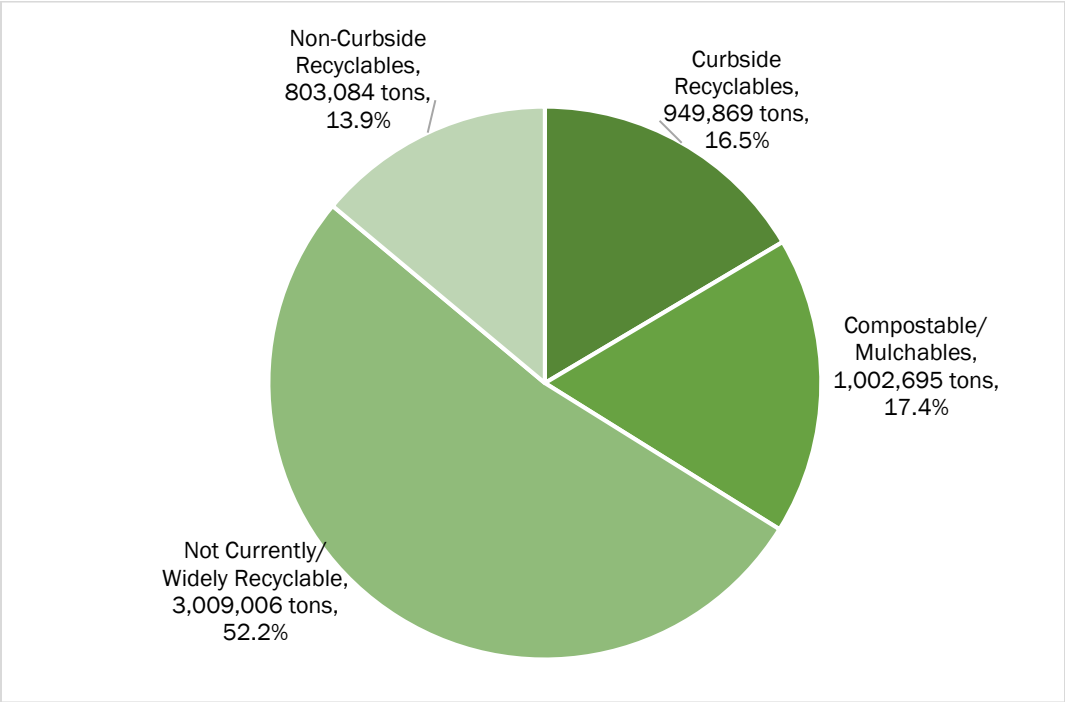


Figure 6-3 presents the composition of disposed waste in terms of the potential for diverting materials from disposal. This figure was developed by assigning a "Diversion Strategy" to each individual constituent in the waste stream, as described in Section 4 of this report. As shown, over 52 percent of statewide materials are not commonly divertible. As previously mentioned, a significant portion of the state's waste stream consists of Contaminated Soils and other industrial byproducts.

Figure 6-3 Statewide Divertibility of Disposed Wastes



It should be noted that the above figure represents the rosiest possible definition of what is "recoverable" in existing programs. To perform this study, manual sorters were trained to separate all items for placement in the correct category, and did not make any adjustments for contamination of sorted materials, nor the ability of a mechanical processing system to accurately separate such materials for recovery. The results of this exercise can be considered an "academic" characterization of the waste stream. Many of the recyclable and compostable organic items would never be recovered or diverted because of contamination, or because they are so intermingled with non-recoverable items prior to placement in the waste receptacle (or as a result of the collection process) that no processing line could economically separate and recover the item.

Table 6-3 indicates how the individual material categories were combined to create the Divertibility profile in Figure 6-3.

Table 6-3 Divertibility of Solid Waste Material Categories

Curbside Recyclables	
Newsprint	HDPE (#2) Natural Containers
Corrugated Cardboard/Kraft Paper (Uncoated)	HDPE (#2) Colored Containers
Magazines	Plastic Containers #3 thru #7
Paperboard	Aluminum Cans & Containers
High Grade Office Paper	Tin/Steel Containers
Mixed Recyclable Paper	Clear Glass Containers
PET (#1) Bottles/Jars	Brown Glass Containers
PET (#1) Non-Bottle Containers	Green Glass Containers
Non-Curbside Recyclables	
Clean Industrial/Commercial Film (non-bag)	Asphalt, Brick, Concrete & Rocks
Clean Film Bags	Household Hazardous Waste
Other Aluminum	Electronic Waste
Other Non-Ferrous	Textiles & Leather Products
Other Ferrous	Tires
Wood - Clean/Untreated	Oil Filters
Compostables/Mulchables	
Compostable Paper	Yard Waste
Food Waste	
Not Currently/Widely Recyclable	
Non-Recyclable Paper	Drywall/Gypsum Board
Other Construction & Demolition	Carpet & Carpet Padding
Expanded Polystyrene #6	Bulky Durable Plastic Products
Contaminated Film/Other Film	Mattresses/Boxsprings
Remiander/Composite Plastic	Bulky Items/Furniture
Remiander/Composite Glass	Disposable Diapers & Sanitary Products
Roofing Materials	Other Non-MSW
Remiander/Composite Organic	Other/Not Elsewhere Classified
Contaminated Soil	Sludge
Wood - Painted/Stained/Treated	Fines
Non-C&D Wood	

6.1.2 COMPARISON WITH 2008 STUDY RESULTS

Table 6-4 provides a detailed comparison of the composition of disposed wastes between the 2008 and 2017 Studies. As previously noted in this report, the waste composition methodology in the 2017 Study did not follow the 2008 Study methodology, and differences in the results may be caused by methodological differences. No detailed investigation has been performed to validate the differences shown in this table.

Table 6-4 Detailed Comparison of Statewide Waste Composition 2017 vs. 2008

	2008 Study		2017 Study	
Material Category	Est. Percent	Tonnage	Est. Percent	Tonnage
MSW	**58.3%**	**3,710,537**	**67.4%**	**3,885,644**
MSW Paper	19.6%	1,247,854	17.5%	1,008,713
MSW Glass	3.2%	201,853	1.9%	109,750
MSW Metal	3.5%	224,116	2.9%	169,239
MSW Plastics	10.1%	640,068	10.3%	595,126
MSW Organics	18.4%	1,172,159	25.1%	1,445,882
MSW Inorganics	2.4%	153,616	8.6%	494,325
MSW Special Waste	1.1%	70,871	1.1%	62,608
Construction	**1.6%**	**95,840**	**2.0%**	**113,378**
Wood	0.8%	48,903	0.5%	28,506
Drywall	0.2%	15,249	0.5%	29,217
Masonry	0.1%	6,689	0.2%	10,769
Metal	0.1%	3,212	0.1%	5,439
Plastic	0.1%	8,050	0.0%	2,061
Cardboard	0.1%	8,739	0.1%	4,081
Other	0.1%	4,998	0.6%	33,305
Demolition	**13.2%**	**809,211**	**6.1%**	**352,447**
Wood	6.0%	383,419	1.2%	70,935
Drywall	1.2%	73,808	0.7%	40,738
Roofing	2.7%	173,040	0.5%	28,687
Masonry	1.8%	111,439	1.1%	63,781
Metal	0.2%	12,594	0.2%	13,243
Carpet	0.7%	43,999	0.2%	9,910
Other	0.2%	10,912	2.2%	125,152
Industrial	**10.7%**	**702,280**	**5.0%**	**290,818**
Cardboard	2.1%	134,577	0.3%	15,414
Paper	0.3%	15,788	0.3%	15,067
Food	1.3%	83,851	N/A	N/A
Metal	0.1%	6,727	0.2%	8,954
Wood	1.6%	100,432	0.7%	43,035
Plastic	0.9%	57,491	0.7%	38,206
Textiles	0.1%	6,557	N/A	N/A
Rubber	0.3%	20,786	N/A	N/A
Other	4.3%	276,071	3.0%	170,141
Other	**2.5%**	**144,640**	**9.0%**	**520,405**
Sludge	0.8%	51,813	2.7%	155,009
Tree Trunks	1.5%	92,827	0.1%	3,515
Other/Not Classified	N/A	N/A	6.3%	361,881
Special	**13.5%**	**851,767**	**10.4%**	**601,962**
Bulky	1.7%	109,106	0.3%	14,684
Contaminated Soil	8.2%	524,204	10.2%	585,313
Asbestos	3.4%	217,418	0.0%	1,965
Tritium	Not Found		Not Found	
E-scrap	0.0%	1,039	Not Found	
Grand Total	**100.0%**	**6,314,275**	**100.0%**	**5,764,654**
No. of Samples	***240***		***599***	

** Percentages for materials may not exactly equal category subtotals due to rounding.*

*** In the 2008 study, aside from the 240 MSW samples, 7,771 vehicles were observed capturing the non-MSW segment.*

6.1.3 COMPARISON WITH OTHER RECENT STATEWIDE STUDIES

Statewide waste characterization studies have become routine checkpoints for many states to track diversion progress, measure the impact of new programs and policies, and assess materials for future planning. Missouri has now conducted three periodic studies. Some of the other states that habitually analyze their waste include California, Connecticut, Delaware, Iowa, Maryland, Minnesota, Oregon and Washington.

MSW Consultants closely monitors the body of waste characterization work that is performed in the U.S. and is a leading national expert on this topic. While it was beyond the scope of this project to perform a detailed comparison of Missouri's disposed waste composition with that of other states, the following trends – which are consistent with patterns in other states – were observed in Missouri's waste stream:

- The incidence of Paper continues to decline. This follows the widely reported shift from print to online media.
- The incidence of Plastics continues to increase, especially the films, as well as more and varied packaging materials.
- With the shift of more materials to recycling programs and a focus on lightweighting of packaging materials, the denser items such as food, textiles and diapers are becoming a higher percentage of the overall stream.

6.2 CONCLUSIONS

- **Comparability**: The 2017 Study was designed to be similarly comprehensive and provide similar material category breakdowns compared to the 2008 and prior studies. However, the 2017 Study methodology was updated to better apply best practices associated with representative sampling of both MSW and non-MSW loads of waste, as well as visual surveying of C&D and bulky loads. In the professional opinion of MSW Consultants, the 2017 Study reasonably reflects a number of expected changes to Missouri's overall waste stream that are consistent with changes found in other waste characterization time series data that have used entirely similar methodologies. In this regard the 2017 and 2008 Studies are somewhat comparable. However, due to differences in data collection protocols in the Missouri time series data, it is not possible to perfectly compare 2017 results with prior study results.
- **Representativeness of Data Collection**: The 2017 Study attempted to distribute field data collection across the state's landfills and transfer stations in close proportion to where wastes are generated. This effort allowed analysis to be performed for each of three demographic regions: Rural, Small Metro and Large Metro. The 2017 Study also captured good representation of both Residential wastes and CI wastes, as well as all MSW in the aggregate. In the opinion of MSW Consultants, the statewide results for Residential, CI and aggregate disposed MSW are in line with the results experienced by other states that have performed similar large-scale studies and reasonably characterize the Missouri's disposed MSW stream. Further, the gate survey and visual analysis of non-MSW waste streams provides Missouri with a more comprehensive snapshot of disposed wastes compared to many states that only analyze the MSW stream.
- **Dwindling Incidence of Curbside Recyclables**: The results of this study (as well as other studies that have been performed nationally) show that the incidence of recyclable fibers and containers continues to diminish in the disposed MSW stream. In the case of fibers, this is probably due to a combination of factors beyond just an increase in recycling (i.e., reductions in paper production). Regardless of the cause, it appears that the incidence of recyclable fiber and containers in disposed MSW has decreased in Missouri, and that the expansion of curbside recycling programs (especially single stream) contribute to this.

- **Opportunities for Increased Cardboard Diversion:** Despite the apparent reduction in the single stream recyclables that are disposed in Missouri's solid waste stream, corrugated cardboard was found in relatively high quantities in the 2017 Study. This was especially apparent in the CI waste stream.
- **Opportunity for Diversion of Organics**: Over one-fourth of the state's disposed waste stream is made up of organic materials. While not all organics are compostable, there are emerging technologies that purport to convert organic wastes into energy, fuels and the like. While this will entice many to push for aggressive diversion of these materials, it should be noted that some of the organic materials may be more difficult to separate and recover than these results might suggest. Mechanical and optical sorting capabilities are not able to achieve the level of accuracy of the manual sorting that occurred in this study. Food Waste, Clean Wood and Yard Waste collectively constitute over 15 percent of the stream and there are existing or emerging diversion programs for these materials.
- **High Incidence of Non-Recyclable Waste**: As important as these study results are to identify incremental diversion opportunities, they are equally informative in showing that over half of Missouri's solid waste stream is not readily recyclable or divertible from landfill disposal at the current time. To achieve the very high diversion rates that have been adopted by other states and cities across the country – which can reach 75 percent or higher – there will need to be significant investments in processing infrastructure, development of new recycled material markets, and adoption of new diversion programs in all generator sectors.
- **Demographic Influence**: Not surprisingly, Missouri's waste stream originates predominantly from Large Metro regions, with less than half from Small Metro and Rural regions. The statewide composition data contained herein consequently reflect this weighting towards Large Metro wastes.

6.3 RECOMMENDATIONS

- **Continue Performing Statewide Studies Using 2017 Study Methodology**: Statewide studies both inform about the overall disposed waste stream for state-level planners, and also provide data to municipal and private solid waste and recycling stakeholders for a variety of uses. Five to seven-year intervals are recommended to reflect changes in the materials generation and diversion program progressions. It was an objective of the 2017 Study to update the statewide methodology so that future updates can be closely compared to the 2017 Study. In the opinion of MSW Consultants, the 2017 Study methodology could be cost-effectively duplicated in future studies to provide a technically robust comparison.
- **Consider Integrating Recycling Composition Data**: The 2017 Study focused exclusively on sampling from disposal facilities. However, this only presents half the equation for evaluating the effectiveness of the state's recycling programs. If detailed quantity and composition data was also available for recyclables, it would be possible to calculate a statewide Capture Rate. Sometimes called a Recovery Rate, the Capture Rate identifies the percentage of a targeted recyclable material that is actually being recycled through the available recycling infrastructure (and hence "captured" in the recycling program). MSW Consultants recommends that Capture Rates be evaluated to get the best understanding of recycling program effectiveness. Such analysis could be performed in conjunction with future statewide studies or conducted independently.
- **Consider More Detailed Analysis of Organic Wastes**: Because of the interest in capturing energy from organic wastes and/or increasing composting of organics it could be useful to expand the categories of sampling to specifically address what percent of food waste (especially) is contaminated by packaging. This can be critical to the success of organics processing facilities.
- **Specialization in Future Studies**: A number of other states that have regularly conducted statewide waste characterization studies have, over time, structured the studies to investigate certain waste streams in greater detail. Specialized analysis has often been conducted in response to feedback from

solid waste and recycling stakeholders in the state. For example, in addition to measuring the composition of disposed wastes in total and by generator sector, some states have opted to focus on:

- Targeted generator sampling of the most prevalent business types (e.g., grocery stores, manufacturing, retail malls, etc.) that generate significant quantities of waste;
- Enhanced research into waste generation indicators for certain waste streams, especially C&D debris, to improve future sampling plans for this waste stream;
- Measuring contamination rates in disposed material (for both particulate matter and moisture) as a means of investigating Mixed Waste Processing potential;
- Calculating energy and heating values in disposed waste for incineration and thermal conversion processes; and
- Determining the composition of residuals from recyclables processing facilities to test recovery efficiency, expansion of targeted materials, and potential for additional processing.

If Missouri continues to support large statewide waste characterization studies, it may consider integrating one or more of these tests in the future. Such future efforts would be limited by available funding, but could provide additional insight into diversion and recycling opportunities in Missouri.

APPENDIX A

BLACK OAK LANDFILL

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APPENDIX A - WASTE COMPOSITION AT BLACK OAK LANDFILL

A 1. OVERVIEW

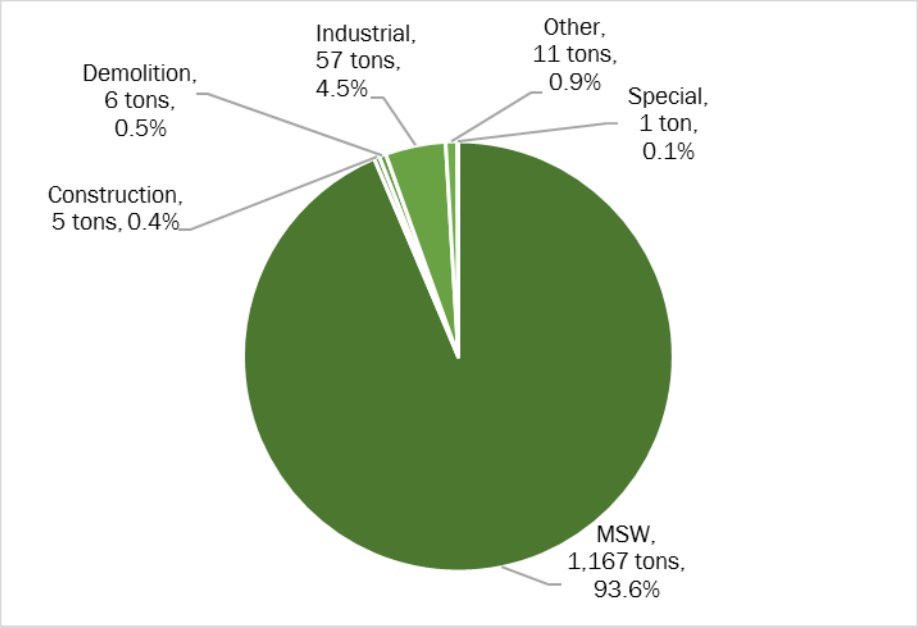
The Black Oak Landfill, located in rural Wright County and part of Solid Waste District Region P, is owned and operated by Waste Corporation of America. The facility accepted 279,300 tons of waste during CY2016. Black Oak hosted both seasons of MSW manual sorting as well as the Gate/Visual non-MSW Surveying phase of the project. Table A-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table A-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	16 Samples	3,567 Lbs	N/A	N/A
Visual Surveys	19 Loads	116 Tons	369 Loads	7,052 Tons
Gate Surveys	82 Loads	1,247 Tons	369 Loads	7,052 Tons

Figure A-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure A-1 Gate Survey Results

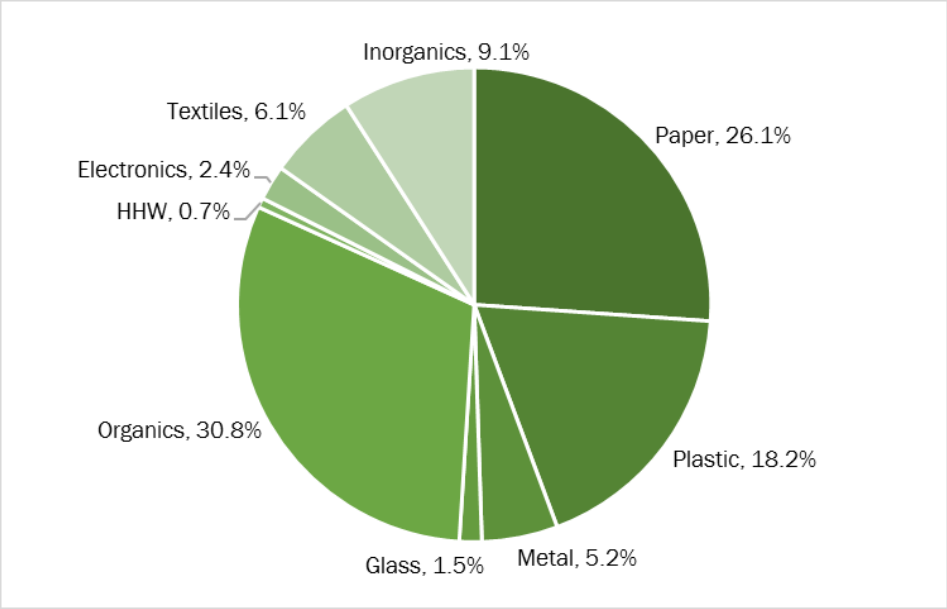


As shown, incoming waste at Black Oak is predominantly MSW, the receiving landfill for wastes from several transfer stations as well as from individual haulers and local routes. The mix of waste types observed in the 2017 Study is reasonably similar to the findings from the 2008 Study, where MSW was found to be 97 percent of inbound wastes.

A 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in each of the Fall and Spring seasons. The aggregate composition of the sampled loads is presented in Figure A-2. Organics was determined to be the largest component of the waste, at almost 31 percent, with over 26 percent being Paper materials.

Figure A-2 MSW Composition



A detailed tabular summary of the 2017 Study's MSW composition results is provided in Table A-2. This table provides the mean composition and 90 percent confidence intervals from the study, and applies the results to the estimated 261,448 tons of MSW found to be disposed at the facility based on gate survey results.

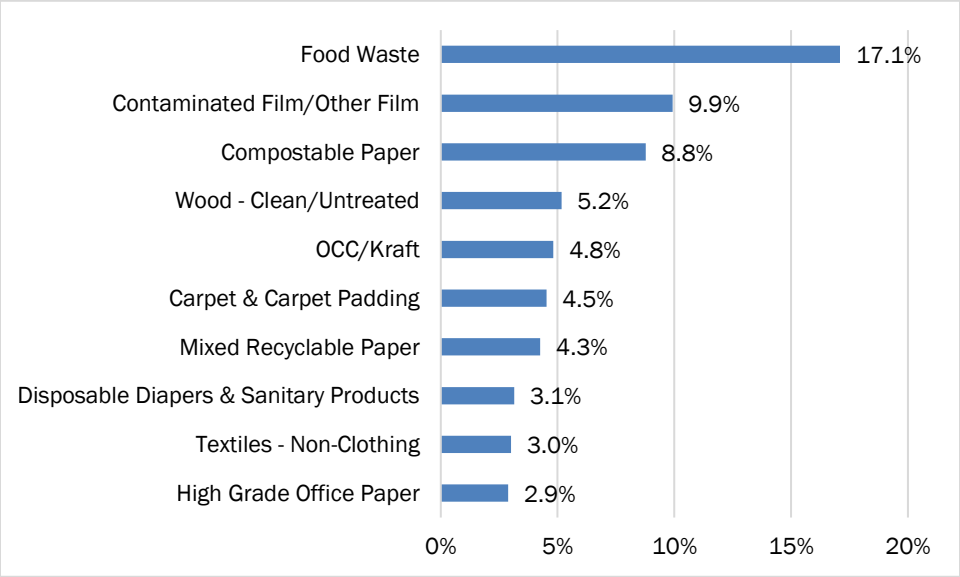
Table A-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**26.1%**	**4.2%**	**68,236**	**Plastic**	**18.2%**	**8.4%**	**47,602**
OCC/Kraft	4.8%	2.2%	12,603	PET (#1) Bottles/Jars	1.5%	0.3%	3,863
Newsprint	1.8%	0.9%	4,782	PET (#1) Non-Bottle containers	0.2%	0.1%	643
Magazines	1.6%	0.8%	4,246	HDPE (#2) Natural Containers	0.5%	0.3%	1,408
High Grade Office Paper	2.9%	1.6%	7,544	HDPE (#2) Colored Containers	0.5%	0.2%	1,263
Mixed Recyclable Paper	4.3%	1.2%	11,140	Clean Film Bags	0.2%	0.1%	591
Compostable Paper	8.8%	1.8%	22,926	Clean Ind'l/Com'l Film	0.6%	0.9%	1,544
Remainder/Composite Paper	1.9%	1.1%	4,993	Contaminated Film/Other Film	9.9%	9.0%	25,936
Glass	**1.5%**	**0.7%**	**3,987**	Plastic Containers #3 thru #7	0.6%	0.1%	1,463
Clear Glass Containers	1.0%	0.3%	2,644	Expanded Polystyrene #6	0.6%	0.1%	1,623
Brown Glass Containers	0.3%	0.4%	753	Bulky Durable Plastic Products	2.0%	1.5%	5,320
Green Glass Containers	0.1%	0.1%	231	Remainder/Composite Plastic	1.5%	0.5%	3,948
Remainder/Composite Glass	0.1%	0.1%	360	**Textiles**	**6.1%**	**3.0%**	**16,003**
Metal	**5.2%**	**2.7%**	**13,535**	Textiles - Clothing	2.5%	1.4%	6,480
Aluminum Cans & Containers	0.7%	0.2%	1,813	Textiles - Non-Clothing	3.0%	1.5%	7,873
Other Aluminum	0.1%	0.1%	278	Shoes/Belts/Leather	0.6%	0.4%	1,650
Tin/Steel Containers	1.3%	0.5%	3,289	**Inorganics**	**9.1%**	**5.1%**	**23,759**
Other Ferrous - Magnetic	2.0%	2.0%	5,275	Fines	0.8%	0.5%	2,009
Other Non-Ferrous	1.1%	1.2%	2,780	Drywall/Gypsum Board	0.4%	0.6%	946
Oil Filters	0.0%	0.1%	100	Asphalt, Brick, Concrete & Rocks	0.2%	0.3%	525
Organics	**30.8%**	**6.6%**	**80,406**	Carpet & Carpet Padding	4.5%	3.7%	11,824
Food Waste	17.1%	6.1%	44,681	Other Construction & Demolition	0.1%	0.1%	303
Wood - Clean/Untreated	5.2%	5.9%	13,516	Bulky Items/Furniture	0.0%	0.0%	-
Wood - Painted/Stained/Treated	0.4%	0.3%	962	Mattresses/Boxsprings	0.0%	0.0%	-
Disposable Diapers & Sanitary Prod.	3.1%	1.5%	8,204	Tires	2.5%	4.0%	6,603
Yard Waste	2.2%	1.7%	5,712	Other/Not Classified	0.6%	0.6%	1,550
Remainder/Composite Organic	2.8%	1.6%	7,331	**HHW**	**0.7%**	**0.5%**	**1,702**
Electronics	**2.4%**	**4.3%**	**6,219**	Household Hazardous Waste	0.7%	0.5%	1,702
Electronic Waste	2.4%	2.9%	6,219				
				Grand Total	**100%**		**261,448**
				No. of Samples	***17***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure A-3 shows the ten most commonly occurring materials in the MSW sorted at Black Oak. Food waste nearly doubles the second highest material, contaminated/other film.

Figure A-3 Top 10 Materials in MSW

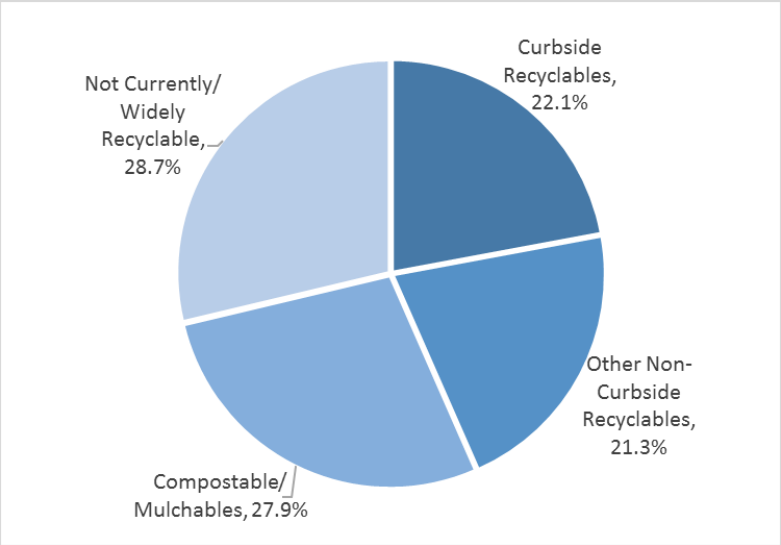


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Black Oak sort activity results are displayed in Figure A-4. As shown, less than 29 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 81 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure A-4 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table A-3 below provides the average composition of Residential wastes and Commercial/Institutional

wastes in comparison to the aggregate results. This table also shows the results of any MSW sorting that was performed in the 2008 Study (note that the 2008 Study sorted into a smaller number of material categories).

Table A-3 Composition Results by Generator Sector

	2017 Study				2017 Study		
Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l	Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l
Paper	**26.1%**	**27.7%**	**18.7%**	**Plastic**	**18.2%**	**12.9%**	**42.1%**
OCC/Kraft	4.8%	5.1%	3.2%	PET (#1) Bottles/Jars	1.5%	1.7%	0.5%
Newsprint	1.8%	2.1%	0.7%	PET (#1) Non-Bottle containers	0.2%	0.3%	0.0%
Magazines	1.6%	1.4%	3.0%	HDPE (#2) Natural Containers	0.5%	0.4%	1.0%
High Grade Office Paper	2.9%	3.3%	1.2%	HDPE (#2) Colored Containers	0.5%	0.5%	0.3%
Mixed Recyclable Paper	4.3%	4.7%	2.2%	Clean Film Bags	0.2%	0.3%	0.0%
Compostable Paper	8.8%	8.9%	8.2%	Clean Ind'l/Com'l Film	0.6%	0.0%	3.4%
Remainder/Composite Paper	1.9%	2.2%	0.3%	Contaminated Film/Other Film	9.9%	4.4%	35.2%
Glass	**1.5%**	**1.8%**	**0.3%**	Plastic Containers #3 thru #7	0.6%	0.6%	0.3%
Clear Glass Containers	1.0%	1.2%	0.3%	Expanded Polystyrene #6	0.6%	0.7%	0.2%
Brown Glass Containers	0.3%	0.4%	0.0%	Bulky Durable Plastic Products	2.0%	2.3%	0.4%
Green Glass Containers	0.1%	0.1%	0.0%	Remainder/Composite Plastic	1.5%	1.7%	0.8%
Remainder/Composite Glass	0.1%	0.2%	0.0%	**Textiles**	**6.1%**	**7.3%**	**0.6%**
Metal	**5.2%**	**4.7%**	**7.5%**	Textiles - Clothing	2.5%	2.9%	0.3%
Aluminum Cans & Containers	0.7%	0.8%	0.4%	Textiles - Non-Clothing	3.0%	3.6%	0.3%
Other Aluminum	0.1%	0.1%	0.1%	Shoes/Belts/Leather	0.6%	0.7%	0.1%
Tin/Steel Containers	1.3%	1.3%	1.1%	**Inorganics**	**9.1%**	**10.8%**	**1.5%**
Other Ferrous - Magnetic	2.0%	2.1%	2.0%	Fines	0.8%	0.8%	0.4%
Other Non-Ferrous	1.1%	0.5%	3.9%	Drywall/Gypsum Board	0.4%	0.5%	0.0%
Oil Filters	0.0%	0.0%	0.0%	Asphalt, Brick, Concrete & Rocks	0.2%	0.2%	0.0%
Organics	**30.8%**	**31.0%**	**29.2%**	Carpet & Carpet Padding	4.5%	5.5%	0.8%
Food Waste	17.1%	15.6%	23.1%	Other Construction & Demolition	0.1%	0.1%	0.0%
Wood - Clean/Untreated	5.2%	6.3%	1.2%	Bulky Items/Furniture	0.0%	0.0%	0.0%
Wood - Painted/Stained/Treated	0.4%	0.3%	0.8%	Mattresses/Boxsprings	0.0%	0.0%	0.0%
Disposable Diapers & Sanitary Prod.	3.1%	3.6%	0.6%	Tires	2.5%	3.0%	0.0%
Yard Waste	2.2%	1.9%	3.4%	Other/Not Classified	0.6%	0.7%	0.2%
Remainder/Composite Organic	2.8%	3.3%	0.1%	**HHW**	**0.7%**	**0.8%**	**0.1%**
Electronics	**2.4%**	**3.0%**	**0.0%**	Household Hazardous Waste	0.7%	0.8%	0.1%
Electronic Waste	2.4%	3.0%	0.0%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**17**	**14**	**3**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

A 3. VISUAL SURVEY RESULTS

Figure A-5 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes were found to be Concrete/Brick/Rock.

Figure A-5 Composition of Construction Debris

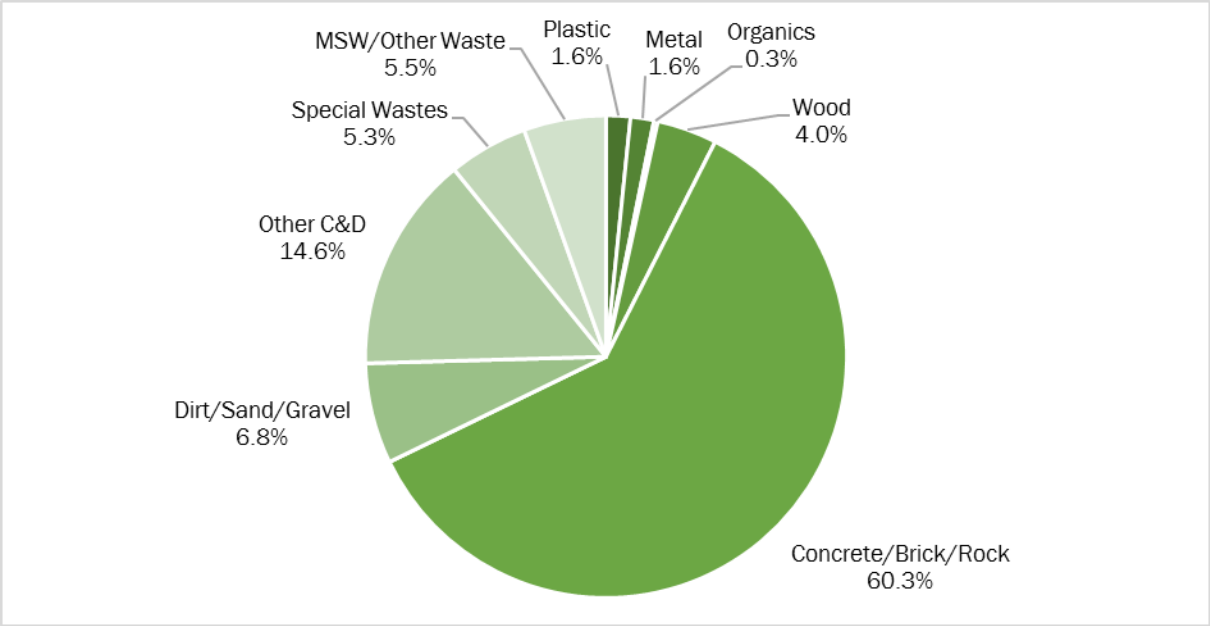


Figure A-6 summarizes the composition of Demolition debris. A substantial percentage of the demolition material surveyed was playground rubber, classified as "R/C and Other Organics."

Figure A-6 Composition of Demolition Debris

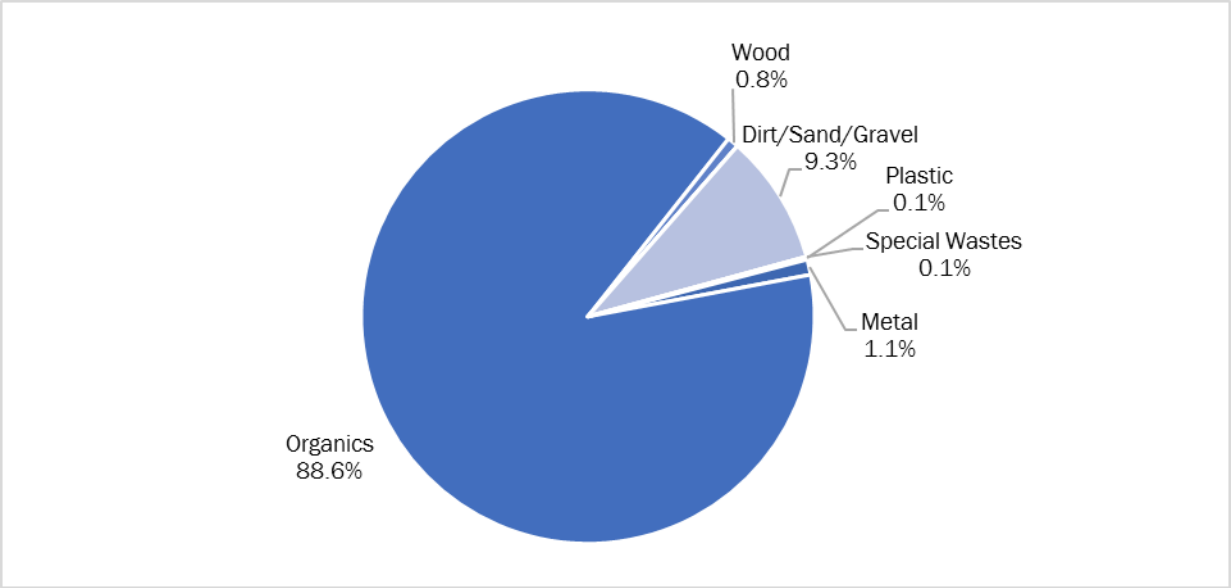


Figure A-7 provides the composition of Industrial materials. Wood constituted almost 77 percent of this sector.

Figure A-7 Industrial Waste Composition

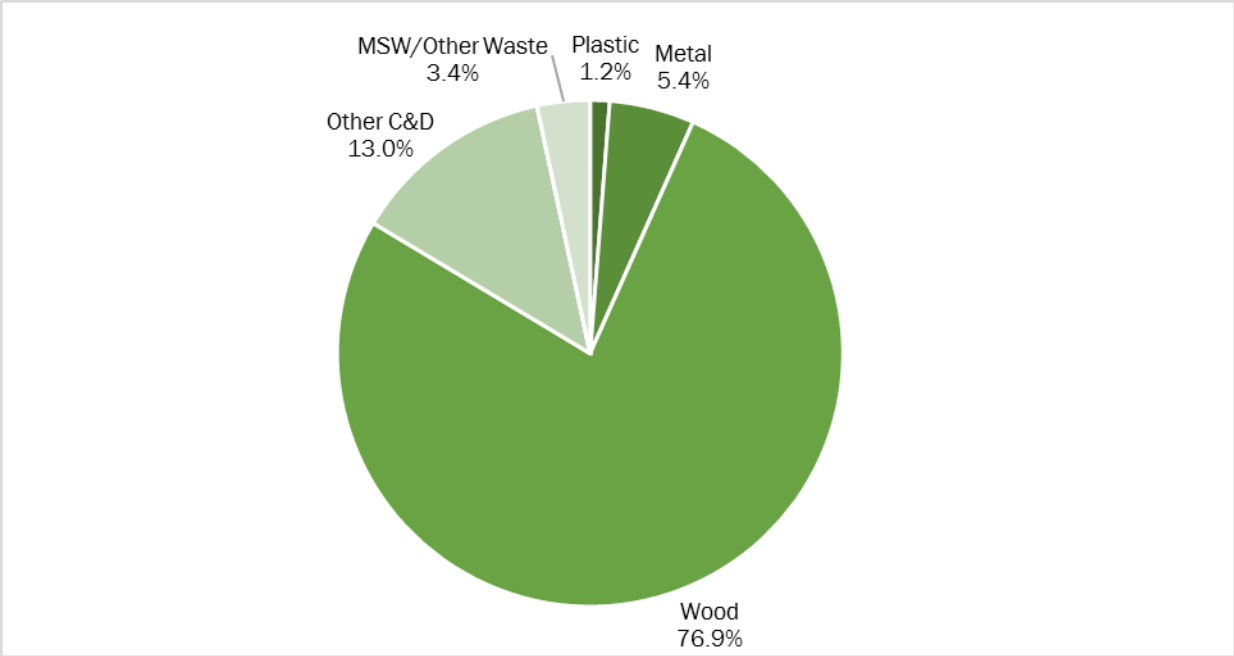


Table A-4 provides the detailed composition of the three material groups.

Table A-4 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construc-tion	Demo-lition	Indust-rial
MSW/Other Waste	Flattened OCC	0.3%	0.1%	1.0%
MSW/Other Waste	Unflattened OCC	0.0%	0.0%	0.3%
MSW/Other Waste	R/C and Other Paper	0.0%	0.0%	0.3%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.0%	0.0%	0.0%
Plastic	Clean Recoverable Film	0.3%	0.0%	0.9%
Plastic	R/C and Other Plastic	1.3%	0.1%	0.5%
MSW/Other Waste	All Glass	0.0%	0.0%	0.4%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	1.4%	0.5%	0.3%
Metal	Other Non-ferrous Metal	0.2%	0.5%	4.8%
Metal	HVAC Ducting	0.0%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	0.0%	0.0%
Organics	Branches/Limbs	0.0%	0.0%	0.0%
Organics	R/C and Other Organics	0.3%	88.4%	42.4%
Wood	Pallets - Standard	1.4%	0.5%	5.4%
Wood	Pallets/Crates/Heavy	0.0%	0.0%	5.5%
Wood	Untreated/Unpainted Lumber	2.4%	0.0%	9.0%
Wood	Treated/Painted/Processed Wood	0.3%	0.0%	3.6%
Wood	Engineered Wood	0.0%	0.0%	6.3%
Wood	Wood Furniture	0.0%	0.3%	4.7%
Wood	Other Wood	0.0%	0.0%	3.3%
Other C&D	Carpet	0.9%	0.0%	0.0%
Other C&D	Carpet Padding	0.1%	0.0%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	60.3%	0.0%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	0.0%	0.0%	0.3%
Other C&D	Ceiling Tiles	0.0%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.0%	0.0%
Gypsum Board	Painted Gypsum Board	0.0%	0.0%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	6.8%	9.3%	9.5%
Other C&D	Insulation	1.2%	0.0%	0.0%
Other C&D	R/C and Other C&D	12.4%	0.0%	0.3%
MSW/Other Waste	Electronics	0.0%	0.0%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	0.0%	0.0%
Special Wastes	Bulky Wastes/Furniture	0.3%	0.1%	0.0%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	5.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	0.0%	0.0%
MSW/Other Waste	Mixed MSW	5.2%	0.1%	1.4%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX B

BRIDGETON TRANSFER STATION

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APPENDIX B - WASTE COMPOSITION AT BRIDGETON TRANSFER STATION

B 1. OVERVIEW

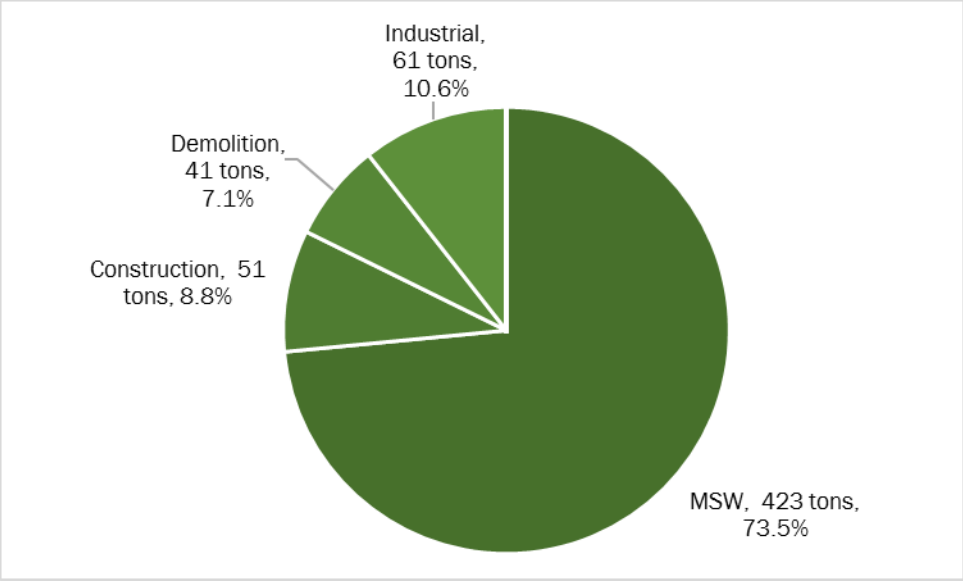
The Bridgeton Transfer Station, located in the metro St. Louis County, is owned and operated by Republic Services, and is part of Solid Waste District Region L. The facility accepted 307,673 tons of waste during CY2016 that was shipped out of state for disposal. The Bridgeton Transfer Station was not a sampling site for the 2008 study. Table B-1 summarizes the sampling activity for 2017. A total of three days was spent for MSW sorting (one in Season 1, two in Season 2) and Bridgeton also hosted the two-day Gate/Visual non-MSW Volumetric Surveying exercise.

Table B-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	25 Samples	5,642 Lbs	N/A	N/A
Visual Surveys	30 Loads	103 Tons	N/A	N/A
Gate Surveys	103 Loads	576 Tons	N/A	N/A

Figure B-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure B-1 Gate Survey Results

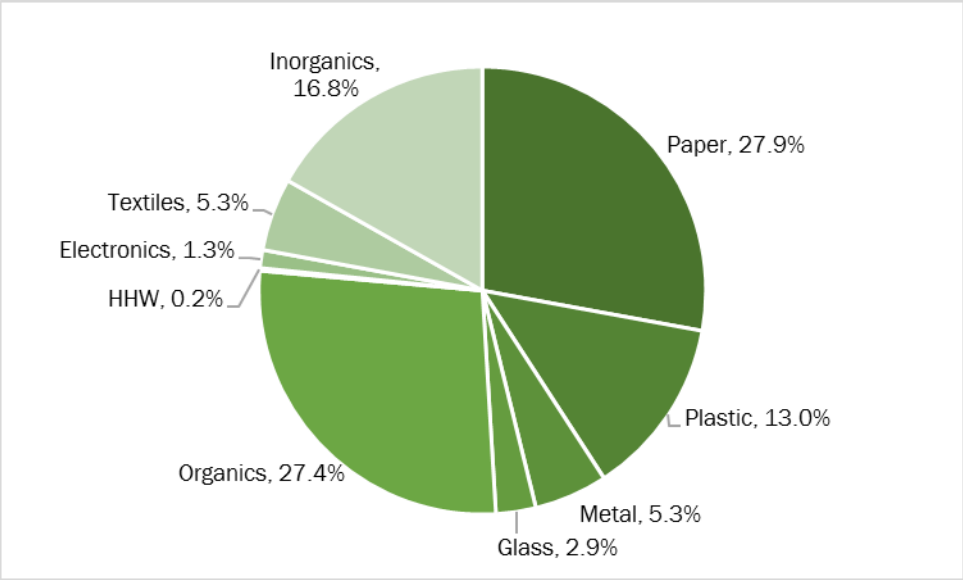


As shown, incoming waste at Bridgeton is predominantly MSW.

B 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in the Fall season and 17 loads in the Spring season. The aggregate composition of the sampled loads is presented in Figure B-2. Paper and Organics materials were determined to be the largest components of the waste, at 27.9 and 27.4 percent, respectively.

Figure B-2 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table B-2. This table provides the mean composition and 90 percent confidence intervals from the study, and applies the results to the estimated 226,012 tons of MSW found to be disposed at the facility based on gate survey results.

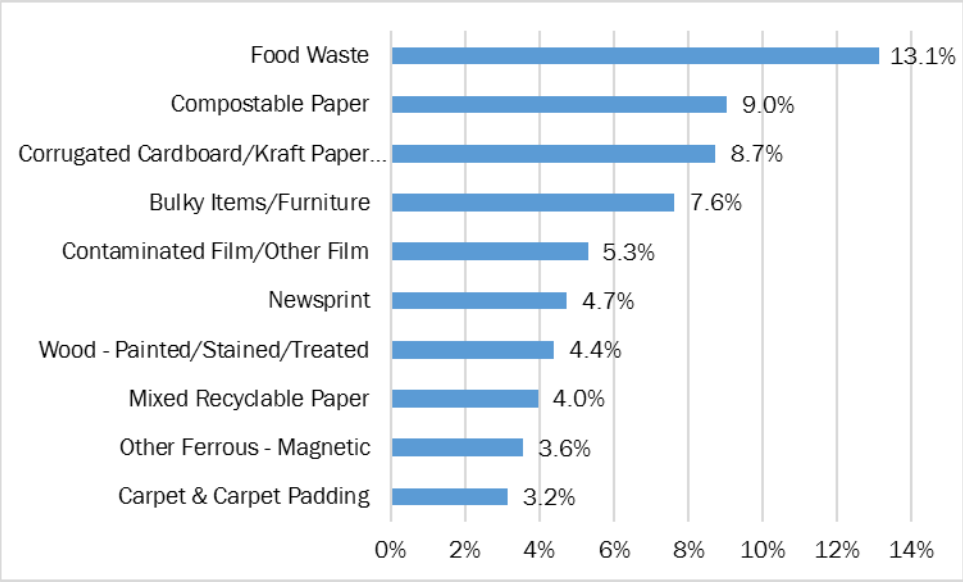
Table B-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**27.9%**	**5.3%**	**85,779**	**Plastic**	**13.0%**	**1.8%**	**39,852**
OCC/Kraft	8.7%	2.4%	26,858	PET (#1) Bottles/Jars	1.5%	0.4%	4,667
Newsprint	4.7%	5.0%	14,537	PET (#1) Non-Bottle containers	0.1%	0.1%	382
Magazines	0.4%	0.2%	1,377	HDPE (#2) Natural Containers	0.3%	0.1%	1,001
High Grade Office Paper	0.4%	0.3%	1,371	HDPE (#2) Colored Containers	0.3%	0.2%	994
Mixed Recyclable Paper	4.0%	1.3%	12,194	Clean Film Bags	0.3%	0.1%	834
Compostable Paper	9.0%	1.8%	27,838	Clean Ind'l/Com'l Film	0.1%	0.1%	329
Remainder/Composite Paper	0.5%	0.2%	1,604	Contaminated Film/Other Film	5.3%	1.0%	16,329
Glass	**2.9%**	**1.0%**	**8,864**	Plastic Containers #3 thru #7	1.2%	0.2%	3,717
Clear Glass Containers	1.3%	0.3%	3,865	Expanded Polystyrene #6	0.7%	0.2%	2,209
Brown Glass Containers	1.2%	0.8%	3,775	Bulky Durable Plastic Products	1.7%	1.0%	5,132
Green Glass Containers	0.3%	0.2%	803	Remainder/Composite Plastic	1.4%	0.3%	4,258
Remainder/Composite Glass	0.1%	0.1%	422	**Textiles**	**5.3%**	**1.9%**	**16,179**
Metal	**5.3%**	**2.4%**	**16,343**	Textiles - Clothing	2.7%	1.4%	8,268
Aluminum Cans & Containers	0.5%	0.2%	1,595	Textiles - Non-Clothing	2.1%	0.7%	6,461
Other Aluminum	0.4%	0.3%	1,152	Shoes/Belts/Leather	0.5%	0.2%	1,449
Tin/Steel Containers	0.8%	0.3%	2,548	**Inorganics**	**16.8%**	**6.0%**	**51,744**
Other Ferrous - Magnetic	3.6%	2.4%	10,995	Fines	1.1%	0.6%	3,460
Other Non-Ferrous	0.0%	0.0%	53	Drywall/Gypsum Board	0.2%	0.3%	736
Oil Filters	0.0%	0.0%	-	Asphalt, Brick, Concrete & Rocks	0.9%	1.2%	2,918
Organics	**27.4%**	**4.3%**	**84,249**	Carpet & Carpet Padding	3.2%	2.6%	9,715
Food Waste	13.1%	2.7%	40,412	Other Construction & Demolition	0.6%	0.8%	1,939
Wood - Clean/Untreated	2.8%	2.8%	8,525	Bulky Items/Furniture	7.6%	2.9%	23,448
Wood - Painted/Stained/Treated	4.4%	2.1%	13,498	Mattresses/Boxsprings	1.4%	1.8%	4,387
Disposable Diapers & Sanitary Proc	2.6%	1.1%	8,124	Tires	0.9%	1.1%	2,830
Yard Waste	2.3%	1.5%	7,145	Other/Not Classified	0.8%	0.4%	2,310
Remainder/Composite Organic	2.1%	1.1%	6,545	**HHW**	**0.2%**	**0.2%**	**604**
Electronics	**1.3%**	**1.8%**	**4,023**	Household Hazardous Waste	0.2%	0.1%	604
Electronic Waste	1.3%	1.2%	4,023	**Grand Total**	**100%**		**226,012**
				No. of Samples	***25***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure B-3 shows the ten most commonly occurring materials in the MSW sorted at Bridgeton. Food Waste constitutes over four percent more of the waste stream than the next highest, Compostable Paper, both of which fall in the Organics material Group.

Figure B-3 Top 10 Materials in MSW

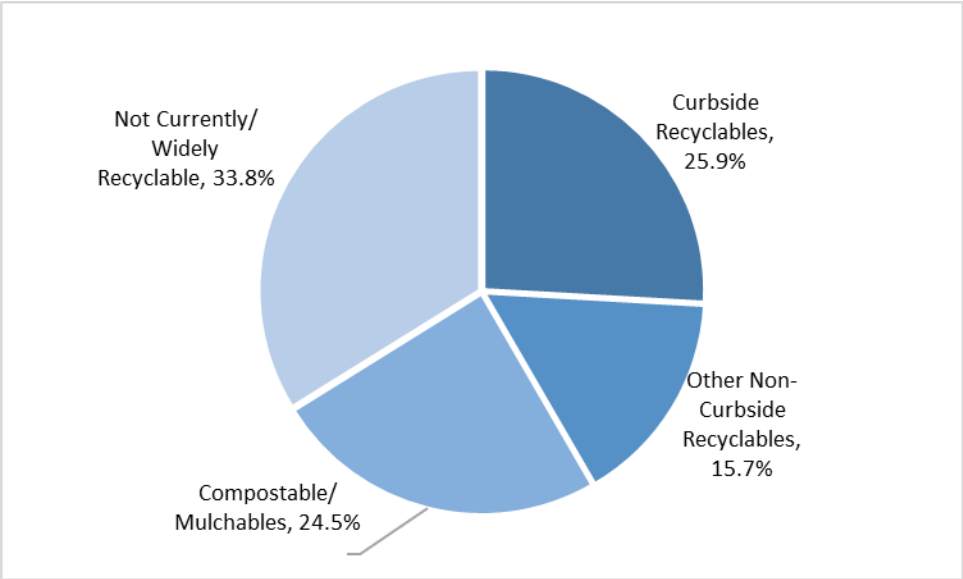


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Bridgeton sort activity results are displayed in Figure B-4. As shown, about 34 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 66 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure B-4 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table B-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results.

Table B-3 Detailed Results

	2017 Study				2017 Study		
Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l	Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l
Paper	**27.9%**	**20.0%**	**34.8%**	**Plastic**	**13.0%**	**11.6%**	**13.9%**
OCC/Kraft	8.7%	3.7%	13.2%	PET (#1) Bottles/Jars	1.5%	1.5%	1.5%
Newsprint	4.7%	2.3%	7.0%	PET (#1) Non-Bottle containers	0.1%	0.1%	0.1%
Magazines	0.4%	0.7%	0.2%	HDPE (#2) Natural Containers	0.3%	0.3%	0.4%
High Grade Office Paper	0.4%	0.4%	0.4%	HDPE (#2) Colored Containers	0.3%	0.4%	0.3%
Mixed Recyclable Paper	4.0%	4.4%	3.6%	Clean Film Bags	0.3%	0.4%	0.1%
Compostable Paper	9.0%	7.9%	9.9%	Clean Ind'l/Com'l Film	0.1%	0.0%	0.2%
Remainder/Composite Paper	0.5%	0.6%	0.5%	Contaminated Film/Other Film	5.3%	4.3%	6.2%
Glass	**2.9%**	**3.3%**	**2.4%**	Plastic Containers #3 thru #7	1.2%	1.1%	1.3%
Clear Glass Containers	1.3%	1.9%	0.6%	Expanded Polystyrene #6	0.7%	0.9%	0.5%
Brown Glass Containers	1.2%	1.0%	1.4%	Bulky Durable Plastic Products	1.7%	1.5%	1.8%
Green Glass Containers	0.3%	0.2%	0.3%	Remainder/Composite Plastic	1.4%	1.2%	1.5%
Remainder/Composite Glass	0.1%	0.2%	0.1%	**Textiles**	**5.3%**	**6.1%**	**4.3%**
Metal	**5.3%**	**4.7%**	**6.0%**	Textiles - Clothing	2.7%	3.3%	1.9%
Aluminum Cans & Containers	0.5%	0.5%	0.5%	Textiles - Non-Clothing	2.1%	2.2%	2.0%
Other Aluminum	0.4%	0.6%	0.2%	Shoes/Belts/Leather	0.5%	0.6%	0.3%
Tin/Steel Containers	0.8%	0.6%	1.0%	**Inorganics**	**16.8%**	**23.3%**	**11.8%**
Other Ferrous - Magnetic	3.6%	3.0%	4.3%	Fines	1.1%	1.3%	0.8%
Other Non-Ferrous	0.0%	0.0%	0.0%	Drywall/Gypsum Board	0.2%	0.4%	0.1%
Oil Filters	0.0%	0.0%	0.0%	Asphalt, Brick, Concrete & Rocks	0.9%	0.3%	1.7%
Organics	**27.4%**	**29.0%**	**25.7%**	Carpet & Carpet Padding	3.2%	4.9%	1.7%
Food Waste	13.1%	13.3%	12.7%	Other Construction & Demolition	0.6%	0.3%	1.0%
Wood - Clean/Untreated	2.8%	0.4%	5.0%	Bulky Items/Furniture	7.6%	10.8%	5.1%
Wood - Painted/Stained/Treated	4.4%	4.5%	4.2%	Mattresses/Boxsprings	1.4%	3.2%	0.0%
Disposable Diapers & Sanitary Prod.	2.6%	4.9%	0.5%	Tires	0.9%	1.3%	0.7%
Yard Waste	2.3%	3.0%	1.8%	Other/Not Classified	0.8%	0.9%	0.7%
Remainder/Composite Organic	2.1%	2.8%	1.5%	**HHW**	**0.2%**	**0.3%**	**0.1%**
Electronics	**1.3%**	**1.7%**	**1.0%**	Household Hazardous Waste	0.2%	0.3%	0.1%
Electronic Waste	1.3%	1.7%	1.0%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	***25***	***12***	***13***

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

B 3. VISUAL SURVEY RESULTS

Figure B-5 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes were found to be Concrete/Brick/Rock.

Figure B-5 Composition of Construction Debris

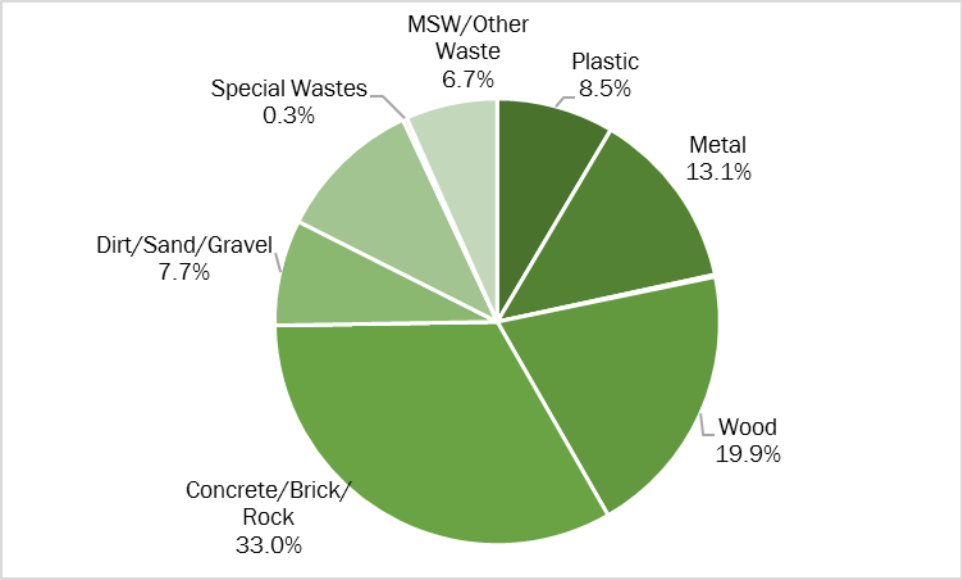


Figure B-6 summarizes the composition of Demolition debris. At almost 43 percent, Wood was the predominant material observed in the Demolition debris.

Figure B-6 Composition of Demolition Debris

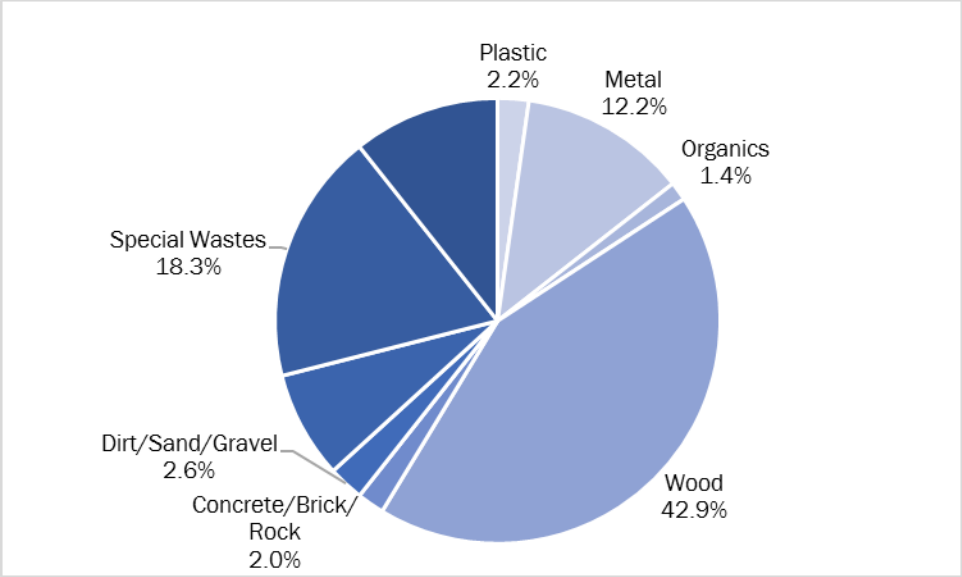


Figure B-7 provides the composition of Industrial materials. Wood constituted almost 33 percent of this sector.

Figure B-7 Industrial Composition

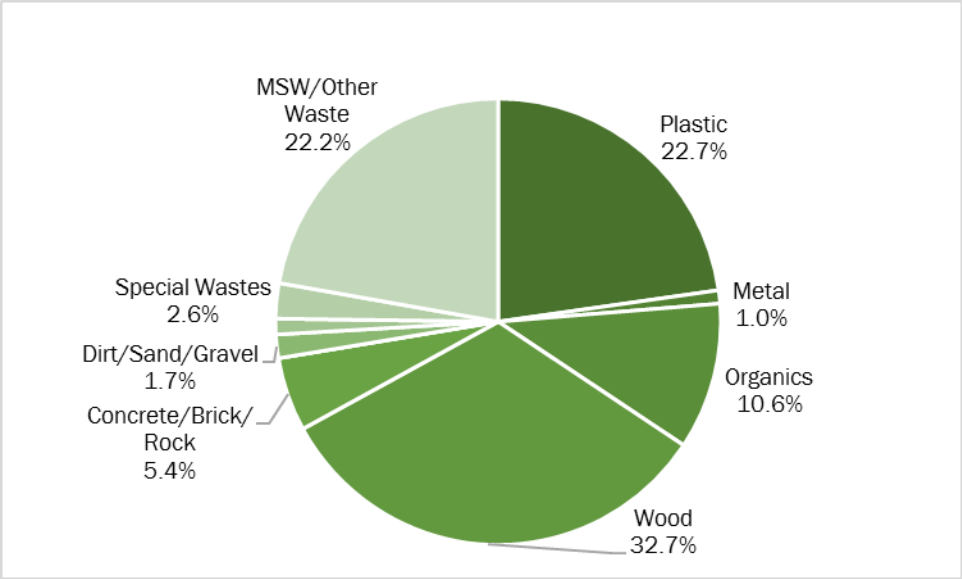


Table B-4 provides the detailed composition of the three material groups.

Table B-4 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	0.8%	0.1%	10.5%
MSW/Other Waste	Unflattened OCC	0.1%	0.0%	0.7%
MSW/Other Waste	R/C and Other Paper	0.0%	0.1%	0.9%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.0%	0.0%	0.0%
Plastic	Clean Recoverable Film	0.4%	0.0%	13.2%
Plastic	R/C and Other Plastic	3.4%	1.1%	7.6%
MSW/Other Waste	All Glass	0.0%	4.0%	0.2%
Metal	Appliances	0.0%	0.0%	0.1%
Metal	Other Ferrous Metals	2.6%	3.1%	0.3%
Metal	Other Non-ferrous Metal	3.3%	2.2%	0.4%
Metal	HVAC Ducting	0.1%	0.5%	0.1%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	0.0%	0.4%
Organics	Branches/Limbs	0.1%	0.7%	1.1%
Organics	R/C and Other Organics	0.0%	0.0%	8.3%
Wood	Pallets - Standard	1.1%	1.0%	9.4%
Wood	Pallets/Crates/Heavy	0.0%	0.0%	4.0%
Wood	Untreated/Unpainted Lumber	2.4%	9.3%	8.1%
Wood	Treated/Painted/Processed Wood	1.6%	8.5%	6.1%
Wood	Engineered Wood	3.8%	0.0%	2.3%
Wood	Wood Furniture	0.0%	1.7%	0.0%
Wood	Other Wood	0.0%	0.0%	0.1%
Other C&D	Carpet	0.7%	0.9%	0.0%
Other C&D	Carpet Padding	0.0%	0.0%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	14.9%	0.9%	4.9%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	5.1%	5.2%	2.5%
Other C&D	Ceiling Tiles	0.0%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.0%	0.0%
Gypsum Board	Painted Gypsum Board	49.8%	46.9%	5.8%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	3.5%	1.2%	1.6%
Other C&D	Insulation	2.7%	1.1%	0.0%
Other C&D	R/C and Other C&D	1.3%	1.7%	1.0%
MSW/Other Waste	Electronics	0.0%	0.0%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	0.0%	0.0%
Special Wastes	Bulky Wastes/Furniture	0.1%	8.8%	2.4%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.9%	0.0%	4.6%
MSW/Other Waste	Mixed MSW	1.2%	0.9%	3.4%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX C

CENTRAL MO LANDFILL

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APPENDIX C - WASTE COMPOSITION AT CENTRAL MO LANDFILL

C 1. OVERVIEW

The Central Missouri Landfill, located in Sedalia, part of rural Pettis County, is owned and operated by Waste Connections, and is part of Solid Waste District Region F. The facility accepted 402,980 tons of waste during CY2016. Central MO hosted the Gate/Visual Surveying phase of the study, but not the MSW Manual Sorting phase. Table C-1 summarizes the data collection activities that took place at this facility.

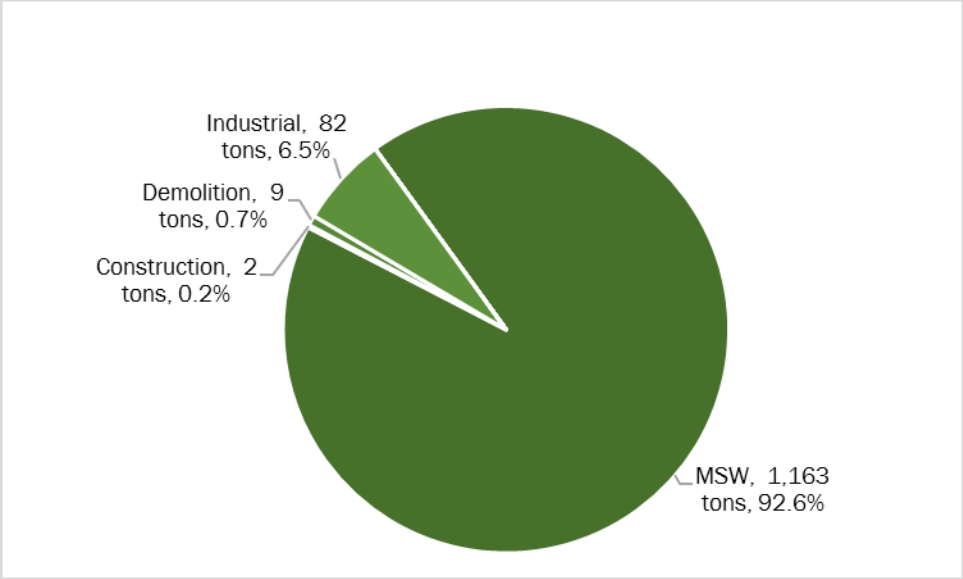
Table C-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	N/A	N/A	N/A	N/A
Visual Surveys	25 Loads	100 Tons	N/A	N/A
Gate Surveys	71 Loads	1,256 Tons	N/A	N/A

shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure C-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure C-1 Gate Survey Results



As shown, incoming waste at Central MO is predominantly MSW, the receiving landfill for wastes from several transfer stations as well as from individual haulers and local routes.

C 2. VISUAL SURVEY RESULTS

Figure C-2 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes were found to be Concrete/Brick/Rock.

Figure C-2 Composition of Construction Debris

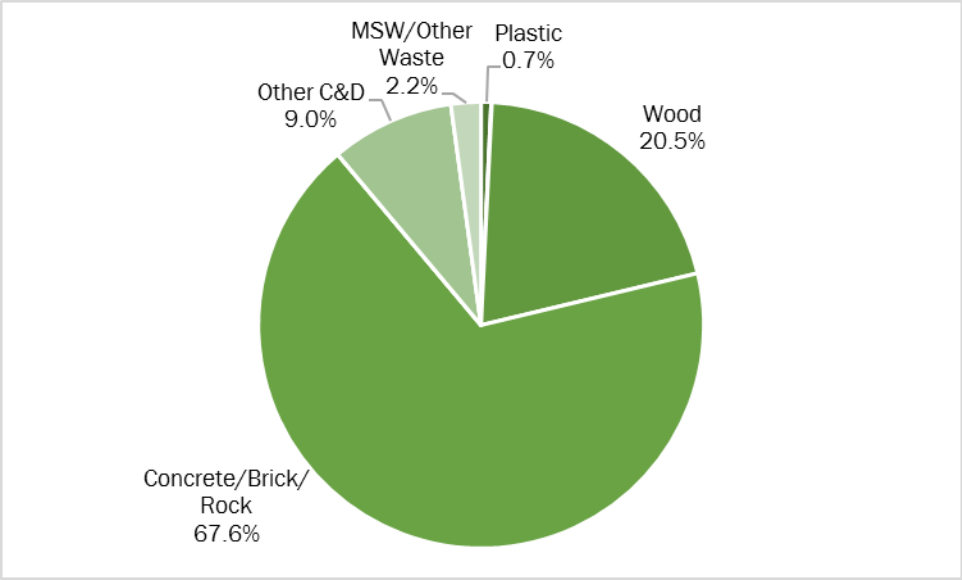


Figure C-3 summarizes the composition of Demolition debris.

Figure C-3 Composition of Demolition Debris

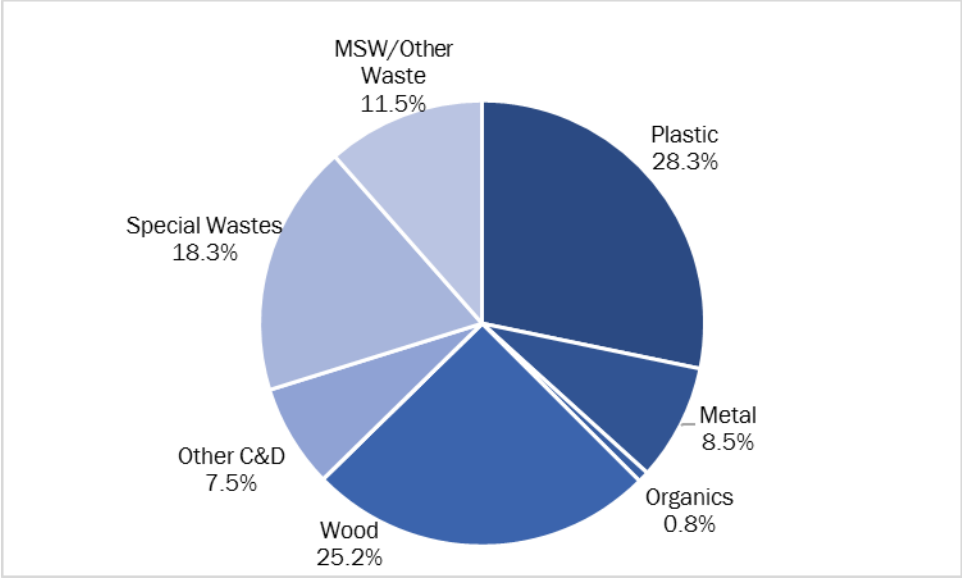


Figure C-4 provides the composition of Industrial materials. Organics constituted almost 63 percent of this sector. Central MO receives multiple loads per day from area food processing plants.

Figure C-4 Industrial Composition

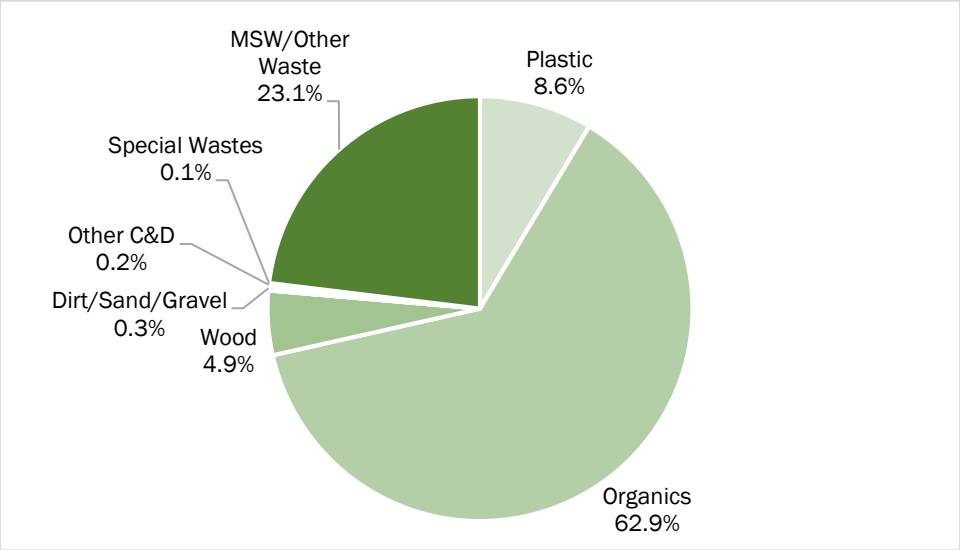


Table C-2 provides the detailed composition of the three material groups.

Table C-2 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	0.1%	1.8%	0.6%
MSW/Other Waste	Unflattened OCC	0.4%	0.5%	0.1%
MSW/Other Waste	R/C and Other Paper	0.4%	0.6%	3.7%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.1%	0.0%	0.1%
Plastic	Clean Recoverable Film	0.3%	0.2%	0.5%
Plastic	R/C and Other Plastic	0.3%	18.0%	7.6%
MSW/Other Waste	All Glass	0.0%	0.0%	15.5%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	0.0%	5.4%	0.0%
Metal	Other Non-ferrous Metal	0.0%	0.0%	0.0%
Metal	HVAC Ducting	0.0%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	0.0%	0.1%
Organics	Branches/Limbs	0.0%	0.0%	0.0%
Organics	R/C and Other Organics	0.0%	0.5%	60.1%
Wood	Pallets - Standard	0.5%	2.6%	0.1%
Wood	Pallets/Crates/Heavy	0.0%	0.3%	2.0%
Wood	Untreated/Unpainted Lumber	11.0%	6.4%	1.9%
Wood	Treated/Painted/Processed Wood	0.0%	5.1%	0.3%
Wood	Engineered Wood	7.8%	1.2%	0.4%
Wood	Wood Furniture	0.5%	0.4%	0.0%
Wood	Other Wood	0.0%	0.2%	0.0%
Other C&D	Carpet	0.0%	0.0%	0.0%
Other C&D	Carpet Padding	0.0%	0.0%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	65.1%	0.0%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	2.7%	22.8%	0.0%
Other C&D	Ceiling Tiles	0.0%	0.6%	0.0%
Gypsum Board	Clean Gypsum Board	1.1%	0.0%	4.4%
Gypsum Board	Painted Gypsum Board	0.0%	12.8%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	0.0%	0.0%	0.3%
Other C&D	Insulation	2.8%	0.8%	0.0%
Other C&D	R/C and Other C&D	5.8%	3.4%	0.1%
MSW/Other Waste	Electronics	0.0%	1.1%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	0.0%	0.0%
Special Wastes	Bulky Wastes/Furniture	0.0%	11.8%	0.1%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	0.0%	0.0%
MSW/Other Waste	Mixed MSW	1.2%	3.3%	2.1%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX D

CHAMP LANDFILL

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APPENDIX D - WASTE COMPOSITION AT CHAMP LANDFILL

D 1. OVERVIEW

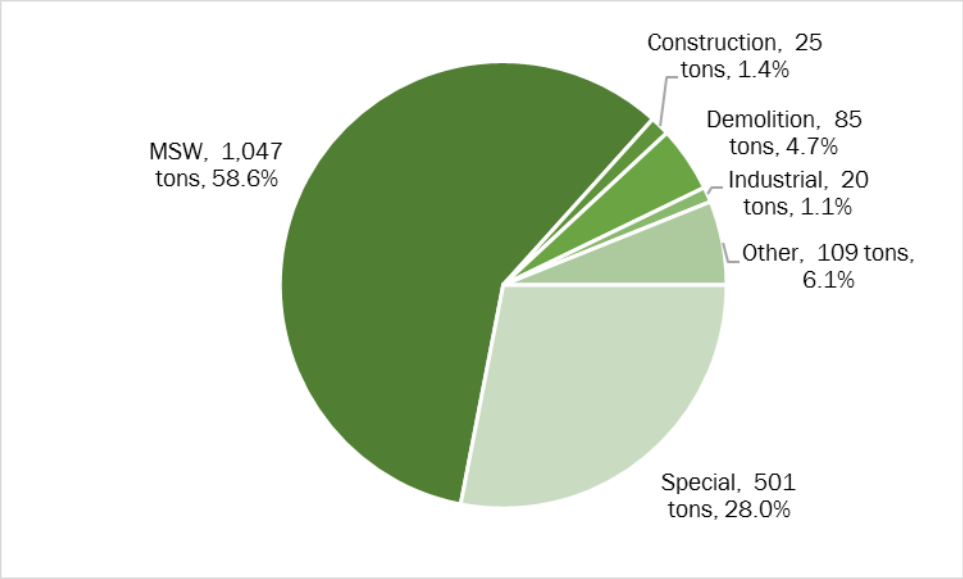
The Champ Landfill, located in metro St. Louis County in Maryland Heights is owned and operated by Waste Connections, and is part of Solid Waste District Region L. The facility accepted 1,054,024 tons of waste during CY2016. Champ hosted the Gate/Visual non-MSW Surveying phase of the study, but not the MSW Manual Sorting phase. Table D-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table D-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	N/A	N/A	N/A	N/A
Visual Surveys	30 Loads	103.3 Tons	1,305 Loads	12,017 Tons
Gate Surveys	144 Loads	1,786 Tons	1,305 Loads	12,017 Tons

Figure D-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure D-1 Gate Survey Results



D 2. VISUAL SURVEY RESULTS

Figure D-2 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the largest component of these wastes was found to be Wood.

Figure D-2 Composition of Construction Debris

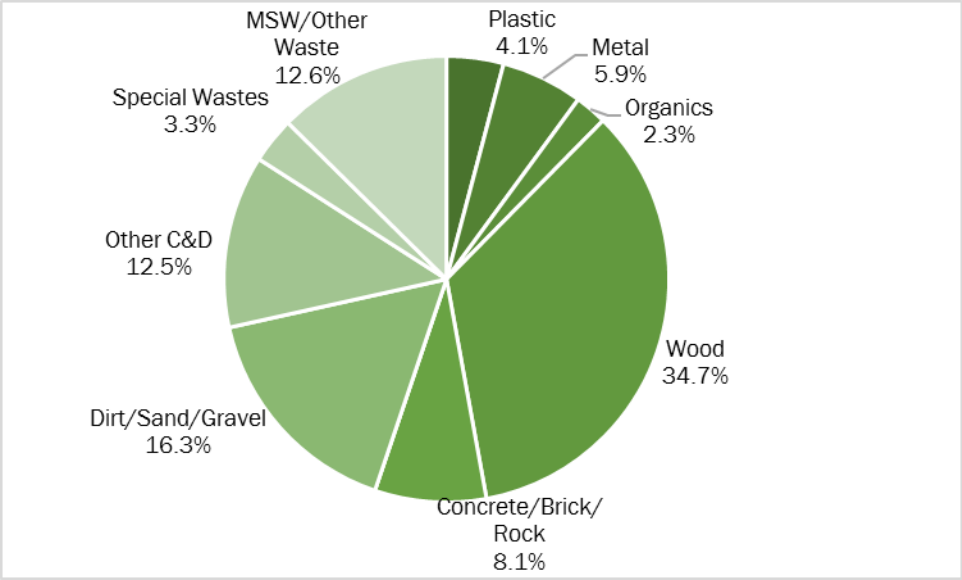


Figure D-3 summarizes the composition of Demolition debris.

Figure D-3 Composition of Demolition Debris

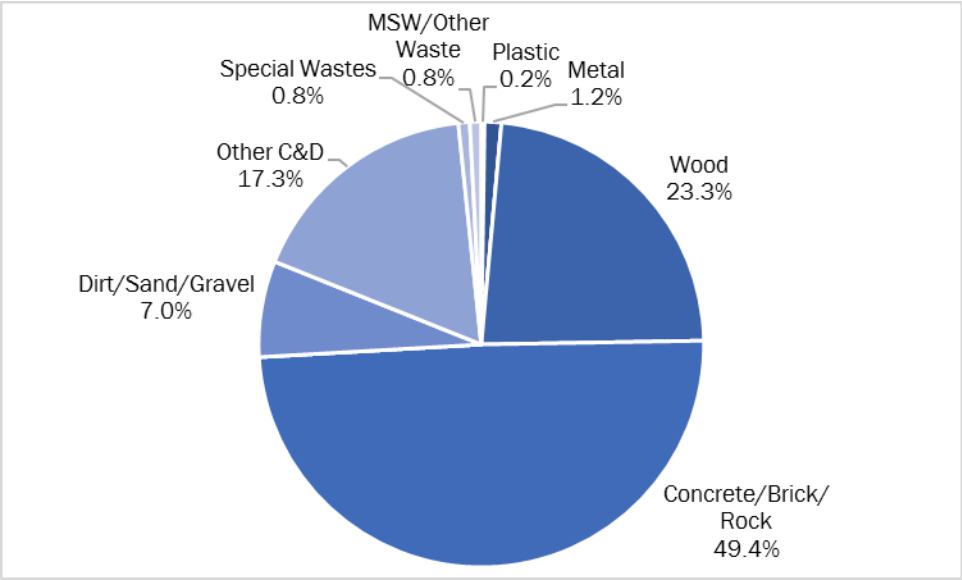


Figure D-4 provides the composition of Industrial materials. Organics constituted almost 71 percent of this sector primarily due to incoming bakery waste.

Figure D-4 Industrial Composition

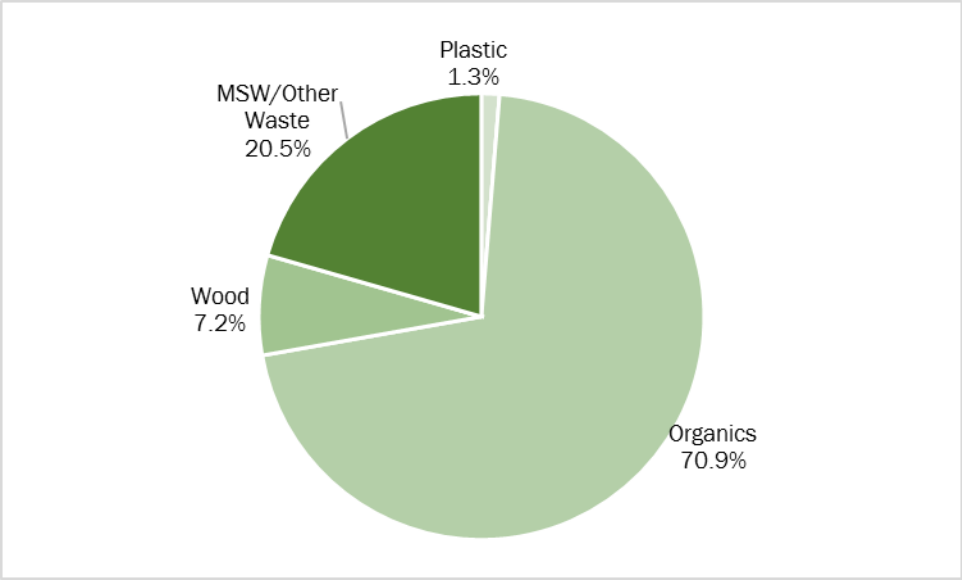


Table D-2 provides the detailed composition of the three material groups.

Table D-2 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	4.4%	0.2%	10.4%
MSW/Other Waste	Unflattened OCC	1.5%	0.1%	6.6%
MSW/Other Waste	R/C and Other Paper	1.3%	0.0%	0.0%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.1%	0.0%	0.1%
Plastic	Clean Recoverable Film	0.4%	0.1%	0.9%
Plastic	R/C and Other Plastic	2.4%	0.1%	0.3%
MSW/Other Waste	All Glass	0.0%	0.2%	0.0%
Metal	Appliances	0.1%	0.0%	0.0%
Metal	Other Ferrous Metals	2.4%	0.7%	0.0%
Metal	Other Non-ferrous Metal	1.4%	0.2%	0.0%
Metal	HVAC Ducting	0.1%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.7%	0.0%	0.0%
Organics	Branches/Limbs	0.0%	0.0%	0.0%
Organics	R/C and Other Organics	0.9%	0.0%	70.9%
Wood	Pallets - Standard	2.2%	0.5%	7.2%
Wood	Pallets/Crates/Heavy	3.7%	0.0%	0.0%
Wood	Untreated/Unpainted Lumber	8.5%	0.5%	0.0%
Wood	Treated/Painted/Processed Wood	1.1%	4.5%	0.0%
Wood	Engineered Wood	7.9%	6.7%	0.0%
Wood	Wood Furniture	0.4%	6.0%	0.0%
Wood	Other Wood	0.0%	0.0%	0.0%
Other C&D	Carpet	5.9%	8.1%	0.0%
Other C&D	Carpet Padding	0.1%	0.3%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	5.5%	38.7%	0.0%
Other C&D	Asphalt Paving	0.0%	2.6%	0.0%
Roofing Materials	Roofing Materials	1.8%	7.5%	0.0%
Other C&D	Ceiling Tiles	0.3%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	28.3%	7.1%	0.0%
Gypsum Board	Painted Gypsum Board	1.4%	7.0%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	11.2%	5.5%	0.0%
Other C&D	Insulation	2.3%	1.0%	0.0%
Other C&D	R/C and Other C&D	0.0%	1.4%	0.0%
MSW/Other Waste	Electronics	0.1%	0.0%	0.0%
MSW/Other Waste	Items with CRTs	0.1%	0.0%	0.0%
Special Wastes	Bulky Wastes/Furniture	2.3%	0.6%	0.0%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.1%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	0.0%	0.0%
MSW/Other Waste	Mixed MSW	1.3%	0.2%	3.6%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX E

COLUMBIA LANDFILL

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APPENDIX E - WASTE COMPOSITION AT COLUMBIA LANDFILL

E 1. OVERVIEW

The Columbia Sanitary Landfill, located in mid-Missouri and Boone County, is owned and operated by the City of Columbia, and is part of Solid Waste District Region H. The facility accepted 179,977 tons of waste during CY2016. This site was included in both seasons of the Manual Sorting phase of this study, but not the Gate/Visual non-MSW Surveying phase. Table E-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

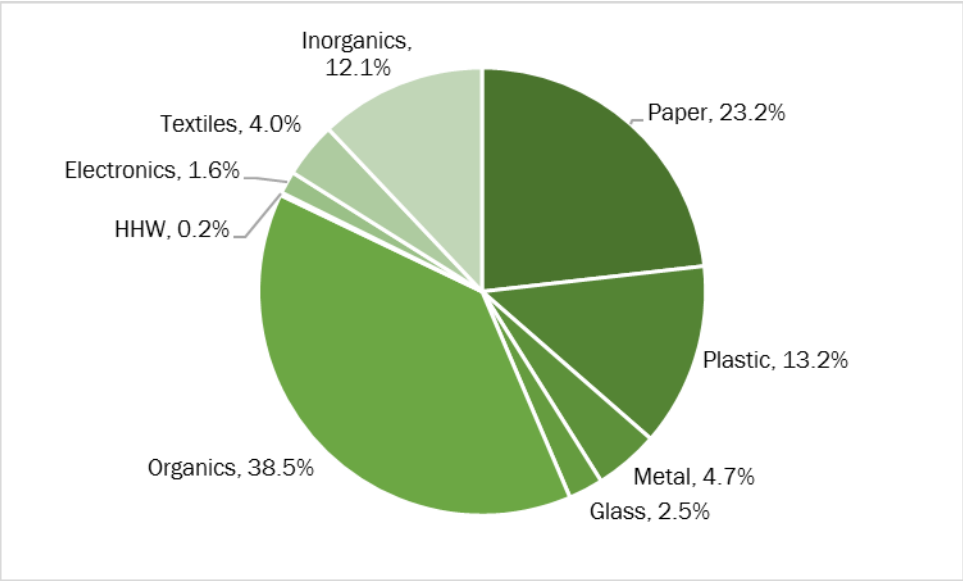
Table E-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	26 Samples	5,850 Lbs	16 Samples	4,025 Lbs
Visual Surveys	N/A	N/A	717 Loads	3,278 Tons
Gate Surveys	N/A	N/A	717 Loads	3,278 Tons

E 2. MSW CHARACTERIZATION RESULTS

Columbia was the first location sorted in both seasons, so 2 days were allocated to account for startup training with the labor crew. This enabled 12 samples to be taken in Season 1 and 14 samples in Season 2. The aggregate composition of the sampled loads is presented in Figure E-1. Organics was determined to be the largest component of the waste, at 38.5 percent, with over 23 percent being Paper materials.

Figure E-1 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table E-2. This table provides the mean composition and 90 percent confidence intervals from the study.

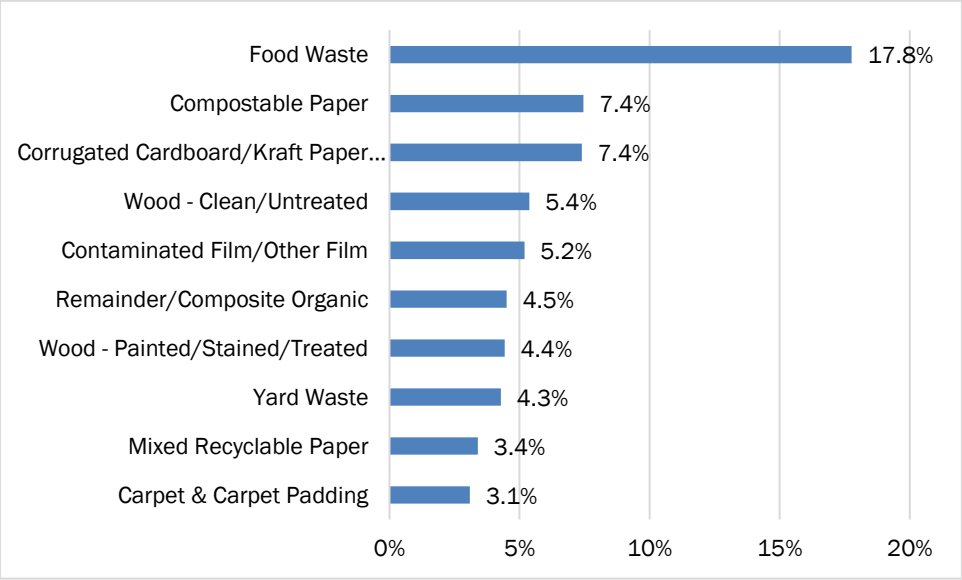
Table E-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**23.2%**	**3.5%**	**41,720**	**Plastic**	**13.2%**	**1.7%**	**23,820**
OCC/Kraft Paper	7.4%	2.6%	13,304	PET (#1) Bottles/Jars	1.4%	0.4%	2,589
Newsprint	0.7%	0.3%	1,332	PET (#1) Non-Bottle containers	0.3%	0.1%	595
Magazines	1.4%	0.7%	2,485	HDPE (#2) Natural Containers	0.4%	0.1%	669
High Grade Office Paper	1.2%	0.7%	2,240	HDPE (#2) Colored Containers	0.5%	0.2%	835
Mixed Recyclable Paper	3.4%	0.8%	6,112	Clean Film Bags	0.3%	0.1%	536
Compostable Paper	7.4%	1.5%	13,408	Clean Indust'l/Com'l Film	0.1%	0.1%	249
Remainder/Composite Paper	1.6%	0.8%	2,839	Contaminated Film/Other Film	5.2%	1.0%	9,337
Glass	**2.5%**	**0.7%**	**4,506**	Plastic Containers #3 thru #7	0.6%	0.2%	1,106
Clear Glass Containers	1.0%	0.3%	1,777	Expanded Polystyrene #6	0.7%	0.2%	1,306
Brown Glass Containers	1.0%	0.4%	1,803	Bulky Durable Plastic Products	1.9%	0.8%	3,358
Green Glass Containers	0.2%	0.1%	352	Remainder/Composite Plastic	1.8%	0.4%	3,239
Remainder/Composite Glass	0.3%	0.2%	574	**Textiles**	**4.0%**	**1.3%**	**7,231**
Metal	**4.7%**	**1.6%**	**8,377**	Textiles - Clothing	1.0%	0.5%	1,748
Aluminum Cans & Containers	0.4%	0.1%	774	Textiles - Non-Clothing	2.2%	1.0%	4,006
Other Aluminum	0.3%	0.1%	573	Shoes/Belts/Leather	0.8%	0.5%	1,477
Tin/Steel Containers	1.0%	0.2%	1,740	**Inorganics**	**12.1%**	**3.4%**	**21,706**
Other Ferrous - Magnetic	2.7%	1.6%	4,905	Fines	1.9%	0.9%	3,431
Other Non-Ferrous	0.1%	0.0%	127	Drywall/Gypsum Board	0.7%	0.9%	1,198
Oil Filters	0.1%	0.1%	257	Asphalt, Brick, Concrete & Rock	0.8%	0.9%	1,386
Organics	**38.5%**	**5.1%**	**69,334**	Carpet & Carpet Padding	3.1%	2.5%	5,566
Food Waste	17.8%	4.4%	31,977	Other Construction & Demolition	1.9%	1.3%	3,458
Wood - Clean/Untreated	5.4%	3.6%	9,679	Bulky Items/Furniture	0.7%	0.7%	1,208
Wood - Painted/Stained/Treate	4.4%	1.8%	7,974	Mattresses/Boxsprings	0.4%	0.6%	674
Diapers/Sanitary Products	2.2%	0.8%	3,905	Tires	2.0%	1.7%	3,527
Yard Waste	4.3%	3.4%	7,698	Other/Not Classified	0.7%	0.5%	1,259
Remainder/Composite Organic	4.5%	2.1%	8,102	**HHW**	**0.2%**	**0.1%**	**363**
Electronics	**1.6%**	**2.3%**	**2,921**	Household Hazardous Waste	0.2%	0.1%	363
Electronic Waste	1.6%	1.5%	2,921	**Grand Total**	**100%**		
				No. of Samples	***26***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure E-2 shows the ten most commonly occurring materials in the MSW sorted at Columbia. Food waste more than doubles the two materials tied as second highest, Compostable Paper and Corrugated Cardboard/Kraft Paper.

Figure E-2 Top 10 Materials in MSW

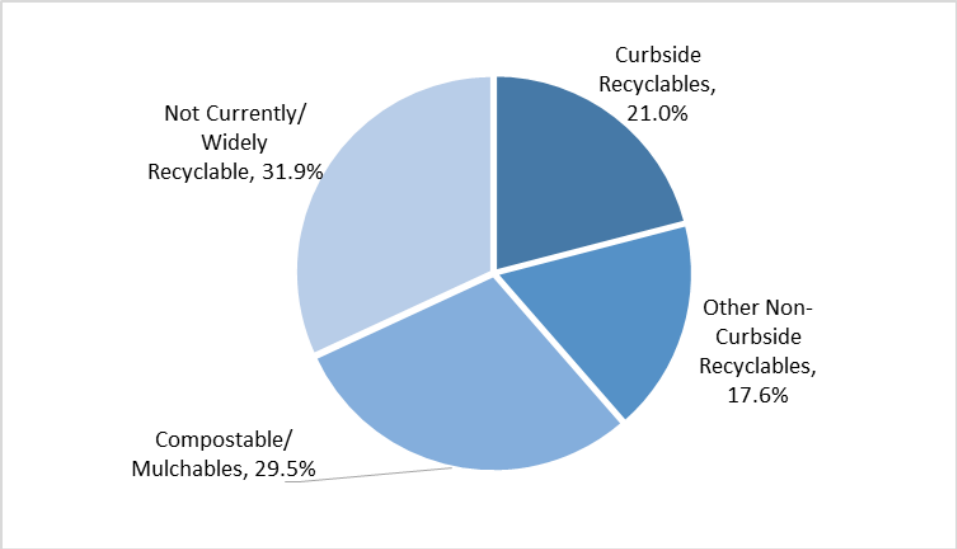


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Columbia sort activity results are displayed in Figure E-3. As shown, about 32 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 68 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure E-3 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table E-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results. This table also shows the results of any MSW sorting that was performed in the 2008 Study (note that the 2008 Study sorted into a smaller number of material categories).

Table E-3 Detailed Results

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	2008 Agg-regate	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	2008 Agg-regate
Paper	**23.2%**	**24.1%**	**21.2%**	**31.5%**	**Plastic**	**13.2%**	**14.1%**	**11.9%**	**18.7%**
OCC/Kraft Paper	7.4%	4.8%	11.3%	8.7%	PET (#1) Bottles/Jars	1.4%	1.8%	0.8%	2.0%
Newsprint	0.7%	1.0%	0.4%	4.0%	PET (#1) Non-Bottle containers	0.3%	0.4%	0.2%	
Magazines	1.4%	1.8%	0.6%	3.0%	HDPE (#2) Natural Containers	0.4%	0.4%	0.3%	1.4%
High Grade Office Paper	1.2%	1.4%	0.9%	4.7%	HDPE (#2) Colored Containers	0.5%	0.6%	0.2%	
Mixed Recyclable Paper	3.4%	4.3%	1.9%	11.1%	Clean Film Bags	0.3%	0.4%	0.1%	6.8%
Compostable Paper	7.4%	8.6%	5.5%		Clean Indust'l/Com'l Film	0.1%	0.1%	0.2%	
Remainder/Composite Paper	1.6%	2.2%	0.5%		Contaminated Film/Other Film	5.2%	5.3%	5.1%	
Glass	**2.5%**	**3.4%**	**1.0%**	**4.5%**	Plastic Containers #3 thru #7	0.6%	0.7%	0.5%	8.5%
Clear Glass Containers	1.0%	1.4%	0.3%	2.9%	Expanded Polystyrene #6	0.7%	0.9%	0.5%	
Brown Glass Containers	1.0%	1.3%	0.5%	0.9%	Bulky Durable Plastic Products	1.9%	1.5%	2.7%	
Green Glass Containers	0.2%	0.3%	0.1%	0.5%	Remainder/Composite Plastic	1.8%	2.0%	1.4%	
Remainder/Composite Glass	0.3%	0.4%	0.2%	0.2%	**Textiles**	**4.0%**	**5.1%**	**2.1%**	**5.1%**
Metal	**4.7%**	**4.2%**	**6.1%**	**4.6%**	Textiles - Clothing	1.0%	1.4%	0.3%	5.1%
Aluminum Cans & Containers	0.4%	0.5%	0.2%	1.4%	Textiles - Non-Clothing	2.2%	2.7%	1.5%	
Other Aluminum	0.3%	0.4%	0.2%	0.2%	Shoes/Belts/Leather	0.8%	1.1%	0.4%	
Tin/Steel Containers	1.0%	1.0%	0.9%	1.8%	**Inorganics**	**12.1%**	**11.0%**	**14.7%**	**5.2%**
Other Ferrous - Magnetic	2.7%	2.1%	4.3%	1.2%	Fines	1.9%	2.1%	1.5%	0.9%
Other Non-Ferrous	0.1%	0.1%	0.0%	0.0%	Drywall/Gypsum Board	0.7%	1.1%	0.0%	4.3%
Oil Filters	0.1%	0.0%	0.3%	0.0%	Asphalt, Brick, Concrete & Rocks	0.8%	0.2%	1.7%	
Organics	**38.5%**	**37.5%**	**39.4%**	**28.1%**	Carpet & Carpet Padding	3.1%	3.5%	2.8%	
Food Waste	17.8%	16.3%	19.6%	19.1%	Other Construction & Demolition	1.9%	1.7%	2.5%	
Wood - Clean/Untreated	5.4%	0.6%	12.8%	1.0%	Bulky Items/Furniture	0.7%	0.6%	0.7%	
Wood - Painted/Stained/Treated	4.4%	5.4%	3.0%		Mattresses/Boxsprings	0.4%	0.6%	0.0%	
Diapers/Sanitary Products	2.2%	3.0%	0.8%	4.7%	Tires	2.0%	0.9%	4.3%	
Yard Waste	4.3%	6.4%	1.0%	3.3%	Other/Not Classified	0.7%	0.3%	1.2%	
Remainder/Composite Organic	4.5%	5.8%	2.3%		**HHW**	**0.2%**	**0.2%**	**0.2%**	**0.5%**
Electronics	**1.6%**	**0.5%**	**3.3%**	**2.0%**	Household Hazardous Waste	0.2%	0.2%	0.2%	0.5%
Electronic Waste	1.6%	0.5%	3.3%	2.0%	**Grand Total**	**100%**	**100%**	**100%**	**100%**
					No. of Samples	**26**	**16**	**10**	**16**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

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APPENDIX F

COURTNEY RIDGE LANDFILL

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APPENDIX F - WASTE COMPOSITION AT COURTNEY RIDGE LANDFILL

F 1. OVERVIEW

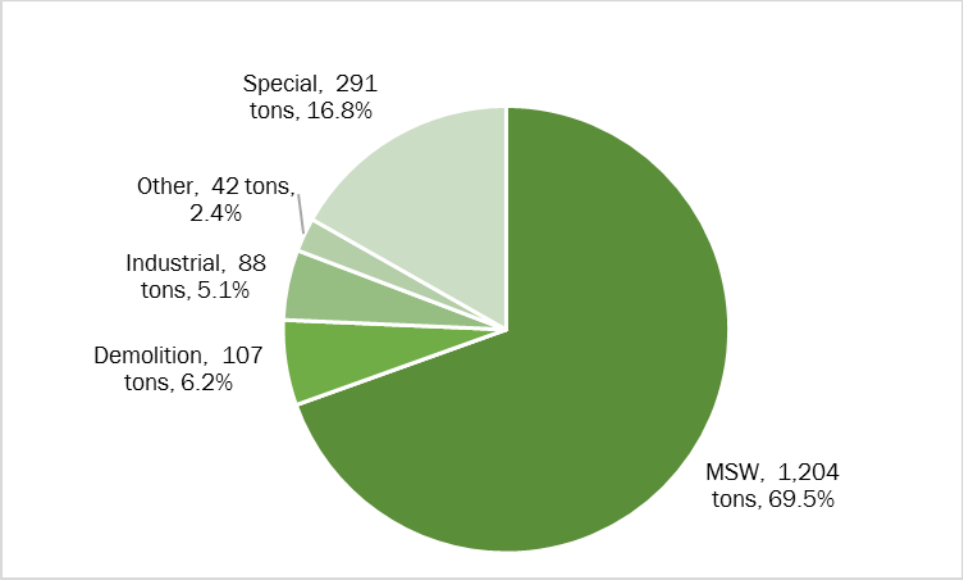
The Courtney Ridge Landfill, located in Sugar Creek, part of the large metro Kansas City area in Jackson County is owned and operated by Republic Services, and is part of Solid Waste District Region E. The facility accepted 520,394 tons of waste during CY2016. Courtney Ridge hosted both seasons of MSW manual sorting as well as the Gate/Visual non-MSW Surveying phase of the project. Due to regional volume, the site was sampled for two days in MSW Season 1 and one day in Season 2. Table F-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table F-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	25 Samples	5,397 Lbs	16 Samples	4,075 Lbs
Visual Surveys	25 Loads	86 Tons	1,152 Loads	10,627 Tons
Gate Surveys	164 Loads	1,731 Tons	1,152 Loads	10,627 Tons

Figure F-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure F-1 Gate Survey Results

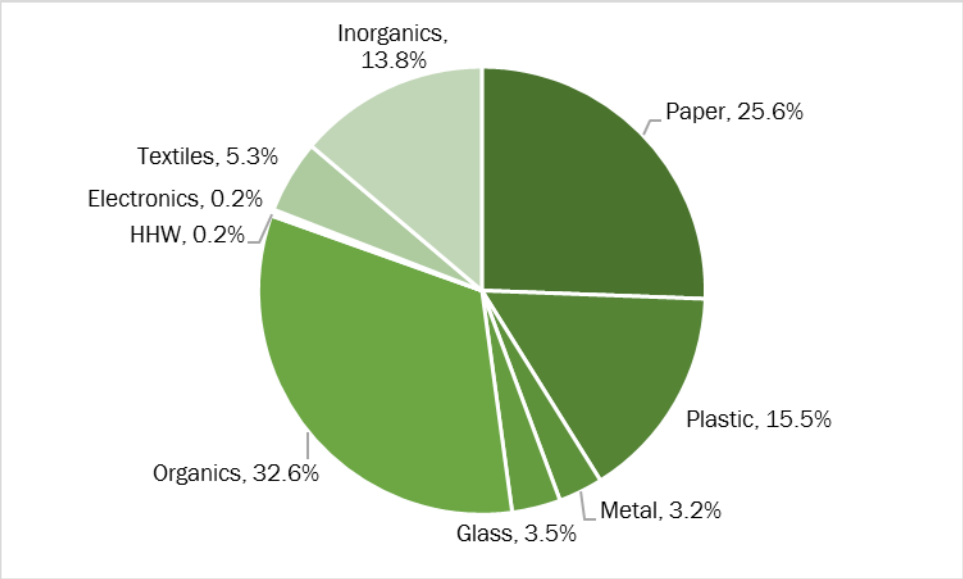


As shown, nearly 70 percent of incoming waste at Courtney Ridge is MSW, the receiving landfill for wastes from several transfer stations as well as from individual haulers and local routes. The mix of waste types observed in 2017 varied substantially from the findings from the 2008 Study, where MSW was found to be 33 percent of inbound wastes.

F 2. MSW CHARACTERIZATION RESULTS

Sorting was conducted for two days during Season 1 and one day during Season 2, a total of 25 samples taken. The aggregate composition of the sampled loads is presented in Figure F-2. Organics was determined to be the largest component of the waste, at almost 33 percent, with nearly 26 percent being Paper materials.

Figure F-2 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table F-2. This table provides the mean composition and 90 percent confidence intervals from the study, and applies the results to the estimated 436,114 tons of MSW found to be disposed at the facility based on gate survey results.

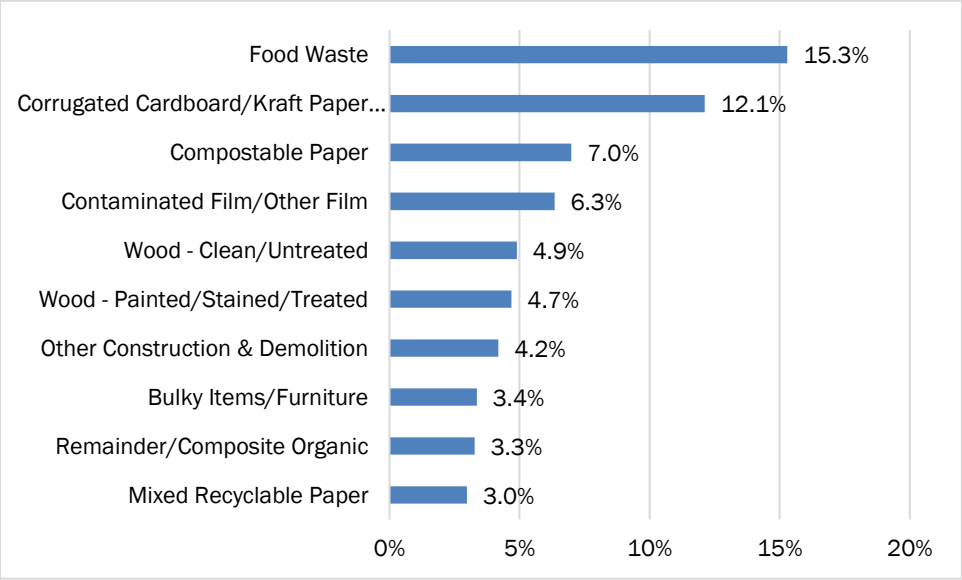
Table F-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**25.6%**	**5.5%**	**160,465**	**Plastic**	**15.5%**	**2.2%**	**97,413**
OCC/Kraft Paper	12.1%	4.8%	76,018	PET (#1) Bottles/Jars	1.2%	0.4%	7,381
Newsprint	0.6%	0.3%	3,769	PET (#1) Non-Bottle containers	0.1%	0.1%	766
Magazines	0.4%	0.2%	2,634	HDPE (#2) Natural Containers	0.4%	0.2%	2,386
High Grade Office Paper	0.3%	0.1%	1,822	HDPE (#2) Colored Containers	0.4%	0.2%	2,453
Mixed Recyclable Paper	3.0%	1.2%	18,668	Clean Film Bags	0.2%	0.1%	1,463
Compostable Paper	7.0%	1.7%	43,853	Clean Indust'l/Com'l Film	2.0%	1.7%	12,808
Remainder/Composite Paper	2.2%	1.7%	13,701	Contaminated Film/Other Film	6.3%	1.6%	39,814
Glass	**3.5%**	**1.3%**	**22,065**	Plastic Containers #3 thru #7	1.2%	0.4%	7,472
Clear Glass Containers	1.5%	0.5%	9,587	Expanded Polystyrene #6	0.7%	0.2%	4,425
Brown Glass Containers	1.2%	0.6%	7,387	Bulky Durable Plastic Products	0.9%	0.8%	5,821
Green Glass Containers	0.3%	0.2%	2,071	Remainder/Composite Plastic	2.0%	0.8%	12,623
Remainder/Composite Glass	0.5%	0.5%	3,020	**Textiles**	**5.3%**	**2.4%**	**33,097**
Metal	**3.2%**	**0.6%**	**20,158**	Textiles - Clothing	2.7%	1.7%	16,778
Aluminum Cans & Containers	0.7%	0.3%	4,577	Textiles - Non-Clothing	1.5%	0.6%	9,633
Other Aluminum	0.5%	0.1%	2,911	Shoes/Belts/Leather	1.1%	0.7%	6,685
Tin/Steel Containers	0.9%	0.3%	5,694	**Inorganics**	**13.8%**	**6.8%**	**86,657**
Other Ferrous - Magnetic	1.0%	0.5%	5,987	Fines	2.6%	1.1%	16,338
Other Non-Ferrous	0.1%	0.2%	905	Drywall/Gypsum Board	0.3%	0.5%	1,846
Oil Filters	0.0%	0.0%	82	Asphalt, Brick, Concrete & Rocks	0.5%	0.4%	3,241
Organics	**32.6%**	**4.7%**	**204,469**	Carpet & Carpet Padding	2.4%	2.1%	15,338
Food Waste	15.3%	5.0%	95,909	Other Construction & Demolition	4.2%	2.5%	26,224
Wood - Clean/Untreated	4.9%	5.2%	30,681	Bulky Items/Furniture	3.4%	3.1%	21,058
Wood - Painted/Stained/Treate	4.7%	2.7%	29,416	Mattresses/Boxsprings	0.0%	0.0%	-
Diapers/Sanitary Products	2.6%	1.3%	16,250	Tires	0.0%	0.1%	288
Yard Waste	1.9%	1.4%	11,660	Other/Not Classified	0.4%	0.1%	2,323
Remainder/Composite Organic	3.3%	1.5%	20,554	**HHW**	**0.2%**	**0.2%**	**1,458**
Electronics	**0.2%**	**0.2%**	**1,469**	Household Hazardous Waste	0.2%	0.1%	1,458
Electronic Waste	0.2%	0.1%	1,469	**Grand Total**	**100%**		
				No. of Samples	***25***		**436,114**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure F-3 shows the ten most commonly occurring materials in the MSW sorted at Courtney Ridge. Food Waste and OCC/Kraft Paper make up well over one-fourth of the materials disposed at this site.

Figure F-3 Top 10 Materials in MSW

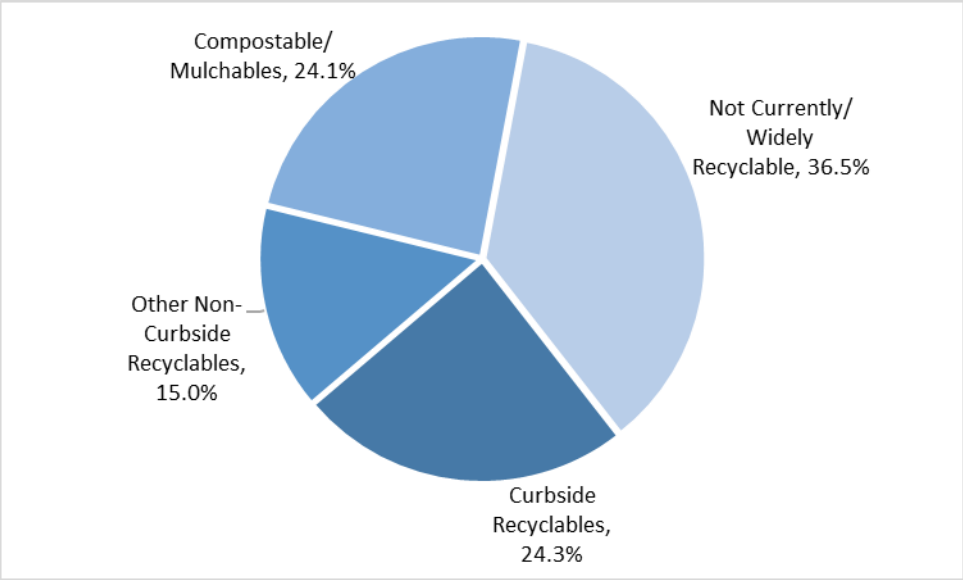


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Courtney Ridge sort activity results are displayed in Figure F-4. As shown, 36.5 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 63.5 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure F-4 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table F-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results. This table also shows the results of any MSW sorting that was performed in the 2008 Study (note that the 2008 Study sorted into a smaller number of material categories).

Table F-3 Detailed Results

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	2008 Agg-regate	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	2008 Agg-regate
Paper	**25.6%**	**19.0%**	**30.1%**	**34.2%**	**Plastic**	**15.5%**	**13.6%**	**16.5%**	**16.8%**
OCC/Kraft Paper	12.1%	3.4%	18.3%	8.9%	PET (#1) Bottles/Jars	1.2%	1.1%	1.2%	2.7%
Newsprint	0.6%	1.3%	0.1%	5.6%	PET (#1) Non-Bottle containers	0.1%	0.2%	0.0%	
Magazines	0.4%	0.6%	0.3%	3.1%	HDPE (#2) Natural Containers	0.4%	0.6%	0.3%	2.0%
High Grade Office Paper	0.3%	0.5%	0.1%	8.0%	HDPE (#2) Colored Containers	0.4%	0.4%	0.4%	
Mixed Recyclable Paper	3.0%	3.8%	2.5%	8.6%	Clean Film Bags	0.2%	0.4%	0.1%	5.1%
Compostable Paper	7.0%	8.3%	5.9%		Clean Indust'l/Com'l Film	2.0%	0.1%	3.4%	
Remainder/Composite Paper	2.2%	1.2%	2.8%		Contaminated Film/Other Film	6.3%	5.8%	6.5%	
Glass	**3.5%**	**4.2%**	**3.0%**	**6.0%**	Plastic Containers #3 thru #7	1.2%	1.4%	1.1%	7.0%
Clear Glass Containers	1.5%	2.3%	1.0%	2.9%	Expanded Polystyrene #6	0.7%	0.9%	0.6%	
Brown Glass Containers	1.2%	1.1%	1.2%	2.1%	Bulky Durable Plastic Products	0.9%	1.2%	0.7%	
Green Glass Containers	0.3%	0.6%	0.2%	0.9%	Remainder/Composite Plastic	2.0%	1.6%	2.2%	
Remainder/Composite Glass	0.5%	0.3%	0.6%	0.1%	**Textiles**	**5.3%**	**7.2%**	**3.8%**	**4.4%**
Metal	**3.2%**	**3.8%**	**2.8%**	**7.0%**	Textiles - Clothing	2.7%	4.2%	1.5%	4.4%
Aluminum Cans & Containers	0.7%	1.0%	0.5%	1.8%	Textiles - Non-Clothing	1.5%	1.9%	1.2%	
Other Aluminum	0.5%	0.6%	0.4%	0.4%	Shoes/Belts/Leather	1.1%	1.1%	1.0%	
Tin/Steel Containers	0.9%	1.1%	0.7%	3.5%	**Inorganics**	**13.8%**	**21.0%**	**9.7%**	**3.5%**
Other Ferrous - Magnetic	1.0%	0.9%	1.0%	1.0%	Fines	2.6%	4.1%	1.5%	0.7%
Other Non-Ferrous	0.1%	0.1%	0.2%	0.1%	Drywall/Gypsum Board	0.3%	0.0%	0.6%	2.8%
Oil Filters	0.0%	0.0%	0.0%	0.2%	Asphalt, Brick, Concrete & Rocks	0.5%	0.4%	0.6%	
Organics	**32.6%**	**30.8%**	**33.5%**	**25.9%**	Carpet & Carpet Padding	2.4%	3.7%	1.7%	
Food Waste	15.3%	14.0%	15.9%	13.2%	Other Construction & Demolition	4.2%	4.8%	4.0%	
Wood - Clean/Untreated	4.9%	0.3%	8.1%	0.7%	Bulky Items/Furniture	3.4%	7.9%	0.8%	
Wood - Painted/Stained/Treated	4.7%	3.8%	5.3%		Mattresses/Boxsprings	0.0%	0.0%	0.0%	
Diapers/Sanitary Products	2.6%	4.7%	1.1%	7.3%	Tires	0.0%	0.0%	0.1%	
Yard Waste	1.9%	3.7%	0.6%	4.7%	Other/Not Classified	0.4%	0.1%	0.5%	
Remainder/Composite Organic	3.3%	4.2%	2.5%		**HHW**	**0.2%**	**0.2%**	**0.3%**	**1.3%**
Electronics	**0.2%**	**0.2%**	**0.3%**	**0.8%**	Household Hazardous Waste	0.2%	0.2%	0.3%	1.3%
Electronic Waste	0.2%	0.2%	0.3%	0.8%	**Grand Total**	**100%**	**100%**	**100%**	**100%**
					No. of Samples	***25***	***10***	***15***	***16***

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

F 3. VISUAL SURVEY RESULTS

There were no Construction waste loads visually surveyed at this facility. Figure F-5 summarizes the composition of Demolition debris surveyed.

Figure F-5 Demolition Composition

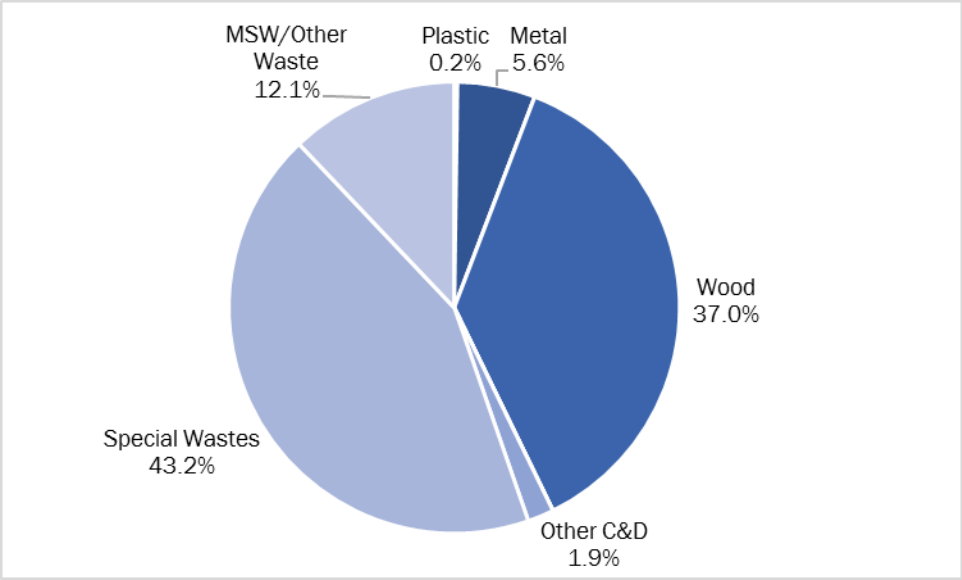


Figure F-6 provides the composition of Industrial materials. Wood and Plastics were the primary constituents of the waste.

Figure F-6 Industrial Waste Composition

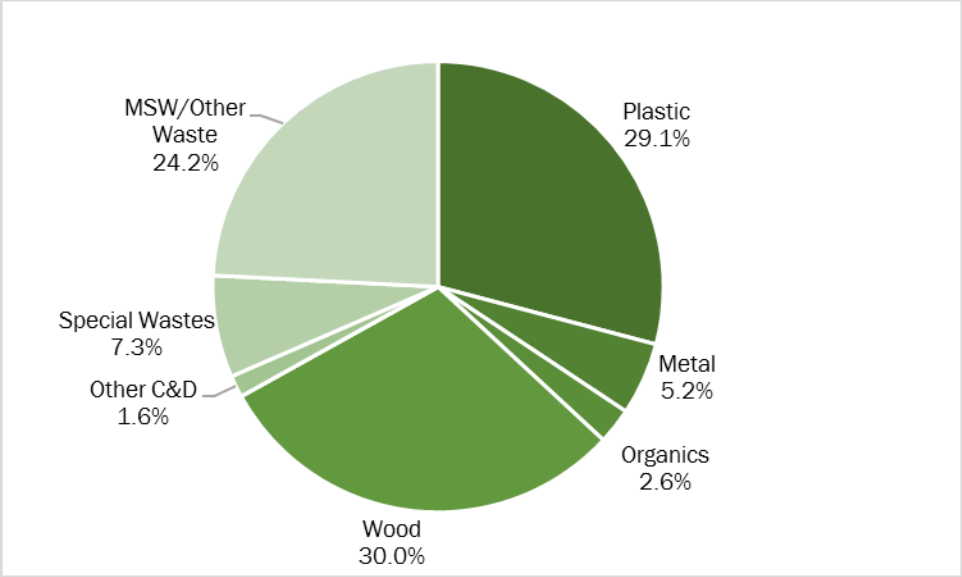


Table F-4 provides the detailed composition of the two material groups visually surveyed.

Table F-4 Detailed Composition of Visually Surveyed Wastes

Group	Material	Demolition	Industrial
MSW/Other Waste	Flattened OCC	0.3%	7.4%
MSW/Other Waste	Unflattened OCC	0.1%	1.1%
MSW/Other Waste	R/C and Other Paper	0.1%	12.3%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.8%
Plastic	HDPE Buckets (unstacked)	0.0%	0.4%
Plastic	Clean Recoverable Film	0.0%	1.7%
Plastic	R/C and Other Plastic	0.2%	26.2%
MSW/Other Waste	All Glass	0.9%	0.0%
Metal	Appliances	0.0%	0.0%
Metal	Other Ferrous Metals	4.3%	4.2%
Metal	Other Non-ferrous Metal	0.2%	1.0%
Metal	HVAC Ducting	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	1.5%
Organics	Branches/Limbs	0.0%	0.0%
Organics	R/C and Other Organics	0.0%	1.0%
Wood	Pallets - Standard	0.1%	2.7%
Wood	Pallets/Crates/Heavy	0.0%	10.0%
Wood	Untreated/Unpainted Lumber	9.9%	10.2%
Wood	Treated/Painted/Processed Wood	8.4%	4.2%
Wood	Engineered Wood	0.9%	0.4%
Wood	Wood Furniture	4.5%	2.4%
Wood	Other Wood	6.2%	0.0%
Other C&D	Carpet	0.3%	0.5%
Other C&D	Carpet Padding	0.1%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	0.0%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%
Roofing Materials	Roofing Materials	1.6%	0.0%
Other C&D	Ceiling Tiles	0.9%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.0%
Gypsum Board	Painted Gypsum Board	17.0%	0.2%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	0.0%	0.0%
Other C&D	Insulation	0.3%	0.0%
Other C&D	R/C and Other C&D	0.0%	1.1%
MSW/Other Waste	Electronics	0.4%	0.0%
MSW/Other Waste	Items with CRTs	0.3%	0.0%
Special Wastes	Bulky Wastes/Furniture	35.2%	1.8%
MSW/Other Waste	Tree Trunks	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%
Special Wastes	All HHW	0.0%	5.5%
MSW/Other Waste	Fines/Mixed Residue	6.0%	0.0%
MSW/Other Waste	Mixed MSW	1.8%	3.3%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%
Total		**100.0%**	**100.0%**

APPENDIX G

FRED WEBER TRANSFER STATION

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APPENDIX G -WASTE COMPOSITION AT FRED WEBER TRANSFER STATION

G 1. OVERVIEW

The F.W. Disposal Transfer Station, located in the large metro St. Louis area in Valley Park, is owned and operated by Waste Connections, and is part of Solid Waste District Region L. The facility accepts waste that is transferred to the Champ Landfill for disposal, where the tonnage is accounted for. This site was included in both seasons of the Manual Sorting phase of this study, but not the Gate/Visual non-MSW Surveying phase. Table G-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

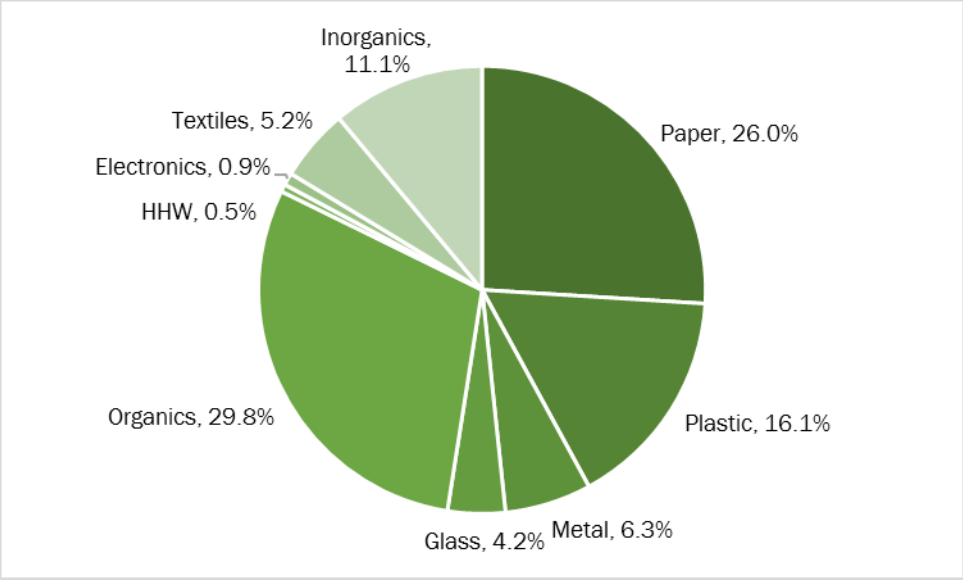
Table G-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manual Sorted	16 Samples	3,499 Lbs.	N/A	N/A
Visual Surveys	N/A	N/A	N/A	N/A
Gate Surveys	N/A	N/A	N/A	N/A

G 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in each of the Fall and Spring seasons. The aggregate composition of the sampled loads is presented in Figure G-1. Organics was determined to be the largest component of the waste, at almost 30 percent, with 26 percent being Paper materials.

Figure G-1 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table G-2 . This table provides the mean composition and 90 percent confidence intervals from the study.

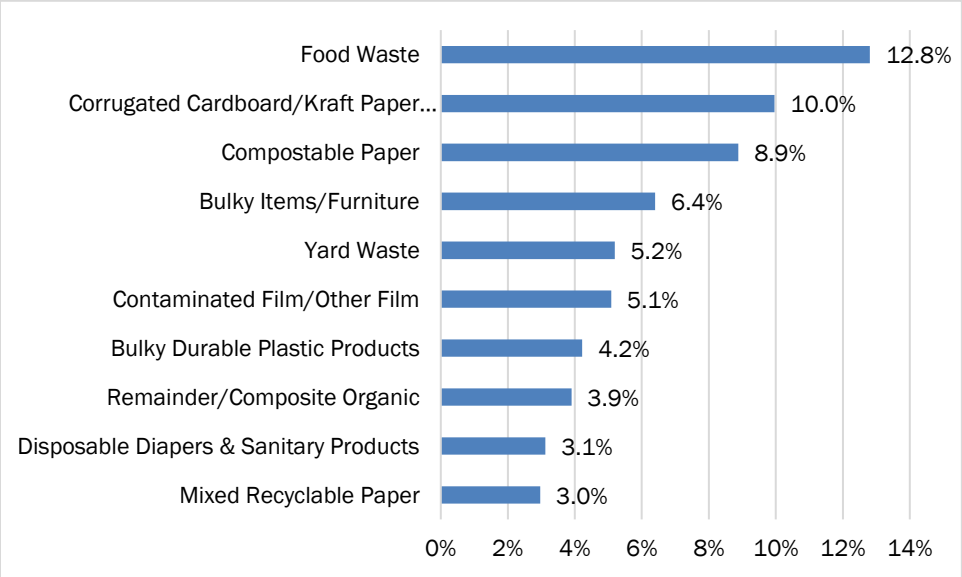
Table G-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**26.0%**	**4.2%**	**909**	**Plastic**	**16.1%**	**2.2%**	**563**
OCC/Kraft Paper	10.0%	3.4%	349	PET (#1) Bottles/Jars	1.4%	0.2%	48
Newsprint	1.3%	0.8%	47	PET (#1) Non-Bottle containers	0.3%	0.1%	12
Magazines	1.0%	0.4%	34	HDPE (#2) Natural Containers	0.4%	0.1%	13
High Grade Office Paper	0.9%	0.6%	33	HDPE (#2) Colored Containers	0.9%	0.3%	32
Mixed Recyclable Paper	3.0%	0.8%	104	Clean Film Bags	0.3%	0.1%	9
Compostable Paper	8.9%	1.1%	311	Clean Indust'l/Com'l Film	0.1%	0.1%	4
Remainder/Composite Paper	0.9%	0.5%	32	Contaminated Film/Other Film	5.1%	0.8%	178
Glass	**4.2%**	**2.2%**	**146**	Plastic Containers #3 thru #7	0.9%	0.2%	32
Clear Glass Containers	1.8%	0.8%	64	Expanded Polystyrene #6	0.6%	0.2%	22
Brown Glass Containers	1.9%	1.9%	66	Bulky Durable Plastic Products	4.2%	1.9%	148
Green Glass Containers	0.2%	0.1%	5	Remainder/Composite Plastic	1.9%	0.5%	65
Remainder/Composite Glass	0.3%	0.2%	10	**Textiles**	**5.2%**	**2.1%**	**183**
Metal	**6.3%**	**1.7%**	**219**	Textiles - Clothing	2.0%	1.7%	71
Aluminum Cans & Containers	0.6%	0.2%	20	Textiles - Non-Clothing	2.1%	0.8%	72
Other Aluminum	0.2%	0.1%	8	Shoes/Belts/Leather	1.2%	0.9%	40
Tin/Steel Containers	1.0%	0.3%	34	**Inorganics**	**11.1%**	**3.9%**	**387**
Other Ferrous - Magnetic	2.6%	1.5%	91	Fines	1.8%	0.6%	64
Other Non-Ferrous	1.8%	1.3%	61	Drywall/Gypsum Board	0.6%	0.8%	20
Oil Filters	0.1%	0.1%	5	Asphalt, Brick, Concrete & Rocks	0.0%	0.1%	1
Organics	**29.8%**	**3.6%**	**1,041**	Carpet & Carpet Padding	0.1%	0.2%	5
Food Waste	12.8%	2.7%	448	Other Construction & Demolition	1.2%	1.4%	42
Wood - Clean/Untreated	2.3%	2.3%	81	Bulky Items/Furniture	6.4%	3.4%	224
Wood - Painted/Stained/Treated	2.4%	1.8%	85	Mattresses/Boxsprings	0.5%	0.8%	18
Diapers/Sanitary Products	3.1%	1.5%	109	Tires	0.0%	0.0%	-
Yard Waste	5.2%	3.4%	182	Other/Not Classified	0.4%	0.2%	13
Remainder/Composite Organic	3.9%	1.3%	137	**HHW**	**0.5%**	**0.5%**	**19**
Electronics	**0.9%**	**1.6%**	**31**	Household Hazardous Waste	0.5%	0.5%	19
Electronic Waste	0.9%	1.2%	31	**Grand Total**	**100%**		
				No. of Samples	***16***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure G-2 shows the ten most commonly occurring materials in the MSW sorted at Fred Weber. Food waste and Compostable Paper represent almost 22 percent of the materials, both compostable materials.

Figure G-2 Top 10 Materials in MSW

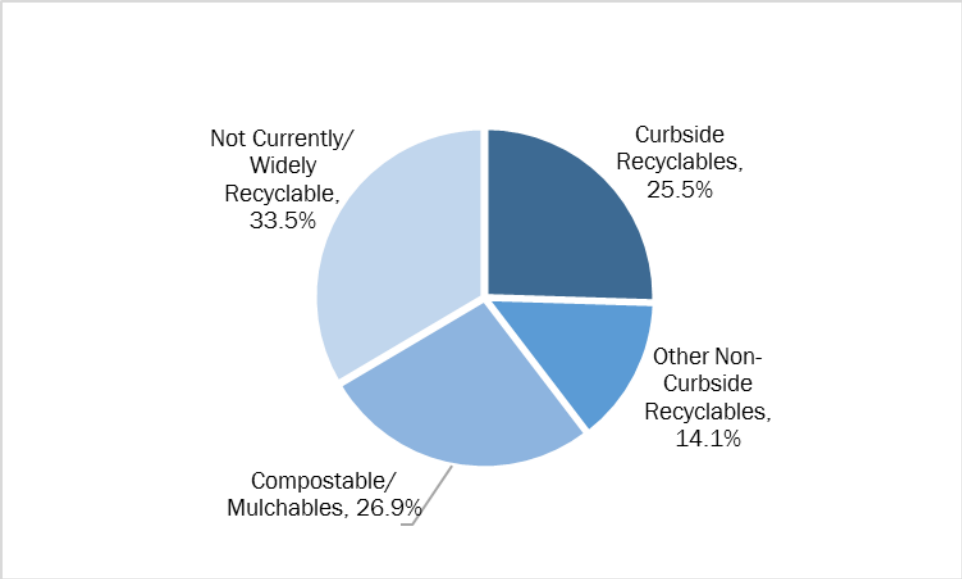


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Fred Weber Transfer Station sort activity results are displayed in Figure G-3. As shown, just one-third of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining two-thirds could be diverted from landfill disposal to either recycling or composting outlets.

Figure G-3 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table G-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results.

Table G-3 Detailed Results

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l
Paper	**26.0%**	**20.5%**	**31.6%**	**Plastic**	**16.1%**	**19.0%**	**13.3%**
OCC/Kraft Paper	10.0%	3.9%	16.2%	PET (#1) Bottles/Jars	1.4%	1.6%	1.2%
Newsprint	1.3%	1.1%	1.5%	PET (#1) Non-Bottle containers	0.3%	0.3%	0.4%
Magazines	1.0%	1.1%	0.8%	HDPE (#2) Natural Containers	0.4%	0.4%	0.3%
High Grade Office Paper	0.9%	0.2%	1.6%	HDPE (#2) Colored Containers	0.9%	1.0%	0.8%
Mixed Recyclable Paper	3.0%	3.3%	2.7%	Clean Film Bags	0.3%	0.3%	0.2%
Compostable Paper	8.9%	9.7%	8.1%	Clean Indust'l/Com'l Film	0.1%	0.2%	0.1%
Remainder/Composite Paper	0.9%	1.2%	0.7%	Contaminated Film/Other Film	5.1%	5.0%	5.2%
Glass	**4.2%**	**5.7%**	**2.5%**	Plastic Containers #3 thru #7	0.9%	0.9%	1.0%
Clear Glass Containers	1.8%	2.0%	1.6%	Expanded Polystyrene #6	0.6%	0.5%	0.7%
Brown Glass Containers	1.9%	3.4%	0.4%	Bulky Durable Plastic Products	4.2%	6.5%	2.0%
Green Glass Containers	0.2%	0.1%	0.2%	Remainder/Composite Plastic	1.9%	2.5%	1.2%
Remainder/Composite Glass	0.3%	0.3%	0.3%	**Textiles**	**5.2%**	**7.0%**	**3.4%**
Metal	**6.3%**	**6.9%**	**5.5%**	Textiles - Clothing	2.0%	2.7%	1.4%
Aluminum Cans & Containers	0.6%	0.6%	0.6%	Textiles - Non-Clothing	2.1%	2.4%	1.7%
Other Aluminum	0.2%	0.3%	0.1%	Shoes/Belts/Leather	1.2%	1.9%	0.4%
Tin/Steel Containers	1.0%	1.6%	0.4%	**Inorganics**	**11.1%**	**11.9%**	**10.5%**
Other Ferrous - Magnetic	2.6%	2.2%	2.9%	Fines	1.8%	2.1%	1.5%
Other Non-Ferrous	1.8%	2.0%	1.5%	Drywall/Gypsum Board	0.6%	1.1%	0.0%
Oil Filters	0.1%	0.3%	0.0%	Asphalt, Brick, Concrete & Rocks	0.0%	0.1%	0.0%
Organics	**29.8%**	**26.4%**	**32.6%**	Carpet & Carpet Padding	0.1%	0.3%	0.0%
Food Waste	12.8%	13.1%	12.3%	Other Construction & Demolition	1.2%	1.9%	0.6%
Wood - Clean/Untreated	2.3%	0.6%	4.0%	Bulky Items/Furniture	6.4%	6.0%	7.0%
Wood - Painted/Stained/Treated	2.4%	2.2%	2.7%	Mattresses/Boxsprings	0.5%	0.0%	1.2%
Diapers/Sanitary Products	3.1%	2.3%	4.0%	Tires	0.0%	0.0%	0.0%
Yard Waste	5.2%	5.1%	4.8%	Other/Not Classified	0.4%	0.5%	0.3%
Remainder/Composite Organic	3.9%	3.0%	4.7%	**HHW**	**0.5%**	**0.8%**	**0.3%**
Electronics	**0.9%**	**1.7%**	**0.2%**	Household Hazardous Waste	0.5%	0.8%	0.3%
Electronic Waste	0.9%	1.7%	0.2%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**16**	**8**	**8**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

APPENDIX H

JEFFERSON CITY LANDFILL

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APPENDIX H -WASTE COMPOSITION AT JEFFERSON CITY LANDFILL

H 1. OVERVIEW

The Jefferson City Sanitary Landfill, located in the small metro mid-Missouri area and Cole County, is owned and operated by Republic Services, and is part of Solid Waste District Region H. The facility accepted 160,780 tons of waste during CY2016. This site was included in the Gate/Visual non-MSW Surveying phase of the study, but not the Manual Sorting phase. Table H-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

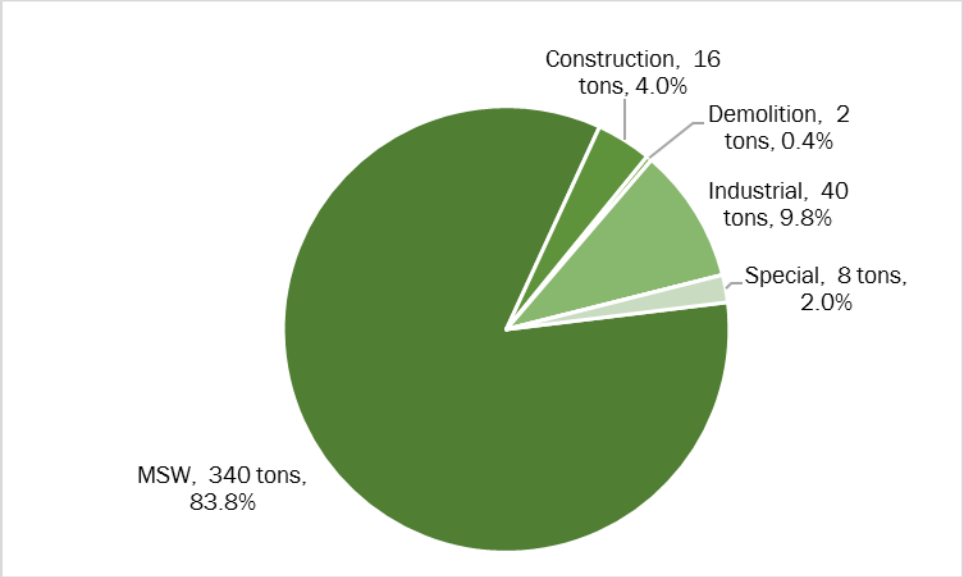
Table H-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	N/A	N/A	N/A	N/A
Visual Surveys	28 Loads	92.6 Tons	460 Loads	3,460 Tons
Gate Surveys	62 Loads	405.2 Tons	460 Loads	3,460 Tons

shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure H-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure H-1 Gate Survey Results



As shown, incoming waste at Jefferson City is predominantly MSW, the receiving landfill for wastes from several transfer stations as well as from individual haulers and local routes. The mix of waste types observed in 2017 is considerably different than the findings from the 2008 Study, where MSW was found to be 52.5 percent of inbound wastes.

H 2. VISUAL SURVEY RESULTS

Figure H-2 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes were found to be Concrete/Brick/Rock.

Figure H-2 Composition of Construction Debris

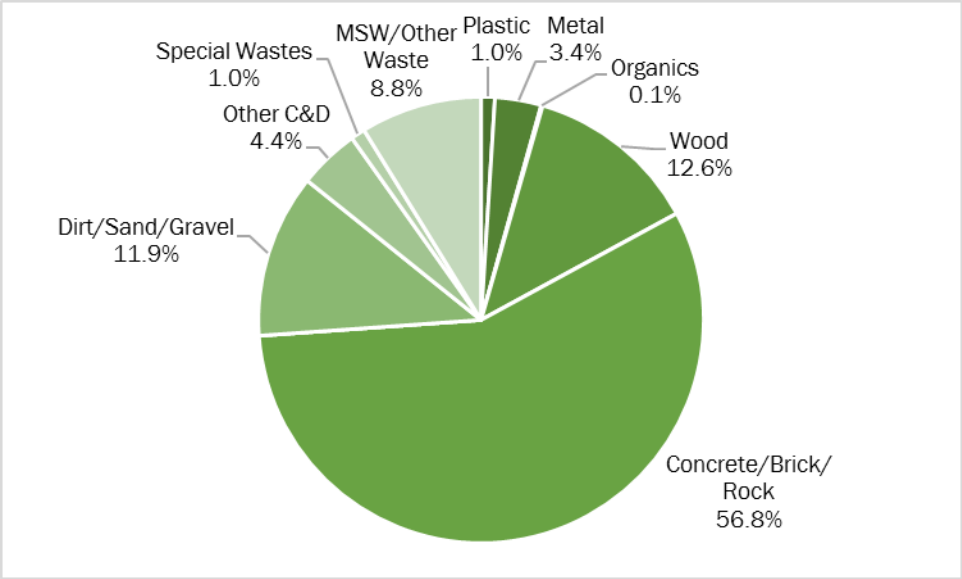


Figure H-3 summarizes the composition of Demolition debris.

Figure H-3 Composition of Demolition Debris

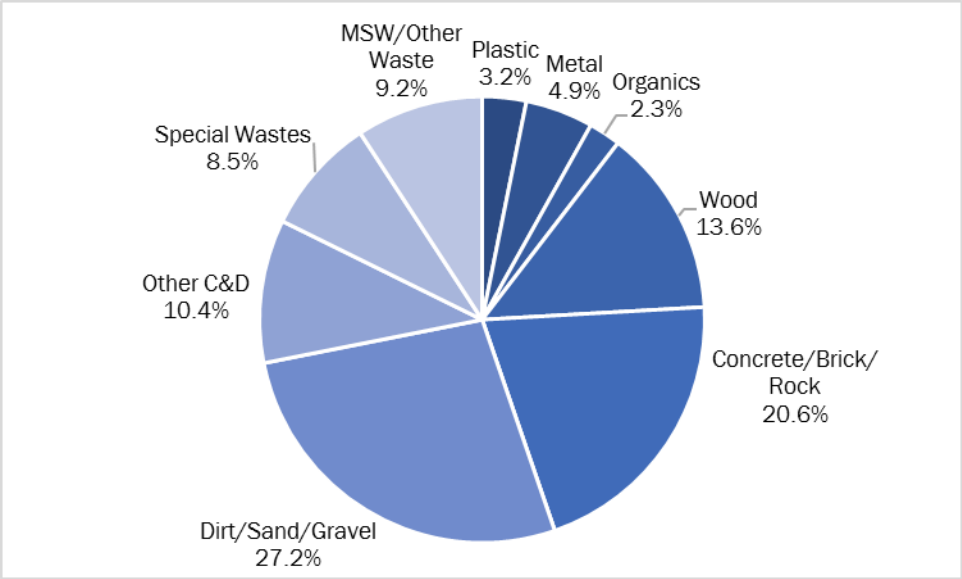


Figure H-4 provides the composition of Industrial materials. MSW/Other Waste and Wood were the primary constituents of the waste.

Figure H-4 Industrial Waste Composition

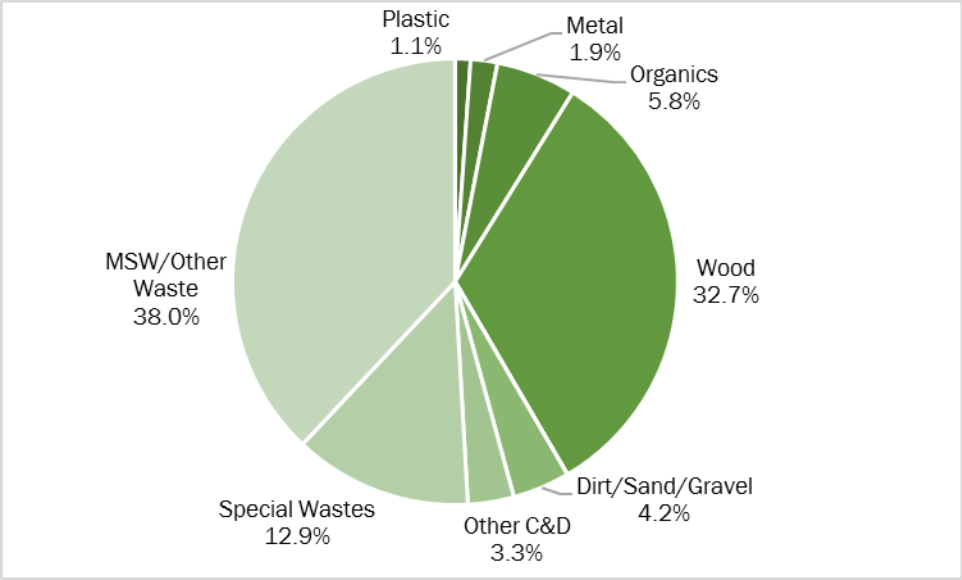


Table H-2 provides the detailed composition of the three material groups.

Table H-2 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	0.4%	0.5%	3.1%
MSW/Other Waste	Unflattened OCC	0.1%	0.1%	0.3%
MSW/Other Waste	R/C and Other Paper	0.2%	0.0%	8.2%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.0%	0.1%	0.0%
Plastic	Clean Recoverable Film	0.1%	0.1%	0.2%
Plastic	R/C and Other Plastic	0.7%	2.1%	0.9%
MSW/Other Waste	All Glass	0.4%	1.6%	4.9%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	2.0%	3.2%	1.8%
Metal	Other Non-ferrous Metal	0.7%	0.3%	0.0%
Metal	HVAC Ducting	0.1%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	0.5%	0.0%
Organics	Branches/Limbs	0.1%	0.0%	0.0%
Organics	R/C and Other Organics	0.0%	1.2%	5.6%
Wood	Pallets - Standard	1.9%	0.0%	3.0%
Wood	Pallets/Crates/Heavy	0.0%	0.0%	0.0%
Wood	Untreated/Unpainted Lumber	2.8%	3.1%	4.0%
Wood	Treated/Painted/Processed Wood	1.0%	2.2%	4.4%
Wood	Engineered Wood	4.3%	1.3%	1.4%
Wood	Wood Furniture	0.4%	2.5%	2.5%
Wood	Other Wood	0.0%	0.6%	16.4%
Other C&D	Carpet	1.1%	2.3%	1.7%
Other C&D	Carpet Padding	0.1%	1.2%	0.1%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	46.5%	14.8%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	2.4%	27.6%	0.0%
Other C&D	Ceiling Tiles	0.2%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.6%	0.0%
Gypsum Board	Painted Gypsum Board	15.7%	0.0%	2.9%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	9.7%	19.5%	4.0%
Other C&D	Insulation	0.9%	0.8%	0.2%
Other C&D	R/C and Other C&D	1.3%	3.2%	1.2%
MSW/Other Waste	Electronics	0.6%	1.1%	5.1%
MSW/Other Waste	Items with CRTs	0.0%	0.0%	2.4%
Special Wastes	Bulky Wastes/Furniture	0.9%	6.1%	12.6%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	4.3%	0.0%	6.7%
MSW/Other Waste	Mixed MSW	1.3%	3.4%	6.2%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX I

JOPLIN TRANSFER STATION

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APPENDIX I - WASTE COMPOSITION AT JOPLIN TRANSFER STATION

I 1. OVERVIEW

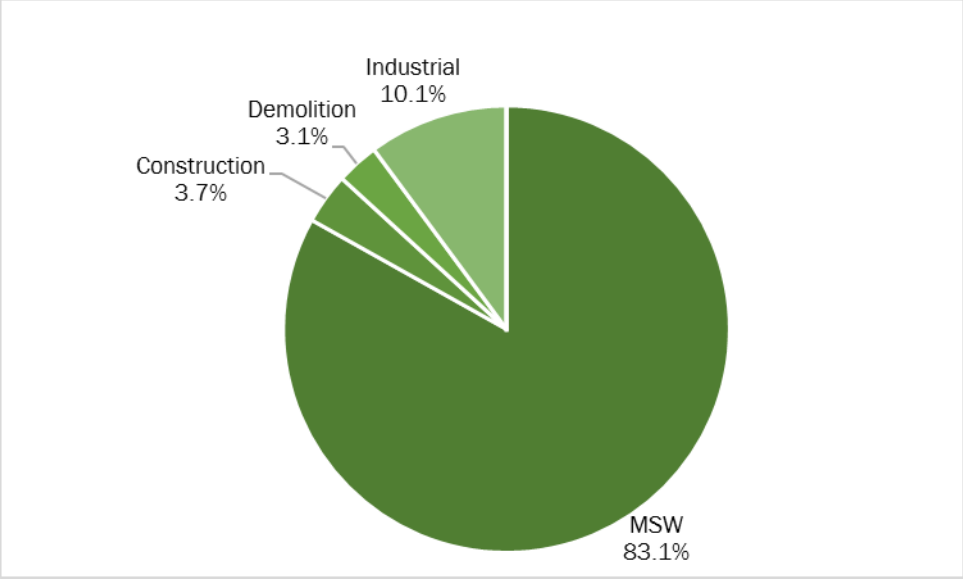
The Joplin Transfer Station, located in the small metro area of Jasper County is owned and operated by Waste Corporation of Missouri, and is part of Solid Waste District Region M. The facility accepted 53,951 tons of waste during CY2016. The site hosted both seasons of MSW manual sorting as well as the Gate/Visual non-MSW Surveying activities. Table I-1 summarizes the data collection activities that took place at this facility.

Table I-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	17 Samples	3,597 Lbs	N/A	N/A
Visual Surveys	18 Loads	62 Tons	N/A	N/A
Gate Surveys	43 Loads	209 Tons	N/A	N/A

Figure I-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey. As shown, incoming waste at the Joplin Transfer Station is predominantly MSW.

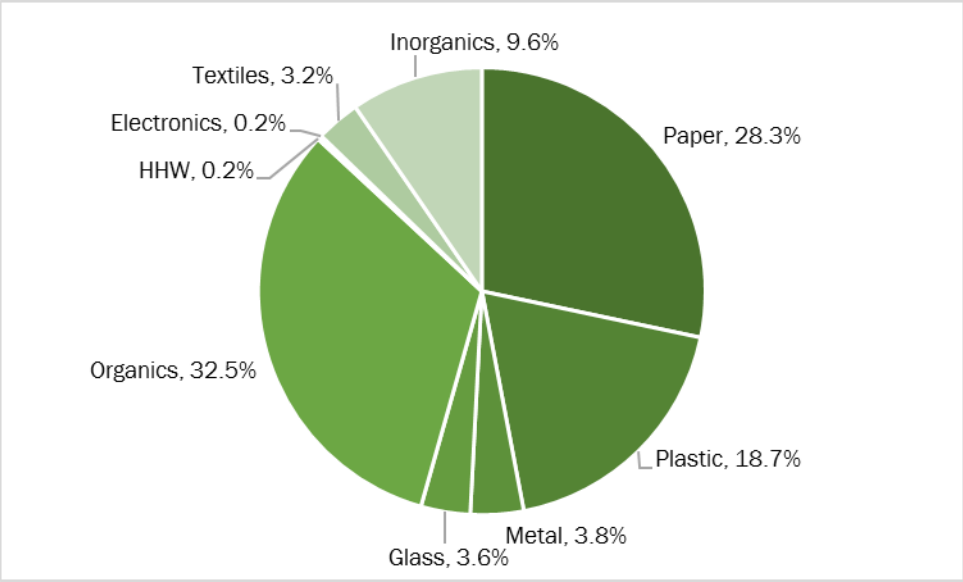
Figure I-1 Gate Survey Results



I 2. MSW CHARACTERIZATION RESULTS

Nine loads of MSW were sorted in the fall season and eight in the spring. The aggregate composition of the sampled loads is presented in Figure I-2. Organics was determined to be the largest component of the waste, at 32.5 percent, with over 28 percent being Paper materials.

Figure I-2 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table I-2. This table provides the mean composition and 90 percent confidence intervals from the study, and applies the results to the estimated 54,752 tons of MSW found to be disposed at the facility based on gate survey results.

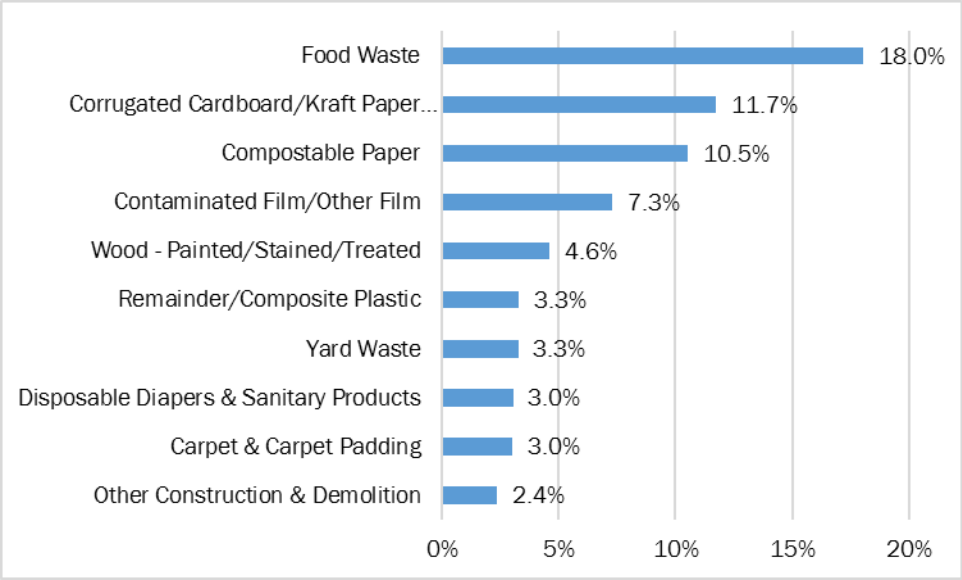
Table I-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**28.3%**	**7.8%**	**18,654**	**Plastic**	**18.7%**	**6.2%**	**12,300**
OCC/Kraft Paper	11.7%	8.7%	7,717	PET (#1) Bottles/Jars	1.5%	0.4%	983
Newsprint	0.7%	0.3%	434	PET (#1) Non-Bottle containers	0.5%	0.2%	301
Magazines	0.7%	0.3%	452	HDPE (#2) Natural Containers	0.4%	0.1%	294
High Grade Office Paper	1.1%	0.7%	702	HDPE (#2) Colored Containers	0.5%	0.3%	359
Mixed Recyclable Paper	2.3%	0.8%	1,483	Clean Film Bags	0.2%	0.1%	140
Compostable Paper	10.5%	2.2%	6,935	Clean Indust'l/Com'l Film	1.7%	2.0%	1,108
Remainder/Composite Paper	1.4%	0.9%	932	Contaminated Film/Other Film	7.3%	4.1%	4,793
Glass	**3.6%**	**1.8%**	**2,345**	Plastic Containers #3 thru #7	0.8%	0.2%	541
Clear Glass Containers	1.4%	0.5%	910	Expanded Polystyrene #6	1.3%	0.7%	835
Brown Glass Containers	0.8%	0.5%	500	Bulky Durable Plastic Products	1.2%	0.6%	776
Green Glass Containers	0.3%	0.1%	170	Remainder/Composite Plastic	3.3%	1.7%	2,170
Remainder/Composite Glass	1.2%	1.3%	765	**Textiles**	**3.2%**	**1.9%**	**2,096**
Metal	**3.8%**	**0.9%**	**2,533**	Textiles - Clothing	1.4%	1.0%	942
Aluminum Cans & Containers	0.6%	0.2%	396	Textiles - Non-Clothing	0.7%	0.5%	466
Other Aluminum	0.3%	0.2%	226	Shoes/Belts/Leather	1.0%	0.7%	688
Tin/Steel Containers	1.4%	0.4%	934	**Inorganics**	**9.6%**	**2.9%**	**6,315**
Other Ferrous - Magnetic	1.3%	0.8%	862	Fines	1.2%	0.6%	809
Other Non-Ferrous	0.1%	0.1%	49	Drywall/Gypsum Board	0.0%	0.0%	17
Oil Filters	0.1%	0.1%	66	Asphalt, Brick, Concrete & Rocks	0.1%	0.1%	79
Organics	**32.5%**	**3.7%**	**21,414**	Carpet & Carpet Padding	3.0%	2.3%	1,976
Food Waste	18.0%	4.9%	11,866	Other Construction & Demolition	2.4%	1.8%	1,569
Wood - Clean/Untreated	2.1%	2.0%	1,365	Bulky Items/Furniture	0.1%	0.1%	60
Wood - Painted/Stained/Treate	4.6%	2.9%	3,026	Mattresses/Boxsprings	1.2%	2.0%	812
Diapers/Sanitary Products	3.0%	1.2%	2,007	Tires	1.2%	1.7%	780
Yard Waste	3.3%	3.3%	2,151	Other/Not Classified	0.3%	0.3%	213
Remainder/Composite Organic	1.5%	1.1%	999	**HHW**	**0.2%**	**0.1%**	**107**
Electronics	**0.2%**	**0.1%**	**107**	Household Hazardous Waste	0.2%	0.1%	107
Electronic Waste	0.2%	0.1%	107	**Grand Total**	**100%**		**54,752**
				No. of Samples	***17***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure I-3 shows the ten most commonly occurring materials in the MSW sorted at Joplin. Compostable materials Food Waste and Compostable Paper are two of the top three, over 28 percent combined.

Figure I-3 Top 10 Materials in MSW

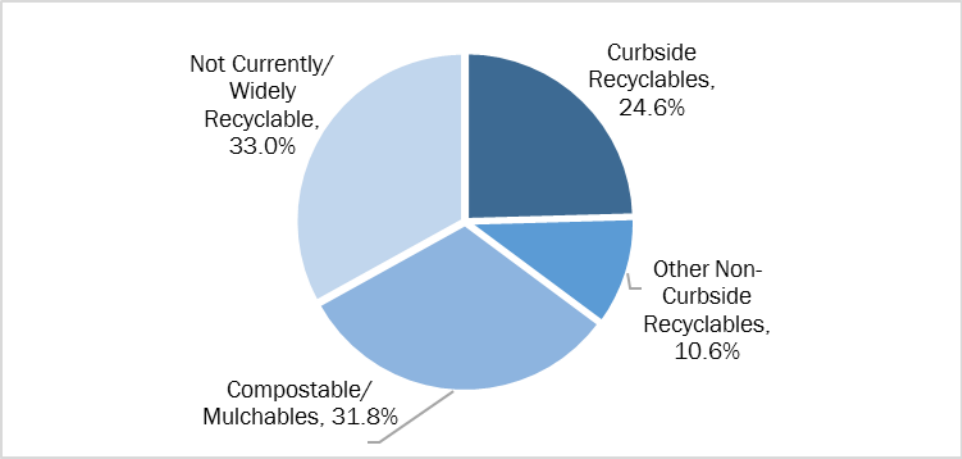


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Joplin Transfer Station sort activity results are displayed in Figure I-4. As shown, 33 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 67 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure I-4 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table I-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results.

Table I-3 Detailed Results

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l
Paper	**28.3%**	**23.3%**	**34.8%**	**Plastic**	**18.7%**	**15.0%**	**24.6%**
OCC/Kraft Paper	11.7%	4.2%	21.8%	PET (#1) Bottles/Jars	1.5%	2.0%	0.8%
Newsprint	0.7%	1.1%	0.0%	PET (#1) Non-Bottle containers	0.5%	0.7%	0.1%
Magazines	0.7%	1.0%	0.2%	HDPE (#2) Natural Containers	0.4%	0.5%	0.3%
High Grade Office Paper	1.1%	1.2%	0.8%	HDPE (#2) Colored Containers	0.5%	0.5%	0.6%
Mixed Recyclable Paper	2.3%	2.3%	2.1%	Clean Film Bags	0.2%	0.3%	0.1%
Compostable Paper	10.5%	11.7%	8.8%	Clean Indust'l/Com'l Film	1.7%	0.0%	4.2%
Remainder/Composite Paper	1.4%	1.6%	1.1%	Contaminated Film/Other Film	7.3%	5.0%	10.9%
Glass	**3.6%**	**5.1%**	**1.3%**	Plastic Containers #3 thru #7	0.8%	1.0%	0.6%
Clear Glass Containers	1.4%	1.9%	0.6%	Expanded Polystyrene #6	1.3%	0.9%	1.9%
Brown Glass Containers	0.8%	1.1%	0.2%	Bulky Durable Plastic Products	1.2%	1.4%	0.9%
Green Glass Containers	0.3%	0.3%	0.2%	Remainder/Composite Plastic	3.3%	2.6%	4.3%
Remainder/Composite Glass	1.2%	1.8%	0.3%	**Textiles**	**3.2%**	**5.0%**	**0.6%**
Metal	**3.8%**	**5.2%**	**1.8%**	Textiles - Clothing	1.4%	2.3%	0.2%
Aluminum Cans & Containers	0.6%	0.7%	0.4%	Textiles - Non-Clothing	0.7%	1.1%	0.2%
Other Aluminum	0.3%	0.3%	0.3%	Shoes/Belts/Leather	1.0%	1.6%	0.2%
Tin/Steel Containers	1.4%	1.8%	0.8%	**Inorganics**	**9.6%**	**11.6%**	**6.7%**
Other Ferrous - Magnetic	1.3%	2.1%	0.2%	Fines	1.2%	1.7%	0.5%
Other Non-Ferrous	0.1%	0.1%	0.0%	Drywall/Gypsum Board	0.0%	0.0%	0.0%
Oil Filters	0.1%	0.2%	0.0%	Asphalt, Brick, Concrete & Rocks	0.1%	0.1%	0.1%
Organics	**32.5%**	**34.5%**	**29.9%**	Carpet & Carpet Padding	3.0%	5.0%	0.0%
Food Waste	18.0%	20.3%	15.0%	Other Construction & Demolition	2.4%	1.8%	3.2%
Wood - Clean/Untreated	2.1%	0.5%	4.4%	Bulky Items/Furniture	0.1%	0.1%	0.1%
Wood - Painted/Stained/Treated	4.6%	3.0%	6.9%	Mattresses/Boxsprings	1.2%	2.1%	0.0%
Diapers/Sanitary Products	3.0%	3.6%	2.2%	Tires	1.2%	0.2%	2.6%
Yard Waste	3.3%	5.5%	0.0%	Other/Not Classified	0.3%	0.4%	0.2%
Remainder/Composite Organic	1.5%	1.6%	1.5%	**HHW**	**0.2%**	**0.1%**	**0.2%**
Electronics	**0.2%**	**0.2%**	**0.1%**	Household Hazardous Waste	0.2%	0.1%	0.2%
Electronic Waste	0.2%	0.2%	0.1%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**17**	**9**	**8**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

I 3. VISUAL SURVEY RESULTS

Figure I-5 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes were found to be MSW/Other Wastes.

Figure I-5 Composition of Construction Debris

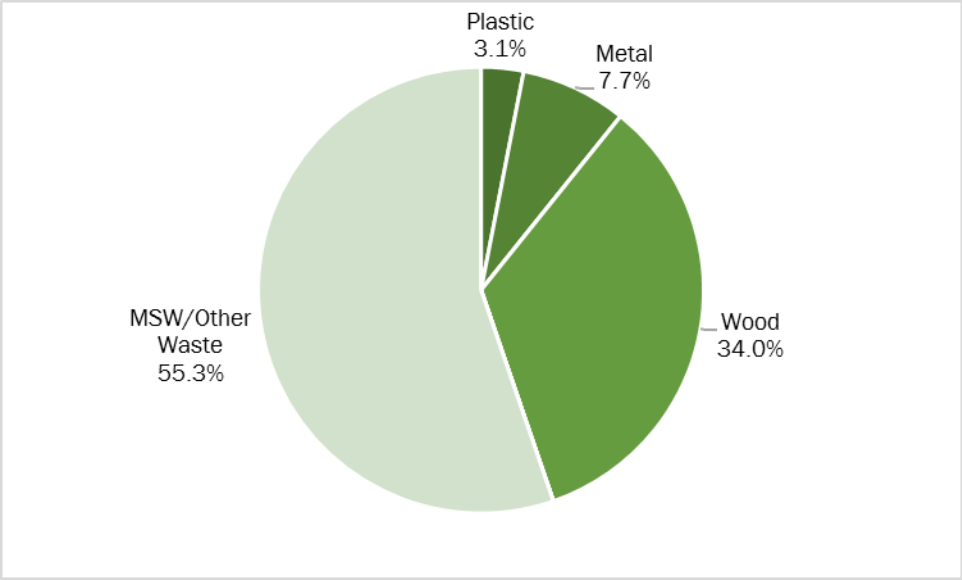


Figure I-6 summarizes the composition of Demolition debris.

Figure I-6 Composition of Demolition Debris

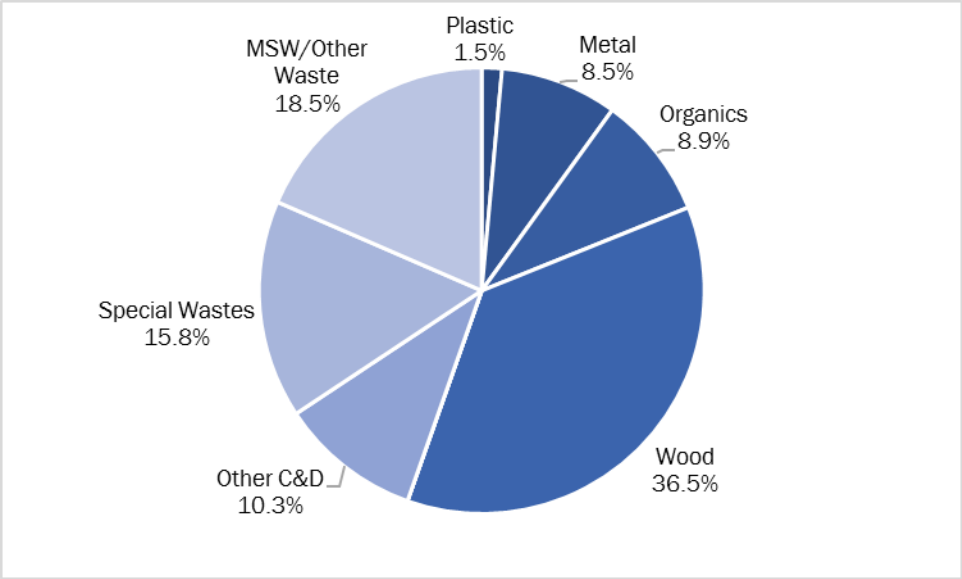


Figure I-7 provides the composition of Industrial materials. Similar to the Construction loads, Industrial had a substantial amount of MSW/Other Wastes mixed in the loads.

Figure I-7 Industrial Waste Composition

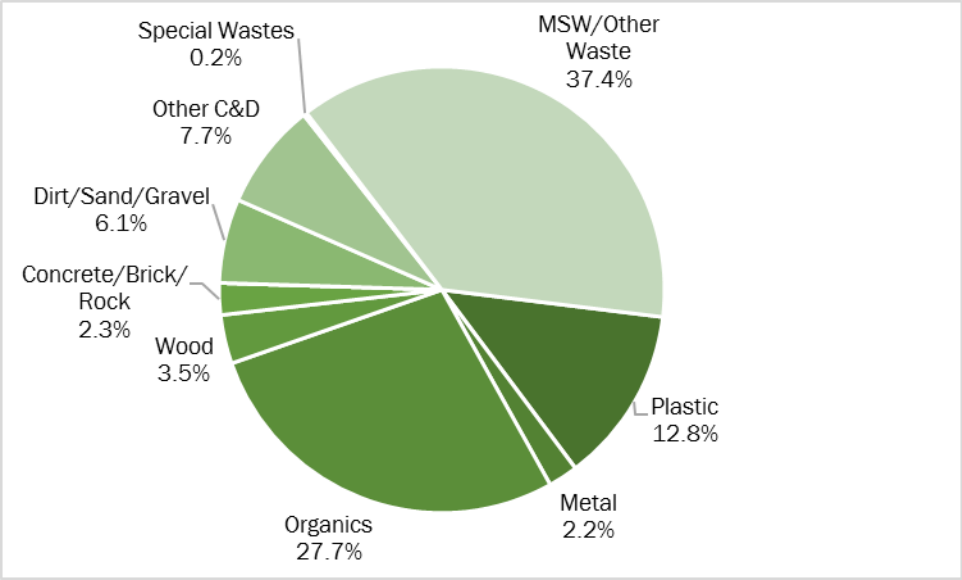


Table I-4 provides the detailed composition of the three material groups.

Table I-4 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	30.9%	1.1%	5.2%
MSW/Other Waste	Unflattened OCC	4.2%	0.0%	1.1%
MSW/Other Waste	R/C and Other Paper	0.0%	0.4%	2.5%
Plastic	Plastic Bottles (Recyclable)	0.4%	0.0%	2.9%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.1%
Plastic	HDPE Buckets (unstacked)	0.2%	0.0%	0.3%
Plastic	Clean Recoverable Film	0.1%	0.0%	7.5%
Plastic	R/C and Other Plastic	2.3%	1.2%	1.6%
MSW/Other Waste	All Glass	0.0%	0.5%	0.6%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	7.7%	5.2%	2.0%
Metal	Other Non-ferrous Metal	0.0%	1.6%	0.1%
Metal	HVAC Ducting	0.0%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	6.3%	0.0%
Organics	Branches/Limbs	0.0%	0.9%	0.0%
Organics	R/C and Other Organics	0.0%	0.0%	26.9%
Wood	Pallets - Standard	25.5%	0.0%	2.6%
Wood	Pallets/Crates/Heavy	0.0%	0.5%	0.0%
Wood	Untreated/Unpainted Lumber	8.5%	9.5%	0.3%
Wood	Treated/Painted/Processed Wood	0.0%	9.7%	0.0%
Wood	Engineered Wood	0.0%	2.7%	0.0%
Wood	Wood Furniture	0.0%	5.9%	0.0%
Wood	Other Wood	0.0%	0.9%	0.5%
Other C&D	Carpet	0.0%	0.0%	0.1%
Other C&D	Carpet Padding	0.0%	0.0%	0.1%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	0.0%	0.0%	2.2%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	0.0%	20.1%	1.5%
Other C&D	Ceiling Tiles	0.0%	0.8%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.0%	0.0%
Gypsum Board	Painted Gypsum Board	0.0%	0.0%	1.6%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	0.0%	0.0%	5.9%
Other C&D	Insulation	0.0%	0.5%	0.6%
Other C&D	R/C and Other C&D	0.0%	6.9%	6.6%
MSW/Other Waste	Electronics	0.0%	5.1%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	4.6%	0.0%
Special Wastes	Bulky Wastes/Furniture	0.0%	12.6%	0.2%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	0.0%	0.0%
MSW/Other Waste	Mixed MSW	20.1%	3.1%	26.8%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX J

LEE'S SUMMIT LANDFILL

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APPENDIX J -WASTE COMPOSITION AT LEE'S SUMMIT LANDFILL

J 1. OVERVIEW

The Lee's Summit Sanitary Landfill, located in the large metro Kansas City area in Jackson County, is owned by the City of Lee's Summit and operated by Summit Waste Systems/HES, and is part of Solid Waste District Region E. The facility accepted 116,444 tons of waste during CY2016. This site was included in both seasons of the Manual Sorting phase of this study, but not the Gate/Visual non-MSW Surveying phase. Table J-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

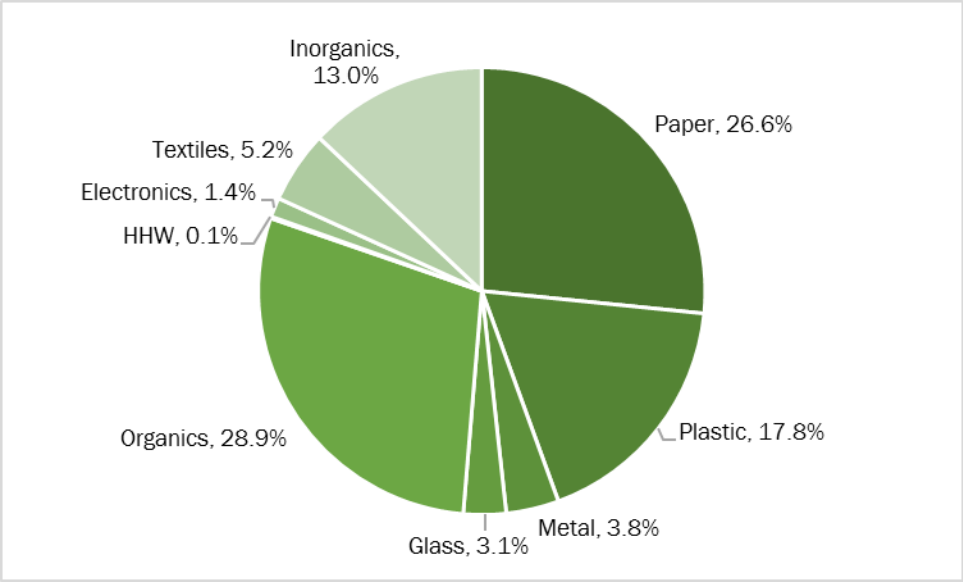
Table J-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	16 Samples	3,475 Lbs	16 Samples	4,110 Lbs
Visual Surveys	N/A	N/A	N/A	N/A
Gate Surveys	N/A	N/A	N/A	N/A

J 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in each of the Fall and Spring seasons. The aggregate composition of the sampled loads is presented in Figure J-1. Organics was determined to be the largest component of the waste, at almost 29 percent, with almost 27 percent being Paper materials.

Figure J-1 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in

Table J-2. This table provides the mean composition and 90 percent confidence intervals from the study.

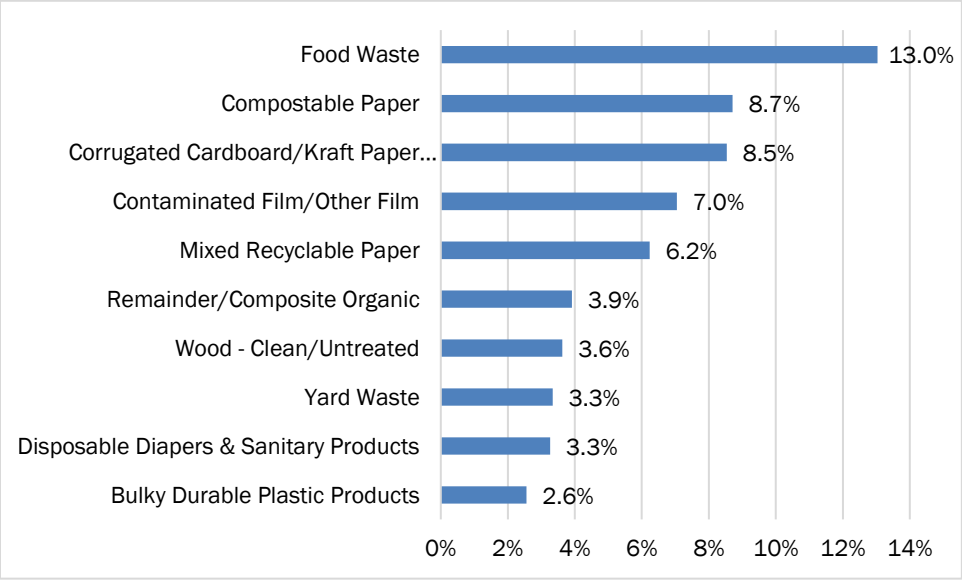
Table J-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**26.6%**	**3.5%**	**30,876**	**Plastic**	**17.8%**	**2.7%**	**20,692**
OCC/Kraft Paper	8.5%	3.4%	9,911	PET (#1) Bottles/Jars	1.3%	0.3%	1,536
Newsprint	0.5%	0.3%	615	PET (#1) Non-Bottle containers	0.1%	0.1%	85
Magazines	0.7%	0.3%	795	HDPE (#2) Natural Containers	0.6%	0.2%	659
High Grade Office Paper	1.1%	0.5%	1,224	HDPE (#2) Colored Containers	0.7%	0.4%	777
Mixed Recyclable Paper	6.2%	1.6%	7,236	Clean Film Bags	0.1%	0.1%	164
Compostable Paper	8.7%	2.1%	10,113	Clean Indust'l/Com'l Film	1.0%	1.6%	1,149
Remainder/Composite Paper	0.8%	0.3%	983	Contaminated Film/Other Film	7.0%	1.9%	8,174
Glass	**3.1%**	**0.9%**	**3,582**	Plastic Containers #3 thru #7	1.4%	0.3%	1,589
Clear Glass Containers	1.6%	0.7%	1,800	Expanded Polystyrene #6	0.8%	0.1%	871
Brown Glass Containers	0.6%	0.4%	680	Bulky Durable Plastic Products	2.6%	1.6%	2,964
Green Glass Containers	0.3%	0.2%	346	Remainder/Composite Plastic	2.3%	0.5%	2,726
Remainder/Composite Glass	0.7%	0.3%	756	**Textiles**	**5.2%**	**2.6%**	**6,064**
Metal	**3.8%**	**1.2%**	**4,432**	Textiles - Clothing	2.4%	1.6%	2,801
Aluminum Cans & Containers	0.7%	0.2%	813	Textiles - Non-Clothing	2.2%	1.2%	2,600
Other Aluminum	0.4%	0.1%	492	Shoes/Belts/Leather	0.6%	0.4%	663
Tin/Steel Containers	1.1%	0.3%	1,230	**Inorganics**	**13.0%**	**4.0%**	**15,058**
Other Ferrous - Magnetic	1.4%	1.1%	1,617	Fines	2.1%	0.5%	2,384
Other Non-Ferrous	0.2%	0.2%	280	Drywall/Gypsum Board	2.2%	2.7%	2,517
Oil Filters	0.0%	0.0%	-	Asphalt, Brick, Concrete & Rock	0.7%	0.6%	802
Organics	**28.9%**	**3.1%**	**33,601**	Carpet & Carpet Padding	1.8%	1.8%	2,130
Food Waste	13.0%	3.1%	15,132	Other Construction & Demolitior	0.6%	0.4%	744
Wood - Clean/Untreated	3.6%	2.7%	4,211	Bulky Items/Furniture	2.4%	2.3%	2,746
Wood - Painted/Stained/Treate	1.8%	1.4%	2,049	Mattresses/Boxsprings	1.0%	1.5%	1,112
Diapers/Sanitary Products	3.3%	2.0%	3,788	Tires	2.0%	3.1%	2,286
Yard Waste	3.3%	2.2%	3,875	Other/Not Classified	0.3%	0.2%	338
Remainder/Composite Organic	3.9%	1.7%	4,545	**HHW**	**0.1%**	**0.1%**	**146**
Electronics	**1.4%**	**1.4%**	**1,616**	Household Hazardous Waste	0.1%	0.1%	146
Electronic Waste	1.4%	1.2%	1,616	**Grand Total**	**100%**		
				No. of Samples	***16***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure J-2 shows the ten most commonly occurring materials in the MSW sorted at Lee's Summit. Food Waste and Compostable Paper, both compostable, as the top two materials combine for nearly 22 percent of the waste.

Figure J-2 Top 10 Materials in MSW

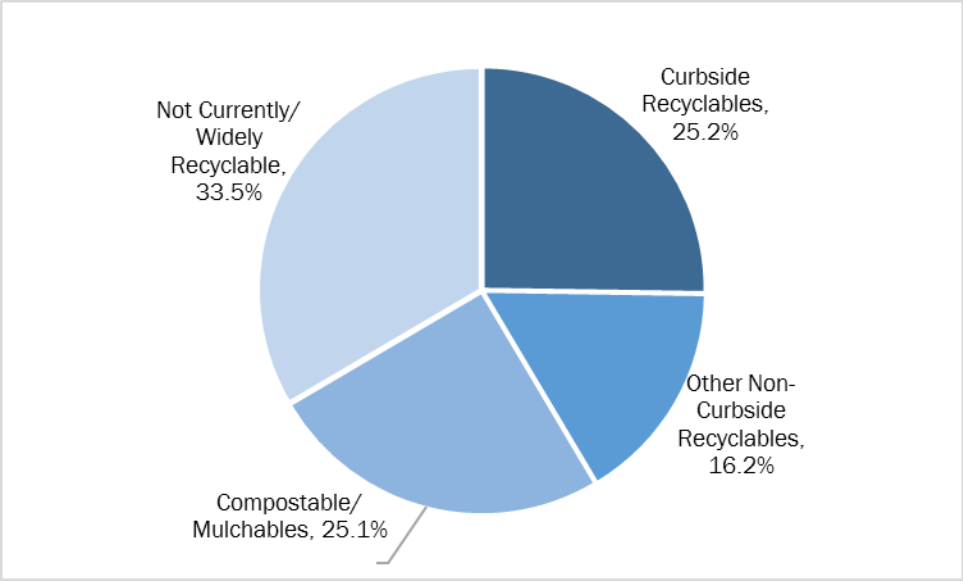


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Lee's Summit sort activity results are displayed in Figure J-3. As shown, less than 34 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 66 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure J-3 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table J-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results. This table also shows the results of any MSW sorting that was performed in the 2008 Study (note that the 2008 Study sorted into a smaller number of material categories).

Table J-3 Composition Results by Generator Sector

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	2008 Agg-regate
Paper	**26.6%**	**21.9%**	**32.5%**	**33.7%**
OCC/Kraft Paper	8.5%	3.9%	14.5%	8.0%
Newsprint	0.5%	0.6%	0.5%	6.2%
Magazines	0.7%	0.6%	0.8%	4.2%
High Grade Office Paper	1.1%	0.9%	1.2%	6.0%
Mixed Recyclable Paper	6.2%	7.4%	4.8%	9.3%
Compostable Paper	8.7%	7.6%	10.1%	
Remainder/Composite Paper	0.8%	1.0%	0.6%	
Glass	**3.1%**	**4.5%**	**1.2%**	**4.3%**
Clear Glass Containers	1.6%	2.5%	0.3%	2.4%
Brown Glass Containers	0.6%	0.7%	0.4%	1.3%
Green Glass Containers	0.3%	0.5%	0.0%	0.4%
Remainder/Composite Glass	0.7%	0.8%	0.5%	0.2%
Metal	**3.8%**	**4.3%**	**3.3%**	**4.7%**
Aluminum Cans & Containers	0.7%	0.7%	0.7%	1.4%
Other Aluminum	0.4%	0.4%	0.4%	0.2%
Tin/Steel Containers	1.1%	1.1%	1.0%	2.4%
Other Ferrous - Magnetic	1.4%	1.9%	0.8%	0.6%
Other Non-Ferrous	0.2%	0.2%	0.3%	0.1%
Oil Filters	0.0%	0.0%	0.0%	0.0%
Organics	**28.9%**	**29.3%**	**28.6%**	**28.7%**
Food Waste	13.0%	11.7%	14.4%	18.2%
Wood - Clean/Untreated	3.6%	0.6%	7.6%	1.6%
Wood - Painted/Stained/Treated	1.8%	2.6%	0.6%	
Diapers/Sanitary Products	3.3%	5.5%	0.5%	5.5%
Yard Waste	3.3%	4.1%	2.4%	3.4%
Remainder/Composite Organic	3.9%	4.7%	3.0%	
Electronics	**1.4%**	**1.9%**	**0.7%**	**1.3%**
Electronic Waste	1.4%	1.9%	0.7%	1.3%

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	2008 Agg-regate
Plastic	**17.8%**	**14.9%**	**21.8%**	**16.3%**
PET (#1) Bottles/Jars	1.3%	1.7%	0.8%	2.3%
PET (#1) Non-Bottle containers	0.1%	0.1%	0.0%	
HDPE (#2) Natural Containers	0.6%	0.5%	0.6%	2.1%
HDPE (#2) Colored Containers	0.7%	0.9%	0.4%	
Clean Film Bags	0.1%	0.2%	0.1%	3.6%
Clean Indust'l/Com'l Film	1.0%	0.0%	2.4%	
Contaminated Film/Other Film	7.0%	4.9%	9.8%	
Plastic Containers #3 thru #7	1.4%	1.5%	1.2%	8.3%
Expanded Polystyrene #6	0.8%	0.8%	0.7%	
Bulky Durable Plastic Products	2.6%	2.3%	3.0%	
Remainder/Composite Plastic	2.3%	2.0%	2.8%	
Textiles	**5.2%**	**8.6%**	**0.8%**	**6.1%**
Textiles - Clothing	2.4%	4.2%	0.0%	6.1%
Textiles - Non-Clothing	2.2%	3.5%	0.5%	
Shoes/Belts/Leather	0.6%	0.9%	0.2%	
Inorganics	**13.0%**	**14.6%**	**11.0%**	**4.6%**
Fines	2.1%	2.1%	1.9%	0.7%
Drywall/Gypsum Board	2.2%	0.1%	5.0%	3.9%
Asphalt, Brick, Concrete & Rocks	0.7%	0.8%	0.5%	
Carpet & Carpet Padding	1.8%	2.9%	0.5%	
Other Construction & Demolition	0.6%	0.4%	0.9%	
Bulky Items/Furniture	2.4%	4.4%	0.0%	
Mattresses/Boxsprings	1.0%	0.0%	2.1%	
Tires	2.0%	3.5%	0.0%	
Other/Not Classified	0.3%	0.4%	0.2%	
HHW	**0.1%**	**0.2%**	**0.1%**	**0.4%**
Household Hazardous Waste	0.1%	0.2%	0.1%	0.4%
Grand Total	**100%**	**100%**	**100%**	**100%**
No. of Samples	**16**	**9**	**7**	**16**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

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APPENDIX K

LEMONS LANDFILL

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APPENDIX K - WASTE COMPOSITION AT LEMONS LANDFILL

K 1. OVERVIEW

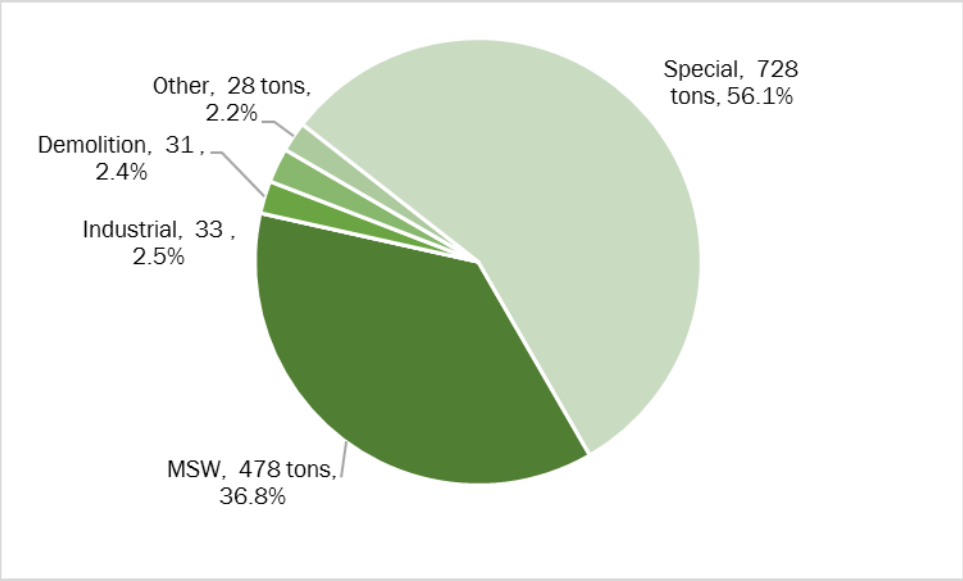
The Lemons Sanitary Landfill, located in rural Stoddard County and part of Solid Waste District Region S, is owned and operated by Republic Services. The facility accepted 197,135 tons of waste during CY2016. Lemons hosted one season of MSW manual sorting and the Gate/Visual non-MSW Surveying phase. Table K-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table K-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	8 Samples	1,721 Lbs	16 Samples	4,110 Lbs
Visual Surveys	28 Loads	161 Tons	223 Loads	2,263 Tons
Gate Surveys	99 Loads	1,297 Tons	223 Loads	2,263 Tons

Figure K-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure K-1 Gate Survey Results

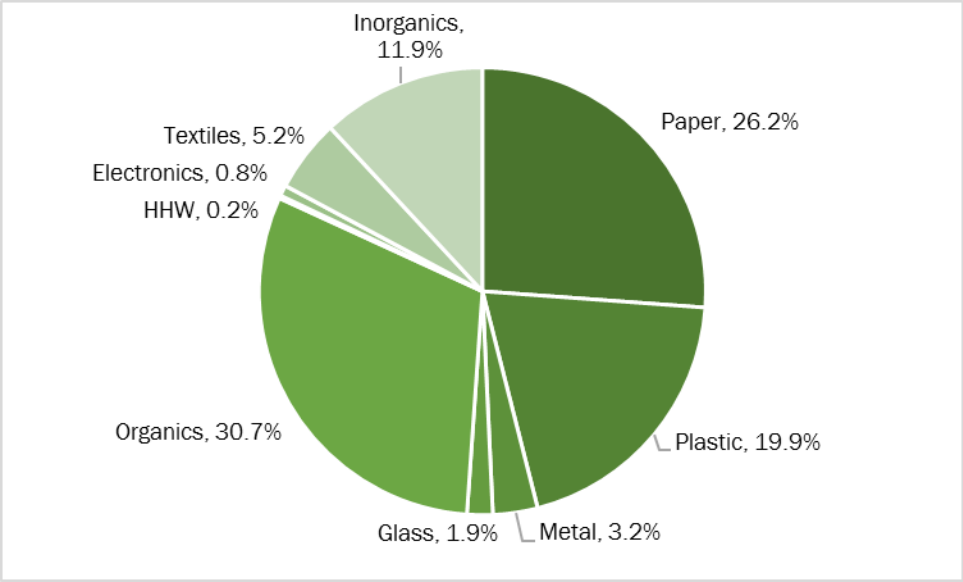


As shown, incoming waste at Lemons was predominantly Special waste, with 39 large volume loads of Contaminated Soil arriving from a project in the area. The mix of waste types observed in 2017 varies from the findings of the 2008 Study, where MSW was found to be almost 60 percent and Special Waste less than three percent of inbound wastes.

K 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted at Lemons during the fall season. The aggregate composition of the sampled loads is presented in Figure K-2. Organics was determined to be the largest component of the waste, at almost 31 percent, with over 26 percent being Paper materials.

Figure K-2 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table K-2.

This table provides the mean composition and 90 percent confidence intervals from the study, and applies the results to the estimated 72,608 tons of MSW found to be disposed at the facility based on gate survey results.

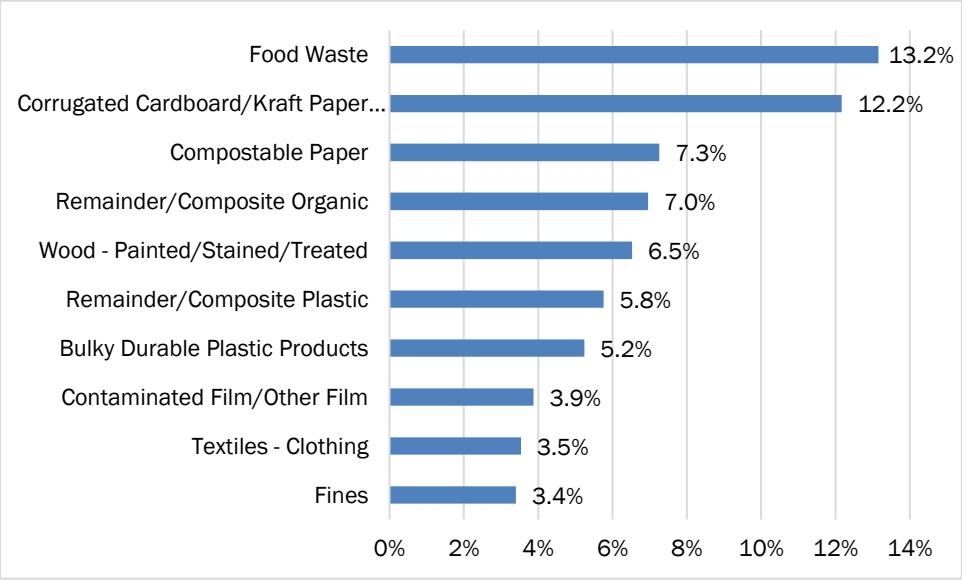
Table K-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**26.2%**	**4.3%**	**51,574**	**Plastic**	**19.9%**	**6.5%**	**39,158**
OCC/Kraft Paper	12.2%	6.3%	23,980	PET (#1) Bottles/Jars	1.6%	0.6%	3,166
Newsprint	1.0%	0.7%	2,006	PET (#1) Non-Bottle containers	0.0%	0.0%	83
Magazines	1.1%	0.5%	2,172	HDPE (#2) Natural Containers	0.4%	0.1%	694
High Grade Office Paper	1.6%	0.8%	3,187	HDPE (#2) Colored Containers	0.8%	0.4%	1,555
Mixed Recyclable Paper	2.5%	0.7%	4,954	Clean Film Bags	0.4%	0.2%	707
Compostable Paper	7.3%	2.4%	14,311	Clean Indust'l/Com'l Film	0.2%	0.2%	409
Remainder/Composite Paper	0.5%	0.3%	965	Contaminated Film/Other Film	3.9%	1.0%	7,643
Glass	**1.9%**	**1.4%**	**3,668**	Plastic Containers #3 thru #7	0.7%	0.2%	1,287
Clear Glass Containers	1.3%	1.2%	2,659	Expanded Polystyrene #6	1.0%	0.4%	1,919
Brown Glass Containers	0.2%	0.1%	394	Bulky Durable Plastic Products	5.2%	3.5%	10,337
Green Glass Containers	0.1%	0.1%	168	Remainder/Composite Plastic	5.8%	6.7%	11,358
Remainder/Composite Glass	0.2%	0.3%	447	**Textiles**	**5.2%**	**2.3%**	**10,343**
Metal	**3.2%**	**0.7%**	**6,368**	Textiles - Clothing	3.5%	2.3%	6,980
Aluminum Cans & Containers	0.9%	0.3%	1,683	Textiles - Non-Clothing	1.0%	0.5%	2,023
Other Aluminum	0.1%	0.1%	264	Shoes/Belts/Leather	0.7%	0.4%	1,340
Tin/Steel Containers	1.3%	0.5%	2,596	**Inorganics**	**11.9%**	**5.2%**	**23,520**
Other Ferrous - Magnetic	0.7%	0.5%	1,369	Fines	3.4%	1.3%	6,709
Other Non-Ferrous	0.2%	0.2%	307	Drywall/Gypsum Board	0.2%	0.2%	303
Oil Filters	0.1%	0.1%	149	Asphalt, Brick, Concrete & Rock	1.3%	1.6%	2,621
Organics	**30.7%**	**4.0%**	**60,554**	Carpet & Carpet Padding	2.3%	3.5%	4,495
Food Waste	13.2%	5.6%	25,935	Other Construction & Demolitior	1.2%	1.3%	2,392
Wood - Clean/Untreated	0.1%	0.1%	185	Bulky Items/Furniture	2.9%	3.6%	5,808
Wood - Painted/Stained/Treate	6.5%	5.7%	12,871	Mattresses/Boxsprings	0.0%	0.0%	-
Diapers/Sanitary Products	3.1%	2.1%	6,199	Tires	0.0%	0.0%	-
Yard Waste	0.8%	1.2%	1,654	Other/Not Classified	0.6%	0.5%	1,192
Remainder/Composite Organic	7.0%	5.9%	13,709	**HHW**	**0.2%**	**0.1%**	**418**
Electronics	**0.8%**	**1.3%**	**1,532**	Household Hazardous Waste	0.2%	0.2%	418
Electronic Waste	0.8%	1.0%	1,532	**Grand Total**	**100%**		**72,608**
				No. of Samples	***8***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure K-3 shows the ten most commonly occurring materials in the MSW sorted at Lemons. Food Waste and Corrugated Cardboard/Kraft Paper combined constitute over a fourth of the waste.

Figure K-3 Top 10 Materials in MSW

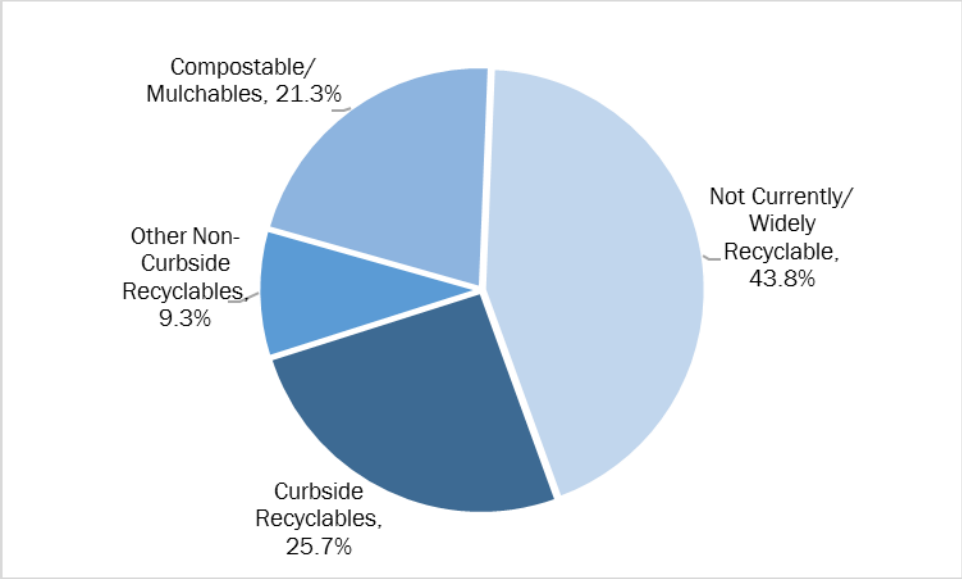


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Lemons sort activity results are displayed in Figure K-4. As shown, about 44 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 56 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure K-4 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table K-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results.

Table K-3 Detailed Results

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l
Paper	**26.2%**	**23.9%**	**28.4%**	**Plastic**	**19.9%**	**17.3%**	**22.4%**
OCC/Kraft Paper	12.2%	4.1%	20.4%	PET (#1) Bottles/Jars	1.6%	2.4%	0.8%
Newsprint	1.0%	2.0%	0.0%	PET (#1) Non-Bottle containers	0.0%	0.1%	0.0%
Magazines	1.1%	1.7%	0.5%	HDPE (#2) Natural Containers	0.4%	0.5%	0.2%
High Grade Office Paper	1.6%	1.5%	1.7%	HDPE (#2) Colored Containers	0.8%	1.2%	0.3%
Mixed Recyclable Paper	2.5%	3.3%	1.7%	Clean Film Bags	0.4%	0.6%	0.1%
Compostable Paper	7.3%	10.5%	4.0%	Clean Indust'l/Com'l Film	0.2%	0.0%	0.4%
Remainder/Composite Paper	0.5%	0.8%	0.2%	Contaminated Film/Other Film	3.9%	4.5%	3.2%
Glass	**1.9%**	**3.0%**	**0.7%**	Plastic Containers #3 thru #7	0.7%	0.9%	0.4%
Clear Glass Containers	1.3%	2.4%	0.2%	Expanded Polystyrene #6	1.0%	1.3%	0.6%
Brown Glass Containers	0.2%	0.2%	0.2%	Bulky Durable Plastic Products	5.2%	4.3%	6.2%
Green Glass Containers	0.1%	0.2%	0.0%	Remainder/Composite Plastic	5.8%	1.5%	10.1%
Remainder/Composite Glass	0.2%	0.1%	0.3%	**Textiles**	**5.2%**	**7.0%**	**3.4%**
Metal	**3.2%**	**3.7%**	**2.7%**	Textiles - Clothing	3.5%	5.3%	1.8%
Aluminum Cans & Containers	0.9%	1.1%	0.6%	Textiles - Non-Clothing	1.0%	0.9%	1.1%
Other Aluminum	0.1%	0.2%	0.1%	Shoes/Belts/Leather	0.7%	0.8%	0.5%
Tin/Steel Containers	1.3%	1.7%	0.9%	**Inorganics**	**11.9%**	**16.8%**	**7.3%**
Other Ferrous - Magnetic	0.7%	0.3%	1.1%	Fines	3.4%	4.7%	2.1%
Other Non-Ferrous	0.2%	0.3%	0.0%	Drywall/Gypsum Board	0.2%	0.1%	0.2%
Oil Filters	0.1%	0.1%	0.0%	Asphalt, Brick, Concrete & Rocks	1.3%	0.6%	2.1%
Organics	**30.7%**	**26.4%**	**35.0%**	Carpet & Carpet Padding	2.3%	4.6%	0.0%
Food Waste	13.2%	13.5%	12.9%	Other Construction & Demolition	1.2%	0.7%	1.8%
Wood - Clean/Untreated	0.1%	0.2%	0.0%	Bulky Items/Furniture	2.9%	5.3%	0.7%
Wood - Painted/Stained/Treated	6.5%	2.7%	10.4%	Mattresses/Boxsprings	0.0%	0.0%	0.0%
Diapers/Sanitary Products	3.1%	5.9%	0.4%	Tires	0.0%	0.0%	0.0%
Yard Waste	0.8%	1.7%	0.0%	Other/Not Classified	0.6%	0.7%	0.5%
Remainder/Composite Organic	7.0%	2.4%	11.3%	**HHW**	**0.2%**	**0.4%**	**0.0%**
Electronics	**0.8%**	**1.5%**	**0.0%**	Household Hazardous Waste	0.2%	0.4%	0.0%
Electronic Waste	0.8%	1.5%	0.0%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**8**	**4**	**4**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

K 3. VISUAL SURVEY RESULTS

Figure K-5 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes were found to be Concrete/Brick/Rock.

Figure K-5 Composition of Construction Debris

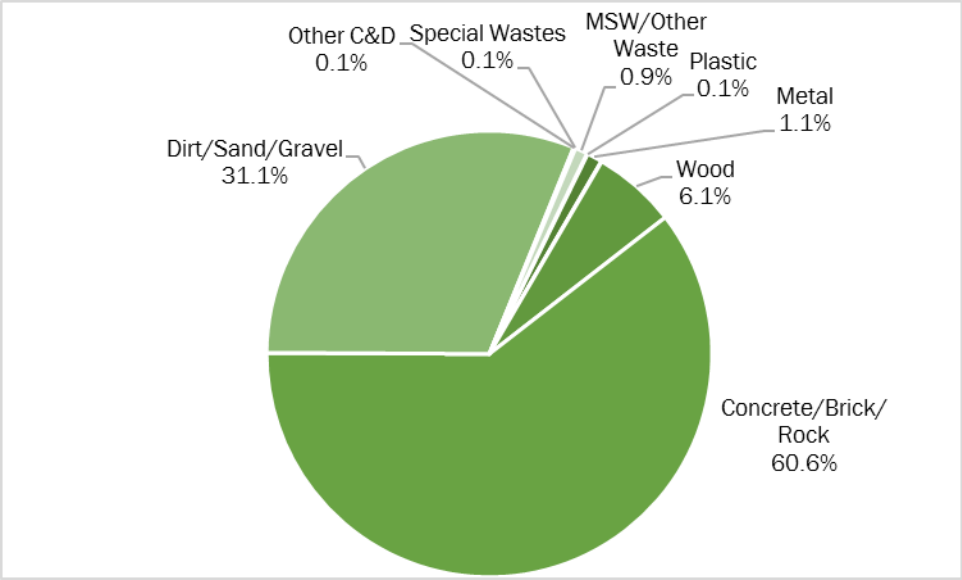


Figure K-6 summarizes the composition of Demolition debris.

Figure K-6 Composition of Demolition Debris

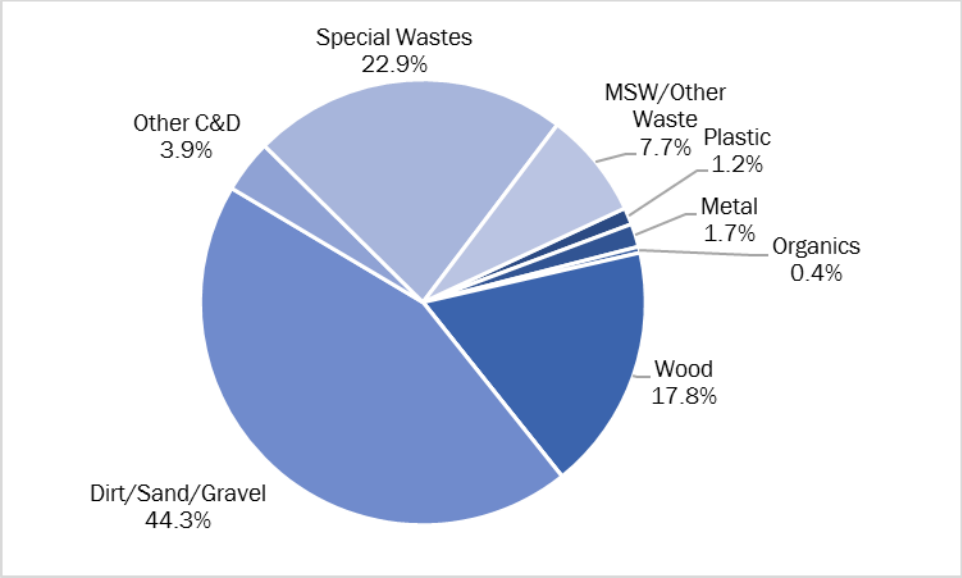


Figure K-7 provides the composition of Industrial materials. Organics constituted over 58 percent of this sector, with a substantial load included from an onion processing plant.

Figure K-7 Industrial Composition

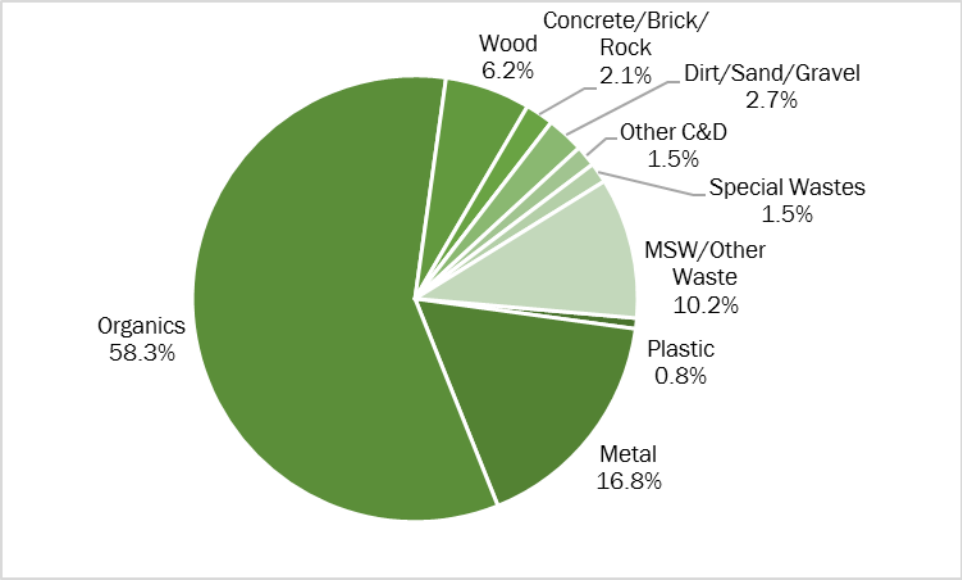


Table K-4 provides the detailed composition of the three material groups.

Table K-4 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	0.0%	0.1%	1.4%
MSW/Other Waste	Unflattened OCC	0.0%	0.2%	0.9%
MSW/Other Waste	R/C and Other Paper	0.0%	3.3%	2.7%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.0%	0.0%	0.0%
Plastic	Clean Recoverable Film	0.0%	0.0%	0.3%
Plastic	R/C and Other Plastic	0.0%	0.9%	0.4%
MSW/Other Waste	All Glass	0.3%	0.4%	0.0%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	0.9%	1.0%	15.9%
Metal	Other Non-ferrous Metal	0.2%	0.3%	0.0%
Metal	HVAC Ducting	0.0%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	0.0%	0.0%
Organics	Branches/Limbs	0.0%	0.3%	0.0%
Organics	R/C and Other Organics	0.0%	0.0%	55.4%
Wood	Pallets - Standard	0.0%	0.0%	5.0%
Wood	Pallets/Crates/Heavy	0.0%	0.0%	0.8%
Wood	Untreated/Unpainted Lumber	5.1%	2.7%	0.0%
Wood	Treated/Painted/Processed Wood	1.0%	5.8%	0.0%
Wood	Engineered Wood	0.0%	0.0%	0.0%
Wood	Wood Furniture	0.0%	4.7%	0.0%
Wood	Other Wood	0.0%	0.0%	0.0%
Other C&D	Carpet	0.0%	1.0%	0.0%
Other C&D	Carpet Padding	0.0%	0.3%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	60.3%	0.0%	2.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	0.0%	17.8%	0.0%
Other C&D	Ceiling Tiles	0.0%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.0%	4.9%
Gypsum Board	Painted Gypsum Board	0.5%	8.9%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	30.9%	32.5%	2.6%
Other C&D	Insulation	0.1%	0.1%	0.0%
Other C&D	R/C and Other C&D	0.0%	1.5%	1.5%
MSW/Other Waste	Electronics	0.2%	0.3%	0.2%
MSW/Other Waste	Items with CRTs	0.0%	0.3%	0.0%
Special Wastes	Bulky Wastes/Furniture	0.1%	16.8%	1.4%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	0.0%	0.0%
MSW/Other Waste	Mixed MSW	0.4%	1.1%	4.6%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX L

MAPLE HILL LANDFILL

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APPENDIX L - WASTE COMPOSITION AT MAPLE HILL LANDFILL

L 1. OVERVIEW

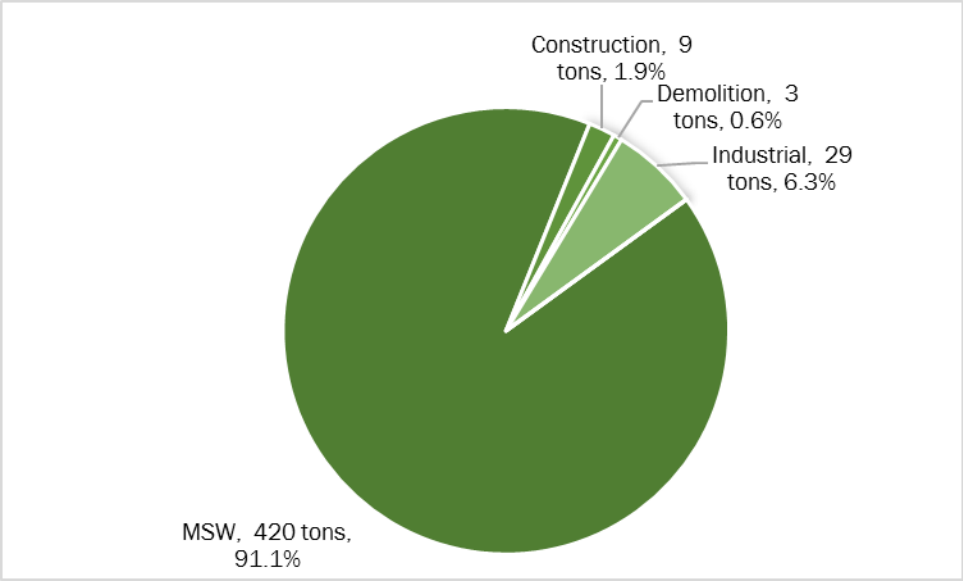
The Maple Hill Sanitary Landfill, located in the rural Macon County, is owned and operated by Advanced Disposal, and is part of Solid Waste District Region G. The facility accepted 138,017 tons of waste during CY2016. This site participated in the Gate/Visual non-MSW Surveying phase of the study, but not the MSW manual sorting phase. Table L-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table L-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	N/A	N/A	16 Samples	4,222 Lbs
Visual Surveys	25 Loads	126 Tons	343 Loads	3,891 Tons
Gate Surveys	40 Loads	460 Tons	343 Loads	3,891 Tons

Figure L-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure L-1 Gate Survey Results



As shown, incoming waste at Maple Hill is predominantly MSW, the receiving landfill for wastes from several transfer stations as well as from individual haulers and local routes. The mix of waste types observed in 2017 is considerable different from the findings from the 2008 Study, where MSW was found to be 53.7 percent of inbound wastes.

L 2. VISUAL SURVEY RESULTS

Figure L-2 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes were found to be Concrete/Brick/Rock.

Figure L-2 Composition of Construction Debris

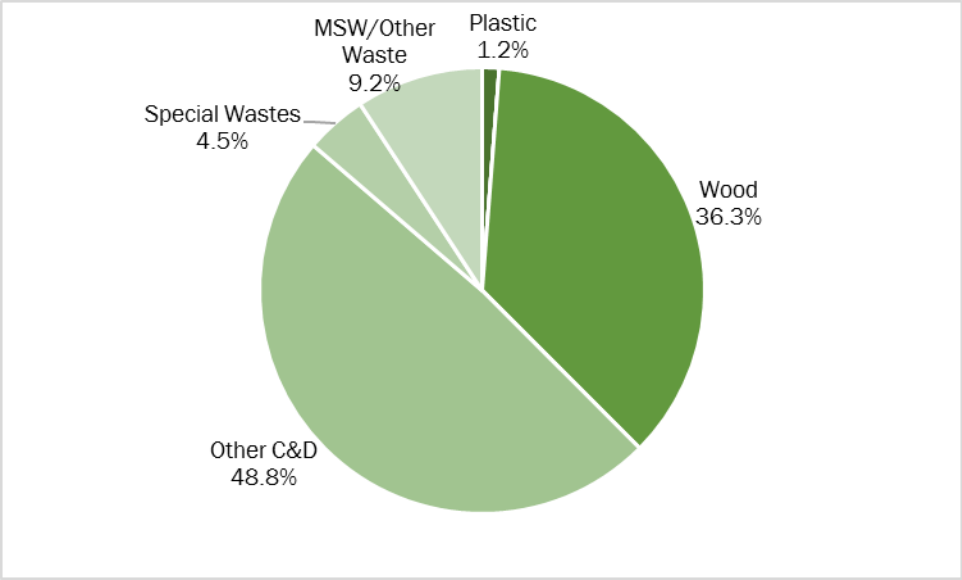


Figure L-3 summarizes the composition of Demolition debris.

Figure L-3 Composition of Demolition Debris

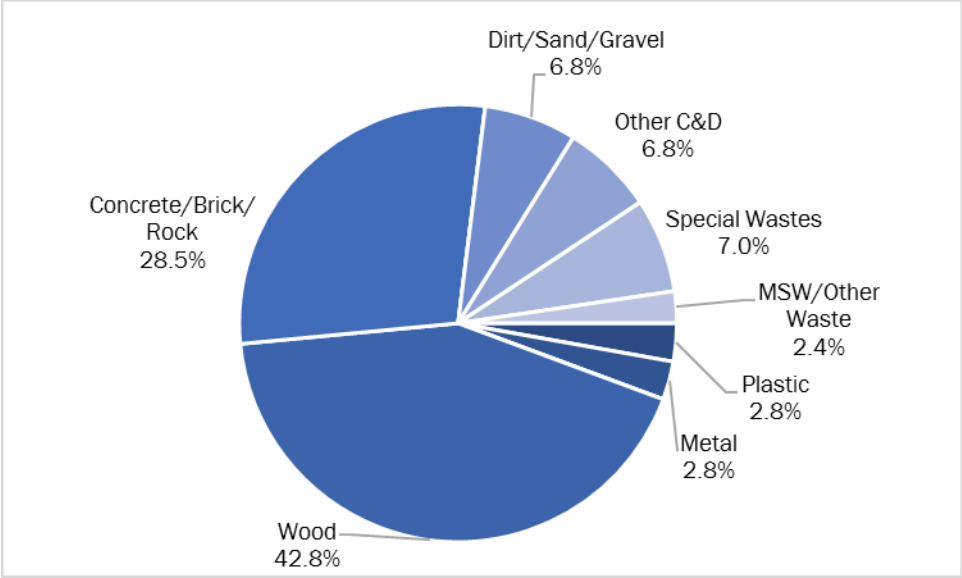


Figure L-4 provides the composition of Industrial materials. Organics constituted almost 72 percent of this sector. Maple Hill receives waste from multiple large food product manufacturers.

Figure L-4 Industrial Waste Composition

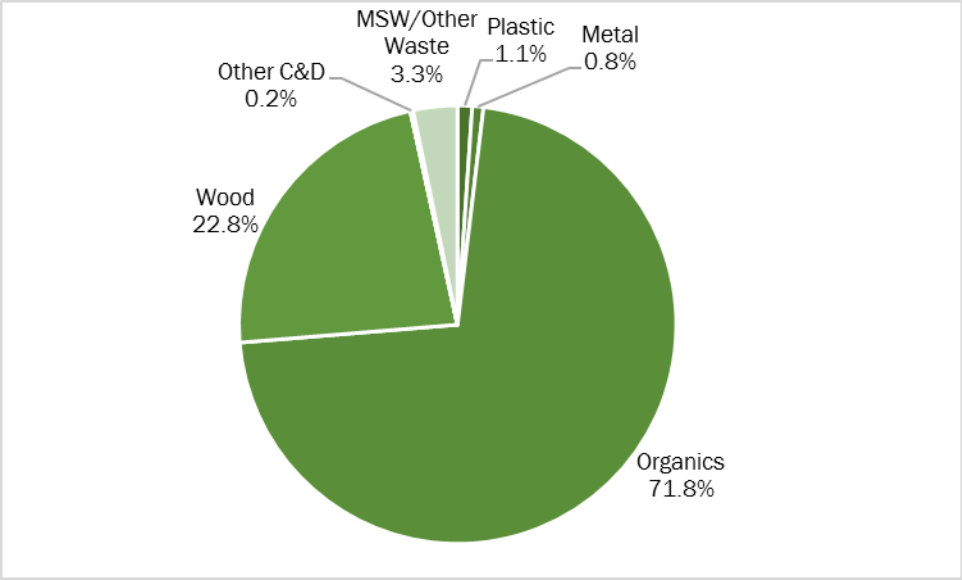


Table L-2 provides the detailed composition of the three material groups.

Table L-2 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	0.5%	0.0%	1.0%
MSW/Other Waste	Unflattened OCC	0.1%	0.1%	0.1%
MSW/Other Waste	R/C and Other Paper	0.0%	0.1%	0.4%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.2%	0.0%	0.0%
Plastic	Clean Recoverable Film	0.1%	0.0%	0.3%
Plastic	R/C and Other Plastic	0.2%	1.6%	0.8%
MSW/Other Waste	All Glass	0.0%	0.0%	0.0%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	0.0%	1.5%	0.8%
Metal	Other Non-ferrous Metal	0.0%	0.2%	0.0%
Metal	HVAC Ducting	0.0%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	0.0%	0.0%
Organics	Branches/Limbs	0.0%	0.0%	0.0%
Organics	R/C and Other Organics	0.0%	0.0%	71.8%
Wood	Pallets - Standard	0.0%	0.0%	0.0%
Wood	Pallets/Crates/Heavy	1.4%	0.0%	0.0%
Wood	Untreated/Unpainted Lumber	5.1%	1.1%	1.3%
Wood	Treated/Painted/Processed Wood	0.0%	16.5%	15.2%
Wood	Engineered Wood	5.8%	7.5%	4.3%
Wood	Wood Furniture	0.0%	0.1%	0.0%
Wood	Other Wood	2.0%	0.3%	2.0%
Other C&D	Carpet	13.2%	1.0%	0.2%
Other C&D	Carpet Padding	4.0%	0.0%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	0.0%	16.9%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	0.0%	36.3%	0.0%
Other C&D	Ceiling Tiles	0.0%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	60.5%	0.0%	0.0%
Gypsum Board	Painted Gypsum Board	0.0%	4.2%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	0.0%	4.1%	0.0%
Other C&D	Insulation	2.1%	1.1%	0.0%
Other C&D	R/C and Other C&D	0.0%	2.0%	0.0%
MSW/Other Waste	Electronics	0.0%	0.0%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	0.0%	0.0%
Special Wastes	Bulky Wastes/Furniture	1.8%	4.2%	0.0%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	0.0%	0.0%
MSW/Other Waste	Mixed MSW	3.1%	1.1%	1.8%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX M

O'FALLON TRANSFER STATION

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APPENDIX M - WASTE COMPOSITION AT O'FALLON TRANSFER STATION

M 1. OVERVIEW

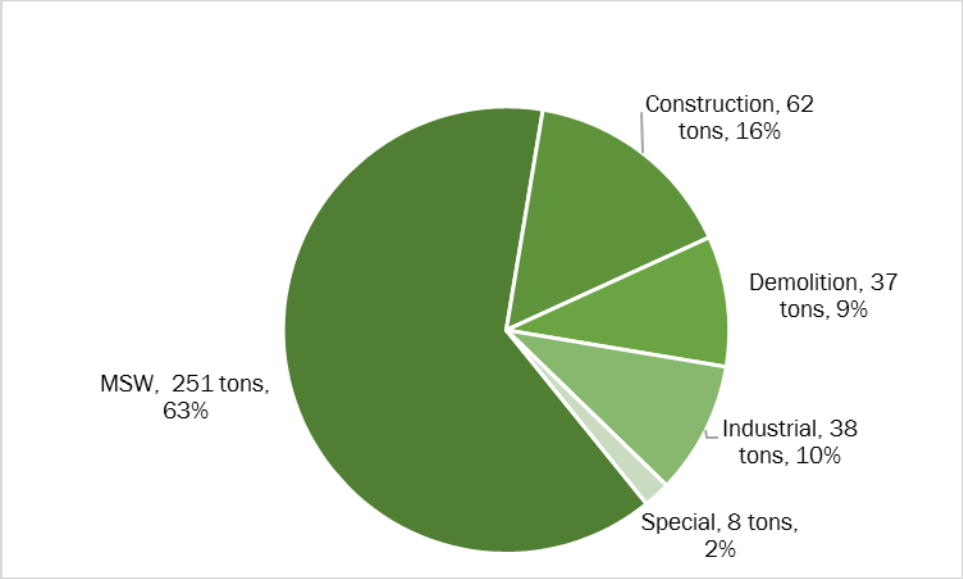
The O'Fallon Regional Waste Transfer Station, located in the large metro St. Louis area in St. Charles County and part of Solid Waste District Region L, is owned by the City of O'Fallon. FWCD, a subsidiary of Meridian Waste operates the facility via subcontractor MBI. The facility accepts waste that is transferred to in-state landfills for disposal, where the tonnage was accounted for during CY2016. O'Fallon hosted both seasons of MSW manual sorting as well as the Gate/Visual non-MSW Surveying phase of the project. Table M-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table M-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	16 Samples	3,571 Lbs	16 Samples	3,426 Lbs
Visual Surveys	30 Loads	84 Tons	N/A	N/A
Gate Surveys	92 Loads	414 Tons	N/A	N/A

Figure M-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure M-1 Gate Survey Results

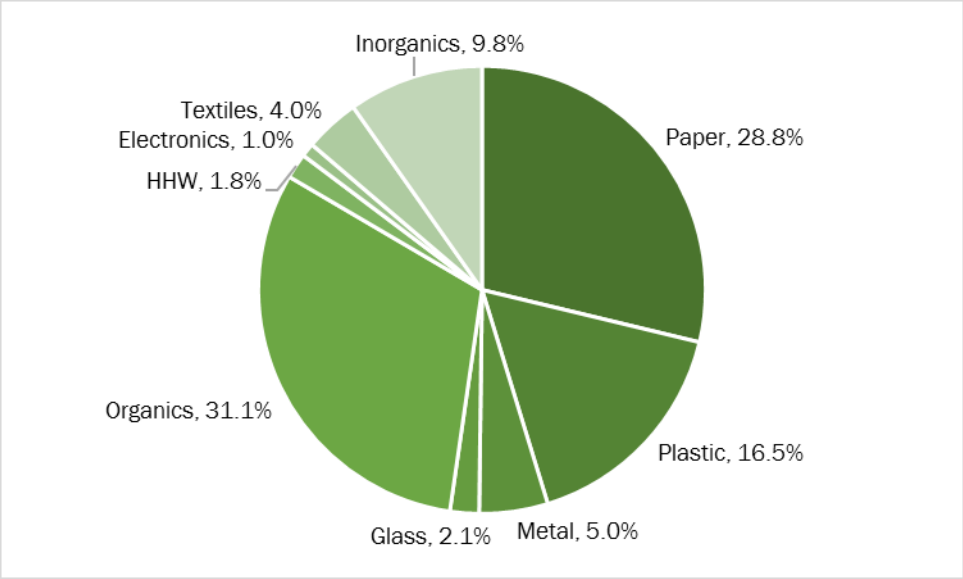


As shown, incoming waste at O'Fallon is predominantly MSW.

M 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in each of the Fall and Spring seasons. The aggregate composition of the sampled loads is presented in Figure M-2. Organics was determined to be the largest component of the waste, at just over 31 percent, with nearly 29 percent being Paper materials.

Figure M-2 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table M-2. This table provides the mean composition and 90 percent confidence intervals from the study, and applies the results to the estimated 49,503 tons of MSW found to be disposed at the facility based on gate survey results.

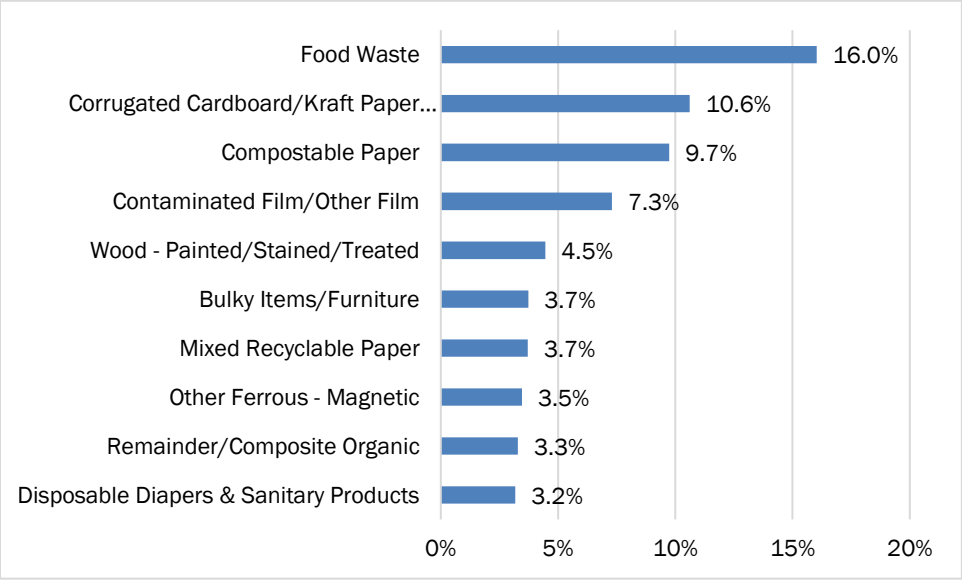
Table M-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**28.8%**	**3.8%**	**1,027**	**Plastic**	**16.5%**	**4.7%**	**589**
OCC/Kraft Paper	10.6%	5.0%	379	PET (#1) Bottles/Jars	1.1%	0.3%	39
Newsprint	1.1%	0.4%	41	PET (#1) Non-Bottle containers	0.1%	0.0%	3
Magazines	0.8%	0.4%	30	HDPE (#2) Natural Containers	0.4%	0.2%	14
High Grade Office Paper	1.4%	1.4%	48	HDPE (#2) Colored Containers	0.4%	0.2%	15
Mixed Recyclable Paper	3.7%	1.1%	133	Clean Film Bags	0.3%	0.1%	9
Compostable Paper	9.7%	2.0%	348	Clean Indust'l/Com'l Film	1.1%	1.7%	39
Remainder/Composite Paper	1.4%	0.5%	49	Contaminated Film/Other Film	7.3%	2.7%	261
Glass	**2.1%**	**0.6%**	**75**	Plastic Containers #3 thru #7	1.3%	0.3%	47
Clear Glass Containers	0.9%	0.3%	31	Expanded Polystyrene #6	0.5%	0.1%	18
Brown Glass Containers	0.7%	0.3%	26	Bulky Durable Plastic Products	1.1%	1.0%	41
Green Glass Containers	0.2%	0.1%	7	Remainder/Composite Plastic	2.9%	1.4%	103
Remainder/Composite Glass	0.3%	0.2%	11	**Textiles**	**4.0%**	**2.0%**	**142**
Metal	**5.0%**	**3.2%**	**177**	Textiles - Clothing	2.5%	1.9%	91
Aluminum Cans & Containers	0.4%	0.2%	15	Textiles - Non-Clothing	1.1%	0.4%	39
Other Aluminum	0.3%	0.1%	9	Shoes/Belts/Leather	0.4%	0.2%	13
Tin/Steel Containers	0.7%	0.2%	24	**Inorganics**	**9.8%**	**3.8%**	**349**
Other Ferrous - Magnetic	3.5%	3.2%	124	Fines	1.3%	0.6%	46
Other Non-Ferrous	0.1%	0.2%	5	Drywall/Gypsum Board	0.6%	0.7%	21
Oil Filters	0.0%	0.0%	1	Asphalt, Brick, Concrete & Rocks	0.0%	0.0%	1
Organics	**31.1%**	**6.8%**	**1,112**	Carpet & Carpet Padding	2.7%	2.7%	97
Food Waste	16.0%	4.7%	572	Other Construction & Demolition	0.1%	0.2%	5
Wood - Clean/Untreated	1.2%	1.2%	42	Bulky Items/Furniture	3.7%	2.3%	133
Wood - Painted/Stained/Treate	4.5%	3.1%	159	Mattresses/Boxsprings	0.6%	0.9%	20
Diapers/Sanitary Products	3.2%	1.3%	114	Tires	0.3%	0.5%	12
Yard Waste	3.0%	2.1%	107	Other/Not Classified	0.4%	0.2%	13
Remainder/Composite Organic	3.3%	1.5%	118	**HHW**	**1.8%**	**2.4%**	**65**
Electronics	**1.0%**	**1.0%**	**35**	Household Hazardous Waste	1.8%	2.1%	65
Electronic Waste	1.0%	0.8%	35	**Grand Total**	**100%**		**49,503**
				No. of Samples	***16***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure M-3 shows the ten most commonly occurring materials in the MSW sorted at O'Fallon. Compostable materials Food Waste and Compostable Paper comprise over one-fourth of the overall waste stream.

Figure M-3 Top 10 Materials in MSW

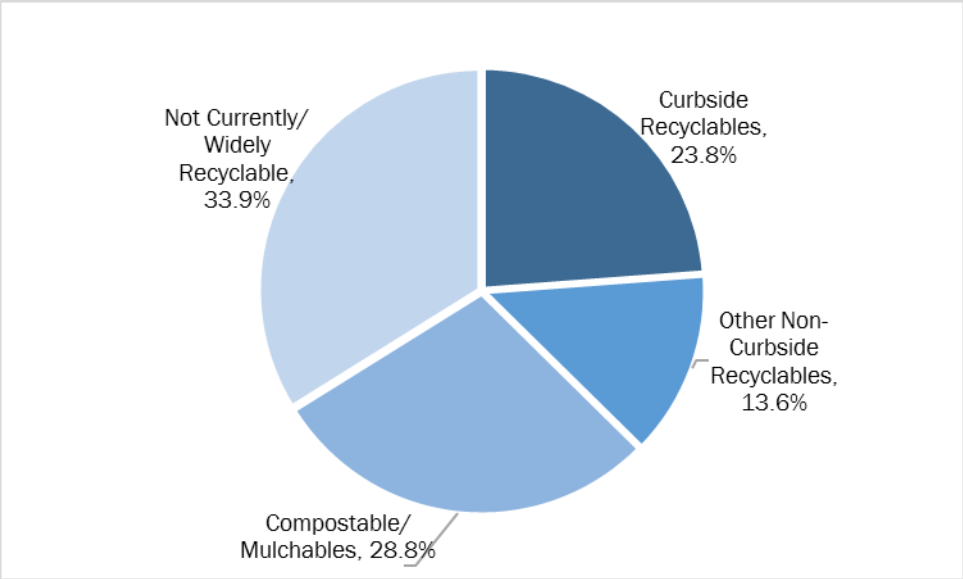


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the O'Fallon Transfer Station sort activity results are displayed in Figure M-4. As shown, almost 34 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 66 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure M-4 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table M-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results. This table also shows the results of any MSW sorting that was performed in the 2008 Study (note that the 2008 Study sorted into a smaller number of material categories).

Table M-3 Composition Results by Generator Sector

	2017 Study			2008		2017 Study			2008
Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l	Agg-regate	Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l	Agg-regate
Paper	**28.8%**	**25.4%**	**34.3%**	**33.7%**	**Plastic**	**16.5%**	**12.9%**	**22.0%**	**14.3%**
OCC/Kraft Paper	10.6%	3.8%	21.7%	6.8%	PET (#1) Bottles/Jars	1.1%	1.5%	0.5%	2.5%
Newsprint	1.1%	1.5%	0.4%	5.9%	PET (#1) Non-Bottle containers	0.1%	0.1%	0.1%	
Magazines	0.8%	1.2%	0.2%	4.1%	HDPE (#2) Natural Containers	0.4%	0.3%	0.6%	1.3%
High Grade Office Paper	1.4%	0.5%	2.7%	6.5%	HDPE (#2) Colored Containers	0.4%	0.4%	0.4%	
Mixed Recyclable Paper	3.7%	4.9%	2.0%		Clean Film Bags	0.3%	0.4%	0.1%	
Compostable Paper	9.7%	11.6%	6.6%	10.4%	Clean Indust'l/Com'l Film	1.1%	0.0%	2.8%	3.2%
Remainder/Composite Paper	1.4%	1.9%	0.5%		Contaminated Film/Other Film	7.3%	5.4%	10.3%	
Glass	**2.1%**	**2.7%**	**1.1%**	**5.0%**	Plastic Containers #3 thru #7	1.3%	1.8%	0.6%	
Clear Glass Containers	0.9%	1.1%	0.5%	2.1%	Expanded Polystyrene #6	0.5%	0.7%	0.2%	7.3%
Brown Glass Containers	0.7%	0.9%	0.5%	1.6%	Bulky Durable Plastic Products	1.1%	0.7%	2.0%	
Green Glass Containers	0.2%	0.3%	0.0%	0.9%	Remainder/Composite Plastic	2.9%	1.8%	4.5%	
Remainder/Composite Glass	0.3%	0.5%	0.1%	0.4%	**Textiles**	**4.0%**	**3.8%**	**4.3%**	**3.6%**
Metal	**5.0%**	**4.3%**	**6.4%**	**4.6%**	Textiles - Clothing	2.5%	1.9%	3.7%	
Aluminum Cans & Containers	0.4%	0.6%	0.1%	1.3%	Textiles - Non-Clothing	1.1%	1.5%	0.4%	3.6%
Other Aluminum	0.3%	0.4%	0.1%	0.4%	Shoes/Belts/Leather	0.4%	0.5%	0.2%	
Tin/Steel Containers	0.7%	1.0%	0.1%	2.2%	**Inorganics**	**9.8%**	**12.8%**	**5.6%**	**5.3%**
Other Ferrous - Magnetic	3.5%	2.1%	6.1%	0.6%	Fines	1.3%	1.8%	0.4%	1.2%
Other Non-Ferrous	0.1%	0.2%	0.1%	0.1%	Drywall/Gypsum Board	0.6%	0.9%	0.0%	
Oil Filters	0.0%	0.0%	0.0%	0.0%	Asphalt, Brick, Concrete & Rocks	0.0%	0.0%	0.0%	
Organics	**31.1%**	**35.9%**	**22.6%**	**32.5%**	Carpet & Carpet Padding	2.7%	4.5%	0.0%	
Food Waste	16.0%	18.3%	11.6%	18.0%	Other Construction & Demolition	0.1%	0.2%	0.0%	4.1%
Wood - Clean/Untreated	1.2%	2.0%	0.0%	1.1%	Bulky Items/Furniture	3.7%	5.1%	2.1%	
Wood - Painted/Stained/Treated	4.5%	1.3%	9.8%		Mattresses/Boxsprings	0.6%	0.0%	1.6%	
Diapers/Sanitary Products	3.2%	4.6%	0.8%	6.0%	Tires	0.3%	0.0%	0.9%	
Yard Waste	3.0%	4.6%	0.2%	7.4%	Other/Not Classified	0.4%	0.2%	0.6%	
Remainder/Composite Organic	3.3%	5.2%	0.1%		**HHW**	**1.8%**	**0.8%**	**3.5%**	**0.8%**
Electronics	**1.0%**	**1.4%**	**0.2%**	**0.3%**	Household Hazardous Waste	1.8%	0.8%	3.5%	0.8%
Electronic Waste	1.0%	1.4%	0.2%	0.3%	**Grand Total**	**100%**	**100%**	**100%**	**100%**
					No. of Samples	**16**	**10**	**6**	**16**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

M 3. VISUAL SURVEY RESULTS

Figure M-5 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the largest component of these wastes was found to be Wood.

Figure M-5 Composition of Construction Debris

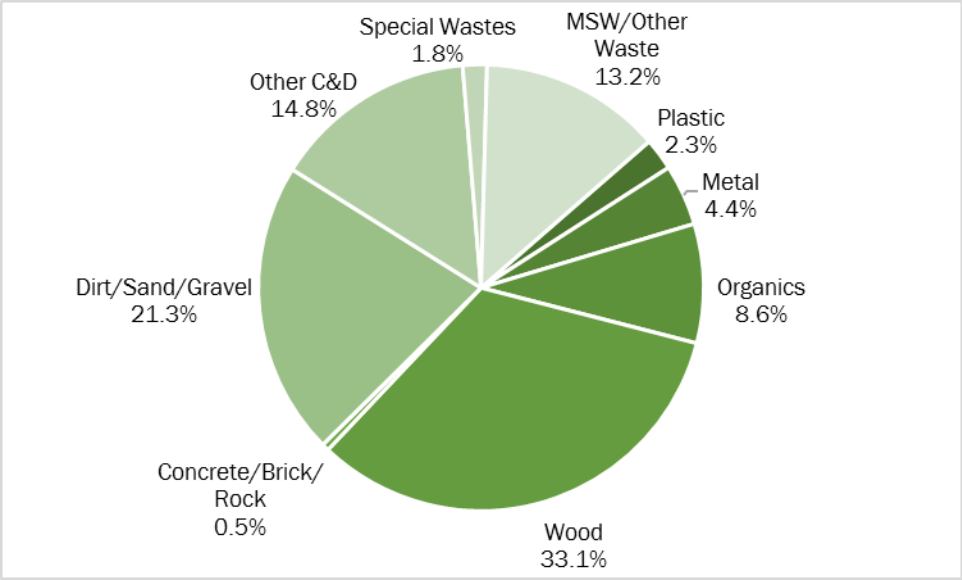
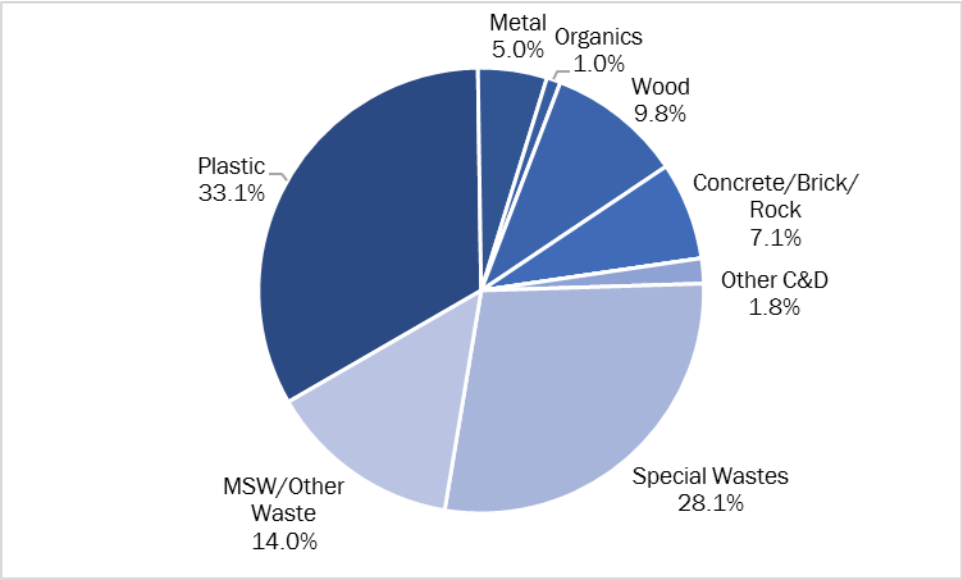


Figure M-6 summarizes the composition of Demolition debris.

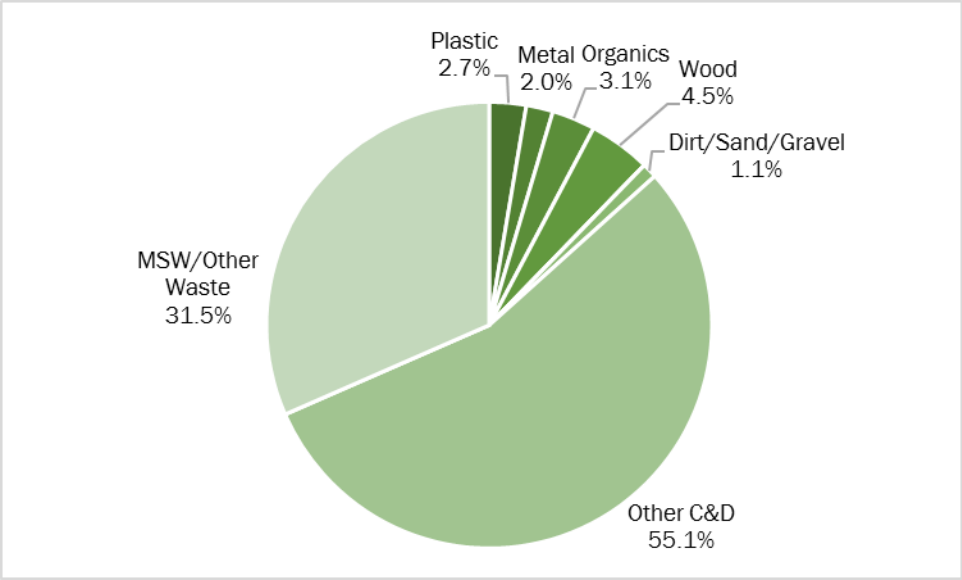
Figure M-6 Composition of Demolition Debris



A substantial percentage of the demolition material surveyed was Plastic and Special Wastes, such as Bulky/Furniture commonly found in large loads of cleanout associated with Demolition.

Figure M-7 provides the composition of Industrial materials.

Figure M-7 Industrial Waste Composition



Other C&D represented a large portion of this sector due to a drywall product manufacturer load. Table M-4 provides the detailed composition of the three material groups.

Table M-4 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	2.0%	2.5%	0.6%
MSW/Other Waste	Unflattened OCC	0.1%	0.3%	0.0%
MSW/Other Waste	R/C and Other Paper	0.5%	0.8%	0.2%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.2%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.1%	0.0%	0.0%
Plastic	Clean Recoverable Film	0.1%	0.1%	0.2%
Plastic	R/C and Other Plastic	1.5%	26.4%	2.1%
MSW/Other Waste	All Glass	0.0%	0.2%	0.0%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	2.5%	3.2%	1.0%
Metal	Other Non-ferrous Metal	1.2%	0.4%	0.7%
Metal	HVAC Ducting	0.0%	0.4%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.2%	0.5%	0.0%
Organics	Branches/Limbs	0.0%	0.0%	0.0%
Organics	R/C and Other Organics	7.0%	0.3%	2.7%
Wood	Pallets - Standard	4.4%	3.0%	1.7%
Wood	Pallets/Crates/Heavy	0.0%	0.0%	0.0%
Wood	Untreated/Unpainted Lumber	9.7%	2.0%	1.3%
Wood	Treated/Painted/Processed Wood	2.0%	1.3%	0.0%
Wood	Engineered Wood	10.9%	0.9%	0.9%
Wood	Wood Furniture	0.2%	0.4%	0.0%
Wood	Other Wood	0.3%	0.2%	0.0%
Other C&D	Carpet	0.7%	0.6%	7.1%
Other C&D	Carpet Padding	0.1%	0.1%	1.3%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	0.4%	5.7%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	4.0%	20.0%	13.9%
Other C&D	Ceiling Tiles	0.0%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.0%	0.0%
Gypsum Board	Painted Gypsum Board	12.8%	0.0%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	17.7%	0.0%	0.9%
Other C&D	Insulation	0.3%	0.5%	0.0%
Other C&D	R/C and Other C&D	11.2%	0.2%	39.0%
MSW/Other Waste	Electronics	0.0%	2.6%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	0.0%	0.0%
Special Wastes	Bulky Wastes/Furniture	1.5%	22.5%	0.0%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	5.8%	0.0%	16.3%
MSW/Other Waste	Mixed MSW	2.5%	4.9%	10.1%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX N

OZARKS TRANSFER STATION

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APPENDIX N - WASTE COMPOSITION AT OZARKS TRANSFER STATION

N 1. OVERVIEW

The Ozarks Transfer Station, located in rural Laclede County, is owned and operated by Waste Corporation of Missouri, and is part of Solid Waste District Region T. The facility accepts waste and transfers to Black Oak Landfill, where the tonnage is accounted for. This site was included in both seasons of the MSW manual sorting phase of this study, but not the Gate/Visual non-MSW Surveying phase. Table N-1 summarizes the data collection activities that took place at this facility.

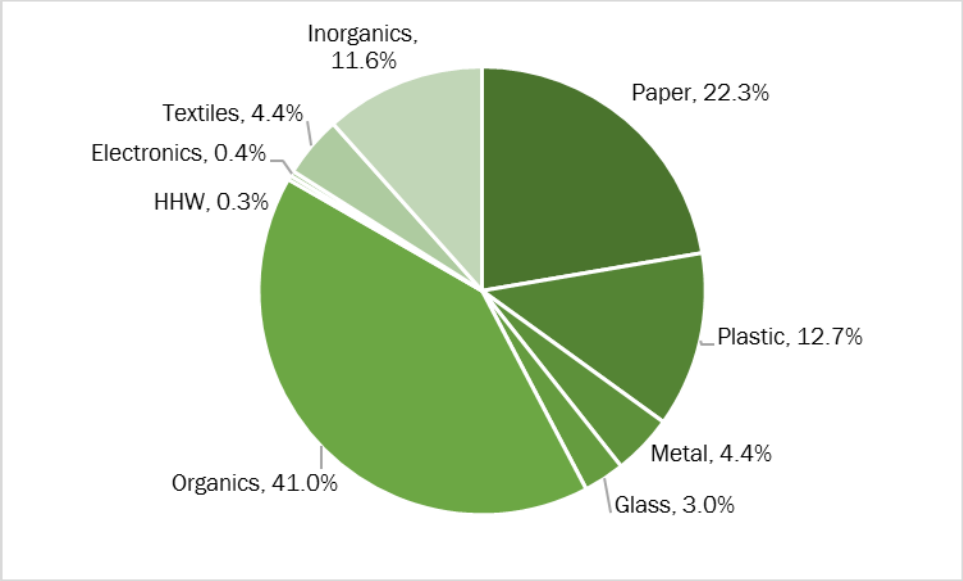
Table N-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	16 Samples	3,410 Lbs	N/A	N/A
Visual Surveys	N/A	N/A	N/A	N/A
Gate Surveys	N/A	N/A	N/A	N/A

N 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in each of the Fall and Spring seasons. The aggregate composition of the sampled loads is presented in Figure N-1. Organics was determined to be the largest component of the waste, at 41 percent, with over 22 percent being Paper materials.

Figure N-1 MSW Composition



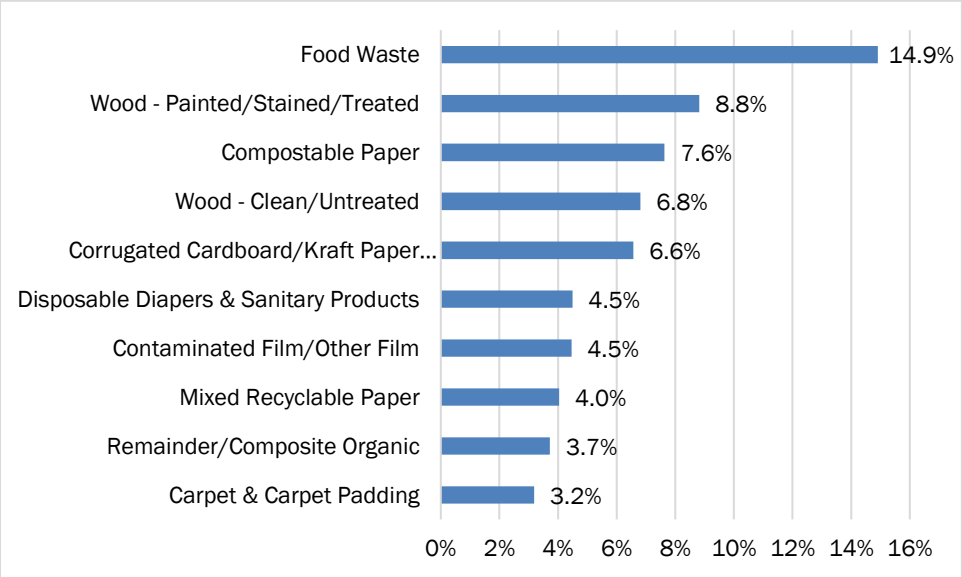
A detailed tabular summary of the 2017 MSW composition results is provided in Table N-2. This table provides the mean composition and 90 percent confidence intervals from the study.

Table N-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Material Category	Est. Percent	Conf. Int (+/-)
Paper	**22.3%**	**3.9%**	**Plastic**	**12.7%**	**1.9%**
OCC/Kraft Paper	6.6%	2.8%	PET (#1) Bottles/Jars	1.7%	0.4%
Newsprint	1.4%	0.7%	PET (#1) Non-Bottle containers	0.2%	0.1%
Magazines	0.7%	0.4%	HDPE (#2) Natural Containers	0.6%	0.1%
High Grade Office Paper	1.1%	0.8%	HDPE (#2) Colored Containers	0.5%	0.1%
Mixed Recyclable Paper	4.0%	1.0%	Clean Film Bags	0.2%	0.1%
Compostable Paper	7.6%	1.6%	Clean Indust'l/Com'l Film	0.4%	0.4%
Remainder/Composite Paper	0.9%	0.4%	Contaminated Film/Other Film	4.5%	1.0%
Glass	**3.0%**	**0.7%**	Plastic Containers #3 thru #7	0.8%	0.2%
Clear Glass Containers	1.7%	0.4%	Expanded Polystyrene #6	1.0%	0.4%
Brown Glass Containers	0.6%	0.3%	Bulky Durable Plastic Products	1.3%	0.9%
Green Glass Containers	0.2%	0.2%	Remainder/Composite Plastic	1.5%	0.4%
Remainder/Composite Glass	0.5%	0.4%	**Textiles**	**4.4%**	**2.1%**
Metal	**4.4%**	**0.8%**	Textiles - Clothing	2.0%	1.5%
Aluminum Cans & Containers	1.1%	0.4%	Textiles - Non-Clothing	1.7%	0.6%
Other Aluminum	0.3%	0.1%	Shoes/Belts/Leather	0.7%	0.5%
Tin/Steel Containers	1.5%	0.3%	**Inorganics**	**11.6%**	**5.2%**
Other Ferrous - Magnetic	0.8%	0.4%	Fines	1.9%	0.8%
Other Non-Ferrous	0.7%	0.7%	Drywall/Gypsum Board	1.3%	1.9%
Oil Filters	0.0%	0.0%	Asphalt, Brick, Concrete & Rock	0.7%	1.0%
Organics	**41.0%**	**6.2%**	Carpet & Carpet Padding	3.2%	2.1%
Food Waste	14.9%	4.1%	Other Construction & Demolitio	1.8%	2.1%
Wood - Clean/Untreated	6.8%	7.0%	Bulky Items/Furniture	1.4%	1.5%
Wood - Painted/Stained/Treate	8.8%	5.7%	Mattresses/Boxsprings	0.0%	0.0%
Diapers/Sanitary Products	4.5%	1.5%	Tires	1.3%	2.0%
Yard Waste	2.2%	1.7%	Other/Not Classified	0.2%	0.1%
Remainder/Composite Organic	3.7%	1.8%	**HHW**	**0.3%**	**0.2%**
Electronics	**0.4%**	**0.5%**	Household Hazardous Waste	0.3%	0.2%
Electronic Waste	0.4%	0.4%	**Grand Total**	**100%**	
			No. of Samples	***16***	

Figure N-2 shows the ten most commonly occurring materials in the MSW sorted at the Ozarks Transfer Station. Food waste outweighs the second highest material, Wood-Painted/Stained/Treated by over six percent.

Figure N-2 Top 10 Materials in MSW

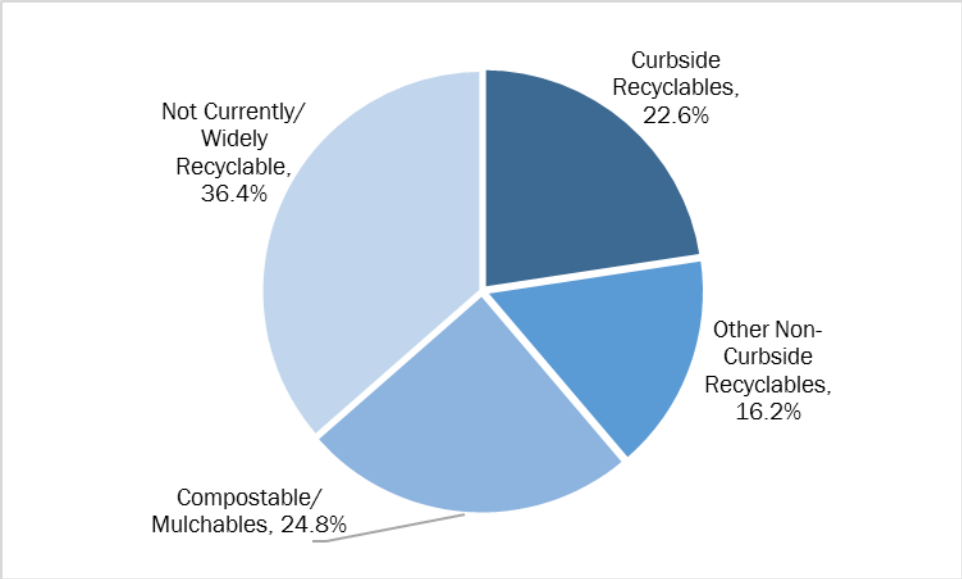


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Ozarks Transfer Station sort activity results are displayed in Figure N-3. As shown, just over 36 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 64 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure N-3 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table N-2 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results.

Table N-3 Detailed Results

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l
Paper	**22.3%**	**23.6%**	**19.5%**	**Plastic**	**12.7%**	**13.9%**	**10.0%**
OCC/Kraft Paper	6.6%	6.1%	7.5%	PET (#1) Bottles/Jars	1.7%	2.0%	1.1%
Newsprint	1.4%	1.4%	1.5%	PET (#1) Non-Bottle containers	0.2%	0.3%	0.1%
Magazines	0.7%	0.8%	0.4%	HDPE (#2) Natural Containers	0.6%	0.7%	0.5%
High Grade Office Paper	1.1%	0.7%	1.8%	HDPE (#2) Colored Containers	0.5%	0.5%	0.3%
Mixed Recyclable Paper	4.0%	4.9%	2.1%	Clean Film Bags	0.2%	0.2%	0.2%
Compostable Paper	7.6%	8.6%	5.6%	Clean Indust'l/Com'l Film	0.4%	0.2%	0.8%
Remainder/Composite Paper	0.9%	1.1%	0.5%	Contaminated Film/Other Film	4.5%	5.0%	3.3%
Glass	**3.0%**	**3.4%**	**2.1%**	Plastic Containers #3 thru #7	0.8%	0.7%	0.8%
Clear Glass Containers	1.7%	2.0%	0.9%	Expanded Polystyrene #6	1.0%	0.8%	1.5%
Brown Glass Containers	0.6%	0.6%	0.6%	Bulky Durable Plastic Products	1.3%	1.8%	0.1%
Green Glass Containers	0.2%	0.2%	0.1%	Remainder/Composite Plastic	1.5%	1.6%	1.2%
Remainder/Composite Glass	0.5%	0.6%	0.5%	**Textiles**	**4.4%**	**5.2%**	**2.8%**
Metal	**4.4%**	**4.5%**	**4.1%**	Textiles - Clothing	2.0%	2.4%	1.1%
Aluminum Cans & Containers	1.1%	1.4%	0.6%	Textiles - Non-Clothing	1.7%	1.8%	1.5%
Other Aluminum	0.3%	0.3%	0.2%	Shoes/Belts/Leather	0.7%	0.9%	0.2%
Tin/Steel Containers	1.5%	1.5%	1.3%	**Inorganics**	**11.6%**	**14.6%**	**5.2%**
Other Ferrous - Magnetic	0.8%	0.7%	0.9%	Fines	1.9%	2.4%	0.7%
Other Non-Ferrous	0.7%	0.6%	1.0%	Drywall/Gypsum Board	1.3%	1.8%	0.0%
Oil Filters	0.0%	0.0%	0.0%	Asphalt, Brick, Concrete & Rocks	0.7%	0.0%	2.1%
Organics	**41.0%**	**34.3%**	**55.8%**	Carpet & Carpet Padding	3.2%	4.6%	0.0%
Food Waste	14.9%	13.6%	17.5%	Other Construction & Demolition	1.8%	2.5%	0.0%
Wood - Clean/Untreated	6.8%	2.4%	16.8%	Bulky Items/Furniture	1.4%	1.0%	2.3%
Wood - Painted/Stained/Treated	8.8%	5.3%	16.3%	Mattresses/Boxsprings	0.0%	0.0%	0.0%
Diapers/Sanitary Products	4.5%	4.9%	3.6%	Tires	1.3%	1.9%	0.0%
Yard Waste	2.2%	3.2%	0.1%	Other/Not Classified	0.2%	0.3%	0.1%
Remainder/Composite Organic	3.7%	4.8%	1.5%	**HHW**	**0.3%**	**0.4%**	**0.1%**
Electronics	**0.4%**	**0.2%**	**0.6%**	Household Hazardous Waste	0.3%	0.4%	0.1%
Electronic Waste	0.4%	0.2%	0.6%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**16**	**11**	**5**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

APPENDIX O

PINK HILL ACRES DEMO LANDFILL

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APPENDIX O - WASTE COMPOSITION AT PINK HILL ACRES DEMOLITION LANDFILL

O 1. OVERVIEW

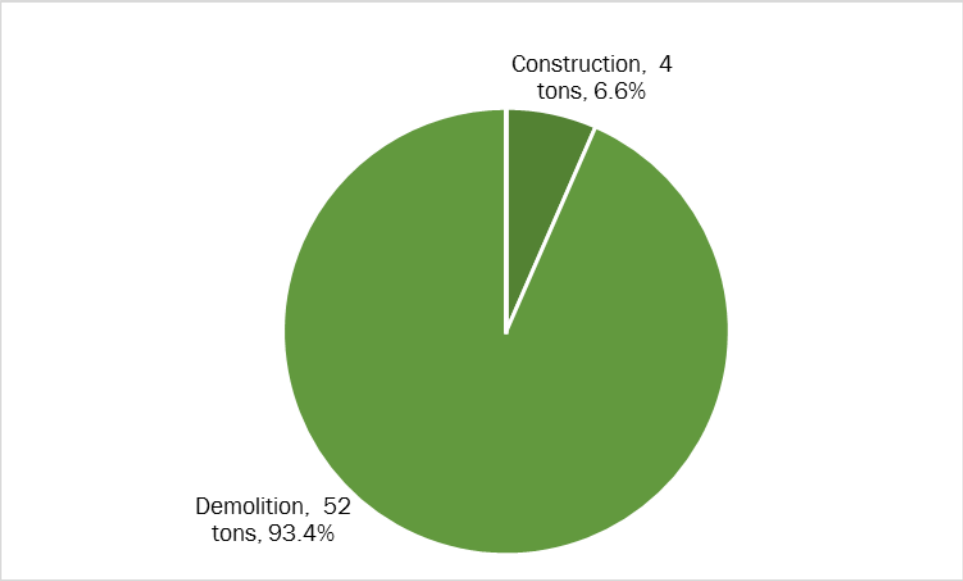
The Pink Hill Acres Demolition Landfill, located in the large metro Kansas City area in Blue Springs and Jackson County, is owned and operated privately, and is part of Solid Waste District Region E. The facility accepted 53,099 tons of C&D waste during CY2016. This site was included in the Gate/Visual non-MSW Surveying phase of the study, but not the MSW manual sorting phase. Table O-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table O-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	N/A	N/A	N/A	N/A
Visual Surveys	4 Loads	19 Tons	129 Loads	706 Tons
Gate Surveys	10 Loads	55 Tons	129 Loads	706 Tons

Figure O-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey. As a Demolition landfill, over 93 percent of incoming materials was demolition materials, while the remainder was from new Construction.

Figure O-1 Gate Survey Results



O 2. VISUAL SURVEY RESULTS

Figure O-2 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the vast majority of these wastes were found to be Wood.

Figure O-2 Composition of Construction Debris

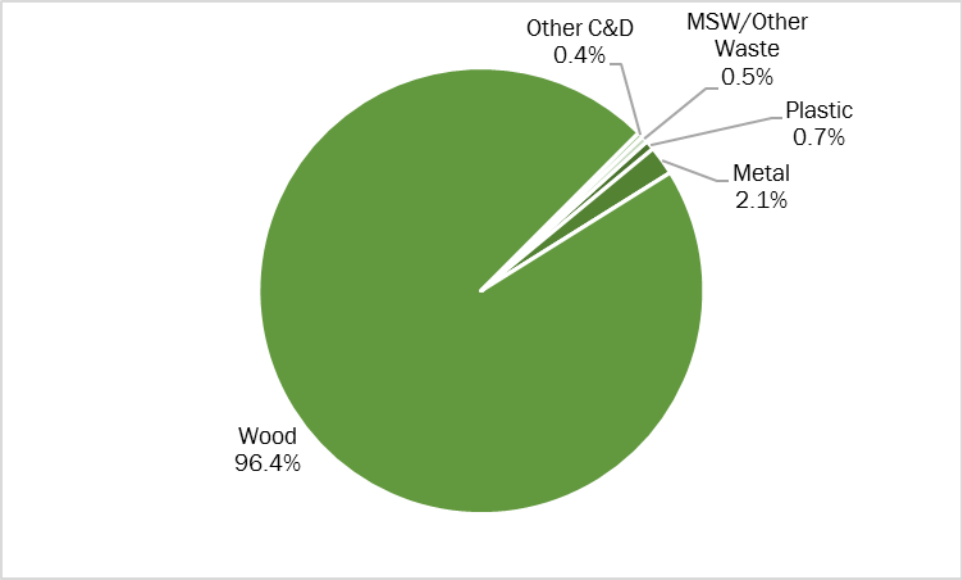
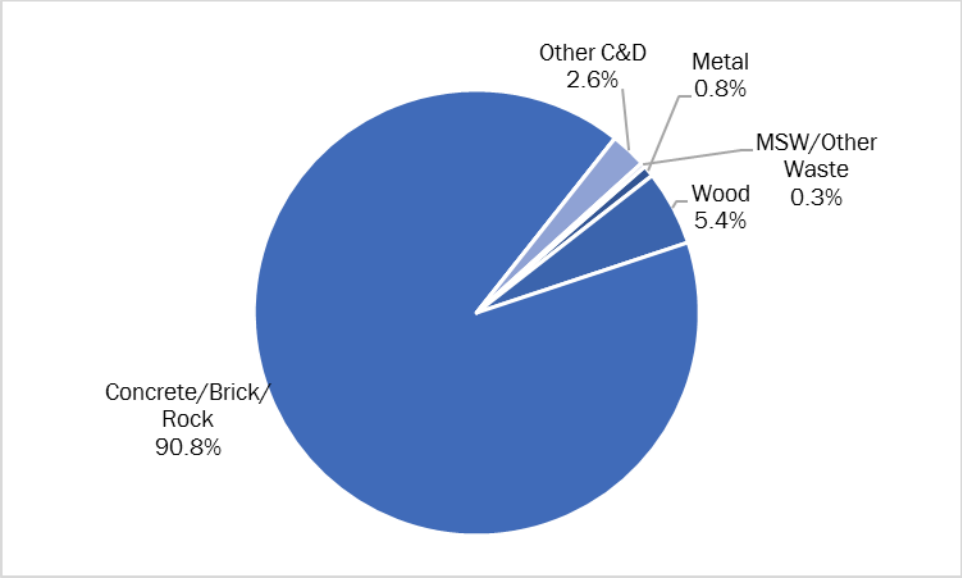


Figure O-3 summarizes the composition of Demolition debris, predominantly Concrete/Brick/Rock.

Figure O-3 Composition of Demolition Debris



No Industrial loads were received at the site during the study activities. Table O-2 provides the detailed composition of the two material groups observed.

Table O-2 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition
MSW/Other Waste	Flattened OCC	0.0%	0.0%
MSW/Other Waste	Unflattened OCC	0.1%	0.0%
MSW/Other Waste	R/C and Other Paper	0.0%	0.0%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.0%	0.0%
Plastic	Clean Recoverable Film	0.0%	0.0%
Plastic	R/C and Other Plastic	0.2%	0.0%
MSW/Other Waste	All Glass	0.0%	0.3%
Metal	Appliances	0.0%	0.0%
Metal	Other Ferrous Metals	0.2%	0.8%
Metal	Other Non-ferrous Metal	0.4%	0.0%
Metal	HVAC Ducting	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	0.0%
Organics	Branches/Limbs	0.0%	0.0%
Organics	R/C and Other Organics	0.0%	0.0%
Wood	Pallets - Standard	0.0%	0.0%
Wood	Pallets/Crates/Heavy	0.0%	0.0%
Wood	Untreated/Unpainted Lumber	27.5%	1.4%
Wood	Treated/Painted/Processed Wood	0.0%	3.9%
Wood	Engineered Wood	0.3%	0.0%
Wood	Wood Furniture	0.0%	0.0%
Wood	Other Wood	0.0%	0.0%
Other C&D	Carpet	0.0%	0.0%
Other C&D	Carpet Padding	0.0%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	0.0%	89.6%
Other C&D	Asphalt Paving	0.0%	0.0%
Roofing Materials	Roofing Materials	71.2%	0.0%
Other C&D	Ceiling Tiles	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.0%
Gypsum Board	Painted Gypsum Board	0.0%	1.3%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	0.0%	0.0%
Other C&D	Insulation	0.1%	0.0%
Other C&D	R/C and Other C&D	0.0%	2.6%
MSW/Other Waste	Electronics	0.0%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	0.0%
Special Wastes	Bulky Wastes/Furniture	0.0%	0.0%
MSW/Other Waste	Tree Trunks	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	0.0%
MSW/Other Waste	Mixed MSW	0.0%	0.0%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%
Total		**100.0%**	**100.0%**

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APPENDIX P

PRAIRIE VIEW LANDFILL

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APPENDIX P - WASTE COMPOSITION AT PRAIRIE VIEW LANDFILL

P 1. OVERVIEW

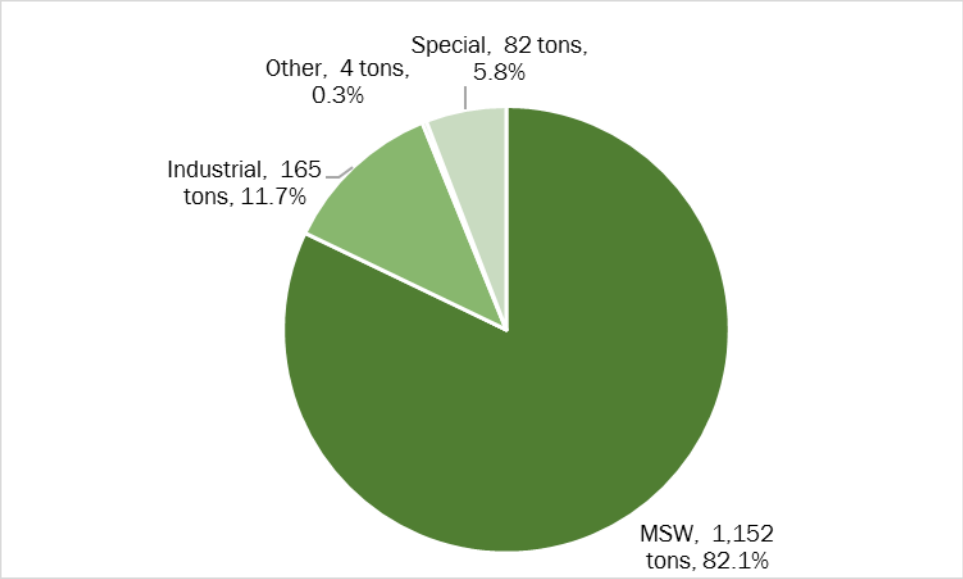
The Prairie View Regional Landfill, located in the rural Barton County and part of Solid Waste District Region M, is owned and operated by Republic Services. The facility accepted 424,407 tons of waste during CY2016. Prairie View hosted MSW Manual Sorting activity during Season 1 and Gate/Visual non-MSW Surveying activity. Due to the significant amount of waste arriving via transfer trailer, MSW Consultants requested to take Season 2 manual samples at one of their upstream Transfer Station. MDNR and Republic Services agreed with this and the samples were taken at Springfield Relay Transfer Station. Table P-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table P-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	8 Samples	1,681 Lbs	N/A	N/A
Visual Surveys	12 Loads	91 Tons	345 Loads	7,887 Tons
Gate Surveys	67 Loads	1,403 Tons	345 Loads	7,887 Tons

Figure P-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure P-1 Gate Survey Results

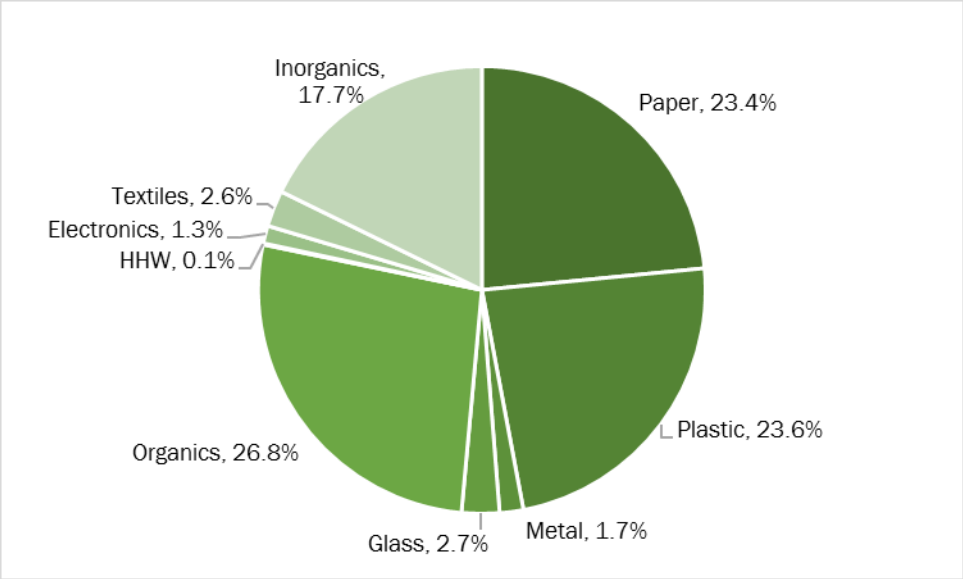


As shown, incoming waste at Prairie View is predominantly MSW, the receiving landfill for wastes from several transfer stations as well as from individual haulers and a few local routes. The mix of waste types observed in 2017 is somewhat different than the findings from the 2008 Study, where MSW was found to be 69 percent of inbound wastes.

P 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in the Fall season. The aggregate composition of the sampled loads is presented in Figure P-2. Organics was determined to be the largest component of the waste, at almost 27 percent, with Paper and Plastics both representing between 23 and 24 percent.

Figure P-2 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table P-2. This table provides the mean composition and 90 percent confidence intervals from the study, and applies the results to the estimated 268,265 tons of MSW found to be disposed at the facility based on gate survey results.

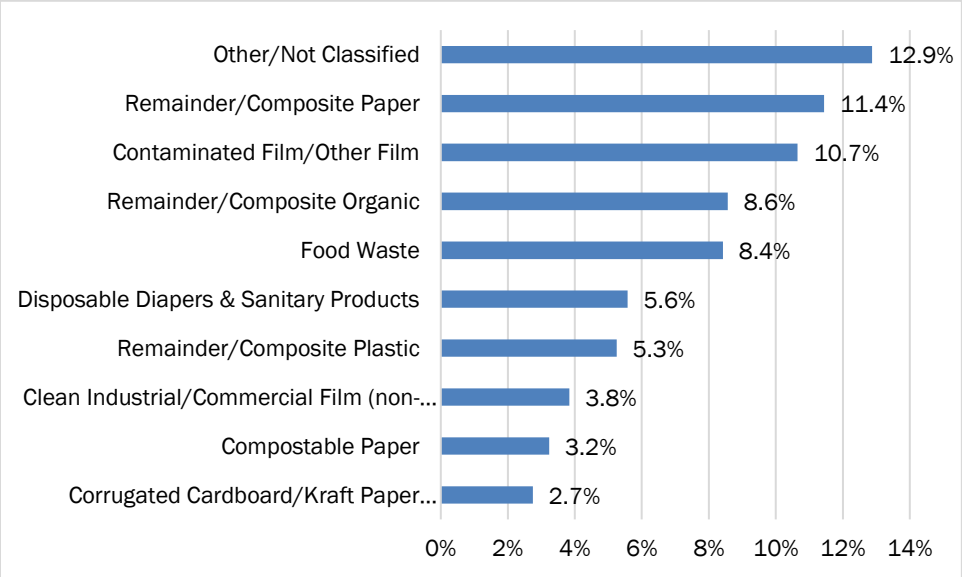
Table P-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**23.4%**	**19.0%**	**76,605**	**Plastic**	**23.6%**	**15.3%**	**77,017**
OCC/Kraft Paper	2.7%	1.6%	8,969	PET (#1) Bottles/Jars	0.6%	0.5%	2,019
Newsprint	1.3%	1.1%	4,299	PET (#1) Non-Bottle containers	0.0%	0.0%	28
Magazines	2.2%	3.2%	7,262	HDPE (#2) Natural Containers	0.2%	0.2%	636
High Grade Office Paper	1.4%	1.7%	4,433	HDPE (#2) Colored Containers	0.2%	0.1%	614
Mixed Recyclable Paper	1.1%	1.5%	3,715	Clean Film Bags	1.9%	2.7%	6,298
Compostable Paper	3.2%	1.9%	10,556	Clean Indust'l/Com'l Film	3.8%	5.4%	12,533
Remainder/Composite Paper	11.4%	17.2%	37,372	Contaminated Film/Other Film	10.7%	7.1%	34,795
Glass	**2.7%**	**4.6%**	**8,910**	Plastic Containers #3 thru #7	0.4%	0.3%	1,229
Clear Glass Containers	1.7%	2.2%	5,537	Expanded Polystyrene #6	0.3%	0.2%	1,066
Brown Glass Containers	0.9%	1.3%	3,003	Bulky Durable Plastic Products	0.2%	0.2%	644
Green Glass Containers	0.1%	0.1%	252	Remainder/Composite Plastic	5.3%	4.2%	17,154
Remainder/Composite Glass	0.0%	0.1%	117	**Textiles**	**2.6%**	**3.1%**	**8,557**
Metal	**1.7%**	**1.0%**	**5,589**	Textiles - Clothing	1.6%	2.4%	5,285
Aluminum Cans & Containers	0.3%	0.3%	1,009	Textiles - Non-Clothing	1.0%	1.4%	3,272
Other Aluminum	0.0%	0.0%	48	Shoes/Belts/Leather	0.0%	0.0%	-
Tin/Steel Containers	0.6%	0.4%	2,046	**Inorganics**	**17.7%**	**21.2%**	**57,985**
Other Ferrous - Magnetic	0.7%	1.0%	2,263	Fines	2.3%	2.7%	7,537
Other Non-Ferrous	0.0%	0.0%	-	Drywall/Gypsum Board	0.0%	0.0%	-
Oil Filters	0.1%	0.1%	223	Asphalt, Brick, Concrete & Rock	0.0%	0.0%	-
Organics	**26.8%**	**11.3%**	**87,560**	Carpet & Carpet Padding	2.0%	2.9%	6,505
Food Waste	8.4%	7.4%	27,501	Other Construction & Demolitior	0.6%	0.9%	1,873
Wood - Clean/Untreated	2.6%	3.1%	8,607	Bulky Items/Furniture	0.0%	0.0%	-
Wood - Painted/Stained/Treate	1.6%	1.6%	5,157	Mattresses/Boxsprings	0.0%	0.0%	-
Diapers/Sanitary Products	5.6%	5.6%	18,228	Tires	0.0%	0.0%	-
Yard Waste	0.0%	0.0%	85	Other/Not Classified	12.9%	19.2%	42,069
Remainder/Composite Organic	8.6%	9.7%	27,982	**HHW**	**0.1%**	**0.0%**	**299**
Electronics	**1.3%**	**1.6%**	**4,173**	Household Hazardous Waste	0.1%	0.1%	299
Electronic Waste	1.3%	1.4%	4,173	**Grand Total**	**100%**		**268,265**
				No. of Samples	***8***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure P-3 shows the ten most commonly occurring materials in the MSW sorted at Prairie View. The top material, Other/Not Classified, is primarily due to bedding material that came in from a Commercial/Institutional load.

Figure P-3 Top 10 Materials in MSW

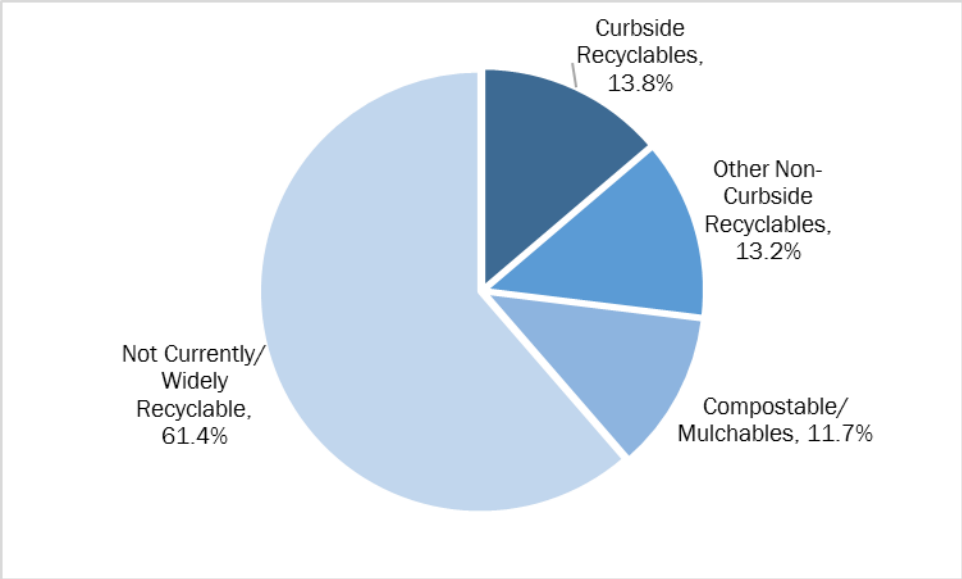


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Prairie View sort activity results are displayed in Figure P-4. As shown, over 61 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 39 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure P-4 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table P-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results. This table also shows the results of any MSW sorting that was performed in the 2008 Study (note that the 2008 Study sorted into a smaller number of material categories).

Table P-3 Composition Results by Generator Sector

	2017 Study				2017 Study		
Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l	Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l
Paper	**23.4%**	**27.1%**	**21.9%**	**Plastic**	**23.6%**	**11.1%**	**28.0%**
OCC/Kraft Paper	2.7%	4.5%	2.2%	PET (#1) Bottles/Jars	0.6%	1.6%	0.3%
Newsprint	1.3%	2.5%	0.9%	PET (#1) Non-Bottle containers	0.0%	0.0%	0.0%
Magazines	2.2%	8.5%	0.1%	HDPE (#2) Natural Containers	0.2%	0.6%	0.1%
High Grade Office Paper	1.4%	4.6%	0.3%	HDPE (#2) Colored Containers	0.2%	0.4%	0.1%
Mixed Recyclable Paper	1.1%	0.4%	1.4%	Clean Film Bags	1.9%	0.5%	2.4%
Compostable Paper	3.2%	5.9%	2.3%	Clean Indust'l/Com'l Film	3.8%	0.0%	5.2%
Remainder/Composite Paper	11.4%	0.7%	14.7%	Contaminated Film/Other Film	10.7%	2.6%	13.3%
Glass	**2.7%**	**10.4%**	**0.2%**	Plastic Containers #3 thru #7	0.4%	0.9%	0.2%
Clear Glass Containers	1.7%	6.2%	0.2%	Expanded Polystyrene #6	0.3%	0.6%	0.2%
Brown Glass Containers	0.9%	3.7%	0.0%	Bulky Durable Plastic Products	0.2%	0.2%	0.2%
Green Glass Containers	0.1%	0.3%	0.0%	Remainder/Composite Plastic	5.3%	3.6%	6.0%
Remainder/Composite Glass	0.0%	0.1%	0.0%	**Textiles**	**2.6%**	**6.6%**	**1.4%**
Metal	**1.7%**	**3.0%**	**1.3%**	Textiles - Clothing	1.6%	6.4%	0.0%
Aluminum Cans & Containers	0.3%	0.9%	0.1%	Textiles - Non-Clothing	1.0%	0.2%	1.3%
Other Aluminum	0.0%	0.0%	0.0%	Shoes/Belts/Leather	0.0%	0.0%	0.0%
Tin/Steel Containers	0.6%	1.8%	0.2%	**Inorganics**	**17.7%**	**11.3%**	**19.8%**
Other Ferrous - Magnetic	0.7%	0.2%	0.9%	Fines	2.3%	1.3%	2.6%
Other Non-Ferrous	0.0%	0.0%	0.0%	Drywall/Gypsum Board	0.0%	0.0%	0.0%
Oil Filters	0.1%	0.0%	0.1%	Asphalt, Brick, Concrete & Rocks	0.0%	0.0%	0.0%
Organics	**26.8%**	**29.2%**	**26.1%**	Carpet & Carpet Padding	2.0%	7.6%	0.1%
Food Waste	8.4%	10.4%	7.5%	Other Construction & Demolition	0.6%	2.3%	0.0%
Wood - Clean/Untreated	2.6%	0.0%	3.5%	Bulky Items/Furniture	0.0%	0.0%	0.0%
Wood - Painted/Stained/Treated	1.6%	6.2%	0.0%	Mattresses/Boxsprings	0.0%	0.0%	0.0%
Diapers/Sanitary Products	5.6%	7.6%	5.1%	Tires	0.0%	0.0%	0.0%
Yard Waste	0.0%	0.0%	0.0%	Other/Not Classified	12.9%	0.1%	17.1%
Remainder/Composite Organic	8.6%	5.0%	9.9%	**HHW**	**0.1%**	**0.1%**	**0.1%**
Electronics	**1.3%**	**1.3%**	**1.2%**	Household Hazardous Waste	0.1%	0.1%	0.1%
Electronic Waste	1.3%	1.3%	1.2%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**8**	**2**	**6**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

P 3. VISUAL SURVEY RESULTS

Figure P-5 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes were found to be Wood.

Figure P-5 Composition of Construction Debris

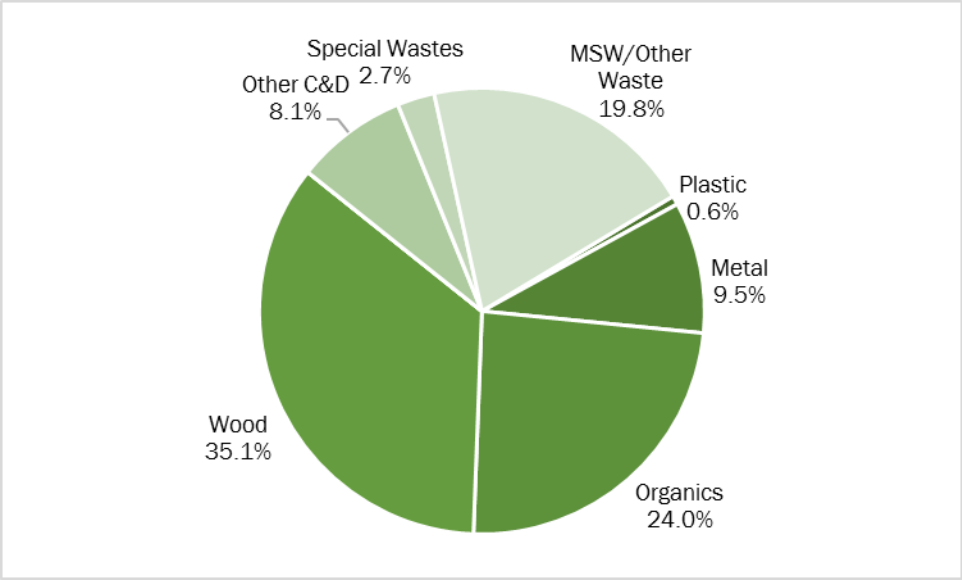


Figure P-6 summarizes the composition of Demolition debris. A substantial percentage of the demolition material surveyed was flour, an Organic material, which was cleanup from a roadside spill.

Figure P-6 Composition of Demolition Debris

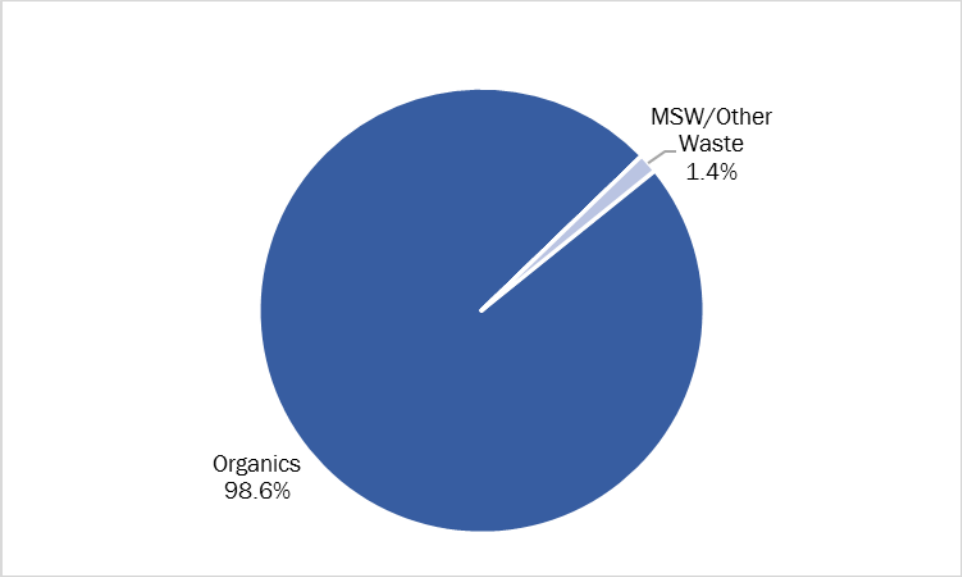


Figure P-7 provides the composition of Industrial materials. Organics constituted 45 percent of this sector.

Figure P-7 Industrial Waste Composition

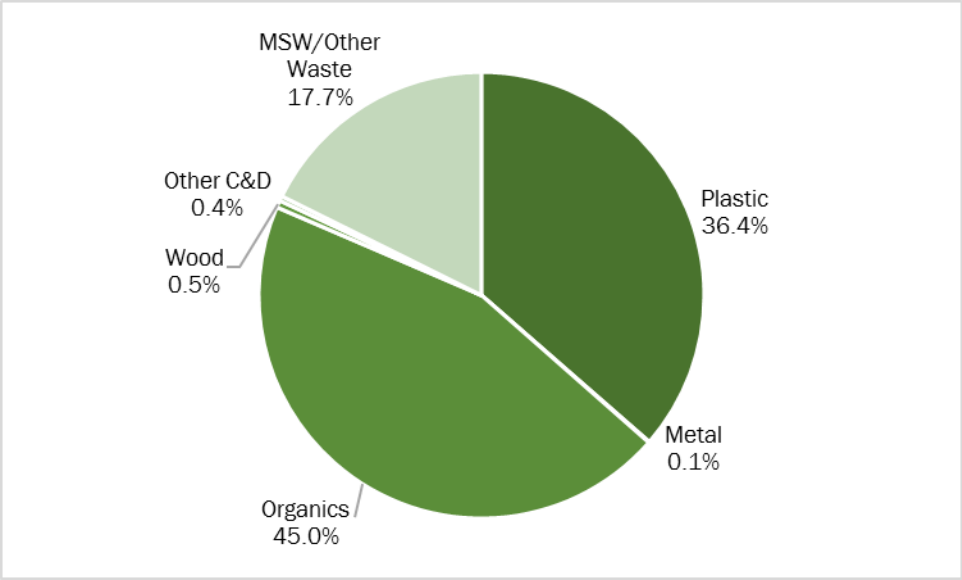


Table P-4 provides the detailed composition of the three material groups.

Table P-4 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	0.5%	0.0%	0.7%
MSW/Other Waste	Unflattened OCC	0.0%	0.2%	0.1%
MSW/Other Waste	R/C and Other Paper	0.2%	1.2%	15.0%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.0%	0.0%	0.0%
Plastic	Clean Recoverable Film	0.1%	0.0%	0.3%
Plastic	R/C and Other Plastic	0.3%	0.0%	36.1%
MSW/Other Waste	All Glass	0.0%	0.0%	1.2%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	6.0%	0.0%	0.0%
Metal	Other Non-ferrous Metal	0.4%	0.0%	0.0%
Metal	HVAC Ducting	0.1%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	16.1%	0.0%	0.0%
Organics	Branches/Limbs	0.3%	0.0%	0.0%
Organics	R/C and Other Organics	0.0%	98.6%	45.0%
Wood	Pallets - Standard	0.0%	0.0%	0.3%
Wood	Pallets/Crates/Heavy	0.0%	0.0%	0.0%
Wood	Untreated/Unpainted Lumber	14.0%	0.0%	0.1%
Wood	Treated/Painted/Processed Wood	3.9%	0.0%	0.0%
Wood	Engineered Wood	6.0%	0.0%	0.1%
Wood	Wood Furniture	0.0%	0.0%	0.0%
Wood	Other Wood	0.0%	0.0%	0.0%
Other C&D	Carpet	0.9%	0.0%	0.0%
Other C&D	Carpet Padding	0.7%	0.0%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	0.0%	0.0%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	0.0%	0.0%	0.0%
Other C&D	Ceiling Tiles	0.0%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.0%	0.0%
Gypsum Board	Painted Gypsum Board	31.9%	0.0%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	0.0%	0.0%	0.0%
Other C&D	Insulation	3.9%	0.0%	0.0%
Other C&D	R/C and Other C&D	0.0%	0.0%	0.4%
MSW/Other Waste	Electronics	2.2%	0.0%	0.0%
MSW/Other Waste	Items with CRTs	0.4%	0.0%	0.0%
Special Wastes	Bulky Wastes/Furniture	1.8%	0.0%	0.0%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	8.7%	0.0%	0.0%
MSW/Other Waste	Mixed MSW	1.4%	0.0%	0.6%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		**100.0%**	**100.0%**	**100.0%**

APPENDIX Q

SPRINGFIELD LANDFILL

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APPENDIX Q - WASTE COMPOSITION AT SPRINGFIELD LANDFILL

Q 1. OVERVIEW

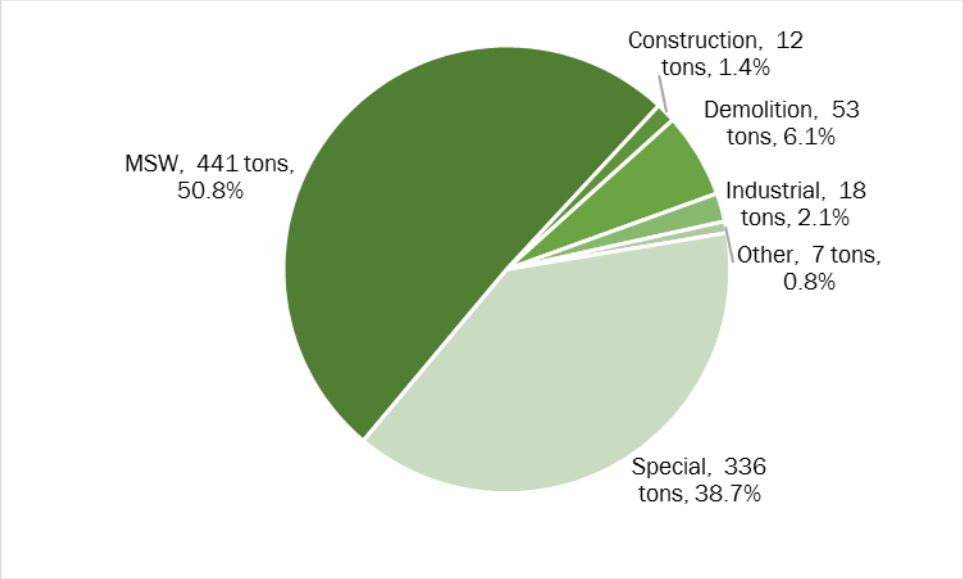
The Springfield Sanitary Landfill, located in the small metro Greene County and part of Solid Waste District Region O, is owned and operated by the City of Springfield. The facility accepted 254,806 tons of waste during CY2016. Springfield hosted both seasons of MSW manual sorting activity as well as the Gate/Visual non-MSW Surveying phase. Table Q-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table Q-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	16 Samples	3,361 Lbs	16 Samples	4,036 Lbs
Visual Surveys	30 Loads	85 Tons	521 Loads	1,802 Tons
Gate Surveys	97 Loads	881 Tons	521 Loads	1,802 Tons

Figure Q-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure Q-1 Gate Survey Results

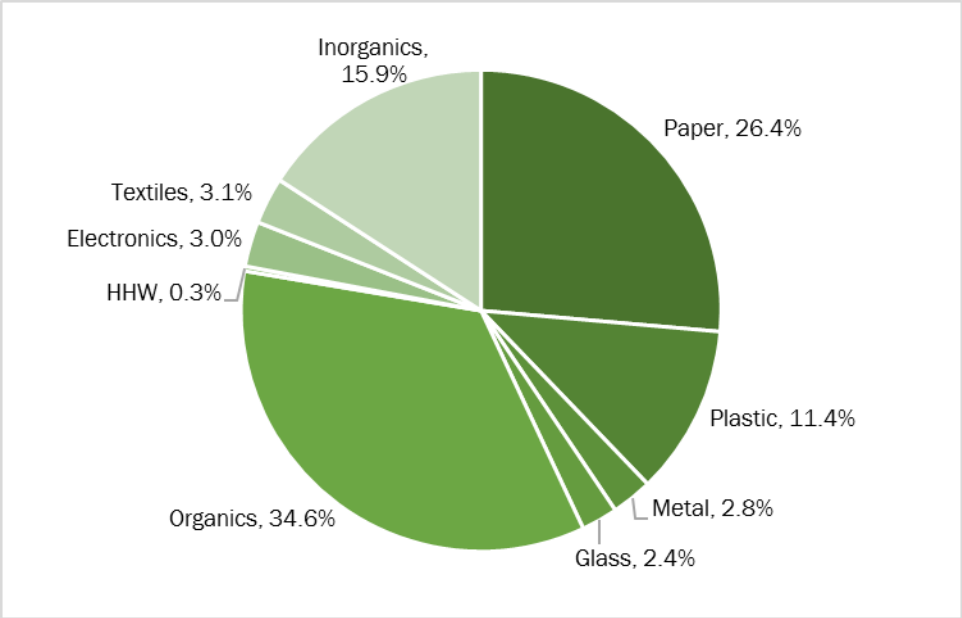


As shown, incoming waste at Springfield is half MSW. The mix of waste types observed in 2017 is very similar to the findings from the 2008 Study, where MSW was found to be 50 percent of inbound wastes.

Q 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in each of the Fall and Spring seasons. The aggregate composition of the sampled loads is presented in Figure Q-2. Organics was determined to be the largest component of the waste, at almost 35 percent, with over 26 percent being Paper materials.

Figure Q-2 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table Q-2. This table provides the mean composition and 90 percent confidence intervals from the study, and applies the results to the estimated 129,440 tons of MSW found to be disposed at the facility based on gate survey results.

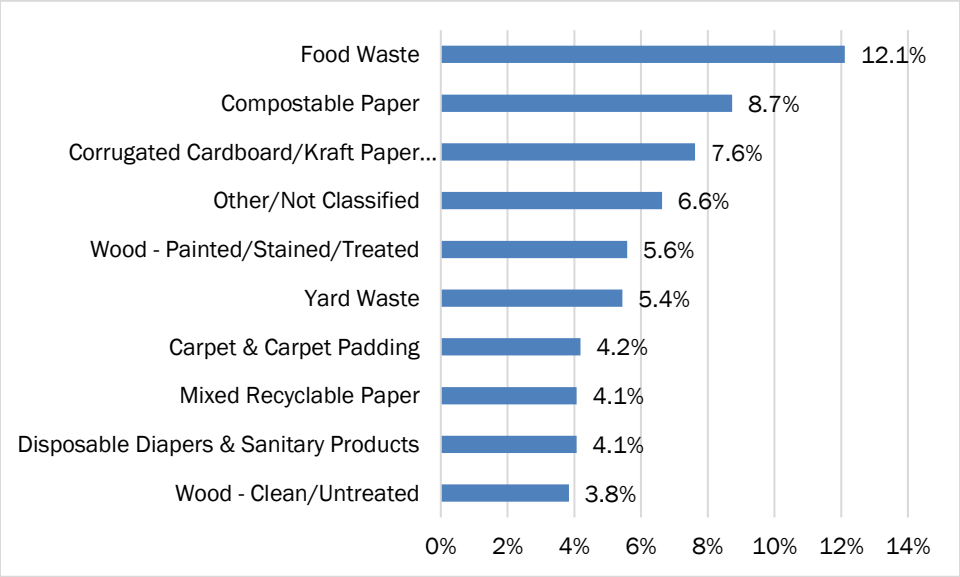
Table Q-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**26.4%**	**5.0%**	**67,237**	**Plastic**	**11.4%**	**2.2%**	**29,065**
OCC/Kraft Paper	7.6%	2.4%	19,421	PET (#1) Bottles/Jars	1.6%	0.6%	3,955
Newsprint	1.0%	0.6%	2,433	PET (#1) Non-Bottle containers	0.3%	0.1%	701
Magazines	1.1%	0.5%	2,889	HDPE (#2) Natural Containers	0.3%	0.1%	836
High Grade Office Paper	2.3%	1.1%	5,775	HDPE (#2) Colored Containers	0.7%	0.6%	1,667
Mixed Recyclable Paper	4.1%	1.6%	10,378	Clean Film Bags	0.1%	0.0%	282
Compostable Paper	8.7%	1.8%	22,248	Clean Indust'l/Com'l Film	0.0%	0.0%	-
Remainder/Composite Paper	1.6%	1.5%	4,093	Contaminated Film/Other Film	3.3%	0.9%	8,459
Glass	**2.4%**	**0.8%**	**6,240**	Plastic Containers #3 thru #7	1.0%	0.3%	2,450
Clear Glass Containers	1.6%	0.5%	4,061	Expanded Polystyrene #6	0.5%	0.2%	1,361
Brown Glass Containers	0.7%	0.4%	1,676	Bulky Durable Plastic Products	0.7%	0.5%	1,754
Green Glass Containers	0.1%	0.1%	141	Remainder/Composite Plastic	3.0%	1.7%	7,601
Remainder/Composite Glass	0.1%	0.1%	362	**Textiles**	**3.1%**	**1.3%**	**8,009**
Metal	**2.8%**	**1.0%**	**7,021**	Textiles - Clothing	0.5%	0.2%	1,267
Aluminum Cans & Containers	0.6%	0.3%	1,591	Textiles - Non-Clothing	2.2%	1.3%	5,637
Other Aluminum	0.2%	0.1%	426	Shoes/Belts/Leather	0.4%	0.2%	1,105
Tin/Steel Containers	1.1%	0.5%	2,735	**Inorganics**	**15.9%**	**9.9%**	**40,411**
Other Ferrous - Magnetic	0.7%	0.6%	1,738	Fines	0.5%	0.2%	1,390
Other Non-Ferrous	0.2%	0.2%	466	Drywall/Gypsum Board	0.1%	0.2%	263
Oil Filters	0.0%	0.0%	65	Asphalt, Brick, Concrete & Rock	0.4%	0.6%	1,050
Organics	**34.6%**	**5.2%**	**88,261**	Carpet & Carpet Padding	4.2%	4.0%	10,668
Food Waste	12.1%	4.1%	30,842	Other Construction & Demolitio	2.5%	1.7%	6,352
Wood - Clean/Untreated	3.8%	3.6%	9,777	Bulky Items/Furniture	0.6%	0.7%	1,420
Wood - Painted/Stained/Treate	5.6%	3.1%	14,226	Mattresses/Boxsprings	0.0%	0.0%	-
Diapers/Sanitary Products	4.1%	1.6%	10,371	Tires	0.9%	1.5%	2,382
Yard Waste	5.4%	4.5%	13,876	Other/Not Classified	6.6%	9.9%	16,887
Remainder/Composite Organic	3.6%	2.0%	9,169	**HHW**	**0.3%**	**0.3%**	**818**
Electronics	**3.0%**	**2.9%**	**7,714**	Household Hazardous Waste	0.3%	0.2%	818
Electronic Waste	3.0%	2.4%	7,714	**Grand Total**	**100%**		**129,440**
				No. of Samples	***16***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure Q-3 shows the ten most commonly occurring materials in the MSW sorted at Springfield. The top two, Food Waste and Compostable Paper, are compostable materials representing nearly 21 percent combined.

Figure Q-3 Top 10 Materials in MSW

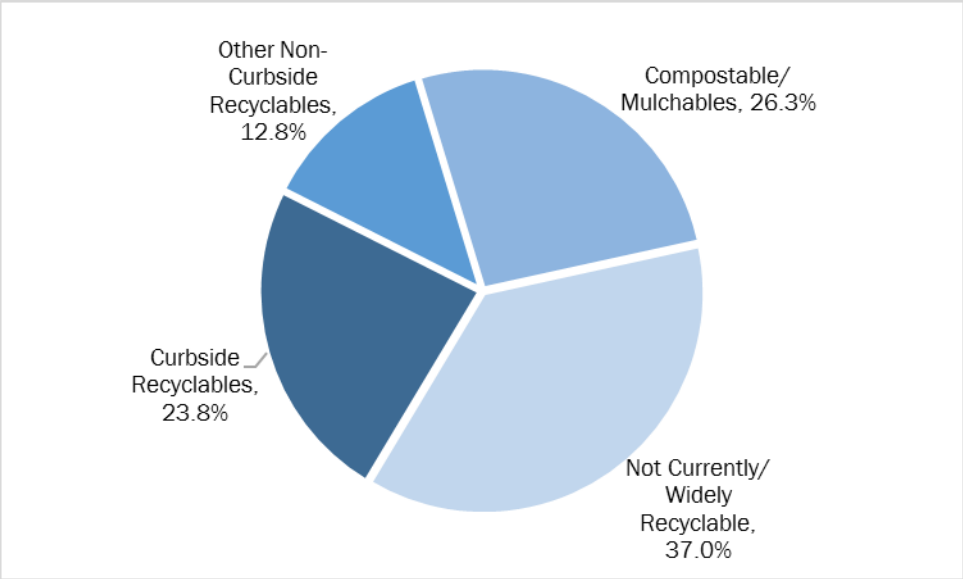


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Springfield Landfill sort activity results are displayed in Figure Q-4. As shown, 37 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 63 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure Q-4 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table Q-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results. This table also shows the results of any MSW sorting that was performed in the 2008 Study (note that the 2008 Study sorted into a smaller number of material categories).

Table Q-3 Composition Results by Generator Sector

	2017 Study					2017 Study			
Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l	2008 Agg-regate	Material Category	Agg-regate	Resi-dential	Com'l/ Inst'l	2008 Agg-regate
Paper	**26.4%**	**26.8%**	**25.5%**	**35.5%**	**Plastic**	**11.4%**	**11.4%**	**11.5%**	**17.4%**
OCC/Kraft Paper	7.6%	6.6%	9.3%	7.6%	PET (#1) Bottles/Jars	1.6%	1.5%	1.6%	2.7%
Newsprint	1.0%	1.4%	0.2%	7.0%	PET (#1) Non-Bottle containers	0.3%	0.3%	0.2%	
Magazines	1.1%	1.0%	1.4%	4.5%	HDPE (#2) Natural Containers	0.3%	0.5%	0.1%	2.1%
High Grade Office Paper	2.3%	2.1%	2.6%	6.8%	HDPE (#2) Colored Containers	0.7%	0.4%	1.1%	
Mixed Recyclable Paper	4.1%	3.9%	4.2%	9.6%	Clean Film Bags	0.1%	0.2%	0.0%	5.2%
Compostable Paper	8.7%	9.8%	6.8%		Clean Indust'l/Com'l Film	0.0%	0.0%	0.0%	
Remainder/Composite Paper	1.6%	2.0%	1.0%		Contaminated Film/Other Film	3.3%	4.0%	2.1%	
Glass	**2.4%**	**2.6%**	**2.1%**	**6.2%**	Plastic Containers #3 thru #7	1.0%	0.9%	1.0%	7.4%
Clear Glass Containers	1.6%	1.7%	1.4%	3.0%	Expanded Polystyrene #6	0.5%	0.6%	0.4%	
Brown Glass Containers	0.7%	0.7%	0.5%	2.1%	Bulky Durable Plastic Products	0.7%	1.0%	0.2%	
Green Glass Containers	0.1%	0.1%	0.0%	0.7%	Remainder/Composite Plastic	3.0%	1.9%	4.8%	
Remainder/Composite Glass	0.1%	0.2%	0.1%	0.4%	**Textiles**	**3.1%**	**4.2%**	**1.4%**	**3.0%**
Metal	**2.8%**	**3.8%**	**0.9%**	**8.0%**	Textiles - Clothing	0.5%	0.6%	0.4%	3.0%
Aluminum Cans & Containers	0.6%	0.8%	0.4%	1.6%	Textiles - Non-Clothing	2.2%	3.2%	0.6%	
Other Aluminum	0.2%	0.2%	0.1%	0.5%	Shoes/Belts/Leather	0.4%	0.4%	0.4%	
Tin/Steel Containers	1.1%	1.5%	0.3%	3.8%	**Inorganics**	**15.9%**	**12.3%**	**22.1%**	**3.4%**
Other Ferrous - Magnetic	0.7%	1.1%	0.1%	1.1%	Fines	0.5%	0.8%	0.2%	0.9%
Other Non-Ferrous	0.2%	0.3%	0.0%	0.5%	Drywall/Gypsum Board	0.1%	0.0%	0.3%	2.5%
Oil Filters	0.0%	0.0%	0.0%	0.5%	Asphalt, Brick, Concrete & Rocks	0.4%	0.7%	0.0%	
Organics	**34.6%**	**36.7%**	**31.2%**	**23.9%**	Carpet & Carpet Padding	4.2%	6.7%	0.3%	
Food Waste	12.1%	15.9%	5.6%	15.6%	Other Construction & Demolition	2.5%	1.4%	4.3%	
Wood - Clean/Untreated	3.8%	0.0%	10.2%	1.2%	Bulky Items/Furniture	0.6%	0.8%	0.2%	
Wood - Painted/Stained/Treated	5.6%	3.4%	9.3%		Mattresses/Boxsprings	0.0%	0.0%	0.0%	
Diapers/Sanitary Products	4.1%	5.4%	1.9%	6.0%	Tires	0.9%	1.5%	0.0%	
Yard Waste	5.4%	8.9%	0.0%	1.1%	Other/Not Classified	6.6%	0.6%	16.8%	
Remainder/Composite Organic	3.6%	3.1%	4.3%		**HHW**	**0.3%**	**0.5%**	**0.0%**	**1.7%**
Electronics	**3.0%**	**1.6%**	**5.3%**	**0.8%**	Household Hazardous Waste	0.3%	0.5%	0.0%	1.7%
Electronic Waste	3.0%	1.6%	5.3%	0.8%	**Grand Total**	**100%**	**100%**	**100%**	**100%**
					No. of Samples	**16**	**10**	**6**	**16**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

Q 3. VISUAL SURVEY RESULTS

Figure Q-5 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes was found to be Wood.

Figure Q-5 Composition of Construction Debris

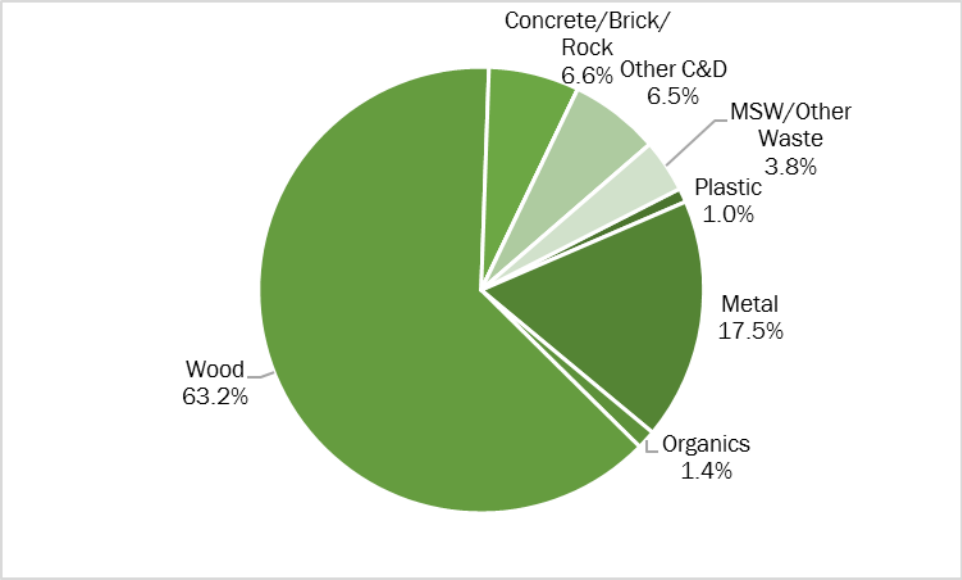


Figure Q-6 summarizes the composition of Demolition debris.

Figure Q-6 Composition of Demolition Debris

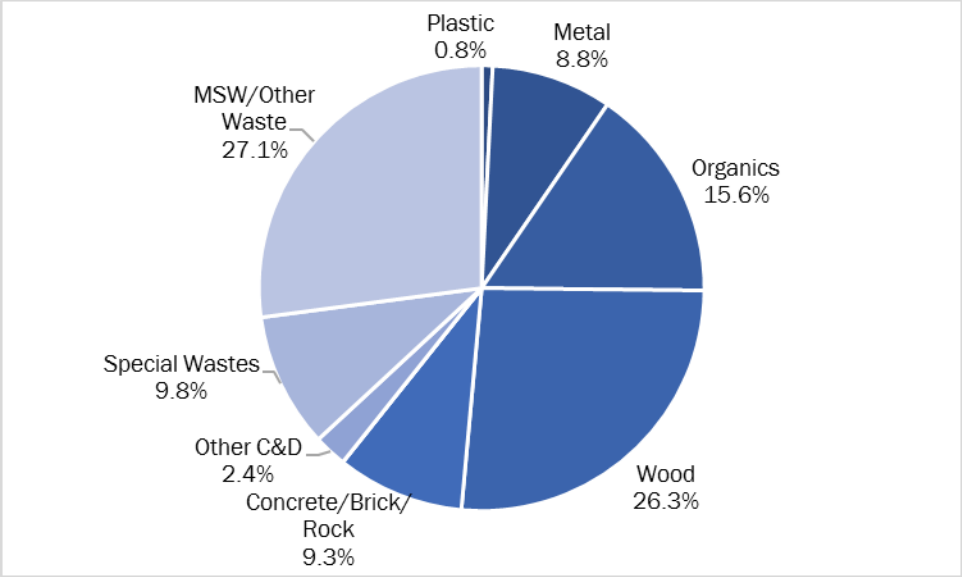


Figure Q-7 provides the composition of Industrial materials.

Figure Q-7 Industrial Waste Composition

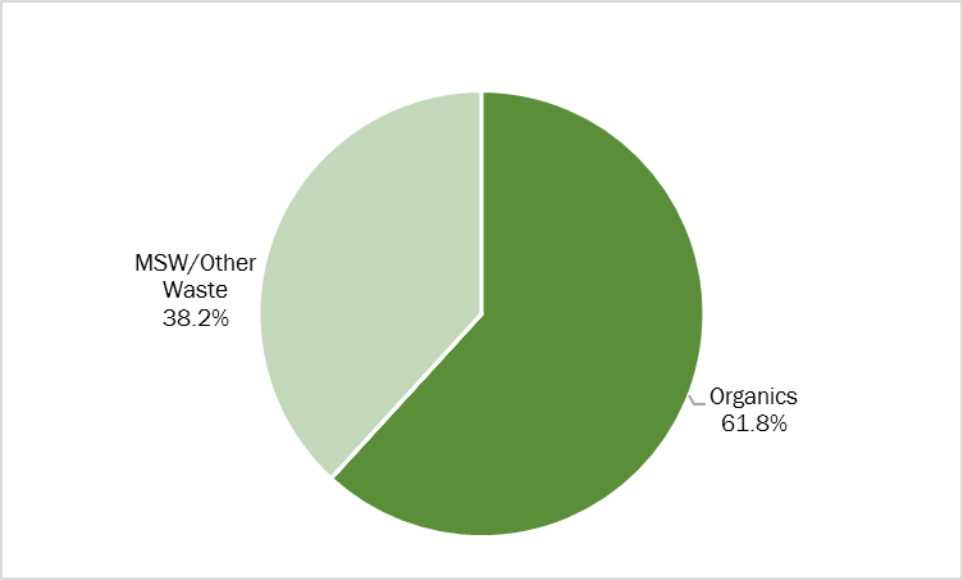


Table Q-4 provides the detailed composition of the three material groups.

Table Q-4 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	0.7%	0.4%	0.0%
MSW/Other Waste	Unflattened OCC	0.2%	0.2%	0.3%
MSW/Other Waste	R/C and Other Paper	0.0%	0.0%	0.0%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.1%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.1%	0.1%	0.0%
Plastic	Clean Recoverable Film	0.0%	0.0%	0.0%
Plastic	R/C and Other Plastic	0.5%	0.6%	0.0%
MSW/Other Waste	All Glass	0.7%	2.1%	0.5%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	5.2%	6.8%	0.0%
Metal	Other Non-ferrous Metal	6.7%	0.6%	0.0%
Metal	HVAC Ducting	0.0%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.9%	0.4%	0.0%
Organics	Branches/Limbs	0.0%	0.5%	0.0%
Organics	R/C and Other Organics	0.0%	12.4%	61.8%
Wood	Pallets - Standard	0.0%	0.8%	0.0%
Wood	Pallets/Crates/Heavy	0.0%	0.0%	0.0%
Wood	Untreated/Unpainted Lumber	27.9%	3.5%	0.0%
Wood	Treated/Painted/Processed Wood	6.0%	6.6%	0.0%
Wood	Engineered Wood	8.7%	0.6%	0.0%
Wood	Wood Furniture	0.0%	0.2%	0.0%
Wood	Other Wood	0.6%	10.6%	0.0%
Other C&D	Carpet	1.3%	1.1%	0.0%
Other C&D	Carpet Padding	0.0%	0.9%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	4.5%	7.9%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	0.0%	10.9%	0.0%
Other C&D	Ceiling Tiles	0.0%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	5.8%	1.3%	0.0%
Gypsum Board	Painted Gypsum Board	25.9%	3.0%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	0.0%	0.0%	0.0%
Other C&D	Insulation	0.5%	0.0%	0.0%
Other C&D	R/C and Other C&D	2.6%	0.0%	0.0%
MSW/Other Waste	Electronics	0.0%	2.1%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	1.2%	0.0%
Special Wastes	Bulky Wastes/Furniture	0.0%	7.9%	0.0%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.4%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	13.1%	0.0%
MSW/Other Waste	Mixed MSW	1.0%	4.0%	1.2%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	36.2%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX R

SPRINGFIELD RELAY TRANSFER STATION

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APPENDIX R - WASTE COMPOSITION AT SPRINGFIELD RELAY TRANSFER STATION

R 1. OVERVIEW

The Springfield Relay Transfer Station, located in small metro Greene County, is owned and operated by Republic Services, and is part of Solid Waste District Region O. The facility accepts waste and transfers to Prairie View Regional Landfill, where the tonnage is accounted for. This site was included in the second season of the Manual Sorting phase of this study to capture waste upstream of the Landfill, but was not a host to the Gate/Visual non-MSW Surveying phase. Table R-1 summarizes the data collection activities that took place at this facility.

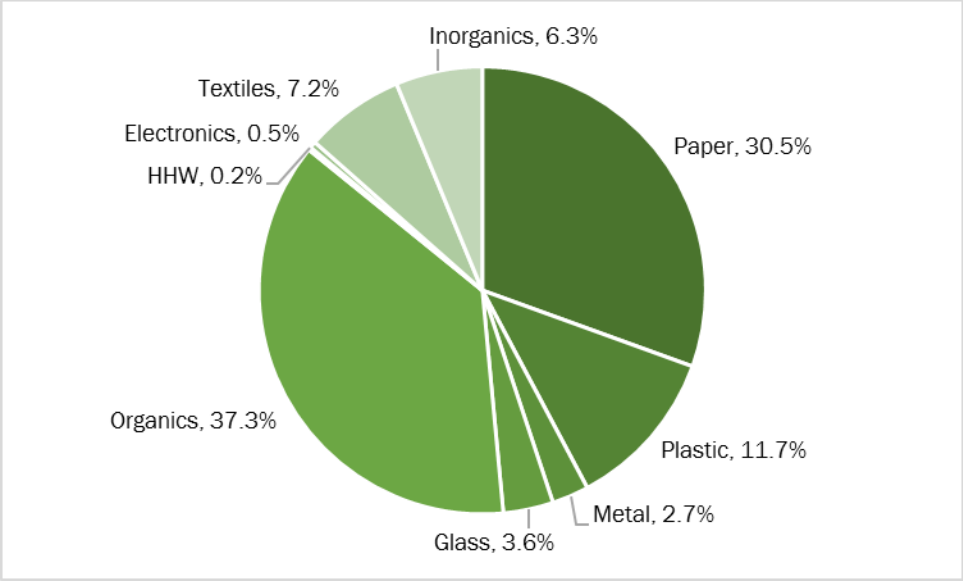
Table R-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	8 Samples	1,710 Lbs	N/A	N/A
Visual Surveys	N/A	N/A	N/A	N/A
Gate Surveys	N/A	N/A	N/A	N/A

R 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted during the Spring season. The aggregate composition of the sampled loads is presented in Figure R-1. Organics was determined to be the largest component of the waste, at over 37 percent, with over 30 percent being Paper materials.

Figure R-1 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table R-2. This table provides the mean composition and 90 percent confidence intervals from the study.

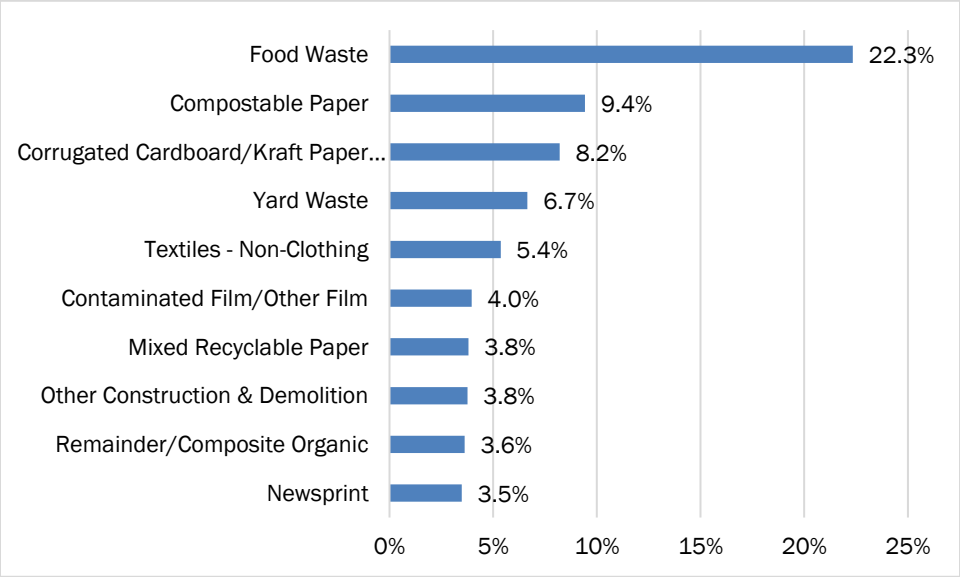
Table R-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Material Category	Est. Percent	Conf. Int (+/-)
Paper	**30.5%**	**6.1%**	**Plastic**	**11.7%**	**1.8%**
OCC/Kraft Paper	8.2%	3.4%	PET (#1) Bottles/Jars	1.3%	0.5%
Newsprint	3.5%	2.2%	PET (#1) Non-Bottle containers	0.3%	0.1%
Magazines	1.7%	0.9%	HDPE (#2) Natural Containers	0.4%	0.2%
High Grade Office Paper	1.0%	0.5%	HDPE (#2) Colored Containers	0.2%	0.1%
Mixed Recyclable Paper	3.8%	1.0%	Clean Film Bags	0.1%	0.0%
Compostable Paper	9.4%	2.6%	Clean Indust'l/Com'l Film	0.0%	0.0%
Remainder/Composite Paper	2.9%	4.0%	Contaminated Film/Other Film	4.0%	1.0%
Glass	**3.6%**	**1.6%**	Plastic Containers #3 thru #7	1.2%	0.5%
Clear Glass Containers	1.4%	0.5%	Expanded Polystyrene #6	0.8%	0.3%
Brown Glass Containers	0.7%	0.4%	Bulky Durable Plastic Products	0.1%	0.1%
Green Glass Containers	0.1%	0.1%	Remainder/Composite Plastic	3.3%	2.5%
Remainder/Composite Glass	1.4%	1.5%	**Textiles**	**7.2%**	**3.6%**
Metal	**2.7%**	**1.4%**	Textiles - Clothing	1.3%	0.8%
Aluminum Cans & Containers	0.4%	0.1%	Textiles - Non-Clothing	5.4%	3.5%
Other Aluminum	0.1%	0.1%	Shoes/Belts/Leather	0.6%	0.5%
Tin/Steel Containers	1.3%	0.5%	**Inorganics**	**6.3%**	**6.2%**
Other Ferrous - Magnetic	0.8%	1.0%	Fines	0.5%	0.3%
Other Non-Ferrous	0.0%	0.0%	Drywall/Gypsum Board	0.3%	0.4%
Oil Filters	0.0%	0.0%	Asphalt, Brick, Concrete & Rock	1.0%	1.0%
Organics	**37.3%**	**5.6%**	Carpet & Carpet Padding	0.4%	0.6%
Food Waste	22.3%	8.8%	Other Construction & Demolitior	3.8%	5.6%
Wood - Clean/Untreated	2.1%	3.3%	Bulky Items/Furniture	0.3%	0.4%
Wood - Painted/Stained/Treate	0.4%	0.3%	Mattresses/Boxsprings	0.0%	0.0%
Diapers/Sanitary Products	2.1%	1.7%	Tires	0.0%	0.0%
Yard Waste	6.7%	5.5%	Other/Not Classified	0.0%	0.0%
Remainder/Composite Organic	3.6%	3.0%	**HHW**	**0.2%**	**0.1%**
Electronics	**0.5%**	**1.0%**	Household Hazardous Waste	0.2%	0.1%
Electronic Waste	0.5%	0.7%	**Grand Total**	**100%**	
			No. of Samples	***8***	

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure R-2 shows the ten most commonly occurring materials in the MSW sorted at the Springfield Relay Transfer Station. Food Waste more than doubles the second highest material, Compostable Paper.

Figure R-2 Top 10 Materials in MSW

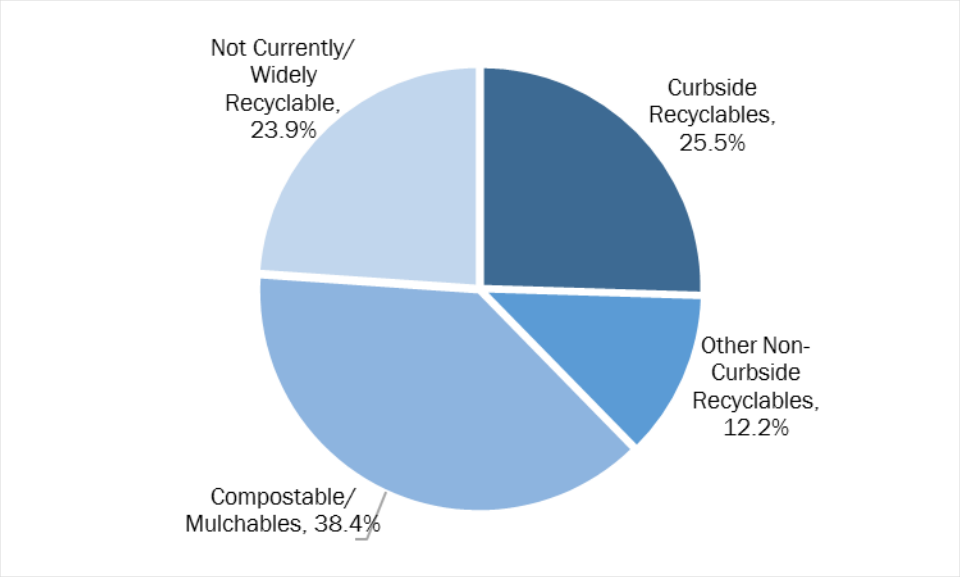


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Springfield Relay Transfer Station sort activity results are displayed in Figure R-3. As shown, less than 24 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 76 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure R-3 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However,

Table R-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results.

Table R-3 Composition Results by Generator Sector

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l
Paper	**30.5%**	**26.6%**	**34.2%**	**Plastic**	**11.7%**	**11.5%**	**11.8%**
OCC/Kraft Paper	8.2%	6.1%	10.4%	PET (#1) Bottles/Jars	1.3%	1.9%	0.7%
Newsprint	3.5%	2.1%	4.8%	PET (#1) Non-Bottle containers	0.3%	0.4%	0.2%
Magazines	1.7%	1.7%	1.6%	HDPE (#2) Natural Containers	0.4%	0.3%	0.5%
High Grade Office Paper	1.0%	0.9%	1.1%	HDPE (#2) Colored Containers	0.2%	0.4%	0.1%
Mixed Recyclable Paper	3.8%	4.8%	2.8%	Clean Film Bags	0.1%	0.1%	0.1%
Compostable Paper	9.4%	10.5%	8.3%	Clean Indust'l/Com'l Film	0.0%	0.0%	0.1%
Remainder/Composite Paper	2.9%	0.4%	5.3%	Contaminated Film/Other Film	4.0%	4.2%	3.7%
Glass	**3.6%**	**3.2%**	**3.9%**	Plastic Containers #3 thru #7	1.2%	0.9%	1.6%
Clear Glass Containers	1.4%	1.6%	1.2%	Expanded Polystyrene #6	0.8%	1.0%	0.6%
Brown Glass Containers	0.7%	0.8%	0.5%	Bulky Durable Plastic Products	0.1%	0.1%	0.1%
Green Glass Containers	0.1%	0.0%	0.3%	Remainder/Composite Plastic	3.3%	2.2%	4.3%
Remainder/Composite Glass	1.4%	0.8%	1.9%	**Textiles**	**7.2%**	**11.1%**	**3.3%**
Metal	**2.7%**	**3.9%**	**1.4%**	Textiles - Clothing	1.3%	1.1%	1.4%
Aluminum Cans & Containers	0.4%	0.6%	0.2%	Textiles - Non-Clothing	5.4%	9.8%	1.0%
Other Aluminum	0.1%	0.2%	0.1%	Shoes/Belts/Leather	0.6%	0.2%	0.9%
Tin/Steel Containers	1.3%	1.6%	0.9%	**Inorganics**	**6.3%**	**4.6%**	**8.2%**
Other Ferrous - Magnetic	0.8%	1.5%	0.1%	Fines	0.5%	0.8%	0.2%
Other Non-Ferrous	0.0%	0.0%	0.0%	Drywall/Gypsum Board	0.3%	0.6%	0.0%
Oil Filters	0.0%	0.0%	0.0%	Asphalt, Brick, Concrete & Rocks	1.0%	2.0%	0.0%
Organics	**37.3%**	**38.0%**	**37.0%**	Carpet & Carpet Padding	0.4%	0.8%	0.0%
Food Waste	22.3%	14.2%	30.8%	Other Construction & Demolition	3.8%	0.2%	7.5%
Wood - Clean/Untreated	2.1%	0.0%	4.2%	Bulky Items/Furniture	0.3%	0.1%	0.5%
Wood - Painted/Stained/Treated	0.4%	0.3%	0.5%	Mattresses/Boxsprings	0.0%	0.0%	0.0%
Diapers/Sanitary Products	2.1%	3.9%	0.4%	Tires	0.0%	0.0%	0.0%
Yard Waste	6.7%	13.4%	0.0%	Other/Not Classified	0.0%	0.0%	0.0%
Remainder/Composite Organic	3.6%	6.2%	1.1%	**HHW**	**0.2%**	**0.2%**	**0.2%**
Electronics	**0.5%**	**0.9%**	**0.0%**	Household Hazardous Waste	0.2%	0.2%	0.2%
Electronic Waste	0.5%	0.9%	0.0%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**8**	**4**	**4**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

APPENDIX S

ST. JOSEPH LANDFILL

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APPENDIX S - WASTE COMPOSITION AT ST. JOSEPH LANDFILL

S 1. OVERVIEW

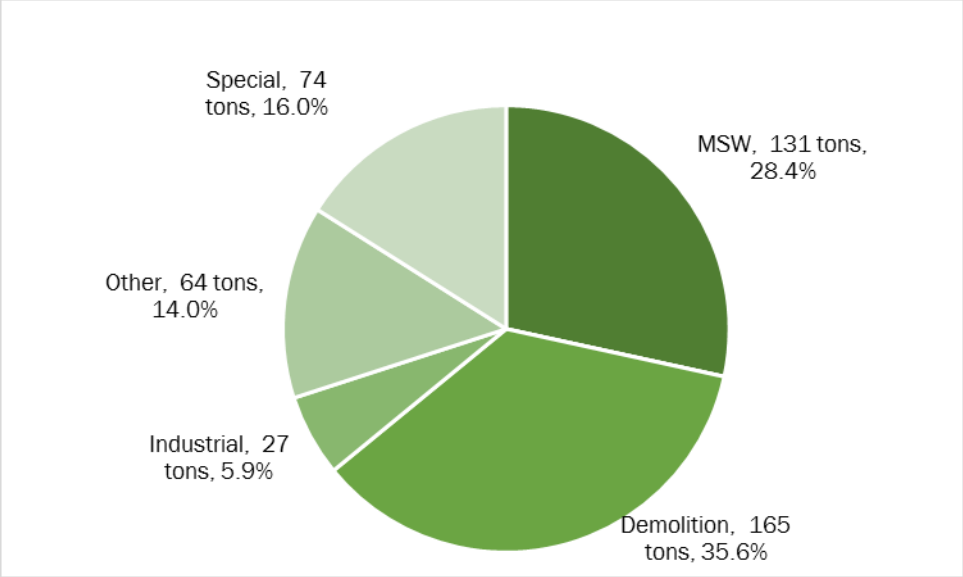
The St. Joseph Sanitary Landfill, located in the small metro Buchanan Macon County, is owned and operated by the city of St. Joseph, and is part of Solid Waste District Region D. The facility accepted 112,701 tons of waste during CY2016. This site participated in the Gate/Visual non-MSW Surveying phase of the study, but not the MSW manual sorting phase. Table S-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table S-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	N/A	N/A	16 Samples	3,735 Lbs
Visual Surveys	30 Loads	103 Tons	646 Loads	3,002 Tons
Gate Surveys	130 Loads	462 Tons	646 Loads	3,002 Tons

Figure S-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure S-1 Gate Survey Results



As shown, incoming waste at St. Joseph is over 35 percent Demolition. The mix of waste types observed in 2017 is varied from the findings from the 2008 Study, where MSW was found to be the main waste stream at 53.7 percent of inbound wastes.

S 2. VISUAL SURVEY RESULTS

Figure S-2 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the majority of these wastes were found to be Concrete/Brick/Rock and Wood.

Figure S-2 Composition of Construction Debris

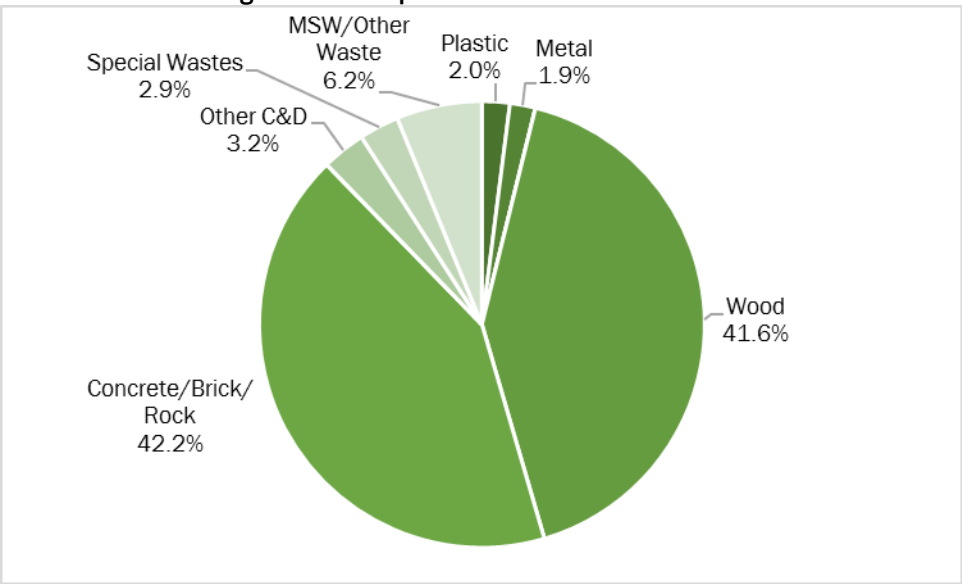


Figure S-3 summarizes the composition of Demolition debris.

Figure S-3 Composition of Demolition Debris

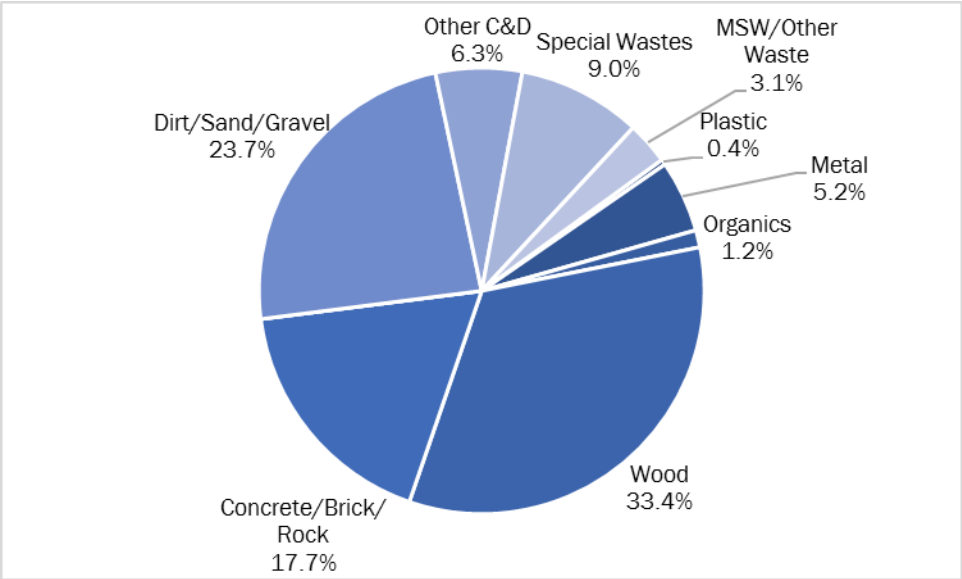


Figure S-4 provides the composition of Industrial materials. Organics constituted over 77 percent of this sector.

Figure S-4 Industrial Waste Composition

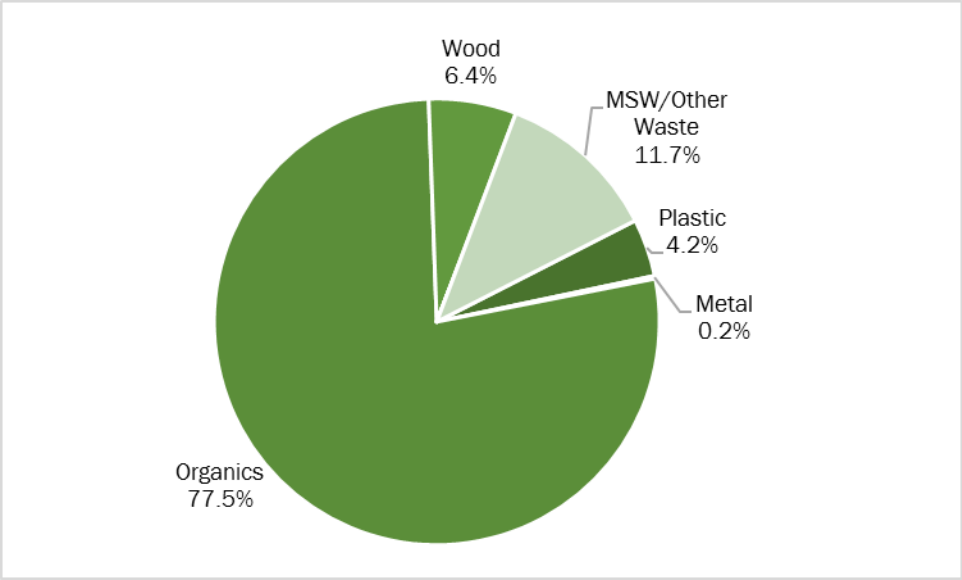


Table S-2 provides the detailed composition of the three material groups.

Table S-2 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	1.0%	0.3%	4.8%
MSW/Other Waste	Unflattened OCC	0.1%	0.2%	2.4%
MSW/Other Waste	R/C and Other Paper	0.0%	0.0%	0.7%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.0%	0.0%	0.0%
Plastic	Clean Recoverable Film	0.0%	0.0%	1.6%
Plastic	R/C and Other Plastic	2.0%	0.3%	2.6%
MSW/Other Waste	All Glass	0.0%	0.0%	0.0%
Metal	Appliances	0.0%	0.6%	0.0%
Metal	Other Ferrous Metals	1.9%	4.1%	0.2%
Metal	Other Non-ferrous Metal	0.0%	0.0%	0.0%
Metal	HVAC Ducting	0.0%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	0.6%	0.3%
Organics	Branches/Limbs	0.0%	0.2%	0.0%
Organics	R/C and Other Organics	0.0%	0.3%	77.2%
Wood	Pallets - Standard	0.0%	0.8%	0.7%
Wood	Pallets/Crates/Heavy	0.0%	0.1%	0.0%
Wood	Untreated/Unpainted Lumber	24.8%	1.6%	3.6%
Wood	Treated/Painted/Processed Wood	0.0%	17.1%	1.0%
Wood	Engineered Wood	16.8%	5.1%	0.9%
Wood	Wood Furniture	0.0%	5.1%	0.0%
Wood	Other Wood	0.0%	0.0%	0.0%
Other C&D	Carpet	0.0%	2.5%	0.0%
Other C&D	Carpet Padding	0.0%	0.5%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	42.2%	15.9%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	0.0%	0.4%	0.0%
Other C&D	Ceiling Tiles	0.0%	0.4%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.3%	0.0%
Gypsum Board	Painted Gypsum Board	0.0%	9.9%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	0.0%	21.2%	0.0%
Other C&D	Insulation	3.2%	1.8%	0.0%
Other C&D	R/C and Other C&D	0.0%	0.4%	0.0%
MSW/Other Waste	Electronics	0.0%	0.1%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	0.3%	0.0%
Special Wastes	Bulky Wastes/Furniture	2.9%	8.0%	0.0%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	0.0%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	0.0%	0.0%
MSW/Other Waste	Mixed MSW	5.1%	1.9%	2.9%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	1.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX T

ST. LOUIS WASTE TRANSFER STATION

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APPENDIX T - WASTE COMPOSITION AT ST. LOUIS WASTE TRANSFER STATION

T 1. OVERVIEW

The St. Louis Waste Transfer Station, located in large metro St. Louis area and St. Louis County, is owned and operated by Republic Services, and is part of Solid Waste District Region L. The facility accepts waste and transfers out of state for disposal and reported 226,282 tons for CY2016. This site was included in both seasons of the MSW manual sorting phase of this study, but not the Gate/Visual non-MSW Surveying phase. Table T-1 summarizes the data collection activities that took place at this facility.

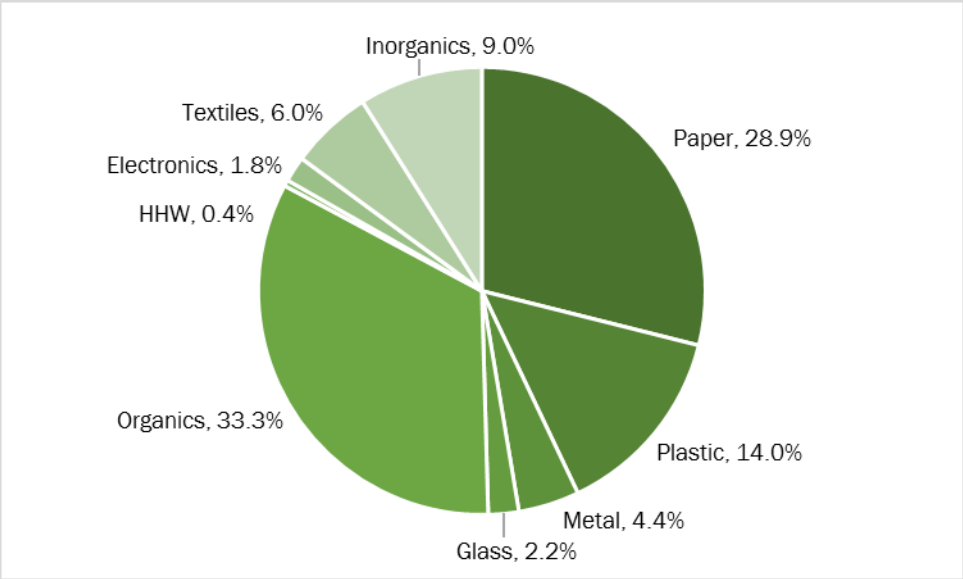
Table T-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	16 Samples	3,528 Lbs	N/A	N/A
Visual Surveys	N/A	N/A	N/A	N/A
Gate Surveys	N/A	N/A	N/A	N/A

T 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in each of the Fall and Spring seasons. The aggregate composition of the sampled loads is presented in Figure T-1. Organics was determined to be the largest component of the waste, at over 33 percent, with nearly 29 percent being Paper materials.

Figure T-1 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table T-2. This table provides the mean composition and 90 percent confidence intervals from the study.

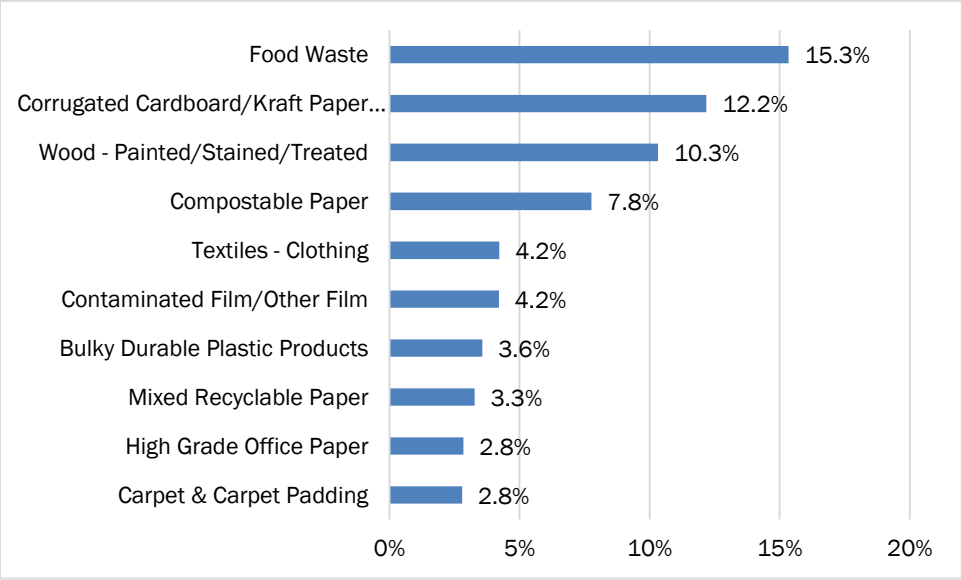
Table T-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**28.9%**	**4.6%**	**65,418**	**Plastic**	**14.0%**	**1.7%**	**31,739**
OCC/Kraft Paper	12.2%	5.1%	27,561	PET (#1) Bottles/Jars	1.2%	0.3%	2,689
Newsprint	0.9%	0.4%	1,970	PET (#1) Non-Bottle containers	0.2%	0.1%	515
Magazines	0.6%	0.3%	1,471	HDPE (#2) Natural Containers	0.2%	0.1%	538
High Grade Office Paper	2.8%	1.9%	6,438	HDPE (#2) Colored Containers	0.2%	0.1%	547
Mixed Recyclable Paper	3.3%	0.9%	7,413	Clean Film Bags	0.3%	0.1%	566
Compostable Paper	7.8%	1.8%	17,571	Clean Indust'l/Com'l Film	0.5%	0.5%	1,069
Remainder/Composite Paper	1.3%	0.7%	2,994	Contaminated Film/Other Film	4.2%	1.1%	9,508
Glass	**2.2%**	**1.1%**	**4,972**	Plastic Containers #3 thru #7	0.9%	0.3%	1,995
Clear Glass Containers	0.9%	0.3%	1,929	Expanded Polystyrene #6	0.6%	0.2%	1,449
Brown Glass Containers	0.5%	0.3%	1,125	Bulky Durable Plastic Products	3.6%	2.2%	8,081
Green Glass Containers	0.2%	0.2%	561	Remainder/Composite Plastic	2.1%	0.9%	4,782
Remainder/Composite Glass	0.6%	0.7%	1,356	**Textiles**	**6.0%**	**4.3%**	**13,480**
Metal	**4.4%**	**2.5%**	**9,984**	Textiles - Clothing	4.2%	3.8%	9,544
Aluminum Cans & Containers	0.6%	0.3%	1,463	Textiles - Non-Clothing	1.3%	0.8%	3,033
Other Aluminum	0.4%	0.2%	906	Shoes/Belts/Leather	0.4%	0.2%	904
Tin/Steel Containers	0.7%	0.2%	1,534	**Inorganics**	**9.0%**	**4.7%**	**20,274**
Other Ferrous - Magnetic	0.8%	0.6%	1,915	Fines	1.0%	0.5%	2,363
Other Non-Ferrous	1.8%	2.3%	4,167	Drywall/Gypsum Board	0.1%	0.2%	221
Oil Filters	0.0%	0.0%	-	Asphalt, Brick, Concrete & Rocks	0.2%	0.3%	419
Organics	**33.3%**	**8.5%**	**75,244**	Carpet & Carpet Padding	2.8%	2.9%	6,307
Food Waste	15.3%	4.7%	34,710	Other Construction & Demolition	0.4%	0.3%	818
Wood - Clean/Untreated	2.7%	2.0%	6,072	Bulky Items/Furniture	2.0%	2.1%	4,576
Wood - Painted/Stained/Treate	10.3%	9.9%	23,343	Mattresses/Boxsprings	1.8%	2.1%	4,185
Diapers/Sanitary Products	1.9%	1.2%	4,251	Tires	0.0%	0.0%	-
Yard Waste	0.7%	0.7%	1,649	Other/Not Classified	0.6%	0.3%	1,385
Remainder/Composite Organic	2.3%	2.1%	5,218	**HHW**	**0.4%**	**0.2%**	**987**
Electronics	**1.8%**	**2.3%**	**4,184**	Household Hazardous Waste	0.4%	0.2%	987
Electronic Waste	1.8%	1.8%	4,184	**Grand Total**	**100%**		
				No. of Samples	***16***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure T-2 shows the ten most commonly occurring materials in the MSW sorted at the St. Louis Waste Transfer Station.

Figure T-2 Top 10 Materials in MSW

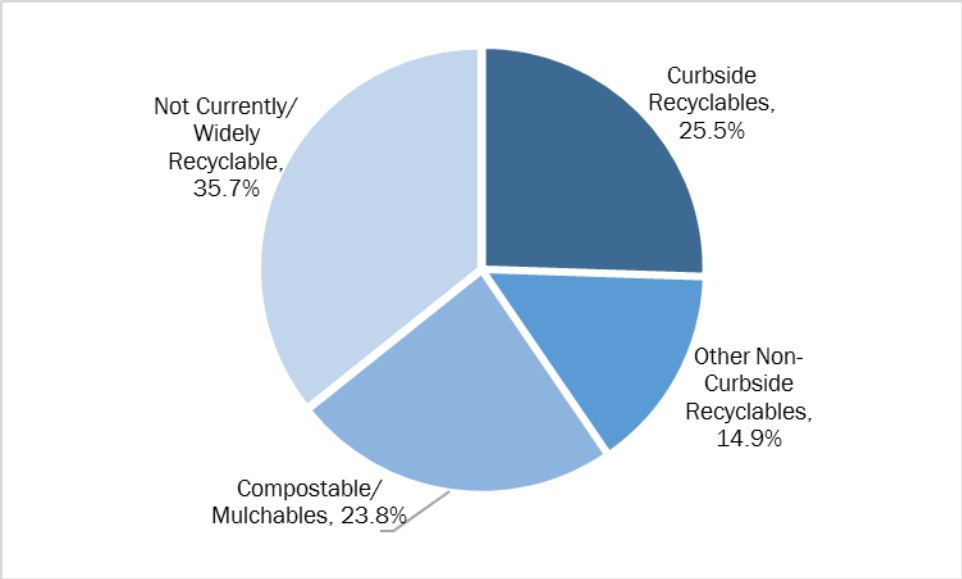


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the St. Louis Waste Transfer Station sort activity results are displayed in Figure T-3 . As shown, approximately 36 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 64 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure T-3 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table T-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results.

Table T-3 Composition Results by Generator Sector

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l
Paper	**28.9%**	**22.3%**	**31.9%**	**Plastic**	**14.0%**	**14.9%**	**13.6%**
OCC/Kraft Paper	12.2%	3.9%	15.9%	PET (#1) Bottles/Jars	1.2%	1.3%	1.2%
Newsprint	0.9%	1.4%	0.6%	PET (#1) Non-Bottle containers	0.2%	0.3%	0.2%
Magazines	0.6%	0.4%	0.7%	HDPE (#2) Natural Containers	0.2%	0.2%	0.2%
High Grade Office Paper	2.8%	1.3%	3.5%	HDPE (#2) Colored Containers	0.2%	0.4%	0.2%
Mixed Recyclable Paper	3.3%	4.6%	2.8%	Clean Film Bags	0.3%	0.4%	0.2%
Compostable Paper	7.8%	9.7%	6.9%	Clean Indust'l/Com'l Film	0.5%	0.0%	0.7%
Remainder/Composite Paper	1.3%	0.9%	1.5%	Contaminated Film/Other Film	4.2%	4.8%	3.9%
Glass	**2.2%**	**2.1%**	**2.3%**	Plastic Containers #3 thru #7	0.9%	1.0%	0.8%
Clear Glass Containers	0.9%	1.4%	0.6%	Expanded Polystyrene #6	0.6%	0.8%	0.6%
Brown Glass Containers	0.5%	0.3%	0.6%	Bulky Durable Plastic Products	3.6%	4.5%	3.0%
Green Glass Containers	0.2%	0.1%	0.3%	Remainder/Composite Plastic	2.1%	1.2%	2.6%
Remainder/Composite Glass	0.6%	0.3%	0.8%	**Textiles**	**6.0%**	**4.9%**	**6.4%**
Metal	**4.4%**	**4.1%**	**4.5%**	Textiles - Clothing	4.2%	2.0%	5.2%
Aluminum Cans & Containers	0.6%	0.8%	0.5%	Textiles - Non-Clothing	1.3%	2.0%	1.0%
Other Aluminum	0.4%	0.3%	0.4%	Shoes/Belts/Leather	0.4%	0.8%	0.2%
Tin/Steel Containers	0.7%	1.1%	0.5%	**Inorganics**	**9.0%**	**16.9%**	**5.8%**
Other Ferrous - Magnetic	0.8%	0.5%	1.0%	Fines	1.0%	1.6%	0.8%
Other Non-Ferrous	1.8%	1.3%	2.0%	Drywall/Gypsum Board	0.1%	0.3%	0.0%
Oil Filters	0.0%	0.0%	0.0%	Asphalt, Brick, Concrete & Rocks	0.2%	0.5%	0.0%
Organics	**33.3%**	**29.0%**	**34.8%**	Carpet & Carpet Padding	2.8%	2.6%	3.1%
Food Waste	15.3%	17.0%	14.8%	Other Construction & Demolition	0.4%	0.6%	0.3%
Wood - Clean/Untreated	2.7%	0.7%	3.5%	Bulky Items/Furniture	2.0%	4.9%	0.9%
Wood - Painted/Stained/Treated	10.3%	5.4%	12.0%	Mattresses/Boxsprings	1.8%	6.1%	0.0%
Diapers/Sanitary Products	1.9%	3.6%	1.1%	Tires	0.0%	0.0%	0.0%
Yard Waste	0.7%	0.6%	0.8%	Other/Not Classified	0.6%	0.3%	0.8%
Remainder/Composite Organic	2.3%	1.7%	2.6%	**HHW**	**0.4%**	**0.5%**	**0.4%**
Electronics	**1.8%**	**5.5%**	**0.3%**	Household Hazardous Waste	0.4%	0.5%	0.4%
Electronic Waste	1.8%	5.5%	0.3%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**16**	**5**	**11**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

APPENDIX U

TIMBER RIDGE LANDFILL

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APPENDIX U - WASTE COMPOSITION AT TIMBER RIDGE LANDFILL

U 1. OVERVIEW

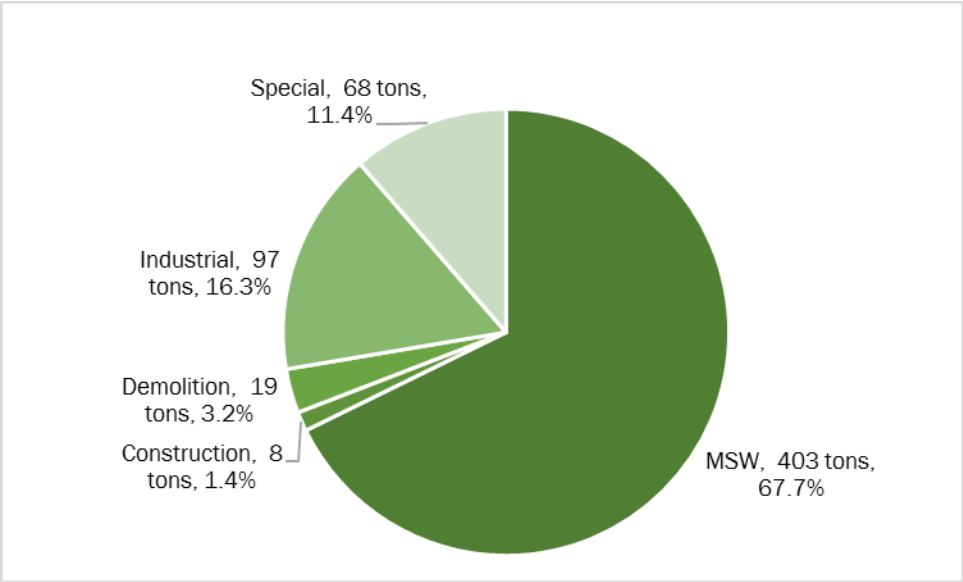
The Timber Ridge Landfill, located in rural Washington County and part of Solid Waste District Region K, is owned and operated by Waste Connections. The facility accepted 200,940 tons of waste during CY2016. Timber Ridge hosted Season 2 MSW manual sorting activities as well as the Gate/Visual non-MSW Surveying phase. Table U-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table U-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	8 Samples	1,673 Lbs	N/A	N/A
Visual Surveys	11 Loads	122 Tons	341 Loads	3,757 Tons
Gate Surveys	51 Loads	595 Tons	341 Loads	3,757 Tons

Figure U-1 shows the breakdown by the six waste types entering this facility, based on the results of the gate survey.

Figure U-1 Gate Survey Results

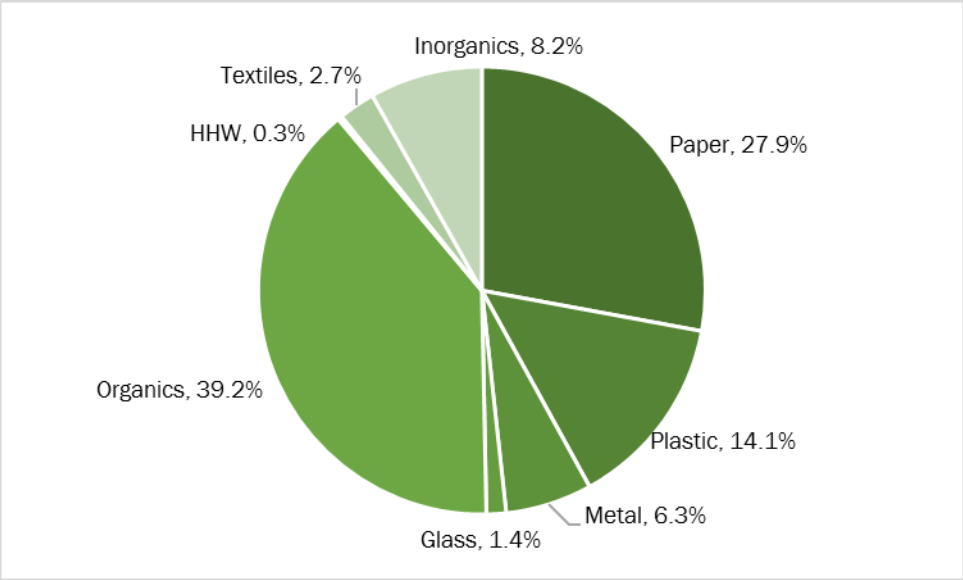


As shown, incoming waste at Timber Ridge is predominantly MSW, the receiving landfill for wastes from several transfer stations as well as from individual haulers and local routes. The mix of waste types observed in 2017 is somewhat different from the findings from the 2008 Study, where MSW was found to be almost 79 percent of inbound wastes.

U 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in the Spring season. The aggregate composition of the sampled loads is presented in Figure U-2. Organics was determined to be the largest component of the waste, at over 39 percent, with almost 28 percent being Paper materials.

Figure U-2 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table U-2. This table provides the mean composition and 90 percent confidence intervals from the study, and applies the results to the estimated 136,132 tons of MSW found to be disposed at the facility based on gate survey results.

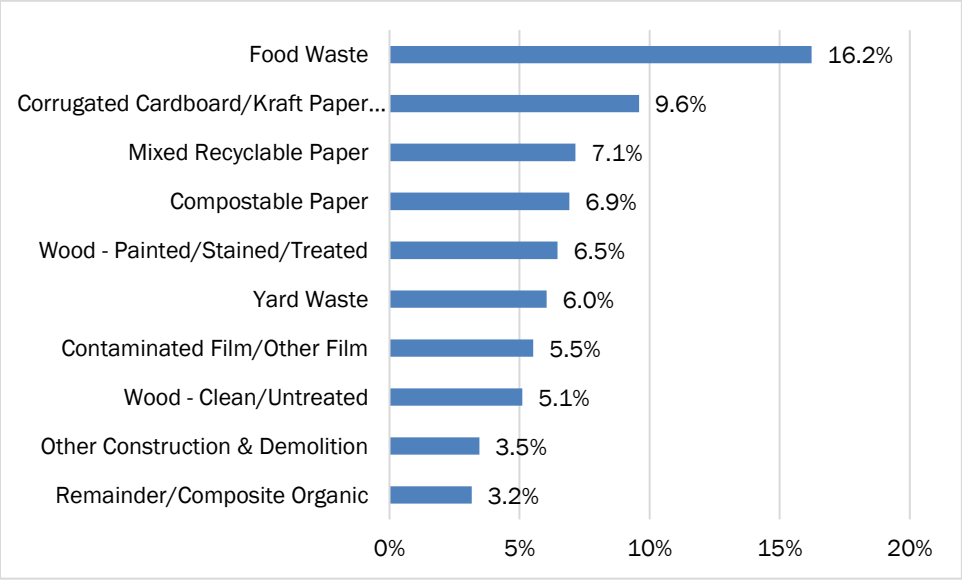
Table U-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**27.9%**	**7.6%**	**56,066**	**Plastic**	**14.1%**	**2.9%**	**28,337**
OCC/Kraft Paper	9.6%	3.9%	19,275	PET (#1) Bottles/Jars	2.1%	0.5%	4,294
Newsprint	0.7%	0.8%	1,491	PET (#1) Non-Bottle containers	0.5%	0.2%	939
Magazines	0.8%	0.7%	1,588	HDPE (#2) Natural Containers	0.4%	0.1%	767
High Grade Office Paper	1.2%	1.1%	2,465	HDPE (#2) Colored Containers	0.5%	0.1%	1,017
Mixed Recyclable Paper	7.1%	4.7%	14,355	Clean Film Bags	0.6%	0.7%	1,212
Compostable Paper	6.9%	1.6%	13,889	Clean Indust'l/Com'l Film	0.0%	0.0%	12
Remainder/Composite Paper	1.5%	1.6%	3,004	Contaminated Film/Other Film	5.5%	1.5%	11,101
Glass	**1.4%**	**0.7%**	**2,850**	Plastic Containers #3 thru #7	0.9%	0.3%	1,736
Clear Glass Containers	0.6%	0.4%	1,270	Expanded Polystyrene #6	0.8%	0.3%	1,698
Brown Glass Containers	0.3%	0.2%	676	Bulky Durable Plastic Products	1.2%	0.6%	2,442
Green Glass Containers	0.0%	0.0%	-	Remainder/Composite Plastic	1.6%	0.7%	3,119
Remainder/Composite Glass	0.4%	0.3%	904	**Textiles**	**2.7%**	**2.2%**	**5,327**
Metal	**6.3%**	**4.1%**	**12,573**	Textiles - Clothing	1.5%	2.0%	3,026
Aluminum Cans & Containers	0.7%	0.2%	1,351	Textiles - Non-Clothing	0.5%	0.2%	1,045
Other Aluminum	0.1%	0.1%	225	Shoes/Belts/Leather	0.6%	0.4%	1,256
Tin/Steel Containers	1.3%	0.6%	2,619	**Inorganics**	**8.2%**	**4.5%**	**16,389**
Other Ferrous - Magnetic	3.0%	3.9%	6,030	Fines	0.7%	0.2%	1,354
Other Non-Ferrous	1.2%	1.7%	2,347	Drywall/Gypsum Board	1.6%	2.5%	3,213
Oil Filters	0.0%	0.0%	-	Asphalt, Brick, Concrete & Rocks	0.3%	0.5%	639
Organics	**39.2%**	**8.2%**	**78,792**	Carpet & Carpet Padding	0.2%	0.3%	375
Food Waste	16.2%	5.4%	32,596	Other Construction & Demolition	3.5%	2.5%	6,943
Wood - Clean/Untreated	5.1%	3.5%	10,257	Bulky Items/Furniture	0.0%	0.0%	-
Wood - Painted/Stained/Treate	6.5%	4.8%	12,981	Mattresses/Boxsprings	1.9%	3.0%	3,865
Diapers/Sanitary Products	2.2%	1.4%	4,479	Tires	0.0%	0.0%	-
Yard Waste	6.0%	5.7%	12,133	Other/Not Classified	0.0%	0.0%	-
Remainder/Composite Organic	3.2%	2.3%	6,345	**HHW**	**0.3%**	**0.1%**	**518**
Electronics	**0.0%**	**0.0%**	**87**	Household Hazardous Waste	0.3%	0.1%	518
Electronic Waste	0.0%	0.1%	87	**Grand Total**	**100%**		**136,132**
				No. of Samples	***8***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure U-3 shows the ten most commonly occurring materials in the MSW sorted at Timber Ridge. Food Waste was the most commonly found material at 16.2 percent.

Figure U-3 Top 10 Materials in MSW

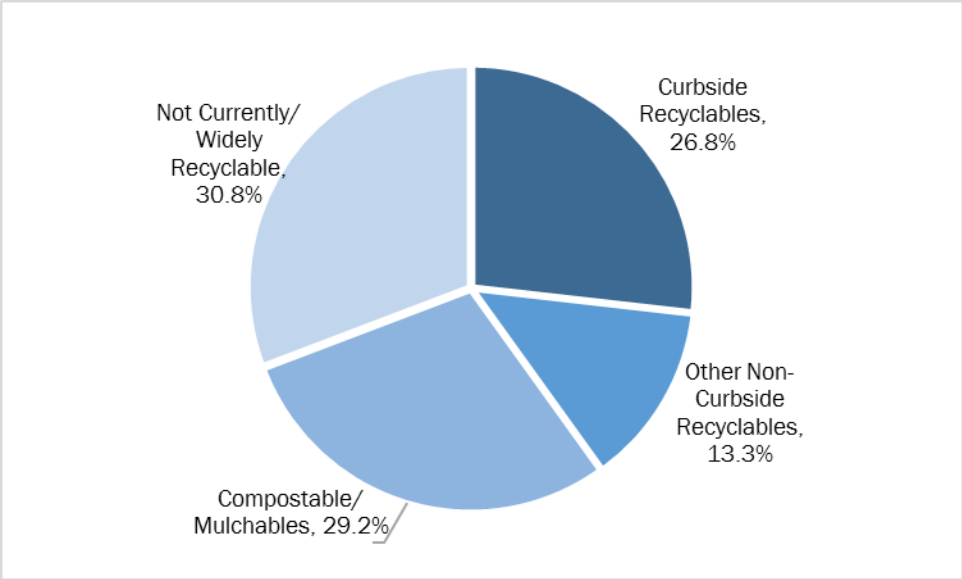


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Timber Ridge sort activity results are displayed in Figure U-4. As shown, approximately 31 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 69 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure U-4 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table U-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results.

Table U-3 Detailed Results

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l
Paper	**27.9%**	**20.1%**	**32.6%**	**Plastic**	**14.1%**	**14.1%**	**14.1%**
OCC/Kraft Paper	9.6%	4.1%	12.9%	PET (#1) Bottles/Jars	2.1%	2.4%	2.0%
Newsprint	0.7%	1.5%	0.2%	PET (#1) Non-Bottle containers	0.5%	0.3%	0.6%
Magazines	0.8%	1.8%	0.1%	HDPE (#2) Natural Containers	0.4%	0.5%	0.3%
High Grade Office Paper	1.2%	0.4%	1.7%	HDPE (#2) Colored Containers	0.5%	0.4%	0.5%
Mixed Recyclable Paper	7.1%	5.4%	8.2%	Clean Film Bags	0.6%	0.2%	0.9%
Compostable Paper	6.9%	6.6%	7.1%	Clean Indust'l/Com'l Film	0.0%	0.0%	0.0%
Remainder/Composite Paper	1.5%	0.2%	2.2%	Contaminated Film/Other Film	5.5%	4.9%	5.9%
Glass	**1.4%**	**2.1%**	**1.0%**	Plastic Containers #3 thru #7	0.9%	1.1%	0.7%
Clear Glass Containers	0.6%	1.1%	0.4%	Expanded Polystyrene #6	0.8%	0.9%	0.8%
Brown Glass Containers	0.3%	0.6%	0.2%	Bulky Durable Plastic Products	1.2%	1.9%	0.8%
Green Glass Containers	0.0%	0.0%	0.0%	Remainder/Composite Plastic	1.6%	1.4%	1.6%
Remainder/Composite Glass	0.4%	0.5%	0.4%	**Textiles**	**2.7%**	**4.9%**	**1.4%**
Metal	**6.3%**	**12.9%**	**2.4%**	Textiles - Clothing	1.5%	4.0%	0.1%
Aluminum Cans & Containers	0.7%	0.5%	0.8%	Textiles - Non-Clothing	0.5%	0.8%	0.4%
Other Aluminum	0.1%	0.3%	0.0%	Shoes/Belts/Leather	0.6%	0.1%	0.9%
Tin/Steel Containers	1.3%	1.4%	1.3%	**Inorganics**	**8.2%**	**8.9%**	**7.6%**
Other Ferrous - Magnetic	3.0%	7.7%	0.3%	Fines	0.7%	0.5%	0.8%
Other Non-Ferrous	1.2%	3.0%	0.0%	Drywall/Gypsum Board	1.6%	4.2%	0.0%
Oil Filters	0.0%	0.0%	0.0%	Asphalt, Brick, Concrete & Rocks	0.3%	0.8%	0.0%
Organics	**39.2%**	**36.5%**	**40.8%**	Carpet & Carpet Padding	0.2%	0.5%	0.0%
Food Waste	16.2%	14.4%	17.2%	Other Construction & Demolition	3.5%	2.9%	3.7%
Wood - Clean/Untreated	5.1%	0.5%	7.9%	Bulky Items/Furniture	0.0%	0.0%	0.0%
Wood - Painted/Stained/Treated	6.5%	4.7%	7.5%	Mattresses/Boxsprings	1.9%	0.0%	3.1%
Diapers/Sanitary Products	2.2%	4.2%	1.0%	Tires	0.0%	0.0%	0.0%
Yard Waste	6.0%	7.5%	5.3%	Other/Not Classified	0.0%	0.0%	0.0%
Remainder/Composite Organic	3.2%	5.3%	1.8%	**HHW**	**0.3%**	**0.2%**	**0.3%**
Electronics	**0.0%**	**0.1%**	**0.0%**	Household Hazardous Waste	0.3%	0.2%	0.3%
Electronic Waste	0.0%	0.1%	0.0%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**8**	**3**	**5**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

U 3. VISUAL SURVEY RESULTS

Figure U-5 summarizes the composition of the Construction waste loads that were visually surveyed at this facility. As shown, the vast majority of these wastes were found to be Concrete/Brick/Rock.

Figure U-5 Composition of Construction Debris

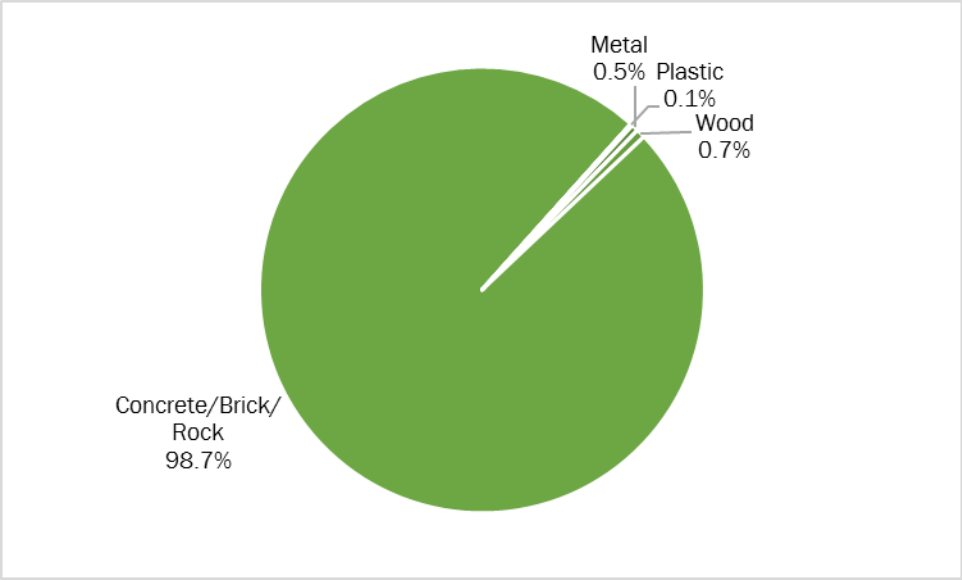


Figure U-6 summarizes the composition of Demolition debris.

Figure U-6 Composition of Demolition Debris

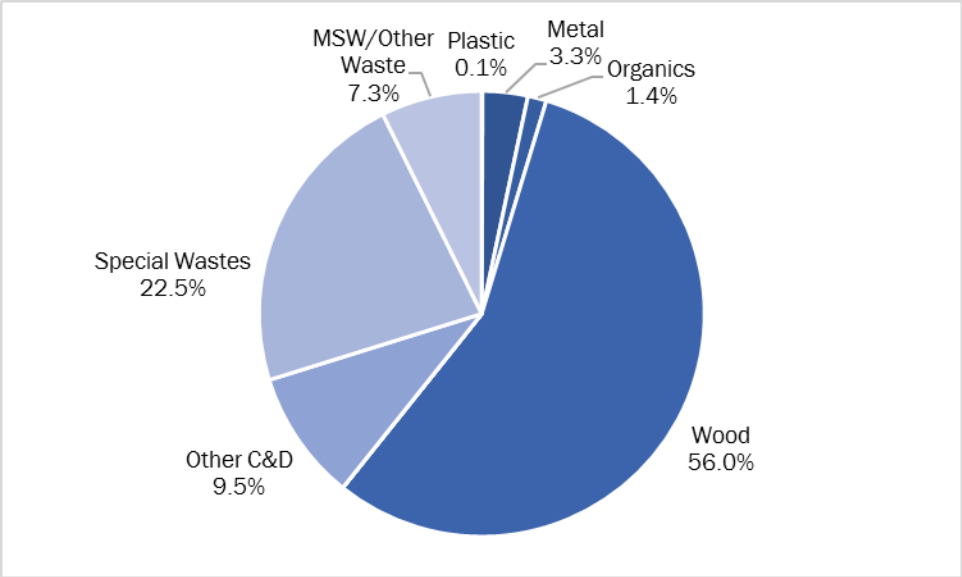


Figure U-7 provides the composition of Industrial materials. A substantial percentage of the industrial material surveyed was wet gypsum powder, classified as "R/C and Other Organics."

Figure U-7 Industrial Waste Composition

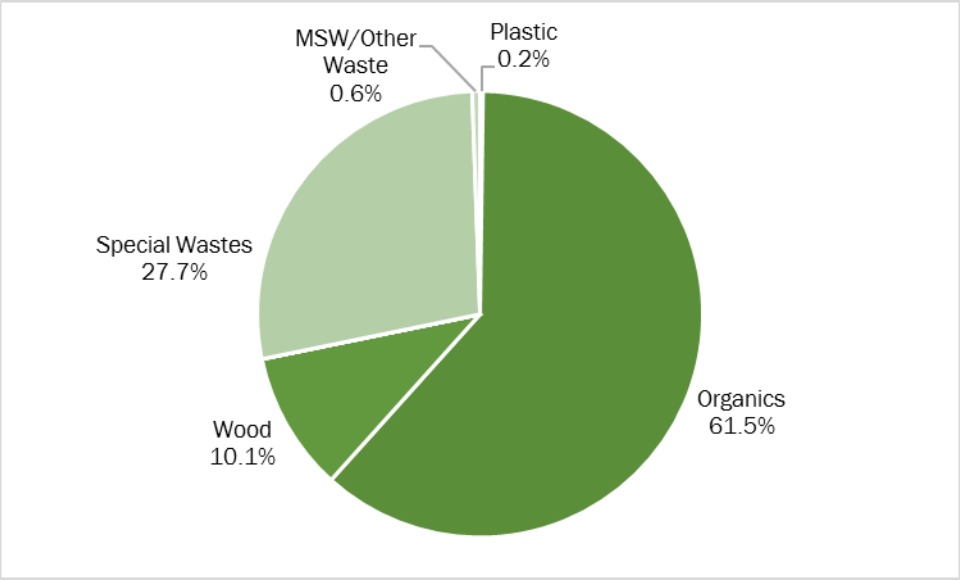


Table U-4 provides the detailed composition of the three material groups.

Table U-4 Detailed Composition of Visually Surveyed Wastes

Group	Material	Construction	Demolition	Industrial
MSW/Other Waste	Flattened OCC	0.1%	0.4%	0.2%
MSW/Other Waste	Unflattened OCC	0.0%	0.3%	0.1%
MSW/Other Waste	R/C and Other Paper	0.0%	0.0%	0.2%
Plastic	Plastic Bottles (Recyclable)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (stacked)	0.0%	0.0%	0.0%
Plastic	HDPE Buckets (unstacked)	0.0%	0.0%	0.0%
Plastic	Clean Recoverable Film	0.1%	0.0%	0.0%
Plastic	R/C and Other Plastic	0.1%	0.1%	0.2%
MSW/Other Waste	All Glass	0.0%	0.0%	0.0%
Metal	Appliances	0.0%	0.0%	0.0%
Metal	Other Ferrous Metals	0.5%	3.3%	0.0%
Metal	Other Non-ferrous Metal	0.0%	0.0%	0.0%
Metal	HVAC Ducting	0.0%	0.0%	0.0%
Organics	Leaves/Grass/Mixed Yard Waste	0.0%	0.0%	0.0%
Organics	Branches/Limbs	0.0%	0.0%	0.0%
Organics	R/C and Other Organics	0.0%	1.3%	61.3%
Wood	Pallets - Standard	0.3%	0.0%	1.3%
Wood	Pallets/Crates/Heavy	0.0%	0.0%	0.0%
Wood	Untreated/Unpainted Lumber	0.3%	0.0%	0.5%
Wood	Treated/Painted/Processed Wood	0.0%	36.2%	0.0%
Wood	Engineered Wood	0.0%	15.7%	6.3%
Wood	Wood Furniture	0.0%	3.7%	0.0%
Wood	Other Wood	0.0%	0.1%	2.0%
Other C&D	Carpet	0.0%	1.0%	0.0%
Other C&D	Carpet Padding	0.0%	0.0%	0.0%
Concrete/Brick/Rock	Concrete/Block/Brick/Stone/Tile	98.6%	0.0%	0.0%
Other C&D	Asphalt Paving	0.0%	0.0%	0.0%
Roofing Materials	Roofing Materials	0.0%	0.0%	0.0%
Other C&D	Ceiling Tiles	0.0%	0.0%	0.0%
Gypsum Board	Clean Gypsum Board	0.0%	0.4%	0.0%
Gypsum Board	Painted Gypsum Board	0.0%	0.0%	0.0%
Dirt/Sand/Gravel	Dirt/Sand/Gravel	0.0%	0.0%	0.0%
Other C&D	Insulation	0.0%	0.7%	0.0%
Other C&D	R/C and Other C&D	0.0%	7.7%	0.0%
MSW/Other Waste	Electronics	0.0%	0.5%	0.0%
MSW/Other Waste	Items with CRTs	0.0%	3.2%	0.0%
Special Wastes	Bulky Wastes/Furniture	0.0%	22.3%	0.0%
MSW/Other Waste	Tree Trunks	0.0%	0.0%	0.0%
Special Wastes	Tires - Cut	0.0%	0.0%	27.6%
Special Wastes	Tires - Whole	0.0%	0.0%	0.0%
Special Wastes	All HHW	0.0%	0.0%	0.0%
MSW/Other Waste	Fines/Mixed Residue	0.0%	0.0%	0.0%
MSW/Other Waste	Mixed MSW	0.0%	3.2%	0.3%
MSW/Other Waste	Agricultural Waste	0.0%	0.0%	0.0%
Special Wastes	Contaminated Soil	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%

APPENDIX V

TOWN AND COUNTRY TRANSFER STATION

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APPENDIX V - WASTE COMPOSITION AT TOWN AND COUNTRY TRANSFER STATION

V 1. OVERVIEW

The Town and Country Transfer Station, located in the large metro Kansas City area and Cass County, is owned and operated by Waste Corporation of Missouri, and is part of Solid Waste District Region E. The facility accepts waste and transfers to Central Missouri Landfill for disposal, where the tonnage is accounted for. This site was included in both seasons of the Manual Sorting phase of this study, but not the Gate/Visual non-MSW Surveying phase. summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

Table V-1 summarizes the data collection activities that took place at this facility. For comparative purposes, this table also includes similar data from the previous study.

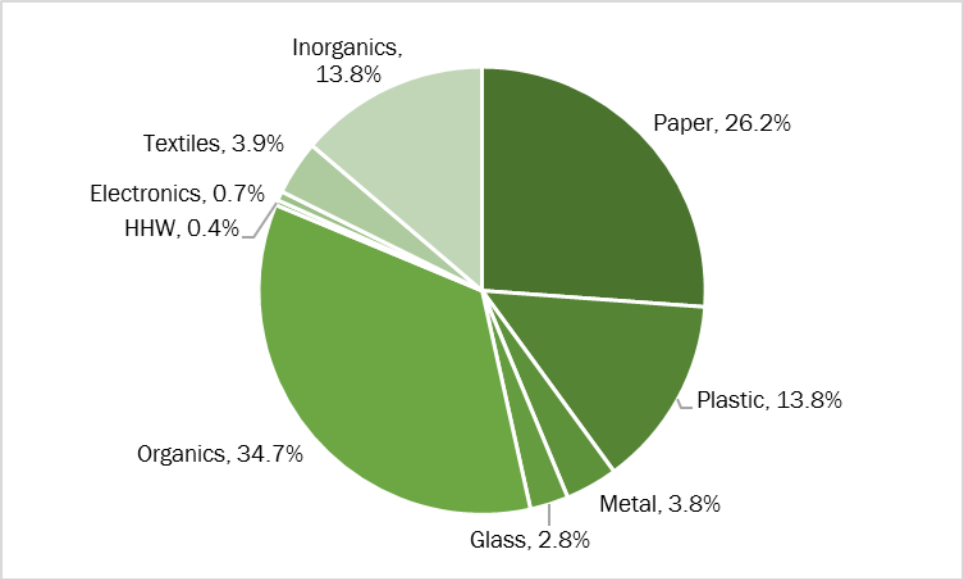
Table V-1 Sampling Summary

	2017 Study		2008 Study	
Data Collection Summary	No.	Weight	No.	Weight
Manually Sorted	16 Samples	3,561 Lbs	N/A	N/A
Visual Surveys	N/A	N/A	N/A	N/A
Gate Surveys	N/A	N/A	N/A	N/A

V 2. MSW CHARACTERIZATION RESULTS

Eight loads of MSW were sorted in each of the Fall and Spring seasons. The aggregate composition of the sampled loads is presented in Figure V-1. Organics was determined to be the largest component of the waste, at almost 35 percent, with over 26 percent being Paper materials.

Figure V-1 MSW Composition



A detailed tabular summary of the 2017 MSW composition results is provided in Table V-2. This table provides the mean composition and 90 percent confidence intervals from the study.

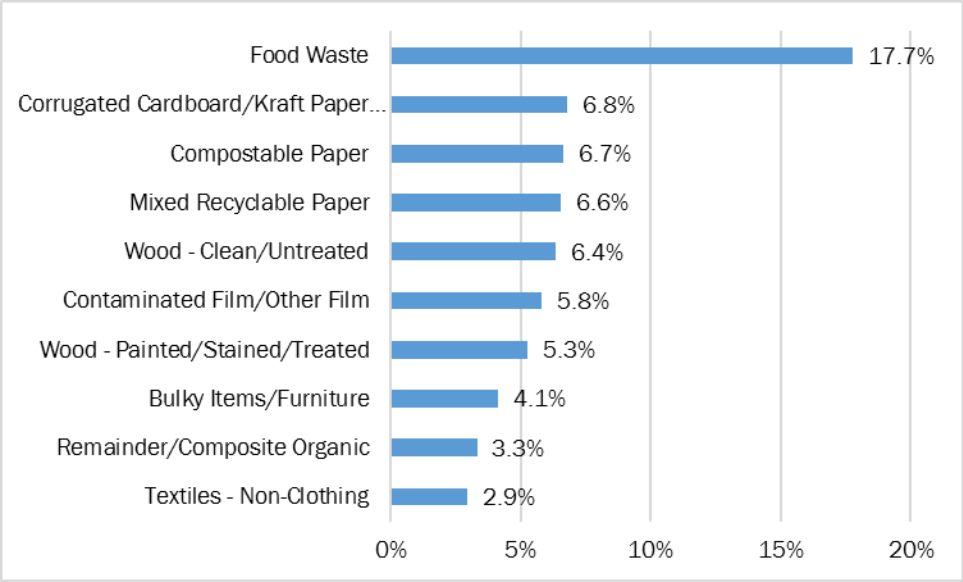
Table V-2 Detailed MSW Composition

Material Category	Est. Percent	Conf. Int (+/-)	Tonnage	Material Category	Est. Percent	Conf. Int (+/-)	Tonnage
Paper	**26.2%**	**3.9%**	**931**	**Plastic**	**13.8%**	**2.3%**	**491**
OCC/Kraft Paper	6.8%	2.2%	242	PET (#1) Bottles/Jars	1.7%	0.6%	62
Newsprint	1.0%	0.4%	34	PET (#1) Non-Bottle containers	0.5%	0.6%	17
Magazines	1.1%	0.9%	39	HDPE (#2) Natural Containers	0.4%	0.1%	14
High Grade Office Paper	2.2%	2.7%	80	HDPE (#2) Colored Containers	0.7%	0.4%	25
Mixed Recyclable Paper	6.6%	2.0%	233	Clean Film Bags	0.2%	0.1%	8
Compostable Paper	6.7%	1.1%	237	Clean Indust'l/Com'l Film	0.3%	0.3%	12
Remainder/Composite Paper	1.8%	1.3%	65	Contaminated Film/Other Film	5.8%	1.4%	207
Glass	**2.8%**	**1.2%**	**99**	Plastic Containers #3 thru #7	1.1%	0.3%	38
Clear Glass Containers	1.6%	0.6%	56	Expanded Polystyrene #6	0.6%	0.1%	23
Brown Glass Containers	0.5%	0.3%	19	Bulky Durable Plastic Products	0.5%	0.2%	19
Green Glass Containers	0.3%	0.4%	12	Remainder/Composite Plastic	1.9%	0.6%	68
Remainder/Composite Glass	0.3%	0.2%	12	**Textiles**	**3.9%**	**2.0%**	**140**
Metal	**3.8%**	**1.0%**	**135**	Textiles - Clothing	0.5%	0.2%	17
Aluminum Cans & Containers	0.5%	0.1%	17	Textiles - Non-Clothing	2.9%	1.7%	105
Other Aluminum	0.4%	0.4%	16	Shoes/Belts/Leather	0.5%	0.3%	18
Tin/Steel Containers	1.1%	0.4%	39	**Inorganics**	**13.8%**	**4.1%**	**490**
Other Ferrous - Magnetic	1.2%	0.7%	42	Fines	2.1%	1.1%	75
Other Non-Ferrous	0.6%	0.7%	21	Drywall/Gypsum Board	0.8%	0.9%	29
Oil Filters	0.0%	0.0%	-	Asphalt, Brick, Concrete & Rock	0.7%	1.2%	26
Organics	**34.7%**	**7.6%**	**1,237**	Carpet & Carpet Padding	2.2%	2.4%	80
Food Waste	17.7%	6.1%	632	Other Construction & Demolition	1.9%	1.5%	68
Wood - Clean/Untreated	6.4%	8.6%	226	Bulky Items/Furniture	4.1%	1.9%	147
Wood - Painted/Stained/Treate	5.3%	3.9%	188	Mattresses/Boxsprings	1.1%	1.2%	39
Diapers/Sanitary Products	1.7%	0.7%	60	Tires	0.0%	0.0%	1
Yard Waste	0.4%	0.4%	13	Other/Not Classified	0.7%	0.5%	26
Remainder/Composite Organic	3.3%	2.1%	118	**HHW**	**0.4%**	**0.2%**	**13**
Electronics	**0.7%**	**1.1%**	**24**	Household Hazardous Waste	0.4%	0.2%	13
Electronic Waste	0.7%	0.8%	24	**Grand Total**	**100%**		
				No. of Samples	***8***		

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Figure V-2 shows the ten most commonly occurring materials in the MSW sorted at Town and Country. Food waste more than doubles the second highest material, corrugated cardboard/kraft paper.

Figure V-2 Top 10 Materials in MSW

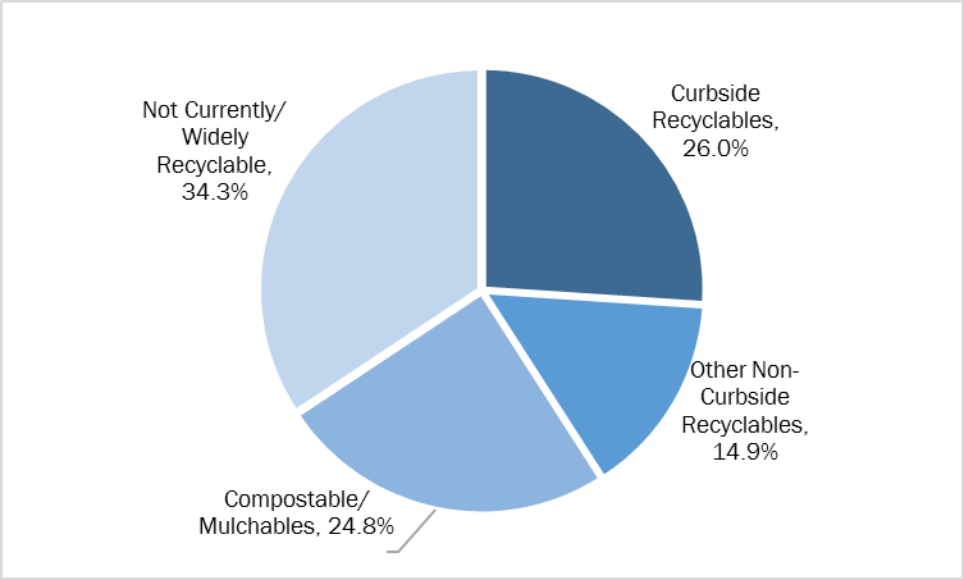


As described more fully in the Final Results MSW section of the report, results were also analyzed with respect to a Diversion Strategy, assigning one of four categories:

- Curbside Recyclables,
- Compostables/Mulchables,
- Other Non-Curbside Recyclables or
- Not Currently/Widely Recyclable.

The analysis for the Town and Country sort activity results are displayed in Figure V-3. As shown, less just over 34 percent of disposed materials were identified as Not Currently/Widely Recyclable. In principle, the remaining 65-66 percent could be diverted from landfill disposal to either recycling or composting outlets.

Figure V-3 Management Methods for MSW



For any individual hosting facility, the number of samples obtained was relatively small. However, Table V-3 below provides the average composition of Residential wastes and Commercial/Institutional wastes in comparison to the aggregate results.

Table V-3 Detailed Results

Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l	Material Category	2017 Study Agg-regate	2017 Study Resi-dential	2017 Study Com'l/ Inst'l
Paper	**26.2%**	**31.1%**	**19.9%**	**Plastic**	**13.8%**	**12.6%**	**15.3%**
OCC/Kraft Paper	6.8%	7.4%	6.0%	PET (#1) Bottles/Jars	1.7%	1.8%	1.6%
Newsprint	1.0%	1.3%	0.5%	PET (#1) Non-Bottle containers	0.5%	0.1%	1.0%
Magazines	1.1%	1.6%	0.4%	HDPE (#2) Natural Containers	0.4%	0.4%	0.4%
High Grade Office Paper	2.2%	3.4%	0.6%	HDPE (#2) Colored Containers	0.7%	0.6%	0.8%
Mixed Recyclable Paper	6.6%	9.0%	3.7%	Clean Film Bags	0.2%	0.2%	0.2%
Compostable Paper	6.7%	6.9%	6.4%	Clean Indust'l/Com'l Film	0.3%	0.0%	0.7%
Remainder/Composite Paper	1.8%	1.5%	2.3%	Contaminated Film/Other Film	5.8%	4.6%	7.3%
Glass	**2.8%**	**3.2%**	**2.2%**	Plastic Containers #3 thru #7	1.1%	1.1%	1.1%
Clear Glass Containers	1.6%	1.8%	1.3%	Expanded Polystyrene #6	0.6%	0.7%	0.6%
Brown Glass Containers	0.5%	0.5%	0.6%	Bulky Durable Plastic Products	0.5%	0.7%	0.2%
Green Glass Containers	0.3%	0.5%	0.1%	Remainder/Composite Plastic	1.9%	2.3%	1.3%
Remainder/Composite Glass	0.3%	0.4%	0.2%	**Textiles**	**3.9%**	**3.8%**	**4.0%**
Metal	**3.8%**	**4.3%**	**3.1%**	Textiles - Clothing	0.5%	0.7%	0.2%
Aluminum Cans & Containers	0.5%	0.6%	0.3%	Textiles - Non-Clothing	2.9%	2.7%	3.2%
Other Aluminum	0.4%	0.6%	0.2%	Shoes/Belts/Leather	0.5%	0.4%	0.6%
Tin/Steel Containers	1.1%	1.0%	1.2%	**Inorganics**	**13.8%**	**18.2%**	**8.4%**
Other Ferrous - Magnetic	1.2%	1.8%	0.3%	Fines	2.1%	2.4%	1.6%
Other Non-Ferrous	0.6%	0.3%	0.9%	Drywall/Gypsum Board	0.8%	1.4%	0.0%
Oil Filters	0.0%	0.0%	0.0%	Asphalt, Brick, Concrete & Rocks	0.7%	1.3%	0.0%
Organics	**34.7%**	**25.5%**	**46.4%**	Carpet & Carpet Padding	2.2%	4.3%	0.0%
Food Waste	17.7%	13.0%	24.0%	Other Construction & Demolition	1.9%	1.0%	3.1%
Wood - Clean/Untreated	6.4%	0.8%	12.6%	Bulky Items/Furniture	4.1%	7.4%	0.0%
Wood - Painted/Stained/Treated	5.3%	6.1%	4.6%	Mattresses/Boxsprings	1.1%	0.0%	2.6%
Diapers/Sanitary Products	1.7%	2.3%	0.8%	Tires	0.0%	0.0%	0.0%
Yard Waste	0.4%	0.6%	0.1%	Other/Not Classified	0.7%	0.4%	1.2%
Remainder/Composite Organic	3.3%	2.6%	4.4%	**HHW**	**0.4%**	**0.4%**	**0.4%**
Electronics	**0.7%**	**0.9%**	**0.3%**	Household Hazardous Waste	0.4%	0.4%	0.4%
Electronic Waste	0.7%	0.9%	0.3%	**Grand Total**	**100%**	**100%**	**100%**
				No. of Samples	**16**	**9**	**7**

Confidence intervals calculated at the 90% confidence level. Percentages for materials may not exactly equal category subtotals due to rounding.

Readers are cautioned that the above results by generator sector have wide confidence intervals (not shown).

APPENDIX W

FIELD FORMS

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MO - DNR Gate Survey

Date:
Survey Site:
Time Started:

		Vehicle Identification													
#	Time (24:00)	Hauler Name	Truck No.	License Plate No.	Hauler Type	Major Waste Sector	Other Waste Type Notes	Vehicle Type	Origin	MSW - Res (%)	MSW - ICI (%)	MSW - Mixed (%)	Net Total Amount	Units	Notes
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															

MO - DNR Visual Survey

Sum of Class Percentages	0%
Total Volume (CY)	0
Actual Weight (tons)	0.0
Actual Sum of Lbs.	-
Sum of Estimated Lbs.	-
Variance	#DIV/0!

Facility Name:	
Date Sorted:	
Sample ID #:	
Time:	
Hauler:	
Truck #:	
Waste Type:	
Vehicle Type:	

Volume Estimation (ft)		L	W	H
Truck Container (CY)				
Container % Full				
Total Volume (CY)	0.0			
Trailer Container (CY)				
Container % Full				
Total Volume (CY)	0.0			

Load Weight (Tons)	
Ticket Number	
Field Supervisor	CP

Class	%	No.	Category	Material %	Material Sum	Density (lbs) Default	Density (lbs) Override	Composition (lbs) Calculated	Composition (lbs) Override	Estimated Lbs.	Notes
Paper		1	Flattened OCC		0%	106		-		-	
		2	Unflattened OCC			45		-		-	
		3	R/C and Other Paper			157		-		-	
Plastic		4	Plastic Bottles (Recyclable)		0%	38		-		-	
		5	HDPE Buckets (Stacked)			70		-		-	
		6	HDPE Buckets (Unstacked)			35		-		-	
		7	Clean Recoverable Film			35		-		-	
		8	R/C and Other Plastic			50		-		-	
Glass		9	All Glass		0%	400		-		-	
Metal		10	Appliances		0%	145		-		-	
		11	Other Ferrous Metals			230		-		-	
		12	Other Non-ferrous Metal			225		-		-	
		13	HVAC Ducting			47		-		-	
Organics		14	Leaves/Grass/Mixed Yard		0%	250		-		-	
		15	Branches/Limbs			127		-		-	
		16	R/C and Other Organics			300		-		-	
Wood		17	Pallets - Standard		0%	169		-		-	
		18	Pallets/Crates/Heavy			250		-		-	
		19	Untreated/Unpainted Lumber			169		-		-	
		20	Treated/Painted/Processed			169		-		-	
		21	Engineered Wood			268		-		-	
		22	Wood Furniture			169		-		-	
		23	Other Wood			169		-		-	
C&D		24	Carpet		0%	147		-		-	
		25	Carpet Padding			62		-		-	
		26	Concrete/Block/Brick/Stone/			999		-		-	
		27	Asphalt Paving			773		-		-	
		28	Roofing Materials			731		-		-	
		29	Ceiling Tiles			75		-		-	
		30	Clean Gypsum Board			467		-		-	
		31	Painted Gypsum Board			467		-		-	
		32	Dirt/Sand/Gravel			929		-		-	
		33	Insulation			75		-		-	
		34	R/C and Other C&D			417		-		-	
Electronics		35	Electronics		0%	343		-		-	
		36	Items with CRTs			343		-		-	
Special Wastes		37	Bulky Wastes/Furniture		0%	200		-		-	
		38	Tree Trunks			127		-		-	
		39	Tires - Cut			175		-		-	
		40	Tires - Whole			100		-		-	
		41	All HHW			75		-		-	
		42	Fines/Mixed Residue			929		-		-	
		43	Mixed MSW			150		-		-	
Other Wastes		44	Agricultural Waste		0%	225		-		-	
		45	Contaminated Soil			929		-		-	

General Sample Notes:

APPENDIX X

MATERIAL CATEGORIES

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PAPER

1 CORRUGATED CARDBOARD/KRAFT PAPER (UNCOATED): Corrugated boxes or paper bags made from Kraft paper. Wavy center layer sandwiched between two outer layers without wax coating on the inside or outside. Examples include cardboard shipping containers and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. Does not include chipboard. Examples of Kraft paper include paper grocery bags, un-soiled fast food bags, department store bags, and heavyweight sheets of Kraft packing paper.

2 NEWSPRINT: Paper used chiefly for printing newspapers – uncoated ground wood paper.

3 MAGAZINES : Magazines/Catalogs includes items made of glossy coated paper. This paper is usually slick, smooth to the touch, and reflects light. Examples include glossy magazines, catalogs, brochures, and pamphlets.

4 HIGH GRADE OFFICE PAPER: Paper that is free of ground wood fibers; usually sulfite or sulphate paper; includes office printing and writing papers such as white ledger, color ledger, envelopes, and computer printout paper, bond, rag, or stationary grade paper. Does not include fluorescent dyed paper or deep-tone dyed paper such as goldenrod colored paper.

5 MIXED RECYCLABLE PAPER: Recyclable paper other than the paper mentioned above. Examples include manila folders, manila envelopes, index cards, white envelopes, white window envelopes, notebook paper, carbonless forms, junk mail, chipboard and uncoated paperboard, groundwood paper, and deep-toned or fluorescent dyed paper. Also includes Aseptic containers (multi-layered packaging that contains shelf-stable food products such as apple juice, soup, soy/rice milk, etc.) and "gable top" cartons (non-refrigerated items such as granola and crackers; refrigerated items such as milk, juice, egg substitutes, etc.).

6 COMPOSTABLE PAPER: Low-grade, biodegradable paper that cannot be recycled, as well as food contaminated paper. Examples include paper towels, paper plates, waxed papers and waxed cardboard , and tissues.

7 REMAINDER/COMPOSITE PAPER: Products made mostly of paper but combined with large amounts of other materials such as plastic, metal, glues, foil, and moisture. Examples include corrugated cardboard coated with plastic, cellulose insulation, blueprints, sepia, onion skin, foiled lined fast food wrappers, frozen juice containers, carbon paper, self-adhesive notes, softcover and hardcover books, and photographs.

GLASS

8 CLEAR GLASS CONTAINERS: Includes all clear glass bottles and jars for beverages or other products.

9 BROWN GLASS CONTAINERS: Includes all brown glass bottles and jars for beverages or other products.

10 GREEN GLASS CONTAINERS: Includes all green glass bottles and jars for beverages or other products.

11 REMAINDER/COMPOSITE GLASS : Glass that cannot be put in any other type. It includes items made mostly of glass but combined with other materials. Examples include Pyrex, Corningware, crystal and other glass tableware, mirrors, non-fluorescent light bulbs, auto windshields, laminated glass, or any curved glass. Includes uncoated plate glass, such as window and door glass, and table-tops.

METALS

12 ALUMINUM CANS & CONTAINERS - NOT MAGNETIC: Aluminum beverage or other containers. Includes cat food containers.

13 OTHER ALUMINUM - NOT MAGNETIC: Includes unsoiled pie plates, non-rigid baking pans, aluminum foils, and other aluminum products.

14 TIN/STEEL CONTAINERS - MAGNETIC: Rigid containers made mainly of steel, such as food and beverage containers. These items will stick to a magnet and may be tin-coated.

15 OTHER FERROUS - MAGNETIC: Any other iron or steel that is magnetic. Examples include empty or dry paint cans, structural steel beams, boilers, metal clothes hangers, metal pipes, some cookware, security bars, and scrap ferrous items and galvanized items such as nails and flashing. This category also includes mixed metal items made of both ferrous metal and non-ferrous metal combined. Examples include small non-electronic appliances such as toasters and motors.

16 OTHER NON-FERROUS - NOT MAGNETIC: Any metal item that is not magnetic, as well as stainless steel. These items may be made of copper, brass, bronze, lead, zinc, or other metals. Examples include copper wire, shell casings, and brass pipe.

17 OIL FILTERS: Metal oil filters from automobiles, trucks or other machinery.

PLASTICS

18 PET (#1) BOTTLES/JARS : Clear or colored PET bottles or jars. When marked for identification, the number "1" is visible in the center of the triangular recycling symbol and may also bear the letters "PETE" or "PET". The color is usually transparent, green, or clear. A PET container usually has a small dot left from the manufacturing process, not a seam. It does not turn white when bent. This category only includes PET bottles or jars that did not previously contain hazardous materials.

19 PET (#1) NON-BOTTLE CONTAINERS : Non-bottle containers such as rectangular PET clamshell or tray containers used for produce; etc. - This category only includes PET containers that did not previously contain hazardous materials.

20 HDPE (#2) NATURAL CONTAINERS: Natural type HDPE containers. This plastic is identified by its cloudy white appearance, allowing light to pass through. When marked for identification, it bears the number "2" in the triangular recycling symbol and may also bear the letters "HDPE. This category only includes natural HDPE containers that did not previously contain hazardous materials.

21 HDPE (#2) COLORED CONTAINERS: Colored HDPE containers. This plastic is idenfied by its solid color, preventing light from passing through. When marked for identification, it bears the number "2" in the triangular recycling symbol and may also bear the letters "HDPE. This category includes colored and natural bottles and containers, as well as buckets, pails or paint cans made of HDPE and designed to hold 5 gallons or less of material. This category only includes colored HDPE containers that did not previously contain hazardous materials.

22 CLEAN FILM BAGS: Clean plastic shopping bags used to contain merchandise to transport from the place of purchase, given out by the store with the purchase. Also includes dry-cleaning plastic bags intended for one-time use.

23 CLEAN INDUSTRIAL/COMMERCIAL FILM (NON-BAG): Clean, non-bag commercial and industrial packaging film used for large-scale packaging or transport packaging. Examples include shrink-wrap, mattress bags, furniture wrap, and film bubble wrap.

24 CONTAMINATED FILM/OTHER FILM: Plastic film or bags that are contaminated or otherwise non-recyclable. Examples include garbage bags, contaminated shopping bags, and other types of plastic bags (sandwich bags, zip (recloseable) bags, produce bags, frozen vegetable bags), painting tarps, food wrappers such as candy-bar wrappers, mailing pouches, bank bags, X-ray film, and plastic food wrap. Also includes Flexible Plastic Packaging, a multi-layer flexible film bag such as those used for coffee, Capri Sun pouches, and baby food pouches.

25 PLASTIC CONTAINERS #3 THRU #7
"TUBS, CUPS, & LIDS": Bottles, tubs, cups, and containers made of types of plastic other than HDPE or PET. Items may be made of PVC, PP, or PS. When marked for identification, these items may bear the number 3, 4, 5, 6, or 7 in the triangular recycling symbol. This subtype also includes unmarked plastic containers. This category only includes plastic #3-#7 bottles, tubs, cups, and containers that did not previously contain hazardous materials.

26 EXPANDED POLYSTYRENE #6
"STYROFOAM": Food and Non-food packaging. Includes clamshell "Styrofoam" food containers, as well as cups, plates, and bowls. Includes finished products made of expanded polystyrene such as block Styrofoam padding and packing peanuts.

27 BULKY DURABLE PLASTIC PRODUCTS: Larger plastic objects other than disposable package items that are usually made to last for a few months up to many years. Items include larger children's toys, furniture, plastic storage bins, mop buckets, sporting goods, plastic landscape ties; plastic railroad ties, etc.

28 REMAINDER/COMPOSITE PLASTIC: Plastic that cannot be put in any other type or subtype. Includes items made mostly of plastic but combined with other materials. Examples include auto parts made of plastic attached to metal, plastic drinking straws, produce trays, foam packing blocks (not including expanded polystyrene blocks), plastic strapping, new plastic laminate (e.g. Formica), vinyl, linoleum, plastic lumber, imitation ceramics, handles and knobs, plastic lids, some kitchen ware, toys, plastic string (as used for hay bales), and plastic rigid bubble/foil packaging (as for medications); CDs, and disposable plastic dishes and cutlery.

ORGANICS

29 FOOD WASTE: Food wastes and scraps, including meat, bone, dairy, grains, rinds, teabags, coffee grounds with filters, etc. Excludes the weight of food containers, except when container weight is not appreciable compared to the food inside. Compostable peanuts, food packaging with food scraps, and small wooden produce crates are also included in this category.

30 WOOD - CLEAN/UNTREATED: Any wood which does not contain an adhesive, paint, stain, fire retardant, pesticide or preservative; includes such items as pallets, skids, spools, packaging materials, bulky wood waste or scraps from newly built wood products. May include screws or nails. Does not including land clearing debris or yard waste prunings and trimmings.

31 WOOD – PAINTED/STAINED/TREATED: Wood coated with paint, stain, adhesives, fire retardant, pesticide or preservative. Includes plywood and other wood laminates as well as predominately wood and lumber products that are mixed with other materials such that they cannot easily be separated. This includes wood with metal, gypsum, concrete, or other contaminants.

TEXTILES

32 TEXTILES - CLOTHING: Includes textiles for use as clothing. Does not include shoes, belts, or leather.

33 TEXTILES - NON-CLOTHING: Textiles for non-clothing uses, such as curtains, blankets, stuffed animals, and other cloth material. Does not include carpeting, which has its own category.

34 SHOES/BELTS/LEATHER: Shoes and belts regardless of composition, and all leather products.

ORGANICS

35 DISPOSABLE DIAPERS & SANITARY PRODUCTS: Adult and baby disposable diapers, and feminine hygiene products.

36 YARD WASTE: Plant material from any public or private landscaping activity. Examples include leaves, grass clippings, and plants. Includes woody plant material such as prunings, shrubs, branches, stumps, and tree trunks. Does not include material from agricultural sources.

37 REMAINDER/COMPOSITE ORGANIC: Organic material that cannot be put in any other type or subtype. This type includes items made mostly of organic materials but combined with other materials. Includes animal carcasses not resulting from food storage or preparation, animal wastes/feces, and kitty litter. Also includes manure and soiled bedding materials from domestic, farm, wild, or ranch animals. Other examples include cork, rubber products (inner tubes, rubber bands), candles, hand soap, hemp rope, hair, cigarette butts, used vacuum cleaner bags, popsicle sticks, chop sticks, and sawdust.

INORGANICS

38 FINES: Remaining mix of materials smaller than 2" square, including miscellaneous fines (paper, plastic, glass, organic material, etc.), sand, and dirt.

39 DRYWALL/GYPSUM BOARD: Interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples include used or unused, broken or whole sheets of sheetrock, drywall, gypsum board, plasterboard, gypsum board, gyproc, and wallboard.

40 ASPHALT, BRICK, CONCRETE & ROCKS: Includes asphalt paving, fired-clay bricks, Portland cement mixtures (set or unset, with or without aggregate), and rock gravel larger than 2"in diameter.

41 CARPET & CARPET PADDING: Flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material. Carpet padding may include plastic, foam, felt, or other material used under the carpet to provide insulation and padding.

42 OTHER CONSTRUCTION & DEMOLITION (OTHER C&D): Construction and demolition material that cannot be put in any other type or subtype. Also includes asphalt roofing materials, ceramics, and fiberglass insulation. May also include items from different types combined, which would be very hard to separate.

43 BULKY ITEMS/FURNITURE: Large, hard-to-handle items that are not defined separately. Examples include all sizes and types of furniture, large appliances, and base components.

44 MATTRESSES/BOXPRINGS: All types of mattresses and supporting boxsprings.

45 TIRES: Rubber and synthetic tires from all vehicles (without metal or plastic wheel assembly).

46 OTHER/NOT CLASSIFIED : Any other type of inorganic waste material not listed in any other sort category. Includes cosmetics, shampoos, lotions, latex gloves, etc.

ELECTRONICS

47 ELECTRONIC WASTE (E-WASTE): Large and small electronic goods that have circuitry. Examples include stereos, VCRs, DVD players, radios, audio/visual equipment, CRT, and non-CRT televisions (such as LCD televisions); computer related electronics such as processors, mice, keyboards, laptops, disk drives, printers, modems, and fax machines; and other small consumer goods such as personal digital assistants (PDAs), cell phones, phone systems, phone answering machines, computer games and other electronic toys, portable CD players, camcorders, and digital cameras.

HOUSEHOLD HAZARDOUS WASTE

48 HOUSEHOLD HAZARDOUS WASTE: All household or commercial products characterized as "toxic", "corrosive", "flammable", "ignitable", "radioactive", "poisonous", and "reactive". Includes solvent or water-based paints, paint thinners, chemical cleaners, adhesives/glues, fluourescent light bulbs and compact fluourescent light bulbs (CFLs), pestides/herbicides, medical waste and sharps, and all types of batteries (wet and dry cell). Also includes asbestos, explosives, certain cosmetics, and other potentially harmful wastes. This category also includes HHW containers with product remaining in them.

PAPER

1 Corrugated Cardboard: 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 R/C and Other Paper: Consists of all non-corrugated and non-Kraft paper products such as newspaper, magazines, catalogs, office, computer, polycoated gable top, aseptic juice boxes, paperboard boxes, direct mail, books soiled and unsoiled tissues, paper towels, napkins, file folders, carbonless paper forms, and tissue paper.

PLASTIC

3 Plastic Bottles (Recyclable): Any recyclable plastic bottle marked with a recyclable symbol bearing the number 1 through 7.

4 HDPE Buckets: High Density Polyethylene Buckets and tubes.

5 Clean Recoverable Film: Any recyclable polyethylene (high density, low density, linear low density) film plastic including sheet plastic, shrink wrap, and some tarps.

6 R/C and Other Plastic : All other plastic materials including plastic bottles, jars and containers; rigid plastic components; expanded foam plastics; and non-recyclable film plastics.

GLASS

7 All Glass: Clear, green, and brown glass food and beverage containers. Miscellaneous glass products such as mirrors, leaded crystal, eyeglasses, and blown glass such as light bulbs, auto glass, windows, TV tubes heat resistant cookware (Pyrex), pottery, ceramic plates and drinking glasses. Also includes broken container glass (mixed glass).

ORGANICS

8 Yard Waste: Plant material from any public or private landscapes. Examples include leaves, grass clippings, sea weed, plants, prunings, shrubs. Limbs, logs, and stumps generated by removing vegetation from public or private land by mechanical or manual means.

9 R/C and Other Organics: Combustible materials including wax, bar soap, cigarette butts, feminine hygiene products, vacuum cleaner bag contents, leather, briquettes, and fireplace, burn barrel, and fire-pit ash, and other organic materials not classified elsewhere.

WOOD

10 Pallets and Crates: Wood pallets and crates used for shipping or storage of goods, whether painted, unpainted, or made of engineered lumber.

11 Untreated/Unpainted Lumber: Non-treated processed wood for building, manufacturing, landscaping, packaging. Examples include dimensional lumber, lumber cutoffs, wood scraps, and wood siding. May contain nails or other trace contaminants.

12 Treated/Painted/Processed Wood: Wood that has had an external coating applied, been pressure treated, chemically treated (with copper etc.) or treated with creosote. Examples include railroad ties, marine timbers and pilings, landscape timbers, and telephone poles. Wood that has an external coating applied. Examples include painted or stained dimensional lumber, lumber cutoffs, wood scraps, wood shake roofing, and wood siding. Plywood is manufactured from thin sheets of cross-laminated veneer. (Chipboard) engineered wood products formed by breaking down softwood into wood fibers and wood particles, combining them with wax or a resin, and forming panels by applying high temperature and pressure. Examples include carpentry, and wood veneers.

13 Engineered Wood: Broad category to include Plywood (layers of wood glued together), Oriented Strandboard (OSB) - a layered, mat-formed panel product made of strands, flakes or wafers sliced from small diameter, round wood logs and bonded under heat and pressure; and Medium Density Fiber (MDF) and Particle Board - manufactured lumber sheeting made of glued wood fibers or particles.

14 Wood Furniture: Household or office furniture manufacture of mostly wood. Includes chairs, tables, sofas, bookcases, and cabinets, doors and desks.

15 Other Wood: All other items that are predominantly wood.

C&D MATERIALS

16 Carpet : Flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material.

17 Carpet Padding: Includes plastic, foam, felt, and other materials used under carpet to provide insulation and padding.

18 Concrete/Block/Brick/Stone/Tile: Hard material made from concrete, brick, or rock. This category includes concrete mixed with or without rebar attached (e.g. building foundations, concrete paving, and cinder blocks), landscaping rock, paving stones, brick, and tile.

19 Asphalt Paving: Asphalt paving including street, side walk, driveway, and some sports courts.

20 Roofing Materials: All materials used for roofing of buildings. Includes asphalt shingles, cedar shake, composite shingles and tar paper.

21 Ceiling Tiles: Synthetic or natural fiber tiles used for coving of ceilings.

22 Clean Gypsum Board: Unpainted gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Includes used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypsom board, gyproc.

23 Painted Gypsum Board: Painted gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Includes used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypsom board, gyproc.

24 Dirt/Sand/Gravel: Materials made of dirt, sand, and gravel. This category is often left over from land clearing activities. This subtype also includes non-hazardous contaminated soil, pathway gravel and other natural or mechanically crushed materials.

25 Insulation: Any of the various types of insulation including synthetic fiber insulation, faced or unfaced matts, "rock wool," and rigid board types. Used in ceilings, walls and around ducting for both thermal insulation and sound attenuation.

26 R/C and Other C&D: Any other material that cannot be put in any other type or subtype.

METAL

27 Appliances: Nonhazardous, not predominantly metal electric appliances such as toasters, microwave ovens, power tools, curling irons, and light fixtures.

28 Other Ferrous Metals: Ferrous and alloyed ferrous scrap materials originated from residential commercial, or institutional sources which are attracted to a magnet. Includes rebar, empty paint cans; includes HVAC ducting (galvanized and ungalvanized).

29 Other Non-ferrous Metal: Non-magnetic metals such as aluminum, brass, bronze, silver, lead copper, zinc, and stainless steel.

ELECTRONICS

30 Electronics: Large and small electronic goods that have circuitry. Examples include stereos, VCRs, DVD players, radios, audio/visual equipment, and non-CRT televisions (such as LCD televisions); computer related electronics such as processors, mice, keyboards, laptops, disk drives, printers, modems, and fax machines; and other small consumer goods such as personal digital assistants (PDAs), cell phones, phone systems, phone answering machines, computer games and other electronic toys, portable CD players, camcorders, and digital cameras.

31 Items with CRTs: Computer monitors and TVs with cathode ray tubes.

SPECIAL WASTES

32 Bulky Wastes/Furniture: Large composite items that are not defined separately. Examples include all sizes and types of furniture, base components, along with mattresses.

33 Tree Trunks: Large, bulky tree trunks and stumps

34 Tires: Includes all synthetic, natural rubber, pneumatic, or solid core tires.

35 All HHW: All household or commercial hazardous materials such as pesticides, herbicides, or cleaning fluids. Also includes dry and wet-cell batteries, vehicle and equipment fluids, wet paints and related wastes.

36 Fines/Mixed Residue: Remainder Material that is small enough to be considered detritus, or does not fit into any other category.

37 Mixed MSW: Household and job site waste that is bagged or loose and consists primarily of municipal solid waste. Examples include bagged garbage, beverage containers, food wastes, and other refuse generated on construction sites by non-C&D activities (i.e., consumption by on-site staff), as well as bagged MSW deposited by third parties in C&D roll off containers.

OTHER WASTES

38 Biosolids: Sewage sludge solids removed during primary, secondary or advanced treatment of domestic sewage. Material can include slime solids, scum, or liquid slurry residue generated during the treatment of domestic sewage.

39 Agricultural Wastes: Agricultural waste produced from various agricultural operations. Includes manure and other wastes from farms, poultry houses and slaughterhouses; harvest waste; fertilizer run- off from fields; pesticides that enter into water, air or soils; and salt and silt drained from fields.

40 Tritium-Containing Products: Radioactive isotope of hydrogen. Used in products with a continuous light source, such as EXIT signs, wristwatch faces, and rifle sights. Tritium sources are required to have labeling consisting of the three-bladed radiation symbol, and the words "Caution - Radioactive Material" Tritium has been identified in landfill leachate, mostly from self-luminous exit signs that have been improperly disposed at the landfill and become crushed, releasing the tritium into the landfill leachate.

41 Asbestos Containing Materials: Thermal insulating building product which may be present on HVAC equipment, piping, roofing tars, and vinyl asbestos tile flooring. May be friable (crumbles and pulverizes under light to moderate hand pressure) or non-friable.

42 Contaminated Soil: Soil that has been affected by a release of a substance (petroleum products, solvents, heavy metals, etc.) at a concentration above the minimum allowed by federal, state, or local jurisdiction.

APPENDIX Y

STUDY DESIGN

(EXCLUDING ORIGINAL APPENDICES)

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STUDY DESIGN

1. INTRODUCTION

In the spring of 2016, the Missouri Department of Natural Resources (MDNR) solicited proposals to update the Missouri Waste Composition Studies previously performed in 1996-1997 and 2006-2008. MDNR's Solid Waste Management Program has as its primary goal the reduction of solid wastes generated. Conducting waste composition studies periodically provides a tool for the department to assess the changes in the waste stream over time and use in program design and implementation to reduce, reuse and/or recycle targeted materials with the waste stream. MSW Consultants, LLC has been selected to design and execute a comprehensive update to these previous studies. The remainder of this document summarizes the critical elements of the study design and field data collection plan.

2. ROLES AND RESPONSIBILITIES

Ms. Kim Case with MDNR will serve as the primary contact for the Project Team during the implementation of the study. MSW Consultants has collaborated with the MDNR in finalizing the solid waste disposal facilities that will host the various components of field data collection. This collaboration will also be focusing on a sampling plan for identified waste generators apportioned amongst the selected host facilities.

MSW Consultants' professional consulting staff have redundant waste characterization management, field supervisory experience, operations and analytical experience, with consistent training to use our firm's proven approach for waste characterization. The staff below, all of whom have significant experience with waste and recycling stream characterization project work, will support this project (and MSW Consultants employs additional staff beyond those shown below who are similar experience). Their roles are listed:

- Cynthia Mitchell, Project Manager (Project Manager, Crew Chief, Visual/Gate Surveyor)
- Joe Vetrano, LEED AP, Project Manager (Field Supervisor),
- Walt Davenport, President (Technical Advisor),
- John Culbertson, Vice President (Sampling Plan, Statistical Analysis, Field Supervisor, Trainer), and
- Denny Holt, Senior Analyst (Field Supervisor).

The following roles will be implemented during field data collection:

The **Field Supervisor** will initiate the sampling process each day using the agreed upon approach. He will arrive at the facility early in the morning to make contact with facility scale house personnel, the loader operator, or other designated personnel. He will also be the designated person to check in and check out with the scale house each day. He will be in charge of tracking samples that need to be taken that day. Lastly, he will be in charge of administering the Health and Safety Plan. The MDNR Project Manager shall be notified of any such changes.

The **Crew Chief** will be in charge of managing the sorting function at each host facility, and verifying and recording sample data. She will be in charge of weighing out all the materials after each sample has been sorted. Lastly she will make sure the sorting crew adheres to the Health and Safety Plan. The Crew Chief will also pick up, transport, and manage the sorting crew throughout the project.

Sorters will be obtained through JobFinders USA, a mid-Missouri temporary labor company based in Columbia, Missouri. JobFinders USA will supply a dedicated sort crew to be trained by our professional staff. The dedicated crew will perform all data collection each season (although there will likely be some staff turnover between the first and second season).

The **Visual/Gate Surveyor** will perform the gate surveys and subsequent visual volumetric surveys at each of the facilities hosting the non-MSW composition analysis. This individual will be responsible for coordinating with the scalehouse to align gate survey data with inbound load data, and will need to work collaboratively with a spotter and loader operator on the tip face/tipping floor during the visual volumetric surveys of tipped loads of non-MSW.

The **Trainer** will supplement the Field Supervisor and Crew Chief at the outset of each seasonal sorting event. The Trainer will train the waste sorting crew on technique and definitions, and cover all aspects of safety and health requirements at the beginning of each season.

3. SITE COORDINATION AND COMMUNICATION

3.1 LOGISTICS

Based on input from MDNR, MSW Consultants drafted a short memorandum for each host facility, describing the host facility requirements. MDNR was subsequently responsible for contacting each facility to introduce the project and secure participation.

MSW Consultants subsequently submitted a detailed information request to the MDNR Project Manager for distribution to each of the selected host facilities to collect data necessary to develop the sampling plan. A copy of the facility survey is included in Appendix A.

3.2 COMMUNICATION WITH HOST FACILITIES

MSW Consultants performed brief site visits to the host facilities prior to the sort in order to assist in communications and planning. Visits to the host facilities served the following crucial functions:

- Introducing the Project Manager to facility personnel;
- Clarifying information provided in response to the information request;
- Finalizing locations for setting up the work area, taking samples, queuing samples, discarding sorted samples, and other in-process activities;
- Confirming procedures requiring coordination between the host facility personnel and the Project Team;
- Reviewing facility-specific health and safety procedures and emergency contact numbers; and
- Answering any questions or addressing concerns of the Facility Managers.

4. SAFETY AND HEALTH PLAN

MSW Consultants maintains a customized Safety and Health Plan for waste characterization studies. A copy of this plan is included in Appendix B and has been provided to all host facilities.

5. TRAINING AND SUPERVISION

At the outset of each season the Trainer and Crew Chief will jointly lead a detailed training session in the morning of the first day of the sort. At the conclusion of the training, the sorting crew will be fully prepared to conduct the seasonal sorts. For the rest of the sort, the Crew Chief will oversee and direct the sort crew.

The training will cover all aspects of the safety and health requirements, as well as sorting and weighing procedures and guidance to improve productivity. Training will include:

- General facility overview;
- Learning and reviewing the material categories and definitions;
- Facility-specific health and safety requirements;

- Personal protective equipment (PPE) requirements;
- Waste handling techniques; and
- Productivity strategies and daily sorting quotas.

Throughout the sort the sorting crew will be under close supervision by the Crew Chief. The Crew Chief will ensure the sorting protocol is being followed along with the health and safety requirements outlined in Appendix B. Lastly, the Crew Chief will closely evaluate each individual sample to ensure that the material categories are understood and adhered to by the sorting crew.

6. MISSOURI'S WASTE STREAM

6.1 WASTE TYPES

This project is comprehensive in scope in the sense that the state's entire disposed waste stream will be characterized. To be consistent with prior studies, the following waste generator types are to be captured in this study:

- **Municipal Solid Waste (MSW**): Routinely generated wastes from residential, commercial and institutional waste generators, commonly collected in commercial compacting collection vehicles (including compactor roll-offs). Includes MSW delivered by self-haulers.
- **Construction**: Wastes generated at construction site sites, including renovation projects. May be collected by commercial haulers in open top containers, or by contractors self-hauling their debris.
- **Demolition**: Wastes generated from demolition activities. Although hauled and delivered in a manner similar to Construction waste, demolition waste is more attached to each other, pulverized, or unable to be easily separated.
- **Industrial**: Wastes that are byproducts of industrial or manufacturing processes. Industrial waste is normally homogeneous, containing a single waste product and/or its packaging. This waste is normally delivered to the waste facility in open top roll-off containers or compactor units.
- **Special**: Includes contaminated soils, asbestos, bulky items, tritium and e-scrap.
- **Other**: Consists primarily of sludge/biosolids and tree trunks and limbs. May include other wastes not elsewhere classified.

6.2 STATEWIDE WASTE DISPOSAL

Table 6-1 summarizes the total waste disposal reported by Missouri landfills and transfer stations in 2015. As shown, almost 5.5 million tons of the above waste types were disposed in the state based on reporting from 78 facilities. Table 6-1 also reflects the waste disposal tonnage by District.

Table 6-1 Missouri Waste Disposal by District - 2015

District	District Name	No. of Disposal Facilities	2015 Tonnage	Percent of Total
A	Northwest Missouri SWMD	3	25,388	0.5%
B	North Missouri SWMD	3	0	0.0%
C	Northeast Missouri SWMD	1	62,990	1.1%
D	Region D Recycling & Waste Mgt. Dist.	1	102,633	1.9%
E	Mid-America Reg. Council SWMD	10	709,370	12.9%
F	West Central Missouri SWMD	4	393,549	7.2%
G	Mark Twain SWMD	3	207,888	3.8%
H	Mid-Missouri SWMD	4	329,155	6.0%
I	East Central SWMD	2	32,045	0.6%
J	Quad-Lakes SWMD	3	13,204	0.2%
K	Ozark Rivers SWMD	5	273,419	5.0%
L	St. Louis-Jefferson SWMD	17	2,116,414	38.6%
M	Region M SWMD	3	485,434	8.8%
N	Southwest Missouri SWMD	3	0	0.0%
O	Ozark Headwaters Recycling and Materials Mgmt. Dist.	3	228,538	4.2%
P	South Central SWMD	2	259,978	4.7%
Q	Ozark Foothills Regional SWMD	0	0	0.0%
R	Southeast Missouri SWMD	7	43,560	0.8%
S	Bootheel SWMD	2	204,227	3.7%
T	Lake of the Ozarks SWMD	2	0	0.0%
Total		78	5,487,792	100.0%

6.3 DATA COLLECTION METHODS

This study update relies on three data collection methods to characterize disposed wastes:

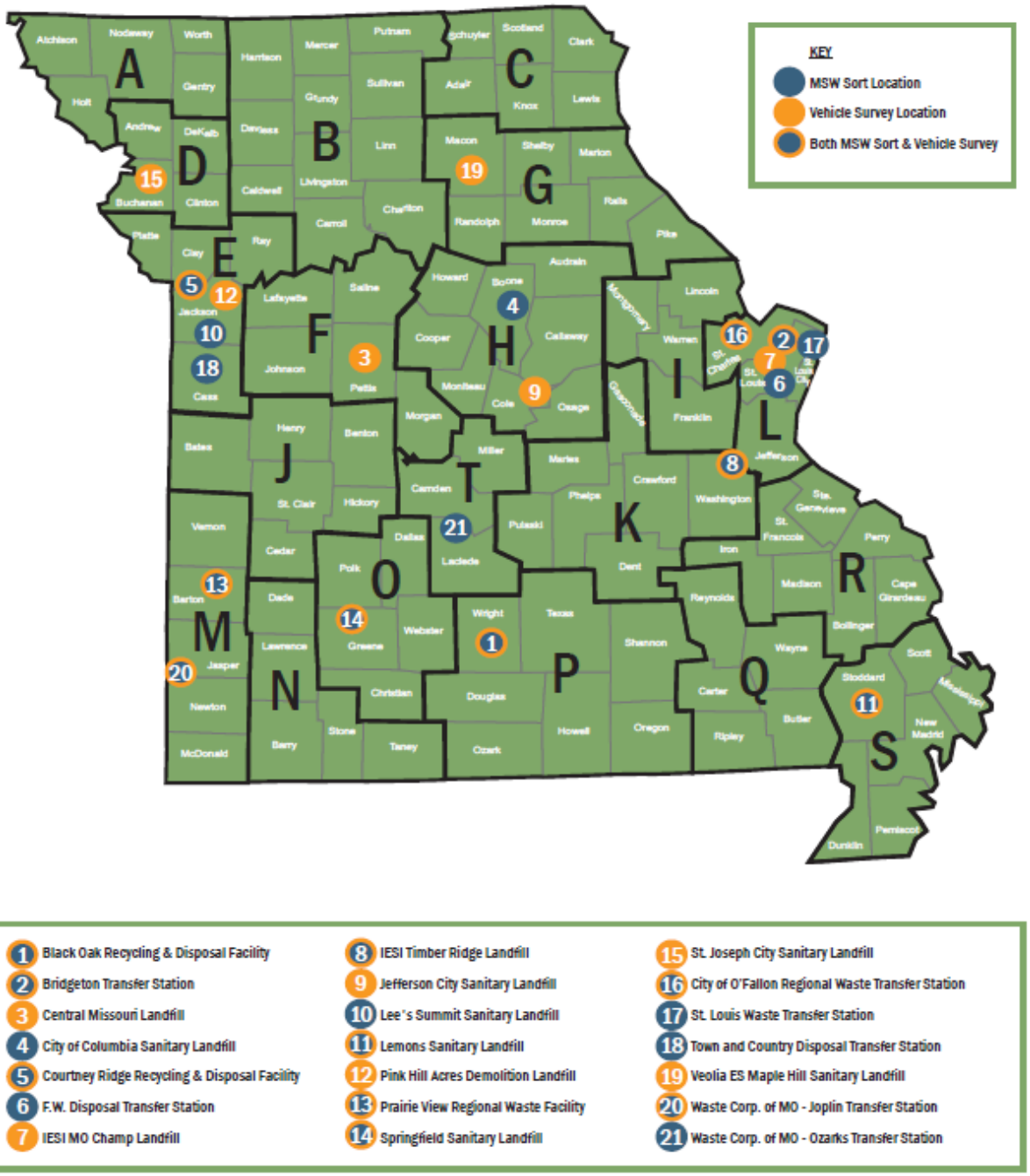
- Manual Sampling and Sorting: For MSW, this study includes extensive manual sampling and sorting of inbound loads.
- Gate Survey of Inbound Vehicles: For both MSW and non-MSW loads, this study will survey inbound deliveries to determine the distribution of wastes delivered.
- Visual Survey of Non-MSW Loads: Loads of non-MSW will be visually surveyed using volumetric estimation as a means to determine the composition of the loads.
- All three data collection methods attempt to representatively sample from the statewide waste stream summarized in Table 0-1.

6.4 HOST FACILITIES

MSW Consultants collaborated with MDNR to identify, contact, and recruit landfills and transfer stations to host the various components of field data collection. The primary strategy for the 2016-2017 Study was to replicate the 2006-08 Study methodology. As such, the host facilities from the 2006-08 Study served as the primary candidates for hosting two seasonal sorting events for the latest study. However, this update also sought to capture samples of wastes in closer proportion to districts where more waste is generated.

The map in Figure 6-1 identifies all facilities involved in manual sorting and visual surveying for the 2016-2017 Missouri Waste Composition Study.

Figure 6-1 2016-2017 Waste Composition Host Facilities



7. MSW SAMPLING PLAN

MSW will be characterized through manual sorting of representative samples from solid waste facilities across the state. This section defines the MSW sampling plan.

7.1 MSW GENERATOR TYPES

Municipal solid wastes will be further delineated between the following generator types:

- Residential: Includes waste generated in single family and multi-family residential households. Residential wastes are predominantly delivered by commercial rearload, sideload and potentially frontloading collection trucks. Some multi-family wastes may be delivered in compactor boxes.
- Commercial/Institutional (CI): Includes waste generated in commercial and institutional establishments. CI wastes are typically collected in frontload and rolloff compactors. Some CI waste may be collected in rearloaders as well as open top containers.

It is important to note that loads containing less than 80% of either residential or CI waste, and loads originating from outside of Missouri, will not be sampled. This means that transfer trailer waste will be omitted from the sampling and sorting (although will be captured in the gate surveys). This is because it is not possible to discern the generator sector from transfer trailer wastes.

7.2 HOST FACILTIES AND SAMPLE ALLOCATION

Table 7-1 presents the host facilities selected for the 2016-17 Study. As shown, a total of 240 samples are targeted for sampling and manual sorting. Samples are allocated across two seasons and 15 host facilities.

Table 7-1 Sort Facilities Samples and District

District	Facility	Samples Season 1	Samples Season 2	Total
E	Courtney Ridge Recycling & Disposal Facility	16	8	24
E	Lee's Summit Sanitary Landfill	8	8	16
E	Town and Country Disposal Transfer Station	8	8	16
H	City of Columbia Sanitary Landfill	8	8	16
K	IESI Timber Ridge Landfill	0	8	8
L	Bridgeton Transfer Station	8	16	24
L	F. W. Disposal, LLC Transfer Station	8	8	16
L	St. Louis Waste Transfer Station	8	8	16
L	City of O'Fallon Transfer Station	8	8	16
M	Prairie View Regional Waste Facility	8	8	16
M	Waste Corporation of Missouri - Joplin Transfer Station	8	8	16
O	Springfield Sanitary Landfill	8	8	16
P	Black Oak Recycling & Disposal Facility	8	8	16
S	Lemons Sanitary Landfill, LLC	8	0	8
T	Waste Corporation of Missouri - Ozarks Transfer Station	8	8	16
	Total	**120**	**120**	**240**

It is important to note that the host facilities shown in the above table proportionately distribute the manual sampling and sorting across Districts where the waste is generated. Below compares distribution of samples by District with the percentage of the state's disposed waste in that district. As shown in Table 7-1, the sampling targets closely match the distribution of statewide waste disposal.

Table 7-1 Percentage of Waste Contribution by Participating Districts - 2015

District	District Name	No. of Disposal Facilities	Samples: Sampling Target	Samples: Percent of Total	Statewide Distribution of Disposed Waste
E	Mid-America Reg. Council SWMD	3	56	23.3%	12.9%
H	Mid-Missouri SWMD	1	16	6.7%	6.0%
K	Ozark Rivers SWMD	1	8	3.3%	5.0%
L	St. Louis-Jefferson SWMD	4	72	30.0%	38.6%
M	Region M SWMD	2	32	13.3%	8.8%
O	Ozark Headwaters Recycling and Materials Mgmt. Dist.	1	16	6.7%	4.2%
P	South Central SWMD	1	16	6.7%	4.7%
S	Bootheel SWMD	1	8	3.3%	3.7%
T	Lake of the Ozarks SWMD	1	16	6.7%	0.0%
	Totals	**15**	**240**	**100.0%**	**83.9%**

7.3 SEASONALITY AND SCHEDULE

Consistent with the 2006-08 Study, MSW composition field data collection will be performed over two seasons. The first manual sorting season will commence in mid-September 2016. The second field data collection event will involve manual sorting and vehicle surveys and will occur during the period between March and May 2017. Both of these data collection windows are consistent with the 2006-08 Study.

Table 7-2 shows the first season field data collection plan. A similar plan will be developed prior to the second season of field data collection for the MSW stream.

Table 7-2 Season 1 Schedule

MDNR District	Facility	Sort Date(s)
H	City of Columbia Sanitary Landfill	Sep 15-16
M	Prairie View Regional Waste Facility	Sep 19
M	Waste Corp. of Missouri - Joplin Transfer Station	Sep 20
O	Springfield Sanitary Landfill	Sep 21
P	Black Oak Recycling & Disposal Facility	Sep 22
T	Waste Corp. of Missouri - Ozarks Transfer Station	Sep 23
E	Courtney Ridge Recycling & Disposal Facility	Sep 26-27
E	Town and Country Disposal Transfer Station	Sep 28
E	Lee's Summit Sanitary Landfill	Sep 29
L	Bridgeton Transfer Station	Oct 3
L	City of O'Fallon Regional Waste Transfer Station	Oct 4
L	St. Louis Waste Transfer Station	Oct 5
L	F. W. Disposal, LLC Transfer Station	Oct 6
S	Lemons Sanitary Landfill, LLC	Oct 7

7.4 SAMPLE WEIGHTS

Consistent with industry standards and RFP specifications, samples will be collected that weigh between 200 and 250 pounds. The Project Team's sampling expertise will ensure that representative and random samples meeting desired weight targets will be acquired consistently throughout the project.

7.5 MATERIAL CATEGORIES

In the 2006-2008 Study, a total of 28 material categories were utilized. For the 2016-2017 Study, a total of 48 material categories have been defined. These are summarized in Table 7-3. Complete definitions are contained in Appendix C.

Table 7-3 Material Categories

Paper	**Glass**
Corrugated Cardboard/Kraft Paper (Uncoated)	Clear Glass Containers
Newsprint	Brown Glass Containers
Magazines	Green/Blue Glass Containers
(High Grade) Office Paper	Other Glass
Mixed Recyclable Paper	**Organics**
Compostable Paper	Food Waste
Remainder/Composite Paper	Wood – Clean/Untreated
Metal	Wood – Painted/Stained/Treated
Aluminum Cans	Textiles - Clothing
Other Aluminum	Textiles – Non-clothing
Ferrous Food Cans	Shoes/Belts/Leather
Other Ferrous	Disposal Diapers and Sanitary Products
Other Non-ferrous	Yard Waste
Oil Filters	Remainder/Composite Organic
Plastics	**Inorganics**
#1 PET Bottles	Fines
#1 PET Non-Bottle Containers	Gypsum Drywall
#2 HDPE Containers – Natural	Asphalt, Concrete, Brick and Rock
#2 HDPE Containers – Colored	Carpet and Carpet Padding
Clean Film Bags	Other Construction & Demolition Debris
Clean Industrial/Commercial Film (Non-bag)	Bulky Items/Furniture
Contaminated Film/Other Film	Mattresses/Boxsprings
Plastic Containers #3 through #7	Tires
#6 Expanded Polystyrene	Other/Not Elsewhere Classified
Bulky Durable Plastics	**Household Hazardous Waste (HHW)**
Remainder/Composite Plastic	HHW
Electronics	
Electronic Waste (E-Waste)	

8. NON-MSW SAMPLING PLAN

8.1 NON-MSW GENERATOR TYPES

Similar to the 2006-2008 Study, MSW Consultants will apply a different characterization methodology to evaluate non-MSW wastes. Non-MSW waste will be categorized as follows:

- **Construction**: Materials generated from construction projects. These materials are normally delivered to a waste facility in a roll-off container brought directly from the construction site.
- **Demolition**: Materials generated from demolition projects. Such materials material are usually attached to each other, pulverized, or unable to be easily separated.
- **Industrial**: Waste generated from industrial facilities and processes. Industrial waste may be visually homogeneous, derived from a single source, and may be delivered to the waste facility by truck, open top roll-off, or compactor unit.
- **Other Waste**: Includes municipal sewage sludge, unidentified sludge, commercial yard waste and stumps, and all other unidentified materials
- **Special Waste**: Waste materials that do not fit into any of the previous categories. Special waste may include bulky items (furniture, mattresses, large fixtures, etc.), asbestos, soil, (contaminated by a pollutant), tritium (exit signs), and electronic waste.

8.2 HOST FACILITIES FOR NON-MSW WASTE CHARACTERIZATION

Table 8-1 summarizes the 15 solid waste facilities that have been recruited to host 2 days each of visual and gate surveying for this project.

Table 8-1 Visual Survey Facilities by District CY 2015

Region	Facility Name
D	St. Joseph City Sanitary Landfill
E	Courtney Ridge Recycling & Disposal Facility
E	Pink Hill Acres Demolition Landfill
F	Central Missouri Landfill, Inc.
G	Veolia ES Maple Hill Sanitary Landfill
H	Jefferson City Sanitary Landfill
K	IESI Timber Ridge Landfill
L	City of O'Fallon Regional Waste Transfer Station
L	IESI MO Champ Landfill, LLC
L	Bridgeton Transfer Station
M	Waste Corporation of Missouri - Joplin Transfer Station
M	Prairie View Regional Waste Facility
O	Springfield Sanitary Landfill
P	Black Oak Recycling & Disposal Facility
S	Lemons Sanitary Landfill, LLC

Table 8-2 compares the percentage of waste received in these facilities with the total waste generated by district. As shown, the selected host facilities receive waste roughly in proportion to the waste generated by district.

Table 8-2 Facilities Hosting Visual Surveys

District	District Name	No. of Disposal Facilities	Tons CY2015	Percent of Total	Statewide Distribution of Disposed Waste
D	Region D Recycling & Waste Mgt. Dist.	1	102,633	2.6%	1.9%
E	Mid-America Reg. Council SWMD	2	563,900	14.5%	12.9%
F	West Central Missouri SWMD	1	312,491	8.0%	7.2%
G	Mark Twain SWMD	1	130,485	3.4%	3.8%
H	Mid-Missouri SWMD	1	329,155	8.5%	6.0%
K	Ozark Rivers SWMD	1	195,926	5.0%	5.0%
L	St. Louis-Jefferson SWMD	3	1,096,493	28.2%	38.6%
M	Region M SWMD	2	467,249	12.0%	8.8%
O	Ozark Headwaters RMMD	1	228,538	5.9%	4.2%
P	South Central SWMD	1	259,978	6.7%	4.7%
S	Bootheel SWMD	1	204,227	5.2%	3.7%
	Totals	15	3,891,075	100.0%	96.8%

8.3 DATA COLLECTION METHODS

The characteristics of non-MSW wastes differ from routinely generated MSW. These non-MSW loads often contain homogeneous materials and bulkier items that are not conducive to grab sampling and manual sorting. Therefore, MSW Consultants will compile data about non-MSW wastes using two complimentary data collection methods.

- **Vehicle Surveying**: First, all inbound vehicles will be surveyed for an entire day at selected host facilities across Missouri to identify the type of waste contained in the load. MSW and non-MSW loads will be captured. Results of the survey, when combined with scale data for the day on which data are collected, will provide a basis for estimating the split between MSW and non-MSW.
- **Volumetric Surveying of Tipped Loads**: Second, for a subsequent full day at the same facility, inbound loads containing non-MSW will undergo a visual, volumetric survey to ascertain the types of non-MSW materials in the loads.

These methods will be described in more detail below.

8.4 SEASONALITY AND SCHEDULE FOR VISUAL SURVEYS

Field data collection for the non-MSW waste stream will occur during the second season of this project, likely to begin in early Spring 2017. Visual surveys will be completed of the course of two consecutive days at each facility.

8.5 MATERIAL CATEGORIES – VISUAL SURVEYS

As mentioned previously, the six main waste sectors to be used for the Visual Surveying classification are MSW, Construction, Demolition, Industrial, Special, and Other. The Material Groups and categories for these sectors have been broken out in Table 8-3. Detailed definitions of these materials are contained in Appendix D.

Table 8-3 Material Categories

Paper	**Construction & Demolition (C&D)**
Corrugated Cardboard/Kraft Paper (Uncoated)	Carpet
Remainder/Composite Paper	Carpet Padding
Plastic	Concrete/Block/Brick/Stone/Tile
Plastic Bottles (Recyclable)	Asphalt Paving
HDPE Buckets	Roofing Materials
Clean Recoverable Film	Ceiling Tiles
Remainder/Composite and Other Plastic	Clean Gypsum Board
Glass	Painted Gypsum Board
All Glass	Dirt/Sand/Gravel
Metal	Insulation
Appliances	R/C and Other C&D
Other Ferrous Metals	**Other Wastes**
Other Non-ferrous Metals	Bio-Solids (Sewage and other Sludges)
Organics	Agricultural Waste
Yard Waste	Tritium-Containing Products
Remainder/Composite and Other Organics	Asbestos Containing Materials
Wood	Contaminated Soil
Pallets and Crates	**Special Wastes**
Untreated/Unpainted Lumber	Bulky Wastes/Furniture
Treated/Painted/Processed Wood	Tree Trunks
Engineered Wood	Tires
Wood Furniture	All Household Hazardous Waste (HHW)
Other Wood	Fines/Mixed Residue
Electronics	Mixed MSW
Electronics	
Items with CRTs	

9. FIELD DATA COLLECTION

9.1 SPACE REQUIREMENTS FOR MSW SORTING

In order for the sorting crew to safely and successfully collect and sort samples at each facility they will need a space approximately the size of two truck bays or about 20x40 feet. This space must also allow a front loader to dump 200 to 300 pound samples onto a designated ground area frequently throughout the day. At the end of the day the crew will have accumulated a large pile of garbage or recyclables, made up of both the sorted and unsorted potion of each grab sample, that will be disposed/processed properly at the direction of the host facility.

9.2 SPACE REQURIEMENTS FOR VISUAL SURVEYING OF NON-MSW LOADS

Visual surveying is expected to take place just off to the side of the tipping face or tip floor. There must be sufficient space for the tipped load to be placed for the visual surveyor to walk the perimeter of the load so that its contents can be viewed. Visual surveying can move around depending on the availability of space at the host disposal facility. It will be important for the surveyor to maintain close communications with the loader (or landfill compactor operators) and spotter.

9.3 VEHICLE AND LOAD SELECTION

The Field Supervisor will follow a systematic selection procedure to identify vehicles for sampling. To calculate vehicle sampling frequency for each waste sector, the Project Team will establish a sampling interval for each based on input from the facility scalehouse each day. Sampling intervals are determined by dividing the total expected number of loads for each sector arriving at the facility on the scheduled day – based on questions asked of each facility in the planning phase of the study – by the number of samples needed each day. The resulting number is the sampling frequency, which determines whether every third vehicle, every sixth vehicle, or every 20th vehicle is selected for sampling. This strategy is referred to as "selecting every nth vehicle" within a waste sector and subsector. .

The Field Supervisor working in coordination with facility scalehouse personnel, will keep a tally of vehicles from each waste sector as they enter the facility. When the designated nth vehicle in each waste sector arrives, the Field Supervisor will escort the vehicle to the sampling area (or otherwise cause the vehicle to go to this area).

The Field Supervisor will obtain and record pertinent information for each vehicle that is identified for sampling, including waste sector (Residential, CI, Construction, etc.), hauler name, vehicle type, and other data that may be needed.

This information will be noted on the vehicle selection form, along with a unique identifying number associated with that vehicle on that day. The field crew supervisor also will note any unusual circumstances associated with the load or the sample.

The sample ID will match the corresponding waste sector prefix. For example, the first CI sample will be CI-01, while the fourth residential sample will be RES-04.

Note that there are five instances where the nth vehicle approach may be modified, mostly for the manual sorting effort:

- On the day of sampling and sorting, if the number of loads expected to arrive at the facility is less than previously anticipated, the sampling frequency will be shortened and a new nth vehicle selection strategy will be calculated and followed;
- For manually sorted samples only, if the nth residential vehicle selected is found to contain significant mixture of commercial, industrial, or institutional waste (above 20%), the next load (nth + 1) may be taken as a replacement;
- For manually sorted samples only, if the nth commercial vehicle selected is found to contain significant mixture of multi-family residential waste (above 20%), the next load (nth + 1) may be taken as a replacement
- To meet daily sampling targets, it is critical to keep the sorting crew actively sorting from the moment the work area is set up. To the extent the sort crew is set up and ready to sort, the Field Supervisor may take the next available residential or CI load in place of the nth vehicle. If this becomes necessary, the remaining vehicles will be taken at every nth interval.
- In the event that the waste is not from Missouri.

The Crew Chief or Visual Surveyor will obtain and record the following information on the Field Supervisor tracking sheet for each vehicle that is identified for sampling.

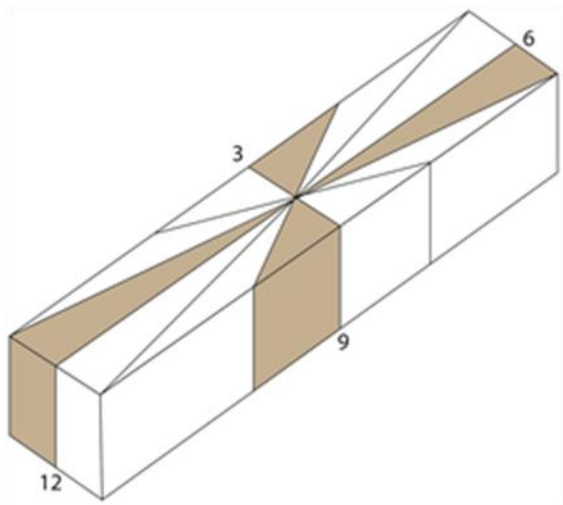
- Date and time of day;
- Generator sector – Residential, CI, Construction, Demolition, or appropriate qualifier (multi-family, etc.);
- Vehicle type – Roll-off Compactor, Residential Dropbox, Packer Truck;
- Hauler name and truck number;
- Weigh ticket number;
- Other data that may be needed

In cases where an insufficient number of vehicles are available for sampling at a disposal facility, the data collection crew can first change the nth vehicle to reduce the number between samples or make up the missing samples at a different location. This strategy may also be used when samples are missed for some other unforeseen reason. In all cases, the sampling plan will assign the frequencies of vehicles to be selected in such a way as to minimize the chance of "running out of" vehicles to represent a particular waste sector at a disposal facility.

9.4 SAMPLE SELECTION: GRAB SAMPLES OF WASTE

Selected loads of waste designated for sorting will be tipped in the designated area at each host facility. From each selected load, one representative and random sample of waste will be 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 will be 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. This concept of systematically rotating around subsequent loads is shown in Figure 9-1.

Figure 9-1 Systematic Sampling Guide for Tipped Loads



Once the area of the tipped load has been selected, the Field Supervisor will coordinate with a facility-provided loader operator to take a "grab" sample of wastes from that point in the tipped load. The loader operator will use the loader to remove a sample of waste that weighs between 200 and 250 pounds.

From each extraction point, the loader operator will be instructed to take a grab sample. From each grab, a sample weighing at least 200 pounds will be extracted from the pile and pre-weighed (to verify that the minimum sample weight has been achieved and to prevent sorting overly large samples, which would diminish sorting productivity). Pre-weighed samples will be loaded into barrels for placement on the sort table, although bulky items may be weighed and recorded separately (thereby eliminating the need to sort them at the sort table). Prior to sorting each sample, a sorting crew member will take a photograph of it with the sample placard and identification number visible in the picture.

Depending upon the availability of host facility personnel, the Field Supervisor will either collect the sample directly from the bucket of the front-end loader, or will direct the sample to be dumped on a tarp or a paved surface. When collecting samples directly from the loader bucket, 35-gallon cans or carts will be arranged side-by-side on a tarp, with the loader bucket positioned directly overhead. The Field Supervisor will collect the sample systematically, by working from one side of the bucket to the other, emptying all of the contents from the front of the bucket to the back, until the desired sample weight was achieved. To help minimize sample collection bias, samples will be collected from the loader bucket in an alternating fashion, that is, working from the left side of the bucket to the right side for one sample, and then from right to left on the next sample.

10. CHARACTERIZATION OF SAMPLES

10.1 SORTING

In Figure 10-1 below, the photograph presents the typical layout of the sorting table and bins into which each targeted material is to be sorted. Based on our extensive experience, we believe a well-thought-out sort area is crucial to efficient and accurate sorting. Maintaining a consistent sort area also improves safety by establishing boundaries for all workers to follow consistently.

Figure 10-1 Layout of Sorting Table and Bins

Once the sample has been acquired and placed on the sorting table, the material will be sorted by hand into the prescribed component categories. Plastic 20-gallon bins with sealed bottoms will be used to

contain the separated components. The sorting crew members typically specialize in groups of materials, such as papers or plastics.

The Crew Chief will monitor the homogeneity of the component bins as they accumulated, rejecting materials that may be improperly classified. Open bins allow the Crew Chief to see the material at all times and verify the purity of each component as it is weighed, before recording the weight into the database. The materials will be sorted to particle size of 2 inches or less by hand, until no more than a small amount of homogeneous fine material (—mixed residuel) remains. This layer of mixed 2-inch-minus material will be allocated to the appropriate categories based on the best judgment of the Crew Chief — most often a combination of Other Paper, Other Organics, or Food Waste. The overall goal is to sort each sample directly into component categories in order to reduce the amount of indistinguishable fines or miscellaneous categories.

10.2 DATA RECORDING

The weigh-out and data recording process is the most critical of process of the sort. The Crew Chief will oversee all weighing and data recording of each sample. Once each sample has been sorted, and fines swept from the table, the weigh-out will be performed. Each bin containing sorted materials from the just completed samples will be carried over to the scale. Sorting laborers will assist with carrying and weighing the bins of sorted material, and the Crew Chief will record all data.

The Crew Chief will use a rugged tablet computer to record the composition weights. The tablet allows for samples to be tallied in real time so that field data collection can immediately identify and rectify errors associated with light sample weights. The tablet synchronizes with the cloud via cellular signal, providing excellent data security. Each sample will be cross-referenced against the Field Supervisor's sample sheet to assure accurate tracking of the samples each day. The real-time data entry offers 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.
- Except where host facilities are outside of cell phone range, the data file syncs routinely and can be accessed and checked by MSW Consultants QA/QC staff back at the office. For remote facilities that cannot synchronize during the work day, it is usually possible to sync in the evening upon returning to the hotel.

The Crew Chief will also carry paper field forms as a back-up in case the tablet computer encounters unforeseen technical difficulties.

10.3 SITE MAINTENANCE AND CLEANUP

The Project Team will be guests at each of the host facilities, and it is therefore critical to leave the work area clean and safe for subsequent operations. The sorting crew is also responsible for keeping litter to a minimum. The Project Team will also conclude each day of sorting operations with sufficient time to perform site clean-up. Clean-up will include the following types of activities:

- Organized stacking and stowing of sorting supplies in a designated location;
- Removal of sorted wastes for burial or transfer (the host facility loader operator will help with this);
- Sweeping and cleaning the sort area to prevent windblown litter and other situations that could attract vectors;
- Removal and discard of day-use personal protective equipment and decontaminating personnel;
- Checking out with the Facility Manager each day; and
- Tarping of any unsorted samples, left for sorting the next day.

10.4 GATE SURVEY AND INBOUND VEHICLES

Inbound vehicles at selected host facilities will be surveyed for a full day (8 hours) to determine what type of waste is being delivered. Consistent with the 2006-08 Study, incoming loads will be categorized into one of six types: MSW, Construction/Remodel, Demolition, Industrial, Other and Special Wastes. To the extent possible, MSW Consultants will work with host facility scalehouse personnel to identify the specific haulers delivering each waste type at the outset of the study, and will survey inbound trucks to confirm the expected waste types. A copy of the Gate Survey Form is included in Appendix E.

10.5 VISUAL VOLUMETRIC SURVEYS OF NON-MSW LOADS

Non-MSW is by nature very different in composition compared to residential and commercial waste collected in compacting vehicles. Where residential and commercial MSW loads consist of waste from dozens (commercial) or hundreds (residential) generators, and since most particles are relatively small (less than 12 inches), physical grab sampling and sorting is both practical from an operations standpoint and is also statistically appropriate.

However, Construction debris and other homogenous special wastes are very different. Construction and Demolition (C&D) wastes typically contains large items that are difficult to "grab" and manually sort, such as drywall, dimensional lumber, and a number of bulky items. Furthermore, grabs of C&D waste frequently miss the densest items in the load – concrete, brick, block and dirt – which sink to the bottom center of the tipped load. Even a 300 pound grab of a C&D load may not come close to representing the full contents of the load.

Since the mid-1990s, the solid waste industry has studied various methods for characterizing C&D debris and other bulky/homogenous waste, and has generally found that visual surveying of these loads provides the best combination of accuracy and cost effectiveness to enable a statistically meaningful number of samples to be collected.

In an improvement over the 2006-08 Study, MSW Consultants' protocol for characterizing non-MSW loads entails visual surveying of the entire tipped load of MSW. Visual surveying of a load of waste involves detailed volumetric measurements of the truck and load dimensions, followed by the systematic observation of the major material components in the tipped load. The basic steps to visual surveying are:

1. Measure the dimensions of the incoming load prior to tipping and (if possible) estimate the percent full of the vehicle.
2. Tip the load. If it is a large load, and if possible, have a loader spread out the material so that it is possible to discern dense materials such as block, brick, and dirt that tend to sink to the bottom of the pile.
3. Make a first pass around the load marking the major material categories that are present in the load—cardboard, drywall, dimensional lumber, etc. Estimate the percentage of the load made up of these major materials. If possible, estimate of the yardage associated with this material.
4. Make a second pass around the load, noting the secondary material categories contained in the load. Estimate the percentage of the load made up of these materials. If possible, estimate of the yardage associated with this material.
5. Validate that the estimated percentages sum to 100 percent, and that the estimated yardage of major material categories is realistic given the overall truck dimensions and volume.

MSW Consultants has developed an electronic field form that provides real-time QA/QC on the visual volumetric estimates, and also compares the estimates 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. A copy of the visual survey is also included in Appendix E, Field Forms.

11. DATA ANALYSIS

Our analysis of physically sorted MSW composition data normalizes each sample by converting the sample data from weight to percentage. A statistical analysis is then performed to calculate the mean composition for each of the material categories. The sample mean is determined 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.

The standard deviation, as well as confidence intervals at a 95 percent level, will be provided for each material category, as statistically appropriate, as well as major material groups (e.g., "paper", "plastic", etc.). Precise statistical formulas will be included in the final report.

Conversely, the visual C&D survey data will undergo a more elaborate analysis. First, volumetric estimates of each surveyed load will be 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 calculated load weights are then compared against the actual reported weights as presented on the weigh tickets obtained for each load. Density factors may be adjusted for certain materials if the variance between the calculated and actual weight of visually surveyed C&D loads varies by more than five to 10 percent.

Once loads are converted to weight-based estimates and normalized, each load is treated as a sample and analyzed using the same statistical measures. Note that the non-MSW loads are analyzed by weight, rather than by percentage as for the MSW samples. This is because heavier non-MSW loads should be given a higher weighting in the overall analysis than lighter non-MSW loads.

12. REPORTING

The following reports will be compiled and delivered at appropriate stages of the project.

12.1 FACILITY ACTIVITY REPORTING

Within four weeks following each data collection event, MSW Consultants will deliver a concise summary of the sampling targets planned and achieved, unweighted waste composition, staffing summary, and a list of problems and proposed resolutions. The activity reports will be in electronic format and will also include the raw sample data at the request of the DNR.

12.2 QUARTERLY REPORTS

Quarterly reports will be submitted consistent with the direction in the RFP. Quarterly reports will include:

- The specific activities performed during the quarterly period;
- The specific activities completed to-date and the completion dates of each activity;
- The specific activities to be completed and projected completion date(s) for the next quarterly period; and
- The specific activities to be completed and projected completion date(s).

12.3 FINAL REPORT

The final report will be provide a comprehensive estimate of the composition of all solid waste disposed in Missouri. The report will be divided into two volumes.

Volume 1 will summarize the composition and quantity of MSW generated by the Residential and ICI sectors within the State and for each host facility. Consistent with the 2006-08 Study, this report will contain the following:

1. Statewide results for disposed MSW
    a. Aggregate

   b. Residential
   c. ICI
2. Aggregate annual results by facility for each of the 15 facilities
3. Seasonal results by disposal facility
   a. Aggregate
   b. Residential
   c. ICI

Additionally, because this represents an update to the prior study, the 2017 Study final report will provide a comparison of the 2017 Study to the 2006-08 and 1997 Studies for the statewide results sets.

Volume 2 will provide the results of the Solid Waste Composition Study, which incorporates the results of Volume 1. Volume 2 will include:

1. Statewide results for disposed solid waste observed by the following major sectors:
   a. Aggregate (including MSW)
   b. Construction
   c. Demolition
   d. Industrial
   e. Special
   f. Other
2. Aggregate annual results by facility for each of the 15 host facilities
3. Comparison of results with 2006-08 Study.

To assure that the final report will adequately inform the State's planners and other stakeholders, the Project Team will prepare a report outline and submit it to DNR for approval. Upon receiving approval, and upon completion of the analysis described in the sections above, we will prepare first draft report that describes the purpose, study methodology, and sampling plan, that summarizes the essential composition findings for each waste sector. Specifically, the report will include:

- An executive summary providing key findings.
- Introduction and background for the study, including objectives.
- A description of the methodology used in the study and a summary of the sampling and sorting plan;
- A description of the data collection and analytical techniques used;
- A summary of the number of samples characterized;
- A summary of the number of loads surveyed
- Waste composition profiles as described above;
- A comparison of the findings against the 2006-08 Study results as described above;
- A summary of findings, conclusions, and supporting documentation.

MSW CONSULTANTS

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